EOCENE CONGLOMERATE - HOPE

009226

Location:

Roadcuts on both sides of the Trans-Canada Highway at the west abutment of the bridge over the Fraser River at the north end of the town of Hope. Park in lot on north side of highway about 0.1 miles west of the outcrops.

General Geology:

These unnamed Eocene conglomerates occur in a band of discontinous outcrops extending from Gordon Creek, about 11 miles north of this locality, southward to and beyond the International Boundary. These strata are approximately 2,000 feet thick and lie unconformably upon Yale intrusions or Custer gneiss in this area, on Hozameen (Upper Paleozoic and/or Middle Triassic) cherts and metavolcanic breccias southwest of Hope, and again on the Custer gneiss in outcrops northwest of Chilliwack Lake. Dips are steep to moderate to the west, except north of Chilliwack Lake, where they outline a syncline. The west boundary of the outcrop band occurs at the Hope fault or is an intrusive contact with the Silver Creek stock (K-Ar 35 m.y.), the Chilliwack batholith (K-Ar 29 to 26 m.y) or the Mount Barr batholith (K-Ar 21 to 16 m.y). Similar Eocene continental strata are found in a fault-bounded lens, also within the Fraser River fault zone, between Lillooet and Lytton in the Ashcroft Map-area.

Local Geology:

The clasts in the conglomerates are dominantly well rounded to rounded and were derived from plutonic rocks, from the Hozameen Group, and from the Custer gneiss. The clasts of chert, white quartz, limestone and sandstone are similar to rocks of Dewdney Creek Group. The steep dip of these rocks can be determined from the elongation of the cobbles as well as from the sandstone lenses. Pollen from this outcrop has been identified by Dr. Rouse as being of Eocene age.

Some flat faults with carbonate cemented gouge can be seen in the outcrops on both sides of the road. Near horizontal fractures, sub-parallel to these faults, cut cobbles and boulders near the east of the outcrop on the north side of the road. A moderately east-dipping fault can also be seen at the east end of this same outcrop.

Questions:

1. Examine the clasts of intrusive rocks in the conglomerates. Compare with the Spuzzum intrusion at the next outcrop to the west. Was the Spuzzum available as a source for the clasts?

2. Compare the composition and roundness of the sand grains from the sandstone lenses with those of the clasts in the conglomerates.

References:

McTaggart, K.C. and R.M. Thompson (1967):
Geology of part of the Cascades in southern British Columbia: Can. J. Earth Sciences, v. 4, p. 1199-1228.

Monger, J.W.H. (1970):
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Richards, T.A. (1971):
Plutonic rocks between Hope, B.C. and the 49th Parallel: unpub. Ph.D. thesis, U.B.C.

WCB/72

SETTLER SCHIST - STULKAWHITS CREEK

Location:

Turn west off Highway 1 north of Stulkawhits Creek and drive about 3.0 miles up the road to Giant Mascot Mine to the 1900 foot level. Park on the south (creek) side of the road.

General Geology:

Westward up the Giant Mascot road we pass through white, shattered outcrops of Custer Gneiss and then through an outcrop of vertically standing Eocene conglomerate bounded on the west by the Hope Fault. This fault is the westernmost of the faults of the Fraser River fault system. The biotite hornblende augen (plagioclase) gneiss and pegmatitic gneiss of the Custer Gneiss extend northward from south of the International Boundary to Alexandra Bridge. It has been correlated with the Skagit Gneiss south of the border from which Mattinson (1970) dated the crystallization of the zircons at 1.6 b.y. The Eocene conglomerate continues from south of the International B Boundary to its faulted northern extremity just north of Emory Creek. Both rock units and the Hope Fault are intruded by the Chilliwack batholith (26 m.y. to 29 m.y.), Mount Barr pluton (16 m.y. to 21 m.y.), and Silver Creek stock (35 m.y.), but the fault cuts the Spuzzum Intrusions (79 m.y. to 103 m.y.)

West of the Hope Fault is a metamorphosed sequence of massive grey pelites, rare layered pelites and very minor metavolcanic rocks and marble. These rocks have been correlated with the Chilliwack Group or Hozameen Group but Lowes (1972) suggested they be called the Settler Schist of unknown age. The metamorphic grade ranges through the staurolite, kyanite, and sillimanite zones. These rocks have been metamorphosed and coaxially deformed at least twice along northwest trending fold axes. These rocks lie between the Shuksan thrust and the Hope fault and continue northward at least to the head of Harrison Lake. Except for a septum at the head of Yale Creek, the Spuzzum Intrusions bound these rocks on the west. The metamorphic zones show a spatial relationship to the outline of the Spuzzum Intrusions with the sillimanite zone nearest. This distribution suggests that the metamorphism might be considered a high pressure contact phenomenon. Within a few hundred yards of the eastern contact of the Spuzzum Intrusions, pseudochiastolite schists form and consist of garnet, muscovite, staurolite and kyanite.

Local Geology:

The roadcuts show metamorphosed massive, grey pelitic and minor arenaceous rocks cut by sills and dykes of metamorphosed granodiorite. The grey pelites consist of fine-grained biotite, muscovite, garnet, quartz and plagioclase with coarser unoriented chlorite, biotite, muscovite and beer-bottle brown staurolite porphyroblasts. Rare grey kyanite porphyroblasts with differential hardness may be found. Kyanite and staurolite are poikiloblastic and contain idioblastic garnets suggesting the growth of these minerals postdates that of garnet. The growth of all unoriented porphyroblasts postdates that of the fine-grained quartz-plagioclase-biotite-muscovite matrix. The unoriented porphyroblasts indicate that the maximum conditions during metamorphism postdate the deformation. Near the large creek is a pseudochiastolite schist consisting of muscovite, plagioclase, quartz, staurolite, kyanite, and garnet forming pseudomorphs after chiastolite. The rhombic prismatic hbit is retained but the cross of inclusions is seen best on a cut and polished surface. About 100 yards down the road from the creek, metamorphosed sills and dykes consist of fine-grained quartz, plagioclase, biotite and garnet. These form gently northwesterly plunging boudins. A lineation defined by mica streaks and oriented pseudochiastolites plunges steeply in contrast to the boudins.

Questions:

1. What does the presence of pseudochiastolites imply with regard to changing conditions of metamorphism?

2. What does the present mineralogy of the pseudochiastolites imply as to local metamomatism?

3. Why do boudins form?

4. Why might the orientation of the boudins and the lineations in the enclosing schist differ?

References:

Hollister, L. S. (1969):
Metastable paragenetic sequence of andalusite, kyanite, and sillimanite, Kwoiek area, British Columbia. Amer. Jour. Sci., vol. 267, p. 352-370

Lowes, B. E. (1972):
Metamorpbic petrology and structural geology of the area east of Harrison Lake, British Columbia. Unpub. PhD thesis, Univ. Washington.

Mattinson, J. M. (1970):
Uranium-lead geochronology of the northern Cascade Mountains, Washington. Geol. Soc. America, Abstracts with Programs, vol. 2, no. 2, p. 116

McTaggart, K. C. and R. M. Thompson (1967):
Geology of part of the northern Cascades in southern British Columbia. Can. Jour. Earth Sci., vol. 4, p. 1199-1228.

Monger, J. W. H. (1970):
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Pigage, L. C. (1972):
Metamorphism and structure in the Fraser Canyon near Yale, British Columbia. Unpub. MSc thesis, Univ. British Columbia.

Read, P. B. (1960):
Geology of the Fraser Valley Between Hope and Emory Creek, British Columbia. Unpub. MASc thesis, Univ. British Columbia.

PBR/72

SPUZZUM INTRUSIONS AND HOZAMEEN GNEISS - NORTH OF YALE

Location:

On the Trans-Canada Highway 5 miles north of Yale. Park on the mountain side (northwest) of the road in an area where broken rock may have been removed for road fill. Roadcuts of interest are on northwest side of road and northward of the parking spot. WATCH OUT FOR TRAFFIC!!!!!!!!

General Geology:

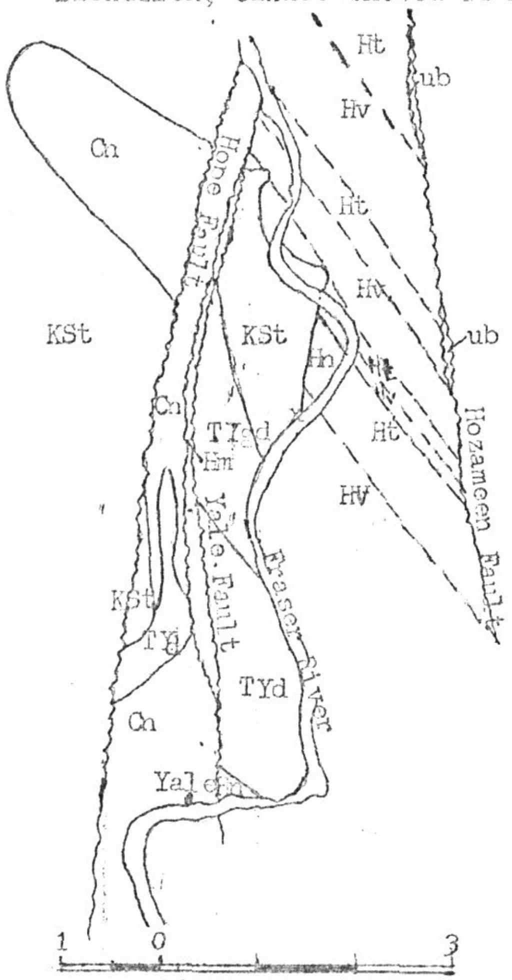
A series of granitic intrusions core the Cascades from south of the International Boundary to the Fraser River by Hope and continues northward northward along the eastern side of the Coast Crystalline Complex. These stocks and batholiths vary in size and age from the Spuzzum Intrusion here, one of the largest batholithic complexes in the Coast Crystalline Complex, (76 m.y. 103 m.y.); the Yale Intrusions (59 m.y.); the Chilliwack Batholith in the vicinity of Chilliwack Lake (26 to 29 m.y.); to the Mount Barr Batholith (16 to 21 m.y.) bordering the Spuszum Intrusions on the south and southwest. West of Hope, the Spuzzum Intrusions consist of two intrusive phases. The older phase is a zoned diorite, forming the central part which is surrounded by a younger mafic tonalite. Along its tonalite, eastern margin, faults of the Fraser River Fault System displace the Spuzzum, Yale Intrusions and adjacent metamorphic rocks. These metamorphic rocks consist of the Custer Gneiss and gneisses of the Hozameen Group. Mesoscopic structures in the rocks between the Hozameen and Yale Faults indicate these rocks form the northeast limb of a southeast plunging antiform. Between Hope and Yale faults, mesoscopic folds plunge moderately northwestward. Distribution of geological units and their relations are taken from Bremner (1973).

Local Geology:

Driving north from Lake of the Woods (Schkam Lake) to Yale, you pass through white, shattered outcrops of pegmatitic Custer Gneiss lying between Hope Fault to the west and Yale Fault to the east. The first roadcut east of Yale exposes well-layered, pegmatite-poor gneiss which is relatively unshattered. This gneiss has been included with the Custer Gneiss (McTaggart and Thompson, 1967) and with the Hozameen Gneiss (Bremner, 1973). North of Yale tunnel outcrops show leucocratic dykes of foliated biotite granodiorite cutting melanocratic, unfoliated diorite which comprise the Yale Intrusions. Inclusions up to a few hundred yards long of gneiss, schist and marble are metamorphosed sediments and volcanics of the Hozameen Group. About ½ a mile southwest of the parking spot we cross from the Yale Intrusions into the older Spuzzum tonalite. Here the Spuzzum is a well-foliated hornblende-biotite tonalite with a foliation that is locally folded. Northeasterly along the road, gneisses, schists, and locally marble with assemblages in the hornblende hornfels facies lie adjacent to the Spuzzum. Southeasterly along the strike of foliation and bedding these rocks pass within a mile into greenschist facies rocks of the Hozameen Group. A metamorphic transition such as this substantiate McTaggart and Thompson's (1967) argument that the Custer was probably formed during regional metamorphism and migmatization of Hozameen strata. However, data such as: (a) some Custer Gneiss appears to have an earlier phase of deformation not recorded in the Hozameen Group; (b) extensive pegmatites are present in some Custer Gneiss but not in gneiss transitional into Hozameen; and (c) widespread tectonic contacts between pegmatitic gneisses and adjacent low grade metamorphic rocks of the Hozameen Group indicate other alternatives should be examined. These features combined with zircon dating of the correlative Skagit Gneiss in northern Washington suggest the Custer Gneiss may have a complex history. Mattinson noted that zircons from the Skagit Gneiss have highly discordant ages and may have crystallized as early as

2000 m.y. ago. These zircons record a 60 to 90 m.y. metamorphism and project to primary intercepts on a concordia plot in the range 2000 m.y. to 800 m.y. A single Pb^{207}/Pb^{206} ratio gives an age of 428±10m.y. These data indicate a Precambrian age for possibly detrital zircons. Resolution of the conflicting evidence on the age of the Custer Gneiss may require that old and young gneisses have been affected by an intense mid-Cretaceous metamorphic event.

Position of the faulted slivers of Spuzzum (76 to 103 m.y.) suggests that the dextral strike-slip component of fault movement on the combined Yale and Hope faults, which separate these slivers from the main Batholith, cannot exceed 12 miles since middle Cretaceous.



Miles
modified from Bremner (1973)

TERTIARY
Yale Intrusions

TYgd foliated biotite granodiorite

TYd massive diorite

CRETACEOUS
Spuzzum Intrusions

KSt foliated hornblende-biotite tonalite

UPPER PALEOZOIC and/or TRIASSIC

ub serpentinite

Hozameen Group

Ht chert, argillite

Hv greenstone

Hn gneiss

Hm mylonitized Hozameen Group

UPPER PALEOZOIC and/or TRIASSIC and EARLIER
Custer Gneiss

Cn pegmatitic gneiss

References:

Bremner T. J. (1973):
Metamorphism in the Fraser Canyon, British Columbia. unpub. MSc thesis, University of British Columbia, Dept. Geol. Sci., pp. 92

Mattinson, J. M. (1972):
Ages of Zircons from the Northern Cascade Mountains, Washington. Geol. Soc. Amer. Bull., vol. 83, p. 3769-3784.

McTaggart, K. C. and R. M. Thompson (1967):
Geology of part of the northern Cascades in Southern British Columbia. Can. Jour. Earth Sci., vol. 4, p. 1199-1228.

Monger, J.W.H. (1970):
Hope Map-Area, British Columbia. Geol. Surv. Canada, Paper 69-47.

Richards, T. A. (1971):
Plutonic rocks between Hope and the 49th Parallel. Unpub. PhD. thesis Univ. British Columbia, Dept. Geol. Sci.

Richards, T. A. and W. H. White (1970):
K-Ar ages of plutonic rocks between Hope, British Columbia, and the 49th Parallel. Can. Jour. Earth Sci., vol. 7, p. 1203-1207.

LADNER GROUP - 9 MILE CREEK

Location:

Roadcuts on the east side of Highway 1 at the south end of 9 Mile (Ainslie) Creek bridge. Parking on the east road shoulder in front of roadcuts.

General Geology:

Rocks of the Ladner Group underlie a northwest trending belt extending from south of the International Boundary to here at its northernmost extremity. Slate interbedded with sandstone are characteristic of the northern part but southeastwards the unit consists mainly of volcanic sandstones and pelites interbedded with flows and pyroclastics. Graded bedding, groove casts, and flute casts indicate these rocks were deposited by turbidity currents. This unit forms a northwesterly trending syncline best exposed in Manning Park but northwestwards Needle Peak pluton and Hozameen and other faults respectively intrude and transect the limbs. In Manning Park, Coates (1970) restricted the Ladner Group to Early to Middle Jurassic age (Toarcian and Bajocian) prior to a Bathonian hiatus. Northwestward the ammonite fauna disappears and these northern rocks are of uncertain age.

Local Geology:

Light to dark grey slate interbedded with light grey siltstone form a well-bedded sequence cut by slaty cleavage. Look carefully for sedimentary features to give facing of the sequence; estimate the respective attitudes of bedding and slaty cleavage; and note the sense of asymmetry (or vergence) of any folds present.

Questions:

1. Which direction does the sequence face and on what feature do you base the facing direction?

2. If the sequence has been deformed only once, which direction would this sequence face if you use the bedding-slaty cleavage relationship?

3. Using the sense of asymmetry (or vergence) of folding, we are presently on, which limb of the major structure of the Ladner Group?

References:

Coates, J.A. (1970):
Stratigraphy and Structure of Manning Park area, Cascade Mountains, British Columbia. Geol. Assoc. Canada, Spec. Pap. No. 6, p. 149-154.

Monger, J.W.H. (1970)
Hope Map-area, West Half, British Columbia. Geol. Surv. Canada, Paper 69-47, p. 14-15.

PBR/72

JACKASS MOUNTAIN GROUP

Location:

Roadcuts on East side of Trans-Canada Highway at Jackass Mountain, about 11 miles south of Lytton. Park in parking area for viewpoint on west side of the highway.

General Geology:

The Jackass Mountain Group, of Early Cretaceous age, has a maximum thickness of about 14,000 feet. It is dominantly marine, but intertongues with and is partly overlain by the non-marine Pasayten Group south of Lat. 49°30' N. The Jackass Mountain Group extends in a NNW direction for over 200 miles from northern Washington to about Lat. 52°N. Much of the unit consists of greywacke, siltstone, and argillite, but conglomerates make up a significant part of the middle of the group. The clasts of the conglomerates were derived largely from the east and consist dominantly of leucocratic plutonic rocks.

Local Geology:

The outcrop immediately across the highway from the parking area consists of interbedded conglomerates, sandstones, and siltstones. The conglomerates are lenticular, with many of the lenses terminating quite abruptly. The clasts are well rounded and composed of several different lithologies. They are not grain supported, but are suspended within a matrix of sand and finer material. Note that the long axes of the clasts are oriented randomly, with no indication of imbrication or preferred orientation. Some of the finer grained units are pebbly mudstones, and contain pebbles similar to the clasts of the conglomerates. The bimodal nature of these sediments suggests that they are not the products of "normal" depositional processes.

Fractures in this outcrop cut through clasts and matrix alike. Some of these fractures are calcite filled. Others show slickensiding.

The next outcrop to the south on the east side of the highway is composed of pelitic sediments, also part of the Jackass Mountain Group. Note the graded stratification with abundant mud clasts in the lower portions of each graded unit, the load casts at their bases, and the abundant soft sediment normal faulting.

Question:

What textural differences are there between the Jackass Mountain and the Eocene conglomerates?

References:

Duffell, S., and K.C. McTaggart, (1952):
Ashcroft Map-area, British Columbia: Geol. Survey Canada Mem. 262.

Coates, J.A. (1970):
Stratigraphy and structure of the Manning Park area, Cascade Mountains, British Columbia, *in* Wheeler, J.O., ed., Structure of the southern Canadian Cordillera: Geol. Assoc. Canada Sp. Paper No. 6, p. 149-154.

WCB/72

SPENCES BRIDGE GROUP - SPENCES BRIDGE

Location:

Roadcuts on northwest side of Highway 1 at north end of bridge crossing Thompson River at Spences Bridge. Parking on southeast (river side of highway.

General Geology:

The Spences Bridge Group which underlies about 500 square miles of the Ashcroft Map-area, outcrops along the Thompson River from Nicoamen River 11 miles south of here to Martel 6 miles north of here. The Group consists mainly of lavas and pyroclastic rocks interbedded with minor conglomerate, sandstone and waterlain tuff. The volcanic rocks are typically volcanic breccia and agglomerate of andesite or dacite composition with less common rhyolite and basalt. Vesicular and amygdaloidal flows with plagioclase phenocrysts outcrop locally. Gentle folding of the more than 5000' thickness of the Group results in dips up to 40 degrees in the subhorizontal regional attitude. Plant fossils establish the age of the Spences Bridge Group as Late Lower Cretaceous (Aptian). This age falls within the depositional interval of the marine Jackass Mountain Group exposed only 15 miles to the west.

Local Geology:

The dominant rock is an amygdaloidal, grey-weathering andesite with fine andesine partly replaced by albite, laumontite and chlorite and dark green stubby augite phenocrysts. Northwestward along the outcrop the andesite is cut by a 3 to 4 foot wide andesite dyke with dark, chilled and vesiculated margins and at the northern end of the outcrop by a tan weathering, porphyritic (andesine partly albitized, hornblende and augite) andesite dyke. This 12 foot wide dyke grades from buff through grey to a phenocryst-free green-grey margin. Look carefully to locate the dyke contacts.

Zeolites, carbonate and quartz fill amygdules and fractures. The light amygdules commonly have a margin of a dull white, fine-grained mixture of quartz and laumontite ($CaAl_2Si_4O_{12}.4H_2O$) passing inward to vitreous quartz with rhombohedral terminations and/or calcite with squat modified rhombohedra, fibrous, pearly white laumontite and clear sheaves of prehnite ($Ca_2Al_2Si_3O_{10}(OH)_2$) hardness = 6 with one good cleavage. Thin fracture fillings are commonly calcite but thicker fracture fillings up to 6 inches wide consist of the above mineralogy plus clear, vitreous datolite ($CaBSiO_4(OH)$) hardness = 5 and granular. The massive prehnite is dull white. The small dark green amygdules are chlorite. This mineralogy is consistent with zeolite facies metamorphism. Earlier geological work in Ashcroft and adjacent areas gives scattered zeolite and prehnite occurrences. The predominance of unstable volcanogenic material and upper Mesozoic age of rocks in this region suggest a metamorphic study of the area would successfully answer speculations on the regional nature of the metamorphism.

On approaching or leaving this stop, notice the steeply dipping dykes in the hillside northwest of the roadcut. These dykes parallel those of the roadcut. The gentle attitude of the volcanic rocks can be verified in roadcuts either north or south of the stop.

Questions:

1. Should vesicles or amygdules be used as criteria in favour of a lava flow versus sills or dykes?

2. Would you expect a different distribution of vesicles or amygdules in a flow versus that found in sills or dykes?

3. Are the distribution and shape of amygdules useful for determining the attitude of the flows at this locality?

4. The alteration minerals are mainly hydrous calcium alumino silicates. Where might this material come from?

References:

Coates, J.A. (1970):
Stratigraphy and Structure of Manning Park Area, Cascade Mountains, British Columbia. Geol. Assoc. Canada, Spec. Pap., 6, p. 149-154.

Duffell, S. and K.C. McTaggart (1952):
Ashcroft Map-Area, British Columbia. Geol. Surv. Canada, Mem. 262, p. 52-55.

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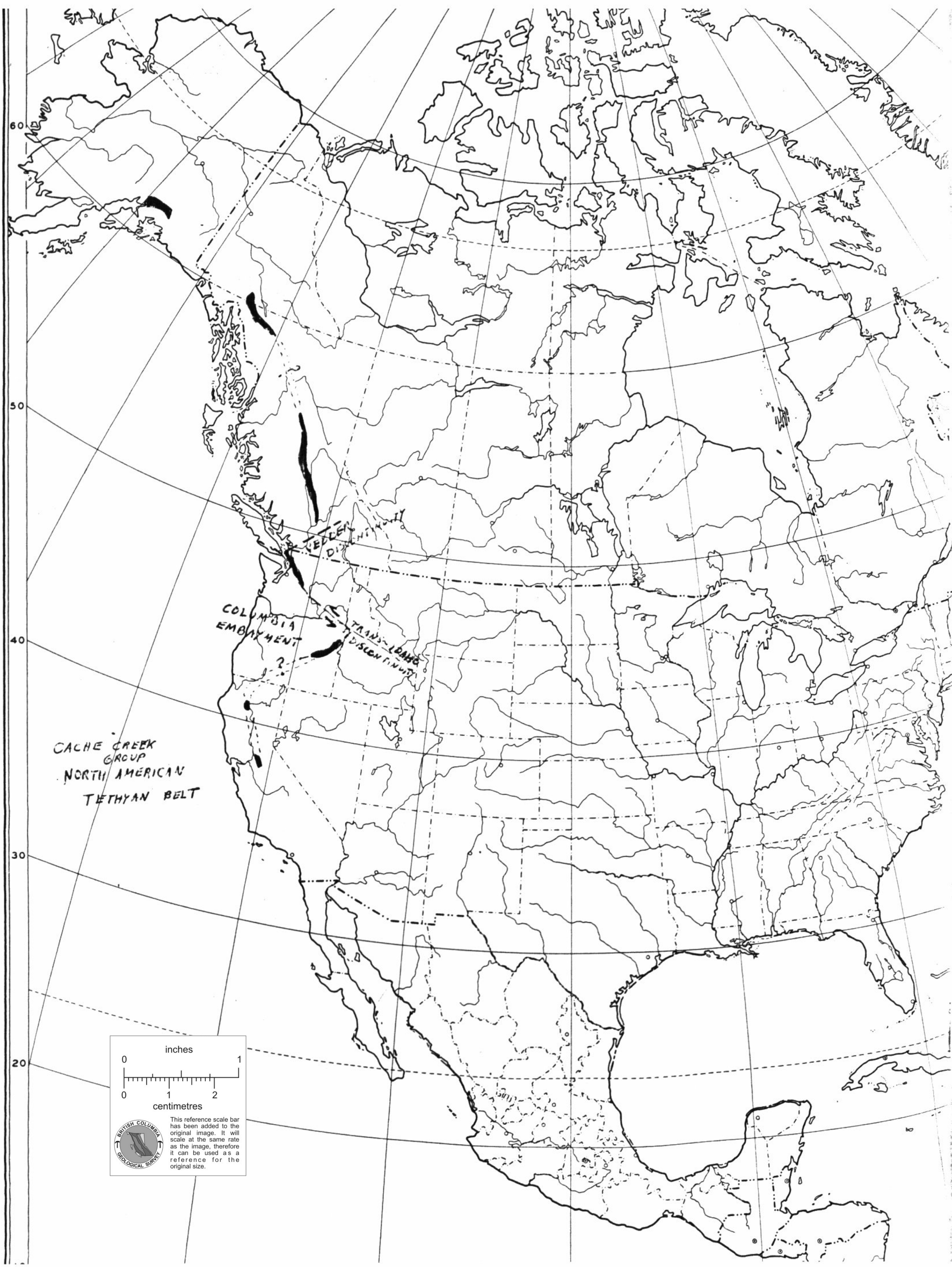
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GIANT MASCOT MINE

(92H/6)

By P. A. Christopher

INTRODUCTION

The Giant Mascot mine (latitude 49° 25'-30', longitude 121° 12'-18', New Westminster Mining Division) represents the only significant nickel producer in British Columbia. With the depletion of ore reserves and closure of the mine imminent, a study of the deposit was undertaken to consolidate geological data for future reference in exploring ultramafic rocks in this and other parts of the Canadian Cordillera. The study has included underground mapping, core logging, surface mapping, examination of showings, sampling for petrographic and geochemical studies, and a review of mine plans and engineering reports.

This report incorporates data compiled by the geological and engineering staff of Giant Mascot Mines Limited. The assistance and information provided by F. W. Holland (mine manager), L. DeRoux (mine geologist), and R. Gonzalez (exploration geologist) are acknowledged.

HISTORY

The initial discovery on the Giant Mascot mine property (also called: Pride of Emory mine, B.C. Nickel, Pacific Nickel, Western Nickel, and Giant Nickel mine) was made in 1923 when Carl Zofka, a trapper, located outcrops of the Pride of Emory orebody on Emory Mountain. B.C. Nickel Company was reorganized as B.C. Nickel Mines, Ltd. by the Smith, Sloan, Spencer Syndicate. Refinancing permitted underground development on the 3550 (No. 1 tunnel) and 3275 (No. 2 or Chinaman tunnel) levels. By 1937 the Syndicate had spent $1,300,000 to develop 1.2 million tons of ore at 1.38 per cent nickel and 0.50 per cent copper. Four ore shipments, totalling 2,134 short tons at 5 per cent nickel were made to Japan for test purposes and gross returns of $63,600 were obtained.

In 1938 B.C. Nickel Mines, Ltd. was reorganized as Pacific Nickel Mines Limited, but poor market conditions caused the property to remain idle till 1942. In 1952, Western Nickel Mines Limited was formed as an operating company of Newmont Mining Corporation of Canada Limited and Pacific Nickel Mines Limited. The property was further explored by establishing the 2600 (main haulage), 2950, and 3250 levels and connecting the levels with an internal inclined shaft. A favourable sales contract was arranged by Western Nickel and from January to July of 1958, under the management of The Granby Mining and Smelting Company Limited, 181,133 tons of ore was treated before market conditions again forced closure.

In 1959 Newmont's interest in the property was sold to Giant Mascot Mines Limited and Giant Nickel Mines Limited was formed as an operating company. In March of 1961, The first three sets appear to provide ground preparation and access for ore while the fourth group appears to be post ore and often displaces ore zones. Tectonic and intrusive breccia zones and agmatite are found to be spatially related to several orebodies and breccia fragments are found in some massive ores. The genetic relationship between breccia zones and ore deposits is not clear, but remobilization is apparent in some of the breccia ore.

Alteration seems to be closely related to structure and intrusive contacts and, therefore, is often associated with orebodies. Four main types have been recognized: (1) crumbly alteration (also called pervasive shearing), (2) talc - amphibole ± magnetite, (3) uralitization, and (4) hornblendization. Crumbly alteration is a descriptive term applied to breakdown of olivine grains to micaceous minerals (phlogopite and chlorite) and to where intense serpentine is formed. Crumbly alteration is generally restricted to peridotite or dunite and is often present as a partial envelope around orebodies. Talc-amphibole alteration is generally associated with intensely faulted or fractured bodies of pyroxenite and is often found adjacent to the ore zones. Although alteration is generally present as a partial envelope around orebodies, there is no established pattern that can be relied upon as an ore indicator.

Twenty-eight mineral deposits have been outlined within the main ultramafic mass (Figs. 3 and 4). Of these deposits, production has been obtained from twenty-two, and five (4600, Pride of Emory, 1500, Brunswick 2, and Brunswick 5) accounted for over two-thirds of the production. Pipe-like orebodies range from a vertical continuity of 1,200 feet to 100 feet and have horizontal sections ranging from 250 by 120 feet to 20 by 40 feet. The orebodies can be divided into three types: (1) zoned, in which sulphides are disseminated through one or more rock types and show gradational change in tenor (for example, Brunswick Nos. 1, 5, 6 and 4600, 1900, and 512), (2) massive, generally confined to fault or contact zones and having sharp contacts (for example, Pride of Emory and Brunswick Nos. 2, 8, and 9), (3) vein, narrow tabular bodies that may enrich an ore zone but have limited tonnage potential.

SUMMARY

A geological study is presently being conducted at the Giant Mascot mie near Hope, to consolidate geological information on this unique deposit. Chemical and petrographic examinations to be carried out should help define ore controls and consolidate genetic theories.

Since low-grade reserves are present within the ultramafic complex and less than a third of the known ultramafic complex has been explored by underground development, this deposit provides an intriguing exploration target.

REFERENCE

Clark, W. E. (1969): Giant Mascot Mines Ltd., Geology and Ore Control, *Western Miner,* No. 42, pp. 40-46.

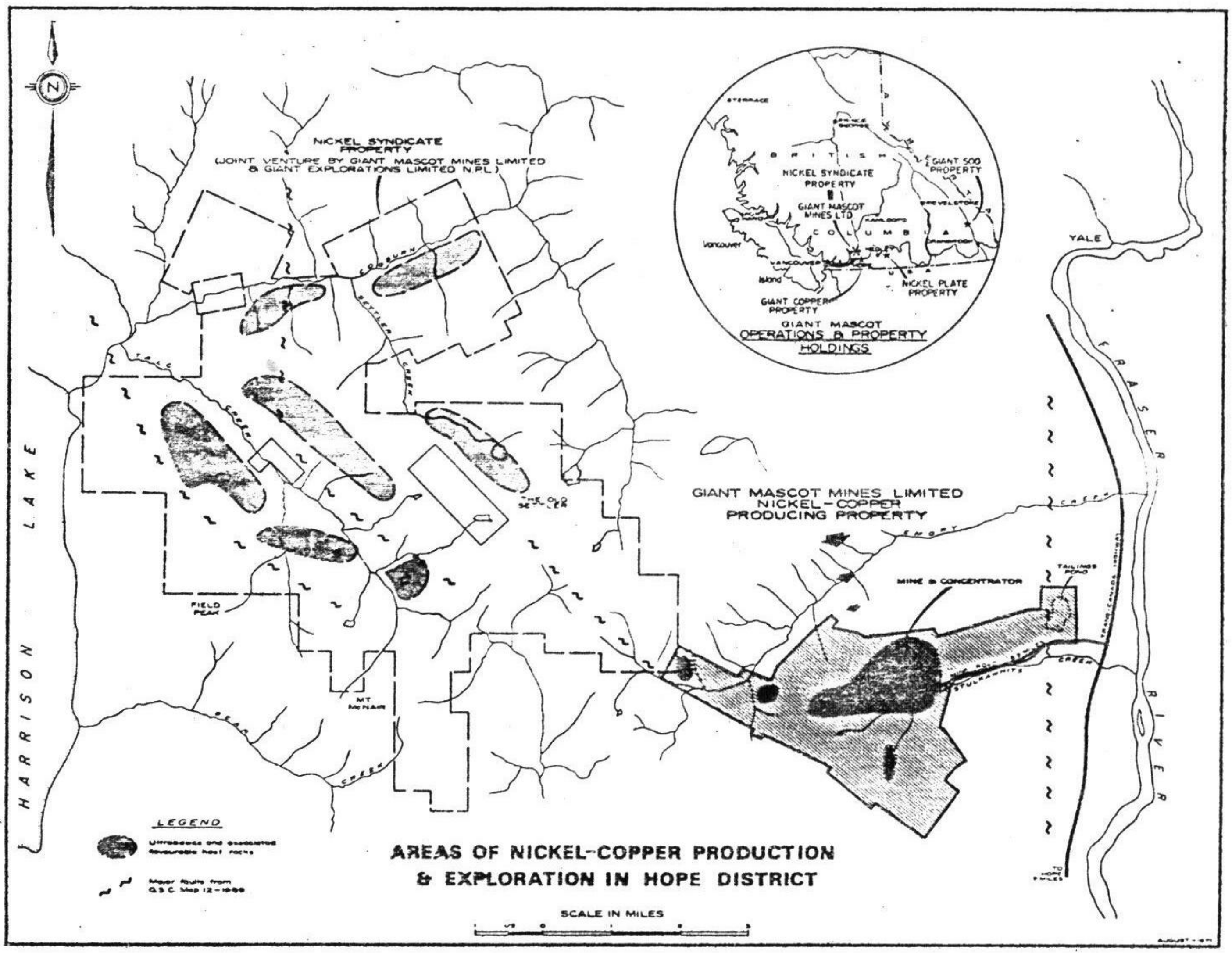

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TABLE 3:

Remaining Mineral Reserves at the Giant Mascot Mine

Deposit Name	Original* tonnage	Original* grade Ni; Cu	Remaining* tonnage	Remaining* grade	Location in mine
Brunswick 2	570,000	1.40;0.60	36,600	0.79;0.28	above and below 2600 level
Brunswick 2A	290,000	0.98;0.35	12,500	?	above 3550 level
2663	102,000	0.86;0.32	61,700	0.61;0.23	footwall of shaft
6800	47,000	0.66;0.24	all	same	between 2950 and 3250 levels
	54,000	0.57;0.21	all	same	
	66,500	0.53;0.18	all	same	
600	83,000	1.42;0.42	1,536	1.42;0.42	below 3225 level
Portal Zone	2,375,000	0.25;0.11	all	same	below 2700' elevation near 2600 portal
4600	805,000	1.35;0.73	46,800	0.81;0.85	mainly in 2950 pillar
4400	27,250	0.51;0.22	all	same	ENE of4600
4300	62,000	0.91;0.51	11,400	1.14;0.70	between 3200 and 3275; broken and in place; left because of shaft breakdown
2000	3,400	1.33;0.33	1,750	1.33;0.33	between 2625' and 2655'
1800	40,000	0.53;0.23	all	same	between 3225' and 3340'
1700 showing	1,000	approx. 2% Ni	all	same	
1500	668,000	1.37;0.45	48,000	0.75;0.29	2950 Level pillar
1400	53,000	0.71;0.32	21;000	0.64;0.41	In place above 3550 level
Chinaman	376,300	0.73;0.30	127,000	0.73;0.30	Between 3000 and 3393'
Climax	210,700	0.78;0.36	22,000	0.78;0.36	3050 level pillar

* Estimates based on company reports, mine plans, and information provided by company engineers. Where data was available, values were recalculated and checked by N. Berg

Soil Profiles of Emory Cr. Showing
(Giant Mascot Property)

Scale 1" = 2'

0 1 2 3 FEET

Ni	Cu.	Co (p.p.m)	Sample	Horizon / Description
23	34	9	P24	(Peat) Organic
26	49	10	P23	(Soil) Dark red brown
61	54	15	P22	B: Light Red Brown, Minor Root Mat.
120	93	17	P21	B
222	144	23	P20	B
219	138	18	P19	C: Grey Sand and Clay Poorly Sorted
510	150	21	P18	C
623	173	24	P17	C
540	87	22	P16	C
465	66	19	P15	C
429	53	20	P14	C
794	102	24	P13	C
9525	5430	245	P12	Decomposed Bedrock

All horizions have Boulders and Cobbles

Horizon / Description	Sample	Ni	Cu.	Co (p.p.m)
30-50% Organic	P11	30	27	13
B: Red-Brown Diorite and Schist Cobbles and Boulders	P10	38	49	14
B	P9	65	58	14
B	P8	74	71	14
C: Poor Sorting, Grey Sand and Clay, Diorite Cobbles and Boulders	P7	289	129	17
C	P6	405	165	24
C	P5	474	161	21
C	P4	1095	197	24
C	P3	11145	233	25
C	P2	2250	451	47
Decomposed Bedrock	P1	(6.33%)	(1.83%)	3050

Bedrock

8ft North East

All of the various types of alteration are closely controlled by, and localized along, joints, faults, dikes, and intrusive contacts.

Since orthopyroxene is unaffected while olivine is serp. the serp. may be int. as having been produced by whatever sol. entering the rocks below 350°C (.

$$2 Fe\, Si_{1/2}\, O_2 + S_2 = 2 FeS + SiO_2 + O_2$$

(Muir.) The lack of any extensive alteration or replacement within the rocks as well as the indications of widespread silicate - sulfide equilibrium points more strongly towards a theory of magmatic sulfides than sulfides having formed by a process such as "sulfurization".

OLIVINE

Aho

Structure: N 75° W ; trend to main mineralized zone

Dikes, veins & Alteration:

Alteration

Uralization is widespread

1.) Widespread, especially in feldspathic rocks.
px → actinolite cores, rims of green hbd., chl., biotite and mag.

Steatization (talc, carbonate, anthophyllite)

Serpentinization: peridotites

incipiently serpentinized peridotites and olivine px → crumbly rx.

Sequence: Poikilitic plates of phlogopite → chlorite → serpentine.

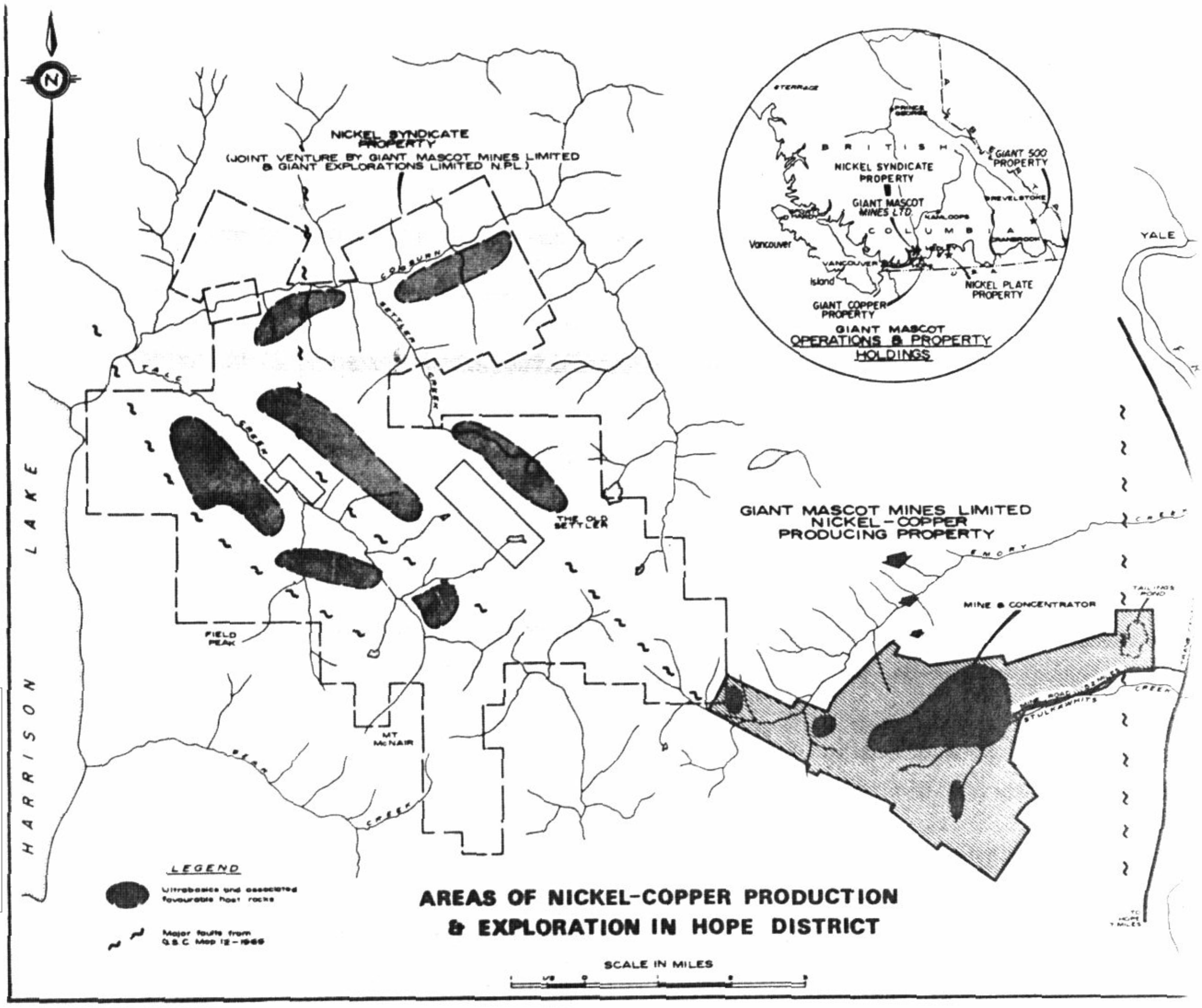
Olivine → Phlogopite → chlorite → serpentinite

Mg_2SiO_4 FORSTERITE FAYALITE $(Mg, Fe)_2 SiO_4$ → (Phlogopite) $\underline{K} Mg_3 (AlSi_3O_{10})(OH)_2$

→ $(Mg, Fe, Al)_6 (Al, Si)_4 O_{10} (OH)_8$

→ SERP. $Mg_6 Si_4 O_{10} (OH)_8$

Serpentine decomposes at about 500°C to
$Mg_2SiO_4 + Mg_3Si_4O_{10}(OH)_2 + H_2O$ (TALC)



AREAS OF NICKEL-COPPER PRODUCTION & EXPLORATION IN HOPE DISTRICT

probably little post-ore movement, they show distinct continuity. The relationships of intersecting fault systems with known ore bodies and mineralized zones presents interesting implications.

The geological interpretation on the accompanying map of the 3550 and Chinaman's Tunnel illustrates these concepts and demonstrates the value of the long-hole diamond drilling program in delineating structural and mineralization trends that with additional detailed exploration could result in the location of ore shoots. At least five northwesterly trending fault zones have been traced over strike lengths up to 2000 ft. and all are associated with important mineralization or actual ore bodies. The area of the Brunswick ore bodies is cut by three northwesterly trending faults, as well as numerous generally north-south striking structures. It is of interest that mineralized ultrabasic rocks have been intersected southeast of the Brunswick zone along these fault structures, in areas previously believed to be occupied by non-productive diorites. Similar extensions of favourable zones may be found along the north-westerly structural trend that is closely associated with the 4600, 4400, 1900, 1600 and 1500 ore shoots. The Chinaman ore zone currently being developed from the 3050 level lies between two strong structures striking N30°W and N50°W respectively.

Further evidence of the importance of structural control is the fact that ore bodies may occur in either peridotite or pyroxenite, with the only obvious reason for selectivity being the presence of faulting and fracturing. The plunges or rakes of ore bodies mined to date may be variable even within the same ore body, suggesting change of ore control from one intersecting ore fault system to another.

The general conclusions which may be drawn to date are that structural trends, as exemplified by present fault patterns, have influenced the intrusion of the ultrabasic host rocks, with further controls on economic sulphide deposition being exerted by the intersection of the two main fault directions. The obvious spatial relationship of known ore bodies to the diorite — ultrabasic contacts cannot be ignored, and while no chemical or mineralogical reasons have as yet been diagnosed, it appears quite possible that particularly favourable structures within the ultrabasics could be developed adjacent to such contacts.

MINERALIZATI

Mineralization occurs clusively in the ultrabasic seminated and massive pyrrhotite (iron), pentlan and chalcopyrite (co pyrrhotite (pale nickelife forms a coarse grained m regular grains of pent chalcopyrite lying betwee the pyrrhotite grains.

In the disseminated ore. minerals are interstitial to in the host rock and u crystallized after the silic In the massive sulphid fractured coarse pentla mutual boundaries with host pyrrhotite. Chalcop regular patches or discret contact of pentlandite a and apparently is later t latter minerals.

The possibility of mas deposits representin sulphide injection and dis posits being hydrotherma has been suggested, bu constancy of the nickel- thoughout the mine doe this theory.