PROPERTY EXAMINATION REPORT

LOIS MINERAL CLAIMS

Lat. 50° 16' N
Long. 127° 37' W

BROOKS PENINSULA AREA

VANCOUVER ISLAND, B.C.

NANAIMO AND ALBERNI MINING DIVISIONS

by

G.H. Rayner, P.Eng.

August 29, 1974

TABLE OF CONTENTS

CONCLUSIONS

The Lois complex is clearly a porphyry copper type of environment. The preliminary work done to date has not indicated any good drilling targets. Neither has it outlined any zoning or other patterns that appear likely to lead to a good target.

In spite of this, environments of this type are sufficiently rare that further work is justified on the property. In the writer's opinion, the potential of the ground has not been fully explored and further basic work is warranted.

Of the peripheral zones, only the south rhyolite breccia deserves further work at this time.

RECOMMENDATIONS

Lois Stock Proper:

1. The geology of the stock should be remapped on a scale of 200 feet to the inch. Close attention should be paid to alteration and sulphide mineralogy.
2. The grid should be extended to the southern edge of the stock and this area geologically mapped, soil sampled and surveyed with a ground magnetometer.
3. The Induced Polarization coverage should be extended to the south, at least to close off the anomaly over the rhyolite breccia and perhaps to the south margin of the stock.
4. A rock chip geochemical survey should be run on the available outcrop within the boundaries of the complex.
5. If the soil samples from the Vanco geochemical survey can be located, they should all be run for zinc.
6. For additional background, the Rio Tinto data on the property should be acquired if possible.

South Rhyolite Breccia:

The south rhyolite breccia area should be mapped in detail. Outcrops should be thoroughly sampled for gold, silver, copper and arsenic. A spectrographic check on a composite sample should also be run.

In addition, a fairly closely spaced grid should be cut over the immediate area and geochemically soil sampled for the above elements.

INTRODUCTION

On the Lois property, a quartz diorite intrusive complex cuts volcanic rocks of the Vancouver Group. Numerous features associated with porphyry copper-type deposits are present.

At the request of Mr. Richard Somerville of Imperial Oil Limited, Vancouver, B.C., nine days were spent on the property from July 20th to 28th, 1974. The object of the examination was to review the data on hand and to suggest a course of action for further development if warranted.

Mr. Randy Clarkson, student, assisted in the work.

LOCATION AND ACCESS

The property is located about eleven miles southwest of the village of Port Alice on northwestern Vancouver Island. The claims straddle the rounded ridge separating the Little Klaskish River drainage on the north and the Nesparti River drainage on the south.

Access to the property is by helicopter, either from the end of the road at Port Alice or from the helicopter charter base at Port Hardy about thirty miles to the northeast.

Logging roads penetrate the Klaskish and Mahatta River valleys to the north of the property, however, neither of these road systems connects with the main Vancouver Island road network.

The property lies about four miles east of the Pacific Ocean at Klaskish Inlet.

Elevations in the area of interest vary between 1,000 and 2,900 feet above sea level.

HISTORY AND PREVIOUS WORK

The first known work on the property was by Rio Tinto Canadian Exploration Ltd., who staked the ground in 1963. During 1963 and 1964, Rio carried out a work program which included geochemical surveys, limited geological and self-potential surveys and four diamond drill holes. The results of this work are not at hand at the moment and some effort should be made to obtain them if possible.

In 1969, the ground was restaked by Vanco Explorations Ltd. of Vancouver, B.C. Vanco conducted geological, geochemical and ground magnetometer surveys over the Lois stock and the surrounding area. In addition, about ten line miles of Induced Polarization survey were run over the northern portion of the stock.

GENERAL GEOLOGY

In the Lois area, a complex quartz diorite stock intrudes rocks of the Vancouver Group. The Vancouver Group is Upper Triassic to Lower Jurassic in age. It is composed of three members, the lower Karmutsen Formation, overlain by the Quatsino Formation and the Bonanza Subgroup.

The Karmutsen Formation is composed of various basaltic volcanics with some sediments in the upper part. The Quatsino is almost entirely limestone. The Bonanza is mainly andesitic volcanic material in the upper part, with some sediments in the lower part.

Regional mapping by Imperial Oil indicates that Karmutsen rocks enclose the Lois stock except on the northern edge, where it is probably in contact with lower Bonanza rocks. The Quatsino, if present, is either poorly developed or poorly exposed in this area.

PROPERTY GEOLOGY

Vancouver Group:

Basaltic flows of the Karmutsen Formation are the major representatives of the Vancouver Group in the area. The Lois complex is in contact with these rocks on all sides except perhaps the north. Some grey limestone and thin bedded argillites are found in the Karmutsen. The amount of this material increases to the north until, in the exposures to the northeast of the stock, it makes up 20 to 30 percent of the section. This sedimentary material is believed to represent the uppermost Karmutsen.

Karmutsen rocks seem to be little affected by the Lois intrusion. There is some hornfelsing near the contact but the effects do not penetrate the flows very far. Beyond about 100 feet from the contact, the only effects noted are dykes, rare veins and one rhyolite breccia zone. A magnetite body replacing limestone about 2,000 feet northeast of the stock may also be related to it.

Regional mapping by Imperial Oil geologists indicates that rocks of the Bonanza Subgroup and perhaps of the Quatsino Formation may be in contact with the complex on the north. This is consistent with the increasing sedimentary component in the northernmost Karmutsen exposures.

Quartz Diorite:

The oldest unit in the complex is a medium to coarse grained hypidiomorphic textured quartz diorite. It forms the outer portion of the intrusive complex and makes up over half of it. It is composed of about 70 percent plagioclase with about 20 percent quartz and 10 percent mafic minerals. The mafics are mainly hornblende with variable amounts of primary biotite.

A narrow band or septum of this rock has been mapped as wrapping around the south side of the rhyolite breccia area. It seems likely that the rocks in this band are not quartz diorite but are part of the quartz diorite porphyry area to the south. Near the breccia body, the porphyry seems to have been altered and the porphyritic texture destroyed. This gives the rock a superficial resemblance to the quartz diorite.

Quartz Diorite Porphyry:

Quartz diorite porphyry occupies much of the core of the complex. In all, it makes up about one-third of the area of the intrusive. The porphyry is darker and slightly finer grained than the quartz diorite. Plagioclase makes up about 70 percent of the rock, mainly as phenocrysts. Quartz totals about 20 percent, with about half as phenocrysts and half as groundmass. The remaining 10 percent is made up of varying proportions of hornblende and primary biotite. The rock usually carries some secondary fine grained biotite as well, which is largely responsible for the darker grey colour.

In texture and grain size the rock is quite consistent throughout most exposures. It is usually moderately well fractured.

One clearly identifiable xenolith of quartz diorite was found in the porphyry, establishing an age relationship between these two rocks.

Rhyolite Breccia:

The rhyolite breccia is the youngest major unit in the complex. It underlies an oval shaped area in the core of the complex, oriented to the northwest. It is about 800 feet in width and 1,400 feet long, with a narrow, structurally controlled lobe extending an additional 600 feet to the north.

The breccia is a white to cream coloured rock that commonly weathers a pale yellowish-brown. It is strongly bleached and altered to clays so that details of structures and textures are often unclear. Most of the exposures seen in the zone are definitely of breccia but some areas may be a highly xenolithic altered rhyolite.

Fragments are usually subrounded and grade in size from dust to three feet. The bulk of the fragments are of rhyolite but in some exposures a high proportion appear to have once been quartz diorite or quartz diorite porphyry.

About one quarter of the breccia exposures show a banding that is probably flow banding. In some areas it is quite fine and in others quite coarse, with bands to one inch in thickness. This coarser flow structure is often developed in a fine grained breccia (?) that may be a highly xenolithic rhyolite. Banding attitudes are variable and locally sinuous. Dips are usually steep.

Small areas of secondary breccia up to ten feet across are common. In one instance a secondary breccia is cut by a dyke-like third stage breccia about three inches wide. These later breccias are clearly crosscutting. They are normally composed of finer grained material than the enclosing breccia. Otherwise their composition and levels of alteration and mineralization are similar.

The similarities between this rhyolite breccia body and the breccias on the nearby Tent Group are too marked to be coincidental.

Clastic Unit:

Within the area previously mapped as quartz diorite porphyry, there is a substantial body of rock that, in the writer's opinion, is clearly not intrusive porphyry. This unit extends in a band about 500 feet wide from about L 16S, 6+00W to the area around L 28S, 14+00E, for a length of some 2,500 feet. It has not been delineated in detail and may be more extensive than this.

This clastic unit is composed of angular to subrounded fragments set in a fine grained groundmass. In the field, some of the fragments resembled the quartz diorite porphyry but because of their altered condition the identification was not certain. In two thin sections cut of this rock, all the fragments seen were of feldspar porphyries. The fragments exhibited a variety of textures. In general they appeared to be volcanic in origin. No clearly intrusive rock fragments were seen in thin section. None of the fragments contained quartz.

In thin section, the matrix showed definite clastic textures. It was composed of rock flour, fine fragments and broken crystal fragments. It also carries up to 10 percent

quartz as clear rounded grains. The origin of this quartz is uncertain. It may represent silicification.

In most exposures the clastic unit is strongly impregnated with secondary biotite. This tends to mask the fragmental texture, so that the rock often superficially resembles the quartz diorite porphyry.

The origin of the unit is not clear. It looks like a normal pyroclastic that has been caught up in the intrusive complex. However, no similar pyroclastics were seen in the surrounding volcanics. If it is a pyroclastic block, it may have undergone considerable vertical displacement during the development of the complex.

Dykes:

Several types of dykes cut the complex. The attitudes of all of them are similar, with strikes slightly east of north and steep dips.

Rhyolite dykes are the commonest type observed. They occur up to at least twenty feet in width. They are found cutting all phases of the complex from the Karmutsen basalts to the rhyolite breccia. Banding is often noted. Rhyolites are commonly porphyritic, with fine quartz phenocrysts in the one to two mm size range.

Andesite dykes are also fairly common. They range in thickness from about four feet to fifteen feet. They are fine grained, grey-green in colour and weakly porphyritic.

The phenocrysts in these dykes are a clear vitreous feldspar with one good cleavage. They are euhedral and occur as roughly square crystals or stubby prisms. In thin section, about 20 percent of them show a single twin plane and the rest are untwinned. They are believed to be sanidine.

Along their margins, andesite dykes often show a chilled band of glass a foot or more thick. Narrow glass dykes composed of similar material are seen at various places through the complex. It is notable that no narrow andesite dykes are observed nor any glass dykes wider than about four feet. It seems reasonable to conclude that these are merely textural varities of the same rock. The sanidine phenocrysts are equally abundant in both types.

One dyke of quartz-feldspar porphyry was seen cutting the rhyolite breccia near its center. It is about forty feet wide, vertical and striking at about 100 degrees. It is somewhat bleached and clay altered, indicating that these alteration processes were active some time after the emplacement of the rhyolite breccia.

The size and shape of the quartz and feldspar phenocrysts are reminiscent of the quartz diorite porphyry. Since their compositions are similar, it may be a late phase of this unit.

The only other dykes noted during the examination were three dark green basalts about three feet wide. All of these were cutting rhyolite breccia.

GEOCHEMISTRY

Previous work by Vanco included a soil geochemistry survey over the northern portion of the complex. The samples were analyzed for molybdenum, copper, lead and silver. A few were also analyzed for zinc.

Samples taken over the Karmutsen volcanics indicated scattered areas anomalous in copper and molybdenum to the northeast of the stock. There is also an area anomalous in lead to the southwest. Values in all of these metals within the stock were surprisingly low. Only one value of greater

than ten ppm molybdenum occurs within the stock, despite the fact that molybdenite has been reported at several points. Similarly, copper values are lower than would be expected from the observed mineralization. Neither copper nor molybdenum results form useful patterns within the stock. Only the scattered lead values in the rhyolite breccia area conform to expectations. Sphalerite and traces of galena were noted in this area of the complex.

The reasons for the low values and lack of contrast within the stock are not well understood. The rocks are not deeply leached. Fresh sulphides can be obtained with the hammer in most exposures. It appears that the chemistry of the soil developed on the stock prevents the retention of copper and molybdenum. No doubt conditions here are more acid than in the surrounding volcanics. Lead, a notably immobile element in soil, seems less affected.

During the Vanco program, 130 rock geochemical samples were collected. These were not numerous enough to develop any patterns but in copper they showed a greater variation than the soils values. In view of the unimpressive soil results within the stock and the poor understanding of soil chemistry in this area, perhaps rock geochemistry would be a useful tool.

GEOPHYSICS

The Vanco ground magnetometer survey outlines the northern portion of the stock quite clearly. The stock itself is quite subdued magnetically. The margins show a rim of highs, no doubt due to metasomatic effects. Beyond these highs there appears to be a band of magnetically low areas. These low areas are not completely covered by the survey. They may in part be a polarization effect.

Beyond the influence of the complex, the Karmutsen rocks show the irregular patterns typical of basic volcanics.

About ten line miles of Induced Polarization survey were run by McPhar Geophysics in 1970. This covered the northern half of the complex. No clear patterns have emerged from the results except an anomalous zone over the rhyolite breccia, reflecting its known higher sulphide content. There are some lower order anomalies over the northwestern portion of the complex and adjoining volcanics. Their significance is unknown at present. According to McPhar, they represent narrow sources.

ALTERATION

In the Lois complex, the most widespread type of alteration is the introduction of secondary biotite. Secondary biotite is common in all main units except the rhyolite breccia. It is so well distributed that it loses its usefulness as an indicator of areas favourable for copper deposition. It is not evenly distributed in all rock types. It is erratic in the quartz diorite, common in the quartz diorite porphyry and very abundant in the clastic unit.

Detailed mapping of secondary biotite will not pin-point a drill target. However, it will hopefully be useful in eliminating some areas from consideration, particularly in the southern portion of the complex.

The rhyolite breccia zone has been strongly bleached and altered to clays. Similar alteration effects can be seen with decreasing intensity for perhaps a hundred feet into the surrounding rocks. The alteration in this breccia is very similar to that in breccias on the nearby Tent Claim Group. The main difference is in the presence of minor amounts of chlorite in the Tent breccias.

The biotite and clay alteration types encompass all of the mapped portion of the Lois complex between them. As a result, there is no development of a normal porphyry copper alteration zoning pattern on the property.

MINERALIZATION AND ECONOMIC POTENTIAL

Significant amounts of economic minerals were noted in only two areas within the stock. One of these was in a small body of andesite porphyry in Drill Creek above the lower camp. The other was in and around the rhyolite breccia.

The andesite porphyry body in Drill Creek is about 200 feet in diameter. Sampling by Rio Tinto returned 200 feet of 0.15 percent copper. Vanco results were somewhat lower. The rock contains two to three percent arsenopyrite, in grains up to about four mm in size. Chalcopyrite is commonly associated with the arsenopyrite. Similar mineralization is present, but weaker, in the surrounding quartz diorite porphyry. Generally, the outlook for tonnage and grade in this area is not impressive.

Rio Tinto collared a diamond drill hole to test this zone. The hole did not go directly under the andesite outcrop. Core that is believed on petrological grounds to be from this drill hole is now located at the Fang camp, some two miles to the northeast. It presumably was taken there at a time when Rio Tinto was operating both properties. This core is entirely of quartz diorite porphyry. It shows only weak arsenopyrite and chalcopyrite mineralization.

The rhyolite breccia body contains the highest levels of sulphide mineralization in the complex. Sulphides are mainly disseminated through the breccia, with minor amounts occurring on fractures. Most of the breccia would carry from two to five percent pyrite. Arsenopyrite is also common in amounts up to two or three percent. Disseminated black

sphalerite is widely distributed in small amounts. The best area was visually estimated at 30 feet of 0.5 percent zinc. Chalcopyrite is erratic but widespread. Of several samples taken in previous work, none graded better than 0.05 copper. This is in line with visual estimates for the best areas seen. Galena is present in trace amounts.

Sulphide deposition in the breccia seems to have been a fairly late event, since dykes cutting the breccia are as well mineralized as the breccia itself.

Sulphide zoning is not well developed in the Lois complex. Weak pyrite and traces of chalcopyrite can be found throughout. The strong sulphide mineralization in the rhyolite breccia is not really an example of zoning, since this limited area contains the strongest concentration of all the sulphides.

Although the work completed to date on the property has not indicated any areas of ore grade material, the ground cannot be said to have been fully explored.

AGE OF THE SYSTEM

The best evidence concerning the age of the system is from dykes and dyke margins of glass found within the complex. The dykes of glass or 'pitchstone' are up to four feet wide. Similar glassy material forms chilled margins up to one foot thick on certain andesite dykes. The andesite dykes concerned are similar in appearance and, probably, in composition to other dykes and small bodies of the intrusive complex and presumably form a part of it. Previous mapping shows no glass-fringed andesite dykes or glass dykes outside the intrusive complex nor were any noted during the present examination.

The glass is generally dark green to grey-green in colour. It is quite fresh in appearance, transparent on thin edges and shows little sign of devitrification.

Since natural glasses crystallize and devitrify with time under near-surface conditions, they are found only in Tertiary and Recent rocks or, more rarely, in the Upper Cretaceous. If it is accepted that the andesite and glass dykes are an integral part of the intrusive complex, then the complex is probably no older than Upper Cretaceous and most likely Tertiary.

This is in keeping with findings of Carson and others for the bulk of porphyry copper deposits on Vancouver Island. It is also consistent with a Potassium-Argon date of 10.7 million years obtained by Imperial Oil on the Tent intrusive, a nearby and probably related stock.

PERIPHERAL ZONES OUTSIDE THE STOCK

Northeastern Copper Veins:

A rather cursory examination was made of the area containing copper vein mineralization about one mile to the northeast of the Lois intrusive. The 1" = 100' map of the area by Jan Alsen proved very useful.

In general, the chalcopyrite mineralization appears discontinuous and lensy. The trenches designated T_A, T_B and T_P seem to expose segments of a single vein but it is not at all clear that the exposures in trenches to the northwest are of the same vein. Although the showings are closely aligned, the attitudes of vein material in the western trenches do not fit the trend. It may be that the western showings were located fortuitously by close prospecting and trenching along the

projected strike of the eastern exposures. If this is the case, small vein-type occurrences may be fairly numerous in the area.

The deposits are too small to be of interest to Imperial Oil in their own right.

The possibility that the veins and the general high copper geochemistry in the area represent a leakage over a porphyry copper environment is intriguing but unlikely. The country rocks are not notably hornfelsed or altered as would be expected above a porphyry complex. The general lack of dyke activity in the area is also not encouraging in porphyry copper terms.

Cobalt Showing:

It is not certain that the cobalt zone sampled by Vanco was found during the present examination because of problems with control in the area between the two grids. However, a zone was located that answered the same general description and showed similar widths. This zone probably is the one noted by Vanco, as it is on a grid line but it was found some 300 feet from the location plotted by Vanco.

The cobalt mineral zone seems to be fairly narrow and restricted. Mineralization is controlled by modest shears. The tonnage potential for this deposit or this type of deposit appears limited.

In the area of the cobalt showing, the proportion of sedimentary material is unusually high and makes up about one-third of the outcrops. The sediments are largely fine grained and siliceous. Thicknesses of over 100 feet of this material were noted. Limestone also occurs as bands varying from two feet to twenty feet in thickness. The limestone was interbedded

in the volcanics and not generally in close association with the siliceous sediments. Details of the stratigraphy have been much obscured by faulting.

South Rhyolite Breccia:

This area of rhyolite breccia is centered at about Line 36 South, 26 West. The area is of interest because a ten foot chip sample taken by Vanco here returned a value of 0.25 oz. in gold. Three other samples were blanks.

The zone is much more complex than indicated on the Vanco 400 scale geological map. In addition to breccia, there are several dykes mainly of basaltic or andesitic composition cutting the breccias and the surrounding basaltic volcanics. At the west end of the breccia there is an outcrop, probably a large dyke, of coarse grained quartz diorite of the type making up the southern margin of the Lois stock a few hundred feet to the north.

The breccia itself exhibits several different alteration types over its 300 to 400 foot length. The most common type, making up over half the exposure, is characterized by strong bleaching, silicification and carbonatization. The carbonate is a brown-weathering, iron-bearing type. The proportions of silica and carbonate vary from place to place. Some areas several tens of feet in width are strongly silicified. These areas show rare traces of a pale green mineral that may be mariposite. The gold-bearing Vanco sample is plotted in one such area. Traces of chalcopyrite are found locally. Two to four percent of pyrite accompanies this alteration type. It is found as disseminations and on fractures.

A less common alteration type consists of bleaching and clay alteration. This is similar to the alteration in the main rhyolite breccia in the center of the Lois stock. These rocks are soft in outcrop and quite weathered. They may once have contained pyrite but only small spots of limonite remain in surface material.

At the east end of the breccia exposures there is a small body of fresh breccia about ten feet by twenty feet in size. From field relations it is not clear whether this exposure is an unaltered remnant of the same breccia or a separate, later, breccia pipe.

Respectfully submitted

G.H. Rayner, P.Eng.

GHR/mj

REFERENCES

1. G.S.C. Memoir #272 - Geology and Mineral Deposits of the Zeballos-Nimpkish Area, Vancouver Island, J.W. Hoadley, 1953.

2. C.I.M. Transactions, Vol. LXXII, pp. 116-125, 1969. Tertiary Mineral Deposits of Vancouver Island, D.J. T. Carson.

3. Lode Metals in B.C., 1968, B.C. Department of Mines and Petroleum Resources, pp. 84-89, K.E. Northcote.

4. Preliminary Report on the Lois Group of Mineral Claims Situated in the Nanaimo and Alberni Mining Divisions, Vanco Explorations Ltd. (N.P.L.), Company Report, T.E. Lisle, 1970.

5. Report on the Lois Group of Mineral Claims, Nanaimo and Alberni Mining Divisions, Northwestern Vancouver Island, B.C., Vanco Explorations Ltd. (N.P.L.), Company Report, T.E. Lisle, 1970.

6. Report on the 1971 Prospecting Program in the Immediate Area of the Tent and Lois Claim Groups, Nanaimo Mining Division, Vanco Explorations Ltd. (N.P.L.), Company Report, T.E. Lisle, 1971.