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CARIBOO QUARTZ MINE
POTENTIAL ORE RESERVES

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Report on

POTENTIAL OF ORE RESERVES AND PRODUCTION

CARIBOO GOLD QUARTZ MINE

Wells, B.C.

March 1, 1966

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MAIN REFERENCES

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A.C. Skerl - "Geology of Cariboo Gold Quartz Mine", Company report, March, 1948

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INTRODUCTION

In October 1965, the officers of Cariboo Gold Quartz Mines Ltd. requested the writer to conduct a geological investigation into the ore potential of the Cariboo Gold Quartz mine at Wells, B.C. The purpose of the investigation was to provide an independent assessment of the possibility of substantially increasing the mine's ore reserves by means of greatly increasing the development. If a specially directed and extensive development program would have a reasonable chance of greatly increasing reserves, thus permitting an appreciable increase in production, then it is sensible that funds should be provided for such a program. To fulfill this investigation the writer has visited the Island Mountain section of the mine and has reviewed all the current mine geological and production records with the mine staff as well as the consultant, Mr. E.E. Mason. In addition, many of the old reports and plans of the entire mine workings have been carefully studied and assessed for their importance to this investigation.

It is evident that the primary known ore control at Cariboo Gold Quartz is directly related to the wall rock types as represented by the various formations in the area. The formational geology in the mine area has been the subject of considerable contraversy by every geologist who has worked on the problem; therefore, since this feature of the geology is so important to the understanding of the ore controls, the writer has devoted the first part of this report to discussion of his interpretation of the areal geology.

LOCATION: The Cariboo Gold Quartz Mine is located at the town of Wells in the Caribou District of Central British Columbia. Wells is reached by paved highway from the city of Quesnel, about 55 miles due west of Wells. Quesnel is served by the Vancouver-Prince George Highway, the P.G.E. Railway and by Canadian Pacific Airlines.

HISTORY: Lode gold deposits were first staked near Wells by placer miners in 1890 and considerable surface trenching was done to expose veins but because the grades of these veins were found to be relatively low serious underground exploration was not done. The first intense exploration of the gold-quartz veins began in 1927 on Cow Mountain, (immediately southeast of Wells), and subsequently a 50 tons per day mill began production on the Cariboo Gold Quartz Mine (Cow Mtn.) in 1933 and was increased to 100 tons per day in 1934.

Productive underground exploration was begun on Island Mountain, northwest of Wells, across Jack of Clubs Lake from Cariboo Gold Quartz, in 1932 and in 1933 the first replacement gold ore was discovered. The Island Mountain Mine went into production at 50 tons per day in November, 1934.

By 1935 Cariboo Gold Quartz had developed intermittently 4 miles of strike length of the favourable Rainbow formation southeast of Wells to a depth of 600 feet. In 1940-41 a main haulage was driven to the B.C. Vein to the southeast and the B.C. Shaft was sunk to meet it. In 1942 development fell and prospecting ceased in both mines because of the war.

In 1946 development was renewed to depth but by 1948 increasing costs suspended activity in the Cariboo Gold Quartz mine. In 1952 the Island Mountain Mine suspended all active exploration and development and was sold to Cariboo Gold Quartz in 1954. All subsequent production by Cariboo Gold Quartz Mines Ltd. has been from the Island Mountain mine, the old Cariboo mine (No. 1 Mine) is now abandoned and the lower levels flooded.

PRODUCTION: The original gold production in the area of course was from the Barkerville placer deposits southeast of Wells. From the gold rush days until just after World War II these placers produced in excess of $35 million in gold by means of shafts, rockers, sluices, hydraulic monitors and dredges. In comparison, the lode deposits have produced approximately $45 million to 1964, including the return from the E.G.M.A. Of this $45 million, $24 million were contributed from the Cariboo Gold Quartz mines southeast of Wells between 1933 and 1959, the final year of production. The remainder, $21 million, was contributed by the deposits on Island Mountain from 1934 to 1964. Peak production was attained from 1937 to 1942 when the Cariboo Gold Quartz mine alone was averaging 40,000 oz of gold per year. Aside from that period the annual production from the two mines has ranged from 15 to 20,000 oz of gold each.

Present annual production, entirely from Island Mountain, is approximately 20,000 oz of gold and 4,000 oz of silver from 32,000 tons milled. The grade in gold of the ore was 0.64 oz/ton in 1964 and about 0.53 oz/ton in the previous four years. Present mine production is approximately 100 tons per day.

The average grade for gold ore from Island Mountain to date has been 0.46 oz/ton whereas that from the Cariboo Gold Quartz Mine was 0.39 oz/ton. This disparity in grade in essentially the same series of deposits is due to the fact that the ore occurs in two types of orebodies, as quartz—pyrite veins and as pyrite replacement bodies. The replacement bodies are consistently higher grade than the veins, and since nearly 60 percent of the Island Mountain production has been derived from replacement bodies, whereas less than 20 percent of the Cariboo Gold Quartz production was from replacement ore, there is this large difference in the average grade of the ore. To the best of our knowledge the emphasis on replacement ore at Island Mountain and vein ore at Cariboo Gold Quartz is not so much due to differences in geological occurrences as to differences in human direction in the history of the two mines. This feature is important to appreciate because it suggests great opportunities for exploration of undeveloped replacement ore in the Cariboo Gold Quartz mines southeast of Wells.

PRESENTATION: In preparing this report the writer has made full use of the multitude of available mine plans and records but, for the sake of brevity in presentation, only a few plans and sections have been chosen for reproduction in this report. These selected examples are primarily included to illustrate specific features discussed in the text without detailed elaboration. It is understood, of course, that anyone proceeding with the exploration program recommended herein will have full use of all the mine plans for detailed study and specific planning.

The writer wishes to extend his sincere appreciation to the staff and officers of the Cariboo Gold Quartz Mines Ltd. who have been most considerate and generous in their assistance on this project.

SUMMARY & RECOMMENDATIONS

Purpose of Investigation

The Cariboo Gold Quartz Mines Ltd., presently earns a net profit of approximately $2.90 per ton from the production of about 100 tons per day of replacement gold ore from the Island Mountain Mine at Wells, B.C. This present study has been to investigate the feasibility, both geological and economic, of diverting a relatively large amount of new capital to an exploration program specifically designed to increase ore reserves at the mines sufficiently to justify an appreciable increase in production.

Conclusions:

The writer finds that sufficient profit potential is available in the ore to support a considerable exploration program, which has a reasonable chance of success. An expenditure of approximately $200,000 in an initial phase of exploration, which would take at least six months to complete, has a very excellent chance of indicating enough new ore reserves to warrant further development and a production increase to 300 tons per day for a net profit of about $300,000 per year. A further expenditure, based on the results of the first phase of exploration, of about $470,000 would then provide enough additional development that in turn would have a good chance of proving and indicating enough new reserves to either establish the approximate duration of the 300 ton per day production or warrant a further production increase to about 500 tons per day for a net profit of at least $480,000 per year. The second phase of exploration would take six months to one year to complete.

If the above amounts of capital cannot be diverted specifically for the recommended programs it is entirely possible that the company can carry out the programs piecemeal, over an extended period, without unduly burdening the normal mine budget.

Geological Background:

This reports represents in some detail the geological background that forms the basis for the foregoing program. Very briefly condensed the geological setting is as follows:

Gold ore occurs in the Gold Belt at Wells, B.C., in two habitats, as quartz-pyrite veins, and as pyrite replacement bodies in limestone. Most of the lode production from the mines has come from vein orebodies; however all of the present production at Island Mtn. Mine is from replacement orebodies. The average size and grade of the vein orebodies renders them uneconomic at present and not worthy of development. The replacement orebodies range in size from about 5000 tons to 15,000 tons, generally grouped in clusters, and in grade from 0.50 oz Au/ton to 1.00 oz Au/ton. At present overhead and costs the average replacement ore at Island Mountain returns a total net profit of about $2.90 per ton, a figure that could probably be increased by expanding production.

The quartz veins occur principally within the Rainbow Member comprised of schistose quartzitic rocks whereas the replacement orebodies occur within a limestone bed in the structurally overlying Baker Member comprised of limey phyllites etc. The replaced limestone bed lies on or immediately adjacent to the Rainbow-Baker contact and is conformable with it. The replac ement ore is directly controlled by drag folds in the bedding and may also be influenced by regional cross faults as well as by the density of quartz—pyrite veins that may occur in the adjacent Rainbow Member.

Essentially all exploration outside of the Island Mtn. Mine has been confined to the Rainbow Member and has been directed to finding vein orebodies. There is no known geological reason to indicate that there is any less replacement ore occurring beyond the Island Mtn. mine than occurs within it. In fact, there are several good reasons to suggest that replacement ore may be greater in tonnage and higher in grade in the No. I Mine and further southeast along the Rainbow-Baker contact than in the Island Mtn. mine where about 500,000 tons of such ore have been mined to date.

Potential for Exploration:

Considering the foregoing geological factors it would appear that the potential tonnages of easily developed replacement ore in unexplored Baker rocks in the various parts of the Cariboo Gold Quartz property are as follows: Island Mtn. Mine = 300,000 tons, No. I Mine = 500,000 tons, Southeast = 500,000 tons. The ultimate potential could be much in excess of these figures in each locality. If all or a reasonable portion of this reserve could be proven and indicated then expansion of production to 300 or 500 tons per day would be warranted. The present mill can be expanded to about 400 tons per day without significant capital expenditure.

RECOMMENDATIONS

A summary of the exploration program recommended in this report, and discussed in detail therein, is:

PHASE I	-	Island Mtn. Mine-Drilling -	$70,000
	-	Surface stripping -	$14,000
	-	No. I Mine - drilling -	$80,000
	-	Possible surface geophysics -	$10,000
	-	Overhead -	$11,000
			$185,000
PHASE 2	-	Island Mtn. Mine development -	$240,000
	-	No. I Mine development -	$180,000
	-	Surface drilling development -	$50,000
			$470,000

Because the targets for this exploration have a potential net profit in excess of $3 million the writer strongly recommends that the suggested program be implemented. In my opinion it has an excellent chance for success.

Respectfully submitted,

Douglas D. Campbell

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DC:ea

GEOLOGICAL SETTING

The lode gold orebodies at Wells occur within formations belonging to the Cariboo Group of Early Cambrian and later age. The Cariboo Group overlies, presumably conformably, metamorphosed sedimentary rocks, (schists, schistose greywackes, micaceous quartzites), of the Kaza Group of Precambrian age. North and east of the mine district the Cariboo Group rocks are overlain, with major unconformity, by unmetamorphosed Carboniferous rocks belonging to the Slide Mountain Group, comprised of cherts, argillites, pillow lavas and conglomerate.

The rocks comprising the Cariboo Group are metasediments, principally phyllites, micaceous quartzites, marbles and limestones. These formations tend to show obscure interrelations to one another because of intense local folding and dynamic metamorphism as well as local hydrothermal alterations, areas of which are regional in distribution. These metamorphosed clastic and carbonate rocks form a relatively thin sequence which is locally duplicated by tight overturned folding and faulting. In the Cariboo District they are folded into the regional Cunningham and Island Mountain anticlinoriums which trend northwestward and plunge at about 20° down to the northwest. This belt of structures has been mapped for a strike length of over 50 miles. In the mine area the Cariboo Group formations occur in a belt about one mile wide and 10 miles long as folds, overturned to the southwest, on the northeast flank of the Island Mountain Anticlinorium. Northeast of this flank of the regional fold is the Snowshoe Synclinorium flanked to the northeast by the overturned Cunningham Anticlinorium. The degree of schistocity and cleavage of the rocks in the Cariboo Group is directly related to the intensity of the folding. The fissility of all rock types increases towards the loci of intense folding. The orebodies are restricted to rocks in the northeast flank of the Island Mountain Anticlinorium but it is necessary to appreciate the regional structural setting in order to understand the contraversies, which are described later, about the positions of the host rock formations.

INTRUSIVES: There are no intrusive rocks of consequence in the mine district. The Cariboo Group rocks, but not the Slide Mountain Group, are intruded by a series of feldspar felsite dikes called the Proserpine Dikes. These dikes range up to 20 feet in width but are most commonly one to four feet in width. They are not conspicuously distributed in the mine area and wherever exposed they are generally schistose and considerably ankeritized.

In the vicinity of the contact between the Cariboo Group and the Slide Mountain Group, many miles northwest of Wells, rocks of both groups are intruded by diabasic and lamprophyre dikes and sills of the Mount Murray Intrusives. These intrusives take the form of dikes in the Cariboo Group and sills, up to 700 feet in thickness, in the Slide Mountain rocks. No such intrusives have been found in the mine area.

FAULTING: In the mine district the Cariboo Group has been displaced by major northeast trending, southeast dipping (60°), right lateral faults which strike at right angles to the formations and tend to shift the regional folds upwards in steps as they plunge to the northwest, thus the plunge of the folds is offset regionally by the displacement on the cross faults. The horizontal offsets of these faults range from 400 feet to 1200 feet. In the mines these cross faults are spaced from 700 to 2000 feet apart and they have probably acted as a partial plumbing system for the ore solutions.

The Cariboo Group formations are generally traversed, nearly at right angles to strike, by steeply dipping tension fractures which are in the nature of regional gash joints. They probably originated during the regional folding and opened during faulting, after which they were extensively mineralized to form the vein deposits of the mines. Because of differences in formational competencies these fractures, and the consequent veins, are almost exclusively well developed in what is referred to as the Rainbow Member beds. Since the replacement orebodies occur exclusively in the adjacent Baker Member beds a sound interpretation of the inter-relation of these two formations is of utmost importance in the search for gold ore in this district. To aid in such an interpretation the following portion of this report is devoted to a summary discussion of the geology of the Cariboo Group rocks, relative to the orebodies.

CARIBOO GROUP

The regional geology in this part of the Cariboo District of British Columbia has been mapped and remapped by numerous geologists of both the federal and provincial governmental services. To the work of these men have been added various contributions by very capable successive mine geologists. Because of the obscurities caused by metamorphism and by hydrothermal alterations to rocks of the Cariboo Group the interpretations by different geologists at different times, in various parts of the area, have varied considerably and, because the ore occurrences are directly related to rock types, the proper assessment of these interpretations is important.

The first mapping of the gold belt was done by Uglow (1927 and Hanson (1935) of the Geological Survey of Canada. Uglow's work was of a regional reconnaissance nature to try to define the source of the placer gold. Hanson's work was more detailed work in the mine area after the lode deposits had been discovered. Later, with the benefit of improved access and facilities, the Cariboo Group 14 miles southeast of the mine was mapped in definite detail by S.S. Holland (1954) and that in the mine area by A. Sutherland Brown (1957), both men of the British Columbia Dept. of Mines. Holland's work established the regional structures, which better defined the Cariboo Group than that of the earlier workers, and his work was then carried into the mine area by Sutherland Brown. Detailed work done in the mines by P.C. Benedict (Island Mountain, 1936) and A.C. Skerl (Cariboo Gold Quartz, 1948) added considerably to the interpretation of the regional geology.

Both Uglow and Hanson mapped the mine area rocks as the "Gold Belt" which they subdivided into five principal members; the Baker, the Rainbow, the B.C., the Lowhee and the Basal. Of these members the Baker was described as grey fissile fine grained calcareous quartzite and the Rainbow as interbedded fine grained argillite and quartzite. A contact between the Rainbow and the Baker in the mine area was mapped by Hanson and it is important to note that all of the known gold vein deposits occur on the Rainbow side of this contact as located by Hanson.

In 1954 Holland conclusively demonstrated that the stratigraphy of the area was complicated by repeated tight overturned folds and for this reason the members of the Uglow-Hanson Gold Belt rocks were not true geological formations but in some instances were repetitions of the same formation. He also indicated that because of overturning of folds, the sequence as previously mapped in the mine area was upside down. The old "series" was revised by Holland into the Cariboo Group comprised of the following members, (14 miles southeast of the mines):

Basal Member -	conglomerate
Lower Member -	Grey white grit and quartzite, some feldspathic.
Middle Member -	Fissile grey argillaceous quartzites and fissile sericitic quartzite with ankerite rendering a characteristic pinkish-brown hue on exposure.
Upper Member -	Limestone, chlorite schist and black argillite (slate).

The old "series" members as designated by Hanson were interpreted to be various beds within the Middle and Upper Members. A broad comparison of Holland's and Hanson's work reveals that Hanson's members described by him as:

(Bottom) Rainbow -	Fissile and non-fissile interbedded argillite (slate) and quartzite with some limestone.
(Top) Baker-	Fissile and non-fissile grey calc-quartzite and limestone.

can be readily correlated with Holland's Middle and Upper members only upside down. This is explained by the fact that where Hanson mapped them they are on the overturned southwest side of a fold and in reality the Baker is the bottom and the Rainbow the uppermost member. It is important to note that Holland recognized a difference between these rock types and indicated the contact between them in an area 14 miles southeast of the mines.

Generally the mine geologists, represented by Benedict and Skerl, have been consistently successful in distinguishing and mapping a contact between the so-called Rainbow and Baker members throughout 15,000 feet of strike extension of excellent exposures in the mines. Throughout this mapping the limestone beds at the top of the Baker, near the Rainbow contact, have comprised dependable horizon markers wherever metamorphism has obscured other rock differences.

There is no doubt, from Holland's work, that the original Gold Belt Series was not a true interpretation of the stratigraphy and many members are not valid; however, it is indicated that two of the original members, the Rainbow and the Baker, are consistently regionally distinguishable and comprise two valid formations, perhaps not in the thicknesses as originally conceived but at least where they are in contact.

The formational problem was sharply focussed in 1957 when Sutherland Brown extended Holland's mapping northwest into the minearea and further separated the Cariboo Group into the following formations:

Cunningham -	500-2000 feet - basal fine crystalline limestone.
Yankee Belle -	300-900 feet - grey-brown fine grained phyllitic rocks (characterized by paper fissility (intense deformations) and chlorite, muscovite and chloritoid (low grade metamorphism).
Yanks Peak Quartzite -	0-200 feet - white, massive 95% quartz.
Midas -	500-1000 feet - black quartzose phyllites, micaceous quartzites, argillites with some limestone and conglomerate.
Snowshoe -	1000 feet - micaceous quartzites, light coloured phyllites and minor limestone beds.

In this interpretation Sutherland Brown suggested that the rocks of Hanson's Gold Belt Series are parts of the Midas and Snowshow formations. The Basal and B.C. members are phases of the Midas Formation, as are most of the Lowhee and Richfield members. He disclosed that extensive hydrothermal alterations in the areas of ore deposits have ankeritized, chloritized, bleached and silicified the formations to such an extent that the earlier geologists incorrectly broke these variations down into sedimentary members. He demonstrated that the areal bleaching is confined to the areas of mineralization and that it can be duplicated by simply heating unaltered Midas Formation argillites, whereupon the rock is cleared of the black carbonaceous matter and is irregularly increased in grain size.

Sutherland Brown further suggested that the Rainbow, the Baker and part of the Lowhee members were all parts of the Snowshoe Formation and that they do not represent truly separable units. He interpreted that some of what had been mapped as Lowhee Member was actually bleached arenaceous rock of the Snowshoe Formation. He describes the Snowshoe Formation as being comprised of arenaceous, argillaceous and calcareous rocks, more or less indiscriminately intercalated, of which the "Baker limestone" beds comprise the host for the replacement ores. He also noted that these limestone beds are more common in the argillaceous than the arenaceous strata and comprise a small percentage of the formation, and seldom exceed 20 feet in thickness.

The important result of Sutherland Brown's work is that on his map of the mine area the Rainbow-Baker contact is not represented. Since the ore deposits have been conclusively proven to be directly related to this formational contact for a length of nearly three miles and since Hanson mapped such a contact for a distance of ten miles it is evident that the existence of such a contact should in all likelihood be a valid formational feature and not the product of capriceous hydrothermal alteration. This is further corroborated by the persistence occurrence of quartz-pyrite veins only on the Rainbow (SW) side of this contact for a distance of ten miles, as well as the consistent position of the Baker limestone on the northeast side of the contact. Also, the mine geologists have had little or no difficulty in distinguishing the two rock types of the "Rainbow" and the "Baker" members, and after only a very brief tour of the Island Mountain the writer could also readily distinguish these rock types.

Thus, for the purposes of this investigation at least, the writer will retain the accepted distinction of the Baker and Rainbow members and the contact between the two is presented in Figure I as a superimposed feature on Sutherland-Brown's geological plan. The economic importance of this contact is evident and its exact location is necessary to be known for proper layout of exploration programs.

RAINBOW MEMBER: The only rock formations at Wells that have economic significance as host rocks for the gold ore deposits are the aforementioned Rainbow and Baker Members. These rocks are briefly described here to provide background for later discussions of the ore bodies.

The Rainbow Member in the mine area is comprised predominently of fissile, fine grained, finely bedded micaceous quartzite. These rocks are distinguished primarily in the mines by their abundance of dark smoky gray quartzites, plus or minus interbedded black argillite, the whole of which comprises 50 to 75 percent of the formation. Some limestone occurs in the Rainbow as discrete, relatively thin beds several hundreds of feet from the Baker contact. One such bed is the 309 Limestone, which comprises a good horizon marker but has apparently not been a favourable host for gold-quartz deposition. The Rainbow rocks are generally darker coloured than the Baker rocks but near the gold-quartz veins they are characteristically bleached of carbonaceous material.

As explained earlier, the Rainbow Member has acted as a unit in that it has been everywhere extensively cross fractured by tension cracks of several orientations but with a common trend at right angles to the strike of the beds. These fractures are most intensely developed along the Baker contact but do not extend significant distances, at least as veins, into the Baker Member. Within the Rainbow rocks these tension fractures are invariably filled with pyrite and quartz many of which have comprised gold ore.

BAKER MEMBER: The old Baker member lies entirely within Sutherland Brown's Snowshoe Formation.

The Baker Member rocks are generally lighter coloured than the Rainbow rocks and on exposure many exhibit a characteristic rusty mottling due to oxidized ankerite. The rock types are predominently gray calcareous sericitic phyllites and quartzites interbedded with a few bands of limestone. One limestone band is persistent within the Baker Member along the contact with the Rainbow. This limestone, termed the Baker Limestone by Sutherland Brown and the 339 by the mine staff, has been traced through both mines for a length of 15,000 feet and ranges from 5 to 50 feet in thickness, lensing out locally. It lies either adjacent to the Rainbow Contact or up to 50 stratigraphic feet away from it.

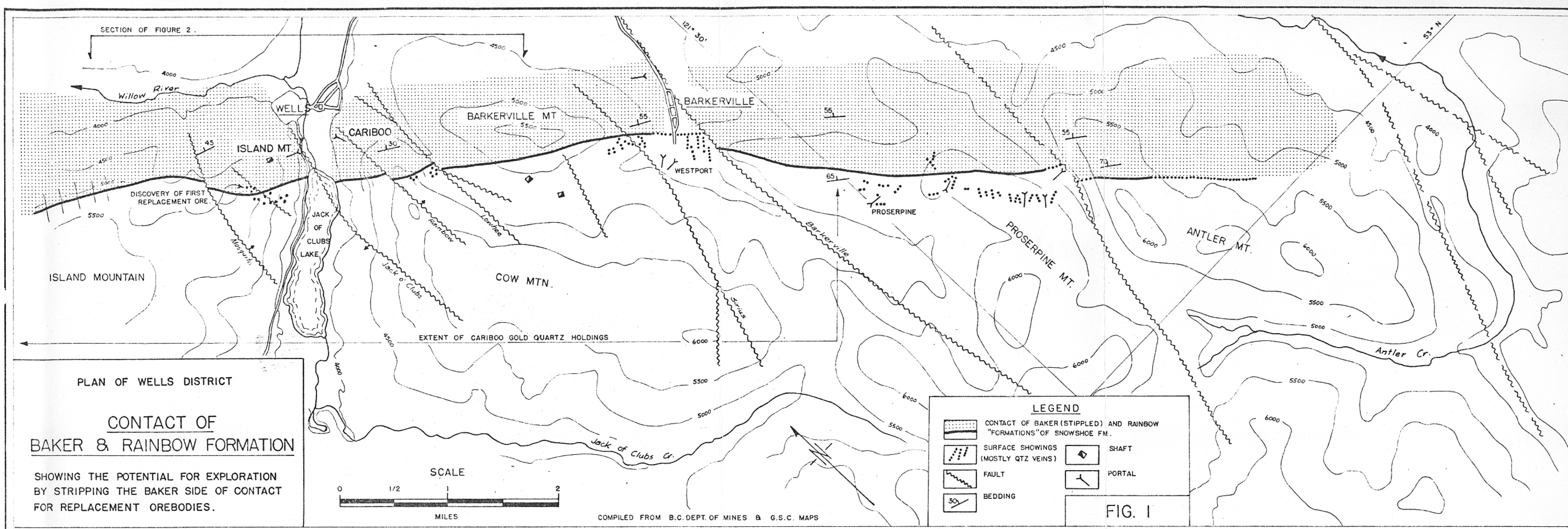
Essentially all of the known replacement pyrite-gold orebodies occur within this bed of limestone. Other limestone beds occur deeper within the Baker beds but they have been very sparsely explored and no ore is known to occur within them.

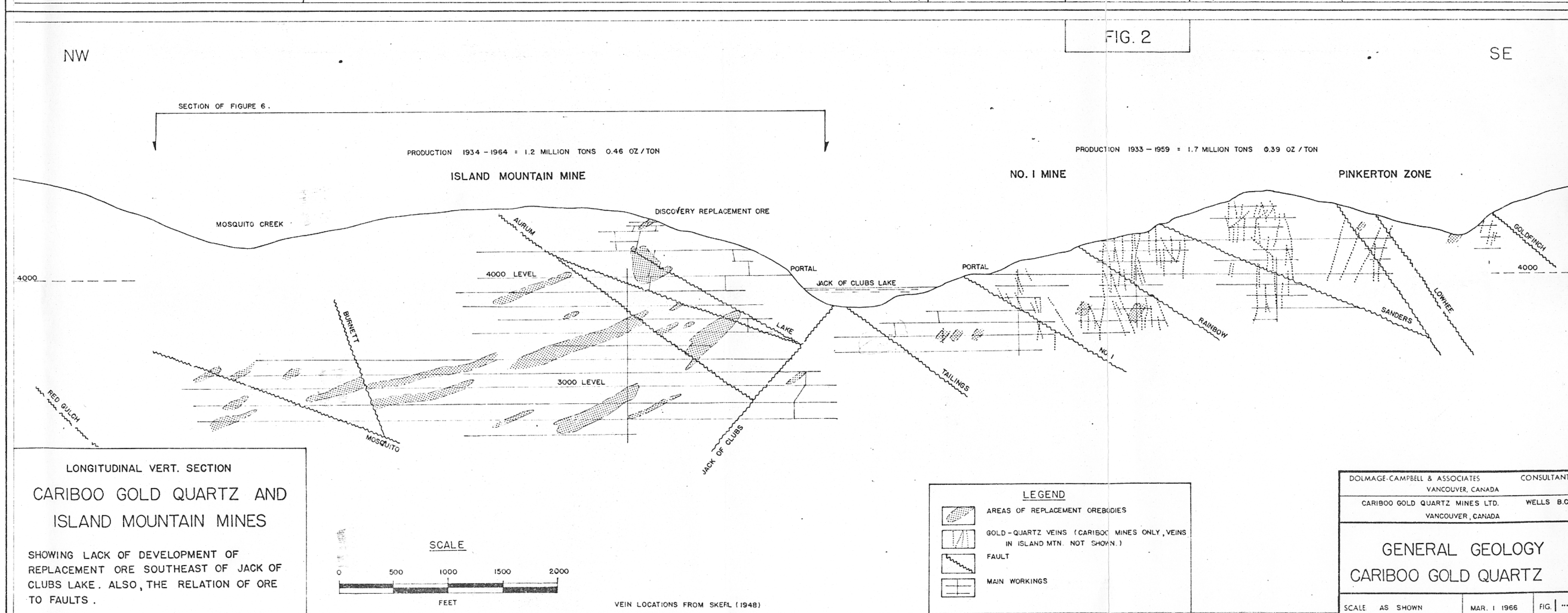
On either one or both, but generally on the north, sides of the 339 limestone bed there occurs a discontinuous series of very lensey beds, ranging in thickness from nil to 50 feet, comprised of fine to medium crystalline quartz, dolomite, diopside and minor garnet, all aligned to lend a vaguely gneissic appearance to the rock. The rock grades laterally into dolomite and/or argillaceous quartzites. This rock was mapped at Island Mountain by Skerl as "volcanic tuff", at Cariboo Gold Quartz by Benedict as "dolomite" and "diorite gneiss" and is now mapped as "diorite" sills. The mineralogy, the texture, and the relation to adjacent rocks of this rock, plus the spatial relation of it to the 339 limestone, generally in the hanging wall, as well as its discontinuous nature indicate to the writer that the rock is a skarn. Examination of a few exposures and specimens of the rock by the writer have confirmed this opinion. The acceptance that this rock is a skarn formed b y the action of hot solutions or gases on the nearby limestone near a formational contact and near quartz veins in the Rainbow Member, is important because it obviously signifies hydrothermal activity and may therefore be correlative with the replacement orebodies in the adjacent limestone. If this is so the skarn occurrences may prove to be ore indicators.

THE CONTACT:

The contact between the Rainbow and the Baker rocks in the mine district is the most important guide to ore. The contact is generally not difficult to recognize underground, with the 339 limestone lending confirmation where needed. The contact trends northwestward and dips at about 40° to the northeast with the Baker Member in the hanging wall. Since the beds are overturned in the Wells area the Baker actually represents the older beds.

Locally the contact strikes reasonably straight for many hundreds of feet but generally it is rippled and saw-toothed because of large and small fault displacements as well as innumerable drag folds. The drag folds range in amplitude from a few feet to 500 feet and plunge down the contact to the northwest at about 20 degrees. Most of the best replacement ore has been found in the vicinity, both troughs and noses, of these drag folds and exploration is therefore, oriented preferentially toward them; however, good orebodies have been found recently along straight sections of the contact, away from folds, therefore all of the contact in the mine area represents favourable ground for exploration.





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CARIBOO GOLD QUARTZ MINES LTD. WELLS B.C.
VANCOUVER, CANADA

GENERAL GEOLOGY
CARIBOO GOLD QUARTZ

SCALE AS SHOWN | MAR. 1 1966 | FIG. 1 – 2

ORE OCCURRENCES

The lode gold ore in the Wells mines occurs in two separate and distinct forms, as quartz veins in the Rainbow Member and as pyrite bedded replacement bodies in the Baker Member. Most of the production from the Cariboo Gold Quartz mine southeast of Wells and much of the early production from the Island Mountain mine was derived from the vein orebodies; however, all of the most recent production and the best grade of past production has been derived from the replacement orebodies. Because of relatively low grade, limited tonnage and high cost of development the vein ore is no longer an attractive target for exploration. Conversely, because of fairly high grade, fair tonnages and reasonable costs of development the replacement orebodies comprise a very attractive and lucrative target for extensive exploration. Despite the unfavourable economic aspects of the vein deposits they warrant close study for, in the opinion of the writer, they are directly related to the replacement orebodies in genesis and to some extent in space. Therefore, the first section of the following discussion is devoted to a summary description of the vein orebodies in the mines, and to their possible relation to the replacement orebodies.

QUARTZ-PYRITE VEINS

The quartz—pyrite veins are essentially exclusively restricted to the Rainbow Member rocks and extend in those rocks for distances up to 900 feet from the Baker contact, and generally strike at right angles to that contact. They represent fillings of an extensive fracture system that regionally ruptured the Rainbow Member and which probably formed during the tight regional folding of the formations. Subsequent regional cross-faulting and displacement of the formations was in all likelihood the event that caused parts of the Rainbow fracture system to open and act as conduits for the passage of hydrothermal solutions.

In the region of the mines Hanson noted the occurrence in the Rainbow Member of thousands of quartz veins. Skerl (1948) reports that trenches on all of the Cariboo Gold Quartz claims have exposed countless veins in the Rainbow rocks. At Island Mountain in 1948 of 200 quartz veins exposed on the 8th Level alone only 8 contained more than 20% pyrite and were therefore drifted. Examination of the geological plans of any level on either the Island Mountain or the Cariboo Gold Quartz mines reveals hundreds of exposed veins ranging in widths from a few inches to tens of feet, but only a very minor percentage of the veins have contained orebodies. This low return for extensive search of a myriad of veins results in high development costs for the ore that is found.

ORIENTATION AND DISTRIBUTION

The vein-fracture systems occur in local concentrations or patterns the individuals of which branch and ramify into one another, commonly changing orientation both along strike and down dip. The veins occur in three host fracture orientations;

> Transverse Veins: Strike N30-50° E, dip 70-90° SE. These veins are the smallest and the most numerous of the system. They are generally of uniform thickness and end abruptly in a taper or in a fan of divergent veinlets. At Island Mountain these veins are generally too small, 1 ft x 100 ft., and widely spaced to mine; however, at Cariboo Gold Quartz they are

larger, 4 ft x 200 ft., and more closely spaced and they provided 60-75% of the ore. These veins are the highest grade of the veins in the system.

These transverse veins and fractures are essentially at near-right angles to their host rocks. Since they are more in tension orientation with the formations and the major faults than are the other veins it can be assumed that they were more open to hydrothermal solutions at some stage in deformation than were the others, thus resulting in their higher grade.

Diagonal Veins: Strike N70-90°E, dip 70°-90° S. These veins are wider and longer (5 ft x 250 ft) than the transverse veins but they are more widely spaced and only about one fifth in number. They comprise the main source of vein ore at Island Mountain.

Strike Veins: Strike N40-60° W, dip steeply N.E. These veins, parallel to the formations, are the largest, fewest and least productive in the area. The only two of note are the B.C. Vein, (2400 ft in length, up to 42 ft in width and 900 ft in depth), and the Canusa Vein, (500 ft in length, 9-11 ft in width), both occurring on the southern extension of Cow Mountain. Ore occurs in these veins as isolated masses of pyrite of which three were mined on the B.C. vein.

In any particular swarm of veins individual veins will commonly occupy both diagonal and transverse fractures along strike and the swarm itself ramifies through these two orientations, (Fig 7).

The veins are generally confined to the Rainbow Member rocks and they are generally best developed within the more competent (quartzitic) sequences within that formation. They are not persistent across extensive thicknesses of rocks of dissimilar type. There are relatively few veins within the Baker Member, possibly because as a unit it is relatively more homogeneous than the Rainbow and is comprised of fissile calcareous quartzites and limestones which would have tended to flow rather than fracture under regional folding stress. Generally the veins pinch or fray out beyond the quartzite bands and most of them terminate before they reach the Rainbow-Baker contact; however, in both mines a significant number of exposures exist of narrow veins crossing the contact, reaching the 339 Limestone band and passing into replacement ore.

MINERALOGY AND GRADE: Ore veins generally contain 15-25% pyrite, samples of which will assay 1-2 oz Au/ton or better. The fine grained pyrite is higher grade than the coarse and the gold occurs within fine fractures in the pyrite. High grade ore may be either intensely mineralized with pyrite or less pyritic but containing cosalite (lead-bismuth sulphide), bismuthinite and free gold. Other vein minerals are arsenopyrite, ankerite and scheelite, much less common are galena, sphalerite and tetrahedrite.? The paragenesis determined by Skerl is: ankerite, quartz, pyrite, sphalerite, chalcopyrite, galena, argentite, cosalite, gold and quartz.

The grade of the vein ore, as mined, has ranged from 0.20 to 0.60 oz Au/ton with an overall average of approximately 0.34 oz/ton. There has been no significant decrease in values with depth or lateral extent along the formation. At present costs and $37 (Can.) per oz of gold the average gross value of the vein ore, $13 (Can.) per ton, is insufficient to make it more than a supplementary ore to the replacement ore, and then only in particularly convenient underground circumstances.

PRODUCTION:

The vein orebodies generally comprise 50-100 percent of their host veins. General average dimensions of the Island Mountain vein orebodies are: 125 ft. in length, 5 ft. in width and 100 ft. down dip. Continuously productive systems of veins have extended through a vertical interval of 1000 feet, trending down the dip of the Rainbow Member beds with the ore raking down the veins along favourable beds. The most noteworthy system of veins in the mines has been the No 2 Zone of the Cariboo Gold Quartz mine on Cow Mountain. Between the 12th and 20th levels about 20 veins in this zone had produced 50% of the mine's tonnage and 60% of the gold to 1948. In 1948 this diagonal vein system still had a reserve of 88,000 tons @ 0.60 oz Au/ton. The veins are spatially related to the Rainbow Fault and the orebodies tended to trend parallel with the dip of the fault both on hanging wall and footwall, and be confined to within about 300 feet of the fault. In this system ore was exposed, and mined, on the fault and appeared to have been formed along the fault and later crushed by subsequent movement.

The above example of the close relation of the No. 2 Zone ore veins to the Rainbow Fault, plus other occurrences in the vicinity of other faults, and an estimate by Skerl (1948) that 75 percent of the Cariboo Gold Quartz vein ore occurred within 100 feet of the major faults has resulted in the tendency at both mines to concentrate exploration in the vicinity of the regional faults. More extensive recent work at Island Mountain has indicated that whereas this theory is generally valid for replacement ore it is not exclusively so, since considerable ore occurs well away from the regional faults.

SIGNIFICANCE TO EXPLORATION:

The Vein orebodies do not comprise worthwhile targets for exploration at the Wells mines; however, there is sufficient indication that the veins and fracture systems in the Rainbow Member provided a plumbing system through which hydrothermal solution gained access to the overlying Baker Member rocks. Although only a very minor percentage of the Rainbow fractures penetrated the Baker Member those that did so invariably reached the 339 Limestone bed immediately adjacent to the contact. Proof is fragmentary but there is enough to indicate the very plausible effect of such leakage into the Baker Member to result in the skarnization of the limey Baker rocks near the contact, generally in the hanging wall of the 339 limestone, and the formation of the replacement orebodies within the 339 Limestone. Obviously, where the 339 Limestone and adjacent beds were severely folded, and/or faulted, they would be more fractured or dilated and would be more permeable for solutions travelling in the adjacent Rainbow fractures. This sequence of events is a common type of geological hydrothermal feature and is reasonably born out by data from underground exposures. If it is valid at the Wells mine then it is obvious that wherever there are strong ore-bearing veins in the Rainbow Member, the adjacent and overlying Baker rocks warrant exploration for replacement orebodies.

PYRITE REPLACEMENT OREBODIES

The pyrite replacement orebodies are entirely restricted to the 339 Limestone bed in the Baker Member, the limestone immediately adjacent to the Rainbow-Baker contact. Other limestone beds occur deeper within the Baker Member, farther from the contact, but the little drilling that has been done on them indicates the absence of both replacement ore and skarn in them. Except in upper (4430 Level). (John's L.S.) This would not be unexpected if the theory of the ore solutions originating in the underlying Rainbow Member fractures, which do not penetrate the Baker rocks more than tens of feet, is valid.

ORIENTATION AND DISTRIBUTION: The replacement bodies follow the 339 Limestone bed and commonly diffuse into adjacent beds as well, therefore they follow the formational trends and of course the Rainbow-Baker contact. About 95 percent of the replacement ore has been derived from the 339 Limestone. The replacement orebodies appear to be best developed in the vicinity of the thickening of this limestone on drag folds. With few exceptions the orebodies rake down the plunge of the drag folds at -20° in a N50° W direction, this feature is true even of those orebodies well removed from any folds. On the crests and in the troughs, but preferentially the former, of the folds the orebodies are in the form of flattened pipes, whereas on the limbs of the folds and along unfolded sections of the beds they are tabular in form.

The replacement orebodies are generally 6-10 feet in stratigraphic width and 100-300 feet in length at any level but up to 600 or more feet in extent down the plunge. Average tonnages range from 2000 to 7000 tons, with the smallest mined being 500 tons and the largest being 35000 tons.

In many reported exposures, and one seen by the writer, some replacement orebodies have a tight curving slip plane, with or without gauge, on their hanging wall side. There is a suggestion of movement of this plane along the plunge of the drag folding. In many locations the hanging wall of the ore bodies is formed by relatively impervious phyllitic rocks which may have acted as dams to rising solutions and consequently impaired ingress higher into the Baker rocks.

Replacement orebodies have been exposed and mined pretty well throughout the entire underground extent of the Island Mountain mine but only in a few underground locations in the Cariboo Gold Quartz mine southeast of Wells. There may be some geological reason for this disparity in distribution, however it would appear that it is more likely due to the fact that lode mining started at Cariboo Gold Quartz, from surface discovery, with exploitation of the Rainbow vein orebodies and because these died out as the Baker contact is approached exploration naturally avoided the Baker contact. According to Skerl there was no exploration for replacement ore at Cariboo Gold Quartz up to 1948. In 1944 the first replacement ore at the Cariboo was found by accident while stoping through the Baker contact on a transverse vein. The few replacement bodies found at the Cariboo are exactly like those occurring at Island Mountain. By 1957, at the end of the life of the Cariboo mine, only 4% of the ore had been replacement. In contrast, a replacement orebody was inadvertently found on the surface early in the history of Island Mountain and by 1935 a few were being mined and had proved to be higher grade than the veins, which were also being mined. This set a general development pattern for the history of that mine whereby the Baker rocks inside the contact were explored when convenient but not systematically, by crosscuts or drill holes. By 1957 about 25% of the Island Mountain ore had been replacement, in 1966 it is all replacement. It should be appreciated that the best exploration and development of the vein orebodies at both mines involved drives and drill holes well within the Rainbow Member, directed along strike thereby not likely to intersect replacement orebodies.

Hanson reports having traced the "basal Baker" (339) Limestone throughout the entire extents of Island Mountain and Cow Mountain. Benedict (1936) records the existence of this same limestone adjacent to the Rainbow Member, in which ore veins occur, on the Proserpine Property several miles southeast of the Cariboo Gold Quartz mine. A study of mine plans indicates negligible exploration across the Baker contact in the Cariboo Gold Quartz mine.

From all available data there is no valid reason to conclude that replacement orebodies in the 339 Limestone are any less widely distributed along the Gold Belt than are the vein orebodies in the Rainbow Member rocks. If it is then assumed that the replacement orebodies are as widely distributed as the vein orebodies then the entire belt southeast of Island Mountain, as well as much northwest of it is completely virgin territory for exploration for replacement orebodies.

MINERALOGY AND GRADE:

The replacement orebodies are comprised of masses of fine grained pyrite within limestone or dolomite beds of the 339 Limestone. Very minor amounts of scheelite, galena, sphalerite and arsenopyrite occur commonly with the pyrite and the gold occurs as free gold. The ore bodies tend to have sharply defined hanging and foot walls but grade out along the bedding through sporadic and very coarsely crystalline euhedral pyrite, low in gold, and an increase in ankerite mottling and finally into silicified limestone.

The finest crystalline pyrite contains the highest gold values, individual samples ranging up to 5 oz Au/ton. The average grade of the replacement ore at Island Mountain to 1964 was 0.67 oz Au/ton and about 0.10 oz Ag/ton. This higher gold content, nearly twice that of the vein ore, is probably due largely to the fact that the replacement ore contains a higher proportion of pyrite than the vein ore.

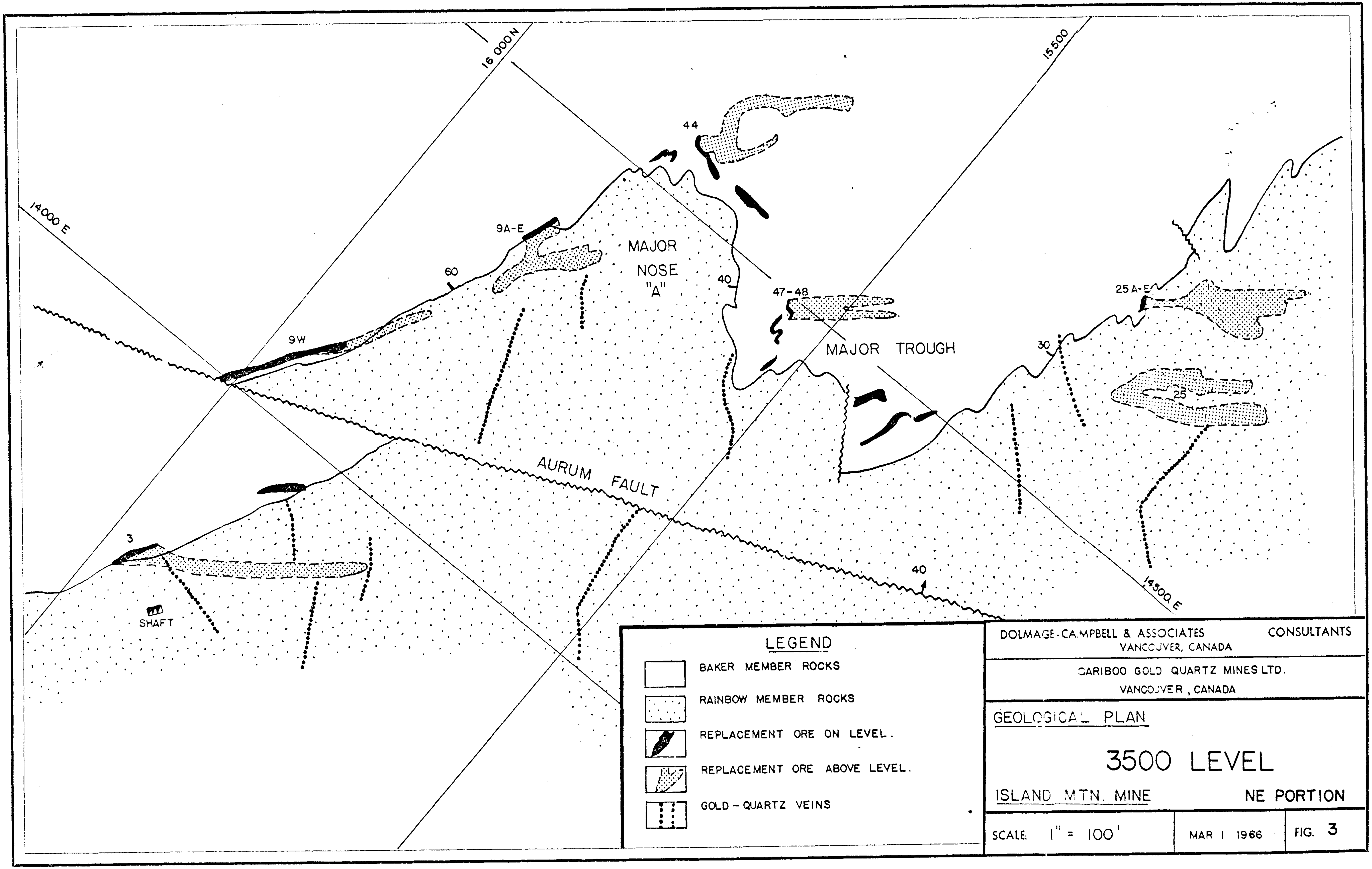
PRODUCTION:

No significant percentage of production at Cariboo Gold Quartz was derived from replacement ore but a most significant and increasing percentage has been derived from this ore at Island Mountain. For example, by 1945 about 30 percent of the tonnage and 50 percent of the ounces of gold had been produced from replacement ore. By 1964 40 percent of the tonnage and nearly 60 per cent of the gold had been derived from replacement ore.

SIGNIFICANCE TO EXPLORATION:

Obviously, the 339 Limestone bed inside the Rainbow-Baker contact is excellent prospecting for replacement ore. Essentially all of this limestone is available for new systemmatic exploration outside of the Island Mountain mine, and a large percentage of it within the mine.

The targets for such exploration would be individual orebodies of about 5000-15000 tons in size, with a present value of about $30 (Can.) per ton or $150,000 - $450,000 total. To date at the Island Mountain mine 32 replacement orebodies in excess of 5000 tons have been mined after exploration of about 50 percent of the favourable 339 Limestone to the bottom level of the mine in a strike length of 5500 feet.



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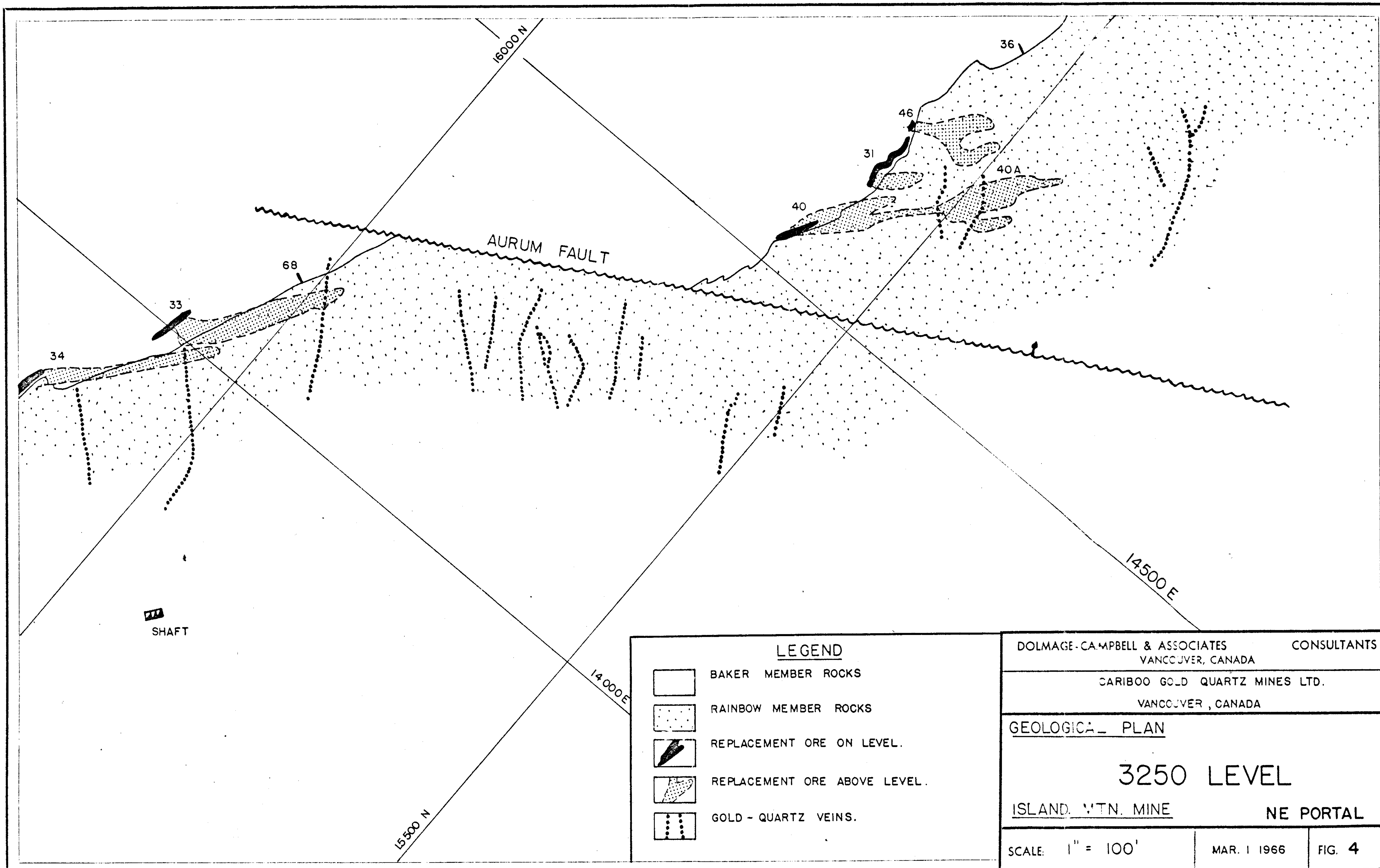
VANCOUVER, CANADA

GEOLOGICAL PLAN

3500 LEVEL

ISLAND MTN. MINE — NE PORTION

SCALE: 1" = 100' | MAR 1 1966 | FIG. 3



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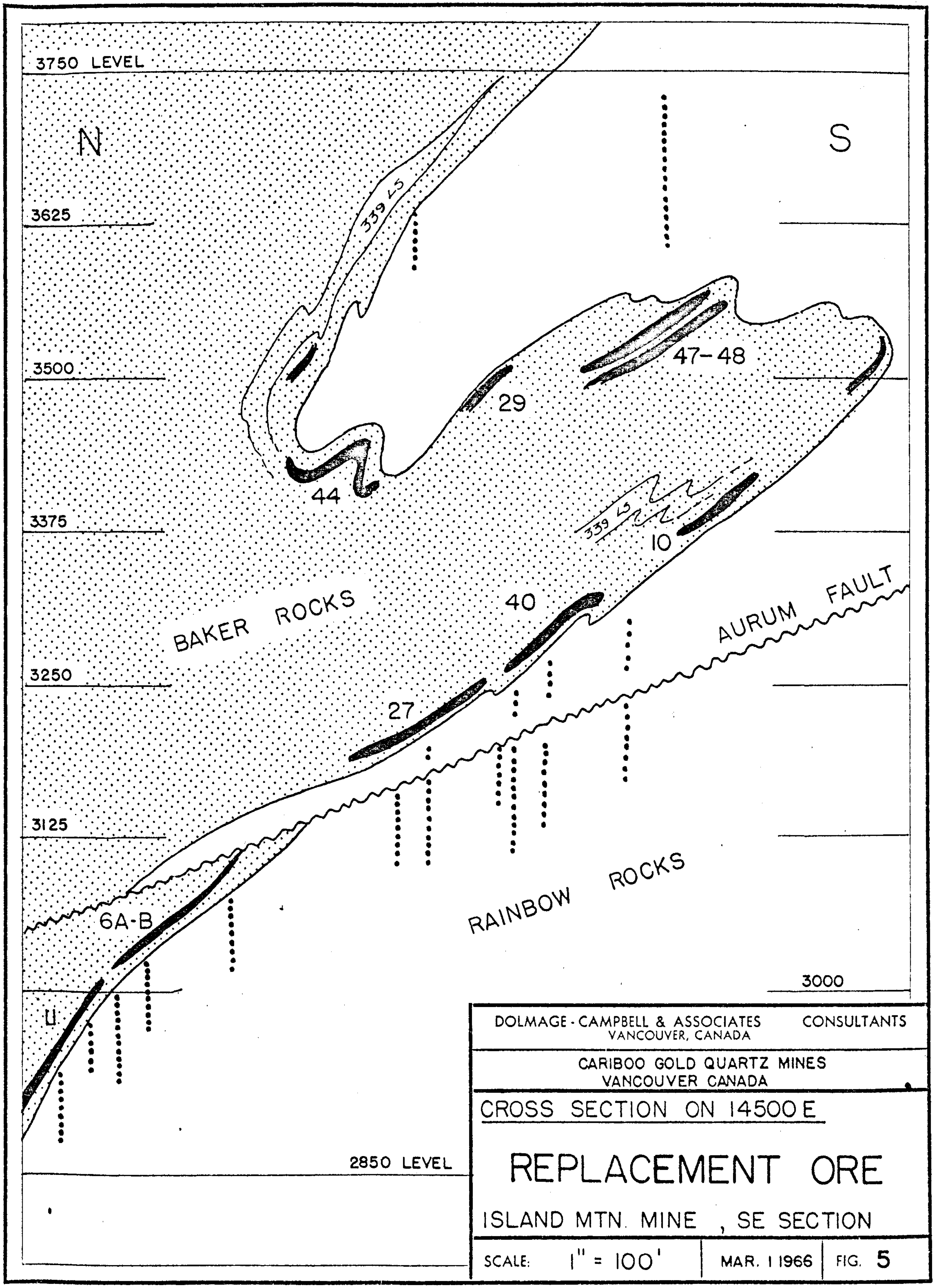
GEOLOGICAL PLAN

3250 LEVEL

ISLAND MTN. MINE NE PORTAL

SCALE: 1" = 100' | MAR. 1 1966 | FIG. 4



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VANCOUVER CANADA

CROSS SECTION ON 14500 E

REPLACEMENT ORE

ISLAND MTN. MINE , SE SECTION

SCALE: 1" = 100' | MAR. 1 1966 | FIG. 5

PRODUCTION POTENTIAL

At the present production rate of 100 tons per day, entirely from replacement orebodies, at the Island Mountain mine the total cost per ton is $27.06 (Can.). The gross profit per ton (Incl. E.G.M.A.) is $29.91, for a total annual net profit per ton (1964) of $2.85. Extrapolating these figures to a production of 300 and 500 tons per day at the present grade the annual net profits would be approximately $300,000 and $480,000 respectively. It is evident from the company's production history that the cost per ton could be appreciatively decreased by such increases in production, therefore the actual net profit would be higher than the foregoing figures. According to Mr. E.E. Mason, consultant, the Cariboo Gold Quartz mill could probably be raised to a capacity of about 400 tons per day without major capital expenditure. Plant expansion costs will not be discussed in this report but are referred to Mr. Mason who is fully conversant with the operation's capabilities, costs and requirements.

The present replacement ore reserves at Island Mountain are calculated to be 65,000 tons of proven-probable ore @ 0.53 oz Au/ton (Mar. 1965). Because of the relatively small orebodies, and the limited funds currently diverted to development of ore, it is difficult to increase reserves much beyond this figure; however, in the last 2 years, since exploration has been purposely directed to finding replacement orebodies to the exclusion of vein orebodies, the accumulation of reserves has been markedly improved. The possibility now presents itself of very appreciably increasing the ore reserves by expending more money and effort in a specific search for replacement orebodies. If the present proven reserve tonnage of replacement ore can thus be increased to about 200,000 tons, with an indicated tonnage of another 100-200,000 tons, thereby warranting a production increase to at least 300 tons per day, it is conceivable that repayment of the costs of the necessary special development program could be accomplished in about 2-3 years depending on rate of debt retirement etc. In addition the future productivity and profitability of the Cariboo Gold Quartz mines at Wells would be appreciably increased.

The major problems governing the foregoing proposals are:

(1) Are there sufficient geological reasons to indicate that an appreciable increase in reserves is possible?

(2) What will be the approximate expenditure necessary to accomplish the exploration and development program to prove the required ore reserves?

Discussion of these problems follows:

EXPLORATION POTENTIAL

ORE CONTROLS:

The potential for successful exploration for new replacement orebodies is of course directly related to what is known concerning the ore controls of these bodies. At the Cariboo mines all of the factors that have influenced the locations of the replacement orebodies are not well known, but a great deal of data has been accumulated from which certain general controls can be derived. Some of these ore controls, so derived, are definitely proven and repeatedly dependable, others are only suggested and remain to be proven by further investigation. These proven and presumed ore controls, for replacement orebodies only, are discussed as follows:

(1) Host Rock - Essentially all of the known replacement orebodies are confined to one or two limestone beds immediately adjacent to the contact between the host Baker Member and the structurally underlying Rainbow Member. The most prominent ore bearing lime bed is referred to as the 339 Limestone.

Therefore, exploration of this host rock, using the Baker-Rainbow contact as a guide, is essential in the search for replacement orebodies.

(2) Relation to Folding - In Figure 6 of this report all of the known replacement orebodies at the Island Mtn. mine are plotted on a vertical longitudinal projection. On this section, the main known (drag) folds in the Baker-Rainbow contact, and consequently in the adjacent 339 Limestone, are also plotted. The general trend of the orebodies is obviously related to the trend of the drag folds, and in many cases the orebodies are definitely confined to specific portions of particular folds. Further illustrations of this relationship are given in Figures 3, 4 and 5, which shown detailed situations in the southeastern part of the mine.

Many replacement orebodies in the mine are not related to any obvious folds but they still follow the plunge (-20° NW) of the folding; indicating a genetic relationship if not a spatial one. Conversely, most of the folds, but not all, that have been thoroughly explored have proven to be hosts to replacement orebodies.

Therefore, although this control is not proven to be infallible it has definitely proven to be more often productive than not. It is thus a valid guide to exploration for replacement orebodies in that:

(a) Any known folded areas should be carefully explored,
(b) A known fold, especially if productive, should be explored along its projections into unexplored areas, and
(c) The contact should be explored particularly for areas of drag folding.

(3) Relation to Faulting - The criteria of exploring for ore in areas of major crossfaults has been followed successfully at Wells for most of the history of the mines; however, a study of mine plans, and

Figure 6, suggests that this may or may not be a valid control and guide. There is a reasonable distribution of ore between the faults in Island Mountain although this may not be the case for wider-spaced faults. Skerl states that the vein orebodies in the No. I Mine are definitely spatially related to the major faults.

It is the writer's opinion that the cross faults are not as direct a control as are the drag folds; however, because the faults are rather regularly spaced throughout the entire known extent of the Gold Belt any exploration along the contact is seldom more than 1,000 feet from a cross fault, therefore, since there is good statistical indication that there is more ore near such faults than away from them, exploration of the contact may just as well begin at such faults.

(4) Relation to Veins - Exposures at the mine have revealed numerous veins which extend from the Rainbow Member rocks into the Baker Member at least to the 339 Limestone. The mine staff and Mr. Mason have described to the writer examples of replacement orebodies which are connected to steep quartz-pyrite veins from below, and some cases which have veins continuing above the replacement orebody. Many examples have been mapped and recorded by past and present geologists at both Island Mountain and No. I Mine of ore veins terminating in the Baker rocks at a replacement orebody. (Fig. 7, this report).

Because emphasis during recent years has shifted largely away from the development of veins the present records are not complete enough to permit a comprehensive study, but compilation of available data strongly suggests that the replacement orebodies in the Baker Member are largest and most numerous where the distribution of ore veins in the underlying Rainbow Members is most pronounced. (See Figs. 5 and 6). The restriction of the replacement ore in the Baker rocks only to the lime beds near the contact at the structural footwall, as well as the development of skarn bands higher in the Baker beyond the orebodies, suggests that the ore solutions rose up to and along the Baker rocks from below. In this case the best plumbing system available would be where the underlying Rainbow rocks are most fractured (and veined?).

Therefore, although this ore control cannot be conclusively demonstrated, mostly because of lack of data, there is a very definite general statistical implication that it is a valid control and a reliable broad guide. Thus, the writer suggests that use of this guide to the exploration of the Baker-Rainbow contact for replacement orebodies would be to search the overlying Baker rocks in areas where the Rainbow Member is densely laced with gold-bearing pyrite-quartz veins. (Fig 5).

(5) Other more general and/or detailed ore controls no doubt exist for the replacement orebodies and they will become evident as development of these bodies increases but at this time the above-described ore controls appear to be reasonably valid and provide a number of good guides for exploration.

The foregoing known and inferred ore controls suggest a very simple and commonplace origin for all of the lode gold orebodies in the Gold Belt. A reasonable sequence of events would have the hydrothermal solutions rising to the surface from an as yet undetermined source and through the section of the Snowshoe Formation known as the Gold Belt. Finding passage through these rocks the solutions would tend to follow the most open plumbing system, which at depth could well be the regional NW faults. Such fault zones, however, are generally rendered less than previous by proliferation of gauge and slickenside planes. The passages that are most travelled in such instances are tension fractures, breccias, or otherwise dilated zones that have developed in adjoining formations of optimum competency for such structures. This type of structure under many circumstances will open and reopen under regional and/or local stresses and thus permit passage of repeated flows of hydrothermal solutions. In the Gold Belt the intensely tension-fractured Rainbow quartzitic rocks could have provided such a plumbing system at least to the depth of those beds. The origin of the areas of intense open fracturing in the Rainbow rocks may or may not have been directly related to the regional faults. It would appear from the evidence that certainly the Rainbow beds are fractured and veined many hundreds of feet from the regional faults, which should be expected considering the regional scale of the deformation and abundance of faults, however, there is also reasonable evidence that the Rainbow fracturing nearer the faults has been rendered more open during mineralization. Solutions rising through the Rainbow fracture system deposited quartz-pyrite-gold veins within that system at the same time would be continually reaching into the overlying Baker beds through those fractures that did persist into these rocks. Such solutions, being probably siliceous upon reaching the limey beds would form skarn minerals and precipitate iron which in this case appeared as pyrite. It is logical to surmise also that areas of drag folding in the Baker rocks would be more dilated, and therefore more susceptible to mineralizing solutions, than areas of no folding.

If the foregoing theory of the related origin of the veins and the replacement orebodies is valid, then a correlation of gold grades between vein orebodies and the overlying replacement orebodies may be, and should be, applicable. This can be viewed in three ways, namely: (1) There is no direct relation in gold grade between neighbouring orebodies, or (2) A high grade set of gold quartz veins in the Rainbow means that the solutions were depleted of gold before reaching the overlying Baker rocks and therefore the replacement orebodies in that area are low grade, or (3) High grade gold-quartz veins means that the overlying replacement orebodies will also be relatively high grade. The first alternative is suggested by the wide range of grades within any one group of veins, however, the better grade veins do tend to occur closely grouped within any one area of veins, suggesting some systemmatic relation between grades and particular locations. The second alternative is geochemically dubious because there is essentially no discernible significant physical or chemical difference between very

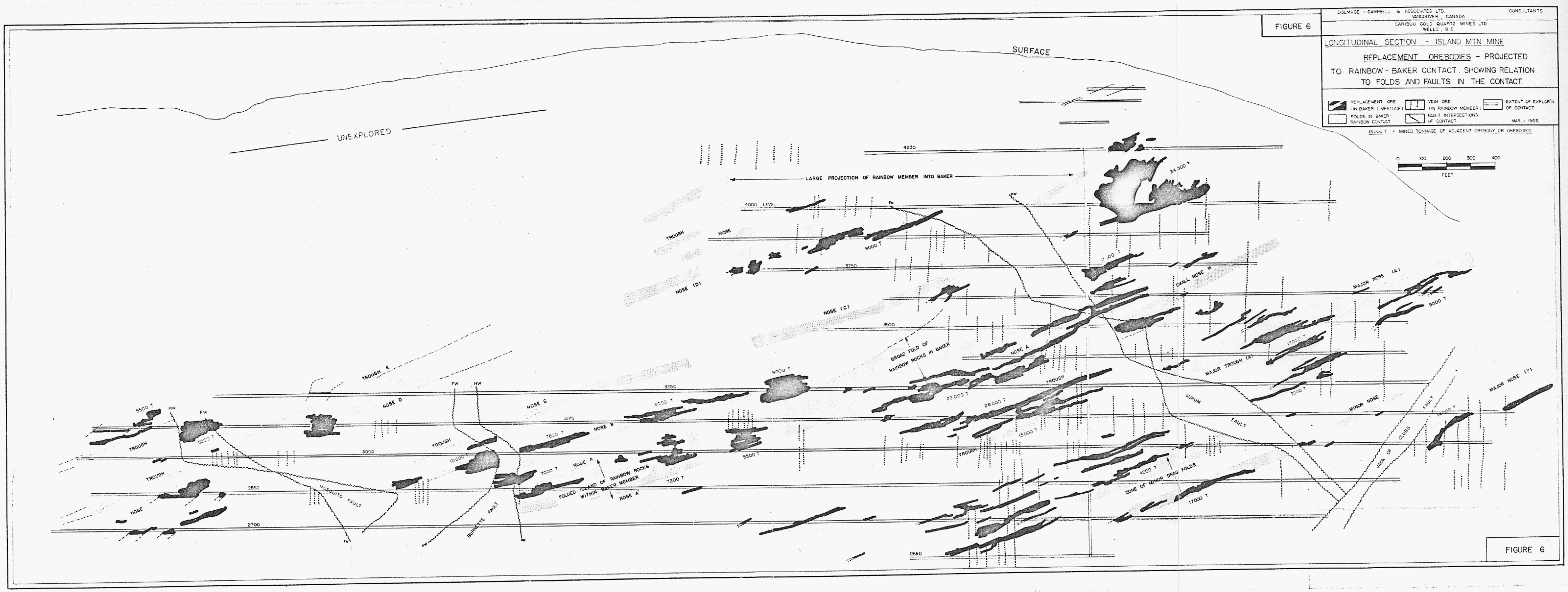
FIGURE 6
DOLMAGE - CAMPBELL & ASSOCIATES LTD.
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CARIBOO GOLD QUARTZ MINES LTD
WELLS, B.C.
LONGITUDINAL SECTION - ISLAND MTN. MINE
REPLACEMENT OREBODIES - PROJECTED TO RAINBOW - BAKER CONTACT. SHOWING RELATION TO FOLDS AND FAULTS IN THE CONTACT.
REPLACEMENT ORE (IN BAKER LIMESTONE)
VEIN ORE (IN RAINBOW MEMBER)
EXTENT OF EXPLOR'N OF CONTACT.
FOLDS IN BAKER-RAINBOW CONTACT
FAULT INTERSECTIONS OF CONTACT.
MAR. 1 1966
13000 T = MINED TONNAGE OF ADJACENT OREBODY OR OREBODIES
0 100 200 300 400
FEET
SURFACE
UNEXPLORED
LARGE PROJECTION OF RAINBOW MEMBER INTO BAKER
4230
4000 LEVEL
3750
3500
3250
3125
3000
2850
2700
2550
34 300 T
9000 T
23 000 T
26 000 T
17000 T
MAJOR NOSE (A)
MAJOR TROUGH (A)
MAJOR NOSE (?)
MINOR NOSE
SMALL NOSE H
NOSE (C)
NOSE (D)
TROUGH
NOSE
TROUGH E
NOSE D
NOSE C
NOSE B
NOSE A
NOSE A'
BROAD FOLD OF RAINBOW ROCKS IN BAKER
FOLDED ISLAND OF RAINBOW ROCKS WITHIN BAKER MEMBER
ZONE OF MINOR DRAG FOLDS
AURUM FAULT
JACK OF CLUBS
MOSQUITO FAULT
BURNETTE FAULT
FW
HW
FIGURE 6

high grade veins and low grade veins; therefore it is difficult to reason that the solution would be depleted in gold more in any one group of veins than any other in this area, unless temperature and pressure conditions were locally appreciably unequal. The only likely remaining reason for the occurrence of higher grade veins in local groups is that the solutions passing through these local fracture systems were either higher in gold content to begin with or they met temperature-pressure conditions that were particularly favourable for the precipitation of gold. In either case it would be very likely that the same conditions would apply to the nearby overlying sites for replacement in the Baker rocks and the ore in them would be comparably higher in grade as well.

The foregoing discussion on the relation of grade of veins and nearby replacement orebodies is important because, in one way or another, it would provide another very useful guide to the search for replacement orebodies. If the best grades of vein and replacement orebodies occur in the same areas then search for replacement bodies should be concentrated in areas of high grade veins. The highest grade veins in the mines occur in the No. I Mine, southeast of Wells, where essentially no exploration for replacement orebodies has been done, therefore this area would comprise an excellent area for exploration.

To pursue this idea further the writer suggests that the staff at the mine make a cursory comparison, if data permits, between the grades of all the replacement orebodies and those of the corresponding (underlying) veins. If the results of such a study indicate a correlation, one way or another, it should be completed in detail and applied to area of known veins where exploration for replacement bodies has been neglected.

SCOPE OF EXPLORATION FOR REPLACEMENT OREBODIES:

The range of exploration possibilities is discussed below, progressing from the particular, where much data is available, to the general, where well established data is meagre.

ISLAND MOUNTAIN MINE: Members of the staff at the mine are well aware of the foregoing suggested ore controls and are currently employing some of them in their search for new replacement orebodies. For the purposes of this report the writer will review the present potential for exploration at this mine, based on the suggested criteria. The areas for such exploration have been divided into three categories; those readily reached by drilling from existing workings, those reached by relatively shoft drifts from existing workings, and those reached by major extensions of the mine workings. Reference for this discussion should be made to Figure 6 accompanying this report.

(I) Requiring drilling: Exploration of the 339 Limestone has been meagre, and folding or known ore trends etc are favourable, in the following places: Hanging wall of Aurum Fault on levels 4000, 3875 and 3625. Between Aurum and Burnett Faults on levels 4000, 3875, 3125-3000 and 2700. Northwest of the Burnett Faults on levels 3250 and 3125 southeast of M 63.

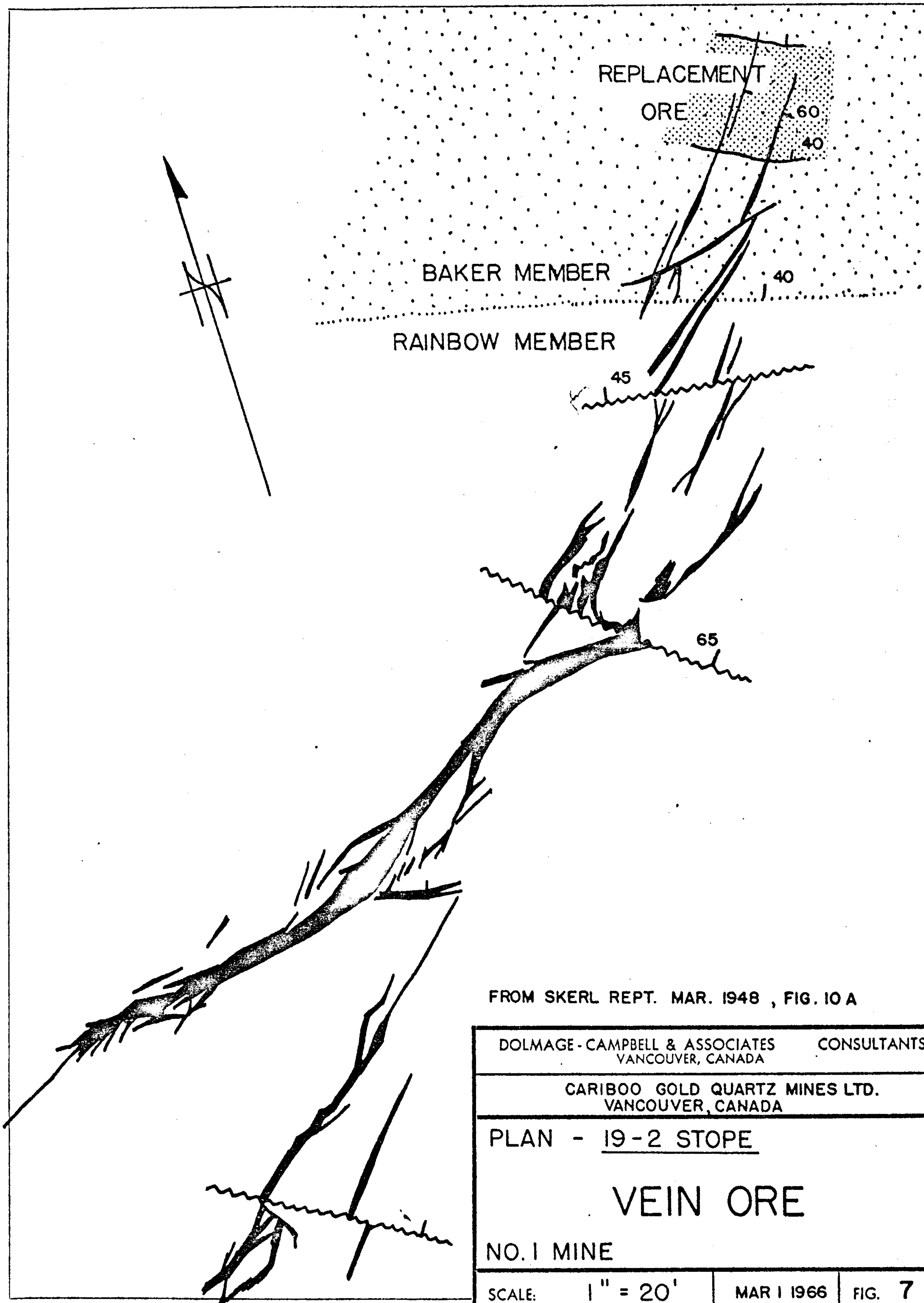
(2) Requiring a few hundred feet of drifting and drilling: Reasonably short drifts will advance the headings into areas of projected folds and/or ore in the following places: Hanging wall of Aurum Fault on levels, 3875, 3750, 3250 (Into FW of Jack of Clubs Fault), 2850 and possibly 2700. Northwest of Mosquito Fault on levels 3000, 2850 and possibly 2700.

(3) Requiring major development: All levels above 3250 have unexplored good prospecting ground for over 2000 feet to the northwest. A suggested method of attacking this target would be to expose the 339 Limestone with surface bulldozer trenches at 50-100 ft. intervals until replacement ore is found, then completely strip such ore and sample. Enough good surface ore would then warrant driving the 4230 level to the northwest. Deeper levels would follow as results warrant. Because of the low rake of the ore to the northwest any good surface ore found within 1000 feet southeast of Mosquito Creek would warrant driving the 3125 level further northwest.

To the southeast the 3125 level could be extended about 1000 feet and would reach any extension, or rake, of the replacement ore found in No. 1 Mine on the second from bottom level, (See Fig. 2). This development should be preceded by diamond drill holes several hundred feet into and ahead of the face to test for water, since it would be proceeding under the lake.

NO. 1 MINE (Reference Fig 2): The old Cariboo Gold Quartz workings immediately southeast of Jack of Clubs Lake are generally referred to as No. 1 Mine. For the purpose of this report all workings southeast to the Lowhee Fault, (Pinkerton Zone in Fig. 2), are considered as the No. 1 Mine. The mine workings are presently flooded below the first level down from the portal (4000) level. The condition of the unflooded workings is not known to the writer but it is assumed that they will not require a major capital investment to rehabilitate. Initial exploration in No. 1 Mine at this time must of course be confined to the unflooded levels but the potential of all levels should be assessed because all of the significant replacement ore found in this mine was exposed in the presently flooded levels.

It's worthwhile to review a few facts concerning replacement ore in the No. 1 Mine. Earlier in this discussion the thesis was advanced that because the highest grade vein ore in the mines was derived from No. 1 Mine (Rainbow Fault) then perhaps the replacement ore in this mine would also be comparably higher grade. This is certainly suggested by the mine's production record; by 1945 ? the mine had produced 101,000 tons of replacement ore whose average grade was 0.83 oz Au/ton, a grade appreciably higher than the replacement ore average from Island Mountain. A study of the No. 1 Mine maps and records vividly illustrates the fact that exploration into Baker Member rocks was everywhere



FROM SKERL REPT. MAR. 1948 , FIG. 10 A

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CARIBOO GOLD QUARTZ MINES LTD. VANCOUVER, CANADA	

PLAN - 19-2 STOPE

VEIN ORE

NO. 1 MINE

SCALE: 1" = 20'	MAR 1 1966	FIG. 7

meagre and inadvertent, with little development across the contact. The data that is available on the Rainbow-Baker Contact in the No. 1 Mine indicates the most important and impressive fact that the beds are considerably drag folded on most levels all the way from the Rainbow Fault to the Lowhee Fault, a distance of 4000 feet (Fig. 2). In the Island Mountain mine such structures are most favourable hosts for replacement orebodies in the Baker (339) Limestone, and there is no reason to expect they would not also be favourable at No. 1 Mine.

When Skerl made his review report of No. 1 Mine in 1948 he strongly advocated that effort be made to explore for replacement orebodies. The fifth level below the portal level was accordingly pushed toward Island Mountain, where replacement bodies were extensively mined, and it was planned to follow the Baker contact in that direction. Due to faulting of the formations the drive missed most of the contact, nevertheless, three sections of replacement ore were found. Eventually the lack of development funds precluded further search for replacement ore while known vein occurrences were more readily available. A few extracts from Skerl's report (1948) are noteworthy:

> (In the hanging walls of No. 1 Fault) ... "small lenses of replacement ore in the No. 2 band have been found accidentally on the 15, 16 and 19 levels". One such lense is 19-2R, 50 ft x 6 ft x 0.5 ft, with a 20° northwest plunge.
>
> (In the area of the Rainbow Fault) "... (a) feature of the 20-2 Vein is the presence of thin bands of bedded replacement sulphides, carrying high gold values, where it pinches out in the Baker rocks."
>
> (In the area of the Sanders Fault). "Possibilities of replacement ore at the Baker contact are essentially unexplored". (Two crosscuts and four drill holes).

There is no doubt in the writer's mind that the No. 1 Mine of Cariboo Gold Quartz has outstanding potential for exploration for replacement orebodies. From the information available there is no reason not to expect as much replacement ore in the developed parts of No. 1 Mine as have been mined from Island Mountain to date, namely about 500,000 tons, with untapped potential at depth.

Exploration of the No. 1 Mine could be readily done in the following stages:-

(1) Bulldozer stripping - The Baker-Rainbow contact should be exposed on the surface across Cow Mountain ridge from Jack of Clubs Lake to the Lowhee Fault, a length of about one mile, (See Fig. 1). Trenches should be 50 feet apart and be done by no smaller piece of equipment than a 1964 D7E Cat with ripper. Rehabilitation of the near-surface levels would be guided by the stripping results. If possible all the upper levels should be operated as adits.

Prob. caved at fault. ?

(2) The Portal level should be rehabilitated - The geological maps should be checked and a comprehensive underground diamond drilling program should then be laid out accordingly, and done for the entire portal level.

Further diamond drilling on other levels would continue as results warranted. If results disclosed appreciable ore on the portal level then the lower levels should be pumped out and that part of the mine rehabilitated and exploration be particularly concentrated in the areas of known replacement ore (Fig. 2).

REMAINING CLAIMS: (Reference Fig. #1): Cariboo Gold Quartz Mines Ltd. holds claims which cover the Baker-Rainbow contact southeastward from No. 1 Mine to the Proserpine Property one mile beyond Barkerville. For about 80 percent of this 3.5 mile distance the contact lies above the 4500 contour. Reports by all workers indicate that there are few outcrops above 4000 feet but that the overburden cover (glacial drift) is generally only a few feet in depth. Practically every geologist on record with these mines has recommended surface trenches for exploration, and indeed that is how the original veins were discovered, but no such work has been comprehensively done for replacement orebodies. Now, with larger bulldozers and rippers available the company will be able to conduct an extensive, comprehensive and probably rewarding program of surface exploration for replacement orebodies that could conceivably increase the total ore reserves of the mines by well over 1000 percent, should the total length of the Baker limestone from No. 1 Mine to Proserpine be as productive as it is northwest of No. 1 Mine.

The possibilities southeast of No. 1 Mine are encouraged by the extensive good grade vein orebodies known in this area within the Rainbow rocks. Many drill hole and adit level intersections in the Westport area (Fig. 1) (Williams Creek Gold Quartz Mining Co. Ltd.) indicate the existence of a fair number of high grade quartz-pyrite veins. Certainly this area of faulting and ore veins warrants careful exploration on the Baker side of the contact for replacement orebodies.

Surface bulldozer stripping should be initiated by cutting trenches at 50 ft. intervals across the Baker (339) limestone, wherever it can be located, until replacement ore is exposed. Such ore should then be completely stripped, sampled and later drilled. Good areas to begin such a program would be at the known vein and fault occurrences; the Lowhee, the Sirius and the Bakerville (Fig. 1).

It is obvious from the foregoing discussion, along with a glance at the trace of the Baker-Rainbow contact on Figure 1, that there is also good prospecting ground for replacement gold orebodies on Proserpine Mountain, southeast of the Cariboo Gold Quartz claims. If this ground is open it should be staked, at least one claim wide, for a summer's stripping.

POSSIBLE RESULTS AND COSTS OF EXPLORATION

The various phases of exploration for replacement orebodies in each area of the Gold Belt are designed as parts of a broad preliminary exploration program whose prime purpose it is to determine if replacement orebodies occur outside of Island Mountain. The geological features of the mines are such that there is no reason to expect that such ore will not occur in all or most of the target areas. For purposes of estimates and assessment of the possible rewards for exploration of the available target areas the writer has listed here his suggestion of a possible reasonable tonnage potential for each area; assuming that such ore does occur in each area and extrapolating tonnages from the Island Mountain area production. These suggestions of course are most hypothetical, but then again they are geologically possible and could reasonably be conservative. Grades are assumed to be the same as the average for replacement ore at Island Mountain, about 0.7 - 0.8 oz Au/ton (equiv.).

Island Mountain Mine	-	300,000	tons (above existing bottom level).
No. I Mine	-	500,000	tons (").
Southeast	-	500,000	tons (within reach by adits).
	TOTAL	1,300,000	tons.

At the current mine net profit per ton this represents a total profit of over $3 million.

COST ESTIMATE FOR EXPLORATION:

Some of the costs for the above exploration prog ram, such as mine rehabilitation, can only be very roughly estimated by the writer, therefore he has endeavoured here to present only a very general estimate of costs of the various phases of the prog ram and recommends that Mr. Mason and the mine staff refine the estimates for execution.

PHASE I (A) Island Mountain Mine - More thorough exploration of mine. Add one diamond drill ($5-10,000), three shifts, 20,000 ft. @ $3 -	$70,000
(B) Island Mountain, No. I Mine - Surface stripping. 10,000 feet of strippable contact, trenches @ 50 ft spacing, 2 per day per cat.	
Two bulldozers 60 days @ $50 per day per machine -	$6,000
(C) No. I Mine - Rehabilitate portal level	$10,000 (?)
One drill as at Island Mtn. -	$70,000
(D) Southeast - Both bulldozers stripping 3 mons. -	$8,000
(E) Surface - Once the 339 Limestone has been reasonably located by stripping, an I.P. or E.M. survey of it may aid as a further guide to stripping. (This should first be tested and only used thereafter if found successful) -	$10,000

	(F) Staff increases (Geologist, samplers, surveyors, etc) - Assays, overhead, etc.		$11,000
	PHASE 1 - Through summer 1966	TOTAL	$185,000
PHASE 2	(A) Island Mtn - extended development. 6,000 feet new drifts to NW and SE, @ $40/ft.		$240,000
	(B) No. 1 Mine - assuming success from Phase 1-C (drilling), rehabilitate whole mine -		$60,000 (?)
	- Add another drill and continue program another six months -		$120,000
	(C) Surface drilling - Limited probing of any targets found by bulldozers -		$50,000
	PHASE 2 - Winter 1966-67 -	TOTAL	$470,000

By the end of Phase 1 the efficacy of proceeding with much of Phase 2 will be pretty well determined, therefore the expenditure of the $470,000 of Phase 2 will be in large measure proceeding on success. Because of widespread existing workings, development costs for new ore found in the two mines will be low, therefore the final profit per ton may well be higher than for the present ore. The development of new ore found beyong the existing workings will of course necessitate new capital expenditures, however, the addition such ore would make to reserves and potential would no doubt warrant this.

An expenditure of approximately $200,000 on a concerted exploration program designed specifically to search for replacement orebodies on the Cariboo Gold Quartz property could indicate enough reserves to warrant expansion to 300 tons per day. In that case a further expenditure of approximately $470,000 on follow up exploration could further extend the indicated reserve potential to warrant a further expansion to 500 tons per day.

CONCLUSIONS:

As explained in the foregoing report, the writer believes that there are excellent geological reasons for assuming that much more replacement pyrite-gold ore exists on the Cariboo Gold Quartz properties than has been mined to date from Island Mountain. Until other geological factors (if any) become known to dictate otherwise there is a reasonable potential tonnage on all properties of at least 1 million tons, with the ultimate tonnage not estimated. This tonnage represents a net profit to the company (at present costs, etc.) in excess of $3 million. The writer estimates that an initial exploration program to provide an indication of the general existence and grade of more than half of this tonnage would cost approximately $200,000. This is certainly excellent return for the money and is therefore strongly recommended to the company by the writer.

If the initial exploration is successful then a more intensive phase of exploration would be necessary and this would cost approximately $470,000. Since this expenditure is predicted only on the success of the first phase, it would be also worthwhile and in that case would be recommended by the writer.

Success of Phase I would warrant eventual expansion of mine production to 300 tons per day, whereas success of Phase 2 would possibly warrant eventual expansion to 500 tons per day if the new orebodies were not too widely distributed. At 300 tons per day and at present net profits per ton ($2.90), the annual net profit would be about $300,000. At 500 tons per day it would be $480,000. Therefore the retirement of the original $670,000 total exploration expenditure could be realized within 3-4 years if necessary.

The writer feels that his cost estimates for the program are generally high and that the staff of Cariboo Gold Quartz Mines Ltd. could probably pare them appreciably. However, there are certain hidden costs such as plant and town-site improvements which will probably have to be met and which though not directly related to this project are almost necessary to keep a stable work force. Therefore, the total figure estimated here by the writer will probably be realized in one form or another before the program is complete.

Respectfully submitted,

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