

1968

008070

LODE METALS

75

**WORK DONE:** An area of bedrock 600 by 200 feet was stripped by D7 bulldozer. Three miles of access road was constructed, two adits were reopened, total length 75 feet, and four holes totalling 675 feet were diamond drilled. Six men were employed for six months.

**REFERENCE:** *Minister of Mines, B.C.*, Ann. Rept., 1967, p. 61.

**Callaghan, Tarn**

**LOCATION:** (50° 123° S.E.) At an elevation of 2,500 to 3,250 feet immediately south and southwest of Dority Creek, an easterly flowing tributary of Callaghan Creek which in turn flows into Cheakamus River.

**CLAIMS:** Callaghan, Tarn 1 to 11.

**ACCESS:** By road and trail from McGuire on the Squamish-Pemberton highway.

**OPERATOR:** Barkley Valley Mines Ltd., 96-67th Street, Ladner.

**METALS:** Gold, silver, copper, lead, zinc.

**WORK DONE:** Electromagnetic and magnetometer surveys on Callaghan and Tarn claims; one 125-foot trench by bulldozer; three holes totalling 125 feet diamond drilled. Three men worked for eight months under the supervision of T. Barkley.

**REFERENCES:** *Minister of Mines, B.C.*, Ann. Rept., 1936, pp. F 53-F 56; 1967, p. 61; Assessment Report No. 1577.

**DESCRIPTION:** This property is a restaking of the old Astra and Cambria property. The showings are reported to include widespread disseminated low-grade mineralization (pyrite, chalcopyrite, sphalerite, and galena) with some localized higher-grade concentrations. These occur in altered sedimentary and volcanic rocks which are surrounded by diorites and granodiorites of the Coast Range intrusives.

HOWE SOUND

**Britannia Mine**

By A. R. C. James

**LOCATION:** (49° 123° N.E.) Britannia mine is on the east side of Howe Sound 40 miles by road from Vancouver.

**OWNER:** Anaconda Britannia Mines Ltd., 1600, 409 Granville Street, Vancouver 2; B. B. Greenlee, vice-president and manager; J. F. Anderson, general superintendent; R. T. Baverstock, mine superintendent; E. R. Parker, mill superintendent.

**METALS:** Copper, zinc (see Table 12 for production).

**WORK DONE:**

Early in the year a decision was made to sink a new shaft from 4100 level to facilitate development and mining of the very substantial reserves of ore indicated in the -040 zone. This ore zone lies to the west of No. 8 section and has been explored over the past few years by drifting and diamond drilling from several levels of No. 8 section, mainly 4700 and 5250 levels.

The new shaft, to be known as No. 10 shaft, is sited 4,000 feet west of No. 8 shaft and 500 feet south of the 4100 main haulage. The shaft is to be sunk 2,200 feet below 4100 level; the bottom of the sump will be at 6300 level. During 1968, access laterals were driven to the shaft-site, a shaft pilot raise driven above 4100 level, the main Koepe hoist room excavated, a service hoist room cut, a service hoist rope raise driven, and other excavations for associated facilities were made preparatory to sinking the shaft.

The following is a summary of development work done in 1968: Drifting and crosscutting, 11,208 feet; raising, 5,107 feet; diamond drilling, 50,068 feet.

New switchgear was installed in the mill for the 200-horsepower blower motors and the 125-horsepower crusher motors.

The main haulage adit of the mine is on 4100 level, with the main portal at Britannia Beach. This now extends for approximately 4 miles along the Britannia shear structure. At present, orebodies are being mined in the Victoria, Bluff, and No. 8 sections of the mine, with important development in the No. 10 section to the west of No. 8. The Victoria section is serviced from the Victoria shaft, which extends from the surface above 1800 level down to the main haulage at 4100 level, 3.8 miles from the portal.

The Victoria workings are now mainly confined to the large long-hole stope in the West Victoria or 188 orebody. The Bluff or No. 7 section is serviced by the No. 7 shaft, which extends from 2200 to 4100 levels and is 2.25 miles from the portal, and also by No. 4 incline shaft, which is in operation between 2700 and 3500 levels. The principal sources of production in the Bluff are now the orebodies adjacent to No. 4 shaft. The No. 8 section is mined from No. 8 shaft, 1.8 miles from the portal. The major part of the production from this section is from stopes between 5100 and 5400 levels. Development was begun during the year on the 5500 level. The method of mining at Britannia is mainly long-hole blasting with a very few shrinkage and square-set stopes.

The accident rate for compensable accidents was 32.0 per million man-hours, a substantial improvement on the rates for 1966 and 1967, which were 50.0 and 53.0 respectively. A commendable feature of this operation is the careful investigations by special committees representative of both management and the union into all serious accidents and any unusual occurrences or accidents.

## NEW WESTMINSTER MINING DIVISION

### HOPE

#### Pride of Emory Mine

By T. M. Waterland

**LOCATION:** (49° 121° S.W.) At the head of Stulkawhits (Texas) Creek, which flows eastward into the Fraser River 8 miles north of Hope.

**ACCESS:** By a gravel road about 5 miles long which leads from the Trans-Canada Highway 8 miles north of Hope to the mine plant at the 2600 level.

**OWNER:** Giant Mascot Mines Limited, 1825, 355 Burrard Street, Vancouver 1; mine address, P.O. Box 1060, Hope; L. P. Starck, vice-president and general manager; F. Holland, resident manager; G. D. Bosnich, general superintendent; G. Hungle, mine superintendent; M. Ould, mill superintendent.

**METALS:** Nickel, copper (*see* Table 12 for production). Concentrates are sold to Sumitomo Metal Mining Co. of Canada Ltd.

#### WORK DONE:

During 1968 extraction was completed in the Pride of Emory "C" and Hangingwall zones.

Development and long-hole drilling of the Brunswick 8 stope was completed and production started. A major cave over the Brunswick 2 stope forced suspension of work in the Brunswick 8 stope.

Production from the Brunswick 2A stope continued until suspension was forced by the major cave in the Brunswick 2 stope.

On 3550 level an access drift was driven from the 1900 orebody to the new 4600 orebody. Extraction of the Brunswick 10 stope was completed. Production continued intermittently from the Brunswick 1 stope. The 1400 and 600 stopes were drawn empty.

### Empress Mine

The Empress mine occupies a position on the foot-wall of the shear zone about 800 feet east of the Fairview. It is confined to a wedge-like mass of schist, embedded in the foot-wall slates,<sup>1</sup> in somewhat the same manner as the Bluff-Fairview ore zone is surrounded by the main slate hood.<sup>2</sup> The Empress structure, however, is much smaller, and has been formed in a different manner. The small wedge of slate forming the hanging-wall (south) side of the structure, is believed to have been dragged into the main shear zone along the local zone of intense shearing which is mapped as silver schist. Just at the west end of the small wedge of hanging slate, the silver schist is narrow and very highly sheared, but farther east it widens considerably, although retaining much of its very fissile character. The Empress structure is developed only above the 1,050-foot level; below this level neither the narrow hanging-wall wedge of slate, nor the narrow band of very highly sheared schist have been found. The ore zone extends from the surface, between the 600 and 700-foot levels, to the 1,600-foot level at least.

The Empress ore zone is divided into two ore-bodies, known as the first and second veins, by a second band of silver schist which meets the foot-wall of the shear zone at a small angle about 100 feet east of the apex of the main Empress structure. Each vein, therefore, is a wedge-shaped body, whose hanging-wall is a soft, intensely sheared schist, and whose foot-wall is either the foot-wall of the shear zone or the silver schist. These walls are all soft and have added considerably to the difficulties of mining. Two basic dykes are found in the hanging-wall section of the mine. The larger of these, striking about parallel to the foot-wall, apparently has been offset by the narrow band of silver schist which, of course, is essentially a fault zone if the Empress structure has been developed in the manner suggested. The reason for the abrupt termination of the other dyke is not known.

Although the walls of the veins are soft, the rock within the vein zones is distinctly massive and less sheared than much of the green-mottled schist of the Fairview mine. The ore occurs as very numerous, irregular, and discontinuous stringers, forming an ore zone rather than a distinctly defined vein. The Empress ores contain appreciable amounts of sphalerite in addition to the quartz, pyrite, and chalcopryrite that are present in all the deposits, and in this respect they resemble the Bluff ores. Silicification, however, is not pronounced except locally, at the west ends of the veins on the upper levels.

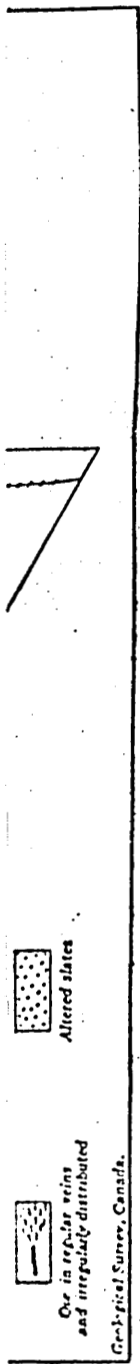
### Victoria Mine

The Victoria mine is the most easterly of the Britannia mines and is situated directly on the foot-wall of the shear zone, about 1,000 feet east of the Empress. None of the veins outcrops on the surface, but all are covered by about 100 feet of glacial till which conceals so much of the shear zone in South valley. The Victoria is the last of the Britannia mines to have been discovered, and was located by diamond drilling along the strike of the shear zone. The early prospectors had recognized the general trend

<sup>1</sup> See plan 1,050-foot level.

<sup>2</sup> See Schofield, S. J.: *Loc. cit.*, p. 234.

Figure 11. Illustrating the grading of the Fairview veins into the Bluff type of mineralization.



of the Britannia ore zone, and had started small shafts almost over the Victoria deposit, but the unusually thick mantle of drift was too great an obstacle to be overcome by individual prospectors with their limited equipment. The red rock, at the west end of the Victoria ore zone, is a short distance above the 1,800-foot level, and is below this level at the east end of the mine. The mine has been developed to the 2,500-foot level without any indication of a decrease in the values or the size of the veins. This is the lowest level that has been developed in the Britannia mines, but a tunnel is being driven on the 2,700-foot level to tap the west end of the shear zone.

The commercial veins of the Victoria mine are confined to a zone 900 feet long by 200 feet wide, along the foot-wall of the shear zone. The northern boundary is indicated by two wedges of slate, and the hanging-wall is defined by a broad band of silver schist which is apparently continuous with one of the silver schist bands of the Empress mine. The Victoria ore zone differs from the Bluff, Fairview, and Empress ore zones, in that sheared members of the Britannia formation are represented, and mineralized, as well as the mine porphyry. In the other mines of the shear zone, except the Jane, the sulphide veins are strictly confined to sheared phases of the mine porphyry, although barite-sphalerite ores and anhydrite veins are found in the foot-wall rocks, which belong to the Britannia formation. In the Victoria mine the sulphide veins not only occur in rocks of the Britannia formation, but cross, indiscriminately from one formation, or one type of schist, to the other. They are not found, however, in the slates or the silver schist, and the anhydrite veins are, apparently, confined to the slates. Aside from the slates, the green-mottled and the silver schists, which are common to all the mines, a "Victoria" and a "light green" schist are recognized in the Victoria mine. The latter is a typical chloritic schist developed from an andesitic rock and is readily distinguished from the other schists in most parts of the mine. The boundaries are obscured by shearing, but the typical rock is quite distinct from the typical green-mottled schist. Usually the cleavage planes contain very sharply defined, dark green, elliptical blotches of chlorite, which are apparently flattened amygdules. The Victoria schist is a difficult rock to describe. It resembles the green-mottled schist, and frequently the two rocks cannot be distinguished, but in general it has a much more irregular, blotchy appearance as though developed from a breccia containing fragments of slightly different composition. It is believed to be a member of the Britannia formation. Owing to the uncertainty of the distribution of the green-mottled and Victoria schists in certain parts of the mine, both types are indicated as green-mottled schists on the accompanying plan of the Victoria mine, except for one band of Victoria schist along the foot-wall of the ore zone.

Within the Victoria ore zone are five distinct veins, as well as small lenses of commercial ore. They strike northwest, parallel to the foot-wall of the shear zone, and dip at 80 to 90 degrees to the southwest. The two northerly veins are from 25 to 30 feet apart throughout the greater part of their length, but coalesce towards the west end in a single, broad, siliceous ore zone. The west end of the two veins, above the 2,000-foot level, is restricted to a wedge of schist embedded in slates, but the slates

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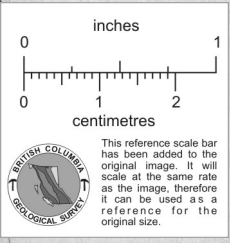
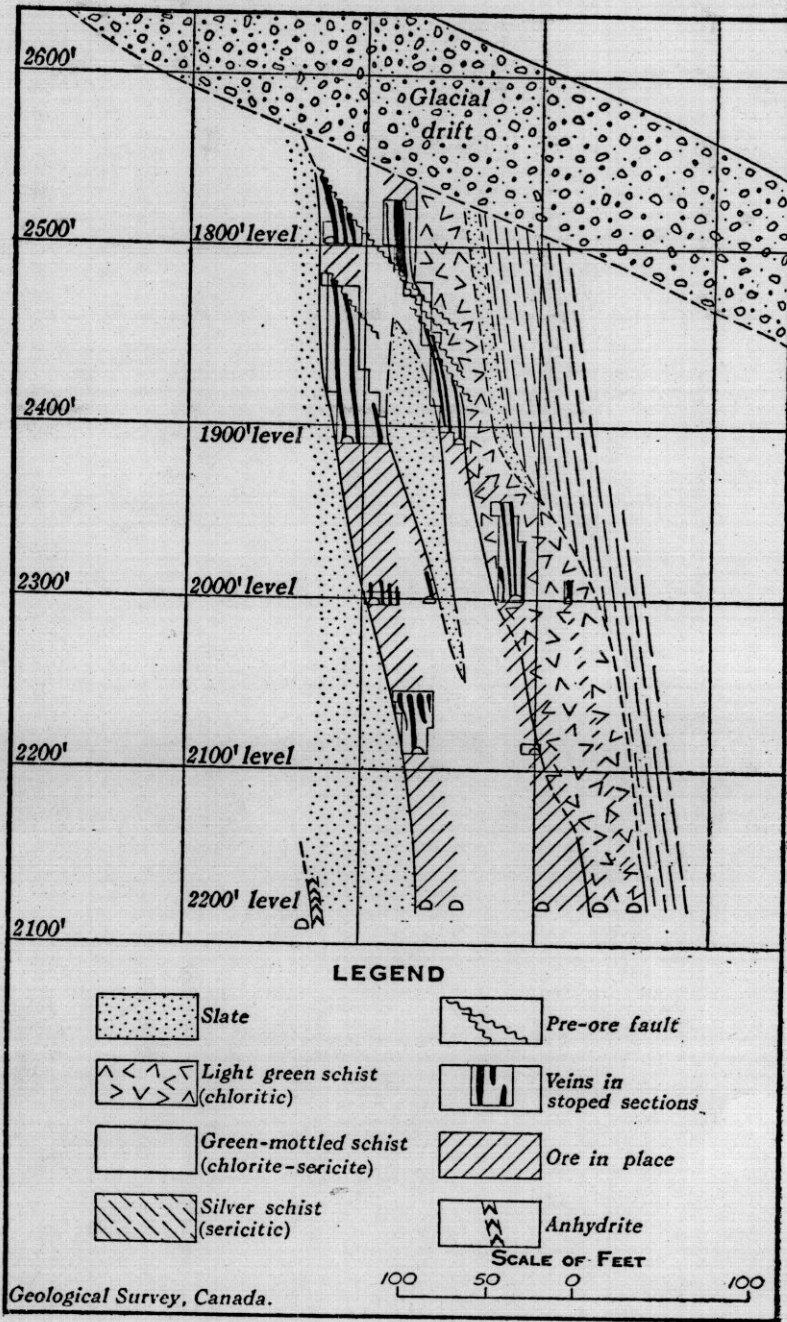
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Geological Survey, Canada.

Figure 12. Transverse section of Victoria mine.

that form the hanging-wall part of the wedge do not continue to the 2,100-foot level (See Figure 12). The ore, in the eastern half of the northerly vein, occurs in a series of distinct lenses arranged *en échelon* along the general trend of the foot-wall. Each lens is 1 or 2 feet to the left of its neighbour. On one of the upper levels, the ore occurs along the contact of the light green and Victoria schists, and the lenses seem to be related to irregularities of the contact, resembling drag folds, but the schists in the vein zone are so difficult to distinguish, that the exact nature of the irregularities and their relation to the lenses could not be determined. In the wider, silicified section of the veins, the ore occurs in a number of parallel zones, each consisting of massive to reticulating stringers of quartz and sulphides.

The remaining three principal veins of the Victoria mine constitute a hanging-wall group of veins, and consist of two short lenses on either side of a long, persistent vein known as the "E" vein. It is about 900 feet long and throughout the greater part of its length it follows the contact of the light green and the green-mottled schist, very closely. The ore, however, is not confined to the contact nor to either one of the schists, and the relation of the vein zone to the contact seems to be a coincidence, and of no particular significance. The unimportance of the contact zones in influencing the position of the Victoria veins is well demonstrated by the manner in which the two foot-wall veins cross from one rock to the other without a break in the mineralization (See plan in pocket). The central vein of the hanging-wall group is relatively narrow at the east end and consists of the usual interlocking stringers and lenses of sulphides and quartz. Towards the west, the vein widens to 20 feet and more, and is made up of a number of narrow, parallel stringers. It is in this section that the two shorter veins of the hanging-wall group make their appearance, one on either side of the main vein.

The mineralogy of the Victoria ores is extremely simple. Quartz and pyrite are essentially the only gangue minerals, and chalcopyrite the only ore mineral present. A specimen of galena was found in one of the foot-wall veins and calcite occurs sparingly.

A description of the Victoria ore zone is not complete without mentioning the beautiful vein of anhydrite which is developed in the foot-wall slates, and exposed in the haulage tunnel on the 2,200-foot level. The vein is 4 or 5 feet wide and is pure, massive anhydrite, except for occasional slivers of unreplaced slate or stringers of secondary gypsum. On the 2,000-foot level the anhydrite vein is completely altered to gypsum, and on the 1,900-foot level, 100 feet below the glacial till, the gypsum has been carried away by the circulating ground waters, leaving a soft mass of residual slate saturated with water. The gypsum is directly related to the surface and is undoubtedly a supergene mineral.

#### Wall-rock Alteration Accompanying the Shear Zone Deposits

The host rock of nearly all the ore deposits in the Britannia shear zone is a sheared or fractured phase of the mine porphyry, and only small amounts of ore are found in metamorphosed igneous and sedimentary rocks in the Jane mine, and in sheared basic rocks in the Victoria mine. The

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mine porphyry is an albite dacite, containing phenocrysts of sodic plagioclase in a fine-grained groundmass of quartz, plagioclase, and chloritized feric minerals. By shearing, the porphyry is converted into a chloritic schist, which is known as the green-mottled schist, owing to the development of irregular chloritic blotches along the cleavage planes. Phases of this rock contain all the commercial ore in the Bluff, Fairview, and Empress mines, and a good proportion of the ore in the Victoria mine.

The only materials that have been added to the wall-rock in any appreciable amounts are quartz and pyrite, and of these, quartz is by far the more abundant. Other minerals appearing as metasomatic products are chlorite, sericite, calcite, apatite, leucoxene, and locally barite, but all of these materials are only intermediate transitory products, developed during the early stages of alteration. The ultimate product of wall-rock alteration in the shear zone deposits is a completely silicified rock. It is true the final stage is never reached, except in tiny areas, frequently microscopic, but the tendency towards complete silicification is very clear. Pyrite is more resistant than the other minerals, but it is invariably corroded by quartz, and is not stable, therefore, under the conditions of intense silicification.

The most feeble expression of hydrothermal alteration is a partial replacement of the plagioclase phenocrysts by quartz, accompanied by small and variable amounts of chlorite, sericite, calcite, and apatite. Some of the chlorite and sericite occurring along the fractures in the phenocrysts, may have been developed during shearing, but the quartz, calcite, and apatite are undoubtedly hydrothermal minerals, introduced during the ore-forming period. Usually the phenocrysts are replaced by aggregates of clear quartz, but, occasionally, calcite represents a considerable proportion of the original crystal, and not infrequently the quartz contains from one to several small crystals of apatite. This feeble stage of the alteration is usually accompanied by the development of tiny pyrite crystals in the chloritic blotches, and is very extensive. It is found on the upper levels, 300 or 400 feet from the nearest known ore-body, and within 50 feet of the highly altered rock at the west end of the third vein on the 1,505 foot level.

More advanced stages of alteration are marked by a complete silicification of the phenocrysts, the removal of calcite, and a more pronounced development of pyrite in the blotches. The amount of pyrite not only increases, but the former pyrite apparently recrystallizes to larger grains. This is followed very closely by a silicification of the chloritic blotches. In nearly every slide that contains pyrite, slender fibres of quartz are found radiating from the pyrite cubes, and replacing either the blotches or the finer groundmass material. The early stages of silicification are accompanied by a slight recrystallization of the chlorite and sericite of the blotches into coarser grained aggregates of the same minerals. The original chlorite has positive elongation, but all the recrystallized chlorite has negative elongation, and resembles the aphrosiderite which occurs in cavities within some of the Fairview veins.

Intense silicification is associated with the copper ores of the Jane and Bluff mines particularly, and is developed to a less extent at the west end of the Fairview veins on the upper levels, and at the west end of the

Victoria foot-wall veins. However, the amount of silicification accompanying the average vein is remarkably slight, and usually cannot be detected in a macroscopic examination of the rock. Silicification seems to be of two different types; first, there is a general silicification which alters the rock to an aggregate of very cloudy quartz containing residuals of the former rock constituents, and the sulphide minerals; and second, there is a development of fine fibrous quartz, which usually radiates from the sulphides, and replaces everything in front of it. Even the first generation of cloudy quartz is replaced by, or recrystallized to, the fibrous variety, and the dust-like particles are removed. The fibrous quartz is not necessarily a late product, for it formed during all stages of alteration, but the point is that it continues to develop even after silicification is, apparently, complete, and does not cease until the older, cloudy, and impure quartz is replaced by clear, pure material.

Sufficient work has not been done to determine the extent of this secondary recrystallization of the quartz, but it may have an important bearing on the distribution of the ore in the Bluff mine, which contains the most typical example of the siliceous ores. It has been shown previously that the most favourable place for mineralization would be in the very apex of the mine porphyry, immediately beneath the slate hood, but that the highest grade ore is not located at this point. The very apex, however, is the most highly silicified zone in the mine, and it would be interesting to find whether or not the sulphides were concentrated there originally, and were displaced later by the quartz, or whether the quartz was there first and simply excluded the sulphides. The first alternative is not at all improbable, for the pyrite is invariably corroded by quartz, and the fibrous quartz is found radiating from chalcopyrite and sphalerite, and is, therefore, later than these minerals. The actual reason for the exclusion of the sulphides from the very apex of the shear zone is not known and cannot be determined without further study.

The Jane mine affords an excellent example of later silicification destroying a good commercial ore. The barite sphalerite ores of the sedimentary rocks are very definitely earlier than silicification, and have been replaced by a fine, dense mass of cherty appearing quartz. The original extent of the barite sphalerite is not known, but the zone was at least a few feet wider than the present zone. The silicification is on the foot-wall, or north side of the ore zone; on the south side, the only metasomatic mineral recognizable in the wall-rock, which is a very fine-grained argillite, is a phosphate, resembling apatite (See page 77).

#### DEPOSITS NEAR THE BATHOLITH

A number of prospects have been located in the highly metamorphosed rocks of the Lower Goat Mountain formation exposed in Indian river. The formation is in a favourable position for general mineralization, for it occupies a depression in the batholith corresponding closely to the topographic depression of Indian River valley. Except at the north end of the valley on the east side, the batholithic rocks form the upper valley walls and the ridges, and the pre-batholithic rocks are restricted to the lower slopes and the valley floor. In addition to being partly surrounded by the

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batholith they are intruded by numerous irregular and dyke-like apophyses from the batholith, with the result that metamorphism is pronounced, particularly in the greenstone members, and at intervals sulphide mineralization is concentrated. The same band of greenstones continues north beyond the limits of the map-area and should be a favourable district for prospecting. Several discoveries have been made in this section, and there is no reason why other mineral occurrences should not be located. The districts around the upper part of Indian and Stawamus rivers have been made accessible by a good pack trail from Squamish, situated at the head of Howe sound.

Chalcopyrite is the one mineral of economic importance, and apparently the only sulphide minerals associated with it are pyrite, sphalerite, and pyrrhotite, the latter occurring very rarely and only in isolated stringers. The sphalerite is a very dark-coloured variety, containing more iron than the amber-coloured and colourless varieties found in the shear zone deposits. The difference in the iron content is apparently 4 or 5 per cent, for the difference in refractive indices is about 0.01. The occurrence of an iron rich sphalerite in this type of deposit suggests that it has been formed at a higher temperature than the shear zone deposits, and this suggestion is supported by the fact that barite, anhydrite, tetrahedrite, and galena are confined to the latter group. This is to be expected on the zonal theory of ore distribution, provided the batholith was the source of the ore solutions, for the shear zone deposits are 4,000 feet from the batholith, whereas the near batholith deposits of this group are within a few hundred feet of it.

#### Belle Group

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The Belle group of claims is situated on the west side of Indian river about three-quarters of a mile south of the divide between Indian and Stawamus rivers. A good pack trail leads from Squamish to an excellent cabin on the group, which has been constructed near the principal showings, at an elevation of about 2,250 feet above sea-level, or 400 feet above Indian river. The group is owned by J. Habrich and P. Herres, and consists of five Crown-granted claims, known as the Ethel, Rose, Irish Molly, Lucky Jack, and Jenny. The workings consist of two tunnels and a number of open-cuts.

The mineralization occurs in a light-coloured, fine-grained, granular rock composed chiefly of oligoclase, quartz, and orthoclase, in variable proportions, and containing in addition small amounts of brown biotite, chlorite, rutile, apatite, zircon, and magnetite. Although rutile and apatite represent only a very small proportion of the rock they are very abundant for accessory constituents, particularly the former. Mineralogically the rock resembles the batholithic rocks of the area, but the microscopic texture is that of a recrystallized rock rather than of an ordinary igneous rock. The original texture is so completely destroyed that the origin of the rock could not be determined. Camsell<sup>1</sup> refers to it as "granodiorite porphyry" and it appears to grade into the batholith on the north side. Exposures, however, were not sufficiently good to prove this conclusively, and since the two thin sections examined obviously

<sup>1</sup> Camsell, C.: "Indian River Copper Deposits"; Geol. Surv., Canada, Sum. Rept. 1917, pt. B, p. 24.

# ANACONDA BRITANNIA MINES LTD.

BRITANNIA BEACH, B.C. Phone (604) 896-2221

## P R E S E N T A T I O N

1970 Managers' Meeting - March 9, 10, 11

During the past several years ore production from the Britannia mine has come from three areas: approximately 50% from the No. 8 mine, 30% from the Bluff, and 20% from the Victoria. Known ore reserves were depleted in the Victoria and the shaft was decommissioned as of the first of the year. The Bluff mine will be phased out within the next month or two. In order to be able to accelerate the No. 10 shaft sinking and the 040 project development, we have curtailed and practically eliminated ore production from the No. 8 mine. The 500,000 tons left in the No. 8 mine can be mined and hoisted from the No. 10 shaft at a later date. However, there are some 200,000 tons of ore remaining above the 4100 that can be retrieved from the 4100 level during the next few years. It is from these remnants that we expect to keep the mill operating at approximately 15,000 tons per month, one-quarter capacity, until the No. 10 shaft becomes productive in October 1970.

At this time last year we had just completed raising the shaft 240 feet, had cut the Koepe hoist room and were about ready to cut the 4100 station. Since then we have sunk the shaft approximately 1400 feet and cut five stations at approximately 300 foot intervals. We have about 350 feet to go to the 5850

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to complete the first stage of shaft sinking according to the new plans adopted last December.

In 1968, in order to speed up shaft sinking, we had driven pilot raises from the 5700 to the 5250, to the 4950 and to within 200 feet of the 4100 level to which we could slash the shaft instead of the conventional sinking. Although we had anticipated some bad ground, conditions have been worse than expected. We have had considerable overbreak and have been required to screen with rockbolts the entire distance, and, except for the last couple of hundred feet, to place 3 to 8 inches of shotcrete. As a result we are seven months behind schedule (and anticipate losing another two months).

When the original feasibility study of the 040 was made in 1968 our information regarding this zone was somewhat scanty. The 6000 foot level was picked arbitrarily as the bottom working level. Since then, as I reported last year, we have had a couple of drill intercepts at the 6300 horizon - 600 feet below the 5700 level, the bottom working level of the No. 8 mine. Engineering during the past year indicated that there would be a number of advantages in making the 5700 level the initial bottom working level of the No. 10 shaft - the most important being that the mine could be put into production up to one year earlier. As soon as convenient after placing the No. 10 shaft into production the shaft could be sunk another

1,000 feet, to the 6700 level. If and when warranted it could be sunk still another 1,000 feet to the 7700 level, the maximum depth for which the new hoist is designed. The underground crushing plant would be put on the 5700 level with a 150 foot sump to the 5850 where a sinking hoist could be installed. Loading pockets would be located just below the 5700 level.

This thinking led us to consider two alternatives to the original plan, both of which would have placed the bottom working level at the 5700 level and both required varying degrees of curtailment of ore production from the No. 8 mine. Plan I, which would allow the 040 start-up October 1, 1970, would require the complete stopping of ore production from the No. 8 shaft in order to allow us to handle waste for the accelerated development of the No. 10 shaft. Plan II allowed continued production from the No. 8 shaft on a curtailed basis but would delay start-up of the 040 project until March 1971. Plan I proved to be the most economical. Copper production will average better than 2,000,000 pounds per month from some 65,000 tons of ore assaying plus 1½% copper. Estimated copper production for the three plans is shown below.

	<u>040 Start-Up</u>	<u>COPPER PRODUCTION (LB.)</u>	
		<u>1970-71 Incl.</u>	<u>1970-74 Incl.</u>
Plan I	October 1970	31,676,000	108,576,000
Plan II	March 1971	27,772,000	100,772,000
Plan III	October 1971	18,324,000	85,624,000

4.

Stoping methods as now planned will in most cases be modified long-blasthole, vertical rings, developed from foot and hangingwall-fringe sub-drifts. A modified sub-level caving may be used for the narrower ore bodies - less than 15 to 20 feet wide. The nature of the ore bodies dictate that each stope must be custom designed. Our ramp system, being driven 125 - 150 feet in the footwall of the ore, is designed to allow for maximum flexibility. Sub-levels for stope preparation and haulage can be established at any elevation for any mining method that might be chosen. Load-Haul-Dump equipment and jumbos, both rubber-tired and diesel-powered, will be used for all short range development and stope preparation. LHD equipment will be used for production, mucking from draw points and tramming to ore passes.

Although exploration drilling above the 4950 has been somewhat discouraging, the drilling on the 4950 and 5250 has confirmed the grade and tonnage estimated by our original exploration work. We will start production from the No. 10 shaft by October 1, 1970.

B. B. Greenlee  
Manager.

3 March 1970  
rw



# ANACONDA BRITANNIA MINES

DIVISION OF ANACONDA AMERICAN BRASS LIMITED

BRITANNIA BEACH, B.C. PHONE (604) 896-2221

21 September 1970

Dr. A. Sutherland Brown  
Department of Mines  
Victoria, B. C.

2150

Dear Athol:

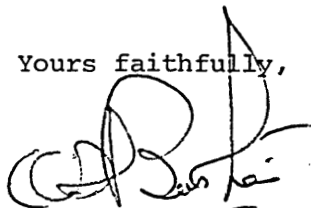
Many thanks for your letter and accompanying maps received a long time ago. I am in substantial agreement with the structural framework that you have proposed. The interpretation of the hangingwall crystal rich tuffs as the less altered equivalent of the chlorite mottled schist seems great to me. I accept that the hangingwall dacite flow (?) should be distinguished from the mine dacite dykes; previously they had been lumped together as of similar origin. The apparent absence of these dacitic units on the footwall is puzzling. They should be recognizable in the sequence from Goat Mountain to the Jane Basin, but those rocks are predominantly andesitic or argillaceous. One wonders if the prevalence of dacitic rocks within and immediately adjacent to the shear zone is fortuitous or whether the Britannia ore deposits are to be correlated with a contact zone between acid and basic sequences.

The syncline to the north of Britannia seems logical to me and furthermore, the absence of argillites in the footwall below 4100, coupled with the ubiquitous north dipping beds in that area on the lower mine levels, seems to strengthen the concept.

I have written my memoirs regarding Britannia and am now busy illustrating these. I will request that a copy be mailed to you. Dave Jennings will have a detailed surface map of the Britannia area prepared during the fall months. This will be the fruits of his summer's work and hopefully next summer this will be integrated into the regional (at least pendant wide) picture.

My departure for Chile has been postponed indefinitely, so in a fit of impatience I have quit and will depart for Tasmania at the end of October. I am determined to grab two summers in one year and put another continent into my kit bag (or tucker bag?).

Yours faithfully,

  
C. C. J. Burton

DEPT. OF MINES AND PETROLEUM RESOURCES		
Rec'd SEP 25 1970		
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ASB		

CCJB:RB

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926NW003-01

ASB

Hon. Leo T. Nimsick,  
Minister of Mines and  
Petroleum Resources,  
Buildings.

November 18 74

Re: Britannia

We have had the subject of Britannia Mines ore reserves, real estate, smelter site possibilities, timber, mining school possibilities, sand and gravel, and taxes paid, all reviewed by our Department and the Department of Economic Development.

I enclose reports from Mr. Peel of the Department of Economic Development; Mr. Peck, Chief Inspector of Mines; Mr. Horn, Mineral Revenue Division; and you already have reports from our Geological Division by Sutherland Brown and our Economic and Planning Division by Jock Poyen. I will summarize these as follows:

(1) Ore Reserves. I do not doubt but that some mineral has been left and there may be possibilities of finding more. However, with increasing depth and temperature, I would not wish to argue with management's decision that this mineral is no longer economic at current copper prices.

(2) Real Estate. I would not feel the evaluation of real estate by the Department of Economic Development is adequate. However, time was a limiting factor. To the 300 acres at Britannia Beach may be added some 4,000 more, part of which is water frontage at the mouth of Furry Creek and which, as a residential area, could be much more valuable than the Britannia Beach area (Furry Creek is about a mile south of Britannia Beach). The homes at Britannia are not all old, a considerable number were built in the mid-Fifties. The commercial value of Britannia Beach may be substantial inasmuch as there is rail and road access; it lies but 30 miles from Vancouver and has deep-sea docking facilities. I would agree that generally the outdoor recreation capabilities are low.

(3) Smelter Site Possibilities. With regard to smelter site, for the above reasons it is admirably situated and has the advantage that Highland Valley and other northern ore is readily accessible to British Columbia Railway and could feed such a site. Britannia Beach has long been looked upon as an industrial site and there is a pulp and paper plant of long standing across the Sound. Furthermore, inasmuch

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PROPERTY FILE

as it is only 30 miles from Vancouver it would have access to a ready labour market. I am reasonably sure that power and water are available in sufficient quantity and should expansion to refineries and fertilizers be deemed feasible there may well be adequate site acreage at Furry Creek.

(4) Timber. I have no way of assessing the timber resource findings other than my personal impression is that it may be vastly understated.

(5) Mining School Possibilities. I would have to agree with Mr. Peck's assessment of its value as a mining school. While mine workings could be reached by two miles of tunnel, considerable infra-structure, as an added hoist, compressors, etc., would be required.

(6) Sand and Gravel. I have some reservations with regard to sand and gravel and feel that their actual value may be many times that stated by Mr. Poyen. However, my statement is predicated on existing contracts for gravel supplies not being honoured by a new owner. If not, my guess is there may be a minimum of 10 million dollars worth of gravel readily available.

(7) Taxes Paid. With regard to the question of taxes it may prove embarrassing to our own Division of Economics and Planning and the Government to simply state that no taxes have been paid even though this proven fact has been substantiated by myself from a personal phone call to Keith Prowse of the Taxation Branch. It is generally looked upon as restricted information.

I do not think that the entire property is of value to the Province and it seems apparent that Anaconda have been more than repaid for their expenditures. Therefore, there may be some moral rights to its re-absorption into Crown lands.

On Wednesday next, i.e. November 20, I expect a visit from Mr. A. J. McDonell, President of the General Mining Division; Mr. C. J. Hansen, Vice President and Chief Counsel, General Mining Division; and Mr. Nathan Arbiter, Group Consulting Metallurgist, to discuss the Anaconda Arbiter Process for reduction of copper sulfide concentrates. This may be an appropriate time to ask them if they have any further interest in the Britannia property or to discuss terms on which they would relinquish their interests.

J. E. McMynn,  
Deputy Minister.

JEM:DB  
Encs.



Date November 14/74.

re: Britannia Mines (Anaconda)

Attached are two reports prepared by the Department following the meeting between yourself and the Honourable Leo T. Nimsick.

With respect to the site itself, there would appear to be relatively little value in the property overall. Development of gravel deposits will probably conflict with Fisheries; the forest resources are not great and have generally been made worse by poor forest management, and industrial or port development at the town site will probably conflict with recreational use of Howe Sound.

A word of caution is needed with respect to the value of resources outlined and that is that all figures should be substantiated by proper appraisal before any action is taken on the property.

We also looked at the financial data provided by the Department of Mines and generally substantiate and support their findings. In short, there has unquestionably been a bleeding off of mine generated profits, however, it is impossible without more precise and confidential data to state exactly what that amount has been. It's probably adequate to say that in fact they have found a way (whatever it was) to pay no taxes whatever on a net cash flow amounting to several millions of dollars or, on net earnings before taxes of \$6.8 million.



A. L. Peel.

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cc: Mr. John E. McMynn,  
— Deputy Minister,  
Department of Mines and Petroleum Resources,  
BUILDINGS.

Encls. (2 reports)



DEPARTMENT OF  
ECONOMIC  
DEVELOPMENT

Government of British Columbia.

MEMO TO MR. A. L. PEEL,

DEPUTY MINISTER.

Date November 12, 1974

RECEIVED

NOV 12 1974

Re: BRITANNIA BEACH

DEPUTY MINISTER

As per your instructions of November 6, 1974, the Economics and Statistics staff have prepared the attached brief report on valuation and possible alternate uses of the Britannia Beach site. Time did not permit a more detailed evaluation, and some of the figures provided herein should be used with caution. The forestry data in particular is subject to change as it is a very complex subject and new information may come to light as a result of our investigations.

G. Ronald Knight.

Encl.

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Anaconda - Britannia Beach

A search of Provincial Government records has been conducted, but time constraints limited the amount of detailed research possible. Before any decision is made to purchase or expropriate Anaconda's property and/or timber holdings - if this is contemplated - a proper evaluation of their worth should be made by qualified assessors.

Property, Britannia Beach

Owned property consists of most of three district lots on the waterfront totalling an estimated 300 acres, plus a small lot on Mount Sheer and reclaimed land (from tailings) at the Beach,

DL 891 except portion in reference plan 4390

DL 892 except portion in reference plan 7313

DL 1897 except portion in reference plan 4390

(exceptions are reported to consist of road and rail right of way).

Assessments (at 50% of actual value, 1972)

	<u>Land</u>	<u>Structures</u>	<u>Machinery and Equipment</u>
Beach Camp	\$115,495	\$873,919	\$715,531
Mt. Sheer	14,363	40,125	82,929
Beach (reclaimed land)	40,286	28,854	21,906

Britannia Beach is within the Squamish-Lillooet Regional District but outside the boundaries of Squamish District Municipality. Taxation is therefore the responsibility of Real Property Taxation Branch, Department of Finance.

The industrial structures and machinery are reported to be old and in poor condition. The residential structures (approximately 140 units) are also old and would generally be considered substandard in terms of present housing requirements.

Resource Potential (excluding metals)(a) Sand and gravel

The general area is reported to have good potential for gravel operations but there is conflict between present operations in the area and the Department of Fisheries. The Construction Aggregates pit will apparently be depleted within one year. Department of Fisheries will oppose further gravel pit developments; thus if good gravel is available on the Anaconda property it may not be possible to exploit it.

(b) Recreation

Discussions were held with Canada Land Inventory and Department of Recreation and Conservation personnel. The site and surrounding area has a low capability for hiking, skiing and other forms of land-based outdoor recreation. The waters of Howe Sound provide good sport fishing and recreational boating and the waterfront land at Britannia Beach has moderate capability for recreational use in this regard. This aspect requires further research to determine if there is a need to provide a public boat launching ramp or other marine-oriented facilities, and if the site is suitable for such facilities.

The mine museum, which is located on Anaconda property, affords some potential for recreational or tourist development. The museum did not open until mid-summer 1974 so its drawing power remains difficult to assess. The land is leased at \$1.00 per year and the museum has used Anaconda services at no charge.

(c) Forest Resources

Around the turn of the century Britannia Mines became interested in supplementing exploration activity from logging revenue and utilizing standing timber for mining props.

Prior to 1906, Timber Licences under the Land Act were granted to Britannia. The Licences were originally renewable for successive periods of 21 years providing merchantable timber exists on those properties in commercial quantities. Upon renewal in recent years, the BCFS has changed the Contracts to make them renewable annually. One Timber Licence has reverted to the Crown, plus parts of others. The BCFS has enforced the Coastal Logging Guidelines which do not allow removal of timber which conflicts with site stability, fisheries, etc.

Because the area was being overcut and the harvest was not on a sustained yield basis, the area has been excluded from the Soo PSYU. It was made into Special Sale Area No. 28, Furry Creek, in 1967.

For 1974 the assessed value is \$128,666 indicating an actual value of \$256,332. A detailed list is attached.

Anaconda's Timber Licences and harvesting operations have been in the Furry Creek Special Sale Area (#28). Bay Forest Products and L & K Lumber Ltd. are the other companies logging in the Furry Creek Special Sale Area (mainly on Timber Sales). Their cut is approximately  $1\frac{1}{2}$  times that of Anaconda.

In the past, Timber Licences have been considered transferable. In recent years the BCFS only allows transfer under special cases and with the approval of the Minister.

Logging is ongoing mainly in the Downing Creek area (S.E. of Furry Creek). The BCFS estimates that enough timber exists for 10 years of harvesting at the present rate providing expensive access roads can be built into three areas.

Ground rent (royalty) on the Timber Licences is 21.875 cents per acre per year. The stumpage appraisal system will be introduced soon.

In the Furry Creek Sale area:

- 34.5% of the forest land has mature timber (1970)
- This timber land represents 0.2% of the mature timbered land in the Vancouver Forest District
- The sites are predominately medium to poor.  
(slightly better than the average of the Vancouver Forest District)
- The mature timber is predominantly Hemlock, Balsam (fir cedar 10%)
- As a result of very poor land management, a large proportion of the logged areas has reverted to deciduous species.
- The property owned by Anaconda contains predominately Alder, Maple with minor quantities of Hemlock, Fir; age 61-80; all immature.

#### Recommendations

- (1) The Squamish area is currently short of housing and the residential buildings at Britannia Beach should be maintained for the present, by the Company or the Government. Subdivisions and sale of residential property to residents is a social measure worthy of consideration.
- (2) In conjunction with the Regional District of Squamish Lillooet, a study should be undertaken to assess the best long-term use of the property (residential or industrial). The site has obvious attractions for industrial use but these must be assessed along with potential air and water pollution problems, etc. and integrated with land use plans for Squamish. (The study undertaken with respect to a proposed coal port may suffice, or provide a starting point.)  
  
It should be noted that Anaconda proposes to continue the precipitation plant operations, which remove copper from water flowing from the mine, and will mothball the mill

rather than dismantle it. This decision - undoubtedly based on the premise that open pit mining and perhaps underground operations as well could be profitable in the future - could hinder plans to use the property for other purposes.

- (3) Operation of the mine museum should be continued, with Government support if required. The historical and educational implications are obvious, but a well managed operation could produce significant economic benefits for the area as well. Demand for small boat facilities should be examined as well as possible sites for same.

APPENDIX

Anaconda Co. Canada Limited,

Britannia Beach, B.C.

Forest Land Assessment

				<u>1974 Assessed Value \$</u>
30011	T.L. 2098	New Westminster	Vancouver	13,830
30012	T.L. 2099	"	"	79,273
30077	T.L. 7500	"	"	9,312
30137	T.L. 9753	"	"	3,436
30165	T.L. 10994	"	"	2,685
30166	T.L. 10996	"	"	7,916
30167	T.L. 10997	"	"	3,425
30168	T.L. 10998	"	"	1,476
30169	T.L. 11000	"	"	7,313



Date November 8, 1974.

RECEIVED

NOV 12 1974

DEPUTY MINISTER

Subject: Anaconda Britannia Mines

A. Background

1. Anaconda Britannia Mines (Britannia) is an operating division of Anaconda Canada Ltd., a subsidiary of the Anaconda Company, a U.S. corporation.
2. Financial information on Anaconda Canada is filed annually with the Department of Consumer and Corporate Affairs. Financial statements filed are on a consolidated basis. Result: from the consolidated income statement, for example, it is impossible to derive specific figures for the Britannia division alone.
3. As an operating mine, Britannia is required to provide comprehensive statistical and financial data annually to Statistics Canada - Provincial Department of Mines gets an unabridged copy of this. StatCan data is for internal use at Dept. of Mines and is highly confidential. (I could not get copies, but access might be possible at a higher level.)
4. The income statement and cash flow data from 1963 to 1974 in attached copy of Table I (prepared by Mines) is derived from the StatCan information described previously. Although the figures are unaudited, they have been checked with the Mining Tax Division of the Provincial Finance Department.
5. Mining Tax Div. confirms the figures as being very close to their own data used for purposes of provincial mining tax assessment. (Mining Tax data was not released to Mines - Mining Tax Div. merely confirmed the StatCan figures.)
6. The financial data contained in the attached copy of Table I relates only to the Britannia mining operation - does not include Anaconda Canada's other exploration or corporate activity in the Province. Some of Anaconda Canada's expenses related to the latter could be charged against the Britannia mine, but specific details on this are not provided on the StatCan form which is made available to Mines. (Only Mining Tax Division knows this - confidential.)



B. Financial Analysis of Data

1. It is confirmed by Mining Tax Div. that since 1963 Britannia has paid no provincial mining taxes and no provincial or federal income taxes.
2. The figures for Britannia's "net before taxes" from 1963 to 1974 (see Table I) indicate the pretax income attributable to the Britannia mine alone. Mining Tax Div. has advised Mines that during this period certain other expenditures were then charged against Britannia's "net before taxes" with the result that the mine's pretax income was reduced to zero in each year.
3. Mines was not able to get precise information on this, and it is impossible from the StatCan data on Britannia to ascertain exactly what these subsequent charges were.
4. Conceivable, however, that the subsequent charges utilized to reduce Britannia's "net before taxes" to zero in each year included one or more of the following:
  - a) certain exploration charges incurred by Anaconda Canada in British Columbia in previous years - some related to Britannia and, possibly, some not related;
  - b) previous losses of the mine carried forward;
  - c) certain interest expenses, possibly incurred by Anaconda in British Columbia and charged against Britannia.
5. (Must be emphasized that preceding is only an explanation of possible ways in which Britannia's net income could have been reduced to zero each year. For verification, it would be necessary to either examine the confidential data in possession of Mining Tax Division or undertake an audit of Anaconda Canada's books.)

C. Conclusions

1. Mines advises that the figures contained in Table I, although unaudited, are probably quite accurate in that they are close to the figures utilized by Mining Tax Division.
2. Given that the figures are reasonably accurate, the cash flow estimates have been calculated correctly, based on the data made available to StatCan and subject to the provision contained in (3) below.

.....3

3. The "net cash flow" figures may be overstated to the extent that certain exploration and interest expenses related only to the Britannia operation (and not to Anaconda's other activities in the Province) were deducted from Britannia's "net before taxes" to reduce pretax income. Result: it may not be in order to state that over the past ten years "Total Cash Flow" has exceeded \$10 million.
4. Definitive statement on the precise cash flow from Britannia is not possible without a detailed examination by a mining accountant of confidential information on file at Mining Tax Division, or, alternatively, an audit of Anaconda Canada's books.



David A. Collier.

Encl.

MEMORANDUM

TO Mr. J.E. McMynn,  
Deputy Minister.

FROM ~~THE~~ <sup>By</sup> *Rutherland Brown*

DEPARTMENT OF MINES  
AND PETROLEUM RESOURCES

VICTORIA, B.C., November 4th, 1974

WHEN REPLYING PLEASE REFER  
TO FILE No. M-12

Re: BRITANNIA MINE - PRECIOUS METALS

SILVER:	Production 1973	102,913 oz.
	Mill heads	0.19 oz./ton
	Grade in place	0.25 oz./ton
GOLD:	No production listed	

I will have the grade of gold and silver from the company reserves for you this afternoon.

Enclosed please find 100 ft. = 1" scale plans of No. 10 development, Britannia Mine, and ore body on 5,470, 5,600, 5,740 and 5,860 level, together with a partial long section at 400 ft. = 1" scale.

*A. Sutherland Brown*

A. SUTHERLAND BROWN,  
Deputy Chief Geologist, Geological Div.,  
Mineral Resources Branch.

ASB/jr

Encls.

DEPUTY MINISTER OF MINES  
& PETROLEUM RESOURCES  
1384  
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REFERRED	TO	DATE	INITIALS
/CCTS			
A. D. M.			
A. D. P.			
M. R.			
E. & P.			
A. D.			

FILE *mining properties*

ANACONDA GRAVEL

926/11E

MEMORANDUM

TO Mr. J. E. McMynn,  
Deputy Minister,  
Department of Mines and Petroleum Resources

FROM THE

DEPARTMENT OF MINES  
AND PETROLEUM RESOURCES

VICTORIA, B.C., November 13th, 1974

WHEN REPLYING PLEASE REFER  
TO FILE NO.....

RE: Value of Gravel Deposits, Anaconda Copper property

There are two gravel pits being operated on Anaconda property near Britannia Beach by Construction Aggregates Ltd., a subsidiary of Ocean Cement.

The Britannia Beach pit has had an annual production rate of 1.4 million tons per year, valued in 1973 at \$1.20 per Ton (Statistics Canada). The time of depletion has been estimated by Sivertson and Carson at 2 years, and by Robinson at 6 months to 1 year. Thus the reserves range from .7 million tons to 2.8 million tons, with a value ranging from \$.8 million to \$3.4 million (1973 prices).

The Furry Creek pit produces 1.0 million tons yearly, valued in 1973 at \$1.14 per ton (Statistics Canada). It is estimated by Sivertson and Carson and by Robinson that the reserves will be depleted in about 5 years. Thus reserves for this pit are approximately 5 million tons, valued at approximately \$5.7 million (1973 prices).

References

- 1974, Robinson, J. W., Mines Inspector, Vancouver Mining Division, personal communication.
- 1974, Sivertson and Carson, Sand and Gravel in British Columbia, A Commodity Study, Economics and Planning Div., B. C. Dept. of Mines and Pet. Res.
- 1973, Statistics Canada, Annual Census of Mines, Quarries, and Sand Pits.

PROPERTY FILE

EVJ

Eugene V. Jackson,  
Geological Division,  
Mineral Resources Branch.

EVJ/crd

Mr. J. E. McMynn,  
Deputy Minister,  
Department of Mines and Petroleum Resources

920/11E

November 13th

74

RE: Value of Gravel Deposits, Anaconda Copper property

There are two gravel pits being operated on Anaconda property near Britannia Beach by Construcion Aggregated Ltd., a subsidiary of Ocean Cement.

The Britannia Beach pit has had an annual production rate of 1.4 million tons per year, valued in 1973 at \$1.20 per Ton (Statistics Canada). The time of depletion has been estimated by Sivertson and Carson at 2 years, and by Robinson at 6 months to 1 year. Thus the reserves range from .7 million tons to 2.8 million tons, with a value ranging from \$.8 million to \$3.4 million (1973 prices).

The Furry Creek pit produces 1.0 million tons yearly, valued in 1973 at \$1.44 per ton (Statistics Canada). It is estimated by Sivertson and Carson and by Robinson that the reserves will be depleted in about 5 years. Thus reserves for this pit are approximately 5 million tons, valued at approximately \$5.7 million (1973 prices).

References

- 1974, Robinson, J. W., Mines Inspector, Vancouver Mining Division, personal communication.
- 1974, Sivestson and Carson, Sand and Gravel in British Columbia, A Commodity Study, Economics and Planning Div., B. C. Dept. of Mines and Pet. Res.
- 1973, Statistics Candda, Annual Eensus of Mines, Qaarries, and Sand Pits.

*EVJ*  
Eugene V. Jackson,  
Geological Division,  
Mineral Resources Branch

EVJ/crd