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A Brief History of

THE BRITANNIA MINE

and its

SEVERAL COMMUNITIES

The Britannia property is situated about 20 air miles north of Vancouver on the east shore of Howe Sound, and is accessible by Pacific Great Eastern Railroad, by car or bus on the paved Seaview Highway, and by boat.

The history of Britannia is well documented in government reports, mining magazines, and some occurrences have made world news. Between 1925-30, Britannia was rated as the largest copper mine in the British Empire. To the end of 1969 it has produced 1,269,926,000 pounds of copper.

Only recently has the Beach been the seat of mining operations on the property, though from the start in 1905 it has been the base of all mining operations. In mining this billion pounds of copper, 50,533,671 tons of ore were dug out of Britannia Mountain and hauled to the concentrator at the Beach where it was crushed, ground, milled, and the valuable minerals separated out. Besides copper, approximately a quarter billion pounds of zinc, over five million ounces of silver, over 450,000 ounces of gold, and more than 700,000 tons of pyrite were extracted. The rejected waste rock was poured into the sea. Lately, even that has found a small market, for use in the making of cement.

In getting out all this metal, the mountain has been riddled with tunnels, and other mine headings; some 140 miles of development workings, extending from the top of the mountain, 4,350 feet above sea level, to our lowest present workings, 1,300 feet below sea level. In the past, the men who did all this work lived in several camps located close to the orebodies which lie in a general easterly direction from the Beach. Now all workers either live at the Beach or commute daily from Vancouver, Squamish, and other centres.

EARLY HISTORY

Captain Richards, surveying the B.C. coast in 1859 for the British Admiralty, named the mountain situated behind the actual townsite, Britannia, after the 100-gun frigate in his command.

The original mineral discovery was made by Dr. A. A. Forbes in 1888. Dr. Forbes was a medical practitioner stationed near Hopkins Landing. He travelled to Britannia Creek in a small boat accompanied by a fisherman named Granger. The doctor later bought the fisherman's share in the discovery in exchange for a small boat. He returned to his discovery the following summers, prospected, did a small amount of development work and tried to interest capital. Five years later he moved up the coast and made another discovery on Texada Island.

While showing this to Thomas T. Turner of Vancouver in 1897, he described his Britannia discovery. This led to the serious development of the prospect. Turner met Oliver Furry (after whom Furry Creek was named) and in 1898 they staked five claims. Incredibly, these original claims have produced the bulk of Britannia ore. Turner then made a deal with Boscovitz & Sons, of Victoria, and sold a half interest for $10,000.

In 1899, these claims were surveyed with two fractions added to make a solid group. A pack-trail was built from the Beach, and a camp established on Jane Flats. Prospecting was done and a 150 foot tunnel was driven. Turner now managed to sell a 7/10 interest in the property for $35,000 to Walters of Libby, Montana, and the balance to G. Robinson of Butte, Montana, for $53,000. (Notice how even before 1900, it was American capital that was interested.) The property also included one lot of 75 acres at the Beach.

In 1900, the property was visited by W. M. Brewer of the Engineering and Mining Journal, who must have been something of a prophet, gifted with second sight. After touring the snow-covered rocky hills, he reported that "If the property was worked under careful management, with a sufficiently large capital to install necessary machinery, and with a large force of men, Britannia ought to develop into a producing mine of great capacity."

At this date, January 1900, Britannia Copper Syndicate was organized to develop the property. Robinson bought out Walters' share, gained control of the Syndicate, and increased its capitalization. He took on the active direction of the company. In 1904, an aerial tram was built from the dock at the Beach to the Halfway (11,800 feet), and from the Halfway to the terminal at the main camp (8,000 feet). A pole line carrying power, alongside the tramway, was erected, and water licenses on Britannia Creek obtained. An upper tram terminal, where the ore could be crushed and sorted, was built, along with a concentrating plant at the Beach. Then, an office, stores, hotel, and some houses were added — also at the Beach.

Robinson now interested a New York banker, Grant B. Schley, in the venture. He organized the Howe Sound Company under the laws of the State of Maine, and it became the holding company for the Britannia Copper Syndicate in 1903.

Editor's Note:

This fascinating and interesting sketch of the history of the Britannia mine and Britannia Beach community up until settlement of the 1965 strike was compiled through the effort of W. B. Montgomery. The remaining period to the end of 1969 has been covered by A. T. "Archie" Smith. Mr. Montgomery, one of our best-known mining engineers, was for several years mine superintendent at Anaconda's operation of the Britannia mine before resigning to accept the position of Inspector of Mines, Reclamation, with the British Columbia Department of Mines and Petroleum Resources, as a result of which he is now resident in Victoria.

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By 1905, the mine, tram, and mill were operating and a shipment was made to the Crofton smelter on Vancouver Island. This smelter, and a lease on the Mount Andrew mine on Prince of Wales Island, Alaska, were bought by the Britannia Smelting Company.

There is little to report for several years. The company did not do very well. Its mill was unable to make a satisfactory product and the mine was slow in developing good ore. In 1908, the Britannia Copper Syndicate and the Britannia Smelting Company were merged under the latter's charter. The new company was known as the Britannia Mining and Smelting Company Limited. It wasn't until 1915 that the Britannia Syndicate was wound up and other companies included — i.e. — the Britannia Land Company Limited, Britannia Power Company Limited, and Howe Sound Power Company (South Valley).

In 1910, an exploratory working off the Mammoth Bluff cut a Fairview vein (Fairview outcrops were known, but inaccessible), and with a fresh impetus, development surged ahead.

There was, of course, extensive prospecting going on over the whole area. Of the many prospects, the Empress group developed the only other mine. The company staked and bought claims until 1915. With few exceptions, they owned or had mineral rights on solid blocks of claims from tide water, on Howe Sound, to east of Indian River — comprising some 25,000 acres, 485 Crown-granted claims, 17 Beach lots, and 8 timber licenses.

All work except Fairview development stopped; and the only drawback to more tonnage was the aerial tram which was handling only 500 tons per day. In 1912, a new low tunnel was started at 2200 Level. By 1913, plans were made for a townsite at 2200 Level. Sinking of the tunnel was completed and shaft (No. 1) and raise (68) were being driven. A railway was also planned to handle the new ore, and replace the aerial tram. By the end of 1914, the railway to the top of the incline was finished and the incline part three-quarters done. Hoists for the incline cable car and No. 1 shaft were on the property.

At this time, the camp on Jane Creek Flat was the base for mine operations. It was crowded. The mine was developing rapidly, and this small flat was home for several hundred miners. The camp consisted of four bunkhouses, and a cookhouse, a Japanese bunkhouse, warehouse, stable, tram terminal, crusher house, office, compressor and power house, blacksmith shop, candle house, and powder magazine. There were numerous single family dwellings, a small school and also a tennis court. All the buildings were connected by wooden covered walkways — even the track joining the Jane and Mammoth Bluff mines to the crusher tram terminal was roofed in. This was necessary because of the very heavy snowfall.

Almost all these supplies were brought up on the aerial tram. The horse trail from the Beach was pretty rugged, particularly the last mile and a half, which climbed 1,200 feet. It was this horse trail which the miners and their wives walked, carrying their babies, on the few occasions they travelled to Vancouver. Another deterrent to "trips out" was the fact that the mine worked seven days a week — three shifts a day at this time — and continued to do so, until legislation, the Hours of Work Act, in 1934, necessitated a change.

It was here, at midnight Sunday, March 21, 1915, that a catastrophic slide wiped out about half the camp. With no warning whatsoever, the whole side of the mountain above the camp gave way. In this slide, 56 people lost their lives. Most of the bodies were never recovered; 22 were severely injured. The biggest loss of life occurred when the messhouse was crushed. All this occurred in pitch dark when there was four feet of snow on the ground. The camp did not recover from this blow, and was for the most part abandoned.

This disaster only stopped production for three months. During that time, a new tram terminal was built next to the surface railway. The raise system from 2200 Level to 1050 was completed. Bunkhouses and a cookhouse were erected at the Tunnel Camp alongside the power house.

The year 1915 was probably the most active ever on the property. Much of the Tunnel Camp was built, including the store, office, and hospital. The dams on Britannia, the bins on the Incline were completed, and the locomotives and cars brought to the surface railway.

In the next year, 1916, the club building, an extension to the bunkhouse, a school, 40 more houses, an extension to the compressor plant and a house for the superintendent were built. Other additions to the camp came more slowly, but in the next 14 years, two more bunkhouses were built, a gymnasium, 4 apartment blocks of 16 units, and a staff house erected, and a copper plant built (1927). A swimming pool, finished in 1930, completed the building at the Townsite, until a brief period in 1952, when the buildings of the Incline Camp were moved into the lower end of town to increase the housing facilities.

While the Townsite or Tunnel Camp was growing, the Beach Camp was also growing, though at a much slower pace. By 1912, there were a large number of cottages on the "flats", and the big store was put up. The mill was treating 600 tons a day, and produced 14,000,000 pounds of copper. That year the Crofton smelter was closed down because there was not enough feed — the new flotation process had reduced the tonnage. The next year, 1913, the club building was put up, and 30 more cottages built. There was regular, daily, boat service to Vancouver.

The year 1914 saw the erection of the No. 2 mill and new wharf bunkers. Then war was declared, the copper market was demoralized, and operations were almost halted.

In 1915, the second 1,000-ton unit of No. 2 mill was installed, and the Canadian Government Telegraph office opened, but the slide at the Jane Camp, and an acute shortage of manpower made it a very poor year.

In 1916, with old and new mills operating, 3,000 tons per day were treated, and the general office and warehouse were built.

During 1917, the Customs house was built. A cloudburst took out the incline railway for almost a month.

In 1920, due to the recession following the war, the mill was shut down and only development crews kept on. The payroll was cut from 1,000 to 250. The railway crew continued to supply the Townsite, and concrete storage bins for development ore were built.

In 1921, the idle mill was destroyed by fire in March, and seven months later, half the Beach Camp was destroyed by flood. On the night of October 28th, water impounded by the railroad fill at the Townsite, broke down the wall and surged down the creek. There had been very heavy rains — approximately 6 inches — on top of some snow. This great wall of water washed all before it out to sea. In all, 37 were killed, 15 seriously injured, and over 50 houses destroyed.

The following year, 15 new houses were built on higher ground

near the railroad connection with the incline.

By 1923, a new mill had been constructed to replace the one destroyed by fire, and a new transportation system for ore, eliminating the incline, was installed.

In 1930, Britannia's peak year, 7,100 tons per day were milled with a production of more than 44,000,000 pounds of copper. To handle the increased production of the mill, larger shops were built, and in 1929 a foundry was added. These shops were capable of making anything used on the property, as well as repairing them. For a period, balls for the mill were made out of rails by a "slug" plant which turned them out between worms, but this job was later done in the foundry.

5-CENT COPPER

Then the depression came. With copper down to 5¢ a pound, the organization was cut to the bone, and employment dropped from 1,000 in 1930 to 400 in mid-1933. But during the depression years, additional accommodation was provided. The Beach hotel, which burned down in 1933, was compensated for by additional rooms added to the store building, until a new hotel and dining room could be built. New style bunkhouses, the Ritz and the Savoy were completed, followed later by two others.

By 1938, production was back to 6,000 tons per day and 1,324 persons were employed.

The Second World War did not affect the copper market as did the First one, but the attraction of armed forces, and higher paid industries, especially shipbuilding, caused the labour force to shrink steadily. One year, 1,152 men quit, and Britannia was hiring just about anyone who could walk. In mid-1946, with only 400 men on the payroll, a labour strike occurred, which lasted from July 1st to October 21st.

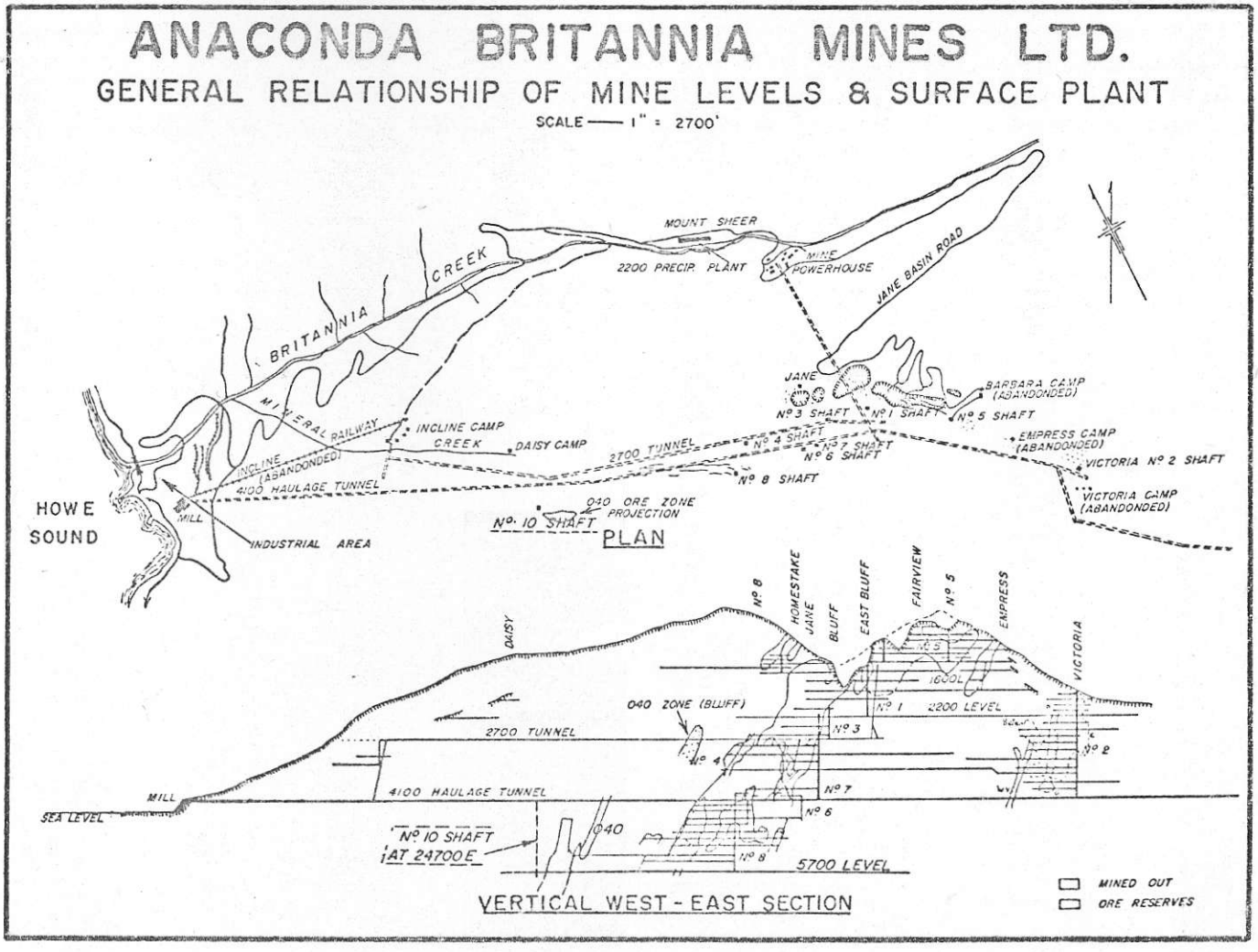
A swimming pool was built at the Beach, and by 1949, the road had been completed into the Beach from Squamish. Gradually, roads were built around the Beach and the Surface crew started using trucks. A road was built to handle backfill to the No. 8 Mine, and the first mile of road to the Townsite was then built.

In 1950, a group of 16 "Honeymoon" apartments was built across from the school, and a new Community Church was constructed. The 4100 yard area was built up with a large "dry" (men's change room), framing shed, car and locomotive barn, powder magazine, etc.

With the increased use of lumber (timber) in No. 8 Mine, and the rapidly increasing cost of timber, it was decided in 1950 to use company timber, which was very abundant along the old mine wagon road, and a site was chosen about one mile above the 4100 yard for a mill. In order to eliminate the cost of operating the surface and incline railways, which was increasing with the cost of labour, the road to the Townsite was started in 1951, and construction was completed during Easter, 1952.

The foregoing outlines the growth and development of the two main camps, but there were numerous other camps which were built and operated as the need arose, and then abandoned.

From 1916 on, the Company did extensive surface prospecting. In 1919, ore was found on the Victoria claim. This ore was developed during the shutdown of 1920-1922.



The area was accessible only by trail up Furry Creek — seven miles from tidewater or through the mine via 1600 level, which was connected to No. 1 shaft in 1918.

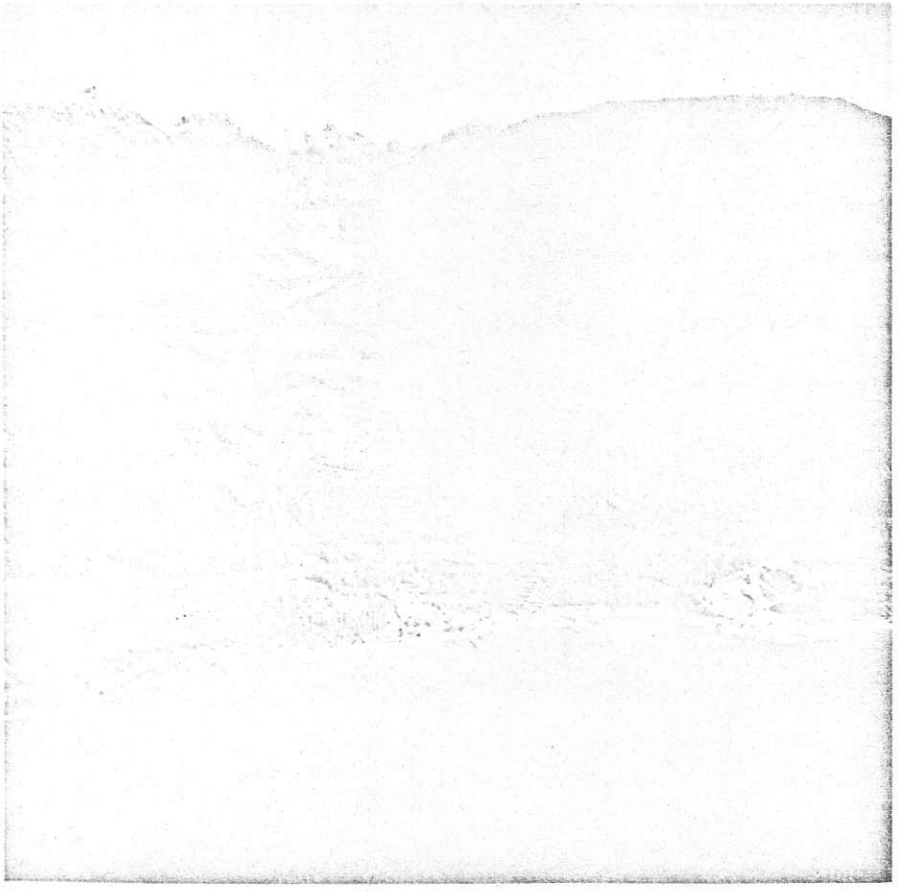
In the spring of 1921, a crew living in tents, put up a sawmill, cut logs, and built a camp, which was occupied in October. This camp at its peak had 300 men. There was a tram line built to the 1600 portal, which carried the Victoria ore to the mill.

An extensive logging operation developed as the Victoria mine required a great deal of timber. A good part of the surface crew were Japanese who stayed in a separate building and also occupied a bunkhouse at 1600 portal.

In 1924, the Victoria mine was connected to the other mine workings on 2200 level and the tram was no longer needed for handling ore. The tram was extended to other portals on that side of the mountain. Victoria was isolated, only accessible through the mine and up the shaft. There were no women at all. Two pool tables, a card room, and a bowling alley were the recreational outlets. There was also a good library and books were exchanged with the Tunnel Camp library. Radio reception was good, but not popular in the bunkhouse, as there was always someone sleeping. Chinese cooks did a good job. The camp was closed in 1933 and re-opened in 1936 for a few years till it was closed down during the war years for want of crews.

On a flat, near the top of Britannia Mountain in a beautiful location, was the Barbara Camp. Here, in 1916, at the 500-foot level, two bunkhouses were built for 80 men. There was also a house for the foreman and his wife, a stable, powder magazine, etc. The camp had a pool table, card rooms, running water in each room and hot-water heating. The men here worked the glory holes on top of the mountain. Generally, the camp was greatly reduced during the winter months, because of the snow, and was closed permanently in 1933.

In 1917, bunkhouses were built at Empress, 1000 Level, and Beta, 1600 Level portals. These large buildings housed 40 men each. The dry and furnace were on the lower floor, the poolroom, dining room and kitchen on the second floor, with the rooms on the third and fourth floors. The Empress was closed in 1933, but re-opened in 1939 for a few years. The Beta camp burned to the ground in 1926.



An aerial view of Britannia Beach (foreground) camp and concentrator with Upper Townsite (Mount Sheer) above and to left. The photo also shows clearly the valley of Britannia Creek.

At the head, or top of the Incline, there was a camp, first for crews working on the incline and driving the 2700 tunnel, and later for the crews hauling and crushing the ore. This was started in 1917, with two 8-room houses. Later, 7 houses and another two-storey house were added. It, too, was closed for a period, 1933-37. In 1938, a new large bunkhouse, a dry, and a hotel were built. These crews used the Townsite recreational facilities, but had a library and card rooms of their own.

Above and below the Incline were camps on Mineral Creek. There was the Goldsmith or Daisy camp, a group of log cabins at about 1600 level where two tunnels were driven and a large amount of trenching done in 1911. Below was the Seaview Camp at 3100 level and 3250 level, and the raises for the 4100 level were driven by men who lived there. This was occupied 1919-24.

In 1925, the Fairwest Camp was established, approximately a mile up Furry Creek from Victoria. This housed a crew which developed a prospect in the mountain south of the creek. It was abandoned the next year, and was used by the Vancouver Water Board guard until 1940.

And, finally, there was the camp on Seymour Creek.

The Townsite, by 1950, had 143 housing units and beds for 350 in 3 bunkhouses and hotel, and its population was approximately 850. Located high in a mountain valley, where the annual snowfall amounts to as high as 30 feet, and the surrounding mountains prevent the sun from reaching it for two months every year, it was isolated — though just 20 air miles from Vancouver. Its connection to the outside was a narrow-gauge railroad, in incline cable cars, and the Union Steamships Line.

COMMUNITY CLUB

But, there was no dearth of entertainment or employment. There were many local organizations, some short lived, and some lasting as long as there was a town. The Community Club was the father of all the organizations. Everybody was a dues-paying member, and had privileges of club rooms, kitchenette, library, reading room, pool room, gymnasium with a professional instructor, swimming pool, and tennis courts.

Traditional annual events were the New Year's Ball, Burns' Night Dance, First Aid Competition, July

1st Celebration, Hallowe'en party, and Christmas Dance. In between times there were innumerable card parties, two movies weekly, frequent dances and many hobby clubs. It was an ideal place for people to develop their own talents, and the place had more "characters" per unit than any other camp.

There was little difference in housing — everyone's house was about the same. The rent was low — $1.00 per room, with free water and cheap electricity, and no taxes. There were no old people, or retired couples, no unemployed. Peddlers were carefully checked at the main office, and were few and far between. There were no thieves — no one locked their doors. There was no juvenile delinquency — parents were told to straighten out their children, or get out. The church was unusual, in that Protestant and Catholic faiths occupied the same building; and there was excellent co-operation between them. There was no graveyard.

All-night poker games occurred after every pay day. They were deadly serious, stakes were high, and many a complete cheque changed hands. There were always bootleggers.

The Beach community, while not so isolated, developed along very similar lines and most organizations were duplicated in the two camps.

In 1954, things began to change at the Beach, to make way for the road, and P.G.E. railroad. This meant tearing down some houses, and moving others. Some fourteen new houses were built to replace the old manager's residence. The following year, nineteen others, and similar units were added. In the fall of 1956, the P.G.E. began regular service through the country, and along the coast of Howe Sound, and for two years, Britannia was the biggest passenger point on the line. With the arrival of the passenger trains, the twice daily service of steamers to Vancouver was stopped, and a real link with the past severed.

19-CENT COPPER

In 1955 and in 1957, the Company was having a difficult time to adjust to the lower metal prices, and early in 1958, had moved the site of all its operations to the Beach to consolidate its position. However, at the end of February, the directors decided to close the operation down because of a further drop in copper to 19¢, and by the end of March, 1958, the Britannia Mining and Smelting Company Limited was employing only ten men. During the shutdown, the place was closed up, scrap and idle machines sold, and the Townsite, or Mount Sheer Camp, about emptied. The Company then divested itself of housing and stores.

On August 8, 1958, the Company went into voluntary liquidation and its assets returned to the parent company, the Howe Sound Company.

By the end of 1958, the metal market seemed promising and a new contract was signed with the Union for two years. On re-opening, thanks to the road, it was not necessary to re-open the bunkhouse, the shops were reduced in scale to take advantage of the larger shops in Vancouver, and the foundry was not re-opened.

At first, the high-grade portions of the orebodies were mined with the thought of salvaging the operation for a few profitable years, but, as the operation developed, it became apparent that the possibility of finding further ore had not been exhausted.

ANACONDA

In 1962, negotiations were started with the Anaconda Company (Canada) Ltd., and in January, 1963, all the properties and assets of the Howe Sound Company at Britannia Beach were sold to Anaconda.

Anaconda acquired the property for use as a base for Canadian operations, but also with the belief that more ore could be found in the Britannia Mine. Anaconda has, and is carrying out intensive detailed exploration, both underground and on the surface, with the objective of locating more ore.

Operations were brought to a halt, and exploration curtailed, as the result of a strike which commenced on August 11, 1964. The strike continued for almost seven months; agreement was reached, with the assistance of the Minister of Mines, the Honorable Donald Brothers, on March 2, 1965.

During the strike, the equipment had been removed from the mine, and the lower levels allowed to flood. After settlement, the equipment was re-installed, the mine pumped out, and mining was resumed at a curtailed rate of production.

The mill was started up on the first of June, and has been operating, after a build-up period, at a rate of approximately 50,000 tons a month. At present, there are about 400 mine employees on the payroll.

The road to the old Jane Camp was constructed and all the old glory holes made accessible by four-wheel drive vehicles, even to the Barbara Camp. This was followed by an extensive sampling campaign and, in 1967, a large amount of ore was brought down from the Jane Flats to the mill by truck.

A new copper plant of the launder type was built on the old railway grade at Mount Sheer and put into operation late in 1965. That winter, all the houses in the area were destroyed due to their deteriorated condition. The only building at the Townsite now is the power house, which still supplies air to the mine.

On Hallowe'en 1966, a fire destroyed half of the 4100 dry building. It was quickly rebuilt and, by the end of 1967, had two more sections added. It is hoped that the surviving portion of the dry will be replaced this summer. Again on Hallowe'en 1967, a flood of Mineral Creek spilled into the 4100 yard and buried the lower part of the Beach copper plant and several houses near the industrial area.

Both the 1967-8 and 1968-9 winters were unusually severe and accompanied by heavy snowfalls and very cold weather.

In the summers of 1968 and 1969, the Park Lane and Utopia dams were extensively rehabilitated and are now better than new. The latter work necessitated extension of the road to Utopia.

The exploration work of Anaconda finally paid off and a large new orebody was located west of the No. 8 Mine. Development of this started in earnest when a new shaft was collared in March, 1969. By the end of the year it was complete above the 4100 level and almost complete to the 5700 level.

At the beginning of 1969, the Britannia operations of The Anaconda Company (Canada) Ltd. were transferred to Anaconda Britannia Mines Ltd. Extensive surface and underground operations were made to improve the operation. New equipment was purchased and the townsite cleaned up.

On December 23rd, 1969, the Victoria hoist shut down and the mine was closed except for some stoping on the 4100 level.

At present, there are approximately 400 employees working at Britannia.

THE NEW '040' OREBODY

of

ANACONDA BRITANNIA MINES

B. B. Greenlee, vice-president and manager of Anaconda Britannia Mines Limited, addressed the Vancouver Branch, Canadian Institute of Mining and Metallurgy, February 19, 1970, and gave a very interesting account of the important underground development, through which the long-time producing mines of the company are being phased out contemporaneously with the start-up and acceleration of mining in the new 040 orebody. He said the following dates are related to significant events in Britannia's history:

1888 — Mine discovered by Dr. A. A. Forbes

1905 — First mill constructed to treat ore from the Jane and East Bluff mines

1912 — Beach store and many houses built on the flats

1915 — Tunnel Camp built
Railroad to top of Incline constructed
No. 2 mill of 2000-ton capacity installed

1923 — No. 3 mill installed

1930 — Britannia's peak year: mill averaged 7100 tpd to produce 44 million pounds of copper for the year; over 1200 employees

1949 — Road connection with Squamish established

1952 — Road constructed from Beach to Townsite, later called Mount Sheer

1956 — Pacific Great Eastern Railway commenced regular passenger service to North Vancouver

1958 — March, operation suspended because of low copper prices; August, Seaview highway to Vancouver opened

1959 — Operations resumed

1963 — Britannia property purchased by The Anaconda Company

1968 — Commencement of sinking No. 10 shaft.

Some interesting statistics, released by Mr. Greenlee, included production from the various mines within the Britannia complex. In the **Fairview** mine, from 1910 to 1957, some 20 million tons of ore grading 1.3% copper were mined to produce 500 million pounds of copper. The mine was serviced by the No. 1 shaft. Mining methods included both shrinkage stoping and induced caving.

From 1913 until the end of 1969, the **Bluff** mine yielded 18 million tons grading 0.95% copper for production of 330 million pounds of copper. Shrinkage, induced-caving, and longhole shrinkage stoping methods were employed. Service was from the No. 7 shaft.

From 1923 to its closure in December 1969, the **Victoria** mine was the source of 4 million tons with the high content of 2.73% copper. Recovery was 230 million pounds of copper. Square-set and shrinkage stoping were serviced from the Victoria shaft.

Some 4.5 million tons grading 1.41% copper have been mined in the **No. 8** mine to produce 125 million pounds of copper by cut-and-fill, square-set, and longhole-shrinkage methods.

040 OREBODY

Mr. Greenlee recounted the events leading to the discovery, exploration, and development of the 040 orebody which will be brought to production this year.

In 1963, The Anaconda Company acquired ownership of the Britannia mine for two reasons. The company desired to establish an exploration base for western Canada. Jack Knaebel, Glenn Waterman and other executives were also convinced that the Britannia property itself offered excellent possibilities for exploration.

A complete geological-research laboratory was established at Britannia Beach and a relatively large staff of competent geologists was employed to relog the tens of thousands of feet of core and to remap the mine workings in an attempt to get some clue as to ore deposition and structure. Along with this, an aggressive exploration

B. B. Greenlee

Barnette Bates Greenlee is the son of a Congregational minister and was born in Los Angeles. He went to sea when he was 15 years old and spent several periods in commercial fishing on the California and Mexico coasts before commencing his mining career at a fluorspar project in Nevada in 1929, where he learned the use of augers, handsteel, and picks. He helped sink a 70-ft. decline shaft with handsteel and windlass in order to follow a small gold vein in the Funeral Mountains on the east side of Death Valley. He worked in several hardrock mines in Nevada and California and in placer mines in Alaska while intermittently attending Stanford University from which he gained a B.S. degree in mining engineering in 1938.

Following graduation he worked in mines in California, Nevada, Utah, Colorado, and Wyoming in jobs ranging from mucker through miner, shift-boss, safety officer, mine clerk, foreman, engineer, and superintendent before becoming a mine manager, twenty years ago.

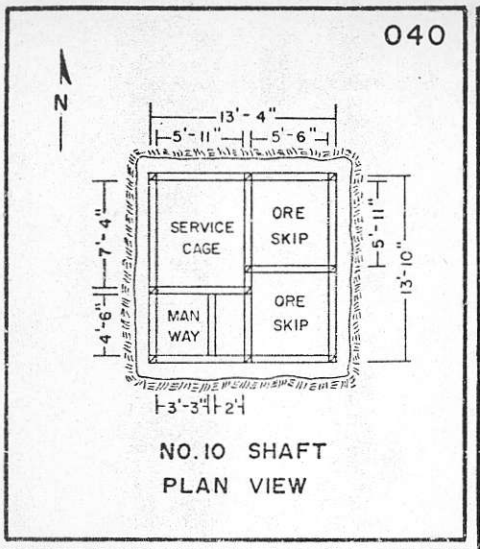
"Barney" first came to British Columbia as an employee of Giant Mascot Mines at its nickel-copper mine near Hope. He arrived at Britannia Beach in 1963. He is a member of the Canadian Institute of Mining and Metallurgy and of the American Institute of Mining, Metallurgical, and Petroleum Engineers.

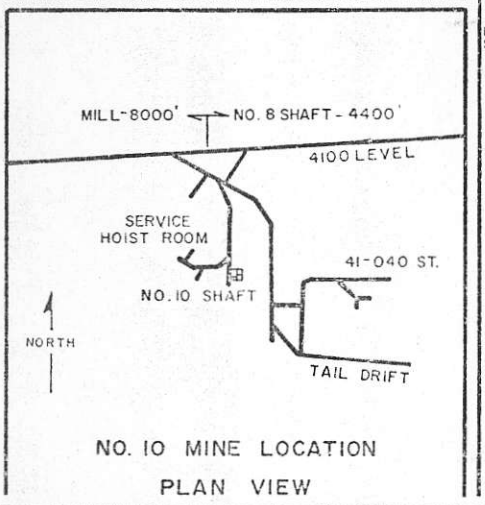
programme was launched, resulting in the discovery of a new ore zone nearly a half mile west of any previously known ore occurrence.

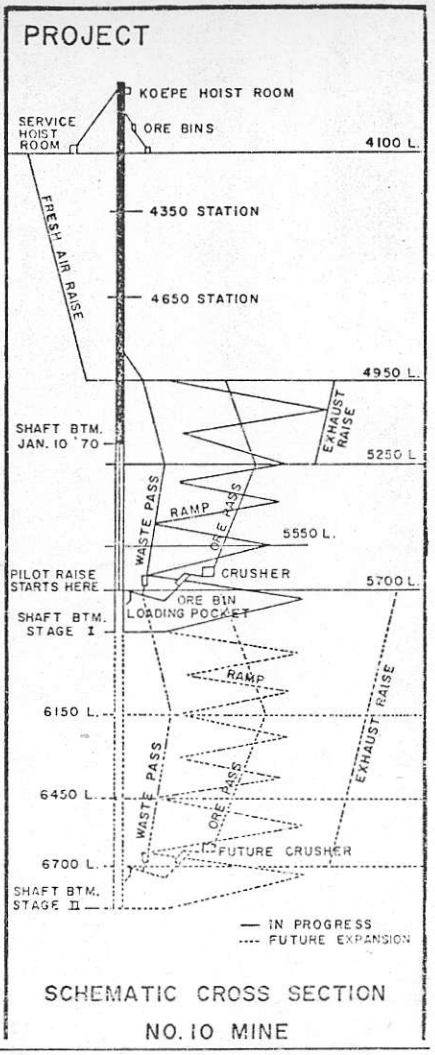
The 040 ore zone is similar in many ways to that of the No. 8 mine. It has an average grade of better than 1.5% copper and contains some silver, but no zinc or gold. Because of its location, some 800 feet further in the hangingwall, and geological features, it was considered a completely new occurrence and one that warranted, if not essentially required, a new shaft and development for exploitation. Accordingly, the No. 10 shaft was sunk from the 4100-ft. level (main haulage) to the current low level at 5700 feet. This shaft is projected for later extension to 6700 feet. The 5700 level reaches the 040 orebody about 1500 feet from the shaft.

In describing the No. 10 shaft development, Mr. Greenlee states:

"In this day and age, square-set mining is ordinarily uneconomical, and our recent experience in No. 8 indicates that vertical or horizontal longhole methods do not provide the answer to mining the No. 8 orebodies because of dilution and high secondary-breakage costs. When we were planning the 040 project we knew very little about the new shoot and assumed it would be similar to the No. 8. We considered the following alternatives: **(a) selective mining and conventional level transportation;** and **(b) relatively large and low-cost mining with ore passes and centralized underground crushing, using a Koepe hoist.**







"In spite of our poor experience with ore passes at Britannia in the past few years, we chose alternative (b) rather than take a chance that the grade of ore would not be as high as earlier drilling indicated and that we would require low-cost mining.

"Stoping methods as now planned will in most cases be modified longblasthole vertical rings developed by footwall and hangingwall fringe sub-levels with a modified sub-level caving for the narrower orebodies. Each stope will be custom designed and our ramp system being driven from 125 to 150 feet into 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. Rubber-tired, diesel-powered, Load-Haul-Dump equipment and jumbos are planned for stope preparation. LHD equipment will be used for production, mucking from draw points, and tramming to ore passes.

"Anticipated future exploration will be from the No. 10 shaft, both to the west and beyond the Daisy mineralization as exposed on the surface, and probably back to the east to determine depth-persistence possibilities of the No. 8 orebody, or in the hangingwall of the No. 8 orebody."

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