# AN OLD MINE BREATHES NEW LIFE

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**Large old mines die hard! There are many examples in the mining industry. The Britannia Mine, located in British Columbia near Vancouver, can be added to the list. A new orebody has recently been discovered at Britannia and we have been asked to document the recent history of the mine and describe the events that led to the new discovery.**

**Britannia has had a long and colorful career. The first mineral discoveries in the mine area were made before the turn of the century. In 1904 an examination showed about one million tons of 3% sulfide copper ore in the outcrop area high in the mountains immediately east of Howe Sound. The early operations were not very successful and remained so until further developments of oil flotation. Since the early days the mine has had its ups and downs. The usual mine fires destroyed mills; low metal prices affected operations. Discoveries of new ore zones were made from time to time but shortly after 1960 it appeared that the mine that once had been the biggest copper producer in the British Empire was on its last legs.**

In 1962, J. B. Knaebel of Anaconda visited Britannia on the invitation of A. D. McCutcheon, Mine Manager of the Howe Sound operations, who suggested an Anaconda examination. McCutcheon's instructions at this time were to operate as long as the project was making money and then to close the mine. The recent exploration had proved disappointing and final operations were a planned completion of mining in the Victoria and lower levels of #8 orebody. Up to this point of time, the property had been examined by several large Canadian and American mining companies but no one was sufficiently interested in the exploration possibilities to acquire the mine and attempt to find new ore.

Knaebel recognized the principle that "old mines die hard" and arranged a formal Anaconda examination for the fall of 1962. Knaebel and Waterman were assigned to conduct the investigation. Knaebel and several assistants evaluated the mine facilities, estimated mining costs under projected variables of copper price and labor costs at several production rates and calculated cash flow on ore developed or known at that time. Waterman and assistants re-calculated the ore reserves, studied the pattern of ore distribution within the complex Britannia rock and structural framework and evaluated the exploration potential in untested areas within the Britannia shear zone.

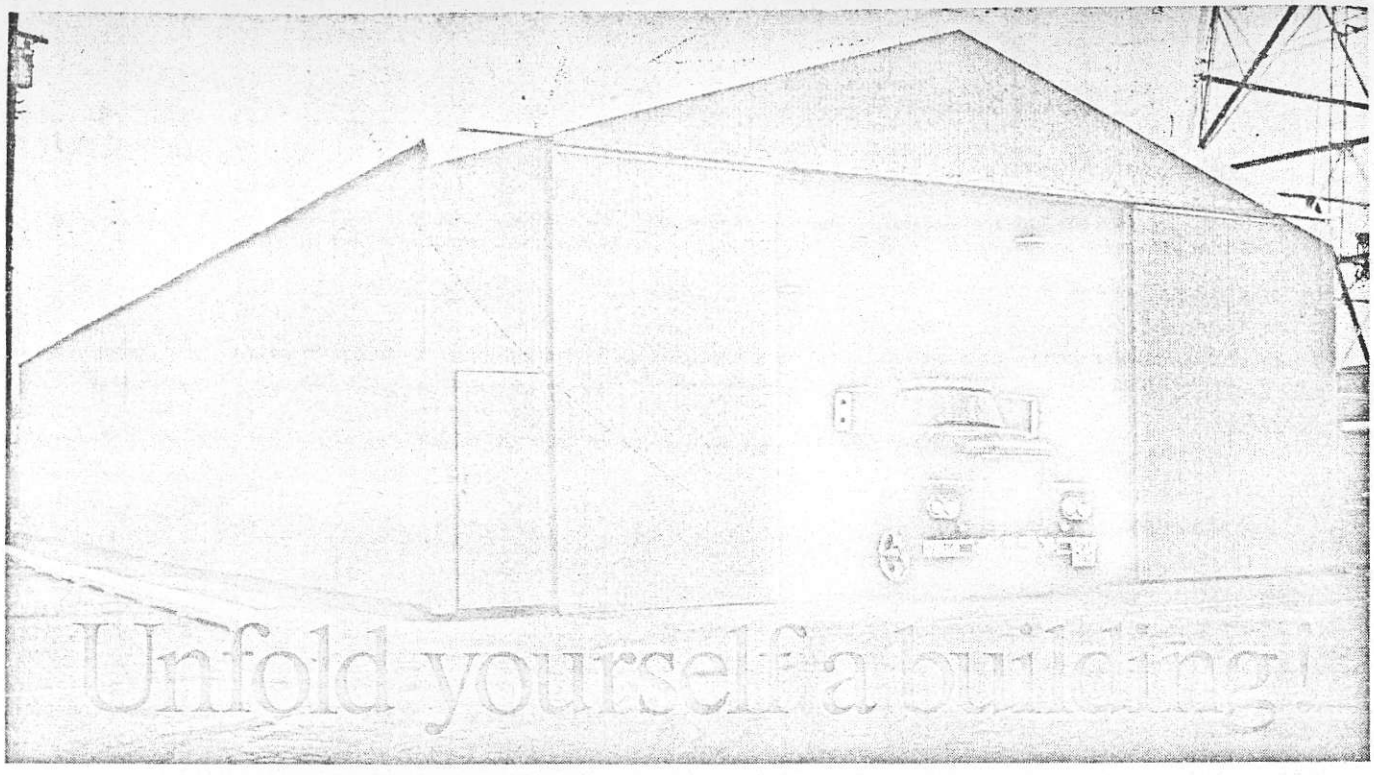
Knaebel's study indicated that mine operations on the known ore reserves at an accelerated production rate would produce sufficient operating profit to pay for an exploration program designed to find new ore. Waterman's study indicated there was a good chance to increase the ore reserves in areas of known ore and a fairly good chance to find new orebodies at Britannia, particularly in the area west of the mine workings in the lowest mine levels.

The geological studies conducted at the time of the examination involved an analysis of the spatial position of the known orebodies within the general seven-mile-by-2000-foot-wide Britannia shear zone. The study clearly indicated that ore was not only localized along the footwall of the shear zone but occurred in intermediate positions between the hanging wall and footwall. It was noted that on one upper level a small pod of ore was localized along the hanging wall of the general belt of sheared rocks.

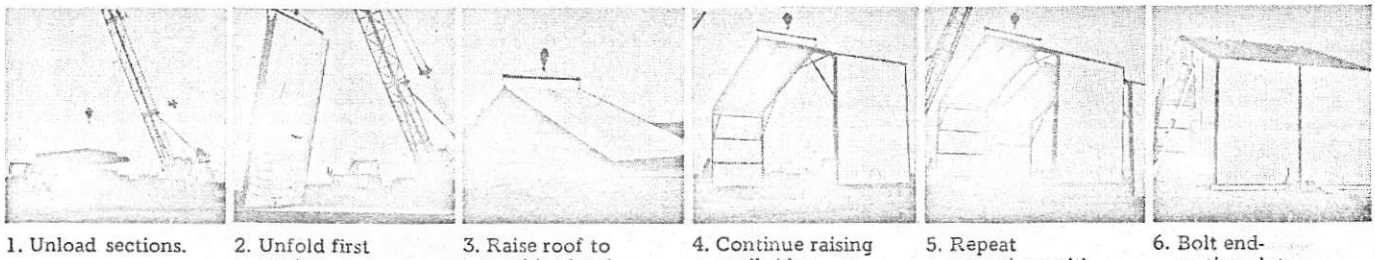
Ore controls appeared to be structural, with relative rock competence of greater importance than particular rock units. Percentage of intrusive dikes and areas of dike coalescence (dacite hoods) and degree of shearing appeared to be related to mineralization intensity and in many instances to ore localization.

Study of the mine maps showed that sulfide mineralization in the form of seams, stringers, and veins was extremely widespread throughout much of the length, width, and depth extension of the sheared portion of the volcanic-sedimentary roof pendant; orebodies on the other hand represented but small areas of concentrated sulfides. This confirmed, in a general way, that ore zones were located in specific areas which were very likely favorable structural foci above significant source areas.

Study of small-scale long sections which showed the distribution of ore zones within the general developed-portion of the shear zone indicated a westerly plunge for most of the orebodies. Dacite closures also had a west plunge. Cross sections constructed at fairly widely-spaced intervals through the developed to partially-developed shear zone indicated that there was a significant wes-




# It's as simple as this



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terly plunge of the upper westerly constriction of the shear zone and that orebodies were located both immediately below this constriction and also at deeper levels below the top of the constriction. Thus, gross target areas for new orebodies were suggested to be immediately under the west plunging constriction as well as deeper horizons, extending from the footwall to the hanging wall of the shear zone.

Inspection of the outline of Britannia workings below the 4100 level main haulage indicated that exploration did not penetrate into the westernly projection of the zone of constriction, nor did it extend far enough westerly to test either a possible westerly-raking position of hanging-wall mineralization exposed in the 2700-level workings or the width of the shear zone in a general westerly-rake position under the zone of constriction. Some old westerly 4100-level drill holes showed copper and zinc values which further suggested the general west area at depth could be of interest.

In addition to the target areas outlined above, evaluation of the #8 orebody being mined below 4100 level suggested #8 ore extensions could be anticipated below the deepest ore extraction level (5100) because at that horizon an assumed weakening at depth of the ore shoot appeared to be a probable local interruption in the downward continuation of the westerly lenses of the orebody.

Inspection of the development and stoping pattern in the Victoria oreshoot area suggested that additional stope tonnage could be developed in untested vein areas above 4100 level. A third area for ore development appeared to be down rake under the old Bluff orebody above the 4100 level.

The final Knaebel-Waterman report on the Britannia examination recommended that Anaconda purchase the property, increase the monthly rate of ore production, and begin an aggressive exploration program, as well as further development of the Victoria, the lower #8 area, and the lower Bluff zones. The purchase was arranged and Anaconda assumed control in January 1963.

The first exploration heading, 5700 level west, was started early in 1963. Diamond drilling on 400-foot centers followed the advance of the heading. Late in 1963 a hanging wall drill hole had to be abandoned due to caving ground conditions. This was the only drill hole lost in the 5700 west drill program. Had it been completed to the hanging wall of the shear zone it would have intersected a thick section of good ore near the east edge of the new orebody.

Near the end of the drilling from the new 5700 west heading, a September 1964 hanging-wall hole cut 40 feet of ore the day before the start of the seven-month strike. This hole was 400 feet west of the hole previously lost in 1963.

It is probable that if ore had not been intersected prior to the work stoppage the 5700 level would not have been reclaimed after termination of the strike. Here is an example of the luck in the mining business. One day made the difference between a new orebody and a probable long life to the Britannia operation compared to a probable shutdown in 1970, when most of the remaining #8-Bluff-Victoria ore zones will be exhausted.

A 5700-level crosscut after the strike and level rehabilitation cut the new orebody. A footwall lateral was driven for diamond-drill stations. Sufficient new ore was indicated above and below 5700 to warrant a long west extension of the 5250 level from #8 workings to establish a base for drill probing of the new ore to about the 5100 horizon. Holes below 5700 indicated minimum ore continuity to the 6000

horizon and the 5250 drilling showed ore to extend above 5100 level. This reconnaissance drill program was sufficiently encouraging to warrant serious consideration of a new shaft required to develop the new orebody. Later drilling established the orebody tops out a short distance above 4100 level and continues below the 6300 level. Present mine planning is directed to a fall 1970 start in stoping operations. The new orebody is about 2500 feet west of the west edge of the #8 orebody and is not connected to it in any way.

Anaconda geological work at Britannia has been pointed towards a detailed study of all facets of mine structure, rock correlations, and chemical and mineralogical evaluations of metamorphism and metasomatism, as well as the normal more or less routine geological work done to assist management in planning of operations.

A geological research facility with fairly complete thin- and polished-section equipment, microscopes, X-ray equipment, a chemical laboratory, and high-pressure equipment was set up and became operative in late 1964. Research geologists in close collaboration with mine geologists have been engaged in investigations of all aspects of the Britannia geology.

Analysis of old diamond-drill logs and mine geological-maps clearly suggested that in order to decipher the complex rock and structural relations it was necessary to revise the geological-mapping methods. Rocks were re-classified as to what they were, with descriptions of superimposed structure, alteration, etc., instead of what they are. For instance, a rock type may be presently classified as a meta-andesitic sediment showing a defined degree of foliation or schistosity instead of being called a chlorite schist. The re-classification has permitted a fair degree of rock correlation although we still have problems due to facies change and uncertainties of correlation because of intensive deformation and alteration.

The geological work to date has been very productive in outlining the sequence of events that has produced many of the complexities observed in the Britannia shear zone. Much more remains to be done but we are sanguine that the continuing studies will enable us to direct exploration to areas favorable for additional ore as well as developing one genetic model of copper ore and structure in a complex volcano-sedimentary roof pendant.