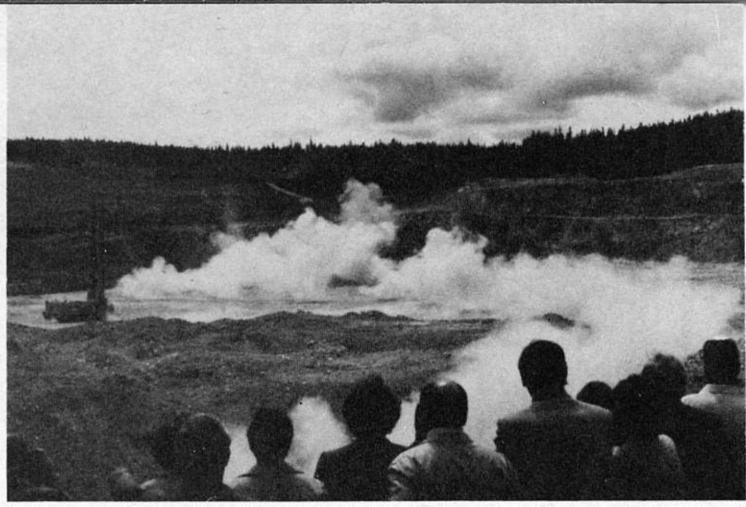

*Highmont: Chairman Roland Michener addressing the large crowd at the opening ceremony*



*Pit blast marked official opening*

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# Highmont Mine launched to a running start

Someone (not a mining man) said recently to *Western Miner* 'I suppose you get to a lot of these openings'. The occasion was the official opening of the Highmont copper-molybdenum mine of Teck Corporation. The fact is, of course, that there have not been all that many mine openings in recent years, though the Teck record of four since 1975 may have coloured the thoughts of the enquirer.

Following on Newfoundland Zinc, Niobec, and Afton, the Highmont mine was officially declared open by the Hon R H (Bob) McClelland, minister of energy, mines and petroleum resources of British Columbia, on 7 June 1981. The ceremony featured a pit blast set off by the minister, and the traditional ribbon cutting augmented by a cortege of three loaded highway trucks which regularly carry concentrate or molybdenite to railhead or to Vancouver for onward shipment.

The directors of Teck and Highmont were also supported by Charles Smith, deputy minister, Energy, Mines and Resources Canada, and Paul McRae, MP for Thunder Bay (the former riding of Robert Andras, who is now a senior vice-president of Teck Corp). Paul McRae is parliamentary secretary to Hon Judy Erola, minister of state for mines.

## SUMMARY OF OPERATIONS

The Highmont mine is in the south part of the Highland Valley of British Columbia, about 200km northeast of Vancouver; the deposits are about 2.5km south of the Bethlehem Copper mine, and half that distance southeast from the Lornex mine.

There are seven mineralized zones, of which two (an east pit and west pit) are being developed on the western slopes of Gnawed Mountain, at elevations in the range 5200-5700ft.

The west pit is forecast to contain some 23-million tons of 0.25% copper and 0.079% $MoS_2$ at a 0.20% Cu equivalent cut-off and a strip ratio of 2.0 to 1.0. The east pit is projected to contain about 110-million tons of 0.26% copper and 0.038% $MoS_2$ at a 0.20% copper equivalent cut-off at a strip ratio of 1.0 to 1.0. In addition, a third zone on Gnawed Mountain has a potential reserve of 48-million tons averaging 0.27% Cu and 0.04% $MoS_2$. These reserves were compiled through a total of 98,000 feet of core drilling.

The official announcement that the project would proceed was made on 24 April 1979. Site preparation began on 10 May 1979 by Dawson Construction. Commonwealth Construction, the main contractor, working in conjunction with Wright Engineers completed the plant construction on 4 March 1981. Pre-production mining of the open pit area began on 2 June 1980.

Construction was finished on the first circuit in the concentrator in December 1980 and March 1981 for the second circuit.

Highmont utilizes bulk rougher/scavenger flotation cells with a total storage capacity of 98,000 US gallons which is sufficient to sustain operations for 30 hours. The bulk concentrate is then pumped to the molybdenum separation circuit and subjected to 10 stages of cleaning. The entire flotation/separation circuits were completed by December 1980 and are able to process 12,500 US gal/min.

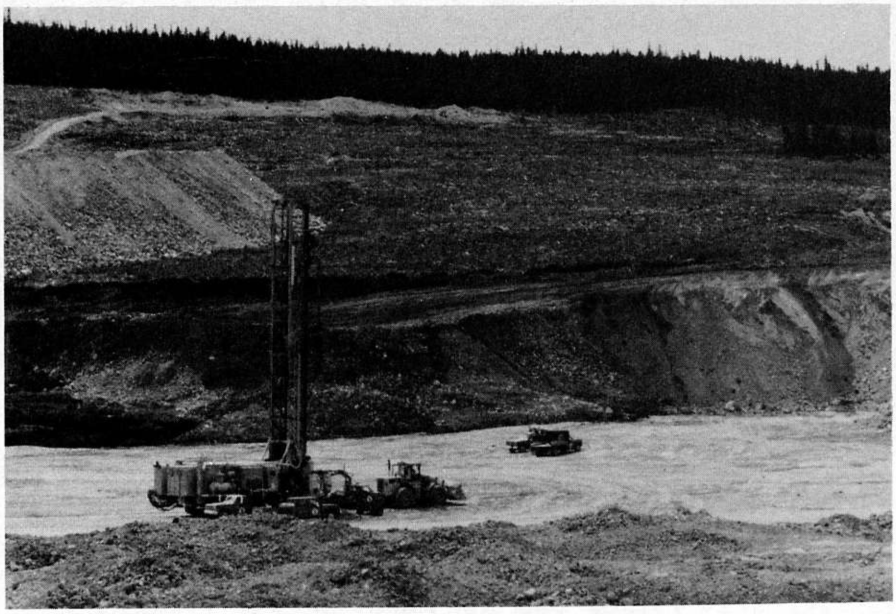
The tailing disposal system is designed as a totally enclosed system with no effluent discharge, to minimize environmental problems.

## HISTORY

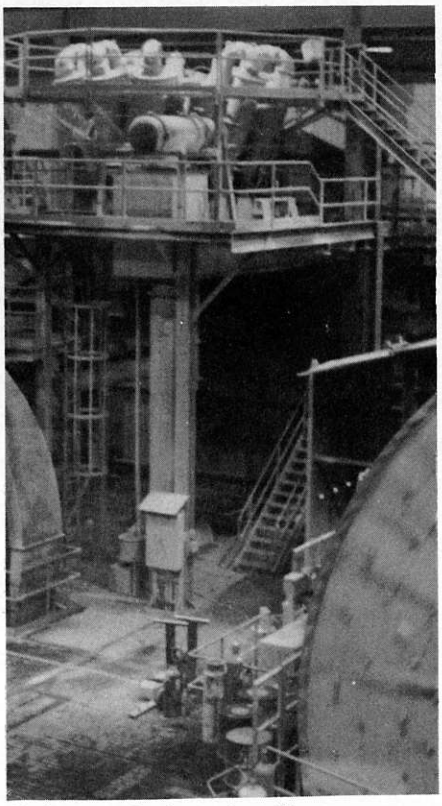
Although the Highmont deposits are very largely hidden by a thin mantle of glacial till, averaging about 12 feet, the nearby higher ground exposes showing of copper/molybdenum sulphides which apparently were explored by prospectors in the 1930s. Because of widely

*Highmont: Convoy of product hauling trucks took part in the ceremonies*

Highmont



*Highmont: Rotary drill in the pit*



*Highmont: Cyclones in mill*

scattered mineralization and favourable geology, the Gnawed Mountain area was repeatedly investigated.

The claims are part of a group that was staked in 1955 and 1956 and were subsequently held by Amador Mines, Highmont Resources Ltd, and subsequently Torwest Resources (1962) Ltd. Bob Falkins, President of Highmont Mining Corporation, participated in the staking almost 25 years ago.

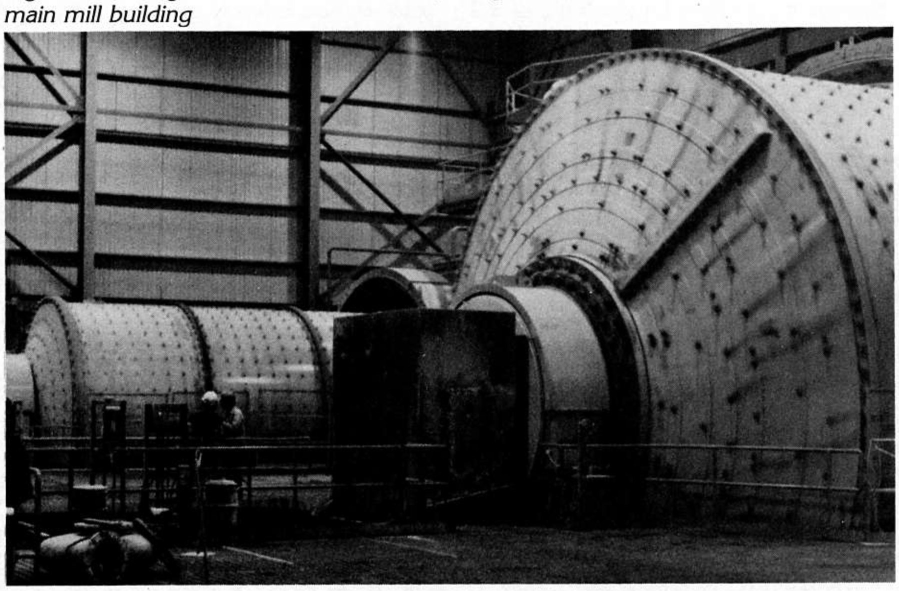
In 1957 the claims were optioned to American Smelting and Refining, who did some preliminary geological mapping and five shallow churn drill holes. In 1959 Kennco Explorations Western Ltd optioned the property for a brief period — their program consisted of mapping, trenching, soil sampling, some IP work, and two short diamond drill holes.

In 1964 and 1965 the claim group formed part of a parcel that was optioned to the Anaconda Group who did further reconnaissance work.

In 1966 Highmont Mining Corporation Ltd, (NPL) was formed and acquired the 34-claim block from Torwest for the consideration of one million shares of escrowed Highmont stock.

In mid-1966 Rio Algom carried out localized IP work and some 2700 feet of percussion drilling on an option basis. Subsequent to this in 1966 and 1967 an extensive program, by Highmont Mining Corporation, of diamond and percussion drilling outlined the largest of the copper/molybdenum deposits and yielded other encouraging results. Underground bulk sampling was conducted and initially financed by Nippon Mining Company. Nippon subsequently withdrew and the program was completed with funds raised by equity sale to the public. In 1969 Teck Corporation entered into a financial agreement with Highmont, which included the right to finance the property to production.

*Highmont: Autogenous mill and ball mill (background) in the main mill building*



By February 1971, the consulting firm of Chapman, Wood and Griswold Ltd, in association with Wright Engineers Ltd, had completed a feasibility study on the project. Because of the economics prevailing at that time the project did not proceed. Subsequent to the feasibility study additional blocks of claims were purchased. In 1977 Torwest Resources Ltd and Highmont Mining Corporation Ltd (NPL) were amalgamated to form Highmont Mining Corporation.

In late 1978 in view of prevailing copper and molybdenum prices, the feasibility study was reviewed and updated and the announcement to proceed with the project was made on 24 April 1979. In July 1979 Teck Corporation announced plans for a merger between Teck Corporation, Highmont Mining Corporation, and Iso Mines Ltd. This merger was completed by November.

## GEOLOGY

The Highmont property contains seven copper/molybdenum deposits, most of which are in Skeena Quartz Diorite of the Guichon Creek batholith.

The four largest Highmont deposits occur adjacent to both contacts of a west-trending, steeply dipping composite dyke that is above 200 metres wide. The

*Highmont: Part of a control room*

*Highmont: Part of the main maintenance shop*

dyke consists mainly of quartz porphyry and has local zones of breccia. Sulphide deposition occurred after the composite dyke was intruded, but chiefly prior to brecciation. Zones dominated by bornite, by chalcopyrite and by chalcopyrite plus pyrite are roughly parallel to the composite dyke. Bornite predominates adjacent to the dyke and gives way outward, to chalcopyrite and pyrite zones. Sulphide zoning and the ore deposits on both sides of the intrusion dip outward, away from the dyke.

North of the dyke the adjacent No 1 (East) and 2(West) zones together contain 134-million tons of Open-pit ore mineable in two separate pits. These two zones will support a 25,000 ton/day (t/d) mill with grades of 0.26% Cu and 0.027% Mo.

Orebody definition and grade confirmation was accomplished by 64,000 feet of core drilling in the East Pit and 34,000 feet in the West Pit.

In the ore zones, chalchopyrite, bornite, and molybdenite form disseminations and fracture-fillings accompanied by gangue minerals.

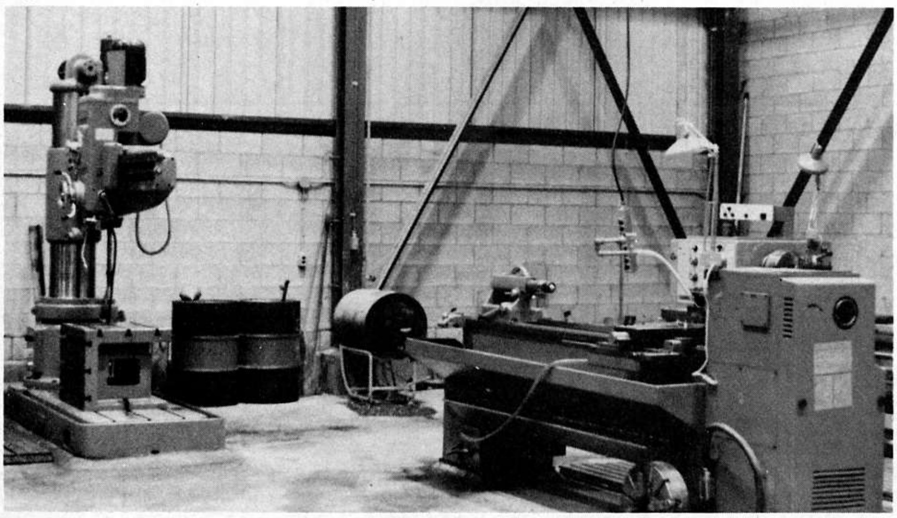
Higher grade mineralization tends to coincide with fracture swarms, or with shear zones and faults which largely parallel these swarms.

The ore zones are reflected by soil anomalies which show some glacial dispersion. IP surveys gave weak but significant responses. The ore zones occur within a strong magnetic gradient, but do not show a significant magnetic response.

## OPEN PIT DEVELOPMENT

**Pre-Production Stripping** began in the West Pit on 2 June 1980 and in the East Pit on 5 November 1980. The average depth of overburden in both pits was about 12 feet. Soils and overburden were mined using pit equipment and were stockpiled for later use in land reclamation. Waste rock mined was used for construction of haulage roads. Some 400,000 tons of treatable ore were stockpiled during the pre-production period.

*Highmont: Part of the machine shop*



**Pit Design.** The Stage I West Pit, 2100x1500ftx300ft deep with about 9-million tons of ore. The West Pit is (June'81) 120ft deep and will be the predominant source of ore during the first year of operation.

The Stage I East Pit is 3400x1600ftx330ft deep and is expected to produce 17-million tons of ore. The Stage I East Pit will become the main ore supply during the second and third years of production.

**Pit Production.** About 3-million tons of ore have been crushed for mill feed. Total mine production to 31 May 1981 including waste, was 16.3-million tons.

Ore and waste rock are mined on 30ft benches. At the pit wall, two 30ft benches are combined to make a 60ft face. Every 60ft down the pit wall there is a step or berm 38ft wide. The overall pit wall slope is 40° from horizontal. Haul roads into the pit are 80ft wide and descend at a grade of $-10\%$.

Rock is broken by drilling $9\frac{7}{8}$in blastholes 25ft apart, loading the blastholes with a slurry or ammonium nitrate/fuel oil explosive, and blasting.

Mining of ore and waste is done by three shovels with 11yd$^3$ or 20-ton dippers. The rock is loaded into 15 diesel/electric 120-ton trucks.

Mine production (June 81) is 65,000 t/d to be increased to 75,000t/d.

## CONCENTRATOR

Ore from the pits (at 24,000t/h) is dumped into a 54x74in 600hp primary gyratory crusher (completed Dec'80) where the rock is reduced in size to 9in or less. The crushed ore is then carried on a 54in wide conveyor belt to the coarse ore stockpile, which contains about 350,000 tons of ore, of which 75,000 tons actively move through to the concentrator.

Ore is drawn from the coarse ore stockpile through two sets of four 4x10 reciprocating feeders and conveyed to the two primary autogenous mills (34x14ft). Discharge from the primary mills is screened. Any ore between 3/8 and 2½in is re-crushed and sent back to the primary mills. Ore less than 3/8in is ground in the two ball mills. When the ore is 55% less than 200 mesh, it is discharged to the flotation circuit.

In flotation, both copper and molybdenum minerals are removed to produce a bulk concentrate. The copper minerals are then depressed and molybdenum is floated separately. The remaining waste rock with most of the process water is discharged to the tailing pond through a 32in 6.4km long pipeline.

The copper concentrate is filtered, dried, and shipped in bulk to the rail head at Ashcroft.

The molybdenum concentrate is leached using acid to remove copper and calcium impurities. The concentrate is then filtered and packed in drums (37 US gallon).

Total production to 31 May 1981 from 2.4-million tons of ore milled was about 5.9-million pounds of copper and 900,000 pounds of molybdenum.

By June'81 the mine had been fully operational for over two months at an average of 22,000t/d. Rated capacity of 25,000t/d should be exceeded in 1981.

A detailed description of the Highmont concentrator, by C V Sibbald, chief metallurgist of Teck Corp, appeared in *CIM Bulletin* 1978 v74 no827 (March).

*Highmont: Part of the crowd during the lunch break at the mine*

## TAILING DISPOSAL

The tailings disposal system is totally enclosed, with no effluent discharge. Water reclamation from the tailings pond at a rate of up to 9000 USgal/min has been incorporated into the process design of the concentrator flowsheet.

Fresh make-up water is added as necessary to complete the water balance in order to compensate for evaporation from the pond. Fine and coarse filter zones have been provided in the design of the tailings dam in order to allow for controlled seepage thus ensuring a stable structure. Seepage water is collected at the base of the dam through a system of collection ditches and small dams, and then pumped back into the main tailings pond.

The tailing pond is situated on a plateau area about 450m above the Highland Valley and 5km from the plantsite area. The ultimate tailing dams will form a horseshoe around the north, south and east sides of the pond. Access between the tailing dams and the open pits will be achieved with a 100-foot wide haulage road.

Construction of the temporary water storage dams began in August 1979, with two small earthfill dams, about 30ft high. The dams were built early to provide water storage required to start concentrating operations. The concentrator depends on reclaim water from the tailing pond; the three fresh water wells can supply a maximum of 30% of total water requirements.

Starter dam construction began in May 1980, with four earthfill dam segments on the north, south, and east sides of the pond. The dams, when completed in October 1980, were about 1400m long and 30m high with a total volume of 765,000m$^3$. The glacial clays and gravels required to build the starter dams were obtained locally within the pond area.

Seepage will be controlled initially with three small earthfill dams. Three submersible pumps will return seepage water to the tailing pond.

Future tailing dam construction will utilize spigotted tailing upstream of centre line, fine filter gravels on centreline with coarse filters and rockfill downstream of centreline. The coarse rock will be supplied by hauling waste 6.5km from the open pit at some 2-million t/year.

Fine filter material will be obtained by crushing and screening glacial gravels located in the dam area.

Tailing sand will be spigotted at 200-foot centres along the dams and against the fine filter. Spigots will be taken from the 32in tailing line using 8in lines controlled with pinch valves. The dams will be raised in 5-foot lifts.

## ENVIRONMENTAL

Highmont maintains an active water sampling program to ensure that contaminants do not enter the Nicola watershed. Quarterly reports are made to the Waste Management Branch, Department of Environment with sample data included.

To compensate for surface runoff water removed from the Witches Brook drainage by the mine and tailing operations, the flow in Witches Brook is supplemented during the driest months by approximately 50,000 US gpd.

Monitoring wells have been established downstream from each seepage control dam in the tailing area. Piezometers have been established at strategic locations beneath the tailings dam to measure water pressure. Monthly readings from these wells and piezometers will quickly show any problems with water flow through the seepage dams or stability problems with the tailings dam.

Highmont is engaged in a reclamation program that will ultimately see most of the area disturbed by mining and tailings operations, returned to its original state or better. Reclamation will begin this year by seeding approximately 35 acres of disturbed lands with grass and 1000 trees.

As active dumps, dam faces and road banks are completed, stockpile soils will be used to dress them. These areas will then be planted with grasses or trees.

Highmont employs 331 men and women, many of whom live at Logan Lake, 24km east of the mine site. Logan Lake, a community of 3500 people, is 56km southwest of Kamloops, in the Highland Valley. (Until recently, the town housed primarily Lornex employees.) The rest of the employees live in Merritt, Ashcroft, Cache Creek or Kamloops. The labour breakdown is: journeymen 94; mill 48; pit 99; staff 80.

The company has sponsored development of housing in Logan Lake through forgiveable second mortgages on houses, townhouses, and mobile home lots. During the summer of 1980 about 204 houses, three 50-unit apartments, and several mobile home lots were built. An additional 220 houses are expected to be built in 1981.

Highmont has sponsored several community projects including a church, figure skating school, hockey school, and rodeo.