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ENDAKO MINES LTD. (N.P.L.)



**Canada's
Largest Producer
of Molybdenum**

**One of
British Columbia's
Largest Mines**





History

In 1927 two Fraser Lake residents, Charles Foote and Alfred Langley, found many fragments of mineralized float scattered along a ridge five miles southwest of the village of Endako. The two men had come to hunt—they stayed to stake claims. Later they sank a 27-foot shaft in a quartz molybdenum vein, and drove a short adit below the shaft. But thirty years passed before sufficient exploration revealed the presence of a major ore body and the space-age demand for molybdenum made development an economic possibility.

Endako Mines Ltd. (N.P.L.) was incorporated in June, 1962, and in August of the same year Placer Development's subsidiary, Canadian Exploration Ltd., entered into an option agreement with Endako.

Clearing and construction began in March of 1964 and the project was completed in May of 1965, after an expenditure of some \$22,000,000. The mine had progressed from its first drill hole to commencement of mill production in slightly more than three years.

Production increased gradually to a rate of 18,000 tons per day in 1967. Late the same year an expansion of milling facilities increased capacity to approximately 27,000 tons per day.

Location and Access

The Endako Mine is situated 115 miles west of Prince George, near the geographic centre of British Columbia. It is five miles southwest of the village of Endako which is served by the northern branch of the Canadian National Railway as well as Provincial Highway 16, running between Prince George and Prince Rupert. A portion of the deposit underlies two small hills in a lightly wooded, gently rolling terrain. The surface elevation of the mineralized area ranges from 3,200 feet to 3,500 feet above sea level.

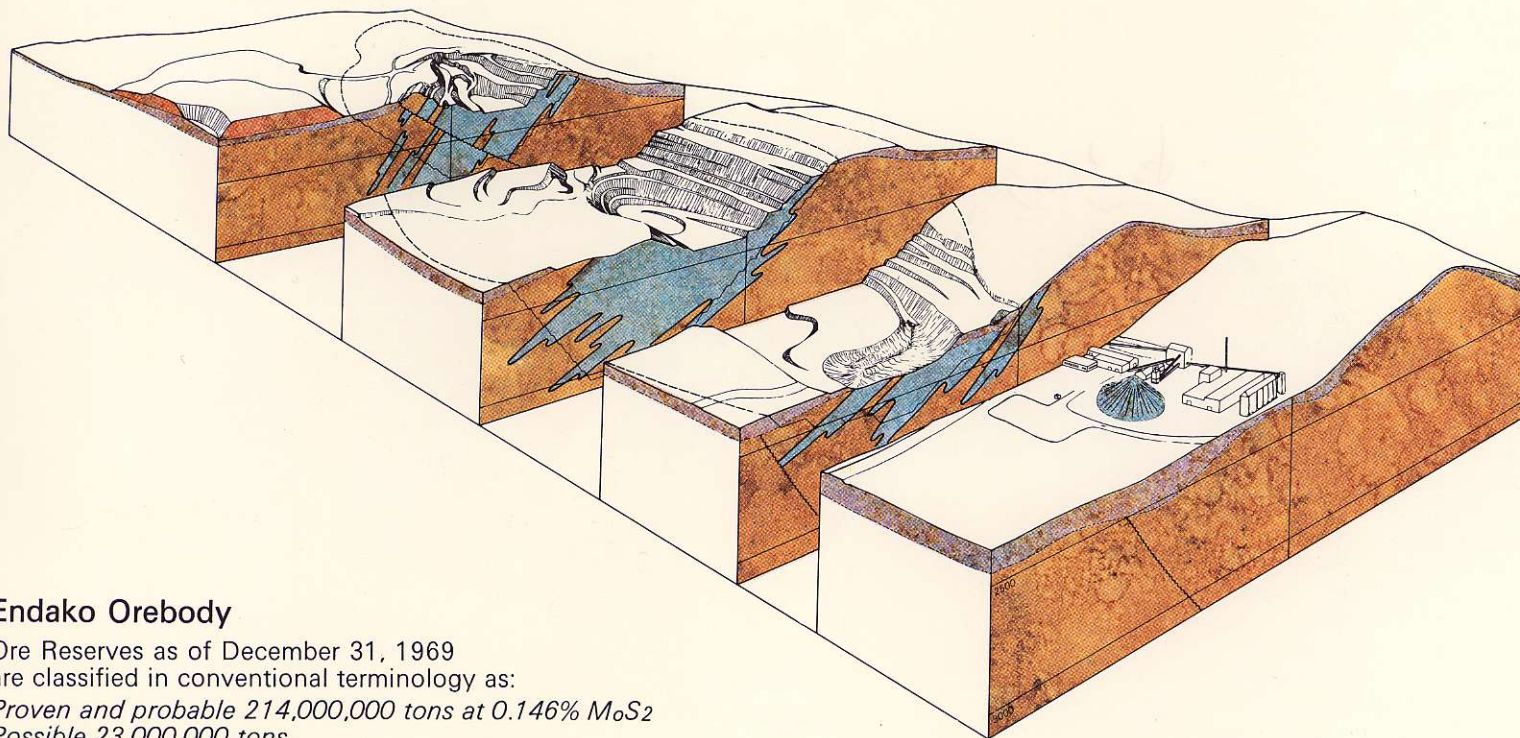


Geology

The Endako molybdenite deposit is located within a northwesterly trending upthrust of igneous rock (Topley Granite), 15 miles long by 10 miles wide, in the area known as the Nechako Plateau. There are essentially two main types of mineralization within the Endako deposit:

The dominant type of the western portion is that of the "vein zones". By this is meant a zone of mineralization which is parallel to and including one or more of the larger quartz veins.

The second type of mineralization, characteristic of the eastern part of the deposit, consists almost entirely of veinlets that may average $\frac{1}{4}$ " or less in width. These smaller veins are characteristically flat in shape and in some sections they are not much more than a hairline in size. This type of mineralization is more uniform in grade than the "vein zone" type.



Endako Orebody

Ore Reserves as of December 31, 1969 are classified in conventional terminology as:






Proven and probable 214,000,000 tons at 0.146% M_oS_2

Possible 23,000,000 tons

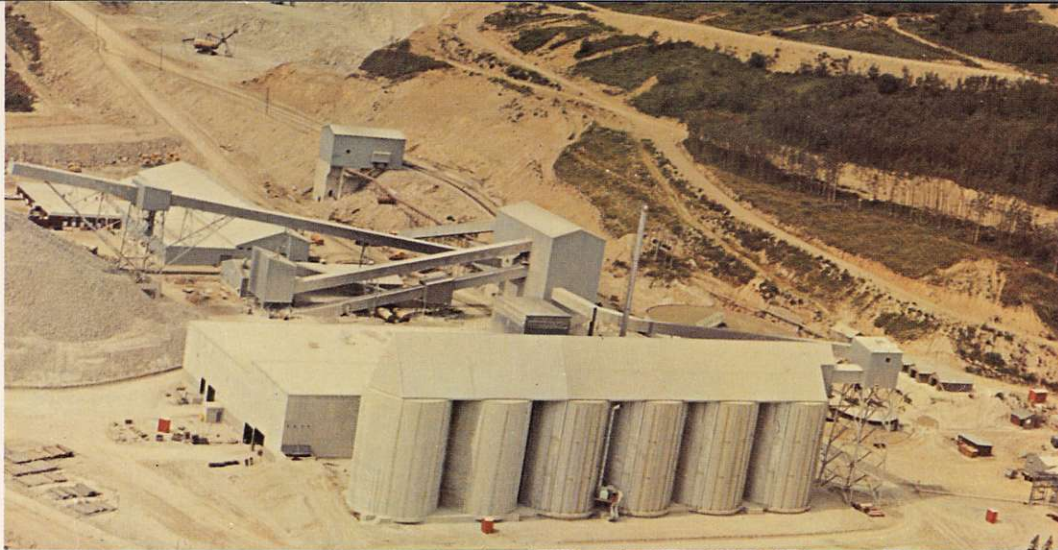
Denak Mines Ltd: (100% owned)

Proven and probable 5,400,000 tons at 0.23% M_oS_2

LEGEND

-  Quartz Monzonite Host Rock
-  Overburden
-  Low Grade Stockpile
-  Orebody
-  Ultimate Pit Limit

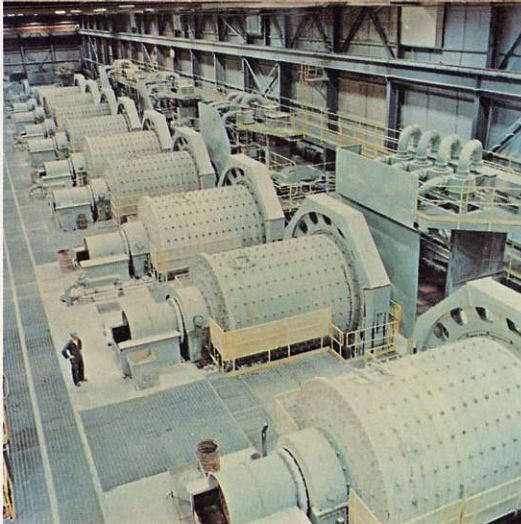
The Endako Mine plant area with fine ore bins in foreground.



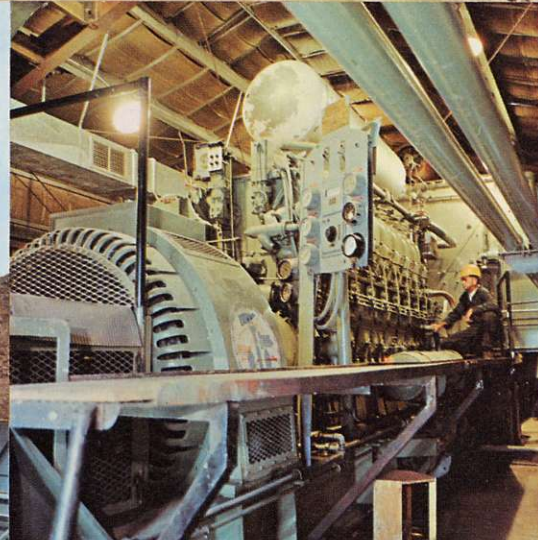
Electric shovel in the open pit. 5 cubic yards.



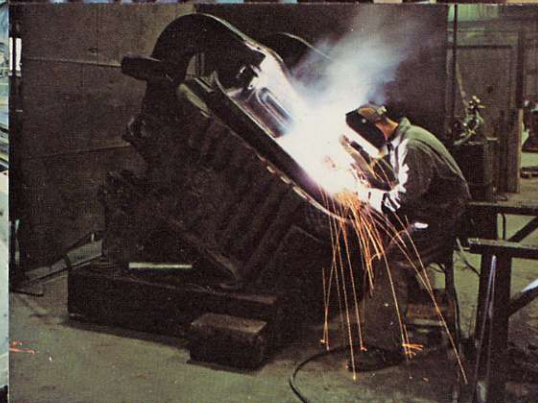
The grinding bay houses 10 main grinding units.



Mill concentrator flotation cells for primary separation of mineral from waste.



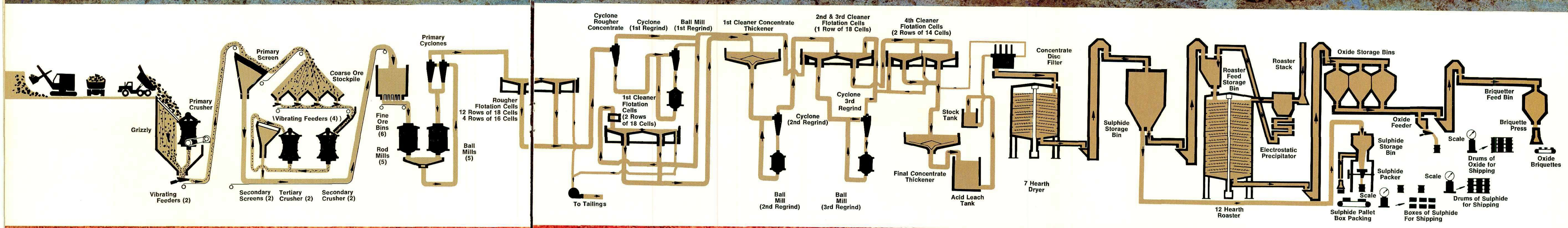
Generator.

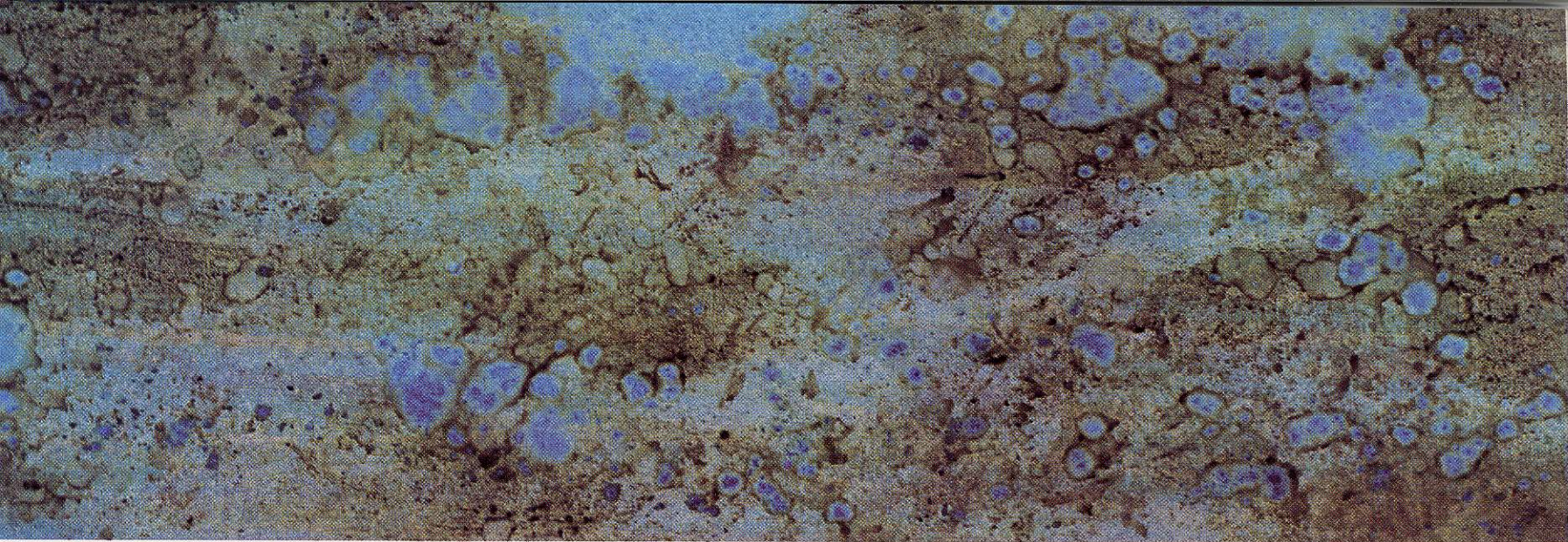


Endako Mines maintenance shop.



Sulphide is shipped in drums to many parts of the world.





Mining

Endako engineers now use computer techniques in planning mining methods in the open pit. Present plans include an ultimate pit 8000 feet long by 2500 feet wide. Wall heights will vary from 700 feet in the south to 1000 feet in the north. The pit will eventually cover a surface of 300 acres estimated to contain 350,000,000 tons of rock.

All the major equipment in the open pit is powered by electricity. Electric rotary drills are used to sink 9 inch holes some 38 feet deep into the benches which are established at 33 foot intervals. Under normal conditions, these holes are loaded with blasting agents consisting of a mixture of ammonium nitrate and fuel oil. If water is encountered, special slurries are used.

The broken ore is loaded by electric shovels, the largest of which loads 15½ tons with each pass of the bucket. 85 ton electric trucks carry high grade ore to the crusher and low grade to ore dumps for treatment at a later date.

Milling

This can be broken down into five basic operations: primary and secondary crushing, grinding, flotation, dewatering and tailings disposal.

The ore trucks dump an average of 1650 tons of ore per hour into the primary crusher. The ore is then screened, and the undersize goes directly to the fine ore bins. Oversize is conveyed to the coarse ore stockpile, then on to the secondary crusher.

Fine ore and water pass through the rod mills and ball mills and into the flotation circuits where reagents are added and the molybdenum is floated to the top. Finally the concentrate is thickened and filtered, and most of the water is removed in a six-hearth natural gas fired dryer. The product at this stage is molybdenum sulfide, a black, powdery material. About one-half of the sulfide goes into a 12-hearth roaster to emerge as molybdic oxide, a buff-colored, dry powder.

The tailings are pumped to disposal ponds where they are impounded behind dams. Water is reclaimed from these ponds and pumped back to the mill where it is mixed with the fresh water pumped up from Francois Lake, two miles away.

The average daily mill throughput is 27,000 tons per day. This yields about 50,000 lbs. of molybdenum, half of which is converted to oxide before going to market.

Marketing

Most of the molybdenum concentrate, both sulfide and oxide, is packed in 33-gallon drums and trucked to Vancouver for shipment to overseas destinations. Most of this goes to various European countries and about a third to Japan. Endako also supplies a substantial part of Canadian requirements.

Free world production in 1968 was 135 million pounds of molybdenum and consumption was 120 million pounds. In spite of the excess of production over consumption typical of the past few years, market conditions have been stable. Endako contributes about 13 per cent of free world production.

Today the iron and steel alloying industry is the greatest user of molybdenum. The addition of molybdenum gives steel increased strength, uniform hardness, resistance to corrosion, and retardation of brittleness at high temperatures. Molybdenum compounds are also used in insecticides, fertilizers, ceramics and high-temperature lubricants. The uses of molybdenum are generally distributed as follows:

ALLOY STEEL	44%
STAINLESS STEEL	20%
TOOL STEEL	11%
CAST IRON	8%
CHEMICALS & LUBRICANTS	7%
SUPER ALLOYS	5%
MOLYMETAL	4%
MISCELLANEOUS	1%
	<hr/>
	100%



Fraser Lake Townsite

Located fourteen miles from the mine site, on the south shore of scenic Fraser Lake, the community is named after Simon Fraser, who explored the area in 1806 and established a fur trading post at the east end of the lake.

From 1964 to 1970 the population has increased from 150 to 1300. Living accommodations, designed and located in accordance with a community plan, include family homes, apartments, single men's quarters, and trailer courts.

There is a 24-classroom school supplying the most up-to-date educational facilities to 500 students from grade 1 to 10. Recreational facilities include a skating rink and clubhouse, a \$125,000 recreation centre with curling rink, a community hall, a boat launching ramp, and fifteen acres of land for future recreational development. There is a new, 30-room hotel in the village, a shopping centre, a well equipped medical clinic with a full-time doctor, and churches serving five denominations.

The surrounding country is lake-studded and forested, offering superlative fishing, hunting and outdoor recreation of many kinds.



Directors

Morris Black, *Financier, Toronto, Ont.*

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Albert E. Gazzard, *Executive Vice-President, Placer Development Limited, West Vancouver, B.C.*

J. Douglas Little, *Vice-President, Operations, Placer Development Limited, Vancouver, B.C.*

Thomas H. McClelland, *President & Chief Executive Officer, Placer Development Limited, Vancouver, B.C.*

Andrew Robertson, *Mining Executive, West Vancouver, B.C.*

Edgar A. Scholz, *Vice-President, Exploration, Placer Development Limited, West Vancouver, B.C.*

Isaac Shulman, *Barrister & Solicitor, Vancouver, B.C.*

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Garth S. Jones, *Comptroller*

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James M. Gibbs, *Assistant Mine Manager*

Richard J. J. Lampson, *Mine Superintendent*

Harvey J. Rutley, *Plant Superintendent*

John F. Davey, *Mill Superintendent*

John D. Simpson, Jr., *Chief Engineer*

George B. Beattie, *Chief Accountant*



