

PRODUCT PRODUIT	COPPER	PROVINCE OR TERRITORY	PROVINCE OU TERRITOIRE	British Columbia	N.T.S. AREA 92 I/7 RÉGION DU S.N.R.C.	REF. CU 1 RÉF.
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NAME OF PROPERTY
NOM DE LA PROPRIÉTÉ

BETHLEHEM (JERSEY) (SNOWSTORM)

OBJECT LOCATED - Jersey open pit.
OBJET LOCALISÉ

UNCERTAINTY 300 m
FACTEUR D'INCERTITUDE

Lat. 50°29'50" Long. 120°59'10"

Mining Division Kamloops District
Division minière District

County Kamloops Township or Parish
Comté Canton ou paroisse

Lot Concession or Range
Lot Concession ou rang

Sec. Tp. R.
Sect. Ct. R.

OWNER OR OPERATOR/PROPRIÉTAIRE OU EXPLOITANT

Cominco Ltd.

DESCRIPTION OF DEPOSIT/DESCRIPTION DU GISEMENT

The property lies within the Lower Jurassic Guichon Creek batholith, which consists of a series of several magmatic intrusives, in general having a concentric zonal arrangement and becoming younger inward. The property straddles an intrusive contact where the younger quartz diorite (Bethlehem phase) forms an irregular embayment in an older quartz diorite (Guichon variety). The orebodies are distributed along this embayment, which forms a semicircular arc about 1 mile in length and concave to the south. In clockwise order, the orebodies are the Huestis, Jersey, East Jersey, Iona, and White. Emplacement of the Bethlehem quartz diorite was followed by a porphyry dyke swarm that extends northward across the property. One of these dykes intersects the weakened contact zone between the quartz diorites and these expand to form a multi-branched intrusion. Subsequent intrusion of numerous other porphyry dykes mainly on north and northeast trends was followed by faulting. Both of the rock formations have been extensively fractured by north-trending regional faults as well as by complementary cross and parallel fractures, but generally the Bethlehem quartz-diorite has not fractured as extensively as

see Card 2

Associated minerals or products - Silver, gold, molybdenum.
Minéraux ou produits associés

HISTORY OF EXPLORATION AND DEVELOPMENT
HISTORIQUE DE L'EXPLORATION ET DE LA MISE EN VALEUR

The property is located at the 4,500 foot elevation in the Highland Valley 2 miles east-northeast of Quiltanton Lake, some 20 miles southeast of Ashcroft. The Jersey orebody underlay Jersey Lake and the hillside to the south. From the Lake the Huestis zone lay about 1,500 foot southwest, the East Jersey zone about 1,000 feet east, the Snowstorm zone 4,000 feet east-southeast, the Iona zone 3,000 feet southeast, and the White zone 4,000 feet southeast.

The Jersey zone was originally staked in 1896 or 1897 as the Last Chance claim and bonded to a French syndicate. After sinking a shaft to a reported depth of 80 feet, the bond was given up. In 1901 the Last Chance and Sunset claims were owned by Mr. J.G. Kirkpatrick.

The Last Chance showings were restaked in about 1905 by Stuart Henderson and Gilbert Couverette, of Ashcroft, as the Ball group, comprising the Football, Handball, Baseball, etc., claims. They also staked the Snowstorm showings as the Storm group, comprising the Snowstorm, Rainstorm, and Hailstorm claims. Work on these claim groups during the period 1905-1907 consisted mainly of trenching and test pitting.

No further activity was reported until 1914 when mining operations were begun on the Snowstorm group of 5 claims, owned by Messrs. Henderson, Couverette, and G. Ward. A shaft was sunk 50 feet and an adit driven 70 feet to connect with the bottom of the shaft. Drifts were run about 30 feet north-east and southwest of the adit. In the northeast drift a winze was sunk 56 feet. Several ore shipments were made before the operation was closed in 1916. During this period the Last Chance showings were held by Mr. Henderson as the Jersey-Gurnsey group of 4 claims and the intervening ground as the Channel group of 4 claims. The three claim groups, forming a compact block of 22 claims and fractions, were subsequently surveyed.

The British Columbia Department of Mines began a diamond drilling program in January 1919 under the Mineral Survey and Development Act. On the Snowstorm showings 8 drill holes totalling 5,452 feet were put down. A drilling attempt on the Iona claim, on which an outcrop of copper stained quartz porphyry had been located, was unsuccessful due to broken ground. An adit was then driven 280 feet in mineralization

see Card 2

HISTORY OF PRODUCTION/HISTORIQUE DE LA PRODUCTION

During 1915-1916, 136 tons were shipped from the Snowstorm. From this ore 8 ounces of gold, 780 ounces of silver, and 76,754 pounds of copper were recovered.

Production by Bethlehem for the period 1962-74 inclusive totals 51,399,531 tons. From this ore 18,924 ounces of gold, 1,665,403 ounces of silver, 517,329,481 pounds of copper, and 28,245 pounds of molybdenum were recovered.

Production for the period 1975-78 inclusive totals 24,673,919 tonnes. From this ore 308.604 g of gold, 23 902.728 g of silver, and 87 935 103 kg of copper were recovered (BC Dept. of Mines data). Molybdenum recovery in 1978 was 435,924 lbs. Production in 1979-80 was 14,117,076 tons milled and a recovery of 87,847,293 lbs of copper and 871,167 lbs of molybdenum (Bethlehem Annual Reports).

Production in 1981 and to closure in June 1982 totalled 10,592,000 tons milled. From this ore 33,900 tons of copper concentrate were recovered (Cominco Annual Reports).

MAP REFERENCES/RÉFÉRENCES CARTOGRAPHIQUES

Geology of the Guichon Creek Batholith, Sc. 1":2 miles - accomp. Bulletin 56, British Columbia Dept. of Mines, 1969.

Preliminary Map No. 7, Preliminary Geological Map of the Highland Valley, Sc. 1":1,320 feet, British Columbia Dept. of Mines.

Map 886 A, Nicola, (Geol.), Sc. 1":4 miles - accomp. Memoir 249.

Map 5212 G, Mamit Lake, (Aeromag.), Sc. 1":1 mile. (1968).

#Map 92 I/7, Mamit Lake, (Topo.), Sc. 1:50,000.

REMARKS/REMARQUES

Comp./Rev. By Comp./rév. par	DMacR	DMacR					
Date Date	05-81	09-83					

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Geology, Exploration, and Mining, British Columbia Dept. of Mines: 1969, p. 245; 1970, p. 331; 1971, p. 357; 1972, p. 170; 1973, p. 179; 1974, p. 146⁺⁺.

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Coveney, C.J., Stevens, D.C., Ewanchuk, H.; Grade Control at Bethlehem Copper; The Canadian Mining and Metallurgical Bulletin, Vol. 58, No. 640, August 1965, pp. 823-826.
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PRODUCT COPPER PRODUIT	PROVINCE OR TERRITORY PROVINCE OU TERRITOIRE	British Columbia	N.T.S. AREA 92 I/7 RÉGION DU S.N.R.C.	REF. CU 1 RÉF.
NAME OF PROPERTY NOM DE LA PROPRIÉTÉ	BETHLEHEM (JERSEY) (SNOWSTORM)		HISTORY OF EXPLORATION AND DEVELOPMENT (continued) HISTORIQUE DE L'EXPLORATION ET DE LA MISE EN VALEUR	
<p>DESCRIPTION OF DEPOSIT/DESCRIPTION DU GISEMENT (continued)</p> <p>has the Guichon quartz-diorite. In the latter rock, strong gouge-covered faults and a multitude of closely-spaced sheet and cross joints and fractures are widespread in the vicinity of the regional faults, particularly near the contacts with the Bethlehem intrusive bodies. Similarly, extensive elongate breccia zones have been developed parallel to the fracture systems, particularly within the Guichon rocks. These fracture and breccia zones within the Guichon quartz-diorite have formed hosts for rich concentrations of copper mineralization. Thus, generally speaking, the Bethlehem copper deposits occur as extensive concentrations of copper minerals deposited along fracture planes and in breccias. These concentrations are located where such fracturing and brecciation has been most intense, i.e., within the Guichon quartz-diorite, near contacts with major bodies of the younger Bethlehem quartz-diorite. The Huestis, Jersey, East Jersey, Iona and White ore zones all occur around the periphery of the same Guichon-Bethlehem contact.</p> <p>Characteristically the rocks in the areas of ore occurrences are pervasively altered hydrothermally by kaolinization, sericitization, silicification and chloritization.</p> <p>The ore itself is comprised of chalcopyrite and bornite occurring both as fillings, with or without quartz, along fractures and as dissemination within the rock itself. The principal ore minerals are hornite and chalcopyrite with molybdenite accompanying them in small amounts. Pyrite is present in parts of the Iona orebody and as a halo around the Jersey orebody. Malachite occurs at shallow depths but there is no appreciable change in copper content by supergene processes.</p> <p>The East Jersey orebody occurs within the older quartz-diorite near and in strong fractures and a breccia associated with younger (porphyry) sheets, thus it tends to be a rather preferentially oriented deposit with local definite trends. In contrast, the Jersey orebody occurs in an area of more evenly distributed and variously oriented pervasive fracturing, less aligned to a dominant structure, thus it is more correctly a true disperse, disseminated deposit. Molybdenite occurs in minor amounts in the Jersey orebody.</p>	<p>but no solid rock was encountered on which drilling could begin. A shaft was then sunk to 40 feet. Test pitting had indicated a mineralized area about 1,000 feet in width and 3,000 feet in length. Work stopped in January 1921. The property was reportedly restaked in 1929 but details are lacking.</p> <p>Mr. C.H. Allen restaked the property in 1937 as the Windy Pass, Tunnel, and Cu groups, totalling 24 claims, which were subsequently transferred to Butalma Mines, Limited. In 1940 the Snowstorm workings were cleaned out and the shaft deepened a few feet. Ventures Limited optioned the claims in 1942 and 4 diamond drill holes were put down in the Iona zone, returning values lower than those obtained in the adit. A 419 foot drill hole put down on the Jersey claim returned fair values. Another showing (White zone), known as the Brynelson, about 1,800 feet southeast of the Iona, was prospected at that time.</p> <p>The American Smelting and Refining Company optioned the property in 1948 but dropped the option without doing any work. The claims subsequently lapsed.</p> <p>In October 1954 the Huestis-Reynolds-McLallen Syndicate sponsored a prospecting examination and approximately 100 claims were staked covering the old Jersey-Snowstorm-Iona zones. Bethlehem Copper Corporation Ltd. was incorporated in February 1955 and the claims transferred to the company. Trenching was begun on the Iona zone and later extended to the Jersey. A bulk sampling plant operated until September 1955. American Smelting and Refining reoptioned the property in September 1955 and carried out extensive exploration work for almost 3 years. Their program consisted of 68,000 feet of churn, rotary, and diamond drilling. The East Jersey zone was discovered in 1957 in drill testing of covered areas. By May 1958 the Jersey and East Jersey orebodies were outlined; the option was abandoned at that time.</p> <p>Bethlehem immediately began an adit to explore both orebodies underground and by late 1961 some 16 million tons of ore were proven. The Sumitomo Group of companies, of Japan, agreed to provide 5.5 million U.S. to put the property into production. Construction began in July 1961 and on November 28, 1962, the 3,300 tons per day mill was put into operation. A molybdenum circuit installed the following year was put into</p>			
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DESCRIPTION OF DEPOSIT/DESCRIPTION DU GISEMENT (continued)

The Huestis zone, a true crackle breccia-type porphyry deposit occurs mainly in the Bethlehem quartz diorite, with only minor mineralization in the Guichon variety. The main copper mineral is chalcopyrite with lesser amounts of bornite.

The Iona zone, a true breccia pipe deposit, is mostly confined to a northerly trending pear shaped breccia zone. The mineralization consists mainly of bornite and chalcopyrite along with minor amounts of molybdenite and chalcocite; the zone grades 0.46% Cu and 0.01% Mo (CMJ, June 1978, p. 46). The zone is extensively oxidized to depths of over 200 feet. Reserves in the Iona, as of Dec. 31, 1975, were reported as 12,050,000 tonnes at 0.47% copper (CIM Spec. Vol. 15, p. 105).

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HISTORY OF EXPLORATION AND DEVELOPMENT (continued)
HISTORIQUE DE L'EXPLORATION ET DE LA MISE EN VALEUR

operation in March 1964; the unit was removed late in 1966 due to unsatisfactory results. Mining began in the East Jersey pit and continued until a slide in the pit wall in February 1965 closed the operation. All mining operations were then transferred to the Jersey pit. Mill capacity was increased to 6,000 tons per day in 1964, to 10,000 tons in 1966, to 12,000 tons in 1967, to 14,000 tons in 1968, to 15,000 tons in 1969, to 16,000 tons in 1972, and to 20,000 tons per day by 1976. Production from the Huestis pit began in 1970 and continued until late in 1976. Production from the Iona pit began in 1976 and continued until the end of 1979. Production from the Jersey pit extension began in 1977.

Newmont Mining Corporation in 1972 purchased a 22% interest in Bethlehem from Sumitomo Metal Mining Co., of Japan. Bethlehem Copper Corporation Ltd. in June 1974 reclassified its authorized capital and changed its name to Bethlehem Copper Corporation. During 1977 Gulf Resources & Chemical Corporation, of Houston, purchased the 26% interest in Bethlehem held by Gränges Exploration Aktiebolag, of Sweden. During 1977-78 Cominco Ltd., which had previously acquired a 12% interest in Bethlehem, purchased additional shares, increasing its interest to 39%. A molybdenum circuit was installed and put into operation in June 1978. In October 1980 Cominco Ltd., through its wholly owned subsidiary Worwil Investments Inc., purchased the 26% interest held by Gulf Resources, thereby raising its interest in Bethlehem to 65%. On February 2, 1981 Cominco Ltd. increased its interest in Bethlehem to 92% with the purchase of the 22.9% interest held by Newmont.

Reserves at the end of 1980 were reported as 53.3 million tons at 0.42% copper (Cominco, 1980 AR).

Through additional share purchases late in 1981 Bethlehem became a wholly owned subsidiary of Cominco Ltd. The mine was shut down June 30, 1982 when mining in the Jersey pit extension became uneconomic. Bethlehem Copper Corporation was amalgamated with Cominco Ltd. on December 31, 1982 under the name Cominco Ltd. The Bethlehem mill was put in operation in January 1983 to process ore from the Valley Copper deposit located some 6 km from the mill at the rate of 23,000 tons per day.