

PRODUCT LEAD  
PRODUIT

PROVINCE OR PROVINCE OU  
TERRITORY TERRITOIRE

British Columbia

N.T.S. AREA 82 F/9, G/12  
RÉGION DU S.N.R.C.

REF. PB 1  
RÉF.

NAME OF PROPERTY  
NOM DE LA PROPRIÉTÉ

SULLIVAN

OBJECT LOCATED - of open pit as shown on Map 15-1957.  
OBJET LOCALISÉ

UNCERTAINTY 300 m Lat. 49°42'30" Long. 116°00'20"  
FACTEUR D'INCERTITUDE Lat. Long.

Mining Division Fort Steele District  
Division minière Kootenay

County 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.,  
200 Granville Square,  
Vancouver, B.C.

DESCRIPTION OF DEPOSIT/DESCRIPTION DU GISEMENT

The area is underlain by Precambrian rocks of the Aldridge, Creston, and Kitchener formations. The Creston and Kitchener sediments lie north of the Kimberley Fault, which strikes about eastwest and dips 45 to 55 degrees north. The block to the south of the fault contains the mine and in its vicinity is composed of beds belonging to the lower part of the Aldridge formation, and a few gabbroic sills and dykes that are called the Purcell intrusions and like the beds are believed to be of late Precambrian age. The north end of the ore zone is displaced by the Sullivan fault; the faulted extension contains a considerable amount of quartz and the zone of mineralization, at the northern end, becomes a quartz vein. Fracture zones of the so-called Sullivan type, which strike northerly and dip steeply west, have caused down throws of as much as 100 feet for the ore on their west sides. The regional strike of the formation is north to N45° west and dips average about 30° east but in the mine area the structure is modified by the presence of a nose-like fold, called the Sullivan anticline. The orebody occupies part of the crest and the east side of this nose. Folding on a large or small scale is quite common

see Card 2 ....

Associated minerals or products - Zinc, silver, tin, cadmium, copper, gold,  
Minéraux ou produits associés pyrites, indium, tungsten.

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

The mine is located on the southeast slope of Sullivan Hill, 2 miles northwest of the center of the city of Kimberley; the concentrator is located at Chapman Creek, 2 miles southeast of the center of the city. The North Star mine is located about 2 miles south of the Sullivan, on North Star Hill.

Prospectors Pat Sullivan, John Cleaver, E.C. "Ed." Smith, and Walter Burchett, of the Coeur d'Alene area of Idaho, were prospecting in the Kootenay Lake area in 1893 when they decided to band together for an overland trip to the Fort Steele area. On their arrival they heard stories of the impressive orebody of the North Star mine which had been discovered the previous year. On reaching North Star Hill, they found all of the hill had been staked but decided to prospect in the vicinity. They crossed Mark Creek to prospect the other slope and soon found the outcrop of the Sullivan orebody. They located 3 claims, the Shylock, Hamlet, and Hope (Lots 1385-1387 respectively). One of the partners, Sullivan, was killed in the Coeur d'Alene district in the winter of 1892 but the remaining three continued work on their claims at intervals when finances permitted until 1896.

The claims were bonded in 1896 to A. Hanson, of Leadville, but the bond was not taken up. Later that same year the property was bonded to Col. Ridpath, Judge Turner & associates, of Spokane. These interests organized the Sullivan Group Mining Company, which was registered in British Columbia in March 1897; the 3 original claims were Crown-granted to the company in 1898. From 1896 to 1899 some surface stripping was done and several small shafts sunk but transportation was a limiting factor and serious development was not begun until a branch line of the C.P. Railway was completed from Cranbrook in 1900. During the following years ore was shipped to the Hall Mines smelter at Nelson and the Canadian Smelting Works at Trail. In 1902 the company began the construction of a lead smelter at Marysville, 4 miles southeast of Kimberley. Due to the many metallurgical difficulties encountered, and also to the depressed condition of the lead market, the smelter was not put into operation until about 1905. The ore could not be treated profitably and both the smelter and mine closed late in 1907 after some 75,000 tons of ore had been smelted. At this stage the company had numerous creditors and

see Card 2 ....

Mineral Policy Sector, Department of Energy, Mines and Resources, Ottawa  
Secteur de la politique minière, ministère de l'Énergie, des Mines et des Ressources, Ottawa

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## HISTORY OF PRODUCTION/HISTORIQUE DE LA PRODUCTION

From 1900 to 1974 inclusive 116,199,323 tons of ore were produced. From this ore 5,397 ounces of gold, 241,221,351 ounces of silver, 10,293,900 pounds of copper, 14,479,191,822 pounds of lead, 12,623,874,102 pounds of zinc, 5,178,052 pounds of cadmium, and 19,273,157 pounds of tin were recovered; the tin data does not include the year 1965 for which only the concentrate (252 tons) was reported. Iron sinter production for the years 1965-1973 inclusive totals 1,084,636 tons.

Production for the period 1975 to 1978 inclusive totalled 7 561 304 tonnes. From this ore 5.132 kg Au, 361 805.959 kg Ag, 437 533 kg Cu, 309 102 634 kg Pb, 294 162 604 kg Zn, 34 701 kg Cd, and 508 668 kg Sn were recovered; the data for gold, copper, and cadmium is incomplete.

## MAP REFERENCES/RÉFÉRENCES CARTOGRAPHIQUES

Map 936 A, Cranbrook, (Geol.), Sc. 1":1 mile - accomp. Memoir 207.

#Map 15-1957, St. Mary Lake, (Geol.), Sc. 1":1 mile.

Map 11-1960, Fernie, West Half, (Geol.), Sc. 1":1 mile.

Map 297 A, Cranbrook Sheet, (Topo.), Sc. 1":1 mile (1934).

Map 82 F/9 E, St. Mary Lake, (Topo.), Sc. 1:50,000.

## REMARKS/REMARQUES

Comp./Rev. By Comp./rév. par							
Date Date	02-73						

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PRODUCT PRODUIT	LEAD	PROVINCE OR TERRITORY	PROVINCE OU TERRITOIRE	British Columbia	N.T.S. AREA 82 F/9, G/12 RÉGION DU S.N.R.C.	REF. PB 1 RÉF.
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NAME OF PROPERTY  
NOM DE LA PROPRIÉTÉ

SULLIVAN

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

DESCRIPTION OF DEPOSIT/DESCRIPTION DU GISEMENT (continued)  
and apparently the deformation continued during and after the period of mineralization. The folding is more pronounced at the hanging-wall than at the footwall, and local folds at the hanging-wall are responsible for the great range in thickness of the deposit. The ore zone may not be more than a few feet thick in synclines, or may be up to 200 feet thick in the crests of anticlines. Dip of the ore zone varies from a few degrees to 45° east. Mostly it is composed of beds of argillite and silty argillite that range from a few feet to 40 feet in thickness.

The sulphide body is essentially a replacement of certain beds in the ore zone, ranging from beds just above the footwall conglomerate to those in the thin-bedded horizon a short distance below the upper quartzite. Most of the ore shows distinct layers which range from a fraction of an inch to several feet in thickness and are the result of preferential replacement of the more argillaceous beds. A small amount of ore in the form of vein networks occurs along fracture zones; locally, on the hanging-wall side, such zones have been mined as much as 100 feet above the main orebody. The most abundant sulphides are pyrrhotite, galena, sphalerite of the iron-rich variety (marmatite), and pyrite. Chalcopyrite and arsenopyrite are minor constituents. Three zones can be distinguished: a central pyrrhotite-pyrite zone, an intermediate galena zone, and an outer sphalerite zone. The pyrrhotite-pyrite zone has a strike length of about 1,100 feet. The orebody has been mined for about 6,000 feet along strike and 4,500 feet down dip, and over a maximum thickness of 272 feet. Wallrock alteration is pronounced in the central part of the mine and consists of 3 principal types, tourmalinization, chloritization, and albitization. The entire orebody contains a very small percentage of cassiterite, the greatest concentration being near the outer margins of the central pyrrhotite zone. Traces of indium occur in the zinc concentrates and a recoverable accumulation was found in one of the process slags from the lead-zinc smelting operation at Trail.

could not raise sufficient money to meet its debts. In 1909 the bond-holders and the creditors re-organized the company under the name of the Fort Steele Mining & Smelting Company, the control of the company being vested in the Federal Mining and Smelting Company, a subsidiary of the American Smelting and Refining Company.

The Consolidated Mining and Smelting Company of Canada (Limited) acquired a lease and bond on the property in December 1909. Subsequent exploration work indicated a large tonnage of complex ore which would become valuable if a satisfactory process of concentration could be developed. Also, these were high-grade ore zones which could be worked during the interval and smelted for lead. Late in 1910 the option on the stock of the Federal company and on that of some of the other shareholders was exercised; purchase of the property was completed in 1913. All of the adjoining claims considered necessary to the operation were purchased by the company in 1910. For the next few years mine development was directed to the discovery of ore sufficiently high in lead and silver, and low enough in zinc to be smelted with the facilities available at Trail. In 1914 the mine became the largest lead producer in Canada.

The future of the mine depended heavily on the improvement of the metallurgy of the ore, particularly the recovery of the contained zinc, and work on this problem began in 1910. Many tests on various processes of separation were carried out until, at last, satisfactory lead and zinc concentrates were produced at Trail by differential flotation in 1920. This new process made it possible to separate the run-of-mine ore into high-grade lead and zinc concentrates, and pyrrhotite concentrate for future use. A concentrator based on this process was built at the Sullivan mine and commenced operating in August 1923 with a capacity of 3,000 tons per day; the capacity was later increased in steps to 8,500 tons, and then to 11,000 tons in May 1949.

Development work on the orebody was initially from small pits and shallow shafts, and later from a main adit at the 4,600 foot elevation. After it was proven that the ore went to depth an adit at the 3,900 foot elevation was driven more than a mile north to the orebody; above it were 4 levels, including the old 4,600 level. In subsequent operations an inclined shaft was sunk from 3,900 level to the 2,650 foot elevation to establish 9 more levels. By the end of 1949 a

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

new 3,700 level haulageway was completed. Two new shafts, 2,000 feet apart, were put down in 1947 to service below the 3,350 foot elevation. In 1960 the main shaft was extended 500 feet to provide two new levels. Mining was done initially in square-set stopes but in order to provide a shipping product low in zinc a kind of room and pillar system was introduced; this was modified somewhat when the concentrator was put into operation. Experimental work in backfilling began in 1936 and the practice has continued, utilizing development waste, cemented float fill, glacial till, and caving. Pillar extraction had become a major part of the operation by the 1950's.

An open pit mining operation began in 1951 to recover the remaining ore in the outcrop and nearby areas, and for several years provided about 20% of total mine production. The pit operation was closed temporarily in May 1957 and not re-opened until 1964. During the latter year the remaining open pit ore was removed, providing about 7% of total production for that year.

Tin was discovered in the ore in 1925. A plant for recovery of cassiterite from the flotation tailings was put into operation in March 1941 and an electric smelter for tin was added in April 1942. Traces of indium in the zinc concentrate had been known for many years and a recoverable accumulation was eventually found in slag from the complex lead-zinc smelting process at Trail. Indium was first recovered at Trail in 1941 and production on a commercial scale began in 1955. In 1954 an estimated 10,000,000 ounces of indium was available in by-product stockpiles built up over the years.

In 1960 the company estimated pyrrhotite flotation concentrate reserves at 15,000,000 tons and calculated an equivalent of 350,000 tons would be added to the total annually from production. Roasting of these concentrates to recover contained sulphur as sulphuric acid began on a limited scale in 1953. Facilities for converting the by-product iron oxide sinter to pig iron were installed in 1961.

The company name was changed in 1966 to Cominco Ltd. The property at that time included 678 Crown-granted claims and fractions and 30 recorded claims, and extended southerly to include the former Stemwinder and North Star mines (see 82 F/9, Zn 1 and Pb 2). In 1975 the company began a modernization program which will, over a number of years, convert the mine to trackless mining methods.

Measured and indicated reserves in the Sullivan mine, as of December 31, 1979, were reported as 54,000,000 tons at 4.5% Pb, 5.9% Zn, 1.1 oz/t Ag (Cominco Ltd., 1979 Annual Report).

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