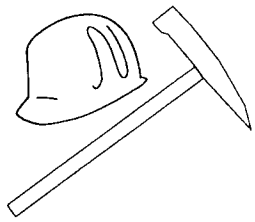

MINING IN BRITISH COLUMBIA 1981 - 1985

Province of British Columbia
Ministry of Energy, Mines
and Petroleum Resources

BC

MINING IN BRITISH COLUMBIA

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FOREWORD

This summary of mining activity in British Columbia completes a record dating back to 1874.

From 1874 to 1968 all statistics relating to metals, industrial minerals, placer gold, and coal; all descriptions of mines and mining activity; and a full report of the Chief Inspector of Mines were published together in the *Annual Report of the Minister*. However, the sector had expanded greatly by the late 1960s, and attempting to include all such descriptions in a single volume rendered the publication large and unwieldy.

In 1969, descriptive material was published separately in a single volume, referred to as *Geology, Exploration and Mining in British Columbia (GEM)*. Descriptions of mines and production activity were eliminated in 1975, and *GEM* was broken down into separate publications.

The *Annual Report of the Chief Inspector of Mines* was published in full until 1974, at which time, and during succeeding years, the report was reduced in scope, with deletion of descriptions of fatal accidents and dangerous occurrences, certifications, etc.

Designed to accompany *GEM* and the *Annual Reports of the Minister,* the two-volume report, *Mining in British Columbia (1975-1980),* was produced to ensure an unbroken record of Ministry activity. *Volume I - Mine Production*, presented the location, a summary of activity, a brief description, and production statistics for all major active metal, non-metal, and coal mines in British Columbia. *Volume II - Report of the Chief Inspector*, presented the full activities of mine inspection, and safety practices in mining, as well as providing an account of the work of the Inspection and Engineering Branch relating to all phases of mineral production.

This present report, covering 1981 to 1985, combines the current activities in a single volume. When combined with the *Annual Reports of the Minister*, the *Summary of Operations - Mineral Resources Division* (B.C. Mineral Statistics Annual Summary Tables), and *GEM*, it constitutes a complete record of activity. Because details of dangerous occurrences are issued periodically by the Inspection Branch, it was not felt necessary to repeat their publication herein, and a statistical summary only is presented. However, recognition of growth in the structural materials and industrial minerals sector, to the point where it constitutes approximately one tenth of the value of all mineral production, has resulted in a much larger section than previously devoted to these mines.

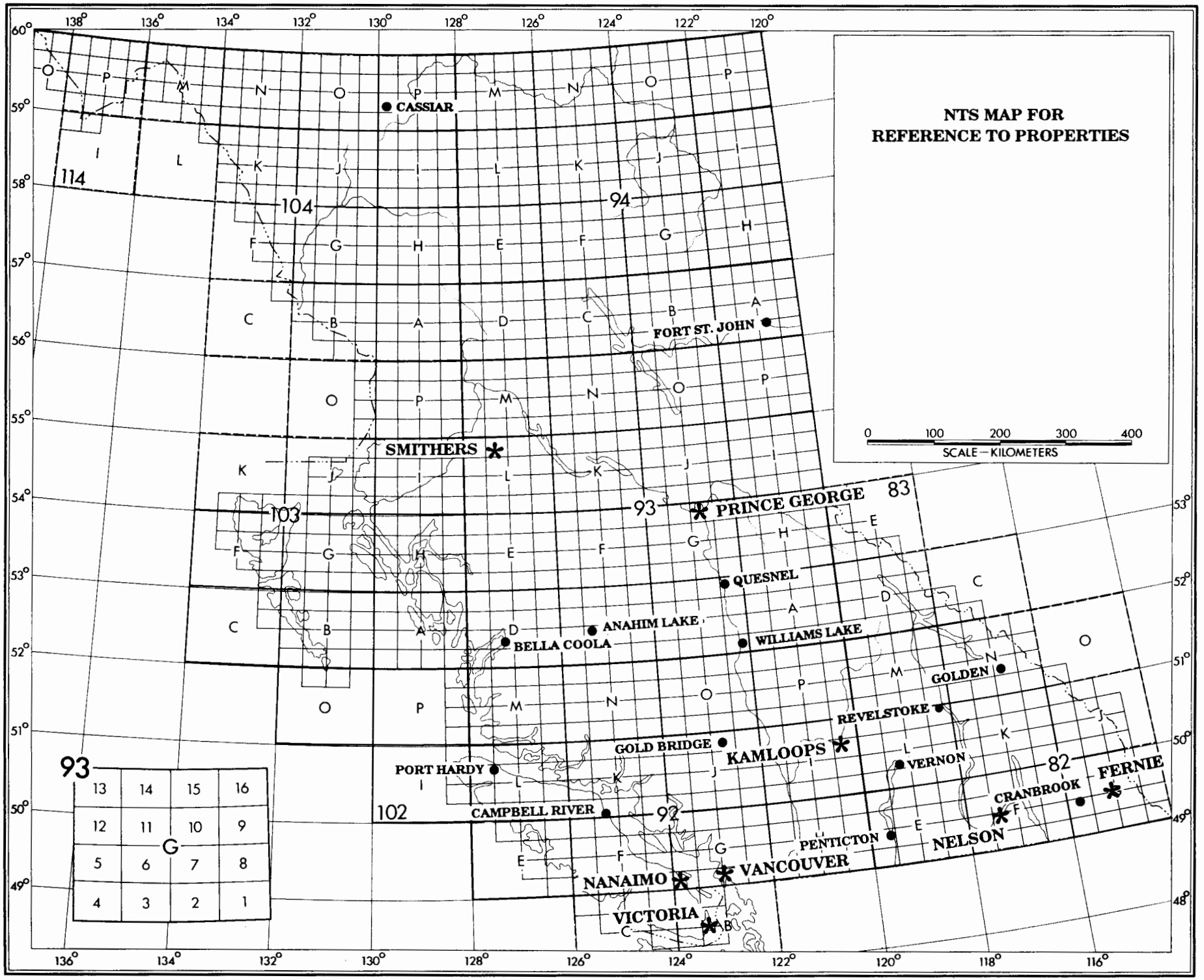
This is the first occasion that this material has been reported by an agency other than the provincial government. Yorkshire Resources, a Victoria-based company, trusts that the completeness and accuracy of this work parallels the previous high calibre of reporting dating back over a century in the Province of British Columbia.

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)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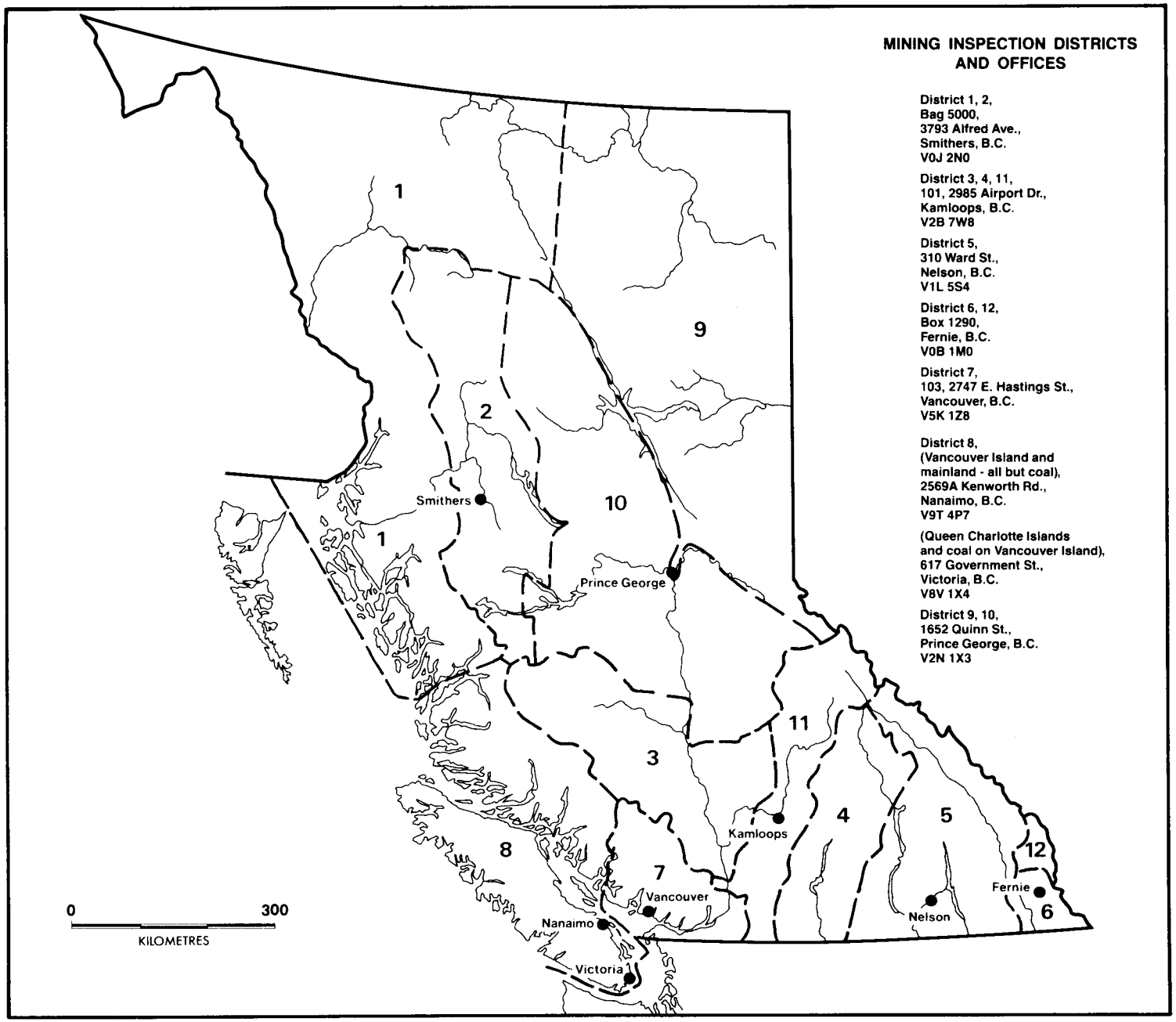
CASSIAR
FORT ST. JOHN
SMITHERS
PRINCE GEORGE
QUESNEL
ANAHIM LAKE
BELLA COOLA
WILLIAMS LAKE
GOLDEN
REVELSTOKE
GOLD BRIDGE
KAMLOOPS
VERNON
PORT HARDY
CAMPBELL RIVER
CRANBROOK
FERNIE
PENTICTON
NELSON
NANAIMO
VANCOUVER
VICTORIA
114
104
94
103
93
83
102
92
82
93
13 14 15 16
12 11 10 9
G
5 6 7 8
4 3 2 1



Mining inspection districts and offices.

PART ONE

MINE PRODUCTION

INTRODUCTION

Prior to 1969, properties were listed according to Mineral Survey Districts and Mining Divisions. Subsequently, listing was by reference to latitude and longitude and by National Topographic System (NTS). Mineral Survey Districts no longer existed, and it was decided that map position was the most accurate means of locating a mineral showing or property. The following notes are intended to clear up uncertainties which may exist concerning the present format.

In accordance with the annual statistical tables, individual mines and properties are listed alphabetically by Mining Division. Property locations are given precisely by latitude and longitude and the general geographic position by reference to an NTS map sheet, east or west half. Figure M-1 shows the locations of all properties which are described herein. These properties are numbered sequentially as they appear in the text.

References are to publications of the Ministry and the Department of Mines, and to relevant articles in publications readily available in libraries. The notation MI refers to the Mineral Inventory, a continuing record (MINFILE) of hard-copy and computerized data relating to mineral properties in the Province. It is the basic data file which has been kept by the Ministry for over a century and which has been available to the public in its present form since 1977.

Production figures were first compiled in metric units in 1975.

Metal production statistics are listed by year in Table M-1, and are the same as those published in Table 3-12 of the Mineral Resources Division Annual Summary of Operations for the years 1981 to 1985.

METAL MINES

ALBERNI M.D.

MYRA FALLS OPERATION (Lynx, Myra, H-W, Price)
(Fig.M-1, NTS 92, No.1)

Alberni M.D. Lat.49°34' Long.125°35' (92F/12E)

The Myra Falls Operation is located on Vancouver Island, approximately 60 kilometres southwest of Campbell River. The operation combines four separate mines. The Lynx mine is on the north side of Myra Creek and the Myra mine on the south side, 1.5 kilometres west of the south end of Buttle Lake. The H-W mine is adjacent to the Myra mine. The Price mine is on the west side of Thelwood Creek, 1 kilometre southwest of the south end of Buttle Lake. The operations are accessed via 88 kilometres of road from Campbell River.

The mines are owned by Westmin Resources Ltd., 1103 Three Bentall Centre, 595 Burrard Street, Vancouver, B.C., V7X 1C4.

The ore deposits consist of massive sulphides, including pyrite, chalcopyrite, sphalerite, and galena, occuring in volcanic rocks of the Sicker Group. The Lynx, Myra and Price mines are within a single structural stratigraphic zone 400 to 500 metres thick, which has been traced over a strike length of 6,000 metres. The H-W mine is at a stratigraphic level 100 metres lower. In the mine area, rocks ranging from massive volcanic rock to breccias, tuffs, and clastic sediments have been affected by dynamothermal metamorphism. The Lynx, Myra and Price mines are segments of a zone of rhyolite, other volcanic rocks, and ore. Large amounts of sericitic, siliceous, and pyritic rock occur beneath the orebodies. Schistocity (which may be folded) is localized primarily in sericitic altered rocks associated with the ore zones. The history of the zone is complex as it contains rocks ranging from flows and breccias to fine-grained tuffs, all of which have undergone a period of deformation and alteration.

Since 1975 all mining has been underground, with a crusher and concentrator located at the Lynx mine. The Price mine did not operate from 1983 to 1985; the Myra mine also ceased production in 1985 as all economic reserves were exhausted. In 1985 construction at the H-W mine was largely completed, and that mine and mill complex came into production.

References: *Minister of Mines, B.C.*, Ann. Rept.,1964, pp.157-166; *CIM*, Bull., Dec.1980, pp.71-90; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, pp.1-2; MI 92F-71, 72, 73.

ATLIN M.D.

ATLIN RUFFNER MINE
(Fig.M-1, NTS 104, No.2)

Atlin M.D. Lat.59°43.9' Long.133°31.2' (104N/12E)

The mine is located approximately 23 kilometres northeast of Atlin. Access to the property is via a 13 kilometre gravel road which connects with the Atlin-Alaska Highway.

The mine is owned by Trident Resources Inc., 1350-409 Granville Street, Vancouver, B.C., V6C 2J5.

Silver-lead-zinc mineralization occurs as fissure fillings along cross-faults or dykes in granite. The main ore block, consisting of vein type galena, sphalerite, and chalcopyrite in a mafic monzonite, exists between the 4100 and 4300 levels.

This is an underground track mining operation consisting of three levels accessed by adits. The mine and mill operated intermittently between 1975 and 1980. The underground mining consisted of pillar recovery on the 4300 level, and mine development on the 4100 and 4300 levels. In April, 1981, rehabilitation work began on the mine and concentrator. The concentrator was test run in June, 1981, but was shut down by the end of July due to equipment breakdown

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Geological Fieldwork, 1976; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol. 1, 1975-1980, p.2; MI 104N-11.

CARIBOO M.D.

BOSS MOUNTAIN
(Fig.M-1, NTS 93, No.3)

Cariboo M.D. Lat.52°06' Long.120°54' (93A/2W)

This property is on the eastern slope of Takomkane Mountain, 91 kilometres by road east of 100 Mile House, B.C., and approximately 9 kilometres from the mine townsite at Hendrix Lake, B.C.

The mine is owned by the Boss Mountain Division of Maclaren Forest Products Inc., 4500 Commerce Court West, Toronto, Ontario.

The ore deposit lies within the Takomkane granodiorite batholith, near the younger Boss Mountain quartz monzonite stock. Molybdenite occurs in quartz-filled breccia zones, and in quartz veins and stringer zones, in subparallel swarms surrounding breccia pipes.

Production began in 1965. Early mining was entirely underground, in general by longhole drilling from sublevels and the use of scrapers and mucking machines. In 1977 an open-pit was started, connected by raise to the mine workings. This was followed by a second open-pit in 1979 and a third in 1980. In 1980 a new haulage road was begun, a primary crusher was installed for pit ore, and an autogenous grinding mill was added to the concentrator. By 1983 the mine was producing about 1800-2000 tonnes of molybdenum ore daily; however, because of depressed market conditions the company ceased mining and milling in March, 1983.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, GEM, 1974, p.234; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, p.3.; MI 93A-1.

GIBRALTAR MINE
(Fig.M-1, NTS 93, No.4)

Cariboo M.D. Lat.52°31' Long.122°17' (93B/9W)

The property is located approximately 161 kilometres south of Prince George, B.C., and 19 kilometres north of McLeese Lake, B.C., on the west side of Granite Mountain by Granite Creek. Access is via a paved road which connects to Highway 97 at McLeese Lake.

The major shareholder in the mine is Placer Development Ltd.(72%), 1600-1055 Dunsmuir Street, Vancouver, B.C., V6C 1A8.

The ore zone is a porphyry copper-rich deposit, occurring within a Triassic pluton of variable composition. The mine phase, which contains the ore zone, is a quartz diorite that has been altered and deformed. Mineralization took place during a complex history of deformation which involved the folding of mineralized foliations. Four orebodies are known: Gibraltar East, Gibraltar West, Granite Lake, and Pollyanna. Ore

minerals are chalcopyrite and molybdenite; however, the Gibraltar East and Pollyanna pits have well-defined zones containing supergene chalcocite.

This is a large open-pit operation that first began production in 1972; up to 1980 the Gibraltor East, Granite Lake, and Pollyanna pits had been mined. In 1981 the Pollyanna pit was further developed (Pollyanna West) to begin Stage II of the operations. Mining operations were suspended in mid-1982 and the concentrator began to process low-grade stockpiled ore. In June, 1983, mining resumed on a limited scale and the Gibraltar West pit was further developed.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, GEM, 1973, pp.299-318; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, pp.3-4; MI 93B-6, 7, 12, 13.

MOSQUITO CREEK
(Fig.M-1, NTS 93, No.5)

Cariboo M.D. Lat.53°07' Long.121°36' (93H/4E)

The property is located approximately 3 kilometres west of Wells, B.C., on the east side of Island Mountain.

The mine is owned by Mosquito Creek Gold Mining Company Ltd., Box 10, Wells, B.C., V0K 2R0.

The area lies within the Snowshoe formation of the Cariboo Group. The rock consists of Meta sediments of early Cambrian age, including phyllites, quartzites, and limestones. The formation has been intensely folded, and the main mineralized areas occur within a fold on the northeast flank of an anticlinorium. Gold is found in two distinct zones, "Rainbow" and "Baker". The Rainbow bed is composed of dark quartzites, argillites, and some phyllites. Tension fractures have developed normal to the bedding which are filled with gold-bearing quartz and pyrite. The Baker member is composed of light, fine-grained calcareous quartzites, talcose rocks, and interbedded limestones. The limestones have been replaced by gold-bearing sulphides, generally in the bed nearest the Rainbow-Baker contact. This contact zone is the main exploration target for the operation.

This is an underground gold mine, with minor silver values also present. A mill was completed, and production commenced, in 1980. The mine closed in June, 1984, and was kept on a stand-by basis until re-opening in July, 1985.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, pp.4-5; MI 93H-10.

CLINTON M.D.

BLACKDOME MINE
(Fig.M-1, NTS 92, No.6)

Clinton M.D. Lat.51°20' Long.122°29' (92O/8W)

The property is located near the peak of Blackdome Mountain, 70 kilometres northwest of Clinton, B.C. Access is via a road off Highway 97 which crosses the Fraser River near Gang Ranch.

The mine is owned by Blackdome Exploration Ltd., 852-409 Granville Street, Vancouver, B.C., V6C 1T2.

The deposits occur within a gently dipping sequence of Tertiary volcanic and volcanoclastic formations, transected by steeply dipping northeast-trending normal faults. The fault zones have provided channels for epithermal mineralization, and contain variable amounts of gouge, clay alteration, silicification, and gold-

silver bearing quartz veining. The mineralized volcanics are overlain by younger basalts which form the crest of Blackdome Mountain. Gold and silver mineralization usually consists of less than one percent dissemination of fine- to medium-grained electrum, acanthite, tetrahedrite, friebergite, chalcopyrite, pyrite, and silver sulphosalts. Quartz veining occurs as multiple stringers and stockworks up to 6 metres in width, and single veins up to 3 metres in width.

An extensive exploration program was carried out in 1981 which continued up to 1985. By 1985 mine development and plant construction was underway, with operations projected to commence in June, 1986.

References: MI 920-51

FORT STEELE M.D.

SULLIVAN
(Fig.M-1, NTS 82, No.7)

Fort Steele M.D. Lat.49°43' Long.116°01' (82F/9E; 82G/12W)

The Sullivan mine and concentrator are located within the city limits of Kimberley, B.C. The mine is on Mark Creek, 3.2 kilometres north of the city centre, and the concentrator is 3.2 kilometres south of the city centre.

The operation is owned by Cominco Ltd., 200 Granville Street, Vancouver, B.C., V6C 2R2.

The Sullivan orebody, one of the largest base metal deposits in the world, is a lens-like body approximately 9,000 metres in diameter and 100 metres thick in its central part. It is tilted to the east, and conformable with the transition zone between the sedimentary rocks of the Lower and Middle Aldridge Formation.

The western part of the deposit lies directly above its conduit zone, the brecciated and altered footwall of the deposit. Linear, north-trending breccia zones, disseminated and vein sulphides, and extensive alteration to a dark, dense, chert-like tourmaline-rich rock are conspicuous features of the altered footwall. Albite-chlorite-pyrite alteration, restricted to the western part of the deposit, occurs in crosscutting zones in the footwall tourmalinite, within the orebody itself, and in the hangingwall up to 100 metres above the orebody.

The main sulphides are pyrrhotite, sphalerite, galena, and pyrite. Chalcopyrite and arsenopyrite are minor constituents. Boulangerite is locally prominent, magnetite is fairly common, and small amounts of cassiterite occur widely but are most common in the western part. In general, metal distribution patterns are directly related to the nearness of zones of chaotic breccia; higher absolute values, and higher lead-zinc and silver-lead ratios, overlie the breccia zones. The western part of the deposit is more massive than the eastern part, which includes five distinct, conformable layers of generally well-laminated sulphides separated by clastic (silty) rocks. The sulphide layers become thinner to the east, away from a transition zone between the western and eastern parts of the orebody, and, at the limits of the deposit, are composed of iron sulphide bands.

This operation has both underground and open-pit mining. The Sullivan open-pit was reactivated in 1980 but was again inactive in 1983, 1984, and 1985. From 1981 through to 1985, work continued on the program of conversion to mechanized mining; by 1985 mechanized mining accounted for 45% of total production. Operations were shut down from August 1 to August 31, 1985, due to poor metal prices and an over-supply of lead and zinc on world markets.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, pp.5-6; MI 82F/NE-52.

GOLDEN M.D.

RUTH VERMONT
(Fig.M-1, NTS 82, No.8)

Golden M.D. Lat.50°57' Long.116°59' (82K/15W)

The property is located 40 kilometres southwest of Golden, B.C., on Vermont Creek, a tributary of Vowell Creek.

The mine is owned by Consolidated Columbia River Mines Ltd., 73 Water Road, Vancouver, B.C., V6B 1A1.

Mineralization is in numerous narrow veins crossing strata of the Horsethief Creek Group. A prominent band of limestone (9 to 15 metres thick and known as the Ruth limestone) is replaced by sulphides, in zones closely controlled by fracturing.

The mill began producing on a test basis in August, 1981; however, operations ceased on December 15, 1981, due to low metal prices and a lack of working capital.

References: *B.C. Minister of Mines,* Ann. Rept., 1966, p.230; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, p.7; MI 82K/NE-9.

GREENWOOD M.D.

BEAVERDELL MINE (Highland Bell)
(Fig.M-1, NTS 82, No.9)

Greenwood M.D. Lat.49°25' Long.119°05' (82E/6E)

The mine is situated on Wallace Mountain, immediately east of Beaverdell, B.C. and 80 kilometres south of Kelowna. The mill and tailings pond are located on the west side of the West Kettle River, and the concentrator is on the flat below Beaverdell.

The mine is owned by Teck Corporation, 1199 West Hastings Street, Vancouver, B.C., V6E 2K5.

The ore is contained in highly fractured and faulted quartz and calcite veins. These veins are found in a large body of quartz diorite which extends into the sedimentary Wallace formation to the east. The veins contain galena, sphalerite, chalcopyrite and pyrrhotite, with occurences of pyrargyrite and native silver. The mineralization may extend for short distances into the wall rock where is has been altered.

This underground mine is one of the oldest in the district having produced silver ore, almost without interuption, since 1916. The ore is mined using open stoping methods and is hauled approximately four miles to the concentrator. Three concentrates are produced, all of which are transported by truck to the smelter at Trail, B.C.

References: *Minister of Mines, B.C.*,Ann. Rept., 1949, pp.145-148; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, p.8; MI 82E/SW-30, 72, 133.

KAMLOOPS M.D.

AFTON MINE
(Fig.M-1, NTS 92, No.10)

Kamloops M.D. Lat.50°39.5' Long.120°30.5' (92I/10E)

The Afton mine is alongside the Trans-Canada Highway, 13 kilometres west of Kamloops, at 640 metres elevation.

Afton Mines Ltd., controlled since 1975 by Teck Corporation, 1199 West Hastings Street, Vancouver, B.C., V6E 2K5, merged with that corporation, in 1981.

The Afton copper deposit is at the northwestern extemity of the Iron Mask pluton, a sub-volcanic multiple intrusion of dioritic to syenitic composition. The orebody consists of a hypogene zone of bornite and chalcopyrite mineralization, and a supergene zone of native copper and chalcocite mineralization. The deposit is 518 metres long and tabular, with a strike of N70°W and a dip of 55° south. It widens and deepens westward, with an average width of 91 metres and an explored depth, in 1985, of 610 metres. Ore reserves remaining in the open-pit are estimated at 8,200,000 tonnes at 0.99% copper at 0.25% copper cut-off. This excludes low grade stockpiles. The strip ratio in 1985 was roughly 1 to 1.

This open-pit began operating in April 1977, an 8,000-tonne-per-day concentrator started up in December 1977, and a smelter (a top blown rotary converter) was blown-in in March 1978. Capacity operation was attained in March 1979. The operation uses conventional mining methods and equipment and produces a copper concentrate, grading over 40% copper, which is shipped to Japan for sale. The mine was closed for economic reasons in June, 1982. Reopening of the mine began in early May, 1983, and by May 14 the concentrator was operating. Full production was maintained through to the end of that year. In July, 1983, the TBRC (smelter) was permanently shut down for economic reasons.

References: *B.C. Ministry of Energy, Mines & Pet. Res.* GEM, 1972, pp.209-220; *CIM*, Porphyry Deposits of the Canadian Cordillera, 1976, pp.376-387; *B.C. Ministry of Energy, Mines & Pet. Res.* Mining in B.C., Vol. 1, 1975-1980, pp.11-12; MI 92I/NE-23.

BETHLEHEM MINE
(Fig.M-1, NTS 92, No.11)

Kamloops M.D. Lat.50°29.5' Long.120°59' (92I/7W)

The Bethlehem deposit is located on the north side of the Highland Valley, 48 kilometres southeast of Ashcroft, B.C.

The mine is owned by Bethlehem Copper Corporation, 1055 West Hastings Street, Vancouver, B.C., which became a subsidiary of Cominco Ltd in 1981.

Four orebodies have been mined by open pit. They are largely within the Bethlehem (younger) phase of the Guichon Creek granodiorite batholith, at the irregular intrusive contact between these phases. Mineralization is located particularly in areas of explosion breccia and intrusive dacite porphyry dykes, which are part of a north-trending dyke swarm 34 kilometres long. The Huestis zone contains very little breccia and few dykes; in it the ore is fracture controlled. The orebodies exhibit zoning of metallic and non-metallic minerals. Peripheral zones of specularite and epidote, and intermediate zones of pyrite and white mica, surround a central copper-rich core defined by relatively large amounts of bornite and secondary biotite.

The mine first went into production in 1962. Mining was by standard open-pit methods and the operation produced copper and molybdenum concentrates; however, in 1981 the molybdenum plant was shut down due to poor world markets. In 1981 and 1982 mining operations were carried out in the south side expansion of the Jersey Pit, and the East Jersey Pit expansion, until operations were shut down in June, 1982, due to economic conditions. The concentrator re-opened in 1983 to treat Valley ore when mining commenced in the Valley pit.

References: *CIM*, Porphyry deposits of the Canadian Cordillera, 1976, pp.105-119; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, pp.12-13; MI 92I/SE-1,2,4,6.

HIGHMONT
(Fig.M-1, NTS 92, No.12)

Kamloops M.D. Lat.50°26' Long.120°56' (92I/6E,7W)

The property is located in the Highland Valley, 42 kilometres southeast of Ashcroft, B.C., and 16 kilometres southwest of Logan Lake, B.C.

The mine is owned by Teck Corporation, 1199 West Hastings Street, Vancouver, B.C., V6E 2K5.

Seven copper-molybdenum deposits are known on the property most of which are in Skeena quartz diorite, a phase of the Guichon Creek batholith. The four largest deposits are on either side of, and near, a west-trending composite dyke about 200 metres wide. The dyke is mainly quartz porphyry and contains local zones of tourmalinized breccia. Sulphide mineralization occurred after intrusion of the dyke, but chiefly prior to brecciation, and continued until after the intrusion of later aplite dykes. Zones dominated by bornite, by chalcopyrite, and by chalcopyrite plus pyrite are roughly parallel to the composite dyke. Hydrothermal alteration is comparatively weak.

Ore production from the open-pit operation began in 1980 using conventional truck and shovel methods. In 1981 and 1982 production was predominantly from the west pit; in 1983 mining commenced in the larger east pit. In October, 1984, the operation was shut down, primarily due to low copper and molybdenum prices. No production took place in 1985.

References: *CIM*, Porphyry Deposits of the Canadian Cordillera, 1976, pp.163-181; *B.C. Ministry of Energy, Mines & Pet.Res.*, Mining in B.C., Vol.1, 1975-1980, p.13; MI 92I/SE-13,, 92I/SW-36.

LORNEX MINE
(Fig.M-1, NTS 92, No.13)

Kamloops M.D. Lat.50°27' Long.121°03' (92I/6E)

The Lornex deposit is located in the Highland Valley, 42 kilometres southeast of Ashcroft, B.C., and 15 kilometres west of Logan Lake. The mine is accessed via highway from Ashcroft, Kamloops and Merritt.

The mine is owned by Rio Algom Limited, 120 Adelaide Street, Toronto, Ontario, M5H 1W5.

The Lornex ore zone is approximately 1,900 metres long, 500 metres wide, and is entirely within Skeena quartz diorite. The host rock is intruded by a pre-mineral quartz-porphyry dyke, most prominent in the southern part of the ore zone. The northwest boundary of the zone is the Lornex fault, a west-dipping regional structure. The Lornex orebody is believed to have formed at the intersection of regional structures where conjugate shears were formed. Mineralization is fracture-controlled, and commonly occurs as fracture coatings or veins. The major sulphides are chalcopyrite, bornite, molybdenite, and pyrite. Sulphide minerals and hydrothermal alteration zones are distributed in a roughly concentric pattern with a

bornite core and surrounding chalcopyrite and molybdenite; pyrite is peripheral. Intensity of hydrothermal alteration and sulphide content increases with fracture density.

This open-pit mine first came into production in 1972; conventional truck and shovel methods are used. In 1981, the concentrator was expanded and a molybdenum leach plant added. Ore is crushed and milled and a bulk concentrate, containing copper and molybdenum, is produced. This concentrate is further treated to produce both copper and molybdenum concentrates.

References: *B.C. Dept. of Mines & Pet. Res.*, GEM, 1970, pp.354-369; *CIM*, Porphyry Deposits of the Canadian Cordillera, 1976, pp.120-129; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, pp.13-14; MI 92I/SW-45.

OK (Alwin)
(Fig.M-1, NTS 92, No.14)

Kamloops M.D. Lat.50°29' Long.121°06' (92I/6E)

This property is located in the Highland Valley, approximately 40 kilometres southeast of Ashcroft, B.C.

The mine is owned by Dekalb Mining Corporation, 630 Sixth Avenue SW., Calgary, Alta., T2P 0S8.

This is a vein deposit in Bethsaida granodiorite, a phase of the Guichon Creek batholith. The veins are sericitized shear zones one to ten metres wide, mineralized with chalcopyrite, bornite, and minor primary chalcocite. Overall, six ore zones are contained in a band 150 to 4,500 metres long. The ore zones pinch, swell, and digitate; there are pre-ore porphyry dykes and post-mineral faulting. The structural pattern is complex.

This is an underground mine employing cut and fill stoping methods; a concentrate is produced that is transported by truck to Ashcroft and then by rail to Vancouver. In September, 1981, all operations ceased due to continued operating losses attributed to high mining costs and low metal prices.

References: *B.C. Dept. of Mines & Pet. Res.*, GEM, 1972, pp.155-157; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, pp.14-15; MI 92I/SW-10.

VALLEY COPPER
(Fig.M-1, NTS 92, No.15)

Kamloops M.D. Lat.50°29' Long.121°02' (92I/6E)

The property is located in the Highland Valley 18 kilometres west of Logan Lake, B.C. It is accessed by highway from Ashcroft, Kamloops, and Merritt, B.C.

The mine is owned by Cominco Ltd., 200 Granville Street, Vancouver, B.C., V6C 2R2.

The Valley Copper mine is situated in the central core of the Upper Triassic Guichon Creek batholith, which consists of several intrusive phases and varieties of calc-alkaline igneous rocks. The youngest phase (Bethsaida) is the host rock and is porphyritic granodiorite, medium- to coarse-grained, with coarse phenocrysts of quartz and biotite. The main sulphide minerals are bornite and chalcopyrite which are associated with a quartz-sericite stockwork system, as well as sericite-rich alteration zones. Pyrite and molybdenite form a weak halo around the edge of the orebody, and a relatively narrow oxide zone occurs in the upper portion of the orebody.

Mining began in the Valley pit in 1983, with ore being trucked 6.4 kilometres to the Bethlehem mill. The operation is an open-pit mine using conventional truck and shovel methods.

References: MI 92I/SW12.

LIARD M.D.

CUSAC TABLE MOUNTAIN
(Fig.M-1, NTS 104, No.16)

Liard M.D. Lat.59°15' Long.130°30' (104P/4E)

The property is located at Table Mountain, 6 kilometres off the Stewart-Cassiar Highway at Cook Lake.

The operation is owned by Cusac Industries Ltd., Suite 330-890 West Pender Street, Vancouver, B.C., V6C 1J9.

The property is on a sequence of andesitic tuffs and minor intrusives interbedded with grey chert, which are overlain by argillite. The main mineralization occurs in quartz veins of varying width, length, and grade, which generally follow steeply dipping faults. The veins contain occasional coarse, visible gold, minor tetrahedrite, galena, pyrite, and siderite, and are frequently accompanied by a mariposite wallrock alteration. Minor gold values have also been reported from sulphide stringers and chert breccia zones.

In 1982 the mine was still in the exploration stage, with some underground drifting and surface trenching. A small mill with a capacity of 50 tonnes per day is on the site. In 1982, additions were made to the mill, and a surface shop and compressor building were erected.

References: MI 104P-19.

ERICKSON GOLD MINE
(Fig.M-1, NTS 104, No.17)

Liard M.D. Lat.59°13.5' Long.129°39' (104P/4E)

The property is located 12 kilometres southeast of Cassiar, B.C., adjacent to McDame Lake.

The mine is owned by Total Erickson Resources Ltd., 203-1209 East 4th Street, North Vancouver, B.C., V7J 1G8.

Gold and silver values in the Jennie quartz vein are contained in metallic gold, pyrite, tetrahedrite, chalcopyrite, and small amounts of galena and sphalerite. The vein is from a few centimetres to nine metres wide, with an average of one metre. Enclosing rocks are interbedded volcanic and sedimentary. A fine-grained dyke parallels the vein.

This gold and silver mine went into production in 1979 using a combination of raise, sublevel stoping, and modified room and pillar methods. A mill expansion was completed in 1982 which doubled the capacity. In 1985 the plant closed to proceed with renovations in the crushing section.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, p.15; MI 104P-29.

TAURUS GOLD MINE
(Fig.M-1, NTS 104, No.18)

Liard M.D. Lat.59°16' Long.129°41' (104P/5E)

The property is located 9.6 kilometres east of Cassiar, B.C., and about 4 kilometres west of Highway 37. It is accessed via 7 kilometres of road off Highway 37.

The mine is owned by Taurus Gold Mine, Cassiar, B.C., V0C 1E0.

The ore minerals are contained in quartz veins and include free gold, auriferous pyrite, tetrahedrite, chalcopyrite, and minor amounts of galena and sphalerite. The veins vary from a few centimetres to one metre in width. The enclosing rocks are interbedded volcanics and sedimentaries.

Mine and mill production began in 1981 using underground shrinkage stoping mining methods. Mill capacity was increased in 1984 and a cyanidation plant installed in 1985.

References: MI 104P-12.

VOLLAUG MINE
(Fig.M-1, NTS 104, No.19)

Liard M.D. Lat.59°12' Long.129°38' (104P/4E)

The property is located on Table Mountain, approximately 14 kilometres southeast of Cassiar, B.C.

The mine is owned by Plaza Mining Corporation, 1100-700 West Georgia Street, Vancouver, B.C., V7Y 1A1.

The Vollaug quartz vein is localized along a thrust fault (trending east-west and dipping 35 degrees to the north) which separates graphitic argillites and argillaceous tuffs from underlying andesite tuffs and flows. The vein varies in width from a few centimetres to three metres and contains pyrite, chalcopyrite, tetrahedrite, sphalerite, galena, and native gold. Mineralization occurs as disseminations, and on argillaceous partings within the quartz vein.

In 1981, approximately 16,000 tonnes of ore was mined and 9,000 tonnes milled. New development was not planned at that time due to a need for further financing.

References: MI 104P-19.

LILLOOET M.D.

BRALORNE
(Fig.M-1, NTS 92, No.20)

Lillooet M.D. Lat.50°46' Long.122°48' (92J/15W)

The property is located on Cadwallader Creek, 112 kilometres by road from Lillooet, B.C., via the Bridge River valley.

The mine is owned by Bralorne Resources Ltd, 205 Fifth Avenue SW., Calgary, Alberta, T2P 2V7.

The Bridge River gold-quartz veins occur within, or adjacent to, a major regional northwest-striking fault zone that trends along the eastern flank of the Coast Range batholith. The quartz veins in the district are sheared and/or closely fractured, and many merge into shear zones or are cut by unmineralized faults.

The final stages of mineralization were preceded and followed by movements along the fault and fracture systems which became hosts of the mineralization. Generally, the "lean", or non-productive, quartz veins are those which are mineralized shears or fault zones. The productive quartz veins are fracture fillings that have been opened more by tension than by shear.

Production at the mine ceased in 1971. Reappraisal and feasibility studies were carried out until 1980 when surface and underground studies were begun by E & B Explorations Ltd. An underground rehabilitation program was underway in 1981 to provide access for underground exploration. This exploration continued until March, 1982, when the mine was put on a "care and maintenance" basis.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, p.16; MI 92J-1, 2.

NANAIMO M.D.

ISLAND COPPER
(Fig.M-1, NTS 92, No.21)

Nanaimo M.D. Lat.50°36' Long.127°28' (92L/11W,12E)

The property is located on Vancouver Island, 16 kilometres south of Port Hardy, B.C., and 8 kilometres east of Coal Harbour, B.C., on the north shore of Rupert Inlet. It is accessed by road from Port Hardy.

The mine is owned by Utah Mines Ltd., 1600-1050 West Pender Street, Vancouver, B.C., V6E 3S7.

The orebody is an elongated ellipse, subparallel to the regional trend. It occurs within rocks of the Bonanza Group, including coarse to fine andesitic to dacite breccias and tuffs. Intrusive into the volcanic rocks is an irregular dyke of quartz-feldspar porphyry which dips at 45°-60° to the north. The orebody is draped about the dyke. The ore zone is strongly fractured, with chalcopyrite and molybdenite occurring in veinlets. About 75% of the ore is in volcanic rocks and the remainder, on both sides of the dyke, is in marginal breccia.

Production began from this open-pit in late 1971; copper concentrate and molybdenum concentrate are produced. In 1983 the pit was mined out to its final limit on the northwest side. The pit was deepened in 1983 (two benches), 1984 (one bench), and 1985 (three benches). A gold leaching circuit was completed in March, 1985, to recover gold from the molybdenum concentrate.

References: *CIM*, Porphyry Deposits of the Canadian Cordillera, 1976, pp.206-218; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, pp.16-17; MI 92L-158.

NEW WESTMINSTER M.D.

AUFEAS GOLD
(Fig.M-1, NTS 92, No.22)

New Westminster M.D. Lat.49°21' Long.121°29' (92H/6W)

This property is located on Wardle Creek. It is accessed via the Silver Creek Road, one mile south of the Trans-Canada Highway at Floods, B.C.

The property is owned by Silver Cloud Mines Ltd., 402-602 West Hastings Street, Vancouver, B.C., V6B 1P2.

The mineral claims comprise six units in the Mac Group, and lie in a steep, narrow gorge of Wardle Creek at 335 metres elevation. The country rock is massive granodiorite. The ore deposits lie in a fissure vein

structure and have an average width of approximately 20cm. Mineralization includes arsenopyrite and chalcopyrite in a gangue of quartz, with accompanying values in gold.

The property was originally developed in 1912 as Aufeas Gold Mines Ltd. Subsequently three horizons of tunnels were opened up, from which early stoping campaigns removed several rich pockets of gold ore. The program of exploration by Silver Cloud Mines Ltd. in 1985 included completion of 53 metres of drift development (which had been started in 1984), and approximately 366 metres of diamond drilling to explore the vein structure below the main horizon.

References: MI 92H/SW36.

CAROLIN (Idaho)
(Fig.M-1, NTS 92, No.23)

New Westminster M.D. Lat.49°31' Long.121°18' (92H/11W)

The property is located on the west fork of Ladner Creek, about 20 kilometres northeast of Hope, B.C. It is accessed via 30 kilometres of gravel road from Hope.

The mine is a joint venture of the Aquarius group of companies (Columbian Northland Explorations Ltd., Aquarius Resources Ltd., Ocelot Industries Ltd., and Windjammer Power and Gas Ltd.) and Carolin Mines Ltd., 535 Howe Street, Vancouver B.C., V6C 2C2.

The Idaho ore body is on the east side of the Coquihalla serpentine belt, along which gold showings with spectacular local values occur. The mine is located about 200 metres east of the faulted serpentine contact, within siltstones of the Ladner Group. Mineralization is a hydrothermal replacement of graywacke and coarse silts, involving multi-stage introduction of material to produce quartz, plagioclase, carbonate, chlorite, pyrrhotite, arsenopyrite, and pyrite, and less magnetite, chalcopyrite, bornite, and gold. Mineralization was emplaced along an early reverse fault that occupies the disrupted limb of an overturned fold. The ore is in an irregular, steeply inclined body approximately 35 metres wide, 100 metres deep, and more than 300 metres long. The body may be termed a quartz-veined shattered zone.

Development of the mine took place from 1978 to 1980. Production began in 1981, with mining being carried out using the long hole open stoping method. The operation produces dore bars for shipment to the Royal Canadian Mint. In the latter half of 1984, both the underground mining and the leaching process on site were suspended. Mill feed was supplied by recycling a slurried feedstock from the tailings pond; treatment involved flotation to produce a concentrate that was shipped to the smelter in Trail, B.C. In 1985 milling was suspended and the operation placed on a care and maintenance basis.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Geological Fieldwork, 1981, Paper 1982-1, pp.87-101; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, p.20; MI 92H/NW-3.

NICOLA M.D.

CRAIGMONT MINE
(Fig.M-1, NTS 92, No.24)

Nicola M.D. Lat.50°12.5' Long.120°55.7' (92I/2W)

The property is located 16 kilometres northwest of Merritt, B.C., and is accessed by a branch road from the highway at Lower Nicola.

The mine is owned by Craigmont Mines Ltd., 700-1030 West Georgia Street, Vancouver, B.C., V6E 2Y3.

The Craigmont orebodies are pyrometasomatic copper deposits, mainly in limey bedded rocks, lying within the thermal aureole of the southern end of the Guichon Creek batholith. Alteration of the rock is intense and varies somewhat with the original rock type. The ore is believed to be localized in sedimentary zones characterized by medium- to coarse-grained clastic rocks. Bands of limestone are not characteristically mineralized. The deposit can be termed a skarn because of the intensity of alteration and the presence of iron oxides, either magnetite, or hermatite, or both.

The mine came into production in 1961. Mining was by a method of transverse sublevel caving; copper concentrates and magnetic iron concentrates were produced. Underground mining ceased in February, 1982, as reserves were exhausted. The concentrator remained in operation, using the copper and iron ore stockpiles, until November, 1982, when it was shut down.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, GEM, 1974, pp.127-130; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, pp.20-21; MI 92I/SE-35.

OMINECA M.D.

BAKER MINE (Chappelle)
(Fig.M-1, NTS 94, No.25)

Omineca M.D. Lat.57°17.5' Long.127°07' (94E/6E)

The property is located 320 kilometres north of Smithers, B.C., between the Toodoggone and Sturdee River valleys.

The property is owned by DuPont Canada Inc. and is operated by DuPont of Canada Exploration Ltd., 102-1550 Alberni Street, Vancouver, B.C., V6G 1A5.

Gold occurs largely as grains of electrum, associated with acanthite, in grey quartz veins which dip at 70° to 80° and strike northeasterly. The principal vein "A" is within altered Takla Group porphyritic tremolite, andesite and dacite. Dykes of quartz feldspar porphyry intrude Takla volcanic rocks in the hanging wall of the vein. Associated minerals are pyrite, chalcopyrite, sphalerite and galena.

The mine began operating in May, 1981. In 1983, 70% of the ore was produced from the underground mine and 30% from the open-pit. The mill treated all of the ore mined, as well as 7,700 tonnes of low grade stockpile ore, at a rate of 100 tonnes per day. The average grade of the ore milled was 14.06 grams/tonne gold and 288 grams/tonne silver. The refinery on site processed the filter cake to produce dore bars, which were shipped to Delta Smelting and Refining for further processing. The ore reserves were depleted, and mining ceased in October, 1983. The milling plant was mothballed, and the openings to the mine sealed, by November, 1983.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, GEM, 1971, pp.65-70; 1973 pp.459, 460; *B.C. Ministry of Energy, Mines & Pet. Res.*, Geological Fieldwork, 1981, Paper 1982-1, pp.129, 130; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, p.22; MI 94E-26.

BELL MINE
(Fig.M-1, NTS 93, No.26)

Omineca M.D. Lat.55°00' Long.126°14' (93M/1E; 93L/16E)

The property is located at the north end of the Newman Peninsula on Babine Lake, approximately 70 kilometres northeast of Smithers, B.C.

The mine is owned and operated by Maclaren Forest Products Inc., Babine Division, 4500 Commerce Court West, Toronto, Ontario.

The Bell orebody is horse-shoe shaped in plan, dips steeply, and is 150 to 300 metres wide by 1,000 metres long. It follows and overlaps the western and northern edges of an Eocene biotite-feldspar porphyry plug, 800 metres long by 200 to 600 metres wide, which was emplaced along the Newman fault, intruding rocks of the Hazelton Group and Eocene rhyodacite. The ore is almost entirely in porphyry and volcanic rocks, and is surrounded by a halo of hydrothermal alteration characterized by biotite in the central zone and by chlorite-carbonate peripherally. The chief copper mineral is chalcopyrite, but bornite is also present, and enrichment with chalcocite occurred in the upper 50 to 70 metres of part of the orebody.

The mine and mill operation went into production in 1972. In 1980, a mill expansion was completed increasing the capacity from 13,600 to 15,400 tonnes per day. Operations were suspended in late 1982 and remained on temporary shutdown for most of 1983. In November, 1983, a program was begun to strip 3,000,000 tonnes of waste rock from the open pit in preparation for future production; however, low copper prices precluded the resumption of operations. The mine was re-opened in September, 1985, with the assistance of the Critical Industries Commission. Re-opening involved a concession package that included lower government taxes, lower power rates, and Union co-operation.

References: *Minister of Mines*, B.C. Annual Report 1965, pp.99-102; *Dept. of Mines and Pet. Res.*, GEM, 1969, p.114; 1970, p.170; 1971, pp.185-186; 1972, pp.426-428; 1973, pp.352-353; 1974, p.266; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, pp.21-22; MI 93M-1.

DUTHIE MINE
(Fig.M-1, NTS 93, No.27)

Omineca M.D. Lat.54°46' Long.127°21' (93L/14W)

The property is located on the southwest slope of Hudson Bay Mountain, 11.2 kilometres due west of Smithers, B.C. Access is via 20 kilometres of road from Smithers.

The mine is owned by Silver Standard Mines Ltd., 904-1199 West Hastings Street, Vancouver, B.C., V6E 3V4.

The three main ore zones (the Fault Plane, Henderson, and Ashman zones) are fault breccia zones where small, angular fragments have been replaced by sulphides. The veins dip sharply, and are bounded by competent hanging- and foot-wall rocks comprising massive, finely crystalline tuffs and andesite flow breccias. Mineralization includes ruby silver, freibergite, native silver, sphalerite, and argentiferous galena, with minor chalcopyrite and pyrite.

From 1981 to 1984 this small underground mine worked on recovering high grade pillars and extensions of the Henderson and Ashman veins. In 1983, construction began on a 50-tonne-per-day mill and flotation plant which was completed in 1984. The mine operated from March to October in 1985, producing ore from raises, subdrifts and slashing.

References: B.C. Report of Ministry of Mines, 1922-1930; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, pp.22-23; MI 93L-88.

ENDAKO MINE
(Fig, M-1, NTS 93, No.28)

Omineca M.D. Lat.54°02' Long.125°07' (93K/3E)

The property is located 190 kilometres west of Prince George, B.C., north of the east end of François Lake.

The mine is owned by Placer Development Ltd., Endako Mines Division, 1030 West Georgia Street, Vancouver, B.C.

This is an irregular and elongated orebody in Endako quartz monzonite, part of the Topley intrusions of Jurassic age. There has been pervasive kaolinization of the Endako quartz monzonite, which is intruded by a variety of premineral dykes and by postmineral basalt dykes. Molybdenite, pyrite, magnetite, and chalcopyrite are closely associated with quartz in veins and fracture fillings. Ore minerals occur in major quartz-molybdenum veins 15 centimetres to one metre wide.

This open-pit molybdenum mine first opened in 1965 The milling and concentrating plant produced molybdenum concentrate. After contructing a new plant in 1980, the mine was forced to close in 1982 due to market conditions; however, reduced quantities continued to be supplied to traditional customers and the roaster plant operated on a toll basis.

References: *CIM*, Porphyry Deposits of the Canadian Cordillera, 1976, pp.444-454; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, p.23; MI 93K-6.

EQUITY SILVER MINE (Sam Goosly)
(Fig.M-1, NTS 93, No.29)

Omineca M.D. Lat.54°11' Long.126°16' (93L/1W)

The property is located 40 kilometres southeast of Houston, B.C., and approximately 15 kilometres north of François Lake.

The mining operation is conducted by Equity Silver Mines Ltd. which is 70% owned by Placer Development Ltd., 1600-1055 Dunsmuir Street, Vancouver, B.C., V6C 1A8.

The ore zone is within a west-dipping dacitic volcanic pile of Mesozoic age. The Mesozoic rocks are intruded on the east by a Tertiary syenomonzonite stock. The base of the mine section is quartz pebble conglomerate, above which is a layer of dacite pyroclastic breccia. The ore occurs within the dacite breccia in a shattered zone about 30 metres thick. Two major ore zones are recognized. The Main (north) zone is characterized by replacement blebs and massive aggregates of pyrite, chalcopyrite, pyrrhotite and tetrahedrite in the host rock. The South Tail zone is characterized by sulphide stringers, veins, and stockworks mineralized sparsely with chalcopyrite and tetrahedrite.

This open-pit mine and milling operation went into production in 1980; a leaching plant was completed in 1981. Concentrates are produced from silver, copper and gold ores. In addition, sodium sulphate is produced as a by-product from the concentrates. In 1984 the South Tail ore zone was mined out and mining focussed on the Main zone. Operation of the leaching plant was suspended since it was not required for the processing of Main zone concentrates. In 1984, a gold scavenger unit was completed, and modifications were made to the leaching plant enabling it to produce a chemically pure molybdenum product.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, GEM, 1969, p.150; 1970, p.126; 1971, p.168; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, pp.24-25; MI 93L-1.

FREE GOLD (Dome Mountain)
(Fig.M-1, NTS 93, No.30)

Omineca M.D. Lat.54°45' Long.126°34' (93L/10E)

The property is located 32 kilometres east of Smithers, B.C., on the east slope of Dome Mountain.

The operation is owned by Reako Explorations Ltd., 501-409 Granville Street, Vancouver, B.C., V6C 1T5, and Panther Mines, Prince George, B.C.

The ore zone, which is approximatey 150 metres wide, comprises a series of quartz veins and quartzose shear zones that range in width from several centimetres to a metre, and trend northwesterly for 220 metres. The veins are mineralized with pyrite and associated sphalerite, galena, tetrahedrite, and chalcopyrite. Free gold is found in the veins.

In 1981, a small portable mill was located 19 kilometres east of Highway 16 on the Babine Lake Road. Ore from the old mine dumps was trucked to this site for milling. During 1982 the mine operated as an open-pit, excavating two narrow gold-bearing quartz veins. The ore was hauled to the mill on Babine Lake Road and the concentrates then shipped to the smelter at Trail, B.C.

References: MI 93L-23.

GRANISLE
(Fig.M-1, NTS 93, No.31)

Omineca M.D. Lat.54°57' Long.126°10' (93L/16E)

The property is located 64 kilometres northeast of Smithers, B.C., on McDonald Island in Babine Lake.

The mine is owned by Maclaren Forest Products Inc., 4500 Commerce Court West, Toronto, Ontario.

The orebody is within a porphyry dyke of Eocene age, with an earlier elliptical plug of quartz diorite phase, and a later biotite-feldspar porphyry phase. The later dyke phase is 120 to 200 metres wide, and intrusive into Hazelton rocks of volcanic origin. Copper mineralization is centered on the contact between early and late intrusive porphyry, and consists of chalcopyrite and bornite in quartz-filled fractures. Alteration shows a central biotitic zone enveloped by a quartz-sericite-carbonate-pyrite zone, and an outer chloritic zone.

The molybdenum plant was in operation until June, 1981, and molybdenum concentrate was stockpiled. Operations were totally suspended in June, 1982, and remained on temporary shut down throughout 1983 and 1984. The mine was closed in 1985 and a final abandonment-reclamation plan was in process.

References: *CIM*, Porphyry Deposits of the Canadian Cordillera, 1976, pp.239-244; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, p.24; MI 93L-146.

LAWYERS PROSPECT
(Fig.M-1, NTS 94, No.32)

Omineca M.D. Lat.57°20' Long.127°12' (94E/6E)

The property is located approximately 280 kilometres north of Smithers, B.C., in the Toodoggone River area. Access is by air from Smithers to the Sturdee River airstrip, then by approximately 30 kilometres of road past the Baker Mine.

The operation is owned by Serem Inc., Box 11175, Royal Centre, 1055 West Georgia Street, Vancouver, B.C., V6E 3R5.

The eastern part of the property is underlain by quartz-andesite-crystal-lapilli-tuff which represents the remnant of a paleo-horst. The western part is underlain by volcano-sedimentary rocks of trachytic source, which represent a graben basin. Several gold-silver showings have been located, all associated with silicified filling of reactivated faults and fractures along the paleo-grabel margins. The three most promising showings (the Amethyst Gold Breccia Zone, the Cliff Creek Breccia Zone, and the Duke's Ridge Zone) are all within, or near, the area of trachyte volcanism deposited west of the paleo-horst.

This operation is in the advanced exploration stage. Total underground development from 1981 to 1985 was 1478 metres, plus 1082 metres of slashing. In addition to the underground work, feasibility studies and environmental studies were conducted.

References: MI 94E-66.

SILVER STANDARD
(Fig.M-1, NTS 93, No.33)

Omineca M.D. Lat.55°19' Long.127°38' (93M/5E)

The property is located on Mount Glen, 9 kilometres north of Hazelton, B.C.

The mine is owned by Silver Standard Mines Ltd., 1199 West Hastings Street, Vancouver, B.C., V6E 3Y4.

Sixteen parallel quartz veins occur mainly in tuffaceous sandstone. Mineralization consists of galena, sphalerite, and tetrahedrite, with pyrite and arsenopyrite.

This small underground mine ships hand-sorted ore to the smelter in Trail, B.C.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, p.25; MI 93M-49.

TETRA (Armagh)
(Fig.M-1, NTS 93, No.34)

Omineca M.D. Lat.55°02' Long.127°14' (93M/3E)

The property is located 20 kilometres north of Smithers, B.C., and 6 kilometres west of Moricetown, B.C., on the east side of the Bulkley River.

The mine is owned by Armagh Mines Ltd., P.O. Box 9354, 770-205 Fifth Avenue SW., Calgary, Alta., T2P 2V7.

The deposit is a vein shear, dipping about 15 degrees east, in folded volcanic sandstones of the Bowser Group. The vein varies from a series of thin veinlets that horsetail into the bedding, to a body a metre or more wide. It consists of partially replaced wallrock with variable amounts of quartz, ankerite, and sulphides. The sulphides include sphalerite, galena, pyrite, tetrahedrite, arsenopyrite, and traces of bournonite, polybasite, and pyrargyrite.

In 1981 construction of a crusher-concentrator complex was completed. Approximately 500 tonnes of ore was milled in a break-in campaign, and silver concentrate was shipped. The mill froze up at the end of 1981 and was not reactivated.

References: *Minister of Mines, B.C.*, Ann. Rept., 1968, pp.124-126; *B.C. Dept. of Mines & Pet. Res.*, GEM, 1969, pp.99-100; 1970 pp.172-173; MI 93M-21.

OSOYOOS M.D.

BRENDA MINE
(Fig.M-1, NTS 92, No.35)

Osoyoos M.D. Lat.49°53' Long.120°00.5' (92H/16E)

The Brenda mine operations are situated 22 kilometres northwest of Peachland, B.C., and 2.5 kilometres southwest of Brenda Lake. Access is via 29 kilometres of road (19 kilometres paved and 10 kilometres gravel) from Peachland.

The mine is owned by Brenda Mines Ltd., Box 420, Peachland, B.C., V0H 1X0.

The orebody is within the Brenda Stock, a composite quartz diorite to granodiorite body of Jurassic age which intrudes rocks of the Upper Triassic Nicola Group. It is cut by pre-ore and post-ore dykes of divergent composition. Mineralization is confined almost entirely to veins, most of which are quartz veins. Chalcopyrite and molybdenite are the main sulphides, accompanied by minor and variable amounts of pyrite and magnetite. Grade is a function of the density of fracturing and mineralogy of the veins. Alteration is generally confined to narrow envelopes bordering veins.

This open-pit mine began producing in 1970 at a capacity of 24,000 tonnes per day; copper concentrate and molybdenum concentrate are produced. In 1982 the capacity was increased to 30,000 tonnes per day; however, operations had to be shut down for six weeks in that year to reduce the molybdenum inventory. The mine closed temporarily in September, 1983, re-opened in May, 1984, and again closed in December, 1984, due to continuing low metal prices. The mine re-opened in September, 1985, helped by the Critical Industries Commission, with reduced hydro rates and property taxes, and a wage freeze for workers until June, 1987.

References: *CIM*, Porphyry Deposits of the Canadian Cordillera, 1976, pp.186-194; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, pp.26-27; MI 92H/NE-47.

FRENCH MINE
(Fig.M-1, NTS 92, No.36)

Osoyoos M.D. Lat.49°20' Long.120°01' (92H/8E)

The property is located on Nickel Plate Mountain. It is accessed via the Nickel Plate road which runs off the highway about 8 kilometres southeast of Hedley, B.C.

The mine is owned by Dankoe Mines Ltd., 7 Ridgewood Road, Toronto, Ontario, M5P 1T4.

The main host rock is an assemblage of limestone-argillite-quartzite-chert-breccia-tuff. The ore mined is not associated with sulphide mineralization, but occurs free in conjunction with bismuth telluride. Generally, the best values occur in skarn comprising a mixture of brownish garnet and streaky green pyroxene. The stopes have a moderate northerly dip; stoping is limited to the west and east by strong faults.

Work began on the property in October, 1982, and ceased in August, 1983. Mining, restricted to bulk sampling, was by drifting and slashing and the use of slushers.

References: MI 92H/SE-59.

GOOD HOPE
(Fig.M-1, NTS 92, No.37)

Osoyoos M.D. Lat.49°21' Long.120°01' (92H/8E)

The property is located approximately 6.4 kilometres southeast of Hedley, B.C.

The mine is owned by Good Hope Resources Ltd., 1518-1177 West Hastings Street, Vancouver, B.C.

The rocks in the vicinity are volcanic flows and fragmentals, with subordinate tuffs, argillite, and limestone, intruded by granodiorite and aplite. Epidote, garnet, and calcite are common metamorphic minerals. Locally the rocks are altered to an epidote-pyroxene-garnet-quartz-calcite skarn and to garnetite. The limestones are recrystallized and may be strongly silicified. The argillites are metamorphosed to a cherty rock in which bedding structures have been preserved. The best ore consists of coarse pyroxene with carbonate, and lesser garnet, lying directly above the limestone foot-wall.

This is an underground mine using drifting and stoping methods. The ore is milled at the Dankoe mill. The mine was only in operation during 1981.

References: MI 92H/SE-60.

HORN SILVER
(Fig.M-1, NTS 82, No.38)

Osoyoos M.D. Lat.49°03' Long.119°41' (82E/4E)

The property is located on the west side of Mount Richter, 20 kilometres south of Keremeos, B.C., on Highway 3.

The mine is owned by Dankoe Mines Ltd., 7 Ridgewood Road, Toronto, Ontario, M5P 1T4.

The ore zone is a monzonite phase of the Kruger syenite. A shear zone about 24 metres wide dips 40 degrees to the south. Quartz lenses within the shear plunge at a low angle to the southwest. Mineralization includes galena, sphalerite, chalcopyrite, and silver-bearing minerals.

After closing in 1970, the mine resumed production in 1974. Operations were temporarily suspended in 1981 due to the low price of silver. Milling was carried out intermittently from 1982 to 1985, with ore being milled on a custom basis. Mine operations ceased on October 31, 1984.

References: *Minister of Mines, B.C.*, Ann. Rept., 1965, pp.162-163; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, pp.27-28; MI 82E/SW-2.

NICKEL PLATE
(Fig.M-1, NTS 92, No.39)

Osoyoos M.D. Lat.49°23' Long.120°02' (92H/8E)

The property is located 6 kilometres north of Hedley, B.C., and is accessed via the Nickel Plate road from Hedley.

The mine is owned by Mascot Gold Mines Ltd., 900-837 West Hastings Street, Vancouver, B.C.

The ore occurs in beds of the Nickel Plate Formation, where silicification has taken place forming skarn minerals. Ore concentration is controlled by intrusive dioritic dykes and sills which separate the mineralized beds. Gold occurs as minute grains in association with arsenopyrite and other sulphides. Silver, copper, and cobalt are lesser minerals.

Between 1981 and 1985 intensive exploration continued, both on the surface and underground, for gold and silver mineralization.

References: MI 92H/SE62.

SAB MINE (Monashee)
(Fig.M-1, NTS 82, No.40)

Osoyoos M.D. Lat.50°06 Long.118°29 (82L/1W)

The property is located along the Kettle River, south of Gunner Creek. It is accessed by 18 kilometres of gravel road from Highway 6, 79 kilometres southeast of Vernon.

The operation is owned by Mohawk Oil Company Ltd., Minerals Division, 325-6400 Roberts Street, Burnaby, B.C., V5G 4G2.

Generally, mineralization on the property is structurally controlled, consisting of quartz veins that contain sulphide minerals. Quartz-sulphide stockwork mineralization is also prevalent. Mineralization includes pyrite and minor chalcopyrite, with significant gold and silver values and minor tungsten. In addition, a lead zone, carrying lead, zinc and silver, is located on an east-west fault.

This is an open-pit mine. In 1982 mining was concentrated in the lead zone, with minor tonnage produced from quartz veins in the south end, and from the H.G. veins in stockwork at the north end. The operation was shut down on November 30, 1982.

References: MI 82L/SE1.

REVELSTOKE M.D.

GOLDSTREAM MINE
(Fig.M-1, NTS 82, No.41)

Revelstoke M.D. Lat.51°38' Long.118°27' (82M/9W)

The property is located approximately 80 kilometres north of Revelstoke, B.C., on the Goldstream River. It is accessed via Highway 20 from Revelstoke.

The mine is owned by Maclaren Forest Products Inc., 4500 Commerce Court West, Toronto, Ontario.

The deposit occurs concordant with the surrounding rock units at a particular stratigraphic horizon, raking across the dip of other units. The mineralized zone, averaging 3 metres in thickness, consists of a single, continuous bed of massive and disseminated sulphides.

In 1981 construction was underway on surface facilities, and work was done on the underground and open-pit mines. Production began in 1983. Mining was by step room and fill in the underground mine, and by conventional methods in the small open-pit. Concentrates were produced at the surface and transported to Revelstoke by truck. The operation closed in April, 1984, due to depressed metal markets. Exploration was carried out in 1984 and the during the summer in 1985.

References: MI 82M-141.

SIMILKAMEEN M.D.

BANBURY MINE (Gold Mountain)
(Fig.M-1, NTS 92, No.42)

Similkameen M.D. Lat.49°21' Long.120°08' (92H/8E)

This property is located 4 kilometres southwest of Hedley, B.C.

Banbury Mine is owned by Banbury Gold Mines Ltd., 302-540 Burrard Street, Vancouver, B.C.

The Gold Mountain area is underlain by Mesozoic sedimentary rocks, including argillite and limestone, with minor beds of volcanic tuff and breccia. These are intruded by a very irregular body of diorite considered to be of late Jurassic age. Both the sedimentary and igneous rocks are intruded by later dykes, most of which are andesitic in character and of similar composition to the main diorite mass. Auriferous sulphide mineralization occurs at and near the margins of the diorite, and fissuring has occurred both in the diorite and the adjoining sedimentary rock. Hydrothermal solutions have percolated through these fissures depositing quartz-calcite gangue with the sulphides arsenopyrite, pyrite, sphalerite, chalcopyrite, and galena. Silver and gold values appear to be related to these sulphides.

In 1981, exploration was carried out by diamond drilling and examination of the underground workings on two veins. Surface drilling continued at a reduced level in 1982, and a geo-chemical survey was conducted, to test for gold and arsenopyrite, which led to a VLF survey being started. Some construction took place, but no mining was carried out, while feasibility plans were under consideration.

References: MI 92H/SE46.

SIMILKAMEEN MINE (Ingerbelle, Copper Mountain)
(Fig.M-1, NTS 92, No.43)

Similkameen M.D. Lat.49°20' Long.120°33' (92H/7E)

The property is located 15 kilometres south of Princeton, B.C. The Copper Mountain mine is on the east side of the Similkameen River and the Ingerbelle mine is on the west side, adjacent to the highway.

The operations are owned by Newmont Mines Ltd., Similkameen Division, 1400-750 West Pender Street, Vancouver, B.C., V6C 1K3.

All of the known copper deposits lie in a 1,100 metre by 4,300 metre belt of Nicola volcanic rocks, bounded on the south by the composite Copper Mountain stock and on the north by the Lost Horse intrusive complex. It is believed that the Copper Mountain intrusions, the mineralization associated with them, and the volcanic rocks, are all of late Triassic age. Fluids producing alteration and mineralization came from

the Lost Horse complex of porphyries and porphyry breccias. Alteration is intense, involving biotite, later pink feldspar, and scapolite. Mineralization of chalcopyrite and bornite is in fracture fillings and disseminations. Pegmatite veins, containing potash feldspar, biotite, and striking masses of bornite occur up to 2.3 metres thick. The Copper Mountain mine is a porphyry copper deposit, and the Ingerbelle mine is a skarn deposit.

The Ingerbelle mine came into production in 1972 and the Copper Mountain mine in 1980. In 1981 the Ingerbelle pit was exhausted. Production focussed on the Copper Mountain pit, with ore being conveyed across the Similkameen River to the concentrator via suspension bridge. A copper concentrate is produced and trucked to Vancouver for shipment.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Bull. 59, Geology of Copper Mountain, British Columbia, 1972; *CIM*, Porphyry Deposits of the Canadian Cordillera, 1976, pp.368-375; B.C. Ministry of Energy, Mines & Pet. Res., Mining in B.C., Vol.1, 1975-1980, pp.28-29; MI 92H/SE-4.

SKEENA M.D.

CINOLA MINE
(Fig.M-1, NTS 103, No.44)

Skeena M.D. Lat.53°32' Long.132°13' (103F/9E)

The property is located 18 kilometres south of Port Clements, B.C., on Graham Island in the Queen Charlotte Islands.

The mine is owned by Consolidated Cinola Mines Limited, 401-595 Howe Street, Vancouver, B.C., V6C 2T5 and Energy Reserves of Canada Ltd., 606-224 Fourth Avenue S., Saskatoon, Sask., S7K 5M5.

Low grade gold mineralization occurs within silicified pebble conglomerate, with interbedded sandstone and siltstone of Miocene age overlying a Cretaceous shale sequence. The gold is associated with a rhyolite dyke along the shale and conglomerate. The mineralization zone extends 300 metres vertically over an area of 1000 metres by 300 metres.

Work on the property prior to 1981 had established gold reserves of approximately 40 million tonnes, grading 2.08 grams/tonne. A feasibility study to bring the mine into production at a level 13,500 tonnes per day was started in 1981 and completed in 1982. In 1984 diamond drilling confirmed a higher gold content in the southern part of the orebody. A combination of apparent metallurgical problems and deficiencies in the Stage I Environmental Impact report meant that the project was not carried forward.

References: MI 103F-34.

GRANDUC MINE
(Fig.M-1, NTS 104, No.45)

Skeena M.D. Lat.56°13' Long.130°21' (104B/1W)

The property is located at the head of the Leduc River, 35 kilometres northwest of Stewart, B.C. The concentrator is at Tide Lake, 32 kilometres north of Stewart. An all-weather road links Tide Lake with Stewart; the mine is reached via a 16.5 kilometre tunnel from the concentrator.

The mine is owned by Canada Wide Mines Ltd., a subsidiary of Esso Minerals Canada Ltd., 1600-400 Granville Street, Vancouver, B.C., V6C 1T2.

The orebodies are in a 60 metre thick sedimentary unit, dipping steeply west between a limestone member above and andesite below. The rocks of the ore zone are mostly fine-grained and thin-bedded, and are cross-folded, crumpled, and sheared with production of compositionally banded quartz-rich biotite and sericite rocks. The orebodies are stringer lodes containing disseminations, specks, streaks, and masses of chalcopyrite, pyrrhotite, magnetite, and minor pyrite. The entire ore horizon has been referred to as a shear zone with a complex history of dragfolding, and of intrusion by andesitic porphyry dykes.

Production recommenced in October, 1980, after having been suspended in 1978. In 1981 rehabilitation work at the mill and mine was complete. It is an underground trackless mining operation using a combination of sublevel caving and open stoping. Production again ceased in April, 1984 due to low copper prices. Salvage, demolition, and reclamation of the mine and plant was completed in October, 1984.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, p.30; MI 104B-21.

KELLY CREEK
(Fig.M-1, NTS 103, No.46)

Skeena M.D. Lat.54°27' Long.128°08' (103I/8E)

The property is located 36 kilometres east of Terrace, B.C., on the south side of the Zymoetz River.

The mine is owned by Kelly Creek Joint Venture (Procan Exploration 70%, Cathedral Minerals Ltd. 15%, and Inves Resources Ltd. 15%), 709-744 West Hastings Street, Vancouver, B.C., V6C 3A9.

Mineralization occurs as disseminations and fracture fillings, in andesitic and rhyolitic volcanic rocks of the Hazelton Group. Minerals include bornite, chalcopyrite, and some chalcocite.

Between April and October of 1981 a total of 1,000 metres of surface and underground diamond drilling was completed. In addition, the underground adit was extended and 65 metres of crosscutting was done. The development ore served for bulk sampling.

References: MI103I-92.

KITSAULT MINE
(Fig.M-1, NTS 103, No.47)

Skeena M.D. Lat.55o28' Long.129o26' (103P/6W)

The property is located approximately 130 kilometres north of Prince Rupert, on the east side of the head of Alice Arm (the east arm of Observatory Inlet). It is accessed by boat, barge, or aircraft, or by road from the Nass Valley road northeast of Terrace, B.C.

The mine is owned by Amax of Canada Ltd., P.O. Box 12525 Oceanic Plaza, 1600-1066 West Hastings Street, Vancouver, B.C., V6E 3X1.

The ore zone is genetically related to the composite Lime Creek complex, which intrudes Jurassic Bowser Lake Group graywacke and argillite units about 3 kilometres east of the Coast Range crystalline complex. The stock is surrounded by an aureole of biotite hornfels. The ore zone is located adjacent to the contact of Tertiary intrusive stock and the Cretaceous Bowser Lake sediments. Molybdenum mineralization occurs as disseminated grains in late magmatic aplites, and in three distinct ages of veining. The outline of the mineralized zone is annular and extends over an area of 600 by 424 metres.

Production commenced on May 1, 1981, with the leach plant coming on stream by the middle of June. Conventional truck and shovel methods are used in the open-pit to extract molybdenum ore. In 1982 the mine experienced production cutbacks, and operations were suspended in November. The mine remained inactive, and in November, 1983, the townsite was closed and maintenance of the access road halted.

References: MI 103P-120.

SCOTTIE GOLD MINE (Summit Lake)
(Fig.M-1, NTS 104, No.48)

Skeena M.D. Lat.56°12' Long.130°15' (104B/1E)

The property is located approximately 30 kilometres northwest of Stewart, B.C., on the west side of Summit Lake.

The mine is owned by Scottie Gold Mines Ltd., 1450-625 Howe Street, Vancouver, B.C., V6C 2T6.

The ore zones are erratic lenses located along near vertical faults and fracture systems, within competent fragmented volcanic and sedimentary rocks. Gold is associated with pyrrhotite-rich lenses, the higher grade values usually occurring at the junction of northwest striking faults and east striking fractures. The ore lenses vary in width from 0.5 to 8.5 metres, and range from 30 to 75 metres in length.

In 1980, underground development commenced and a mill and crusher were installed; milling operations began in 1981. Ore is mined by conventional shrinkage stoping and longhole methods. Dore bars are produced and shipped to the Royal Canadian Mint. The mine was closed down in February, 1985, and put on a care and maintenance basis.

References: MI 104B-74.

SILBAK PREMIER MINE
(Fig.M-1, NTS 104, No.49)

Skeena M.D. Lat.56°04' Long.130°00' (104B/1E)

The property is located along the Granduc Mine road, 18 kilometres north of Hyder, Alaska, and 15 kilometres north of Stewart, B.C.

The mine is owned by British Silbak Premier Mines Ltd., 1130-1176 West Georgia Street, Vancouver, B.C., V6E 4A2.

The orebodies are in schistose, intercalated volcanic agglomerates, tuffs, and porphyries, cut by several varieties of dyke rocks. Ore is in lenses of silicified and pyritized country rock, and is localized along northwest and northeast fracture zones, particularly at contacts between fragmental volcanics and feldspar porphyries. Ore minerals include sphalerite, galena, chalcopyrite, silver-bearing sulphides, and electrum. Some of the early-mined ore was of bonanza grade.

Between 1976 and 1979 exploratory activities took place, and small shipments of ore and mill clean-up were made. In 1981 surface and underground exploration work was conducted that included 374 metres of drifting, 1337 metres of surface diamond drilling, and 54 metres of underground diamond drilling.

References: *Minister of Mines, B.C.*, Ann. Rept., 1964, pp.21-22; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, p.31; MI 104B-54.

TASU MINE (Wesfrob)
(Fig.M-1, NTS 103, No.50)

Skeena M.D. Lat.52°46' Long.132°03' (103C/16E)

The property is located on the south side of Tasu Sound on Moresby Island in the Queen Charlotte Islands. Access is by boat or barge, or by aircraft from Sandspit.

The mine is owned by Falconbridge Ltd., Wesfrob Mining Division, P.O. Box 40, Commerce Court West, Toronto, Ontario, M5L 1B4.

The ore zone is in a folded and tilted panel of stratified rocks, surrounded and underlain in part by the north end of San Christoval batholith. The stratified rocks are the upper part of the volcanic Karmutsen Formation, and in the overlying Kunga Formation. A laccolith of diorite porphyry lies between the two formations. The batholith has produced skarnification of all these rocks. Magnetite and chalcopyrite ore, and associated skarn, occur for the most part in Kunga limestones and diorite porphyry, and in limited amounts in Karmutsen volcanic rocks. Most of the ore is in a stratiform zone about 63 metres thick, which is cut by many post-ore dykes.

Production began in 1967. Mining was by open-pit until 1977, and then by underground longhole drilling and trackless haulage. Mining operations ceased permanently on October 5, 1983, due to the exhaustion of economic reserves.

References: *Minister of Mines, B.C.*, Ann. Rept., 1974, pp.320-321; *B.C. Ministry of Energy, Mines & Pet. Res.*, Bull.54, pp.83-89; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, pp.31-32; MI 103C-3.

SLOCAN M.D.

HEWITT
(Fig.M-1, NTS 82, No.51)

Slocan M.D. Lat.49°56' Long.117°18' (82F/14W)

The property is located 4.8 kilometres east-southeast of Silverton, B.C., on the south side of Silverton Creek.

The mine is owned by Dungannon Explorations Ltd. and Sabina Industries Ltd. both at 412-8 King Street East, Toronto, Ontario.

Mineralization occurs in pods and lenses that lie in a broad shear zone crossing Slocan sedimentary rocks. The pods and lenses contain galena, sphalerite, and ruby silver.

In 1981, broken ore was pulled from the 1390 level shrinkage stope. The stope was cleaned down and sealed off.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980. pp.33-34; MI 82F/NW-65.

SILVANA (Silmonac)
(Fig.M-1, NTS 82, No.52)

Slocan M.D. Lat.49°58' Long.117°15' (82F/14W)

The property is located on the east bank of Tributary Creek, 1.6 kilometres west of Sandon, B.C. Access is via 8 kilometres of paved highway and 6 kilometres of gravel road from New Denver, B.C.

The mine is owned by Dickenson Mines Ltd., 2600-130 Adelaide Street West, Toronto, Ontario, M5H 3P5.

Mineralization occurs as a lode within a strong shear that cuts Slocan Group sedimentary rocks; the lode structure dips at 20-30 degrees. The oreshoots vary in width from a few centimetres to three metres, and can be considerably altered by graphite shearing. Mineralization is mainly in the form of argentiferous galena and sphalerite.

This is an underground mine using a subdrifter slash room and pillar method. The mine office was moved from New Denver to the minesite in 1983. In December, 1983, all production ceased in order to emphasize exploration while metal prices were low. Production resumed in September, 1984.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, pp.36-37; MI 82F/NW-50.

UTICA
(Fig.M-1, NTS 82, No.53)

Slocan M.D. Lat.49°59' Long.117°08' (82F/14E)

The property is located on Keen Creek, a branch of the Kaslo River, 31 kilometres by road from Kaslo, B.C.

The mine is owned by David Minerals Ltd., 1016-475 Howe Street, Vancouver, B.C., V6C 2B3.

The property is underlain by metamorphosed and deformed interbedded argillite and limestone. The argillite is altered to an andalusite schist, and strikes northwest with a 25-60 degree dip to the northeast. The metasedimentary rocks are intruded by small bosses or stocks, and dykes. Veins of quartz, calcite and siderite occur with good continuity, generally following the bedding planes, and are mineralized with galena and sphalerite with associated silver values.

In 1981 all mill feed was obtained from a dump recovery program. Underground work was confined to rehabilitation of an adit, and 48 metres of drifting. In 1982 the mill processed custom ore from other mining operations as well as Utica Mine ore. Concentrates were shipped to the Cominco smelter in Trail, B.C.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, p.37; MI 82F/NW-86.

VANCOUVER M.D.

ASHLU GOLD MINE
(Fig.M-1, NTS 92, No.54)

Vancouver M.D. Lat.49°56' Long.123°24' (92G/14W)

The mine is located on Ashlu Creek, a tributary of the Squamish River. It is accessed via 45 kilometres of gravel road from Squamish, B.C.

The mineral claims are owned by Slim's Mining and Exploration Co. Ltd. The mine was operated by Osprey Mining and Exploration Co. Ltd., 6446 Nelson Avenue, Burnaby, B.C., V5H 3J5, for a brief break-in period in 1984.

The claims area forms part of the Coast Crystalline Complex. It is composed of extensive Cretaceous granodiorite intrusives, intertwined with metamorphic rocks, as well as unaltered volcanics and sediments. The geology of this region is extremely complex since the plutonic rocks are difficult to separate from the roof pendant rocks. There are two principal vein structures, the Ash (Ashlu) vein and the Pokosha vein. To date, developments have been focussed on the Ash vein which is outlined within the metamorphic zone and which is up to 30.5 metres wide.

The property was first discovered in 1923 and limited drafting was accomplished on the Ash vein in 1924-1925. Development accelerated during 1932-1935 and production began in 1935. In 1983, construction began on a production plant with a capacity of 50 tonnes per day. The plant was completed in the spring of 1984; however, later in that year mining and milling operations ceased, and a re-evaluation of the ore reserves was initiated.

References: MI 92G/NW13.

WARMAN (Brandywine)
(Fig.M-1, NTS 92, No.55)

Vancouver M.D. Lat.50°08' Long.123°06' (92J/3E)

The property is located 11 kilometres north of Brandywine Falls on the east side of Callaghan Creek, approximately 65 kilometres north of Squamish, B.C. It is accessed by 12 kilometres of gravel road from Highway 99.

The mine is owned by Northair Mines Ltd., Brandywine Operation, 1450-625 Howe Street, Vancouver, B.C., V6C 2T6.

A quartz-carbonate vein zone, containing galena, sphalerite, chalcopyrite, and pyrite, strikes northwest and dips steeply. It is emplaced in a series of foliated volcanic rocks, including dacite, rhyodacite, and feldspar crystal tuff, that form in a roof pendant in granodioritic rocks of the Coast Intrusions. Three separate zones are known: the Discovery, Manifold, and Warman. It is presumed that these are segments of a single vein system, known to be cut by many north-trending faults and by post-mineral basic dykes. There is variation throughout the length of the entire zone in terms of ore minerals, metal content, and gold-silver ratios.

Production commenced in 1976; however, operations were suspended in July, 1982, due to economic conditions. The main mining method used was cut-and-fill, with minor shrinkage used in small, remnant pillar recoveries.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, GEM, 1974, pp.200-202; *B.C. Ministry of Energy, Mines and Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, pp.39-40; MI 92J/W-12.

VERNON M.D.

CHAPUT
(Fig.M-1, NTS 82, No.56)

Vernon. M.D. Lat.50°16' Long.118o57' (82L/7W)

The property is located on Bessette Creek, 2 kilometres northeast of Lumby, B.C., and is accessed by municipal road.

The mine is owned by Wallace Chaput and Edward Chaput, and is operated by United Mineral Services Ltd., 1326-510 West Hastings Street, Vancouver, B.C.

This is a quartz vein deposit in metamorphosed rocks of Carboniferous age. It is mineralized with galena, argentite, and sphalerite, and minor chalcopyrite, pyrite, and pyrrhotite.

In 1981, underground mapping continued, the lower adit was rehabilitated, and minor production was treated in the mill. In 1982, no work was carried out on the property.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, p.40; MI 82L/SE-6.

ALBERNI MINING DIVISION

MYRA FALLS OPERATION (Lynx, Myra, H-W, Price)

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	246,150	287,584	248,376	203,636	585,670	1,571,416
Product Shipped (t)						
Lead concentrates	5,354	5,576	5,316	3,615	2,833	22,694
Zinc concentrates	27,602	32,944	30,654	23,422	53,979	168,601
Copper concentrates	7,970	9,078	11,969	4,335	33,042	66,394
Gross Metal Content						
Gold (g)	572,366	656,781	578,431	405,154	811,884	3,024,616
Silver (g)	26,940,813	33,364,451	27,086,089	19,011,347	27,131,675	133,534,375
Copper (kg)	2,402,623	2,677,011	2,580,863	1,945,768	8,200,962	17,807,427
Lead (kg)	2,286,971	2,409,516	2,542,008	1,978,933	1,377,572	10,595,000
Zinc (kg)	15,863,753	17,923,645	17,204,718	14,056,197	29,484,968	94,533,281
Cadmium (kg)	63,984	75,528	67,278	-	-	206,790

ATLIN MINING DIVISION

ATLIN-RUFFNER MINE

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	1,082	-	-	-	-	1,082
Product Shipped (t)						
Lead concentrates	33	-	-	-	-	33
Zinc concentrates	6	-	-	-	-	6
Gross Metal Content						
Gold (g)	250	-	-	-	-	250
Silver (g)	26,405	-	-	-	-	26,405
Copper (kg)	443	-	-	-	-	443
Lead (kg)	15,832	-	-	-	-	15,832
Zinc (kg)	5,869	-	-	-	-	5,869
Cadmium (kg)	15	-	-	-	-	15

CARIBOO MINING DIVISION

BOSS MOUNTAIN

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	468,000	445,000	29,770	-	-	942,770
Product Shipped						
Molybdenite conc.(t)	1,655	955	93	-	-	2,703
containing Moly (kg)	906,000	539,355	51,539	-	-	1,496,894
Gross Metal Content						
Gold (g)	-	-	-	-	-	-
Silver (g)	-	-	-	-	-	-
Copper (kg)	-	-	-	-	-	-
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

GIBRALTAR MINE

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	13,257,620	13,378,760	13,517,000	13,142,200	13,401,587	66,697,167
Product Shipped						
Copper conc.(t)	166,600	127,790	107,698	116,086	137,692	655,866
Molybdic oxide (t)	890	1,265	1,213	1,666	600	5,634
containing Moly (kg)	487,361	686,395	662,602	910,227	359,919	3,106,504
Gross Metal Content						
Gold (g)	-	-	-	-	49,050	49,050
Silver (g)	5,624,599	4,281,954	4,098,101	5,165,254	7,042,574	26,212,482
Copper (kg)	44,231,267	32,279,933	28,018,884	32,026,361	37,617,000	174,173,445
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

CARIBOO MINING DIVISION (Continued)

MOSQUITO CREEK

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	21,121	22,508	18,947	2,329	7,545	72,450
Product Shipped						
Gold bullion						
Gross Metal Content						
Gold (g)	247,177	260,978	205,591	46,741	64,330	824,817
Silver (g)	64,661	75,215	63,762	13,281	29,069	245,988
Copper (kg)	-	-	-	-	-	-
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

FORT STEELE MINING DIVISION

SULLIVAN

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	2,209,667	2,446,247	2,017,383	2,472,236	1,973,301	11,118,834
Product Shipped						
Lead conc.(t)	130,613	115,369	169,657	140,556	170,035	726,230
Zinc conc.(t)	119,696	117,384	125,264	163,732	150,480	676,556
Tin conc.(t)	361	316	421	484	259	1,841
containing Tin (kg)	124,213	119,975	136,377	169,356	80,110	630,031
Gross Metal Content						
Gold (g)	-	-	-	-	-	
Silver (g)	116,505,665	95,864,617	127,609,074	102,983,487	111,216,453	554,179,296
Copper (kg)	-	-	-	-	-	-
Lead (kg)	86,733,470	76,006,790	111,437,071	95,172,159	114,049,293	483,398,783
Zinc (kg)	65,309,242	63,634,613	69,505,850	91,670,301	82,385,337	372,505,343
Cadmium (kg)	-	-	-	-	-	-

GREENWOOD MINING DIVISION

BEAVERDELL MINE (Highland Bell)

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	35,801	36,235	36,203	36,795	36,820	181,854
Product Shipped (t)						
Lead concentrates	471	331	291	329	338	1,760
Zinc concentrates	409	252	172	201	180	1,214
Jig concentrates	200	509	513	345	269	1,836
Gross Metal Content						
Gold (g)	10,762	4,634	4,106	4,043	3,297	26,842
Silver (g)	12,100,372	12,922,904	9,962,164	12,019,441	10,709,207	57,714,088
Copper (kg)	319	278	0	421	916	1,934
Lead (kg)	157,293	111,629	89,760	109,440	97,785	565,907
Zinc (kg)	182,044	145,206	104,317	138,317	135,478	705,362
Cadmium (kg)	1,026	794	154	-	-	1,974

KAMLOOPS MINING DIVISION

AFTON MINE

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	2,324,119	655,464	1,075,853	2,639,082	2,651,281	9,345,799
Product Shipped (t)						
Blister copper	16,421	3,903	3,869	-	-	24,193
Copper concentrates	-	-	7,524	32,643	45,507	85,674
Gross Metal Content						
Gold (g)	1,089,617	240,243	472,275	972,015	1,510,354	4,284,504
Silver (g)	6,459,290	1,780,643	3,384,014	7,855930	9,488,738	28,968,615
Copper (kg)	16,247,062	3,869,000	7,312,220	15,802,578	22,265,480	65,496,340
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

KAMLOOPS MINING DIVISION (Continued)

BETHLEHEM MINE

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	6,496,250	3,112,829	-	-	-	9,609,079
Product Shipped						
Copper conc.(t)	50,576	37,224	-	-	-	87,800
Molybdenite conc.(t)	413	-	-	-	-	413
containing Moly (kg)	275,049	-	-	-	-	275,049
Gross Metal Content						
Gold (g)	54,151	76,732	-	-	-	130,883
Silver (g)	3,662,092	4,251,939	-	-	-	7,914,031
Copper (kg)	16,264,628	15,281,276	-	-	-	31,545,904
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

HIGHMONT

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	6,397,689	8,905,999	8,796,983	8,565,800	-	32,666,471
Product Shipped						
Copper conc. (t)	24,447	32,615	43,891	46,402	-	147,355
Molybdenite conc. (t)	1,839	3,505	2,872	4,003	-	12,219
containing Moly (kg)	1,161,600	2,021,988	1,550,333	2,131,692	-	6,865,613
Gross Metal Content						
Gold (g)	-	-	-	-	-	-
Silver (g)	-	-	-	-	-	-
Copper (kg)	7,636,480	10,267,974	15,993,486	16,321,000	-	50,218,940
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

LORNEX MINE

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	20,739,392	27,842,904	28,766,769	28,162,932	29,211,503	134,723,500
Product Shipped						
Copper conc. (t)	215,947	362,330	322,736	273,051	340,848	1,514,912
Molybdenite conc. (t)	1,637	1,386	5,313	2,847	3,095	14,278
Molybdic oxide (t)	4,521	2,612	-	2,928	2,706	6,911
Ferro-molybdenum (t)	201	20	-	-	-	221
containing Moly (kg)	1,732,772	2,109,237	2,768,393	3,082,566	3,151,589	12,844,557
Gross Metal Content						
Gold (g)	-		-	-	-	-
Silver (g)	17,921,014	28,849,936	24,992,888	22,580,533	28,732,801	123,077,172
Copper (kg)	66,180,006	102,788,005	87,442,989	77,744,825	105,822,586	439,978,411
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

OK (Alwin)

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	107,129	*	-	-	-	107,129
Product Shipped (t)						
Copper concentrates	5,629	809	-	-	-	6,438
Gross Metal Content						
Gold (g)	35,432	5,112	-	-	-	40,544
Silver (g)	1,773,333	301,000	-	-	-	2,074,333
Copper (kg)	2,082,134	311,955	-	-	-	2,394,089
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

* Produced in 1981

KAMLOOPS MINING DIVISION (Continued)

VALLEY COPPER

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	-	-	7,171,985	8,437,148	9,295,598	24,904,731
Product Shipped (t)						
Copper concentrates	-	-	67,651	92,173	89,383	249,207
Gross Metal Content						
Gold (g)	-	-	92,936	121,086	118,815	332,837
Silver (g)	-	-	11,747,100	14,484,515	13,948,978	40,180,593
Copper (kg)	-	-	29,965,965	39,506,773	39,000,115	108,472,853
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

LIARD MINING DIVISION

ERICKSON GOLD MINE

	1981	1982	1983	1984	1985*	Total
Ore Produced (t)	38,243	38,724	69,497	83,153	26,000	255,617
Product Shipped (t)						
Gold concentrates	907	825	1,815	906	1,250	5,703
Gross Metal Content						
Gold (g)	534,949	655,786	1,149,706	813,854	634,000	3,788,295
Silver (g)	-	-	-	500,634	506,000	1,006,634
Copper (kg)	-	-	-	-	-	-
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

* Estimated

LIARD MINING DIVISION (Continued)

TAURUS GOLD MINE

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	-	37,169	42,256	93,398	38,111	210,934
Product Shipped (t)						
Gold concentrates	-	1,150	1,060	1,804	1,165	5,179
Gross Metal Content						
Gold (g)	-	251,119	174,646	284,805	174,218	884,788
Silver (g)	-	-	-	-	-	-
Copper (kg)	-	-	-	-	-	-
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

LILLOOET MINING DIVISION

BRALORNE

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	Clean-up	-	18	-	-	N/A
Product Shipped (t)						
Crude ore	-	-		-	-	-
Gross Metal Content						
Gold (g)	12,434	-	1,462	-	-	13,896
Silver (g)	2,332	-	379	-	-	2,711
Copper (kg)	-	-	-	-	-	-
Lead (kg)	59	-	-	-	-	59
Zinc (kg)	139	-	-	-	-	139
Cadmium (kg)	-	-	-	-	-	-

NANAIMO MINING DIVISION

ISLAND COPPER

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	14,156,617	15,291,656	16,330,081	16,360,917	16,506,367	78,645,638
Product Shipped						
Copper conc. (t)	232,652	235,590	260,497	230,323	221,003	1,180,065
Molybdenite conc. (t)	3,091	4,018	3,696	3,046	3,165	17,016
containing Moly (kg)	1,266,788	1,785,863	1,672,777	1,461,690	1,542,478	7,729,596
Rhenium	-		*	*	*	*
Gross Metal Content						
Gold (g)	1,658,562	1,395,613	1,618,220	1,734,765	1,786,739	8,193,899
Silver (g)	13,113,910	13,537,073	14,931,722	13,433,965	14,638,509	69,655,179
Copper (kg)	53,075,826	53,890,102	60,032,220	57,929,749	57,671,194	282,599,091
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

* Confidential

NEW WESTMINISTER MINING DIVISION

CAROLIN (Idaho)

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	-	262,057	346,949	292,560	-	901,566
Product Shipped (t)						
Gold bullion: crude ore	-	12	12	571	-	595
Gross Metal Content						
Gold (g)	-	275,806	597,443	576,471	-	1,449,720
Silver (g)	-	12,493	62,746	34,479	-	109,718
Copper (kg)	-	-	-	-	-	-
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

NICOLA MINING DIVISION

CRAIGMONT MINE

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	1,450,995	690,029	*	*	*	2,141,024
Product Shipped (t)						
Copper concentrates	34,088	11,411	-	-	-	45,499
Iron concentrates	40,778	43,093	23,906	48,634	54,225	210,636
Gross Metal Content						
Gold (g)	-	-	-	-	-	-
Silver (g)	-	-	-	-	-	-
Copper (kg)	9,545,277	3,018,203	-	-	-	12,563,480
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

* No milling.

OMINECA MINING DIVISION

BAKER MINE (Chappelle)

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	17,545	31,030	29,021	-	-	77,596
Product Shipped						
Dore bars						
Gross Metal Content						
Gold (g)	306,525	528,532	361,111	-	-	1,196,168
Silver (g)	4,883,930	11,234,669	6,996,370	-	-	23,114,969
Copper (kg)	-	-	-	-	-	-
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

BELL MINE

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	5,429,531	3,374,530	0	0	1,587,760	10,391,821
Product Shipped (t)						
Copper concentrates	85,243	39,656	0	0	20,394	145,293
Gross Metal Content						
Gold (g)	1,010,459	376,134	0	0	175,766	1,562,359
Silver (g)	2,835,020	2,039,424	0	0	998,982	5,873,426
Copper (kg)	22,648,730	10,849,825	0	0	5,326,924	38,825,479
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

DUTHIE MINE

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	-	-	-	-	242	242
Product Shipped (t)						
Lead concentrates	-	-	-	-	125	125
Crude ore	-	-	-	-	117	117
Gross Metal Content						
Gold (g)	-	-	-	-	1,482	1,482
Silver (g)	-	-	-	-	895,859	895,859
Copper (kg)	-	-	-	-	-	-
Lead (kg)	-	-	-	-	32,670	32,670
Zinc (kg)	-	-	-	-	37,642	37,642
Cadmium (kg)	-	-	-	-	28	28

OMINECA MINING DIVISION (Continued)

ENDAKO MINE

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	10,492,000	2,948,000	*	*	*	13,440,000
Product Shipped						
Molybdenum conc. (t)	487	107	135	197	207	1,133
Molybdic oxide (t)	5,009	4,037	1,700	2,564	1,555	14,865
Ferro-molybdenum (t)	221	134	182	252	203	992
Ammonium Di-molybdate	-	-	-	-	93	93
containing Moly (kg)	3,420,413	2,574,426	1,223,038	1,822,689	**1,247,269	10,287,835
Gross Metal Content						
Gold (g)	-	-	-	-	-	-
Silver (g)	-	-	-	-	-	-
Copper (kg)	-	-	-	-	-	-
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

* No milling.

** Includes concentrates from other sources.

Product shipped from own ores = 345,612 kg of molybdenum

OMINECA MINING DIVISION (Continued)

EQUITY SILVER MINE (Sam Goosly)

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	1,909,871	1,939,546	2,179,740	2,089,710	2,058,700	10,177,567
Product Shipped (t)						
Copper-silver-gold concentrates	26,508	42,995	37,175	59,016	37,275	202,969
Gross Metal Content						
Gold (g)	512,274	959,106	835,816	978,983	922,840	4,209,019
Silver (g)	175,628,426	274,986,398	152,684,000	180,133,000	135,170,858	918,602,682
Copper (kg)	4,285,854	7,633,814	7,346,833	10,990,901	8,389,459	38,646,861
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

FREE GOLD (Dome Mountain)

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	544	4,717	-	-	-	5,261
Product Shipped						
Lead conc. (t)	21	-	-	-	-	21
Gold conc. (t)	-	49	-	-	-	49
Crude ore (t)	-	13	-	-	-	13
Gross Metal Content						
Gold (g)	3,085	7,572	-	-	-	10,657
Silver (g)	4,254	13,424	-	-	-	17,678
Copper (kg)	-	-	-	-	-	-
Lead (kg)	434	1,204	-	-	-	1,638
Zinc (kg)	-	6,114	-	-	-	6,114
Cadmium (kg)	-	-	-	-	-	-

OMINECA MINING DIVISION (Continued)

GRANISLE

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	3,832,538	1,880,953	-	-	-	5,713,491
Product Shipped						
Copper conc. (t)	38,471	22,353	-	-	-	60,824
Molybdenum conc. (t)	13	-	-	-	-	13
containing Moly (kg)	6,582	-	-	-	-	6,582
Gross Metal Content						
Gold (g)	284,534	135,570	-	-	-	420,104
Silver (g)	3,249,878	1,707,084	-	-	-	4,956,962
Copper (kg)	11,763,221	6,433,439	-	-	-	18,196,660
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

SILVER STANDARD

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	424	571	133	280	175	1,583
Product Shipped (t)						
Crude ore						
Gross Metal Content						
Gold (g)	1,010	2,146	323	1,145	441	5,065
Silver (g)	853,940	1,105,418	215,485	681,473	429,005	3,285,321
Copper (kg)	-	-	-	-	-	-
Lead (kg)	26,896	41,039	7,302	30,016	9,930	115,183
Zinc (kg)	26,965	45,334	7,336	22,279	9,932	111,846
Cadmium (kg)	-	76	-	-	-	

OSOYOOS MINING DIVISION

BRENDA MINE

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	10,199,317	9,484,562	8,185,403	6,109,097	3,006,313	36,984,692
Product Shipped						
Copper conc. (t)	38,160	37,225	34,061	26,920	16,635	153,001
Molybdenite conc. (t)	5,605	4,408	4,037	4,904	3,435	22,389
containing Moly (kg)	3,134,312	2,473,945	2,250,143	2,755,942	1,926,185	12,540,527
Gross Metal Content						
Gold (g)	102,452	91,457	99,798	79,505	34,229	407,441
Silver (g)	5,877,521	5,783,839	5,883,743	4,488,838	2,488,182	24,522,123
Copper (kg)	11,225,206	10,690,976	9,831,329	7,790,650	4,692,860	44,231,021
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

FRENCH MINE

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	-	1,044	3,394	-	-	4,438
Product Shipped (t)						
Gold-silver conc.	-	18	-	-	-	18
Copper concentrates	-	-	19	-	-	19
Lead concentrates	-	-	140	-	-	140
Gross Metal Content						
Gold (g)	-	2,790	23,606	-	-	26,396
Silver (g)	-	18,600	116,668	-	-	135,268
Copper (kg)	-	2,900	17,635	-	-	20,535
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

GOOD HOPE

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	-	6,874	-	-	-	6,874
Product Shipped (t)						
Gold-silver conc.	-	124	-	-	-	124
Gross Metal Content						
Gold (g)	-	77,410	-	-	-	77,410
Silver (g)	-	-	-	-	-	-
Copper (kg)	-	-	-	-	-	-
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

HORN SILVER

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	21,468	2,918	3,600	2,636	-	30,622
Product Shipped (t)						
Gold-silver conc.	710	108	-	-	-	818
Silver concentrates	-	-	-	181	-	181
Lead concentrates	-	-	54	39	-	93
Gross Metal Content						
Gold (g)	7,460	7,816	3,296	5,846	-	24,418
Silver (g)	2,651,520	551,962	282,451	873,634	-	4,359,567
Copper (kg)	-	325	1,755	-	-	2,080
Lead (kg)	4,694	1,225	-	8,114	-	14,033
Zinc (kg)	6,882	-	-	6,087	-	12,969
Cadmium (kg)	-	-	-	-	-	-

REVELSTOKE MINING DIVISION

GOLDSTREAM MINE

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	-	-	293,631	134,255	-	427,886
Product Shipped (t)						
Zinc concentrates	-	-	419	818	-	1,237
Copper concentrates	-	-	38,659	19,543	-	58,202
Gross Metal Content						
Gold (g)	-	-	-	-	-	-
Silver (g)	-	-	2,644,604	1,175,711	-	3,820,315
Copper (kg)	-	-	8,202,987	3,645,850	-	11,848,837
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	186,786	318,390	-	505,176
Cadmium (kg)	-	-	-	-	-	-

SIMILKAMEEN MINING DIVISION

SIMILKAMEEN MINE (Ingerbelle, Copper Mountain)

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	6,868,587	6,704,021	6,850,166	6,516,307	6,881,099	33,820,180
Product Shipped (t)						
Copper concentrates	80,707	74,861	72,284	72,416	77,907	378,175
Gross Metal Content						
Gold (g)	837,648	623,563	613,018	526,489	539,708	3,140,426
Silver (g)	4,527,422	5,383,576	5,687,955	6,435,247	8,294,240	30,328,440
Copper (kg)	23,146,864	22,098,129	21,577,679	21,677,799	23,902,186	112,402,657
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

SKEENA MINING DIVISION

GRANDUC MINE

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	613,936	500,335	1,031,805	352,630	-	2,498,706
Product Shipped (t)						
Copper concentrates	26,969	18,900	42,123	20,251	-	108,243
Gross Metal Content						
Gold (g)	75,283	52,627	133,273	55,771	-	316,954
Silver (g)	4,850,000	3,606,800	7,950,859	3,944,057	-	20,351,716
Copper (kg)	7,626,025	5,380,913	11,925,042	5,602,592	-	30,534,572
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

KITSAULT MINE

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	1,840,717	2,228,831	-	-	-	4,069,548
Product Shipped						
Molybdenite conc. (t)	1,738	4,691	-	-	-	6,429
containing Moly (kg)	548,929	2,556,679	-	-	-	3,105,608
Gross Metal Content						
Gold (g)	-	-	-	-	-	-
Silver (g)	-	-	-	-	-	-
Copper (kg)	-	-	-	-	-	-
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

SKEENA MINING DIVISION (Continued)

SCOTTIE GOLD MINE (Summit Lake)

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	6,646	49,072	60,861	43,685	-	160,264
Product Shipped (t)						
Gold bullion						
Gross Metal Content						
Gold (g)	90,542	1,048,840	980,742	863,930	-	2,984,054
Silver (g)	39,501	546,667	531,928	507,049	-	1,625,145
Copper (kg)	-	-	-	-	-	-
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

TASU MINE (Westfrob)

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	1,031,909	1,108,162	906,563	*95,888	-	3,142,522
Product Shipped (t)						
Iron concentrates	533,313	695,690	442,406	-	-	1,671,409
Copper concentrates	11,773	13,407	17,214	-	-	42,394
Gross Metal Content						
Gold (g)	62,207	67,184	79,768	-	-	209,159
Silver (g)	2,346,969	2,536,293	3,363,880	-	-	8,249,142
Copper (kg)	2,394,377	3,029,558	3,782,281	-	-	9,206,216
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

* Mine closed in 1983, last shipment in early 1984.

SLOCAN MINING DIVISION

HEWITT

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	3,166	-	-	-	-	3,166
Product Shipped (t)						
Lead concentrates	98	-	-	-	-	98
Zinc concentrates	205	-	-	-	-	205
Gross Metal Content						
Gold (g)	43	-	-	-	-	43
Silver (g)	26,405	-	-	-	-	26,405
Copper (kg)	-	-	-	-	-	-
Lead (kg)	2,565	-	-	-	-	2,565
Zinc (kg)	104,481	-	-	-	-	104,481
Cadmium (kg)	-	-	-	-	-	-

SILVANA (Silmonac)

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	27,671	26,196	28,234	7,381	23,058	112,540
Product Shipped (t)						
Lead concentrates	1,968	1,625	1,398	1,046	2,796	8,833
Zinc concentrates	1,109	827	1,159	640	2,388	6,123
Gross Metal Content						
Gold (g)	-	-	-	-	-	-
Silver (g)	11,059,618	9,735,699	8,187,524	5,085,107	14,561,404	48,629,352
Copper (kg)	-	-	-	-	-	-
Lead (kg)	1,092,290	868,502	778,115	764,554	2,075,875	5,579,336
Zinc (kg)	813,878	654,701	758,587	405,948	1,398,437	4,031,551
Cadmium (kg)	4,139	50	4,966	-	-	9,155

SLOCAN MINING DIVISION (Continued)

UTICA

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	147	5,383	1,257	-	-	6,787
Product Shipped (t)						
Silver concentrates	*	*821	-	-	-	821
Lead concentrates	-	-	66	-	-	66
Gross Metal Content						
Gold (g)	-	-	157	-	-	157
Silver (g)	327,737	1,757,500	174,584	-	-	2,259,821
Copper (kg)	-	-	-	-	-	-
Lead (kg)	6,765	41,872	6,021	-	-	54,658
Zinc (kg)	24,120	126,436	15,155	-	-	165,711
Cadmium (kg)	-	-	-	-	-	-

* Clean up

VANCOUVER MINING DIVISION

ASHLU GOLD MINE

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	-	-	-	36	-	36
Product Shipped (t)						
Gold concentrates	-	-	-	20	-	20
Gross Metal Content						
Gold (g)	-	-	-	3,174	-	3,174
Silver (g)	-	-	-	2,957	-	2,957
Copper (kg)	-	-	-	255	-	255
Lead (kg)	-	-	-	-	-	-
Zinc (kg)	-	-	-	-	-	-
Cadmium (kg)	-	-	-	-	-	-

WARMAN (Brandywine)

	1981	1982	1983	1984	1985	Total
Ore Produced (t)	62,452	27,187	-	-	-	89,639
Product Shipped (t)						
Lead concentrates	1,247	820	-	-	-	2,067
Zinc concentrates	2,061	1,178	-	-	-	3,239
Dore bars						
Gross Metal Content						
Gold (g)	480,555	242,931	-	-	-	723,486
Silver (g)	1,498,670	1,062,806	-	-	-	2,561,476
Copper (kg)	109,87167,302	42,569	-	-	-	109,871
Lead (kg)	620,196	424,627	-	-	-	1,044,823
Zinc (kg)	11,189,914	7,087,143	-	-	-	18,277,057
Cadmium (kg)	-	-	-	-	-	-

NON-METALLIC MINES AND QUARRIES

ASBESTOS

Reported occurrences of asbestos in British Columbia are mainly in serpentinites. In addition to the one producing mine at Cassiar, there is a lower-grade potential producer at Kutcho Creek and four other large but low grade occurrences in the southern part of the province (Sproat Mountain, Moon Creek, J, and Ace).

CASSIAR
(Fig.M-1, NTS 104, No.57)

Liard M.D. Lat. 59°20' Long.129°49' (104P/5W)

The mine is approximately 4.8 kilometres north of Cassiar townsite, on Mount McDame, between 1,680 and 2,130 metres elevation. Cassiar is 140 kilometres by road from Watson Lake, Yukon Territory. The plant site is nine kilometres from Highway 37, approximately 120 kilometres north of Dease Lake.

The property is owned by Cassiar Mining Corporation, 2000-1055 West Hastings Street, Vancouver, B.C. V6E 3V3.

The Cassiar asbestos orebody is in a sill-like mass of serpentinite intrusive into Devonian-Mississipian sedimentary rocks. The orebody strikes approximately north and dips 30 degrees to 40 degrees to the east. Numerous veinlets of chrysotile asbestos occur in light to dark green serpentinite. Magnetite is fairly abundant, occurring in microscopic veinlets and larger veins. Other associated minerals include picrolite, magnesite, nemalite, brucite, tremolite, and antigorite. On the hanging-wall, zones of zoisite-quartz-tremolite hornfels occur at the contact of serpentinite with argilites and contain local, irregular bodies of nephrite jade. Blocks of this jade are recovered during waste rock stripping and sold on the semiprecious stone market.

This is an open-pit truck/shovel operation, with benches 13.6 metres high initially; the final pit wall is double-benched. After blasting, the ore is loaded into trucks and transported to a primary crushing plant, where it is crushed and then fed to an aerial tramline which carries the ore 5.2 kilometres to the plant site. Various grades of asbestos fibre are packaged and transported by road to the dock at Stewart, B.C. The fibre is then barged to Vancouver, B.C.

The mine started development in 1952, and by 1985 was producing around 100,000 tonnes of asbestos fibre per year. Several grades of fibre are produced for spinning, asbestos cement, gaskets and filter products, and these are shipped to over 40 countries around the world.

In the early 1980s, an underground exploration program discovered and partially outlined the new McDame orebody - a mirror image to the old mine, indicating similar grades and at least similar size. In 1983, the company proceeded with drilling of fibre anomalies in soils on its Tanya claims north of the mine, and continued investigations of the McDame orebody, which is adjacent to the present pit, but does not reach the surface. In 1984, a drill hole totalling 622.4 metres intersected 150 metres of asbestos-bearing serpentinite believed to be the southwest extension of the McDame orebody. During 1985, a major underground exploration program was initiated to study the McDame orebody in detail. This orebody is now expected to extend the life of the Cassiar mine well beyond the year 1990, when the present mine will be depleted.

Reference: *Ministry of Energy, Mines & Pet. Res.,* Mining in British Columbia, Vol.1, 1975-1980, p.41; MI 104P-5.

BARITE

Since the closure of the Walton mine in Nova Scotia, the bulk of barite production in Canada comes from British Columbia. In 1980, however, the National Energy Policy negatively affected oil and natural gas exploration, and subsequent demand for barite as used for drilling mud. As a result, in the early 1980s, several barite producers did not operate, or operated at reduced levels.

FIRESIDE BARITE
(Fig.M-1, NTS 94, No.58)

Liard M.D. Lat.59°46' Long.127°12' (94M/14E)

The Fireside mine is located at 887 kilometres north on Highway 97. A 4.5 kilometre access road on the north side of Highway 97 leads into the property.

The property is owned by the Magcobar Minerals Division of Dresser Industries Inc., P.O. Box 6504, Houston, Texas, U.S.A. 77005.

The mine is an open pit operation, where overburden is removed by bulldozers to expose the vein surface. The ore is then blasted and loaded by hydraulic excavators and front-end loaders into 13.5-tonne haul trucks. The ore is then hauled to the crushing plant and from there to the mineral dressing plant at Watson Lake. The mined-out pits are then backfilled and seeded.

Bulk sampling of the deposit was performed in 1983, and production commenced in 1984. By 1985, the mine was in full operation, and produced 41,071 tonnes of barite. During 1985, a 1.3-hectare area was cleared for a plant site/camp site, and a 25 tonne-per-hour jig plant was built to separate high density barite ore from the lower density wall rock.

Reference: MI 94M-3.

PARSON
(Fig.M-1, NTS 82, No.59)

Golden M.D. Lat 51°01' Long. 116°39' (82N/2E)

The Parson barite mine is located 7 kilometres south-west of Parson, at an elevation of 1,200 metres. It is accessed by crossing the Columbia River from Parson and following the Crestbrook forest road.

It is owned by Mountain Minerals Limited, 714 - 5th Avenue S., Lethbridge, Alta., T1J 0V1.

Two sub-parallel fissure veins, about 100 metres apart and dipping 55 degrees west, are in Lower Cambrian sedimentary rocks.

Mining is underground, by room and pillar method, with ore trammed to an ore pass by scoop. From there, it is hauled to the surface by a front dump skip on a skipway inclined at 44 degrees. The ore is trucked from the mine to Parson, then by rail to Mountain Minerals' grinding plant in Lethbridge, Alberta.

The Parson mine did not operate in 1981 and 1982. In 1982, the mine switched from diesel generation to electric power. The mine was reactivated in 1983, and from then to 1985, operated on a reduced scale, producing about 2,000 tonnes of barite a month.

Reference: *Ministry of Energy, Mines & Pet. Res.,* Mining in British Columbia, Vol.1, 1975-1980, p.42; MI 82N-2.

SILVER GIANT
(Fig.M-1, NTS 82, No.60)

Golden M.D. Lat.50°56' Long.116°28' (82K/16W)

The old Silver Giant lead-zinc mine is located on the west slope of Jubilee Mountain, on the northeast side of Spillimacheen River.

This property is owned and operated by Barold of Canada Ltd. P.O. Box 250, Onoway, Alberta, T2P 0T9.

Silver Giant Mine is a barite replacement orebody in Cambrian limestone. From 1981 to 1983, the company proceeded with small-scale processing of 900,000 tonnes of ore. In 1984 the tailings and stockpile were considered depleted, and the processing facility became inactive. However, in 1985, the mine was reactivated to recover pockets of barite still remaining in the open pit.

Reference: MI 82K/NE-18.

BRISCO
(Fig.M-1, NTS 82, No.61)

Golden M.D. Lat.50°49' Long.116°19' (82K/16W)

The Brisco mine is located 4 kilometres west of Brisco at an elevation of 990 metres.

This is another property in the Golden area owned by Mountain Minerals Limited, 714 - 5th Avenue S., Lethbridge, Alta., T1J 0V1. As in the case of Parson and Mineral King (Toby Creek), barite produced from the Brisco mine was shipped to the company's processing plant at Lethbridge.

A fault zone averaging 12 metres wide in dolomite was originally quarried, but subsequent to 1975, was mined by underground stoping. The mine produced a total of 1,426 tonnes of direct grinding barite ore in 1981. In 1982, the mine was not worked due to poor market conditions. During 1983, about 1,000 tonnes per month were hand-picked and sorted from the old open pit during a four-month period in the summer. Hand-picking continued in 1984. However, a successful underground drilling program in 1984 outlined additional reserves at Brisco.

Reference: *Ministry of Energy, Mines & Pet. Res.,* Mining in British Columbia, Vol.1, 1975-1980, p.42; MI 82K/NE-13.

MINERAL KING (Toby Creek)
(Fig.M-1, NTS 82, No.62)

Golden M.D. Lat.50°20' Long.116°26 (82K/8W)

The former Mineral King lead-zinc mine is located at the junction of Toby Creek and Jumbo Creek, 40 kilometres from Invermere.

This is another property in the Golden area owned by Mountain Minerals Limited, 714 - 5th Avenue S., Lethbridge, Alta., T1J 0V1. As in the case of Parson and Brisco, barite produced from the Mineral King mine was shipped to the company's processing plant at Lethbridge.

The Mineral King mine is a replacement orebody in Proterozoic dolomites. The mine operated from 1954 to 1967 and produced 2,313,000 tons of baritic ore that was processed for base metal concentrate, and also produced 25,000 tons of barite. Between 1970 and 1980, some 150,000 tons of barite were recovered from the old tailings pond.

Using open-pit methods of mining, front-end loaders and dump trucks move the tailing material from the old Mineral King lead-zinc mine to the gravity separation plant, where it is re-pulped and run across Deister tables.

No work was done in 1981, 1983, 1984 and 1985, however, in 1982, 4,317 tonnes of concentrate were produced and shipped by truck to Athelmere. The concentrate was then transported by rail to Lethbridge. In 1982, it was estimated that a further 10,000 tonnes of tailings remained to be concentrated.

Reference: *Ministry of Energy, Mines & Pet. Res.,* Mining in British Columbia, Vol.1, 1975-1980, p.41; MI 82K/SE-1.

GIANT MASCOT MINE
(Fig.M-1, NTS 82, No.63)

Golden M.D. Lat.50°56' Long.116°28' (82K/16W)

The old Giant Mascot lead-zinc mine is located 11.26 kilometres west of Spillimacheen, south of Golden, B.C.

The property is owned and operated by Baroid of Canada Ltd. P.O. Box 250 Onoway, Alberta, T2P 0T9, for the purpose of producing barite.

The property was purchased in 1960, and since that time most of the activities have been directed to the recovery of barite from a large tailings dump that was left by the former operators.

The tailings are loaded by a front-end loader, trucked to the mill, and crushed to a slurry. A barite concentrate is then recovered by a set of separation tables and dewatered by a Dorrco filter. The concentrate is then shipped to the company's processing plant at Onaway, Alberta.

A small crew was employed at the mine during the summer months of 1981, 1982, and 1983, producing approximately 1,000 to 4,000 tonnes of barite per year. No work is recorded during 1984 and 1985.

Reference: MI 82K/NE-18.

BUILDING STONE

In the past, quarries scattered along the coast and in the southern part of the province provided a wide variety of dimension stone applied in many old public buildings.

Pink and white spotted granite from Beaverdell, pink granite from Vernon, light grey granodiorite from Nelson, and grey granodiorite from Nelson Island were at one time popular building materials. Also, black monzonite from Rossland, brown pulaskite with bluish iridescent feldspars from Ymir, bright grey andesite from Haddington Island, streaky grey marble from Kootenay Lake and Tahsis Inlet on Vancouver Island can still be seen in several buildings in Nanaimo, Vancouver, and Victoria. The Cretaceous sandstone from many quarries on Vancouver Island, as well as on several of the Gulf Islands, was used in may old buildings. At present, building stone is produced in British Columbia as flagstone and facing stock: quartzite from the Salmo area and a mica-schist from Revelstoke.

BABETTE AND WISHAW LAKE QUARTZITE
(Fig.M-1, NTS 93, No.64)

Cariboo M.D. Lat.54°01' Long.120°14' (93I/1E)

The quarry is accessed from Prince George by following Highway 16 East for 160 kilometres to the Walker Creek Forest Road, then heading northeast for approximately 100 kilometres to the north side of Wishaw Lake.

The property is owned by Canroc International Corporation, 9333-120A Street, Surrey, B.C., V3V 7G6.

The Canroc quartzite is a massive rock of pleasing beige colours and aesthetically can compete with the best varieties of marble. In 1983, Canroc opened the quarry on the McGregor Pass site and the finishing plant in Delta came into production. Canroc proposed to produce 25,000 tonnes of large blocks (approximately 20 tonnes each) in 1984 and double this number in the following years. However, due to cash-flow problems, the quarry did not operate in 1984 and 1985. The company did, however, perform custom work at its Delta finishing plant by processing granite blocks from South Dakota for a Seattle construction project, and old stockpile blocks of coastal granite from Nelson Island.

Reference: MI 93I-5.

PITT RIVER QUARRY
(Fig.M-1, NTS 92, No.65)

New Westminster M.D. Lat.49°17' Long.122°40' (92G/7E)

The quarry is located on Sherridan Hill, on the east bank of the Pitt River. It is owned by Pitt Polder Ltd., and operated by Dillingham Corporation of Canada, 20 Brooksbank Avenue, North Vancouver, B.C., V7J 2B8.

Open-pit bench mining methods are used to produce quartz diorite rip-rap. Undersized rip-rap is crushed and screened to produce marketable products, which are shipped by scow along the Pitt River to markets in the Lower Mainland, and eastern Vancouver Island. The quarry operated intermittently throughout the 1981 to 1985 period.

Reference: MI 92G/SE-7.

CLAY AND SHALE

In the past, at least 26 brickyards scattered around the province produced common brick and tile from local clays or shales. At present, only the Abbotsford plant of Clayburn Industries is active. The bulk of brick and tile products used in British Columbia come from Alberta or Washington State. While fireclay has been reported from Ginscombe Rapids and stoneware clay from the Quesnel, Prince George, and Coal River areas, the ceramic clay potential of Cretaceous-Tertiary basins in British Columbia is poorly known.

FIRE CLAY MINE
(Fig.M-1, NTS 92, No.66)

New Westminster M.D. Lat.49°03 Long.122°17 (92G/1E/1W)

An underground mine and two open pits were operated by Clayburn Industries Ltd., at Sumas Mountain, near Kilgard. The company's head office is at Railway and Pine, Abbotsford, B.C., V2S 5C1.

The mine is located in a small Eocene outlier that consists of a sequence up to 400 metres thick of alternating beds of claystones, siltstones and conglomerates. Several different 'shale beds' have been mined over the years and exhibit a variety of fired colours ranging from buff-pink grey to deep red. A layer of fire clay three to four metres thick occurs at the base of the sequence, and exhibits pinkish white to light buff colour.

Underground mining in the Fireclay mine was by room and pillar on a single level utilizing auger drills, electric slushers, and winch haulage. The open pits are worked on a bench system with bench heights of seven metres. Equipment used in the pits consists of an air trac, front-end loader, and seven-tonne trucks.

The mine produces fire clay, shale and sandstone which is trucked to the Abbotsford plant where it is either precalcined or used in brick manufacturing. Some shale and sandstone is also sold to the cement industry. Total tonnage mined in 1981 was approximately 80,000 tonnes, although in subsequent years annual production was reduced to between 17,000 and 35,000 tonnes.

During 1983, the company produced very few refractory bricks because of weak market conditions, instead, production concentrated mainly on castable refractories and the small-scale facing brick production line. In 1984, Clayburn commenced processing Quesnel diatomite into specialty insulating and refractory brick for the aluminum industry. As a result of this successful research and development project, the Abbotsford plant underwent a major expansion in 1984 and 1985.

Reference: *Ministry of Energy, Mines & Pet. Res.*, Bull.30, Clay and Shale Deposits of British Columbia; Mining in British Columbia, Vol.1, 1975-1980, p.43; MI 92G/SE-4, 5, 31.

STRAITON (SUMAS) QUARRY
(Fig.M-1, NTS 92, No.67)

New Westminster M.D. Lat.49°06' Long.122°08' (92G/1E)

This quarry is located on Sumas Mountain, near Kilgard, and is operated by Toews Bros. Bulldozing of Abbotsford.

It is owned by Canada Cement Lafarge Ltd., 1051 Main Street, Vancouver, B.C., V9A 2V9.

Thin sandstone and shale are bedded in near-horizontal layers from three to ten metres thickness. The quarry is worked using a bench system, with bench heights of seven metres. Sandstone is drilled and blasted; shale layers are ripped using bulldozers; both products are trucked to an in-pit jaw crusher. The product is cement quality shale and sandstone for the Lafarge cement plant in Richmond, B.C.

Reference: MI 92G/SE-24.

DIATOMITE

There are many diatomite occurrences in B.C., but only the Quesnel deposit has reached the production stage. Diatomite beds in British Columbia consist almost exclusively of Melosira granulata diatoms; these are usually very small and are mixed with variable amounts of clay, silt and volcanic ash.

MICROSIL (CROWNITE)
(Fig.M-1, NTS 93, No.68)

Cariboo M.D. Lat.52°57' Long.122°32' (93B/15E)

This open pit operation in diatomaceous earth is 2.4 kilometres southwest of West Quesnel.

It is owned and operated by MicroSil Industrial Minerals (Raymark Holdings), Box 4505, South Edmonton, Alberta, T6E 4T7.

This is a part of the most extensive deposits known to occur in British Columbia. Diatomite formed in what is believed to have been a series of lakes, at or near the same location, which were formed by blockage of the Fraser River in Tertiary time. The deposits are believed to be Upper Miocene in age. As a result of slumping and faulting, the deposits are now in discontinuous blocks at different elevations, on the west side of the Fraser River from Alexandria, 38 kilometres south of Quesnel, to the large bend 13 kilometres north of Quesnel.

Pit operation is straightforward. Diatomaceous earth is loaded into trucks for transport to the plant near the confluence of Quesnel and Fraser Rivers. The earth is dried in a rotary kiln, pulverized, screened, sized by air elutriation, pelleted as required, and bagged for marketing. Calcined diatomaceous earth is used as absorbent; hydroponic gardening; pozzolan and lightweight aggregate.

The 100-tonne per day capacity was utilized at about fifty per cent in the early 1980s. In 1985, the operation became inactive, but some sales continued from the stockpile.

Reference: *Ministry of Energy, Mines & Pet. Res.,* Mining in British Columbia, Vol.1, 1975-1980, p.44; MI 93B-23.

DOLOMITE

Two small companies in the southern part of the province were producing white pulverized rock. Both were mining small bodies of crystalline carbonate rocks:

Dolowhite Mines Ltd., of Rock Creek produced ground dolomite, as a soil conditioner, and a variety of sized white rock chips for landscaping and decorative purposes. In 1983, company ownership changed to **Mighty White Dolomite Ltd**. This operation was active throughout 1981 to 1985.

International Marble and Stone Co. Ltd. (IMASCO) marketed several grades of pulverized limestone and dolomite from its underground operation at Sirdar north of Creston. This operation also processed white limestone and dolomitic limestone into a variety of fillers, extenders and coating agents, from several underground mines in the Kootenay Lake area and south of Salmo. The general trend of the pulp and paper industry to switch from caolin to micronized limestone in paper coating helped this company weather the otherwise unfavourable market conditions of the early 1980s. .

FLUORSPAR

Production of fluorspar in British Columbia dates back to the 1920s, when the Rock Candy mine in southern British Columbia was active. This deposit was abandoned in 1929, and since then only very small tonnages produced as a by-product from the silica quarry near Oliver have been sold. There are three known large occurrences of economic potential: the Rexspar deposit on the eastern side of the North Thompson River Valley, 130 kilometres north of Kamloops; north of Liard

River Hot Springs; and the Eaglet deposit. At present, the aluminum industry in the Pacific Northwest is importing fluorspar, mainly from Mexico, and the Eaglet deposit is the only fluorspar prospect in the province which is being actively developed.

EAGLET MINES LTD.
(Fig.M-1, NTS 93, No.69)

Cariboo M.D. Lat.52°34' Long.120°58' (93A/10W)

The Eaglet mine is located approximately 128 kilometres by road from Williams Lake to Quesnel Lake, via Horsefly, then eight kilometres by boat across the lake.

The mine is owned and operated by Eaglet Mines Ltd., Box 11107 Royal Centre, 1400-1055 West Georgia Street, Vancouver, B.C., V6E 3P3.

Fluorspar occurs as a stockwork with scattered veins and irregular lenses up to 20 centimetres wide, and as impregnations in altered Proterozoic Kaza Group feldspathic gneiss over an area of 1,500 metres by 500 metres.

Eaglet Mines has been actively engaged on the Quesnel Lake fluorite deposit since 1979. To 1984, a total of 115 diamond drill holes were put down, for a total of 18,630 metres. In addition, two adits were driven into the mineralized zone for geological purposes and material sampling. In 1983, a laboratory was established at the site to enable on-site fluorspar assaying. In 1984, on-site geotechnical and environmental studies were conducted in connection with a pre-feasibility report, and preparatory work and studies were conducted in connection with pilot mill testing. In 1984, the project entered the Mine Development Review Process.

Reference: MI 93A-46.

GYPSUM

In British Columbia, gypsum has been produced from two areas: Falkland and the East Kootenays. The Falkland deposit, which was active between 1913 and 1956, was briefly reactivated in 1983 and 1984. There are two other lesser-known gypsum deposits: Forget-me-not Creek near the Alberta border, and O'Connor River near the Alaska panhandle. At present, most gypsum for the Vancouver area is imported from Mexico.

LUSSIER RIVER (Coyote Creek)
(Fig.M-1, NTS 82, No.70)

Fort Steele M.D. Lat.50°02' Long.115°31' (82J/4E)

The mine is located on the east bank of the Lussier River, approximately 2.5 kilometres south of its confluence with Coyote Creek, at an elevation of 1,306 metres. Access is via a gravel road which leaves Highway 93/95 six kilometres south of Canal Flats and heads east for Whiteswan Lake. At km 21.3, this road branches and the main Lussier River logging road heads south parallel to the Lussier River. At km 30.5 a spur road branches east and south to the mine. The crushing, screening and rail load facility is located in Canal Flats.

The mine is owned and operated by Domtar Inc., 1805 - 30th Avenue S.E., Calgary, Alberta, T2G 4X8.

The claims lie within the foreland thrust zone of the Western Cordillera, on the western edge of a north-plunging syncline. The Burnais formation hosts the well-bedded and firmly-laminated gypsum deposit. The bedding strikes north-east and dips south-east.

The deposit is mined in 12-metre benches by backhoe and front-end loader. Ore is transported to the crushing/loud-out plant by 40-tonne trailer units. At the crushing/load-out plant, the gypsum is crushed to minus 15 centimetres before being transported by CP Rail to market. Gypsum is used in the production of wallboard and cement products.

Mine operation commenced in late 1984. That year, a total of 16,536 tonnes of gypsum was shipped. In 1985, 126,000 tonnes of gypsum was produced.

Reference: MI 82J/SW-9.

WINDERMERE
(Fig.M-1, NTS 82, No.71)

Golden M.D. Lat.50°29' Long.115°53' (82J/5W)

The mine is located on the south fork of Windermere Creek, approximately 11 kilometres west of Invermere, and is accessed by a private haul road which starts from Highway 93/95 approximately 1.5 kilometres north of Invermere. The haul road crosses the highway and continues to the crushing/screening plant and rail load-out site on the east banks of the Columbia River.

The mine is owned and operated by Westroc Industries Ltd., 2424 Lakeshore Road West, Mississauga, Ontario L5J 1K4.

Outcrops of gypsum and numerous sink holes that indicate its presence are scattered over large areas of the Stanford Range. The gypsum forms lenticular bodies in the Burnais Formation of Devonian age. The Burnais Formation is composed principally of well-bedded, finely-laminated, gypsum.

Overburden is stripped by dozer. The gypsum is then mined in a series of 20-metre benches. After blasting, the ore is transported by front-end loaders to a primary crusher where it is crushed to minus 20 centimetres. The ore is transported to the crushing/load-out facility in 100-tonne semi-trailers pulled by off-highway tractors. The majority of production is shipped by CP Rail to wallboard plants in British Columbia and Alberta. Production in 1981 was 771,000 tonnes. In 1982, when its original quarry was depleted after several decades of continuous production, Westroc shifted its operations to the new Elkhorn site, 3.5 kilometres to the south. From 1982 to 1985, the quarry operated at about 50 per cent capacity, producing around 400,000 tonnes annually.

Reference: *Ministry of Energy, Mines & Pet. Res.,* 1954, Bull. 35; Mining in British Columbia, Vol.1, 1975-1980, p.44; MI 82J/SW-21.

FALKLAND
(Fig.M-1, NTS 82, No.72)

Vernon M.D. Lat. 50°30' Long.119°33' (82L/12E)

Access to the mining area is by road, one kilometre north of Falkland, B.C. south of Kamloops.

The property is leased by Canada Cement Lafarge Ltd., 1051 Main Street, Vancouver, B.C., V9A 2V9.

Gypsum with anhydrite occurs as a series of lenses along two parallel shear zones. The deposit is interpreted as intrusion from underlying sediments by plastic flow during folding and faulting. The mineable gypsum was formed by hydration of anhydrite, which comprises the deeper parts of the deposits. The deposit produced 1.25 million tonnes during continuous operation between 1913 and 1956. Since 1956, when the high grade gypsum was depleted, Lafarge conducted intermittent production of a gypsum and anhydrite mixture to supply its cement plant in Kamloops.

Under contract in 1981, Plateau Construction carried out development of safety berms and intermittently trucked the broken gypsum rock to the cement plant at Campbell Creek, a distance of 50 kilometres. In 1981, development began on providing calcium sulphate for both Lafarge plants in British Columbia (Kamloops and Richmond), thus tripling production volumes. Up to 1982, the Richmond plant used gypsum imported from Mexico. In 1982, Plateau constructed a road to, and reopened the former Domtar quarry, while mining continued in the lower quarry. Production in 1982 was 30,638 tonnes of gypsum rock, which was transported by Highway 97 to the cement plant, to be used as an additive in making cement.

The Falkland quarry operated in 1983 and 1984, but was inactive during 1985.

Reference: *Ministry of Energy, Mines & Pet. Res.,* Mining in British Columbia, Vol.1, 1975-1980, p.44; MI 82L/NW-1.

JADE

Jade is the only commercially-produced semiprecious stone in British Columbia. It occurs as lenticular bodies associated with alpine-type serpentinite intrusions of mid-Paleozoic to Triassic age. Generally, jade pods occur along contacts with cherty rocks: to a lesser degree they occur with volcanic or plutonic rocks. The major deposits are at Mount Ogden in the central part of the province, and at Cry Lake area in northern British Columbia.

In the early 1980s, the by-product from Cassiar Asbestos was almost sufficient to satisfy the market, and by 1983, only one other producer was operating: Continental Jade. However, in 1984, Mohawk Oil Co. Ltd., conducted an exploration program for nephrite jade on the Jadex property in the Kutcho Creek area, and shipped approximately 45 tonnes of nephrite jade by air to Dease Lake. In 1985, Mohawk was still active in the Kutcho Creek area; also, Jade World Inc., and Far North Jade Ltd., reported work on their properties in the Mount Ogden area.

CONTINENTAL JADE LTD.
(Fig.M-1, NTS 93, No.73)

Omineca M.D. Lat.55°50' Long.125°46' (93N/13W)

This company, 1696 West First Avenue, Vancouver, operates with a seasonal crew employing a diamond saw, on the southern slope of Mount Ogden. Most personnel and supplies are transported by helicopter. The company operated throughout the period 1981 to 1985.

Reference: *Ministry of Energy, Mines & Pet. Res.,* Mining in British Columbia, Vol.1, 1975-1980, p.45; MI 93N-156,157.

LIMESTONE

Most domestic limestone production is processed and used in British Columbia, but significant quantities are exported and processed in a variety of places along the Pacific Coast from Alaska to northern California. The main production centre on Texada Island provides chemical, cement, agriculture and glass grade limestone from four independent operators. There are other producing centres in the Interior, near Lillooet; the Prince George area, Rock Creek; near Nelson, and near Kamloops.

A prolonged strike in the cement industry in 1980 to 1981, followed by the loss of U.S. export markets to Japanese imports, combined with a general decline in construction activities, led to a significant decline in provincial limestone production in the early 1980s. However, by the mid-1980s, improved conditions found some operators producing at record levels.

Tri-Lime Resources Ltd., and Western Lime and Marble Ltd.:

In 1982, Tri-Lime Resources Ltd. developed and put into production the Red Rocky Creek deposit, situated 100 kilometres north of Prince George, with the aim of providing agricultural limestone for the Peace River area. The processing capacity of the unit is approximately 80 tonnes per hour. In the Bowron River area east of Prince George, Western Lime and Marble Ltd. started a smaller-scale operation of a similar kind for Alberta markets. In both cases, transportation costs appeared prohibitive, and both operations subsequently closed due to financial difficulties.

International Marble and Stone Co. Ltd. (IMASCO):

In 1983, after having difficulties with the landowner in maintaining access to its limestone mine at Swift Creek south of Salmo, IMASCO developed and put into production a new site in the nearby Lost Creek area. As well, the new mine in the Crawford Bay area became fully operational. On the coast, the company outlined reserves of white limestone in the Port McNeil area on Vancouver Island and constructed a milling facility in Delta to produce micronized limestone.

In 1984, IMASCO continued preparing their two new underground limestone quarries, one in the Bonanza Lake area of Vancouver Island, and the other on Lost Creek, south of Salmo. Both limestones were to be processed into filler grade product. In 1985, production continued from Lost Creek, but the Bonanza Lake Quarry was abandoned as a result of contamination by aplite and amphibolite dykes.

In 1985, IMASCO developed a deposit of white limestone for filler grade products in the Benson Lake area.

Prime Lime and Marble Ltd., and Westmin Resources Ltd.:

In 1984, Prime Lime and Marble Ltd., and Westmin Resources Ltd., were preparing for agricultural lime production from their new locations on Sukunka River, 80 kilometres south of Chetwynd. The Prime Lime quarry started to produce during October, 1984.

VTS Quarry Ltd.:

In 1984 at Grand Forks, VTS Quarry Ltd. started to produce agricultural-grade lime on a small scale from locally-quarried dolomite. However, the operation became inactive in 1985.

Note that production figures given in Table 3-7E of the Ministry's annual Summary of Operations show only that production which is sold, and do not reflect rock mined by owners for use in their own cement plants.

BLUBBER BAY (DOMTAR QUARRY)
(Fig.M-1, NTS 92, No.74)

Nanaimo M.D. Lat.49°47' Long.124°37 (92F/15E)

The Blubber Bay quarry is located at the north end of Texada Island, one kilometre south of Blubber Bay, and owned by Ash Grove Cement West Inc., 470 Granville Street, Vancouver, B.C.
This quarry operated throughout the period 1981 to 1985. In 1982, ownership changed from Domtar Chemicals to Oregon Portland Cement Co., of Portland, Oregon. On April 1, 1983, the mine and plant operations were officially taken over by the new company.
This new operator was given the contract to supply the Genstar plant in Delta, formerly supplied by Ideal Rock Products. In 1985, Oregon Portland changed its name to Ash Grove Cement West Inc. Also in 1985, the operation set a record for its production of cement limestone, with 897,398 tonnes being crushed and shipped that year.

Reference: *Ministry of Energy, Mines & Pet. Res.,* Mining in British Columbia, Vol.1, 1975-1980, p.46; MI 92F-397.

COBBLE HILL QUARRY
(Fig.M-1, NTS 92, No.75)

Victoria M.D. Lat.48°40' Long.123°37' (92B/12E)

This quarry is located at the southwest corner of Cobble Hill, three kilometres southwest of Cobble Hill Station.

It is owned by the British Columbia Cement Company Limited, RR1, Mill Bay, B.C.

In 1981 the Cobble Hill quarry was permanently closed. Since then, most of the equipment and some of the buildings have been removed and reclamation has taken place.

Reference: *Ministry of Energy, Mines & Pet. Res.,* Mining in British Columbia, Vol.1, 1975-1980, p.46; MI 92B-17, 18.

IMPERIAL QUARRY
(Fig.M-1, NTS 92, No.76)

Nanaimo M.D. Lat.49°44' Long.124°32' (92F/10E)

The Imperial quarry is located on the north end of Texada Island, 3.2 kilometres southeast of Vananda.

The quarry was owned and operated by Imperial Limestone Company Limited, 5427 Ohio Avenue South, Seattle, Washington, 98134, until 1982, when ownership changed to J.A. Jack & Sons. Inc., of the same address. Imperial Limestone continues to operate the property.

The quarry operates to produce coarse limestone for a plant at Spratt Bay which produces chemical grade limestone, stucco dash, coarse sand, fine sand, domestic whiting and sports-field whiting. As well, in 1982, white limestone was shipped to a new fine-grind white limestone plant in Seattle. The Imperial quarry operated throughout the 1981 to 1985 period, shipping approximately 150,000 tonnes of limestone per year.

Reference: *Ministry of Energy, Mines & Pet. Res.,* Mining in British Columbia, Vol.1, 1975-1980, p.45; MI 92F-394.

IDEAL QUARRY
(Fig.M-1, NTS 92, No.77)

Nanaimo M.D. Lat.49°42' Long.124°33' (92F/10E)

The Ideal quarry is located on the north end of Texada Island, 4 kilometres south of Vananda.

It is owned and operated by Ideal Basic Industries Ltd., Rock Products Division, 610, 1200 West Pender Street, Vancouver, B.C., V6E 2S9.

In 1981, a 300-tonne per hour crushing and screening plant to process chemical grade limestone was constructed. During the period 1981 to 1985, the operation employed an average workforce of about 40 people, and shipped approximately 1.25 million tonnes of limestone a year.

Reference: *Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.46; MI 92F-395.

VANANDA QUARRY
(Fig.M-1, NTS 92, No.78)

Nanaimo M.D. Lat.49°45' Long.124°31' (92F/10E)

The Vananda quarry is located on the north coast of Texada Island, 1.6 kilometres southeast of Vananda.

It is owned and operated by Canada Cement Lafarge Ltd. (Pacific Region), 1051 Main Street, Vancouver, B.C., V9A 2V9.

In 1981, a new 10-tonne hoist for turning rock in the crusher and for general hoisting was installed in the crusher house. In 1982, a conveyor was installed in the screening plant to allow scalping of fines from the mill circuit, to remove overburden from the product. Limestone shipped declined from 783,202 tonnes in 1981 to 384,243 tonnes by 1985, and the workforce was reduced from 28 to nine people.

Reference: *Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.45; MI 92F-396.

PAVILION LAKE QUARRY (Marble Canyon)
(Fig.M-1, NTS 92, No.79)

Kamloops M.D. Lat.50°49' Long.121°39' (92I/13E)

The quarry is located near the eastern entrance to Marble Canyon, 35 kilometres west of the Cariboo Highway, within the boundaries of Pavilion Indian Reserves 3 and 4.

The land is owned by the Pavilion Indian Band, and operated by Steel Brothers of Canada Limited, Richmond; local office, Cache Creek. This company also owns the machinery and calcining plant.

The chemical-grade high calcium limestone is crushed, sized, and the minus five plus one centimetre product is fired in an oil-fired rotary kiln for calcining. The resultant calcium oxide is transferred to storage bins for sale, but can be custom crushed and rescreened to meet customer

specification. In 1982, the majority of the 23 employees were native Indians living within 13 kilometres of the operation, and the remainder commuted from surrounding villages. In 1982, a second rotary kiln was installed, which doubled production capacity. However, as a result of poor market conditions in 1983, the quarry operated at only 25 per cent of capacity.

Reference: *Ministry of Energy, Mines & Pet. Res.,* Mining in British Columbia, Vol.1, 1975-1980, p.47.; MI 92I/NW-81.

DAHL LAKE QUARRY
(Fig.M-1, NTS 93, No.80)

Cariboo M.D. Lat.53°47' Long.123°17' (93G/14W)

The quarry is located at the northeast corner of Dahl Lake, 35 kilometres southwest of Prince George.

Kokanee Contracting of Prince George, supplies several local pulp and paper mills with a a chemical-grade limestone. The company selectively mines high-grade pockets from the larger limestone body locally contaminated by intrusive dykes and siliceous zones. The 1982 and 1983 output was significantly reduced from previous years. In 1984 and 1985, the quarry was active only in the later part of each year.

Reference: *Ministry of Energy, Mines & Pet. Res.,* Mining in British Columbia, Vol.1, 1975-1980, p.47; MI 93G-32.

HARPER RANCH QUARRY
(Fig.M-1, NTS 92, No.81)

Kamloops M.D. Lat.50°40' Long.120°03' (92I/9E)

The quarry is situated on the north side of the South Thompson River approximately 25 kilometres east of the City of Kamloops. It is approximately one kilometre north of the cement plant which is accessible by public road from the Trans-Canada Highway.

It is owned and operated by Canada Cement Lafarge Ltd., 1051 Main Street, Vancouver, B.C., V9A 2V9.

The limestone is quarried under contract by Plateau Construction Ltd., of Kamloops, with an average crew of seven persons. An Allis-Chalmers A1 primary crusher and Symons cone crusher reduce the blasted rock to minus 2.5 centimetres at the rate of 180 tonnes per hour. The limestone is the primary constituent of Type 10 Portland cement produced at the nearby plant.

In 1982, the quarry produced 248,709 tonnes. However, in 1983, operations were severely reduced, and closed in 1984 when the Lafarge Cement plant in Kamloops shut down as a result of the depressed cement market.

Reference: *Ministry of Energy, Mines & Pet. Res.,* Mining in British Columbia, Vol.1, 1975-1980, p.46; MI 92I/NE-1.

PTARMIGAN CREEK
(Fig.M-1, NTS 93, No.82)

Cariboo M.D. Lat.53°41' Long.120°54' (93H/10W)

The quarry is located on the east bank of Ptarmigan Creek, near Urling station on the Canadian National Railway, approximately 120 kilometres east of Prince George.

The quarry is operated by Quesnel Ready Mix Cement Co. Ltd., of Quesnel, B.C.

A band of Lower Cambrian limestone is on ground owned by the Canadian National Railways. The band, 30 metres in thickness, is quarried and treated in a crushing, screening and washing plant. Washed and sized crushed limestone is shipped to Prince George pulp mills. Riprap and crushed limestone for ballast are also shipped by rail. The economic situation of the early 1980s did not have as severe an impact on this operation because the CNR was the major client. The site has expansion problems, however, because it is adjacent to a provincial park.

Reference: *Ministry of Energy, Mines & Pet. Res.,* Mining in British Columbia, Vol.1, 1975-1980, p.47; MI 93H-17.

MAGNESITE

All economically-interesting magnesite occurrences in carbonate rocks are near the Rocky Mountain Trench, both on the eastern and western sides. While some occurrences have sedimentary characteristics, others seem to be replacement deposits. Stratigraphically, the southern and northern occurrences are in Lower Cambrian rocks, the largest deposit (Cross River) is in Middle Cambrian carbonate rocks, and occurrences near Brisco are in Late Proterozoic rocks of the Upper Purcell Mount Nelson Group. Magnesite was mined near Marysville during the early 1940s to supply the Cominco smelter in Trail. In recent years, various European companies have shown considerable interest in this commodity.

MOUNT BRUSSILOFF
(Fig.M-1, NTS 82, No.83)

Golden M.D. Lat.50°47' Long.115°41' (82J/13E)

The mine is located one kilometre north of the confluence and between the Mitchell River and Assiniboine Creek, near Mount Eon, at elevation 1320 to 1460 metres. Access is by Highway 93 from Radium to Settlers Road, thence by the Palliser Road to Cross River Road, and by the Mitchell River Road to the mine, approximately 65 kilometres from Radium, B.C.

It is owned and operated by Baymag Mines Co. Ltd., 200-1144 29th Avenue, Calgary, Alberta, T2E 7P1.

This coarsely crystalline, white to grey, magnesite deposit, occurs within the Cathedral Formation carbonates. The magnesite has some contaminants, principally dolomite and pyrite which occur erratically, requiring close grade control.

The deposit is mined by stripping topsoil and overburden, drilling and blasting the ore, transporting the ore to the primary crushing and screening plant at the mine. The ore is transported 200 kilometres by road to Baymag's calcining facility at Exshaw, Alberta, where it is processed into refractory and chemical grade magnesia.

The mine commenced production in 1982. By 1985, it employed an average of eleven men, and shipped 114,000 cubic metres of ore.

Reference: MI 82J/NW-1.

MARL

CHEAM MARL
(Fig.M-1, NTS 92, No.84)

New Westminster M.D. Lat.49°11' Long.121°44' (92H/4E)

A deposit of marl, two to three metres thick, is mined from the bed of the former Cheam Lake, near Popkum, B.C.

The operation is owned by Cheam Marl Products Ltd., 13 Fletcher Street South, Chilliwack, B.C.

The marl deposit is overlain by a metre or so of clayey overburden. It was formed by deposition of lime marl (minute shellfish) during the post-glacial period, on the bed of Cheam Lake. The lake was drained, and mining of marl commenced in 1952.

Marl is mined by dragline, and trucked to an asphalt drainage pad for air drying. The dried marl produced is sold to Fraser Valley and Lower Mainland farmers for soil conditioning, and a small amount is purchased by mushroom growers in the Chilliwack area. About 54,000 tonnes was produced in the 1981 to 1985 period. In 1985, reserves appeared sufficient for a further ten years.

Reference: *Ministry of Energy, Mines & Pet. Res.,* Mining in British Columbia, Vol.1, 1975-1980, p.47; MI 92H/SW-106.

PERLITE

Prior to the opening of the Frenier mine, and with the exception of a small trial shipment in 1953, no perlite had been produced in British Columbia. There are several known occurrences of volcanic glass throughout the province. Mount Meager, north of Pemberton, and Terrace Mountain near Vernon are easily accessible, while Empire Valley and occurrences to the south and west of Burns Lake are in more remote locations. Prior to the Frenier mine, all perlite used in Canada was imported; the British Columbia market being serviced by Oregon.

FRENIER (AURUN)
(Fig.M-1, NTS 92, No.85)

Clinton, M.D. Lat.51°19' Long.122°18' (92O/8W)

The property is located near Higginbottom Creek in the Empire Valley, five kilometres west of the Fraser River, and 60 kilometres northwest of Clinton. The minesite is at elevation 1,185 metres. Access is provided by a road from Highway 97 which crosses the Fraser River near Gang Ranch, a total distance from Clinton, B.C. of 120 kilometres.

The Frenier mine is owned and operated by Aurun Mines Ltd., P.O. Box 602, Aldergrove, B.C., V0X 1A0.

This perlite deposit occurs in two zones forming part of a felsic volcanic sequence centred in the Blackdome Mountain area, where overburden is generally less than 0.7 metres.

The deposit is mined by open pit method, ripping and dozing in benches one metre high. The perlite is loaded into road haulage trucks, hauled to a stockpile near White Lake, then transported to the processing plant located in the lower Fraser Valley.

In 1983, the company finished drilling and bulk sampling of the deposit, and produced 1,000 tonnes of perlite which was processed on a trial basis in the newly-built plant in Aldergrove. The mine continued production on the same scale in 1984, and doubled its production in 1985 to 2,000 tonnes of perlite.

Reference: MI 92O-72.

SILICA

Early records of silica production in British Columbia refer to silica flux that was used in local smelters. Such silica was not always of high purity and frequently contained some gold values.

At present, there are three different types of silica produced in B.C. Quartz conglomerate at Sumas Mountain near Abbotsford and a devitrified rhyolite ash at Barnhard Vale near Kamloops are quarried to provide the silica component for cement manufacturing. Massive, Ordovician Mt. Wilson (Wonah) quartzite is produced from two quarries near Golden for ferrosilicon and silicon carbide; its friable part is processed into a blasting and glass sand. In the kamloops area, a quartz vein near Chase is quarried for silicon carbide, and intermittently a similar vein near Armstrong has provided small tonnages of high purity silica for special uses.

The largest past-producer, now almost depleted, is a pegmatitic plug at Oliver. Presently it is selling small tonnages of silica chips derived by processing the old piles of waste. IMASCO Ltd. at Sirdar also produces small amounts of silica chips as stucco dash, roofing granules, and poultry grit.

BUSE LAKE
(Fig.M-1, NTS 92, No.86)

Kamloops M.D. Lat.50°37' Long.120°01' (92I/9E)

The quarry is at Buse Lake, 11 kilometres south of the cement plant, which is on the north bank of the South Thompson River, approximately 17.5 kilometres east of Kamloops.

It is owned by Canada Cement Lafarge Ltd., 1051 Main Street, Vancouver, B.C., V9A 2V9. In 1981 and 1982, it was operated under contract by Plateau Construction Ltd.

The rock is a Miocene tuff of the Tranquille Formation, and the product is used as a cement additive. Rock is blasted and hauled to the crushing station at the company's Harper Ranch quarry.

The operation produced 23,000 tonnes in 1981, and 20,832 tonnes in 1982.

Reference: *Ministry of Energy, Mines & Pet. Res.,* Mining in British Columbia, Vol.1, 1975-1980, p.48; MI 92I/NE-123.

FORDING COAL LIMITED
(Fig.M-1, NTS 82, No.94)

Fort Steele M.D. Lat.50°12' Long.114°52' (82J/2W)

The property lies in the upper Fording River Valley, 68 kilometres north of Sparwood, B.C. Access is via 67 kilometres of road north of Natal Junction on Highway 3.

Fording Coal Limited, P.O. Box 100, Elkford, B.C.,V0B 1H0, is owned by Canadian Pacific Limited (60%) and Cominco Limited (40%).

The property is in the northern section of the Elk Valley coalfield in the Fording River Valley. The seams are contained within the coal-bearing Kootenay Group and are found in two distinct blocks of coal-bearing strata. West of the Fording River is the Greenhills area with a syncline plunging to the north as it traverses the Greenhills Mountain Range. On the east side is a second syncline, lying at a much higher elevation, which also plunges to the north and is well faulted in the Eagle Mountain and Brownie Ridge areas.

The mine operates on both sides of the Fording River with the office, maintenance site and preparation plants located on the east side at the base of Eagle Mountain. The mine is operated primarily by truck and shovel, but also has a Marion Dragline.

In 1981, construction of a 1.8 kilometre interceptor ditch was started in the North Greenhills to divert surface run-off around the K-pit mining area. The North Greenhills catch basin was enlarged, and a primary settling pond excavated in the Clode area. Several projects were constructed in 1982 under the general title of the Eagle Mountain Development. These projects, which included a haul road, power lines, and settling ponds, were for the development of new mining areas on Eagle Mountain. During 1984 and 1985 nine pits were worked as the mine attempted to concentrate its operations in the Eagle Mountain area.

FORDING COAL LIMITED

Year	Clean Coal Production (tonnes) Thermal	Metallurgical	Total
1985	178,376	3,895,256	4,073,632
1984	220,925	3,794,670	4,015,595
1983	60,225	2,695,886	2,756,111
1982	106,168	3,793,987	3,900,155
1981	-	3,721,184	3,721,184
Total	565,694	17,900,983	18,466,677

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, p.51; Coal in B.C., Paper 1986-3, p.24; MI 82J/SE-9, 12.

WESTAR MINING LIMITED (Balmer Operations)
(Fig.M-1, NTS 82, No.95)

Fort Steele M.D. Lat.49°45' Long.114°45' (82G/10W,15W)

The mine is located adjacent to Highway 3, five kilometres southeast of Sparwood, B.C.

The operator, Westar Mining Limited, P.O. Box 2000, Sparwood, B.C., V0B 2G0, is owned by B.C. Resources Investment Corporation.

The Balmer operations are located on a syncline at the north end of the Fernie Basin. The area is underlain by the Kootenay Group which contains up to ten seams having an aggregate coal thickness in excess of 45 metres. The Harmer open-pit operations are in the area of a deformed thrust plate on the east limb of the syncline; the western boundary of the pit is governed by the Harmer West Fault. The Balmer North underground mine is located south of the Harmer open-pit, and the Balmer South hydraulic mine is on the west limb of the syncline under Sparwood Ridge.

In the Harmer open-pit, coal is mined and waste moved by a fleet of shovels, front-end loaders, and trucks. In the Balmer North underground mine, three continuous miners cut coal in a room and pillar system and load on to shuttle cars. In the Balmer South hydraulic mine , six Nikki jet monitors hydraulically cut and load coal from sub-levels developed by continuous miners. The coal is then treated in the Elkview Preparation Plant and transported by rail to the Roberts Bank terminal.

In July, 1981 the Elkview Production Plant capacity was increased to 6.5M tonnes. Panel 6 of the underground hydraulic mine was permanently closed in February, 1985.

WESTAR MINING LIMITED (Balmer operations)

Year	Clean Coal Production (tonnes) Thermal	Metallurgical	Total
1985	156,665	5,684,176	5,840,841
1984	240,170	4,968,583	5,208,753
1983	-	5,226,199	5,226,199
1982	6,819	5,598,756	5,605,575
1981	403,675	7,101,360	7,505,035
Total	807,329	28,579,074	29,386,403

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in B.C., Vol.1, 1975-1980, p.51; Coal in B.C., Paper 1986-3, p.25; MI 82G/NE-11,13,14,16,23.

WESTAR MINING LIMITED (Greenhills Operations)
(Fig.M-1, NTS 82, No.96)

Fort Steele M.D. Lat.50°10' Long.114°50' (82J/2W)

The property is located in the Greenhills Range, between Elk Valley and Fording Valley, overlooking the village of Elkford. It is accessed by Highway 43 between Sparwood and Elkford, and by the Fording Mine road from Elkford.

The operator, Westar Mining Limited, P.O. Box 2000, Sparwood, B.C., V0B 2G0, is owned by B.C. Resources Investment Corporation.

PACIFIC SILICA
(Fig.M-1, NTS 82, No.87)

Osoyoos M.D. Lat.49°11' Long.119°33' (82E/4E)

Pacific Silica is located one kilometre north of Oliver, on Highway 97, and is the old Gypo Crown-granted mineral claim, owned for many years by Cominco.

Throughout 1981 to 1985, a small crew from Pacific Silica Products, Box 863, Osoyoos, B.C., processed the dumps of former operations, and salvaged silica remnants in former mined areas. Reclamation and restoration of mine and dump areas was a continuous part of the operation. The quarry produces small tonnages of landscaping chips and other similar products.

Reference: *Ministry of Energy, Mines & Pet. Res.,* Mining in British Columbia, Vol.1, 1975-1980, p.48; MI 82E/SW-84.

MOUNT ROSE SILICA
(Fig.M-1, NTS 82, No.88)

Vernon M.D. Lat.50°26' Long.119°16' (82L/6W)

The property is located on Mount Rose, six kilometres west of Armstrong.

It is owned and operated by Mount Rose Mining Co. Ltd. of Vernon, B.C.

In 1975, a quarry was started on a quartz vein in a quartz-diorite intrusion in phyllite. Approximately 800 tonnes was blasted from a 4.5 to 6-metre high face for transportation to a crushing and screening plant at the end of the access road.
In succeeding years, up to and including 1981, small tonnages of hand-picked material were shipped for use in the electronics industry. No work has taken place subsequently.

Reference: *Ministry of Energy, Mines & Pet. Res.,* Mining in British Columbia, Vol.1, 1975-1980, p.49; MI 82L/SW-66.

MOBERLY SILICA
(Fig.M-1, NTS 82, No.89)

Golden M.D. Lat.51°22' Long.116°57' (82N/7W)

The mine is located approximately ten kilometres northwest of Golden, B.C. at an elevation of 1,500 metres. Access from Golden is via the Upper Donald Road and the mine haul road. The plant is located ten kilometres west of Golden, on the TransCanada Highway at an elevation of approximately 1,000 metres.

It is owned and operated by Mountain Minerals Limited, 714-5th Avenue South, Lethbridge, Alberta. T1J 0V1.

Several bands of friable sandstone occur within Ordovician Mt. Wilson Formation quartzites, which strike southeast for 125 degrees and dip 75 degrees to 90 degrees northwest.

Stripping is limited to removing trees and topsoil. The mine is worked in seven-metre benches, and after blasting, the ore is loaded into dump trucks by a front-end loader. The ore is transported to the crushing and screening plant, and washed to high purity silica sand. The sand is shipped by rail and truck to Alberta and British Columbia, where it is used for foundry sand, blasting sand, glass-making sand, and golf course sand.

The mine went into production in 1980, and by 1985 was operating at full capacity, producing approximately 100,000 tonnes of silica per year.

Reference: *Ministry of Energy, Mines & Pet. Res.,* Mining in British Columbia, Vol.1, 1975-1980, p.48; MI 82N-1.

HORSE CREEK (HUNT) SILICA
(Fig.M-1, NTS 82, No.90)

Golden M.D. Lat.51°13' Long.116°50' (82N/2W)

The crushing, screening and rail loadout facility is situated just west of Highway 95, eleven kilometres south of Golden, B.C. at Horse Creek. The mine is approximately two kilometres east of the plant.

The property is owned by the Coastal Mining Co. of Canada, c/o Davis & Co., 1030 West Georgia Street, Vancouver, B.C., V6E 3Z2, and operated by Bert Miller Trucking, P.O. Box 744, Golden, B.C., VOA 1HO.

Silica is mined from quartzite of the Mt. Wilson formation. After removing trees and minimal overburden stripping, the ore is drilled and blasted, and transported to the crushing, screening and loadout facility. The operation started production in 1982, but did not operate in 1983. In 1984, 45,000 tonnes of quartzite was shipped to the Hanna Mining plant in Wanatchee, Washington, while some of the finer grade waste was used by Genstar for cement manufacturing in its plants in Delta and Edmonton. Production in 1985 was 80,000 tonnes, of which 55,000 tonnes was sold for the production of silicon, and 25,000 tonnes for specialty cement.

Reference: *Ministry of Energy, Mines & Pet. Res.,* Mining in British Columbia, Vol.1, 1975-1980, p.48; MI 82N-43.

FS SILICA
(Fig.M-1, NTS 82, No.91)

Kamloops M.D. Lat.50°48' Long.119°49' (82L/13W)

This quarry is located on Niskonlith Creek, near Chase, B.C.

It is owned by Contech Enterprises Ltd., Box 3008, Salmon Arm, B.C., VOE 2T0.

The silica lies in a quartz vein running north and south. Some scattered tungsten mineralization occurs throughout.

The quarry commenced production in 1980, and construction of a crushing plant was completed in 1981 when silica shipments were made to the railway at Chase. However, the company went into receivership in 1983, and the property has remained inactive.

Reference: *Ministry of Energy, Mines & Pet. Res.,* Mining in British Columbia, Vol.1, 1975-1980, p.48; MI 82L/NW-31.

COAL MINES

FORT STEELE MINING DIVISION

BYRON CREEK COLLIERIES LIMITED
(Fig.M-1, NTS 82, No.92)

Fort Steele M.D. Lat.49°30' Long.114°40' (82G/10E)

Located 30 kilometres east of Fernie, B.C., on Coal Mountain, the property extends approximately five kilometres south of the old townsite of Corbin. Access is via 25 kilometres of gravel road south from Highway 3.

Byron Creek Collieries Limited, P.O. Box 1960, Sparwood, B.C., VOB 2G0, is a wholly-owned subsidiary of Esso Resources Canada Limited.

The Coal Mountain operations are located on the eastern edge of the Crowsnest Coalfield. Coal Mountain comprises complex folded and faulted Jura-Cretaceous sedimentary rocks. The seam mined in 1985 averaged about 30 metres in thickness and ranked medium volatile bituminous by ASTM standards.

Coal is mined from three open pits on Coal Mountain. Rock and coal are loaded by a hydraulic shovel and front-end loaders, and transported by a fleet of haulage trucks with maximum capacity of 120 tonnes. From a breaker station, coal is washed in a treatment plant then transported by overland conveyor to the rail loadout facility.

In 1982, the Colliery administration offices were moved from Blairmore, Alberta to Byron Creek. In 1985, Corbin Creek was diverted in two areas to accommodate the construction of a new plant and shop, and a new 140,000m^3 settling pond was constructed on the creek. The pond supplies process and fire water to the mine, and acts as a settling area.

Sixty-nine per cent of the sales in 1985 were domestic, the largest customer being Ontario Hydro. This coal was shipped by rail to Thunder Bay Terminal for transshipment to lake vessels. The remainder of 1985 sales were exported by rail to Westshore Terminals at Roberts Bank for transshipment to ocean vessels and Pacific Rim markets.

BYRON CREEK COLLIERIES LIMITED

Year	Clean Coal Production (tonnes) Thermal	Metallurgical	Total
1985	1,048,297	-	1,048,297
1984	1,337,787	-	1,337,787
1983	1,292,148	-	1,292,148
1982	1,029,908	-	1,029,908
1981	441,237	-	441,237
Total	5,149,377	-	5,149,377

References: *B.C. Ministry of Energy, Mines & Pet. Res.,* Mining in B.C., Vol.1, 1975-1980, p.50; Coal in B.C., Paper 1986-3, p.26; MI 82G/NE-1.

CROWS NEST RESOURCES LIMITED (Line Creek Mine)
(Fig.M-1, NTS 82, No.93)

Fort Steele M.D. Lat.49°55' Long.114°45' (82G/15W)

The Line Creek Mine site is located in the Crowsnest Pass area, approximately 24 kilometres northeast of Sparwood, B.C. and 14 kilometres southeast of Elkford, B.C. The plant site, located adjacent to the C.P. railway spur-line to Fording Coal, is situated 9 kilometres downstream from the mine. Access is via an eastern lateral from Highway 43, midway between Sparwood and Elkford.

Crows Nest Resources Limited, P.O. Box 2003, Sparwood, B.C., is owned by Shell Canada Resources Limited.

The Line Creek property is situated on the west limb of the Alexander Creek syncline, near the south end of the Elk Valley Coalfield. Up to 550 metres of Mist Mountain Formation are preserved as dip-slope on Line Creek Ridge. The Mist Mountain Formation contains seven coal seams that are thicker than 2.8 metres and have an aggregate thickness of up to 55 metres. Ninety percent of the reserves are in the four lower seams. The seams range from low- to medium-volatile bituminous in rank.

The mine is a truck and shovel operation, stripping Line Creek Ridge approximately 14 kilometres up the Line Creek Valley. The coal is transported to the processing plant by a coal haul fleet through the canyon road.

1982 was the mine's first full year of production, when the infrastructure became substantially complete; however, the metallurgical plant was not completed until 1983. A 2.5 kilometre access/haulage road to North Line Creek was constructed in 1985.

CROWS NEST RESOURCES LIMITED (Line Creek Mine)

Year	Clean Coal Production (tonnes) Thermal	Metallurgical	Total
1985	998,827	1,042,704	2,041,531
1984	1,148,375	1,114,479	2,262,854
1983	611,058	834,412	1,445,470
1982	795,297	-	795,297
1981	-	-	-
Total	3,553,557	2,991,595	6,545,152

References: *B.C. Ministry of Energy, Mines & Pet. Res.,* Coal in B.C., Paper 1986-3, p.25; MI 82G/NE-20

The property is nearly midway along the Elk Basin, which is the northern section of the Crowsnest Coalfield. The seams are contained in the coal-bearing member of the Kootenay formation within an elongate synclinal formation trending north-northwest. Twenty-nine seams are known to exist; however only a few are economic to mine. The coals are of medium-volatile bituminous rank, and of high-volatile A bituminous rank.

The mine itself is situated on the top of the Greenhills Range. The raw coal is conveyed down the mountain, via the preparation plant and dryer, to the valley bottom where the load-out silos are located.

Development of the open-pit started during 1981, as well as the construction of associated facilities which were completed by the end of 1983. The mine began to produce metallurgical coal in July, 1983, after the completion of the processing plant.

WESTAR MINING LIMITED (Greenhills operation)

Year	Clean Coal Production (tonnes) Thermal	Metallurgical	Total
1985	586,505	1,793,758	2,380,263
1984	728,144	1,782,490	2,510,634
1983	444,906	514,360	959,266
1982	347,500	-	347,500
1981	-	-	-
Total	2,107,055	4,090,608	6,197,663

References: *B.C. Ministry of Energy, Mines & Pet. Res.,* Mining in B.C., Vol.1, 1975-1980, p.51; Coal in B.C., Paper 1986-3, p.24; MI 82J/SE-7.

LIARD MINING DIVISION

BULLMOOSE OPERATING CORPORATION
(Fig.M-1, NTS 93, No.97)

Liard M.D. Lat.55°07' Long.121°30' (93P/4E)

The Bullmoose mine is located 87 kilometres south of Chetwynd, B.C., and 35 kilometres northwest of Tumbler Ridge, B.C. It is accessed by following Highway 29 to kilometre 71, then west along Bullmoose Creek for 18.5 kilometres.

Bullmoose Mine, Box 500, Tumbler Ridge, B.C., VOC 2W0, is owned by Teck-Bullmoose Coal Inc. (51%); Lornex Mining Corporation Ltd. (39%); and Nissho-Iwai Coal Development (Canada) Ltd. (10%)

In two areas on the Bullmoose property the lower part of the Gates Formation occurs at shallow depth and with gentle dips; the northern portion is the "West Fork" area and the southern portion is the "South Fork" area. The West Fork area lies along the axial portion of a broad syncline and strata are generally flat lying for about two kilometres along the structure. In the South Fork area, the lower Gates strata form a platter-shaped outlier which dips gently to the north and is crudely concordant with the slope. Erosion has exposed coal seams around the entire periphery of the South Fork area, and along the southern edge of the West Fork area. Five mineable seams have been identified that range from less than a metre to five metres in thickness, and have an aggregate thickness of approximately 12 metres.

This is a conventional truck and shovel operation. Coal is loaded into haul trucks and transported to the truck conveyor dump and into a Bradford breaker. From there the coal goes to the raw coal silo, and thence to the coal preparation plant. After washing and drying, the coal is transported by truck to rail load-out silos, and is then hauled by unit train to Prince Rupert.
Commercial production began in November, 1983, with contracts for metallurgical coal established with nine Japanese customers. The mine was officially opened in June, 1984.

BULLMOOSE MINE

Year	Clean Coal Production (tonnes) Thermal	Metallurgical	Total
1985	69,618	2,098,000	2,167,618
1984	66,780	1,719,031	1,785,811
1983	-	206,291	206,291
1982	-	-	-
1981	-	-	-
Total	136,398	4,023,322	4,159,720

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Coal in B.C., Paper 1986-3, p.20; MI 93P-1,12,16.

MOUNT KLAPPAN PROSPECT
(Fig.M-1, NTS 104, No.98)

Liard M.D. Lat.57°15' Long.128°45' (104H/2W)

The Mount Klappan coal property is located 150 kilometres northeast of Stewart, B.C. Access to the property is gained by following Highway 37 north from the Meziadin junction to the Ealue Lake turnoff 17 kilometres south of Iskut. The property is then accessed by following the railway grade for 140 kilometres.

The exploration and development of the Mount Klappan anthracite project is the main focus of activity for the Coal Division of Gulf Canada Resources Inc., 401-9th Avenue S.W., Calgary, Alberta, T2P 2H7.

The Mount Klappan property has, in recent years, been the subject of the most concentrated exploration activity in the Groundhog Coalfield. The Groundhog coal deposits lie in the Skeena Mountains, which are formed largely of folded sedimentary rocks of Late Jurassic and Early Cretaceous age. The structure at Mount Klappan shows open to tight folds that are almost vertical or are overturned to the northeast. The fold axes strike 30 to 60 degrees to the northwest and the axial planes dip from 25 to 85 degrees southwest. The folds are cut by thrust faults striking 20 to 40 degrees to the northwest and dipping ten to 25 degrees southwest. The whole area is cut by younger high-angle faults trending northwest, north or northeast.

The coal measures have a minimum thickness of 350 metres and consist of conglomerate, sandstone, mudstone, marl and coal seams. The coal seams occur in three units: the Lower, Middle, and Upper units. The Lower unit has six coal seams with an average thickness ranging between one and five 5 metres and an aggregate total of ten metres. There are ten seams in the Middle unit averaging one to five metres in thickness and having an aggregate thickness of seven metres. An aggregate thickness of 22 metres is found in the four seams making up the Upper unit and these average between two and ten metres thick. Anthracite is the rank of the coal seams found here.

The project is an open-pit trial excavation. Overburden is stripped using a bulldozer and backhoe. Coal is then loaded by front end loader and backhoe into Caterpillar 777 haul trucks and transported to a temporary portable wash plant. After washing, the coal is loaded into highway haulage trucks and transported to Stewart for shipping. Waste tailings and water are delivered to a 1.84 hectare tailings pond impounded by a 4.5 metre high dam.

In 1984, an eight kilometre access road and an exploration camp were constructed; exploration consisted of 25 drill holes for a total length of 2,404 metres, and 95 trenches for a total length of 416 metres.

In 1985, new construction included: removal of overburden down to the coal seam, and upgrading of the existing haul road; construction of a waste dump at elevation 1,820 metres; construction of a pilot wash plant; and excavation and construction of a tailings pond. Exploration consisted of 34 diamond drill holes totalling 6,146 metres; 6 rotary drill holes totalling 620 metres; and 45 hand trenches totalling 178 metres.

The Mount Klappan trial project produced 140,000 tonnes of raw anthracite in 1985. 120,000 tonnes were washed to render a clean product of 80,000 tonnes.

References: *B.C. Ministry of Energy, Mines & Pet. Res.,* Coal in B.C., Paper 1986-3, p.31; MI 104H-20,21.

QUINTETTE COAL LIMITED
(Fig.M-1, NTS 93, No.99)

Liard M.D. Lat.55°01' Long.121°13' (93I/15W)

The minesite is located 120 kilometres south of Chetwynd, B.C., and 12 kilometres west of Tumbler Ridge, B.C. It is accessed either by Highway 29, or by the Heritage Highway through Tumbler Ridge, to the Quintette plant site.

The managing partner and operator of the mine is Denison Mines Ltd., Suite 3900 South Tower, Box 40, Royal Bank Plaza, Toronto, Ontario, M5J 2K2.
The Gates Formation and the Gething Formation both contain coal seams of mineable thickness on the Quintette property; however, the Gates Formation contains all the reserves. Underlying the Babcock Mountain area is an extensive area of gently dipping seams bounded by dipping limbs. Six seams are of mineable thickness and two pits have been delineated: the Babcock pit on the eastern slope of Babcock Mountain; and the Roman pit, located within a fairly simple chevron fold at the southern end of the Murray syncline. North of the Murray River, in the Wolverine area, two more pits have been delineated. The Mesa (formerly McConkey) pit, which is located on Mast Ridge, is contained in a complex syncline overlying a large thrust fault. The Deputy pit is situated in a smaller syncline immediately to the southwest and is contiguous with the Mesa pit. The Mast syncline, an area of relatively minor faulting, is located further to the southwest of the Mesa pit and contains the Wolverine (formerly Frame) pit.

This is a truck and shovel operation. The raw coal is transported by haul-trucks to the truck conveyor dump where it is fed into a Bradford breaker, through a crusher, and onto a 13
kilometre conveyor system. The coal is delivered to three silos, then further conveyed to the Preparation Plant. After washing and drying the coal goes to clean coal silos, is fed to a coal load-out surge bunker, and loaded into unit trains.

In 1983 much of the infrastructure was completed, and the mine began production at the Mesa (McConkey) pit. The Wolverine (Frame) pit came into production in 1984.

QUINTETTE COAL LIMITED

Year	Clean Coal Production (tonnes) Thermal	Metallurgical	Total
1985	613,244	4,925,746	5,538,990
1984	703,331	2,856,603	3,559,934
1983	39,650	42,001	81,651
1982	-	-	-
1981	-	-	-
Total	1,356,225	7,824,350	9,180,575

References: *B.C. Ministry of Energy, Mines & Pet. Res.,* Coal in B.C., Paper 1986-3, p.21; MI 93I/10,11, MI 93P/19,20.

NANAIMO MINING DIVISION

WOLF MOUNTAIN COAL LIMITED
(Fig.M-1, NTS 92, No.100)

Nanaimo M.D. Lat.49°07' Long.124°01' (92F/1E)

The property is located on Vancouver Island approximately 10 kilometres southwest of Nanaimo, midway between Mount Benson and the Nanaimo River.

Wolf Mountain Coal Limited is owned and operated by Wolf Mountain General Limited Partnership, 5240 Gulf Place, West Vancouver, B.C., V7W 2V9.

The geological structure of the property is that of an asymmetrical syncline. The axis of the syncline plunges gently to the east, the southern limb being generally shallow and the northern limb steeper. The coal seam considered to be of economic interest is correlated with the Wellington seam and is of variable thickness.

The mine is worked by the room and pillar system, using a continuous miner and shuttle car. A conveyor belt transports the coal to the surface. The coal is then taken in 15-tonne trucks to a central depot where it is screened to remove some of the waste. In 1984 most of the processed coal was loaded onto barges and shipped to cement plants in the United States, while small quantities were shipped to customers on Vancouver Island.

Only limited production was accomplished toward the end of 1983, with no coal being marketed. During 1984 the mine produced 18,000 tonnes of raw thermal coal, and in 1985, 45,900 tonnes of clean thermal coal.

References: MI 92F-322.

OMINECA MINING DIVISION

CROWS NEST RESOURCES LIMITED (Telkwa Prospect)
(Fig.M-1, NTS 93, No.101)

Omineca M.D. Lat.54°35' Long.127°10' (93L/11E)

The Telkwa property is located approximately 10 kilometres southwest of the village of Telkwa, B.C., adjacent to Goathorn Creek.

Crows Nest Resources Limited (Telkwa Prospect), c/o Box 100, Calgary, Alberta, T2P 2H5, is owned by Shell Canada Resources Limited.
The coal measures of the Telkwa basin occur within the Skeena Group which is of Cretaceous age. These coal measures dip to the northeast or east, generally average 400 metres in thickness, and consist of three stratigraphic units. The coal seams are found in the upper zone of the lower unit and the lower zone of the upper unit. The coal ranges from medium- to high-volatile bituminous in rank.

In 1981, an estimated 15,000 tonnes of fine dust coal was screened and shipped by rail to Manitoba; a further 300 tonnes of raw coal was removed for shipment to local markets. No work was done on the site in 1982. Crows Nest Resources Limited conducted a field program and submitted a prospectus, followed by a Stage 1 application, in 1983. Further exploration was carried out in 1984, but no work was done in 1985.

TELKWA (Bulkley Valley)

Year	Clean Coal Production (tonnes) Thermal	Metallurgical	Total
1985	-	-	-
1984	-	-	-
1983	-	-	-
1982	275	-	275
1981	-	-	-
Total	275	-	275

References: *B.C. Ministry of Energy, Mines & Pet. Res.,* Coal in B.C., Paper 1986-3, p.31; MI 93L/152,155,156.

PART TWO

REPORT OF THE CHIEF INSPECTOR

REPORT OF THE CHIEF INSPECTOR

INTRODUCTION

The Inspection and Engineering Branch carries out activities to provide safe operations at all mines, to ensure worker health and safety, to ensure the suitable reclamation and conservation of land affected by mining and exploration, and to ensure that mining systems provide the maximum possible economic recovery of the province's mineral and coal resources. Most activities are required and carried out under the Mines Act, the Mines Regulation and the Coal Mines Regulation.

During the year, inspectors stationed at various locations inspected coal mines, metal mines, sand and gravel pits, placer mines and quarries in accordance with the Mines Act and the prescribed regulations. Specialized research and support for field inspections were provided by Victoria-based professionals in the areas of reclamation, environmental control, geotechnical engineering, mechanical-electrical engineering and coal mining. The development and maintenance of access roads into areas of promising mineral potential were administered by a roads supervisor. Mine rescue training is a continuous program administered by coordinators for areas in which mine rescue stations are located.

STAFF

Personnel employed during 1985 are listed below:

W.C. Robinson, Chief Inspector of Mines	Victoria
V.E. Dawson, Deputy Chief Inspector of Mines	Victoria
T.G. Carter, Senior Mechanical-Electrical-Inspector	Victoria
R.F. King, Electrical Inspector	Victoria
J.E. Brenner, Roads Supervisor	Victoria
D.J. Murray, Senior Environmental Control Inspector	Victoria
D.M. Galbraith, Reclamation Inspector	Victoria
J.C. Errington, Senior Reclamation Inspector	Victoria
R.T. Martin, Senior Geotechnical Inspector	Victoria
J.E. Beswick, Reclamation Inspector - Technician	Victoria
R. Bone, Inspector of Mines and Resident Engineer	Victoria
B.M. Dudas, Inspector of Mines and Resident Engineer	Vancouver
S.J. Hunter, Inspector of Mines	Vancouver
R. Kumar, Environmental Control Inspector	Vancouver
V. Pyplacz, Environmental Control Inspector (Audiology)	Vancouver
A. Parker, Environmental Control (Noise) Inspector-Technician	Vancouver
J.W. Robinson, Inspector of Mines and Resident Engineer	Nanaimo
H.A. Armour, Inspector of Mines - Technician	Nanaimo
V.A. Pakalnis, Inspector of Mines and Resident Engineer	Smithers
R.W. McGinn, Inspector of Mines & Resident Engineer	Smithers/Victoria
T. Vaughan-Thomas, Inspector of Mines and Resident Engineer	Prince George
R.W. Lewis, Inspector of Mines and Resident Engineer	Prince George
D. Turner, Inspector of Mines and Resident Engineer	Prince.George
J.J. Sutherland, Inspector of Mines - Technician	Prince George
B.A. Gordon, Reclamation Inspector - Technician	Prince George
K. Hughes, Mechanical Inspector - Technician	Prince George
S. Ghoneim, Environmental Control Inspector	Prince George
A. Whale, Inspector of Mines and Resident Engineer	Fernie
R. Booth, Inspector of Mines	Fernie
G.A. MacDonald, Mechanical Inspector - Technician	Fernie
J.B.C. Lang, Inspector of Mines and Resident Engineer	Nelson

M.A. Mellor, Inspector of Mines - Technician	Nelson
A.L. O'Bryan, Reclamation Inspector - Technician	Nelson
F.J.T. Hancock, Inspector of Mines and Resident Engineer Engineer	Kamloops
E. Sadar, Inspector of Mines and Resident Engineer	Kamloops
J.P. MacCulloch, Inspector of Mines and Resident Engineer	Kamloops
R. Heistad, Mechanical Inspector - Technician	Kamloops
E.J. Hall, Reclamation Inspector Technician	Fort St.John

Co-ordinators, Mine Rescue Training

R.F. Brow	Nanaimo
J.E.A. Lovestrom	Smithers
B.A. McConachie	Kamloops
E.C. Ingham	Nelson
P.J. Switzer	Fernie

STAFF CHANGES

1981

In February, J. Cartwright resigned from the staff as Electrical Inspector. In March, S. Elias retired from the staff as Senior Environmental Inspector. P.E. Olsen retired as Road Engineer in April. In October, R. Stevenson resigned from the staff as Mine Rescue Coordinator; and in October, D.I.R. Henderson resigned from the staff as Inspector of Mines and Resident Engineer.

J.E. Beswick commenced employment as Reclamation Inspector-Technician in the Vancouver office, on January 5. On February 2, G.A. MacDonald joined the Ministry as Mechanical Inspector-Technician in the Fernie office.

E. Seronik joined the Ministry as Acting Road Engineer on April 21, 1981, and on June 29, R.F. King joined the Ministry as Electrical Inspector. D. Pearce joined the Ministry as Office Technician on November 16; and on November 18, D.J. Murray, Senior Environmental Control Inspector, was transferred from the Vancouver office to the Victoria office.

1982

Early in 1982, S.J. Hunter was transferred from Smithers to the Vancouver office as Inspector of Mines, and R.W. McGinn commenced employment as Inspector of Mines and Resident Engineer in Smithers.

In February, J.E. Brenner joined the Ministry as Roads Supervisor, and in March, E. Seronik terminated his employment as Acting Roads Supervisor. In April, G. Palm joined the staff as Co-ordinator, Mine Rescue Training, in the Prince George office, and he resigned in September. Also in April, B. Varkonyi resigned from the staff as Inspector-Technician in Prince Rupert.

In May, S. Ghoneim joined the Ministry as Environmental Control Inspector in Prince George. Also in May, W.H. Childress retired from the staff as Inspector-Technician in Vancouver. In August, F.J.T. Hancock commenced employment as Inspector of Mines in Prince Rupert, and in September G.J. Lee retired from the staff as Senior Coordinator, Mine Rescue Training. In October, R. Bone transferred from Fernie to Victoria as Inspector of Mines.

In October, a tragic vehicle accident claimed the life of D. Pearce, Office Technician.

In October, A. Whale joined the staff in Fernie as Inspector of Mines, and in December, R. Booth commenced employment in Fernie as Inspector of Mines. In December, D. Turner joined the staff as Inspector of Mines in Prince George.

1983

Early in 1983, J.D. McDonald was transferred to the Mineral Policy and Evaluation Branch, and the position of Senior Reclamation Inspector was left vacant.

In February, E. Beswick, Reclamation Inspector-Technician, transferred to Victoria from the Vancouver office.

1984

Early in 1984, the Prince Rupert office was closed. The Inspectors were transferred March 31 to other Branch offices, V.A. Pakalnis to Smithers and F.J.T. Hancock to Kamloops.

At the end of March, A.J. Richardson, Deputy Chief Inspector (Metal), resigned from the Ministry.

In May, H.J. Dennis, Senior Coal Inspector, resigned from the Ministry.

In November, J.A. Thomson, Inspector-Technician in Kamloops, retired after 16 years with the Ministry.

1985

In July, W.C. Robinson, Chief Inspector of Mines, retired after 26 years of service with the Ministry.

Also in July, R. Bone was appointed Inspector of Mines and Resident Engineer for coal, based in the Victoria office.

In August, V.E. Dawson was designated Chief Inspector of Mines until the position could be filled permanently.

Effective August 1, T. Vaughan-Thomas was appointed to the newly created position of Manager, Inspection Services, Coast, and was transferred from Prince George to Victoria. R.W. McGinn was appointed Manager, Inspection Services, North, and was transferred from Smithers to Victoria. The third manager position for the South region remained vacant.

In November, D. Turner was promoted to the position of Inspector of Mines and Resident Engineer in the Prince George office.

The following is a review of the work of the various sections of the Inspection and Engineering Branch during the year.

BOARD OF EXAMINERS

Mines - Other Than Coal

W.C. Robinson, Chairman	Victoria
B.M. Dudas, Member	Vancouver
E. Sadar, Member	Kamloops

Section 24 of the Mines Act requires that examination of applicants for underground and open-pit shiftboss certificates and issuance of certificates at all mines other than coal mines, shall be effected by a Board of Examiners consisting of the Chief Inspector as Chairman and two other inspectors appointed by the Minister as members.

It is also a requirement of this section that every person employed underground or in open-pit workings, in a mine other than coal mine, shall be under the daily supervision of a person who holds an appropriate shiftboss certificated issued under this Act.

Coal Mines

V.E. Dawson, Chairman	Victoria
R. Bone, Secretary	Victoria
T. Vaughan-Thomas	Prince George

Section 35 of the Mines Act requires that a Board of Examiners consisting of the Chief Inspector as Chairman and two other inspectors as members be appointed by the Minister to carry out the examination of applicants and the issuance of certificates for the following:

(1)	First Class Certificate of Competency - Underground	Coal Mines
(2)	Second Class Certificate of Competency - Underground	Coal Mines
(3)	Third Class Certificate of Competency - Underground	Coal Mines
(4)	Mine Surveyor Certificate - All Coal Mines.	

Four different shiftboss certificates are issued:

(1) Underground Mining - Non-coal
(2) Open-pit Mining - Non-coal
(3) Sand, Gravel and Clay Removal
(4) Open-pit Mining - Coal

A fee of $50 is charged for the examination and the passing grade is 65 per cent. A shiftboss certificate will not be issued unless the person has successfully passed the written examination and holds a blasting certificate (except for sand and gravel pits), an applicable mine rescue certificate, and a valid first aid certificate.

ACTS

During the period 1981-1985, the *Mining Regulation Act* and the *Coal Mining Regulation Act* were replaced by the *Mines Act* and the *Mines Regulation* and *Coal Mines Regulation*. The *Mines Act* had been assented to in August, 1980; however it was not proclaimed until 1983.

The purpose of the change was to facilitate future additions, deletions or changes to Regulations. These can now be made by Order-in-Council rather than by the more cumbersome Statute Amendment process.

Revision of rules affecting mines was relatively minor during this period, but did include the change to the metric system.

FATAL ACCIDENTS, 1981-1985

The following table shows the number and type of property on which 27 fatalities occurred in the 1981-1985 period. The average 5.4 fatalities per annum is disappointing compared to the previous average of 4.8 for the period 1976 to 1980. However, of significance is the subsequent closure of the last underground coal mine in British Columbia. Outbursts, explosions and "bumps", from the accumulation of large pockets of methane, had constituted a continuous threat for almost a century. In 1984, Joseph Wenisch was the last coal miner to die underground in British Columbia.

Year	Type of Property					Totals
	Metal Mines		Coal Mines		Quarries	
	U/G	Sur.	U/G	Sur.		
1981	2			1	1	4
1982	3	3		1	1	8
1983		1	2	4		7
1984			1	1		2
1985	1	1		4		6
Totals	6	5	3	11	2	27

Below is a tabulation of the mines at which fatal accidents occurred in the period 1981-1985, and a comparison with those occurring in the period 1976-1980.

NUMBER OF FATAL ACCIDENTS

Company and Location	Totals 1976-1980	1981-1985
Atlin Silver Corp., Atlin	1	0
Bethlehem Copper Corp., Ashcroft	1	0
Byron Creek Collieries Ltd.,		
Byron Creek	0	1
Carolin Mines Ltd., Ladner Creek	1	0
Cassiar Asbestos Ltd., Cassiar	0	1
Cominco Ltd.,		
Fording Mine	1	1
HB (David Minerals)	0	1
Sullivan Mine	3	2
Craigmont Mines Ltd., Merritt	1	0
Dekalb Mining Corp., Highland Valley	1	0
Domtar Chemicals Ltd., Blubber Bay	1	0
Equity Silver Mines Ltd., Houston	0	1
Granduc Operating Co., Stewart	0	1
Gulf Canada Resources, Mt.Klappan	0	1
Highmont Mines, Highland Valley	1	0
Island Copper Mines (Utah Mines)		
Port Hardy	0	1
Newmont Mines Ltd., Similkameen	2	0
Noranda Mines Ltd., Boss Mountain	1	0
Quintette Mines Ltd., Tumbler Ridge	0	5
Scottie Gold Mines Ltd., Stewart	0	2
Silvana Mines Inc., Sandon	1	0
Teck Corp. Ltd., Bullmoose	0	1
Texada Mines Ltd., Gillies Bay	2	0
Westar Mining Ltd.,		
Greenhills	0	2
Balmer (Kaiser)	1	3
Wesfob Mines Ltd., Tasu	2	0
Westmin Mines Ltd., (Western Mines)		
Myra Falls Operations	4	3
Westroc Industries Ltd., Invermere	0	1
Totals	24	27

ACCIDENTS CAUSING DEATH OR INJURY - CLASSIFIED

The following tables classify the accidents causing death or injury by year, which were reported to the Branch. The accidents are classified as to: cause, occupation, and parts of the body injured.

ACCIDENTS CAUSING DEATH OR INJURY
CLASSIFIED AS TO CAUSE

CAUSE	1981		1982		1983		1984		1985	
	No.	%	No.	%	No.	%	No.	%	No.	%
Atmosphere	4	0.6	19	3.7	10	2.2	2	0.5	6	1.6
Explosives	17	2.6	0	0	0	0	0	0	1	0.3
Falls of ground	49	7.6	28	5.5	31	7.0	35	8.9	30	7.7
Falls of persons	170	26.4	161	31.4	148	33.2	110	28.1	112	29.0
Lifting and handling material	162	25.1	101	19.7	93	20.8	77	19.6	96	24.8
Machinery and tools	134	20.8	117	22.9	99	22.2	99	25.3	59	15.3
Transportation	30	4.7	38	7.4	32	7.2	47	12.0	62	16.1
Miscellaneous	79	12.2	48	9.4	33	7.4	22	5.6	20	5.2
Total	**645**	**100**	**512**	**100**	**446**	**100**	**392**	**100**	**386**	**100**

ACCIDENTS CAUSING DEATH OR INJURY
CLASSIFIED AS TO THE OCCUPATION OF THOSE INJURED

Occupation	1981		1982		1983		1984		1985	
	No.	%	No.	%	No.	%	No.	%	No.	%
Underground										
Chutemen	9	1.4	3	0.5	0	0	1	0.3	0	0
Haulagemen	46	7.1	12	2.3	22	4.9	14	3.6	25	6.4
Miners	99	15.4	60	11.7	54	12.1	101	25.7	56	14.4
Helpers	46	7.1	5	1.0	5	1.1	10	2.6	4	1.0
Timber and Facemen	15	2.3	14	2.7	14	3.1	9	2.3	12	3.0
Mechanics (electricians,) supplymen, welders, etc.	59	9.1	29	5.7	17	3.8	14	3.6	27	7.0
Miscellaneous	7	1.1	3	0.5	11	2.5	0	0.0	3	0.7
Total underground	**281**	**43.6**	**126**	**24.6**	**123**	**27.6**	**149**	**38.0**	**127**	**32.6**
Surface										
Mechanics, electricians, repairmen	94	14.6	151	29.7	118	26.6	100	25.5	122	31.5
Mill & crusher workers	88	13.6	81	15.8	47	10.5	46	11.7	18	4.6
Carpenters	10	1.6	26	5.1	15	3.4	7	1.8	9	2.3
Labourers, surveyors, construction, etc.	20	3.1	8	1.6	56	12.5	20	5.1	28	7.2
Miners, drillers	81	12.6	40	7.8	7	1.6	8	2.0	5	1.3
Vehicle drivers	15	2.3	35	6.8	54	12.1	53	13.5	71	18.3
Miscellaneous	56	8.7	45	8.8	26	5.8	9	2.3	9	2.3
Total surface	**364**	**56.4**	**386**	**75.4**	**323**	**72.4**	**243**	**62.0**	**262**	**67.5**
Total	**645**	**100**	**512**	**100**	**446**	**100**	**392**	**100**	**389**	**100**

ACCIDENTS CAUSING DEATH OR INJURY - CLASSIFIED
(Continued)

ACCIDENTS CAUSING DEATH OR INJURY
CLASSIFIED AS TO PARTS OF THE BODY

Location	1981		1982		1983		1984		1985	
	No.	%	No.	%	No.	%.	No.	%.	No.	%
Eyes	39	6.0	41	8.0	15	3.1	19	4.5	13	3.3
Head, face & neck	45	7.0	43	8.4	52	10.7	29	6.9	41	10.4
Trunk	212	32.9	100	19.5	196	40.2	159	37.9	147	37.4
Upper extremities	161	25	112	21.9	111	22.8	88	21.0	81	20.6
Lower extremities	171	26.5	104	20.3	106	21.8	120	28.6	99	25.2
General	17	2.6	32	6.3	7	1.4	5	1.2	12	3.1
Total	**645**	**100**	**512**	**100**	**487**	**100**	**420**	**100**	**393**	**100**

FATAL ACCIDENTS

FATAL ACCIDENTS, 1981

Jasminder Singh Thind: On January 7, 1981, Thind, 30 years of age, received fatal injuries while employed as a fourth-year apprentice heavy-duty mechanic at Fording Coal Ltd.'s Greenhills open-pit coal operation at Elkford. Death was caused by the ejection of the split rim of a wheel assembly when the wrong bolts were removed.

At the beginning of the January 7th day shift, Thind and Daryl Lockwood, a certified heavy-duty mechanic, were deployed by Acting Supervisor Alfred Kaye, to continue stripping down an L700 LeTourneau loader.

It is understood that both Thind and Lockwood had worked on the loader on previous occasions, thus Kaye gave no detailed instructions or advice as to how the task was to be carried out.

A sling, wrapped around the circumference of the tire and attached to a crane, held the wheel in place as Thind and Lockwood started to remove the bolts securing the wheel assembly to the axle housing.

The wheel assembly is a split-rim design consisting of a two-part rim base with two removable side rings. The two rim base segments and removable rings are held together by 16 19-millimetre-diameter capscrews. Forty-eight 25-millimetre-diameter capscrews are then used to attach the entire wheel assembly to the axle housing. Apparently, Thind removed all 48 of the 25-millimetre capscrews and, not realizing that the wheel assembly was now detached from the axle, proceeded to remove the 16 19-millimetre capscrews that were holding the split-rim assembly together.

At this time Lockwood, having returned to the air compressor to adjust its ouput for the heavy use of the air-operated wrench, heard an explosion and saw a great deal of dust. When the dust cleared Thind was found lying underneath the outrigger of the crane which had been located approximately two metres from the wheel.

Ralph Schelle, parked in his pick-up truck 30 metres from the accident, radioed for an ambulance and first aid assistance. First Aid Attendants Allen Elford and David Main arrived 5 minutes later and commenced cardiopulmonary resuscitation. At 3.10 p.m., Dr. Corneal of Elkford arrived and arranged for Thind to be transferred by ambulance to the Elkford Diagnostic Centre where he was pronounced dead at 4.07 p.m. Injuries included broken ribs, arms, and legs and a dislocated spine.

The investigation revealed that Kaye, being unfamiliar with section 255 of the Coal Mines Regulation Act, had not properly examined the work site and, therefore, had not given the mechanics detailed instructions or advice.

The investigation further found that several capscrews, both 19 and 25-millimetre diameter, were missing on the remaining wheels. Thind's apparent lack of knowledge of the construction and method of removal of the wheel assembly on the loader is, however, considered to be the prime cause of the accident. This was compounded by the fact that the acting supervisor had no knowledge of the specific task to be performed.

At the inquest held in Sparwood on February 17, 1981, the following verdict was given by the jury:

"Death was caused by the explosion of the split rim of a tire when improper bolts were removed from wheel assembly. The death was unnatural and accidental.

"We the jury recommend that contractors should be given a list of potential hazards on the property within their scope of work and the safety features involved in combatting these hazards.

"...a more frequent check by supervisors.

"That safety features not be passed along verbally and that safety manuals should be signed by employees as well as any contractors on the property.

"That all tires be deflated before being removed from wheel.

"Supervisors make sure that proper communication is relayed along the line."

Cameron Fowlow, 37 years of age, married and employed as a miner by Canadian Mine Enterprises, mining contractors developing Scottie gold mine, was fatally injured from a fall to the bottom of the 3000-level waste pass raise.

On the night shift of March 27, 1981, Fowlow and his partner, Hubert Weir, entered the mine on a man carrier. At about 8.45 p.m. they reached the 2800-level shaft station and were informed that the previous shift in their working place had blasted two 1.8-metre-long subdrift rounds at 7.15 p.m. leaving the drill header open and the air on after the blast.

About 9.00 p.m., Fowlow and Weir proceeded to the face of the raise in the Alimak raise climber. Fowlow told his partner to remain on the drilling platform and went to free the muck on the ladders. Planks were not placed between the drill deck and the footwall of the finger raise for freeing the muck and scaling the working place as was planned. When Fowlow was on the second ladder Weir heard the rocks coming down the raise and immediately after saw his partner passing the drill deck and falling 54 metres down the raise. The exact circumstances leading to Fowlow's loss of balance and ensuing fall were not witnessed by his partner.

Weir came down the raise, noted Fowlow lying face down below the Alimak subdrift, and immediately went down the manway to the 3000 level to stop the pulling of muck from the waste pass chute. The haulage operator, Barrie Cullum, and Weir went to the 2800 level to report the accident and secure the stretcher. The other chute puller, Joshua O'Shea, returned to the scene of the accident where he discovered Fowlow's body lying face down buried in the muck. He cleared the body from the surrounding muck, and checked for signs of life but found none.

Weir, after notifying his supervisor, Chris Coleman, returned to camp to summon the rescue party. Coleman secured the stretcher and first aid kit and accompanied by Cullum, N. Williams, and O'Shea returned to the accident scene, placed Fowlow on a stretcher, and transported him in a man carrier to camp.

First Aid Attendant Richard Gagne took oxygen therapy equipment and met the rescue party on its way to the mine camp. He examined the body but found no pulse or break. At approximately 10.45 p.m. the attendant and John Christensen transferred Fowlow to an ambulance and left for the Stewart hospital. They arrived at 11.30 p.m. and after an examination Dr.M. Guard pronounced Fowlow dead.

Although an investigation noted several safety hazards at the work site, none directly accounted for the accident. The Coroner's inquest found no blame and made no recommendations.

5. Some type of underground ambulance be devised and equipped.

6. Rock-bolting procedures be kept within 5 feet [1.5 metres] of the face.

7. Some means be available to ensure that crews are at proper strength."

FATAL ACCIDENTS, 1982

John Gal: On February 9, 1982, Gal, 52 years of age, sustained fatal injuries at the Cassiar asbestos open-pit mine, when the bulldozer he was operating rolled down an embankment.

At about 12.20 p.m. on February 9, following a major blast in the pit, Gal was instructed by Mr. Borsato, the Acting Blasting Foreman, to clear a layer of snow from the 6185 bench, the next area to be drilled on the north side of the blast.

At 12.45 p.m. the shifter, Mr. Bucar, visited the 6185 bench to drop off the No. 705 drill operator and to check on Gal's progress. Gal was operating the D-8 bulldozer at the north end of the bench.

At 1.40 p.m. Bucar parked on the 6140 bench where he could see smoke from Gal's bulldozer, which was then working approximately halfway along the blast area.

At about 1.50 p.m., G. Willis went to the 6185 bench to refuel Gal's D-8 which, at this time, was working at right angles to the face about one-third of the way along the blast area. Gal turned the machine parallel to the bench for refuelling.

Bucar went to the 6185 bench at about 2.20 p.m. but could not see the machine driven by Gal. Bucar turned around and drove to the 6140 dump to see if the machine was there. It was not, so he returned to the 6185 bench and drove to the south end of the bench following newly made bulldozer tracks. He parked the pickup, got out, and looked over the edge to the 6140 bench. There he saw the bulldozer lying on its side. He immediately radioed for help, and then climbed down to check on Gal, who was unconscious. He shut off the mast key (opening all electrical circuits) and, finding that he could do nothing more, climbed back to his pickup. There he radioed for a bulldozer to make a road into the accident site over the newly blasted rock at the 6140 bench. He then returned to the accident site. By this time other persons had arrived to render assistance to Gal. Cardiac pulmonary resuscitation was administered as soon as he was moved out of the machine. No pulse was detected at this time, but treatment continued for about 45 minutes until a medical practitioner pronounced Gal dead at 3.15 p.m. The body was removed from the site and taken by ambulance to the Cassiar hospital.

There were no witnesses to the accident.

It would appear that the machine was travelling in a southerly direction with the edge of the bench on the right-hand side of the machine when the hard crust of an overhang beneath the right track gave way, causing the machine to fall off the bench and roll at least 1 1/4 turns to the next bench 13 metres below. No conclusion could be reached as to the reason for the operator driving the machine into this area.

The machine was fitted with an approved R.O.P.S. canopy which withstood the fall without visible damage. It was noted that the seat belts provided did not appear to have been worn at the time of the accident.

The Coroner's jury recommended the following:

"1. Seat belt use in equipment fitted with R.O.P.S. should be stringently enforced.

2. There should be closer communication to ensure that machines are working in designated areas."

Michael Joseph Desforges: On April 29, 1982, Desforges, 34 years of age, was fatally injured at the Equity Silver mine.

Desforges was employed as a Mill Shift Supervisor responsible for the mill operation and the operating crew during the night shift. The accident occurred at a covered fine-ore stockpile 50 metres in diameter and about 15 metres high. The ore is reclaimed onto two centrally located conveyors, No. 8 and No. 9, by slot feeders located below the stockpile. Constant freezing problems exist during the winter period causing blockages at the slot feeders.

On April 29, Desforges began the shift at 8.00 p.m. assisting Jocelyn Gauthier in freeing large lumps of frozen ore at the feeders with tiger torches. He instructed Jacques Gauthier, the crusher operator, to assist Jocelyn Gauthier while he left about 8.20 p.m. to refill some propane bottles.

At approximately 9.00 p.m., Desforges arrived back and lowered two bottles of propane through the escape tunnel to Jacques Gauthier. Desforges then left; this was the last time he was seen alive.

At 11.30 p.m., Jocelyn Gauthier, returning from her coffee break to the slot feeder, noticed a hand dangling from the slot feeder on No. 8 conveyor. She panicked and ran for help. While she was away, Jacques Gauthier arrived, saw an arm and a head protruding from the slot feeder, and he also ran for help.

First Aid Attendant, Roger Cloutier, was summoned and he ordered a shutdown of operations, including the propane tiger torches which were burning the protruding parts of the body. Checks for signs of life on several occasions resulted in negative response.

The Maintenance Supervisor, Acting Mine Manager, and Safety Director were called to supervise recovery of the body which took approximately two hours. On arrival at the Houston Clinic at 4.00 a.m., Desforges was officially pronounced dead by Dr. Myles.

During the following investigation it was determined that Desforges had been in the habit of frequently entering the fine-ore stockpile to ascertain the condition of the ore feeding down into the slots below. Desforges' pickup truck was found parked on a ramp at the north end of the ore pile with the engine running and the driver's door open. There were footprints along the approximately 5-metre slope up to the edge of the concave muck cone. It would appear that Desforges had become trappped in the moving ore and gradually dragged down into the slot feeder. The hazard was well sign-posted and Desforges was aware of the hazard involved.

The Coroner's office decided that an inquest was not necessary. The pathologist's report determined that death was by asphyxiation due to suffocation in a cement-like substance.

Keith Gordon Cook: On October 21, 1981, Cook, 25 years of age, was fatally injured at approximately 1.10 p.m. at the Westroc Industries Ltd.'s operation near Invermere.

Mr. Cook was the driver of a Kenworth 110-tonne tractor trailer truck used to transport ore from the mine to the treatment plant and stockpile. All the trucks are radio controlled.

On October 21, the Mine Superintendent, F.W. Jarrett, ordered the trucks, by radio, to dump their loads onto the centre of the stockpile. This order was acknowledged by Cook. However, both he and another driver, N. Barrington, continued to dump on the edge of the stockpile. At lunch, mechanic G. Harrison replaced the transmission gauge and set up the Jacobs brake on Cook's truck. The incident occurred on the first load after lunch.

At approximately 1.10 p.m., Cook proceeded along the west rim of the stockpile. Tracks show he drove closer and closer to the edge, climbing the 0.5-metre berm. Several people heard him say "Here I go". The truck then rolled down the embankment. It is not known whether the truck had stopped to dump, or continued moving ahead off the stockpile. Mr. Rossi, a loader operator working at the toe of the stockpile, heard Cook's cry and drove his loader to the scene. Because of heavy dust, he could see nothing. Grabbing his fire extinguisher and calling for Mr. Hemmelgarn, they went to Cook's aid. There was no response from Cook. At this time the truck-shop mechanics arrived, turned off the ignition in the truck, tried but failed to get a response from Cook, and then removed the batteries.

The police (Constable B.L. Coldwell) arrived at about 1.15 p.m., and the ambulance at about 1.25 p.m. They required the "Jaws of Life" to remove the body from the cab.

During investigation it was brought to light that instructions given by radio are not acknowledged by those people concerned. Also, Cook did not have his seat belt on and it was the passenger side of the cab which was most seriously damaged.

The inquest jury's findings were as follows:

> "Keith Gordon Cook came to his death on 21st October 1981, at approximately 1.00 p.m. Place of death was Westroc Industries stockpile north of Invermere. Cause of death, multiple brain contusions. The category was 'Accidental'. By what means in our consideration the deceased misjudged the position of the unit in relationship to the edge of the dump site, consequently because of the position we consider that the edge collapsed causing the unit to roll down the stockpile causing fatal injuries to the driver. We recommend strict adherence to the Mines Act concerning safety of operators of vehicular equipment. Verbal confirmation of all radio messages by unit operators. The 5 ft. [1.5 metres] berm be maintained at all times. Possible revision of the Mines Act to cover all dump sites. Ministry of Mines legislate roll-over equipment for haulage trucks."

John Attila Molnar: On November 9, 1981, Molnar, 42 years of age, was fatally injured on the 2600 level of the Granduc mine where he was employed as a development miner.

At the beginning of the afternoon shift of November 9, Molnar and his partner, Yves Maciagowski, went to the 106-213 crosscut on the 2600 level. The face had been mucked out and partially scaled by the day-shift crew. Mine Shift Supervisor, Norman Mainer, examined the back and face for loose. Noticing some loose on the back of the drift, he asked Maciagowski to scale it down and sound the back. This was done and the face was marked at about 6.45 p.m.

Molnar positioned the jumbo and commenced drilling. Maciagowski, after bringing explosives for the round, proceeded with a scooptram to the 106-914 drift and then to the 2600 level shop. At approximately 7.15 p.m. shop mechanic Wayne McGillivray came to the 106-213 crosscut to change the feed motor of the jumbo. He noticed two drills running and Molnar lying unconscious and partially covered with rock near the face of the crosscut. He removed large rocks from Molnar's head and smaller pieces covering the body. As his head was in the water, he lifted it, checked for signs of life and, finding none, left to report the
accident.

The First Aid Attendant, Glen Mathews, arrived at the accident at about 8.00 p.m. and, after thorough examination, found no signs of life in Molnar. The victim was evacuated and transported by ambulance to the Stewart hospital. An emergency evacuation helicopter with Dr. Mase aboard met the ambulance en route to the hospital. The doctor examined Molnar and pronounced him dead.

The Mine Inspector and the R.C.M.P. Constable carried out an investigation the following morning. The investigation revealed that a triangular-shaped loose near the face at the centre of the crosscut fell and caused Molnar's death. The width of the crosscut at the face was 8 metres. It represented a regular round 5 metres wide and a 3-metre slash. The work place had been properly scaled and sounded for loose. Presence of a mud seam was visible on the portion of the back from which the loose fell. Rock-bolting on the back and walls was approximately 8 metres away from the face. Molnar had been working near the face while two jumbo rock drills were running.

On December 10, 1981, a Coroner's jury determined that John Attila Molnar's death was accidental and attributable to a fall of rock causing massive crushing of the head and chest.

The jury found that:

"1. The crew and supervisor had carried out proper scaling procedure prior to commencement of work.

2. The loose rock may have been caused by vibration from drilling or a geological fault or the extra width of that point on the curve.

3. The first aid attendant was hindered from reaching the victim by equipment being parked in the way. The emergency equipment was not immediately accessible. Time was wasted on preliminary communications.

4. The reason the victim was at the face has not been adequately determined."

The jury made the following recommendations:

"1. No person should work on the face without a second person in the immediate vicinity.

2. No person should work on or approach the face without shutting down all equipment in the heading.

3. First aid equipment is to be placed in such a way that the attendant will be able to pick it up upon leaving the First Aid Station.

4. A form of emergency communications to be set up that would not require any time to be wasted by the first aid attendant in an emergency situation.

John Henry Potvin: On May 11, 1982, Potvin, 24 years of age, was fatally injured at the Sullivan mine of Cominco Ltd. when an uncontrolled flow of mud and rock inundated a crusher chamber.

At about 11.30 a.m., Brent Patterson, Supervisor, instructed Potvin to go down to the 2500 crushing chamber and wait for the Training Supervisor, Art Giles, and a helper. They planned to pull the crushing chamber pocket.

At about 12.00 noon, Patterson contacted Giles and told him to take a mucker to the 2500 crushing chamber to start crushing, stating that Potvin was also on his way. The pocket had previously been emptied on April 20, 1982, but since that time 672 tonnes of ore, 69 tonnes of clean-up, and 196 tonnes of mud had been deposited behind the crushing chamber gate. A small trickle of water was also entering the crushing chamber pocket via the ore pass. It is assumed that the material in the pocket retained additional moisture from this source up to the time the accident occurred, thus becoming extremely fluid.

On arriving at No. 10 conveyor belt leading from the 2500 crushing chamber, Giles saw the material on the belt and knew something was wrong. On going directly to the crushing chamber he found the room inundated with mud and Potvin lying on the crusher control catwalk. The time was about 12.55 p.m. No pulse was evident and a radio was used to summon help as the telephone had been damaged.

The jury recorded a verdict of unnatural accidental death due to a massive skull fracture, with the following recommendations:

"1. Improve communications upon local, unusual, or dangerous situations.

2. Improve control of fluid muck as recommended by Mr. Boyle, Operating Superintendent, Sullivan mine, and other engineers as outlined below.

(A) Visual assessment of muck at 2600 level before start-up.

(B) Redesign of chute assembly to retard uncontrolled flow of muck by chains and grizzly bars.

(C) Protective guard and escape route for operator."

Gunter Gros: On May 17, 1982, Gros, 47 years of age, was fatally injured at the Scottie gold mine, between 11.30 a.m. and 12.15 p.m. at 32-101 stope.

Gros and his partner, Laszlo Rada, had received instruction to drill 2.4-metre-long upper holes approximately one metre apart. Rada talked with Gros, at approximately 9.30 a.m., about moving muck away from the nearby 32-98 raise as it was hindering Gros in his work. Rada was to drill two more holes and then set up the scraper to remove the muck. At about 11.00 a.m. the Shift Supervisor, Jim Szakacs, visited 32-101 stope and noticed bad ground conditions. He told Gros to stop drilling immediately and proceed to scrape the muck lying underneath the raise. Gros wanted to continue to finish the drill hole but was instructed to discontinue and to commence scraping and tramming the muck on 3200 level, as there was a large loose slab on the back in the area where he was drilling. He agreed to stop drilling and commence scraping and tramming the muck.

The Shift Supervisor left Gros' working place and proceeded to the other end of the stop where Rada was drilling upper holes. He discussed the scraping and tramming with Rada and decided that Gros would tram the scraped muck. The supervisor did not return to the east end where Gros was working but went to a lower level.

At about 12.20 p.m., Rada went to the east end of the stope subdrift and found Gros lying unconscious under a heavy slab of rock near the muck pile. He also noticed the stoper drill still running, covered by other slabs of rock. Seeing no signs of life from Gros, he proceeded to report the accident to his supervisor and cagetender, Mr. McKee, who in turn summoned the rescue team.

At 12.45 p.m., Szakacs, Rada, McKee, and two other miners arrived at the scene of the accident and were just able to lift the slab from the injured man. The rescue party could find no pulse after examining Gros. Gros was then transported out of the mine, and again checked for signs of life before being brought by ambulance and helicopter to the Stewart hospital. At 1.45 p.m., Dr. M. Guard officially pronounced Gros dead.

Findings during the investigation substantiated the fact that loose rock existed at the back of the subdrift. The entrance to the working place was obstructed by a muck pile, and the working place had not been scaled or rock-bolted prior to the commencement of drilling. The large rock covering Gros measured 4.9 metres by 1.37 metres by 0.15 metre with an estimated weight of one tonne. Two other large slabs of rock were lying nearby, the full area extending over 4.5 metres. The average width of the subdrift was 2.6 metres, with loose ground evident at the time of the investigation.

The Coroner's jury recommended the following:

"1. A specific safety program and supervision structure be incorporated into the daily operation of Scottie gold mine and that a system be developed to monitor and ensure this occurs.

2. The management of Scottie Gold Mines Ltd. review the inventory of safety equipment and ensure that adequate supplies are maintained and readily available.

3. More rigid disciplinary procedures be developed and enforced, especially regarding safety procedures and/or supervisor's instructions.

4. A certified industrial first aid attendant be required to fulfill all necessary procedures and actions occurring in any serious accident."

William W. Sharpe: On May 26, 1982, Sharpe, 34 years of age, sustained fatal injuries at the Quintette Coal Limited's Sheriff mine project, when he was crushed between two drilling machines being manoeuvred for repairs.

Prior to the accident, which occurred at 11.10 a.m., the two drills were being moved down to the Geddes Contracting Ltd.'s maintenance shop area, the rockwork having been finished on the mine road. Sharpe's drill required some hydraulic and electrical repairs and was stopped in the vicinity of the shop.

The drill was to be washed down before repairs were carried out. Sharpe's drill required a boost as the batteries were dead. The second drill, operated by D. Carlson, came into the area at that time and C. Person, master mechanic, decided to use this to boost Sharpe's drill. Carlson's drill was backing up to Sharpe's drill on an angle. Both Person and H. Hauer, mechanic apprentice, stated they saw Sharpe standing in the clear alongside his drill.

Person, fearing that because of limited visibility to the rear that Carlson's drill might run into the other drill, went alongside the cab of Carlson's drill and motioned him to the left so as to be parallel with the other drill.

Carlson stopped momentarily, and at this time Hauer, who was approaching from the shop, said that the drills were about 30 centimetres apart. Also at this time, J. Wasylenko, mechanic, was standing at the rear of Sharpe's drill, and saw Sharpe move in between the two drills, pick up the loose ends of the jumper cables, and reach toward him with the ends. Carlson's drill began to move back and turn, catching and crushing Sharpe at chest level between the two drilling machines. A shouted warning from Wasylenko was too late.

Both Wasylenko and Hauer rushed to the front of Carlson's machine to get it moved forward. Sharpe was found lying on his back. Aid was summoned by radio and Kilborn Engineering's first aid attendant responded within minutes. D. Lamb, First Aid Attendant, checked for vital signs and received no response, even after ventilation was attempted.

It would appear that when Carlson's drill stopped momentarily to receive instructions from Person, Sharpe assumed that they were ready to connect the booster cables. He moved in between the two drills to pick up and hand the ends of the booster cables to Wasylenko just as the Carlson drill started moving, crushing him between the bumper of Carlson's drill and the side rail of his own stationary drill.

Esko Riikonen: On June 20, 1982, Riikonen, 49 years of age, was fatally injured by a fall of rock at the Westmin Resources Ltd.'s H-W shaft. Riikonen was employed by MacIsaac Mining and Tunnelling as Shift Supervisor and had started his shift at 3.30 p.m.

The next shaft bench was drilled and blasted at approximately 7.30 p.m. following installation of rockbolts and straps. While the blasting fumes were being cleared a meal break was called. Riikonen and J. MacDonald then went down the shaft, and scaled some loose rock from the shaft sides, before commencing to unhook and fill the first bucket.

At approximately 8.50 p.m., both men stepped back to the side of the shaft to allow the Riddell mucker to fill the bucket. Just at that time a large piece of rock 1.2 metres by 0.75 metre by 0.22 metre, with a broken strap attached, fell approximately seven metres from the side of the shaft above the 450 station, striking and fatally injuring Riikonen and knocking MacDonald unconscious. MacDonald recovered consciousness and was assisted to the surface in the sinking bucket and transported to hospital. E. Ellis, First Aid Attendant, carried out a physical check of Riikonen and found no pulse or respiration but a large gash to the back of the head. Riikonen was placed on a stretcher and brought to the surface and then to hospital. It is assumed that the blast had further loosened the piece of rock, and that Riikonen and MacDonald had missed this loose piece of rock during the scaling operation prior to mucking. Within the area where the rock had been dislodged was a drill hole with a rockbolt shell still in place. The bolt had not been sheared off but appeared to have been removed for some reason. A similarly sized hole was in the large piece of rock that fell.

The company agreed to implement the measures listed below:

"1. Scale the area below the blasting set and bolt more thoroughly.

2. Screen more of the area around every brow.

3. Make more use of shotcrete.

4. Investigate the use of four-inch [10-centimetre] screen in conjunction with shotcrete.

5. After each shaft station has been cut and before shaft sinking is started again, the blasting set will be lowered and the brow and upper area will be scaled thoroughly."

Allan Gibson: On November 2, 1982, Gibson, 46 years of age, was fatally injured by a fall of rock at Westmin Resources Ltd.'s H-W shaft. Gibson was employed by MacIsaac Mining and Tunnelling who was contracted to sink a 4.26-metre by 6.4-metre rectangular five-compartment shaft and do the initial shaft station excavation.

The shaft had been sunk 645 metres below the surface to a point just below the 25 level or crusher level. The shaft is advanced by a benching technique using Riddell muckers and 2.54-cubic-metre buckets to hoist the broken muck from the shaft bottom. Ground support consists of installing a complete horizontal ring of 1.5-metre bolts and 6.3-millimetre by 152.3-millimetre by 1.5-metre straps approximately every metre. In poor ground conditions, 2.4-metre-long bolts are used. The bolting is done as the shaft proceeds so that it is always within 1.2 to 1.5 metres of the shaft bottom.

The bolting had been carried close to the shaft bottom in the usual manner and the last timber set had been installed 15.2 metres from the shaft bottom. The graveyard shift coming off duty reported that they had blasted a bench on the shaft bottom, the initial 25 level station round, and the station brow, that had been previously drilled off. The day shift crew then proceeded to the headframe and waited for the blasting fumes to clear before proceeding to the shaft bottom at approximately 8.00 a.m. It was planned to level the muck pile with the Riddell mucker and then drop the birdcage to the muck pile to scale and rock-bolt the newly blasted station brow. This calls for the moveable steel working deck to be slowly lowered with the shaft
crew on it checking and scaling the shaft walls as it is lowered.

B. Schlosser started levelling the muck pile with the No. 2 Riddell mucker; during this operation one of the left cables broke on the Riddell mucker. He directed M. Koskela and A. Gibson to go to the bottom to repair the cable. During the repair of the cable and without warning, approximately 75 tonnes of rock fell from the west wall of the shaft. Koskela managed to jump away from the falling rock and in the process was pushed into the southeast corner of the shaft behind the spare bucket by the force of the falling rock and the No. 1 Riddell clam. He suffered
only minor bruises and scratches to his right leg. Gibson, who was more to the centre of the shaft, was completely buried and crushed by the massive fall of ground. The time was 8.15 a.m.

Gibson's body was recovered and brought to the surface at 10.00 a.m. and sent to the Campbell River hospital.

On examining the scene of the accident, the right-hand side of the west shaft wall had fallen a vertical distance of 5.5 metres from above the station brow and to a depth of 2.4 metres from the normal shaft wall position. A piece measuring 4.5 metres by 2.4 metres by 1.8 metres thick, and weighing approximately 60 tonnes, fell as one piece with rockbolts still installed.

Examination of the wall from where the rock fell revealed a series of parallel slips striking at about 45 degrees to the shaft west wall and dipping at 55 degrees to the north. It would appear that when the station round was blasted, the wedge-shaped piece was undercut, and with little or no strength on the slips the large piece fell out.

The following procedure was implemented by the company:

"1. All bolts shall be a minimum 2.4 metres in length. Longer bolts to be used where conditions warrant.

2. Resin rebar rockbolts shall be used in the shaft and station brows in an effort to obtain more effective ground support.

3. Reinforced 1.2-metre concrete rings shall be installed at 2.1-metre centres from the 297 to the 25 level. Any loose rock to be scaled or blasted down and rebolted prior to the installation of the concrete ring.

4. The station brow to be concreted and supported on reinforced concrete walls from the brow to the station floor.

5. The shaft shall be checked and mapped by a competent geologist with a view to detecting geological structures that could cause deterioration of ground integrity. Concrete rings shall be poured in the shaft if conditions warrant it.

6. The two remaining stations to be cut shall be concreted with four reinforced concrete rings at 2.1-metre centres as the excavation is advanced.

7. All station brow backs and walls shall be carefully examined, scaled, rebarred, shotcreted and/or concreted as conditions warrant.

8. A weekly shaft inspection shall be commenced with the view to detection of any deterioration of shaft walls, station backs, brows and walls."

Richard R. Quibell: On December 8, 1982, Quibell, 23 years of age, sustained fatal injuries when the trailer load of ore material he was dumping, at the David Minerals Ltd.'s HB concentrator operation, toppled onto the cab of his truck. Quibell was the driver of a 1977 Mack highway truck, model RS797LST, G.V.W. rating 38 200 kilograms, owned by Rutherford Trucking Ltd. of Wasa and leased to Salmo Transport Ltd. of Salmo. The truck was pulling a 1977 Arnes, end dump trailer, hauling mill feed from the War Eagle waste dump at Rossland to the HB concentrator for milling.

At about 12.30 p.m., Quibell had backed the loaded unit up to the coarse orebin grizzly for dumping. Due to the 15.55-metre length of the unit and due to there being only an 11-metre length from the edge of the grizzly to a bank running parallel with the edge of the grizzly, the cab was left at an approximately 90-degree angle to the trailer prior to dumping.

T.A. Castle, a witness to the accident, stated that Quibell backed his vehicle into the dump area, got out of the cab, and checked around the vehicle. Quibell then got back into the cab and raised the box of the trailer to dump the load of ore. The ore did not run from the box, possibly due to being frozen, as observed during the investigation. Castle called to Quibell asking him if the tailgate was open; no reply was given. Quibell lowered the box, then lifted it quickly, presumably to try and free the load. The box, full of ore, fell to the left over and onto the cab of the truck, striking the cab behind the driver and crushing it down onto Quibell.

No mechanical failure was found, only damage caused by the twisting of the trailer and box. The tailgate latch was, upon investigation, operable with the remaining air still left in the air receivers on

the trailer. The marks which the tailgate pins made in the gussets covering the latch when the trailer fell on its side, pushing the tailgate in an upward direction, proved that no problem existed in this area.

The Coroner's jury concluded that the accident was caused by:

"1. The unit being dumped in a jack-knifed position.

2. The site in question being inadequate for the type of unit involved.

3. Inexperience of the operator with this type of equipment."

The jury recommended that:

"1. Signs be posted at dump sites to avoid dumping of these units in a jack-knifed position.

2. The dump site in question should be extended to facilitate tandem trailer dump units if these units are to be used in the future.

3. The driver training programs and manuals* should stress safety factors concerning the safe operation of specific equipment.

4. More permanent safety and operation decals to be attached to any unit requiring specific safety measures.

*Department of Mines, Department of Transportation."

FATAL ACCIDENTS, 1983

Harry Makiev: On January 7, 1983, Makiev, 48 years of age, received fatal injuries when he fell approximately 24 metres from a conveyor loop take-up tower to the ground at the B.C. Coal Ltd.'s (Westar Mining Ltd.) Greenhills open-pit project.

Makiev, one of a team of ironworkers, was employed by the Foundation Company of Canada. The accident occurred during the delivery of steel plate punchouts to the counterweight of a conveyor loop take-up, housed in an enclosed tower. The punchouts had been delivered to the site in 200-litre (45-gallon) barrels by the conveyor manufacturer. A 20-tonne crane was to be used to hoist the barrels to a window 24 metres above ground level, and a chute had been fabricated leading from the window opening inside the tower down to the counterweight container.

Shortly after 1.00 p.m., Makiev and M. Lanktree were sent to secure the flooring at the second floor level of the tower. During this time the barrels, which had been delivered to the base of the tower, were being prepared for lifting. A dynamometer was used to weigh the barrels to check the adequacy of the crane and the jib angle. The first barrel to be lifted contained 1000 kilograms (2210 pounds). This checked with a previous weight marked on the barrel despatched from the factory. The choke method had proved unsuccessful when the barrels were being lifted from a truck to the base of the tower, therefore two 6.06-metre slings were used to attach the barrel, via the shackles through the holes in the rim of the barrel, to the crane hook. This had been suggested by the crane operator so that the ball of the hook would not damage the cladding on the side of the tower building. The slings were too long on the first lift, as the crane jib could not be extended high enough.

The intention was to lift the barrel to the tower window and set it on the window ledge. Makiev and Lanktree, who had been told to go to the tower window prior to the lift to receive the barrel, were then to burn a hole in the bottom of the barrel and allow the punchouts to run down the chute into the weight container. The same torch was to be used to loosen the frozen punchouts if necessary.

To attempt the second lift, the barrel was lowered to remove one of the slings and double up on the other. Makiev requested a shovel be sent up on the barrel so a long-handled shovel was put through the eye of the sling. At about 1.30 p.m. the barrel was again lifted up to the window level. Makiev attempted to free the shovel, the handle of which had been nipped in the eye of the sling. Failing to free the shovel, he climbed onto the window ledge 1 metre above the upper floor of the tower and placed one foot on the barrel. Holding onto the sling with one hand, he attempted to dislodge the shovel with the other by shaking and twisting it. The shackle tore through the metal at the top of the barrel, allowing it to fall to the ground. Makiev, with his weight on the barrel and holding the sling, also fell to the ground and landed on his back in about 150 millimetres of snow, 4 metres away from the base of the tower, beside the barrel.

A radio was used to summon R. Brhem, First Aid Attendant, who arrived 2 to 3 minutes later and proceeded to render first aid until the ambulance arrived. Makiev was transferred to the Elkford Clinic where staff and three doctors were waiting. At 2.09 p.m. Makiev was officially pronounced dead by Dr. Ketene.

Cause of death was reported as a combination of torn heart and aorta. The jury found that:

"1. Very poor safety procedures were being enforced at the time of this accident, specifically:

(a) lack of good communication regarding safety
(b) inadequate supervision due to inexperience with barrel-lifting procedures.

2. The victim was ultimately responsible in the cause of his death by not applying proper safety procedures."

The jury recommended that:

"1. There is continued encouragement in the use of safety belts in appropriate situations.

2. All holding barrels should be lifted with an appropriate safety cage. The design of these cages should be engineered for safety and maximum load. The maximum capacity load of these cages should be clearly and legibly labelled.

3. All hand tools should be lifted up in a separate closed container (basket type).

4. The Mine Inspector should further check into the safety levels of Foundation and other companies on the Greenhills minesite.

5. Individual responsibility for safety must continually be stressed to all workers. B.C. Coal be encouraged to take a leading role in promoting safety in all aspects of mine work."

Martin Hruby and *Jack Dodsley*: On January 28, 1983, Hruby, 59 years of age, and Dodsley, 48 years of age, were fatally injured at the Balmer South hydraulic mine of B.C. Coal Ltd. (Westar Mining Ltd.).

The two men were working in the 20 sublevel of the underground mine as monitor operators engaged in cutting coal by means of a hydraulic monitor. The seam was 16.5 metres thick, inclined at approximately 45 degrees. The monitor projects a concentrated high-pressure jet of water to cut the coal.

Prior to the day shift commencing, workers at 20 sublevel were ready to extract coal by means of the hydraulic monitor, 19 sublevel was rocked out, and 21 sublevel pulled back ready to cut if required. The work began in 20 sublevel at about 8.30 a.m.

B. Watkin, the day-shift fireboss, contacted the workmen in each sublevel, who reported no problems. Watkin then travelled into 21 sublevel to see J. Smith and K. Kosiora. They were changing the nozzle on the monitor in preparation to start cutting, in the event that 20 sublevel working area became blocked with rock, stopping the flow of coal. At approximately 9.15 a.m., a distant rumble was heard as the area weighted. The rumble was longer than normal. Smith commented that 20 sublevel waste area had probably caved. After an estimated two to three minutes, a second more violent rumble was heard. It shook the sublevel and
was accompanied by a bang, then more rumbling.

The air in 21 sublevel moved violently in and out, knocking the three men off their feet. This also raised a lot of dust and tripped the auxiliary ventilation fan. A reading by Watkin showed a 2-per-cent methane content in the air. Watkin then telephoned and instructed F. Petras, the operator at coal processing 2, to shut off all the high-pressure water to the sublevel. Watkin then telephoned 20 sublevel but got no reply, only static. He then telephoned 19 sublevel; on the second attempt he contacted D. Bertcotte. Bertcotte said that he and the other men were at the bottom of 18 sublevel and they were not injured. They had been forced out of 19 sublevel by a blast of hot air and a lot of dust. Watkin then ascertained the whereabouts of his materials men and electrician, and brought J. Smith and K. Kosiora out of 21 sublevel to the bottom. At the junction of 21 sublevel and 4 slant, the ventilation had returned to normal.

Watkin instructed Petras at coal processing 2 to contact C. Hall, General Mine Foreman, and M. Fisher, Mine Manager, to come into the mine. He then attempted on two occasions to locate the two missing persons in 20 sublevel, accompanied by several of the other workers. The auxiliary ventilation system had been disrupted, items of equipment were found out of their normal position, and the sublevel was partially blocked with debris. On both occasions they had encountered dust in the atmosphere and a smell of sulphur but no flammable or noxious gases. As some of the workers complained of being sick, it was decided to return to the surface rather than attempt to travel further into the 20 sublevel.

The workers were told to leave the mine and one of them was designated to take a sick worker to the first aid station. Hall and Watkin returned to 20 sublevel taking O2, CH4, CO, and NO readings as they proceeded. While passing the monitor cab, observed earlier, they found the body of Hruby alongside the flumes. Dodsley was found further up the sublevel at the side of the roadway 54 metres from Hruby. Both were apparently dead. The Acting Coroner, Dr. Graham, gave permission to the mine management to pronounce the two men dead. Before the site of the accident was
disturbed, an investigating party went into the mine.

The party included the Coroner, an R.C.M.P. officer, United Mine Workers of America representatives, B.C. Coal management personnel, and R. Booth, Inspector of Mines.

At the inquest the jury found that the causes of death were brain and head injuries; the category of death was accidental, caused by a major air blast resulting from a massive rock fall. The blast caused the deceased persons to be hurled to their deaths and buried in coal, rock, and dust. The jury recommended:

> "1. Continued collaboration between the coal company, union representatives, and Ministry of Mines to ensure a proper level of safety be maintained.
>
> 2. B.C. Coal refer to the consultant's report and explore an additional air roadway with sublevel ventilation."

Phillip Bouchard: On March 5, 1983, Bouchard, 43 years of age, was fatally injured when he fell during construction work at the Coal Preparation Plant for the Quintette Coal project.

Bouchard was instructed by his foreman, Peter Bang, to install guardrails on stairs and landings at the 955.6-metre elevation, that is, 45.9 metres above ground level. Guy Hachey, a foreman elsewhere on the construction site, stated that Bouchard spent the morning at ground level gathering material to be used on the job. After lunch, at about 2.00 p.m., he went up to the 955.6-metre level to start fitting the guardrails.

At approximately 3.00 p.m. he was assigned an apprentice, Collin Bryant, to assist him with the installation. After five pieces of handrail had been fitted to the stairs, the foreman, Peter Bang, told them to install a 75-centimetre piece of railing at the top of the stairs on the edge of the landing. The prefabricated piece of guardrail would not fit into position due to the kickplate fouling the first of two planks on the landing area acting as a temporary platform. To overcome this, two buckets of bolts were moved from the first to the second plank and the former was pulled back slightly from the 10-centimetre channel iron to allow room for the kickplate. The second plank was not moved. The buckets were then transferred back to the first plank. Bouchard picked up the handrail, and told his apprentice to make ready with a bolt. Bouchard walked onto the second plank (this plank had wooden cleats attached which were facing upward), carrying the guardrail to the place for positioning it. As he reached the end of the plank he lost his balance and fell to the ground, 45.9 metres below. The opposite end of the plank tipped up in the air and lodged itself on a wire rope overhead. The time was approximately 4.30 p.m.

As Bouchard fell he shouted "Pete", the name of the foreman. Peter Bang stated that as he was climbing the stairway from 952-metre level to give Bouchard further instructions he saw Bouchard walk onto the plank and fall to his death. On the way down, Bouchard struck a beam at 944.7-metre elevation.

Robert Cummings, employed by J.K. Campbell and Associates Ltd., was the first person to the spot where Bouchard landed. At approximately 4.30 p.m. he had been standing at the J.K. Campbell tool box talking with Dieter Dessau. They both heard a loud noise and a clatter and looked up to see Bouchard hit the ground. A piece of guardrail was seen to bounce off the side of the building and land on top of the victim, hitting the ground and Bouchard at the same time. Dessau ran to the First Aid Station and Cummings to the victim to remove the guardrail from the body. Margesson, an ironworker, arrived on the scene and started artificial respiration, while Cummings tried to take a pulse from Bouchard's left arm but could feel nothing.

Ronn Selnes, First Aid Attendant of J.K. Campbell and Associates, was the initial first aid attendant at the scene and thought he heard respiration from the victim. He felt for the carotid pulse but finding none immediately started cardiopulmonary resuscitation, assisted by several other workers. Gerald Rupp, First Aid Attendant of Quintette Coal Limited, prepared a spine board and checked Bouchard's pupils. Rupp felt at this time that there were no signs of life.

The doctor at Dawson Creek hospital pronounced Bouchard dead at 5.35 p.m. According to Bouchard's fellow workers, Bouchard was a good ironworker with about 22 years of experience. He had been in good spirits and seemed to have no personal problems. The weather conditions on the day of the accident were warm and clear, however the ground was still frozen.

From the investigation the following conclusions have been drawn:

1. The major causes of the accident were the failure to secure the planking which was being used as a temporary platform, thus allowing the plank to tip under Bouchard's weight, the failure to wear a safety harness and lifeline and the failure to provide a temporary guardrail along the decking.

2. There was no evidence to suggest that the deceased may have suffered from any sudden impairment because, as he slipped, he shouted out the name of his supervisor which appears to indicate that he was in full possession of his faculties.

3. The weather conditions would have played no part because the operation was inside the buiding and when inspected there was no evidence of moisture or ice in the vicinity.

At the Coroner's inquest, the cause of death was a ruptured heart and other multiple injuries. The category and means was recorded as unnatural as a result of accidentally falling approximately 46 metres to the ground while in the process of installing a handrail.

The jury recommended that:

> "Anything used as a temporary platform should be adequately secured. Further, there should be regular and continuous consultation between management, union and regulatory bodies regarding the application of Health and Safety Regulations on a given job site."

James Dunwoodie Fraser: On July 19, 1983, Fraser, 72 years of age, received fatal injuries when he fell 20 metres to the ground from the outside of a cylindrical steel surge bin.

Fraser, a journeyman painter, was employed by Dillingham Construction Ltd., and, at the time, was engaged in painting a welded seam. The ring girder on which he was working was 1.3 metres above a working scaffold which was supported by 81-centimetre brackets attached to the outside of the surge bin. The scaffold had 117-centimetre-high posts at the outer end through which ran two nylon ropes to act as a guardrail. The temporary decking consisted of three 5-centimetre by 25-centimetre by 3-metre planks straddling and tied to the brackets. Before commencing work Fraser had been told by the Dillingham area superintendent, Gary Marro, to make an assessment of materials and equipment for the job including safety belt and lines. Fraser was stated to have said that he never used a safety belt, but was advised that all necessary safety equipment was to be worn.

At approximately 9.55 a.m. several witnesses observed, at various stages of the accident, Fraser falling from the ring beam, either over or through the nylon fibre hand-rails, the bottom one being slack. Some of the witnesses prior to the accident had cautioned Fraser to use a safety belt or advised him to use a long-handled brush to carry out the task, but Fraser commented that he knew what he was doing. Sam Shalaby, the Hitec Construction ironworkers' Superintendent, after receiving the above comment, was in the act of alerting the Dillingham safety

personnel when Fraser fell to the ground. From the statements received, two possible causes were put forward. One that Fraser's foot came in contact with a bracket on the ring girder causing him to stumble and, the other, that as he was seen to look up he could have caught sight of the clouds passing across the top of the bin, giving him the impression that the scaffold was falling and causing him to lose his balance.

In falling to the ground, Fraser struck the third girder of the structure 6.1 metres above ground.

Joseph McLean, an ironworker who witnessed the fall, was one of the first workers to reach Fraser; he checked the neck pulse but could not detect any movement. Jeffry Calder, the Dillingham First Aid Attendant, also checked for pulse and breathing which were not evident. He then started cardiopulmonary resuscitation but discontinued this when he realized the extent of the chest injuries. It was concluded that Fraser was beyond help. A helicopter took Fraser to the Dawson Creek hospital where he was pronounced dead on arrival by Dr. David Clee at 2.15 p.m.

Recommendations:

"1. The requirements of sections 21(1) and 26 of the Mines Act must be strictly enforced. Workers and management have the same responsibility to ensure that all tasks are safely carried out.

2. The use of rigid guardrails as required under regulation 26(1) of the Coal Mines Regulation must be enforced.

3. Supervisors giving verbal instructions to personnel working in hazardous situations must ensure that they are carried out."

Wendy Hawthorne: On August 29, 1983, Hawthorne, 21 years of age, employed as a camp cook by Gulf Canada Resources Inc. at its Mount Klappan exploration camp, received fatal injuries when she fell from the back of a pickup truck.

At 8.45 a.m., Hawthorne left the cookhouse to return to the geological camp to collect her personal belongings before being flown out at approximately 10:00 a.m. She climbed into the box of a small pickup truck as there were two persons and the driver already in the cab. Steve McClemont, the camp First Aid Attendant, climbed in and sat to the left side of the truck box. Hawthorne elected to stand on a spare tire with her back against the truck cab. The truck had travelled approximately 100 metres along the British Columbia Railway right-of-way when McClemont warned Hawthorne about standing up. The warning was not heeded and Hawthorne remained in a standing position.

The truck driven by Craig Nogas, a geology student, had travelled 0.85 kilometre at approximately 50 kilometres per hour along the roadbed when it was slowed down to take a right-hand turn into the geological camp. Hawthorne lost her balance and was attempting to regain it when the truck went over some uneven ground just past the turn. This caused her to overbalance and be thrown out of the box of the truck. As she landed, her head struck the ground. Nogas stopped the truck and McClemont jumped out and ran to Hawthorne who was lying face down on the ground. She was unable to talk; blood was issuing from her mouth and nose. First aid and oxygen therapy were given by McClemont from the time of the accident until Hawthorne arrived at Dease Lake.

The accident occurred at approximately 8.50 a.m. and a helicopter was used to transport Hawthorne from the camp at 9.25 a.m. She arrived at Dease Lake at 10.02 a.m. and was taken to the Dease Lake Medical Clinic. After examination by a medical practitioner, she was transferred to the Whitehorse hospital as the helicopter did not have the range to travel to Terrace. On August 30, Hawthorne was transferred to the Prince George regional hospital where she remained in the

Intensive Care Unit in a coma until she died on September 12. The cause of death was recorded after the inquest as craniocerebral trauma and classified as unnatural and accidental.

The Coroner's inquiry did not make any recommendations, but the District Mines Inspector recommended that section 28.01 of the Workers' Compensation Board of British Columbia Regulations should be followed, that is, that no worker shall ride in or on any conveyance in a standing position unless protected against being thrown off balance, or ride with any part of the person's body outside any part of the conveyance.

The attention of companies is drawn to the fact that where helicopters are used to supply exploration camps, they must be capable of carrying patients to the most suitable medical facility.

David Roy Thorrougood: On September 7, 1983, Thorrougood, a 34-year-old millwright employed at Cominco Ltd.'s Sullivan mine concentrator, was fatally injured in the collapse of a 30.5-metre-long elevated semimobile stacker conveyor. The conveyor was located at the top of the Sullivan concentrator reject float rock disposal system.

Thorrougood was standing on the elevated end of the conveyor as it was being repositioned by a front-end loader, and fell approximately 12 metres with the conveyor section when the supporting structure collapsed. He was rushed to the Kimberley hospital where he subsequently died at 11 a.m. The cause of death was extensive internal injuries to the chest and abdominal areas, resulting in massive hemorrhaging.

On the morning of September 7, Thorrougood and an apprentice millwright, V. Hummelle, were assigned to radially reposition the end unit of the float rock disposal conveyor system. This unit, the last of a series of conveyors from the concentrator, is a semimobile elevated stacker conveyor mounted on a pair of dual truck-tire assemblies. The feed end of the conveyor is attached to a heavy skid plate assembly through a tri-axial pivot arrangement.

A motorized drive unit attached to the conveyor framework proved ineffective to radially move the conveyor. This necessitated the use of a loader for pushing or towing the conveyor through the desired arc of movement. (Longitudinal repositioning of the unit involved rotating the wheel assemblies to a position parallel to the conveyor, elevating the feed end and skid plate, and then towing to the desired location.) A cable sling, connected to the stacker and the loader, was used to move the conveyor unit.

Upon arrival at the loader at 9 a.m., Thorrougood hooked a 2.4-metre rope sling, made from two clevis-connected 1.2-metre wire-rope slings, between a hook on the loader bucket and a protruding pin on the stacker wheel assembly frame, to control the forward movement of the stacker when pushed by the loader. The usual practice was to use a clevis to secure the wire-rope sling around the stacker wheel assembly frame but, in this instance, it was not done.

Hummelle and the conveyor system operator, V. Hoang, removed the wheel chocks and stood by to replace them when the stacker had been moved the desired distance. The loader operator, K. Inness, was ready to move the stacker on the radial move by pushing with the loader bucket against the stacker frame. At this time, despite a warning not to do so by the loader operator, Thorrougood had started to climb the service walkway of the stacker conveyor, up to the delivery end, to oversee the repositioning.

Upon receiving Thorrougood's instruction, the loader operator gave the stacker a push. It rolled about 1.5 metres before coming to a halt, accompanied, however, by an unusual amount of swaying of the structure. Thorrougood, still at the top of the conveyor, called for another couple of feet of movement to correctly position the discharge point.

The stacker was again started in motion with a push from the loader, which was then backed up to remove the slack from the wire-rope sling. With the stacker moving down a 5.3-per-cent grade, Hummelle, standing on the downslope side and holding a wooden wheel chock, heard a loud noise, noticed the stacker jerk, and saw the restraining cable come loose from the stacker. He then threw down the timber to block the wheels, intending to stop further movement of the stacker. At this point, the entire conveyor structure toppled over in the direction of travel, tearing the wheel assembly loose from the connecting beam. The conveyor structure struck the ground for three quarters of its length, the last 7.6 metres breaking at the crest of the dump and pivoting to impact lower down on the side of the float pile. Thorrougood, despite an attempt to climb through the hand-rail and jump free, was carried down with the end of the conveyor.

First aid assistance was immediately rendered and Thorrougood was transferred by ambulance to the Kimberley hospital.

After a series of site inspections, an informal inquiry was convened on September 8 with Dr. A.W. Askey, Regional Coroner, as Chairman. Witnesses and others involved in the accident were interviewed and questioned by Dr. Askey and representatives of the R.C.M.P., Ministry of Energy, Mines and Petroleum Resources, United Steelworkers of America, and Cominco Ltd.

This preliminary investigation revealed the following:

"1. It was neither approved, necessary, nor common practice for an employee to be on the stacker assembly during a repositioning move.

2. The cable sling between the stacker and loader was insecure, again contrary to common practice. The cable became unattached during the move, preventing any control of the unit by the loader operator.

3. The supporting structure of the stacker conveyor failed at a series of poor quality welds between the wheel assembly connecting beam and the support beam."

Preliminary recommendations were:

"1. The rule prohibiting personnel riding the stacker conveyor while in motion be strictly enforced.

2. The support structure design of any subsequent stacker placed in service be modified to improve load-carrying capacity.

3. All structural welds be checked.

4. The method of moving the stacker be by using a solid draw-bar arrangement between the loader and the stacker, or by using a self-propelling drive unit; the present ineffective drive be redesigned to work effectively.

5. Before the stacker is moved, the surface area be smoothed and levelled."

A formal Coroner's inquest was scheduled for November 3. Due to striking government employees picketing the Court House, Dr. Askey cancelled the inquest. The Coroner's report on the informal inquiry held on September 8 is considered to be accurate and his recommendations agree with the preventative measures discussed and generally agreed upon by the various representatives. Cominco Ltd. is to act on all of the recommendations as detailed previously.

FATAL ACCIDENTS, 1984

Joseph Wenisch: Wenisch, 50 years of age, married and employed as a miner by Westar Mining Ltd. at the Balmer South hydraulic coal mine at Sparwood, was fatally injured on Saturday, February 4, 1984, when buried under a fall of ground.

On the day of the accident Wenisch, who was considered an experienced coal miner, was working with four other miners changing damaged coal transportation flumes. The group was lifting flumes out of a trench using a rope which passed over a wheel suspended from an arched roof support. This rope was being pulled by a diesel-powered supply vehicle. At approximately 11.45 a.m. Wenisch, who had taken the lead in this operation, was positioned close to the wheel. The rope was tightened and witnesses reported hearing a small bang and seeing Wenisch running. The arches were seen to come down and Wenisch was buried in the subsequent cave. Rescue efforts were immediately started; however, because of the difficulty of preventing loose coal from running into the roadway and the large volume of material to be moved, Wenisch's body was not recovered until 2.30 a.m. on Sunday, February 5, 1984.

During the recovery operations approximately 1750 tonnes of material (mainly coal) were removed from seven metres of roadway. This roadway was driven close to the hangingwall of a very thick, steeply dipping (40-degree) coal seam and was supported by "T.H." sections yielding arches. The mechanism of failure is thought to have been either a small movement of the arches releasing a large mass of coal which separated from the hangingwall, or a small movement of the arches being sufficient to cause a rapid yielding of arch clamps already loaded close to their yield point, or a combination of both. The yielding action of the arches allowed the interarch distance to increase, the struts failed in tension and lagging slipped from behind the arches, allowing fine coal to flow into the roadway.

At the inquest held in Sparwood on April 5, 1984, the verdict given by the jury was as follows:

> "We, the jury, serving on the inquest into the death of Joseph Wenisch have determined accidental death caused by multiple brain contusions and suffocation by being buried under a cave-in caused by the displacement of roof support.
>
> "We recommend that:
>
> "(A) The practice of pulling by using a diesel vehicle and a rope of inadequate strength should be terminated and the practice of lifting using a motive force such as a diesel vehicle, which is difficult to control, should also be terminated.
>
> (B) A standard procedure should be developed for lifting or pulling off arches. This procedure should include supervision, checking and re-torquing of bolts, and the setting of temporary support.
>
> (C) A review of the support system used at Balmer South Mine should be implemented. This review should include a study of the yielding characteristics of the arches; strutting arrangement of arches; and the material used to lag or cog the arches."

James Henry Stewart: Stewart, 32 years of age and employed by an industrial cleaning services company was fatally injured on April 25, 1984 by the explosion of a high pressure vessel.

At the time of the accident Stewart was standing adjacent to a tank containing a degreasing chemical under pressure which was being used to clean a P&H 2100 BLE shovel at the Bullmoose Operating Corporation open-pit coal mine. The force of the explosion blew Stewart about 5 metres from the side of the truck causing multiple fractures and lacerations of his body and limbs which resulted in his death.

On the afternoon of April 24, 1984, at approximately 1.30 p.m., Stewart and his partner, K. Donofrio, arrived with the chemical/steam cleaning unit at the Bullmoose mine. Before commencing work at about 2.15 p.m., they were supplied with Action 45-SRD, a chemical degreaser, to use in their equipment by Robert Berry, a maintenance foreman of Bullmoose Operating Corporation. They cleaned a front-end loader near the service bay without experiencing any problems. The cleaning unit was then moved to 1424 metre bench to clean the P&H shovel. At this time, approximately 5.30 p.m., the chain drive on the pressure pump broke. R. Donofrio, the owner of the unit, was called, and spare parts were brought to the mine from Fort St. John and fitted.

During the period from the time of the breakdown until they recommenced work, Stewart and K. Donofrio were idle for about seven and a half hours. They restarted at approximately 1.45 a.m., on April 25, 1984. At this time snow was falling and the temperature was about minus twelve degrees centigrade.

Stewart, when last seen by K. Donofrio, was adjusting the valves on the chemical tanks. Stewart's job was to heat the water for the steam cleaning operation whilst Donofrio sprayed the degreaser onto the boom of the shovel. Donofrio was spraying chemical on the far side of the shovel boom from the cleaning unit when he heard an explosion and he ran from the boom to the other side of the machine where he saw Stewart lying on the ground.

The cleaning unit, mounted on a truck, consisted of two water tanks of approximately 4 000 litres capacity and on top of each, a smaller tank was fitted. These smaller tanks had been manufactured to hold propane but were now being used as pressurized containers for chemical cleaning substances. Active Chemicals, the manufacturer of Action 45-SRD, was contacted to ascertain the active components of the degreasing fluid. Methylene chlorite, which has a boiling point of 36 degrees centigrade, and mineral spirits are the two major constituents of Action 45-SRD. The mixture has a high viscosity but will remain fluid to temperatures as low as minus thirty-three degrees centigrade. The
manufacturer stated that if heat was applied to the fluid, then rapid evaporation of the methylene chloride would take place, resulting in pressure quickly building up in a closed container.

An examination of the area around the truck and shovel revealed the following:

(1) Part of the tank containing the Action 45-SRD under pressure was found 12 metres from the truck on the east side.

(2) The pressure gauge belonging to this tank was found next to the sticks and bucket of the shovel, approximately 28 metres from the truck.

(3) The second chemical tank, containing CC17, was found two metres to the west of the truck.

(4) A propane bottle of 20 pounds capacity was seen on top of the two water tanks on the truck.

(5) A hose and thumb wheel, said by R. Donofrio to be part of the equipment attached to the propane bottle, was found some 50 metres to the east of the truck.

(6) A "Tiger" torch, said by R. Donofrio to be part of the equipment attached to the propane bottle, was found near the Bullmoose Operating Corporation crane, approximately 24-metres to the southwest of the truck.

(7) Clothing and a pool of blood was found on the ground five metres to the east of the truck, where, as stated by witnesses, Stewart landed.

Examination of the ruptured tank showed a bronze-coloured discoloration along the edge where the tank had burst open and the paint adjoining this edge appeared to be blistered.

It was concluded there were three possible causes for the explosion of the tank:

(1) Stewart could have been heating the chemical tank in an effort to make the degreasing fluid flow more freely, because it is possible that Stewart assumed that the flow of the mixture was impeded by the sub-zero temperatures. If heat was applied to the tank, the fluid inside would have boiled, building up pressure and causing a violent rupture of the tank.

(2) A second possibility is that the liquid boiled, built up a pressure, and caused a slight rupture of the tank, thus resulting in a "BLEVE" (boiling liquid expanding vapour explosion).

(3) A 1.3-centimetre pipe, which fed chemical under pressure to the spray hose, may have been knocked off the tank (possibly by Stewart dropping a wrench on it) causing a "BLEVE" type explosion.

Recommendations:

(1) All equipment in use at a mine shall be in compliance with the Mines Act and Coal Mines Regulations and shall be inspected by contractors and the mining company personnel before being allowed to operate on the property.

(2) Operators shall prepare a scheme to ensure that equipment entering the property is in compliance with the Mines Act and Regulations.

(3) All persons shall be made aware of the composition, characteristics and safety procedures of any chemical to be used before being permitted to use that chemical.

FATAL ACCIDENTS, 1985

Henry Joseph Desrosiers: Desrosiers, 42 years of age and employed by Island Copper Mine as a truck driver, drowned on January 9.

Desrosiers was seen driving his truck toward the waste dump at 1355 hours. The driver and the truck were reported missing at 1550 hours. A search of the dump area and of the repair shop was immediately made to see if the truck had broken down. A search was made of the waste dump, and at 1630 hours tire tracks and a small slough were found which indicated that the truck could have travelled over the dump and into the water. Rescue personnel were mobilized immediately for a land and water search. Divers entered the water at 1830 hours, and surfaced at 1850 hours reporting they had found the truck. A thorough and intensive search by 60 persons for four days on land, by boats and helicopters was made but the truck driver was not found. The truck was recovered, inspected by a mechanic and no deficiencies were found in the braking systems.

At the inquest held in Port Hardy, British Columbia on October 17, and the Coroner's jury ruled the death accidental with the following findings and recommendations:

"(1) Employers and employees take appropriate steps to aggressively pursue enforcement of the 30-foot dumping rule.

(2) There be no dumping over any bank which is more than three metres in height as set out in the Mines Act Regulation section 293(1)."

Kenneth Michael Kennedy: Kennedy, 23 years of age and employed at the Myra mine, Westmin Resources Limited, received fatal injuries when he was struck by a fall of loose rock on February 27.

Kennedy had approximately four years of underground experience and was undergoing school stope training with another mining trainee, Rene Primeau. Their instructor, Anton Christensen, a miner with 24 years experience, had planned, after a new cut was opened on February 22, to scale the area, drill pin holes, move the slusher and scrape to open the plugged mill hole. The area was scaled by the instructor and the two trainees throughout February 25, and for most of February 26.

On February 27, they continued scaling for about one-half hour, rechecked the area and considered it safe. The instructor decided to install two 8-foot safety bolts from the muck pile before drilling pin holes. Whilst the first of the 8-foot safety bolt holes was being drilled, a wedge-shaped piece of loose rock weighing approximately four tonnes and measuring 1.2 metres wide by 1.2 metres high by 2.4 metres in length dislodged from the brow of the raise and struck Kennedy a glancing blow as it fell to the floor. There was no prior warning of the fall given by any smaller pieces of rock falling in the area of the drilling operation. It was found that two slips in the strata came together in a "V" shape 1.5 metres above the stope back, and it was concluded that the vibration of the drill had caused the loose rock to fall.

At the inquest held in Courtenay, British Columbia on September 27, the Coroner's jury ruled the death accidental with the following findings:

(1) Drawings of the minesite given were not detailed enough.

(2) Insufficient room in stope.

The jury recommended that:

"(1) More detailed measurements from investigating agencies.

(2) Safety sprags should be used in the school stope.

(3) Eye bolts should be drilled before the blast in the school stope.

(4) Some classroom training be given before practical work undertaken."

Patricia Lynn Salter and *Brooklyn Brenton*: Salter, 21 years of age and Brenton, 43 years of age, employed by Quintette Coal Limited, received fatal injuries April 12 when the truck Salter was driving, and in which Brenton was an observing passenger, rolled down a steep bank.

The Wabco haul truck, HT116, was reversed approximately 36 metres down a 5.6-per-cent ramp with a 7-per-cent cross-grade which was under construction alongside an existing dump, at a point where the ramp was about 10 metres wide with a highwall on one side and a berm on the other. The right rear (blind side) wheel pushed through the berm causing the truck to roll over sideways and continue down the bank approximately 62 metres.

At the inquest held in Tumbler Ridge, British Columbia, July 10 and 11, the Coroner's jury ruled the death accidental and made the following recommendations:

"(1) Always build ramps wide enough to allow trucks to drive down forward then turn and back to the berm, in accordance with the Mines Act.

(2) Seat belts must be worn at all times.

(3) Berms be built of adequate material and kept at proper height, according to the Mines Act.

(4) Rescue crews and first aid attendants should be equipped with hand held radios so they can communicate with each other."

Raymond Edward Fontaine: Fontaine, 21 years of age, was fatally injured at about 1400 hours on November 19, at a surface diamond-drill site located 9.7 kilometres northeast of Topley, British Columbia.

Fontaine was hired by Bishop Resources Development Limited on October 15, and was employed as a drill helper. Previous employment records show that he had no diamond drilling or mining experience.

At the beginning of the shift of November 19, 1985, Fontaine and his partner, Kevan Ford Branner, arrived at the drill site at approximately 0830 hours. Diamond driller Branner started the engine to allow it to warm up and both men sprinkled rock salt on the icy floor and started the water supply pump and coil heater. They then pulled the rods and core barrel to replace the worn-out bit and began drilling at approximately 1030 hours. Shortly before the accident, Fontaine emptied a core tube requiring replacement of a lifter. Branner, after noticing him having difficulty removing the lifter, stopped the drill and helped Fontaine to remove the retainer ring and lifter from the case. Then he resumed drilling and turned towards the drum-type wood stove to check the damper.

Minutes before 1400 hours, Branner heard an unusual sound and after turning towards the drill, saw Fontaine being carried by the rotation of the drill rods with his clothing caught on the rods. Branner disengaged the clutch to stop the rotation of the drill rods. Fontaine was lying in a prone position on the floor between the rods and wall of the drill shack, facing the wall with his right arm under the rods, the left arm severed and his coveralls, warm jacket and underwear torn off.

Unable to find vital signs of life, Branner proceeded to Topley, B.C., approximately 9.7 kilometres south of the drill site, to notify the R.C.M.P. and the Inspector of Mines about the fatal accident. Sergeant A. Pritchard and Constable A.B. Witwicki of the R.C.M.P. and the ambulance attendants proceeded to the drill site where the examination of Fontaine showed no vital signs of life. The accident victim was transported to Houston B.C., where he was pronounced dead by the attending physician at approximately 1630 hours.

At the inquest held in Houston, British Columbia on February 13, 1986 the Coronor's jury ruled the death accidental and made the following recommendations:

> "(1) Mines Act, part 12, section 299(b) be amended to read: 'every revolving part shall be covered, enclosed or guarded with a substantial casing or railing'.
>
> (2) The Ministry of Energy, Mines and Petroleum Resources, in conjunction with the Workers' Compensation Board of British Columbia and the Canadian Diamond Drillers Association, compile and circulate a Safety Training Handbook similar to the Fallers' and Buckers' Handbook provided by the Workers' Compensation Board of British Columbia."

Norman Shufelt: Shufelt, 47 years of age, fell to his death on September 26, while working on a major construction project.

Shufelt was an ironworker employed by Northern Steel Inc., a sub-contractor for Dillingham Construction Ltd., the prime contractor for the construction of a new coal preparation plant and thermal dryer. The deceased had been working with a team who had just completed erecting some bracing on a roof truss. A hook on the crane line caught, shaking the roof trusses and when the hook sprung free, caused a pendular swing of the crane line and ball. Shufelt recovered his balance from the first shake but was struck in the back by the swinging hook, losing his balance and falling 14 metres to his death.

No inquest was conducted as the Coroner was satisfied with his inquiry.

Following the accident, prior to restarting work, the management of Dillingham Construction were instructed to ensure that the following points were reinforced with all employees:

> (1) Be alert to all hazards and never turn your back on a potentially hazardous situation.
>
> (2) All signals should be clear.
>
> (3) Should any operation not be completed by a coffee break, do not hurry. All employees will still get their break.

The following recommendations were made:

> (1) All persons working higher than three metres from the ground should be provided with some form of fall protection.
>
> (2) All regulations should be amended to provide for this.

DANGEROUS AND UNUSUAL OCCURRENCES, 1981-1985

Section 13 of the Mines Act requires that all dangerous and/or unusual occurrences, whether an actual injury occurred or not, at any mining operation, be reported to the Inspector of Mines within 24 hours of their happening. It is established that the detailed study of such occurrences and the wide dissemination of information about the causes can help to reduce future accidents. Consequently, the branch attempts to study and distribute the information as widely as possible.

The statistics concerning these occurrences are tabulated below, by year, for the 1981-1985 period. Condensed summaries of all occurrences are compiled and issued periodically by the branch.

DANGEROUS OR UNUSUAL OCCURRENCES
1981-1985

YEAR	METAL MINES		COAL MINES		OTHER	TOTAL
	SUR.	U/G.	SUR.	U/G.	SUR.	
1981	49	17	66	2	8	142
1982	82	20	19	0	10	171
1983	41	13	52	1	5	112
1984	44	26	58	4	26	136
1985	31	19	56	5	6	117
Total	247	95	251	12	55	678

PROSECUTIONS

1981

One prosecution was instituted under the Mines Regulation Act.

On or between March 15 and March 26, Scottie Gold Mine employed a person underground for a longer period than eight hours in 24 hours. They also allowed a miner to prepare a blast while he did not have a valid blasting certificate; and they failed to examine all working parts of the mine at least once during each shift. At the Court Hearing on December 10, a plea of guilty was made, and a fine of $200 on each count was imposed.

1982 and 1983

No prosecutions.

1984

One prosecution was instituted under the Mines Act.

On July 9, six counts were laid against Kamad Silver Company Limited concerning failure to comply with sections 9(1), 20(2), 16(1) of the Mines Act, sections 41(b) and 58(1) of the Mines Regulation, and section 14 of the Mines Act. Of primary concern to the Court were Counts five and six:

> "Count five, the failure to remove explosives, the blasting caps eluded to, and Count six, failure to secure the entries to the mine. Because those represented a prospective ongoing danger to the public for some period of time."

The company was fined a total of $1650.00.

1985

Charges for contravention of sections 230, 231(1)(b) and 237(1) (a) and (b) of the Coal Mines Regulation, Mines Act, were formally sworn on October 1 against Quintette Coal Limited. Court proceedings were scheduled for February 17 to 21, 1986.

BLASTING CERTIFICATE SUSPENSIONS

1981

There were five blasting certificate suspensions issued for the period, ranging from one to six months. One suspension was issued for an electric blasting infraction and the other for storing more than 24 hours' supply underground and failure to remove explosives from a shut-down mine. The remainder involved either drilling too close to a hole that had been charged and blasted, or failing to properly examine an exposed surface for holes or sockets in which an explosive may have remained from previous blasting.

1982

Five blasting certificate suspensions were issued, varying in length from three weeks to six months. The reasons for the suspensions were drilling too close to bootleg sockets, inattention and negligence in a blasting procedure.

BLASTING CERTIFICATE SUSPENSIONS
(Continued)

1983

There were five blasting certificate suspensions, varying in length from one to three months. The reasons for the suspensions included not carefully examining the face before drilling, and not following Regulation requirements and mine instructions for dealing with explosives, re-drilling of caved holes, and blasting procedures.

1984

Three blasting certificate suspensions were issued, varying in length from one to three months. The reasons for the suspensions included not carefully examining the face before drilling, and not following Regulation requirements and mine instructions for dealing with explosives, re-drilling of caved holes, and blasting procedures.

1985

May 2 to August 2, 1985 - Leonard Barry Hale's blasting certificate was suspended due to violation of section 43 of the Coal Mines Regulation - if at any time the holder of a blasting certificate is, in the opinion of the inspector, guilty of inattention or negligence in execution of the holder's duties, or is suffering from any physical or mental infirmity likely to be detrimental to the efficient discharge of the holder's duties, the inspector may immediately suspend the certificate for such period as he considers necessary, or may cancel it.

May 8 to May 21, 1985 - Douglas Pinder's blasting certificate was suspended due to violation of section 95(1) of the Mines Act - in an underground mine no drilling shall be done within 15 centimetres of a bootleg or socket of a hole that has been charged and blasted.

May 14 to August 14, 1985 - Ambrose Pittman's blasting certificate was suspended due to violation of section 43 of the Mines Act - when supplies of explosives are removed from a magazine, those that have been longest in the magazine shall be used first if they are not defective.

MECHANICAL-ELECTRICAL, 1981-1985

1981

Mining activity continued at a high pitch during 1981, although some abatement occurred at the metal mining operations as the year progressed. Construction of new plant and facilities continued at a rapid pace in the south-east coalfield and the amount of contractors' equipment in this area remained at a high level.

During the year a diesel-powered vehicle was qualified for use at underground coal mines. The vehicle was remarkable in that it probably incorporated in its design the most advanced engineering techniques available to ensure safety of operation in an underground coal environment. Since the introduction of the first model, several additional units have been placed in operation.

The introduction of new models of heavy haul trucks into surface mines continued, with a trend towards all--hydraulic braking. Close monitoring of safety systems, together with physical testing, continued to be an important part of the branch's work in the accptance of new equipment.

Electrical engineering reviews and inspections of new and existing mines continued, with the increased mining activity.

Considerable time was devoted to the review of the new Part V (Use of Electricity in Mines) of the Canadian Electrical Code, which was to be completed in 1982. Other proposed changes in electrical standards were also receiving examination, and assessment for possible inclusion in the Mining Regulation Act and the Coal Mine Regulation Act.

1982

Apart from routine mechanical/electrical inspections and accident investigations at mines in the province the following is a list of some of the highlights which occurred.

A mechanical/electrical symposium, sponsored by this Branch, was held during February at the Harbour Towers Hotel in Victoria. Well over 100 persons attended the symposium and a volume containing the proceedings was issued.

Many new model haul trucks, in excess of 50 000 kilograms gross vehicle weight, were qualified for use at mines; acceptance of such vehicles was dependent upon a rigorous examination of engineering data, together with witnessing high-speed downhill braking tests.

Four separate technical papers were given by mechanical staff members, three at the mechanical/electrical symposium held in Victoria, and one at the Mines Accident Prevention Association of Ontario in Toronto.

Two mechanical and one electrical member of staff presently serve on Canadian Standards Association technical committees which were all quite active during the year.

A substantial amount of time was spent with coal companies, engineers, contractors, and others regarding the northeast coal development. The branch gave much input into meetings with both Quintette and Bullmoose regarding the introduction of mechanical and electrical equipment into the proposed mines and coal preparation plants in the northeast coalfield. Much of this work was concerned with the use of electrical equipment in hazardous locations in the mines and associated plant.

The Branch was represented on the Mobile Equipment Committee of British Columbia which is instrumental in bringing together and formulating the views of all regulatory bodies in the province regarding the use of mobile equipment; meetings are held on a monthly basis.

Several new mine shafts were in the process of being sunk during the year and a good deal of time was spent in inspecting sinking hoists and new hoist installations; these included both drum hoists and friction hoists.

1983

Mechanical-electrical inspections were carried out with increased frequency during the year. With the introduction of new systems and equipment, many with a high degree of automation, it was found that added time had to be spent evaluating the safety features incorporated in, or required with, such systems. Examples of such systems were the fully automated production hoist installed at Westmin H-W shaft, and the overland conveyor system at Quintette coal mine.

Many of the newer haul trucks started using all-hydraulic service brakes in contrast to the air/hydraulic systems common previously. Downhill braking tests on these vehicles included emergency brake testing, as well as service brake testing. These tests were performed after detailed review of the engineering drawings for the brake systems.

The development of the northeast coalfield placed a heavy demand on the resources of the section; however, the cooperation received from the mining companies and contractors involved in the design and installation of equipment ensured that no delays were caused by lack of action from this branch.

Technical examination of all major electrical installations at mines and quarries continued, with special attention being directed to the inspection of open-pit electrically-powered mobile equipment and the isolation procedures used during maintenance and trailing cable handling.

1984

Over 200 minesite mechanical-electrical inspections were carried out during 1984. The approval and commissioning of new equipment and systems used in the coal mines in the northeast of the province high-lighted deficiencies in both mobile equipment and coal conveying systems. These deficiencies in both equipment design and operation were addressed by manufacturers and mine operators to the satisfaction of this branch.

The approval and testing of braking and steering systems on new haul trucks in conjunction with the review of annual braking tests of all large trucks in use in the province continued to place a heavy demand on the section.

Technical evaluation of electrical distribution systems at new mines continued, with special attention paid to the H-W Mine project at Buttle Lake, which included an 8 mW hydro generating facility, and the extensive electrical systems at Bullmoose and Quintette. The installation of the 50 kV electric railway into the Northeast Coalfield and to the Quintette minesite was also of considerable interest to the Branch.

1985

Over 160 minesite mechanical-electrical inspections were carried out during 1985. This figure was down on previous years as the Senior Mechanical/Electrical Inspector was involved in Branch computerization activities during the period.

Good cooperation was established between the Branch and the two new northeast coal mines to overcome safety problems related to operating procedures, equipment maintenance and the transport of coal.

Monitoring of critical production items such as hoists, hoist ropes, haul trucks over 50 tonnes, mobile cranes, etc. was continued as well as the qualification of various items of new equipment to confirm that its performance is in accordance with the Mines Act and Regulations.

Several new electrical distribution systems were evaluated during the year and a survey was commenced to determine the extent of any hazardous substances remaining in various items of electrical equipment.

SYNOPSIS OF MAJOR MECHANICAL EQUIPMENT IN USE AT MINES IN BRITISH COLUMBIA DURING 1985

SURFACE EQUIPMENT

Haulage Trucks

	Capacity (tonnes)								
Type of Operation	0-19	20-39	40-74	75-99	100-149	150-174	175-199	200+	Total
Coal Mines	10	16	27	51	98	76	12	1	291
Metal Mines	28	32	40	76	44	55		11	286
Others	170	67	6	2		1			246
Totals	208	115	73	129	142	132	12	12	823

Front-End Loaders

	Bucket Size (m3)								
Type of Operation	0-1.9	2.0-3.9	4.0-5.9	6.0-8.9	9.0-11.9	12.0-14.9	15.0-19.9	20.0+	Total
Coal Mines	5	8	12	5	23	4	10	4	71
Metal Mines	25	34	8	1	7				75
Others	43	114	57	15	7	1		2	239
Totals	73	156	77	21	37	5	10	6	385

Shovels

	Shovel size (m3)									
Type of Operation	0-1.9	2.0-3.9	4.0-5.9	6.0-7.9	8.0-9.9	10.0-11.9	12.0-14.9	15.0-19.9	20.0+	Total
Coal Mines	2		2	2		6	25	4	10	51
Metal Mines	1		3	4	24	17		6		55
Others	16	5	6	2	1	1				31
Totals	19	5	11	6	27	24	25	10	10	137

SURFACE EQUIPMENT (Continued)

Rotary Drills

Type of Operation	Drill Diameter (mm) 0-79	80-159	160-204	205-254	255-299	300+	Total
Coal Mines	3	6	1	10	4	23	47
Metal Mines	3		1	22	2	6	34
Others	4	1					5
Totals	10	7	2	32	6	29	86

Mobile Cranes

Type of Operation	Lifting Capacity (tonnes) 0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80+	Total
Coal Mines	3	7	6		5	1	3	1	5	31
Metal Mines	6	12	3	6	6		1	1		35
Others		1								1
Totals	9	20	9	6	11	1	4	2	5	67

Other Equipment Over 5000 kg Mass

Type of Operation	Dozers	Graders	Scrapers	Other*	Total
Coal Mines	150	41	21	91	303
Metal Mines	82	39	11	111	243
Others	59	13	6	51	129
Totals	291	93	38	253	675

*Includes service vehicles, backhoes, sand and water trucks, compactors, lift trucks, portable compressors, generators, screening plants, draglines, etc.

UNDERGROUND EQUIPMENT

Diesel Powered		Hoists in Use	
Load-haul-dump	67	Sullivan	2
Front-end Loaders	1		
Haul Trucks	13	Westmin-Lynx	2
Locomotives	5	Westmin-H-W	2
Drill Jumbos	21	Bralorne	1
Graders	10	Mosquito Creek	1
Dozers	4	Jewel	1
Others	53	Parson Barite	1
Total	174		

ELECTRICAL

Metalliferous Mines

The following table shows the kilovolt ampere capacity of the company-owned generating plants and the reported power generated in 1985.

Prime Mover	Generator Capacity kVA	Units Generated kwh
Diesel & Hydro	39 305	72 111 944

Power purchased from public utilities totalled 2 183 143 830 kwh giving a total power consumption of 2 255 255 744 kwh.

An analysis of connected load at operating mines was as follows:

Equipment	Power (kW)
Trams and Hoists	1 097
Scraper Hoists	5 125
Shovels	24 385
Drills	5 351
Fans	9 662
Pumps	7 466
Rectifiers	2 323
M.G. Sets	3 033
Air Compressors	14 285
Sink & Float	3 300
Crushing	17 595
Grinding	137 625
Concentrating	47 190
Magnetic Separation	41
Conveyors	20 221
Mill Pumps	33 372
Fresh Water Pumps	34 325
Workshops	5 301
Miscellaneous	29 356
Total	401 053

Structural Material and Industrial Minerals

The capacity of company-owned generating plants and the total power generated and purchased in 1985 was as follows:

Generator Capacity kVA	50 664
Power Generated kwh	47 185 479
Power Purchased kwh	22 529 381
Total Power Consumption	69 765 524 kwh

An analysis of the connected load was as follows:

Equipment	Power (kW)
Hoists and Trams	477
Fans	339
Pumps	396
Air Compressors	223
Drying Plant	2 140
Crushing Plant	11 182
Milling and Screening	5 137
Conveyors	19 644
Shovels	910
Drills	488
Workshops	688
Miscellaneous	4 531
Total	46 155

Coal Mines

Purchased power for the operation of coal properties during 1985 was 634 919 919 kwh.

The distribution of connected load was as follows:

Surface Equipment	Power (kW)
Draglines	6 490
Ventilation & Drying	3 230
Electric Shovels	40 254
Electric Drills	13 692
Conveyors	9 388
Hoisting	282
Haulage	447
Coal Breaker	2 017
Washing & Screening	45 372
Pumping	19 448
Air Compressors	2 849
Miscellaneous	15 983
Underground Equipment	Power (kW)
Ventilation	200
Pumping	2 900
Conveyors	100
Miscellaneous	100
Total	159 452

ACTUAL CONSUMPTION OF POWER (IN MILLIONS OF KILOWATT HOURS)
1975-1985

YEAR	METAL MINES	INDUSTRIAL MINERALS	COAL MINES	GRAND TOTAL
1975	2 092.1	66.8	363.3	2 522.2
1976	2 125.7	80.9	211.2	2 417.9
1977	2 212.1	78.7	312.0	2 602.8
1978	2 057.9	67.9	289.2	2 415.1
1979	2 257.4	88.8	299.8	2 646.0
1980	2 359.3	95.1	277.9	2 732.3
1981	2 761.6	65.3	319.6	3 146.5
1982	2 605.5	77.5	330.4	3 013.4
1983	2 434.1	76.9	356.6	2 867.6
1984	1 975.0	91.2	578.4	2 644.6
1985	2 255.3	69.8	634.9	2 960.0

ENVIRONMENTAL CONTROL

The Ministry of Energy, Mines and Petroleum Resources' environmental control inspectors conduct inspection surveys for dust, asbestos fibre, ventilation, radon daughters, gases and noise at metal, coal and industrial minerals mines and quarries throughout the Province of British Columbia.

Measurements of the ventilation and observations of the condition of dust-control systems and other measures relative to the prevention, suppression and elimination of dust and health hazards are conducted on a regular basis. Subsequently, recommendations and advice are given on improvements to assist in lowering the health hazard in general.

The Konimeter, the main instrument used to sample various types of dust in British Columbia since 1935, was displaced in October, 1983, by personal gravimetric sampling. Personal gravimetric samplers use the infra-red method to analyze filters for the mass of free silica present or, at coal mines, for the mass of respirable coal dust per unit volume of air. At the only asbestos mine in the province, the membrane filter method is used to measure the number of asbestos fibres per unit volume of air.

Selected surveys are conducted on non-uranium underground mines for alpha and gamma radiation. A Tri-Met alpha counter is used to measure alpha radiation using the Kusnetz method. A Ludlum Micro R meter is used to assess gamma radiation levels.

AUDIOMETRIC PROGRAMS

In 1979 and 1980 a hearing conservation program for miners was established in the Province. This included conducting, collating, and computerizing individual hearing tests, conducting training and refresher courses for industrial audiometric technicians, the supply of audiometric data to all mines and district mining offices on a monthly basis for follow-up, providing information to all mines on ear protection, audiometers and tests booths, and provision of data to the Workers' Compensation Board on claims.

In 1982, two medical clinics were set up to perform industrial hearing testing for the mines in their areas: the Elkford Diagnostic and Treatment Centre in Elkford, and the Murakami Medical Clinic in Hope.

The environmental control audiologist is responsible for training, examining, and certifying audiometric technicians for the mining industry. The audiologist also implements and monitors hearing conservation programs at mines to ensure compliance with the Mines Act.

AUDIOMETRIC TRAINING/SOUND SURVEY STATISTICS
1981-1985

	1981	1982	1983	1984	1985
Audiometric Technicians					
- Number trained	97	36	27	42	33
- Certificate Renewal	-	88	75	93	74
Sound Surveys					
- Number conducted	27	44	47	10	45
- Number of operations	26	44	47	10	43
Results:					
- Workers wearing ear protection where required	93.5%	90%*	90%*	90%*	90%*
- Drill mufflers in use	100%	100%*	100%*	100%*	100%*
- Properties peforming audiometric tests on workers	100%**	100%**	100%**	100%**	100%**

* Approximate

** With the exception of a few small gravel pits.

DUST CONTROL

The following table shows the numbers of dust control inspections carried out each year during the period, and the results obtained.

SUMMARY OF DUST CONTROL INSPECTIONS
1981-1985

Type of Inspection	1981	1982	1983	1984	1985
Metal, Coal, Asbestos, Uranium, Limestone and Rock Quarries					
Number of inspections	58	64	49	44	55
Number of operations	52	49	45	34	34
Percent Meeting Standards:					
Underground Mines					
- Drilling	73%	89%	90%*	90%*	90%*
- Other U/G operations	78%	95%	95%*	95%*	95%*
- Crushing plants	70%	71%	75%*	75%*	75%*
- Assay grinding rooms	100%	100%	100%	100%	100%
Open Pit Mines					
- Drilling	90%	100%	100%	100%	100%
- Other operations	100%	100%	100%	100%	100%
- Crushing plants	58%	69%	75*%	75*%	75*%
Structural and Industrial Minerals					
Number of inspections	22	13	10	12	8
Number of operations	22	13	10	12	8
Percent Meeting Standards:					
- Drilling	100%	100%	100%	100%	100%
- Crushing and screening	100%	100%	100%	100%	100%

* Approximate

SHIFTBOSS CERTIFICATES

Section 24 of the Mines Act requires that every person employed underground or in an open-pit working shall be under the daily supervision of a shiftboss or other official who is the holder of a shiftboss certificate issued under the Act.

An applicant for a shiftboss certificate must hold a non-restricted blasting certificate (gravel pits excluded), a mine rescue certificate (surface or underground as requisite), a currently valid first-aid certificate, and is required to pass an examination on the regulations and rules, as contained in the respective Acts. Four different certificates are issued: one for underground metal-mining operations; one that is valid in coal-mining open-pit operations, one that is valid in metal-mining open-pit operations, and a fourth for sand-gravel and clay-removal operations. A fee of $50 is charged for the examination and the passing grade is 65 per cent.

The Board of Examiners may grant provisional certificates on a one-time basis for a period of six months under such conditions as it considers advisable.

CERTIFICATES

Shiftboss

The following tables analyze the annual activity:

	1981	1982	1983	1984	1985
Applications received	196	143	92	67	N/A
Examinations written	184	143	92	67	62
Number passed	173	134	86	65	58
Number of Certificates issued	131	123	86	59	26

Analysis of Shiftboss Certificates Issued by Type

Type	1981	1982	1983	1984	1985
Underground	68	44	33	18	10
Open Pit	*53	*63	*43	*34	*15
Gravel Pits	10	16	10	7	1
Provisional	121	50	39	20	6

* 1981 20 coal; 1982 31 coal; 1983 13 coal; 1984 20 coal; 1985 10 coal

CERTIFICATES OF COMPETENCY

Sections 32, 33 and 34 of the Mines Act require that managers and certain other supervisory officials of underground coal mines shall be holders of certificates of competency issued under this Act. A Board of Examiners is responsible for setting examinations from time-to-time for these certificates, for considering applications, for interchange certificates, and for issuing certificates in accordance with section 35 of the Act.

The following table summarizes the issue of certificates of competency for the period 1981 to 1985.

Certificates of Competency (Coal)

Year	1981		1982		1983		1984		1985	
Type of Certificate	**R**	**I**	**R**	**I**	**R**	**I**	**R**	**I**	**R**	**I**
1st Class	0	1	0	1	0	0	0	4	1	0
2nd Class	0	0	0	0	0	0	0	0	2	0
3rd Class	0	0	0	0	0	0	0	0	0	1
Provisional 3rd Class	0	0	0	0	0	0	0	0	0	0

R = Regular; I = Interchange

Surveyor Certificates (Coal)

There were no surveyors' certificates of competency issued during the period 1981 to 1985.

MINE RESCUE, SAFETY, AND FIRST AID

The promotion of mine rescue, safety and first aid, and providing assistance to the industry, is one of the key functions of the Inspection and Engineering Branch.

MINE RESCUE

Six district mine rescue stations were fully maintained under the supervision of coordinators fully qualified in all aspects of first-aid and mine rescue. These districts are: Fernie, Nelson, Kamloops, Nanaimo, Prince George, and Smithers. Each station is established as a mobile unit to transport equipment anywhere in these areas to be available for either rescue or training services, and is capable of equipping one surface and two underground mine rescue teams with breathing apparatus.

Major producing mines within the province maintain mine rescue equipment and supplies on site and train personnel in its use. In accordance with the Mines Act, the rescue facilities and training of personnel at the operating mines are monitored by the Inspection and Engineering Branch Mine Rescue Co-ordinators under the direction of an Inspector of Mines and Resident Engineer.

The district coordinators of rescue training make regular visits to the mines to give rescue training to open-pit and underground employees, and to check the rescue equipment to ensure its serviceability.

Both full and refresher courses in underground, survival, gravel pit and surface mine rescue training, as well as first-aid, were presented regularly by the district coordinators at various mines and centres throughout the Province. In 1981, a new course was added to the training syllabus concerning back problems.

The type of training courses, and the number trained, assisted, or examined by the mine rescue co-ordinators, was as follows:

MINE RESCUE AND FIRST-AID CERTIFICATES
1981-1985

Certificate	1981	1982	1983	1984	1985	Total
Mine Rescue						
Underground	187	198	99	52	92	628
Underground (Refresher)		21	47	9	13	90
Surface	390	390	277	290	142	1489
Surface (Refresher)		44	69	24	11	148
Survival	685	308	379	376	133	1881
Gravel Pit	31	21	22	28	13	115
Mine Rescue Instructors						
Underground	3	1	1	3	0	8
Surface	26	1	5	5	1	38
Survival	2	1	3	1	0	7
First Aid						
St. John Standard	238	360	250	256	93	1197
Safety Orientated	139	294	174	63	26	696
Totals	1701	1639	1326	1107	524	6297

MINE SAFETY ASSOCIATIONS

The four mine safety associations established throughout the province are again commended for their efforts in promoting mine rescue, first aid training, and safety education within their respective zones. The associations are as follows:

Vancouver Island Mine and Industrial Safety Association;
Central B.C. Mine Safety Association;
East Kootenay Mine and Industrial Safety Association; and
West Kootenay Mine and Industrial Safety Association.

The associations are sponsored by grants from the Ministry of Energy, Mines and Petroleum Resources and the Workers' Compensation Board. The association members consist of representatives from industry, the Inspection and Engineering Branch, the Workers' Compensation Board, and St. John Ambulance. One of the important functions of each association is to organize and run the zone mine rescue and first aid competitions.

Each association sponsors annual competitions between mines in the district for underground rescue. The four winners from the districts compete for the provincial championship in their region. The winner of the underground competition goes on to compete in the Canadian competition. There is no Canadian surface mine competition.

The First-Aid Team competition and, since 1978, the Underground Bench competitions, are held concurrently.

Surface mines are covered by Northern, Central, and Southern Divisions, which are similarly sponsored, hold similar annual competitions, and promote safety in their respective areas.

COMPETITIONS

Interest in mine safety and rescue work is stimulated by the various competitions held annually among all the mines in the Province.

These competitions are basically in five areas:

1. Mine Rescue - Underground.
   Mine Rescue - Surface.

2. Underground bench competition to demonstrate maintenance of safety equipment. (This event was instituted in 1978 in memory of the late B. Abbott, captain of the Cominco Ltd., H.B. Mine Rescue team of 1976, and the winner of the Canadian Mine Rescue Competition of the same year.)

3. Safety competitions based on annual accident frequency rates for small mines (West Kootenay Mine Safety Association), and open pit mines and quarries (Ministry of Energy, Mines and Petroleum Resources): two trophies.

4. First aid competitions.

5. John T. Ryan Safety Trophies: open to all Canadian mines, with one division for metal mines and one for coal mines. These trophies are awarded annually on the basis of accident frequency results. There are regional and Canada-wide awards.

In addition, the United Steelworker's Union awards a Canada Trophy for Metal Mines and a Canada Trophy for Coal Mines annually based on safety records.

The surface and underground mine rescue competitions were judged by personnel of the Inspection and Engineering Branch. The three-person first aid events were judged by St. John Ambulance personnel.

The winning teams are recorded below, followed by a brief outline of the requirements for each competition.

1981

The winners of the provincial mine rescue, underground bench and three-person first aid events were as follows:

Underground	**Open Pit**	**Three-person First Aid**
Cominco Ltd.	Brinco Mining Ltd.	Newmont Mines Ltd.
Sullivan Mine	Cassiar Division	Similkameen Divison
Capt. A. Stuart	Capt. S. Hanley	Capt. A. Mintzier

Underground Bench
Cominco Ltd.
Sullivan Mine
Capt. A. Stuart

Six provinces or territories competed at the Canadian Meet, held at Banff, Alberta, on June 20, 1981: British Columbia, Yukon, Northwest Territories, Alberta, Saskatchewan and Nova Scotia. British Columbia's Cominco Sullivan Mine team, captained by A. Stuart, won the trophy.

1982

Zone winners, who went on to compete in the provincial competition in Nanaimo on June 19, 1982, were as follows:

VANCOUVER ISLAND MINE AND INDUSTRIAL SAFETY ASSOCIATION

Underground	**Open Pit**	**Three-person First Aid**
Westmin Resources Ltd.	No entry	Erickson Gold Mines
Capt. H. Uhrig	(Island Copper moved into South Zone)	Capt. J. Bondeson

CENTRAL B.C. MINE SAFETY ASSOCIATION

North Zone:

Underground	**Open Pit**	**Three-person First Aid**
No entry	Equity Silver Mines	Equity Silver Mines
	Capt. G.Andrews	Capt. R. Burri

South Zone:

Underground	**Open Pit**	**Three-person First Aid**
No entry	Utah Mines (Island Copper Division)	Utah Mines (Island Copper Division)
	Capt. J.Pelletier	Capt. A. Thurgood

Central Zone:

Underground	Open Pit	Three-person First Aid
No entry	Bethlehem Copper Capt. J. Crookes	Lornex Mines Ltd. Capt. A. Smith

WEST KOOTENAY MINE INDUSTRIAL SAFETY ASSOCIATION

Underground	Open Pit	Three-person First Aid
Cominco Ltd. Sullivan Mine #2 Capt. R.A. Gyurkovits	No entry	No entry

EAST KOOTENAY MINE INDUSTRIAL SAFETY ASSOCIATION

Underground	Open Pit	Three-person First Aid
B. C. Coal Ltd. Sparwood Capt. D. Saunders	B.C. Coal Ltd. Sparwood Capt. E. Hingston	Cominco Ltd. Sullivan Mine Capt. A. Wilson

In addition, eight senior first-aid teams represented various zones throughout the province. The winners of the Provincial in this event were the first-aid team from the East Kootenay Zone, Kimberley Ambulance No.2, Capt. R.Smith.

The winners of the provincial mine rescue and three-person first aid events were as follows:

Underground	Open Pit	Three-person First Aid
Cominco Ltd. Sullivan Mine #2 Capt. R.A. Gyurkovits	Utah Mines Ltd. Island Copper Div. Capt. J. Pelletier	Erickson Creek Gold Capt. J.T. Bondeson

The Canadian Underground Mine Rescue Competition was hosted by British Columbia at Beacon Hill Park on June 26, 1982 in Victoria, B.C. Seven provinces and/or territories participated in the competition, with team representation from Alberta, British Columbia, Nova Scotia, the Northwest Territories, New Brunswick, Saskatchewan and the Yukon. The team from Saskatchewan took top honours in the event.

1983

The zone winners, who went on to compete in the provincial competition in Cranbrook, on June 11, 1983, were as follows:

VANCOUVER ISLAND MINE AND INDUSTRIAL SAFETY ASSOCIATION

Underground	Open Pit	Three-person First Aid
Westmin Resources Ltd. Capt. D. Glaeser	No entry	Erickson Gold Mining Capt. J. Bondeson

CENTRAL B.C. MINE SAFETY ASSOCIATION

North Zone:

Underground	Open Pit	Three-person First Aid
No entry	Cassiar Mine Capt. D. Harrison	Quintette Coal Ltd. Capt. J. Balmer

South Zone:

Underground	Open Pit	Three-person First Aid
No entry	Utah Mines Ltd. Island Copper Mine Capt. J. Pelletier	Newmont Mines Ltd. Similkameen Division Capt. L. Vandale

Central Zone:

Underground	Open Pit	Three-person First Aid
No entry	Cominco Ltd. Valley Mine	Lornex Mining Corp. Capt. J. Horvath Capt. W. Maldidier

WEST KOOTENAY MINE INDUSTRIAL SAFETY ASSOCIATION

Underground	Open Pit	Three-person First Aid
Westar Mining Ltd. Balmer Mine Capt. E. Taje	No entry	No entry

EAST KOOTENAY MINE INDUSTRIAL SAFETY ASSOCIATION

Underground	Open Pit	Three-person First Aid
Westar Mining Ltd. Fernie #1 Capt. D.Saunders	Byron Creek Collieries Capt. L. Robin	Cominco Ltd. Sullivan Mine Capt. M. Boisvert

In addition to the above zone winners, a guest underground mine rescue team from Kellogg, Idaho participated in the provincial underground event on a non-competing basis. This team, the American Smelting & Refining Co. (Coeur mine) was captained by Mr. Dave Turcotte.

The winners of the provincial mine rescue and three-person first aid events were as follows:

Underground	Open Pit	Three-person First Aid
Westar Mining Ltd. Fernie #1 Capt. D.Saunders	Utah Mines Ltd. Island Copper Mine Capt. J. Pelletier	Newmont Mines Ltd. Similkameen Division Capt. L. Vandale

The winning underground and surface mine rescue teams were invited to the United States to compete in an international competition. The underground representative, Westar Mining Ltd. captained by D. Saunders, competed at Louisville, Kentucky. The team placed 75th out of 107 teams. The Island Copper surface mine rescue team from Port Hardy, B.C., captained by J. Pelletier, competed at Gillette, Wyoming, and won top honours in the event. The teams were sponsored by their respective mines.

The Canadian underground mine rescue competition, originally planned for June 25, 1983 in Yellowknife, N.W.T., was cancelled.

1984

The winners of various zones went on to compete in the provincial competition in Kamloops on June 23, 1984. Zone winners were as follows:

VANCOUVER ISLAND MINE AND INDUSTRIAL SAFETY ASSOCIATION

Underground	Open Pit	Three-person First Aid
Westmin Resources Ltd Capt. D. Glaeser	No entry	No entry

CENTRAL B.C. MINE SAFETY ASSOCIATION

North Zone:

Underground	Open Pit	Three-person First Aid
No entry	Quintette Coal Capt. H. Latreille	Gibraltar Mines Ltd. Capt. L. Walley Equity Silver Mines Capt. M. Jeffrey

South Zone:

Underground	Open Pit	Three-person First Aid
Teck Corporation Beaverdell Capt. T. Richards	Utah Mines Ltd. Island Copper Mine Capt. J. Pelletier	Newmont Mines Limited Similkameen Division Capt. W. Wallace

Central Zone:

Underground	Open Pit	Three-person First Aid
No entry	Highmont Operating Corp. Capt. B. Duncan	Lornex Mining Corp. Capt. J. Horvath

WEST KOOTENAY MINE INDUSTRIAL SAFETY ASSOCIATION

Underground	Open Pit	Three-person First Aid
Cominco Ltd. Sullivan Mine Capt. R. Gyurkovits	No entry	No entry

EAST KOOTENAY MINE INDUSTRIAL SAFETY ASSOCIATION

Underground	Open Pit	Three-person First Aid
Westar Mining Ltd. Balmer Operation Capt. E. Taje	Westar Mining Ltd. Balmer Operation Capt. E. Hingston	Cominco Ltd. Sullivan Mine Capt. M. Boisvert

In addition to the above zone winners, a guest underground mine rescue team from Kellogg, Idaho, participated in the provincial underground event on a non-competing basis. This team, the American Smelting & Refining Co. (Coeur mine), was captained by Mr. Dave Turcotte.

The winners of the provincial mine rescue and three-person first aid events were as follows:

Underground	Open Pit	Three-person First Aid
Cominco Ltd. Sullivan Mine Capt. R. Gyurkovits	Utah Mines Ltd. Island Copper Mine Capt. J. Pelletier	Cominco Ltd. Sullivan Mine Capt. M. Boisvert

1985

In 1985, a rule was established that when more than four teams enter in a zone competition, the first and second winners go forward to compete in the provincial competition.

Due to the reduction in underground mining, there were not sufficient teams to warrant holding underground zone competitions. Consequently, the three competing teams went directly into the provincial competition.

The winners of various zones went on to compete in the provincial competition in Kamloops on June 22, 1985, as follows:

Open Pit Mine Rescue Competition	Three-person First Aid
North Zone:	
Bullmoose Operating Corp.	Quintette Coal Ltd. Brinco Mining Ltd., Cassiar Resources Div.
South/Central Zone:	
Utah Mines Ltd., Island Copper Mine Lornex Mining Corp. Ltd.	Utah Mines Ltd., Island Copper Mine Lornex Mining Corp. Ltd.
East Kootenay:	
Crows Nest Resources Ltd. Byron Creek Collieries Ltd.	Sullivan Mine, Kimberley 'A' Team Sullivan Mine, Kimberley Concentrator Team

The winners of the provincial mine rescue competition and three-person first aid events were as follows:

Underground	Open Pit	Three-person First Aid
Westar Mining Ltd., Balmer Operation Capt. E. Taje	Utah Mines Ltd., Island Copper Mine	Quintette Coal Ltd.,

The National Underground Mine Rescue Competition was held in Glace Bay, Nova Scotia. The winning provincial team, Westar Mining Ltd., Balmer Mine, captained by E. Taje, represented British Columbia and came second in the overall task-oriented competition. The winner was the Phelan Mine team from Glace Bay, Nova Scotia.

SAFETY COMPETITIONS, OPEN-PIT MINES AND QUARRIES

In 1961, the Ministry of Energy, Mines and Petroleum Resources organized a safety competition for the open-pit mine and quarry industry, instituted awards and donated a trophy for annual competition for operations having the least number of compensable accidents during the year. In 1965, in order to provide a more equitable competition basis, it was decided to donate a second trophy and to divide the entrants having a large number of man-hours into two groups; the "A" group, for those operations having from 35,000 to 200,000 man-hours per year; and the "B" group, for those having in excess fo 200,000 man-hours per year. In addition, since 1977 a Certificate of Achievement has been awarded to operations amassing 15,000 man-hours without accidents over any continuous time interval not previously used to obtain an award.

The following mines achieved a zero accident frequency rate and thus qualified for the "A" trophy:

1981:
Canada Cement Lafarge Ltd., Vananda
Domtar Chemicals Group, Lime Division
Construction Aggregates Ltd., Producers Pit
B.C. Coal Ltd., Greenhills Mine

1982:
Argus Aggregates Ltd.
Canada Cement Lafarge Ltd.. Vananda
Construction Aggregates Ltd., Hillside Pit
Construction Aggregates Ltd., Producers Pit
Domtar Chemicals, Lime Division
Westroc Industries Ltd., Windermere

1983:
Domtar Chemicals Ltd., Blubber Bay Quarry
Canada Cement Lafarge Ltd., Vananda
Placer Development Ltd., Endako
Westroc Industries Ltd., Windermere

1984:
Construction Aggregates Ltd., Producers Pit
Placer Development Ltd., Endako

1985:
Allard Contractors Ltd., Coquitlam
Ideal Cement Company Ltd., Vananda
Placer Development Ltd., Endako
Westroc Industries Ltd., Windermere.

The "B" trophy was won by:

1981 - Noranda Mines Ltd., Babine Division
1982 - Brinco Mining Ltd., Cassiar Division
1983 - Brinco Mining Ltd., Cassiar Division
1984 - Equity Silver Mines Ltd.
1985 - Equity Silver Mines Ltd.

Certificates of Achievement were awarded to the following:

1983:
Blackham's Construction Ltd.
Domtar Chemicals Ltd., Blubber Bay Quarry
Canada Cement Lafarge Ltd., Vananda
Goodbrand Construction Ltd., LeFeuvre
Lafarge Concrete Ltd., Kitsul
Maclaren Forest Products Inc., Granisle
Placer Development Ltd., Endako
Valley Rite Mix Ltd., Woodbrook-Central
Westroc Industries Ltd., Windermere

1984:
Blackham's Construction Ltd.
Canada Cement Lafarge Ltd., Vananda
Jack Cewe Ltd., Delta-Treat Creek
Construction Aggregates Ltd., Producers Pit
Goodbrand Construction Ltd., LeFeuvre Pit
Maclaren Forest Products Inc., Granisle
Placer Development Ltd., Endako
Rivtow Industries Ltd., Pacific Rim Aggregates
Valley Gravel Sales Ltd.

1985:
Canada Cement Lafarge Ltd., Vananda
Jack Cewe Ltd., Coquitlam
Construction Aggregates Ltd., Hillside Pit
Dillingham Construction Ltd., Pitt River quarry
Lafarge Concrete, Earle Creek
Rivtow Industries Ltd., Pacific Rim Aggregates
Valley Gravel Sales Ltd.

WEST KOOTENAY MINE AND INDUSTRIAL SAFETY ASSOCIATION TROPHY FOR SMALL MINES

In 1951 the West Kootenay Mine Safety Association donated a Safety Trophy for annual competition in order to encourage and promote safety in small mines. Entrants were originally restricted to the West Kootenay area, but in 1956 this restriction was removed and entries are accepted from any qualifying mine in the province.

The award is made to the underground mine having the lowest accident frequency rate and having worked a total of from 2,500 to 30,000 shifts per year, at least one third of which were worked underground.

The trophies were awarded as follows:

1981 - Newmont Mines Ltd., Trout Lake Division
1982 - DuPont Canada Inc., Baker Mine
1983 - DuPont Canada Inc., Baker Mine
1984 - Dickenson Mines Ltd., Silvana Division
1985 - Mountain Minerals Ltd., Parson barite mine

JOHN T. RYAN TROPHIES

The John T. Ryan safety trophies were established in 1941 by the Mine Safety Appliance Company of Canada Limited to promote safety in Canadian metalliferous and coal mines. The administration of these annual awards is conducted by the Canadian Institute of Mining and Metallurgy.

There have been a number of changes in the regulations and qualifications over the years so that there are now three categories open for annual competition.

(1) Metalliferous underground mines, for which there is a Canadian trophy and four regional trophies. B.C. mines compete in the B.C. and Yukon Region.

(2) Select mines which include open-pit and strip mines for any mineral including coal. There is a Canadian trophy and two regional tropies. B.C. Select Mines compete in the Western Region including all Canada west of the Manitoba-Ontario border.

(3) Coal mines, which are restricted to underground mines. There is a single Canadian trophy in this category.

Applications for these awards are submitted annually through the Chief Inspector of Mines. Awards are presented to the company or companies having the least number of compensable accidents in a continuous period in which 500,000 man-hours (120,000 for underground coal mines) of employment are recorded. If the 500,000 man-hours cannot be achieved in one year, they may be accumulated over a longer continuous time period but the complete calendar year must be included. No portion of that period may be used in another application for the same award. A fatality causes automatic disqualification for the period in which it occurs.

The regional trophy for British Columbia and Yukon was awarded to:

1981 - Cominco Ltd., Sullivan Mine
1982 - Craigmont Mines Ltd.
1983 - Canada Wide Mines Ltd., Granduc Mine
1984 - Westmin Resources Ltd., Myra Falls Mine
1985 - No award.

The regional trophy for select mines Manitoba and West was awarded to:

1981 and 1982 - No award
1983 - Brinco Ltd., Cassiar Resources Division
1984 - Equity Silver Mines Ltd.
1985 - International Minerals and Chemicals Corp. (Canada) Limited, K-2 mine in Saskatchewan.

The Canada trophy for underground coal mines was awarded to:

1981 - 1984 No award
1985 - Westar Mining Ltd., Balmer operations.

RECLAMATION

Information on reclamation activity for the 1981-1985 period will be included in *B.C. Ministry of Energy Mines & Pet. Res.*, Mining in B.C., 1986-1987.

GEOTECHNICAL 1981-1985

A separate section, the Geotechnical Section operating within the Inspection and Engineering Branch, was established to carry out geotechnical engineering work in 1980. Nineteen eighty-one was the section's first full year of work.

The duties of the Geotechnical Section involve the inspection of works at mines and the assessment and regulation of geotechnical designs. The structures monitored include tailings impoundments, waste rock dumps, spoil piles or stockpiles, and pit slopes. Other projects of concern are main surface haul roads and water-retaining or water-controlling works. The Section was initially staffed by one geotechnical engineer, with the title of Senior Geotechnical Inspector, operating under the terms of the Mines Act.

The Geotechnical Section became a subsection of the Geotechnical/Roads Section which was formed in 1985. However, for the sake of consistency in this report the information on the Geotechnical Subsection for 1985 is included here, and that of the Mining Roads Subsection is included under the title **MINING ROADS 1981-1985**.

1981

Most of the activity involved the regulation of tailings impoundments as well as a few water-retaining structures. There were 26 major tailings impoundments in the province in 1981, most of which were inspected by the Senior Geotechnical Inspector at least once. Eleven requests for approval of new ponds or significant modifications to existing ponds were made to the Chief Inspector. The limitation of use was ordered in one insecure case.

Thirteen inspections of pit walls and dump slopes were made by the Geotechnical Inspector, and five approvals of new or modified pits and/or dumps were recommended to the Chief Inspector. In addition, four water-controlling schemes were approved.

In total, the work of the Section resulted in 25 mining projects being visited, 35 geotechnical features being inspected, and 19 geotechnical approvals being issued.

Several minor failures occurred during the year but neither injury nor serious damage resulted. A few dangerous or undesirable situations were identified in the existing operations, and appropriate measures were taken to mitigate them.

1982

In 1982, most of the work dealt with urgently needed approvals for both existing and proposed mines. Twenty-seven applications for approval were reviewed, two of these were denied and two did not require action by this Section. Of the 23 approvals that were recommended to the Chief Inspector 21 were approved. Nearly two-thirds of these approvals went to coal mines, reflecting the decrease in activity at metal mines and the development of the Quintette coal project. Two approvals were also recommended by an outside consultant.

The number of inspections of geotechnical features fell to 19 and only 12 mining projects were visited due to the emphasis on approvals and reduced funding.

There were 25 active tailings impoundments in 1982. No serious failures or breaches occurred, however, there were two difficulties involving unplanned discharges at the Bell mine and the Ladner Creek mine. The latter was the more serious resulting in the release of water that did not meet standards.

Two major waste dump failures occurred, at the Line Creek mine and the Balmer mine, in which weather was a primary factor. No loss of life or appreciable damage resulted.

1983

Much of the work again involved the assessment of applications made to the Chief Inspector for approval of new, or substantially modified, geotechnical structures. However, reviewing approvals became less urgent allowing the Section to handle more routine tasks. Two submissions were rejected and 16 recommendations for approval were made that included tailings impoundments, waste rock dumps and other impoundments. The majority of these approvals were for coal mining projects.

Mine site visits increased to 19 in 1983 and 26 geotechnical features were inspected. Eight of these inspections were due to failures, unusual design characteristics or perceived problems.

Due to temporary mine closures it was difficult to establish the number of active tailings impoundments, but there were estimated to be about 20. One temporary restriction was applied at the Ladner Creek mine to ensure adequate safety.

Several significant failures occurred on waste rock dumps at coal mines near Elkford. The largest, which took place at the Greenhills mine, moved approximately one kilometre; however, no appreciable damage resulted as the movement occurred within the confines of the future dump.

During 1983, new guidelines were prepared to cover approvals of major surface haul roads, and guidelines dealing with tailings impoundments were revised. Discussions were also held with the Ministry of Environment in an attempt to reach a protocol on overlapping jurisdiction.

1984

In 1984, nineteen approvals were recommended to the Chief Inspector and three applications were rejected. The number of visits to mine sites increased to 21 and 37 geotechnical features, mainly tailings impoundments, were inspected.

There were 24 active tailings impoundments, though several operated sporadically or ceased operation during the year. Five impoundments generated concern which related to: insufficient capacity at Taurus gold mine; safe storage of local surface drainage at Brenda mine and Quintette coal mine; a structural problem at the Sullivan mine; and a perceived defect at the Mosquito Creek mine. However, no serious failures or breaches occurred.

Two large slides occurred at the Brownie Creek waste rock dump at the Fording coal mine. An extremely large slide also occurred at the Quintette coal mine. No damage or injury was sustained.

1985

During 1985 the Geotechnical Section and the Roads Section were amalgamated into the Geotechnical/Roads Section under the direction of the Senior Geotechnical Inspector. The Section is part of the newly organized Inspection and Engineering Branch of the Mineral Resources Division, and is staffed by one geotechnical engineer and one certified technician. The objectives of each subsection remain the same as before.

The Geotechnical Subsection recommended 18 approvals in 1985, most involving waste disposal systems. These approvals constituted about half of the projects completed by the Subsection.

There were 20 active tailings emplacements and a number of concerns and incidents did occur. The most serious was a severe erosion on the surface of the Lornex LL dam in May. Corrective and preventative measures were quickly implemented and what little damage did occur was confined to the structure alone. A small erosion was reported on the Brenda main dam but the damage was slight.

There were two massive failures of the waste rock dumps at Quintette coal mine. Although neither death nor injury resulted from these events, the Chief Inspector issued a comprehensive order to alter the operation of the dumps and to submit a redesign of all dumps at Quintette coal mine. Several major slides also occurred at both the Fording and the Greenhills coal mines.

During 1985 a set of guidelines was issued on the classification and approval requirements for dumps. Another guideline was distributed internally on the design requirements for underground dams and bulkheads.

MINING ROADS 1981-1985

The Ministry of Energy, Mines and Petroleum Resources conducts a Roads Assistance Program under the authority of the Ministry of Energy Mines and Petroleum Resources Act. The purpose of the program is to encourage and assist in the development of mineral and fossil fuel resources in the province.

1981

$200,000 was spent on annual general maintenance of the Omineca and Takla Spur roads. The Omineca road is located north of Fort St. James and covers approximately 335 kilometres. The Takla Spur access runs from the Omineca road 12 kilometres north of Manson Creek for approximately 113 kilometres west. These roads open up a vast region, servicing many mining exploration and placer mining projects.

$166,052.62 was spent on annual general maintenance of the Sierra-Yoyo road. This road covers about 60 kilometres and accesses the gas exploration and production areas east of Fort Nelson.

A shared-cost grant of $45,000 was made to assist with the construction of the Finlay Bow airstrip. The airstrip is expected to greatly facilitate exploration, becoming more important as mining activity in this area progresses.

A total of $30,964.60 went to shared-cost grants for seven smaller projects throughout the province.

1982

$316,639.12 was spent to provide annual general maintenance to the Omineca road, to provide limited maintenance to the Takla Spur road and to construct a new bridge across Upper Lay Creek.

A total of $186,138 was spent on the Sierra-Yoyo road. Work included replacement due to washouts, extensive gravelling and culvert repairs.

Due to budgetary constraints in 1982 the shared-cost road grant program, to assist in the construction or maintenance of roads or trails to mining properties, was discontinued.

1983

A total of $218,625 was spent on the annual general maintenance of the Omineca road and the Takla spur road, as well as for the construction of a new bridge north of Johanson Lake.

$66,361 was spent on the annual general maintenance of the Sierra-Yoyo road.

The shared-cost road grant program was again discontinued due to budgetary constraints.

1984

$110,000 was spent on the annual general maintenance of the Omineca road, the Takla Spur road and bridges.

The Ministry of Energy, Mines and Petroleum Resources and Serem Inc. entered into a joint agreement that included a total of $11,830 to review a possible extension of the Omineca road north of Moose River. This extension would lead to the Lawyers property, a distance of approximately 104 kilometres.

The shared-cost road grant program was again discontinued due to budgetary constraints.

1985

During 1985 the Roads Section was amalgamated with the Geotechnical Section to form the Geotechnical/Roads Section under the direction of the Senior Geotechnical Inspector. The objectives of each subsection remained the same as before.

The BC Ministry of Energy, Mines and Petroleum Resources and the Government of Canada entered into a joint Mineral Development Assistance Program to assist with road access studies for new mine developments. The Roads Subsection, in collaboration with the Mineral Policy and Evaluation Branch of the Mineral Resources Division, then participated in two major study projects:
(1)
The 104 kilometre Omineca road extension from Moose Valley to the Lawyers property. Governments participated in the study project at a total cost of $111,300.
(2)
A Mount Klappan Road Access Study was organized to select a suitable route for the transportation of coal from the Mount Klappan coal project to the town of Stewart, BC. Several routes were investigated; however, the preferred route would start from Highway 37 at the Bell Irving River Crossing, then run east to Konigus Creek. After that point two alternatives are under consideration:

a. continuing east then north along the Nass River valley, or
b. turning north through Sweeny Pass to the site.

The cost to governments for this study was $179,720.

The shared-cost road grant program was again not supported this year due to budgetary constraints.