THE MONARCH MINE

SUMMER ESSAY

BY

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FOURTH YEAR GEOLOGICAL ENGINEERING

Golden

THE UNIVERSITY OF BRITISH COLUMBIA
DEPARTMENT OF GEOLOGY
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Dean S. H. Finlayson,
University of British Columbia,
Vancouver, B. C.

Dear Sir -

Please pardon me for being late in submitting my summer essay. As the 15th was Sunday, I was under the impression that Monday the 16th would be satisfactory.

Yours very truly,
W. A Lammers.

600094

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4th Year Geological Engineering

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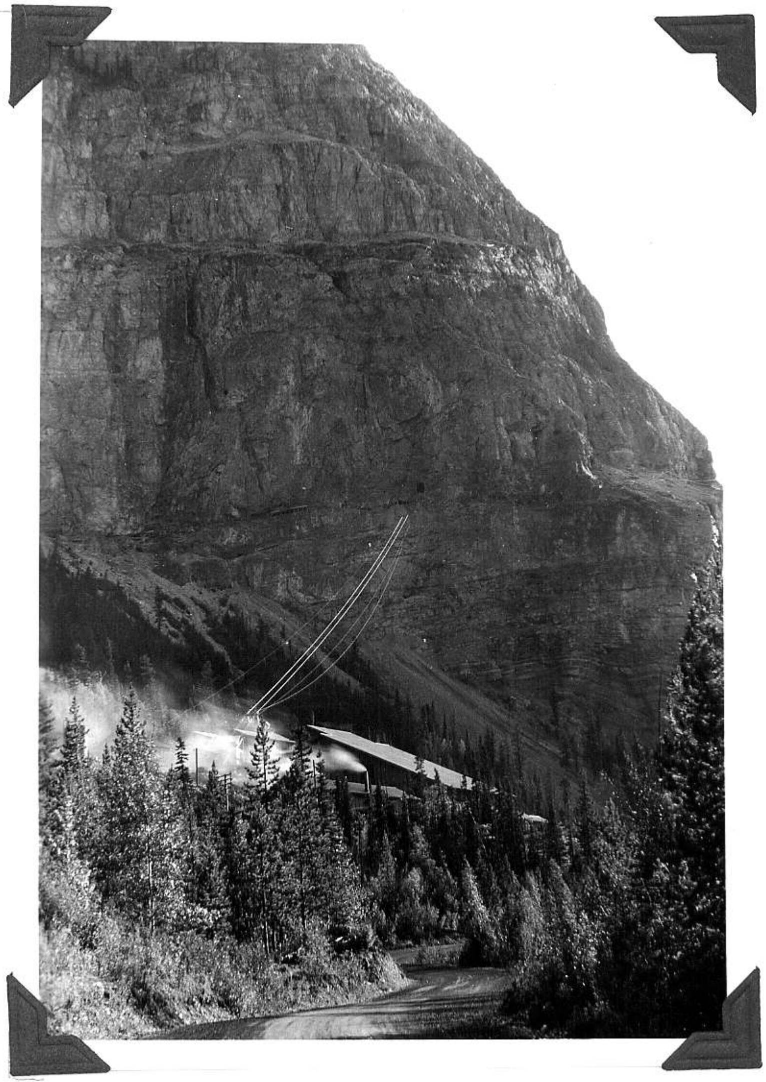


Portal in Face of Mount Stephen

THE MONARCH MINE

Location

The Monarch Mine is situated about 3 miles east of the town of Field, British Columbia, in the precipitous face of Mount Stephen, at an elevation of 5,010' above sea-level and 700' vertically above the Canadian Pacific Railway.

Mount Stephen, a part of the Western Cordilleran System, lies near the western flank of the Rocky Mountains, and forms a part of the south-east wall of the glacially sculptured Kicking Horse Valley. The mountains defining the valley are a most striking sight, and one which has but few parallels on this continent. They are Alpine in character, with jagged and knife-edged ridges, steep and often precipitous slopes, high cliffs housing glacierets and castellated crags. These mountains rise to a height of 8,000' to 10,000' above sea-level. Mount Stephen attains a height of 10,495', and towers 6,500' above the broad alluvial floor of the Kicking Horse Valley.

History and Development

Few mines have as interesting a history as the discovery and subsequent development of the Monarch Mine. Its history dates back to the early Eighties, when the Canadian Pacific Railway was building its main line through the Rockies.

During construction pack trails and trains were pushed forward along the line of survey, over the divide at Hector, and through the Kicking Horse Pass, discovered by the English explorer, Sir James Hector, in the year 1858.

J. S. Bingley, in the Engineers' commissary store, and Tom Wilson, a packer, noticed galena float along the right of way at the base of Mount Stephen. Their observations led to further exploration and to the subsequent staking and recording of a mining claim. This claim was filed in 1884 at Wild Horse Creek, in the upper Kootenay - first called the Tunnel Mountain Camp.

Crude assays of some outcropping ore showed 6 ounces of silver per ton. These assays proved disappointing to the partners, who did not consider that such silver values warranted further exploration or development work. Considerable interest in the claim, however, was shown by outside parties, as the metal content was kept a close secret by the partners. Moved by the opportunity of a joke rather than by the expectancy of riches, the partners, in conjunction with several others in the commissary store, decided to salt the ore samples with scrapings from a nugget carried as a watch fob, and some horn silver. This "salt" was held in place in the porous rock by mucilage, and taken east to Winnipeg for sampling by Joe, a Frenchman, who carefully guarded the samples in a locked bag. These samples assayed the amazing values of $21,000 in gold and $28,000 in silver. News of this immensely "rich strike" soon caused excitement in the East, and offers came from eager prospective purchasers to buy the "Bonanza" - but the story of the salting became generally known before a sale was consummated.

Bingley finally gave his share of the claim to James (Hot Water Jim) Coffroth, and Wilson apparently let his interest lapse. A brother of James Coffroth, known as "Cold Water George", came in as a partner. Some work was done by these men on the property, which was sold after a few years for a reported $200.00.

About 1885 a smelter was built at Golden B. C. by Mr. Sam Fowler, to treat the ore. The presence of so much zinc, however, made smelting impossible, and the project was abandoned.

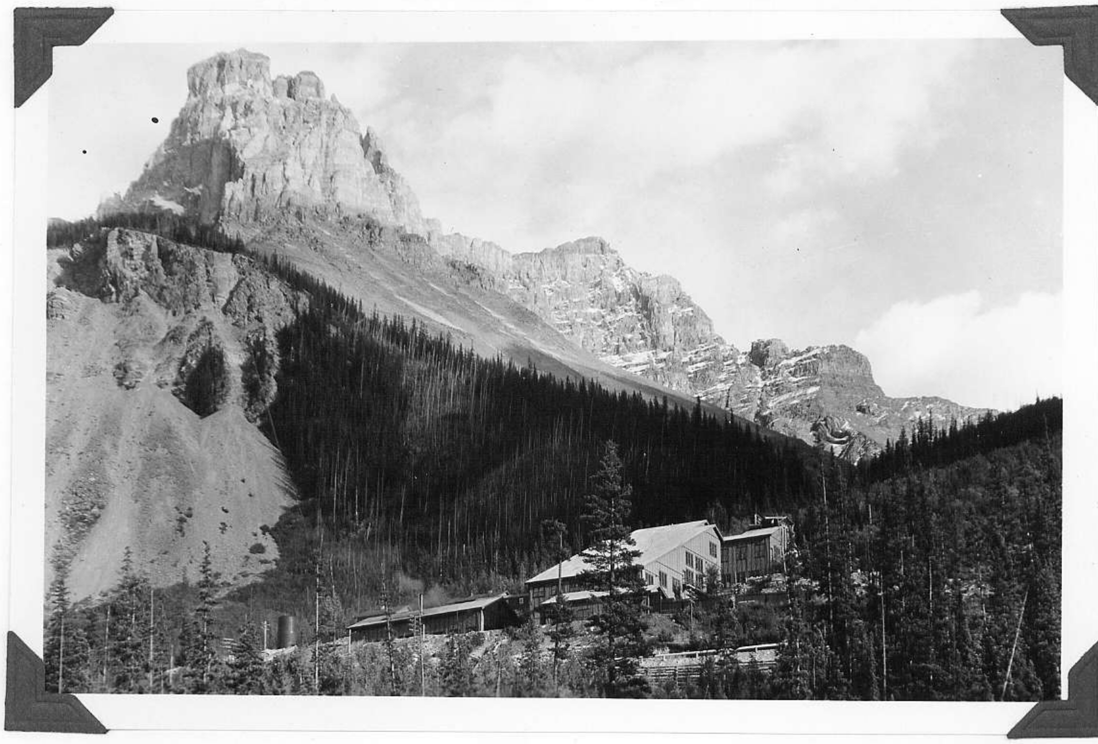
Little is known of the vicissitudes of the mine from this time until 1910, when the Mount Stephen Mining Syndicate took over the operation of the property, now known as the Monarch Mine. After sending some ore to Trail, B. C., to be milled and smelted, a 75-ton concentrator, using jigs and tables, was erected and operated for a few years. During the years 1915 and 1916 the Great Western Mines Company took out some 115,000 tons of ore from one body, known as the East Monarch, and also discovered another extensive ore body - called the West Monarch. During the continuation of the World War operations were stopped, due to high costs and scarcity of labor. This mill was extremely inefficient. In fact the tailings, sampled by engineers during 1923, showed 18% zinc and 4% lead.

Prospect Holes of Kicking Horse Mine - Mt. Field

In 1922 the Monarch Mine was acquired by the New Monarch Mines Limited. This company repaired the mill, but after operating it for several months, was unable to show a profit, and work was suspended. About that time engineers for Mr. John Anderson of Vancouver, B. C. staked a large number of claims on Mount Field. These claims covered the old workings, and included claims of what was known formerly as the Black Prince Mine. The latter property, renamed the Kicking Horse Mine, is on the opposite side of the Kicking Horse River. It is, however, a continuation of the same formation comprising the Monarch Mine.

In 1925 Major A. W. Davis undertook serious development on behalf of the Pacific Mines and Petroleum Company, headed by Mr. A. B. Trites of Vancouver, B. C., and outlined the ultimate potentialities of the ore bodies. Considerable exploration work was done on the Kicking Horse property. The old compressors were reset, and an incline was driven between the two Monarch ore bodies. Furthermore, sufficient development work was done in the West Monarch to prove about 75,000 tons of ore. Work was suspended when cold weather began.

During 1927 the mine was examined by many engineers. It was at this stage that Mr. Frank Eikelberger became interested in the proposition. Upon Mr. Eikelberger's initiative the properties were first purchased by Goldfield Consolidated Mines Exploration Company in 1928. A substantial interest was acquired subsequently by the Mining Corporation of Canada, and finally the Base Metals Mining Corporation Limited was formed to take over the enterprise.



Mount Cathedral - Mill in Foreground

During 1928 new compressors were installed. Seven months of intensive development work was carried on in both the Monarch and Kicking Horse Mines. This work resulted in finding the extension of the East Monarch ore body, and a large increase in the tonnages in both the Monarch and Kicking Horse Mines.

In 1929 a completely modern flotation mill of 300 tons daily capacity was built. A 1,000 horse-power Diesel Plant supplied power for the mill and compressor plant, and for the new camp which was built on the Monarch side of the Kicking Horse River.

Owing to extremely low metal prices the property was closed down from the first part of April, 1931, to ~~1st~~ July 1st, 1933. From this time, however, operations have been continuous.

General Geology

According to Allan*, Mount Stephen consists almost entirely of Middle Cambrian carbonate rocks, except for a small capping of Upper Cambrian sediments at its summit and some Lower Cambrian quartzites at its base. On a faunal basis Allan divided the Middle Cambrian into three main formations, namely, from youngest to oldest:

Eldon	2,728	feet
Stephen	640	"
Cathedral	1,595	"
Total	4,963	feet

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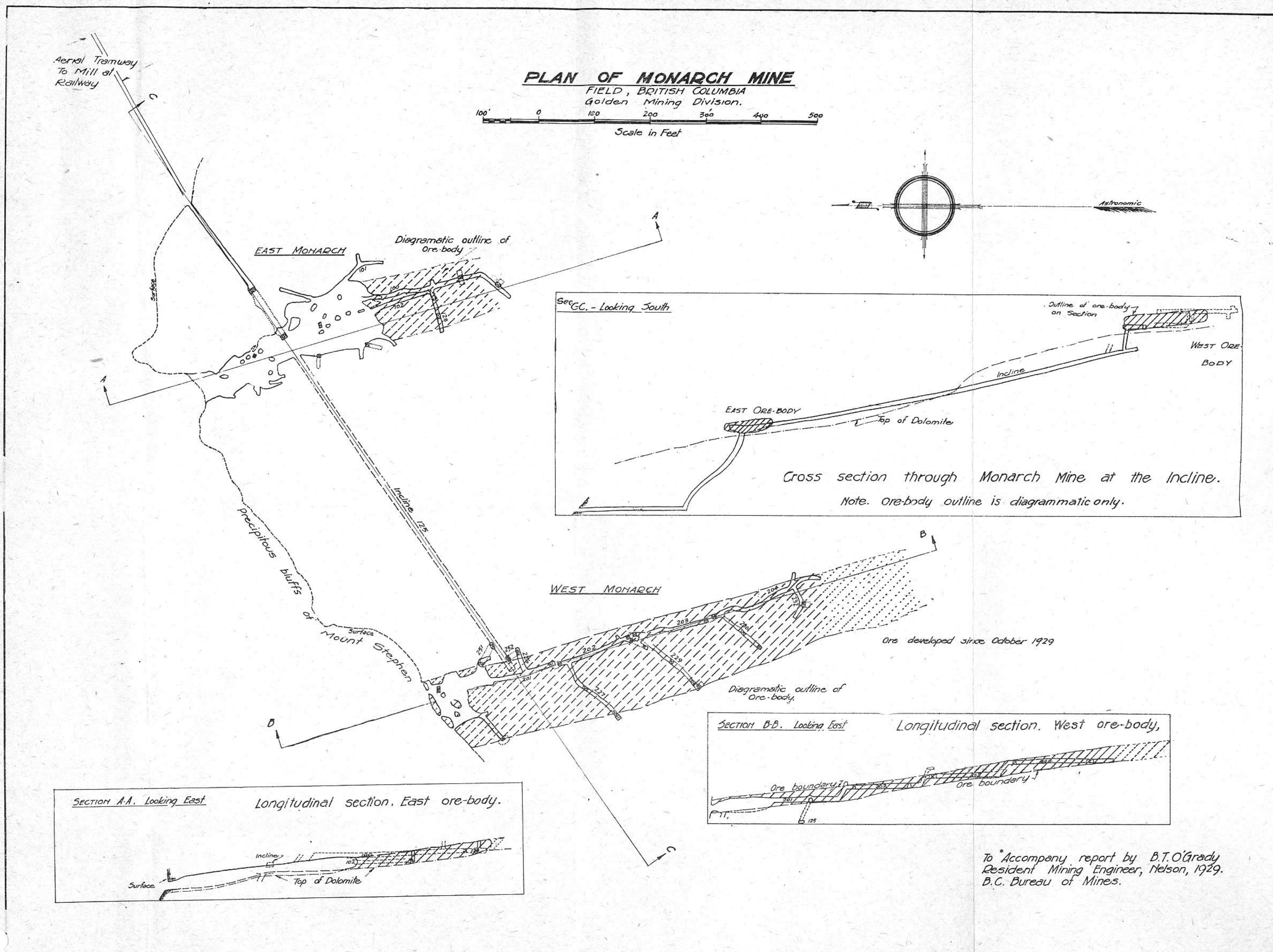
* Geology of Field Map Area of B. C. and Alberta - 1914.


PLAN OF MONARCH MINE
FIELD, BRITISH COLUMBIA
Golden Mining Division.
100 0 100 200 300 400 500
Scale in Feet
Aerial Tramway To Mill at Railway
Astronomic
EAST MONARCH
Diagramatic outline of Ore-body
Surface
Incline 125
Precipitous bluffs of Mount Stephen
WEST MONARCH
Ore developed since October 1929
Diagramatic outline of Ore-body.
Sec C.C. - Looking South
Outline of ore-body on Section
West Ore Body
Incline
East Ore-Body
Top of Dolomite
Cross section through Monarch Mine at the Incline.
Note. Ore-body outline is diagrammatic only.
Section B-B. Looking East
Longitudinal section. West ore-body,
Ore boundary
Section A-A. Looking East
Longitudinal section. East ore-body.
Incline
Surface
Top of Dolomite
To Accompany report by B.T. O'Grady Resident Mining Engineer, Nelson, 1929.
B.C. Bureau of Mines.

These three formations are composed dominantly of magnesium- and lime-bearing, light grey to black carbonate beds, containing some arenaceous and argillaceous material. Only the lowest, or the Cathedral formation which lies at the base of the Middle Cambrian, has been proved ore-bearing to date. This Cathedral formation consists of dark, fissile, fine-grained dolomites interbedded with a horizon of about 300' in thickness, consisting essentially of massive, partly brecciated, light grey to black, fine to medium grained carbonate rock, which on the weathered surface has a pinkish color. The large replacement ore deposits occur in and near the base of this massive, partly brecciated horizon.

The strata composing Mount Stephen, in the main, strike about north-east, dip from a few degrees to about 40° to the north-east and south-west, and are slightly crenulated by minor drag folds. Structurally, Mount Stephen is an asymmetrical anticline, bounded on the east by the Stephen Cathedral fault, on the south and west by the Dennis Stephen fault, and on the north-west by the Kicking Horse Valley. The Kicking Horse Valley is entirely an erosion valley, as the same Middle Cambrian sediments are exposed on the north side of the valley and form Mount Burgess and Mount Field.

Mine Geology

The ore deposits, known as the East and West Monarch ore bodies, are within a medium to fine grained, somewhat brecciated dolomite (known locally as the limestone), which occurs immediately above a considerable thickness of thin-bedded, fine grained ferruginous dolomites (known locally as the dolomite). The ore-bearing horizon is in the vicinity of 300' to 400' in thickness. To date, no commercial ore has been found except in the immediate proximity of the contact between these two horizons. The contact between the horizons usually grade into one another within a distance of approximately five feet. At points, such as those in and near the present southern terminus of the East Monarch, the contact is quite definite, for here the two horizons differ appreciably in grain size and in color. Generally, the ore horizon shows signs of slight brecciation near the contact.

The host rock in the East Monarch is essentially a slight to non-brecciated, more or less jointed, medium grained crystalline, white to grey carbonated rock, composed of calcium- and magnesium-bearing carbonate.

Petrographic studies by Dr. Gorenson* on the carbonate with refractive index oils, showed that the omega index is about 1.685. This figure indicates that the carbonate is approximately a true dolomite, a deduction later verified by J. Dick# in a partial analysis of the rock. The results are given in Table I, column 1A.

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* Dr. Gorenson, retaining geologist for Base Metals.

J. Dick, assayer at Base Metals.

TABLE I

	1	2	1A	2A	3
CaO	30.5	27.7	31.8	30.2	30.4
MgO	19.1	16.8	19.9	18.3	21.7
FeS_2	3.2	2.1	-	-	-
FeO	1.1	4.5	1.1	4.9	-
Insoluble	0.2	5.5	-	-	-
CO_2(cal.)	45.4	42.8	47.2	46.6	47.9
Total	99.5	99.4	100.0	100.0	100.0

Column 1 Partial analysis of ore-bearing carbonate rock.

" 2 " " " dolomite rock.

" 1A Calculated percentage of oxides in the carbonate of 1

" 2A " " " " " " dolomite of 2

" 3 Composition of ordinary dolomite

In thin-section this rock consists of slightly uneven, medium grained, allotriomorphic, granular interlocking grains of carbonate, which are dotted by minute grains appearing white in reflected light and probably due to kaolinite. A small amount of black, opaque carbonaceous material and grains of pyrite in subhedral to anhedral crystals are scattered through the slides. The pyrite grains show oxidation about their peripheries.

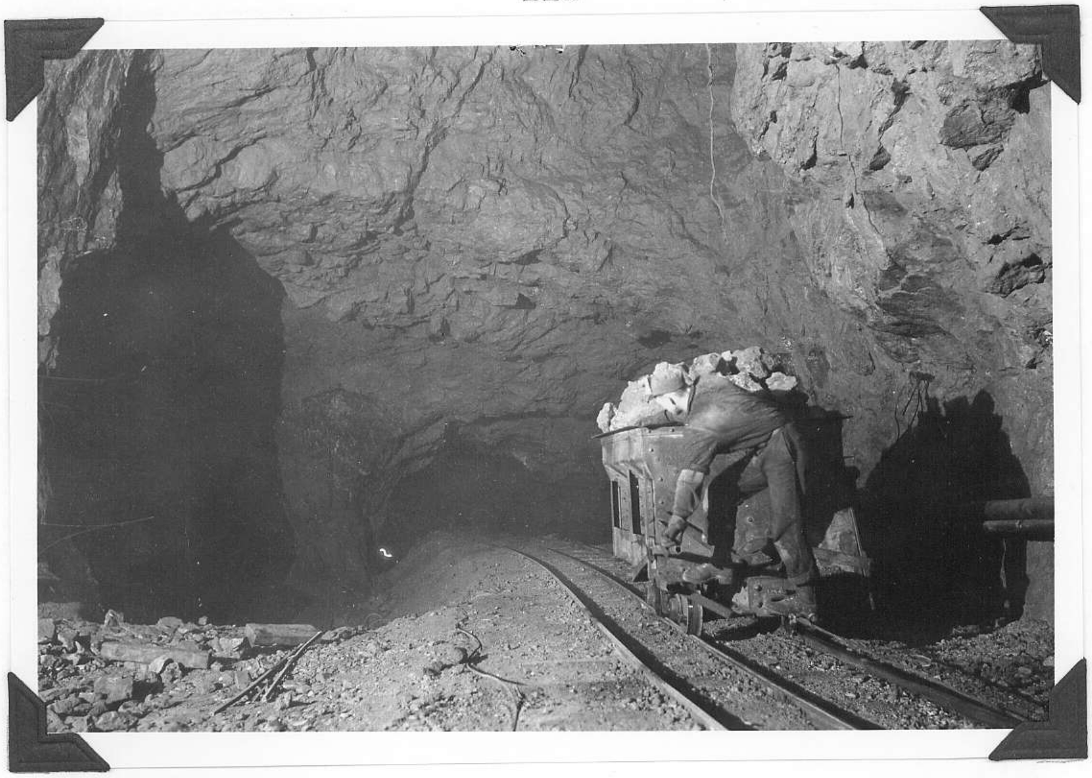
In the West Monarch the host rock consists of a fine grained, crystalline, dark and somewhat brecciated carbonate rock. The breccia fragments are partly or completely replaced by white, medium grained carbonate, having the same chemical composition as the fragments. The brecciation of the host rock and its replacement by white carbonate varies considerably at different places along the strike of the ore body. So far, no relation between the degree of brecciation and the extent and localization of the ore has been found. The brecciation commonly persists beyond the sharply defined mineralogical and commercial limits of the ore. This phenomenon apparently indicates that the brecciation is not a dominant controlling factor in the genesis of the ore deposits. This inference is also supported in the East Monarch, where brecciation appears in the main to be slightly developed.

The original host rock in the West Monarch resembles the dolomite physically except for lack of bedding and for the brecciation and the subsequent replacement of white carbonate. In places bedding can be recognized in this horizon. The bedding is displaced by fine-grained argillaceous carbonate lenses in and near the ore. These lenses have withstood chemical replacement by the ore to a large extent, and are important in aiding the interpretation of the structure of the ore body. The lenses are found along the hanging wall, the foot wall, and also within the ore.

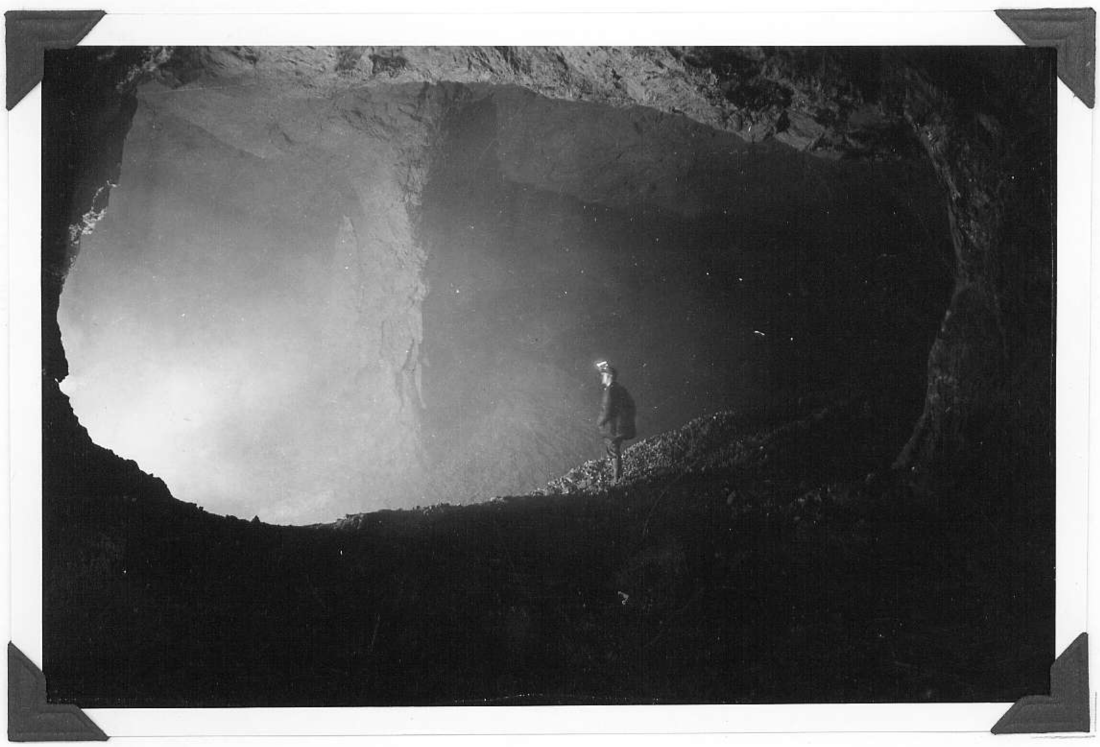
A medium-grained light grey carbonate rock closely resembling the host rock in the East Monarch occurs at points along the walls of the ore deposits. It is just possible that this rock represents a continuous horizon. The brecciated country rock commonly shows at least three stages of carbonate, which in order of succession are: a primary fine-grained dark carbonate, which composes the inclusions; a light grey, fine-grained carbonate, which replaces the inclusions partially or completely; and thirdly, a white, medium-grained carbonate which replaces the other two, and which is related to the ore in the time of formation.

Petrographically, the brecciated host rock consists of crystalline, interlocking, anhedral grains of carbonate which vary in size from the fine-grained variety composing the fragments to the medium-grained matrix carbonate. The fine-grained carbonate is flecked with tiny spots of kaolinite, and contains some carbonaceous material. According to the silimmersion tests made by Dr. Gorenson, the compositions are identical with one another and with the host rock in the East Monarch.

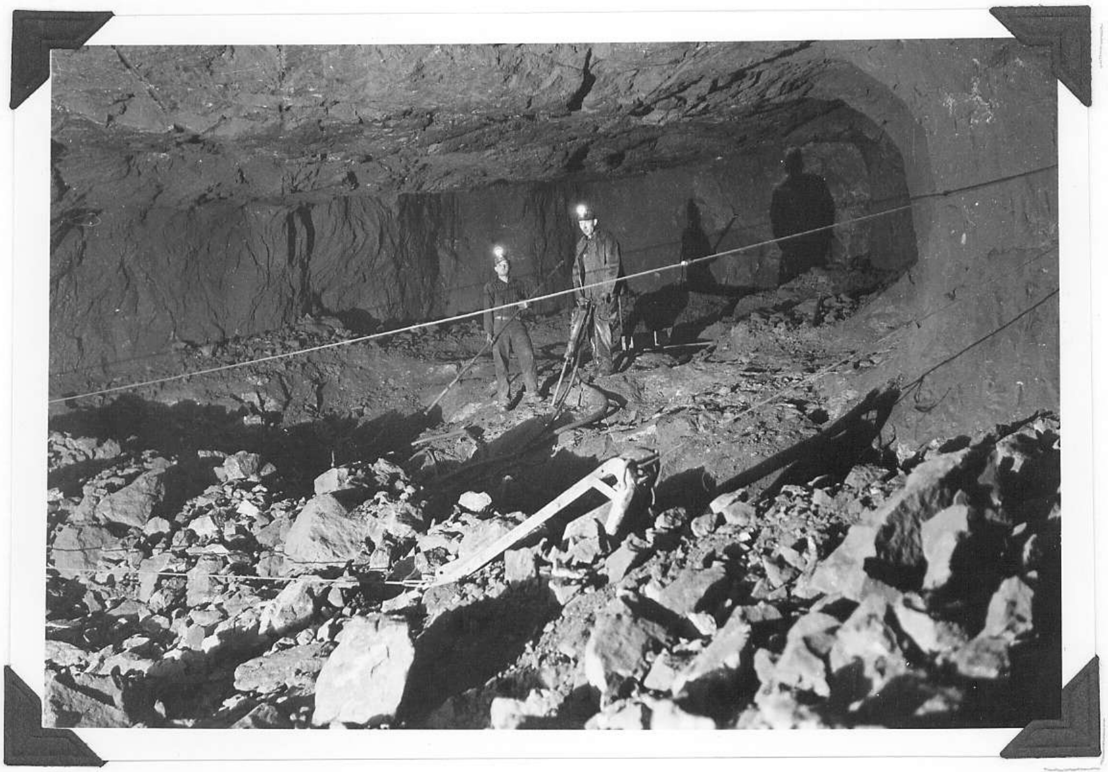
The underlying horizon, which is known locally as the "dolomite", consists mainly of thin-bedded, dark, fine-grained, crystalline carbonate. In thin-section, the rock is composed of interlocking, granular, somewhat uneven-grained anhedral grains of carbonate. Impurities present are carbon, which is segregated about the peripheries of the anhedral grains, and small specks of kaolinite. Examined in immersion oils, this carbonate shows an omega index of 1.694. Analysis is given in Table I, column 2; and from the composition of its carbon in 2A it will be noted that the magnesia in the carbonate is slightly less than in that of the ore-bearing horizon. On the other hand, the iron is higher. The presence of the iron is apparently the cause of the higher refractive index.



An Ore Car on Main Haulage Incline



A Stope in West Monarch Ore Body



"Stoper" at Work in East Monarch Ore Body

The Mine

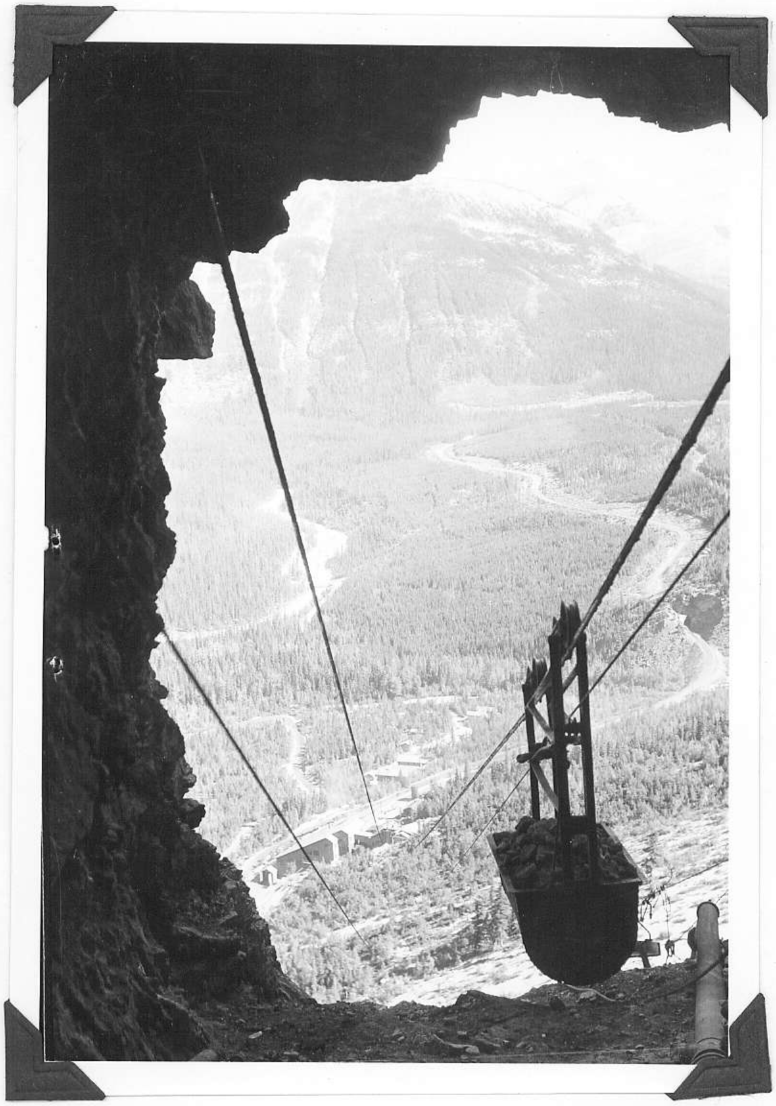
The main development workings are connected by ore passes to a common haulage tunnel. The haulage incline has a dip of 14°, and has two five-ton cars running in balance operated from the upper terminal. As there are both waste and ore pockets at each end of the incline, either can be handled with equal facility. Under the West Monarch ore body is a production drift. In this operates a car running in balance. The loader rides on the car, which may be stopped at any desired point. A flat production drift,which connects with the main haulage incline, has been driven under the East Monarch ore body.

Developments along the trend of the West Monarch have been carried south for 2,200' from the portal, with the face of the work still in ore. All the ore which has been milled has come from this ore body since the resumption of operations in August, 1933.

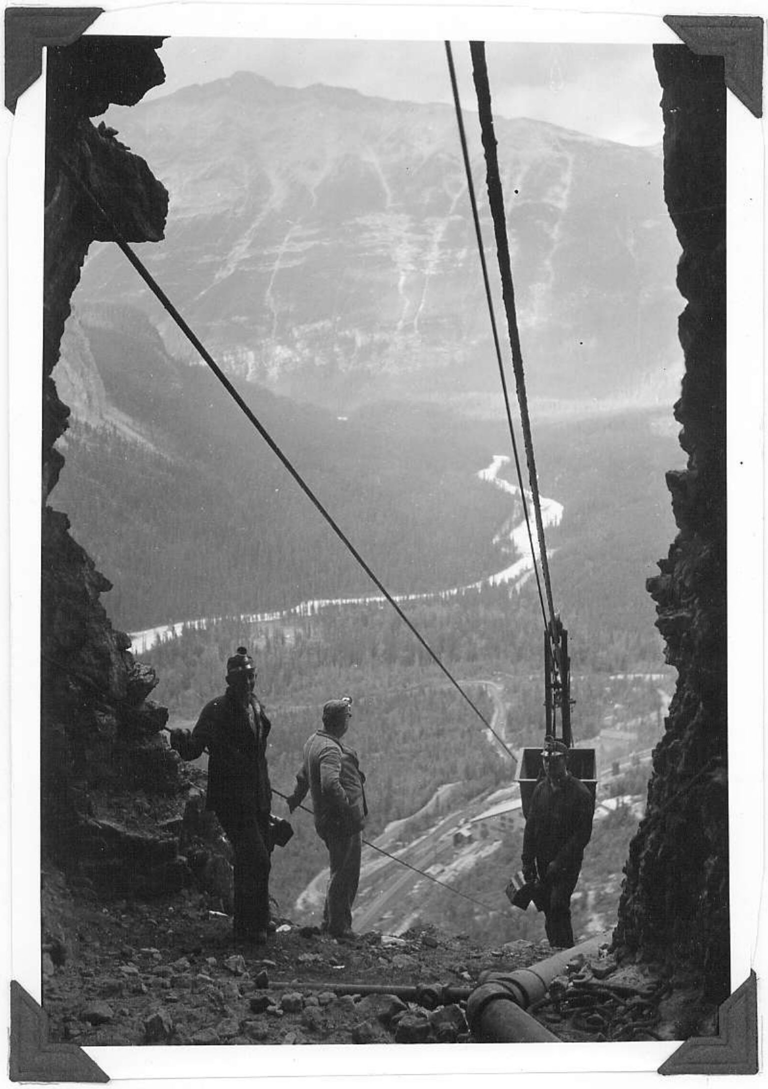
The East Monarch ore body has been developed over 650' in length, with the production drift extending 400' further than the present stopes. While no ore is being mined at present from the ore bodies, the stopes contain a large quantity of broken ore held in reserve. The mill is supplied with 300 tons of ore a day, and the search for further ore bodies is proceeding concurrently with stoping operations.

Aerial Tramway - Buckets in Motion

The Mill Taken from Aerial Tramway



Loaded Bucket Leaving Portal



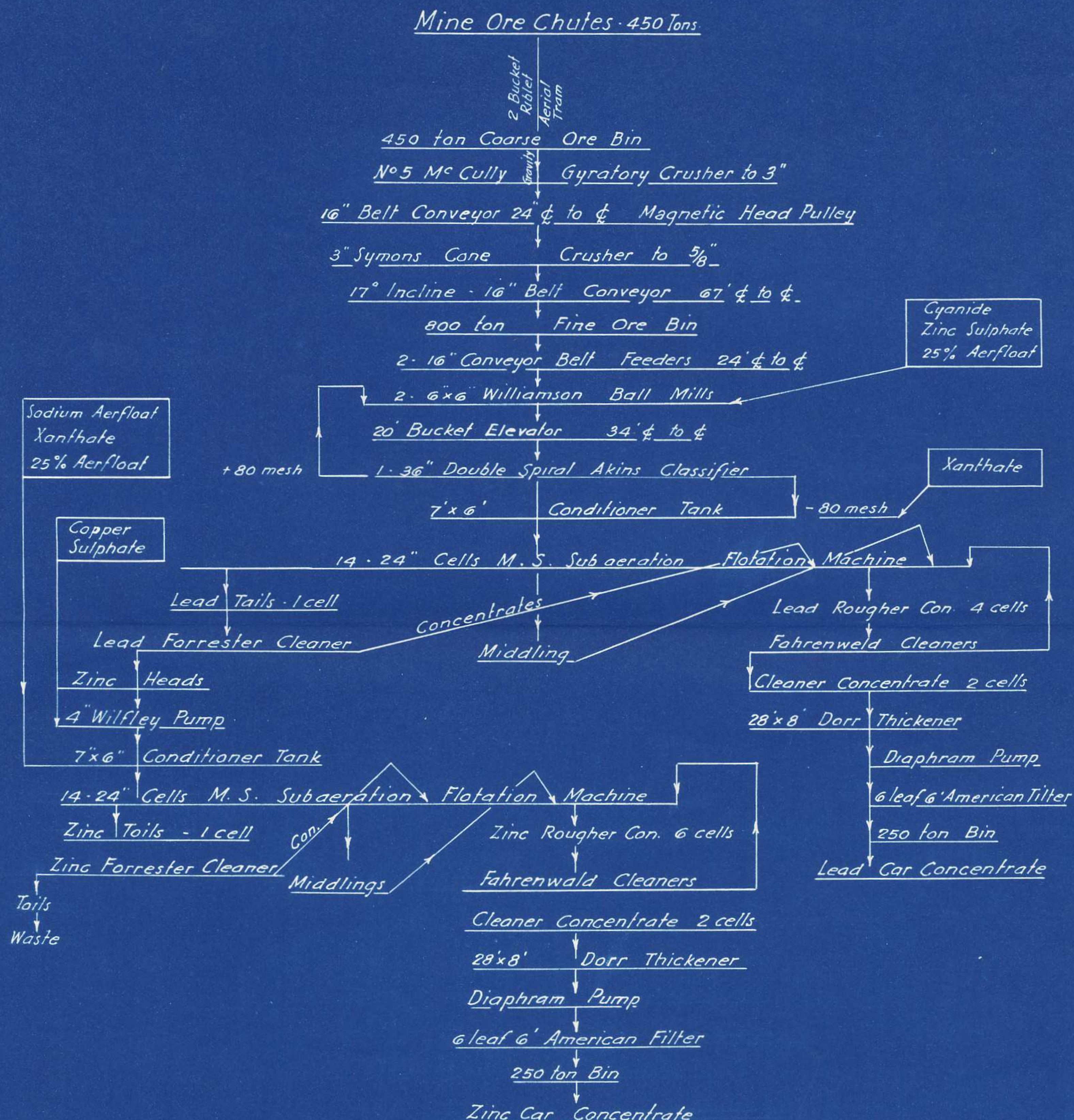
Empty Bucket Approaching Portal

Mount Burgess in Background

BASE METALS MINING CORPORATION LTD.

— FLOW SHEET OF CONCENTRATOR —

— MONARCH MINE, FIELD, B.C. —



The Tramway

An aerial tramway connects the terminal of the main haulage tunnel to the mill ore bins. The buckets, which hold two tons of ore, run at a speed of 2,500' per minute. This tramway is 1,720' between terminals, and has a capacity of 60 tons per hour. The tram can be operated from either terminal, and is power driven from the bottom when it is necessary to hoist men or supplies.

The Mill

The mill, designed and built with the object of taking full advantage of the gravity possibility on the talus slope of Mount Stephen, was placed 300' above the Kicking Horse River, and on the main line of the Canadian Pacific Railway. The flow-sheet for the mill is shown. The ore is dumped from the tram bucket into a 450-ton hopper bin, from which it goes by gravity into a Number 5, McCully 3-inch Gyratory Crusher. A belt conveyor connects to a 3-foot 5/8 inch Symons Cone Crusher. A belt again conveys the ore over an automatic scales into an 800-ton bin. From this bin the ore is fed by belts to two Williamson 6 x 6 ball mills. A 24-inch bucket elevator carries the discharge from the ball mills to a 36-inch double-spiral Akins classifier of the submerged overflow type, capable of handling a circulating load of 2,000 tons a day. The slimy overflow from the classifier enters a 5' x 7' lead conditioner tank. The coarse material from the classifier is returned to the ball mills. After conditioning for seven minutes, the pulp flows by gravity to a bank of fourteen Mineral Separation Sub A 24-inch cells. The froth from the first four cells is pumped to six 24-inch Fahrenwald flotation machines where the concentrates are cleaned. The middlings are returned to the head of the lead separation cells. The tails go through a Forrester cleaner where nearly all the lead is extracted. This concentrate is returned to the head of the lead separation. The lead tails or zinc heads from the Forrester drop into a 4-inch Wilfley pump which elevates them to a 5 x 7 conditioner tank from which the pulp flows to another bank of fourteen cells similar to the lead circuit. The froth from the first two Fahrenwald cells goes into a 28' x 10' Dorr Thickener tank.

In the zinc circuit the froth from the first six cells goes to six Fahrenwald cleaners. The middlings are returned to the head or rougher cells, while tailings enter a Forrester cleaner. The concentrate formed there is returned to the rougher cells. The tailings are discarded and flow into the Kicking Horse River. As in the lead Fahrenwald cells, the froth from the first two enters a Dorr Thickener tank, and the remainder is pumped back to the rougher cells.

Circulating rakers in the bottom of the thickener tank gather the pulp towards the center of the tank, from which place it is pumped to a 6'-12 leaf American Filter; six leaves being used for zinc and six for lead concentrates. From the filter the concentrates drop into bine. They are then loaded by gravity and hand into box cars standing on track scales, so that accurate weights can be obtained at the time of sampling.

The separation of the lead and zinc is brought about as follows: Zinc sulphate, 25% aerfloat and cyanide are added in the ball mills. Xanthate is added in the lead conditioner tank. Copper sulphate is added to the Wilfley pump, and sodium aerfloat, xanthate and 25% aerfloat are added to the zinc conditioner. One pound of sodium aerfloat is dissolved in seven gallons of water, and three pounds of xanthate are dissolved in seven gallons of water.

The quantities of reagents used per twenty-four hours are: zinc sulphate 400#, sodium aerfloat 10#, aerfloat 90#, xanthate 30-40# and cyanide 20#. These quantities, of course, vary slightly with changes in feed concentration.

Aerfloat acts as a collector, and causes frothing. Xanthate is a mild frother and an active collector. Cyanide is a depressor, keeping zinc and iron down. If too much is used the lead will also be depressed. Zinc sulphate depresses the zinc in the ball mills, and copper sulphate raises the zinc in the zinc conditioner.

Assaying Methods

Daily assays of each shift guide the flotation operators. Five samples of each eight-hour shift are automatically taken and consist of: (1) Heads (2) Lead tails or zinc heads (3) Final tails or zinc tails (4) Zinc concentrate (5) Lead concentrate.

For weighing up the samples, convenient weights for lead are: One-half grams on high leads - one gram on medium -

and two grams on low leads. The leads are dissolved in nitric acid (HNO_3) and evaporated to dryness. Sulphuric acid (H_2SO_4) is added, and heat is applied to evaporate the nitric acid. One to one sulphuric acid is added to stop fuming. The precipitates are then cooled. Thirty cubic centimetres of water is added, and the solutions heated to boiling. Then the solutions are cooled, filtered and the precipitates thoroughly washed with cold water.

In case of a high lime content, the calcium and lead as sulphates are washed back into the original beakers. One hundred cubic centimeters of water and five cubic centimeters of sulphuric acid are added. The solutions are boiled five minutes to dissolve the calcium sulphate ($CaSO_4$).

Following this, the precipitates are dissolved in ammonium acetate $NH_4(C_2H_3O_2)_2 \cdot 3H_2O$. Fifty cubic eentimeters of water are added, the solution is brought to boiling and titrated against ammonium molybdate $(NH_4)_6Mo_7O_{24} \cdot 4H_2O$ while hot. The outside indicator used is tannic acid ($C_{14}H_{10}O_9$). A direct percentage reading of lead is given for a one gram sample.

For weighing up the zinc content samples, one gram is used for low zincs and one-half gram for high zincs. The sample is dissolved in a solution known as "zinc mix", which consists of three parts by volume of nitric acid, one and one-half parts of sulphuric acid and two parts of "chlorate mix." This "chlorate mix" is a saturated solution of potassium chlorate in nitric acid.

The mixture is evaporated to dryness. A few drops of hydrochloric acid, thirty cubic centimeters of water, a pinch of ammonium persulphate and about two cubic centimeters of ammonium chloride are added. The ammonium persulphate precipitates any manganese present. The solution is made alkaline with ammonium hydroxide to precipitate iron; boiled for about two minutes and filtered while hot. A hot solution of water, ammonium chloride and ammonium hydroxide is used to wash the precipitate. The filtrate is made acid with hydrochloric; about ten grams of test lead is added to precipitate any copper and to prevent bumping. The solution is diluted to about three hundred cubic centimeters with water; boiled for fifteen minutes and titrated against potassium ferrocyanide $K_4Fe(CN)_6 \cdot 3H_2O$. The outside indicator is ammonium molybdate. A direct percentage reading of zinc is obtained for a one-half gram sample.

The percentage of iron is determined for every shift. To the filtrate from the lead assay are added aluminum strips. The solution is boiled until it is clear. When it is cold it is titrated against potassium permanganate. A direct percentage reading of iron is obtained for a one gram sample.

The silver content of the concentrates of every car and of composites of the "heads" and "tailings" is obtained each day by a fire assay. A half assay ton sample is used. The flux for fusing consists of lead oxide, four parts by volume - sodium carbonate two parts - borax glass one and one-half parts, and silica one-half parts.

A certain amount of nitre (KNO_3) is also added to obtain a proper sized "button". The following formula is used to determine the nitre content.

$$0.4 \quad (\%Fe(1.1) + \%Zn(1) + \%Pb(0.4) - 15 \quad = gms.KNO_3$$

If the result is zero, there is no need to add nitre; if negative, it is necessary to add flour, or some other reducing agent to increase the size of the button.

In cupelling, a temperature of about 1,750° C is maintained; particular care being taken to have the cupel show "feathers."

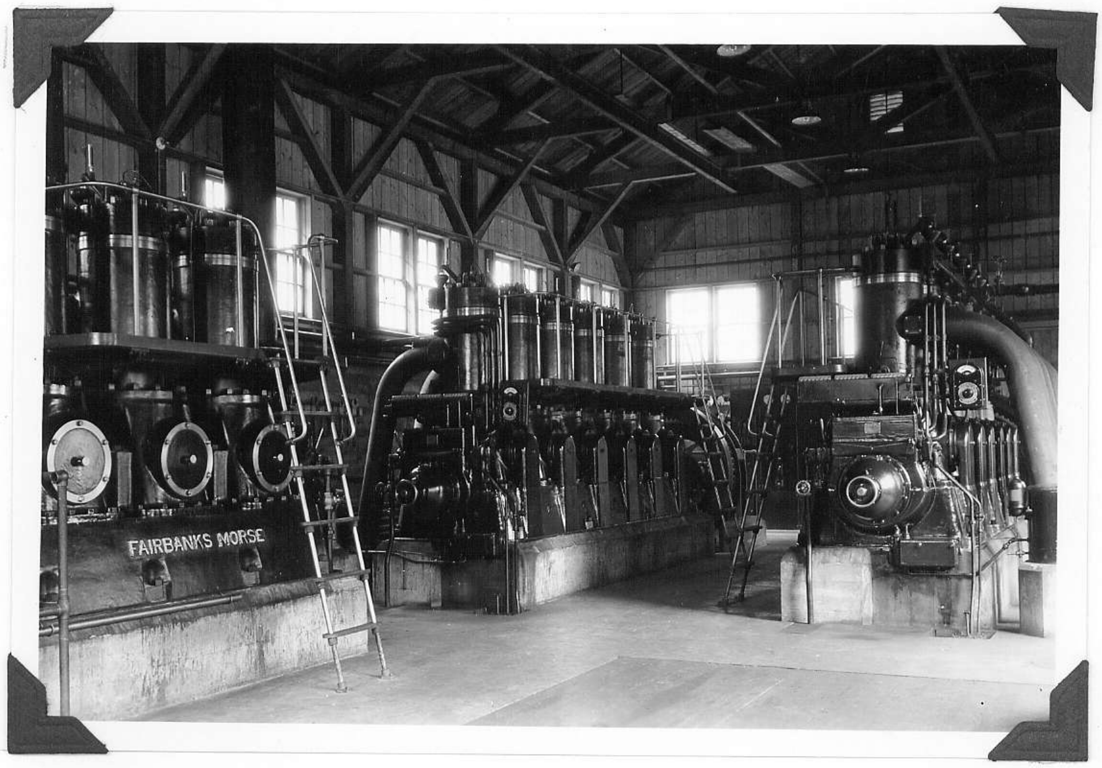
As a half assay ton (14.5833 gms.) sample was taken, twice the weight of silver in milligrams is equivalent to the number of ounces of silver per ton of "ore."

Approximately 300 tons of "ore" is milled per day, producing about forty tons of lead concentrate averaging 81.5% lead, 2.8% zinc and 12 oz. of silver per ton, and 70 tons of zinc concentrates averaging 61.5% zinc, 1.9% lead and 2.8 ounces of silver per ton.

The ore is free from deleterious ingredients such as arsenic, bismuth and fluorine, and carries such a small amount of iron sulphide as to produce a concentrate in which this mineral is practically negligible.

Power Plant

The power house stands near the mill on the same railway siding. There are three power units. Two 400 horse-power Fairbanks-Morse engines are connected directly to 375 K.V.A. Westinghouse alternators, generating at 480 volts.



Power Plant Showing Three Power Units

The exciters are driven by V belts from the main engine shafts. The third unit is also a Fairbanks-Morse engine of 180 horse-power, driving a 150 K.V.A. Fairbanks alternator, and through a friction clutch a 1,000-foot Sullivan compressor. Either or both of these machines can be run at the will of the operator. There is also a 550-foot Sullivan compressor directly connected to a 100-horse-power synchronous motor.

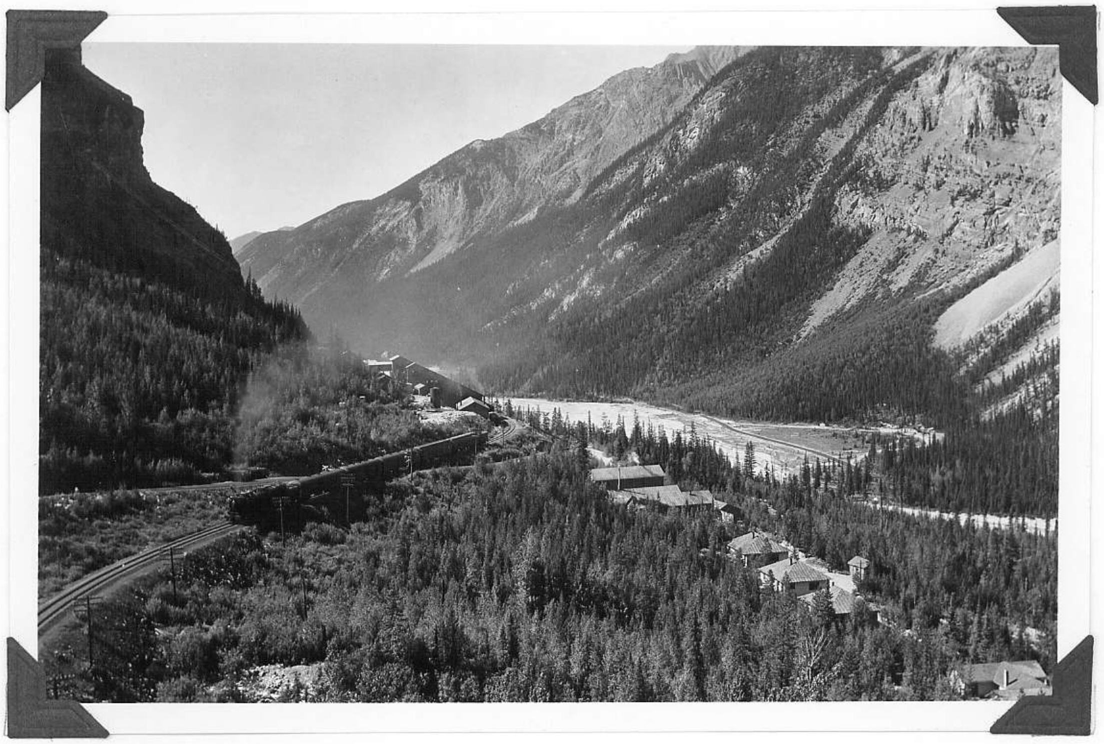
The switchboard is very complete, with voltage regulators and synchronizing panel, so that any alternator can be cut in or out. The hot water from the engine jackets and the compressor water is pumped to the head of the mill for use in the mill circuit.

The power plant supplies lights on an A.C. circuit to the mill and all buildings and living quarters. Heat is supplied by two small steam plants.

Living Quarters

Living accomodations are extremely convenient. Two double bunkhouses, with showers and toilets on each floor, accomodate eighty men, two men to a room. The mess hall is placed between the bunkhouses, making it easy of access for the men, and has modern kitchen equipment, including a large Sorvel cooled cold storage room.

Two stucco,five-room houses, east of the bunkhouses, equipped for housekeeping, are occupied by the mine superintendent and the staff. A four-room,stucco house, with two baths, is available for visiting directors and official guests. The general manager has a bungalow further east. Three two-



Living Quarters in Foreground

car garages amply house the trucks and official car. A few married employees occupy the old camp of the Kicking Horse Mine.

Costs

(1) Mine

Mining costs, inclusive of all overhead, depreciation and sundry contingencies, have been reduced to the astonishing figure of about one dollar per ton.

(2) Mill

Milling figures are extraordinary. With a ratio of concentrates of less than three to one, an amount of about 100 tons of lead and zinc concentrate is being produced each day at a total treatment cost of about $1.31 per ton of "ore" mined.

Extent of Operation

The operation has grown to be one of world wide significance. In substantiation of this statement, it may be said here that at the present time the only profitable lead-zinc mines within the Empire to be operated on an important scale are the Bawdwin in Burma, Broken Hills Mine in Australia, the Sullivan at Kimberley, B.C. and the Monarch; and the grade of concentrate that is being produced at the Monarch concentrator is the highest in the world.

The operation represents a triumph of efficiency over obstacles inherent to precarious market conditions. Over one hundred men are employed, and it is estimated that in wages and supplies, and in connection with freight and transport, a sum of over $750,000 is put into circulation annually.

Market

The total output from the mine has been contracted for by the British Metal Corporation Ltd. of London. The entire lead concentrate is sold to Belgium, while the zinc concentrate is disposed of throughout Europe.

Stock Prices

Toronto Exchange prices for Base Metals stock during the past five years are as indicated:

	High	Low
1933	$ 2.45	$ 0.80
1932	1.45	0.55
1931	1.45	0.90
1930	4.45	0.90
1929	6.55	2.75

There are 3,000,000 shares of stock - par value $1.00 - on which a dividend has never been paid.