SILVER-LEAD ORE OF THE BEATRICE MINE
LARDEAU MAP-AREA, BRITISH COLUMBIA

Very good effort. English could be better.

A Mineralographic Study of Ore from the Beatrice Mine

600371

Prepared as a final problem in Geology 409

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April, 1959

Aknowledgements

For assistance in the preparation of this report the writer is indebted to the following people: to Dr. R.M. Thompson of the Department of Geology, University of British Columbia, who performed a spectrographic analysis and supervised the laboratory work; and to J.A. Donnan of the above department, who gave technical assistance.

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Mt. Abbott and cabin at Abbott's Pass (copied from GSC Mem. 162)

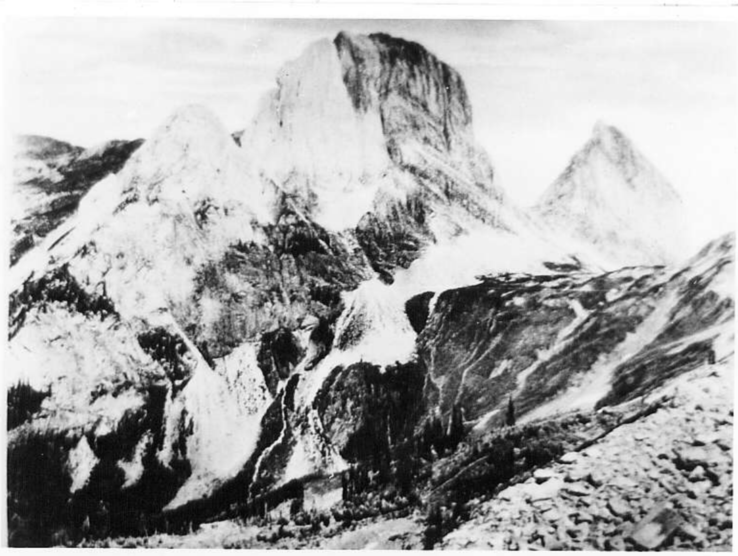

Fig. 2
Mt. Badshot, part of the Badshot or "Lime Dyke" formation.
(copied from GSC Mem. 162)

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Introduction

The Beatrice Mine, developed principally as a galena property, has been worked intermittently since 1898, with the only production hand-sorted ore which was removed in exploration. Throughout the history of the property high transportation costs and heavy smelter penalties for high zinc-content have discouraged attempts to put the mine into production. As the ore assays show good silver values, Beatrice Mining Company Limited is presently reconditioning the old workings, idle since 1920, preparatory to further exploration. Improvements in accessibility, and modern methods of ore-dressing may permit profitable operation.

This study was made to determine mineral associations, paragenetic sequence, and to give some guidance in the future treatment of the ores.

Previous Work

First mention of the Lardeau[2] is made by G.M. Dawson, R.C. Selwyn, H.M. Ami, and E.D. Ingall in the Annual Reports of the Geological Survey of Canada for the years 1887 to 1892, and by A.P. Coleman in Transactions of the Royal Society of Canada for 1889. R.W. Brock spent the seasons of 1903, 1904, and 1907 investigating the geology of the area, and the results of his work are to be found in the Summary Reports of the Geological Survey for those years. Daly's work is found in Memoir 68 of the Geological Survey. The Annual Reports of the British Columbia Minister of Mines from 1888 to the present describes the numerous properties of the area. Results of fieldwork of M.F. Bancroft in seasons of 1917, 1918, 1920-22, and J.F. Walker, M.F. Bancroft, and H.C. Gunning in 1926, are found in full in Memoir 162 of the Geological Survey. In the above publication H.C. Gunning exteneively describes the mineralogy of the area, devoting some attention to the Beatrice property. The Beatrice property is also described in the Annual Reports of the British Columbia Minister of Mines for the years 1898, 99, 1903, 04, 06, 14, 18, 20, and 1954-57. A brief account of the general stratigraphy of the area is found in Geology and Economic Minerals of Canada, 1947.

Location

The Lardeau Map-area includes parts of Ainsworth, Trout Lake, and Revelstoke Mining Divisions in the Kootenay District, southeastern British Columbia. The Beatrice[1] property is situated in the Trout Lake Mining Division at the head of the east fork of Mohawk Creek, latitude 50°44' north, longitude 117°34' west. Mohawk Creek is a tributary of Pool Creek, which flows into the Incommapleaux River at Cambourne. The Incommapleaux empties int the north east arm of Upper Arrow Lake at the town of Beaton.

1. See fig. 3 & 4
2. See figs. 1 & 2 for general pictures of countryside.

Fig. 3
The Beatrice Property, head of Mohawk Creek, elevation about 7000 feet.
(copied from GSC Mem. 162)

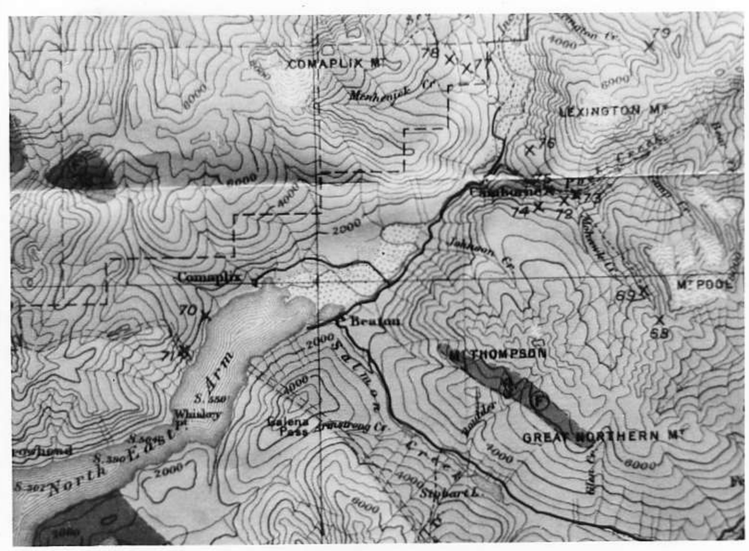


Fig. 4
Map of country in vicinity of Beatrice Property. (photograph of a portion of map included with GSC Mem. 162) Beatrice property is numbered 68, Spider Mine is numbered 74, formerly known as the Multiplex property.

Nearby towns are Cambourne, seven miles from the mine, and Beaton, about five miles from Cambourne.

Access is by road[i] to the Spider Mine (see fig 4) and from there four miles by tractor trail.

The property is about 450 miles from Vancouver, and may be reached by several routes. From Revelstoke both a road and the Canadian Pacific Railway extend to Arrowhead, at the north end of Upper Arrow Lake. From Arrowhead Beaton may be reached by small boat, or by twice-weekly auto ferry. From Beaton a five mile road extends to Cambourne, and remainder of route is as above. Approaching through Vernon one may either pass through Revelstoke, or drive 80 miles to Needles on Upper Arrow Lake, then take the above mentioned auto ferry. Approaching from the Trail area one may either take the ferry all the way up the Arrow Lakes, or drive up the east side of Kootenay Lake and all the way to Beaton by road.

Ore from the area can be shipped either to Trail or to the United States. At present, ore from the Spider Mine is trucked to Beaton, barged to railhead at Nakusp, and shipped to smelters in the U.S.A.

General Geology

The Lardeau map-area comprises a long irregular strip of country reaching from the north end of Kootenay Lake northwesterly across the Selkirk Mountains to the Columbia Valley at Revelstoke. It follows the trend of the Sedimentary rocks (Bancroft, Walker & Gunning, p6, 1929).

The southwestern side of the map area from Kootenay Lake to Upper Arrow Lake is bordered by the Kuskanax Batholith. North from Upper Lake granite gneiss forms the western boundary. Granitic and sedimentary gneisses extend across the northern border and granitic rocks extend southeasterly, crossing the northeast corner of the map area and continuing about half the length of the map-area, but beyond it, then trend east into the Purcell Range.

Most of the area, then, is surrounded by granitic rocks, the sedimentary rocks occupying a great trough between the igneous masses.

The bulk of the sediments comprise the oldest rocks in the area, and were placed by early workers in the Windermere.[ii] Later work showed that these sediments were stratigraphic equivalents of Lower Cambrian and later age, the top of the Windermere then being placed at the base of these sediments. These rocks are divided into three formations; the Hamill, Badshot, and Lardeau. The Hamill, a great variety of quartzites to schists to limestones outcrops along most of the northeast border of the trough, along the northwest border, and along the southwest border from Revelstoke to Trout Lake. Overlying the Hamill is the Badshot, or "Lime Dyke" formation, outcropping in a narrow band along the northeast, and a thin equivalent formation outcropping along the northwest and southwest. The central part of the trough is mainly the Lardeau formation consisting of a lower carbonaceous slate, or phyllite resting conformably on the Badshot formation. Following is a succession of grey

i. from Cambourne.

ii. Geology and Economic Minerals of Canada.

to greenish schists and phyllites, calcareous in part to the south, grading into limestone in the north. Succeeding the schists is a prominent band of limestone in the south, succeeded by quartzites, mica-, quartz-, and chlorite-phyllites and schists, with local bands of quartzite and limestone. Occupying smaller areas in the southwest side of the map-area, the Lower Milford Group overlies the Lardeau unconformably. The group is of slate, argillite, and limestone, with local basal conglomerate.

Intrusive into the sediments is a variety of greenstone dykes and sills of Triassic age. These are believed the intrusive equivalents of volcanics of the Kaslo Series found locally in the southwest part of the area.

Granite gneiss is intruded into Cambrian rocks in the northwest, and is in turn cut by granitic rocks resembling the Nelson and Kuskanax Batholiths. These rocks were correlated with the Nelson Batholith. The Kuskanax Batholith intrudes sedimentary rocks along the southwest. Intrusions are a wide range of fine to medium grained light colored granites, dykes and sills of aplites, alaskaites, syenites, granodiorites, and diorites.

The following table of formations is given by Bancroft, et al (1929), with ages revised to agree with those given by Geology and Economic Minerals of Canada (1947).

Table of Formations

Quaternary	Recent Pleistocene	Alluvium Glacial silts, Gravel	
Mesozoic and? Tertiary	Cretaceous	Kuskanax Batholith - granites	
		Nelson Bath. -	granite, granite-gneiss, porphyritic granite.
	Triassic	Kaslo series	massive & schistose, chloritic eruptives & intrusives sediments.
Unconformity			
Mesozoic & Paleozoic	Triassic & Upper Carb.	Milford Group -	cgl., slate, arg., limestone.
Unconformity			
L. Cambrian & later Paleozoics	U. Camb	Lardeau	sch., phyll., ls. etc.
	M. Camb	Badshot	crystln ls.
	L. Camb	Hamill.	qtzite, sch, phyll, ls.

The district was largely glaciated during the Pleistocene, with only the higher peaks projecting above the ice.

Structural Geology

The major structural feature of the Lardeau is a great synclinal trough, the sedimentary rocks surrounded by granitic rocks. The Badshot formation forms the one well-defined horizon in the area, and is a key to the general structure. (Bancroft, et al, p16, 1929)

In the south is a syncline overturned to the west, with the following succession to the west; an anticlinal arch spanning Kootenay Lake, another syncline, and a closely appressed anticline. These structures continue northward with the westernmost anticline tending to die out towards the centre of the map area, its place being taken by a large synclinal structure. Near the north end of the area the structures merge into one great south-plunging syncline.

Faulting is poorly displayed. The few faults observed have shown no great displacement. Undoubtedly much faulting occurs, and considerable displacement may exist, but evidence for it is difficult to find.

Economic Geology

The mineral deposits of the Lardeau have been explored since the early nineties, but at no time has the district been an important producer. (Gunning, Mem. 162, 1929) The most important properties were worked primarily for their lead and silver content, but also contained appreciable gold values and important quantities of sphalerite. As concentrating methods were inadequate to treat such a complex ore at the time of major development, many of the values were lost. Since high zinc-penalties were imposed by the smelters much of the ore was hand-sorted, to produce a lead-silver ore, and much valuable ore was left on the dumps as a result. Gunning believes that worthwhile mines would have resulted had some of the better properties been discovered thirty years later, with modern ore-dressing methods.

Much money has been spent on the development of gold-quartz veins in the district, but, due to the pockety nature of the deposits, and poor management, very few properties became economic producers.

Gunning (1929) divides the mineral deposits of the Lardeau as follows:

- Contact Metamorphic Deposits
- High Temperature Fissure Veins
- Gold-Quartz Veins
- Silver-lead-zinc Veins
- Galena - Sphalerite Replacement Deposits in Limestone
- Quartz-tetrahedrite Veins
- Silver-lead Veins in Limestone

The ore deposits of the district follow the strike of the sediments in distinct zones. As bodies of granite of presumably the same age surround the sediments, it is probable that the sediments form a huge trough entirely underlain by granitic rocks. (Gunning 1929)

The ore-forming solutions ascended along fissures, fractures, shear-zones and bedding planes in the sedimentary rocks. As fissures, fractures and shear-zones generally parallel the strike of the sediments, the solutions ascended along zones parallel to the bedding.

The belts of greenstone and chlorite schist have been unfavorable to formation of deposits. Where veins do occur in these rocks they are generally low grade, and erratically mineralized. However, where these rocks are carbonated, important deposits have been found. The beds of crystalline limestones are the most favourable horizons for mineral deposits. Replacement has occurred mainly along or near contacts of limestones with adjoining rocks. For fissure deposits containing lead, zinc, and silver the slates and argillaceous or carbonaceous schists seem to be most favourable. The massive beds of quartzite are generally unfavourable, being mineralized only where highly fractured.

Since little deep mining has been done in the area there is meagre evidence of the vertical extent of the deposits. Although deposits occur in the Lardeau from the mountaintops to the valley bottoms, there is no evidence that mineralization of a particular deposit should persist over such a range. However the Silver Cup property has been explored to a depth of 1200 feet below the outcrop, with reports of commercial ore in the lower levels. (Gunning 1929)

The mineral deposits of the Lardeau area are believed to have formed during the ascention of heated solutions during the final stages of intrusion of the Kuskanax Batholith and other granitic rocks surrounding the sediments. The age of these intrusions is considered to be Cretaceous, with the Kuskanax Batholith somewhat younger than the Nelson batholith. It is quite probable that the final stages of activity carried on into early Tertiary times.

History of the Beatrice Property

The Beatrice property is at the head of Mohawk Creek, about seven miles from Cambourne. The original property, first worked in 1898, consisted of four claims, the Beatrice, Edmonds, Florence, and Folsom. Original owners were F.F. Fuller and Bonaker Brothers. Ore consisted of argentiferous galena, carrying argentiferous tetrahedrite, a varying percentage of sphalerite, and a little pyrite. Width of ore at the outcrop was nine feet. Work the first year consisted of a small amount of drifting and sinking, with no ore shipped as transportation was too expensive.

The following year the property was bonded to Chicago capitalists. Men were engaged in cutting a rawhide trail, and 70 tons of ore were shipped to the smelter in the summer. Average silver content was $85.00 per ton with special shipments running to $160.00 per ton. All the ore taken out to this time was removed in sinking a 40-foot shaft, and driving a 60-foot tunnel. Many claims were staked in the vicinity of the Beatrice group.

In 1903 the property was worked by Beatrice Mines Ltd. organized in 1902. Although the Beatrice had been considered essentially a galena property, in the summer of 1903 a large ledge of free-milling gold assaying favourably was uncovered. Principal work was done on the galena showing, with 400 feet of tunnel driven to hit the surface outcrop at depth. The gold ledge was also opened up. Galena ore shipped from property was all hand-sorted as transportation costs still ran high. Installation of a cable tramway from the mine to Cambourne was considered. ?

In 1904 the Beatrice was found to be on the southeast extension of a gold belt which continued for ten miles northwest. The group then consisted of three crown-granted claims. With a new trail nearly completed, almost 445,000 lbs. of ore had been shipped to date.

Management passed from the original owners to the hands of shareholders, with work continuing until 1906, when much development was done. From 1906 to 1910 the mine lay idle. Operations were resumed in 1910, but ceased once more in 1911.

In 1914 the orebodies consisted of two veins. The first, two to five feet in width, carried fine-grained solid sulphides of an intimate mixture of galena, sphalerite, pyrite, and grey copper. The Annual Report of the B.C. Minister of Mines for 1914 gives the following assay: Gold - 0.25 oz. per ton; Silver - 120.72 oz. per ton; Lead - 17.42%; Zinc - 10% to 23%. Considerable work was done, and much ore shipped to Trail. Due to the distance ore had to be rawhided (7 miles to a wagon road), and penalties on high zinc-content imposed by the smelter, the mine was still not a paying proposition. The vein was highly contorted in badly broken phyllite, and required much timbering. The mine now consisted of two adits, the lower at elevation 7000 feet, and the upper (No. 2 level) driven from the opposite side of the butte, 150 feet below No. 1. The lower level was 3000 feet long, and connected to the old prospect shaft by means of a raise. Ore shipped in doing this work was low zinc-content, within smelter limits. Later ore had zinc-content in excess of 15%.

The second vein, the "gold lode", lies to the west of the galena bearing vein. This vein has been opened up by surface cuts which showed four to six feet width. Ore ran 0.15 oz. gold, and 0.95 oz. silver, the mineralization being pyrite and a small amount of galena. Insufficient work was done to determine its economic value. Other quartz outcrops occur on the property, but have not been prospected.

In 1918 the mine was bonded to New Era Mines, Limited, of Vancouver, who expected to reopen the mine. Operations were started in 1919, but suspended late in 1920. The property then consisted of two claims, the Folsom, and the Edmond. The main work was done in clearing out the old workings in order to exploit the exposed orebodies. A.G. Langley[i] gives the following assays:

(1) Across two feet exposed in face of raise from No. 2 adit:
Gold - 0.06 oz., Silver - 69.8 oz., Lead - 16.1%, Zinc - 31%.

(2) Across two feet of small lens in roof of drift in No. 2 adit:
Gold - 0.03 oz., Silver - 29.8 oz., Lead - 7.2%, Zinc - 16%.

(3) Sorted ore:
Gold - 0.75 oz., Silver - 82.5 oz., Lead - 25%, Zinc - 28%.

A light, two-bucket tramway was installed to connect No. 2 level with new bins on the main trail. The trail was improved, and everything put in readiness for production, but high zinc-content prevented a satisfactory market.

The mine then lay idle until 1954, when Beatrice Mining Co. Ltd. was formed to develop the property. Capitalized at 50,000 shares of $1.00 par value, the company has offices at 404 Pemberton Building, 744 West Hastings St., Vancouver. The first year the trail was reopened, the adits rehabilitated, and the old camp improved. In 1955 some assessment work was done on the surface. The property then consisted of the original Beatrice and Folsom crown-granted claims, and four recorded claims covering in part the cancelled crown-granted Florence and Silver-Crown claims. From 1955 through 1957 camp, trail, and rehabilitation work was continued, with the mine finally accessible by four-mile tractor-road in 1957.

i. Ann. Rept. Minister of Mines, B.C., 1920, p. 128.

" The rocks on the property are Lardeau black slates and carbonaceous schists, fine-grained dark grey grits, quartzites, and light grey talcose schists. Their average strike is N 40° W, and dip is 60° to 70° N.E., but much contortion has occurred." (Gunning, 1929) The carbonaceous schists contain the ore-bodies. The ore occurs along slips and shears parallel or sub-parallel to the bedding. Irregular veins varying from a few inches to several feet wide, contain sphalerite, galena, tetrahedrite, pyrite, and minor chalcopyrite in a gangue of quartz, minor carbonate, and inclusions of silicified country-rock. Replacement has played an important part in the formation of the ore. Except at the outcrop there is no indication of the vein at surface. Little has been recognized as a guide to ore, except that the crushed zone, which extends northeast, might be favourable.

Mineralographic Report

Samples

Samples consisted of approximately one dozen hand specimens and eight accompanying polished-sections.

A. Megascopic

Specimens were roughly equidimensional to elongated angular fragments ranging from 3/4 inch to 3 inches in diameter.

Minerals observed were pale brass-yellow pyrite, light yellow to orange sphalerite, galena, tetrahedrite, and minor chalcopyrite. The samples were divided into three main groups on the basis of variations in mineralization.

1. Dense, very fine-grained orangy-brown sphalerite, fine to coarse grained pyrite, replaced by and interfingered with galena and tetrahedrite (See fig. 5) No chalcopyrite was observed. A small amount of quartz gangue was present. Samples were of varying freshness, some specimens showing a little limonitic stain. Estimated composition is as follows:

Sphalerite - - - - - 50%
Tetrahedrite - - - - 24%
Galena - - - - - - - - 20%
Pyrite - - - - - - - - 5%
Quartz gangue - - - - 1%

Evidence?

Replacement has played an important part in the formation of this ore.

2. Coarse-grained galena, medium to coarse-grained light yellow sphalerite, and a slight amount of chalcopyrite. The cubes of galena show no particular orientation, and, while some of these specimens are extremely dense, others show some open spaces between the coarse grains. The minor amount of chalcopyrite appeared to fill some of these spaces. No pyrite, and very little quartz was observed in this ore. Tetrahedrite also could not be observed in the hand specimens, but some fine grains may exist. Samples had generally a very fresh appearance. Estimated composition is as follows:

Galena - - - - -88%
Sphalerite - - -10%
chalcopyrite - - 2%

3. Quartz lightly mineralized with galena and tetrahedrite, very slight pyrite and chalcopyrite. This ore may occur near the fringes of mineralization

as some open spaces are present in the sample. Quartz is present both as the white, fine- to microcrystalline variety and as optically clear hexagonal prisms up to one - quarter inch in diameter, with pyramidal terminations. Pyrite is mainly present as isolated well-crystallized pyritohedrons. Some samples showed considerable limonitic alteration, with a small amount of $PbCO_3$. A few slender crystals of calcite have been deposited on the quartz crystals.

As would be expected, gradations occur between these groups.

B. Microscopic

(a) Minerals Present (see figs. 15 a & b)

Sphalerite: showed good polish, hardness C, medium grey in plain light, hazy golden-brown internal-reflection in carbon-arc.

Galena: surface well-polished, but extremely pitted (see fig. 6) due to cubic cleavage, color galena-white, hardness B.

Tetrahedrite: polish good, color light grey, hardness D. Microchemical tests: Sb positive, As negative.

Pyrite: poor polish, color pale brass-yellow, hardness F.

Chalcopyrite: good polish, color brass-yellow, hardness C, brittle, slightly anisotropic.

(b) Order of Abundance, and Amounts Present

Polished sections were grouped on the same basis as the above hand specimens.

1. Sphalerite - - - - - - 10% - 60%
   Galena - - - - - - - - - 15% - 40%
   Tetrahedrite - - - - - 10% - 20%
   Pyrite - - - - - - - - - 10% - 15%
   Chalcopyrite - - - - - 0.5%
   Quartz gangue - - - - - 5%

2. Galena - - - - - - - - - 90%
   Sphalerite - - - - - - 5%
   Quartz gangue - - - - 5%

3. Galena - - - - - - - - - 40%
   Tetrahedrite - - - - - 15%
   Sphalerite - - - - - - 10%
   Chalcopyrite - - - - - 1%
   Pyrite - - - - - - - - - trace
   Quartz gangue - - - - 29%

Note: as samples were small and grain-size varied considerably, many samples must be examined to determine the true % composition.

C. Spectrographic Analysis

As negative microchemical tests for silver were obtained from tetrahedrite previously reported to be silver-bearing, a spectrographic analysis of a sample of tetrahedrite was performed by Dr. R.M. Thompson of the University of British Columbia. Dr. Thompson gives the following results:

Major Elements (over 1%)	Minor Elements (0.1% - 1%)	Trace Elements (below 0.1%)	Not Detected		
Cu	Ag	Pb	Mo	Al	In
Sb		Si	Ba	Ce	P
Fe		Mg	As	Mn	Hg
Zn		Cd	B	Be	Ti
		Bi	Se	Ge	Te

It can be seen that silver is present in an appreciable amount, i.e., between 32 and 320 oz. of silver per ton of tetrahedrite. Taking the average tetrahedrite content of the ore as 15% yields between 4.8 oz. and 48 oz per ton of ore. Early assays indicated from 28 oz. to 120 oz. of silver per ton of ore. As it is not known from which part of the mine this sample of tetrahedrite was obtained, a closer comparison cannot be made. However it is evident that though silver values vary considerably throughout the mine, they are generally high enough to be attractive.

D. Textures

Ice-cake texture was observed in pyrite, with extremely corroded grains inset in groundmasses of sphalerite, galena, and tetrahedrite. (see fig.9 & 10)
Caries texture is exhibited by sphalerite, galena, tetrahedrite, and chalcopyrite in contact with each other.(see fig. 7 & 11)
Crystallographic texture is shown by minute veins of sphalerite replacing galena along its cleavages. These veins show a fine relict texture, pseudomorphing galena. (see fig.12)
Mutual-boundary texture is exhibited by some grains of tetrahedrite and galena in contact.(see fig. 7)
Graphic texture is shown by very fine grains of galena in sphalerite.(see fig.13)

E. Grain Sizes (diameters)

Mineral	Min. size (microns)	Max. size (microns)	Average (microns)
Pyrite	10	700	70
Sphalerite	10	3 cm.	- - - -
Galena (ore)		50 mm.	
Galena (in sphalerite)	2	4	3
Tetrahedrite	10	2.4 mm.	
Chalcopyrite (in sphalerite)	10	20	
Chalcopyrite (in gal. & tetra.	100	400	100
In some cases average grain sizes were difficult to determine			

F. Paragenesis

The following relationships were observed:

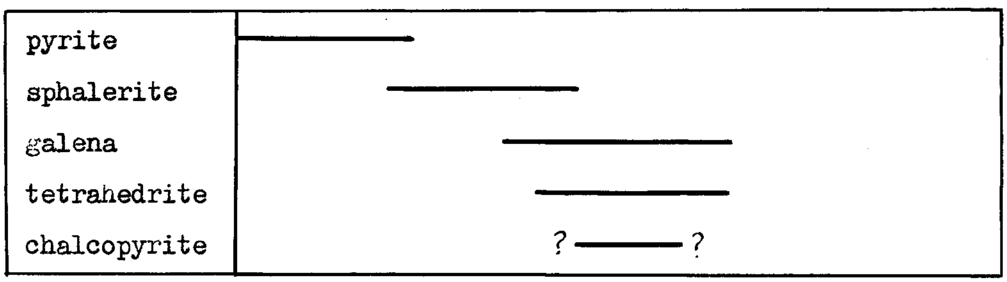
1. Pyrite is replaced by sphalerite, galena, and tetrahedrite.(see figs. 8, 9, 10)
2. Sphalerite is replaced by galena and tetrahedrite. (see figs. 7 & 8)
3. Sphalerite also replaces galena in extremely fine veins along galena cleavage directions. (see fig. 12) The cubic structure of the galena is preserved as relict structure.
4. Minute irregular grains of galena are found in sphalerite. (see fig.13) This may be replacement or exsolution.
5. Galena and tetrahedrite are intimately associated, and both are generally

later than sphalerite. Since no tetrahedrite was found in the sample having spalerite replacing galena along cleavage directions it is possible that tetrahedrite deposition began slightly later than galena deposition.

6. As chalcopyrite occurred sparingly, conclusive relationships could not be determined. However, chalcopyrite was undoubtedly deposited later than pyrite, and may have been later than sphalerite, but its relationship to galena and tetrahedrite are not at all clear. (see fig. 11)
7. As was mentioned previously, small amounts of limonite and amorphous lead-carbonate were present on weathered ore.

The paragenetic sequence is then as follows: pyrite, followed by an overlapping deposition of sphalerite, galena, and tetrahedrite. Galena and tetrahedrite may have been simultaneous, or, as shown in 5. above, tetrahedrite may have been slightly later than galena. Chalcopyrite deposition may have beon contemporaneous with galena and tetrahedrite, or may have occurred during the last stages of mineralization. Much later in time some of the ore became oxidized, either at the surface, or at depth through percolation of ground waters. Limonite and lead carbonate formed as alteration products of pyrite and galena respectively.

A graph showing deposition with time is given below.



time

A Vandeveer Diagram showing paragenetic relations is given on page (fig.)

G. Temperature Classification

As sphalerite, galena, tetrahedrite, and chalcopyrite are all intermediate temperature minerals, temperature of deposition is between 500°C and 250°C.

The presence of open space filling as well as massive replacement indicates deposition at intermediate depth.

The deposit is therefore a mesothermal hypogene deposit.

Conclusions

The Beatrice Mine, then is a mesothermal silver-lead vein deposit in the Lardeau Formation carbonaceous schists. Minerals present are pyrite, galena, sphalerite, tetrahedrite, and chalcopyrite, with attractive silver values, carried mainly by the tetrahedrite. While high zinc content caused much valuable ore to be left on the dump during early operations of the mine, a knowledge of grain-sizes and of modern ore-recovery methods may make crushing and further treatment of this ore economical. Hampered throughout its history by transportation difficulties, the mine is now connected by tractor trail to the Spider Mine road, and thence to Cambourne. This, together with present excellent transportation facilities from lakehead to smelter, may serve to make the mine a paying proposition. An added inducement is the present smelter bonus on silica-content.

While it is evident from past history of the mine and the Lardeau country as a whole that economic operation is difficult to achieve, these recent improvements in mineral dressing methods, transportation, and smelter-rates may well permit the present owners, Beatrice Mining Co, Ltd., to put the property into production.

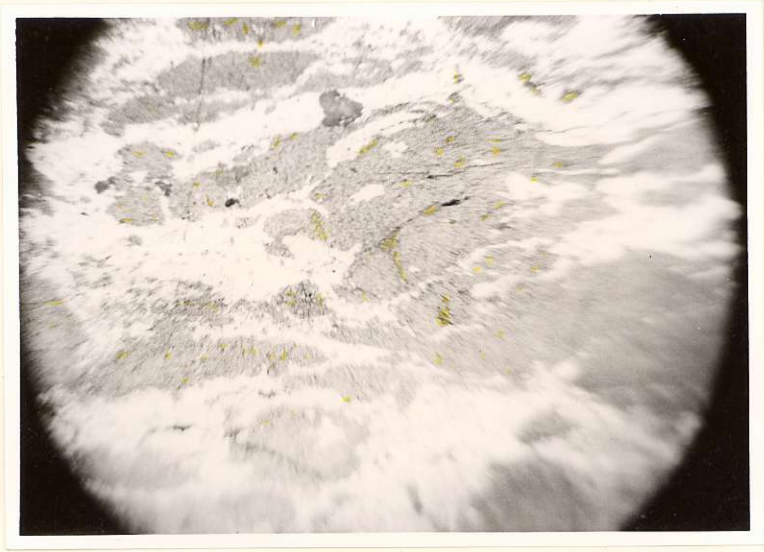


Fig.5

Polished section of fine-grained replacement ore, Magn. approximately X3. White mineral is mixture of galena and tetrahedrite, yellow is pyrite, medium gray is sphalerite, dark gray is quartz.

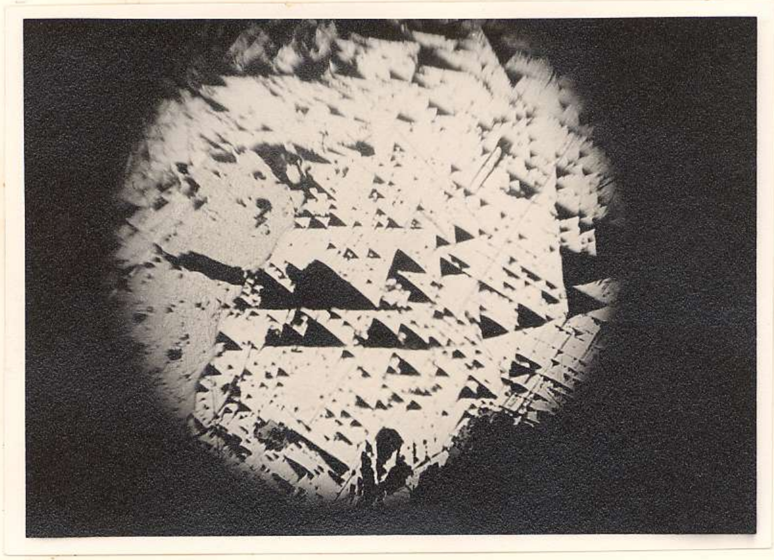


Fig. 6

Polished section showing cleavage pits in galena (white). Gray mineral is tetrahedrite.

Magnification X 50 (approx.)

Fig. 7
Polished section showing caries texture in sphalerite, and caries to mutual-boundary texture in galena and tetrahedrite. Magnification X 150(approx)

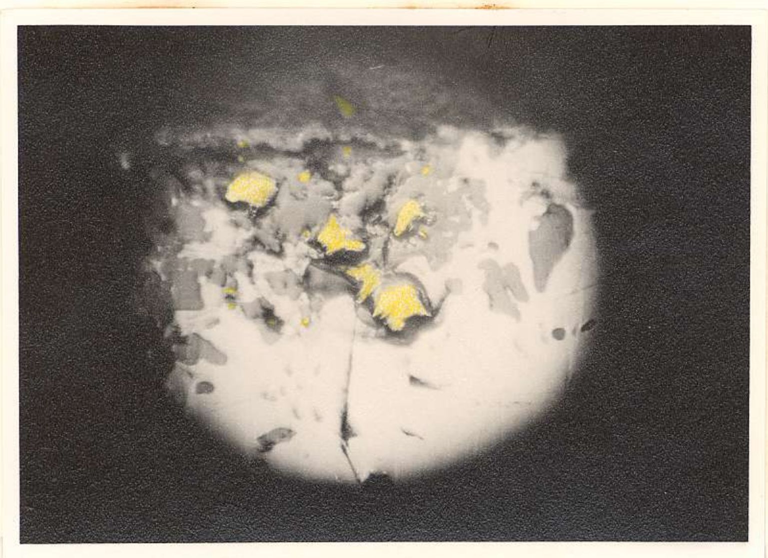


Fig. 8
Photomicrograph of polished section showing pyrite (yellow) replaced by sphalerite (gray), and sphalerite replaced by galena (white). Magnification X 150 (approx).

Fig. 9
Photomicrograph of polished section showing galena (white), and tetrahedrite (gray) replacing pyrite (yellow). Magnification X 100(approx).

Fig. 10
Photomicrograph of sphalerite replacing pyrite, showing ice-cake texture. Black mineral is quartz. Magnification X 100 (approx)

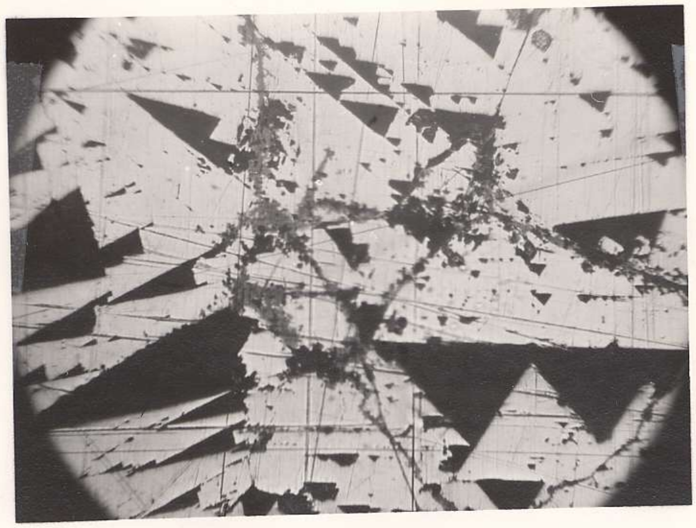


Fig. 11

Photomicrograph of chalcopyrite showing caries texture in galena. Medium gray mineral is sphalerite, dark gray mineral is quartz. Magnification X 150 (approx)

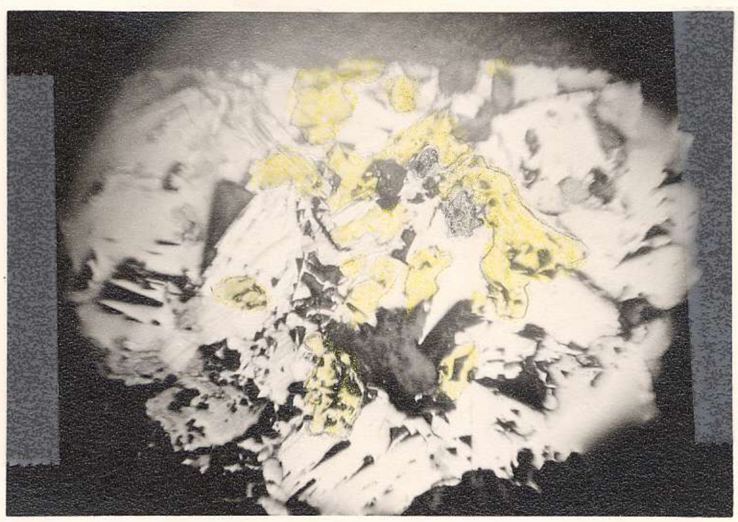


Fig. 12

Photomicrograph of sphalerite pseudomorphing galena, showing crystallographic texture. Magnification X 300 (approx).

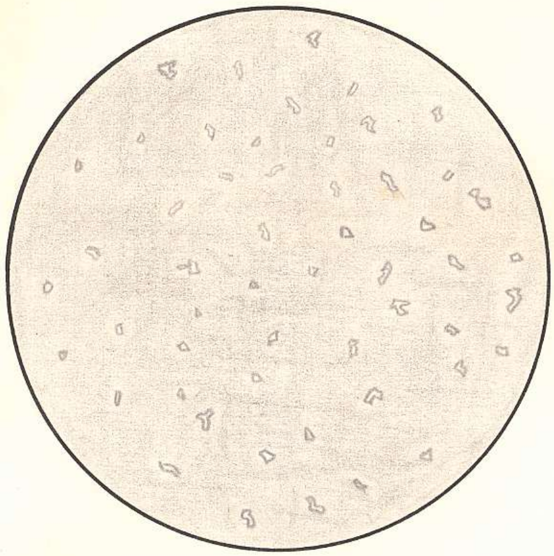


Fig. 13

Drawing of polished section showing graphic texture of galena in sphalerite. Magnification approximately X1000.

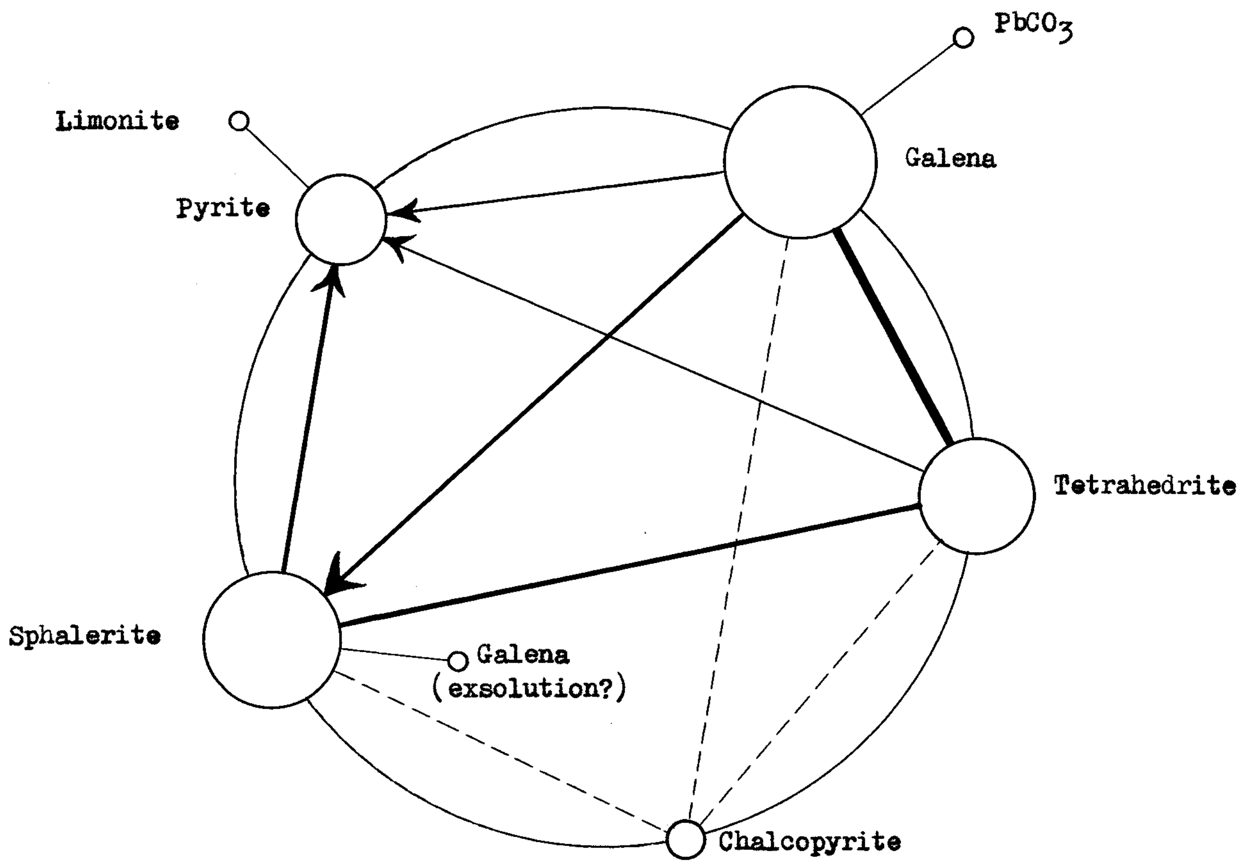


Fig.14 Vandeveer Diagram

The primary minerals are represented by small circles arranged on the circumference of a large circle. Diameters of small circles indicate relative abundance of minerals. Lines connect each pair of minerals observed to be in contact, with thickness of line indicating frequency of contact. Where replacements occur, arrowheads point towards minerals replaced. Absence of arrows indicates simultaneous deposition. Dotted lines are used where order of deposition is uncertain. Exsolution minerals are placed on a circle within the primary circle, and supergene minerals are placed on a circle outside the primary circle.

MINERALOGRAPHIC LABORATORY

Date Mar. 17, 1959.

Name or number of section Beatrice - 1.

Polish	good	good	good but pitted	poor	good
Colour	med. gray	light gray	white	pale brass-yellow	brass - yellow
Hardness	C	D	B	F	C
Streak	orange		black		
Texture	caries	caries mut.-bndry	caries mut-bndry	ice-cake	caries
Anisotropism	---	---	---	---	slight
Pleochroism	---	---	---	---	---
Twinning	---	---	---	---	---
Internal reflection	golden-brown	---	---	---	---
Texture under xd. nicols	---	---	---	---	---
Cleavage	--	---	cubic -	---	---
Association					
Etch tests					
$HgCl_2$					
KOH					
KCN					
$FeCl_3$					
HCl					
HNO_3					
Aqua regia					
Microchemical tests		As neg. Sb pos. Cu pos.			
Grain size					
Mineral or Group	sphalerite	tetrahedrite	galena	pyrite	chalcopyrite

Confirmatory features such as magnetism, sectility, fluorescence, blowpiping, radioactivity, etc. . . . .

Interpretation of textures.

Fig 15a

MINERALOGRAPHIC LABORATORY

Date March 17, 1959.

Name or number of section Beatrice 2.

Polish	good, but pitted	good	good
Colour	white	med gray	med gray
Hardness	B	C	C
Streak			
Texture	caries	caries	crystallographic - veined
Anisotropism			
Pleochroism			
Twinning			
Internal reflection		golden brown	
Texture under xd. nicols			
Cleavage	cubic - pits		
Association	sphalerite	galena	galena, sphalerite
Etch tests.			
$HgCl_2$			neg.
KOH			neg.
KCN			neg.
$FeCl_3$			neg.
HCl			stains rapidly black
HNO_3			
Aqua regia			
Microchemical tests			
Grain size			10 mu.
Mineral or Group	galena	sphalerite	sphalerite

Confirmatory features such as magnetism, sectility, fluorescence, blowpiping, radioactivity, etc.

Interpretation of textures.

Fig 15b

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