BRITISH COLUMBIA DEPARTMENT OF MINES

HON. W. A. McKENZIE, Minister

Non-Metallic Mineral Investigations

REPORT No. 1.

BARITE IN BRITISH COLUMBIA

By

A. M. RICHMOND

Submitted by

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Bureau of Mines

Victoria

Department of Mines.

Office of Provincial Mineralogist

BUREAU OF MINES
Victoria

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To the Honourable W.A. McKenzie,

Minister of Mines.

Sir:-

I beg to submit herewith Report No. 1 of a series on Non-Metallic Investigations by A.M. Richmond.

In accordance with your instructions, Mr. Richmond commenced this investigation in June, 1931, and has been continuously engaged since that time. The objective is to investigate primarily many non-metallic mineral deposits to see if they can be utilized in British Columbia manufactures and industries. It involves field examination, a study of imports of non-metallics, specifications of purchase, and many intricate factors in non-metallic trade.

It is hoped that the facts obtained and inferences drawn therefrom will stimulate the use of Provincial deposits of certain non-metallic minerals.

Further reports in the series will be issued from time to time as completed.

I have the honour to be,
Sir,
Your obedient servant,

JOHN D. GALLOWAY

Provincial Mineralogist.

NON-METALLIC INVESTIGATIONS

FOREWORD

By

John D. Galloway, - Provincial Mineralogist.

Under the classification of "Non-Metallic Minerals" is included a wide variety of minerals mined, quarried and processed for use in industry and manufacturing. Coal is also classed as a non-metallic mineral but is not considered in this investigation as it is of sufficient importance in British Columbia to constitute a distinct and separate class of mining. The production of "Structural Materials" is a branch of non-metallics that is of considerable importance in British Columbia. In recent years the annual production of structural materials has varied from $3,000,000 to $4,000,000, while the total output to the end of 1930 is recorded at $62,538,833.

In addition to structural materials, such as clays, limestone, sand and gravel, building-stone, etc., many other non-metallic minerals are used in industry and manufacturing. Much progress has been made in recent years in manufacturing and processing various non-metallics for the complex uses of modern civilization.

The non-metallic branch of the mining industry of most countries is of great importance, as to quite an extent it is the basis of building and construction work. In Canada in recent years, non-metallics (exclusive of coal) account for about 25 per cent of the total gross value of the mineral industry. In British Columbia in 1930 structural materials and other non-metallic minerals amounted to 8.2 per cent of the gross value of the mineral output.

British Columbia is bountifully supplied with a variety of useful non-metallic minerals and the basic minerals of the structural materials industry are plentiful. Building-stones of many kinds, brick and tile clays, sand and gravel and limestone are found in many parts of the Province and a local supply is generally available wherever required. The determining factor in the growth of the structural materials industry is the growth of population and the accompanying

building and other constructional work. This branch of the mineral industry has been adequately developed in British Columbia and quarries and plants, many of them up-to-date and well-equipped, are prepared to supply any demands of the building trade. The present extent of the industry is shown by the fact that structural materials output in 1930 amounted to $4,092,568 and in addition, other non-metallic minerals produced were valued at $436,234, making a total of $4,528,802, or 8.2 per cent of the gross value of the mineral output for the year.

The present investigation is directed towards compiling information which may result in the greater use of local deposits of non-metallics, or the opening up of certain deposits now lying unworked. It is not expected that much can be done in the field of ordinary structural materials but even here some useful results may be obtained. Expansion of this branch of the mineral industry will come with increase of population and industry. In certain lines present plants and equipment have capacity in excess of demands. The present investigation may show, however, where certain deposits are more suitable, owing to quality or location, than those now actually being used.

It is known, however, that certain non-metallic minerals either in a raw or manufactured form are imported into the Province. It is possible that certain local deposits could supply this demand where there is sufficient potential business to warrant the investment of the necessary capital to open up the deposits. It is in this field that the present investigation is largely centred with the objective of starting new industries, even though these may initially be quite small. There is also a Canadian demand (and possibly from other countries) for certain non-metallic minerals of a high degree of purity. An examination of Provincial deposits may show that some of them have the requisite purity to command these far-away markets.

It should be realized that in some instances the reports will show that the profitable working of certain deposits is improbable under present conditions. Varied factors of increased market, changing tariffs and freight rates, and the results of further research may, however, at any time make such non-metallic mineral deposits of commercial value. It is believed therefore that the compiling of the facts and the reasonable inferences deducible therefrom will be useful to those interested in the field of non-metallics.

In the literature which has been issued there is much information about the known non-metallic mineral deposits of

the Province. Investigations have been carried out by the Dominion Mines Branch on abrasives, clays, diatomite, building-stone, etc., and further information is contained in the Geological Survey of Canada reports and the Annual Reports of the British Columbia Department of Mines.

A.M. Richmond commenced this investigation in June, 1931, and for several months was engaged on a field examination of non-metallic deposits. These included diatomite, bentonite, various clays, sodium carbonate, sodium sulphate, barite, asbestos minerals, talc, shales, certain building-stones, gypsum, etc. Many samples were secured for analysis and physical tests. The co-operation of the Dominion Mines Branch is gratefully acknowledged in connection with analytical and testing work on many of these samples. The Mines Branch has well-equipped Non-Metallic and Ceramic Laboratories and an excellent research staff for this work. The Bureau of Mines at Victoria is only equipped for ordinary analytical work, but through the courtesy of the Dominion officials, the unsurpassed facilities at Ottawa are made available in this investigation. In the last three months Mr. Richmond has been engaged in a careful study of the existing reports and compiling much data from these. He has also commenced the important work of investigating the potential local and outside markets for various non-metallic minerals. This is perhaps the most important part of the investigation and much remains to be done.

It is planned to issue information from time to time in this series of mimeographed reports of which this one is the first. Copies of this report can be obtained free of charge from the Department of Mines, Victoria. The investigation will be steadily carried on and eventually the whole field of non-metallic minerals studied in this way. The reports as issued are naturally condensed as seems advisable, but additional detail information that is available may be secured by writing to the Bureau of Mines, Victoria, B.C. Prospectors and owners of non-metallic deposits which they think may be of value are invited to forward samples and descriptive information about them to the Bureau of Mines at Victoria.

BARITE IN BRITISH COLUMBIA

by

A. M. Richmond, Non-Metallics Engineer

Victoria, B.C.

INTRODUCTION

The purpose of this report, the first of a series to be issued by the British Columbia Department of Mines dealing with the non-metallic minerals of the Province and the possibilities existing for their economic development, is to briefly present information about the mineral BARITE, its composition, occurrence, uses, markets, prices, etc.; to describe in some detail the occurrence in the Province, and from the assembled data, arrive at some definite conclusions as to the economic possibilities of utilizing these local deposits as a source of barite and its chemical compounds.

The selected bibliography at the end of this report has provided much of the general information given in the first part of the paper, which is devoted to a description of the mineral, its characteristics, uses, etc., and these various sources are herewith gratefully acknowledged.

BARITE

The word barite, or barytes as it is sometimes called, was originally derived from the Greek word meaning heavy. Barite is also known as heavy spar, cawk, tiff, etc., and its use as a filler and adulterant is not new, many countries having legislated in past times against the use of the mineral as an adulterant. Today, however, the rapid industrial development of modern civilization has recognized and extended the many and varied uses to which this heavy, white, chemically inert and basically very cheap non-metallic mineral can be put.

Composition.

Barite, chemically known as barium sulphate, when pure is composed of 65.7 per cent barium oxide and 34.3 per cent sulphur trioxide. It is a heavy, white, opaque to translucent mineral which is not readily attacked by acids, this chemical

inertness giving the mineral much of its industrial value as a filler and extender. However, as found in nature, barite is usually contaminated by the inclusion of small amounts of lime, gypsum, silica, alumina, and small quantities of iron oxides. These impurities have a detrimental effect on the marketing of barite and the usual maximum allowances permitted are stated in the section on specifications.

While sometimes found as tabular crystals, barite in commercial deposits is generally found as granular or crystalline masses, sometimes as fibrous masses. In color it varies from white, in the case of the pure mineral, through a range of light greys, light yellowish browns and reds, to the dark reds and browns, the color essentially depending on the amount of impurities present in the form of iron oxides. The color of the mineral powder is always white and its lustre can be either resinous, pearly or earthy.

As denoted by its name barite is a heavy mineral. It has a specific gravity of 4.5 which is nearly twice that of most of the light colored non-metallic minerals. The mineral can be readily scratched with a knife-blade as it has a hardness of 3 in Moh's scale. This is the same as for calcite or pure lime carbonate.

Barite is easily distinguished in the field by its weight and from calcite and witherite (the carbonate of barium) by its inactivity in acids. If a small quantity of the powder be strongly heated in a flame a yellowish-green coloration of the flame will indicate barium.

Occurrence.

Barite is found as lenses and veins in many kinds of rocks, its origin generally being attributed to the deposition of barium sulphate in rock openings from ascending solutions of meteoric waters, which have become loaded with barium sulphate in their travels through the country rocks. In the United States most of the commercial production of barite comes from deposits which consist essentially of barite nodules and remnants found in the weathered outcrops of dolomite and limestone rocks, the barite being retained in the decayed clay and oxide outcrop as a residual deposit. In Canada the barite deposits are predominantly of the vein type. In British Columbia the principal deposits of barite so far discovered occur as veins and lenses in basic schists and limestone and associated with metallic sulphides.

Uses.

Crude barite ore must be prepared before it is of value industrially. It forms the ore from which ground barite, lithopone and the barium chemicals are derived by processing. The uses for these three main classes of barium products are treated separately, though it will be noted that in some instances the same use will be found for more than one of the trio.

Ground barite, prepared by washing, jigging, crushing, and, when necessary, bleaching the crude barite ore from the mines with sulphuric acid, is used for many purposes where a heavy, white, cheap and chemically inert filler is required. The white colored ground barite is used as a paint pigment; as a filler in the paper business where a heavy stiff, highly calandered surface such as for playing cards and Bristol board, is required; as a filler in linoleum, rubber goods, window shade cloth, oilcloth, and various textiles; as a filler and base for the manufacture of artificial ivory and buttons; as a plaster aggregate in the plastering of hospital X-Ray rooms; and also in the manufacture of a great number of other industrial products such as artificial marble, explosives, fireworks, phonograph records, printers ink, sealing wax, soap, and paints (lake colors). Ground barite when finely ground and mixed with bentonite is used in the drilling of oil and gas wells. The ground mixture suspended in a suitable liquid makes a heavy fluid which is used to hold back the flow of gas from the well until such time as the casing has been properly placed.

Off-color barite, or barite that is not perfectly white, is often used as a pigment in the darker colored paints. It brings an appreciably lower price when of inferior color.

Lithopone, which is composed of approximately 70 per cent barium sulphate, 28 per cent zinc sulphide, and 1 per cent to 3 per cent zinc oxide, is made by combining clear solutions of barium sulphide and zinc sulphate, the resulting precipitate being filtered, dried, calcined, quenched with water, washed again, dried and disintegrated to a powdered form.

It is used extensively, both alone and with other pigments to make inside paints and flat wall tints. Until recently, when a number of outside paints were introduced to the trade by the paint manufacturers, lithopone was not used for outside paints because it darkens in color when exposed to sunlight or becomes wet. Lithopone is also used as a filler in high-grade rubber goods such as automobile tires, rubber matting, fruit jar rings, rubber tubing, etc., where in addition to its use as a filler the zinc sulphide of the lithopone has a curative effect on the

rubber. Lithopone also finds extensive use in the manufacture of oilcloth, window shade cloth, linoleum, printers ink, etc., and due to its marked superiority over ground barite in the matter of color and fineness it commands a much better market price.

There are a great number of barium compounds that are made from crude barite and they all have several uses. However, many of the uses are of a specialized nature and only a few of the more important chemicals will be listed in this paper to indicate something of the scope of this field.

Blanc Fixe, the most important of the barium compounds, is precipitated barium sulphate, often called artificial barium sulphate, and is usually made by precipitation from a solution of barium sulphide by means of salt cake or sodium sulphate. It is much superior to barite as a filler and for pigment purposes due to its very finely divided state and pure white color. It is the best grade of barium sulphate for pigment purposes and for the manufacture of lithographic inks. It is sold either as a powder or as a pulp containing 30 per cent water, it being customary practice to use the pulp for paper filling and lithographic inks, and the powder for paint pigments.

Barium carbonate is used largely in the ceramic industry to prevent scumming on brick and tiles and in pottery glazes. When chemically pure it is used in the optical trade in the manufacture of special glasses. Paint containing 45 per cent barium carbonate has a smooth velvety appearance when applied. The carbonate is also used in enameling iron and steel and for rodent poisons.

Barium Chloride is used in the manufacture of lake colors, rat poisons, and in the purification of salt, as a water softener in boiler compounds as well as in the leather and ceramic industries.

Other barium chemicals not mentioned above include barium nitrate, barium hydroxide, barium peroxide, barium sulphide, barium chromate, barium chlorate and barium manganate.

Specifications.

There are no standard specifications for crude or ground barite but general usage demands that commercial grade ore shall contain not less than 93 per cent barium sulphate content with but from 1 per cent to 3 per cent silica and preferably less than 1 per cent iron. Barite running less than 90 per cent $BaSO_4$ is not acceptable, and the better grades of ore will

contain from 95 per cent to 98 per cent barium sulphate ($BaSO_4$) with very small percentages of silica and iron as the only contamination present. Color is important, the white crude bringing a premium over the off-color crude.

Ground barite is sold in a variety of forms the price depending on the color and the fineness to which it has been ground, the whiter and finest products bringing the best prices. For filler purposes the finer the barite is ground the better; it should be ground to at least 200 mesh and preferably 300 mesh or finer. For the paint trade a pure white product is essential and while extreme fineness is not always required the grinding is usually minus 200 to 300 mesh.

It is particularly important that close attention be paid by the manufacturers of ground barite to the requirements of the trade and that their ground barite product conform within very close limits to those accepted as standard among the consumers, especially as regards sizing, color, and fineness.

Soft barite, such as commonly found in the southern United States is preferred for ground barite, while the Hard crystalline varieties of barite are extensively used in the preparation of lithopone and the various barium chemicals. The Canadian and British Columbian deposits are of the Hard variety.

The lithopone of commerce is an exceptionally white and very finely divided powder, 98 to 99 per cent of which can be passed through a 300-mesh screen.

Markets.

A study of the list of uses to which barite and its derivatives are put to in industry - as listed in another part of this report - will enable the reader to see where the Canadian markets are to be found. In British Columbia most of the barite used is absorbed by the paint manufacturing industry of Vancouver and Victoria.

The size of the local market is indicated by the following figures which were kindly prepared by the Department of National Revenue, Customs Branch, and the Dominion Bureau of Statistics at Ottawa. The figures show the imports of Barite, Lithopone, and Blanc Fixe into British Columbia for the 12-month period ending March 31st, 1931. There is no production of barite in the Province.

Commodity.	Weight in Tons	Value	$ per Ton
Barytes or barite,	65.45	$ 1,334.00	$ 20.40
Lithopone,	420.291	32,743.00	78.00
Blanc Fixe,	1,613	149.00	92.20
TOTALS:	487.354	$34,226.00	-----

The size of the Canadian market is indicated by the following table which shows the imports of barite, blanc fixe and lithopone into Canada for the years 1929 and 1930 as well as the Canadian production of ground barite for the same period. The Canadian production came from the Lake Ainslie deposit in Nova Scotia and was all used by the owner-producer, a Halifax paint company. The figures are taken from a recent memorandum by the Mines Branch at Ottawa, and from the 1930 issue of the Department of Revenue Statistics "Trade in Canada."

Apparent Canadian Consumption of Barite, etc.

		1929.	1930.
Canadian ground barite:	Wt.Tons	105.0	66.0
	Value $	2,341.00	1,484.00
	$ per ton	22.30	22.50
Imported ground barite:	Wt.Tons	2,646.2	1,949.2
	Value $	52,078.00	35,945.00
	$ per ton	19.70	18.45
Imported Lithopone:	Wt. Tons	9,704.2	8,025.8
	Value $	852,079.00	722,341.00
	$ per ton	87.80	90.00
Imported Blanc Fixe:	Wt. Tons	945.6	1,055.0
	Value $	52,473.00	52,591.00
	$ per ton	55.50	49.80
Total apparent Canadian consumption of barite and products.	Wt. Tons.	13,401.0	11,096.0
	Value $	958,971.00	812,361.00

The figures indicate a substantial Canadian market for barite, lithopone and blanc fixe, but only a very limited Provincial market. The explanation as to why there is no Canadian manufacture of lithopone is that in the past very little attention has been paid by the miner of barite to the exacting requirements of the consumer, particularly with regard to color and fineness of grinding.

The American market, which is approximately 70 per cent of the total world market, is effectively blocked to any possible Canadian producer by the high tariff barriers.

Tariffs.

Crude barite entering Canada is subject to a general tariff of 17.5 per cent, the British preferential tariff being 15 per cent. Lithopone entering Canada is subject to a general tariff of 5 per cent, the British lithopone being admitted free of duty.

Crude barite exported into the United States is subject to a tariff of $4.00 per ton when unprepared, $7.50 per ton when ground or manufactured, and $20.00 per ton when in the form of blanc fixe.

Prices.

The following prices are from the January 28th, 1932, issue of the Mining and Metal Markets, all prices being f.o.b. the mines in the respective States:-

California.	Crude $7.00 per ton.
Georgia.	Crude $6.00 to $6.50 per long ton.
Missouri.	Crude ore with a minimum of 95 per cent barium sulphate content and less than 1 per cent iron, $6.00 per ton. Crude ore with a minimum of 93 per cent barium sulphate content and 1 per cent iron content, $5.50 per ton. Crude, low-grade ore, $4.50 per ton. Water ground, floated, and bleached barite in car lots, $23.00 per ton.

BRITISH COLUMBIA DEPOSITS OF BARITE

In the past Annual Reports of the Department of Mines references to barite deposits in widely separated parts of the Province have been noted by the Resident Engineers, but of those so far discovered, only two are of possible interest as a prospective source of barite, though at some future date when transportation facilities are improved and larger markets warrant some of the deposits briefly mentioned under the heading of Miscellaneous Occurrences may prove of value. The two deposits above referred to are the Giant in the East Kootenay and the Homestake, north of Kamloops.

GIANT. The Giant property of 5 claims, situated in the Golden Mining Division of the Eastern Mineral Survey District, is owned by the Pacific Mines, Petroleum and Development Co. Ltd., of Vancouver, B.C. Mr. A.B. Trites of that city is one of the principal owners.

The claims are located one mile to the east of and 600 feet above the Spillimacheen river and can be readily reached by a 7-mile wagon-road which runs northwesterly from the town of Spillimacheen, a small station on the Golden-Cranbrook branch of the C.P.R. The elevation of the camp is some 3,500 feet above sea-level, the several adit tunnel portals being located a short distance to the east of and above the camp buildings.

The property has been known for many years, in 1909 being equipped with an unsatisfactory Elmore flotation mill which in later years was destroyed by fire. In 1926 the property was taken over by the present owners who have since expended appreciable sums of money for underground development and diamond-drilling, endeavouring to develop sufficiently low-grade lead-silver barite ore to warrant the construction of a modern concentration plant. The more recent work of 1929 and 1930 was under the direction of J.L. Parker and was discontinued due to the adverse condition of the metal markets.

As mentioned previously the property is essentially a lead-silver mine but large tonnages of barite are found as gangue mineral and as lenses near the contact of the limestone and slate-schist country rocks.

Extensive development underground and past glory-hole mining operations have developed a lead-silver-barite lens, roughly spear-shaped in horizontal cross-section, over a vertical range of 900 feet, the lateral width averaging between 25 and 40 feet and the lateral length as yet indefinitely determined though of considerable dimension.

(Evidence showing a length of 250 feet can be seen on the surface). Assays from a 26-foot section across the lens, 600 feet below the outcrop are reported to have between 1 and 2 ounces in silver per ton and 6 to 8 per cent lead. Drilling across a section at the 750-level (750 feet below the outcrop) showed 32 feet of 1.15 ounces silver and 8.1 per cent lead ore, while a section at the 900-level assayed 3.24 ounces silver per ton and 23.6 per cent lead over a width of 10 feet, according to notes supplied by the management.

The gangue mineral which is chiefly barite contains the metallic sulphides in disseminated form and in places sections of the deposit contain very small amounts of sulphides and might be used as a source of barite.

Some 800 feet to the south-east of the main development, other outcrops of barite are to be found on what is known as the Rothchild claim, and while only developed at a few points, indications are that a considerable tonnage of barite could be obtained from this source.

A sample of barite taken by A.G. Langley as representing a large tonnage of barite upon assay was found to contain 96.76 per cent $BaSO_4$ and had a specific gravity of 4.72. No estimate of tonnage can be prepared from the data at hand but it can be safely stated that several hundred thousand tons of barite, much of which is contaminated with lime, silica, and small amounts of metallic sulphides, is available at this property.

In October, 1929, samples of lead-barite ore and barite ore weighing 135 pounds and 108 pounds respectively were sent to the laboratories of the Ore Dressing and Metallurgical Branch of the Mines Department at Ottawa to determine the feasibility of economically separating the lead and barite, and concentrating the barite ore to give a commercial product.

The investigators, Messrs. J.S. Goddard and G.B. Walker of the Mines Branch staff, concluded that, while it was possible to make a saving of the various minerals in the lead-barite ore, the concentration of barite from the lead-barite ore should only be attempted under the most favourable marketing conditions. The best grade of barium sulphate concentrate obtained from the lead-barite ore and that only after three cleaning operations had been made, was 95 per cent $BaSO_4$ with only a 58 per cent recovery.

The tests on the barite ore, which assayed 94 per cent $BaSO_4$, small amounts of lead, zinc, and iron and less than 3

per cent silica as received, led the same investigators to conclude that a commercial grade of barite with a good recovery could be obtained by flotation. It was also found that the grade of the barite concentrate was improved when a rougher lead concentrate was first removed. The barite concentrate taken without removing a rougher lead concentrate assayed 97.5 per cent $BaSO_4$ with a 91.5 per cent recovery, while the grade of concentrate produced after a lead rougher concentrate had been removed assayed 98 per cent $BaSO_4$ with an 89.5 per cent recovery of the values.

The salient points in the above data are first, the distance of the property from large centres of population and consequently markets; second, the apparent large tonnage of contaminated barite in the deposit; third, the necessity of employing underground mining methods and eventually hoisting methods to win the ore, an expensive proceedure for a very low-grade product having a limited local market; fourth, the necessity of concentrating the crude barite before it could be used commercially; and fifth, the impracticability of making both a metallic sulphide concentrate and a barite concentrate from the same ore. The barite is of the hard variety and light brown to white in color.

HOMESTAKE. The Homestake property situated in the Kamloops Mining Division of the Central Mineral Survey District was, according to the last available information, held by J.L.B. Abbott of Vancouver, and W.F. Wood and associates of Kamloops, though since then the property was operated by the Tretheweys of Abbotsford and later by a small syndicate under the management of W.L. Bell of Vancouver, B.C.

The claims are situated 3 miles north-west from Squam bay, Adams lake, and 18 miles by road from Louis Creek station, on the C.N.R. Louis Creek station is 35 miles north of Kamloops, and 295 miles from Vancouver, rail distances. The workings are at an elevation of 2,300 to 2,600 feet above sea-level and to the west side of Falls creek, a small stream flowing south into Sinmax creek.

A series of north-westerly striking lenses and veins of barite have been developed in the schist country rock. The barite is the gangue mineral, the ore minerals for which the property has been extensively developed and partially stoped, consisting of lead and zinc sulphides, tetrahedrite, associated silver values, and minor amounts of chalcopyrite and gold.

From information appearing in the 1924, 1927 and 1929 Annual Reports it would appear that the main underground

development has exposed a barite vein dipping at 25 to 30 degrees to the north-east across the schist country-rock. The length of 300 feet along the outcrop, the depth of 450 feet down the dip, and an average thickness in the stoped area of 4 feet of barite indicates as possible reserves about 75,000 tons of barite of which 9,000 tons has been removed by stoping operations.

In addition to the above tonnage of barite many outcrops have been located along the strike of the vein to the west and it could be reasonably anticipated that a continuance of the barite- sulphide mineralization would be encountered with further development work in this direction.

As the property would not be worked as a barite producer, except as a by-product operation, it should be noted that in 1924, A.W. Davis, then Resident Engineer for this District, gave a tentative estimate of 15,000 tons of silver-lead-barite ore in possible reserve, which he stated might average 30 ounces in silver per ton.

Since that date, in 1926 and 1927 W.L. Bell and associates mined and shipped 2,880 tons of ore, presumably sorted, which averaged 75.6 oz. silver per ton; 3.3 per cent lead, and 5.6 per cent zinc, and had a gross value of $129,000. Work was discontinued after this mining campaign and though the property has been examined since by engineers who are of the opinion that the property presents attractive prospecting possibilities, nothing further in the way of development or mining has been done.

The average thickness of the pay-streak of sulphides in the stoped area was estimated at 15 inches by F. W. Guernsey, mining engineer of Vancouver, who examined the property in 1927. This average thickness of pay-streak if applied over the area developed would indicate a small tonnage in reserve and considerable underground development would be required before sufficient ore in reserves could be accumulated to warrant the construction of a treatment plant.

Summing up the available data in the light of tests conducted on a somewhat similar ore from the Giant mine in the Spillimacheen area, it will be seen that the Homestake property as a producer of barite is more unfavourably situated than is the Giant.

MISCELLANEOUS OCCURRENCES. Barite is found as a gangue mineral at the Toric, Dolly Varden and adjoining properties in the Nass River Mining Division of the North-Western Mineral Survey District. Its occurrence is of mineralogical interest. In the Portland Canal Mining Division of this District a discovery of barite near the Premier gold mine was reported in 1931 by E.J. Conkle of Stewart, B.C.

Samples of lignite containing barite were found many years ago by Dr. Dawson of the Canadian Geological Survey in the Horsefly River area of the Quesnel Mining Division. This is in the south-eastern portion of the North-eastern Mineral Survey District. In addition to the Homestake deposits of barite in the Central Mineral Survey District, sample crystals of barite have been found in the stream beds below Kelly lake in the Clinton Mining Division.

Barite has been found as tabular crystals in vugs in the fluorite ore from the Rock Candy mine in the Grand Forks Mining Division of the Southern Mineral Survey District.

Many properties in the Windermere and Golden Mining Divisions of the Eastern Mineral Survey District contain barite as a gangue mineral and when transportation facilities are improved some of the barite occurrences could be utilized as a source of supply. At the Bunyan property near Invermere, barite occurs as lenses in schist associated with copper sulphides. The Mineral King property 26 miles west of Invermere contains appreciable quantities of barite as a gangue mineral associated with lead and zinc sulphides. A few miles to the north-west barite is found at the Tatler group and undoubtedly many other occurrences of barite would be discovered in the area with a little prospecting, should that at any time become advisable. Properties in the vicinity of the Giant also contain barite as a constituent mineral.

Barite is found as a gangue in the mines of the Mt. Sicker area in the Western Mineral Survey District.

CONCLUSIONS

From the material presented in this brief report two significant things stand out. The first is the existence within the Province of appreciable reserves of barite ore which it would be necessary to concentrate before it could be used industrially. The second is the existence of a small local market for a mineral that brings a comparatively low price. Other markets are difficult to reach on account

of either the high freight rates to Eastern Canada, or an effective tariff barrier on exports entering the United States.

Should local markets develop or should the tariff wall be lowered, the deposits at the Giant and Homestake properties might be seriously considered as a source of barite, but only as a by-product operation in conjunction with the mining and milling of the metallic sulphides found at these properties. The advisability of mining and milling the metallic ores at these two properties is outside the scope of this paper, but any plan to concentrate the metallic ores should give consideration to the barite market situation.

BIBLIOGRAPHY

1. Barium and Strontium in Canada, by H.S. Spence, Mines Branch, Department of Mines, Ottawa, Bulletin No. 570, 1922. Free.

2. Non-Metallic Minerals, by R.B. Ladoo, McGraw-Hill Book Company, New York, 1925, pp 67-80. $5.00.

3. Barite and Barium Products, Parts I and II, by R.M. Santmyers, U.S. Bureau of Mines Information Circulars Nos. 6221 and 6223. U.S. Department of Commerce. Free.

4. Annual Reports for 1924, 1927, 1929 and 1930, B. C. Department of Mines, Victoria, B.C. Free.