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A PICTOU COPPER SMELTER

The Dominion Mining & Smelting Company, of Pictou, Nova Scotia, is urging upon the Government and people of that Province the necessity of securing lower rates of transportation. There are several promising deposits of copper in Pictou, Colchester and Cumberland Counties. There are also more than a few totally undeveloped properties being held by persons who cannot afford to open them under the conditions now prevailing. The Pictou smelter is favorably situated as regards water shipments. It overlooks the splendid harbor of Pictou. The present capacity of the smelter is seventy tons of ore per day, making a forty-five per cent. matte. The average charge of treatment at the smelter is about $6 per ton for ore laid down at their wharf, or in the ore sheds by rail f.o.b. The company also offers to treat ores on the custom basis.

As a commercial enterprise, the Pictou copper smelter is decidedly worthy of encouragement. Concessions in the direction of nominal freight rates and active help from the Government in the development of individual properties should be offered cheerfully. The Provincial Government owns several diamond drills and has a Department of Mines. In what better work could the Department be engaged than in giving active assistance to the owners of copper properties. All of our important metallurgical industries have either started from very small beginnings or in their inception have met with serious obstacles. The soundest success is that resulting from a small beginning. It is altogether likely that Nova Scotia, by judiciously encouraging the attempt of the Dominion Mining & Smelting Company, will be taking the first step in establishing a successful and important industry of this nature. There is no need of injecting a large amount of capital. The smelter is already in operation. To keep it profitably employed, everyone at all interested in the copper possibilities of the Province should energetically push forward prospecting and development. And it is necessary always to bear in mind that rich returns must not be expected. The enterprise must be conducted on careful, business-like lines. Even though some time should elapse before a small margin of profit is obtainable, it must also be remembered that whenever a measure of success justifies the erection of a larger and more modern plant, the cost of operations can be very largely reduced. We hope that the Province will see and grasp its opportunity. We hope also that the Town of Pictou will substantially encourage what seems to be a most deserving undertaking.

READJUSTMENT

On the first day of June the holders of stock in the Trethewey Silver-Cobalt Mine, Limited, were officially notified that the directors had decided not to pay the expected quarterly dividend of 4 per cent. An explanatory letter from the president, Col. Alex. M. Hay, and a copy of a report upon the condition of the mine by Consulting Engineer Frank C. Loring, were published in the daily papers. The immediate effect of the directors' decision was a pronounced drop in Trethewey stock.

The Trethewey has already paid two quarterly dividends of 4 per cent. It is producing about 50 tons of concentrating ore per day, from which, according to Mr. Loring's estimate, a net profit of $500 per day, or $150,000 per annum, may fairly be counted upon. To insure a supply of high grade ore, development work must at once be undertaken. Further, there is a large amount, 6,000 tons, of low grade ore on the dump, and an indefinite quantity of similar ore in the mine, which, upon concentration, will, Mr. Loring affirms, yield a net profit of at least $10 per ton. To realize upon this ore a concentrator must be erected.

The cash available for both development and construction purposes is $60,000, represented by ore in transit and ore in sight or ready to be shipped. All of this ore is, of course, high grade. Mr. Loring, after reporting upon the amount of work actually done in the way of mining, demonstrates clearly the necessity of passing the current quarterly dividend and devoting the available cash to the purposes outlined above.

We heartily endorse the action of the new Board of Directors. The president's letter clearly states the condition of the company's affairs. Mr. Loring's report is lucid and forceful. Like many other Cobalt enterprises, the Trethewey Mine is laboring under a colossal capitalization. It will be impossible for the majority of them to satisfy clamorous shareholders and at the same time give the mine fair play. But the common laws of honesty and decency demand that the shareholders should know the exact state of their company's affairs.

ENGLISH MINING LABOUR

Our English contemporary, *The Colliery Guardian*, in commenting upon the report of the Miners' Eight-Hour Day Committee, shows that although the average time worked, bank to bank, in British coal mines on a day of full work is now nine hours and three minutes; still owing to voluntary absenteeism, the men now work 13.36 per cent. less time than their theoretical full time; which loss, if evenly distributed, would reduce the average working day to seven and one-quarter hours. "The final conclusions of the committee as to the possible effects of an eight-hour day are sufficiently definite," *The Guardian* continues, "to have raised a feeling of distrust in the minds of some who have been most ardent in their zeal; it is being realized that grave issues are plainly indicated in the report, for which no one would willingly claim responsibility." It is worthy of note that the committee found that the general health and physique of coal miners compared not at all unfavorably with those of any other class of laborers.

ELECTRIC SMELTING AND BRITISH COLUMBIA

The Victoria Daily Colonist urges upon the Federal Government the propriety of sending Dr. Haanel to British Columbia to investigate the possibilities of the extensive iron deposits of the west coast and of the abundant water powers. It may be stated, with a large degree of moral certainty, that within the next few years the electric smelting of iron ores will have become a commercial process. In sending a Commission to Europe to investigate the experimental electric smelters there, and in appropriating money for subsequent experiments at Sault Ste. Marie, the Federal Government acted wisely and well. It has put its hand to the plow. The energy and money already spent will be relatively profitless unless more energy and more money are at once directed to further investigation. No more promising fields offer than certain sections of British Columbia. Changed conditions may throw new light upon the whole subject.

QUEBEC MINING LAW

The evidence in the libel suit of Asselin v. Prevost, which has been in progress recently in Quebec, has very clearly demonstrated the weak points in the mining laws of the Province. Under the provisions of the law as it now stands, speculators are enabled to secure and tie up large areas of mineral territory in promising districts by the payment merely of the fees demanded for prospecting permits. Directly mineral is discovered in a new area these speculators rush to grab all the territory within miles of it, and, in consequence, the man with the pick, the legitimate prospector, who makes a business of searching for property worth developing, has in the face of such circumstances no chance whatever. Moreover, under this system undue temptation is put in the way of the Government employes in the Provincial Mines Department to show favoritism in mining permits.

One of the witnesses at the trial in question swore that he had been a victim of a clerk's mistake, although he did not say it was intentional, whereby land for which he had been the first to apply was granted to a later applicant. It is, however, an ill-wind that blows nobody good, and at least many of those who have taken advantage of the Act to secure large areas at a nominal figure have managed to make a very handsome thing of it, one gentleman admitting that he had "cleaned up" the snug little of sum of between "a hundred thousand and a million dollars" from the sale of his prospecting permits in one district alone in the last two years.

EDITORIAL NOTES

From figures compiled by the *Labor Gazette,* it has been shown that, with the exception of the professional classes, the wage-earners engaged in the mining industry in Canada receive higher average annual wages than any other class of workers. While the professional classes average $678.88, the miner averages $513.77.

Mr. A. P. Low is the new Deputy Director of the Department of Mines. Dr. Haanel is to retain his present position. Mr. John Marshall, formerly accountant of the Geological Survey, is to be account of the new department. The Deputy Director will still perform the functions pertaining to the office of Director of the Geological Survey.

A startling statement is made by a writer in a recent number of the *United Mine Workers' Journal.* He claims that, during the labor trouble in Colorado, a well-known detective bureau employed men to work their way into the labor organizations for the purpose of securing early information as to the plans of the unions. These spies, it is alleged, sent to headquarters exhaustive reports of the proceedings of the miners' meetings. In this way a great many of the strikers' plans were rendered abortive. It is sincerely to be hoped that employers of labor in Canada will never stoop to such degrading measures.

The Klondike River was free of ice early in May. Placer working and dredging have already been commenced in the Yukon. While this northern region has been favored with a remarkably early disappearance of ice and snow, Middle and Eastern Canada have suffered from an abnormally late and malignant spring. Adverse weather conditions have prevented and retarded prospecting and general development. On the Nova Scotia coast, late in May, pack ice from the north blocked North Sydney Harbor and caused a short though very vexatious delay in coal shipments. Already the fuel shipments from Nova Scotia to St. Lawrence ports are far below the figure attained at corresponding dates of last summer.

In this number of THE CANADIAN MINING JOURNAL will be found an article on the Boston-Richardson Gold Mine. This Nova Scotian mine is working profitably a very low grade gold ore. It affords a very striking example of the benefits of the application of common sense and modern methods of mining and ore reduction and concentration. In these respects it stands out prominently against the dark background of failure, incompetency, mismanagement and ill-fortune that so characterizes the gold industry in Nova Scotia. It is encouraging, however, to notice that in several districts the same methods are producing the same cheering results. Nova Scotia's gold mines need and must have competent, careful management.

Authorities appear to agree in the view that not only will the present high price of copper be maintained, but that there is every likelihood of a marked advance within the next six months. This belief is based on several apparently sound reasons, of which may be mentioned the recent falling off in output, the restlessness of labor in many of the large copper mining centres of the United States, Canada and Mexico; the relatively limited available supply of the metal for immediate delivery, and the increased demand from Europe. The *London Financial News,* reviewing the copper situation, points out that whereas sixteen years ago the world's visible supply represented 25 per cent. of the yearly production, at the end of 1906 it was only 2 1-2 per cent.; and, allowing for the natural increase in the world's output for this year, in the month of April, barely 2 per cent., or just sufficient for a week's supply.

The Dominion Government has announced that it will shortly publish a report upon the mining industries of Canada. This is most commendable. If suitable appropriations are made and capable men engaged, the report should be a very valuable work of reference. The Dominion Geological Survey and the Mines Department have done a great deal towards diffusing information about Canada's mineral wealth. So also have the Mines Departments of Ontario, British Columbia, Nova Scotia and Quebec. But although a large amount of valuable information has been published from time to time, it is so scattered as to be of very little practical use. It is also true that only the fringe of Canada's possibilities has been touched.

To collect, redact and condense all available published information touching the mining industry of Canada would be a heavy task in itself. If it is intended to bring this up to date, and to do more than merely indicate the country's undeveloped resources, then there will be required the continuous services of a large staff of experienced specialists, over a long period of time.

We are informed by Mr. H. Carnegie Williams that his company, the Copper Mining & Smelting Company of Ontario, has ordered and is soon to install one trial unit of the Elmore Vacuum process ore concentrator at their Bruce Mines plant. One unit has a capacity of 40 tons per day. As the company's mill requires 400 tons per day, a considerable installation will be required if the trial unit proves satisfactory. The company's consulting engineers, Messrs. Pellew-Harvey & Fell, of London, England, inspected Elmore installations in Cornwall, and reported very favorably upon them. Waste dumps, containing from 0.65 to 0.76 per cent. of copper, associated with other minerals, are being treated. An actual recovery of 90 per cent. of this copper is reported. As the Bruce Mines ore is a clean chalcopyrite, and as the old waste heaps, amounting to 120,000 tons, carry 1.15 per cent. copper, the Elmore

process should be most readily applicable. Indeed, experiments carried on by the inventors on samples of Bruce Mines ores have shown a saving of 93.5 per cent. of the values. One need not be a confirmed optimist to hope for great things from this new process.

An article entitled "Some Facts About Cobalt" appears in the issue of *Canada* for May 18th. While the writer of the article in question is perfectly justified in warning the British public against investment in some of the prospectusless Cobalt undertakings which are now being floated in London, he goes to extremes in stating that Cobalt's record for the last twelve months is unsatisfactory. The writer also attacks a recent Canadian promotion and stigmatizes as an extravagant falsehood, "sufficient to destroy all confidence in the company or its directors," a statement of one of the promoters that in one of the company's mines ore to the value of three millions sterling had been blocked out above the one hundred foot level. As many of our readers know, this particular statement is strictly within bounds and is vouched for by no less an authority than Professor Miller. As to the Cobalt district, though doubtless many worthless properties have been foisted on the public, there is probably no mineralized area in the world, of like extent, comparable in point of richness of silver values; nor are we aware of any silver camp which in so short a time has equalled Cobalt's record in the matter of output or dividends. In short, there is no mining district in Canada where it should be a matter of so little concern whether British capital is invested there or not.

The reports of the Mines Inspectors for 1906 for the Newcastle (England) District shows that approximately 28,000,000 tons of coal were raised during that year. Beside 347,162 tons of fire-clay, small quantities of ironstone, brick shale and ganister were mined. For five successive years a record output of coal has been raised in the district. Among permitted explosives used in the collieries, Bobbinite stands at the head, 281,808 pounds of this explosive having been used. Saxonite ranks next, with 206,567 pounds In other explosives, gunpowder has 3,256,687 pounds to its credit. The disc class of coal-cutting machine has precedence in this district over others, and compressed air is used as motive power more extensively than is electricity.

In the west of Scotland district, 18,897,278 tons of coal were raised, fire-clay 492,350, and ironstone 727,158. It is true, also, in this district, that the disc coal-cutting machine is by far the most popular, and compressed air is the favored motive power. After gunpowder, gelignite is more extensively used than any other explosive.

Yorkshire and Lincolnshire are credited with 32,547,905 tons of coal, all of which comes from Yorkshire. The same remarks about the disc coal-cutter and motive power apply again. A great variety of explosives are used in this district. Bobbinite comes first, with gunpowder a close second. The Marsant safety lamps, fitted with lead rivet locks and burning colza or colza mixed with paraffine, are most largely used.

MICA IN ONTARIO

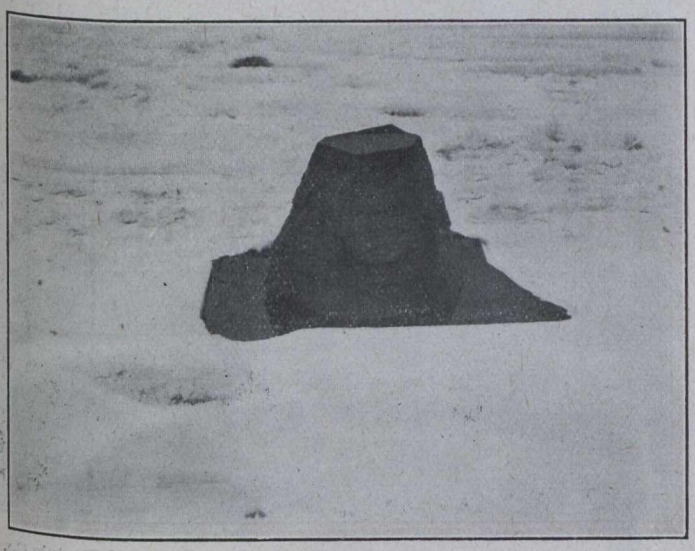
By E. T. CORKILL

The mining of mica in Ontario dates back to about the year 1860, when a quantity of large and carefully selected sheets from lot 17, in the ninth range of the Township of North Burgess was sold in Paris for the use of the French navy, at a price of $2 a pound. Some of this mica was in sheets twenty inches square, or larger. At this time, 1860, and for the following thirty years, mica was used chiefly for stove fronts, lanterns, lamp chimneys and also instead of glass in the windows of ships of war, to save breakage from concussion. The production of mica from the sixties until the beginning of the nineties was chiefly as a by-product of apatite. These two minerals are very intimately associated, and during that time there was a large trade in apatite, with a rather small demand for mica, and then only for the large sizes. As a result the deposits were all worked for apatite, and the mica was simply a by-product. Between 1890 and 1895 mica, particularly phlogopite, or amber mica, was first used in the electrical industry, which gave an impetus to the industry in Ontario. Prior to the time the small sizes of mica had not been marketable, thus this new industry created a market for a size of the material of which a large quantity had already been mined and thrown away as useless. This has, therefore, been re-sorted, and the small sizes previously thrown away saved and marketed. The sizes of amber mica now asked for by the buyers, and the approximate price which the cleaned mica will bring, are the following:—

1 in. x 2 in.....	5-6 cents	per pound.
1 in. x 2 in.....	10	"
1 in. x 3 in.....	20	"
2 in. x 3 in	45	"
2 in. x 4 in.....	65	"
3 in. x 5 in.....	75	"
4 in. x 6 in.....100		"

Mica, on account of its peculiar characteristics, has a wide field of usefulness. Its elasticity, non-conductivity and infusibility make it a mineral particularly adaptable for use in insulating armature slots, armature magnets, commutator cores, transformers, etc. A great many artificial substitutes have been tried, but none have been found as yet that have been satisfactory. In Ontario all the mica mined at the present time is phlogopite, or the amber mica of commerce. This mica is used almost exclusively in the electrical industry. A small quantity only is used in manufacturing lamp chimneys, for lights for windows, in stoves and peep holes in furnaces, which enables the operator to watch the process without suffering from the intense heat. Micanite has become an important factor in the

utilization of the small sizes of mica as 1 x 1, 1 x 2, 1 x 3 and 2 x 3, by being cemented together by the aid of a cement as shellac. After the mica has been built up into these plates by means of the shellac, it is put into steam presses and baked and steamed at the same time.



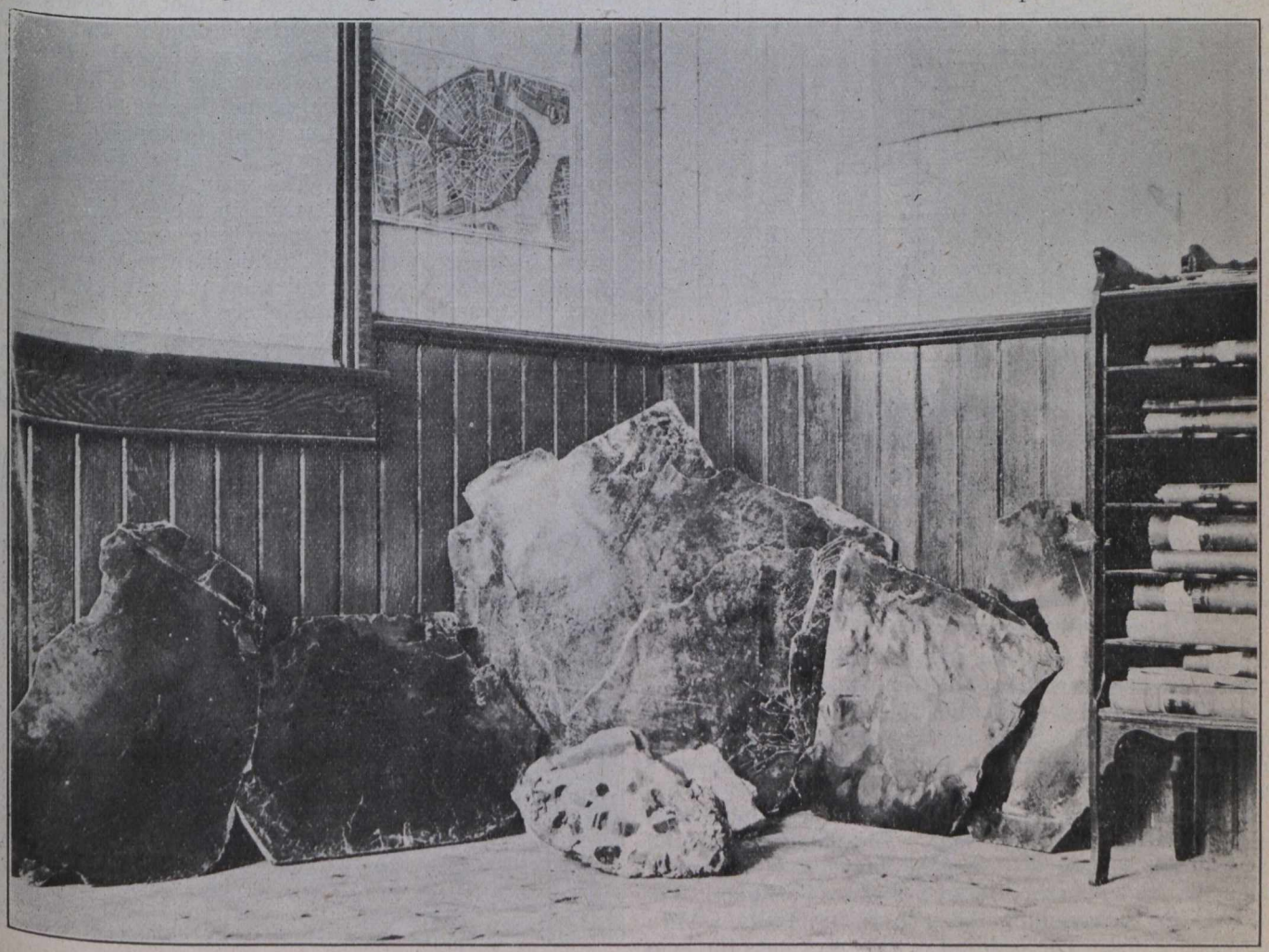
CRYSTAL OF MICA

All the properties of the shellac, excepting the cementing quality, are supposed to be eliminated in this process, so that the insulating qualities of the plates are not reduced or lowered. After being baked and pressed, the plates are milled for the purpose of making them smooth and even. They are then sawn into segments. If it is required to make rings, etc., out of this plate, they are made by steaming the micanite to the shape required. Another use for mica that is coming more into prominence is the use of the scrap mica for boiler and pipe covering. This has proved very efficient whenever used. The scrap mica is also used when ground and mixed with oil as a lubricant.

Mica, as referred to above, was first mined in the Township of North Burgess, County of Lanark, in the early sixties. Since that time, this township has proved to be one of the most productive sections of Ontario. The other most productive mica area in Ontario is the Township of Loughboro'. These two townships of North Burgess and Loughboro' have produced more than fifty per cent. of the total production of Ontario.

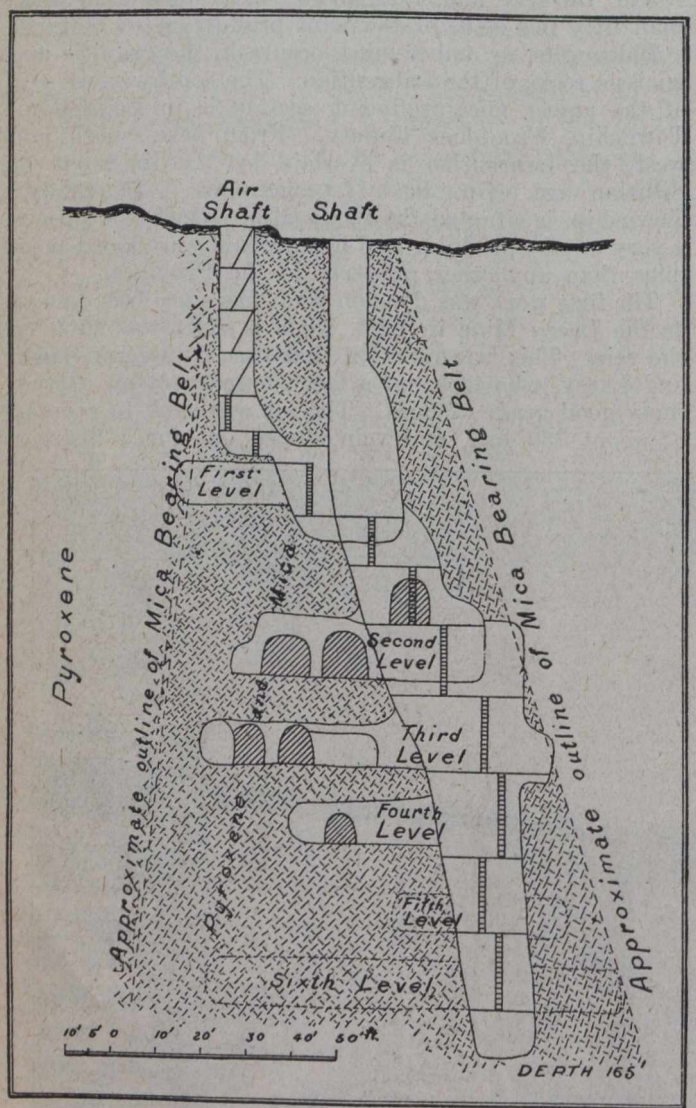
Phlogopite, or amber mica, occurs in the granitic and gneissic rocks of the Laurentian. The southwestern end of the amber mica-producing section is in Loughboro' Township, Frontenac County. From here, south and west, the Laurentian is overlaid by the limestone of Silurian age. On lot 11, concession 7, Loughboro' Township, is situated the Lacey Mine, which has proved a very steady producer and has probably produced more mica than any other property in the Province.

The first work was done on what has since been known as the Lacey Mine in 1884, when a shaft was sunk on the vein. This was owned at that time by Messrs. Smith and Lacey, who took out a large tonnage of an exceedingly good grade of mica. The pit was sunk to a depth of about 130 feet, and vein stoped out for a distance



SPECIMENS OF ONTARIO MICA

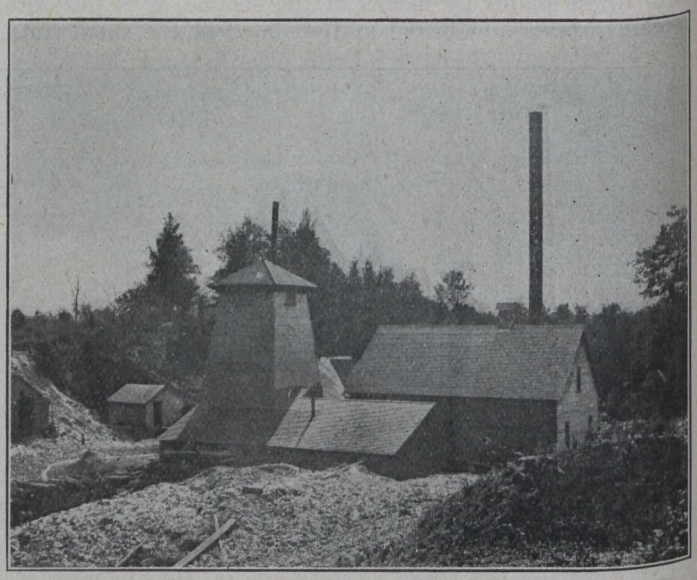
of about 130 feet along it, with an average width of vein of from 10 to 15 feet. This pit was abandoned in the early nineties, and the mineral right of the lot sold to the General Electric Company of Schenectady, N.Y. In 1899 a new discovery of mica was made about 200 feet southeast of the old workings. This has been worked continuously since that time and has been a large producer. It has been worked to a depth of 185 feet and longitudinally over 200 feet. The vein in some places is 20 to 25 feet in width. On the first level at a depth of 60 feet the drift has been run southeast on the vein a distance of 175 feet. On the fourth level at a depth of 117 feet two drifts run southeast, the easterly drift being 150 feet and the westerly drift 135 feet in length. Northwest of the shaft the mica has been stoped



Vertical Section of Lacey Mica Mine, Sydenham, Ont.

out for a distance of about 50 feet. On the second level a cross-cut has been driven a distance of 55 feet to cut a parallel ore body, which thus lies between the old and new workings. This body is about 75 feet in length, 60 feet in depth, and has an average width of about 8 feet.

The mica, which is a phlogopite, occurs in a vein matrix of calcite and pyroxene. The phlogopite is well crystallized, sometimes occurring in crystals 6 feet in diameter, and sometimes 4 to 5 feet in thickness. The wall matter surrounding the vein is essentially a mica pyroxene schist. The bedding of this rock cuts the vein at right angles. This is very marked on the fifth level of the mine, where the bedding occurs at an angle of about 20 degrees from the vertical and at right angles to the vein.



Lacey Mica Mine, Sydenham, Ont. Operated by the General Electric Co.

The mine is well equipped with two 60 horse-power return tubular boilers, six drill compressor and hoist.

About three miles from the Town of Elgin, on lot 7, in the 6th concession of Bastard Township, County of Leeds, the Brockville Mining Company are working a property which is of interest in that it occurs some distance from any other workable deposit, and also the mode of occurrence of the mica is different. The mica is a very dark amber, almost verging into a biotite. The vein is about 4 feet in width and dips at 30 degrees to the horizontal. The vein material is composed, as usual, of calcite and pyroxene, with the mica crystals, being crystallized throughout. The main difference between it and the larger mica deposits in the Province is that there is no (what the miners term) mica rock lying along each side of the vein. This mica rock is generally a mica pyroxene schist, which occurs between the vein and the granite or granite gneiss. At this particular deposit the vein cuts the country rock, which is a very dark hornblende granite, thus leaving the mica crystals lying right against the granite. On account of the hardness of the rock, the mica has been crushed considerably

Mica Mine near Elgin. Owned by the Brockville Mining Co.

on crystallization and the vein is more liable to be in the form of lenses.

The Hanlan Mine, situated on lot 11, in the 6th concession of North Burgess, is probably the best example of a true fissure vein of any amber mica mine in the Province. Here the vein has been mined for a depth of 120 feet, and a length of about 200 feet, without a break in it. The vein is quite uniform in width, averaging about 6 to 8 feet, while in some places it widens out to about 15 feet. The vein matrix, as is usual, consists of calcite and pyroxene, with occasional pockets of apatite. The mica in parts is well crystallized, while in adjacent parts it is quite badly crushed. The wall rock is a mica pyroxene schist, but not enough work has been done cross-cutting this to show whether there is any distinct bedding. In other respects it is quite similar to the corresponding mica pyroxene schist at the Lacey Mine. This vein strikes east and west, cutting the granite gneiss of Laurentian age, and dips to the south at an angle of about 75 degrees to the horizontal.

As an example of a deposit where the apatite predominates in the vein matrix, I shall briefly describe the mine known as the Smith Mine, owned by the Dominion Development & Improvement Company. This mine is situated on the east half of lot 13, in the 5th concession of North Burgess, and was originally opened up as a producer of apatite. After a pit had been sunk about 25 feet on the vein, mica crystals were found through the apatite. The apatite is soft and granular, thus giving the mica a favorable matrix in which to crystallize out freely. The vein in some places is 10 feet wide, consisting of apatite, calcite and mica. The vein dips at an angle of 50 degrees to the horizontal. On each side of the vein we find a mica pyroxene schist some few feet in thickness, which in turn cuts through the granite gneiss. This belt of mica pyroxene schist can be traced for some distance along the surface, where at different places a little mica has been taken out. The association of the pyroxene rock with the mica veins is very marked over the whole mica area. In fact, it is very rare to find a large, healthy deposit unless it is enclosed by this rock.

FINISHING HOUSE—LACEY MINE, SYDENHAM.
Operated by the General Electric Company.

At the present time the preparation of the mica for the trade has created quite an industry in Eastern Ontario, especially in Ottawa, which is quite favorably situated as the centre of the mica-producing sections of Ontario and Quebec. In Ottawa two of the large consumers, The Laurentide Mica Company (Westinghouse) and The General Electric Company, have built factories in which they employ from 500 to 600 girls in the preparation of the mica for the market. The preparation consists of cleaning or breaking off all the ragged or broken edges of the run of mine crystals, and splitting it down to about one-eighth of an inch in thickness, and grading it to the different marketable sizes.

This is then knife-trimmed and taken to the tables for thin splitting. The chief and essential characteristic of mica is its highly perfect basal cleavage, permitting the mineral to be split exceedingly thin. This characteristic is made use of in thin splitting. The purpose of the mica being thin split is to enable it to be built up into what was described above as micanite. Most of the mica mined in Ontario is shipped to the United States.

Canada has for some years been the second largest producer of mica in the world, India producing the greatest tonnage. The India mica is all white mica, or Muscovite, of which quality of mica Ontario produces none, although we have some pegmatite veins containing white mica, which have been but little explored.

Canada can thus be said to rank first in the production of phlogopite.

THE MARBLE BAY COPPER DEPOSIT

BY O. E. LEROY.

(By permission of the Director, Geological Survey of Canada. Toronto meeting, 1907.)

INTRODUCTION.

During a reconnaissance survey of part of the southern coast of British Columbia, in the summer of 1906, the writer had an opportunity of examining briefly the ore deposits occurring on Texada Island. One type of deposit is of particular interest, both on account of its being in a contact metamorphic zone and of its economic importance in containing valuable ores of copper. These deposits have previously been described in the reports of the Provincial Mineralogist, and in several papers by Mr. W. M. Brewer. In his later papers Mr. Brewer has drawn attention to certain deposits occurring on Gribbel Island, and in the White Horse District, Yukon Territory*, and shows that in mode of occurrence they are very similar to those on Texada Island.

The object of this paper in describing an example of this type is to again emphasize the economic importance of these deposits lying in widely separated areas, and to show that they are worthy of the careful consideration of those interested in mining.

GEOGRAPHICAL POSITION.

Texada Island, named by Elsa in 1791, lies in the Strait of Georgia, its south-east end being about 80 miles north of Victoria, and 47 miles from Vancouver. (See Fig. 1, Inset Map.) The town of Van Anda, where the chief mines are situated, is about 75 miles from Vancouver, and is a port of call of the Union Steam Ship Company. The island has a length of 30 miles with a maximum width of 6½ miles. High and mountainous throughout, especially in the eastern half, where Mount Shepherd attains a height of 2,900 feet, it presents to the observer when viewed at a distance the appearance of part of a submerged mountain chain. The shores are very rugged, with bold cliffs fringed in part with narrow boulder beaches. Sand and gravel beaches are few and there are only three harbors, Marble, Gillies and Blubber Bays, the two latter being somewhat exposed in certain winds.

GENERAL GEOLOGY.

The island is underlain by the Vancouver series of Dawson, part of which has been referred to the Triassic. There seems, however, to be an entire absence of fossils in the associated limestones, and part, if not all, of the series may belong to the Paleozoic era. The series admits of two divisions. The lower is composed of chlorite and hornblende schists, tuffs, amygdaloidal lavas, porphyrites and agglomerates which show over small areas obscure bedding. The upper division consists of limestone, which varies from a massive thick bedded unaltered rock to a fine grained pure white marble.

Subsequent to the deposition of the limestone there was considerable volcanic activity, and the whole of the Vancouver series was much disturbed by intrusions of diorite, gabbro, hornblende and augite porphyrites and diabases. The relations of these rocks with the limestones are well seen where they have intruded as dykes, sills and irregular masses faulting, and marbelizing the latter.

These igneous rocks, both older and younger than the limestones, have been much altered, and a large proportion of their present mineral content consists of secondary epidote, magnetite, chlorite, pyrite and calcite. They are widely developed and underlie the greater part of the island. The limestone, with the exception of a few small outliers, appears only at the north-west end, where the exposure has a length of 7½ miles, with a maximum width of two. In upper Jurassic times extensions of the great Coast Range batholith, consisting of granites and syenites, penetrated this older series and had a profound effect on them, producing schistose structure and shear zones in many of the igneous rocks, and converting the limestone to various crystalline types along with widespread faulting as the discordant strikes and dips now show.

The coast batholith was followed by a great series of basic dykes, principally diabases, and all the older rocks have been cut by them.

The Cretaceous has a limited exposure at Gillies Bay, consisting of feldspathic sandstones with calcite cement. The beds are probably basal, and are but slightly disturbed with low dips to seaward.

During the Glacial Period the island was eroded by the Strait of Georgia Glacier. A thin mantle of drift covers certain areas composed of sandy boulder clay, the boulders being principally varieties of granite from the main coast.

In the general depression which followed the island was much reduced in size, being some 400 feet lower with respect to sea-level than at present.

ECONOMIC GEOLOGY.

In the early nineties attention was first called to the occurrence of free gold in quartz veins, and later, deposits of rich copper sulphides were found in the limestone. These latter were not considered of any great importance at the time, but subsequent development has proved the contrary. Both divisions of the Vancouver series contain valuable ore bodies, which are found in the eruptive rocks, at their contact with the limestone, and in the limestone.

In the eruptive rocks, the ores occur in shear and fracture zones with quartz and country rock gangue.

Much movement is shown by the slickensided walls, and later cross fractures are filled with calcite. The ores are galena, zinc blende, copper and iron pyrites carrying as a rule low values in gold and silver. The ore is also very pockety, and solid ore alternates with barren zones. The width of the veins varies from 2 to 4 feet, and one mine only, the Surprise, has been proved to a depth of 360 feet. Other veins contain pyrite chiefly and have been noted for the rich showings of free gold in quartz. These, unfortunately, were only surface enrichments and had no depth, the pyrite immediately below being practically barren.

Contact deposits between the various igneous rocks and the limestone, include the large and important bodies of magnetite situated on the south side of the island and owned by the Puget Sound Iron Company. On this property there is also a series of copper deposits—chalcopyrite and carbonates—along the contact of the limestone with the altered porphyrites or the magnetite. The ore occurs in rudely lenticular bodies lying at various angles from vertical to horizontal, the limestone being almost invariably the hanging wall or roof.

The important deposits of bornite and chalcopyrite, to which particular reference will be made, are found wholly in the limestone. At present two mines are being worked—the Marble Bay and Cornell. The Copper Queen, which was the pioneer mine of the district, is lying idle. (Fig. 1).

THE MARBLE BAY MINE.

In 1897, an insignificant outcrop of copper and iron pyrites with some bornite was found a quarter of a mile east of Sturt Bay, on a Crown-granted lot, owned by Messrs. Christie and Palmer, of Toronto. A shaft was sunk on the ore and drifts run, but it was not until the 260-foot level was reached that the ore body assumed a definite character.

In 1902 the property was purchased by the Tacoma Steel Company for $150,000, and it was extremely gratifying to the company to have been able to pay the whole of the purchase price in three years out of the profits earned by the mine. The mine is now 760 feet deep and 715 feet below high tide. The ore body from the 260-foot level to the present workings has varied in length from 75 to 115 feet, and in width from a few inches to 45 feet. On the first floor of the 760 level, it is 87 feet long with a maximum width of 32 feet.

From the 140 to the 560 level the ore body pitched north at a high angle, but from there to the 760 it is practically vertical.

From the data collected this deposit may be described as an ore chute, occurring in a zone of brecciation in the crystalline limestone, this zone being approximately parallel to the strike. Divided into subordinate chutes above the 360 level, it has, below that, been continuous. The borders are broadly irregular, and small stringers are given off which run a few inches into the country rock. In the upper levels the walls were brecciated and weak, but in the lower they are firm, and very little work is necessary in the way of lagging. The ore is bornite with subordinate chalcopyrite, and a little pyrite, pyrrhotite and molybdenite. These occur in a gangue made up largely of pale green pyroxene—"green-felsite,"—and reddish brown garnet—"bull-felsite,"—with calcite. The ore is either finely disseminated through the pyroxene, or occurs in large rather pure masses between the pyroxene and the limestone. Very little is found in the garnet. A considerable proportion of the pyroxene gangue is partially altered, and disintegrates rapidly on exposure to the air. There are also large areas of the pyroxene which are practically barren. A microscopic examination of a few prepared sections of the gangue shows that the pyroxene (variety omphacite) occurs in mosaics of clear individuals with turbid borders. The garnet, which shows zonary structure, and optical anomalies, is traversed by numerous cracks which are filled with turbid material, in part calcite. Towards the calcite, the garnet has a tendency to develop crystal outline. Bornite and chalcopyrite occur in small grains, solitary, or connected in groups by narrow stringers between the pyroxene individuals, inter-grown with them, or along cracks in them and the garnet. Calcite with the larger grains of the sulphides, well formed garnets-andradite—and vesuvianite, were the last to crystallize out, and filled all the interstitial spaces.

Subsequent to the formation of the ore body, it was cut by one of the later dykes of basic porphyrite. Between the seventh and eighth levels it varied in width from 4 to 6 feet, with ore on both sides. This dyke dipped to the south, and in its downward extension became much reduced in size. On the 760 level it is only 7 inches wide, and crosses the drift some distance south of the ore body. It is highly altered with a development of numerous fissures now filled with epidote, and pyrite. This intrusion caused considerable movement in parts of the ore body, and many small fissures were formed and subsequently filled with chlorite, pyrite and calcite. Some beautiful examples of slickensided surfaces are seen, especially where molybdenite occurs. The pyroxene and garnet have both been fractured, and under microscopic examination the former showed strain shadows, incipient and complete granulation, with considerable alteration. Bornite has been re-deposited along these lines of fracture, between individual grains, and along cleavage planes. It occurs in solitary and connected grains and parallel bands. Calcite of the first generation shows strain shadows, and the last phase in the formation of the deposit was the filling up of the small interstitial spaces with calcite. The order of crystallization was pyroxene and garnet, simultaneously, along with the greater part of the bornite, then the remainder of the bornite in larger masses associated with well-formed garnets, vesuvianite and calcite.

ORIGIN.

This deposit is closely connected with the intrusion of the coast granite, and is clearly of pneumatolytic origin, being an example of the Kristania type.

It is well known that molten magmas give off enormous quantities of aqueous vapors which in this case would have a profound effect on the limestone through which they would pass along zones of brecciation or bedding planes. The limestone has here been replaced by silicates rich in lime, and by sulphide ores with the consequent liberation of carbonic acid gas. With the exception of the lime and a small amount of magnesia, all the other constituents are foreign to the limestone, and must have been brought up from below with the aqueous vapors.

An approximate analysis of the pyroxene gangue resulted as follows: SiO_2 55.25, Fe_2O_3 and Al_2O_3 6.50, CaO 25.00, MgO 14.50.

Garnet (andradite) averages about 31%, and vesuvianite about 35% of lime oxide.

The deposition of ore and gangue went on simultaneously with the cooling of the granite magma, and the ore body was formed before the intrusion of the aplite dykes. These dykes have not been found as yet in the

Marble Bay mine, but they have been noted in two instances in the neighboring deposits.

ORE VALUES.

The ore throughout is essentially high grade and carries good values in gold and silver. The ore, which is finely disseminated through the pyroxene gangue, carries much higher values in gold and silver than the purer and more massive bornite and chalcopyrite. It has also been found that the percentage of copper has steadily increased with depth.

As it is necessary to mine considerable barren gangue which is intimately mixed with the productive, the ore is hand sorted before shipping and graded into coarse and fines. The waste, on account of its fluxing properties, is shipped in large part and sold to the smelter. At present the total production is sent to the Tacoma smelter for treatment.

In order to ascertain the average value of the ore, the smelter returns for the year beginning in June, 1905, and ending June, 1906, were examined with the following result:

Grade.	Gold oz. per ton.	Silver oz. per ton.	Copper per ct. (dry)	Net value per ton.
Coarse	0.498	4.138	6.765	$28.77
Fines	0.1678	1.569	1.602	6.88
Waste	Tr.–.08	0 15–0.9	0.22–0.8	0.50
Coarse	1.006	5.73	11.25	

The last entry of coarse grade refers to a shipment of 116 tons made in July, 1906.

About 13,000 tons are mined annually, and approximately for every ton of coarse, two tons of fines and two of waste are shipped. Through the courtesy of Mr. F. C. Robinson, of the Sheffield Smelting Works, I am enabled to publish a few interesting assays which he made of the ore and gangue. The samples were taken from a stope on the 660 level, and the gold and silver values are stated in ounces per long ton.

Assays			Analyses	I	II
Number.	Gold.	Silver.			
I.	0.40	18.60	Insoluble ..	31.60	43.10
II.	1.05	7.85	Copper	43.00	13.60
III.	0.008	0.86	Iron	10.30	9.90
IV.	0.025	0.07	Lime	Trace	....

I. Bornite and chalcopyrite (massive ore).

II. Pyroxene and garnet gangue with finely disseminated bornite.

III. Calcite after removing mineralized portions.

IV. Calcite and garnet after removing mineralized portions.

Numbers III. and IV. are interesting in showing the occurrence of gold and silver in what was apparently barren gangue. Free gold in distinguishable leaves and grains has been found occasionally, but it is not a common occurrence.

SIMILAR DEPOSITS.

The ore chutes of the Copper Queen and Cornell mines adjacent to the Marble Bay are associated with basic dykes, some of which are older than the ore bodies. These are very much decomposed and in places have altered to a serpentine which carries ore, and is occasionally traversed by small veins of greenish white asbestos. The former mine has been noted for certain occurrences of free gold and argentiferous tetrahedrite. The deposits in the White Horse District, Yukon Territory, differ from the above, in that they carry low values in gold and silver, and higher values in copper. Their mode of occurrence, however, seems to be identical.

CONCLUSION.

The past development of these mines on Texada Island has proved the ore bodies to a considerable depth, the Copper Queen being 740 feet deep, while a winze is now being sunk to the 860 level in the Marble Bay. As regards the permanence of these deposits, there seems to be very little doubt but that they will continue until the limestone granite contact is reached.

Magnetic Concentration of Iron Ores by the Grondal Process

By P. McN. Bennie, FitzGerald & Bennie Laboratories,
Niagara Falls.

(Toronto Meeting, 1907).

The writer had the pleasure of attending the Toronto meeting of the Canadian Mining Institute, in March, 1904, when a very interesting paper on Magnetic Separation was presented by Mr. F. T. Snyder. The technics of the magnetic separation of various materials were well covered in Mr. Snyder's paper, so that those features need hardly be again referred to.

In the present paper it is proposed to give an account of progress in magnetic separation with a specific process, and to draw some conclusions as to its possible bearing on the utilization of certain Canadian iron ores or to the economic benefit of the Dominion.

It is not the intention to enter closely into mechanical details of the various forms of apparatus used in the Gröndal Processes for grinding, separating and briquetting iron ores. The results obtained in actual practice are probably of superior interest, and for this purpose a typical series of products may be taken, as follows:

1. Ore from Herräng, Sweden, ground in the Gröndal Ball Mill, as prepared for subsequent magnetic separation by the Gröndal Process.

2. Tailing from this Herräng ore, after passing through the Gröndal Magnetic Separator.

3. Concentrate from Herräng ore, showing the perfection of the separation.

4. Briquette made from such concentrates by the Gröndal Briquetting Process.

The composition of these various materials, with reference to iron, sulphur and phosphorus content, is as follows:

TABLE I.

Results of Treatment of Herräng Ore.

	Crude Ore	Concentrates	Slimes	Briquettes
	per cent.	per cent.	per cent.	per cent.
Iron	40.00	65.20	9.6	63.01
Sulphur ...	1.20	0.17	...	0.003
Phosphorus.	0.003	0.0025	...	0.0025

Porosity: Per cent. of volume of briquettes = 23.9.

DEVELOPMENT OF THE GRONDAL PROCESS.

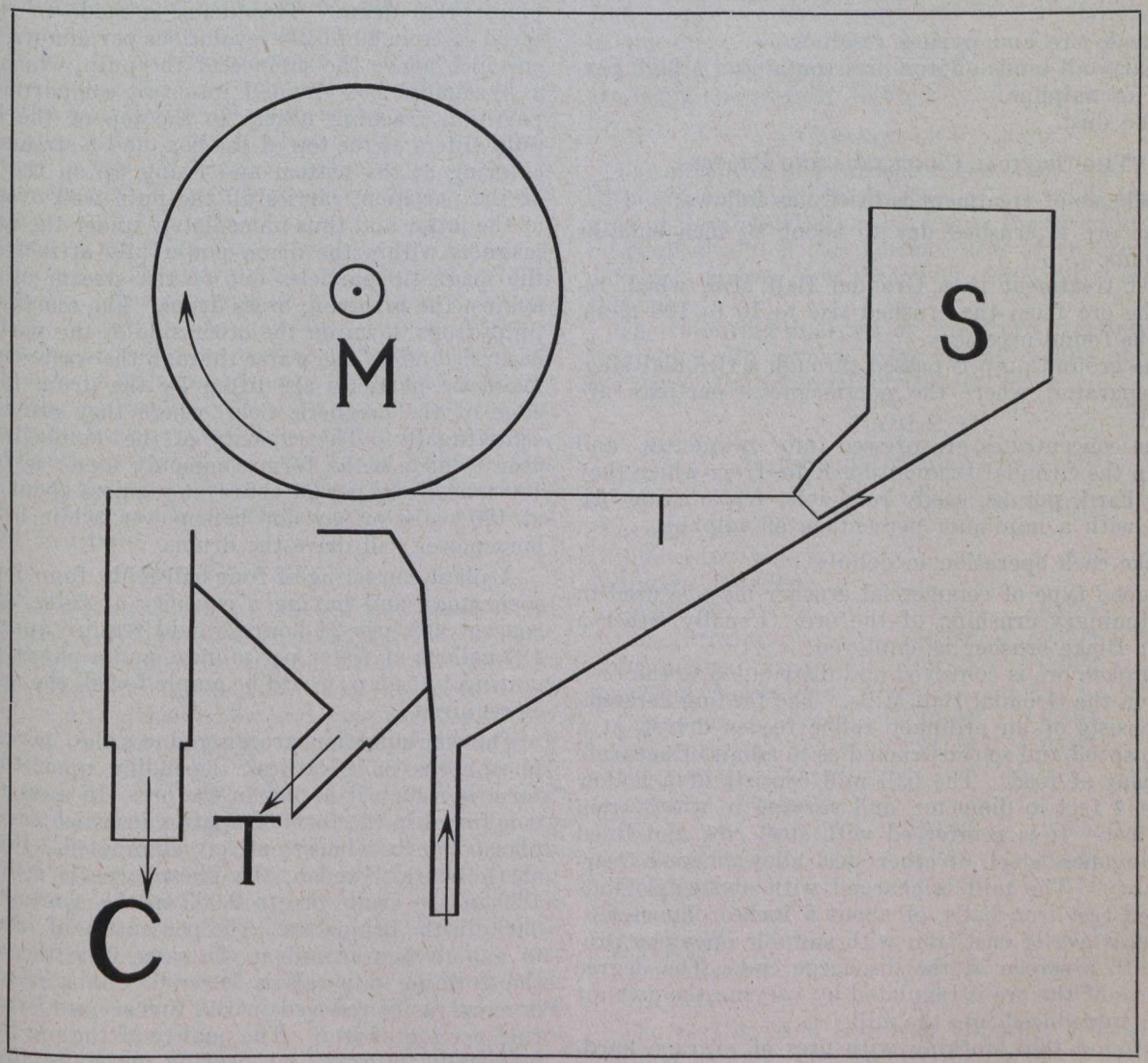
About 20 years ago the question of iron ore supplies became serious, and at that time magnetic separation received considerable attention from Conkling, Ball and Norton, and others, with the idea of utilizing large bodies of magnetc iron ore which could only be made available by means of magnetic concentration.

Then came the rapid development of the immense bodies of Lake ore, of a quality which could advantageously be used in the blast furnace, and except in certain restricted districts, interest in magnetic ores was lost. About the same time there was some hope that the magnetic iron ore deposits in Ontario would receive serious development, and indeed a number of fairly large shipments were made to the United States. But the development of the Lake ore bodies practically closed that market, and work on the Ontario mines declined to insignificance. In fact the discovery of those same Lake Superior ore bodies has had an influence upon the metallurgical life of both Canada and the United States but little appreciated nowadays.

In European countries, however, especially in Sweden, conditions were different. The supply of suitable ores ready for blast furnace use in their natural condition was limited and low grade; in many cases highly phosphatic and sulphurous ores had to be used; consequently great efforts have been made to perfect concentrating methods. The attention of many prominent engineers and metallurgists has been turned, with more or less success, towards the solution of the difficult problems involved in turning to account these ore supplies.

Mr. Gustaf Gröndal's efforts in this direction, extending over a number of years, have been more successful, the appliances and machinery invented by him for crushing, concentrating and briquetting low grade and impure ores being now so perfected as to constitute a complete commercial process. By these methods a great many hitherto practically valueless iron ores can be turned to excellent account by reason of the richness and purity of the concentrates and briquettes produced, and the comparatively low cost of production.

Primarily the Gröndal processes permit of the economic use of the many, in some cases immense, deposits of iron ore which are found in various places throughout the world, and which are unsuitable in their native state, owing to some objectionable characteristic, for economic



blast furnace practice, and the production of good quality pig iron. Usually, the objection to their use will be found to be one of the following:

1. That the ore is too low in iron content.
2. That it contains impurities which cannot be eliminated in the blast furnace.
3. That it occurs in a mechanical condition unsuitable for blast furnace use, except to a limited extent, such as iron sands and small ores generally.

Among the ores which may be commercially utilized by the Gröndal Processes may be instanced:

1. Magnetites of all kinds, including magnetic iron sands, containing as low as 25 per cent. iron.
2. Magnetites containing a high percentage of phosphorus and copper not chemically combined with the iron.
3. Purple ore and pyrites residues.
4. Nearly all kinds of iron ores containing a high percentage of sulphur.
5. Flue dust.

The Gröndal Concentrating Process.

The scheme of treatment is briefly as follows:

1. The ore is crushed dry to about ½ inch cube or thereabouts.
2. Wet treatment in a Gröndal Ball Mill, which reduces the ore from the crushed size to 10 to 100 mesh, as may be found necessary.
3. The ground pulp is passed through a Gröndal Magnetic Separator, where the non-magnetic particles are removed.
4. The concentrates are pressed into briquettes and heated in the Gröndal Briquetting Kiln, from which they issue as hard, porous, easily reducible, ferric oxide briquettes, with a minimum percentage of sulphur.

To take each operation in detail:

Any good type of commercial crusher may be used in the preliminary crushing of the ore. Usually either a Gates or Blake crusher is employed.

The broken ore is conveyed and distributed to the feed hopper on the Gröndal Ball Mills. The feeding arrangement consists of an ordinary roller feeder driven at a uniform speed and so constructed as to admit of accurate adjustment of feed. The ball mill consists of a hollow cylinder, 4 feet in diameter, and varying in width from 4 to 8 feet. It is reinforced with steel ribs and lined with manganese steel, or other steel alloy of good wearing quality. The mill is charged with about two tons of chilled cast iron balls, of about 6 inches diameter.

The ends are of cast iron with suitable openings provided with a screen at the discharge end. The degree of fineness of the ore is regulated by varying the amount of water introduced into the mill.

It is found that working with ores of average hardness the consumption of iron, represented mainly by the wear on the balls, amounts to about 2 pounds per ton of ore treated.

The mills require from 20 to 25 horsepower each, make from 25 to 30 revolutions per minute, and grind from 50 to 100 tons of ore per 24 hours, from ½ inch down to from 10 to 100 mesh in fineness.

In order to free the pulp from the bulk of the non-magnetic slimes, it is often advisable to pass the pulp coming from the ball mill through a slime box before charging it into the separator proper. The slime box consists of a V-shaped box, the pulp entering at the top and a stream of water at the bottom. The slime boxes are usually built in pairs, and between each pair is placed an electro-magnet with a hatchet-shaped pole piece. This electro-magnet is of such strength as just not to lift any magnetic particles out of the water. The velocities of the pulp and clear water are so arranged that the heavier particles settle at the bottom, from whence they are drawn off to the separator. The function of the magnet is to arrest magnetic particles in the fine slimes which collect on the surface of the water immediately under the pole piece, and from time to time drop to the bottom whence they are carried off with the main pump to the separators.

The accompanying diagram shows the principle of the separator proper. The pulp feed from slimes now passes to this part of the apparatus. This consists of a series of magnets with flat pole pieces arranged with their N and S poles alternately. The magnets are enclosed in a plain brass drum. This drum is made to rotate at a speed of from 80 to 100 revolutions per minute, and about one inch above the surface of the pulp, which traverses a pyramidal box divided into two compartments by a partition reaching nearly to the top of the box. The pulp enters at the top of the box, and a stream of water, entering at the bottom and rising up on the same side of the partition, carries all the pulp well over the edge of the latter and thus immediately under the drum. The magnets within the drum powerfully attract and bring the magnetic particles out of the stream of pulp and against the revolving brass drum. The remainder of the pulp drops down on the other side of the partition, and is carried off by the water through the waste outlet. The magnetic particles are lifted by the drum to the very edge of the magnetic field, where they are thrown off centrifugally. The capacity of the double-drum separator (which is the form commonly used) is from 70 to 100 tons of ore per 24 hours; it requires about 6 amperes at 120 volts, or say one horsepower, while less than ¼ horsepower will drive the drums.

A plant consisting of four ball mills, four double-drum separators, and having a capacity of fully 200 tons of concentrates per 24 hours, would require approximately 180 gallons of water per minute, and a power plant generating 150 e.h.p. would be ample for all the motive power required.

The concentration process reduces the percentage of phosphorus more or less, depending upon the mineral form in which it occurs in the ore. In most magnetites it is found in the form of apatite, in which case the phosphorus can be almost entirely eliminated. For example at Gellivare, Sweden, the phosphorus is reduced from 1.29 in the crude ore to 0.005 in the concentrates, and 0.006 in the briquettes. The percentage of iron is raised to a high figure, and at the same time the amount of slag-forming minerals is lowered. As a result the ore is more easily reduced in the furnace, and requires less fuel per ton of iron. The quality of the pig iron will be materially improved when using purer ore and less fuel than ordinarily.

Sometimes the ore mined is a mixture of magnetite and hematite. The dry magnetic concentrating methods hitherto employed give rather unsatisfactory results as regards the iron content of the tailing. With the Gröndal concentrating process, where the ore is already slimed up in water, a retreatment of the tailings on jigs or slime tables can be carried out with advantage, thus increasing the output of the plant without crushing or grinding any additional tonnage of ore.

The Gröndal concentrating process can be regarded as practically the only existing method for the economic treatment of low grade ores in which the magnetite is so finely and intimately mixed with the gangue that the

ore has to be crushed down to less than say 20 mesh before it can be separated. Take the case of the banded jasper ore in the Temagami district, which would require very fine grinding to effect an economic recovery of iron; the Gröndall Process could do this where no other could. But it is also obvious that such fine ores must be briquetted.

The Grondal Briquetting Process.

Concentrates produced by this process, iron sands, pyrites, residues, small ores generally, as well as ores containing a high percentage of sulphur, which are unsuited for use in the blast furnace, are next briquetted.

The material is conveyed to the briquetting process. These are drop presses—the height of the drop being from 6½ to 7½ inches, and the briquettes receive three blows, the falling weight being about 1,800 pounds. The briquettes may be of various sizes, but are usually made 6 in. x 6 in. x 3 in., weighing from 8 to 10 pounds each. Each press requires 3 e.h.p., and will make from 500 to 750 briquettes per hour. The pulverized ore is pressed into briquettes without any binding material whatever, the moisture in the ore being so adjusted as to obtain briquettes sufficiently firm to be removed from this press to the cars used in the furnace.

The briquettes are taken from the press and placed on the furnace cars. These are made of iron and covered with fire brick. Along each side of the car is a deep flange which dips into a channel filled with sand placed along the sides of the furnace, thus forming a gas-tight seal. The ends of adjacent cars are fitted with a groove and projecting rib respectively. By this means the surface of the cars forms a gas-tight partition and thus prevents the lower portion of the cars, frame, wheels, etc., from becoming heated. The cars measure 3 ft. 6 in., and hold from 15 to 16 hundredweight of briquettes arranged on edge in two tiers.

The Furnace.

The furnace is fired by gas derived preferably from gas producers, although blast furnace gas can be used. The combustion chamber is situated about one-third of the length from the intake end. The air needed for combustion is introduced below and traverses the row of cars, thus helping to keep the wheels and framework cool, and at the end of the furnace is diverted to the top of the row of cars, traversing the burnt briquettes, cooling them, and becoming itself heated before reaching the combustion chamber. The products of combustion pass over the entering cars, assist in drying and heating the briquettes, and finally escape through a stack at a temperature of only 150 deg. Centigrade. The furnace being thus constructed on the regenerative principle, has a very good thermal efficiency, radiation is small, and the chief loss of heat is due to the evaporation of the water contained in the briquettes (5 to 7 per cent.) A car of finished briquettes is drawn about every half hour, depending somewhat on the degree of desulphurization required. Recently, furnaces have been arranged so as to give a continuous movement to the cars, increasing the capacity of the furnace considerably.

The temperature in the combustion chamber of the briquetting furnace reaches 1,300 deg. to 1,400 deg. C. At this heat the particles agglutinate sufficiently to form a firm, hard briquette, able to stand rough handling and long transport. The briquettes, though hard, are very porous, and are consequently far more easily reduced in the blast furnace than ordinary lump ore. The briquette made from Herräng ore, previously mentioned, has a porosity of 23.9 per cent. of its volume.

When briquetting iron ore concentrates and using producer gas for fuel, the consumption of coal has been found to average 7 per cent. of the weight of briquettes burnt.

Grondal Briquettes.

The Gröndal Briquette is unique in that it does not contain an added binder, and, therefore, there is no foreign material such as lime, to be heated and slagged off. In the case of magnetic oxide concentrates the particles are completely peroxidized, owing to the very free supply of air given to the furnace during the process of burning the briquettes. Such peroxidized ore is very easily reduced in the furnace, thus introducing a certain fuel economy.

Treatment of Pyrites Residues.

Briquettes made by this process from pyrites residues and purple ore have proved to be entirely satisfactory in the open hearth steel furnace. At Cwmavon, ores containing 2 to 4 per cent. sulphur, and sometimes more, are being successfully treated by this process.

Capacity of Furnace.

The output of one furnace varies from 30 to 80 tons in 24 hours, according to the class of ore used, and the degree of desulphurization required; for in addition to its mechanical action this furnace acts as an exceptionally efficient calciner for removing practically all of the sulphur.

The following analyses of crude ore, concentrates and briquettes will give an idea of the results obtained by the use of the Gröndall Processes:

TABLE II.

Results of Gröndal Treatment.

	Iron.	Sulphur.	Phosphorus.
Herrang, Sweden.			
Shown in Table I.			
Gellivare, Sweden.			
Crude ore	58.96	0.036	1.29
Concentrates	72.38	0.003	0.005
Briquettes	69.49	0.002	0.006
Salengen, Norway.			
Crude ore	36.43	0.021	0.318
Concentrates	71.76	0.015	0.008
Briquettes	.....	.....	.....
Pitkaranta, Finland.			
Crude ore	28.40	2.60	0.260
Concentrates	69.59	0.132	0.007
Briquettes	67.98	0.011	0.008
Cornwall, Penna.			
Crude ore	30.65	1.603	0.012
Concentrates	69.95	0.036	0.003
Briquettes	69.90	0.010	0.005

The results from Cornwall ore were obtained with a ten ton sample sent to Herräng about a year ago, as there is not yet a plant available on this side of the Atlantic.

Separation of Titanium.

At the FitzGerald & Bennie Laboratories, Niagara Falls, Ontario, a small separator of the Gröndal type was installed in June of last year, and some tests were made on the separation of titanium from ore, working with what are known as Moise Beach sands, from the St. Lawrence River. The following results were obtained:

Original ore	16.57 pct. TiO_2
Concentrate	4.21 "
Middling	19.48 "

It should be remarked that the concentrates were obtained by a single passage through the separator. Doubtless even better results could be obtained from finer grinding, and repassing through the separator.

Cost of Plant.

It is impossible to give anything but bare approximations as to cost of plant, which varies considerably with the local situation and conditions. The figures quoted are based upon cost of materials, and cost of erection, in the United States:

Concentrating plant for 400-500 tons of crude ore per day	$45,000
Briquetting plant for 200 tons of concentrates in 24 hours	65,000
	$110,000

For 100 tons of concentrate per day these figures would be about $27,000 and $39,000 respectively, a total of $66,000.

Cost of Concentrating.

The cost of concentrating will naturally vary with the character of the ore treated and the amount of iron contained in same. Assuming the treatment of an average magnetic iron ore, containing 40 per cent. iron, and the production of a concentrate carrying about 63 per cent. iron, the cost of concentrating varies from 30 to 45 cents per ton of concentrates. These figures refer to the mechanical treatment only, and exclude the cost of ore.

Cost of Briquetting.

The cost of briquetting is also an item varying with local conditions. A briquetting plant of 200 tons daily capacity would consist of four to seven furnaces, depending upon the ore, and to a large extent on the amount of sulphur to be removed. The cost per ton for briquetting can be taken, under normal conditions, as varying between 45 and 85 cents per ton.

At a small plant consisting of one furnace, producing 25 to 30 tons per day, the actual cost, including labor, coal, rent and taxes, but exclusive of depreciation and royalty, amounts to 85 cents. This plant is working on pyrites residues, and owing to its small size and nature of the work, the cost is high.

On the other hand, at a typical plant in Sweden, turning out 120 tons of briquettes daily, the cost of briquetting amounts to 77 cents per ton. At one of the Swedish plants of recent construction the cost has been reduced to 67 cents per ton.

Recently the briquetting furnace has been simplified and improved so as to materially decrease the cost of installation, and at the same time to lower the cost of briquetting.

Treatment fo Canadian Ores.

The present situation in Canada, and particularly in the Province of Ontario, is similar to that in the Scandinavian countries, in many ways. Not over blessed with ready fuel, and with iron ores that in many instances require concentration, yet it is well known that certain qualities of iron (Swedish pig, for example) are produced, which bring a premium on the market. There is no reason why Canada should not largely augment its production of high-grade pig iron, and have as great a demand for it as for the Swedish article.

There are many bodies of magnetic iron ore in Ontario, running from 35 to 50 per cent. iron, that would be so improved by proper treatment as to produce premium ores, for which there is now and probably will continue to be a brisk demand.

For ores that demand fine grinding to recover an economical percentage of iron content, the Gröndad briquette affords a means of converting unsalable ores into an article that will actually bring a premium, thus helping to pay for the cost of treatment. Only recently a blast furnace manager told me he would be glad to get 200 tons a day of such briquettes. Gröndal briquettes are now being shipped in considerable quantities from Sweden to Great Britain, where they command an instant market at prices above the average.

Electric-Thermic Processes.

Another feature certain to be of considerable economic value to Canada is the application of electro-thermic processes for producing high-grade pig iron and steel. Broadly speaking, the use of sufficient electrical energy to produce one ton of pig iron in the electric furnace means the displacement of about 1,600 pounds of fuel. Coal once used is gone forever, while water powers maintain themselves by a natural process, a fact of great economic importance to Canada. The fortunate existence practically side by side, of iron mines and extensive water powers, produce conditions very favorable to the electro-thermic process. The writer believes the Government would do well to foster the development of that branch of metallurgy as much as possible, to enable the country to realize on its natural and unique resources.

Many of the ores could doubtless be used direct, others would require concentration, and still others would have to be briquetted, but the economy of producing finished material wherever possible "on the spot" is obvious. Science and Art have now placed in the hands of those who will, means of utilizing these resources, and thus adding to the nation's wealth.

The monazite produced in the United States in 1906 all came from North and South Carolina. The output of crude sand amounted to approximately 2,000,000 pounds, averaging about 30 per cent. monazite. The grade of this sand was so variable and the prices realized on different lots were so irregular that cleaned sand has been used as an estimate of the quantity of monazite produced, an additional reason for so doing being furnished by the fact that the greater part of the crude material is cleaned by local mills before shipment, and the grade brought up to 80 per cent. or more of monazite. On a basis of 80 per cent. production, North Carolina produced 697,275 pounds of the mineral, valued at $125,510; and South Carolina 148,900 pounds, valued at $26,802; the total for the United States amounted to 846,175 pounds, valued at $152,312.

The production for 1905 amounted to 1,352,418 pounds, valued at $163,408. This amount represented in part crude and in part cleaned sand—a fact that explains the increase in quantity without correspoding increase in value.

The condition of the monazite market in the United States in 1906 was fairly strong, despite the fact that the price of thorium nitrate, which is manufactured principally from monazite, was reduced nearly one-half early in the year by the German thorium combine. Though made with the intention of killing all competition, this cut has resulted only in the temporary closing down or the bankruptcy of a few of the smaller companies.

THE RICHARDSON MINE

Upper Seal Harbor Gold District, Nova Scotia.

BY PERCY BROWN, M.E.

The Richardson Gold Mine is situated about two miles from the Village of Goldboro, Guysborough County, which is located on the east side of Isaacs Harbor, an important harbor on the Atlantic coast of Nova Scotia, some 80 miles east of Halifax.

The mine was discovered in 1892 by a prospector named Howard Richardson, who found rich quartz in the bed of a brook known as Gold Brook. This has given the name Goldbrook to the settlement which has sprung up in the vicinity of the mine.

Local capitalists became interested and a fifteen-stamp mill was erected in February, 1893. In July, 1894, this was enlarged to a twenty-stamp mill. In 1896 twenty stamps more were added and the plant modernized to a certain degree. The returns for these first four years are as follows:—

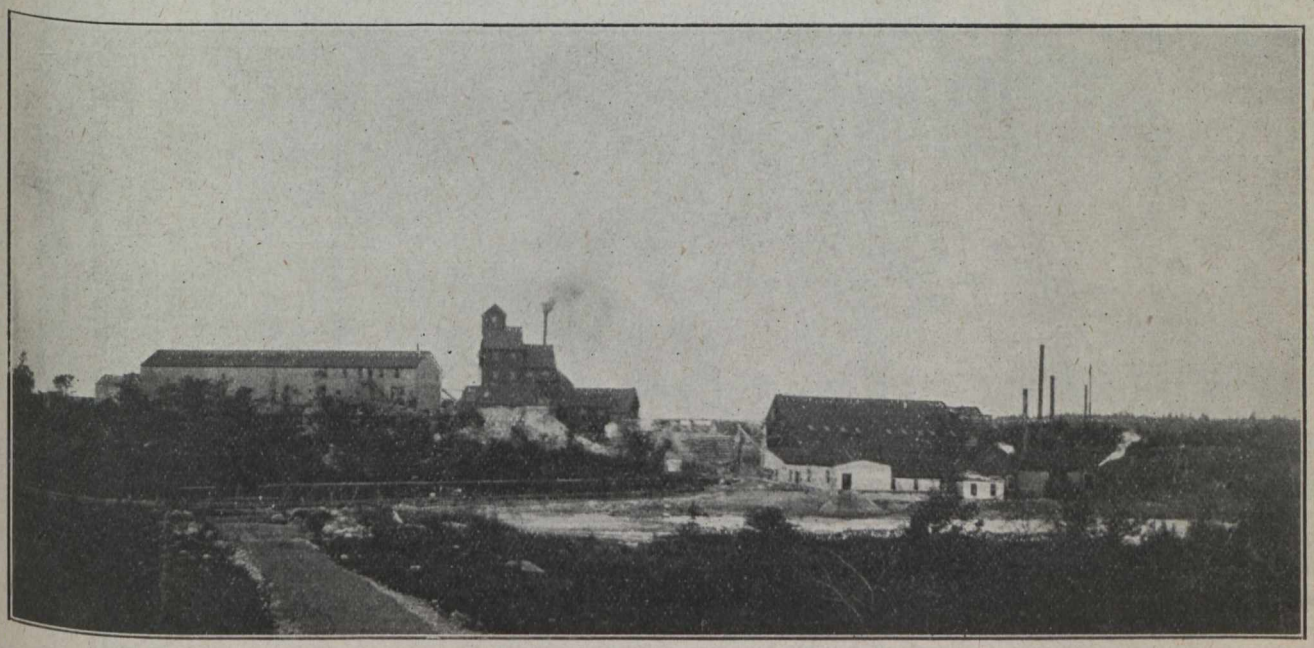
Year.	Tons. Crushed.	Yield. Ozs. Gold.
1893	5,408	2,054
1894	6,997	1,674
1895	10,293	1,677
1896	16,626	2,186
1897	25,150	3,004
1898	24,124	2,478

from 193.363 tons of quartz crushed, or a total value of nearly $600,000. It must be remembered that this value represents only the amount of free gold in the ore, and that large amounts went to waste can be seen by noting the amount of gold now being secured from the concentrates.

It is true that a large cyanide plant was erected to treat the tailings from the mill without concentration, but, while the percentage of recovery in the plant was satisfactory, yet the value of the mill tailings was too low to admit of economical treatment in this way.

In 1903 the Richardson Mine was taken over by the present owners, The Boston Richardson Mining Company, who spent the first year of their ownership in carrying out a new system of development, namely, sinking a 400-foot vertical shaft, rebuilding the 60-stamp mill and putting the plant in its present shape.

The accompanying plan shows a portion of the plant and property of the Boston Richardson Mining Company. It does not show, however, the location of the other belts, similar to the Richardson, which are being opened about 1,000 feet east of the vertical shaft at what is known as East Goldbrook, or the very rich and promising, though probably smaller belts, cut near the



BOSTON RICHARDSON MINING COMPANY'S PLANT.—Looking West.

The ore body or belt consists of a mixture of bands of slate and quartz. Under the early management an attempt was made to sort the ore, throwing out the slate as worthless and milling the quartz. The result of this policy was that the mine was nearly closed down and the manager resigned. The new manager, not only milled the whole belt, but actually crushed the waste dump from former operations with most satisfactory results.

As a direct consequence of this policy the mill was enlarged to one of sixty stamps early in 1901.

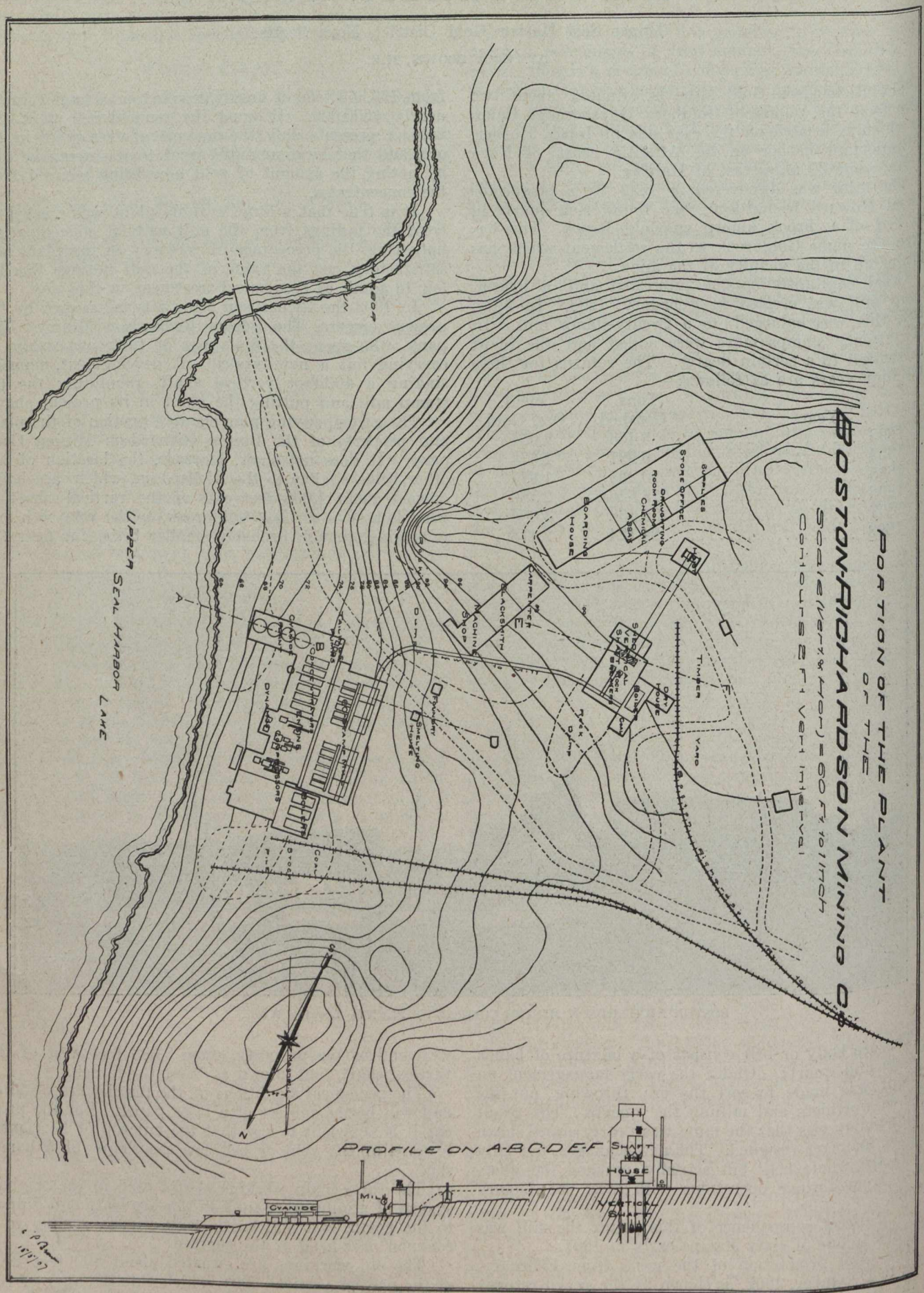
The total production of the mine from February, 1893, to December, 1902, as shown by the sworn returns at the Mines Office at Halifax, was 28.054 ozs. of gold

west end of the property, some 3,000 feet west of the vertical shaft, and known as West Goldbrook.

The geological conditions of the district are peculiar and will be the subject of a later paper. For the present it is sufficient to say that the outcrop or horizontal sections of the vein or belt has the shape of a horse-shoe.

The three main working shafts used in the original system of mining were sunk in this ore body and dipped to the north, east and south, respectively, coming to a common deck-head at the surface.

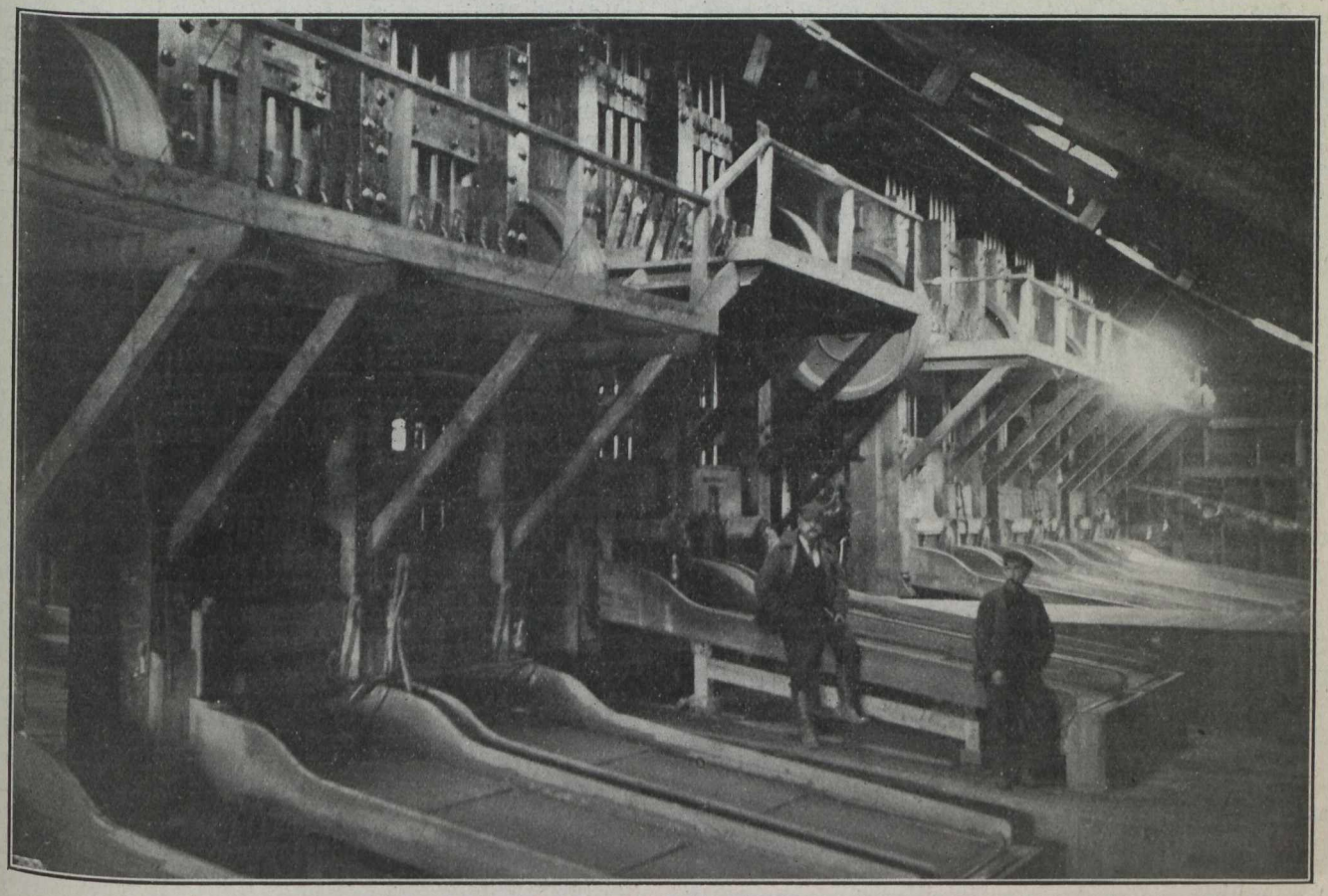
The old workings are situated about 800 feet west of the present vertical shaft, which cuts the apex of the belt, as it pitches eastward, at a depth of about 400


PORTION OF THE PLANT
OF THE
BOSTON-RICHARDSON MINING Co.
Scale (Vert & Hori) = 60 Ft. to 1 Inch
Contours 2 Ft. Vert. Interval
UPPER SEAL HARBOR LAKE
PROFILE ON A-B-C-D-E-F
CYANIDE
MILL
SHAFT HOUSE
VERTICAL SHAFT
BOARDING HOUSE
STORE OFFICE
BLACKSMITH
MACHINE SHOP
CARPENTER
TIMBER YARD
DRY HOUSE
SMELTING HOUSE
ROCK DUMP
COAL
STOCK
N

feet. From the bottom of this shaft levels have been driven westward on the north and south legs, the former being about 1,000 feet and the latter about 1,200 feet in length.

Raises have been driven upward towards the old works from these levels and the ore mined by a modern system of overhand or back stoping. In this connection it may be noted that the early management of the mine claimed they could not use the method of overhand stoping as the back would not stay up. The present management, although they have mined portions of the same ground, have not experienced this difficulty. The underground foreman says he finds the chief difficulty is that the back is too ready to stay up.

The ore is run into chutes, from which it is trammed to large bins at the bottom of the vertical shaft. It is hoisted from here to the surface in a self-dumping skip of two tons' capacity.



INTERIOR OF 60-STAMP MILL—BOSTON-RICHARDSON GOLD MINE.

The ore is dumped from the skip on to an inclined steel plate and grizzly, over which it is fed by hand to one of the two 9″ x 15″ Blake rock crushers. The crushed ore drops into a bin and is trammed to the mill in a side dumping car holding about 1½ tons. This work is so arranged that one man at the rock breaker and one man running the car can handle all the ore crushed by the 60 stamps in 24 hours during one shift of 10 hours. Four of the 10-stamp batteries in the mill are set on concrete foundations and two 10-stamp batteries on end wood. The results of the work here show conclusively that when concrete foundations are properly set and where rubber is used between anvil and mortar, that the concrete is more durable than wood.

The mill is equipped with suspended Challenge feeders. The stamps, newly shod, weigh 950 pounds each. They drop 7 to 7½ inches 95 to 98 times per minute. The height of discharge (top of die to bottom of screen) is about 6 inches. The screen now used is 18 by 24 mesh, No. 26 wire, twilled. Considerable experimental work has been done with regard to screens. Formerly one of plain wire, 30 mesh, No. 28 wire, was used; but this was discarded in favor of the one in use at present, as the first cost of this screen is about half as much as the other, it lasts almost twice as long, the efficiency of the stamps is greatly increased thereby and there is very little difference in the saving of gold.

The water is introduced at the back of the mortars and is so arranged that it strikes about half way up the die. No inside plates are used. The chuck blocks were originally provided with them, but their use has been discontinued. Silver-plated copper apron plates 12 feet in length are used and are found to keep in excellent condition as the amalgamators do not attempt to take off the amalgam too close. Under ordinary conditions the amalgam is removed twice a week. Mercury is fed to the batteries, the amount being judged by the "feel" of the plates. Five men are employed, 3 on day shift, 2 at night. The mill is cleaned up once a month in the usual way. Ten stamps only are cleaned up at one time, the rest of the mill running as usual.

From the apron plates the pulp passes to 6 Wilfley concentrators. The concentrates, which consist almost wholly of Arsenopyrite, are carried by a shaking sluice to a settling tank. From this they are shovelled to a ing box and thence to the treatment tank.

The method used is known as the Bromo-Cyanide process, and is a modification of that employed so successfully at Deloro, Ontario. The cyanide plant is very simple, and consists of:—

4 treatment vats 12 feet in diameter, 18 inches deep.
4 sump tanks, 6 feet diameter, 6 feet deep.
2 storage tanks, 6 feet diameter, 6 feet deep.
2 zinc boxes.
1 acid clean-up tank.

Two men, one on each shift, look after the concentrators and run the cyanide plant. One man is employed, on day shift, to load and unload the tanks.

It is the intention of the company to install at an early date a plant for the recovery of the arsenic.

The following table gives a summary of results for the past year:

Month.	Tons of Ore Milled. Value	Recovered in Mill.	Tons of Concentrates Treated.	Value Recovered in Cyanide Plant.	Total Value Recovered.
May, 1906	3,258	$8,041.00	82.02	$ 807.50	$ 8,848.50
June, 1906....	3,345	8,601.75	76.48	778.75	9,380.50
July, 1906....	2,964	7,072.84	78.25	722.16	7,795.00
August, 1906..	3,939	9,310.17	82.72	646.83	9,957.00
Sept., 1906 ...	3,441	9,082.87	32.78	439.13	9,522.00
October, 1906.	4,014	10,735.22	98.58	1,344.28	12,079.50
Nov., 1906 ...	4,326	9,186.72	132.11	1,847.78	11,034.50
Dec., 1906 ...	3,873	5,743.41	93.80	1,901.09	7,644.50
January, 1907.	3,024	6,493.08	134.03	1,933.24	8,426.32
February, 1907	3,283	7,517.23	143.03	2,610.72	10,127.95
March, 1907 ..	3,717	8,514.09	150.57	2,289.90	10,803.99
April, 1907 ..	3,837	9,612.03	185.12	2,044.29	11,656.32
	43,021	$99,910.41	1,289.49	$17,365.67	$117,276.08

The average cost of mining—operation and maintainance—during this time was *$135 per ton,* and it must be borne in mind that this cost covers, not merely the ore milled, which includes only about one-half the ore broken in the mine, but also the remainder which is left in the mine as filling until such time as the stopes in that portion of the mine are worked out. Thus at the present time there are over 20,000 tons of broken ore in the mine ready to be hoisted.

The above cost includes also the cost of all development and prospecting, sinking an incline shaft 22 feet x 10 feet for a depth of 400 feet from the 400-foot level to the 550-foot level, driving the greater portion of a 500-foot cross-cut and driving the levels and raises necessary to mining.

The average cost of Milling—operation and maintainance—for the year was *0.33 per ton.* The average cost of cyaniding for the past six months was $2.37 per ton of concentrates, or $0.08 per ton of ore milled. The following cost of supplies and scale of wages is given in order that the reader may intelligently compare the above costs with those in other places:

Coal, average cost, $4.00 per ton.
Dynamite, average cost, $0.20 per pound.
Wages—Drillmen, $1.75 per day.
Helpers, $1.50 per day.
Trammers and muckers, $1.50 and $1.35 per day.
Millmen, $40.00 to $65.00 per month.
Cyanide men, $2.00 per day.
Hoistmen, $2.00 per day.
Engineers, firemen and machinists, $1.65 per day.
Blacksmiths, $1.75 to $2.50 per day.
Carpenters, $1.60 to $1.75 per day.
Laborers, $1.35 per day.

The high price of coal may not be, as some of our authorities declare, the reason of the decline of the gold mining industry in Nova Scotia; but it certainly tends to greatly increase the cost of mining and milling.

The Boston Richardson Mining Company intend to greatly enlarge their milling capacity at an early date; indeed, ten extra stamps and accessories are now on the ground.

The Company also intend to change their system of power to electricity or gas, which will materially reduce costs.

My thanks are due to Mr. H. S. Badger, superintendent of the Boston Richardson Mine, for his kind assistance in the preparation of this paper.

PIG LEAD ANALYSES

The following is a list of analyses made by the Osaka (Japanese) Technical Analyzing Department. The Trail brand is electrolytic lead, produced by the Consolidated Mining & Smelting Company of Canada, Limited:—

Selby—Per cent. lead, 99.9579; per cent. insolubles, 0.0040; per cent. bismuth, 0,0300; per cent. cadium, trace; per cent. nickel, 0.0001; per cent. cobalt, none; per cent. silver, 0,0010; per cent. manganese, 0.008; per cent. copper, none; per cent. antimony, none; per cent. tin, 0.0004; per cent. arsenic, 0.0024; per cent. zinc, 0.0003; per cent. iron, 0.0027.

Trail—Per cent. lead, 99.9890; per cent. insolubles, trace; per cent. bismuth, none; per cent. cadium, none; per cent. nickel, trace; per cent. cobalt, none; per cent. silver, 0.0025; per cent. manganese, none; per cent. copper, 0.0003; per cent. antimony, none· per cent. tin, 0.0007; per cent. arsenic, 0.0020; per cent. zinc, 0.0002; per cent. iron, 0.0053.

Smelter—Per cent. lead, 99.9762; per cent. insolubles, trace; per cent. bismuth, 0.0046; per cent. cadium, 0.0002; per cent. nickel, trace; per cent. cobalt, trace; per cent. silver, trace; per cent. manganese, 0.0003; per cent. copper, none; per cent. antimony, 0.0137; per cent. tin, none; per cent. arsenic, 0.0090; per cent. zinc, trace; per cent. iron, 0.0039.

English Chemical—Per cent. lead, 99.9693; per cent. insolubles, trace; per cent. bismuth, trace; per cent. cadium, 0.0007; per cent. nickel, 0.0003; per cent. cobalt, trace; per cent. silver, 0.0020; per cent. manganese, none; per cent. copper, 0.0097; per cent. antimony, 0.0149; per cent. tin, none; per cent. arsenic, 0.0002; per cent. zinc, trace; per cent. iron, 0.0029.

B. H. P.—Per cent. lead, 99.9853; per cent. insolubles, trace; per cent. bismuth, none; per cent. cadium, trace; per cent. nickel, none; per cent. cobalt, none; per cent. cobalt, trace; per cent. silver, 0.0009; per cent. manganese, none; per cent. copper, none; per cent. antimony, 0.0108; per cent. tin, 0.0004; per cent. arsenic, none; per cent. zinc, 0.0001; per cent. iron, 0.0025.

Enthoven—Per cent. lead, 99.9851; per cent. insolubles, trace; per cent. bismuth, 0.0048; per cent. cadium, trace; per cent. nickel, trace; per cent cobalt, trace; per cent. silver, 0.0015; per cent. manganese, none; per cent. copper, none; per cent. antimony, 0.0160; per cent. tin, none; per cent arsenic, none; per cent. zinc, trace; per cent. iron, 0.026.

Note.—Selby and Smelter are American; Trail, Canadian; Enthoven and Chemical, English; B. H. P., Australian.

NOTES ON THE MINERAL FUEL SUPPLY OF CANADA

R. W. Ells, D.D.

(Abstract of paper read before the Royal Society of Canada.)

In discussing the question of mineral fuels, a number of substances other than coal proper must be considered. The coals themselves include several varieties, such as anthracite, which is found along the eastern flank of the Rocky Mountains, and to some extent on one of the Queen Charlotte group of islands in the Northern Pacific Ocean; the true or bituminous coals with their resulting coke, and the lignitic coals and lignites which are not capable of being coked, and which vary from brown to black and in quality from a fuel nearly equal to many of the true coals to others not far removed from peat. In addition to these, the minerals anthraxolite, oil shale, albertite and petroleum and natural gas must all be regarded as forms of fuel. They are often found in large quantities and at many widely separated points; while the immense stores of peat are bound to become valuable in a few years.

At points where the distance from coal fields is great, peat must become locally valuable. This is true of Quebec, Ontario and Eastern Manitoba.

The geological horizons of the several coal deposits found in Canada extend from the Devonian upward into the Tertiary. Of the other fuels, some of them range downward to our lowest rocks, anthraxolite, which is a form of carbon, being found in those of Huronian and Cambrian age. The geological horizons of the workable coals are, however, rather more limited, although even here the early ideas that the economic deposits of coal belonged especially to the Carboniferous time have long been set aside, by the fact that many of the highest grade coals of the West belong to comparatively recent rocks and extend through the Cretaceous to the middle Tertiary. These Western coals present several varieties in the same field, the difference being due apparently to various degrees of alteration of the original deposit of carbonaceous matter.

Anthraxolite is more closely related to the rock oils or petroleum than to the true coals It is found in widely separated horizons. In its mode of occurrence it differs entirely from coal, in that it is always found in the form of veins which traverse strata of different ages instetad of occurring as bedded deposits. From its presence in the rocks of the Laurentian and Huronian systems, as well as in the Cambrian and Silurian formations, it would, on the hypothesis that all bituminous substances are of organic origin, indicate that life in some form existed in the remotest periods of the earth's history.

Anthraxolite is the oldest mineral fuel. In Labrador it has been found in veins some inches wide, traversing the Cambrian rocks; in Quebec, along the St. Lawrence, near Point Levis, and on the Island of Orleans, it occurs in pockety masses in slates and sand stones of upper Cambrian age. It is also found in Ontario in black Cambrian slates; in granite as veins of very pure quality; and in limestone in association with veins of barite. Anthraxolite has no economic importance as a fuel.

Closely allied to anthraxolite in composititon are petroleum and asphalt, as also to some extent the peculiar form albertite, which was at one time largely mined in New Brunswick, and which also was exceptionally free from ash. As a class these minerals are quite distinct from the several varieties of coal proper, in composition and in origin.

In some areas where oil wells occur the oil has come to the surface and become thickened, forming what are known as gum-beds. This material was found in large masses in the Petrolia oil fields prior to tthe discovery of the oil itself in quantity. But in the case of the albertite of the Albert mines in New Brunswick, this thickening of the natural oils must have recurred through some cause other than exposure, since this mineral filled a fissure in bituminous slates to a depth of 1,500 feet, with a length of over half a mile.

In the matter of hard coal or anthracite, the people of Eastern Canada are to a large extent dependent upon the immense deposits which occur in the eastern portion of the United States; but in all other varieties it will be found that Canada has an unlimited supply, much of which is readily accessible. Anthracite, also, of excellent quality and of great extent, is found along the eastern slopes of the Rocky Mountains.

The existence of coal fields in Southwestern Newfoundland has been known for many years. These may possibly represent the extension eastward of the Sydney coal basin. The actual extetnt and value of these coal basins have never been definitely ascertained.

In Nova Scotia the coals are for the most part confined to the Carboniferous formation and the largest workable seams belong to the middle portion, or what is usually styled the productive coal measures. This formation is found at Sydney, on the eastern coast of Cape Breton, and in Richmond and Inverness, on the west side of the island; at Pictou, in the eastern part of Nova Scotia proper; and at Springhill and the Joggins in the northwest of the Province.

Seams of considerable size are found in tthe underlying portion of the Carboniferous, otherwise known as the millstone-grit formation, and occasionally the mineral occurs in the upper Carboniferous or Permian, where coals of no great thickness have been recognized in that part of the Counties of Colchester and Pictou.

All the coals at present worked in the Province are of the bituminous variety. Associated with the Pictou coals are occasional seams of rich bituminous oil shale, known as stellarite, from which oil can be distilled.

In the southern half of Nova Scotia, which is occupied by great areas of granite, slates, quarttzite, etc., no trace of coal is found.

The Sydney coal field extends along the eastern shore from Mira Bay on the southeast to Cape Dauphin at the entrance of Bras D'Or Lake. Mr. Hugh Fletcher estimates the area of the basin as about 200 square miles. The aggregate thickness of coal in the several workable seams varies from 13 1-2 feet in the Dauphin area to 44 1-2 feet in Sydney Harbor, the seams ranging from 3 to 9 feet in thickness. The dip is generally at a low angle seaward.

On the west side of the island of Cape Breton, in Inverness and Richmond Counties, large and important coal basins are located, the seams being thick and of good quality.

On the mainland the thick seams of the Pictou basin have been producers of coal for more than eighty years. In this area are comprised some of the largest seams

in Eastern America, the main seam in the Sttellarton area having a thickness of forty feet, with several others in the vicinity of very large size.

In the Cumberland basin, as seen at Springhill mines, there are a number of seams, many over ten feet thick. These have been worked for more than thirty years. In tthe western part of this basin, along the shore of Cobequid Bay, is the old colliery known as the Joggins mine, showing thin seams, the thickest only five feet. These seams extend along the margin of the Springhill basin, and along the outcrops are a number of small collieries.

(To be continued.)

CRYSTALLIZATION OF ASBESTOS

By W. J. Woolsey, Cobalt, Ont.

During the past winter I obtained hand samples of serpentine from the various producing localities in the Eastern Townships, Quebec, and had rock sections made for examination under the miscroscope.

Work on the various sections exhibited the characteristics commonly noted in the serpentines. One section, however, exhibited the phenomenon of crystallization of the chrysotile in a marked degree, as shown by the accompanying micro-photograph.

It will be observed that the crystallization extends from a cleavage plane outward in either direction. The concentration of the impurities to this centre accounts for the accumulation of foreign material so frequently found in the centre of the asbestos veins.

TRIPOLI DEPOSITS IN CALIFORNIA

The diatomaceous deposits so widely distributed in the coast ranges of California are found in such purity and such inexhaustible quantities in Northern Santa Barbara County as to give them great commercial value, and it is for this reason that a description of the occurrences is included by the United States Geological Survey in the Contributions to Economic Geology for 1906 (Bulletin No. 315). The paper was prepared by Messrs. Ralph Arnold and Robert Anderson as the result of field work in 1906 in the Lompoc and Guadalupe districts.

The deposits are variously known as infusorial earth, tripoli, diatomaceous earth, and, in Santa Barbara County, "chalk rock." The most appropriate of these names is diatomaceous earth, as the material is composed almost entirely of the skeletons of minute organisms called diatoms—one-celled plants that adapt themselves to a wide range of conditions of depth and temperature in fresh or salt water and secrete siliceous casings around their organic matter. They must have lived in great abundance in the sea that ages ago covered this part of the land, for the rock was built up of the little shells of these plants that dropped to the sea bottom. Examination with a hand lens always reveals a large number of the round forms of the diatom shells thickly imbedded in the shale. Many of these shells are in a good state of preservation, and in some of the material they can be plainly distinguished with the naked eye. The name "chalk rock" is inappropriate, for although the deposits resemble chalk in appearance, they are made of siliceous instead of calcareous material.

The uses to which the diatomaceous earth are put are constantly increasing, and the methods of application are developing. Formerly employed solely for abrasive purposes, it soon became useful in the manufacture of polishing powders, soaps, etc.; but its abrasive quality makes it a good absorbent and it is extensively used in the manufacture of dynamite from nitroglycerine. Being very light and a poor conductor of heat, it is valuable for use in the manufacture of packing for safe, steam pipes, and boilers, and of fireproof building materials. It also serves as a base for the manufacture of cement suitable for withstanding heat. It is a good filtering substance and is so used commercially. Some of the earth from the Lompoc region is said to be used in the refining of beet sugar. In the Lompoc region and also at Monterey, farther north on the California coast, it is used in the construction of buildings. The shale is easily quarried into smooth blocks which can be readily placed in position. The blocks are compact and yet elastic under changes of temperature, seem to possess sufficient strength, and are very resistant to weathering. As a building material it is finely adapted to a region subject to earthquakes, for the shock effect on a substance so light would probably be the minimum and a smaller amount of damage would result from falling materials. The Santa Barbara County deposits are rendered exceptionally valuable by their proximity to railroad and ocean transportation facilities.

The paper referred to includes descriptions of the various occurrence of the diatomaceous earths, a discussion of their physical and chemical properties, and statistics of production in the United States. It may be obtained by applying to the Director, United States Geological Survey, Washington, D.C.

MINING IN THE BOUNDARY DISTRICT

Mr. Frederic Keffer, the president of the Canadian Mining Institute, and engineer of the British Columbia Copper Company, contributes an interest article to the current number of *The Engineering Magazine.* on "Mining in the Boundary District." While, naturally, the information given is not all new, the subject is treated for, perhaps, the first time in a manner at once concise and comprehensive. Mr. Keffer points out that four general conditions have contributed to the successful mining and smelting of the low grade ores of the district, these being: (1) The enormous extent of the ore bodies, admitting of mining on a large scale; (2) the solidity and firmness of the ground which renders the opening of great stopes without the use of timbers feasible and safe; (3) the chemical composition of the ores, which, by rendering them self-fluxing, obviates the use of any barren fluxes; and lastly, the presence in the near neighborhood of coal areas, by which a cheap and abundant supply of fuel is made available. Had any one of these conditions been absent, it is questionable whether mining in the Boundary could have been profitably carried on. The district enjoys the advantage also of an abundant water and timber supply, while the mines generally are dry and require little pumping.

The mining methods employed are two, one by open pits or "glory holes," and the other by pillars and stopes. The former may only be employed where the overburden of soil rock is not too great, and is most effective in mines where the dip of the ore deposit is high. But, owing to the low dip of many of the deposits, glory hole work is necessarily limited, and, as square-set timbering in underground work is imposible on account of the prohibitive cost, the usual plan is to open stope above a roof supported by pillars of ore.

The writer notes that the great irregularity in form of the deposits necessitates that each section of the work, even in the same mine, must be treated individually, and plans made to suit the form and dip of the ore contained in that section.

In the British Columbia Copper Company's Mother Lode Mine the ore is all conveyed to the main shaft, where it is dumped into pockets. The cars mostly used have a capacity of from 2 to 2 1-2 tons, and are drawn by horses in trains of from 4 to 5 cars. The ore is drawn from the pockets into 5-ton skips, and hoisted to a bin at the surface, whence it passes to electrically driven Blake crushers. From the crushers the ore falls on to a conveying belt, which carries it to the railway bins. At the Granby Mines most of the haulage is done by electric motors and steam locomotives, bins being located at two tunnel entrances to the mine on the upper levels. Here the ore is crushed in crushers with jaw openings of 30 and 42 inches, and then passed to railway bins. The ore from the Dominion Copper Company's mines is delivered directly to the railway bins without crushing.

Steam power has been practically displaced in the Boundary by electricity, which is generated at Cascade and Bonnington Falls. The capacity of the former plant is 2,000 to 3,000 horse-power, while the larger plant at Bonnington is capable, it is estimated, of generating 60,000 horse-power at low water.

The progress of mining in the Boundary is indicated by a comparison of the tonnage of ore smelted in 1900, which was 62,389 tons, and the returns for last year, 1,276,589 tons.

RICHNESS OF COBALT ORES*

By Dr. Albert R. Ledoux, New York.

I have been asked by several members of the Institute what is the grade of Cobalt ores, as determined by my sampling works in Jersey City. Since January, 1905, we have handled at our works 366 carload lots of this ore, and 52 other lots—less than carloads—including what we call nuggets, the nuggets either coming separately consigned or as part of a carload. I do not feel at liberty to state the assays of any particular lots of nuggets, as there have been some delicate questions concerning the value of some of these "Bonanza shipments." These nuggets, as you are aware, are not pure silver, but run anywhere from 700 parts to 870 parts of silver in the thousand. There are more or less gangue and other minerals associated with the silver, and the metallic silver itself, visibly free from gangue, runs about 950 fine.

Leaving out of consideration the nuggets and native silver, and including only the lots of regular ore, a review of 394 lots sampled shows that the highest lot ran 7,402 ounces of silver to the ton, the next in order being 6,909, 6,413, 6,163 and 5,948 ounces per ton. In the 394 lots we found:

						Per cent.
Over	6,000 ozs.			4 lots	(say)	1
Between	5,000 ozs.	and	6,000 ozs.	3 lots	(say)	0.75
Between	4,000 ozs.	and	5,000 ozs.	12 lots	(say)	3
Between	3,000 ozs.	and	4,000 ozs.	17 lots	(say)	4.25
Between	2,000 ozs.	and	3,000 ozs.	30 lots	(say)	10
Between	1,000 ozs.	and	2,000 ozs.	72 lots	(say)	18.25
Between	900 ozs.	and	1,000 ozs.	11 lots	(say)	2.75
Between	800 ozs.	and	900 ozs.	7 lots	(say)	1.75
Between	700 ozs.	and	800 ozs.	12 lots	(say)	3
Between	600 ozs.	and	700 ozs.	21 lots	(say)	5.25
Between	500 ozs.	and	600 ozs.	10 lots	(say)	2.5
Between	400 ozs.	and	500 ozs.	13 lots	(say)	3.25
Between	300 ozs.	and	400 ozs.	20 lots	(say)	5
Between	200 ozs.	and	300 ozs.	44 lots	(say)	11.25
Between	100 ozs.	and	200 ozs.	66 lots	(say)	17
Less than	100 ozs.	and		43 lots	(say)	11

You are of course aware that while the greater part of shipments of cobalt have come to New York, some have gone abroad and many have gone to Copper Cliff.

It seems to me that this is a remarkable showing for a camp so young as Cobalt, the first car having reached our sampling works about the first of February, 1905.

Silver, of course, in point of value, is the more important element. The highest percentage of cobalt found in any one shipment is 11.96 per cent., the average being 5.99 per cent. The highest assay for nickel in any car is 12.49 per cent., the average being 3.66 per cent. The highest percentage of arsenic is 59.32 per cent., the average 27.12.

Discussion.

Mr. Campbell—Could you tell us, in the case of these nuggets and of the silver, what it was which makes them less than one thousand fine?

Dr. Ledoux—There are mixed up with the nuggets other minerals; sulphides, arsenides, etc., and the gangue matter. We have paid no attention as to what reduces the fineness of the native silver—we do not know what it is.

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*The above formed the subject for a brief address by Dr. A. R. Ledoux, following the reading of papers on the Cobalt District at the Toronto meeting, 1907.

PRODUCTION OF COAL IN 1906

According to statistics compiled for the United States Geological Survey by Edward W. Parker, coal mining expert in charge, the total production of coal in the United States in 1906 was 414,039,581 short tons of 2,000 pounds, valued at $512,610,744. These figures, compared with those of the preceding year, when the output amounted to 392,919,341 short tons, valued at $476,756,963, show an increase of 21,120,240 short tons, or 5.4 per cent. in quantity, and of $35,853,781, or 7.5 per cent. in value.

Of the total production in 1906, Pennsylvania contributed 200,546,084 short tons, or 48.4 per cent., in quantity, and $262,182,935, or 51.1 per cent., in value, the larger percentage in the value being due, of course, to the higher value of anthracite, which is produced almost exclusively in that State.

The anthracite production of Pennsylvania in 1906 was 63,645,010 long tons (or 71,282,411 short tons), valued at $131,917,694, while the bituminous production was 129,263,673 short tons, valued at $130,265,241. The anthracite production of Pennsylvania in 1906 was 5,694,142 long tons (or 6,377,439 short tons) less than that of 1905, with a decrease in value of $9,961,306, while the bituminous production showed an increase of 10,850,036 short tons in quantity and of $16,874,734 in value.

One of the interesting facts presented in the statistics of coal production last year is that West Virginia has supplanted Illinois as the second coal-producing State, West Virginia showing a total output of 43,276,485 short tons, while the production of Illinois was 41,497,435 short tons. This was due principally to the almost complete suspension of mining in Illinois (as in other States where labor union forces were strong) during all of April and a part of May, when the miners and operators were in conflict over the wage scale, whereas the majority of the operations in West Virginia were more actively worked, as a result of the suspension of work in the other districts.

Notwithstanding, however, the loss of from six to eight weeks in the States where mining operations were suspended, there was a general increase in production east of the Mississippi River, the only exceptions noted being in Michigan, Georgia, and North Carolina. In Illinois, where the question of the wage scale is most sharply contested, the production increased from a total of 38,434,363 short tons in 1905 to 41,497,435 short tons in 1906. Indiana's production of coal increased from 11,895,252 short tons in 1905 to 12,084,281 short tons the following year. Ohio's production increased from 25,552,950 short tons in 1905 to 27,729,843 short tons in 1906, while the bituminous production of Pennsylvania increased from 118,413,637 short tons in 1905 to 129,263,673 short tons in 1906.

In West Virginia, where there was no suspension of mining, the output of coal increased from 37,791,580 short tons in 1905 to 43,276,485 short tons in 1906.

Among the other coal-producing States in which there was an increased production in 1906 were Alabama, Colorado, Iowa, Kentucky, Maryland, Montana, New Mexico, Tennessee, Virginia, Washington, and Wyoming. In addition to the three States previously named in which decreases occurred, the following showed losses in tonnage: Arkansas, Indian Territory, Kansas, Michigan, Missouri, Texas, California, Oregon and Alaska. In California, Oregon, Arkansas, Indian Territory and Texas the decreases were due principally to the use of fuel oil. In Kansas, Michigan and Missouri the decreases were due, in the main, to the fact that in these States the industry did not recover from the idleness previously referred to.

PRODUCTION OF COAL IN 1906, BY STATES.

State.	Production.	Value.
Alabama	13,107,663	$17,467,886
Arkansas	1,864,518	2,999,774
California and Alaska	30,831	78,684
Colorado	10,114,074	12,738,509
Georgia and North Carolina	363,463	407,247
Idaho and Nevada	6,165	24,238
Illinois	41,497,435	44,742,440
Indiana	12,084,281	13,105,168
Indian Territory	2,859,450	5,481,053
Iowa	7,321,639	11,688,598
Kansas	6,010,858	8,935,195
Kentucky	9,673,536	9,794,823
Maryland	5,434,528	6,473,829
Michigan	1,336,338	2,402,529
Missouri	3,755,778	6,163,449
Montana	1,787,934	3,186,620
New Mexico	1,963,558	2,635,571
North Dakota	300,998	437,894
Ohio	27,729,843	30,386,297
Oregon	79,731	212,338
Pennsylvania:		
Anthracite	71,282,411	131,917,694
Bituminous	129,263,673	130,265,241
Tennessee	6,262,686	7,682,121
Texas	1,160,707	2,058,731
Utah	1,773,847	2,411,992
Virginia	4,275,815	4,207,521
Washington	3,276,184	5,908,434
West Virginia	43,276,485	40,777,382
Wyoming	6,138,152	8,019,486

The calorimeter is an instrument of value in the hands of a trained chemist. For any given class of coals it gives an excellent standard of comparison. But when a large number of determinations are to be performed on coals of widely differing composition, it is often necessary to correct and adjust results. This means that each fuel develops its own "error" and a correcting factor must be found for each. Results obtained by means of the calorimeter must not be considered absolute. Relatively they are correct. But unless refinements are introduced, making the work too tedious and elaborate for commercial purposes, it is not desirable that comparisons based upon calorimeter results should be instituted between coals of different characters.

The same general truth applies to commercial laboratory work. While the determination of some of the elements is simple and should always be accurate, there are operations, such as the volumetric determination of sulphur in pig iron, where a constant error is observable. Exactness is here sacrificed for speed. So long as the error is constant no harm need be done

GEOLOGICAL SURVEY OF CANADA

PROPOSED DISTRIBUTION OF FIELD PARTIES, SEASON 1907.

YUKON:

Messrs. McConnel and Maclaren.—An examination of the mineral areas of the southern portion of the territory, including the copper deposits of Whitehorse and the rich silver deposits of Conrad.

Mr. Cairnes—The mapping and investigation of the coal areas along the Yukon River, between Whitehorse and Tantalus.

Mr. Keele—An examination of the upper waters of the Pelly and Hoole and Kiza Rivers, extending over two seasons, the return journey to be made across the mountains, and thence to Dawson by the Mackenzie, Rat and Porcupine River route.

BRITISH COLUMBIA:

Mr. J. A. Bancroft—Continue the examination of the rocks and minerals northward from Texada Island, giving particular attention to the copper and iron deposits.

Mr. Leach—Continuation of the mapping and investigation of the coal and copper areas in the vicinity of the Bulkley Valley, Skeena River.

Mr. Camsell—Continuation of the mapping and geological investigation of the Similkameen valley.

Messrs. Brock and Boyd—Completion (in two or three weeks) of the Rossland, or continuation of the mapping and geological investigation of the Lardeau camp. If possible, investigations in the Slocan district.

ALBERTA:

Mr. Malloch—Continuation of the mapping of the Cascade, Palliser and Costigan coal fields in the Rocky Mountains, between the Red Deer and Clearwater Rivers.

SASKATCHEWAN:

Mr. McInnes—Examination of the country lying to the north of the Canadian Northern Railway, and extending to the north of the Saskatchewan River to 50° N. lat. The east and west boundaries being lines drawn through Prince Albert and The Pas.

ONTARIO:

Mr. Collins—Continuation of the study of the geology and economic minerals along the route of the N. T. Ry., in the western part of the Province.

Mr. W. A. Johnston—Continuation of the mapping and geology of the Simcoe sheet.

QUEBEC:

Mr. Morley Wilson.—Continuation of the mapping and geological investigation in the western portion of Pontiac County east of Lake Temiskaming.

Mr. W. J. Wilson—Continuation of the mapping and geological investigation of the belt along the N. T. Ry., eastward from the crossing of Bell River.

Mr. O'Sullivan—Mapping and geological investigation of the belt along the N. T. Ry., from La Tuque westward.

Mr. Dresser—Study of the serpentines of the Eastern Townships, with special reference to the mode of occurrence in them of the valuable deposits of chrome iron ore, asbestos and copper.

NEW BRUNSWICK:

Dr. Ells—Continuation of the revision of the geology of Southern New Brunswick.

Mr. Robert—Continuation of the mapping and geology in the environments of the City of St John.

NOVA SCOTIA:

Mr. Fletcher—Continuation of the mapping and geological investigation in Kings, Annapolis, Digby and Cumberland Counties.

Messrs. Faribault and O'Farrell—Continuation of the mapping and geology of the gold-bearing rocks in Lunenburg and Queen's Counties.

Dr. Young—Investigation of the granites and other irruptive rocks, with special reference to the occurrence of tin and other valuable minerals.

SPECIAL WORK.

Mr. Ingall—Investigation of the copper resources of Eastern Canada.

Mr. Denis—Superintendence of the selection of samples of coal at the mines for the practical coal tests. Study of each mining centre for information to accompany the report on the tests.

Prof. Macoun—Collection of specimens illustrating the forest wealth of Canada for the new Victoria Museum.

Messrs. Willimott and McKinnon—Collection of mineral specimens for High School collections and for the Victoria Museum.

Mr. R. A. A. Johnston—Special duty of rare minerals in various localities.

Dr. Ami—Study and collection of fossils in Nova Scotia and New Brunswick to determine geological horizons.

BOOK REVIEWS

THE METALLURGY OF THE COMMON METALS—gold, silver, iron, copper, lead and zinc—by Leonard S. Austin, Professor of Metallurgy and Ore-dressing, Michigan School of Mines, first edition. Published by *The Mining and Scientific Press*, San Francisco. Price $4, postage, 16 cents; 407 pages, 6 inches by 9 1-4 inches.

This volume outlines, in a manner at once comprehensive and connected, the metallurgy of the metals mentioned in the title. It is divided into ten sections. Part I. is general. The definition and classification of ores is followed by brief, singularly lucid paragraphs on the metallurgical treatment of ores, combustion, fuels, refractory materials, sampling, preparatory treatment of ore, and thermo-chemistry as applied to metallurgy. This whole section displays a wide general acquaintance with the basic principles of metallurgy. None but a man of ripe experience could crystallize into words definitions so succinct and so informing.

Part II. deals with the general principles of roasting and with certain specific applications of those principles. To the chemistry of roasting four pages are devoted. Heap and stall roasting of lump ore are taken up, and the mechanical roasting of ores in a pulverized condition is very carefully, though of course briefly, developed. One meritorious feature of this section and, indeed, of every section of the book, is the care taken in specifying figures of capacity and costs.

Parts III. and IV. cover the metallurgy of gold and silver. Instructive diagrams of the stamp mill accompany these sections. The pages describing the cyaniding of gold and silver ores have been revised and modified by Mr. F. L. Bosqui, a most eminent authority on the

process. Both parts are profusely illustrated with diagrams and photagravures. Parts V., VI., VII., VIII. and IX. take up iron, copper, lead, zinc and refining, respectively. In each of them the practical is wedded to the theoretical. Perhaps the most valuable section is Part X., which is headed "Commercial." In logical sequence the various steps in the establishing of a metallurgical industry are taken up, from location of works to the marketing of ores and metals.

We have read Professor Austin's volume, not only with interest, but with decided pleasure. So skilfully has the kernel of each subject been extracted, and so simple and comprehensive is the author's presentation of each, that it is impossible not to feel instructed and edified after a perusal of this excellent though unpretentious book.

CORRESPONDENCE

Bruce Mines, Ont., June 8th, 1907.

The Editor THE CANADIAN MINING JOURNAL,
Toronto.

In your June number the article entitled "Reciprocity" appeals to the writer forcibly, and for the benefit of those who may fall into similar errors it may be of interest to place on record how easily mistakes can be made in the treatment of ores, especially those of an auriferous nature, which, in appearance, are similar to those from which former experience has been acquired, and yet when put to the test of milling the result is entirely different. The writer having erected two stamp mills in South America, and made a very good recovery by battery and plate amalgamation, afterwards in Australia handling ore which was cyanided after being stamped, had the management of a considerable area in the Philippine Islands placed in his charge—this was in 1893-96, before the American war.

After making several hundred fire assays, development work was commenced, and samples taken every week across each heading, a quantity equal to two pounds weight of ore being broken for each foot in width; after a little practice this was done very fairly, and, there not being any gouge, the samples were representative. After drying the ore, it was ground by hand on an Indian rubbing stone by means of another stone. The ore was washed in a "batea"—the native wooden pan—by an expert panner, and the resultant gold fused into a small bead in the half of a species of sea shell; this was done by means of a a bamboo blowpipe on a few bits of charcoal. The lime in the shell acted as a flue, and the resultant bead was about 820 fine. In those days we could not get any acids carried by the coasting steamers, hence parting the gold was out of the question.

A continuous series of samples, aggregating two tons, showed rather more than $15 per ton, and there was present some pyrites which carried good values.

Now having a three-quarter ounce proposition of apparently free milling ore, it was considered safe to erect a ten stamp mill, and we proceeded to select a site where the tailings could be accumulated for future treatment. I will not dwell upon the difficulties of handling the machinery and erecting it, but it was done, and a mill man sent from the United States, who had been in charge of the Father de Swet Mill at Homestake, S.D., but do what we would, or could, the recovery in the battteries and on the plates did not average more than $2.75. We put in blanket strakes and saved concentrates going from 5 to 15 ounces of gold.

After making a most careful examination of everything, we came to the conclusion that whilst the abrasive action of the grinding by hand liberated the gold so that it could be saved in panning, the pounding action of the stamps flattened the gold, and it was carried off by the water without coming in contact with the amalgamated surfaces, and this in spite of mercury traps, etc. Ever since this experience the writer has been very chary of advocating stamp mills not followed by cyanide.

To add to his annoyance a report was circulated, and finally reached the ears of the managing director, resident in Manila, that the gold had been recovered but stolen! Fortunately, mill records had been carefully kept, and all amalgam weighed and the gold smelted and weighed in the presence of two or more of the white employes.

Now, how this may be applied to the present day is evident. Much of the ore to be treated from the new discoveries of Larder Lake, etc., cause the same disappointment, and perhaps this warning will be of service to those who are loking forward to results based upon assays, and the opinion of the writer may be taken for what it is worth, viz., that in many instances, especially for friable ores, the improved Huntingdon mill, or any other type in which grinding or abrasive action as opposed to stamping, will yield better results for those working on a small scale who wish to get quick returns with a minimum of expenditure. It should be remembered that the primitive form of the arrastra has produced many million dollars worth of bullion.

Yours obediently,

H. J. CARNEGIE WILLIAMS.

EXCHANGES

The Mining Investor, June 3rd, contains a caustic letter from "Critic."

The British Columbia Mining Record for April is, as usual, entirely readable and reliable.

The Coal Trade Journal, May 29th, announces that it has removed its offices to Nos. 20, 22 and 24 Vesey street, New York.

The Mining and Scientific Press, May 25th, gives a third instalment of "Letters of a Self-Made Miner to His New Foreman."

The Mining World, June 1st, gives a sketch of the oil fields of Colorado. The second installment of "British Columbia Placers: Past and Present" makes most interesting reading.

The Engineering Magazine for June contains several articles dealing with power and production. The system of mining low grade copper ores in the Boundary District, B.C., is described by Mr. Frederick Keffer, president of the Canadian Mining Institute.

The April number of *Economic Geology* has been received. In it are a number of most valuable articles. Especial mention may be made of the following: "The Composition of Coals," "Magmatic Emanations," and "Recent Improvements in the Utilization of Coal."

In *The Engineering and Mining Journal* for June 1st are articles on "Zinc Oxide and Zinc Lead Pigment Manufacture," and on the "Novel Equipment of Tywarnhaite Copper Mine." The latter paper describes an installation of dynamos driven by power from producer gas engines and the vacuum process of concentrating low grade copper ore.

The Industrial Advocate, May, prints a letter from Mr. Louis N. Fuller, general manager of the Dominion Mining & Smelting Company, of Pictou, N.S. Mr. Fuller rightly urges the claims of his enterprise for Government help in the direction of low freight rates. Each number of the *Advocate* contains valuable information corncerning the gold mines of Nova Scotia.

The Colliery Gaurdian, May 24th, in concluding a strong editorial touching the "Report of the Eight-Hour Day Committee," characterizes the movement as "but one phase of that rather selfish class individualism which has always been a characteristic feature of the coal miners of Great Britain." This issue contains also a second instalment of a paper on "Coal Analysis from the Commercial Point of View."

The Mining Journal (London), May 25th, comments editorially upon the recently issued annual report of the Nova Scotian Department of Mines. Of gold mining in that Province The Mining Journal justly remarks: "On the other hand, gold mining has been in progress since the early sixties, yet the rate of production is less than that which the small community of Australian settlers in New Guinea have reached in a few years. The report, even making allowance for inadequate resources, is certainly not an encouragement to outside capital, as it should surely be possible to collect similar returns from all sources, collate them and present complete and harmonious figures for such data as are afforded to the public." We need add nothing to our contemporary's criticism. It is, unfortunately, as true as it is incisive.

The Iron and Coal Trades Review for May 24th contains a translation of an article from Glückauf entitled "Judging Coke from its Appearance. The difference in the structure of coke made from various coal and under different conditions is well illustrated by means of photographs. Incidentally, a photograph of a speciment labelled "Metallic coke from unwashed coal produced in Canada" appears in the course of the article. It is credited with 38.48 per cent. ash, and the text explains that this coke comes from Sydney, Cape Breton, where it is used with entire success. Of course, this is utterly incorrect. There is no Nova Scotian coke that contains anything approximateing the absurd figures given in the matter of ash. Such a fuel, indeed, would be a commercial impossibility. The Sydney coke, on the other hand, rarely exceeds 10 per cent. in ash content, and is usually below that figure. We have mentioned this at some length, because a totally wrong impression is unintentionally given by the writer of the article referred to.

SPECIAL CORRESPONDENCE

Nova Scotia.

In common with the rest of the Dominion, Cape Breton has experienced a very backward spring, and the month of May was remarkable for the exceptional ice conditions that have prevailed in the Gulf of St. Lawrence, the Cabot Straits, and along the shores of Cape Breton. The drift ice is stated to have been heavier than at any time during the past thirty years, and both Louisburg and Sydney have been blocked for days together; in fact, Sydney Harbor was full of ice on the 3rd of June. In consequence, the shipments of the Dominion Coal Company have been much restricted, being almost 70,000 tons behind the corresponding month of 1906. The mines, however, did not lose any time from this cause. The output and shipments for May this year are approximately as follows, the corresponding figures for 1906 being also given.

Output and shipments for the month of May (approximate):—

Output.	1907. Tons.	1906. Tons.
No. 1	47,314	49,778
No. 2	57,592	52,186
No. 3	34,380	33,291
No. 4	41,538	50,761
No. 5	70,031	55,686
No. 6	18,362	7,859
No. 7	.....	15,024
No. 8	22,090	22,761
No. 9	34,964	36,431
	326,271	323,777

Shipments, 1907, 284,330 tons; 1906, 357,509 tons.

Glace Bay.

The Emery Seam, containing 4 feet 2 inches of good clear coal, underlaid by 5 inches of fire-clay, has been proved by a Calyx drill hole put down by the Dominion Coal Company on their property near No. 6 Mine at Big Glace Bay. The seam was met with at a depth from the surface of 222 feet. A previous borehole in this neighborhood was sunk in the near vicinity of a small dislocation, and did not show the exact thickness of the seam, as proved at other points. The present section shows the continuity of the measures under Big Glace Bay Pond, and there can be no doubt that the Emery Seam will prove a good second to the Phalen Seam at all of the Coal Company's mines. In all probability it will become entirely a longwall seam, and has a future before it.

Quebec.

An engineer who has just returned from a visit to the Eastern Townships, speaks in very glowing terms not only of the gratifying results attending the operation of the established mines, of which the general public hears litttle or nothing, but of the great potentialities of the section as a copper-producing area. Last year no less a sum than, in round figures, a million and a half dollars, was distributed in dividends, this representing the profits of five properties only. Of these mines, two are producing copper, the ore averaging perhaps $30 a ton for all values. The Nichols Chemical Company utilize their ores primarily for the manufacture of sulphuric acid, of which a large and increasing production is made; while another concern, the Eustis Company, is earning very handsome returns on the shipment of copper ore, carrying also fair gold and silver values. There is probably no district in Canada where, having regard to the capital originally invested, so good a showing has been made as in the Eastern Townships.

A press despatch announces the sale of the Eagle Mining Company's Golconda Mine, situated at Ascot, near Little Magog Lake, to a New York syndicate, for $60,000.

The Shawinigan Water & Power Company's transmission line from Shawinigan to Thetford, a distance of 97 miles, has been completed, and was recently carried to Black Lake, six miles distant from Thetford. It is now proposed to extend the line to Chrysotile. The first mine in the district to use electric power

was the American Asbestos Company at Black Lake, at whose property a plant was installed towards the close of 1904, and power supplied by the St. Francis Electric Power Company. Both the Bell Company and Messrs. King Bros.' mills are operated by electricity, and the Beaver Asbestos Company's property is now being equipped with an electric plant. It is anticipated that a majority of the asbestos and chrome iron mines of the district will utilize electricity for power requirements in the near future.

A small experimental plant has been installed by Mr. Kerr, of Boston, at one of the properties owned by the Black Lake Chrome & Asbestos Company, near Coleraine Sttation. A larger plant, it is expected, will be provided later, development having satisfactorily demonstrated the potentialities of the area.

At the mine and mill near Chrysotile some thirty men are employed under the direction of Mr. John Penhale. This property has meanwhile been acquired by Providence, R.I., manufacturers.

The foundations for the large 300 ton mill, in course of erection at the property of the Dominion Asbestos Company at Black Lake, are now in place, and it is expected that the mill itself will be completed in readiness for operation before October next.

The Dominion Asbestos Company has acquired from the Standard Asbestos Company some two hundred and seventy-five acres of valuable asbestos-bearing territory.

At the Standard Asbestos Company's property eighty men are employed in and about the mine and mill; and recently a new cyclone pulverizer and ore dryer was installed to provide for an increased production of mill fibre.

Production of crude asbestos is being made from the Manhattan and the Montreal and Glasgow Mines, which have been purchased by the American Asbestos Company. The milling material is being treated in the large mill erected by the company some years ago. Meanwhile the Montreal and Glasgow Company's old mill is being dismantled. This mill is of historic interest, as it was the first to be built in the district for the mechanical separation of asbestos.

All the big mines at Thetford, the Johnson, Bell, King's and Beaver, are being worked to full capacity; and some new, rich ground has been unexpectedly opened up at the Bell asbestos mine, while driving the incline tunnel to connect the mill with the big quarry.

Considerable activity is expected to be shown in the near future in the East Broughton district, where recently a number of promising properties have been acquired by companies. Among others, the property adjoining that owned by the Quebec Asbestos Company on the east, has been purchased by the Frontenac Asbestos Company, who purpose shortly erecting a mill thereon.

New rich territory is reported to have been opened up on the Quebec Asbestos Company's mine, while the asbestos fibre now being produced is of excellent quality.

The additions and improvements to the Broughton Asbestos Company's milling plant are now about completed, and when operations commence production should be at least twice as great as formerly.

The asbestos area between the Quebec Asbestos and the Broughton Asbestos Company's mines has been acquired by a Mr. P. Augers and associates, who are erecting a mill designed to treat 250 tons of rock per day. The machinery is to be in readiness for the commencement of operations by September next.

Cobalt.

Professor Mickle is in town, and, with the inspectors, is arranging the summer work. It is the purpose to confine their attention at the present to the Montreal River district. A recorder's office has been opened in Latchford, with Professor A. McPhail, of the School of Mines, Kingston, in charge. An assay office will be opened in connection, for the convenience of the mining inspectors.

The firm of Evans & Laidlaw, mining engineers and assayers, Cobalt, have opened offices at Latchford and Larder Lake.

Since the snow has gone and trenching in earnest has begun, almost every day new finds are reported. Last week one of the largest veins in the camp was uncovered on the Nipissing, from which a nugget weighing over seven hundred pounds was taken.

The same vein has also been traced into the McKinley-Darragh property.

The Buffalo has uncovered some more high grade veins.

Work is progressing rapidly on the Peterson Lake property. It is the intention of this company to lower the lake some fifteen feet, and, as it is very shallow, a great deal of rock will thus become exposed. Already a number of veins have been uncovered on the shore allowance.

Professor Miller is in town, accompanied by Mr. Cyril Knight, geologist. They intend to devote their attention to geology of the Montreal River district, while Professor Brock, of Queen's University, will work out the rock formation in the Larder Lake region.

BRITISH COLUMBIA.

Atlin.

Atlin miners are much incensed at J. M. Ruffner, manager of the Pine Creek Power Company and the North Columbia Gold Mining Company, two district compaines jointly operated, for bringing in Japanese. Mr. Ruffner insists that he could not obtain sufficient white labor, so had to employ Japanese. Several meetings have been held, with the result that it has been determined to form a Miners' Protective Association, with the following objects: To oppose the invasion of the camp by Japanese; to induce white men to decline to work for any company employing Japanese, and to help those caused hardship thereby; and to so influence all dealers and merchants as to prevent them from catering for the trade of any company so long as it shall employ Japanese.

The suits of the Pine Creek Flume Company against the Pine Creek Power Company, and North Columbia Gold Mining Company, respectively, relative to the right to enter upon and work claims of an area of 36 acres, are now before the British columbia courts.

Information has been received from Paris to the effect that the Otter Hydraulic Gold Mines Company had been formed in that city for the purpose of hydraulic mining on Otter Creek. It is stated locally that the ground to be worked covers five miles, and is situated in the neighborhood of Otter Creek and Surprise Lake.

East Kootenay.

Work has been resumed at the Crow's Nest Pass collieries. The number of miners is not yet nearly sufficient for the increasing demands for coal, but efforts are being made to secure more for both collieries of the Crow's Nest Pass Company, viz., at Coal Creek and Michel. Coke is again being shipped to Kootenay and Boundary smelters, which will soon be in receipt of plenty to keep them going at full capacity.

A new mine is being opened up between Coal Creek and Fernie by the Crow's Nest Pass Coal Company, which is also giving attention to the cannel coal also occurring near Coal Creek.

At both lead-silver mines—the St. Eugene and Sullivan—operations are being continued with vigor, and a large output of ore is being maintained. At the St. Eugene particularly there is much activity, with increasingly large bodies of ore being developed to induce the Consolidated Mining & Smelting Company, owning this big lead-silver mine, to enlarge its production.

ROSSLAND.

After lengthy negotiations looking to that end, an amalgamation of the Giant and California interests has been effected, and the recently incorporated Giant-California Mining Company has commenced operations under the direction of Mr. W. Yolen Williams, who, prior to devoting all his time and energies to the opening up of the Granby Company's big mines at Phoenix, Boundary district, had the supervision of the work done on the California mine, which is situated west of mines of the Le Roi and Le Roi No. 2 Companies, which, during the last year or two, have been so successfully operated in Rossland camp. When the Giant was being worked several years ago, some 4,300 tons of ore were shipped from it, so that the value of its ore in bulk is known. The ore showings in both mines are good, so it is believed the new enterprise will be successful, especially under the conditions that it has ore bodies believed from experience to be payable, and the equally important essential of competent and careful management.

The installation of the big hoist has been completed at the Centre Star mine, and the group of which this mine is the centre is at last furnished with ample hoisting facilities. The hoist is a Nordberg 1,150 horse-power engine, having cylinders 28 x 60, drums 10 feet diameter x 5 foot face, and capacity 1,350 tons in ten hours from a depth of 3,000 feet, using 4 1-2 ton skips in balance. Ordinary speed when hoisting is 2,500 feet per minute. Brakes, reversing gear and clutches are operated by auxiliary engines. Corliss valve is controlled by a governor. Hoisting cable is of 1 1-4 inch steel. The engine is set on massive cement-concrete foundations, and is housed in a frame building 53 x 56 feet, erected for its protection.

BOUNDARY.

The output of ore from Boundary district mines during the month of April totalled 117,907 tons, in the following proportions:—

	Tons.
Granby Company's mines	70,518
British Columbia Copper Company's mines	22,890
Dominion Copper Company's mines	13,289
Snowshoe mine	11,030
Small high grade mines	180
Total	117,907

The average tonnage for four months of 1907 to April 30th, inclusive, is as under:—

Month.	Tons.
January	60,003
February	53,965
March	100,219
April	117,907
Total	332,094

The West Kootenay Power & Light Company, with head office in Rossland, has purchased the hydro-electric plant and other assets of the Cascade Water Power & Light Company. The former company has for years been engaged in generating electric power at Lower Bonnington Falls, on the Kootenay River, eleven miles below Nelson, and has supplied power and light to the Towns of Nelson and Rossland, and to mines and smelters in the Nelson and Trail Creek districts. The Cascade Company has made developing power for four or five years at Cascade, on Kettle River, and has supplied power and light to several Boundary district towns, mines and the Granby smelter at Grand Forks. Last year the West Kootenay Company commenced to carry out contracts it had succeeded in making in the Boundary with some of the larger users of electric power, viz., the smelters, but failed to obtain legislative sanction to its action in entering territory the exclusive right to operate in which had been granted to the Cascade Company. As the West Kootenay Company, now that its new generating station at Upper Bonnington Falls is completed, is in a position to supply much more power than is at present required, while the Cascade Company at times had difficulty in meeting district requirements, the purchase lately concluded appears to have been in the best interests of both the companies concerned and the district at large.

COAST.

Dr. Porter, Professor of Mining, and Dr. Stansfield, Professor of Metallurgy at McGill University, accompanied by some of the students of the McGill Summer Mining School, which had just completed a field course in the Kootenay and Boundary districts, arrived in Victoria on May 24th on a few days' visit to the capital. Dr. Stansfield took advantage of the opportunity to go up to Ladysmith and look over the Tyee Copper Company's copper smelter there. He was shown around by the superintendent, Mr. W. J. Watson, a former McGill student.

Mr. R. R. Hedley has been in Victoria conferring with the Provincial Mineralogist, Mr. W. F. Robertson, as to the most effective method of gathering information concerning the mining and smelting industries of the West, in furtherance of the plan of the Dominion Department of Mines to obtain for publication reliable data relative to mines, mills, smelters etc. It is stated that Mr. Hedley is to collect the required information in British Columbia, Alberta, Saskatchewan and Manitoba. This work is an undertaking involving a considerable amount of time and trouble, as will be realized more fully before much progress with it shall have been made. Its great practical usefulness is, though, ample warrant for its having been authorized.

GENERAL MINING NEWS

NOVA SCOTIA.

During the investigation of the miners' trouble at Springhill, N.S., a question arose as to the application of the Lemieux Act, to a subsidiary branch of the mine operations in which only six men are employed, and the Minister was asked for an interpretation of the law as applicable to the case. The Hon. Mr. Lemiux replied as follows: "My understanding of the intention of section 21, of Industrial Disputes Investigation Act, is of the numbers of employes directly or indirectly affected by a dispute is ten or more, the dispute may be referred to a board, though the persons to whom it may directly relate are fewer in number than ten. If the failure to effect a settlement in regard to a matter affecting directly only six men is likely to result in ten or more being either immediately or subsequently affected, the reference of such a dispute would, in my opinion, come very properly within the provision of the Act."

It is reported that negotiations are in progress for the sale of the Nova Scotia's Stteel & Coal Company's general stores and dwelling houses at Sydney Mines to a local syndicate. The value of the property is roughly estimated at half a million dollars.

Iron ore mining at Torbrook, Annapolis County, is very active. Mr. F. Burrows, the local manager, is beginning to sink the new shaft on the Martin Farm, and is conducting railway construction work.

Coal shipments from Cape Breton collieries to Montreal are already 100,000 tons short of what they were this time last year. This amount can hardly be made up before winter sets in again.

The Dominion Iron & Steel Company created a new record in the matter of blast furnace output for the month of May. The month's total output of pig iron from the three stacks now in blast totalled 28,128 tons, as against the previous record of 23,003 tons.

The first exportation of copper matte in the history of the Maritime Provinces was made on May 20th from the Pictou smelter. Twenty-five thousand and sixty-three pounds were shipped tto New York.

Sydney Mines, May 30th.—On account of the extraordinary ice conditions prevailing in North Sydney Harbor, the collieries of the Nova Scotia Steel & Coal Company are temporarily closed. This put 2,500 men out of work. About 100,000 tons of coal are banked ready for shipment.

The Maritime Coal, Railway & Power Company have acquired the property of the Canada Coal & Railway Company in Cumberland County.

Sphinghill.—On May 30th the Conciliation Board met in Truro. Mr. Archibald represented the Cumberland Coal & Railway Company. Mr. Justice Graham was chairman. Two questions were up for settlement. On one of these the board agreed, deciding in favor of the men. No agreement could be reached on the second point by the three arbitrators. The session was therefore postponed until June 27th. The point gained by the men had to do with the pay of workers at counter level crossings on No. 14 chute. The rate of pay was raised from $1.23 per day to $2.44. The second point hinges upon the men's claim of 4 cents for areas of an inch by a yard. The chairman held that in 1894 an agreement was made for 2 cents a box, and that this is still binding. Each of the three members of the board holds a different view.

Ontario.

Operations on Loon Lake Iron Mines are soon to be commenced.

At the O'Brien Mine, Cobalt, two men were killed by an explosion of dynamite on June 3rd.

The Algoma Steel Company announces that it will commence at once the erection of a large blast furnace. The furnace is to cost $1,000,000, and will be the largest in Canada. Coke ovens will also be erected. The building of a new furnace has become essential because of the high price of American pig iron.

The Mining Recorder's Office for the Montreal River Division was opened on May 30th. Mr. Alex. McPhail is in charge.

An air compressor is being installed at the Government workings on the Gilies Limit.

In a south cross-cut, at a point 250 feet southwest from the original 49 strike, a new vein, rich in silver, has been discovered on the Nipissing.

The Evans Mine is making a shipment of cobalt ore to Wales. A French syndicate controls a reduction plant there.

On Monday, May 26th, a prospector named Peter Leclair was killed by the T. & N. O. yard engine at Cobalt.

The Rat Portage Diamond Drill Company have commenced drilling on the Hamilton property at Stobie Falls.

The Clover Leaf Copper Mine, near Grassy Lake, in the Larder Lake District, is owned by a Pennsylvania syndicate. It has produced about 150 tons of fair ore. The ore has never been shipped. Adjoining this property a Toronto syndicate has purchased a number of claims and will operate them this summer.

The Gamey property of 40 acres, near the Coniagas Mine, has been purchased by the Cobalt Central Mining Company.

Alberta.

A Commission has been appointed to investigate the car shortage and to inquire into the conditions existing among the coal miners of the Province. The Commission consists of the Hon. A. L. Sifton, Chief Justice of the Supreme Court, chairman; Mr. Louis Stockett, manager of the Bankhead coal mines, and Mr. Hansom, a working miner, belonging to Coleman. Sittings will be held in all the leading coal mining centres of the Province.

The coal mine operators of Bankhead have advanced the price of coal at the mines by 15 per cent. This is rendered necessary, they claim, by the advanced rates of miners' pay.

Mr. Chas. P. Hill, manager of the Hillcrest Coal Mine at Hillcrest, Alberta, refused to sign an agreement taking back into his employ the striking miners. Mr. Hill claims that the new wage schedule leaves him absolutely no room for profit.

In Edmonton rumors are still flying around concerning the discovery of gold in the Yellowhead Pass of the Rocky Mountains.

The miners employed by the Alberta Railway & Coal Company have made application to the Federal authorities for the appointment of a board of investigation and conciliation to enquire into alleged grievances, which are stated to be the general condition of employment, wages and hours of work. The Minister of Labor has consented to appoint a board, and the company has been notified to name its representatives.

British Columbia.

On the Rose Gulch Hydraulic Company's property, adjoining the Cariboo Consolidated, in Cariboo District, newly discovered ground breasts out fully six feet of pay dirt, with a width of 75 feet. One monitor only is at work on the new property.

The Rambler-Cariboo Mine will begin shipping ore in the first week of June. Ore has not yet been struck on the 1,400 foot level.

The Bowen Island Copper Company has sunk a prospecting shaft, 60 feet, in what appears to be a strong, true fissure vein, containing a good grade of chalcopyrite. A drift has been run 50 feet on the lead. A working shaft will now be sunk. This property is within twenty miles of the City of Vancouver.

The British Columbia Copper Company, Greenwood, was able to tide over the coke shortage of last month. Superintendent McIntosh has now about 200 men employed at the Mother Lode, in Deadwood Camp. The new crusher for this company's mine at Oro Denoro is being installed.

The Tip Top Mine, east of Greenwood, has been purchased at a cash price, reported to be about $10,000.

Dr. J. Bonsall Porter, with a large party of McGill mining students, has visited the principal mining camps of British Columbia. Many of the students will remain here for the summer. They have secured temporary positions.

The Sullivan Group Mining Company, Kimberly B.C., with mines at Kimberly and a 125 ton smelter at Marysville, seven miles distant from the mine, owns and operates the Heberlin process for roasting ore before smelting. The smelter capacity is soon to be increased to 150 tons daily. During April the smelter turned out 521 tons of bullion, worth $50,000.

A new ten drill air compressor has been started at the Ymir Mine.

The demand for coal continues to be far in excess of the supply at the Vancouver Island and Puget Sonud coal mines.

Boundary District miners, smelter men and laborers have been given substantial raises in pay. All underground men get a fifty cent raise. Surface men will get 10 per cent. increase on present pay. Smelter day laborers will receive $3 per day of nine hours. In other departments an increase of from 25 to 50 cents is granted.

Suit has been brought against F. Augustus Heinze by the Canadian Pacific Railway. Mr. Heinze owns 600,000 acres of timber lands and coal fields in British Columbia. The C. P. R. is trying to compel Mr. Heinze to take title of his land in order that the railroad may then proceed with the development of other properties after Mr. Heinze has definitely designated the exact boundaries of his own.

The Golden Eagle Mine is reported to have been sold to a Vancouver syndicate for $60,000. The Golden Eagle is in the North Fork district and was originally owned by Christopher Tobiason. Five years ago an English syndicate took a bond of the property for $75,000, but the bond lapsed.

Mr. D. R. Irving left Victoria on May 18th to take charge of the operations of the Berry Creek Hydraulic Mining Company.

The extensive iron ore deposits of Texada Island are to be reopened. Mr. James A. Moore, of Seattle, is behind the movement. The ore is to be shipped from Gillies' Bay, where a deep-water wharf is being built, to the Irondale smelter on Puget Sound.

On May 22nd a large seam of coal was discovered near Wellington. The seam is seven feet deep.

Hydraulicking was commenced near Barkerville, Cariboo, on May 4th.

At No. 4 Mine, one of the largest of the Wellington Colliery Company's mines at Union, B.C., a serious fire broke out on June 1st. The mine, which employs about 700 miners, will have to be flooded. The mine is approached by a slope.

YUKON.

Mr. A. J. Beaudette, Territorial Engineer for the Yukon, in a report gives the following particulars and costs of thawing ground for dredging operations on Bonanza Creek:—Wood used per 24 hours, 5 1-2 cords; cost of wood per cord, $13.50; labor, 2 shifts, 3 men per shift, $40; cubic yards thawed per 24 hours, 400; cost per cubic yard for thawing, 28.5 cents. Notwithstanding this substantial addition to dredging costs in the Yukon, due to the frozen condition of the gravel throughout the season, dredging operations in the Territory have so far yielded fair returns.

Catalogues and Other Publications Received

The Allis-Chalmers-Bullock's Bulletin No. 201 deals with "Lidgerwood Hoisting Engines for Mining Purposes."

The catalogue of R. H. Buchanan & Company, 234 Craig street west, Montreal, has been received. This firm makes a specialty of pumps and pumping machinery. They handle the Pulsometer steam pumps and the Rider-Ericsson hot air pumping engines.

An attractive catalogue, received from the Cleveland Car Company, West Park, Ohio, presents much information and many illustrations pertaining to industrial and narrow gauge railway equipment. Many designs in trunnion, two-way, bottom, end, one-side, either-side, rotary and other varieties of dump cars are manufactured by this firm.

Bulletins 741, 756, 703, 103, 106, 712, have been received from the Jenckes Machine Company, Limited, Sherbrooke, Que. In these the Jenckes Company's hoisting engines, standard iron cars, "special cableway" engines, vertical tubular boilers, locomotive type boilers and "special" hoisting engines are illustrated and described. Their hoisting engines are of especial interest.

Surveying and Other Instruments of Precision (semi-centennial edition, 1857-1907), issued by Hearn & Harrison, opticians, 10-12 Notre Dame street east, Montreal. This catalogue illustrates and describes the microscopes, telescopes, hydrometers, thermometers, hygrometers, surveying, meteorological and nautical instruments, drawing instruments and accessories manufactured and imported by this celebrated firm.

Catalogue G, from the Blaisdell Company, engineers and manufacturers, 334 Pacific Electric Building, Los Angeles, California; New York office, 2600 Park Row Building, describes the Blaisdell Pressure Filter. This filter is devised for dewatering mill pulp and separating cyanide solution and wash water from the slime. It consists of three parts; a series of filter leaves; a pressure cylinder, and pumps for vacuum, slime, water and solution, with pipes and valves. The process is continuous. One operator on each shift can control one or more filters and handle a large tonnage. Skilled labor is unnecessary, owing to the simplicity of the installation. The filter is adapated to any variety of slime. The various sizes range in capacity from 12 tons of dry slime per day to 500 tons per day. The manufacturers invite prospective purhcasers to send 50 pound sample of dry slimes for testing at their plant, with a view to ascertaining their requirements.

From the Power & Mining Machinery Company, Cudahy, Wisconsin, have been received a number of catalogues and pamphlets. In their catalogue No. 5 there is presented a description of gold and silver milling machinery. A very useful set of general specifications for a ten-stamp gold mill is given on pages 73-75. Catalogue No. 6 deals with "Roasting, Smelting and Refining." The first part of the catalogue takes up the "Preparation of Ores for the Smelter." Then follow descriptions of the standard machinery, furnaces and complete equipment used in roasting, smelting and refining for the recovery of precious metals. Gas power plants are also handled by this firm. In the same catalogue the American-Crossby Suction Producer Plant is described. It is recommended for requirements up to 500 horse-power, where charcoal, coke or anthracite pea coal may be purchased at reasonable figures. For powers of 500 horse-power and greater, the Loomis-Pettibone Gas Generating System in connection with gas engines is recommended.

PERSONAL AND GENERAL

Mr. N. Timmins, of Cobalt, was in Sudbury during the latter part of May.

Mr. B. F. Pearson, of Halifax, N.S., one of the chief promoters of the North Atlantic Collieries Company, spent a few days in Toronto recently.

Mr. W. Stanley Lecky, head of Messrs. Mussens, Limited, mining machinery department, has returned to Montreal after an absence of some weeks in England.

Mr. W. Yolen Williams, formerly mine manager for the Granby Company at Phoenix, has been appointed superintendent of the Giant-California Company, Rossland, B.C.

Mr. J. A. Dresser has been retained by the Director of the Geological Survey to do special geological work for the Department this season in the Eastern Townships.

Mr. A. P. Low, Director of the Geological Survey of Canada, has been appointed Deputy Minister of Mines. Mr. Low will retain the former post in addition to his new duties.

Mr. A. A. Hassan, mining geologist and consulting engineer, is making the King Edward Hotel, Toronto, his temporary headquarters while engaged in examining various districts around and near Cobalt.

The imports of nickel in ore and matte to the United States in 1906 were 15,156 tons, containing approximately 18,500,000 pounds of metallic nickel, valued at $1,816,631. These figures show a material increase over the returns for 1905.

Mr. Erik Nystrom, of the staff of the Mines Branch, has received instructions to investigate the peat industries of Holland, Norway, Sweden, Denmark, Finland and Germany, and prepare a full report on the subject for the Department. He sails for Europe immediately.

The forty-sixth general meeting of the Institution of Mining Engineers will be held in London on June 13th and 14th. We note that Mr. J. B. Tyrrell's paper on "Development of Placer Gold Mining in the Klondike District, Canada," will be open for discussion.

Dr. J. Bonsall Porter returned to Montreal on the 2nd inst. after an absence of some weeks in the West in charge of the annual McGill summer mining excursion. The excursion was an exceptionally successful one, visits being paid to Cobalt, Lethbridge, Frank, and the several mining districts of British Columbia.

Mr. A. A. Hayward, at one time manager of the famous Golden Lode Mine in Nova Scotia, and a past president of the Nova Scotia Mining Society, paid a visit to Toronto early in June. Mr. Hayward is a mine manager with an excellent record behind him. It is probable that he will make Toronto his permanent residence.

One of the recipients of the Carnegie Research Scholarships awarded recently by the Council of the Iron & Steel Institute, is Mr. C. A. Edwards, a Canadian by birth, who, however, gained his experience of foundry practice at Horwich, England, at the works of the Lancashire & Yorkshire Railway. Mr. Edwards is joint author of the Eighth Report to the Alloys Research Committee, and was recently appointed Research Fellow and Demonstrator in the Metallurgical Department of the University of Manchester, under Professor Carpenter.

STATISTICS AND RETURNS

Cobalt ore shipments for the week ending June 1st, 1907:—

	Pounds.
May 27th—O'Brien Mine, to Perth Amboy, N.J.	65,200
May 27th—Coniagas Mine to Perth Amboy, N.J.	54,300
May 28th—Coniagas Mine to Perth Amboy, N.J.	63,000
May 30th—Coniagas Mine to Perth Amboy, N.J.	62,000
May 27th—Nipissing Mine to New York	65,480
May 28th—Nipissing Mine to New York	64,790
May 30th—Nipissing Mine to New York	55,400
May 30th—Temiskaming and Hudson Bay Mine to Copper Cliff, Ont.	55,500
May 31st—Trethewey Mine to Perth Amboy, N.J.	63,200
	545,870

ROSSLAND ORE SHIPMENTS.

Shipments for the week ending June 1st: Centre Star, 1,960 tons; Le Roi, 2 910 tons; Le Roi No. 2, 2,455 tons; White Bear, 70 tons, milled, 350 tons. Total for the week, 5,745 tons, and for the year to date, 105,414 tons.

CROW'S NEST PASS OUTPUT.

The output of the collieries of the Crow's Nest Pass Coal Company for the week ended May 31st was 21,504 tons, a daily average of 3,584 tons. For the corresponding week of last year the output was 20,835 tons, a daily average of 3,573 tons.

DOMINION STEEL.

It is reported that the output of the Dominion Iron & Steel Company at Sydney this season will be at the rate of 30,000 tons pig iron per month, as compared with 20,000 per month last year.

Shipments from the Springhill collieries of the Cumberland Railway & Coal Company for May amounted to 36,559 tons.

Shipments for week ending May 18th:—Centre Star, 2,185; Le Roi, 3,455; Le Roi Two, 315; White Bear, 95; White Bear (milled), 350. Total for week, 6,380, and for the year to date, 94,912. Trail smelter received 2,723 tons during the week, and Northport smelter, 3,455 tons.

Nelson, May 18.—The following are the ore shipments and smelter receipts in Southeastern British Columbia districts for the past week and year to date in tons:—

Shipments: East of Columbia River, week 2,509, year 44,785; Rossland, week 6,814, year 97,323; Boundary, week 3,620, year 370,392; total, week 12,943, year 512,500.

Smelter receipts: Grand Forks, week nil, year 207,822; Greenwood, week 3,500, year 96,777; Boundary Falls, week nil, year 94,147; Nelson, week 387, year 7,092; Trail, week 3,723, year 85,185; Northport, week 3,207, year 32,185; Marysville, week 600, year 12,000. Total, week 11,567, year 4z5,546.

BOUNDARY ORE OUTPUT.

Phoenix, May 23.—A compilation of figures regarding the ore output of the mines of the Boundary for the month was the best for more than half a year in the district, although May is falling down badly, on account of the coke shortage. Shipments from several mines of the Boundary that have been sending out ore are figured as follows, in tons:—

Granby mines		70,518
British Columbia Copper Company—		
Mother Lode	21,040	
Emma	1,470	
British Columbia Mine	40	
Morrison	340	
		22,890
Dominion Copper Company—		
Brooklyn	4,469	
Rawhide	5,024	
Sunset	2,626	
Mountain Rose	357	
Idaho	813	
		13,289
Snowshoe		11,030
Providence		110
Elkhorn		30
Strathmore		20
Duncan		20
April total		117,907

The Granby's record for April exceeded that for any month since last fall, and the British Columbia Copper Company's record is the highest in the history of the company. That of the Snowshoe, also, is a large one for that mine. As the British Columbia Copper Company is the only smelter having coke this month, the other two have been idle, and the May story will be a very small one.

The Boundary output by months, in tons, has been as follows:—

January	60,003
February	53,965
March	100,219
April	117,907
Total	332,094

WEEK'S ORE SHIPMENTS.

Week ending June 1st.

Boundary shipments—

Mine.	Week.	Year.
Granby	1,431	207,932
Mother Lode	4,520	84,217
Brooklyn	1,376	25,115
Idaho	300	1,196
Rawhide	1,275	26,756
Mountain Rose	105	1,942
Elkhorn	25	47
Other mines	.....	44,590
Total	9,032	385,795

Rossland shipments—

Mine.	Week.	Year.
Centre Star	1,608	36,142
Le Roi	1,608	54,808
Le Roi No. 2	517	9,397
White Bear	102	1,094
Other mines	.....	5,570

Kootenay-Slocan shipments—

Mine.	Week.	Year.
Sullivan	600	13,200
La Plata, milled	425	9,350
Queen, milled	185	4,070
Eva, milled	230	920
Whitewater, milled	300	750
Queen Victoria	2z7	1,858
Silver King	142	910
St. Eugene	445	6,280
La Plata	48	1,422
North Star	41	484
Silver Cup	32	407
Vancouver	42	324
Hunter V.	56	2,079
Other mines	.....	8,469
Total	2,868	50,623

The total shipments from the mines in the above districts for the past week were 16,128 tons, and, for the year to date, 643,329 tons.

Week ending May 25th:—

Boundary shipments—

Mine.	Week.	Year.
Mother Lode	6,350	79,691
Solly	22	64
Other mines	.....	297,763
Total	6,372	376,763

Rossland shipments—

Mine.	Week.	Year.
Centre Star	1,447	34,534
Le Roi	3,012	52,807
Le Roi No. 2	535	8,880
White Bear, milled	350	2,200
White Bear	116	992
Other mines	.....	3,370
Total	5,460	102,783

Kootenay-Slocan shipments—

Mine.	Week.	Year.
Sullivan	600	12,600
La Plata, milled	425	8,925
Queen, milled	185	690
Whitewater, milled	300	450
Hunter V.	79	2,023
Queen Victoria	126	1,561
St. Eugene	512	5,835
La Plata	54	1,374
Vancouver	41	282
Silver Cup	41	375
Payne	18	18
Whitewater Deep	64	259
North Star	164	343
Last Chance	31	325
Other mines	.....	7,710
Total	2,870	47,655

The total shipments for the mines in the above districts for the past week were 14,702 tons, and for the year to date 527,201 tons.

RAND GOLD OUTPUT.

The output of gold from the Transvaal mines in May, as estimated by Kaffir houses in London, was 500,000 ounces fine. This represents a decrease of 37,000 ounces from the April out-turn, but interference and forecast are difficult, owing to the strike in the Rand.

The value of the May output, roughly, is $10,625,000, as compared with $11,405,550 in April, $11,684,860 in December, the record month, and $9,795,310 in May a year ago. If this estimate proves correct, last month's output will have been the lightest of any month since last July, when 491,793 ounces were turned out. Prior to the Boer war, the high record of Transvaal production was $8,604,000 in August, 1899.

COMPANY NOTES

Tyee Copper (B.C.).—The report for April state: Smelter ran 13 days and smelted—Tyee ore, 880 tons; Customs ore, 2,121 tons; total, 3,001 tons. Matte produced from same, 269 tons. Gross value of contents (copper, silver and gold), after deducting costs of refining and purchase of Customs ore, $7,658.

Nearly the whole of the second vein allotment of British Columbia Copper Company stock was taken up by stockholders in the ratio of 30 per cent. of holdings. In January the management increased the company's capital from $2,000,000 to $3,000,000 by an issue of 200,000 shares, par value $5 each. At the present time there are 96,640 shares of unissued stock.

Le Roi No. 2 (B.C.).—In a recent report to the London office the manager states that he is confident that he has discovered the H vein on the 900 foot level. As yet the values are not as high as they were at the 700 foot level, where they averaged 2.75 ounces gold, but the new discovery is regarded as most promising. In view of this report the shares have advanced 3-16 on the London Market.

A gigantic gain in profits for 1906, dsepite a material falling off in production of metal, was shown yesterday by the Anaconda Copper Mining Company, in its annual report. The total production was z4,963,835 pounds, or 479,895 pounds less than in 1905. The company's gross profits from its sales of copper, silver and gold, however, aggregated $20,955,532, or $3,526,434 more than sales during the previous year. Its total receipts amounted to $26,968,870, or $3,234667 more than in 1906, while its total disbursements involved $18,384,870, $238,220 more, leaving a total net income of $8,842,669, or $3,123,841 more than the net earnings for the previous year. This net income represented 29.47 per cent. earned on the company's $30,000,000 of capital stock. Divident disbursements at the rate of 28 per cent. involved $6,000,000, or $3,450,000 more than in 1905, leaving a surplus for the year of $1,942,669, or $326,159 less than at the close of the previous year. The company's profit and loss surplus, which amounted to $9,183,241, was equivalent to 30.61 per cent. on the outstanding stock.

NEW COMPANIES

The Vancouver Coal & Prospecting Company, Limited, capital twenty thousand dollars, divided into twenty thousand shares of one dollar each; Victoria, B.C.

The Combined Goldfields, Limited, the share capital to be three million dollars, divided into three million shares of one dollar each. Head office, Toronto, Ont.

The Eastern & Cobalt Mining Company, Limited, share capital to be one million dollars, divided into one million shares of one dollar each. Head office, Cobalt, Ont.

The East Bay Larder Lake Gold Mines, Limited, share capital to be one million dollars, divided into one million shares of one dollar eeach. Head office, Toronto, Ont.

The Empire Larder Lake Gold Mines, Limited, share capital to be one million dollars, divided into one million shares of one dollar each. Head office, Toronto, Ont.

The Rush Larder Lake Mining Company, Limited, share capital to be one million dollars, divided into one million shares of one dollar each. Head office, Toronto, Ont.

The Ontario Copper Company, Limited, share capital to be three million dollars, divided into six hundred thousand shares of five dollars each. Head office, Toronto Ont.

The Martin Larder Gold Mines, Limited, the share capital of the company to be one million dollars, divided into one million shares of one dollar each. Head office, Toronto, Ont.

The Anglo-Canadian Petroleum Company, Limited, incorporated under the laws of the Imperial Parliament of Great Britain and Ireland. Capital to be used in Ontario not to exceed $250,000.

The Maple Leaf Mines, Limited, non-personal liability, capital two hundred and fifty thousand dollars, divided into two hundred and fifty thousand shares of one dollar each; Victoria, B.C.

The James Township Silver Mines, Limited, share capital to be one mililon five hundred thousand dollars, divided into one million five hundred thousand shares of one doller each. Head office, Toronto, Ont.

The Ontario Exploration Company, Limited, share capital one million dollars, to be divided into one million shares of one dollar each, of which fifty thousand shares are to be preference shares. Head office, Bracebridge, Ont.

The Portland Canal Mining & Development Company, Limited, capital one hundred thousand dollars, divided into three hundred and twenty-five thousand shares of twenty-five cents each, and fifty thousand shares of twelve and one-half cents each; Victoria, B.C.

The Lake Superior Iron & Steel Company, Limited, the share capital of the company to be one million dollars, divided into ten thousand shares of one hundred dollars each. Head office, Sault Ste. Marie, in the District of Algoma, Ont. One of the objects of this incorporation is to manufacture and deal in iron, steel, nickel, and any other ore products of the mine and products thereof. Another is to manufacture charcoal and by-products, coke and by-products, and to deal in wood and the products thereof.

The following extra-provincial companies have been registered in British Columbia:—

The Bella Coola Copper Company, Limited, capital two million dollars, in shares of one dollar each, head office Spokane.

The Jewel Syndicate, Limited, capital twenty-five thousand pounds, in shares of one pound each, head office in Scotland.

The Falls Copper Mining Company, Limited, capital one million five hundred thousand dollars, in shares of one dollar each, head office Spokane.

The Alberta Fuel Company, Limited, capital one hundred thousand dollars, in shares of one dollar each, head office Spokane, State of Washington.

The Copper Mountain Mining Company (specially limited), capital five hundred thousand dollars, in shares of one dollar each; head office, Phoenix, Arizona.

METAL, ORE AND MINERAL MARKET

Aluminium, No. 1 grade ingots—46 cents per lb.

Antimony—15 to 18 1-2 cents per lb.

Arsenic, white—7 1-2 to 7 7-8 cents per lb.

Barytes, crude—$11.25 to $14.50 per short ton.

Bismuth—$1.50 to $1.75 per lb.

Cadmium—$1.40 per lb.

Carbons, for drills—$78 to $85 per carat.

Carborundum, powdered—8 cents per lb.

Chromium, metal pure—80 cents per lb.

Cobalt, f.o.b. Cobalt, Ont., unrefined—35 to 50 cents per lb.

Corundum—7 to 7 1-2 cents per lb.

Feldspar, ground—$9.75 to $10 per short ton.

Flourspar, lump—$10 per short ton.

Graphite, domestic—$50 to $150 per short ton.

Gypsum, lump—$4.50 per long ton.

Infusorial earth, ground—$15 to $30 per ton.

Lead—5.75 cents per lb.

Manganese, pure metal—75 cents per lb.

Mica, ground—$80 per short ton.

Mica, scrap—$15 per short ton.

Molybdenum, pure—$1.70 per lb.

Molybdenite ore, 95 per cent. pure—$4.50 to $5 per unit.

Nickel—45 to 60 cents per lb.

Platinum, ordinary metal—$27 per ounce.

Pyrite, 38 per cent. to 45 per cent. sulphur, lump.

Quicksilver—$41 to $42 per 75 lb. flask.

Talc—$18 to $23 per ton.

Tungsten, pure metal—$1.25 per lb.

Tungsten ore, 60 per cent. pure—$400 per ton.

Tin—41 1-2 cents per lb.

Zinc Sheets—$8.60 per 100 lbs.

MARKET NOTES.

Northern pig iron, No. 1, ranges from $27 to $27.50. Bessemer malleable, $26 to $27.50. Bessemer ore, old range, $5. Bessemer, Mesabi, $4.75. Non-Bessemer, old range, $4.30.

Copper market is still unchanged. Lake copper, 24 1-4 to 25 cents per lb.; electrolytic, 23 to 23 1-2 cents per lb. The London market is unsettled, with a tendency towards lower prices. Standard, £99 1s. for spot.

Tin—There has been a marked fall in the price of this metal, apparently due to increased supplies. New York, 41 1-2 cents per lb; London, £187 per long ton for spot.

Lead—A decreasing demand has brought lead down to 5.75 cents per pound. The London market holds at £20.

Silver is moving upward. New York, 67 1-4 cents per ounce; London, 31d. Mexican dollars, 52 1-8 cents.

Spelter is steadier. New York, 6.47 1-2 cents per lb.; London, £24 10s. per long ton.

Cobalt, refined metal, $2.40 per lb.

The economic value of monazite lies in the incandescent properties of the oxides of the rare earths—cerium, lanthanum, didymium and thorium—which it contains. The cerium goes to the drug trade; the thorium, together with limited quantities of lanthanum and didymium, is used in the manufacture of mantles for Welsbach and other incandescent lights.

The zircon produced in 1906—all from Henderson County, N.C.—amounted at 1,100 pounds, valued at $248.

Mines and Minerals for June contains a leading article on "Montana Coal Mines." "An article on "Cobalt" is concluded from the May number.