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CANADIAN MINING JOURNAL

VOL. XXXVI TORONTO No. 6

Synopsis of Coal Mining Regulations

COAL mining rights of the Dominion, in Manitoba, Saskatchewan and Alberta, the Yukon Territory, the North-West Territories and in a portion of the Province of British Columbia, may be leased for a term of twenty-one years at an annual rental of $1 an acre. Not more than 2,560 acres will be leased to one applicant.

Application for a lease must be made by the applicant in person to the Agent or Sub-Agent of the district in which the rights applied for are situated.

In surveyed territory the land must be described by sections, or legal sub-divisions of sections, and in unsurveyed territory the tract applied for shall be staked out by the applicant himself.

Each application must be accompanied by a fee of $5 which will be refunded if the rights applied for are not available, but not otherwise. A royalty shall be paid on the merchantable output of the mine at the rate of five cents per ton.

The person operating the mine shall furnish the Agent with sworn returns accounting for the full quantity of merchantable coal mined and pay the royalty thereon. If the coal mining rights are not being operated, such returns should be furnished at least once a year.

The lease will include the coal mining rights only, but the lessee may be permitted to purchase whatever available surface rights may be considered necessary for the working of the mine at the rate of $10.00 an acre.

For full information application should be made to the Secretary of the Department of the Interior, Ottawa, or to any Agent or Sub-Agent of Dominion Lands.

W. W. CORY, Deputy Minister of the Interior.

N.B.—Unauthorized publication of this advertisement will not be paid for.—58782.

THE CANADIAN MINING JOURNAL

VOL. XXXVI. TORONTO, March 15, 1915. No. 6

The Canadian Mining Journal

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REGINALD E. HORE

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CONTENTS.

TAXATION OF MINING COMPANIES

In the Ontario Legislature last week, Mr. Sam Carter, member for South Wellington, moved for a return relating to the royalties and taxes paid by nickel companies operating in Ontario. According to the newspaper accounts of the discussion evoked by Mr. Carter's motion there appears to be, among those unfamiliar with the facts, a general belief that mining companies do not bear a fair share of the burden of taxation. The great success of the International Nickel company makes some of our members of Parliament envious. Some, claiming patriotic motives, ask for prohibition of export of nickel matte. Some, professing great faith in public ownership and showing an utter disregard for vested interests, ask that the Dominion and Imperial Governments take over the nickel business. Mr. Carter seems very much in favor of confiscation of the property of the Canadian Copper company. To such a proposition there is but one honorable reply.

The Mining Tax Act, providing for a three per cent. tax on profits over $10,000, came into force in 1907. In that year the Province received from this source $66,-741.68; in 1908, $65,922.48; in 1909, $78,327.58; in 1910, $111,546.17; in 1911, $131,577.75; in 1912, $210,275.25; in 1913, $206,212.77, and in 1914, $201,940.20; a total of $1,075,273.54.

The contribution by companies in 1914 was as follows:

Beaver Consolidated Mines, Ltd.	$ 3,080.32
Buffalo Mines, Ltd.	5,957.70
Canadian Copper Co.	40,000.00
Casey Cobalt Silver Mining Co.	3,549.07
Cobalt Comet Mines, Ltd.	1,003.20
Cobalt Lake Mining Co.	3,287.63
Coniagas Mines, Ltd.	22,787.78
Dome Mines, Ltd.	7,335.59
Hollinger Gold Mines, Ltd.	28,787.39
Kerr Lake Mining Co.	15,067.68
La Rose Mines, Ltd.	18,919.14
McKinley-Darragh-Savage Mine	10,824.88
Mond Nickel Co.	4,000.00
Nipissing Mining Co.	25,691.06
Porcupine Crown Gold Mines, Ltd.	1,307.80
Seneca Superior Silver Mines, Ltd.	7,339.48
Temiskaming Mining Co.	1,535.63
Trethewey Silver Cobalt Mines	775.85
Wettlaufer Lorrain Silver Mines	690.00

The amount paid to the Provincial Government is by no means the only tax levied on the mining companies. The municipalities collect almost as much for local improvements.

While the tax to be levied on the silver mining companies can be rather easily determined, it is not such a simple matter to determine the tax on the nickel mining

companies. Most of the silver ore is sold to smelting companies and the actual value of the ore can be approximately fixed. On the other hand the nickel mining companies do not sell their ore. They smelt it themselves. The Mining Act provides for a tax on the value of the ore at the mines. The problem is to determine the value.

If the smelters were independent concerns buying ore in an open market the prices paid would decide the question. But the smelting of the ore and subsequent refining of the matte produced are of themselves large industries. Independent concerns would be expected to derive a profit from the work. Hence to the cost of smelting and refining must be added a reasonable amount for profit. Ontario has no right under the Act to tax the profit on the three industries; mining, smelting and refining. Hence it is obvious that the total profits of a company derived from the three sources cannot be taxed. The problem is to determine what proportion of the whole profit should be considered as derived from the mining of the ore.

This problem was carefully studied by the Department of Mines and it was decided to tax the Canadian Copper company at the rate of $40,000 for the three years 1912, 1913 and 1914. If to this be added $20,000 per year spent on local improvements, for the company bears all such expense, we arrive at a total of $60,000. In other words the Canadian Copper company is taxed three per cent. on an annual mining profit of $2,000,000.

The earnings of the International Nickel company for these three years averaged much above $2,000,000. For the year ending March 31, 1914, the company reported a profit of $4,792,664.75 in addition to $687,394.63 written off for mineral exhaustion. Some of the members of the Ontario Legislature are confusing these figures with the profits of the Canadian Copper company's mining operations.

In addition to the revenue from the three per cent. tax on profits of the above mentioned companies the Ontario Government has a large revenue in royalties from some of the Cobalt silver mining companies. Up to Oct. 31, 1914, the Government had received directly in royalties alone $1,836,049.84, most of which was paid by the O'Brien, Crown Reserve and Hudson Bay mining companies. In addition the Ontario Government Railway (T. & N. O.) Commission received $666,915.22, chiefly from the Cobalt Townsite, City of Cobalt and Right of Way mining companies.

THE GEOLOGIST'S WORK

In his excellent introduction of the discussion on "Stimulation of Prospecting," at the recent meeting of the Canadian Mining Institute, Professor H. E. T. Haultain suggested that the work of prospecting should be undertaken by the geologists. He says that the staff of the Geological Survey is large and that the survey might very well undertake to direct the efforts of the men without technical knowledge.

The idea that the number of government geologists is large enough for the undertaking of such work is one which Professor Haultain may have obtained by examination of the volume of reports issued annually. As a matter of fact the number of field geologists is so small that the areal mapping of the Dominion will take very many years, without giving the geologists new duties. Before loading them with new work, should we not wait until the work for which they are specially trained is finished? Why not leave prospecting to prospectors?

Geologists as a class are not prospectors. Some might make good ones and others certainly would be failures. Some are doing very useful work without having as good a knowledge of men and mining as the average prospector. A scientific knowledge of minerals and rocks may be useful to the prospector; but it is not essential. On the other hand a knowledge of mining matters, while desirable, is not essential to the geologist. He can make very useful maps without knowing how many ore deposits are in the area mapped. Of course the maps would be much more useful if all the ore deposits were marked; but the government geologist in this country must give his attention to the large features and map large areas. The critical examination of all outcrops is the proper task of the prospector.

If some geologists make good prospectors, is it owing to their scientific knowledge of rocks and minerals? To some extent it may be; but should we overlook the characters held in common by many successful prospectors and geologists, keenness of observation, an overwhelming desire to investigate and understand natural phenomena, a fondness for life in the open, physique which can successfully withstand the hardships of that life, and above all a mind determined on honestly and constantly searching and filled with the hope of making important discoveries and adding to their and the world's knowledge and wealth.

If added to such characters a man possesses a thorough training in the science of minerals and rocks, he may be expected to become a successful geologist. Denied such training, but given more actual experience with the prospector's pick, he might become a very successful prospector. Does the ability to detect and strip a mineral deposit and to determine its value depend so much on geological study as on experience in prospecting and familiarity with ore deposits being worked in various parts of the country?

Can we afford to have the geologists do the prospectors' work? If it can be done as well by men without special scientific training, why should we ask that the efforts of geologists be diverted from the enormous task of geologically mapping the Dominion? Who is to do the work of the geologist? Are we to urge scientific training on the prospectors so that they may be qualified to take up the work of mapping, while the geologists are demonstrating how to prospect?

DR. W. G. MILLER AWARDED I.M.M. MEDAL

The announcement of the award of the gold medal of the Institution of Mining and Metallurgy to W. G. Miller, Provincial Geologist of Ontario, will be received with great pleasure by his numerous friends. The medal is awarded only to men who have rendered eminent service to mining or allied professions. By his work as an economic geologist Dr. Miller has aided greatly the mining industry in Ontario. The citizens of Ontario should congratulate themselves that the Provincial Geologist is a man of such high calibre as to be chosen by the world's leading mining institution as the man most worthy of the highest distinction in its power to confer.

PUBLICATIONS OF THE MINES DEPARTMENT

We have heard it stated frequently that the Department of Mines, especially the Geological Survey branch, publishes too much; that the staff should be encouraged to devote more time to field work and research and less to writing books. Some of this criticism is hardly fair. The government employs specially trained men to make observations and conduct investigations. What for? Is it for the purpose of removing these men from useful occupations? Is it to give them congenial employment at the country's expense? We think not. The able members of the staff of the Mines Department are employed to make additions to our knowledge of the mineral resources of Canada. This they cannot do by exploration and investigation alone. To be useful to the public the results must be permanently recorded.

In a country like Canada where so much of the territory is unexplored it is obvious that the first duty of a survey is to make maps. Until the whole country has been topographically and geologically mapped this work may well occupy the best energies of the Geological Survey.

But the survey gathers much information of permanent value besides that used in map making. Reports on districts explored are surely useful publications.

While we cannot agree that the publication of reports should be discouraged, we are willing to agree that a change in classification and character of the publications is desirable. The numerous changes in the past ten years in the classification of publications have resulted in the production of a bewildering series of reports, memoirs, bulletins, handbooks, etc. An overindulgence in classification of the publications has resulted disastrously for the reader. The earlier system of annual volumes was much more satisfactory.

The voluminous character of some of the reports has led some critics to say that the authors have too much time to write. On the contrary, they seem to not have had enough. If more labor had been put on the writing, the reports might have been very much condensed. Much of the matter should never have been printed. Much of it should have been rewritten in briefer form.

The make-up of some of the recent reports indicates that the instructions to the printer were to make attractive looking books and not to worry about the reader or the cost. Thick rough paper on which half-tones cannot be reproduced is used for the text. The half-tones are segregated in the back of the book, where they cannot be conveniently referred to by anyone reading the text. The pages are given extremely wide margins, as though bulk were the chiefly desired end in printing. Both in reading matter and in make-up the reports are not what they should be.

CORRESPONDENCE

THE STIMULATION OF PROSPECTING.

Editor Canadian Mining Journal:

Sir,—It was with great interest I read, in the February bulletin of the Mining Institute, Professor Haultain's introduction to the subject entitled "Stimulation of Prospecting." Being myself an humble "knight of the pick," I am awaiting anxiously the publication of the papers and discussions on this very important subject, the hearing of which I was deprived of, owing to not being able to attend the annual meeting of the Mining Institute in Toronto.

In the meantime I would like to make a few remarks from the standpoint of a prospector, by way of expressing my opinion of some of the views held by the eminent gentlemen who discussed the subject in the March number of the Mining Institute bulletin. Right here let me say that I recognize fully enough the importance of the subject to realize that I am not offering a satisfactory solution, I may be permitted, however, to write a few words on a subject which I think should have the best thought and attention of every mining man in Canada.

In his paper, Professor Haultain describes the "good type prospector. He is a man in whose make up the element of hope has become predominant, and as years go by this feature becomes abnormal until it finally amounts to fanaticism. He is the real world's gambler, staking his all, civilization, family, comfort, friends, time, etc., against the chance of discovery. His grubstaking partners could trust him without the need of legal documents to bind the partnership."

These are certainly capital qualities and I believe that, if were added to these a knowledge of the rudiments of geology and mineralogy, the really necessary essentials of his calling, we would recognize in him the ideal type of prospector, and one who would be able to "deliver the goods."

To my mind, the prospector who is possessed of all these requirements is the man who must be depended upon to make the real discoveries of the future and although this type was not predominant in the Cobalt, Gowganda and Porcupine camps, yet, I believe there are still many of these men in Canada to-day, not forgetting some of the brave fellows who are now at the front, performing their assessment duties in "the trenches of the Empire."

In view of the above, my opinions are not entirely compatible with those of Mr. Lamb, who seems to think that the way out of the difficulty is to eliminate the old-timer and encourage, in his stead, the introduction of the professional mining engineer, as a prospector.

This policy would, undoubtedly, be a good one insofar as the taking up and working of old prospects or claims already staked, is concerned. But when it comes to exploring and prospecting new and inaccessible territory, the old type of prospector would come in, because, as Mr. J. McIntosh Bell states, in discussing the same subject, "There still seem to be men who love the free life of the woods and it is to them we must look for the discoveries of the future."

There are many young university graduates who do not particularly like this sort of life, and in addition, are not well suited for it. To my way of thinking, a man must love his work if he is to make a success of it, he must have his mind made up to overcome all the difficulties peculiar to his occupation and must not let such trivial matters as personal comfort, etc., interfere with his sensibilities. Some of the best woodsmen I have ever met were college men; but the average college man spends most of his life up to the time of graduating in at least comparative comfort and convenience, and when he finds himself suddenly deprived of these, and thrown upon a cold and unyielding nature, such as one invariably encounters in the business of prospecting, he is not perfectly equipped. His technical knowledge is abundant, but his practical knowledge, in some cases at least, is lamentably absent and, unless he has sufficient backbone to meet and combat the many obstacles which he is sure to encounter, he is apt to become a failure.

Some people seem to think that a practical experience in prospecting is unnecessary. But I have observed during my life time as a prospector and more particularly in the northern camps, that fifty per cent. of the men who go into the woods fail because of lack of effort or ability to apply it. On the other hand, as Mr. Lamb states, "it is reasonable to expect that scientifically directed effort in selected areas should be profitable." There should be no question about this, and, I believe, one good way to handle the matter would be to carry out Mr. Bell's suggestion that more reconnaissance parties should be sent out each year, headed by a geologist and with skilled prospectors attached to carry out the work. And this I think should be done in a detailed manner, that is to say, each party should be equipped with a small, but complete portable mining outfit, consisting of light mining tools, blacksmith's forge, dynamite, etc., using these tools to take the place of that much desired but still lacking "scientific instrument" of which Mr. Gwillim speaks, for seeing through brush, muck and overburden.

The objection to this form of prospecting would lie in the fact that any disposal of interests in discoveries thus made would be difficult. One way out of the difficulty would be to give each man employed a reasonable salary and interest, the Government retaining a certain percentage, or royalty, to reimburse itself for its part in the undertaking.

In the case of syndicates employing prospectors, I believe that more care should be exercised in the selection of men. In many cases the most important feature is the one in which most carelessness is exhibited, the selection of the prospector. To my mind the proper men to select are those possessing a knowledge of geology and mineralogy, who are willing to sacrifice personal comforts, friends, etc., who have a practical knowledge of the woods, camping, canoeing, the compass, etc., and above all who are honest and consistent in all their efforts.

Mr. Lamb further states that the decline of prospecting is traceable to the effects of wild-catting booms and all must agree with him. Why then, would it not be wise for the Government to draft legislation, requiring that only prospectors who can furnish certain qualifications and who will live up to them, be allowed miners' licenses in the event of another Cobalt or Porcupine being discovered?

Yours, etc.,
J. J. BYRNE.

Sault Ste. Marie, March 6, 1915.

CANADIAN MINING INSTITUTE ANNUAL MEETING

The seventeenth annual meeting of the Canadian Mining Institute, held in Toronto, March 3rd 4th and 5th, was a distinct success. The attendance was not as large as at the 1912 meeting in Toronto; but the interest in discussions was keen and the attendance at the business session was larger than usual. The local committee in charge of arrangements for the annual meeting was composed of A. J. Young, Dr. W. G. Miller and Col. A. M. Hay.

At the opening of the session it was announced that Mr. G. G. S. Lindsey, president of the Institute, had been detained in England and would be unable to attend the meeting. Mr. A. A. Cole, vice-president of the Institute, presided.

Hon. G. Howard Ferguson, recently appointed Minister of Lands, Forests and Mines of Ontario, welcomed the members to Toronto. Mr. Ferguson referred to the fact that, next to agriculture, mining is the most important industry in Canada and that the responsibility of those directing the industry is great. He promised to do his best to further the industry in Ontario and in his work he hoped to have the support of the members of the Institute.

Amendments to By-laws.

The chief topic of discussion at the Wednesday morning session was proposed amendments to the by-laws. The amendments proposed by C. E. Smith and seconded by A. G. Burrows were designed to make representation in council proportional to the membership in various parts of the Dominion. The principle of representation according to membership found many supporters and few critics. There was however much opposition, organized by the Cobalt branch, to the amendments. The reason given for this opposition was that the present is not an opportune time to make any important change in Institute affairs as the meeting was not expected to be large. The large attendance and keen interest in the meeting practically nullified this contention.

The discussion was spirited and Mr. T. W. Gibson, who presided, was called upon frequently to decide points of order. A motion by A. A. Cole called for a twelve months' hoist of the discussion was put and lost. The discussion on the proposed amendments was then resumed. The motion was finally put and carried by a vote of 48 to 22.

The amendments provide that each Province (British Columbia including Yukon; Alberta including Saskatchewan and Manitoba; Nova Scotia including New Brunswick and Prince Edward Island) shall be represented in Council by a number of councillors proportional to the number of members entitled to vote in such Province. There is to be no change in method of electing the President and vice-presidents.

Mineral Statistics for 1914.

Statistics of mineral production for the Dominion of Canada and the Provinces of Ontario and Quebec were presented by John McLeish, Chief of the Division of Mineral Statistics, Mines Branch; Thos. W. Gibson, Deputy Minister of Lands, Forests and Mines, of Ontario; and Theo. Denis, Superintendent of Mines of Quebec. Elsewhere in this issue of the Journal the statistics are reprinted.

The Stimulation of Prospecting.

At the Wednesday afternoon session H. E. T. Haultain introduced a discussion on "The Stimulation of Prospecting." There was a lively interest displayed in the subject, for it is generally recognized that mining activity is based on the work of the pioneers and that recently these hardy woodsmen have been much less in evidence than they were a few years ago.

Mr. Haultain in introducing the subject referred to the peculiarities of the men who have made prospecting their life work. He spoke of them as men filled with a desire to make a big "stake" and willing to take a gambler's chance. In them hope is abnormally developed. They work in the face of hardships hoping that fortune will favor them sooner or later, and that they will be some day rich men. With these enthusiasts he contrasted the stakers of claims who have been so active in following up discoveries in Ontario.

Mr. Haultain suggested that an organized campaign in charge of geologists might have the desired results.

Other papers presented at the meeting were: Conservation of Our Mineral Resources, by Dr. Frank D. Adams, Montreal; Some Notes on Possible Effects of the Present European War on the Mineral Industry of Canada, by Robt. A. A. Johnston, Ottawa; Coal Tar Products and Artificial Dyestuff Industry, by L. O. P. Walsh, Sydney, N.S.; Safety Engineering at the Canadian Copper Company's Works and Mines, by E T. Corkill, Copper Cliff; Accident Prevention at Ontario Mines, by T. F. Sutherland, Toronto; Some Recent Developments in Metallurgy, by A. Stansfield, Montreal; The Oxygen Iron Torch, by David H. Browne, New York; The Hall Sulphur Process, by H. F. Wierum, New York; The Cottrell Process, by Walter A. Schmidt, Los Angeles; The Smelting of Titaniferous Iron Ores, by Bradley Stoughton, New York; The Economic Possibilities of the Yukon, by D. D Cairnes, Ottawa; Recent Developments in the Gold Dredging Industry in the Yukon, by O. B. Perry, New York; The Zinc Industry in America, by J. A. Van Mater, New York; The Recovery of Mercury from Residues of Amalgamated Cobalt Ores, by E. B. Thornhill, Cobalt; Miller Chlorine Process at the Royal Mint, Ottawa, by Ralph Pearson, Ottawa; Some Comparisons of Steam and Electric Hoisting Machinery, by J. B. Porter, Montreal; The Weedon or McDonald Mine, Weedon, Quebec, by L. D. Adams, Weedon; The Origin of Wabana Iron Ore, by Albert O. Hayes, Ottawa; Primary Cambrian Manganese Deposits of South-eastern Newfoundland, by Nelson C. Dale, Clinton, N. Y.; Gold on the North Saskatchewan River, by J. B. Tyrrell, Toronto; A New Gold Area in Northern Saskatchewan, by E. L. Bruce, Ottawa; The Ore Deposits of Copper Mountain, Similkameen, B.C. by Frederic Keffer, Greenwood, B.C.; The Ore Deposits of the Ainsworth Mining Camp, B.C., by S. J. Schofield, Ottawa; The Use of Potash in Agriculture, by R. Harcourt, Guelph; The Future of the Clay Products Industry in Eastern Canada, by Jos. Keele, Ottawa.

On Thursday evening the annual banquet was held. About 110 members and guests attended and a very enjoyable evening was spent. Col. Hay provided an excellent menu and Mr. Knight had arranged a musical program which was evidently much enjoyed.

There was no formal toast list. A number of guests and a few members were called on by Mr. Cole for short addresses. Hon. G. H. Ferguson, H. M. Tolmie, Bradley Stoughton, J. A. Van Mater, W. A. Schmidt, David H. Browne, H. E. T. Haultain, S. S. Fowler, A. J. Young and Col. Hay were among the speakers.

The results of the election of officers were: President, G. G. S. Lindsey; vice-presidents, Thos. Cantley and A. A. Cole; councillors, M. B. Baker, J. W. Bell, R. W. Brock, Theo. Denis, D. A. Dunlap, M. B. R. Gordon, A. J. Young, G. C. Mackenzie, D. H. McDougall and J. T. Stirling.

"FOES OF THINE OWN HOUSEHOLD"

"This war may yet prove a blessing rather than a curse if through it our people learn that the state is not something from which we are all to get as much as we can grab by the unscrupulous use of our votes, but represents rather ideals for which we are ready, if need be, to sacrifice our very lives."—Extract from Lord Robert's last article in the Hibbert Journal, October, 1914.

Who are the foes of Britain's race? What her
statesmen's secret fear?
The Hohenzollern false, the senile Turk, the fierce
Magyar?
Nay, for we fear not open foes. We dread the traitors
in our midst,
Robbers of soldier's kits, hungering for gold though
brave men die.

On Belgium's plain, 'midst Polish snows, hourly die
Germania's sons,
Freely, gladly, proving full her measured boast that
she breeds men.
Ruthless maybe, and cruel, but cowards, No! They
have staked their all
Upon the dice of war, nothing have held back from
Fatherland.

And we, whose pulses yet course blood of Nelson and
of Drake,
Whose proud ancestry at Mons and Coronel was not
bedimmed;
Have we given all? Or use we Britain's agony, this
dread hour,
For private gain, raking deep for power the slime-
beds of the vote?

The wine-crazed Hun, berserk with loathly lust and
hate primeval,
We execrate, and shortly will we cleanse the tired
earth of him.
Yet, with those who strive for party vantage and for
gold compared,
This Teuton pagan shines a jewel bright from out the
mire.

If but this scourge of War drive from the fair temple
of our Race,
The foul money-changing brood, the leprous leeches of
the polls,
Cleansing our nation's life. Then welcome we the grim
Gods athirst.
Better the Valkyrie's shriek than the sweet slothful
pipes of peace. —F. W. Gray.

A TRIP TO GREAT SLAVE LAKE

By Gwynn G. Gibbins.

During the season of 1914 it was the writer's privilege to spend six months in that vast district of North-West Canada lying north of Athabasca Landing, particularly the district around Great Slave Lake.

As the trip is a rather unusual one it has been suggested to the writer that a short narrative, descriptive of the journey, might be of interest to fellow readers of the Journal.

Outfitting.—We outfitted at Athabasca, carefully checking over our supplies—a precaution not to be neglected if the voyageur looks forward to three square meals a day. We purchased a scow and loaded our provisions and camp outfits. These scows are made by the score each spring, and are 50 ft. long, 10 ft. wide and 3 ft. deep, and carry from five to eight tons. Our next, or rather our first real, difficulty was to engage a capable and reliable steersman. With the aid of the Hudson's Bay Company, this was finally done, though at an exorbitant cost, viz., $165 and grub both ways for the 265 mile journey between Athabasca and Fort McMurray.

Before starting we had to get numerous permits from the R.N.W.M.P., to wit: hunting license, permit to carry a gun, another for a hunting knife; but, above all, for permission to take in with us a bottle or two of Hennessy Three Star—for medicinal purposes only! By sad experience we found that this permission could only be granted by the Attorney-General for Alberta. Two of us spent a whole day in Edmonton fulfilling the required regulations. We found it was necessary to get a doctor's certificate from a doctor who knows one personally. Though all of us were strangers in Edmonton, this technicality was overcome by the payment of the inevitable fee, and we returned joyfully to the Government buildings, where we were again mulcted and granted leave to carry one gallon of liquor.

Shortly after noon on May 19th, our dreadnought and accompanying destroyer flotilla of eight canoes, manned by eighteen officers and seamen, fired the last salute and cast off—only to find that our steersman, David, had disappeared. We detailed parties to the various saloons and private rendezvous, but 'twas not till nearly 6 p.m. that we found him stowing away some kind of wood alcohol.

We cast off rather ignominiously on our long drift to the Arctic regions and barely reached the first bend when we ran aground and our steersman keeled over, dead to the world. Then we found and cast overboard his cache of several bottles of alcohol. Indians may not be served with liquor legally, so they drink anything at all containing an intoxicant, peruna, sarsaparilla, pain-killer, etc.—the latter being an especial favorite.

As there are no dangerous rapids for the first 100 miles north of Athabasca, we decided to continue, and accordingly set watches for the night—four hours on and eight hours off.

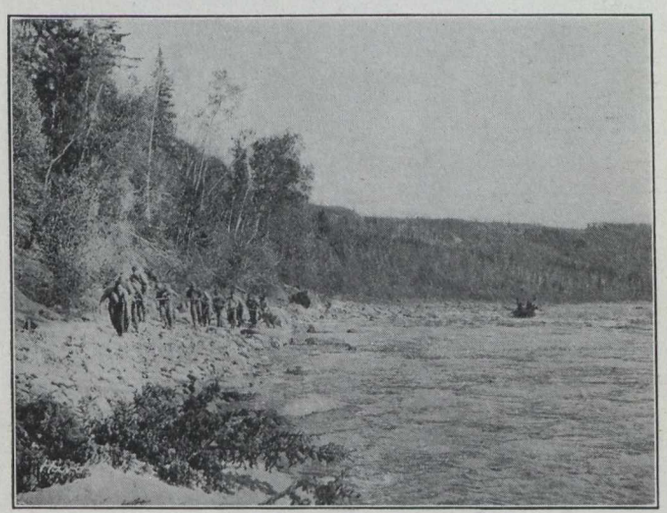
The "Flotilla" at Athabasca Landing, May, 1914

Method of navigating.—A few words here in reference to the modus operandi may not be out of place. The scow is fitted with six oars or "sweeps," made from small trees and each about 25 ft. long. The steering oar is a larger tree, about 35 to 45 ft. long, with a hole bored through it at a place not far from its point of balance, giving a leverage of about 15 ft. for the steersman. An iron post securely fastened to the stern of the scow passes through this hole, and this gives the steersman ample chance to wield the apparently clumsy oar. The Indians are remarkably adept at this work, and the best steersman can guide the scow, aided at intervals by the oars, with wonderful precision and skill through rapids seemingly impassable.

Towards the end of the following day our steersman had recovered sufficiently to be of material assistance to us.

Pelican gas well.—Early on Friday morning we reached the gas well of the Pelican Gas and Oil Com-

pany, situated on the east bank, about six miles above Pelican rapids. There was only a watchman on the property. The gas was burning, with a pressure of 7 lb. per square inch, and it has been piped to the buildings for cooking and heating purposes. Owing to the Calgary oil boom this summer, work was restarted, but no oil was struck. On our return in the fall we found the Government telegraph line had been constructed from Athabasca to this point.



Tracking up the Atbabasca River

Government bore hole.—About a mile above the rapids, on the west bank, is the site of the Government bore hole, drilled many years ago to a depth of 800 ft. to tap the underlying Dakota Tar Sands. The pressure of gas was so excessive that the drillers were unable to proceed, nor were they able to cap the well, and the roar of the escaping gas could be heard for many miles. It is now well capped, but the pressure is still very great. The holdings of the Athabasca Oil Company are situated here, and during the past summer a very considerable amount of work was done, though apparently with no great success.

Grand Rapids.—The Pelican rapids were run without mishap, and we camped Friday evening at House River, about nine miles above Grand Rapids. From House River there is a very rough pack trail to Fort McMurray, used by the mail carrier, but almost impassable except in winter.

We had a hard time making the landing at Grand Rapids Island and still a harder time portaging our goods to the foot of the first rapids. The river falls over 50 ft. in less than 2,000 ft., forming a continuous cascade. These rapids are formed by the wearing away of the Grand Rapids sandstone, which is characterized by the number and size of silicious spherical concretions contained. These concretions, some 10 to 15 ft. in diameter, roll into the river and form obstructions over which the water falls.

Across the island the Hudson's Bay Company has built a narrow gauge railway, which pays no attention to grades or curves, consisting merely of rough wooden rails, upon which is tacked a strip of old iron. In some places there are ties, but almost as often not. It was built over twenty years ago—looks its age—and seems to be in a perennial state of collapse. It must pay handsomely upon the capital invested, as the charges are $2.50 per ton and $2.00 per canoe—you load the truck, haul across and unload yourself. The portage is less than 500 yards long, and as the duties of engineer, stoker, traffic and passenger agents, general manager and section gang are all performed by one man, perhaps this with the tariff schedule, explains why this railway is called the best paying in the world.

The Indians ran our unloaded scow down the east channel of the Grand Rapids. It was very exciting; several times she struck, but the water carried her over. At one place she struck very hard, went up in the air and came down with a terrific crash; but the steersman and his men hung to their posts and brought the scow through safely into the large back eddy just below the junction of the two channels.

From the lower end of the island, we then threw into the main or western channel a cordwood stick to which was tied a stout one-inch manilla rope about 600 ft. long. The current carried this stick into the back eddy and was picked up by the Indians on the scow. They fastened the end to the scow, and at a signal we all got into our tumplines by way of harness and pulled away until the scow reached the island. It was a very hard pull and, at times, though there were over a dozen of us on the line, no headway was made.

The scow was then loaded and our real thrills commenced. From here we had to run all but the two small canoes, which were taken up on the scow, through all the rapids. Two men were in each canoe, this left six men and our local Indian steersman on the scow. The Lower Grand rapids were very exciting; but luckily the water, though rough, was very deep. The Brulee rapids were easily run. Natural gas rises off Point Brulee, and we burned it in several places on the shore just above Little Buffalo river.

Boiler rapids, about 40 miles below Grand rapids, proved a stumbling block, and we had a very anxious time. Our scow struck and was whirled around but held fast.

The canoes immediately behind the scow had a hard time to escape being caught. However, we managed

Shooting Grand Rapids, May 1914

to land and tried to help. Two of our Sault Ste. Marie Indians, by very skilful work, got to the rock about 20 ft. above the scow. A rope from the stern of the scow was securely fastened to the rock, and then the boys in the scow pried and shoved. Suddenly she started and like a flash swung around. At the right moment, David, our steersman, cut the rope with an axe and the scow was off again. Meanwhile consternation spread on the scow because the water

was pouring in through a large hole. A canvas sheet and a couple of sacks of flour effectually stopped serious leakage until the boys were able to beach the scow above the rapids, where we made repairs.

The Middle rapids were very rough and exciting, but Long rapids and Crooked rapids were easily run. Rock rapids gave us a thrill when one of the canoes capsized. Luckily the boys got to shore safely.

At Boiler rapids the Dakota sandstones or Tar Sands were first seen, and gradually increase in thickness as we go north.

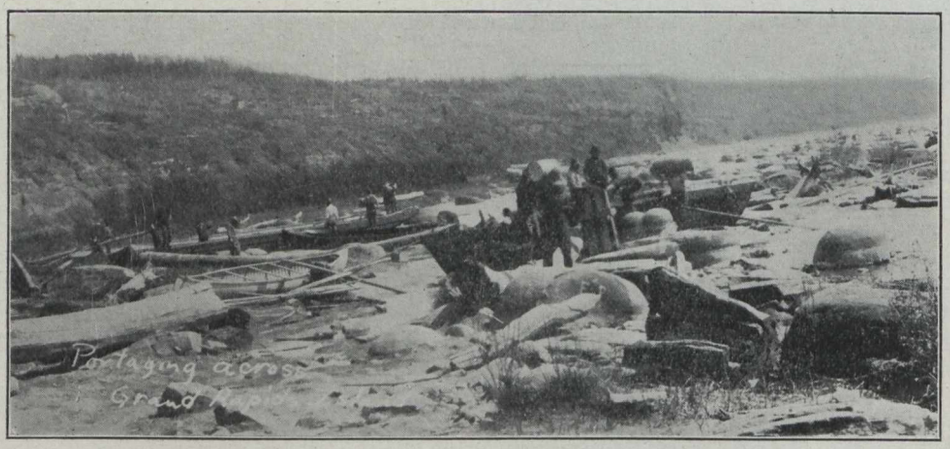
The Devonian limestone underlying uncomformably the Cretaceous Dakota sandstones first appeared just below the Crooked rapids. It lies nearly horizontal, with a dip of about 5 to 10 ft. south. Numerous fossils were seen, especially shells of the species "stromatoporoid." At Little Cascade rapid the limestone forms a ridge completely across the river, making a fall of about 2 ft. at low water. There was not quite sufficient water for our loaded scow, but we managed to get over without portaging. At Big Cascade we had a hard and laborious time. The drop here is about 4 to 5 ft. We had to portage every pound and then drag our scow over.

"Evinrudes," which we had brought purposely with us, we rigged them up on our scow and continued on our journey. We passed several deserted oil wells and the La Saline springs. The current is appreciably slower below McMurray, probably not averaging more than three miles per hour. We drifted by Fort McKay during the night, and only those of us on watch, the dog watch as it happened, saw the post. The last exposures of the Tar Sands were seen just below McKay. From here to Lake Athabasca all was drift.

Athabasca Lake.—With the aid of our Evinrudes we crossed the twelve miles of Athabasca lake at the mouth of the river, in about five hours against a fairly strong wind and reached Fort Chipewyan late on the evening of Wednesday, June 3rd, having drifted 450 miles from Athabasca.

Fort Chipewyan, to me, is the most picturesque and interesting of all the Hudson Bay posts to the north of Edmonton, at least south of Great Slave lake.

Both the Roman Catholics and the Church of England have large missions here, and in addition to the Hudson Bay Company there are several independent traders.



Portaging Across Grand Rapids Island

Mountain rapid gave us a little excitement because it is necessary to cross from the left bank to the right bank in a little space of comparative calm waters. If this crossing is made correctly, there is no danger, but if not, judging by the water, it would be a hard struggle to get through.

This is the last real rapid and we reached Fort McMurray about 5 p.m. on Wednesday, May 27th.

Fort McMurray.—A railway is being constructed between Edmonton and Fort McMurray, giving the place quite a real estate boom. Lots on the main street (by courtesy) are reported to have sold as high as $3,000 for a frontage of 25 ft. Fort McMurray, at the confluence of the Clearwater with the Athabasca rivers, was at one time a very important port. Before the railways were built across Canada all supplies used to go from Winnipeg by way of the Saskatchewan river, across portages to the Clearwater river, and down the Clearwater to Fort McMurray, which was the refitting point and terminus. From here all was comparatively easy. Now, however, so far as the Hudson Bay Company is concerned, it is merely a freight handling post, and practically no furs are traded.

Below McMurray.—After a stay of a couple of days, during which time we experimented with two small

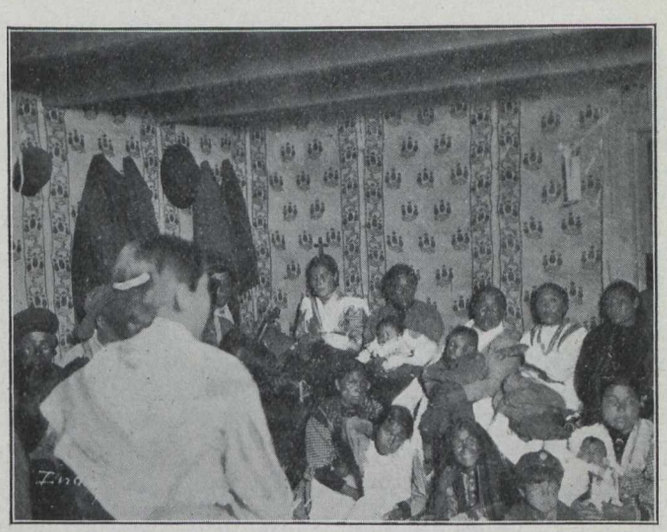
Athabasca Lake abounds with whitefish and huge trout, sometimes 60 lb. in weight. We caught several over 40 lb. in our nets. The annual catch is about 900,000 lb., all for local consumption; dried fish being the chief food for the dogs in the winter time. There are two tribes of Indians here—the Chipewyans, who are industrious, hardy and in general prosperous, as compared with the Crees, a very inferior tribe, slovenly, improvident, careless and "white livered"—so called by the Chipewyans because they are afraid, or at least prefer not, to hunt far from home.

The remains of the old fort can still be plainly seen.

Geologically, at Chipewyan, Lake Athabasca cuts the western fringe of the great Archean shield, and from here north to Great Slake lake the rivers follow closely the contact between the Devonian limestones and the Archean gneissic rocks.

At Chipewyan our party broke up into several small groups, each group performing a certain duty. The writer continued northward, carrying all supplies in a 20 ft. chestnut canoe.

We left the Fort about 10 a.m. on Saturday, June 6th, and reached the Riviere du Rocher a few hours later. This river connects Athabasca lake with the mighty Peace river, and below the junction is called Great Slave. Riviere du Rocher is remarkable for the



Indian Party, Fort Resolution, 1914

fact that it changes the direction of its flow according as the Peace River is higher or lower than Athabasca lake.

Great Slave River is at times very rough, as we found out, especially as the prevailing winds in the spring are north.

We reached Smith Landing early in the evening of June 9th, after a miserable, monotonous, arduous journey of about ninety miles. All was excitement here owing to the arrival of the first scows of the season, which we passed a few miles above the landing. Every half-breed had a "permit," and cargoes were immediately broached and Bacchus reigned supreme, from the Hudson Bay factor down to the Indian with the smallest trickle of white blood in him.

The R.N.W.M.P. alone seem to remain steady and they had their hands full. We hired a team to take us across the 16 mile portage to Fort Smith, but in an hour our teamster was dead to the world. This portage is necessary because of the series of rapids between Smith Landing and Fort Smith. The river has here cut through a fringe of the Devonian limestone in a series of deep gorges and cascades. At Fort Smith the river is over 1½ miles wide and the townsite is on the plateau, probably 200 ft. above the river.

By the aid the R. N. W. M. P. and courtesy of the Hudson Bay Company at Fort Smith, we were fortunate in getting transported the following day.

Indian Dance, Fort Resolution, 1914.

Fort Smith is an important Hudson Bay post, being the head office for the entire district to the north. The Northern Trading Company have a large post, while the Dominion Government Indian Agent is also located here. River steamers run from Fort Smith to the Arctic, a distance of over 1,500 miles.

The soil appears to be fertile and indeed it is expected that settlers will eventually locate along the rivers as far north as Fort Smith and westward. Fort Smith itself is just beyond the 60th parallel of North Latitude, and hence in the district of Mackenzie. The boundary line crosses the road to Smith Landing a couple of miles from Fort Smith. Navigation extends from about the first of June to the end of September.

We left Fort Smith on the evening of Thursday, June 11th, and arrived at Fort Resolution on Great Slave lake on the 16th, having had a couple of days very bad wind, which caused us to seek shelter.

(To be continued.)

INTERNATIONAL ENGINEERING CONGRESS, 1915, SEPT. 20-25, SAN FRANCISCO, CAL.

The technical success of the International Engineering Congress is now well assured. Notwithstanding the difficulties arising as a result of the present European war, the Committee on Papers is able to count on from 200 to 250 papers and reports covering all phases of engineering work and contributed by authors representing some eighteen different countries. The Congress will therefore be truly international in scope and character, although the representation from the countries involved in the European war will naturally be less than originally planned.

The Secretary, W. A. Cattell, announces that papers are now rapidly coming in and their character gives the fullest assurance that the proceedings will form a most important collection of engineering data and a broad and detailed review of the progress of engineering art during the past decade.

The Committee of Management is now issuing to all important engineering societies invitations to appoint official delegates to attend the sessions of the Congress, and the presence of a considerable body of such delegates is well assured.

Membership in the Congress with the privilege of purchasing any or all of the volumes of the proceedings is open to all interested in engineering work.

The mineral products of the United States are discussed in a small volume now being distributed by the United States Geological Survey which contains a fund of useful information concerning the useful minerals and their values and production in all the States during 1912 and 1913. The figures given in some of the tables are so stupendous as to be beyond comprehension. In one table are given the figures for mineral production from 1880 to 1913, the metals being valued at $185,000,000 in 1880 and increasing to $883,000,000 in 1913. The non-metallic minerals increased $173,000,000 in 1880 to $1,562,000,000 in 1913, and the total mineral production from $365,000,000 to $2,446,000,000. This total for 1913 was an increase over 1912 of more than $200,000,000. The value of the metals imported for consumption in 1913 was $237,000,000 and of those exported $319,000,000. The value of the total mineral production from 1880 to 1913, inclusive, was $35,197,000,000.

DR. W. G. MILLER HONORED BY INSTITUTION OF MINING AND METALLURGY.

At a meeting held on Feb. 17 the Institution of Mining and Metallurgy, London, awarded its gold medal to Dr. Willet G. Miller, Provincial Geologist of Ontario "in recognition of the eminent services rendered to mining by his admirable work as an economic geologist." The medal will be presented at the annual meeting, Thursday, March 18.

In 1910, this medal was also awarded to Dr. R. W. Raymond, now secretary emeritus of the American Institute of Mining Engineers. The then vice-president of the Institution, Mr. Rawlinson T. Bayliss, in presenting the medal to Dr. Raymond, said: "I should like to add that the gold medal of the Institution of Mining and Metallurgy is the highest award which it has the power to bestow. It is not given indiscriminately; it is not confined to members of the Institution; it is not awarded for any specific, limited reason. It is, in fact, the 'order of merit' of the Institution of Min-

The Medal of the Institute of Mining and Metallurgy

From R. W. Raymond Presentation Book

ing and Metallurgy, and it is bestowed not necessarily upon mining men, but upon any man who, in any scientific profession, proves himself to be head and shoulders above his fellows, and who by his work and influence for good in the profession of which he is a member, has become entitled to this honor."

At the centennial celebration of the Geological Society of London, the medal was given to Sir Archibald Geikie in recognition of the great services he had rendered to the science of geology; and, a year after, it was awarded to Dr. James Douglas, for his eminent services in mining and metallurgy.

Dr. Miller was born in Norfolk county, and is a graduate of the University of Toronto. He was professor of geology in Queen's University, Kingston, from 1893 to 1902. He has been connected with the Ontario Bureau of Mines since 1896, and was appointed Provincial Geologist in 1902. He was a member of the International Committee on Pre-Cambrian Nomenclature from 1902 to 1904.

Dr. Miller's field of labor has been largely in the geology of the pre-Cambrian rocks, particularly in Ontario. As these formations are pre-eminently the metal-bearing formations not only of Ontario, but also of Michigan and Minnesota, containing such well-known areas as Sudbury, Cobalt and Porcupine in this Province, and the great Mesabi, Vermilion, Gogebic, Marquette and other iron deposits as well as the copper deposits of Michigan, Dr. Miller's attention has necessarily been devoted to the practical and economic aspects of his work, as well as to the more purely scientific. He is recognized not only in Canada but also in the United States and Britain as one of the foremost authorities in the difficult field of pre-Cambrian geology, where fossiliferous means of identification are absent, and where the correlation of rock formations, perhaps widely distant, depends upon lithological, structural and other inorganic data.

The corundum belt of Eastern Ontario was examined by Dr. Miller in 1896, 1897 and 1898, and its relationships thoroughly worked out and established.

Even more brilliant was the work done by him at Cobalt. When silver was discovered there in 1903, he was the first geologist in the field and with his assistants in a remarkably short time deciphered and classified the rock formations, and his reports and geological maps have proven of the greatest possible assistance to miner and capitalist alike in the practical exploitation of the silver deposits. In volume 19, part 2, of the Bureau of Mines Reports, Dr. Miller has given a complete account of the geology and mineralogy of the Cobalt area, showing among other things the famous diabase sill, and its relations to the silver-bearing veins in the conglomerate and Keewatin.

Dr. Miller also investigated the pre-Cambrian formations of Eastern Ontario and showed, what had not been previously recognized, their parallelism to the corresponding series of northern and northwestern Ontario. The results of his observations were published in the 22nd report of the Bureau of Mines, part 2, under the title "The Pre-Cambrian Geology of Southeastern Ontario." Dr. Miller has also contributed freely to geological and mining publications, and is a past-president of the Canadian Mining Institute.

OPPORTUNITIES IN PATENTS*

By Stanley Lightfoot.

Some time ago a short article was published in this Journal relating to the patent situation as affected by the war, particularly referring to the opportunities presented to Canadian manufacturers by reason of the provision under the War Measures Act, 1914, for the avoidance of patents held by persons who are subjects of a state at war with His Majesty, and during the last few months it has been my pleasure to review the situation and note the general effect and increasing possibilities arising from the new conditions regarding enemy patents.

There has been, up to the present, a surprising lack of appreciation of these opportunities. Whilst many thousand inventions, some of extreme value, are patented in this country, there have been but few applications made for the avoidance of such patents, and for the granting of licenses to prospective manufacturers of the same, although I am advised that in Great Britain, in which country an act practically identical with our War Measures Act exists, there has been a marked movement of late towards the acquisition of licenses under these enemy patents with a resultant increase in business activity.

It is therefore my object to endeavor to indicate the reason of this apathy towards these patents which are subject to adoption. In order to do this, it is necessary to understand a matter which is not very often given much thought by the average patentee, he usually regards the granting of a patent as being merely something which he has bought and paid for, and that he has therefore fulfilled all his obligations with respect to the same. As a matter of fact, a patent is not granted merely in consideration of a fee. This franchise is

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conferred upon an individual as a reward for the benefits which he, himself, confers upon the public. It is, therefore, expected of the patentee that he shall commercially promote his invention to such an extent that these benefits will be actual as a result of the increase in commerce or production or the general advancement of trade by the use of the invention. Sec. 38 of our Patent Act accordingly provides that a patentee must commercially manufacture or work his invention within two years of the date of the patent grant, and in order that these requirements shall not be unreasonable, sec. 44 provides for exemption from the provisions of the first mentioned section where such manufacture cannot be profitably effected and articles held in stock owing to the particular nature of the invention.

Foreign inventors have, of course, to comply with one or other of these sections, and, owing to the present state of war, it will be readily understood that German and Austrian inventors will be unable to promote their inventions in the required manner, especially in view of the fact that they have not legal status in our courts. Prior to the outbreak of the war the usual method which has been adopted by foreign patentees has been to lease their rights in this country upon a royalty basis; but during the continuance of the war the payment of such royalties to the enemy is illegal and would ordinarily leave the patents open to a species of claim jumping owing to the inability of the patentee to obtain redress. This, however, is by no means the course which is advisable, either morally or otherwise, as upon the cessation of hostilities complicated situations as well as considerable friction would be bound to arise. This situation has been clearly foreseen and the introduction of the War Measures Act has not been, as many supposed, a form of reprisal upon enemy patentees; but on the contrary, as a form of protection to them as well as to our own inventors holding patents in the countries with which we are at war. This is an indication of good faith on our part for, as Section 14 of the British Patent Act, 1907, states in part "A patent sealed with the Seal of the Patent Office shall have the same effect as if it were sealed with the Great Seal of the United Kingdom." Where a patent is granted and the inventor has fulfilled all his obligations it is not the intention of the Government to treat these patents as if they did not exist, using the state of war as an excuse.

There can be no doubt that a great deal of the reluctance to take up the manufacture of these inventions is due to lack of knowledge as to the legal situations, and fear of losing capital in an enterprise which might not be protected against infringement proceedings at the termination of the war, or the possibility of competition arising as a result of others taking up these inventions. This is just what would actually occur had the annulment of enemy patents automatically come into force, as many imagined to be the case. The Government takes the responsibility, however, in granting the licenses upon such terms as it may deem to be fitting indemnity to the patentee, taking into full consideration the expense which the licensee will be put to. A further argument sometimes met with is that the licensee will find himself with possibly an expensive plant on his hands or a large quantity of unsold goods in stock upon the cessation of hostilities, and, owing to the patentee again coming into control of his patent rights, will be unable to dispose of same or continue to use his plant without consent of the inventor. This again is a mistaken notion as the duration of the license will be arranged to remain in force for a period extending beyond the cessation of hostilities to a sufficient degree as to ensure the licensee having reasonable opportunity to make a good return upon his investment. This is quite reasonable from the point of view of all parties when it is considered that the licensee has kept the patent before the public and has fulfilled the patentee's obligations.

It will be clearly seen that the granting of these licenses serves two purposes, one to take care of the patentee's interests and keep the invention before the public, and the other to serve the public and increase industrial activity. Accordingly in making application for the avoidance of a patent under the War Measures Act, a person may be actuated by a desire to better his own conditions as well as by a patriotic spirit, in benefiting commerce. By no means would this be construed as claim jumping or a desire to take advantage of a foreign inventor's inability to protect himself. That would not be in accordance with British spirit and respect for the seal of our patent office.

Whilst Austria is not a nation of inventors, Germany is decidedly a scientific nation and her subjects have produced a vast number of inventions which have materially added to the world's progress, many of these being patented in Canada. Perhaps the most important progress in German science has been in chemical research, resulting in the invention of processes involved in the production of many substances. Various structural devices have also been invented, whereby such processes are put into use. Considerable attention has also been given to various methods of tunnelling, well drilling, etc., and considerable space might be given to tabulating the many arts and manufactures which these patents cover. Probably the greatest German inventive activity has been in connection with the manufacture of, and various processes involved in dyeing, for which numerous patents are applied for every year by one of the large firms in Germany. There is no reason why the chemical industry should not be developed to a greater extent in Canada, and under the circumstances which at present exist, this country is in a position to undertake enterprises which have been practically unknown here previously. The public, however, seem to be extremely loth to take advantage of the opportunity which is knocking at their door, whilst they are bemoaning their fate as sufferers under present conditions. It is well to impress upon that class of the progressive community who are responsible for the furthering of industry, that these patents do exist, and that the profits of their production are to be had for the asking.

Procedure to Secure Licenses.

It is not to be considered that because comparatively few German inventions are widely known in this country, that is, along lines which especially appeal to the average reader of this journal, that such inventions are not protected. Every person is not acquainted with patents sufficiently to be able to see just where these opportunities lie, but it is not at all difficult to have a search made to ascertain just what patents have been issued to patentees at war with us, along such lines as the person may be interested in.

After deciding that a certain patent would repay one for the cost and trouble of manufacture, it is well as a precautionary measure to obtain an abstract of the case to ascertain what assignments, if any, have been registered, after which the application for avoidance should be made to the Commissioner of Patents, by means of a petition as prescribed in the Act. The acceptance of assignments which may be offered by an enemy patentee for what may appear to be an exceptionally reasonable sum, should be avoided as such assignments are liable to be declared invalid.

GOLD-BEARING GRAVELS OF BEAUCE COUNTY, QUEBEC*

By J. B. Tyrrell.

A short time ago I paid a visit to the alluvial gold fields on the tributaries of the Chaudiere river in Beauce County, Quebec, in company with A. O. Dufresne, late manager of the Champs d'Or Rigaud-Vaudreuil, and now Assistant to the Superintendent of Mines of the Province of Quebec. As the conditions under which the gold occurs in this district are not very generally known, and present some interesting features, a brief description of these conditions, and a consideration of the causes which gave rise to them, may be of interest to other mining engineers.

During the latter half of last century the country was visited by many mining engineers and geologists, and many references to it may be found in the reports of the Geological Survey of Canada between 1848 and 1911. The most important of these are by J. A. Dresser and J. Keele and the late Robert Chalmers. The Department of Colonization and Mines of the Provnce of Quebec also published a report with map on the district by J. Obalski.

From the earliest times the valley of the Chaudiere river formed one of the main avenues of approach to the St. Lawrence in the vicinity of Quebec from the country to the south as far as the seaboard of the States of Maine and Massachusetts. The Indians had a well-known trail along the banks of the stream, and armed troops and foraging parties constantly moved backward and forward along it between Quebec and New England in those insecure times before the ceding of Canada to Great Britain.

Discovery of Gold.

In 1823 or 1824, a woman first discovered gold in the Chaudiere Valley near the mouth of Gilbert river. No attention was paid to the discovery, but in 1834 a young girl named Clothilde Gilbert, taking a horse to water, found in the creek, close to the location of the previous discovery, a nugget of gold weighing 44 dwt. Eleven years later the DeLery family, owners of the seigniory of Rigaud-Vaudreuil, obtained a patent from the Crown giving them exclusive privileges forever to mine the precious metals within their seigniory.

In 1847, the year before gold was discovered in California, the Chaudiere Mining Co., which leased the mining rights from Mr. DeLery, mined gold on the Gilbert and Des Plantes rivers, and during the three following years continued to operate on the Gilbert river.

In 1851, the mining rights of the whole seigniory were leased to Dr. James Douglas and others of Quebec, who continued operations, chiefly on the Gilbert river, until 1864. After this date mining was prosecuted with more or less activity for about 30 years.

In all, up to the end of the century, about $2,000,000 worth of gold was extracted from the gravels of the Gilbert river valley, while it would seem that about $500,000 worth of gold was extracted from the gravel of the other tributaries of the Chaudiere river.

Character of Country.

That portion of the watershed of the Chaudiere river and its tributaries, from whose buried gravels gold to the value of $2,500,000 has been extracted, extends for twenty miles in the direction of the valley, and six miles transverse to it, forming a block of land about 120 square miles in area, in which placer mining has been more or less systematically prosecuted. It lies in Beauce County, Quebec, 50 miles southeast of the city of Quebec, and 25 miles west of the International Boundary Line between Quebec and the State of Maine. The principal town is Beauceville, with 1,700 inhabitants, situated on both banks of the river at an elevation of 500 ft. above the sea, with hills rising to heights of 600 or 700 ft. both to the northeast and southwest of it. Transportation to or from the district is afforded by the Quebec Central Railway, which at the present time runs two passenger trains a day each way to and from Quebec. The railway runs up the valley of the Chaudiere river through a number of small prosperous towns which are located on the bank of the stream, while back from the river the country is laid out in farms which are for the most part cleared of timber and in a good state of cultivation. Two wagon roads run up the valley, one on each side of the stream, and the method which has been generally adopted here, as elsewhere in Quebec, of surveying farms with a narrow frontage on the river and a long extension back from it, permits the farmers to live moderately close to one another beside the main roads, giving these roads the appearance of long-extended scattered villages.

The country in which the gold-bearing district is situated is a dissected plain or tableland with a mean elevation of 1,000 or 1,100 ft. above the sea, lying between two old and greatly degraded mountain ranges.

These mountains are the northern extensions of the Green Mountains of Vermont and the White Mountains of New Hampshire. They run in two parallel chains about 50 miles apart northeastward from the International Boundary into the Gaspe Peninsula. The stronger chain, which has been called the Megantic Range, runs along the International Boundary Line, and some of its peaks rise to heights of 2,500 or 3,000 ft. above the sea. Some of the peaks of the other chain, known as the Sutton Range, rise as high as those farther to the southeast, but taken as a whole this range is the lower of the two.

Between these two ranges of mountains lies an extensive tableland which has been worn down by long-continued atmospheric erosion into rounded hills and wide valleys. The summits of the hills are covered with a thin mantle of glacial drift, while the lower slopes are rounded up by a thicker layer of the same unassorted material. In their native condition the hills were completely covered by magnificent forests of pine and maple, now largely cut down since the land has been brought under cultivation.

Drainage.

The general direction of the drainage from this tableland is either northeastward or southwestward, parallel to the mountains. Nevertheless, it is trenched across, and the Sutton Mountains are cut through by the great transverse valley of the Chaudiere, which collects the water from the many normal longitudinal streams, and carries it down into the St. Lawrence river. This valley has been cut deep into the old plateau and has reached a fairly mature condition, with gentle slopes descending from the high lands on both sides to the river, which has a moderate and fairly regular grade of about 8 ft.

*Extracts from a paper presented at the New York Meeting of the American Institute of Mining Engineers, February, 1915.

to the mile from the upper portion of the area under consideration to the St. Lawrence river. Such minor obstructions as do occur in the stream, as at the Devils' rapids, have probably been caused by diversion of the river from its old channel by glacial agencies.

Structural Geology.

The rocks that compose the Sutton and Megantic mountains are pre-Cambrian gneisses, and talcose, chloritic, and micaceous schists.

Between these mountain ranges, in the region of the Chaudiere, the plateau country is underlain by green and reddish slates, quartzites, and sandstones, which are stated by the officers of the Geological Survey of Canada to be of Cambrian and Cambro-Silurian age. In many cases these slates, etc., present a remarkable similarity to the pre-Cambrian slates and schists of Keewatin age in northern and western Ontario. Some of the slates are ordinary water-worn sediments, while others have recently been proved to be ash rocks, or similar rocks of igneous origin.

These rocks were deposited in a horizontal attitude in the seas of the Paleozoic era, but have been squeezed and crushed so that they are now generally steeply inclined or even vertical, and strike about N. 45° E., parallel with the mountain ranges.

Through the schists and slates, dikes and bosses of igneous rock, varying in character from peridotite to quartz-porphyry, have been injected. It is highly probable that some of the igneous rocks intercalated with the slates were injected into them as sills or laccoliths before they were tilted and folded into their present attitude, but some of the dikes are doubtless subsequent to the folding. However, it is significant of the age of the igneous rocks associated with the gold-bearing gravels in the vicinity of Beauceville, that some of the green schists, associated with and included in the folding of the Cambro-Silurian rock in the valleys of Mill creek and Chaudiere river, were found to be volcanic rhyolite tuffs, while the igneous rocks in the vicinity are quartz-porphyries of similar composition, and probably of somewhat similar age.

In the valley of Gilbert river, from which most gold has been collected, quartz-porphyries and acid intrusives, either sills or dikes, are particularly abundant. In the vicinity of many of the more acid intrusives quartz veins have been found to occur containing more or less gold associated with such sulphides as pyrite, chalcopyrite and galena. These are all the hard rocks known to exist in the district under consideration, and such sediments as overlie them consist of unconsolidated material of very much younger age.

The oldest of the later sediments consist of thin beds of stratified gravel extending down the bottoms of the valleys, but of no considerable lateral extent. In places they contain grains and nuggets of gold. Overlying these gravels is a varying thickness, sometimes as much as 100 ft., of unassorted and unstratified boulder clay. Other and later sands and gravels also occur in gorges in the bottoms of the valleys, which also contain a small quantity of gold. Overlying these is a second thickness of boulder clay. Finally there is gravel in the bottoms of the present streams.

Historical Geology, Beauce County Gold Field.

The sequence of events which led up to the formation of these buried gold-bearing gravel deposits was about as follows:

After both the igneous and sedimentary rocks of early Paleozoic and pre-Paleozoic times had been formed or deposited and had been intensely crushed and folded into what must have been a range of mountains, they appear to have been intruded by dikes of the following igneous rocks: Peridotite, pyroxenite, gabbro and diabase, granite, quartz-porphyry, etc.

Subsequent to these intrusions, probably to the last of them, the rocks were again subjected to heavy strains, so that they were still further fractured. Into some of the more acid of the igneous rocks (whether dikes or sills is not always certain), siliceous waters carrying sulphides of iron and copper, with native gold, were introduced along the fractures, also from these fractures the gold-bearing solutions seeped out into the adjoining rocks, forming quartz veins and pyritized zones carrying a smaller or larger percentage of gold. Thus the veins were formed from which the grains and nuggets of gold found in the valley gravels have undoubtedly been derived.

Toward the close of the Paleozoic era, and after the rocks had assumed a fairly stable condition, the whole country was raised above the level of the sea, and since that time it would appear to have remained above sea level, and to have been exposed constantly to the influence of atmospheric and stream erosion and denudation. During this vast period of time, extending from the end of the Paleozoic era, to the present, an enormous thickness of rock was undoubtedly removed from the general surface, and as the softer rocks would be worn away faster than the harder ones, the latter remained as higher points and ridges.

At first the water which drained from the district would flow downward to the sea over the lowest parts of the surface, irrespective of the hardness of the rocks of which this surface was composed, and water courses so begun might persist to the present. The great valley of the Chaudiere is probably such a persistent water course, while the smaller streams have been cut off from their direct connection with the sea, and have been obliged to become tributary to the Chaudiere, their courses being finally determined by the varying characters of the underlying rock.

While the surface was being decomposed through the agencies of air and moisture, with the help of plants and animals, the decomposed rock was constantly being carried downward by the rills and streams, and at the same time was being assorted into heavier and lighter portions. In this process the coarser and heavier portions constantly lagged behind and became entrapped by the inequalities of the underlying rock, while the smaller and lighter portions were carried down into the main channel of the Chaudiere river, and thence into the sea.

In this way, during the long period which intervened between the uplift near the close of the Paleozoic era and the beginning of the Pleistocene period, the country was worn down, possibly from a high range of mountains, to a fairly mature physiographic relief, in which rocky cliffs and gorges were unknown, and the slopes of the hills were everywhere gentle, with coverings of decomposed residual rock. Also in the bottoms of the wide valleys the streams flowed with gentle regular current without rapids or waterfalls. In and beside these streams were deposits of sand and gravel which undoubtedly contained most of the heavy minerals that had been washed down from the adjoining hills during the whole period of their long-continued erosion, unless these minerals had been carried away in solution, or were in a sufficiently fine state of division to have been transported to the sea with the lighter sediments. Of

these heavy minerals the most important, and at the same time the most persistent, was gold.

The general relief of the country at the beginning of the Pleistocene period would have been very much like that of the Klondike district, in Yukon Territory, at present, particularly those parts of the Klondike drained by Dominion creek and Indian river, where later gorges have not been developed; with this difference, that the Quebec slopes were easier and the whole topography was more mature.

Another point of similarity between the two districts is, that throughout the whole time when active erosion was in progress the drainage of the country was local and the whole of the gravel concentrated in the bottom of any valley was derived from that particular valley or its tributaries, and not from a foreign valley.

Again, the gravel in the bottom of a valley was the ultimate concentrate from the vast quantity of material which had been eroded from that valley, possibly aggregating many cubic miles of rock, and consequently if the gravel was rich in gold it was due to the quantity of rock concentrated, rather than to the original high gold tenor of the rock.*

At the beginning of the Pleistocene period there was a break in the continuous course of atmospheric and stream erosion which had been in progress throughout the Mesozoic and Tertiary epochs, for snow and ice began to collect in great quantity on the Adirondack Mountains to the south, and from this center or gathering ground the ice moved northwestward down the valley of the Chaudiere river, across the hills which flank it on both sides, and over the valleys of the tributaries which flow into it approximately at right angles to its course, until it stopped in the vicinity of the south bank of the St. Lawrence river.

From the standpoint of the miner engaged in the exploitation of alluvial gold-bearing deposits, this first ice invasion from the south is of great interest, for, inasmuch as it moved down the Chaudiere valley, where this valley runs northwestward, it doubtless removed any stratified sand and gravel which may have been in the bottom of those portions of the valley so oriented, and at the same time it rounded up the sides of the valley, and filled in the mouths of the lateral valleys with debris collected from the valley itself or from the sides of the adjoining hills. During its later waning stages it probably also left lateral moraines on both sides of the valley.

When at its greatest extent, this Adirondack glacier covered the higher lands and moved over the valleys of the tributaries of the Chaudiere river which were transverse to its general course. In these cases it moved the decomposed rock from the summits and the south sides of the ridges down into the valleys and covered the gravel, which had previously been deposited there, with a coating of boulder clay or till.

In most cases, as in the valley of the Gilbert river, the glacier had lost the greater part of its pushing power when it reached the lower levels, so that it left the gravels undisturbed and merely covered them with its heavy coating of dirt brought from above. In some cases, as in some places on the banks of Meules creek, there was still a little vertical energy left in the glacier when it reached the bottom of the valley, and so it kneaded up the sand and gravel into a compact unstratified mass of water worn material a few feet in thickness before covering it with unassorted till.

While this northwestward moving glacier pushed a certain quantity of loose unassorted material into these smaller transverse valleys it did not fill them, but deposited its load on their southern slopes, and consequently when it retired it left the new bottoms of these valleys farther north than they were before, while the old pre-glacial gravels in the original bottoms of the valleys were buried under the talus of rock debris to the south.

When the Adirondack ice withdrew from the country at the close of the first glacial period, the brooks and rivers flowed in the same valleys which they had occupied before the ice invasion, but as the bottoms of the transverse valleys had been moved toward the northwest the streams naturally adopted the lowest parts of the valleys, and therefore now flowed in channels northwest of their former channels, and usually at somewhat higher elevation; at the same time they were cut off from the main Chaudiere valley by the ridges or lateral moraines which had been piled up along its sides. Consequently, in their endeavor to reach the main stream, the lateral brooks cut new gorges in the bottoms of the valleys northwest of the old channels, but their sides remained steep, for the period during which the country was free from ice does not appear to have been sufficiently long to have permitted of the grading of the sides of these second gorges to gradual slopes. One of these interglacial gorges has been outlined by shafts and drill holes on the northwest side of Meules creek.

After the deep, narrow, interglacial gorges had been formed the country was again, and probably more deeply, covered with ice, but on this occasion the ice accumulated on the Laurentian hills north of the St. Lawrence and then moved southward and southeastward across the St. Lawrence river and up the long slope south of it for about 100 miles almost to the summit of the Megantic range of mountains on the International Boundary line. This second invasion of ice therefore moved up the valley of the Chaudiere river in the opposite direction to that in which it had moved on the former occasion. Again it scored out and smoothed off the bottom and sides of the main valley. Also, as it passed over the valleys tributary to the main valley, and at right angles to its course, it pushed such decomposed and broken rock as it was able to collect down into these valleys, covering their

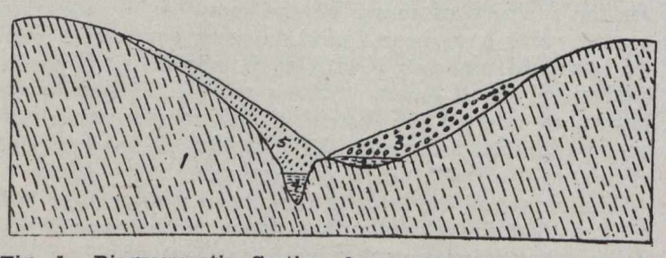

Fig. 1.—Diagrammatic Section Across the Valley of Meules Creek, Which Flows Northeastward into the Chaudiere River.
1.—Paleozoic slate.
2.—Pre-glacial gold-bearing gravel.
3.—Boulder clay of the Adirondack glacier from the southeast.
4.—Interglacial sand and gravel.
5.—Boulder clay of the Laurentian glacier from the northwest.

northern sides with debris and filling in and covering up the interglacial gorges which had recently been cut in them, but it did not completely fill the valleys with boulder clay, so that when this glacier in its turn melted away and disappeared, and open streams again began to drain the country, they flowed in channels independent of either of the earlier channels, and in some cases at least, intermediate between them.

Since the close of the last glacial period, when the ice finally retired from the country and left it in

*Cf. The Gold of the Klondike, by J. B. Tyrrell, Transactions of the Royal Society of Canada, vol. vi, New Series, Sect. 4, pp. 29 to 59 (1912), and The Law of the Paystreak in Placer Deposits, by J. B. Tyrrell, Transactions of the Institution of Mining and Metallurgy, vol. xxi, pp. 593 to 613 (1912).

much the same condition as it is at the present time, the streams in the transverse valleys are again cutting new channels for themselves in the bottoms of the valleys through the covering of clay and down into the underlying rock on lines indepedent of the earlier channels.

A striking feature of the new system of drainage which prevails in the country at the present time is that the lateral streams discharge into the main valley of the Chaudiere over rapids or waterfalls from "hanging valleys." This condition indicates clearly that the lower parts of these lateral streams are not now occupying their old pre-glacial or interglacial channels. In no case was I able to learn of either one or the other of the old channels having been traced all the way down into the Chaudiere channel.

When the ice had finally retired it left the whole country, both hills and valleys, covered with a sheet of glacial drift. On the hills this sheet is usually thin, while in some parts of the valleys it may reach a thickness of 100 feet.

This sketch of the causes which led to the formation of the beds of gold-bearing alluvial gravels, and of the methods which Nature adopted in giving them their present characteristics, and in hiding them in their present obscure locations, may be summarized as follows:

Summary of Gold Conditions, Beauce County, Quebec.

1. Gold was probably introduced into the folded Paleozoic rocks subsequent to, but in close association with, sills or dikes of acid rocks, such as quartz or granite-porphyry.

2. It was introduced along with pyrite and other sulphides in siliceous water which formed quartz veins in or near these dikes, etc.

3. Toward the close of the Paleozoic era the country was raised above the level of the sea, and has remained above the sea until the present time.

4. Throughout the most of this immensely long period, until the beginning of the Pleistocene period, it was constantly suffering erosion from atmospheric and stream agencies, and it was worn down to a fairly mature condition with gently sloping hills and wide valleys.

5. When gold occurred in these hills it had been washed down through countless ages into the bottoms of the valleys, and was concentrated in the alluvial gravels beneath and beside the streams.

Many streams throughout northern Canada which flowed over gold-bearing rocks must also have had gold-bearing gravel in their beds in pre-glacial times. In most cases, however, the subsequent glaciation was sufficiently severe to have carried away all this gravel, while in the Chaudiere district the glaciation was less severe, and some of the gravel was left in place.

6. After this long period of erosion and concentration a great glacier formed on the summit of the Adirondack Mountains and moved northwestward over the country toward the St. Lawrence river. On its way it crossed the valleys which lay transverse to its course, and buried some of the gravel which lay in the bottoms of those valleys under a heavy mantle of boulder clay. Sometimes the gravel was left quite undisturbed in its original condition, sometimes it was kneaded together so that its stratified character was obliterated. It is chiefly from these pre-glacial beds of gravel that gold has been extracted.

As the glacier moved directly down the Chaudiere valley it probably scored out most, if not all, of the gravel which had accumulated in it, though up to the present time this question does not appear to have been definitely settled, for the bottom of the valley has not been thoroughly prospected either by shafts or drill holes. At one place, namely at Devil's rapids, gold has been found in the Chaudiere river, but here the stream is flowing for a short distance transverse to the general direction of the valley and the course of glaciation.

7. After the Adirondack glacier had retired, new and narrow channels were cut by the transverse streams in the bottoms of the transverse valleys, to the north of the old pre-glacial channels. These contain a small quantity of gold, but the interglacial period was not sufficiently long to permit of the concentration of much gold in them, so that except where they may possibly have cut into or across the earlier pre-glacial channels they have not proved, and are not likely to prove, rich in gold content.

Up to the present time interglacial channels do not appear to have been distinguished from pre-glacial ones, and doubtless some of the failures which have occurred in the district have been caused by expending time and energy on the buried, but poor, interglacial channels, under the impression that they were the rich pre-glacial channels.

8. After the interglacial channels were formed another glacier advanced across the country from the northwest and buried these channels under another and later sheet of boulder clay.

9. When this glacier retired from the country the streams began to cut out their present channels, which are independent of the two former sets, but as yet no large quantity of gold has been concentrated into these new channels.

Whether all the buried gold-bearing gravels have been discovered or not will not be discussed here, but it may be pointed out that the pre-glacial channels of the lateral streams, which in their upper courses are gold-bearing, do not appear in a single case to have been traced down to their junctions with the main valley of the Chaudiere river, though it is reasonably certain, from the mature character of the topography throughout the country, that such channels are continuous without falls or interruption from the lateral valleys into the main valley.

Character of Bedrock.

The bedrock underlying the pre-glacial gold-bearing gravels consists chiefly of green and grey chloritic and quartzitic slates striking N. 45°E. and dipping southeastward at an angle of 70° or steeper. Where these slates are overlain by pre-glacial gravels they are rough and uneven and form excellent natural riffles, so that the gold was collected either in the inequalities of their surface, or immediately above them, and they have not been smoothed and polished by glacial agencies like the rocks of the adjoining hills.

On the Gilbert river and in other localities these slates were intruded by sills or dikes of quartz-porphyry, and these sills or dikes occur at places which are said to have been the most productive in the whole area; but in the absence of personal observation of the old mines it is impossible for me to say what effect the character of this bedrock had on the pay streak in the old channels.

Character of Gold.

The gold obtained from the gravels of the tributaries of the Chaudiere river is mostly such as is usually known to placer miners as coarse gold, very little

of it being in the form of very minute flakes or particles. There can be little doubt but that the fine gold existed in the veins from which the placer gold was originally derived, but if it did it was carried farther down the streams and much of it was probably deposited in the gravels of the Chaudiere river. One nugget was found on the Gilbert river which weighed 51 oz., 18 dwt., 6 grains, another weighed 45 oz., 12 dwt., while another nugget found on the same river weighed 42 oz.

Last summer Louis Matthieu recovered 50 oz. of gold from the gravels of Meules creek, all of which was quite coarse and granular. The largest nugget weighed between 2 and 3 oz., while the next largest, which I obtained, weighed 24 dwt., 12 grains.

Mr. Obalski gives the fineness of two samples of gold as 874 and 879, equal to a value of $18.06 to $18.15, and these may be considered as representing the average fineness of the gold of the district.

Methods of Mining.

In the earliest days of mining in the district the gravel was collected from the bars in the river, probably where the river crossed or cut into one of the old channels, and was washed in a gold pan or in a cradle or rocker to recover the gold.

Afterward some parts of the pre-glacial channels were discovered which were covered with but thin layers of boulder clay. The boulder clay was thrown to one side, and the underlying gravel was shoveled from the open pits into sluice boxes, supplied with water from higher up the river, and the gold was collected in the boxes.

At a later period the rich gravels were found under a heavy overburden of boulder clay, in places 60 or 70 ft. thick. In some cases this buried gravel was reached by tunnels driven into the sides of the hills, and in other cases by vertical shafts sunk to it. From the end of the tunnels and from the bottoms of the shafts as much of the gravel and underlying bedrock as contained gold was mined and brought to the surface, where it was washed in sluice boxes as before, and the gold extracted.

Four or five years ago a much more ambitious plant was installed on Meules creek. A ditch 7 miles long was dug from Lake Fortin, at the head of Mill creek, in which water was conducted to a penstock on the high ground south of Meules creek. Thence it was conducted in a pipe to a point on Meules creek where hydraulic operations had been determined upon, the head of the water at this point being 260 ft. Here one or more hydraulic giants were installed and through them the water was projected against the south side of the valley, and the gravel and debris were washed down and run through a sluice to collect the gold. At the tail of the sluice a bucket elevator picked up the tailings and stacked them lower down the valley. Unfortunately, the operations do not appear to have been financially successful, for the bank which it was proposed to wash down proved to consist of boulder clay, with but a thin layer of reassorted pre-glacial material beneath it, which was not sufficiently rich to compensate for the poverty of the boulder clay above. The plant has not been in operation for the past two summers.

During the past summer a few tributers or laymen were working in a small way "shovelling in" on Meules creek, with the result stated at the beginning of this paper, but mining work appears to have ceased on Gilbert, Des Plantes and other streams in the vicinity some years ago.

MINE FATALITIES IN BRITISH COLUMBIA.

A statement of coal and metal mine fatalities in British Columbia for the fourth quarter of 1914, compiled by Mr. Thomas Graham, Chief Inspector of Mines for the Province, has been printed and distributed. Reports received from the district inspectors of mines and from the operating mining companies show that during the quarter ended December 31 there were four fatalities in and around coal mines, but not any in or about the metal mines of the Province. During the corresponding period of 1913 there were four fatalities at coal mines and three at metalliferous mines. Taking the figures for the whole of the calendar year 1914, it is shown that there were 17 men killed in and about coal mines as compared with 27 in 1913, and 19 in and about metal mines, against 13 in 1913.

The coal mine fatalities in 1914 took place at the following collieries: Canadian Pacific Railway Co.'s Hosmer colliery, 3; Crow's Nest Pass Coal Co.'s Michel colliery, 1, and Coal Creek colliery, 3; Canadian Collieries (Dunsmuir), Ltd., Cumberland, Vancouver island, 6; Western Fuel Co.'s colliery, Nanaimo, Vancouver island, 4. The metalliferous mines at which lives were lost were: Rambler-Cariboo, Slocan, 1; Centre Star and War Eagle, Rossland, 1 each; Golden Horn, Ymir, 1; mines in Boundary district, Jewel-Denero, 2; Rawhide, 2; and Granby Co.'s mines, 5; Nickel plate, Similkameen, 1; Britannia, Howe Sound, 2; and Hidden Creek, in Skeena mining division, 3.

Causes of death were: At the coal mines, falls of roof and rock 2, falls of coal 1, mine cars and haulage 6, suffocation on fine coal 2, returning on unexploded shot 2, electricity 1, coke-oven larry 1, cage 1, falling off bucket 1; total 17. At metal mines, picking or drilling into unexploded powder 1, premature blasts 5, gassing or suffocation from powder fumes 3, falling in chutes or winzes 1, falls of ground 3, mine cars and haulage 1, returning on unexploded shot 1, slide of rock off quarry face 3, aerial tramway 1; total 19.

NEW JERSEY ZINC CO.

The real aristocrat among the American-owned zinc properties is the New Jersey Zinc Co. Its profits at the present time are little short of fabulous.

This company excels all others in the amount of spelter produced and marketed annually but owing to the closeness with which the stock is held nothing regarding earnings has ever come to light.

The company has been a big dividend payer for years having maintained a rate of $20 a share and paid extras in addition. In 1913 three "extras" of $10 each were paid making $50 for the year. Capital stock is $10,000,000; bonds $4,000,000. The last known sale of the stock was last fall at $525 a share. Current quotations range from $550 bid to $590 asked.

Last year the New Jersey Co. produced approximately 100,000 tons of spelter of a total of 349,000 tons in the whole country.

The company's Franklin Furnace mines in New Jersey yield the highest grade spelter in existence, this brand being marketed as "Horsehead." It always commands the highest premium over the prime western grades, being now quoted at about 18 cents a pound.

The New Jersey Zinc Co. does not, however, confine its operations to spelter alone for it produces as well sulphuric acid and other by-products. Not only does the company own and operate mines, but it buys ores and concentrates for smelting. It recently imported 10,000 tons of concentrates from Australia.—Boston News Bureau.

PRELIMINARY REPORT OF THE MINERAL PRODUCTION OF CANADA, 1914

By John McLeish, Chief of the Division of Mineral Resources and Statistics.

The preliminary report on the mineral production of Canada in 1914 presented herein shows a total value of the production during the year just closed of $128,475,499. The total value of the production in 1913 was $145,634,812 compared with which the 1914 output shows a decrease of $17,159,313 or 11.8 per cent. The average production per capita was $15.91 as against $18.77 in 1913; $18.27 in 1912, and $14.93 in 1910.

The production of the more important metals and minerals is shown in the following tabulated statement in which the figures are given for the two years 1913 and 1914 in comparative form.

	1913.		1914.	
	Quantity	Value	Quantity	Value
Copper, lbs.	76,976,925	$11,753,606	75,738,386	$10,301,935
Gold, ozs.	802,973	16,598,923	770,374	15,925,044
*Pig iron, tons	1,128,967	16,540,012	783,164	10,002,856
Lead, lbs.	37,662,703	1,754,705	36,337,765	1,627,568
Nickel, lbs.	49,676,772	14,903,032	45,517,937	13,655,381
Silver, oz.	31,845,803	19,040,924	27,544,231	15,097,269
Other metallic pro.		1,313,732		1,123,919
Total.		81,904,934		67,733,972
Less pig iron credited to imported ores, tons	1,055,459	15,543,583	687,420	8,863,944
Total metallic		66,361,351		58,870,028
Asbestos and Asbestic, tons	161,086	3,849,925	117,573	2,909,806
Coal, tons	15,012,178	37,334,940	13,594,984	33,433,108
Gypsum, tons	636,370	1,447,739	510,663	1,137,157
Natural gas, M. ft.	20,477,838	3,309,381	21,047,028	3,511,302
Petroleum, bbls.	228,080	406,439	214,805	343,124
Pyrites, tons	158,566	521,181	224,958	735,514
Salt, tons	100,791	491,280	107,038	493,648
Cement, bbls.	8,658,805	11,019,418	7,172,480	9,187,924
Clay products		9,504,314		7,090,898
Lime, bush.	7,558,484	1,609,398	6,245,189	1,247,517
Stone.		5,504,639		5,593,485
Mis. non-metallic		4,274,807		3,921,988
Total non-metallic		79,273,461		69,605,471
Grand total		145,634,812		128,475,499

*Short tons throughout.

In presenting a total valuation of the mineral production as is here given, it should be explained that the production of the metals copper, gold, lead, nickel and silver is given as far as possible on the basis of the quantities of metals recovered in smelters in Canada, or probably recovered from ores exported, and the total quantities in each case are valued at the average market price of the refined metal in a generally recognized market.

The quantities thus given will differ from those which represent metal contents of ore shipped by amounts due (1) to losses in smelting (2) to the "lag" or lapse of time between the ore shipment and its treatment in the smelter. Thus the production of refined lead during the past two years has been very much lower than that reported as contained in ores shipped from the mines, the difference being due both to smelter losses and the large accumulation of ore at the smelter.

The metal miner is usually paid for his product on the basis of the value of the refined metals less a variety of deductions and in many cases it would be exceedingly difficult to obtain a record of the net value received. It is for this reason and for the facility of comparisons that the refined values are used.

It will be observed that there has been a general falling off in the production of nearly all mine products, the notable exceptions being, pyrites, salt, and natural gas. In the case of pyrites there is an increase of about 42 per cent, and about 6 per cent in quantity of salt produced. The number of cu. ft. of natural gas produced shows an increase of about 3 per cent, with an increase of over 6 per cent in value.

The falling off in the production of the metals is no doubt to be ascribed in large measure to the conditions resulting from the war. Especially is this true in the case of the metals: copper, nickel, and silver. The cutting off of markets and the closing of metal exchanges with the consequent cessation of market quotations resulted in the almost immediate closing down or restriction of operation at many properties. However, before the close of the year, many of these adverse conditions had been adjusted although prices had fallen considerably.

The actual quantities of copper and lead produced were but little less than in the previous year; nickel showed a decrease of 8 per cent, and silver of 13.5 per cent in quantity.

The total values, because of lower prices, showed much larger percentage decreases.

The iron industry was undoubtedly affected by industrial conditions of depression and shows a falling off of 30 per cent in tonnage of pig iron made.

The total value of the metallic production in 1914 was $58,870,028 as against $66,361,351, a decrease of $7,491,323 or 11 per cent.

The production of non-metallic products also shows a large falling off in 1914, the total value for the year being $69,605,471 as against $79,273,461 in 1913, a decrease of $9,667,990 or 12.19 per cent.

The decrease is most pronounced in the case of coal, asbestos and gypsum and in those products such as cement, clay products (building brick, sewer pipe, etc.) and lime, generally classed as structural materials, although there was a small increase in the production of stone quarries.

Industrial depression the culmination of over development and extravagant land speculation is largely responsible for this sudden reverse although the asbestos output would be restricted by the disturbance in foreign markets and the coal production would also be affected by the restricted metallurgical operations. Reference has already been made to the increased production of pyrites, salt and natural gas.

There were also slight increases in the production of white arsenic, feldspar, grindstones, ochres, phosphate and tripolite. Asbestos shows a decrease of 27 per cent in tonnage and 24 per cent in value, coal a decrease of 10 per cent. in tonnage and 9 per cent. in value, petroleum a decrease of 5.8 per cent. in quantity and 15.6 per cent in value, clay products 25 per cent in total value and lime 17.4 per cent in quantity and 22.5 per cent in value.

Mineral Production By Provinces 1913 and 1914.

	1913. Value of Production.	1914. Value of Production.
Nova Scotia	$19,376,183	$17,514,786
New Brunswick	1,102,613	1,034,706
Quebec	13,475,534	12,259,637
Ontario	59,167,749	52,147,973
Manitoba	2,214,496	2,428,902
Saskatchewan	881,142	710,840
Alberta	15,054,046	12,773,669
British Columbia	28,086,312	24,202,924
Yukon	6,276,737	5,402,062
Dominion	145,634,812	128,475,499

The record of production by provinces given in the above table shows the relative importance of the several provinces in the same order as the previous year. A decreased production is shown in each province with the exception of Manitoba and in this case the increase is due chiefly to the operation of the new cement mill near Winnipeg by the Canada Cement Co. and the inclusion of a more complete record of the production of sands and gravels. Ontario again has the largest output with a value of $52,147,973, or 40.59 per cent of the total, practically the same proportion as in the previous year. British Columbia is second with a value of $24,202,924 or 18.8 per cent of the total; Nova Scotia is third with a production valued at $17,514,786, or 13.6 per cent; Alberta fourth with $12,773,669 or 9.94 per cent; Quebec fifth with $12,259,637, or 9.5 per cent., Yukon sixth with $5.402,062 or 4.2 per cent; Manitoba seventh with $2,428,902 or 1.89 per cent; New Brunswick eighth with $1,034,706 and Sasketchewan ninth with $710,840, each less than one per cent.

Annual Mineral Production in Canada Since 1903.

	Value of production.	Value per capita.
1903	$61,740,513	$10.83
1904	60,082,771	10.27
1905	69,078,999	11.49
1906	79,286,697	12.81
1907	86,865,202	13.75
1908	85,557,101	13.16
1909	91,831,441	13.70
1910	106,823,623	14.93
1911	103,220,994	14.42
1912	135,048,296	18.27
1913	145,634,812	18.77
1914	128,475,499	15.91

The Mineral Production of Canada in 1914.

Subject to Revision.

Product.	Quantity.	Value.
Metallic.		
Copper, value at 13.602 cents per lb., lbs.	75,738,386	$10,301,935
Gold, ozs.	770,374	15,925,044
*Pig iron from Canadian ore, tons	95,744	1,138,912
*Iron ore sold for export, tons	60,410	135,300
Lead, value at 4.479c. per lb., lbs.	36,337,765	1,627,568
Nickel, value at 30c. per lb., lbs.	45,517,937	13,655,381
Silver, value at 54.811c. per oz., ozs.	27,544,231	15,097,269
Cobalt and nickel oxides, lbs.	1,387,101	595,999
Cobalt material and residues	.....	82,620
Zinc ore, tons	13,140	310,000
Total.	.....	58,870,028
Non-Metallic.		
Actinolite, tons	119	1,304
Arsenic, white, tons	1,737	104,015
Asbestos, tons	96,542	2,892,266
Asbestic, tons	21,031	17,540
Chromite, tons	136	1,210
Coal, tons	13,594,984	33,433,108
Corundum, tons	548	72,176
Feldspar, tons	18,060	70,824
Graphite, tons	1,647	107,203
Grindstones, tons	4,078	54,497
Gypsum, tons	510,663	1,137,157
Magnesite, tons	358	2,240
Manganese, tons	28	1,120
Mica, tons	.....	102,315
Mineral pigments—		
Barytes, tons	612	6,129
Ochres, tons	5,890	51,725
Mineral water	.....	122,574
Natural gas, M. cu. ft.	21,047,028	3,511,302
Peat, tons	685	2,470
Petroleum, bbls.	214,805	343,124
Phosphate, tons	954	7,275
Pyrites, tons	224,956	735,514
Quartz, tons	54,148	83,583
Salt, tons	107,038	493,648
Talc, tons	10,808	40,418
Tripolite, tons	650	13,000
Total.	.....	43,407,737
Structural Materials and Clay Products.		
Cement, Portland, bbls.	7,172,480	9,187,924
Clay products—		
Brick, common, pressed, paving	.....	4,809,046
Sewerpipe.	.....	1,102,100
Fireclay, drain tile, pottery, etc.	.....	1,169,752
Kaolin, tons	1,000	10,000
Lime, bush.	6,245,189	1,247,517
Sand and gravel	.....	2,448,738
Sand-lime brick	.....	624,335
Slate, sq.	1,075	4,837
Stone—		
Granite.	.....	2,179,930
Limestone.	.....	2,730,438
Marble (not complete)	.....	192,533
Sandstone.	.....	490,584
Total structural materials and clay products.	.....	26,197,734
All other non-metallic	.....	43,407,737
Total value, metallic	.....	58,870,028
Grand total, 1914	.....	128,475,499

*Tons of 2,000 lbs.

Metal Prices.

	1913. Cents.	1914. Cents.
Copper, New York	15.269	13.602
Lead, New York	4.370	3.862
Lead, London	4.072	4.146
Lead, Montreal	4.659	4.479
Nickel, New York	40.000	40.000
Silver, New York	59.791	54.811
Spelter, New York	5.648	5.213
Tin, New York	44.252	34.301

Smelter Production.

Statistics of the production of copper, lead, and silver smelters and refineries, showing the tonnage of ore treated, the matte, blister, base bullion, or refined metal produced, have been collected by the Mines Branch since 1908.

The total quantity of ores and concentrates treated in three smelters during 1914 was 2,649,935 tons (including 58,894 tons of imported ore), as compared with 3,037,391 tons in 1913. The largest proportion of the total tonnage, about 61 per cent. in 1914, consists of the copper-gold silver ores of British Columbia, chiefly from the Boundary (Phoenix and Greenwood), Rossland and Coast (Britannia, Texada Island and Granby Bay) districts. The nickel-copper ores of the Sudbury district, Ontario, contributed about 35.7 per cent of the tonnage, the balance being lead ores and other ores treated in lead furnaces and the silver cobalt ores of Ontario treated in silver smelters. Gold and silver ores treated by cyanide processes are not included in this record.

The quantities of the several classes of ores smelted during the past seven years, have been as follows:—

	Nickel-copper ores.	Silver-Cobalt ores.	Lead ores.	Copper-gold Silver ores.	Totals.
1908.....	360,180	7,182	53,545	1,797,488	2,218,395
1909.....	462,336	8,384	54,539	1,850,889	2,376,148
1910.....	628,947	9,466	57,549	1,987,752	2,683,714
1911.....	610,834	9,330	55,408	1,517,981	2,193,553
1912.....	725,065	8,097	59,932	2,212,316	3,005,410
1913.....	823,403	6,124	88,100	2,119,754	3,037,391
1914.....	947,053	5,661	71,064	1,612,197	2,649,935

The products obtained in Canada from the treatment of these ores include: pig lead produced at Kingston, Ont., (furnace idle in 1914); refined pig lead and lead pipe produced at Trail, B.C., and fine gold, fine silver copper sulphate and antimony produced from the residues of the Trail lead refinery; silver bullion, white arsenic, nickel oxide and cobalt oxide produced in Ontario from the Cobalt district ores. In addition to these refined products, blister copper, copper matte, nickel-copper matte, cobalt material or mixed nickel and cobalt oxides are produced and exported for refining.

The aggregate results of smelting and refining operations may be summarized as shown in the next table. Unfortunately the figures cannot be taken to represent the total production from smelting ores mined in Canada, since considerable quantities of copper and silver ore are still shipped to other smelters outside of Canada for smelting.

Smelter and Refinery Production in Canada.

Smelter products obtained and exported for refining	1911. Tons	1912. Tons	1913. Tons	1914. Tons
(1) Blister copper	10,710	17,063	15,270	13,238
(2) Copper matte	11,320	6,727	5,159	6,291
(3) Nickel-copper matte	32,607	41,925	47,150	46,396
(4) Cobalt material	630	642	122	101

	Refined products.	Metals contained in matte, blister, and base bullion
Gold, ozs.	11,088	170,818
Silver, ozs.	11,096,861	873,400
Lead, lbs.	36,443,706	.....
Copper, lbs.	.....	59,237,016
Copper sulphate, lbs.	152,060	.....
Nickel, lbs.	.....	45,517,937
Cobalt oxide, lbs.	895,789	.....
Nickel oxide, lbs.	391,312	.....
White arsenic, lbs.	3,474,322	.....

(1) Blister copper carrying gold and silver values.
(2) Copper matte carrying gold and silver values.
(3) Bessemer nickel-copper carrying small gold and silver values as well as metals, of the platinum group.
(4) Cobalt material carrying nickel and silver values.

Gold.

The total production of gold, in placer and mill bullion and in smelter products in 1914, is estimated at 770,374 fine ounces valued at $15,925,044 as compared with 802,973 fine ounces valued at $16,598,923 in 1913, showing a decrease of $673,879 or about 4 per cent.

Of the total production in 1914, about $5,695,508 was derived from placer and alluvial mining—$6,050,690 in bullion from milling ores, and $4,228,846 from matte, blister copper and other smelter products, etc. In 1913, of the total production, about $6,346,072 were derived from alluvial workings; $5,185,544 in bullion from milling ores, and $5,067,307 from smelter products derived from ores, concentrates, etc., smelted.

The production in Nova Scotia and Quebec is small compared with the other provinces but shows an increase of over 25 per cent in 1914.

The Ontario production $5,546,356 shows an increase of over a million dollars due to the extension of milling facilities in the Porcupine field.

No records have been received with respect to gold production in the Beaver Lake district of Saskatchewan or of recoveries from the river bars near Edmonton, Alberta, although activity has been reported in both localities.

The production in British Columbia was $5,177,343, of which $524,000 is credited to placer workings as estimated by the Provincial Mineralogist, and $4,653,343 to smelter products and bullion from milling ores. The British Columbia production in 1913 was $6,149,027, being $510,000 from placer workings, and $5,639,027 from smelter products and mill bullion.

The Yukon production shows a falling off of $721,384, the total in 1914 being $5,125,396 including a small value in mill bullion, as against $5,846,780 in 1913. The total amount on which royalty was paid during the year 1914, according to the records of the Mining Lands and Yukon Branch, Interior Department, was 309,691.17 oz. as against 352,900.04 ozs. in 1913.

The exports of gold bearing dust, nuggets, gold in ore, etc., in 1914, were valued at $15,242,200.

Silver.

The falling off in price of silver amounting to 4 cents on the average price for the year, the cessation of price quotations and the difficulties of marketing the metal immediately following the declaration of war restricted operations in the Cobalt camp, causing a lower production than might have been expected under normal conditions.

The total Canadian production in 1914 was 27,544,231 ozs. valued at $15,097,269, as against 31,845,803 ounces valued at $19,040,924 in 1913, a decrease of 4,301,572 ozs. or 13.5 per cent in quantity, and of $3,943,655, or 20.7 per cent in total value.

Of the total production 24,215,926 ozs. or 88 per cent is credited to Ontario. The production from the silver camps is reported as 9,614,069 fine ozs. in bullion shipped, and 14,544,524 ozs. (after deducting 5 per cent for smelter losses) contained in ore and concentrates shipped from Cobalt district. There is also included in the total a small quantity of silver contained in gold bullion shipped.

The Ontario production in 1913 was 28,411,261 ozs. showing a falling off for the province of 4,003,805 ozs. or about 14.1 per cent.

In addition to the bullion shipments from the Cobalt camp, 9,052,993 ozs. were produced in other silver refineries in the province, making a total of 18,667,062 ozs. or 67.7 per cent of the Ontario production recovered within the province in the form of bullion.

The production in British Columbia, representing refined silver and silver contained in smelter products and estimated recoveries from ores exported, was in 1914 about 3,212,111 ozs. as compared with 3,312,343 ozs. in 1913.

In Quebec province there is a small silver content in the pyrites ores shipped, while in the Yukon 67,432 ozs. are estimated as being contained in the placer gold produced and recovered from the copper ores shipped from Whitehorse.

The exports of silver bullion and silver in ore, etc., as reported by the Customs Department, were 28,020,089 ozs. valued at $15,584,813. There is also an importation recorded of silver in bars, blocks, etc., valued at $629,279.

The price of silver in New York reached a maximum of 59 cents during the first week of May but fell off to 49 cents during the last two months of the year.

Copper.

The copper situation in 1914 was marked by an increased production in Ontario and Quebec as against a falling off in British Columbia and the Yukon, leaving the net result as a very slight decrease.

The copper contained in matte, blister copper, etc., produced in Canadian smelters together with the estimated recoveries or amounts paid for in ores exported amounted in 1914 to 75,738,386 lbs. which, at the average New York value of refined copper, would be worth $10,301,935. Compared with the production in 1913, which was 76,976,925 lbs. valued at $11,753,606, there was a falling off of only 1,238,539 lbs. or 1.6 per cent, but, owing to the lower price, a much larger percentage decrease in total value.

The production in Quebec from pyrites ores was 4,201,497 lbs. as compared with 3,445,887 lbs in 1913. The actual copper content of the ores shipped was nearly 50 per cent. in excess of these figures, but only about two-thirds of the copper is reported as paid for.

The Ontario production is derived chiefly from the nickel-copper ores of the Sudbury district and of the Alexo mine, although there is a small amount of copper contained in the silver ores shipped from Cobalt, some of which is paid for. There was also a small shipment from the Dane mine on the T. & N. O. railway.

The production in 1914 is reported as 28,948,211 lbs. an increase of 3,062,282 lbs. over the 1913 output which was 25,885,929 lbs. The Mond Nickel Company contributed a much larger percentage of the total production during 1914 than in 1913, and, as this Company's ores are higher in copper than those being worked by the Canadian Copper Company, we have the perhaps somewhat unexpected result of a decrease

in nickel production accompanied by an increase in copper production from these Sudbury district ores.

The British Columbia production was 41,221,628 lbs. as against 45,791,579 lbs. in 1913, a falling off of 4,569,951 lbs. The Greenwood smelter closed down in August and the Grand Forks smelter restricted its operations very severely on the outbreak of war, but started up several furnaces again before the close of the year. The blowing in of the smelter at Anyox, treating the Hidden Creek and other coast ores, and the continuance of large shipments from the Britannia mine made the coast production slightly greater than that of the southern interior smelters and, with an increased production at Trail, almost compensated for the falling off in the Boundary district.

The Pueblo mine was again the principal copper producer in the Yukon with an output only slightly less than that in 1913.

The New York price of electrolytic copper fell off from 14.7 cents in February to 12.7 cents during the last week of July. Quotations ceased on the declaration of war but were resumed in November at a little over 11 cents, increasing to 13.2 cents in December. The average monthly price for the year was 13.602 cents as against 15.269 cents in 1913, and was with the exceptions of 1912 and 1913 the highest average since 1907.

There was a large falling off in the imports of copper of all kinds in 1914. The total imports were valued at $4,256,901 and included crude and manufactured copper, 28,280,812 lbs. valued at $3,983,322, copper sulphate 1,143,039 lbs. valued at $53,802 and other manufactures of copper valued at $219,777. The total imports in 1913 were valued at $7,415,008 and included crude and manufactured copper, 41,011,961 lbs. valued at $6,935,822, copper sulphate 2,037,714 lbs. valued at $107,960 and other manufactures valued at $371,226.

The exports of copper were: copper fine in ore, matte, etc., 68,830,059 lbs. valued at $7,130,778 and copper black or coarse, etc., 6,581,564 lbs. valued at $908,201, a total of 75,411,623 lbs. valued at $8,038,979.

Lead.

The smelter production of lead from Canadian ores in 1914 was 36,337,765 lbs. which valued at 4.479 cents per lb., the average price of pig lead in Montreal for the year, would be worth $1,627,568. The production in 1913 was 37,662,703 lbs. valued at $1,754,705. With the exception of a small tonnage from the Yukon, the 1914 production was entirely from British Columbia ores, and was almost all recovered at the Trail smelter.

The exports of lead in ore, etc., in 1914 are reported as 246,100 lbs. valued at $2,681 and of pig lead 510,573 lbs. valued at $19,507.

The total value of the imports of lead and lead products in 1914 was $1,042,538 and included old scrap and pig lead, 15,444,100 lbs. valued at $590,557, manufactured lead 3,394,930 lbs. valued at $186,165, manufactures n.o.p., $99,285, and litharge and lead pigments $166,531. The imports of litharge and pigment would contain approximately 1,449 tons of metallic lead and the total imports of metallic lead would therefore exceed 10,869 tons.

The average monthly price of lead in Montreal during 1914 was 4.479 cents as against 4.659 cents in 1913. This is the producer's price for lead in car lots as per quotations kindly furnished by Messrs. Thos. Robertson and Co.

The average monthly price of lead in New York was 3.862 cents and in London £19.079 per gross ton, equivalent to 4.146 cents per lb.

Nickel.

The declaration of war resulted in the almost immediate closing down of a considerable portion of the mining and smelting operations of the Canadian Copper Company in the Sudbury district, and although they were partially resumed before the close of the year the Company's output was greatly reduced. The Mond Nickel Company on the other hand, having increased the capacity of its smelter at Coniston, nearly doubled its output. Ores from the Alexo nickel north of Cobalt were also reduced in this smelter. Ten separate properties were worked by these companies.

The nickel-copper ore is reduced in smelters and converters to a Bessemer matte containing from 77 to 82 per cent of the combined metals and shipped in that form to Great Britain and the United States for refining; the product of the Canadian Copper Company going to New Jersey and that of the Mond Nickel Company to Wales. A portion of the matte produced by the Canadian Copper Company is used for the direct production of Monel metal, an alloy of nickel and copper, without the intermediate refining of either metal.

The total production of matte in 1914 was 46,396 tons valued by the producers at the smelters at $7,189,031, and containing 28,895,825 lbs. of copper and 45,517,937 lbs. of nickel. The tonnage of ore smelted (part being previously roasted) was 947,053. The production in 1913 was 47,150 tons of matte, containing 25,875,546 lbs. of copper and 49,676,772 lbs. of nickel, showing an increase in 1914 in copper content and a falling off in nickel.

There is also a small recovery of nickel in the form of nickel oxide from the Cobalt district ores, the production in 1914 being reported as 391,312 lbs. of oxide valued at $26,483.

The aggregate results of the smelting operations on nickel-copper ores during the past five years and the exports of nickel are shown in tabular form while a record taken from the "Foreign Commerce of the United States" has been added showing the imports of nickel into, and exports from that country. The values of the United States exports, which are not quoted in the tables, range from 31 to 39 cents per lb. and averaged about 34 cents in 1914.

It will be noted that a much larger quantity of nickel finds its way to the United Kingdom through United States refineries than is exported directly from Canada.

Exports of nickel from New Caledonia for the first seven months of 1914 are reported as 52,498 metric tons of ore and 2,275 tons matte, of which the total nickel content would probably not exceed 8,000,000 lbs.

The price of refined nickel in New York remained fairly constant throughout the year, quotations published by the Engineering and Mining Journal, 40 to 45 cents per lb. for nickel shot, blocks or plaquettes; electrolytic 5 cents higher per lb.

Production of Nickel in Canada.	1911. Tons of 2,000 lbs.	1912. Tons of 2,000 lbs.	1913. Tons of 2,000 lbs.	1914. Tons of 2,000 lbs.
Ore mined	612,511	737,584	784,697	1,000,364
Ore smelted	610,834	725,065	823,403	947,053
Bessemer matte pro...	32,607	41,925	47,150	46,396
Copper con. of matte..	8,966	11,116	12,938	14,448
Nickel con. of matte..	17,049	22,421	24,838	22,759
Spot value of matte...	$4,945,592	$6,303,102	$7,076,945	$7,189,031

Exports of Nickel Matte from Canada.	Lbs.	Lbs.	Lbs.	Lbs.
Nickel contained in matte, etc.—				
To Great Britain ...	5,023,393	5,072,867	5,164,512	10,291,979
To United States ...	27,596,578	39,148,993	44,224,119	36,015,642
To other countries .	.....	.....	70,386	220,706
	32,619,971	44,221,860	49,459,017	46,538,327

Imports of Nickel into United States.	1911.	1912.	1913.	1914.
Gross tons of ore and matte, tons	23,993	33,101	37,623	29,564
Nickel contents, lbs....	29,545,967	42,168,769	47,194,101	35,006,700
Exports of nickel from United States—				
To France, lbs.	5,463,358	5,083,947	3,631,858	3,457,157
To Netherlands, lbs.	9,101,150	7,387,447	6,622,811	855,168
To United Kingdom, lbs.	7,196,259	8,191,364	8,221,640	10,836,369
To other countries, lbs.	3,338,819	5,152,258	10,096,779	12,446,458
Total lbs.	25,099,586	25,815,016	29,173,088	27,595,152

Iron Ore.

The iron ore shipments from mines in Canada during 1914 are reported as 244,854 short tons valued at $542,041. These shipments included 199,292 tons of hematite and roasted siderite and 45,562 tons of magnetite and concentrates.

The total shipments of ore in 1913 were 307,634 tons including 92,386 tons of hematite and roasted siderite, 209,886 tons of magnetite and concentrates and 5,362 tons of titaniferous ore.

Exports of iron from Canada during 1914 were recorded by the Customs Department as 135,451 tons valued at $360,974.

According to mine operators' reports however 184,444 tons were shipped to Canadian smelters, and 60,410 tons were exported to the United States. The imports into the United States from Canada are also reported by the Washington Trade Statistics as 58,816 tons, valued at $153,415.

Imports of iron ore in 1914 were, according to Customs records, 1,147,108 tons, valued at $2,387,358.

Shipments of iron ore from the Wabana mines, Newfoundland, in 1914, by the two Canadian companies operating there were 639,430 short tons, of which 422,920 tons were shipped to Sydney, Cape Breton, and 216,510 tons to the United States and Europe. In 1913 the shipments were 1,605,920 short tons, of which 1,048,432 tons were shipped to Sydney, and 557,488 tons to the United States and Europe.

Pig Iron.

The total production of pig iron in Canadian blast furnaces in 1914 was 783,164 tons of 2,000 lbs., valued at approximately $10,002,856, as compared with 1,128,967 tons, valued at $16,540,012 in 1913. A large portion of this production is used directly in the manufacture of steel and the values are in part estimated. The output shows a falling off of 345,803 tons or 30.6 per cent. and is the smallest since 1909.

Of the total production in 1914, 9,380 tons were made with charcoal and 773,784 tons with coke. The classification of the production, according to the purpose for which it was intended, was as follows: Bessemer 230,817, basic 346,553, foundry and malleable 205,794.

The ore charged to blast furnaces included 182,964 tons of Canadian ore and 1,324,326 tons of imported ore, and 33,583 tons of mill cinder, etc. The amount of coke used during the year was 921,171 tons, comprising 330,269 tons from Canadian coal, and 590,902 tons of imported coke or coke made from imported coal. The quantity of charcoal fuel used was 920,045 bushels and of limestone flux 447,636 tons.

The number of men employed at blast furnaces was 1,018 and total wages paid $693,632.

The furnace plants operated for varying periods of time included those of the Dominion Iron & Steel Co., and the Nova Scotia Steel & Coal Co., at Sydney, and North Sydney; the Algoma Steel Co., at Sault St. Marie; the Steel Co. of Canada at Hamilton, the Standard Iron Co. at Deseronto, and the Canadian Iron Furnace Co. at Port Colborne. All other furnaces were idle throughout the year.

The production of pig iron by provinces in 1914 was as follows:

	1914.		
	Tons.	Value	Value per ton
Nova Scotia	227,052	2,951,676	$13.00
Ontario.	556,112	7,051,180	12.68
	783,164	10,002,856	12.77

There was also a production during 1914 in electric furnaces of 7,524 tons of ferro alloys (ferro-silicon and ferro-phosphorus) valued at $478,354, compared with 8,075 tons valued at $493,018 in 1913. This production is chiefly 50 per cent ferro-silicon.

The exports of pig iron and ferro-silicon etc., during the year are reported as 19,063 tons, valued at $486,366. The imports were: pig iron 78,594 tons valued at $981,107; charcoal pig 86 tons, valued at $1,082; ferro-manganese and ferro-silicon 22,147 tons, valued at $549,485; or a total of 100,827 tons, valued at $1,531,674.

Coal and Coke.

The total production of marketable coal for the year 1914 comprising sales and shipments, colliery consumption and coal used in making coke or otherwise used by the colliery operators, was 13,594,984 short tons, valued at $33,433,108, as against 15,012,178 tons, valued at $37,334,940 in 1913, showing a decrease of 1,417,194 tons, or 9.4 per cent in quantity and of $3,901,832, or 10.4 per cent in total value.

In estimating the values of the coals, arbitrary values are assumed for Nova Scotia and for British Columbia, viz: $2.50 per long ton for the former and $3.50 per long ton for the latter. The value of the coal production in the other provinces is that returned by the operators. The production in Nova Scotia was 7,338,790 tons, a falling off of 641,283 tons, or 8.0 per cent. The Alberta production as kindly furnished by Mr. John Stirling, Inspector of Mines, Alberta, was 3,667,816 tons, a decrease of 346,939 tons or 8.6 per cent, while the British Columbia production was 2,238,339 tons a decrease of 476,081 tons or 21.2 per cent. Sasketchewan with a production of 232,541 tons shows in increase of 19,644 tons or 9.2 per cent, while New Brunswick reports a production of 104,055 tons, an increase of 33,744 tons or 48 per cent. The production of the Yukon is reported as 13,443 tons, a decrease of 6,279 tons or 32 per cent from 1913.

Production of Coal by Provinces 1914.

	Tons.	Value.
Nova Scotia	7,338,790	$16,381,228
British Columbia	2,238,339	6,994,810
Alberta.	3,667,816	9,367,602
Saskatchewan.	232,541	375,438
New Brunswick	104,055	260,270
Yukon.	13,443	53,760
Total.	13,594,984	$33,433,108

The exports of coal in 1914 were 1,423,126 tons, valued at $3,880,175 as compared with exports of 1,562,020 tons valued at $3,961,351 in 1913, a falling off of 138,894 tons or 8.89 per cent.

Imports of coal during the year included bituminous, round and run of mine 7,776,415 tons, valued at $14,954,321, or an average of $1.92 per ton; bitumin-

ous slack 2,509,632 tons valued at $3,605,253 or an average of $1.43 per ton; and anthracite 4,435,010 tons valued at $21,241,924 or an average of $4.79 per ton or a total of 14,721,057 tons, valued at $39,801,498. The imports in 1913 were bituminous, round and run of mine 10,743,473 tons valued at $21,756,658; bituminous slack 2,816,423 tons, valued at $4,157,622; and anthracite 4,642,057 tons valued at $22,034,839; or a total of 18,201,953 tons valued at $47,949,119.

There was therefore a decrease in imports of bituminous run of mine of 2,967,058 tons or 27.6 per cent, a decrease in the imports of bituminous slack of 306,791 tons or 10.9 per cent and a decrease in the imports of anthracite of 207,047 tons or 4.5 per cent or a total decrease in coal imports of 3,480,896 tons or 19.1 per cent.

The apparent consumption of coal during the year was 26,809,778 tons as against a consumption of 31,582,545 tons in 1913. Of the consumption in 1914 about 45.4 per cent was from Canadian mines and 54.6 per cent imported.

Coke.—The total output of oven coke during 1914 was 1,015,253 tons of 2,000 lbs. made from 1,533,365 tons of coal, of which 1,030,053 tons were mined in Canada, and 503,312 tons were imported. The total quantity of coke sold, or used by the producers during the year was 1,019,082 tons valued at $3,634,511.

In 1913 the total output was 1,517,133 tons and the quantity sold or used by the producers 1,530,499 tons valued at $5,919,596.

The output by provinces in 1914 was; Nova Scotia 345,880 tons; Ontario 377,514 tons; Alberta 28,541 tons, and British Columbia 263,318 tons. The production from Ontario was entirely from imported coal.

By-products from coke ovens during the year included 8,572 tons of ammonia sulphate; 5,714,172 gallons of tar and 3,201,097 thousand ft. of gas.

The only coke ovens operated during the year were those at Sydney, Sydney Mines and Westville, Nova Scotia; Sault St. Marie, Ontario; Coleman, Alberta; and Fernie, Michel and Hosmer, British Columbia. At the end of the year there were 797 ovens in operation and 2,297 idle.

Asbestos.

The asbestos production in 1914 was obtained from the districts of Black Lake, Thetford, Robertsonville, and Danville in the province of Quebec. Both output and sales show a considerable falling off while there is an increase in the stocks on hand at the close of the year, a result which is no doubt due largely, if not entirely, to the war.

The total output in 1914 was 107,668 tons, as against 132,564 tons in 1913, a falling off of 24,896 tons, or 18.7 per cent. Notwithstanding this decrease the output was greater than that of any other preceding year. The sales and shipments of asbestos during 1914 were 96.542 tons, valued at $2,892,266 or an average of $29.96 per ton, as against sales in 1913 of 136,951 tons valued at 3,830,909, or an average of $27.97 per ton. The 1914 sales were exceeded during each of the previous three years. Stocks on hand at December 31, 1914, were 31,171 tons, as compared with stocks of 20,787 tons at the end of the previous year.

The number of men employed in mines or quarries and mills, was 2,992 and amount paid in wages $1,283,977, as against 2,951 men employed, and $1,687,957 paid in wages in 1913.

The total quantity of asbestos rock milled during the year is reported as 1.717,629 tons which, with a mill production of 103,607 tons, shows an average estimated content of about 6.03 per cent of fibre in the rock.

The output and sales of crude and mill stock separately is shown for 1913 and 1914, in the following tables. The classification is based on valuation: Crude No. 1, comprising material valued at $200 per ton and upwards, and Crude No. 2, under $200; mill stock No. 1, includes mill fibre valued at from $30 upwards, No. 2 from $15 to $30, and No. 3 under $15.

The total sales of crude asbestos in 1914 were 4,147.5 tons valued at $773,193 or an average of $186.42 as against sales in 1913 of 5,660.3 tons, valued at $989,162, or an average of $174.45 per ton, showing a lower tonnage but a higher average value in 1914.

The total sales of mill stock in 1914 were 92,394 tons, valued at $2,119,073, or an average of $22.94 per ton, as against 131,291 tons in 1913, valued at $2,841,747, or an average of $21.64 per ton, again a smaller tonnage but a higher average price than in the previous year.

Exports of asbestos during the twelve months ending December 31, 1914, were 81,081 tons, valued at $2,298,646 as against 103,812 tons, valued at $2,848,047 exported in 1913. There was also an export classed as asbestos sand in 1914, amounting to 18,991 tons, valued at $108,548, or an average value per ton of $5.71.

Petroleum and Natural Gas.

Although crude oil has been struck in several of the prospect wells being sunk in Alberta and a few thousand gallons obtained from the Dingman Well, No. 1, of the Calgary Petroleum Products, Ltd., were sold, the western fields have not, as yet, reached the stage of commercial production and the Canadian output is still practically confined to the old established fields in Ontario supplemented by a few barrels pumped from gas wells in New Brunswick.

The annual output, which has been steadily declining during the past seven years, shows a further falling off in 1914. The average price received for crude oil was also lower than in the previous year.

A bounty of one and a half cents per imperial gallon is paid upon the production of crude petroleum, the Petroleum Bounty Act being administered and payments made by the Department of Trade and Commerce.

According to the records of this department, the total output of petroleum in Ontario and New Brunswick during 1914 was 214,418 barrels, or 7,504,619 gallons on which a bounty of $340,924 was paid. The

Output Sales and Stocks of Asbestos in 1914.

	Output. Tons.	Tons.	Value	Per ton.	Tons.	Stock on hand Dec. 31 Value.	Per ton.
Crude No. 1.	1,450.55	1,335.9	402,417	$301.23	984.3	$301,237	$306.04
Crude No. 2.	2,610.4	2,811.65	370,776	131.87	1,410.9	187,338	132.78
Mill stock No. 1	16,144	19,388	932,893	48.12	4,616	229,361	49.69
Mill stock No. 2	58,362	47,851	963,973	20.15	15,114	305,809	20.23
Mill stock No. 3	29,101	25,155	222,207	8.83	9,046	76,522	8.46
Asbestos.	107,667.95	96,541.55	2,892,266	29.96	31,171.2	1,100,267	35.30
Asbestic.	.....	21,031	17,540	0.83	.....	.....	.....

average monthly price per barrel at Petrolia was $1.59 as compared with $1.782 in 1913. During the first three months of 1914, $1.89 per barrel was quoted, but the price decreased to a minimum of $1.33 during the past three months of the year.

In addition to the above 13,549 gallons, or 387 barrels, valued at $2,200, were reported as having been sold from the Dingman Well in Alberta upon which no bounty was claimed. The total Canadian production is therefore stated as 7,518,168 gallons or 214,805 barrels valued at $343,124.

The production in 1913 was 7,982,798 gallons, or 228,080 barrels, valued at $406,439. The production in Ontario during 1914 included in the above total was 212,693 barrels. The production by districts in this province, as furnished by the Supervisor of Petroleum Bounties, at Petrolia, was as follows, in barrels: Lambton, 154,186; Tilbury, 18,530 Bothwell, 33,961; Dutton, 2,190; Onondaga, 2,437, and Belle River, 1,191, or a total of 212,495 barrels. In 1913 the production by districts was; Lambton, 155,747; Tilbury, 26,824; Bothwell, 34,349; Dutton, 4,610; Onondaga, 4,172, and Belle River, 464, or a total of 226,166 barrels.

The production in New Brunswick in 1914 was 1,725 barrels, as against 2,111 barrels in 1913, and 2,679 barrels in 1912.

Exports of petroleum entered as crude mineral oil in 1914 were 3,996 gallons valued at $362, and of refined oil 3,922 gallons valued at $826. There was also an export of naptha and gasoline of 43,023 gallons valued at $11,607.

The total value of the imports of petroleum and Petroleum products in 1914 was $11,174,763, as against a value of $13,348,326 in 1913.

The total imports of petroleum oils, crude and refined in 1914 were 244,487,973 gallons valued at $11,072,362 in addition to 1,594,236 lbs. of wax and candles valued at $102,401. The oil imports included: crude oil, 195,207,210 gallons valued at $5,750,971; refined and illuminating oils, 12,833,065 gallons valued at $970,481; gasoline, 24,396,401 gallons valued at $2,747,360; lubricating oils, 5,767,676 gallons valued at $940,143, and other petroleum products, 6,282,621 gallons valued at $663,407.

The total imports in 1913 were 222,779,028 gallons of petroleum oils crude and refined valued at $13,238,429, in addition to 1,628,837 lbs. of paraffin wax and candles valued at $109,897. The oil imports included: crude oil, 162,061,926 gallons, valued at $5,250,835; refined and illuminating oils 19,393,627 gallons, valued at $1,394,440; gasoline, 29,525,180 gallons, valued at $4,822,941; lubricating oils, 6,789,451 gallons, valued at $1,172,986, and other petroleum products, 5,008,844 gallons, valued at $597,227.

There was thus in 1914 an increased importation of crude oils and a decrease in imports of refined illuminating oils, lubricating oils and gasoline.

Natural Gas.

The total production in 1914 was approximately 21,047 million ft., valued at $3,511,302, of which 426 million ft., valued at $54,249 was produced in New Brunswick; 13,675 million ft., valued at $2,206,733, in Ontario; and 6,946 million ft. valued at $1,250,320 in Alberta.

The production in 1913 was 20,478 million cu. ft., valued at $3,307,381 of which 829 million ft. valued at $174,147 was produced in New Brunswick; 12,475 million ft. valued at $2,055,768, in Ontario; and 7,174 million ft., valued at $1,079,466, in Alberta.

These values represent as closely as can be ascertained the value received by the owners or operators of the wells for gas produced and sold or used. The values do not represent what consumers have to pay, since, in cases where transmission is by separately operated pipe line companies, such cost is not included.

Cement.

The year 1914 has witnessed a very large falling off in the production of nearly all materials of construction. This situation while possibly aggravated by the war was due primarily to conditions which had already begun to show their effects during the latter part of 1913.

The total quantity of Portland cement, including slag cement and natural Portland, made in 1914 was 8,727,269 barrels of 350 net lbs. each as compared with 8,886,333 barrels made in 1913, a decrease of 159,064 barrels, or about 2 per cent.

The total quantity of Canadian Portland cement sold or used during 1914 was 7,172,480 barrels valued at $9,187,924 or an average of $1.28 per barrel, as compared with 8,658,805 barrels valued at $11,019,418 or an average of $1.27 per barrel in 1913, showing a decrease of 1,486,325 barrels, or 17 per cent.

The total imports of cement in 1914 were 343,076 cwt. equivalent to 98,022 barrels of 350 lbs. valued at $147,158, or an average of $1.50 per barrel, as compared with imports of 254,093 barrels valued at $409,303, or an average of $1.61 in 1913.

The total consumption of cement therefore, neglecting a small export, was 7,270,502 barrels, as compared with a consumption of 8,912,898 barrels in 1913; a decrease of 1,642,396 barrels, or 18.4 per cent.

Production of Cement 1913 and 1914.

	1913. Bbls.	1914. Bbls.
Portland cement sold	8,658,805	7,172,480
Portland cement manufactured	8,886,333	*8,727,269
Stock on hand Jan. 1st	862,067	*1,074,610
Stock on hand Dec. 31st	1,089,595	*2,629,399
Value of cement sold	$11,019,418	$9,187,924
Wages paid	3,466,451	.....
Men employed	4,276	.....

*Partly estimated.

The average price per barrel at the works in 1914 was $1.28 as compared with $1.27 in 1913, 01.28 in 1912, and $1.34 during 1911 and 1910.

The imports of cement in 1914 included 26,774 barrels valued at $35,517 from Great Britain; 69,117 barrels valued at $108,487 from the United States, and 2,131 barrels valued at $3,154 from other countries.

Exports of Products of the Mine and Manufactures of Mine Products, Calendar Year, 1914.

(Compiled from Trade and Navigation Monthly Statements.)

Products.	Quantity.	Value.
Arsenic, cwt.	37,519	$132,567
Asbestos, tons	81,081	2,298,643
Asbestos sand, tons	18,991	108,548
Coal, tons	1,423,126	3,880,175
Feldspar, tons	18,072	74,100
Gold.	.....	15,242,200
Gypsum, tons	345,830	404,234
Copper, fine, in ore, etc., lbs.	68,830,059	7,130,778
Copper, black or coarse in pigs, lbs.	6,581,564	908,201
Lead, in ore, etc., lbs.	246,100	2,681
Lead, pig, etc., lbs.	510,573	19,507
Nickel, in ore, etc., lbs.	46,528,327	5,149,427
Platinum, ozs.	43	2,161
Silver, ozs.	28,020,089	15,584,813
Mica, lbs.	669,163	178,940
Mineral pigments, cwt.	35,549	22,311
Mineral water, gals.	2,287	599
Oil, mineral, crude, etc., gals.	3,996	362
Oil, refined, gals.	3,922	826
Ores—		
Antimony, tons	.....	.....
Corundum, tons	947	87,740
Iron, tons	135,451	360,974
Manganese, tons	30	750
Other ores, tons	12,770	782,437

Phosphate, tons	247	677
Plumbago, cwt.	18,375	50,528
Pyrites, tons	89,999	377,985
Salt, cwt.	9,527	5,229
Sand and gravel, tons	952,370	802,358
Stone, ornamental, tons	231	5,607
Stone, building, tons	63,009	46,198
Stone, crushed, tons	25,130	18,153
Stone, for man. of grindstones, tons	54	294
Other products of the mine	.....	101,096
Total mine products	.....	53,781,102
Manufactures.		
Agricultural Implements—		
Mowing machines	21,457	725,831
Cultivators	6,030	146,668
Reapers	3,919	223,228
Drills	3,961	259,701
Harvesters and binders	19,474	2,019,996
Ploughs	12,896	324,349
Harrows	6,252	92,556
Hay rakes	6,524	196,519
Seeders	32	1,810
Threshing machines	1,965	799,307
All other	.....	290,520
Parts of	.....	712,414
Asbestos, manufactures of	.....	94,538
Bricks, M.	1,486	11,871
Cement	.....	2,223
Clay, manufactures of	.....	26,866
Coke, tons	67,838	306,117
Drugs—		
Acetate of lime, lbs.	16,052,255	282,146
Acid sulphuric, lbs.	7,485,509	45,612
Calcium carbide, lbs.	15,447,014	470,387
Phosphorus, lbs.	610,350	92,303
Earthenware and manufactures of	.....	9,336
Fertilizers	.....	2,390,494
Grindstones, manufactured	.....	24,113
Gypsum and plaster ground	.....	35,490
Iron and steel and manufactures of—		
Stoves	4,198	25,149
Gas buoys and parts of	.....	21,009
Castings, N.O.P.	.....	24,218
Pig iron, tons	14,198	201,145
Ferro-Silicon, Ferro-Com., tons	4,865	285,221
Wire and wire nails, cwt.	193,255	355,781
Linotype machines and parts of	.....	5,562
Machinery, N.O.P.	.....	344,689
Sewing machines	2,109	31,392
Washing machines	.....	33,986
Typewriters	3,055	200,441
Scrap iron and steel, cwt.	708,107	446,337
Hardware, viz. tools, etc.	.....	95,497
Hardware, N.O.P.	.....	190,763
All other, N.O.P.	.....	2,931,908
Lime	.....	16,927
Metals—		
Aluminum, in bars, etc., cwt.	145,108	2,364,907
Aluminum, manufactures of	.....	5,571
Brass, old and scrap, cwt.	21,209	196,710
Copper, old and scrap, cwt.	19,871	231,710
Metallic shingles, etc.	.....	105,663
Metals, N.O.P.	.....	393,829
Mineral and aerated water in bottles	.....	1,768
Oil, gasoline and naptha, gals.	43,023	11,607
Oil, N.O.P., gals.	455,867	104,179
Plumbago, manufactures of	.....	72,718
Stone, ornamental	.....	1,752
Stone, building	.....	370
Tar	.....	36,719
Tin, manufactures of	.....	24,531
Vehicles—		
Automobiles	5,621	3,011 327
Automobile parts	.....	384,428
Bicycles	111	10,021
Bicycle parts	.....	3,973
Total manufactures	.....	21,752,203
Grand total	.....	75,533,305

MINERAL PRODUCTION OF ONTARIO, 1914

By Thos. W. Gibson, Deputy Minister of Mines.

The growth which marked the output of the mining industry of Ontario during the previous decade underwent a decided check in 1914, the value of the production being $46,632,105, as compared with $53,232,311 in 1913—a decrease of $6,600,206, or 12.3 per cent. It fell below the level of 1912 by $1,641,406, but considerably exceeded that of any preceding year. The decrease was somewhat greater in amount in the metallic than in the non-metallic products, being $3,638,438, as compared with $2,961,768. Since the value of the metallic output was much greater than of the non-metallic—being $33,869,497, as compared with $12,762,608—the decrease in the metals was much less in proportion, being only 10.8 as against 23 in the non-metals.

The causes of the diminution are not far to seek. Early in 1914 it became evident that a business depression had set in which in any event would have the effect of curtailing the output of many mineral products, notably pig iron and materials of construction. But the outbreak of war in the beginning of August frightened capital, shut off demand, lowered prices and consequently diminished production in nearly every branch of the industry, gold mining being almost the only exception. For a time it seemed as if a number of the Cobalt silver mines would have to shut down altogether from inability to market their product, and the Canadian Copper Company, the leading producer of nickel, reduced the number of its furnaces in blast from six to two. Fortunately, this condition was of short duration; the silver mines resumed operations, and ere the close of the year the Copper Company had four furnaces in operation and was preparing for resumption of a normal output. The low price of silver and the diminished production of several of the mines aided in reducing the yield from Cobalt, and it is a testimony to the productivity of that remarkable field that the decrease in fine ounces of silver as compared with 1913 was considerably less than four million.

Mineral Products of Ontario, 1914.

Metallic—			
Gold, oz.	268,942	$5,529,767	$4,558,518
Silver, oz.	25,999,374	13,209,726	16,579,094
Copper, tons	14,453	2,081,332	1,840,492
Nickel, tons	22,760	5,109,088	5,237,477
Iron ore, tons	240,059	531,379	424,072
Pig iron, tons	556,112	7,041,079	8,719,892
Cobalt ore, tons	97	27,743	.....
Cobalt oxide, lbs.	640,653	516,542	
Nickel oxide, lbs.	303,752	27,716	433,712
Cobalt and nickel oxides, unseparated, lbs.	113,843	45,189	
		34,231,449	37,793,257
Less Ontario iron ore smelted into pig iron (163,779 tons)	.....	361,952	285,322
Net value metallic production	.....	33,869,497	37,507,935
Non-Metallic—			
Arsenic, refined, lbs.	4,059,868	116,624	64,146
Brick, common	294,400,000	2,336,207	3,452,352
Tile, drain	14,710,000	277,530	292,767
Brick, paving, etc.	11,455,000	128,800	243,119
Brick, pressed	60,620,000	646,604	919,741
Stone, building, etc.	.....	1,088,862	1,137,153
Calcium carbide, tons	2,381	142,883	123,100
Cement, Portland, bbls.	2,609,750	2,852,930	4,105 455
Corundum, tons	548	65,730	137,036
Feldspar, tons	18,062	55,686	67,142
Graphite, refined, tons	1,363	87,167	93,054
Gypsum, tons	106,643	229,269	92,627
Iron pyrites, tons	107,258	264,722	171,687
Lime, bush.	2,075,228	333,363	390,600
Mica, tons	349	40,402	55,264
Natural gas, M. cu. ft.	13,223	2,347,737	2,362,021
Peat, tons	600	2,100	1,750
Petroleum, Imp. gals	7,437,356	337,867	398,051
Phosphate of lime, tons	450	3,150	.....
Pottery	.....	25,720	52,875
Quartz, tons	52,947	82,544	130,860
Salt, tons	104,774	498,383	474,372
Sand and gravel, cu. yds.	359,100	151,909	233,567
Sewer pipe	.....	571,756	600,297
Talc, tons	10,435	74,583	125,340
Non-metallic production	.....	12,762,608	15,724,376
Add metallic production	.....	33,869,497	37,507,935
Total	.....	46,632,105	53,232,311

Ontario Gold Production, 1914.

The number of ounces of gold produced last year was 268,942, having a value of $5,529,767 as compared with 220,837 ounces worth $4,558,518 in 1913—an increase of over 21 per cent. The producing mines were 12 in number, eight being in Porcupine and four in other parts of the Province.

About half the total production came from the Hollinger, where 208,936 tons of ore were treated for a yield of 129,364 ounces, or an average of $12.79 per ton. Additions to the milling capacity of this mine were under construction during the year, which, when completed, will increase the ore handled from 500 to 1,600 tons per day. Underground development in-

creased the estimated value of ore reserves from $11,604,800 at the beginning of 1914 to $13,358,420 at the beginning of 1915. At the Dome mine 51,026 ozs. were obtained from 221,390 tons of ore, an average of $4.76 per ton. Porcupine Crown milled 40,857 tons and recovered 33,020 ozs., the average being $16.70 per ton. At McIntyre Porcupine 62,284 tons of ore were treated and 26,398 ozs. of gold won, an average return of $8.75 per ton. The other producers in the Porcupine camp were the Acme, Mines Leasing (Rea), Porcupine Pet and Porcupine Vipond.

At Long lake, the Canadian Exploration Company, having enlarged its plant, nearly doubled its 1913 output. Tough-Oakes, at Kirkland lake, was busy installing a new mill which is expected to go into operation this month; meantime the yield from 3,734 tons of ore amounted to 5,524 ozs. of gold. La Mine D'or Huronia, in Gauthier township, and Cordova, in Belmont township, Peterboro county, made small contributions to the total. Nothing is reported from northwestern Ontario.

For the whole Province, 608,200 tons of ore were crushed, the yield being 268,942 ozs. of gold and 55,153 ozs. of silver, of a total value of $5,559,520, or an average of $9.14 per ton.

The aggregate value of the gold produced in Ontario to 31st December, 1914, was $14,822,995.

Silver.

The output of silver in Ontario in 1914 was 25,999,374 fine ozs., being a decrease, as compared with 1913, of 3,725,557 ozs., or 12.5 per cent., or as compared with 1911, when the Cobalt mines were at their maximum and produced 31,507,791 ozs., or 17.4 per cent.

The return to the mining companies was $13,209,726, an average of 50.807 cents per oz. The average price of fine silver in New York for the twelve months was 54.811 cents per oz., but while at the opening of the year the price was 57.572 cents, rose to 58.519 cents in April, and to 58.175 cents in May, it fell in July to 54.678 cents. In August the price declined to 54.344 cents, and receded month by month until in December it reached 49.375 cents. Since the beginning of 1915 it has continued to fall; the average for January was 48.855 cents, low point, 48 cents, being touched February 3rd.

It may be pointed out that after the outbreak of the war New York prices were largely nominal, and represented little or no actual business. Sales were for a time impossible, and continued to be attended with difficulties, owing to the rise in freights and insurance against war risks, which at one time amounted to 6¼ cents per oz. over and above the usual charges.

The Ontario silver production by camps was as follows:

	Ounces.	Value.
Cobalt proper	24,940,613	$12,678,184
Casey township	499,643	236,298
South Lorrain	104,665	54,310
Gowganda	399,300	211,181
	25,944,221	$13,179,973
Silver recovered from auriferous ores	55,153	29,753
Total	25,999,374	$13,209,726

With regard to the form in which the silver was shipped out from the camp, the figures show a nearly even division among ore, concentrates, and bullion, as follows:

	Tons.	Ounces.	Value.
Ore	4,655	8,447,338	$4,275,519
Concentrates	12,152	8,915,958	4,390,021
Bullion	.....	8,580,925	4,514,433
Total	.....	25,944,221	$13,179,973

Cobalt silver output—Since the opening of the mines at Cobalt the production of silver has amounted to over 211 million ozs., having a value of more than 111 million dollars, the output by years being as follows:

	Ounces.	Value.
1904	206,875	$111,887
1905	2,451,356	1,360,503
1906	5,401,766	3,667,551
1907	10,023,311	6,155,391
1908	19,437,875	9,133,378
1909	25,897,825	12,461,576
1910	30,645,181	15,478,047
1911	31,507,791	15,953,847
1912	30,243,859	17,408,935
1913	29,681,975	16,553,981
1914	25,944,221	13,179,973
Total	211,442,035	$111,465,069

The average price received for silver during the eleven years was 52.716 cents per fine oz. The total production of silver from all sources up to the end of 1914 had a value of $126,965,109.

It is natural to ask how much longer the mines at Cobalt will last. To this question no definite answer can of course be given. There is little doubt that the decline in output which began in 1912 will continue, probably at an accelerating rate. The typical Cobalt silver mine is essentially high grade, and the economy of nature is seen in the fact that very rich deposits are apt to be small, while low grade bodies tend to be large. Some properties in Cobalt which formerly produced freely are now closed down or have greatly reduced their output. The yield from others, while still considerable, is below its former level. It is not to be concluded, however, that all of the latter class are approaching exhaustion. By the discovery of new veins on the surface or below ground, some have in a measure renewed their youth, and in a number there are reserves of low grade ore which will yield much silver and keep their concentrating plants busy for a considerable time to come. New veins containing high grade ore were discovered in the Beaver and Temiskaming mines. Hope is entertained in this part of the field that if the diabase sill were bottomed productive veins might be found at or near the contact.

Ten Cobalt silver mines produced more than a million ozs. in 1914. Following is the list; the production for 1913 is given for purposes of comparison:

	Oz. 1914.	Oz. 1913.
Nipissing	4,704,499	4,844,169
Mining Corporation of Canada. (Townsite and City of Cobalt)	3,079,275	2,414,760
Coniagas	2,459,007	3,252,566
Kerr Lake	1,817,087	2,072,407
Crown Reserve	1,425,320	1,776,678
Seneca-Superior	1,409,766	1,124,577
La Rose	1,398,404	2,592,775
McKinley-Darragh-Savage	1,260,355	2,228,497
Mining Corporation of Canada. (Cobalt Lake)	1,247,677	980,858
O'Brien	1,231,834	1,240,931

Large acreage, many openings and productive veins early placed Nipissing at the head of the list, where it still remains. Cobalt Townsite and City of Cobalt, united under the management of Mining Corporation of Canada, now take second place, Coniagas being third, instead of second as in 1913. There are other changes in position as compared with the list given in last year's bulletin, but the only new name is Mining Corporation of Canada (Cobalt Lake), which displaces Buffalo.

The silver refineries operating in 1914 were the Coniagas Reduction Company at Thorold, and the Deloro Mining and Reduction Company at Deloro. The Canada Smelting and Refining Works rebuilt their plant at Orillia, destroyed by fire in January, 1913, and resumed work towards the close of 1914. Adding the bullion produced by these works—9,273,247 ounces—to that from the refining plants at Cobalt gives a total of

bullion refined in Ontario of 17,754,172 ozs.—about 68 per cent. of the entire silver production for the year.

At the refineries, too, were produced and shipped 640,653 lbs. of cobalt oxide and 303,752 lbs. of nickel oxide, as well as 113,843 lbs. of these oxides mixed; also 4,059,868 lbs. of white arsenic. One inevitable consequence of the war was the closing of the markets for cobalt and nickel oxide on the continent of Europe. Canadian makers of cobalt oxide now control the trade. Under the provisions of the Metal Refining Bounty Act bounties amounting to $26,038.02 were paid to the refineries on cobalt oxide and $8,978.70 on nickel oxide. The bounty is at the rate of six cents per pound on the metallic contents of the oxides. The Act expires in April, 1917.

Nickel and Copper.

The production of nickel was active during the first six months of 1914 and it looked as if the year's output would surpass the record. The declaration of war at once checked this activity, and the Canadian Copper Company which exports its matte to the United States for refining, cut down its output at once, though increasing it later in the year. The Mond Nickel Company, whose refinery is in Wales, kept its new works at Coniston in full blast, and the year's total of matte was but little less than in 1913, being 46,396 tons as against 47,150. The nickel contents are estimated as 22,760 tons, and the copper contents as 14,453 tons, valued at $5,109,088 and $2,081,332 respectively, including small quantities of both from the Cobalt mines. The copper product exceeded that of 1913 by 1,512 tons in weight and $240,840 in value, the explanation being found in the increased production by the Mond Nickel Company, whose ores contain rather more copper and less nickel than those of the Canadian Copper Company. As regards the figures of value, these are supplied by the companies themselves, the computation being based on the metals as contained in the matte at the point of shipment. They are equivalent to 11.2 cents per lb. for nickel and 7.2 cents for copper.

The quantity of nickel-copper ore raised was 1,072,207 tons, and the quantity smelted 947,053 tons. Some 79,825 tons of this came from the Alexo mine in Dundonald township, and was treated by the Mond Company in their works at Coniston. This company raised 348,074 tons of ore, more than half of which was from the Garson mine, the remainder being from seven other openings, including the Worthington and the new property at Levack. The Canadian Copper Company extracted 618,781 tons, the bulk of it being from the Creighton mine, which is again the chief source of this company's supply. Crean Hill yielded 58,689 tons, No. 2, 42,114 tons, and No. 3 or Frood 87,688. The large scale operations projected at the Frood mine will not for the present be proceeded with.

Iron Ore and Pig Iron.

There was shipped to blast furnaces in Ontario and the United States 115,910 tons of ore from the Helen and Moose Mountain mines, and from the concentrating plants at Trenton, Moose Mountain and Magpie 124,149 tons of concentrates or briquettes, the whole having a value at the mines or works of $531,379. The ore at the Magpie is siderite, and is roasted to eliminate the sulphur and carbonic acid. The analysis of the roasted product is; iron 50 per cent., phosphorus .012, silica 7.24, manganese 2.85, alumina .60, lime 8.34, magnesia 8.05, sulphur .20. The material is reported as being entirely satisfactory from a blast furnace point of view. Moose Mountain briquettes show the following analysis: iron 63.12, phosphorus .036, silica 6.52, manganese .05, alumina 1.00, lime 1.5, magnesia 1.53, sulphur .012. These briquettes have also been very favorably received.

The four blast furnace plants in operation at Sault Ste. Marie, Hamilton, Port Colborne and Deseronto respectively produced 556,112 tons of pig iron, valued at $7,041,079. This is a decrease as compared with 1913 of 14.3 per cent. in quantity and 19.2 per cent. in value. The demand for pig iron began to fall off some time before the declaration of war, and conditions in the business were far from satisfactory at the close of the year.

The quantity of Ontario ore used in making the pig iron was 163,779 tons, and of imported ore 752,560 tons.

Non-Metallic Materials.

Of the 25 substances in the list of non-metallic products, seven only show an increase in value as compared with 1913, these being arsenic, calcium carbide, gypsum, iron pyrites, peat, phosphate of lime and salt. These increases amounted to $330,574, while the decreases on the remaining eighteen products totalled $3,291,217, leaving a net diminution of $2,961,768.

All materials of construction fell off to a considerable degree, the building trade feeling acutely the sudden stoppage of money on the outbreak of war, amounting in many cases to an impossibility of procuring funds to finish houses already begun. Common brick fell off in number by 114,408 thousand and in value by $1,116,145; they were also lower in price per thousand from $8.44 to $7.99. Pressed brick dropped in number by 20,618 thousand, in value by $273,137, and in price from $11.32 to $10.66. The falling off in stone was smaller in proportion, the decrease in value being $48,291. Lime was less by $57,237, and Portland cement by no less than $1,252,525; the price per barrel at the works however remained undiminished, and even rose by two cents. The production of corundum—the demand for which varies with the state of iron and steel manufacturing—was cut in two, the drop being from $137,036 to $65,730. Natural gas remained at practically the same figure so far as value is concerned, but the output was greater, rising from 12,516 million cu. ft. in 1913 to 13,223 million cu. ft. in 1914. Petroleum again showed a decline, the output being 478,405 Imperial gals. less and the value $60,184 less than in 1913. Quartz fell $48,316, mica $14,862, sand and gravel $81,658, and talc $50,757.

The advances in gypsum and iron pyrites were notable. The former gained 66,062 tons in quantity and $136,642 in value; the latter 35,638 tons in quantity and $93,035 in value. There was also a decided gain in arsenic—1,205,110 lbs. in weight and $41,483 in value.

Dividends.—Up to the end of the year the dividends returned to shareholders of companies operating silver mines in the Cobalt area had reached a total of 57 million dollars. For the year itself they amounted to about $6,700,000. Two gold mining companies—Hollinger and Porcupine Crown—paid out or declared $1,350,000, a total for silver and gold companies in 1914 of $8,050,000. Profits earned in nickel, construction materials, and other products will increase this sum by five or six million dollars at least, so that even in times marked by so great a calamity as a war in which the future, not only of the British Empire but of civilization itself is at stake, it is a tribute to the substantial character of Ontario mining that a reasonably good return continues to be made.

Water Power.—The principal mining camps now depend almost entirely upon water power for operating their mines and machinery. In Porcupine, Sudbury, Michipicoten, Kirkland Lake and elsewhere the energy is delivered in the form of electric current. In Cobalt it comes also as compressed air. The source in all cases is the falling of water on near-by rivers, and the cost of power is much less than when generated by the burning of coal or wood—averaging probably not more than one-third the price of the latter. The precipitation of moisture in 1914, however, was much less than usual, and the consequence was that when the season of low water came on in January and February, 1915, operations were curtailed by lack of power. Building plants at Cobalt were obliged to close down one week in four, and this will tend to diminish the output of silver for the present year.

Legislation.—Two legislative enactments came into force, one on 1st January, 1914, and the other a year later, affecting the mining industry. The first was the law prohibiting underground labor for more than eight hours out of the twenty-four. This was accepted by the mining community as a whole with little dissent, and is now a recognized part of mining routine. The second was the Workmen's Compensation Act, which covers all other industrial operations as well as mining. Necessarily the first year's experience with this measure will be more or less tentative, but the machinery provided for its administration will enable satisfactory adjustments to be made. One result is certain—the relations between capital and labor will no longer be distributed by a system under which the employer was often made the unwilling instrument in denying justice when an employee was killed or injured, and which too frequently led to the still further impoverishment of the victim or his beneficiary by ill-advised and expensive litigation.

MINERAL PRODUCTION OF QUEBEC, 1914

By Theo. Denis, Superintendent of Mines.
(The figures for 1914 are subject to revision.)

The total mineral production of the Province of Quebec for the year 1914 amounted to $11,325,428. As compared with 1913, this is a decrease of $1,794,383. For the first time in twelve years, we are unable to record an increase in yield over the previous year. And, in fact, it is a matter for gratification that the figures have not fallen off more than this 13.7 per cent. decrease.

The first six months of 1914 augured well for a record-breaking year, and it is due to the activity which prevailed until the end of July that our decrease of production, as compared with the previous year, is not greater. But soon after the opening of hostilities in Europe, the disturbed industrial conditions began to be felt by our mining industry.

As in the past, the figures given in the accompanying table for 1914 are provisional. They are subject to revision as, at this date, some dilatory producers have not yet complied with the regulations concerning sending their report of production. However, the preliminary figures are usually well within two per cent. of the revised figures. These will be given in the final report, ready for distribution to the public in May.

The last column of the general table of production gives the revised figures for 1913, for the purposes of comparison. Moreover, the following figures show the progress of the mineral industry in Quebec since 1902:

	Value of Mineral production
1902	$ 2,985,463
1903	2,772,762
1904	3,023,568
1905	3,750,300
1906	5,019,932
1907	5,391,368
1908	5,458,998
1909	5,552,062
1910	7,323,281
1911	8,679,786
1912	11,187,110
1913	13,119,811
1914	11,325,428

Asbestos.

The shipments of asbestos during the first six months of the year were in excess of the corresponding period in 1913. But during the last five months, the conditions of the market compelled most of the producers to practically discontinue operations or decrease them to a fraction of what they would have been under normal conditions. Germany was an important consumer of our asbestos, much more so than appears from the tables of export figures, for most of the exports to Belgium went to Antwerp in transit to German consumers. This, however, is in the way of being remedied. Since the early part of January, activity has been apparent in the Thetford district, and important shipments are now being made, particularly to the United States. It looks as if the South American trade of manufactured asbestos products, which was in a great measure monopolized by Germany, were being taken up by American manufacturers.

The short tables which follow give an analysis of the asbestos mining industry in 1914 and 1913:

Production of Asbestos for 1914.

Designation of Grade.	Shipments. Tons.	Value	Average value per ton	Stock on hand Tons	Value
Crude No. 1	1,336	$402,417	$301.96	985	$301,237
Crude No. 2	2,812	370,776	131.85	1,345	187,688
Mill Stock No. 1	10,485	633,289	60.40	2,737	166,761
Mill Stock No. 2	32,847	818,765	24.93	9,757	231,874
Mill Stock No. 3	59,921	670,688	11.18	16,968	204,429
Totals	107,401	2,895,935	26.96	31,792	1,091,989
Asbestic	13,251	4,904			
	120,652	2,900,839			

Quantity of rock mined during year 1914: 2,127,395 tons.

Table of Mineral Production of the Province of Quebec in 1914.

Substance.	Production 1914 Quantity	Value.	Value in 1913.
Asbestos, tons	107,401	$2,895,935	$3,830,504
Asbestic, tons	13,251	4,904	20,346
Chromite, tons	135	1,210	.....
Copper and sulphur ore, tons.	117,778	801,129	812,899
Feldspar, tons	98	2,156	1,554
Gold, oz.	996	21,084	14,794
Graphite and magnesite, tons.	619	21,126	12,955
Iron ore, titaniferous, tons	.....	.....	9,824
Kaolin, tons	1,000	9,000	4,354
Magnesite, see graphite, tons	.....	.....	.....
Mica, lbs.	423,821	55,636	117,038
Mineral waters, gals.	56,068	15,582	31,728
Mineral paint, (ochre), tons.	5,690	36,600	40,868
Phosphate, tons	635	5,057	3,506
Quartz, tons	200	525	2,363
Silver, oz.	57,426	31,809	21,791
Zinc and lead ores, tons	969	15,490	7,370
Structural Materials—			
Brick, M.	136,885	1,093,731	1,297,592
Cement, bbls.	2,840,436	3,325,055	3,361,292
Granite	.....	561,900	496,588
Lime, tons	53,728	383,927	464,424
Limestone and marble	.....	1,566,145	1,824,748
Phonolith	626	2,114	
Sand	.....	336,853	405,750
Sandstone	.....	.....	5,072
Slate, square	1,071	5,105	6,286
Tile, drain and sewer pipe, pottery, etc.	.....	133,355	326,165
		$11,325,428	$13,119,811

Copper and Sulphur Ores.

Returns have been received from four producers of copper and sulphur ores, all in the Eastern Townships. Both the Eustis Mining Company and the Weedon Mining Company (McDonald mine at Weedon) have shipped actively, and, moreover, have done much blocking out work with excellent results. Sub-

stantial shipments from development work have also been made from a promising prospect at Stratford, near Weedon, and from the Ives mine at Eastman.

Gold and Silver.

Most of the production of gold and silver can be ascribed to the small values in the metals contained in the copper-sulphur ores of the Eastern Townships. But a certain proportion results from work on the Beauce alluvial deposits, where individual miners worked on a royalty basis, paid to the "Champs d'Or Rigaud-Vaudreuil," the present owners of the mining rights on the Rigaud-Vaudreuil Seigniory.

Mica.

The mica industry appears to have suffered considerably from the industrial disturbances. Our total production fell much below the previous year's, and lower prices prevailed.

In previous years, the mica industry in the Province of Quebec was practically confined to the region of the Gatineau and Lievre district, but in 1914, substantial quantities of an excellent mica were shipped from a mine situated some eighteen miles below the city of Quebec, at Petit Pre, about two miles inland from the St. Lawrence.

Iron Ores.

We have to record complete inactivity in the iron and iron ore industry of Quebec. For the past two or three years iron mining has been limited to titaniferous iron ores, which were used in the manufacture of ferro-titanium, but in 1914, none was shipped.

Building Materials.

There is a decrease to record in the total value of the building materials. This is to be expected in times of unsettled industrial conditions and financial stringency. In fact, considering the conditions which have prevailed since the middle of the year 1914, it is a matter of congratulation that our building materials industry did not suffer more than it did.

Other Products.

Numerous enquiries have been received regarding the possibility of various products which are known to occur in the province, but which, so far, have not been worked or have been worked only on a limited scale. Such are, molybdenite, magnesite, feldspar as a source of potash. This has been due to the fact that the European hostilities cut off a very large proportion of the sources of supply of these substances. Magnesite was produced in large quantities by Austria, and the main source of potash is the German deposits. As feldspar (orthoclase) contains nearly 17 per cent. potash, it is quite natural that attempts to utilize this should be made.

Accidents.

During the calendar year 1914, an average of 6,756 men were employed in the mines, quarries, mills and concentrators in the Province of Quebec, as compared with 8,611 during 1913. The total amount of wages paid was $4,138,059.

In 1914, reports were made to the Mines Branch of 133 accidents, of which 9 were fatal. This gives a ratio of 1.33 deaths per 1,000 men employed. In 1914, we recorded 16 fatal issues out of 197 accidents, or a ratio of 1.86 per 1,000.

There were no fatal accidents in quarries in 1914. The accidents resulting in deaths of men all occurred in mines, which employed 3,116 men, giving 2.84 fatalities per 1,000 men, as compared with 3.19 per 1,000 during the previous year.

PERSONAL AND GENERAL

Mr. E. Dedolph, of Nelson, B.C., who for a comparatively long time was engaged in connection with the experiments in electric smelting of lead-zinc ores conducted by the Dominion Department of Mines, has been commissioned to report on the ore of the Cork-Province mine on the South Fork of the Kaslo river, in Ainsworth mining division of British Columbia, with the object of determining the most suitable method of treatment to recover the zinc and lead contained in that ore.

Mr. W. J. Elmendorf, for several years employed in directing the mining work near Stewart of the Portland Canal Mining Co., and later of the Portland Canal Tunnels, Ltd., has opened an office, as consulting mining engineer, at Seattle, Washington.

Mr. Charles Graham, manager of the Corbin colliery, in Southeastern Kootenay, British Columbia, has been ill with inflammatory rheumatism.

Mr. J. Cleveland Haas, connected with mining development in the Boundary district of British Columbia, has returned to Spokane, Washington, after having spent some months on a placer gold property in Montana.

Mr. G. H. Kirkpatrick, of Vancouver, who for some time was associated with the Messrs. Leckie at Vancouver, B.C., is now Lieutenant-Colonel in command of the 11th Canadian Mounted Rifles, in British Columbia.

Mr. Andrew G. Larson, of Vancouver, was one of several mining engineers from British Columbia who attended the Northwest Mining Convention held last month in Spokane, Washington.

Mr. F. Chas. Merry recently left Kaslo, B.C., for Utah, U.S.A., after having spent several years as superintendent of silver-lead mines in the Lardeau district of British Columbia.

Mr. John L. Retallack, who last month went from West Kootenay to Victoria, B.C., was convalescent at the end of February, after having been in a hospital three weeks suffering from a severe attack of la grippe.

Mr. Lewis Stockett has returned to Calgary, Alberta, from a visit to Vancouver Island, British Columbia.

Mr. S. W. Cohen is in Nicaragua examining a gold property for the Crown Reserve Mining Company.

Mr. G.. G. S. Lindsey, who has been in England for the past few weeks, has been re-elected president of the Canadian Mining Institute. It is understood that he will leave for China shortly after his return from England.

Mr. W. G. McIntosh has recently been appointed sales engineer for Toronto by the Herbert Morris Crane and Hoist Co., Ltd. Mr. McIntosh is a graduate in mechanical engineering, University of Toronto, and has been connected with the Otis-Fensom Co., Toronto Power Co., Canada Foundry Co. and Dominion Bridge Co.

Ricketts & Banks, mining, metallurgical and chemical engineers, New York city, announce the termination, March 1, of the co-partnership existing between Pierre de P. Ricketts and John H. Banks for the past 40 years. Dr. Ricketts will remain at 80 Maiden Lane and Dr. Banks is located at 61 Broadway.

SPECIAL CORRESPONDENCE

BRITISH COLUMBIA

The estimates of revenue from the mining industry of the province for the ensuing fiscal year, as stated by the Minister of Finance in his budget speech delivered before the Legislative Assembly of British Columbia at the end of February, appear to be conservative, almost to the extreme of caution. They show a total of only $341,500 as compared with the actual receipts for the fiscal year 1912-13 of $658,725. Particulars follow, the figures in parentheses being amounts received for the last mentioned fiscal year: From free miners' certificates, $50,000 ($62,986); mining receipts, general, $50,000 ($94,754); mineral tax, $100,000 ($155,163); royalty and tax on coal and coke, $100,000 ($302,225); unworked Crown-granted mineral claims, $40 000 ($42,734); Bureau of Mines, $1,500 ($863). It will be seen that of the estimated decrease, as compared with the year of highest total annual value of mineral production in the history of mining in the province, nearly two-thirds is on revenue from coal and coke. It may easily happen that receipts will be larger than estimated, and, too, with the outlook for the production of metalliferous minerals gradually improving, it is not unreasonable to look for more revenue from both general mining receipts and the mineral tax than the amounts estimated.

East Kootenay.

Sullivan Group—Receipts of lead ore from this mine at Trail during four weeks ended February 25, totalled 3,231 tons, an average of 808 tons a week, compared with 2,654 tons during four weeks ended January 28, for which latter period the weekly average was 663 tons. For eight weeks the total was 5,885 tons and the weekly average over that period 736 tons.

Agreement with Coal Miners.—At a coal miners' convention sitting at Lethbridge, Alberta, on several days in the latter part of February the question of a new agreement with the Western Coal Operators' Association was discussed. The current agreement will expire at the end of March, and no secret has been made of the intention of the United Mine Workers of America to endeavor to secure advantages for the miners not enjoyed by them under the existing agreement. There seems, however, to be a general recognition of the fact that it is most unlikely, under present unfavorable conditions and the unpromising outlook for any considerable improvement for some time to come, the operators will concede an increase in rates of pay, and the opinion has been freely expressed that the miners will not strike. There will, however, be made strong efforts to induce the operators to meet certain of the requirements of the miners that their representatives consider them fairly entitled to. The U. M. W. of A., District No. 18 includes the Crowsnest section of Southeast Kootenay.

West Kootenay.

Slocan—At the annual general meeting of the Star Mining and Milling Co., held recently in Sandon, a resolution was passed as follows: "Whereas there are no apparent benefits to be gained by the continuation of this company, therefore be it resolved that this company be wound up voluntarily." The Star company was plaintiff in the lateral rights litigation that for several years seriously hampered the further development of the Slocan Star mine and which, after the close of long and costly trials before British Columbia courts of law, eventually ended in an amalgamation of the properties concerning which there had been very much trouble with little or no material advantage to either side, and which are now owned and being operated by the Slocan Star Mines, Ltd. A meeting has been called to confirm the above quoted winding-up resolution, and thereafter there will disappear from the memory of the general public the plaintiff in the famous "Star vs. Byron White" case which finally left those chiefly concerned, on both sides, sadder and wiser, and, too, poorer men. A very large amount of money was wasted in litigation, and lawyers and expert witnesses benefited largely therefrom.

From New Denver has come the news that the lessee of the Molly Hughes mine, situated near that town, has encountered a narrow vein of high-grade ore in the course of the development work he has been doing lately. The "Slocan Record" also publishes the report that the Standard Silver-Lead Mining Co.'s concentrating mill at Silverton is soon to be again operated at full capacity, the reason being suggested that the action of the Slocan Board of Trade supported by the efforts of the Dominion member for Kootenay, Mr. R. F. Green, M.P., has resulted in a modification of the smeltery charges or terms in connection with the reduction of silver-lead ore and concentrate from Slocan district mines. As during eight weeks ended February 25th there was received at the Trail smeltery only 690 tons of ore and concentrate from Slocan mines, of which 444 tons was from the Rambler-Cariboo and the remainder from five other properties, it is evident, with much ore available for shipment, that conditions have not of late been favorable to production at a profit, otherwise there would have been a larger output. However, it is hoped that market conditions will soon admit of the disposal of silver and lead to advantage so as not to leave the smelting company to carry the heavy burden of holding a very large quantity of unsaleable metals and the accompanying financial loss involved by the continuance of such an unusual market condition.

Nelson—The "Daily News" has published the balance sheet of the French Complex Ore Reduction Co., Ltd., as at November 30, 1914, which had been filed with the Registrar of Joint Stock Companies for British Columbia, as follows: Liabilities—Capital authorized, $20,000. Capital paid up, $18,950; share premiums, less unpaid, $10,850; salaries outstanding, $44.90; creditors, sundry persons, $29.90; total, $29,874.80. Assets—Ore treatment franchise, $28,165.06; stocks and shares, $1; sundry debtors, $15.15; cash at bank, $1,693.59; total $29,874.80. The company had for several years made Nelson the headquarters for its experiments in the reduction of lead-zinc ores, under the direction of Mr. A. Gordon French. Last month it was announced that Mr. French was about to leave Nelson for England.

Information concerning the Northwest Mining Convention, published in Nelson on February 25, gave the following particulars: The annual Northwest Mining Convention now being held in Spokane, Washington, is proving a decided success and is being attended by a considerable number of mining men from Kootenay

and Boundary districts and other parts of British Columbia. Exhibits are on display at the convention from practically every mining camp in British Columbia, as well as from those of the northwestern portion of the United States, and these exhibits are attracting considerable attention. From the Kootenay and Boundary districts there are also being shown excellent exhibits of the products of the Consolidated Mining and Smelting Co. and the French Complex Ore Reduction Co. Prominence is given in the display to ores from Nelson, Ainsworth, Kaslo, Slocan, and Rossland. It is stated that the convention is proving the greatest success of any movement for the advancement of the mining industry held in the Northwest in the last ten years.

Rossland—The "Rossland Miner," in its issue of February 20, gave much prominence to the subject of a "War Tax Call Made on Big Four Shareholders," concerning which it said, in part: "The knowledge that the promoters of the Big Four Consolidated Gold Mines, Limited, have resumed activity is a piece of news that will bring anything but satisfaction to residents of this district and others who are also interested in its welfare. This activity takes the form of circulars, signed by James Lawler, secretary, mailed from Vancouver to shareholders of the company, calling for the payment of assessments, styled by the persistent originator of the enterprise as 'Emergency War Tax Calls.'

"The people of Rossland and district know how much value to attach to anything that James Lawler undertakes, and to either the possibilities or intentions of the Big Four Company. Unfortunately people outside may not know this, the result being that trading upon the good name of this camp, made especially conspicuous by prosperity in the midst of country-wide adverse conditions, the uninformed public is gulled of its savings, which, on being transferred to the treasury of the Big Four Consolidated Gold Mines, Limited, are not likely to accomplish any desirable development of temporary or lasting good to mining at Rossland.

"The whole proposition needs no elaboration, as far as Rossland people are concerned, to ensure their treatment of it in the way that it deserves. But it should be given the widest publicity possible for the sake of the innocent shareholder, uninformed as to conditions, and for the sake of the good name that the camp has attained. It was concerns of the Big Four character that surrounded all Rossland mining development with suspicion a few years ago. Now that the stigma has been lived down, and mining here has been placed on a basis of absolute stability, this good name should be so jealously guarded that all attempts made by James Lawler and similar enemies of progress should be throttled instantaneously and finally."

The "Miner" points out misstatements in the circulars (which it reprints in full) and adds that "informed people state that the property has been idle from ten to fourteen years," also a caution to those likely to be misled by the circulars. The Nelson "Daily News" has also printed in its editorial columns a lengthy notice of the circulars of the secretary of the Big Four company, and closes it comments with the following paragraph: "Rossland is a flourishing mining section which has been placed on a prosperous and stable footing by sound mining methods. Every effort should be made to stop any attempt to trade upon the reputation of the camp to forward any purpose that will not stand the most searching investigation."

The output of ore from the Rossland mines of the Consolidated Mining and Smelting Co. and the Le Roi No. 2, Ltd., is being maintained at well on for 7,000 tons a week. A report from Spokane was to the effect that six men left that city on February 24th for Rossland to commence unwatering and repairing the Blue Bird mine, in the South Belt, preparatory to its being examined with the object of determining what work shall be undertaken under the lease of the property held by Mr. E. L. Tate, of Spokane.

Boundary.

News notes published by the Greenwood "Ledger" indicate that work is again being done on a number of mineral claims in that part of Boundary district. The E. P. U. shipped a carload of gold ore early in February. The Prince Henry, another gold claim situated near the town, has been leased. The Argo company has bonded the Dynamo claim, which is adjacent to the property on which the Argo tunnel has been driven. Ore has been taken out recently from the Strathmore, situated above the 3,000-ft. crosscut adit driven by the Greenwood-Phoenix Tramway Co. Mining and ore-crushing are being continued by the Jewel-Denero Co., which is steadily maintaining its output of gold-silver ore. The Granby Co. is making an output of more than 2,000 tons of ore a day from its mines at Phoenix.

COBALT, GOWGANDA AND SOUTH LORRAIN

Very few members of the Canadian Mining Institute went down to the annual meeting from Cobalt, Porcupine and subsidiary camps. The reason for this is that while conditions are not bad relatively they are so positively in comparison with last year. And considering the importance of the Cobalt and the Porcupine fields there were not many papers directly affecting these camps. The one by Mr. Thornhill, superintendent of the Buffalo mill, on the method he has perfected for saving and refining mercury from high grade ore residue was listened to with a good deal of interest. The paper by Mr. Cunningham, late of the Hollinger mill, now of New York, was printed in the proceedings, but not read. These were all the papers that directly related to the Cobalt and Porcupine camps, although the discussion on the stimulation of prospecting was of great interest to everyone in the north.

A noteworthy feature of Mr. Gibson's summary of the mineral production of the province was that the gold industry was the only item in the list that showed any gain. This, Mr. Gibson stated, was almost entirely due to the development of Porcupine.

The great advance in the insurance rate of silver bullion to London more than offsets the advance in the price of silver. Before the war the express charge on bullion was $6.50 on $1,000 and 75 cents for insurance. The insurance rate was raised to $1.80 when the war commenced, but dropped back to the old price on the assurance of protection by the Imperial government. Since the disturbed conditions commenced in the Irish Sea it has been raised to the unprecedented amount of $10 per $1,000 for insurance alone, which is prohibitive and will undoubtedly lead to a restriction in the silver output. This is the more likely to be the case since it is not likely that this rate will long be maintained. The mine owners will the less bewail their inability to ship direct if the tendency for silver to rise continues.

No doubt much silver bullion will be diverted to New York, but experience has shown since the war started that in spite of war conditions London is still the silver bullion market for the world and the bulk

of the white metal must find its way there eventually. There is no restriction in the ore shipments so that there does not appear to be any great cause for alarm in the sudden rise of the insurance rates.

When the official figures for the silver output for the first quarter of the year are published it will undoubtedly be found that there has been a very notable falling off. Any criticism based on this of the sudden caving in of the camp will not, however, be on a sound basis. During the past first quarter the output has been arbitrarily curtailed by the shortage of power which has shut down all the mills in rotation for a quarter of their time every month. The low price of silver has not been conducive to feverish exertions to produce to the maximum and now the excessive insurance rates will again cause a diminution of the shipments.

Nipissing.—During the month of February the Nipissing mine shipped ore of an estimated net value of only $164,140, and shipped bullion from Nipissing and customs ore of a net value of $183,646. The company explains the short production as follows: "Owing to the shortage of electrical power it was necessary to close down the low grade mill during the last week of the month, which also meant the closing down of the washing plant. The production for the month therefore represents three weeks instead of the usual four."

Of the $164,140 produced only $57,194 came from the low grade mill for this reason.

Raises on one of the branch veins from the fourth level at shaft 73 produced good results. At the beginning of the month the raise had been put up 62 ft., over which distance the vein averaged two inches of 2,000 oz. ore. For about 30 ft. it averaged 2,500 oz. for three in. During the month the vein was raised on for 101 ft., and while not so wide or so high grade it was quite satisfactory. But at the fourth level further drifting on the vein encountered a fault beyond which the ore has not yet been picked up.

Crosscutting into new territory was carried on at five different places on the fourth level. One of these crosscuts encountered what is believed to be an extension of vein 64. It was cut about 200 ft. to the east and the same depth as where the vein was last developed from a winze. The vein is low in silver and only about an inch wide. The crosscut is being extended in order to endeavor to pick up an ore shoot or a parallel vein.

Interesting prospecting is in progress on several calcite veins carrying some cobalt but no silver of any importance.

Results are still not encouraging on the 1,000 ft. level of vein 64, and it is not improbable that operations there may be shortly discontinued.

Temiskaming and Beaver—Good results continue to be met with at the Temiskaming and Beaver mines. Just one week before the annual meeting it was learned that a vein of very high grade ore had been found at the back of the old stopes in the upper levels of the Temiskaming. The grade is similar to that which has made the Temiskaming famous. The week before the annual meeting also a carload of ore was shipped from the new development which will probably bring back to the company from the smelters about $90,000. On the main vein system itself the grade and the width are still satisfactory. The ore is wider in the face than it has been for some time, and the ore shoot is now about a hundred feet in Temiskaming territory alone.

Silver Leaf.—The discovery on the Silver Leaf property is still holding good in the winze. It is in fact at the bottom of the winze wider and of higher grade than when it was first struck. Work by the Crown Reserve mining company is actively proceeding on it.

PORCUPINE, KIRKLAND LAKE AND MUNRO TOWNSHIP

The shortage of power has now spread to the Porcupine camp and all mines but the Dome and Hollinger have had to curtail their activities very materially. There was a good deal more rainfall in the Mattagami River watershed than south of the height of land and the power company hoped that it might be possible to tide over an exceptional year without any great inconvenience to the companies concerned. But the drought was too severe, and while it has been thawing in the daytime, it has been freezing at night and little water is going over the dams. In consequence of the situation the Northern Canada Power company had to give notice that after March 1st they would be compelled to cut off half the power from all mines but the Dome and the Hollinger. These two mines were parties to the power consolidation in the camp and were then granted special privileges. It is probable that some arrangement may be made which may be more equitable to the smaller companies and at the same time not prove of much inconvenience to the Dome and the Hollinger.

As it is the Porcupine Crown, the McIntyre, the Vipond and the Dome Lake have been obliged to curtail operations very considerably. This state of affairs should not continue after the middle of April. Two years ago any shortage of power would have been considered most unlikely, it then being considered that the camp would never need all that had been developed. But the tremendous strides of the Hollinger in development has overthrown all calculations. Most of the mines in the Porcupine camp have subsidiary steam plants; but most of them are quite inadequate to their present requirements, and with the high price of coal the companies are naturally very reluctant to revert to steam unless under compulsion.

Teck-Hughes.—The decision of the Nipissing mining company to throw up their option on the Teck-Hughes caused a good deal of surprise in the district. It was believed that while the development had not been spectacular it had been steady and that substantial progress had been made. It was also thought that the Nipissing had secured the option on such terms as would enable them to take further chances with the property. The ore zone at the 300 ft. level was 12 ft. wide; but most of this width only yielded two dollar ore. The property has been turned over to the Great Northern Silver Mines and the pumps have been pulled up.

Dome.—It is reported that some ore, much above the usual grade has been struck and is now being mined at the 600 ft. level of the Dome mines. It is most probable that ore will be raised to the surface at the No. 2 shaft and hauled on the surface by electric motors and trucks to the rock house. This will be in addition to the ore that is being hauled up the incline from the 100 ft. level.

Taylor Claim.—Some very spectacular ore is being obtained in hand samples from the Taylor claim in Munro township. The ore is very rich. The Taylor claim adjoins the Dobie, upon which the first discovery of importance was made in this field. There may probably be a little activity in claims in this section.

CALUMET AND HECLA.

Never before in the history of Lake Superior copper has there been such insistent demand for immediate shipment at this season of the year. As a rule local smelters begin to accumulate refined copper in March, to hold until navigation opens, to take advantage of water freight rate. But now smelters are shipping daily to New York, and 200,000 lb. left in one shipment from the Calumet and Hecla smelter following a shipment of 300,000 lb. the day before. Report has it that this company is selling direct to the French Government.

According to a recent despatch Calumet and Hecla has raised its price for Lake copper to 15⅜ cents a lb. and is understood to have booked sales at that level. Other Lake brands range down to 14¾ cents a lb.

Fair domestic demand for electrolytic copper has developed with sales at 14¾ cents a lb., but the demand for Lake grades other than "C. & H." has been light. Michigan producers state that they have sold practically no copper for the past week.

The premium commanded by Calumet & Hecla over the electrolytic price of 14¾ cents establishes the widest spread ever known between the two brands. Ordinarily this spread varies from ⅛ to ¼ cent per lb.

HILLCREST COLLIERIES.

Montreal, March 6, 1915.

Net profits of $92,764 for the year ending December 31, 1914, a decrease of $32,312 as compared with the previous year, were reported at the annual meeting of the Hillcrest Collieries, Limited, held in Montreal on Tuesday last. The general curtailment of business during the year affected the company's output to a large extent, as was pointed out at the meeting of shareholders by President C. B. Gordon. In addition, of course, the company suffered considerably from the explosion of June 19 last, although the property loss was small when compared with the loss of actual life. A foot note to the annual statement, by the auditors, sets forth that all replacements of plant necessitated by the explosion at the mine have been charged against revenue. Presumably, therefore, the shrinkage in earnings may be attributed in part to the replacement of plant, as well as to the curtailment of business.

At the present time the directors of Hillcrest find it impossible to compute their liability in respect to the accident of last June, in spite of the fact that various independent estimates have been made. It appears that a large majority of the employees killed in the explosion were foreigners—a large number of them being Austrians.

Under existing conditions it is impossible to recognize claims on behalf of the families of aliens, even if such claims were made. Acting in accordance with the custom in Alberta, however, the company is paying compensation for beneficiaries into the District Court, which pays it out in monthly instalments to the proper claimants. The arrangement between the company and the District Court calls for the payment by the company of a sum of $3,000 per month until full liability has been liquidated—said full liability being impossible of computation at the present time, as already indicated.—Financial Times.

TECK-HUGHES.

Cobalt, Ont., March 3.

Owing to the fact that the ore shoot on the 300 ft. level of the Teck-Hughes suddenly pinched out, the Nipissing Mining Company has abandoned its option on that property.

The zone of enrichment at the 300 ft. level was 12 ft. wide, but two-thirds of this width ran very low in gold contents, although the vein proper was as rich as the average grade of the Kirkland Lake ore.

The Nipissing took up the option on the understanding that they would buy control at the rate of 15 cents a share in the two million dollar company. They were to arrive at a final decision in August. Each month a certain amount of money had to be spent in development, which was to be returned to them in stock.

The deal was made with the Great Northern Silver Mines, which has control of the Teck-Hughes stock. The Great Northern is not in a position to finance operations itself, so that if the mine is again worked it will have to be by some other company. In the district the mine was regarded as quite promising, and its closing down was a surprise.—Journal of Commerce.

SLICK MINE TIES.

The Cambria Steel Co. has issued a pamphlet on Slick mine ties, for mine and industrial railroads. The Slick mine tie is the result of study and experiment to produce a metal cross tie for mine and industrial railroads, that will prove of distinct advantage in use and meet the needs of mines, mills, quarries, contractors and others who are desirous of using a satisfactory substitute for wooden ties, which latter are no longer conveniently available in good quantity at reasonable prices.

AGITATORS WARNED.

Houghton—The biggest Finnish demonstration in the history of Northern Michigan was held at Calumet last week, and labor agitators and red socialists were given formal notification to leave Calumet or be run out of town. The Calumet armory was packed to its doors at mass meeting, following a big parade. The speeches were all in the Finnish language, and were by miners, except one which was made by John Doelle, superintendent of the Houghton public schools, who advocated the deportation of the red agitators "by fair means if possible; and otherwise, if necessary."

LE ROI NO. 2, LIMITED.

Josie Mine Report for January—Shipped, 1,082 tons of ore and 76 tons of concentrates. The receipts from smelter are $16,548, being payment for 989 tons ore shipped and $1,354, being payment for 102 tons concentrates shipped. Sundries, $973. Total, $18,875.

Estimated working costs for corresponding period—Ore produciton $5,500, milling $625, development, $3,250.

LA ROSE.

La Rose Consolidated Mines declared a quarterly dividend of 1 per cent., payable April 20 to stock of record March 31. Previous rate was 2½ per cent. quarterly.

FELDSPAR AS A POSSIBLE SOURCE OF POTASH*

By Allerton S. Cushman and Geo. W. Coggeshall.

Muriate of potash is the chief potash salt imported in America. It is sold on the basis of "80 per cent. muriate," and usually contains from 70 to 80 per cent. KCl, or from 44 to 50 per cent. K_2O. This material, having its values in such a small bulk, will bear the cost of freight shipment easily. It is the cheapest potash sold for use as a raw material for chemical manufacturing, and it is also well adapted for mixing into general commercial fertilizers. Any potash salt, however, running not less than 17 per cent. K_2O (or 26 per cent. KCl) is adapted for use in mixed fertilizers. A salt lower than 17 per cent. K_2O could only be used where the final K_2O content in the complete fertilizer was to be less than 5 per cent.

Therefore, for the uses of the fertilizer industry, the economical production of any material containing 26 per cent. or higher of KCl, would find large use, but for the replacement of all or a portion of the one million dollars' worth of concentrated muriate salts used yearly in the United States for chemical manufacturing, it is necessary to produce a salt containing at least about 70 per cent. KCl.

A comparatively small quarry of feldspar, containing 1,000,000 cu. ft. of rock, or 100 ft. in cube, would contain 17,000,000 lb. of potash (K_2O) which, if it could be extracted, would be worth even at ante-bellum prices, $700,000. One ton of such an ore would contain 200 lb. of potash, worth, if it could all be extracted, about $7. If we assume, however, that only 75 per cent. of it would yield to a chemical engineering process, we still have $5 per ton in value to work for. When we remember that in large scale operations in the gold mining industries, quartz that carries no more than $2 per ton in valuable constituents has been profitably worked, the problem need not necessarily frighten us away at the outset.

During the fiscal year ending June 30, 1914, there was imported into the United States $15,000,000 worth of potash salts, kainit, manure salts, muriate of potash, and sulphate of potash. In addition to this, considerable quantities of caustic and carbonate of potash, not included in the later available statistics, were also imported. Of the total, $8,000,000 worth was muriate of potash. The fertilizer industry uses, of course, the larger proportion of these potash importations, the percentage in the last few years being about 85 per cent. of the total of muriate of potash imported, there being left about $1,000,000 worth of muriate of potash which was used in industrial work. About half of this total, or $500,000 worth, was used to make caustic potash and carbonate of potash. These are used principally in the soap industries, although a large portion is used as a wrapper-tobacco fertilizer and in the manufacture of glass, paper, preparation of colors, in printing, in photography and in more strictly chemical industries. Some nitrate of potash is manufactured from the chloride. About one-eighth of the muriate is manufactured into chlorate of potash at present, which is largely used in the growing safety-match industry. Potash bichromate uses about one-twentieth of the muriate and this is used in textile and color industries, also in photography.

A process for the production from feldspar of potassium chloride salts similar to the concentrated muriates imported from Europe is as follows:

A mixture of ground feldspar, containing about 10 per cent. of K_2O, and burned limestone, is formed into rounded aggregates or "clumps" about ¼ in. in diameter, using a solution of calcium chloride for this purpose. Calcium chloride is the by-product of the ammonia-soda alkali process and is the reactive agent in unlocking the potash from the silica. It was found that a proportion of burned lime mixed with the powdered feldspar will unite with $CaCl_2$ from a solution sprinkled on the powder, to form an oxychloride compound which cements the whole powder into aggregates, giving such a very intimate union of the particles that when heated the reaction yields are high. These aggregates or "clumps" pass directly into the rotary kiln heated either by oil or powdered coal flame. The clumps fall out of the kiln in the same form in which they entered it, but the potash has been converted from the insoluble form into the water-soluble muriate. These red-hot clumps fall into water in leaching vats, where the potassium chloride goes into solution. Several of these leaching vats are used so that the solution of the salt, the leaching, washing, etc., is continually performed. The strong solutions are pumped to the evaporators. The weaker wash liquors are used as leaching liquids for a new lot of processed clumps. The strong liquor containing roughly 10 per cent. of KCl will be continuously sprayed down through the hot gases passing out of the kilns to the stacks. This operation is well known and has been studied particularly by our engineers.

The bulk of the water in these solutions is thus evaporated and only very concentrated solutions or sludges are allowed to pass out. These very strong hot liquors are finally dried out in a rotary dryer placed at the head of the lime-burning kiln, using its hot waste gases. The crusts formed are then ground for the market.

The concentrated solution before complete drying contains a small proportion of sodium chloride, corresponding in amount to the proportion of Na_2O in the original feldspar. On a spar running 10 per cent. K_2O the Na_2O content has averaged from 1½ to 2 per cent. This would give from the liquors completely dried at once, without any fractional separation of the NaCl, a product having about the following composition: KCl, 70 to 80 per cent.; NaCl, 14 to 16 per cent., and the balance a very small amount of lime salt and moisture. It is thus seen that without any attempt at fractional separation, muriate of potash, equal in character to the usual imported muriates, may be made from American feldspars.

If the hot concentrated liquors are not at once brought to dryness, but are given a fractional crystallization treatment, which may be made a continuous operation, whereby most of the NaCl is removed, the KCl crystals then obtained will run pure enough to enable their direct use in the manufacture of chemicals of a high grade of purity.

The plant required is equipped in a general way similarly to a Portland cement mill. There must be rock hoists, trackage, crushers, rolls, rock dryers, grinding mills, a rotary lime burner, the "clumpers" and rotary kilns, coal dryer and grinder, besides bins, elevators and conveyors, also leaching vats, tanks for strong liquors and for wash water, pumps, flue arrangements at stack for spraying the liquors, dryers and pulverizer, also air compressor and general power plant, stairs, ladders, handrails and buildings to house the plant.

*Extracts from a paper read before the American Institute of Chemical Engineers, at the Philadelphia meeting on December 2, 1914.

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Bldg., Toronto, Ont.)

March 8, 1915.

New York Curb.

	Bid.	Ask.
Alaska Gold	.30⅝	.30⅞
British Copper	.17¼	.17¾
Braden Copper	.06¾	.06⅞
Chino Copper	.36½	.36⅝
Giroux Copper	.00¼	.01
Green Can.	.27	.28
Granby.	.68	.68¾
Miami Copper	.20	.20⅛
Nevada Copper	.12⅞	.13
Ohio Oil	131.00	133.00
Ray Cons. Copper	.17¼	.17½
Standard Oil of N. Y.	191.00	192.00
Standard Oil of N. J.	393.00	395.00
Standard Oil (subs)	800.00	.....
Standard Oil (old)	1200.00	.....
Tonopah Mining	.07⅝	.07⅞
Tonopah Belmont	.04¾	.05
Tonopah Merger	.40	.42
Inspiration Copper	.20¼	.20½
Goldfield Cons.	.01⅝	.01 11/16
Yukon Gold	.02⅝	.02¾

Porcupine Stocks.

	Bid.	Ask.
Apex.	.02	.02⅞
Dome Extension	.05¼	.05⅞
Dome Lake	.22¼	.23
Dome Mines	6.60	6.90
Foley O'Brien	.17	.20
Hollinger.	22.60	22.75
Jupiter.	.09	.09⅛
McIntyre.	.30	.31
Pearl Lake	.01½	.01¾
Porcupine Gold	...	.00⅝
Imperial.	.01½	.02¼
Preston East Dome	.01¼	.02
Rea.	.12	...
West Dome	...	.09
Vipond.	.36	.36½
Porcupine Pet	...	.20
Teck Hughes	.05¾	.06½

Cobalt Stocks.

	Bid.	Ask.
Bailey.	.02⅛	.02¼
Beaver.	.26¾	.27
Buffalo.	.65	.95
Chambers Ferland	.11¾	.15
Coniagas.	4.25	4.40
Crown Reserve	.84	.90
Foster.	.02	...
Gifford.	.01	...
Gould.	.00¼	.00½
Great Northern	.02½	.03
Hargraves.	.00⅞	.01⅛
Hudson Bay	...	.25
Kerr Lake	4.40	4.65
La Rose	.60	.69
McKinley.	.45	.51
Nipissing.	5.50	5.65
Peterson Lake	.22	.22½
Right of Way	...	.04
Leaf.	.02	.02½
Cochrane.	...	.12
Silver Queen	...	.02½
Temiskaming.	.17⅛	.18
Trethewey.	.10	.14
Wettlaufer.	.05	.05½
Seneca Superior	1.25	1.35

TORONTO MARKETS.

Mar. 9—(Quotations from Canada Metal Co., Toronto.)
Spelter, 15 cents per lb.
Lead, 5½ cents per lb.
Tin, 60 cents per lb.
Antimony, 25 cents per lb.
Copper, casting, 17 cents per lb.
Electrolytic, 17 cents per lb.
Ingot brass, yellow, 10c. per lb; red, 12 cents per lb.

Mar. 9—(Quotations from Elias Rogers Co., Toronto.)
Coal, anthracite, $8.00 per ton.
Coal, bituminous, $5.25 per ton.

NEW YORK MARKETS.

Mar. 8—Connellsville coke, (f.o.b. ovens.)
Furnace coke, prompt, $1.55 per ton.
Foundry coke, prompt, $2.00 to $2.50 per ton.

Mar. 8—Tin, straits, 50.00 cents.
Copper, Prime Lake, 14.75 cents.
Electrolytic Copper, 14.60 cents.
Copper wire, 15.87½ cents.
Lead, 3.95 cents.
Spelter, 11.25 cents.
Sheet zinc, (f.o.b. smelter), 13.50 cents.
Antimony, Cookson's, 27.00 cents.
Aluminum, 19.00 to 19.25 cents.
Nickel, 42.00 to 45.00 cents.
Platinum, soft, $41.00 per ounce.
Platinum, hard, 10 p.c., $44.00 per ounce.
Bismuth, $2.75 to $3.00 per lb.
Quicksilver, $60.00 per 75-lb. flask.

SILVER PRICES.

	New York cents.	London pence.
February—		
20.	48¾	22 7/8
22.	....	22 7/8
23.	48¾	22 15/16
24.	48½	22 7/8
25.	48⅝	22 7/8
26.	48⅞	23
27.	48⅞	23 1/16
March—		
1.	49¼	23¼
2.	49	23¼
3.	49½	23⅜
4.	49⅛	23⅛
5.	49¼	23 3/16
6.	49⅜	23¼
8.	50⅛	23⅝

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

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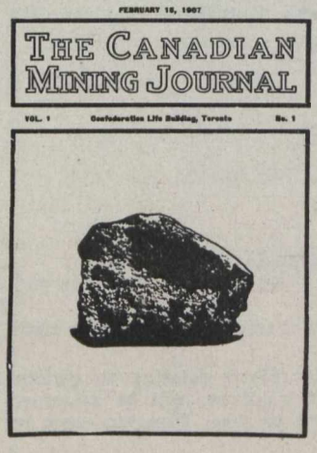

DEPARTMENT OF MINES GEOLOGICAL SURVEY.

PUBLICATIONS

The Geological Survey has published maps and reports dealing with a large part of Canada, with many local areas and special subjects.

A catalogue of publications will be sent free to any applicant. A single copy of a map or report that is specially desired will be sent to a Canadian applicant free of cost and to others at a nominal price. The applicant should state definitely the precise area concerning which information is desired, and it is often of assistance in filling an order for a map or report if he states the use for which it is required.

Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

REPORTS RECENTLY ISSUED:

CANADA
Summary Report of the Geological Survey for the year 1913.
NEW BRUNSWICK and NOVA SCOTIA
Memoir 20. Gold fields of Nova Scotia, by W. Malcolm.
Memoir 60. Arisaig-Antigonish District, Nova Scotia, by M. Y. Williams.
Memoir 41. The "Fern Ledges" Carboniferous flora of St. John, New Brunswick, by Marie C. Stopes.
QUEBEC
Museum Bulletin No. 3. The Anticosti Island faunas, by W. H. Twenhofel.
Memoir 39. Kewagama Lake Map-Area, Quebec, by M. E. Wilson.
ONTARIO
Museum Bulletin No. 5. A Beatricea-like Organism from the Middle Devonian, by Percy E. Raymond.
Memoir 40. The Archaean Geology of Rainy Lake Re-studied, by Andrew C. Lawson.
Museum Bulletin No. 8. The Huronian Formations of Timiskaming Region, Canada, by W. H. Collins.
NORTH-WEST PROVINCES
Memoir 47. Clay and Shale Deposits of the Western Provinces, Part 3, by Heinrich Ries.
Memoir 53. Coal Fields of Manitoba, Saskatchewan, Alberta and Eastern British Columbia (Revised Edition) by D. B. Dowling.
Museum Bulletin No. 4. The Crowsnest Volcanics, by J. D. MacKenzie.
Memoir 61. Moose Mountain District, Southern Alberta (Second Edition), by D. D. Cairnes.
BRITISH COLUMBIA
Memoir 32. Portions of Portland Canal and Skeena Mining Divisions, Skeena District, B.C., by R. G. McConnell.
Memoir 51. Geology of the Nanaimo Map-Area, by C. H. Clapp.
Memoir 55. Geology of Field Map-Area, B. C., and Alberta, by John A. Allan.
YUKON AND NORTH-WEST TERRITORIES
Memoir 31. Wheaton District, Yukon Territory, by D. D. Cairnes.

MAPS RECENTLY ISSUED:

CANADA
Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.
NEW BRUNSWICK AND NOVA SCOTIA
Map 27A. Bathurst and vicinity, Gloucester County, New Brunswick. Geology.
Map 39A. Geological Map of Nova Scotia.
Map 121A. Franey Mine and Vicinity, Victoria County, N.S.
QUEBEC
Map 95A. Broadback River, Mistassini territory, Quebec. Geology.
Map 100A. Bell River, Quebec. Geology.
ONTARIO
Map 124A. Wanapitei (Falconbridge, Street, Awrey, and Parts of Maclennan and Scadding Townships), Sudbury District, Ont. Geology.
Map 49A. Orillia sheet, Simcoe and Ontario counties, Ontario. Topography.
NORTH-WEST PROVINCES
Map 55A. Geological map of Alberta, Saskatchewan, and Manitoba.
BRITISH COLUMBIA
Map 43A. Sooke Sheet, Vancouver Island, British Columbia. Topography.
Map 136A. Hazelton-Aldermere, Cassiar and Coast Districts, British Columbia.
1321. Diagram Showing the Geology of Texada Island, British Columbia.
Map 106A. Groundhog coal field, British Columbia. Geology.
YUKON AND NORTH-WEST TERRITORIES.
Map 113A. Canadian routes to White River District, Yukon, and to Chisana District, Alaska.
Map 58A. Explored Routes in the Lower Parts of the Drainage Area of Churchill and Nelson Rivers, Manitoba and Saskatchewan. Geology.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

Communications should be addressed to THE DIRECTOR, GEOLOGICAL SURVEY, OTTAWA.

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Continued on page 30.

ALPHABETICAL INDEX TO ADVERTISERS

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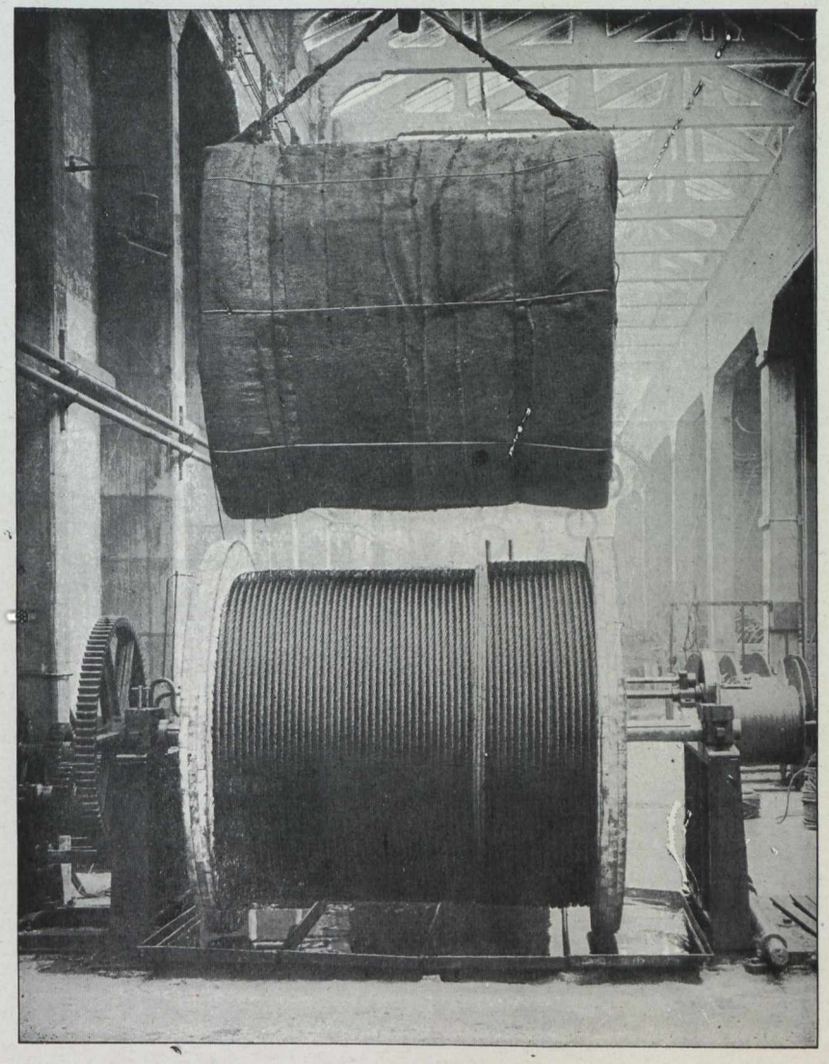

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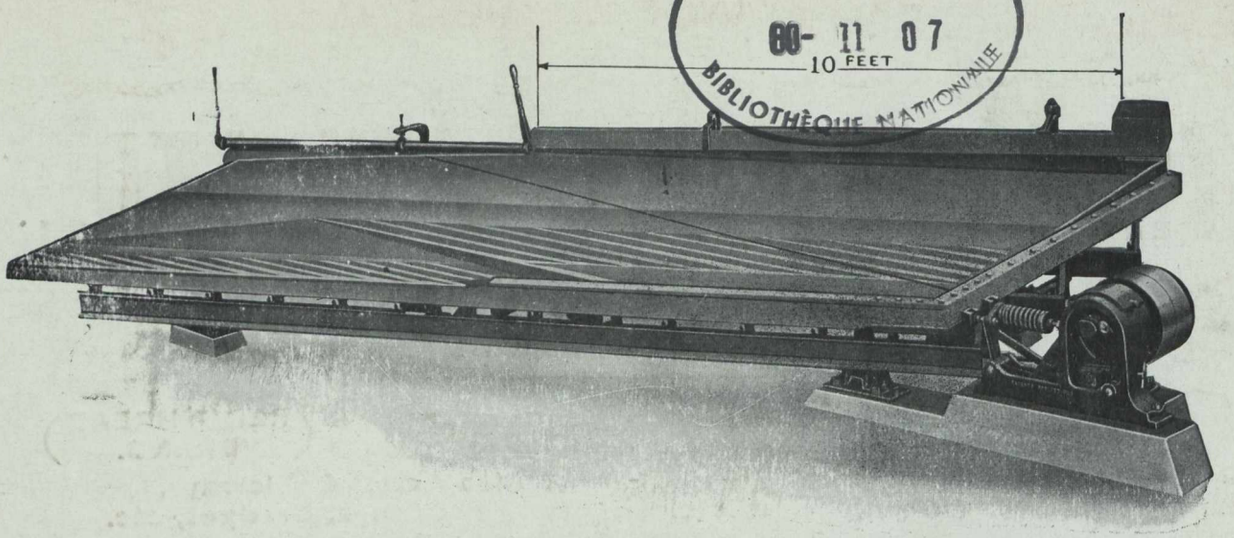

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