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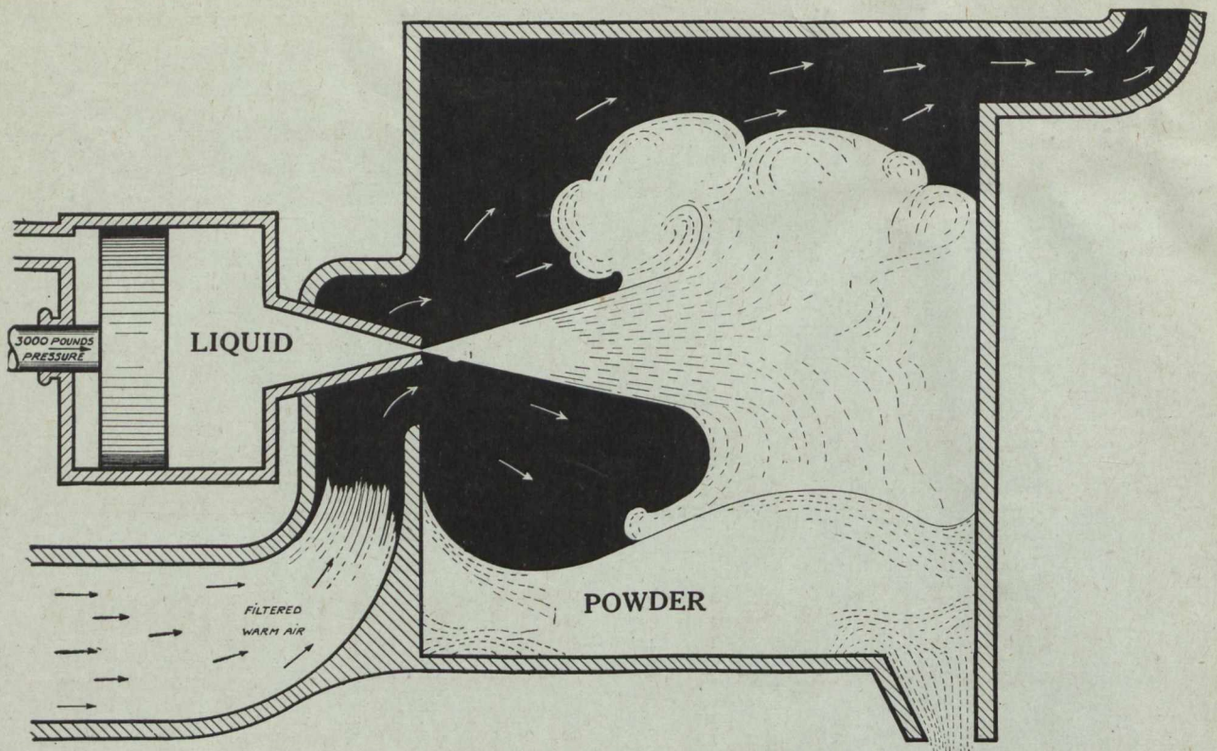

THE BLIZZARD OF KLIM

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The diagram shows how the liquid milk is forced at high pressure in the form of a fine spray into a chamber through which a swiftly-moving current is filtered, heated air passes. The fine spray of milk and the swiftly-moving dry heated air meet and cause a swirling action in which the water in the milk becomes absorbed into the air and the milk solids fall to the floor of the box in a drift of pure powdered separated milk, which is KLIM.

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PROVINCE OF ONTARIO

DEPARTMENT OF LANDS FORESTS & MINES

BUREAU OF MINES

Ontario's Mining Lands

Ontario, with its 407,262 square miles of area contains many millions of acres in which the geological formations are favorable for the occurrence of minerals, 70 per cent. of the rocks being of pre-Cambrian age. The phenomenally rich silver mines of Cobalt occur in these rocks; so also do the far-famed nickel-copper deposits of Sudbury, the gold of Porcupine and Kirkland Lake, and the iron ore of Helen, Magpie and Moose Mountain mines.

Many other useful minerals, both metallic and non-metallic, are found in Ontario:—actinolite, apatite, arsenic, asbestos, cobalt, corundum, feldspar, fluorspar, graphite, gypsum, iron pyrites, mica, molybdenite, natural gas, palladium, petroleum, platinum, quartz, salt and talc.

Building materials, such as marble, limestone, sandstone, granite, trap, sand and gravel, meet every demand. Lime, Portland cement, brick and tile are manufactured in quantity within the Province.

Ontario in 1917 produced 46 per cent. of the total mineral output of Canada. Returns made to the Ontario Bureau of Mines show the output of the mines and metallurgical works of the Province for the year 1917 to be worth $72,093,832, of which the metallic production was $56,831,857.

Dividends and bonuses paid to the end of 1917 amounted to $11,486,167.45 for gold mining companies, and $70,821,829.34 for silver mining companies, or a total of $82,307,996.79.

The prospector can go almost anywhere in the mineral regions in his canoe; the climate is invigorating and healthy, and there is plenty of wood and good water. A miner's license costs $5.00 per annum, and entitles the holder to stake out in any or every mining division three claims of 40 acres each. After performing 240 days' assessment work on a claim, patent may be obtained from the Crown on payment of $2.50 or $3.00 per acre, depending on location in surveyed or unsurveyed territory.

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MINISTER OF LANDS, FORESTS AND MINES,

Toronto, Canada

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EDITORIAL

GEOLOGICAL SURVEY REPORTS.

The Geological Survey has published a summary report on work done during 1918 in British Columbia and Yukon. The authors are W. E. Cockfield, C. Camsell, V. Dolmage, B. R. McKay, S. J. Schofield and M. F. Bancroft. Mr. Cockfield reports on Mayo area, Yukon and silver-lead deposits of the Twelvemile area, Yukon. Mr. Camsell reports on mercury deposits of Kamloops lake; boring operations for oil in the vicinity of Vancouver; the Copper Mountain area; and platinum investigations. Mr. Dolmage writes on Quatsino Sound and Mr. MacKay on Cariboo gold fields. Mr. Schofield reports on Britannia map area and Ainsworth mining district. Mr. Bancroft reports on Lardeau map area. These gentlemen are to be congratulated on getting their reports ready for publication in a reasonable time.

SOME PLAIN TALK.

Col. Thomas Cantley, in his presidential address to the Mining Society of Nova Scotia spoke strongly against the tendency to favor putting all industries too largely under government control. He wants captains of industry to be allowed to get back to work.

Industries during the war were properly taken more largely under government control for war purposes. There has since been a desire on the part of many to see government control continued and made more complete. Others consider that the industries enlisted for war purposes should now be unfettered, and allowed to develop according to the ability and energy of the individuals connected with them. Our readers will find Col. Cantley's address elsewhere in this number.

MINING INSTITUTE MEETINGS.

An account of the annual meeting of the Mining Society of Nova Scotia, held in New Glasgow, is given in this number of the Journal. Much of the credit for the success of this meeting belongs to Mr. F. W. Gray of the staff of the Nova Scotia Steel & Coal Co. Our readers will be pleased to learn that Mr. Gray, who is an authority on the coal mining industry, is joining the staff of the publishers of this Journal and will be Associate Editor of the Journal. Mr. Gray will devote his attention chiefly to coal mining and to general mining in the Maritime Provinces.

In concluding his comments on the New Glasgow meeting, Mr. Gray makes some suggestions respecting meetings for consideration of members of the Canadian Mining Institute. We would be pleased to have comments on these suggestions, with a view to making the meetings more useful to members and the industry.

We have one suggestion to make. It is that some endeavor should be made to have, during the summer, local meetings in some of the mining camps, which would be made sufficiently attractive to bring men from other parts of the same province at least. For instance we might this summer have in Ontario visits to the gold and silver mining centres. To attend such meetings we would invite all interested in the mining industry.

MINING.

Recent discussion among members of the Canadian Mining Institute makes it more than ever evident that the term "mining" is understood to mean very different things by different persons. Some of the metallurgists, notably those in the iron and steel industry, like to consider that mining is the proper term to apply to the taking of ore from the ground, while the term metallurgy should be applied to the processes for winning the metals from the ores after the mining has been done. This would be in accordance with test book definitions. The term "mining" is, however, commonly used in a much wider sense.

A mining company that limits its attention to the extraction of ore is the exception rather than the rule in Canada. For many years gold mining companies have considered it their business to produce metallic gold, but none have found it desirable to call themselves gold mining and metallurgical companies. The latter term is superfluous in this connection.

We have before us the report of the Nipissing Mining Company for the year 1918. The report shows that the company produced and shipped during the year silver bullion worth $5,485,427, and residue and concentrates worth $352,099. We find in this report a detailed analysis of the cost of treating the ore. We find remarks on metallurgical problems as well as underground development. We find a record of income and expenditure; of exploration, development, and production; of costs and profits. This is the ordinary business of a mining company. Metallurgy is a necessary branch of mining as the term mining is used in the mining business. Managing ability, commonsense and good salesmanship have, however, their place in this industry as in all others.

OUTLOOK FOR COBALT SILVER MINES IS PROMISING.

The removal of restrictions on the price of silver seems likely to result in an advantage to producers. At the ruling prices there is assured successful operation of many mines at Cobalt. If the price goes much higher a market will be made for very low grade ore. This will lead to further exploration of supposedly worked-out properties. The Cobalt area has as many lives as a cat. It is particularly fortunate that the high prices have been obtainable during the period of high costs, for otherwise much silver that has been marketed would have remained in the ground. An excellent opportunity to get out an exceptionally large percentage of the silver in the Cobalt area is afforded by the present price of the metal. If, as seems possible, the price rises materially, an even more complete clean up than has ever seemed likely will be made. Cobalt has a wonderful record in many ways. It has made not only a very large production of silver, but it has done so at an unusually low cost. The demand for the metal seems likely to add further laurels to Cobalt, for the price warrants every attempt being made to increase the percentage of recovery.

MANUFACTURERS IN CONVENTION.

The twenty-fourth annual convention of the National Association of Manufacturers will be held at the Waldorf-Astoria Hotel, New York, on May 19, 20 and 21. The convention will discuss prevalent forms of social and industrial unrest, government of railroads, government, supervision and stabilizing of trade prices, federal revenue and tax legislation, employment relations, the employer's duty to provide jobs for soldiers, the approaching revision of patent laws, the industrial legislative outlook, and vocational training.

WESTERN ONTARIO IRON ORE DEPOSITS.

In this number a correspondent calls attention to Ontario's undeveloped iron ore resources. The war has directed the thoughts of all to the importance of iron and coal mining industries. Under the circumstances our correspondent's remarks are very timely. He does well to point out that while comparatively little investigation has been carried on, we are too ready to assume that the development of iron ore in Western Ontario is not commercially feasible at present.

It is true that we do not know much about our iron ore deposits. A large part of the little work that has been done, has been done by and for Americans interested in the Lake Superior iron ranges. We have benefitted to some extent by such work, but it is high time that Canadians made some endeavor to determine the nature and value of our deposits. We should have the iron areas examined and geologically mapped with a view to directing attention to the more promising areas and assisting those who undertake development.

CHICAGO MEETING—A.I.M.M.E.

The American Institute of Mining and Metallurgical Engineers will hold its convention in Chicago, September 22nd to 26th. This meeting promises to be one of decided importance to the industry, as subjects of vital concern will be under discussion.

In addition to the technical talks, an elaborate social programme is being arranged and excursions by the Institute as a body are planned to many points of interest in the vicinity, including the Steel Mills at Gary, the oil refineries at Whiting, metallurgical plants at East Chicago, and North Chicago, and to the LaSalle district, where the cement, coal and zinc industries are represented.

DOMINION ENGINEERING AND INSPECTION CO. OPEN VANCOUVER BRANCH.

The Dominion Engineering & Inspection Company, engineers and chemists, of Montreal, have recently opened an office in Vancouver at 44 Canada Life Building, Hastings Street West, under the management of Mr. John B. Croly, who is well known to engineering and construction interests in this district.

The business built up by this company in Montreal, Toronto and Winnipeg, has been conducted along sound professional lines, and it is interesting to note the company's confidence in the future of Vancouver and British Columbia generally, in opening an office in this province.

THE CANADIAN MINING MANUAL.

The publishers of the Canadian Mining Journal announce the appearance of a new edition of the Canadian Mining Manual. The editor has endeavored to make this a useful handbook for those interested in Canadian mines and minerals. Some idea of the contents of this manual will be found on another page.

MOLYBDENUM AND TUNGSTEN.

A communication has just been received by the Department of Mines from the Colonial Office, London, announcing a change in policy in regard to the purchase of molybdenum and tungsten ores. The communication states: "During the war the production of these ores throughout the world has increased enormously, while the demand has since the date of the Armistice greatly decreased. The stocks in this country, or on the way will be more than enough to meet the requirements of the United Kingdom for at least eighteen months. If the arrangements by which His Majesty's Government buy the Empire output of these ores are continued, by the end of 1919 there will be in stock in this country enough to meet the requirements of the United Kingdom, home and export trade for no less than two years, and as these stocks will have to be realized at a price not higher than the world's price, which will presumably be much lower than that now paid by His Majesty's Government, there will be for two years no market in this country for Empire ores and the effect will almost certainly be that many mines within the Empire will have to close down, and the result to the future of the industry might be disastrous.

In the circumstances the only satisfactory solution for both His Majesty's Government, and the producers, appears to be an agreement by which the Empire output and shipments to this country will be drastically reduced for the present, thus allowing stocks to be realized and the world's market to settle down so that the industry might resume normal working as soon as possible. Consequently the Minister of Munitions has decided to terminate the existing purchase arrangements at once, and will not accept delivery of any tungsten ore or molybdenite loaded from British Oveasea ports on ocean steamers after the 30th of April.

In addition, the Minister of Munitions hopes producers in their own interests will take immediate steps to reduce the production of these ores."

On April 29th before Mr. Chas. Macnab, Magistrate of the County of Carleton at Ottawa, Mr. A. S. Munich, Manager of the Kingdom lead mine at Galetta, was fined $100 and costs for allowing a cage to be used for the raising and lowering of men which was not equipped with safety devices as required by the Mining Act of Ontario.

Carbide Lamps.

The Justrite Manufacturing Co., Chicago, has just issued a catalogue illustrating miners' carbide lamps. A large number of lamps are shown and specifications given. The catalog is of the loose leaf pattern and the company plans to keep its customers supplied with complete up-to-date illustrations of its products.

Meeting of the Mining Society of Nova Scotia

The twenty-sixth regular Annual Meeting of the Mining Society of Nova Scotia was held in New Glasgow on the 23rd and 24th of April, about seventy-five members and visitors being in attendance. The occasion was the first on which the Annual Meeting had been held outside of Sydney since the Society's headquarters were moved there from Halifax. The Council had some hesitation in selecting New Glasgow, as it was feared the distance from headquarters might cause a meagre attendance, but on the other hand it was felt that some consideration of the claims of the Mainland members was required, and that further, New Glasgow was not far away from Halifax, and was more convenient for visitors from the West.

Col. Cantley's Address.

Colonel Cantley, the President was in the Chair, and following the transaction of routine business in the opening morning session of the 23rd, delivered the presidential address, which is published elsewhere in this issue of the Journal.

Mr. Cole's Paper on the Salt Industry.

At the afternoon meeting Mr. L. H. Cole, of the Mines Branch, presented a paper dealing exhaustively with occurrences of salt and brine in Canada, and the salt industry as a whole. Mr. Cole's remarks were chiefly descriptive of the numerous and excellent lantern slides shown, which illustrated the recovery of salt from sea water, from brine springs and crystalline salt deposits. An interesting feature was Mr. Cole's full explanation of the varied methods of evaporation used in concentration of brines, most of which was in the nature of new and fresh knowledge to the coal and metal miners and steel men who composed a very representative Nova Scotian gathering. Description of the important salt industry and its outgrowth of chemical industries in the neighborhood of Windsor, Ontario, came as a surprise to most present, who had not realized that a second and greater Northwich had arisen. Special interest, however, centered around the recent discovery of rock-salt at Malagash, Cumberland County, Nova Scotia, which was fully described in a recent issue of the Journal by Mr. Cole, and is now being developed by Messrs. Chambers of New Glasgow.

In this connection Dr. Hayes of the Geological Survey mentioned a reference made in 1840 by Dr. Abraham Gesner, one of the geological pioneers of the Maritime Provinces, to the presence of salt springs in the district of Malagash, and pointed out the necessity to trace the brine flow to its crystalline source, and the possibilities of a salt industry to supply the requirements of the "British Provinces," remarking that the "infancy of the colony was but a trite apology for backwardness in development of natural resources!"

Mr. Cole's talk and the lantern slides were much appreciated, and the Department of Mines does well to pay attention to the non-metallic minerals of Canada, and does still better in making its work known.

The Council of the Society, bearing in mind the interest of its members in steel manufacture and coking processes hopes that Mr. Cole at the next Annual Meeting may tell them something of the silica deposits of Canada, and the resources of the Dominion in refractories.

Refractories.

A paper descriptive of some important developments in the home manufacture of refractory bricks and shapes by the Dominion Iron & Steel Company had been looked for, but it was thought better to leave this paper until the results obtained were more definitely ascertained and tested. Although Nova Scotia, so far as is now known, is unfortunately short of high-grade refractory clays, there is an abundance of silica in occurrences of great purity, and Nova Scotia does not expect to be always so dependent on outside sources for refractories as is the case to-day. It cannot be said that as yet the clays and shales associated with the coal seams are either known fully or tested for suitability to any appreciable extent, and the very close resemblance between the coal measures of Nova Scotia with those of other countries where valuable clays are found in association with the Millstone Grit and the productive Measures, indicates that hope for the discovery of better clays than are now known is well founded.

"Romance and Rascality in Mine Promoting."

Mr. C. M. Odell removed any tendency to stiffness which may have lingered in the meeting by a contribution on "Romance and Rascality in Mine Promoting." The title of this paper had been wrongly printed in advance as "Romance and Rascality in Coal Mining," but the speaker explained that he knew of no reason to think that coal mining was more distinguished in regard to romance or rascality than other kinds of mining.

Mr. Odell's satirically humorous philosophy has come to be rightly regarded as one of the features of the Mining Society's annual gathering. To those who are acquainted with Mr. Hoover's translation of Agricola the following excerpt from Mr. Odell's remarks will seem reminiscent, and show how great minds have thought alike in all ages. Mr. Odell speaks thus:

> "The lure of the wanderlust and the innate gambling instinct of the Anglo-Saxon lead men to the mining camp and the lumber woods. The thirst for wealth drives men to discovering mines and a philanthropic instinct prompts them to offer the stocks and bonds to a guileless public, whose desire for easy money is in inverse ratio to their ability to acquire it. Faced with the problem of gazing at a mean ticket with the rim all punched out, the young man gravitates between going into politics promoting a mining enterprise. This last-named, i.e., promoting, seems to be the safest method of prying a living loose from this earth; as trying to get a dividend from a mine by legitimate means — for the original investor — is about as hopeless as setting a hen on a porcelain door-knob and expecting her to hatch out a row of miners cottages."

Mr. Odell enlightened the Society as to the probable origin of a well-known description of a mine. At the time when the promoter's of King Solomon's Mines were flooding the Nile Valley with watered stock, the chief advisor of Rameses II is reported in conversation with his master as follows:

"Rammy, my boy, Rammy," sez he, "Rammy, you're right, a mine **is** a hole in the ground, and the owner **is** a liar!"

Mr. Odell's admixture of modern instance with ancient fable did not prevent him from giving the members some real information on early mine promotions in Nova Scotia.

"Tunneling on the Western Front."

Lt. George Morley, M.C., formerly on the survey staff of the Dominion Coal Company, and now invalided home from active service gave a paper, illustrated with diagrams, on "Tunnelling on the Western Front," which will be found elsewhere in this issue. Lt. Morley was intimately connected with some of the major tunnelling operations of the Canadian forces near St. Eloi and with the large mines whose explosion preceded the taking of the Messines Ridge. He gave a well-deserved tribute to the resourcefulness and gallantry of the Nova Scotian miners in the tunnelling companies.

The vote of thanks which followed Lt. Morley's paper was not the merely perfunctory thing that sometimes follows the reading of papers. The modesty of his manner, combined with the sober reality of the scenes and occurrences he described — scenes in which many of those present were intimately interested because of the letters received from friends and relatives who had taken part therein—made Mr. Morley very welcome. The interesting details elicitited from the speaker during the discussion strengthened the belief that some valuable additions to technical practice will be the result of the operations of our tunnelling corps, who in the course of hazardous warfare undertook experiments in the use of explosives, and in mining practice generally that under our rigid mining laws could not be tried in civilian life.

COL. THOMAS CANTLEY,
President, Mining Society of Nova Scotia.

Lt. Morley's references to the magnitude of the shaft sinking operations was rather a surprise to his hearers. Mine shafts from 120 to 150 feet deep are first class operations in themselves, without any of the additional difficulties imposed by war conditions.

The Wabana Iron Ore Deposits.

The evening session of Wednesday consisted of a paper by Dr. A. O. Hayes of the Geological Survey on the origin of the Wabana Iron Ore Deposit, in Conception Bay, Newfoundland. Mr. Hayes's monograph on the Wabana Deposit published by the Mines Department at Ottawa is the fullest and most authoritative account of this remarkable deposit yet written, and as Dr. Hayes was to speak in New Glasgow, a community always deeply interested in the iron ore mines at Wabana, the Council issued invitations to a number of local residents, who were present in addition to the members of the Society.

The meeting was presided over by Mr. R. E. Chambers, the mining engineer of the Nova Scotia Steel & Coal Company, whose part in the development of the Wabana ore is not perhaps appreciated outside the circle of his associates. Colonel Cantley quite properly remarked "that for the knowledge we have of this valuable body of ore, and for its development, both the Dominion and the Scotia Companies, and the Province, owes Mr. Chambers a debt of gratitude greater than to any other man alive or dead."

Mr. Chambers briefly related his experiences from the time he first examined the Wabana exposures in 1893, and referred to the completion of the two main haulage slopes which now are handling the ore extracted from the practically unlimited submarine areas of the Nova Scotia Steel & Coal Co. at a distance of over two miles from shore.

Dr. Hayes described the deposit carefully and at length, with the assistance of excellent slides, but the most informative part of his talk was his references to the boring algae which seemed to have taken so prominent a part in the formation of the spherules which combine to make the oolitic hematite of which the Wabana ores are so largely composed. Many of Dr. Hayes's auditors were men who daily life was spent in dealing in one form or another with Wabana iron ore, and had doubtless not suspected the existence of the fairy-land of deduction through which Dr. Hayes led them. One begins to realize how hopeless it is for one man to compass entirely even one branch of applied science in these days, for in Dr. Hayes's short lecture he quoted proofs elicited by zoology, by petrology, by chemistry, by geology. How many sciences have been utilized to perfect the naturally colored micro-photographs of rock sections that were shown, who shall say? The net result of Dr. Hayes's remarks appeared to be that while he would not hazard the assertion that the boring algae were the real originators of the Wabana ore seams, these minute and fragile organisms played a prominent part in their deposition. Dr. Hayes intimated that he did not favor the replacement hypothesis, the inference of which

would be that the Wabana ore seams will be found to persist over the whole of the basin in which the original sediments were laid down, apparently under conditions of absolute quiescence.

Colonel Cantley in the discussion said the striking part about Wabana was the relatively small amount of ore in the land areas compared with the tonnages that are practically proved to exist under the sea. Colonel Cantley remarked:

> "The volume of ore is so great that it presents a new feature in mining, to this extent, that it will make practically no difference, not only to this generation, but to several generations to come as to what rate of extraction is carried on at Wabana."

Dr. Hayes made a suggestive statement as to a great similarity between the Wabana ores and those found in some parts of Nova Scotia, more particularly near Mira Bay.

The unique character of the Wabana deposit, the enormous quantity of ore known to exist, its relative importance in the world's markets, and its still greater relative importance as an Imperial asset, and the unprecedented distance from shore at which ore is being mined in the under-sea operations, are matters on which much could be written, and matters which were only touched upon in the evening's proceedings.

Visit to Allan Shaft Colliery.

The morning of Thursday the 24th was occupied by a visit to the Allan Shaft Colliery of the Acadia Coal Company at Stellarton, where the visitors were shown over the surface-plant by Mr. Notebaert, the mining engineer, and others of the Acadia Company's staff.

The Allan Shaft is equipped with what is probably the largest steel-bankhead in Nova Scotia, having a capacity to handle 4,000 tons of coal daily. The shafts are the deepest coal-shafts in Eastern Canada, being over 1,000 feet deep and brick-lined. The power-plant, boiler house, ash-handling equipment and other surface erections are of the most modern and efficient type, and have all been fully described in previous issues of this Journal.

Visit to Steel Works.

Following the visit to the Allan Shaft the members were taken to the works of the Eastern Car Company, visited the shipbuilding yard of the Nova Scotia Steel Company, where two 2,800 ton steel ships are now being built for the Canadian Government, and went through the Steel Works at Trenton.

The plant of the Eastern Car Company is large and of the most modern description, and the visitors must have realized that in a very short time and in a small radius, they were able to inspect a modern colliery, a steel-car works of the latest type, a ship-building plant, and a steel works which during the pressing times of 1917 and thereabouts saw 5,000 men and women turning out shells in extremely large quantities, and played also an important part in providing heavy marine forgings for the numerous "lame ducks" which made Halifax during war days. While small perhaps, compared with other industrial centres in Canada, there are not many places which can show so complete a microcosm of the coal industry, and its "homologues" if one may be permitted to use the term. For after all, every one of these industries is an outgrowth of the mining of coal.

Air Consumption in Collieries.

At the afternoon session a paper by Mr. John Casey, manager of Dominion No. 4 Colliery, was read in condensed form by proxy—in Mr. Casey's absence—on "Some Economies of Air Consumption in Collieries."

This paper was a valuable contribution, from actual experience, of the economies which are possible in the use of compressed air underground by using all possible checks against leaks, and more particularly by the use of an air-meter designed to record not only pressure values but actual quantities of air in cubic feet. Mr. Casey pointed out that friction in air lines was just as fruitful a source of friction losses as it was in water pipes, and that in extending the air system, sound judgment is required to allow for the proper pipe sizes and the keeping down of the velocity of the air to a minimum.

The use of an air-meter will detect air-driven machines, such as hammer-drills, "punchers" and other forms of cutters that are wasteful of air, and will oftentimes show that a new air-chest, or possibly a new machine, would be less expensive than the waste of air and loss of efficiency that more often than is suspected arises from worn-out parts or antiquated types of air-driven machines.

The loss of air and pressure from leaky hoses, and from leaky hose-couplings is another prolific source of complaints of insufficient compressor capacity. It is not the large and noisy leak that runs away with the compressor yield. It is the numerous small leaks, "bleeding" hoses, and wasteful tools which in the aggregate make many compressed air installations so inefficient.

The discussion which followed was a really worthwhile one, for it was participated in by men who had many years of intimate experience with air as a motive power, both in surface and underground operations, and in coal and iron-ore mining, and also in open limestone quarrying on a large scale.

Mr. J. S. Whyte, of the Acadia Coal Company, mentioned an actual experiment when the compressors were run on a Sunday with no pressure on the line, and no air being used. The pressure built up from nothing quite rapidly, but in about twenty minutes the pressure reached a maximum and the curve flattened. Though the compressor was kept running at full capacity, the pressure did not increase, so that a point was actually reached, with no air in use, when the entire capacity of the air-compressor was taken up by the leaks.

There is no reason to suppose that this experiment could not be repeated in many mines with similar results.

It was very evident from the keen interest shown in the discussion that Mr. Casey's paper had raised a topic of first-class importance. The matter is one which is of especial interest to Cape Breton collieries mining undersea areas. The only motive power we now know of that can be economically transmitted for five to seven miles from its source of origin, or entrance into the mine workings, is electricity, which is to-day looked upon as largely inadmissible because of its danger in the presence of inflammable gases. If electricity cannot be made safe for underground use in the undersea areas, then the undersea coal cannot be worked beyond a very limited distance from shore, but it is hardly necessary to admit at this time that man's invention will not overcome what is after all a matter of detail. One method in which electricity can be utilized will be to compress air at some point underground, sufficiently near to the working faces to enable the air to be utilized under conditions of

maximum efficiency to operate air-driven coal-cutters; and here those who favor the use of compressed-air will have an excellent field in which to demonstrate the possibilities of its efficient use. Indeed, if they cannot do this, they must yield the field to some other motive power.

The Pictou Coalfield.

A series of notes on the Pictou Coalfield and more particularly the part of that field contained in the areas of the Acadia Coal Company had been compiled by Messrs. J. J. McDougall(assistant to the Mining Engineer, and G. A. McHattie, surveyor, both of the Acadia Coal Co. and was read by Mr. McDougall. The completed paper will be forthcoming at a later date.

Mr. McDougall detailed the thickness of 18 seams of coal some of them 30 and exceeding 20 feet in thickness, which are present in the Stellarton section of the Pictou Field. The number and thickness of the seams in a comparatively shallow depth of strata is extraordinary, and certainly not paralleled elsewhere in Canada. An interesting statement to those who know the Pictou Field is that the presence of the Ford Seam has been proved to the north of the Allan Shaft within a hundred feet from the surface, but the actual outcrop has not been discovered.

The Pictou Field is a geological puzzle, the solution to which is probably not to be found from explorations in the limited area of the coalfield itself. The coalfields of Cape Breton, of Pictou County, of Springhill and Joggins, and of New Brunswick, including the possibly concealed coalfields lying to the south-west of the Springhill coal exposures, cannot be disassociated from each other in considering the problem of any one field. A study of the tectonic geology of the great Carboniferous basin of deposition which extends over a great part of New Brunswick, Nova Scotia, and the Gulf and continues far into Newfoundland, may throw light on the limits of the known coalfields, where these are obscured by the presence of newer overlying sediments.

Great interest attaches in New Glasgow to the persistence, or otherwise of the coal seams under the New Glasgow conglomerate, but while the explorations of the Acadia Coal Company have yielded valuable information on the internal structure of the Pictou Field, they have not thrown any definite light on this question. Boreholes have been put down in the Conglomerate, but the results were negative, particularly as they could not be tied up with known conditions because of the absence of intermediate boreholes.

Confirmation of Early Work of Logan and Hartley.

It was pointed out that the information obtained by the Acadia Coal Company's diamond drill boreholes was most striking confirmation of the accuracy of the work of Messrs. Logan and Hartley, who in 1869 reported the same number of coal-seams, from purely surface observations, that have to-day been proved by diamond bores sunk through the floor of an extensively worked seam (the McGregor seam). Naturally the particulars of the seams given by Hartley and Logan were not so exact as those revealed by the cores of a diamond drill, but when one considers the unknown character of the Pictou Field in 1869, and the unreliability of surface indications, the painstaking and conscientious nature of the work accomplished by these public servants of fifty years ago calls for some recognition.

More Mapping Needed.

Reference was made by several speakers to the out-of-date and inadequate condition of the geological maps of the coalfields, which have to a large extent remained as they were drawn by Hugh Fletcher. Dr. Hayes spoke of the accurate and painstaking work of Fletcher, a geologist whose memory needs no enconium to Nova Scotians. He mentioned the depleted nature of the Geological Survey Staff on account of the war, and while it was generally felt that during the war probably neither the men nor the money were available for the not absolutely necessary work of revising the geological maps, that in the past insufficient attention had been paid to Nova Scotia. Dr Hayes mentioned that the Survey was undertaking to map certain portions of the Joggins Coalfield (where a number of collieries are now operating), which have not been previously mapped. This is the district that the late Hugh Fletcher was engaged in mapping when he died.

The meeting was also pleased to learn from Dr. Hayes that Dr. Wight, Professor of Geology at Acadia University, was detailed to conduct investigations into the oil shales of Pictou County during the ensuing summer.

Mr. D. H. McDougall's Address.

The meeting, on the motion of Professor J. H. Sexton, which was seconded by Mr. C. M. Odell, passed a vote of congratulation to Mr. D. H. McDougall, past-president of the Mining Society, on his election to the presidency of the Canadian Mining Institute.

In replying, Mr. McDougall gave an account of the activities of the Canadian Mining Institute, and indicated the aggressive policy which the Council had outlined for the future of the Institute, particularly the intention of the Institute to become a factor in the framing of mining legislation. President McDougall also referred to the stand which was being taken by the C. M. I. and also the Engineering Institute on the question of inadequate salaries now being paid to public servants of technical departments. He also mentioned the suggestion which the Institute had made to the Federal Government to grubstake prospecting parties of returned soldiers, and the undertaking of the Institute to superintend the work of these parties. Mr. McDougall expressed his belief that the union between the Mining Society and the C. M. I. had been a proper and desirable thing, and that his own selection as President of the Institute was one result of the union, which generally had brought the members of the Mining Society of Nova Scotia into closer touch with the literature and movements now energizing the technical societies of North America.

Resolutions.

During the course of the Sessions a number of resolutions were passed. The Mining Society joined its forces to those of the Canadian Mining Institute and the Engineering Institute of Canada in the matter of technical salaries, it being resolved to

> "Respectfully urge upon the Dominion and Provincial Governments the pressing need of paying better salaries to those civil servants who are technical officers of the Department of Mines and similar services."

The following resolution was sympathetically received and passed, following remarks on the record of the Nova Scotians in the war from the President, Colonel Cantley, and from the past-President, Colonel Mc-

Dougall, who spoke in this connection as President of the Canadian Mining Institute. The resolution read:

"The Mining Society of Nova Scotia takes the opportunity of the first Annual Meeting following the defeat of our enemies to express its sense of the honor reflected upon the industries and profession it represents by the very gallant record of Nova Scotians on the fighting fronts.

"Our Society will keep in sacred memory those who fell, and desires to honor those who have so nobly served."

Following this resolution the Society very properly recorded:

"Its recognition of the duty of its members to assist in every way the re-establishment of returned soldiers in civil life."

Professor Sexton's Address on Repatriation.

In speaking to this resolution, Professor Sexton, whose work in the vocational training of disabled soldiers is so well known, said:

"I am glad this resolution has been moved. I find that the barometer of sympathy for returned men has lately been dropping. The greatest support we are getting is from the large industries of the Province. Soon after the declaration of war the Dominion Steel Corporation and the Nova Scotia Steel & Coal Company promptly declared they would take back all their enlisted men returned from overseas, and who had been on their payroll when they volunteered. I am glad to say they have lived up to this, and have even done more. I would like to state my appreciation of the contribution these companies have made to the rehabilitation of returned men."

Professor Sexton brought to the attention of the Society the necessity of vocational training for the cripples of industry, and the opportunity afforded by the existing organization which was working so successfully in refitting crippled soldiers for branches of civilian endeavor varying from their occupations previous to enlistment.

The consensus of the meeting was that Professor Sexton had opened up an important question with far-reaching possibilities, but a question that was itself in the process of development through existing agencies.

Amendments to Compensation Act.

During the progress of the meeting the Committee on Legislation reported on amendments to the Workmen's Compensation Act, which are proposed to be enacted during the current session of the Nova Scotia House of Assembly, and reference had been made to a proposal to increase the scope of the Act to include compulsory medical aid in all cases of accident. This will, if enacted, increase the disbursements under the Act by possibly twenty per cent., and while the present proposals contemplate medical aid for 30 days following an accident only, the implications of medical aid must eventually go much further. It was also mentioned that arrangements had been made to commence a Safety Council, under the direction of the Workmen's Compensation Board, empowered to make certain regulations concerning the safety of workmen, which if approved by the Board, will become compulsory upon all members of any given industry within the scope of the Act.

As there now exists at the collieries and steel-works of the Province and in many other industries, systems by which medical aid and hospital treatment is secured not only for workmen in the case of accidents arising out of their employment, but for the workman and his family also in sickness as well as accident, it was felt that while the matter was complicated, yet the existing benefactions and movements indicated a possible method by which some form of training could be extended to the cripples of industry, as it is now extended to the cripples of war.

A Committee was appointed to study the question raised by Professor Sexton and to report thereon to the Council.

The Committee named was as follows: The President, Colonel Cantley; the past-President, Mr. D. H. McDougall; the Vice-President, Mr. A. J. Tonge, of the Dominion Coal Co.; Mr. F. E. Lucas, of the Dominion Steel Company, and Prof. Sexton.

Majority of Meeting Favor Change in Name.

An echo of the Canadian Mining Institute Meeting was heard in a motion approving the suggested change of the name of the Institute. After some discussion a resolution was passed recording that "a majority of the members of the Mining Society of Nova Scotia present at the Annual Meeting in April, 1919, were in favor of changing the name of the Canadian Mining Institute to "The Canadian Institute of Mining and Metallurgy to "The Canadian Institute of Mining and desire to bind the individual members of the Society in voting through the letter ballot proposed on this question, and that each member would use his own judgment in voting.

The opinion of the meeting was overwhelming in favor of the proposed change of name.

A resolution of condolence was passed on the death of Mr. J. D. Maxwell, late the Assistant General Superintendent of the Dominion Coal Company, who was for many years past an active member of the Society and a Member of Council.

The proceedings of the Annual Meeting came to a close with a smoking concert on Thursday evening, when some really excellent singing, and some pleasant nonsense, concluded an enjoyable meeting.

Suggestions for Mining Institute Meetings.

The opinion of one who has attended both the meetings of the C. M. I. and those of the M. S. of N. S. is that the Mining Society has not suffered in its individuality nor in its virility by its union with the Institute, and possibly some improvements might be suggested in the Institute's form of annual meeting gathered from watching the proceedings of the smaller Society. The papers presented at the Annual Meeting in New Glasgow were few in number, but designed to evoke thorough discussion. The reading of the papers was not interrupted by outside attractions, and as the meeting took place in an "upper hall" at the top of three flights of stairs, the discussion was not spoiled by intermittent wafts of the animated gabble taking place outside which has so often spoiled the delivery and reception of a paper read before the C. M. I. on which the author had probably spent months, if not years of study and preparation. The writer has always thought that if the papers read at the C. M. I. Annual Meetings were fewer in number and more adequately discussed, without the usual interruptions, the annual gathering would be more useful from the technical side, although possibly it might lack in social attractions. As to this, however, one cannot be quite sure, because it may be that more people attend the meetings to hear the papers than has been popularly supposed.

The writer feels disposed to make an even more radical suggestion, namely, that no papers should be asked for the Annual Meeting of the C. M. I., but that a number of papers, limited to perhaps six, should be selected from among the papers read at the meetings of the Branches, for presentation at the Annual Meeting, and for discussion. Written discussion should be particularly sought, and in order to make this possible to the widest extent, the papers selected should appear in the Bulletin a month or more before the date of the Annual Meeting at headquarters. — F. W. Gray.

Canada's War Record

By COL. THOS. CANTLEY.

On the occasion of our last meeting at Sydney, May first, 1919, Col. D. H. MacDougall, in his presidential address, directed your attention largely to the subject of coal—its importance in the prosecution of the struggle in which we in company with the other portion of the Empire were then engaged, and its influence upon the National life of Canada. In view of the fact that since that date the arms of the British Empire and our Allies have been crowned with victory—our foes having on the 11th November, last, cried, "enough", and accepted armistice conditions which in effect ended the war so far as they were concerned — I think it now fitting at this the first meeting of the Mining Society in a new era after four and three quarters years experience of war conditions, that your President with your permission, direct your attention to what Canada has done in the Great War, its cost to the Dominion in men and money, the effect produced on our people, the conditions arising out of the War, and how we may best meet these.

As to the Dominion's part in the Great Struggle, some idea as to the development, extent, and cost of our effort may be gathered from the following figures:

	Number of men sent overseas.	Expenditures.
1914	30,999	$ 25,275,749.
1915	84,334	127,616,300.
1916	165,555	248,665,770.
1917	65,536	515,094,895.
1918	73,630	360,000,000.
	418,052	$1,076,756,714.

From the figures just quoted it is shown that up to November 15th we had sent overseas 418,052 men. Of this total it is estimated that some 6,000 coal miners enlisted from Nova Scotia. Surely a very creditable record — and altho some may doubt the wisdom of the authorities in permitting so many skilled men to enlist, the spirit and patriotism of these volunteers is beyond question.

The losses in the Canadian Army for the same period amount to 218,433 and 52,176 were killed in action or died of wounds. Reviewing some of the more illuminating details it would appear that Canada's participation in the Great War up to November last had cost One Billion dollars. Of this amount more than half, or to be exact, $567,540,000 represents pay and allowances. For the maintenance of our Army in France we have paid out $114,367,000, Separation allowances called for $81,470,000 — the clothing for the Army has cost $57,000,000 — boots and repairs, $11,333,000. To transport our army across the seas we paid $17,815,000, and the land transport cost $19,112,000 — horses and remounts $6,594,000, machine guns, $4,494,000 — outfit allowances $11,622,000.

The average cost of rations per man in Canada was fifty cents and in Great Britain, .38½ cents per day. The average pay to our soldiers was about $1.25 per day for all ranks. The cost per man for clothing is about $64. per year, to which about $5.00 is added for necessaries. Upkeep has been placed at $20. per man per month. On the 31st October, 1918, there were 90,000 families of dependents of soldiers in Canada who received an average of $33. a month for all ranks—this by way of separation allowance. The maintenance of our men in France worked out at about $2.50 per day—this includes everything.

History has been enriched by the record of Canadian arms. How proudly we recall the immediate response to the Empire's call for men, when over 33,000 Canadians volunteered, went into training at Valcartier in August and on September 25th, 1914, embarked for overseas, arriving safely in England October 16th. In the early days of February 1915, they crossed to France, and soon took their place in the front lines as an integral part of the British forces. What a thrill of pride went thru all Canada a few months later at the wonderful stand of the Canadians at the Second Battle of Ypres, where the Hun first used gas, and when the Canadians held the broken line against overwhelming odds, and saved not only the Channel ports for England, but also saved the British Army from a military disaster. Month by month the Canadian army steadily grew in strength, always adding fresh lustre to its proud record. Langemarck, St. Julien, Courcelette, the Somme campaign, the storming of Vimy Ridge, Passchendale, the breaking of the Hindenberg Line, the capture of Cambrai, Amiens, and finally the dramatic entry into Mons at the closing moment of the war, all have added to Canada's fame, and it is our Army's proud boast that Canadians never failed to capture their objective.

Of their exploits and individual bravery much has been and more will be written. Their activities have extended from France and Flanders to the Archangel and Vladivostock fronts in Russia. Canadians participated in the Dardanelles campaign, others were in Mesopotamia, Medical units and our airmen assisted in Egypt, and wherever the need was geatest our men were found. For their gallantry already 55 Canadians have been awarded the Victory Cross, 513 the D. S. O., 1882 the Military Cross, 1,188 Distinguished Conduct Medals, and 4,697 received the Military Medal. Canadians were mentioned in despatches on 3,333 occasions, and won numerous foreign decorations. We can also point with pride to the fact that nearly if indeed not more than 200 Nursing Sisters were awarded the Royal Red Cross.

Canada in her participation in the great war literally found herself. Not only did we as citizens of this great Dominion rise to a higher conception of our individuality as a Nation, but demonstrated our place as one of the chief Dominions in the greater Empire that the world has ever known. We also won the unfeigned admiration not only of the world in arms, but also of the great brotherhood of world wide nations who with few exceptions were one in the conviction that the military conception and purpose of the Central Powers must be utterly destroyed. While it is true that our neighbors of the Republic to the south for several years did not join us in what for a considerable time seemed to them at least a doubtful conflict, the great majority of their better citizens secretly, and many of their most prominent men, openly, expressed their admiration for the instant action of Canada in springing to the defence not only of the Empire, but of civilization, and applauded the energy and determination with which so small a people ventured all for what they conceived to be the right.

As to the people of Canada, who can measure, who can determine or set bounds to the moral and national uplift which came to us thru the participation of their sons in this great conflict. More than 400,000 of the youth and vigor of Canada went from our shores, all of them having counted the cost, and most realizing that they would soon be engaged in a war waged by methods more destructive, more deadly beyond all parallel in past history, and opposed by a foe who resorted to methods not only deadly but detestable, and even diabolical beyond human experience. Despite all this they went forward with a smile and a joke, and today 60,000 of them lie in lonely graves not only in France and Flanders, but on the shores of the Dardanelles, in Egypt, Russia, and many in the old home land. Over 218,600 have been wounded, and more than 30,000 are still in hospitals in Great Britain, France or Canada, and when all will have been demobilized, Canada will have a number more or less maimed and permanently disabled exceeding that heroic vanguard of 30,000 who sailed from Valcartier, October 1914.

These men, our returned soldiers, who have participated in the struggle, who have seen all its horrors, the wastage of life, the wanton destruction of homes and property, and have borne uncomplainingly in some cases for years, conditions of existence, of which we at home have no conception, have given the best years of their lives that we Canadians might continue to enjoy what we so often glibly and without understanding its cost, refer to as "liberty". To these men and to those who have fallen, the Nation and particularly this Dominion, owes a debt of gratitude beyond computation. To those who still live, and for the parents and friends of our heroic dead, the greatest reward must be the consciousness of having done their part, and contributed their best to the winning of the freedom of the world. We who have not been combatants but remained quietly at home must remember that we owe much, and that obligation we must recognize and discharge as best we can, and in the spirit and so far as it is possible, in measure equal to the service and sacrifice which our returning men so spontaneously and so gloriously rendered on our behalf.

Conditions Arising Out of the War.

When an economic period, measured in this case by nearly five years, suddenly ends, and the world is brought face to face with wholly opposite conditions, a period of uncertainty and confusion is bound to follow. Many predictions are more or less fulfilled, but often in unexpected ways and with unexepected immediate consequences. Some things which we thought would certainly follow do not occur, or if they do, the result is often opposite to what was anticipated. The effect is bewildering and a comprehensive grasp of the situation is impossible. This conditions of affairs is not new, but has marked the immediate close of every great war. As by comparison the war which began in August 1914 was from every point of view the greatest that history has ever known, it is natural, on reflection, to suppose that the dislocation of commerce and trade, and the readjustment and return to normal conditions must present corresponding difficulties, and require a corresponding period in which to effect complete readjustment.

We are now emerging from the artificial conditions of war, during which trade and industry, politics and legislation, and the habits of our people have been more or less run in new and unfamiliar channels, and in most cases not to our liking. Our instincts are to get back as quickly as possible to former ways. In the doing of this, however, we encounter many obstacles. At first thought it would appear that the abnormal high war prices, which were the result of the war itself, and war time requirements (enhanced by lack of transport) would immediately disappear with the cessation of hostilities, that the disbanded armies would return to productive work, and that instead of a shortage of labor, the world's demands for curtailed supplies of manufactured goods of every description would provide occupation for all our workers, but the fact is that to quickly adapt industrial plans and activity to after-the-war altered conditions is difficult and complex.

High prices have stimulated certain manufacturers and made possible the marketing of certain raw materials at points and under conditions which can no longer be carried on at a profit. War time prices were not merely a cause, but in many cases, the effect of was time advanced wages — but wages do not come down relatively to the decline of prices. Prospective buyers are waiting and will continue to wait until convinced that automatic readjustment has carried prices to the lowest or nearly the lowest point. The question of wages, therefore, is not merely an industrial but also a social problem.

Such transition period past history has shown to be always a trying one, and our experience will be no departure from that of the past. It is no exaggeration, to say that the result, or up to the present, the lack of result, of the deliberations of the Peace Conference has been a great disappointment everywhere, and in provoking feelings of resentment which are not confined to the manufacturing or working classes, to the shipping or the agricultural community, but is wide spread throughout the world, and that for good reasons. The general view of the duties of the Peace Conference was that at the earliest possible moment, and with the least delay, and ignoring all extraneous questions, they would determine the terms of peace with Germany, and Germany's allies, such terms to include the amount to be paid by them towards the loss and cost of the war to the Allies, together with the territorial rearrangement due to the altered conditions resulting from the war, and the enforcement of adequate physical restrictions upon Germany, which would prevent that country reaching a

position where it could be a menace to the peace of Europe within the life of the next generation.

Unfortunately there is too much reason for concluding that other considerations than these have more or less governed the deliberations and protracted the work of the Peace Conference. The time has been wasted in the discussion of academic theories and illusionary suggestions by which it is asserted continuous world peace might be secured. Ideas put forward by visionaries who have forgotten, if indeed they ever realized, that man has, as all recorded history proves, always been a pugnacious animal, with a latent unrest, looking forward to and reaching out for a better and more satisfactory adjustment of physical needs and physical possessions. While it might be going too far to say that all human material progress has been the outcome of war, it can at least be safely asserted that much af the material advantage and comforts arising out and enjoyed by civilization has been the result of past wars.

The world as a whole at present has had its full of fighting, is sated with slaughter. A large part of the civilized world today is in mourning — all the warring nations are more or less exhausted physically and economically, and are disposed to cry out "enough". But given twenty or thirty years of peace, with war debts paid, the British Empire, France and Germany again prosperous, Russia returned to civilization, Japan enormously grown in power and wealth, China and the East having found themselves, with a new generation of men governing the world who will know the horror of war only through history and tradition — men of like passions, like hopes, like aspirations, and like desires as ourselves, what League of Nations will prevent, and how far, think you, will decisions arising out of the generalities and resolutions of a war-weary world then restrain or control any of the world powers of that time, who for causes then pressing on them, determine to emancipate themselves from conditions which they consider intolerable? Or who on the other hand, as did Germany in 1914, may decide to extend their influence and better their position by an appeal to arms. Abstract theories, be they ever so virtous, have not sufficed in the past to keep of the world, and will not in the future. Reliance on, not scraps of paper, but on adequate military training and ability to defend ourselves, is the only proven safeguard against loss of liberty.

Practically the condition today before us as Canadians is as to how we can the earliest, the most certainly, and with the least cost, return to normal economic conditions, pay our vast accumulation of war debt, and bring plenty and contentment to the people of this Dominion by providing employment for all our workers be engaged in mining, agriculture, fishing, manufacturing, or commerce. There is a disposition on the part of many to think that all this can be accomplished by Governmental authority — these men forgetting entirely the functions of Government.

In our judgment the first thing necessary is the removal of all Governmental control arising out of the war, or imposed on us on the pleas that such was necessary for the proper prosecution of the War. Included in this is the release of all requisitioned shipping, the readjustment of taxation, on such a basis as will provide the amount necessary for the carrying on of the Government, meet the interest, and provide a sinking fund which will retire our War Debt not within ten or fifteen years, but say forty or fifty years hence.

Much has been heard and more written on the subject of Reconstruction, both at home and abroad. Social reformers have vast schemes of re-employment, better housing, the so-called Whitley and other schemes for labor co-operation in marketing and distribution of commodities, nationalization of transportation, of mines, and of other sources of raw material. These in the main are discussed and advocated by people in academic life or habit of thought, men devoid of all practical experience in business or commercial life, but whose self-conceit is thereby none the less diminished, but who on the other hand, are quite convinced that they are competent to advise and direct the commerce of the country at the most difficult crisis in history.

In some circles great hopes are held out as to extensive markets being found for our manufactured goods in the devastated regions of France and Belgium. The active head of the American Red Cross Construction work in France is reported as stated that that country would require 80,000 ploughs, 56,000 cultivators, 39,000 mowing machines, 115,000 farm waggons, 88,000 harrows, 50,000 rollers, 36,000 seed drills, 13,000 fertilizers, 16,000 horse drawn rakes, 32,000 reapers and binders, and various other farm implements. We have no means of knowing as to the correctness of these figures, the sources of information available to or capacity of those who give them. Neither have we any information as to whether all this agricultural machinery is required during the present year or over a period of years.

Other estimates have been made and published as to the enormous amount of reconstruction material required for the rebuilding of devastated areas in France and Flanders. People not lacking in imagination, but possessing that characteristic in a greater degree than knowledge or judgment, have assumed that these two countries will buy from Canada and America during the coming year, more manufactured goods than we are probably prepared to supply, or at any rate than we can find transport for. Now France and Belgium will both require considerable quantity of sawn lumber, also certain raw materials such as cotton, coal, leather, pig iron in limited quantities, and some steel. Of course considerable quantities of food, cheap clothing, and a very common type of furniture in a knock-down condition, will also be wanted. Beyond these the requirements of France and Belgium are few, which need not be surprising when it is realized that these countries have their own problems of providing employment for their demobilized armies, coupled with the fact that that they have not the money, nor can they easily obtain the credit, if they wished it, for large importations. Their expressed intention is to provide employment for their own people, first, by manufacturing their own requirements and, second, so far as possible, by supplying the world's market with such products and goods as their resources will permit them to supply. Further, the ruined cities and towns of devastated France will not all be rebuilt either during this year, or even within the next five years.

It is a self-evident fact that if Canada is to pay the interest on her debts, raise the amount necessary for pensions and so keep faith with her illustrious dead, and returned broken men, and also maintain the ordinary public service of the country, the Government must be provided with an amount of money practically three times that contributed by Canada in pre-war days. This can only be done by a large export of agricul-

tural and manufactured products, and while we must look to Europe to absorb our agricultural products, it is not in that direction we should look for a market for the great bulk of our manufactured goods, but rather to our sister Dominions, the islands of the West Indies, and the Republics of South America, to supply which the transport charges should not be greater from Canada than from Europe, and where we can meet the manufacturers of Europe on practically equal terms. This can only be done by complete freedom from Governmental control of business, and from subserviency to class interests, whether it be that of labor, agricultural, or capital. The financial policy of Canada must be such as will raise sufficient revenue without an abnormal tax on invested capital, without which industry is impotent.

Economic laws will soon automatically lower prices of both food and commodities, and with a lower cost of these must come a lowering of the wage scale, which all Governments so generously advanced during the war times now past.

The solution of the labor troubles will perhaps best be met by the recognition by both capital and labor that a spirit of reasonable accommodation must prevail — that leadership must be recognized, and that conspicuous ability, be it among manufacturing managers or industrial workers, must be rewarded on a different scale from that of mediocracy. A broad minded policy on both sides which will learn to be fair and firm in essentials and also complacent and generous as regards non-essentials. These we suggest as some of the requisites for a return of properity to Canada, which we fully believe will soon enter upon a period of development and expansion greater than anything we have yet seen — great as that has been — for though much has been accomplished the greatness of the Dominion is still practically potential, and Canada is still of all countries par excellence the Land of Opportunity.

BELMONT SURF INLET MINES, LIMITED.

A report covering the ten months ending 31st December, 1919, has just been issued by the Belmont Surf Inlet Co., Ltd., operating mines at Surf Inlet, B.C. The net earnings of the company amounted to $323,242. The report also states that a loan made to the Company by the Tonapah Belmont Development Company amounting to $1,295,726, and interest has been repaid.

The average metal content of 83,142 dry tons of ore milled was 0.421 oz. in gold, 0,3114 oz. in silver and 0.2606% copper per ton, giving a total value of $924,847 or $11.12 per ton. The ratio of concentration is 11.09 to 1, which gives 7498 dry tons of concentrates having a gross value of $854,537.20 or an average value of $113.97 per ton.

Gold, silver and copper were sold at an average of $19.74 per oz., 97.13 cents per oz. and 20.957 cents per lb., respectively. Operating costs amounted to $7.185 per ton, the net realization being $3.888 per ton or 35.1% of the gross value of the ore. Mill tailing losses were .846 per ton.

Mining costs, which are especially interesting at the present time, show stoping to have cost $2.22 per ton, development work $0.361, milling $1.278, flotation royalties $0.116 and administration and taxes $0.614 per ton. The total operating costs being $4.83 per ton. Loss on boarding and bunk houses $0.182 per ton. The costs of drifting 893 feet, cross-cutting 241 feet, and upraising 753 feet were $16.41; $16.26 and $13.215 per foot respectively. The average cost of the 1887 lineal feet of all development work was $15,116 per foot. Each foot driven yielded 4.18 tons.

Operating costs were seriously affected by advanced prices paid for supplies and by the abnormally high labor costs. High wages, however, did not improve the low efficiency of the labor.

Ore reserves are calculated to be 422,761 tons or an increase of 153,790 tons since March, 1917.

New ore development was satisfactory although development work was less than the advisable minimum owing to labor shortage.

Milling operations fully met expectations for both efficiency and economy, 93.7% of the possible operating time, namely 13,818 hours the concentrator ran continuously, milling 272.6 tons per day, although over 300 tons per day have been milled since the end of the year.

Concentrates amounting to 6,374 dry tons were shipped to the smelter yielding $780,775.02 and 1123 tons of concentrates valued at $73,762.18 remained unshipped owing to a difficulty in securing steamers.

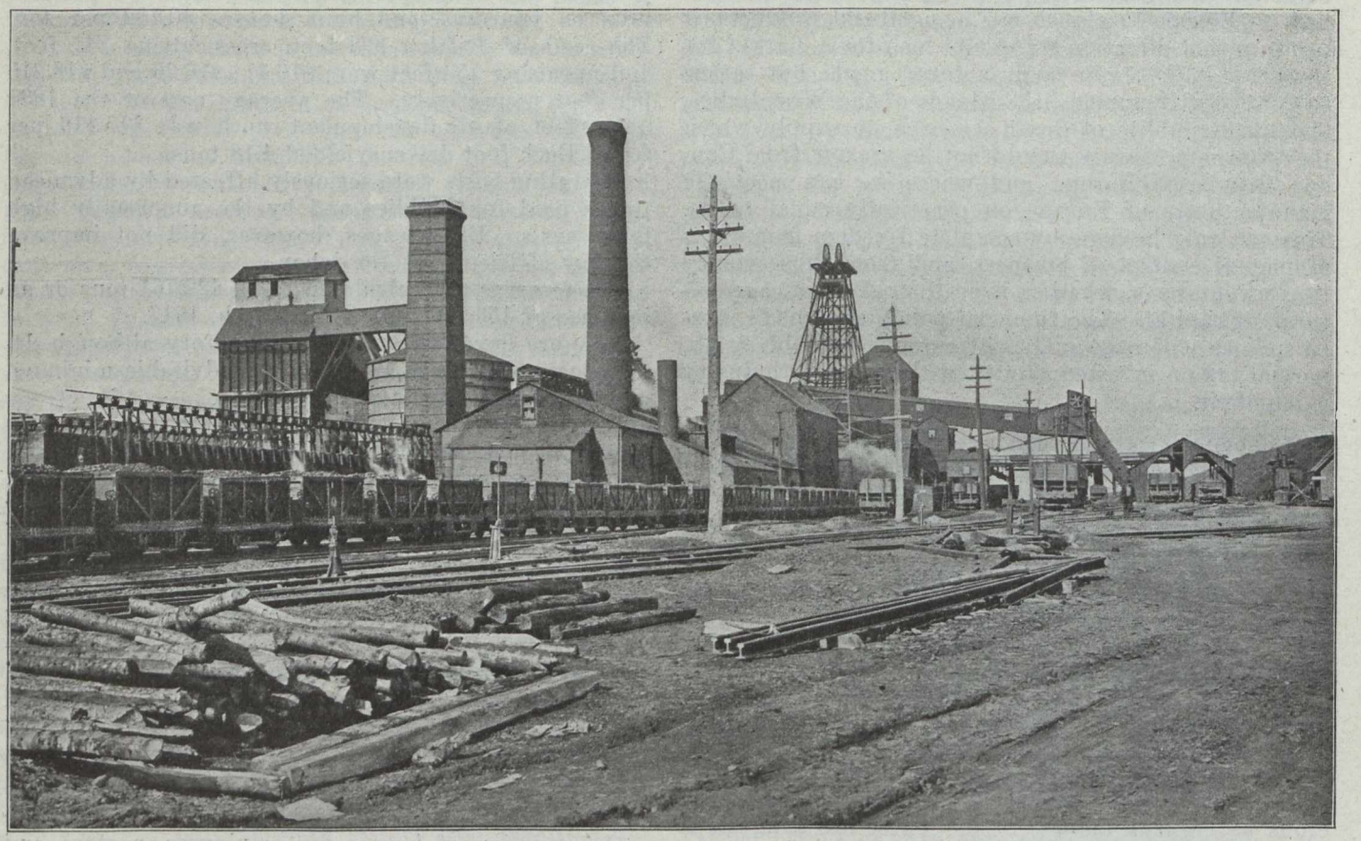
The hydro-electric plant gave excellent results, 4,737,360 kilowatt hours being generated with 4,394,525 k.w.h. delivered or a loss of only 7.37% in lines and transformers. The cost of producing the power was $9,966.78 or $1.23 per horse-power month.

Construction of houses for employees, a store and school-house was undertaken at a cost of $45,569.77.

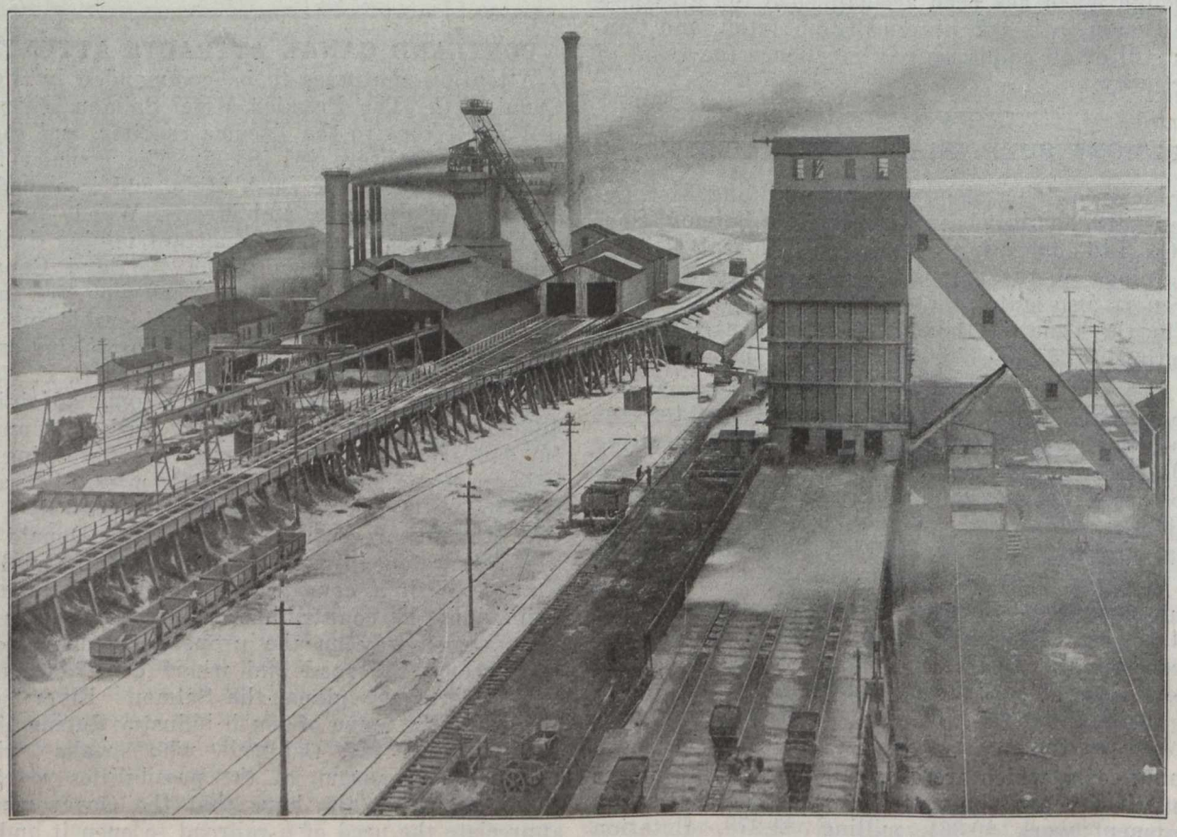
A dividend of 5% or 5c per share was paid on 15th April, 1919.

PORTLAND CANAL ATTRACTS ATTENTION.

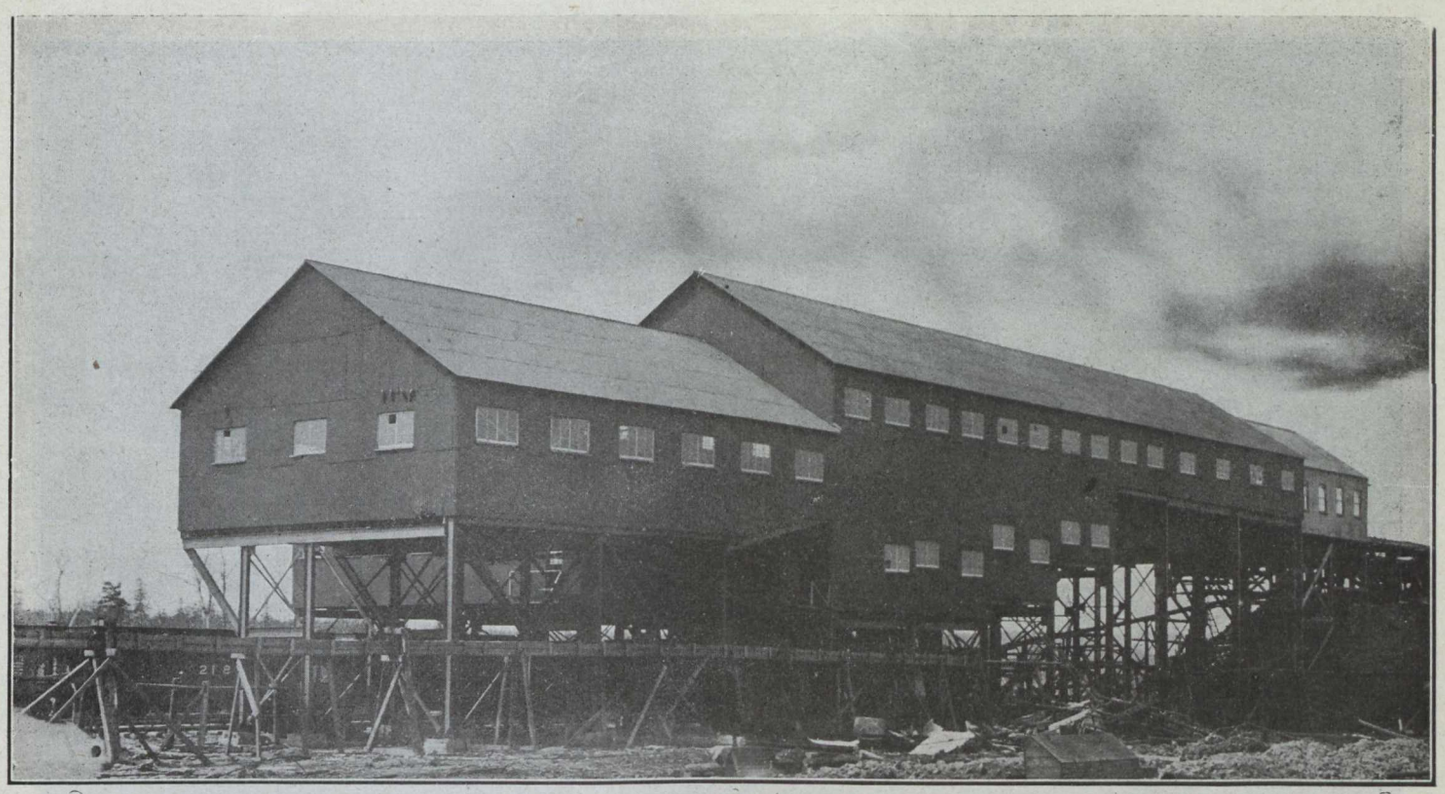
Attention continues to be commanded by Portland Canal, B.C. The Premier Mine, Salmon River, shipped 204¾ tons to the Tacoma Smelter, and the gross value returns were $67,483.55. The Premier formerly was known as the Bush Mine, and is owned by R. K. Neill, of Spokane, and Messrs. Woods and Trites, of Fernie, B.C. Several important mining deals have taken place recently in which Portland Canal properties were the issue. New York men, for instance, are said to have acquired a considerable interest in the Premier or Bush mine. The Forty-Nine and Yellowstone Groups have been bonded to C. F. Caldwell for $125,000. The Silver King Group, adjoining the Joker, has been bonded by O. B. Bush, of Vancouver, for $100,000. Mining properties now working in the Salmon River section are the Premier, Mineral Hill, and Joker. Work will commence about July 1 on the Big Missouri, recently bonded to Sir Donald Mann, the Yellowstone, Bush Mines, Forty Nine and Silver Creek. With a considerable number of prospectors going into the country this summer, and with operations under way on the properties enumerated, not to overlook the road and wharf construction which the Government plans, the Salmon River district should be the scene of much industry during the next few months. Mr. Caldwell, who speaks with unbounded enthusiasm, of the possibilities of the new camp, expresses the hope that the Government will appreciate the need of a railroad to open it and to aid in the development of its mineral.



"Princess" Colliery of the Nova Scotia Steel and Coal Company, Sydney Mines.

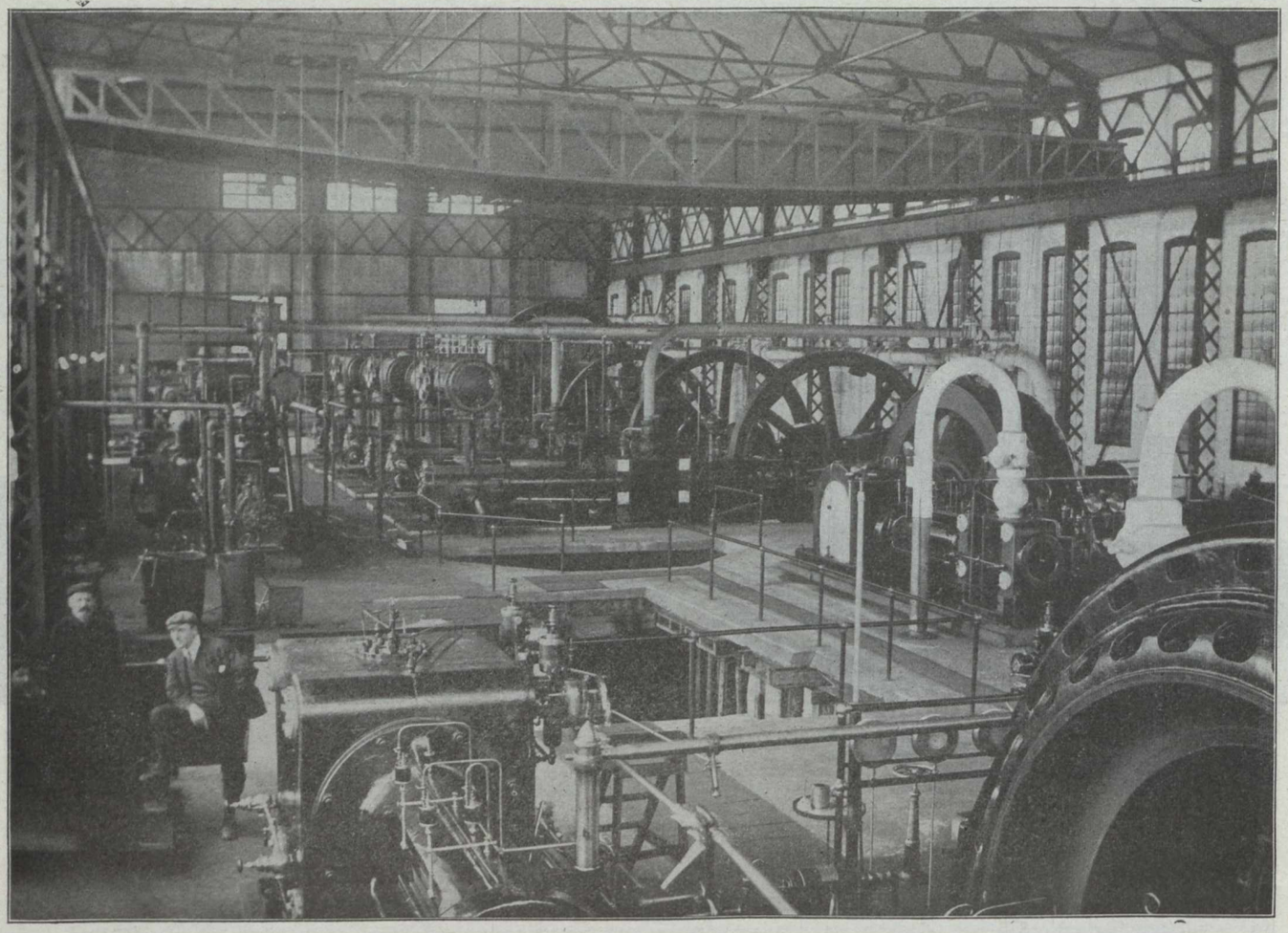


Blast Furnaces and Coke Ovens of the Nova Scotia Steel and Coal Company, Sydney Mines.
—Photo courtesy Mines Branch, Ottawa.

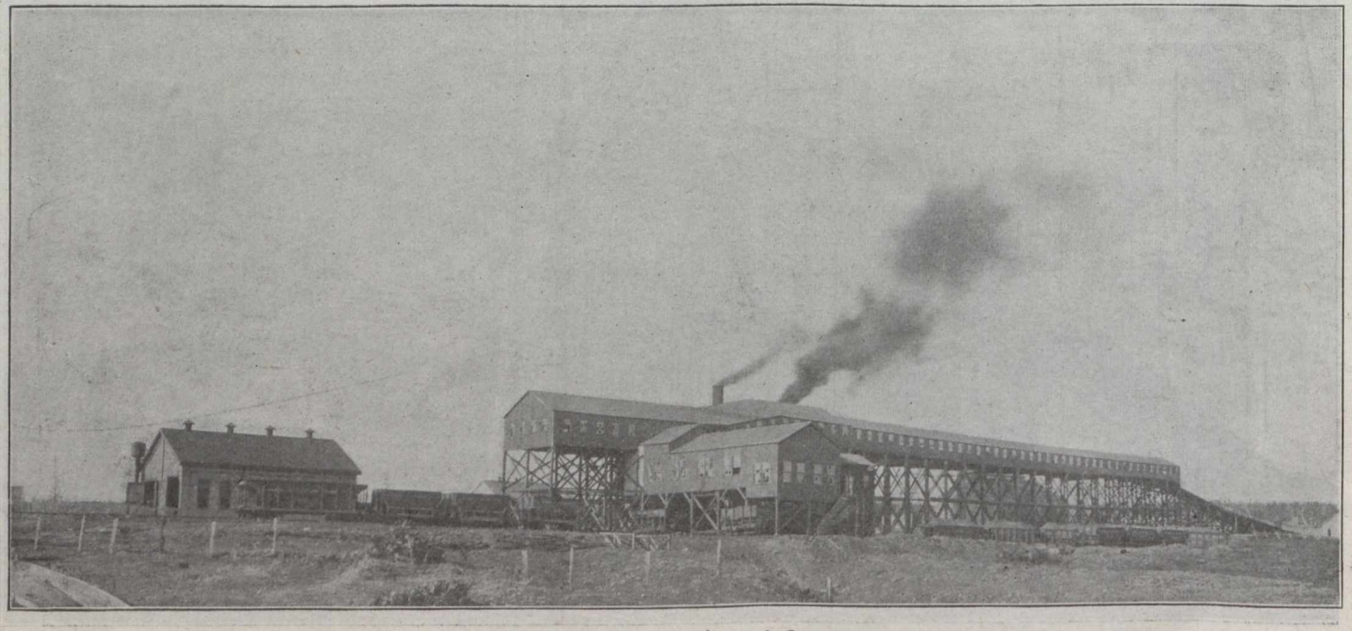


No. 17 Colliery, Dominion Coal Co., Nova Scotia.

No. 2 and 9 Collieries of the Dominion Coal Company. Two Coal Seams Are Worked at The Mine to Contiguous Shaft.

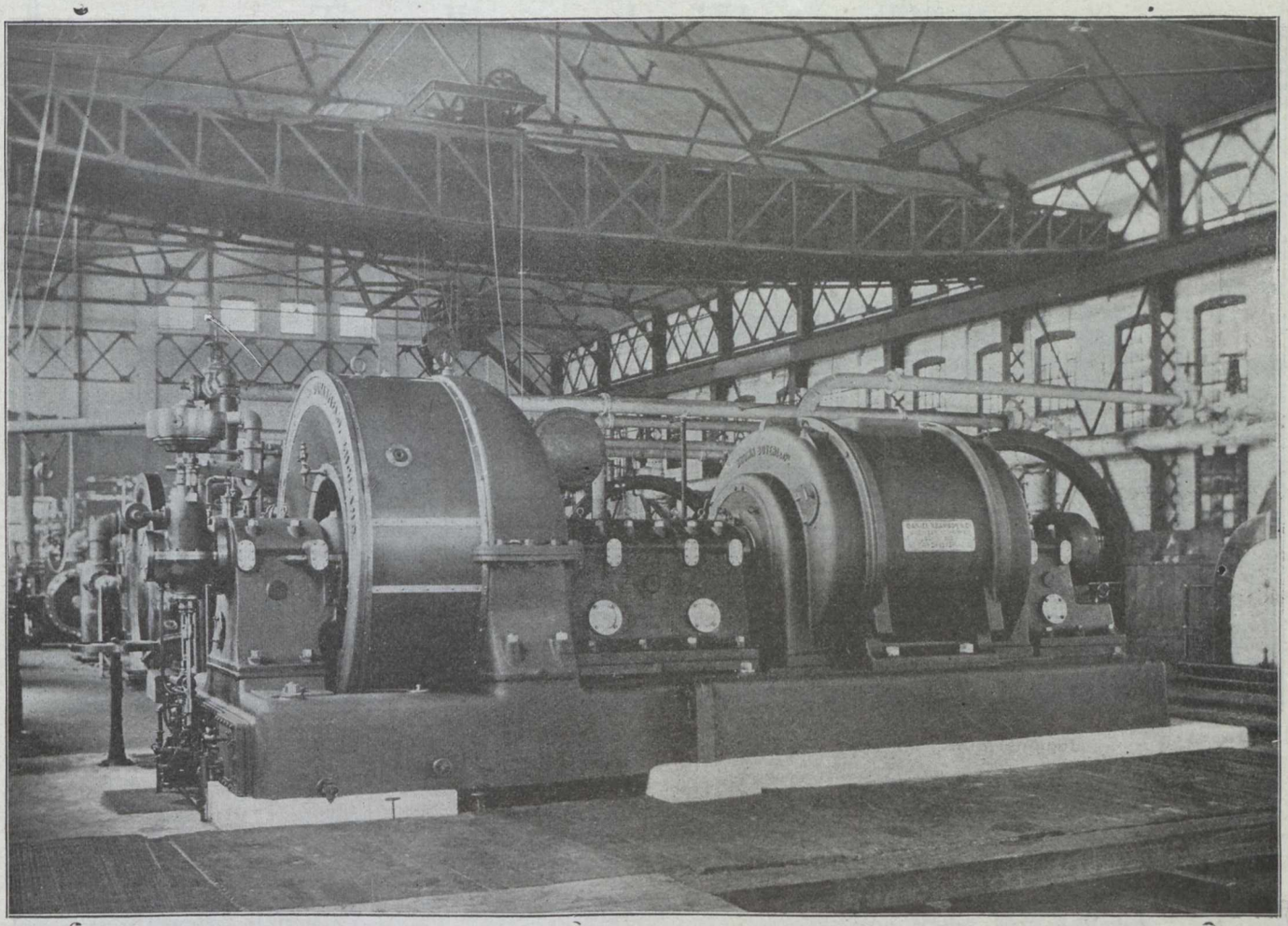


Interior of Power House No. 2 Colliery of the Dominion Coal Company, at Glace Bay, N. S., Showing Air Compressors and Electric Generators. (The Unoccupied Space in the Centre of the Floor is Now Occupied by the Turbo-Generator Set Shown on the Opposite Page.)

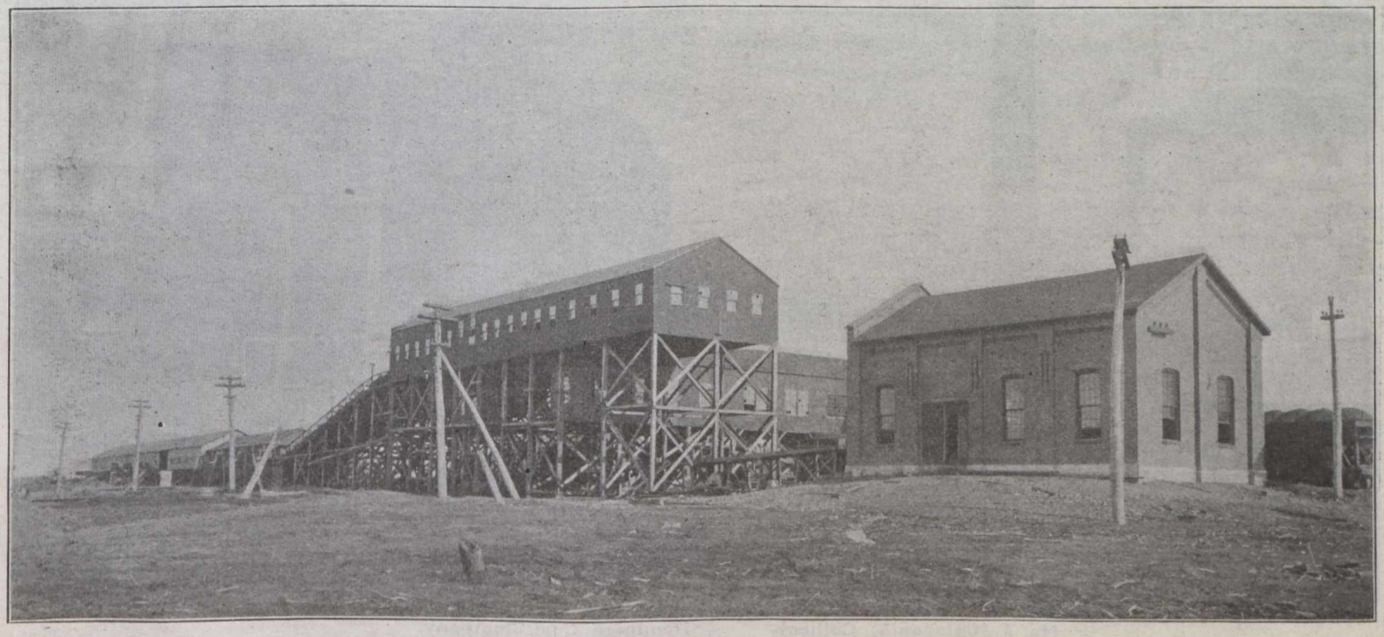


No. 12 Colliery. Dominion Coal Company.

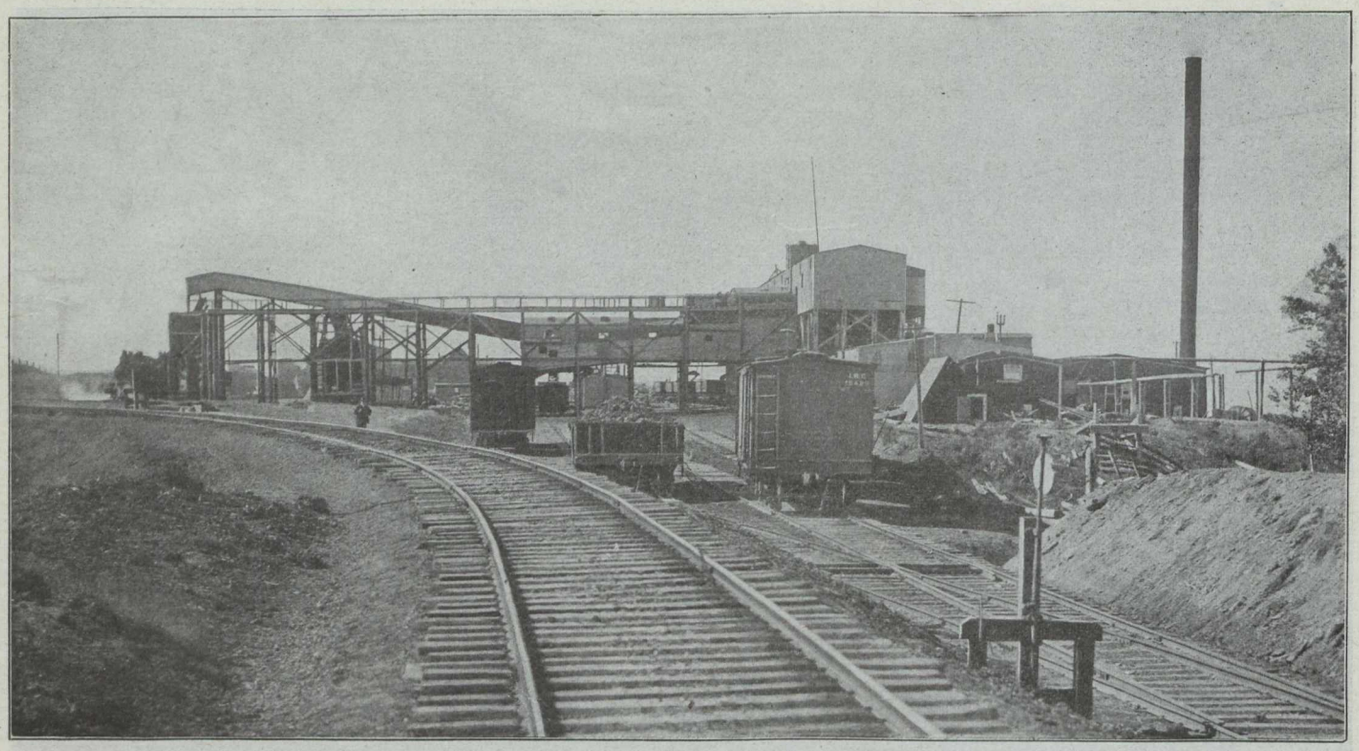
—Photos courtesy Mines Branch, Ottawa.



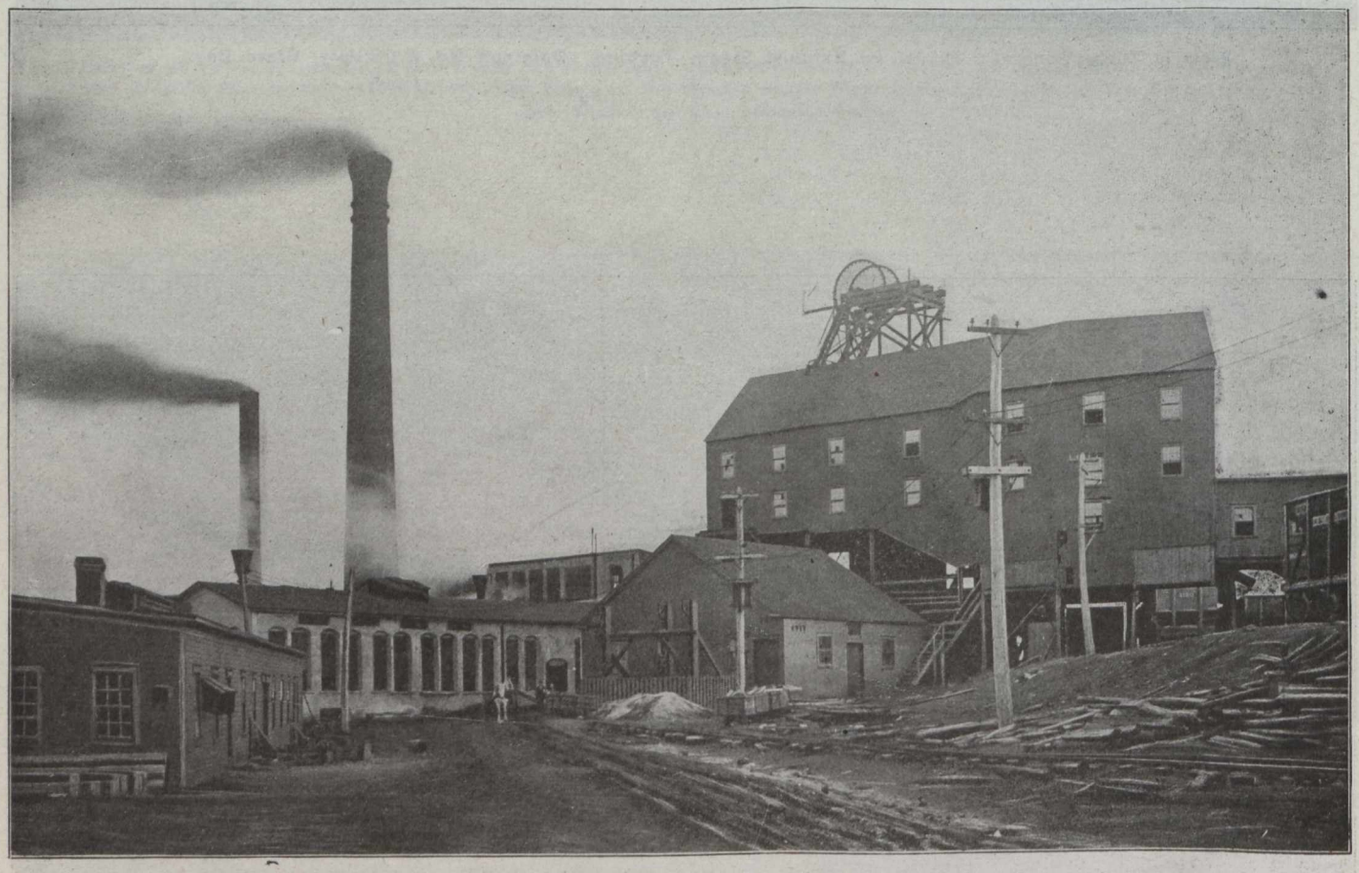
Electric Turbo-Generator Driven by Exhaust Steam Turbine. Dominon No. 2 Colliery, Glace Bay.



No. 14 Colliery, Dominion Coal Company, Showing Electric Hoisting Engine House at Rear of Bankhead.



Joggins Mine. Maritime Coal, Railway, and Power Company, Cumberland County.



No. 4 (Caledonia) Colliery, Dominion Coal Company.
—Photos courtesy Mines Branch, Ottawa.

Tunnelling on the Western Front

By LT. GEO. H. MORLEY, M.C.

The object of this paper is to give a general idea of the work of Tunnelling Companies in the last war.

Tunnelling was first recognized by the British as an important arm of the service in the middle and latter part of 1915, when a call was sent to all units for men and officers with mining experience in civil life to volunteer to serve in this new kind of warfare.

Large number of miners from all parts of the world —Cape Breton being well represented—came forward, and what was known as the Brigade Mining Sections were formed and the work of stopping the Boche underground was started.

These units were not properly organized and were not given the support necessary to compete with an organized, fully equipped and prepared enemy; consequently the Boche held absolute control of the mining situation up to the beginning of 1916.

It was then that the Tunnelling Companies were formed, organized and fully equipped in every detail. These Companies started with an establishment of some five hundred officers and men, had their own transport, blacksmith, carpenter and repair shop; in fact, were complete in themselves.

This establishment was sufficient at the start, but as the work undertaken grew, and the underground systems became extensive, it was found necessary to add to the strength from time to time, and toward the end most Companies had a total of anywhere from ten to twelve hundred all ranks.

The work, in the beginning, was started from the makeshift systems of Brigade Mining Sections. These systems served the purpose of keeping the Hun checked, to a certain extent, until such time as the new companies were able to sink large new shafts, at greater depths than had been previously attempted, and push forward new systems with a definite plan of action. These systems consisted of: 1st, Shafts sunk at depths of anywhere from 16 to 120 feet at varying distances along either the front or support line trenches. 2nd, From the shafts a large gallery, generally 5ft. by 3ft. was driven out towards the German front line for a short distance, as a rule 10 or 20 feet in front of our lines. From these large galleries, smaller ones, 4ft. 3in. by 2ft. 3in. were broken off to the right and left and driven to parallel our trenches.

The parallel galleries were for defensive purposes only and were generally connected up with the galleries of the shafts on both flanks, forming a complete barrier against any enemy offensive mining and at the same time affording several exits for the men below in case of any shaft being wrecked by the enemy artillery.

At intervals of roughly sixty feet listening posts were driven from the parallel galleries towards the German lines. The listening posts were "Feelers" pushed out until they came in contact with the Hun. In these posts men trained in listening underground listened for sounds of enemy mining. If sounds were heard it was from these posts that the task of stopping his work and pushing him back was undertaken. It was in this line of work that the British miner proved his superiority. In the first place we must remember that the German not only had his systems well across No Man's Land when we started, but in many places had his offensive galleries well under our trenches, waiting the opportune moment to blow and start his big push forward.

The Reason for Deep Shafts.

Our problem was: How can we pass his systems, and get ours well out without fighting every inch of the way with great loss of life and material.

The obvious thing to do was go deeper. Up to this point all operations were carried on near the surface, the greatest depths being roughly twenty feet. The difficulty of going below that was due to a layer of quicksand varying from fifteen to thirty feet. Both sides found it impossible to sink a shaft through this sand with the material and plant supplied.

We tried piling through time and again and managed at some points to get down to the firm blue clay; but so much water came down continually that all our time and attention was taken up with the problem of keeping the water in check and very little work was accomplished.

Water Tight Steel Shafts.

Next we tried to jack down a water tight shaft through the quicksand into the blue clay, taking the muck out of the shaft after it was down in position and set. This proved to be very satisfactory and it was on this principle that all shafts either timber or steel were sunk afterwards and we were able to mine at any depth we wished.

Driving Under Hun Galleries.

Galleries were pushed ahead generally at two depths. Sometimes as many as three levels were driven from the one shaft, the two upper being defensive saps, the lower an offensive.

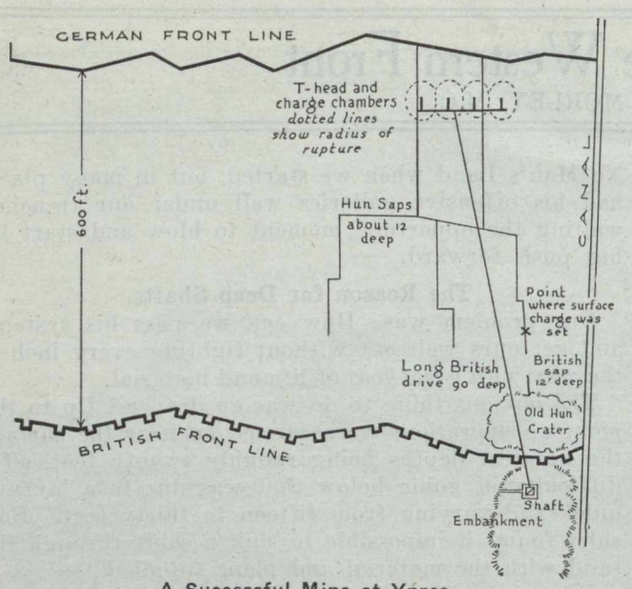
In this manner we drove under the Hun galleries, far enough below to work without being heard by his listeners, rising as we advanced, and in time our sapheads were driven close to his front line. With the use of the geophone—a very sensitive listening apparatus, on the principle of the stethoscope by very careful listening our listeners were able to locate the position of the enemy saps. We then carefully and quietly drove a post towards where we judged these enemy saps to be, made sure of the distance above and the exact location of his sap and placed a charge sufficient to wreck his gallery at that point, thereby cutting him off from the forward and main part of his system. If it was thought advisable we would drive into that forward part of his system, occupy it and work it as part of our defensive scheme.

A Successful Coup.

Below is a rough sketch of one highly successful coup planned and carried out by the 1st Canadian Tunnelling Company.

When the First Tunnelling Company started operations on this front (The Bluff, South-East of Ypres), the Hun had eight months start, sufficient time to mine our front line and have a complete defensive system prepared.

Shortly after we started operations; we found he was consolidated in every sense of the word. As the



A Successful Mine at Ypres.

plan shows. We found this by running a shallow sap from the outer rim of one of his old mine craters towards his line.

After we had driven a short distance the Hun blew; wrecking most of the gallery and killing the crew working at the time. We then realized that we were up against a proposition that required the greatest care and skill to accomplish the task set us.

We then drove ahead cautiously and slowly until we got to a point where we considered it wise to stop for the time being. Meanwhile we had sunk a shaft well to the rear of the front line and drove a sap, ninety feet below surface, towards the Hun. At the same time we carried out an extensive listening programme on the surface at night in No Man's Land and located the Hun system to be between 10 and 15 feet. We then placed a small charge of 25 pounds of ammonal on the surface in No Man's Land, directly over the point where we thought his gallery passed, and exploded it. This sprung a hole in which we placed a charge of 100 pounds that in turn was exploded at night, crushing his gallery below.

We immediately drove ahead from our shallow working and captured some thirty feet of Hun sap which we converted into a defensive gallery and held the German in that position. By this time our deep gallery had been driven quite close to the Hun front line, directly under the point we judged his main gallery passed. We then T-ed off, or drove a post to the right and one to the left. the total length of the two being roughly 160 feet. Four chambers were put in at fifty feet intervals and charges of 600 to 800 pounds of ammonal were placed in each chamber and exploded, cutting any galleries that passed across the T-head.

From the captured portion of the Hun sap we drove ahead as fast as possible and in a little under four hours we broke through into the Hun System and captured the whole thing complete with tools, listening devices and dead sappers.

We gained a great deal of information about Hun methods and appliances and found that all were inferior to ours at that stage of the game.

I might add that this put an absolute stop to Hun mining on this front and that great credit is due to Major North, O. C. of the Company, and Captain Roy Spencer, officer in charge of the work. Both are Nova Scotians as were most of the men who played their part so bravely and devotedly in that "Little Show."

Men Liked Work in "Offensive" Galleries.

Defensive mining was only one of the many lines of work which the Tunnelling Companies had to undertake.

The one ambition of every Tunnelling Company was to drive an offensive gallery, and if authority was granted to a Company to drive one, it was the one ambition of every sapper in that Company to work on it, and the sappers that were chosen to work there would show the same interest in it that a mother does for a sick child.

When those men came off duty the one topic of conversation would be "The big job," guesses would be made and bets laid as to the number of feet the following day's progress sheet would show, the date of completion, the number of tons to be placed in the charge, and what a poor unfortunate, miserable wretch the Hun was; and what a cute little prize packet they would hand him on "Der Tag"—Ourtag!

Such a thing as failure was unheard of. They did not know, and refused to recognize the word. Hadn't everything they'd undertaken proved successful? Had the Hun beaten them anywhere? The Hun had the wrong idea, the wrong spirit, the wrong breed of men to beat them.

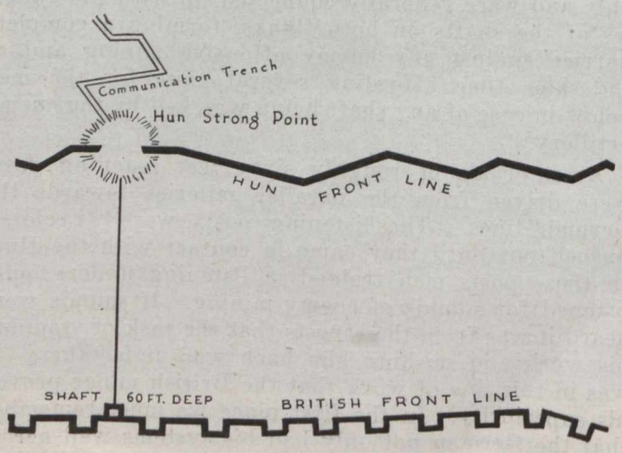
Confident, they were over confident possibly, but this was the spirit that overcame innumerable difficulties, that drove the Hun out of No Man's Land underground, made that part of No Man's Land British. The same spirit eventually drove the Germans to the German side of the Rhine.

As a rule defensive saps were driven at the same time as the offensive, and at times what was intended for an offensive sap had to be turned into a defensive or righting sap, due principally to running into a Hun defensive or offensive system.

There was one good example of this on the St. Eloi front.

A Problem on the St. Eloi Front.

An old R. E. timber shaft was used, as this was to be a surprise blow and time was a big factor. The shaft was sixty feet deep, deep enough to serve our purpose, but there was one drawback, and that was water. Water poured in continually from an old caved-in-system that had been driven from the shaft on a thirty-five foot level.



The distance from the shaft to our objective, a decidedly strong point at the head of a communication trench, was two hundred and thirty feet. We managed to drive 200 feet when the Hun became suspicious and started to bore large holes from his front line to a depth of anywhere from 30 to 50 feet. He placed heavy charges in these holes and exploded them, hoping by this searching method to blow one over or close enough to our gallery to wreck it. He blew three times.

Explosion Causes Flooding.

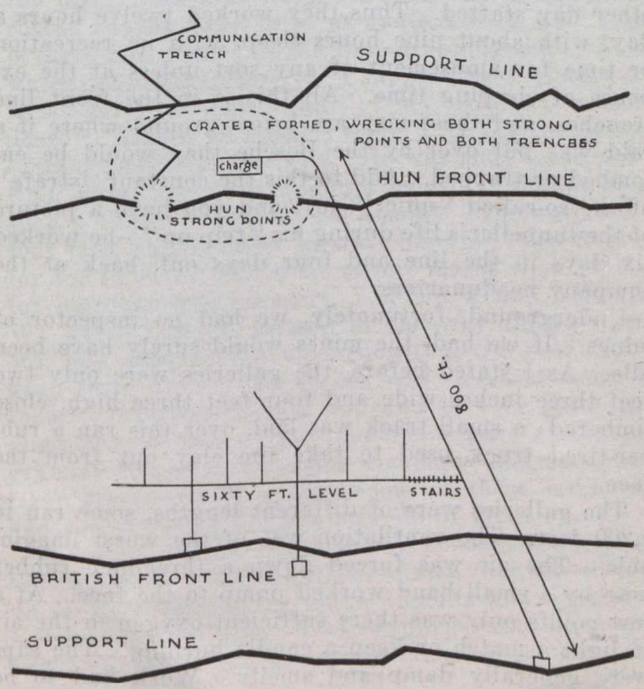
The first time he blew he crushed several timbers and pinned the two men at the face. The next blow was distant and did no damage. The third was a long way down his trench and under ordinary circumstances would have been perfectly harmless, but an extraordinary thing happened, the blow let in a small body of water through the old system on the high level, necessitating the withdrawing of the men and the lowering of two extra pumps.

All hands came on top and the first pump was lowered to the pump landing and a man just started down the ladder to set it up, when a deep roar was heard, and in less than two minutes the whole gallery and half the shaft was filled with water. This water came in from the old workings on the high level, it had evidently been dammed by a small cave-in and the jar of the third blow loosened the dam, let in the first bit of water which paved the way for the second and large body.

By the time we had pumped the water out of the sap and restarted work the Hun was prepared for us and we had to give up the idea of an offensive show from that sap, and it was converted into what became in time to a very elaborate defensive system and the scene of continuous underground fighting.

The Long Gallery to Destroy Two Strong Points.

It was then decided to sink a large new shaft at a greater depth back in the support line. There was several reasons for sinking it so far to the rear, the principal one's was that the spoil could be disposed of more easily, and there was less chance of being observed, also we were not bothered by the infantry to such a great extent as in the front line and fewer people would see the work being carried on. This last was most important, as the work had to be carried on with the greatest secrecy, and the fewer that had any knowledge of the work the greater the chance of success.



This shaft was sunk to a depth of 101 feet in a little less than fifteen days.

The dimensions was six feet long by four feet wide, timbered skin tight. 9in. by 3in. timber was used.

At a depth of 35 feet a large elaborate dug-out system was driven.

This system had accommodation and bunking for one hundred men. Was electrically lighted by a small gas driven engine and dynamo. Was well ventilated and drained. Five sets of stairways were driven to the surface which allowed a sufficient number of exits for the men in case of an attack.

The main offensive gallery was driven towards the Hun front line a distance of 800 feet, at 300 feet a stairway and gallery was broken away to the left to connect with the large defensive system on a sixty foot level.

50 Tons Ammonal in the Charge.

After many weary months of hard, delicate, monotonous work, under the worst of conditions, the sap was pushed behind the German front line, swung to the left and one of the largest charges ever laid in underground warfare (a matter of 50 tons of ammonal) was placed between the two Hun strong points. These strong points are famous in Canadian War Records. They are better known as the St. Eloi Craters Nos. 2 and 3.

19 Mines in Messines Ridge Blow.

This mine was exploded at the beginning of the Battle of Messines Ridge. In this show 19 mines with charges ranging from thirty to fifty tons, at depths of 60 to 130 feet, were exploded simultaneously, the greatest show of its kind in history. The mines were laid out at intervals under strong points on a twelve mile front—from Hill 60 to Plug Street.

Object of the Tunnelling.

The object was not so much to kill Boche as to reduce these trench forts, demoralize the enemy and save British lives; and in every case the mines more than served their purpose.

Ordinarily a whole Company would be sacrificed in taking any one of these points and much valuable time lost, whereas in this show the attacking troops advanced over and beyond the Hun first, second and third line of defences with practically no opposition and no casualties, in fact, on part of the front they advanced to a depth of 3 miles without any greater loss of men than would have been experienced in the ordinary routine of trench warfare on a day that the Official Reports would show "Everything quiet on the Western Front."

From a spectacular point of view it was thrilling, wonderful and inspiring, it was not a sight that a man could see without being impressed, without feeling that even though it was glorious it was awful—awful to think that there were hundreds of men in that inferno you'd helped let loose. There never was nor never will be anything like it. As one of the boys from Caledonia remarked to his butty, "There's gotta be a mighty big change in the fire works at the Halifax Exhibition before they'll get a half dollar out of me again."

The Effect on the Enemy.

What the Hun's impression was I can only guess, as a matter of fact I don't believe there was any lasting impression because the majority of those that survived were dazed, their day of usefulness as fighters was a thing of the past. Some gathered sufficient energy to run, but the greater number seemed to have lost all interest in living and what was taking place, and what proved to be the greatest advance in one day, up to that date, on the most strongly held and fortified front, with a minimum of casualties, was accomplished due to the way being cleared by the mines and perfect artillery co-operation.

Miners Were Needed at the Front.

As sorely as miners were needed on the home fronts, that is, men as producers, the need in France in the early stages of the war was much greater. It was a work that called for miners and the best type of miners; men who would stand any hardship, go through any danger for the cause; men of skill and initiative.

Nova Scotia Miners Did Well.

It would be superfluous for me to say that those Nova Scotian miners who answered the call came up to that standard. Their record speaks for itself. No task was too great for them. All difficulties encountered were overcome. They handled the defense of a trench or went into the attack with the same spirit and high standard of efficiency as they handled the work underground.

A Miner's Show.

A story of one of their shows might well be told. Following the Messines show on the night of July 31st, an attack on a ten mile front was started to the north of Messines. This was really the beginning of what was afterwards called the Paschendale Push. A party of tunnellers was sent with the attacking troops, which were English, for the purpose of examining cross-roads, dugouts, and material dumps, for booby traps or land mines. Very often the Hun on evacuating a position would leave a concealed charge there. This charge would be exploded by a trip wire, an acid time fuse, or by any one of his hundred and one different contrivances. Before a dugout could be entered or used by the infantry it had first to be reported safe by the tunnellers.

The first wave of the attacking troops had pushed forward, leaving a regular village of concrete dugouts to be cleaned up by our boys, and when they went to enter they found the Hun still active, shooting the troops that had gone ahead, in the back, and firing on the second wave as they were coming up. The tunnelling officer, Mr. Murray from Springhill, got one of the English infantry officers to go to one of the large dugouts with him and ordered the Huns to surrender. For answer, the English officer was bayoneted in the throat. The party immediately withdrew to a shell-hole and started rifle fire, when Dan Lynk, of Glace Bay, thought of a scheme, which was carried out. His plan was for the party to split, one-half to keep sniping, the other to creep up on the blind side of the dugout, get on top, and from that elevated and comparatively safe position toss bombs down through the doorway.

Dan Lynk as Santa Claus.

Lynk got up without mishap and the others passed bombs up to him. Just before he started he noticed the Huns had put a 4-inch square vertical ventilator up through the centre of the roof. "Here," he thought, "is where I play Santa Claus," and dropped his little prize packets through the "chimney." Immediately the first exploded, the Huns made a frantic rush for the door to "Kamarad," and were met by the rifle fire of the party left in the shellhole, so rushed back just as frantically and another bomb exploded. This game of Puss in the Corner kept up until our fellows figured that Fritz was weary of it, so walked up and made prisoners of those that lived.

Dinnie Cameron is Decorated.

Dinnie Cameron, of the Dominion, was sent in to examine the place. Inside he found a door leading into a long underground passage, which in turn lead into a large comfortable room, where, much to Dinnie's surprise, a dapper little German officer was enjoying his beauty sleep. Dinnie gently woke him by jerking him out of bed by the hair. The German sprang to his feet in a great fright and Kamaraded. Dinnie observed that the Hun wore the iron cross, and instructed the Bosche to transfer the decoration to his tunic. Dinnie now has the distinction of being about the only Canadian decorated with the iron cross. True, it was not placed there by the Kaiser, but by his representative in the field—a commissioned officer.

The Miner's Working Day at the Front.

In civil life miners and standard houses go together. When a new mine is started one of the first things considered is the laying out of the town site and the immediate erection of comfortable dwellings. We all know that men cannot work underground all day with the best results and sleep in the bush, in a hut or a shack. He needs comfortable quarters. Likewise the army miner. He needs and deserves the best that can be given. He works harder and longer hours than his civilian brother, and under the very worst of conditions. I'll describe a few of those conditions.

The day was divided into four shifts of six hour periods. The men of No. 1 shift would breakfast at 5 a.m., go on duty at 5 and work until 12 noon, being relieved by No. 2 shift which worked until 6 p.m. On being relieved No. 1 gets dinner, a rum tot, and immediately goes to bed and sleeps till 5 p.m., when supper is given out. They go on duty again at 6 p.m., work till 12 midnight, and are again relieved by No. 2 shift. They have another meal and sleep until 5 a.m.—another day started. Thus they worked twelve hours a day, with about nine hours sleep, with no recreation or time for amusement of any sort unless at the expense of sleeping time. All this is in the front line trenches, and those men are below ground where if a raid was put over by the Bosche they would be entombed or trapped. Add to this the constant "strafe" of the so-called "quiet" day, and you have a picture of the tunneller's life during his "trip up"—he worked six days in the line and four days out, back at the company headquarters.

Underground, fortunately, we had no inspector of mines. If we had, the mines would surely have been idle. As I stated before, the galleries were only two feet three inches wide and four feet three high, close timbered; a small track was laid, over this ran a rubber-tired truck used to take the clay out from the face.

The galleries were of different lengths, some ran to 1,200 feet. The ventilation was of the worst imaginable. The air was forced down a three-inch rubber hose by a small hand worked pump to the face. At a few points only was there sufficient oxygen in the air to light a match or keep a candle burning. The saps were generally damp and smelly. Work had to be carried on at high speed, but silently. The men moved

about with their feet thickly padded with sand bags to muffle the sound of the tread; they sometimes went so far as to go barefooted. The man at the face, the post of honor, worked bare-buff, his clothing consisting of a pair of boots and a pair of pants.

Standard Dugouts Were a Success.

In the very early stages of the game both men and officers realized that comparatively safe and comfortable quarters were necessary; that a dry spot on the parapet, or a ramshackle dugout was not good enough for these men, so decided to "build" good, dry, safe dugouts. These were not successful, for numerous reasons. Then one of the officers thought it would be a good plan to "dig" our future homes—to make standard dugouts in conjunction with our mining scheme; to make the dugouts part of the scheme. This was tried and found to be highly successful. As time went on, our standard dugout, a wooden affair, seven feet high, seven wide, and generally thirty feet long, with an eight inch borehole to the surface for ventilation, was improved upon, and towards the last stages of the game the dugouts were all steel and finished, were seven feet high and nine feet wide, and ran sometimes to a hundred feet in length. The top and mud sills and side pieces were 5″ x 3″ I beams placed at 18 inch centres, with a sheet of corrugated iron above and between the I beams to keep the soil from falling through. The dugouts were finished with soft wood sheathing, pointed white, and bunks installed. There would never be less than five exits to a system, and in some of the large ones there were as many as twenty.

Generally a small gasoline motor and dynamo would be installed for lighting purposes. This was a necessity as well as a luxury, as lights were needed through the saps and candles would not burn, and the life of a portable electric mine lamp was too short.

Miners' Dugouts Appreciated by Infantry.

We were very comfortable and safe in our underground homes until one day an Imperial staff officer thought he'd like to take a look at a sap and see the dirty miners at work. At the beginning he was rather nervous, and kept us amused with his "I say, is there any chance of the roof dropping in"; "Is the water deep down there"; "I suppose these clothes will never be fit to wear again"; "My word, we must be deep"; "is that an electric light"; "I say this is most extraordinary"; and so on. He was most surprised to find clean, airy, dry dugouts below. "Didn't think such a thing possible in such soil." The outcome of that visit was an order to start building deep dugouts for the infantry, and some of our places were pinched for battalion headquarters, Y.M.C.A.'s, and such like. We weren't at all pleased at the way things turned out, and came to the conclusion that the best way to keep them out of our places was to build some for them. This was carried out, and in very short time dugout work was a very important part of the programme of every tunnelling company, and some very large systems were built. Some of these large ones had accommodation for a brigade of men.

These places were invaluable as concentration points before a push. Large numbers of men could be brought up at night and put in these dugouts and wait there for the show to start. They would be safe from shell fire and, what was more important, they were free from observation.

Underground Hospitals.

Large hospitals were built underground, almost in the front line. A man could get attention almost immediately he was hit. In this work, as in the other branches, the Canadian miner "showed the way." Their style of dugout was adopted by the army and made standard; their methods of handling the soil and construction were taught in the army mining schools, and when an important rush job was to be done the Canadian was sent to do it, and never was the trust misplaced.

The Canadian miner's record in this war is unexcelled, and is one of which he, and all Canada, may be very proud.

MAY OPERATE GREENWOOD SMELTER.

It is possible that the Greenwood Smelter recently closed down by the Canada Copper Corporation, which has moved to Copper Mountain, will be re-opened as the company has offered the plant and contiguous properties to the citizens of Greenwood for the sum of $125,000. As the continued existence of the town depends on the maintenance of an active mining industry, and as the company's proposition is considered very reasonable, it is very probable that it will be accepted and arrangements made for the revival of the new dormant mines and plant. At Boundary Falls is situated the New Dominion Smelter which has been idle for some years. This also has been proferred to Greenwood's business men, together with its mines, on favorable terms. Two or three alternative propositions have been advanced in connection with the latter and it is thought likely that one will be accepted. Hugh R. Van Wagenen, manager of the Canada Copper Company, states that while the basis fixed for the transfer of these holdings is low it has its advantage for the company if it can be financed by the Greenwood people. It would cost probably $400,000 to $500,000 to instal such a plant to-day even if delivery could be obtained, but it is costing the company for watchmen, taxes, insurance and other expenses around $500 or $600 a month to retain the property. By wrecking the plant probably $125,000 could be realized, but the company would prefer to see Greenwood live. The Greenwood committee assert that the Greenwood business is worth half a million dollars as a going concern and they propose, with the aid of outside capital, to keep the furnaces going. The mines included in the Greenwood deal are the Mother Lode Group, B. C. Mine, Oro Denora, Mountain Rose, Lone Star, and several others. Some of the equipment has been removed from the Mother Lode, but there is still one compressor, the hoist and the crusher. The equipment is sufficient to handle a couple of hundred tons a day, probably all the profitable ore that could be extracted from the mine in its present state of development. The smelter, however, is intact and ready to be blown in at any time. Mr. Oscar Lachmund, metallurgical engineer, who has been retained by the Greenwood Committee in an advisory capacity, is satisfied that there are ore supplies within shipping distance of the smelter to keep it running for years and it is believed that the cost of treatment with Mother Lode, Brooklyn or other fluxing ores will always keep the cost of copper production at a low point.

The Salt Industry and the Possibilities for the Future Development in Canada

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(By permission of the Director, Mines Branch.)
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Until recently, the only salt deposits in Canada being exploited, were those located in Ontario, hence this province has been at a great advantage economically. With the discovery of rock salt at Malagash, N. S., and the prospect in the near future of operating deposits in the vicinity of McMurray, Alberta, considerable of the expected increase in the domestic demand will in a few years be available from these newly operated deposits.

The rapid development of the country during the Great War has led to the establishment of new manufacturing industries utilizing the natural resources of the country. The salt industry has, naturally, been influenced by this growth and plants have already been established in certain parts of the Dominion to utilize the large deposits of sodium chloride, as a base from which to produce other commercial chemicals. Past enterprise in this direction has only touched the fringe of the available resources. The chances of profitable exploitation and investment along this line of industry are worthy of serious consideration.

In order to bring to your notice the salient points of this subject I wish to describe briefly to you the merest outlines of the technology of the salt industry; to cover the uses of salt as shown in the table of contents attached; then to summarize the present known salt and brine deposits of Canada commencing from the Pacific and concluding with the deposit in which you will be most interested at these meetings, namely, the Malagash deposit of rock salt in Cumberland Co., Nova Scotia. I will conclude with a few remarks on the probable markets, both domestic and foreign, which have special bearing on the Malagash deposit.

1. The Technology of the Salt Industry.

The technology of the salt industry has, like many other industries, made great advances in the last twenty years. The improvements, however, have been along mechanical lines rather than chemical processes and all improvements tend to increase the production with the minimum amount of fuel.

The following flow sheet gives, at a glance, the methods employed in the recovery of commercial salt from nature.

Commercial salt is obtained from two sources in nature: a. rock salt, b. natural and artificial brines.

Rock Salt.

Rock salt is found in many countries in beds of such extent as to permit of it being mined or quarried; or else recovered by dissolving the beds with water and pumping the resultant brine to the surface, to be evaporated.

1. The Mining and Milling of Rock Salt.

Where the salt beds are sufficiently near the surface to enable the salt to be recovered directly, the common practice is to either quarry it or mine it by the pillar and chamber method. In the former case it is taken from an open quarry, possibly with very little stripping. Mining is generally carried on from a shaft sunk to tap the deposits. Galleries are run, and chambers mined out on each side of the gallery, leaving pillars at regular intervals.

The salt from both quarry and mine is generally crushed between cast iron rolls, after which it is screened. The coarse lumps are sold as lump salt while the material passing through the screens is fed into buhr mills. The ground salt from these buhr mills is passed through pneumatic separators, which take out the dust, and separate the market salt, or else it is screened into the different grades. When the salt is too impure to handle in this manner, it is dissolved in large tanks, and the saturated brine is evaporated by one of the several methods hereinafter described.

2. Artificial Brines From Rock Salt.

Where the beds of rock salt are at too great a depth to be worked economically by mining methods the common practice is to put a drill hole down to the beds and dissolve the salt by means of water, afterwards pumping the saturated brine to the surface and evaporating it.

The drilling of the wells is accomplished by the ordinary churn drill, common to oil drilling practice: The diameter of the holes at the collar being between 8″ and 10″. It is customary to carry the hole several feet through the salt bed, and to blast or torpedo the bottom in order to form a collecting chamber for the brine, when formed. The hole is then cased, to ensure that the brine will not escape through some of the overlying porous strata.

There are several methods employed in the pumping of the brine.

In the northern part of the Ontario salt field, where underground waters form the solvent for the salt, the most common practice is to pump the brine through the casing of the hole, by means of a plunger pump —after the Cornish pump pattern, with walking beam. In the southern part of this field, where water has to be forced down the hole, the common method adopted is to case the hole down to the top of the salt strata, and then to put down an inner piping, almost to the bottom of the hole. The case pipe has a diameter of from 6″ to 8″, and the inner piper from 3″ to 4″. The joint at the top between case pipe and the hole is made tight by a heavy rubber washer. Fresh pure water is then forced down the space between the outer casing and the inner pipe under sufficient pressure to cause the brine to flow up the inner tube. The brine pipe reaching to the bottom of the cavity ensures a saturated solution ascending to the surface.

A third method, sometimes adopted is to pump the brine by means of compressed air. In this method the double tubing is also required, air being forced down the inner tube, and allowed to rise through the outer tube, carrying with it the brine.

The brine coming from the wells is piped to settling tanks, where it is allowed to stand for a certain length of time, in order to allow any sediment or mechanically suspended matter to settle. In these tanks the brine is sometimes treated with lime, to precipitate any gypsum present; and in some plants is partially heated by means of exhaust steam, so that time will be gained when the brine is fed into the evaporators.

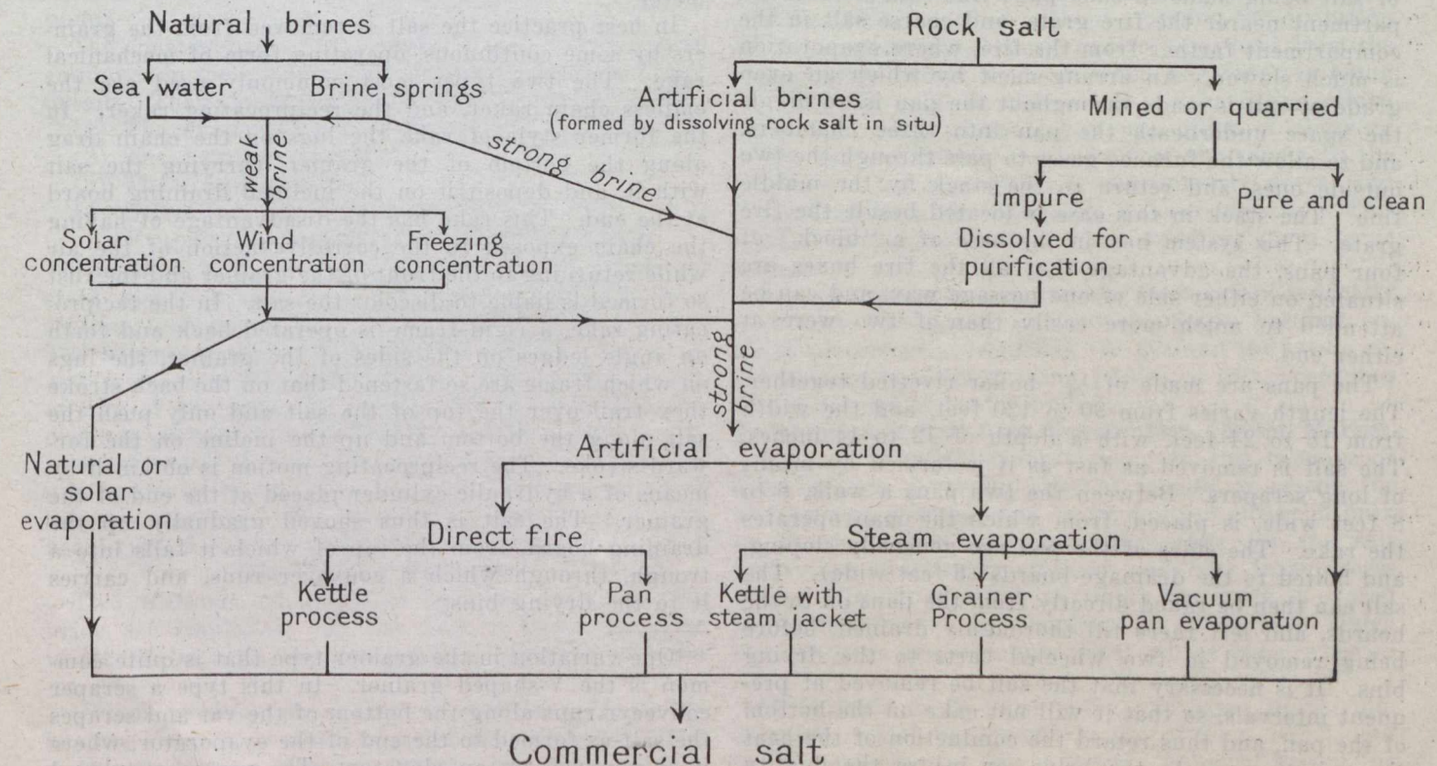
Salt From Brines.

In the recovery of salt from brines there are several methods being employed. These can more readily be followed by studying figure I. The three main processes for salt manufacture from either natural or artificial brines, are Solar Evaporation, direct fire evaporation and steam evaporation.

1. Solar Evaporation.

The recovery of salt from sea water and weak brines, has, in nearly all cases, been made by the solar method: employing the agency of the heat of the sun and the evaporating power of the wind. This method has not been employed with any great success in Canada, and it is doubtful if it will ever become a factor in the methods employed for preparing salt for the Canadian market. Briefly the method of preparing salt by solar evaporation may be described as follows:

Sea water or brine is allowed to run or is pumped into salt ponds or artificial vats and there allowed to stand, till all the impurities are settled out after which the purified brine is run into pickling ponds or vats where it is exposed to the sun and air. In these the brine is allowed to remain till, due to the evaporation of the excess water the brine has become saturated. It is then conveyed to the crystallizing ponds or salt rooms where the evaporation continues and the salt crystallizes out completely. The salt is then recovered and prepared for the market.



2. Direct Fire Evaporation.

Kettle Process. One of the earliest methods employed in the salt industry consisted in evaporating the brine in large hemispherical kettles, over an open wood fire. An improvement was shortly made in this method by setting the kettle in an arch of masonry. Later, two kettles were employed, then four, using the same fire, and finally, the kettles were placed in long rows, as high as 30 or 40 in each row; with one common fire box, and a common stack for several rows. The salt formed was removed by hand, and placed in baskets to drain. The method was, at best, very wasteful of fuel, since in order to heat the kettles furthest away from the fire box, heavy fires had to be made, and this caused an excessive heat under the nearest kettles. Naturally, on account of this difference in heat under the different kettles, a uniform grade of salt could not be obtained. Due, therefore, to these, and several other drawbacks, the kettle method of evaporation was gradually replaced by the English open pan method.

Pan. Process. As first adopted in Canada — upon rejection of the kettle method, the pan employed consisted of a long shallow pan placed upon two walls, with a fire-place at one end and a chimney at the other. These pans were made of ¼″ boiler plate, and were from 40 to 50 feet long, 12 to 20 feet wide, and 10 to 12 inches deep. One fire grate was used, and the products of combustion passed under the pan, and directly up the chimney. The best practice of the present at plants where the open-pan method is employed is, to have two or four pans in one "block," as these salt plants are called. If, for example four pans are employed, they are arranged in pairs, side by side; the pairs being placed end to end, so that one common chimney or stack is utilized for all four pans. Where the furnace gases pass under the length of the pan, and are then allowed to escape, the pan is generally divided into two compartments, two grades of salt being made in each pan; fine salt in the compartment nearer the fire grate, and coarse salt in the compartment farther from the fire, where evaporation is much slower. An arrangement by which an even grade of salt is made throughout the pan is, to divide the space underneath the pan into three chambers, and to allow the furnace gases to pass through the two outside ones, and return to the stack by the middle flue. The stack in this case is located beside the fire grate. This system has, in the base of a "block" of four pans, the advantage that all the fire boxes are situated on either side of one passage way, and can be attended to much more easily than if two were at either end.

The pans are made of ¼″ boiler rivetted together. The length varies from 90 to 120 feet, and the width from 18 to 24 feet, with a depth of 12 to 14 inches. The salt is removed as fast as it is formed by means of long scrapers. Between the two pans a walk, 6 to 8 feet wide, is placed, from which the man operates the rake. The sides of the pan are generally sloping, and bolted to the drainage boards (6 feet wide). The salt can then be raked directly from the pans on to the boards, and left there till thoroughly drained, before being removed in two wheeled carts to the drying bins. It is necessary that the salt be removed at prequent intervals, so that it will not cake on the bottom of the pan, and thus retard the conduction of the heat through the pan to the brine, or injure the quality of the product. If the brine is not agitated frequently by the removal of the salt by these rakes, there is a tendency for a film of crystallized salt to form on the surface of the brine as a scum, and thus prevent the escape of the steam of evaporation. The open pan method is employed in a number of the Canadian plants.

3. Steam Evaporation.

The fact that the preparation of salt by the open pan system was extravagant in fuel, and that the product obtained varied considerably, led to the adoption of other methods which utilized either exhaust or live steam.

Kettle With Steam Jacket.

The earliest use of steam in the salt industry was in steam jackets surrounding the kettles or pans of the kettle and open pan processes. A second bottom was placed under the kettle or pan, through which steam, either live or exhaust, was allowed to circulate. This produced a constant temperature in the evaporator, and thus an even product was obtained. The grainer system and the vacuum pan, however, produced the same results, and are much more economical; so that in nearly all the best plants, these processes are employed.

Grainer Process.

Grainers consist, in general, of shallow vats of various shapes, near the bottom of which a series of steam pipes are placed, through which steam is allowed to circulate, and heat the brine. These vats are generally rectangular in shape, with a depth of from 18 to 24 inches, a width of from 8 to 16 feet, and a length of from 60 to 120 feet. They may be built either of wood, lined with tile for protection, cement, or steel.[1]

The pipes are arranged after the manner of ordinary heating coils, so that the steam entering at one end passes through the whole series of coils before leaving the grainer. The pipes are generally 2″ diameter.

In best practice the salt is removed from the grainers by some continuous, operating form of mechanical rake. The two types most commonly used are the endless chain raker, and the reciprocating raker. In the former style of rake the lugs on the chain drag along the bottom of the grainer, carrying the salt with it, and deposit it on the inclined draining board at the end. This rake has the disadvantage of having the chain exposed to the corrosive action of the air while returning to the front of the grainer and the rust so formed is liable to discolor the salt. In the reciprocating rake, a rigid frame is operated back and forth on angle ledges on the sides of the grainer, the lugs on which frame are so fastened that on the back stroke they trail over the top of the salt and only push the salt along the bottom and up the incline on the forward stroke. The reciprocating motion is obtained by means of a hydraulic cylinder placed at the end of the grainer. The salt is thus shoved gradually up the draining board, from the top of which it falls into a trough, through which a conveyer runs, and carries it to the drying bins.

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[1]One variation in the grainer type that is quite common is the V-shaped grainer. In this type a scraper conveeyr runs along the bottom of the vat and scrapes the salt as formed to the end of the evaporator, where it is removed by an elevator. The pipes are placed above this conveyer.

These grainers may use either live or exhaust steam. The temperature can be regulated at will, so that the grainer can be made to produce whatever grade of salt is required.

Vacuum Pan Evaporation.

The application of the vacuum pan process to the manufacture of salt is a comparatively new departure. Although vacuum pans have been employed for many years in the sugar and other similar industries, it was not until the year 1887 that the first vacuum pan for the manufacture of salt was placed in operation. This pan was erected by Mr. Joseph Duncan at Silver Springs, N. Y. From that time their use has extended with gradual improvements, to all the more modern plants on the American continent.

The principal upon which the vacuum pan process is based is, that, when the pressure on the surface of the brine is decreased, the boiling point of the brine is correspondingly lowered. The brine can then be evaporated with a great saving in the amount of heat required. The heating medium employed in evaporation of the vacuum type, is steam, either live or exhaust. No vacuum evaporators have been, so far, designed to successively operate by direct heat.

Vacuum evaporators may be operated in series as double effect, triple effect, quadruple effect, etc. When the pans are employed in this manner, the steam formed by the evaporation of the brine in the first pan is conducted to the heating chamber in the second pan, in which a greater vacuum is carried. Likewise, the steam generated from the brine in the second pan is led to the steam chamber in the third pan, where a still greater vacuum is maintained. Similarly, each pan is heated by the steam produced in the preceding pan, for as many pans as are operated in series. The steam from the last pan is carried to a condenser. The vacuum in each pan is created by the condensation of the steam in each succeeding steam chamber, the vacuum in the last pan being produced by a vacuum pump.

The construction of the several types of evaporators employed in the salt industry varies only in a few minor details. They consist essentially of four parts, namely:

(1) The evaporating and condensing chambers,
(2) The heating element,
(3) The coned bottom,
(4) Salt filter, or barometric leg.

Evaporating and Condensing Chambers.

The main body of the evaporator may be built of steel, cast iron, or copper, generally circular in cross section, and either cone, or dome-shaped at the top. The height of this chamber varies with the diameter, and is made sufficiently high to prevent the escape of any of the brine by entrainment, or foaming. In order to prevent a loss of heat by radiation, the evaporation chamber is covered completely (as well as all other parts of the evaporator) with a heavy coating of asbestos packing. The condensing chamber is of the usual type, furnished with a vacuum pump.[1]

The Heating Element.

Two methods of applying heat to evaporate the brine are employed. In the first, a steam chamber is placed between the evaporating chamber and the coned bottom, in which a series of copper tubes, varying from two to four inches in diameter, are fastened vertically in the top and bottom plates of the chamber. These tubes are open at either end, and thus permit free circulation of the brine between the cone-shaped bottom, and the evaporating chamber. The steam is passed into this chamber, and circulates in and out around the tubes, thus heating the brine circulating within them. The condensed steam is drawn off by suitable means from the bottom of the steam chest. The second method employed in heating the brine is to have the steam pass through a series of coils, or tubes, around which the brine has free circulation. In this method of heating, special means have to be adopted to properly dispose of the condensed steam, and the coils of pipe have to be so arranged as not to impede the salt, as it is formed, from descending into the cone-shaped bottom.

One of the great difficulties encountered in the application of vacuum pans to salt manufacture is the scale which deposits upon the heating surface.[1] This has to be removed at frequent intervals, or else the evaporative capacity of the pan will be greatly reduced. In order to facilitate the removal of this scale, the heating element should be either removable from the pan, or else easily accessible.

The Cone-shaped Bottom.

The bottom of the pan is sharply coned, so that the salt crystals, as formed, may readily fall to the bottom, clear of the heating tubes, and can then be drawn off from time to time. The pipe for the entry of the brine is generally attached to this cone.

The Salt Filter, or Barometric Leg.

In order that the operation may be continuous, there must be some means of removing the crystals of salt as fast as they are formed. This is accomplished in two ways: (1) by a salt filter, (2) by a barometric leg. In using a salt filter, the salt is drawn off into a filter or chamber, connected with the cone bottom. The connecting valve is closed when the filter is filled, and the salt is removed without stopping the operation of the evaporator. Sometimes two pipes lead from the cone to two filters, so that, when one filter is being emptied, the valve to the second is opened and allowed to fill. This prevents any possibility of clogging of the salt crystals in the bottom of the cone. In the barometric leg the salt falls continuously down, and is removed from the bottom by a closed elevator. This method is very efficient, when working on a large scale.

The salt made in vacuum pan evaporators is mostly of a very fine grain, and, consequently, has not entirely succeeded in replacing the grainer, the latter being able to produce varying grades of salt, according to the amount of heat supplied.

Preparation of Salt from Evaporation, for the Market.

All salt, whether manufactured in the vacuum or open pan, is generally allowed to age or season for at least two weeks before being shipped either in bulk or barrels. This seasoning gives time for the salt to become thoroughly drained and free from excess brine. The stock house in which the stock is stored is generally on the floor underneath the level on which the grainers are situated. The salt is then wheeled

[1]When working in double or multiple effect, the heating element or steam chest of the succeeding unit is the condensing chamber for the preceding evaporator.

[1]This scale is, in most cases, composed of calcium sulphate, which is present in the original brine, and in the best practice this is largely removed before the brine enters the evaporators.

in carts along trestles over the stock house, and dumped on the floor below.

The crude salt is shipped in bulk, being placed in cars or boat by any suitable means.

When packed in barrels the packing is carried on by hand on the floor of the stock house. Each barrel contains 280 pounds net. These barrels are generally manufactured on the premises.

In the case of table and dairy salt, a further treatment is carried on before the salt is placed on the market. The crude salt is passed through long, cylindrical, rotating driers, in which a current of hot air is blown through in the opposite direction to that in which the salt is moving, i.e., in a direction counter to the incline of the drier. After being thoroughly dried, it is passed through a series of screens of various sizes, and then automatically bagged and sold as Dairy, Table, and Cheese salt. Each company has a special trade name under which it markets its product.

By-Products From the Industry.

The brine used for the recovery of salt, in many cases, contains small quantities of other salts, etc., which in some cases are recovered. Bromine, potassium salts, glaubers salts, epsom salts, and calcium chloride are some of the by-products which are being saved commercially.

2. Uses of Salt.

Salt is one of the essential materials in many of our present day industries. Its use is being extended all the time. The possibilities for extending the salt industry in Canada are good and with the return of normal conditions throughout the country the salt production should show a substantial increase. The uses of salt are numerous, but they may briefly be described as follows:

a. Domestic.

For table and culinary consumption the salt is generally required to be very white and fine, and to be as free from impurities as possible. The salt made in the vacuum pans is ideal for these purposes. In the Dairy and Cheese making industries a slightly coarser grade is required. For refrigerating purposes a coarse salt is best suited and for salting cattle, both in the stable and in the field, a coarse grade or lump salt is employed, the latter form being preferred.

b. Fish and Meat Curing.

The salt for the fisheries is generally a granular salt the bulk of which is caught by a 20-mesh screen. The color and purity are factors in the marketing of salt to the fishermen as they are very particular that the color and taste of their fish is in no way impaired. A similar grade of salt can be used for the curing of meat.

c. Metallurgical Industries.

Salt finds an extensive use in the metallurgy of copper, lead, silver and gold in chloridizing roasting and leaching processes, as well as in the refining of copper-nickel matte by the Oxford process. As high as 10% of sodium chloride is aded to the charge in some of the roasting furnaces.

d. Associated Chemical Industries.

One of the most important uses of sodium chloride is in those chemical industries which prepare sodium salts for the market. In order that some idea may be obtained of the possibilities of developing these industries I will give a brief resume of several of the more important processes for the manufacture of these chemicals from salt.

Caustic Soda. (Sodium Hydrate.)

Until the last fifty years, the manufacture of caustic soda was not extensive. The most common process in preparing this material was the one in which advantage was taken of the reaction of sodium carbonate and slaked lime. This process at first entailed the production of soda ash. Of late years, however, caustic soda has been prepared by the direct decomposition of sodium chloride in an electrolytic cell; producing chlorine gas and metallic sodium, which latter at once unites with water present in the cell to form caustic soda. The weak solution of caustic soda thus produced is concentrated in vacuum pan evaporators. From these evaporators the solution passes to storage tanks after passing through separators — to eliminate the sodium chloride. The final concentration is then carried out in finishing pots of about 18 tons capacity and the pure caustic soda is run from the final pot into iron drums (700 lbs. capacity), and allowed to solidify. The product is then ready for the market. One firm is already making caustic soda in Canada by this process.

Sodium Carbonate. (Soda Ash.)

Although sodium carbonate is often found in extensive deposits in nature, it is generally very impure. Owing to the cost of dissolving, evaporating and purifying, it rarely pays to operate a deposit of this nature except at actual points of consumption as commercial sodium carbonate can be prepared artificially from sodium chloride at less cost.

In the artificial preparation of sodium carbonate there are three processes of importance which use sodium chloride as a raw material. These three processes are: (1) the Solvay, or ammonia-soda process, (2) the electrolytic process, (3) the Le Blanc process.

(1) The Solvay Process.

This process is based on the well known reaction of ammonium bicarbonate on sodium chloride, with the separation of part of the sodium as sodium bicarbonate. The raw materials required for this process are limestone, sodium chloride (either as brine as it comes from the wells or rock salt dissolved) ammonia (either in the form of an ammonium hydrate solution or ammonium sulphate) and fuel.

In brief, the essential operations in this process are, to manufacture carbon dioxide from limestone; to pass this gas into the ammoniacal brine which has previously been prepared by saturating the brine with ammonia gas; the separation of sodium bicarbonate which forms as a precipitate from the solution; and the calcining of this precipitate to form sodium carbonate or soda ash. The product of this method is remarkably pure and will average over 98.5% sodium carbonate, the principal impurity being sodium chloride.

(2) Electrolytic Process.

An electrolytic process for the manufacture of sodium carbonate crystals by the electrolysis of brine has been operated commercially on a small scale, in England. This process, known as the "Hargreave and Bird process" employs a diaphragm cell of unique arrangements. The diaphragm is impervious to the salt solution, but permits the sodium ion to pass to the cathode. As the sodium ions are set free, they are converted into soda crystals by the blowing in of steam and carbon dioxide. The sodium carbonate made by this process is very pure and will average when dehydrated 97.5 to 98% Na_2CO_3.

(3) The Le Blanc Process.

This process for making sodium carbonate from salt consists of first making sodium sulphate — to be later described — and then fusing this with a mixture of limestone and carbon. The raw materials required are sodium sulphate (salt cake), pure limestone and a good grade of coking coal. The reactions are involved but the process in brief, is as follows: The salt cake, limestone and coal in predetermined proportions, are fused in a furnace and the fused mixture, called black ash, which is produced is allowed to cool. The black ash is then lixiviated with water and the resultant lye is purified giving commercial sodium carbonate which will vary in composition from 75 to 98% Na_2CO_3. The finished product from this process should be white or nearly so.

Both the crystal form and the soda ash are met with in commerce. The crystal form known as soda crystals or washing soda has the formula $Na_2CO_3 . 10H_2O$. These crystals readily dehydrate and effloresce when exposed to the air.

Sodium Sulphate (Salt Cake.)

Like sodium carbonate, sodium sulphate occurs naturally, but owing to the artificially manufactured substances being so cheap, it seldom pays to use the natural deposits.

The commonest process for producing sodium sulphate is by the action of sulphuric acid on sodium chloride. The salt for this process is preferably rock salt, or the coarsest salt produced from evaporation.

The process may be carried out in two ways: (1) sulphuric acid, as such, may be added directly to the salt or (2) sulphur dioxide, oxygen and steam may be added to the sodium chloride.

By the first method the acid sodium sulphate is formed, and this reacts again with salt to form sodium sulphate.

In the second method, known as the Hargreave process, steam and oxygen are caused to combine with sulphur, dioxide to form sulphuric acid which simultaneously attacks the salt, forming sodium sulphate and hydrochloric acid, as represented by the following equation:

$$4NaCl + 2SO_2 + 2H_2O + O_2 = 2Na_2SO_4 + 4HCl.$$

Chloride of Lime (Bleaching Powder.)

When dry chlorine gas is passed over a thin layer of slaked lime, a compound is formed which has the power to readily give up its chlorine, when acted upon by an acid.

In brief, the process generally employed in the manufacture of bleaching powder is to utilize the chlorine gas produced by the electrolytic decomposition of sodium chloride and pass it through a series of lead-lined chambers in which slaked lime is spread on the floor to a depth of about two inches. Generally a number of these chambers are operated in series. The bleaching powder is discharged through openings in the chamber floor to the shipping room beneath. It is then packed in drums of 700 lbs. capacity.

The percentage of bleach in the chloride of lime thus produced will vary from 37 to 39 per cent. chlorine, i.e., the bleach contains from 37 to 39 per cent. chlorine that is available for bleaching purposes.

I have devoted considerable space to the sodium salts as these are of great importance, and it is only within the last ten years that any of them have been manufactured in Canada. The rapid growth and commercial progress made by the Dominion during the last few years has greatly increased the demand for those chemicals into the manufacture of which sodium chloride enters either directly or indirectly as one of the principal raw materials. The increasing demand for these chemicals — as evidenced by the figures of imports shown in the following table, has naturally evoked the question whether they cannot be manufactured in Canada. This question has been partially answered by the fact that one company is already successfully producing caustic soda and bleaching powder from sodium chloride in the form of brine, and another company has a plant completed for the production of soda ash by the Solvay process. There are several other chemicals in the manufacture of which sodium chloride is used; and there is no reason why use should not be made of the extensive salt deposits of Canada for their production. In view of the rapidly increasing market there should be no difficulty in the disposal of the products of such undertakings.

e. Incidental Uses of Salt.

Besides the uses already mentioned there are a number of other markets for salt, such as in the construction of wooden ships, the salt glazing of pottery and for the preventing of cracking of bricks in drying and firing, and in the manufacture of carborundum. A coarse grade of salt is also used as a land dressing for certain crops.

3. THE SALT DEPOSITS OF CANADA.*

Salt producing springs or beds of rock salt have been encountered in nearly every part of our Dominion. A number of the springs, of course, are only weakly saline, but may indicate the presence of beds of rock salt in the vicinity.

*For more detailed descriptions of the salt deposits of Canada see Salt Deposits of Canada and The Salt Industry. L. H. Cole, Mines Branch report No. 325, 1915.

Imports of Caustic Soda and Chloride of Lime.

	Caustic Soda		Chloride of Lime	
	Pounds.	Value.	Pounds.	Value.
1910	13,974,444	$267,338	10,386,519	$116,923
1911	13,812,053	259,982	11,725,167	118,501
1912	14,544,545	278,579	12,183,765	113,346
1913	15,983,298	291,008	12,761,153	115,614
1914	18,436,827	314,278	15,147,645	138,619
1915	7,737,149	184,468	12,015,999	112,142
1916	12,502,758	508,860	7,892,923	158,546

Note.—For purposes of comparison the pre-war years—1912-13-14 should be examined.

a. British Columbia.

Until the last few years, the known occurrences of salt in British Columbia were in the form of a number of saline or mineral springs, the waters of which are more or less saline.

In August, 1911, however, reports came in of the discovery of a strong saline spring 45 miles from Prince Rupert, situated on the banks of the Skeena river, at Kwinitsa, on the line of the Grand Trunk Pacific railway. That year, the location of the spring was staked and recorded by one of the cooks in the construction camps. Experiments were carried on in a crude way and it was found that the brine was strong enough to collect considerable quantities of a good quality of salt, by evaporation.

Early in 1913, a syndicate of western men started drilling operations in an endeavor to locate rock salt at this point, and in April of the same year, their efforts were rewarded — according to reports — by encountering salt in five different holes. During 1913, some 15 tons of salt were produced from this deposit. A company entitled the British Columbia Salt Works, Ltd., Prince Rupert, B.C., was organized and expected to have a plant operating by the fall of 1914, but due to the war the project was abandoned for the time being.

Of the known brine springs occuring elsewhere in the Province, the most strongly saline are those at Nanaimo, Admiralty or Salt Springs island, Chilcoton Valley, and Maiden Creek, and Bonaparte Valley, northwest of Ashcroft, B. C. The flow of these springs is not so copious, or the strength of the brine sufficient to warrant a belief in their economic importance at the present time.

b Alberta, Saskatchewan and North West Territories.

In the prairie provinces of Alberta and Saskatchewan as well as the North West Territories, numerous saline springs are known to occur. Up to the present time, however, these have not been economically important, owing to their inaccessibility to ready markets. Moreover, very little is known about them, and so far I know of only one definite attempt to prospect for rock salt in place. Since the springs occur over such a wide area, it is possible that stronger brines, in more favorably situated localities may yet be found, and there is always the possibility of finding beds of the mineral in place near the surface. The Mackenzie basin, in which all the springs at present known, occur, has been lacking, until recently, in railway transportation. With the advent of the railway into McMurray, it is altogether likely that this district will become a salt producer, and furnish this necessary article of consumption to a portion of the prairie provinces and British Columbia.

Probably the most important occurrence of salt in the district in question is that of the Northern Alberta Exploration Co. This company has, since 1907, been carrying on drilling operations for oil in the vicinity of McMurray, Alta. Two wells have been sunk, in both of which they claim to have encountered rock salt or salt bearing formation. The first hole has been drilled to a depth of 1475 feet, while the second reached a depth of 1406 feet. The collars of the holes are 155 feet apart and according to the logs of the wells (here given) show the same formations in each hole.

	No. 1	No. 2
Loose dirt	17 feet	24 feet
Limestone	117 "	124 "
Soapstone and Limestone.	520 "	590 "
Salt formation	620 "	690 "
Limestone	635 "	765 "
Salt Formation	740 "	855 "
Limestone	770 "	935 "
Sandstone	1475 "	1406 "

There is a possibility that this coming summer a plant for the preparation of salt from brine may be erected on this property.

Of the brine springs, the most accessible seem to be those occuring at La Saline, 26 miles north of McMurray and these have from time to time been noted by the several explorers of the district. The brine will run about 25° salinity, 100° being a saturated brine.

Other saline springs are found at numerous points further north in the Mackenzie basin, notably at Salt River, Slave River District; Tar Island, Peace River, Red Earth Creek, and Great Bear River, North West territory.

In the plain lying to the north of the Cypress hills, Saskatchewan, numerous small lakes occur which are more or less saline and there are also many alkali lakes throughout the prairie provinces which carry small quantities of sodium chloride associated with other salts.

c. Manitoba.

Beds of rock salt have not, as yet, been discovered in the Province of Manitoba, but numerous brine springs are known, and from these, in past years, salt has been recovered by evaporation. When first these springs became known, the area in which they occurred seemed to be limited to the district lying to the west of Lake Winnipegosis, and this still remains the only district in which natural flowing springs occur. Of late years, however, in drilling operations in the vicinity of the city of Winnipeg and the district to the west as far as the boundary line between Saskatchewan and Manitoba, brines have been encountered in numerous holes and wells. Further drilling will most likely demonstrate a considerably larger area under which brine waters may be found.

The saline springs in the northern part of the province have, in past years, been utilized for the manufacture of salt. For the convenience of reference only the localities where these waters have been found have been divided, tentatively, into three districts.

The Winnipegosis District.

In this district the saline waters all appear in the form of flowing springs. The area in which these springs occur, is approximately confined to the west shore of Lake Winnipegosis, and the district between Lake Winnipegosis and Porcupine and Duck mountains on the west. The southern boundary is Dauphin lake; and the northern boundary the northern shore of Dawson bay. In this area, as outlined, numerous saline springs are known to rise to the surface through the till which covers the district in question.

The topography of the district is that of low lying country, at an average elevation of only a few feet above the level of the water of Lake Winnipegosis. To the west, the prominent ridge of the Manitoba escarpment rises to a height of from 1,000 to 1,500 feet above the surrounding country. The whole area is, with the exception of small portions of the southern part, covered with a growth of small pine, spruce and poplar, which increase in size farther to the north.

The saline springs throughout this district are very numerous, and many small saline areas can be noticed where the brine oozes up through the overlying drift.

The areas in the Winnipegosis district visited by the writer were all very similar in appearance, and one general description for them all will suffice. In general, they consist of a barren area, varying from a few acres to over a hundred acres in extent, devoid of any vegetation, with the occasional exception of scattered patches of the red salt plant (Salicornia herbacea). Surrounding these areas there are generally a few acres of meadow land, with timber consisting of pine, spruce, and poplar, enclosing the whole area

Here and there in the barren flat, saline springs bubble through the till, forming in some cases small truncated, conical mounds of reddish sinter, in the centre of which lie clear pools of brine. In some of these springs bubbles of gas are constantly rising. The brine, flowing from the pools, spreads over the whole flats, and either evaporates — leaving a thin deposit of salts or, if the flow is strong enough, forms a small stream of brine.

Occasionally, the brine is found in lakes or pools some 20 or 30 feet in diameter, in which the surface is constantly constantly moving, owing to the bubbling up of the brine from below. These are surrounded by mud flats covered by a sod of coarse bunch grass. The ground in the vicinity of this type of spring is generally marshy.

The brines of all springs vary greatly in their salt content and will range from 10° to 26° salinity.

Westbourne District.

The region included, in this district, covers the area lying to the west of Portage la Prairie and the western boundary of Manitoba and south of the town of Dauphin. In this district, several saline areas occur, and a number of drill holes have encountered saline waters. The principal localities where saline waters have been noted are, in two wells near Gladstone, Man., in a saline spring seven miles west of Westbourne and in a well drilled for gas, about 200 yards from the C. P. Ry. station at Neepawa. In this latter hole two flows of strong brine were encountered at depths of 1225 feet and 1455 feet respectively. It is interesting to note that the brine from this last well, although high in calcium chloride and calcium sulphate, contained the highest sodium chloride (common salt) content of any examined from Manitoba. The total solid content was 190.896 grammes per litre or approximately 72° salinity.

Winnipeg District.

A syndicate of Winnipeg men have drilled 7 wells in the district within a radius of 20 miles of Winnipeg and in five of them they encountered water of a more or less degree of salinity. In all cases, however, the brines thus encountered were not of sufficient strength from which to commercially manufacture salt.

d. Ontario.

Ontario, at the present time, is the centre of the salt industry of Canada. The salt obtained in this province is recovered by the evaporation of brine which has leached out rock salt from beds which occur in the Saline formation in the southwestern part of the Province bordering on Lake Huron; the St. Clair river; lake St. Clair; and the Detroit river. It is impossible, with our present knowledge, to determine definite boundaries of the salt basin; but, as far as it now stands proved, the area underlain by salt in Ontario is approximately contained within lines joining the towns of Kinkardine, Teeswater, Brussels, Seaforth, London, St. Thomas, on the west; and Thamesville, Dresden, across lake St. Clair, through Elmstead to a point on the Detroit river between Amherstburg and Sandwich. The area enclosed within this boundary in Canada is about 3,000 square miles.

The salt beds are known to vary in thickness. In some wells they occur in thin beds interstratified with dolomite and shale; the total combined thickness of all these beds varying from 100 to 200 feet. In other localities, as in the case of the beds at Windsor, the salt beds are of great thickness, one bed alone having a thickness of 200 feet. The average depth at which the salt is found is in excess of over 1,000 feet, there being a gradual increase in depth of the beds as one goes farther south.

The production from a few wells has hitherto been sufficient to supply the domestic demand, and little exploration has been carried on by which the area underlain by salt can be definitely outlined. There has, however, been a great deal of exploratory work in connection with the development of petroleum and natural gas fields. Where these boreholes extend below the salt horizon, they give evidence of either the presence, or the absence of salt.

From the records available, it would appear that within the area mentioned, the salt beds are practically continuous; there are, however, some limited areas within these boundaries where — according to the records of drill holes that have penetrated below the Salina — there are no salt beds.

The southeast boundary of the salt area is at present unknown, as no drill records are obtainable from the district along the north shore of Lake Erie between St. Thomas and Chatham. Records from a hole at Orford, Kent county, show 171 feet of salt, at 1,510 feet below the collar of the hole; while another from Glencoe shows 104 feet of salt, at 1,290 feet below the surface. These records lead one to believe that possibly the beds are dipping to the southeast and may be found by deeper drilling in the vicinity of Lake Erie.

The southwestern boundary merely marks the dividing line between the area beneath which salt beds are encountered, and the area where brines of a more or less density were found, although no rock salt was obtained.

The salt beds are supposed to extend under the Detroit river; Lake St. Clair, St. Clair river, and the southern part of Lake Huron, since rock salt has been found in the Salina formation in the State of Michigan, on the opposite side of the International Boundary.

All the salt is obtained from the evaporation of waters which have been allowed to remain in contact with the salt beds until a saturated solution has been formed. The water employed is derived either from natural underground springs, or else is forced down through the cased drill holes penetrating the salt beds. The brine produced in this district is very pure and seldom requires the addition of any chemicals to precipitate impurities. An analysis of brine taken from one of the salt wells in this district showed the following composition:—

	Per cent.
NaCl	26.6415
$CaCl_2$	0.1895
$MgCl_2$	0.1884
$CaSO_4$	0.2757
H_2O	72.7049
Total	100.000*

*F. G. Wait, analyst.

The salt is prepared by one or other of the methods previously described in this paper.

Brine from this district is already being used at Sandwich, Ont., in the manufacture of caustic soda and chloride of lime and another plant has been recently completed for the manufacture of sodium carbonate (soda ash) at Amherstburg.

e. Maritime Provinces.

New Brunswick.

In this province no beds of salt have, so far, been discovered. Several localities, however, are known where brine springs have been observed. These springs apparently have their origin in the rocks of Lower Carboniferous age. Small quantities of salt were manufactured each year from the brine of these springs; but for the last ten years, operations have ceased. The best known localities are at Sussex, and Salt spring brook, both in Kings county; and on the Tobique river, Victoria country.

Nova Scotia.

In the province of Nova Scotia no deposits of salt with the exception of the Malagash deposit, have, so far, been discovered; but numerous saline springs of a greater or less degree of salinity are known to occur. These springs, where noted, seem to have their origin from the beds of the Lower Carboniferous formation, and are closely associated with the gypsum deposits which occur so extensively in this formation, throughout the province. Numerous drill-holes have been put down throughout the province, passing completely through the Lower Carboniferous formation, but in none of them has rock salt been found.

Attempts have been made from time to time to manufacture salt on a commercial scale from these springs; but where have all been abandoned. At the present time there is no production of salt in the province. The weakness of the brine, and the consequent high cost of production, have, so far, made it impossible to compete with the Ontario salt, or that imported from the United States, or Great Britain.

A few of the places at which brines occur will be mentioned.

Whycocomagh:—Brine springs have been noted half way between Baddeck and Whycocomagh, on the road running along the northwest shore of St. Patrick's channel. The brine has a strength of about 19° salinity.

Antigonish:—In the vicinity of the village of Antigonish and in the adacjent district numerous saline springs and ponds are found. A brine flow was encountered in this district at a depth of 159 feet from the surface. A number of years ago an attempt was made to utilize this brine and a considerable quantity of salt was made, but the brine becoming weak, the work was abandoned.

Spring Hill, Cumberland Co.:—Attemps have been made to manufacture salt at Spring Hill from a brine spring which was reported to be about 30° salinity, but operations were soon abandoned.

Cheverie, Hants Co.:—In two bore holes drilled at Cheverie, strong brines were encountered at depths of 1400 and 1870 feet, respectively. The brine was reported as having a strength of 76° salinity. Other springs have been noted at Walton, Hants Co. and Salt Springs, Pictou Co.

With the discovery of a deposit of rock salt at Malagash, Cumberland Co., Nova Scotia, the prospect for extending the salt industry to this province looks very encouraging. This is the first known discovery of rock salt in the Maritime Provinces and the first in Canada to be discovered at a depth sufficiently shallow to enable it to be won economically by actual mining.

Discovery and History of the Malagash Deposit.

Some time in 1912 Mr. Peter Murray drilled a well for water on his farm on the Malagash road, about 7 miles northeast of Malagash Station, a station on the C. G. Ry. branch line operating between Orford Jnc. and Pictou. He encountered salt water and sent a sample of the same to Dr. F. Shutt of the Dominion Experimental Farm at Ottawa. Dr. Shutt reported on this sample as follows:

	Malagash Brine, N. S.	—Western Ontario Brine—			
Sodium (Na)	99.50	96.270	101.728	96.368	100.397
Potassium (K)	0.55	n.d.	n.d.	n.d.	n.d.
Iron (Fe)	0.07	n.d.	n.d.	n.d.	n.d.
Calcium (Ca)	1.37	1.552	1.630	2.496	1.531
Magnesium (Mg)	0.22	.244	.257	.127	.118
Sulphuric Acid (SO_4)	3.11	2.631	2.634	1.698	2.803
Chloride (Cl)	154.70	150.122	158.742	152.294	156.884
	259.52	250.319	265.001	252.983	262.333
Hypothetical Combination: Parts per thousand.					
Sodium Chloride (NaCl)	252.90	244.860	258.770	245.111	256.891
Potassium Chloride (KCl)	1.04	n.d.	n.d.	n.d.	n.d.
Magnesium Chloride ($MgCl_2$)	0.66	.966	1.017	.503	.467
Calcium Chloride ($CaCl_2$)	0.22	1.265	1.484	4.964	1.007
Calcium Sulphate ($CaSO_4$)	4.42	3.728	3.730	2.405	3.971
Ferric Oxide (Fe_2O_3)	0.10	n.d.	n.d.	n.d.	n.d.
	259.54	250.818	265.001	252.983	262.336
Sp. Gravity at 15.5°C.	1.200	1.197	1.2045	1.178	1.198

"Our analysis of this water shows it to contain 28.83% total solids, of which 28.32% is common salt. It is in fact a very strong brine.

"There are present very small quantities of sulphate of lime and possibly of allied compounds, but essentially this is a saturated, or practically saturated, solution of common salt."

No action was taken with regard to this discovery until the early month of 1917 when another sample was forwarded to Dr. Shutt who reported 26.65% common salt content. At this time Dr. Shutt referred the parties interested to Dr. Haanel, Director of the Mines Branch, Department of Mines. The Mines Branch immediately obtained another sample and had it analyzed. It was found to be a saturated brine, its analysis being given in the accompanying table, together with four analyses of brine from the Western Ontario district, for comparison.

As a result of this analysis it was suggested that further exploration was desirable in order to ascertain if the parent salt bed could be located. It was also decided that the writer should visit and examine the locality at the earliest possible moment. When the locality, therefore, was visited in June, 1917, brine had been encountered in several other holes. A personal examination of the local conditions convinced the writer that there was a good possibility of discovering rock salt in place, and he strongly advised the owners to continue their prospecting along lines already advised. Subsequent development has demonstrated that these deductions were sound.

In the summer of 1917, A. R. Chambers and George McKay of New Glasgow, N. S., took an interest in the operations and drilled a series of holes, after which they sank a prospect shaft—June, 1918. In this shaft rock salt was encountered at a depth of 85 feet from the surface and when the locality was again visited by the writer on October 10, 1918, it had penetrated to a depth of 17½ feet in the salt formation. Since then I have been informed that the shaft has penetrated about 25 or 30 feet in the salt formation and that they are now drifting on the deposit.

The overlying beds penetrated by the shaft appear to be in a nearly horizontal position and consist of clays, soft shales, gypsiferous muds, etc.

The underlying saline beds appear to dip to the west of south at an angle of about 25° and have a strike of S.70°E.

The saline beds as encountered in the shaft, show, in the upper 12 feet, considerable impurities in the form of mud, but there appear to be banded layers of whiter rock salt as one goes deeper. The indications from a drill hole located on the site of the shaft, are that the salt beds have a thickness, at this point, of at least 50 feet.

The saline beds are found associated with beds of gypsum, mapped by Fletcher as of lower Carboniferous age. These gypsum beds are seen exposed on the shore to the north of the shaft. To the south of the shaft there is a small unmapped outcrop of what appears to be New Glasgow conglomerate. The salt beds are on the south slope of an anticline, and little is so far known as to their lateral extent. To the west, about one mile from the shaft, there is a pronounced fault shown in the shore section, and this may cut off the western extension of the beds. To the east, about the same distance, the occurrence of a marsh, caused by the sea eroding the northerly lying and protecting sandstone barrier, may determine the eastern extension of the deposit. The evidence at hand, however, indicates the presence of a salt formation of considerable extent. On the basis of data obtained from the shaft, from surface indications, and from the drill holes, it is possible that the saline formation, measured at right angles to the dip, may have a thickness of 175 feet.

A general sample of the whiter rock salt was taken for analysis with the following results:

	Dried at 110° C.
Sodium (Na)	38.45
Potassium (K)	0.20
Iron and aluminium (Fe and Al)	none
Calcium (Ca)	0.25
Magnesium (Mg)	trace
Sulphuric acid (SO_4)	.61
Chlorine (Cl)	59.35
Insoluble in water	1.05
Total	99.91

	Conventional Combination.
Sodium chloride (NaCl)	97.60
Potassium chloride (KCl)	0.40
Magnesium chloride ($MgCl_2$)	trace
Calcium chloride ($CaCl_2$)	none
Calcium sulphate ($CaSO_4$)	0.86
Ferric oxide (Fe_2O_3)	none
Insoluble in water	1.05
Total	99.91

Analyst: T. W. Hardy, Mines Branches.

Although the quantities of potash salts present in the two samples examined from this locality are small, it does not of necessity mean that they are absent in commercial quantities in this area. The drilling and prospecting so far carried out have only in the most superficial way indicated the present of a large bed at one horizon, and the probability of encountering potash salts, interbedded with the sodium chloride at other horizons than the one penetrated by the prospect shaft and drill holes, is quite within the bounds of possibility.

There is an interesting point which may be worthy of noting in passing, with reference to this deposit. When sinking the shaft a flow of gas was met with at one part of the workings. A sample of this was forwarded to us for analysis and the following are the results obtained on this analysis:

Chemical Analysis.

Carbon dioxide	% 0.13
Oxygen	% 5.37
Methane	% 5.80
Nitrogen	% 88.70

Technical Analysis.

Air	% 25.66
Fire damp	% 5.80
Black damp	% 68.54

Chemist: James Moran.

Mr. Moran in referring to this gas in his report says in part:

"Regarding danger from this gas, we may say that it is dangerous to breathe for more than a few minutes. It is not poisonous, as if carbon monoxide, sulphuretted hydrogen, etc., were present; but its low oxygen content makes it impossible to support life any length of time.

"As to its apparent non-inflammability, this was due to the deficiency in oxygen. There was not enough oxygen present to burn the methane. In our analysis,

we diluted the sample with air and burnt the methane, in estimating it. Dilution with air will raise the oxygen content, and therefore reveal the inflammable nature of one of its constituents. If any ordinary mine air sample contained the same percentage of methane as this sample, it would be highly explosive, but in such cases there is always sufficient oxygen to admit of complete combustion of the methane. The limits of explosibility of methane are from 5.5% to 13%. If the sample submitted is a true sample of the issuing gas, and further evolutions do not exceed this percentage of methane, it is possible of course by proper ventilation to reduce the black damp content to a figure within safety limits, as is the practice in coal mines; for when diluted with very much air the methane percentage of course drops considerably, and although two or three per cent. of methane in mine air is not to be desired as it takes up the place of oxygen, yet an explosion is not possible before 4½ to 5% of methane is present. So dilution of sample with air cannot give an explosive mixture, although it does give an inflammable one.

"We would say in conclusion that most coal mines keep the methane content down below one per cent.; that two or three percent methane is getting to be serious; while, 4 to 4½% is on the limit of explosibility. Also in England, coal mines are forbidden to operate if the oxygen content falls below 19%. In normal air it is 20.93%."

The discovery of this deposit should be of great assistance to engineers in their search for other similar deposits. A careful study of the conditions of the Malagash area may well indicate to those familiar with the Province, other localities where the conditions are similar and where surface prospecting and drilling might offer a reasonable chance of obtaining results.

4. Markets.

a. Domestic.

The importance of this discovery to Canada and more especially to the Maritime Provinces can readily be seen. The only salt producing district in Canada at present is the western Ontario district. Thus Canada at the present time imports over half of her annual consumption. The calculated consumption of salt in Canada in 1918 was 296,328 tons* valued at $2,535,465 as compared with a consumption in 1917 of 301,076 tons valued at $2,041,633. The total sales in 1918 were 131,727 tons, valued at $1,285,039. Of this only some 893 tons valued at $16,743 were exported. There is thus an opportunity for a considerable domestic market for salt to replace the imported material. This import of salt in 1918 amounted to 165,494 tons, valued at $1,267,169 and included: 51,450 tons of fine salt in bulk valued at $294,676; 13,941 tons of salt in packages, valued at $156,736; and 100,103 tons imported imported for the use of fisheries and valued at $815,757. This last item is employed either on the Atlantic or Pacific seaboards in the fishing industry. From a study of the trade statistics of the Customs and Trade and Commerce Departments, I think it is safe to say that about 75% of this fisheries salt is utilized on the Atlantic seaboard including the Gulf of St. Lawrence. The average value of this salt at point of shipment for 1918 was approximately $8.15 per ton of 2000 lbs. The ocean freight rate to bring this salt to Canadian ports of distribution would bring the cost up to at least $10.00 per ton.

This price will probably be a normal price for salt for fisheries for a number of years to come — the price during war time ranging between $15.00 and $25.00 per ton selling price at selling points in Nova Scotia. If, therefore, a deposit of salt can be developed in a centrally located point in Nova Scotia, and a grade of salt produced suitable for the fishing industry a market of some 75,000 tons, valued at $750,000, is available.

In addition to this a considerable demand for salt for domestic uses in the Maritime Provinces could be supplied from such a deposit.

b. Foreign.

Among the foreign markets for the salt from the Malagash deposit the principal ones will be the fishing industry industry of Newfoundland, which consumes, according to reports, about 50,000 tons per year and the fishing and metallurgical industries along the Atlantic seaboard of the United States. It will remain to be seen how much of this latter market can be captured by material produced in Canada.

One feature with relation to the Malagash deposit which is well worthy of serious consideration for future action is the possibility of establishing an industry for the manufacture of sodium compounds. It may well be that, situated as this deposit is, with ready access to shipping facilities both by rail and water, and comparatively close to abundant supplies of fuel, an industry using the salt from these beds as the principal raw material, could be established which would turn out products at a price which could compete in foreign markets such as South America and South Africa with similar material from the English and United States plants.

It will thus be seen that, although the Canadian market alone for salt, or the associated chemical industries, for material produced at this deposit would guarantee its success, its favorable location to water transportation on the Atlantic seaboard will also likely enable it to develop an export trade with the United States, South Africa and South America.

*Figures given in this section are taken from Preliminary Report of the Mineral Production of Canada, 1918. John McLeish, B.A., Mines Branch, Dept. of Mines, Ottawa. No. 506.

Concentrating Mills at Galena Farm Mine Again Operating.

The concentrating mill at the Galena Farm Mine is in operation again and the mine management looks for a steady season's run. A general meeting of the Lucky Jim Mining Company's shareholders will be held at Victoria, B.C., on May 1st. R. O. Whitaker, the American smelting and metallurgical expert, has arrived at Nelson, B.C., to assist in the preparation of a report on the custom rates charged by the Consolidated Mining & Smelting Co. of Canada at its Trail Smeltery. Charles F. Coldwell, prominent Slocan mining operator, who has acquired an interest in properties of the Stewart District, Northwest British Columbia, is in Ottawa with a view to interesting the Federal Government in the construction of a railway from the head of Lynn Canal through the Stewart River section. He is enthusiastic in his predictions of the future importance of this district from the viewpoint of the mining industry.

BEATTY TOWNSHIP GOLD DEPOSITS.

We are advised that arrangements are being made to develop the property of the Cartwright Gold Fields, Ltd., at Painkiller lake, Beatty township. The property has been idle since the buildings were destroyed by fire in 1916. The plant included a 5 drill compressor, hoist and two 60 h.p. boilers. At the time of the fire a 10 stamp mill was on the property. It is said that the machinery can be used again, a comparatively small sum being necessary to put it in good working order.

A shaft has been sunk 100 ft. and about 50 ft. drifting done at that level. It is planned to sink to 400 ft. This work is on the South Claims. On the North Claims exploration will be by diamond drilling, for which tenders are now being asked.

These properties are in the Beatty-Munro area described by Mr. P. E. Hopkins in the 1915 report of the Ontario Bureau of Mines. Claims were staked for gold in Beatty and Munro townships in 1908. Mr. A. G. Burrows mapped Munro township and a portion of Guibord in 1911. Mr. Hopkins mapped Beatty and parts of Warden and Coulson in 1914. The two maps, embracing about 150 square miles, have been incorporated and published as a geologically colored map on the scale of one mile to the inch.

Mr. Hopkins says of the deposits examined: "The gold veins are small and belong to the pyritic-gold type, with transitions to the arsenical type. The study of the veins in the vicinity of Painkiller lake, shows the presence of considerable tellurides associated with the gold. These veins resemble the small gold telluride veins of Kirkland Lake."

"Tellurides were recognized in several small gold-bearing quartz veins in the vicinity of Painkiller lake, on lots 8 and 9, concession V, Beatty township, and on lots 6, 7 and 9, concession VI, of the same township. No doubt they occur and will be found elsewhere in the vicinity. The best telluride specimens were obtained from No. 1 vein on the Treadwell property, lot 9, concession VI, Beatty township.

"Owing to the tellurides being in very fine grains and in close association with the gold, it is difficult to identify them. These minerals occur in fractures in the quartz with grains and seams of gold through them. Certain polished surfaces of the tellurides were examined under a miscroscope with reflected light, special attention being paid to the slight variation in color and the effect after adding a drop of nitric acid. Most of the tellurides have a creamy-white color and after the addition of a drop of HNO_3, turn brown and effervesce strongly, leaving a characteristic etching resembling that of calaverite. There are small amounts of another telluride, light grey in color, which were found to contain bismuth."

Of the Cartwright proper Mr. Hopkins said in his report:

"The Cartwright Gold Fields, Limited, have their main workings on the south shore of Painkiller lake on lot 8, concession V, Beatty. The small quartz vein carrying visible gold, telluride and pyrite runs northward into the lake. A shaft is down 100 feet and work is being carried on at the present time (May, 1915). The old plant and buildings were burned in 1913. The new plant consists of a 3-drill compressor, hoist, and two 60-h.p. boilers. All the machinery in connection with a 10-stamp mill is on the ground and being erected."

In concluding his report on the area Mr. Hopkins said:

"The Beatty-Munro gold area is one worthy of more systematic prospecting. The veins so far found are mostly small, but thorough prospecting may reveal wider and richer ones. Several samples assayed showed the gold to be widely distributed. The veins in the vicinity of southwest Munro are of the Porcupine type, while those at Painkiller lake closely resemble the gold-telluride veins at Kingland lake. The finding of so many gold-telluride veins in the immediate vicinity, viz., Kirkland lake, Maisonville and Grenfell townships, Opasatika lake, Painkiller lake and Deloro township, shows that the gold-telluride minerals are widely distributed, and by further searching larger and richer deposits are likely to be found."

Now that the war is over we may see exploration of this area carried out as recommended.

Mountain Chief Copper Mine.

The Mountain Chief Copper Mine at Renata, B. C., is another property which is expected to be on the producing list shortly. J. W. Evans, president of the company, states that a new tramway has almost been completed and that other equipment will be ready for operation at an early date. Mr. Evans expects that a daily output of forty tons of copper ore will be maintained after a start is made.

Flotation Plant at Granite Mill.

The Eureka Mines, Ltd., operating the Eureka, one of the well-known copper producers of the Nelson District, will have their flotation plant installed at the Granite Mill in a short time. The stamp mill has received an overhauling and the flotation plant is now in Nelson ready to be transported to the property.

Alamo Claims Bonded.

The Alamo Group of six claims on Wolfe Creek, adjoining the Queen Mines, on which important development work is being done by A. W. McCune and associates, has been bonded by eastern interests for $40,000. G. R. B. Elliott put the deal through on the latter's behalf. Mr. Elliott has been investigating the properties for some weeks and seems optimistic as to their possibilities.

Wage Reduction at Rock Candy Mine.

The reduction of 50 cents a day in the wages of miners has resulted in a partial strike at the Rock Candy Mine of the Consolidated Mining & Smelting Co. near Grand Forks. Twenty-nine of thirty-five men left their work shortly after the announcement was made. No more men will be employed at present pending the completion of the concentrator. The grading of the extension of the railway from Lynch Creek to the Mill has been finished and the roadbed is ready for steel.

Developing Property at Arrow Lake.

A large deposit of zinc ore with some showings of galena is situated at Pingston Creek, about twelve miles south of Arrowhead. Further north is a promising copper property. A wagon-road has been constructed to these properties, and considerable development done with encouraging results. The Reneta, a copper property on the Lower Arrow Lake, is again under development on a new bond, on which the first payment of $15,000 has been made.

BELMONT SURF INLET GOLD MINE.

General manager Frederick Bradshaw, of the Tonopah Belmont Development Co., in his report to president Clyde A. Heller, says of the Surf Inlet mine: "The operation of the property of the Belmont Surf Inlet Mines, Ltd., which had been started six months previously, continued throughout the period (10 months ending Dec. 31, 1918), under conditions that were particularly arduous on the gold mining industry. The scarcity of all labor, and especially of skilled mine labor; the higher wages paid and the decreased efficiency of labor; the increased cost of, and in some instances the impossibility of securing supplies, with no advance in the price received for the gold produced, greatly increased the operating cost and decreased the earnings. Notwithstanding these conditions, the Surf Inlet property became the leading producer of gold in British Columbia and the operations for the ten months period, from the treatment of 83,142 tons of ore, resulted in net earnings from operations of $323,242."

The directors of Belmon Surf Inlet Mines, Ltd., are: E. A. Cleveland, Vancouver; M. B. Cutter, Minneapolis; Jos. C. Fraley, Philadelphia; Clyde A. Heller, Philadelphia; Richard G. Park, West Chester, Pa.; Wm. M. Potts, Wyebrook, Pa.; S. Deas Sinkler, Philadelphia; Thomas W. Synnott, Wenonah, N.J., and C. Berkeley Taylor, Philadelphia. C. A. Heller is president; Wm. A. Potts, vice-president and S. D. Sinkler 2nd vice-president, J. K. Kitto is secretary-treasurer. At Surf Inlet F. W. Holler is superintendent, E. W. Hawkins auditor, F. H. Pennlas mill superintendent, and H. J. O'Connell mine superintendent.

President Heller under date of March 26, 1919, says that $45,569 was expended last year for houses for staff employees, school-house, retail store and warehouse, etc. During this year several more cottages for employees, a hospital building and a slight extension of the railroad will be necessary. There was spent last year on development of the Pageley mine, held under option, $7,646, the conditions being unfavorable for progress. A renewal of the option is expected.

General manager Frederick Hawkins says in his report on operations during the 10 months ending Dec. 31, 1918, that the 83,142 tons of ore milled during the 10 months period had a gross content of 39,999 ounces gold, 25,893 ounces silver and 433,399 pounds copper and a gross value, calculating gold at $20 oz., silver at $1.01⅛ and copper at 22,661 per lb., of $924,847. Average value per ton ore was $11.12.

Ore reserves March 1, 1919, were estimated at 385,320 tons. Since then 116,349 tons has been mined, but the reserves increased to 422,761 tons, positive and probable ore.

Mine, mill and power plant operations have proven to be satisfactorily efficient and the improved conditions should soon be reflected in the cost sheets.

Martin Gold Mine.

The shaft on the property of the Martin Gold Mining Company's property, near Amos, Quebec, on the National Transcontinental Railway, having reached a depth of 125 feet, cross-cutting has been carried out and the vein encountered about ten feet from the shaft. At this point the vein is said to be about 13 feet in width, and contains visible gold.

A Montreal syndicate is negotiating with a view to purchasing control of the company.

Reduction of Wages at Trail.

A further reduction in the wage scale paid by the Consolidated Mining & Smelting Company is announced in a recent circular which reads:

Trail, B.C., April 12, 1919.

To the employees:

The average price of copper for the month of March was 14.84c., consequently the wages in the copper mines will be reduced 50 cents per man per day. As arranged in the smelter scale a 25 cent raise was given on July 1st, 1916, which was to remain in force until the mines scales were reduced owing to a drop in the price of metals, and then was to be reduced by an equal amount of one-half of the reduction made at the mines.

On April 15th, 1919, the copper scale will be reduced 50 cents per day, which will call for a reduction of 25 cents at the smelter. It is recognized by the company that the cost of living is still high and, therefore, for the present, at least, the minimum wages will be held at $3.50 per day with the exception of boys and apprentices.

The company has been forced to carry an ever increasing stock of unsold metals, so much so in fact that were it not that many of our employees have voluntarily increased their efficiency we would have been forced to close them.

In recognition of that effort of our employees, while forced to make some of the reduction called for in the wage scale, we will make further efforts to try and finance the production of these metals. We must, however, remind our men that only their best co-operation will make it possible for us to continue operating for any length of time.

Thanking you for your increased effort and trusting that you will give even further co-operation and so enable us to keep the plant in operation till the present critical period is past,

Yours truly,
(Sgd.) S. G. BLAYLOCK,
Assistant General Manager.

Aeroplanes Will Help Prospector.

Discussing the possibilities of the aeroplane in connection with the development of the mineral resources of British Columbia, Captain Alfred Eckley, R.A.F., in a recent address delivered at Vancouver, B.C., said: "The prospector of the future will not spend weeks and months toiling through lofty passes and over forest trails to the distant fields where he proposes to win fortune. He will load himself and his six months grub into an aeroplane, fly over the ranges and land on the spot he has selected. When the season is over the airplane will call again, pick him up along with such ore samples or gold dust he has secured, and carry him back to the Vancouver Chamber of Mines where he can display the results of his work. When he is ready to return with machinery and men the airplane again will be at his service. He need not wait for the government to build roads in order to transport his supplies and plant. The airplane that was designed to carry bombs by the ton to Berlin will be found quite capable of delivering comparatively heavy machinery. It also will bring out ore, for it will pay to transport high-grade stuff 500 miles by air. Thus the development of the airplane in British Columbia becomes the key to the exploration and exploitation of the rich mining deposits of the interior districts, which have scarcely been seen as yet by white men."

Special Correspondence

ONTARIO'S UNDEVELOPED IRON RANGES.

To the Editor Canadian Mining Journal:

Sir,—In your publication dated April 2, 1919, there was an interesting article by Jas. W. Moffat on the treatment of Canadian iron ores, especially those of low grade. This article was both timely and of great importance to the industry.

A portion of this article gave a description of the known iron orebodies in Canada. Among these, the larger orebodies are given as the Helen and Magpie mines of the Algoma Steel Corp.; Atikokan mine, of the Atikokan Iron Co.; the Moose Mountain mine, of the Moose Mountain Co., Ltd. The other orebodies in the older, more populous parts of Canada are mentioned as not being large and of low grade as a rule. A statement was also made that with the exception of the mines mentioned, no really large property has been thoroughly proven to contain one million tons of marketable ore.

In connection with the above statement, if the use of the term marketable ore is applied to the Moose Mountain mine, which is almost entirely a concentrating proposition but turning out a valuable high grade product, the same term should apply and the same allowance as reserves should be made to other large orebodies of a similar nature in Western Ontario. Also the statement that the Atikokan mine of the Atikokan Iron Company, represents the only large proven orebody of this district is, to say the least, misleading, though the additional high grade tonnage is mainly on the range of that name, but held by other mine owners.

On my own explorations, which extend over a period of nearly twenty years and which was given almost exclusively to the study of the Canadian Iron Ranges, I have visited personally over one thousand lineal miles of iron ranges in western Ontario alone, independent of Michipicoten, Magpie, or Moore, Mt., all within rail haulage distance of lake freight as well as being conveniently near existing railway lines. I know of the whereabouts of another thousand miles that would be considered as future reserves of the Dominion, but are at present, too distant from railway transportation.

In the whole of these explorations, while I have found but few large outcroppings of shipping ore, I would consider that in the first thousand miles of ranges there were at least one hundred miles which were worthy of being given the much closer examination which would precede diamond drilling. Outside of this there were large areas which can well be taken into consideration as concentrating propositions.

From west to east the most important iron ranges occur tributary to the Head of Lake Superior,—Steep Rock, Atikokan, Mattawan, Kaministiquia, Loon Lake, Nipigon and Little Long Lake. Less explored ranges are, Hunter's Island, Little Pine Lake, Onamon River and a number of others which extend east from Thunder Bay for a distance of over two hundred miles.

The following tonnages are based on my own surveys and the estimates furnished me by engineers engaged in drill work and other development on the different ranges;

West of Sabawe Lake,—Atikokan Iron Range, 15,000,000 tons, average 55% Iron, 13% Sulph. .03% Phos.

East of Sabawe Lake, Atikokan Iron Co. Mine 10,000,000 tons running 55% Iron, 2% Sulph. .10% Phos.

The Mattawan and Kaministiquia ranges — banded iron formation (Jaspilites) running from 35 to 40% of Iron, 150,000,000 tons which might be concentrated.

Loon Lake Iron Range is estimated as having a total tonnage of 25,000,000 tons.

In addition to the above, on the Mattawan Range there are great tonnage of massive low grade hematite which would be useful in any local furnaces as a mixing ore, running from 35% to 40%.

A considerable proportion of the Loon Lake Ore when hand sorted, would make a shipping, merchantable product, while the lower grades of more massive ores, of which there is a large tonnage on that range, would be well adapted for a local furnace supply.

Extensive tests have been made of the higher sulphur ores on the Atikakon, which gave splendid results. A shipment for experimental purposes, of 400 tons was made and roasted in Wedge furnaces. The analysis of the ore before treatment was 59.34 Iron; .02 Phos.; 2.85 Silica; 21.44 Sulph. After roasting this gave the following product: Iron 65.53; Phos. .02; Silica 3.44; sulph. .59. This test was made from the ores carrying the highest sulphur content on the range, while there is a large tonnage that will run in the neighborhood of 2% in sulphur included in the reserves of the range.

On the Steep Rock Range, which is the thickest and most extensive in that particular district, a small amount of drilling was done at Straw Hat Lake which disclosed a body of hematite of merchantable grade, but as very little work was done on this deposit, estimates are not available.

On the Kaministiquia Range, I recently made a survey of a single outcropping of proven depth which contained over 14,000,000 tons which could be open cut, without taking into consideration a very large tonnage on the same property which would have to be mined. A Government test taken from the outcropping mentioned, of crude ore, the sample weighing about 250 lb. when treated for concentration by jig and water separation and breaking only to quarter inch mesh, gave the following results;

Analysis of crude ore .. ..37.19 Fe.
Ratio of concentration 1-2
Analysis product .. ..53.25 Fe.

A number of hand tests gave an average of 52.96Fe. .09 Phos. and .08 Sulphur from crude ore averaging 33.61 Fe. It is a banded magnetite-hemetite. This ore shews by analysis as follows:

Total Iron 37.19%
Hematite.....Fe_2O_3.....17.19%
Magnetite.....Fe_3O_4.....33.97%

When we consider a proposition of this kind with a 25 mile rail haul and situated immediately on the tracks of two railways, and developed electric power within 6 miles, the advantages this would have over magnetic concentration requiring fine grinding briquetting and a more expensive plant, are evident. In addition to the open cut tonnage already given and the other ore reserves on the same property, we have, within a radius of five miles, the remainder of the 150,000,000 tons mentioned in the tonnage reserves of this

district. This tonnage is easily within the mark.

In the eastern portion of Thunder Bay district, a very small amount of drilling was done on the Onaman River and Nipigon District where there are very extensive iron ranges of great thickness without considering the Little Long Lake range which is of equal importance.

In summing up these ore reserves which are practically on the railway tracks and easily within the limit of haul by rail, it would seem that eastern men in compiling statistics, etc., have practically shelved this district altogether. In my opinion, it is really the most important point in Canada as regards iron ore reserves.

In the New York Mining and Engineering Journal dated June 22, 1918, they published an estimate of the iron ore reserves of the world. This statement gave Canada as follows: "**Not estimated, scattered and relatively small.**" Is not this a splendid advertisement for our iron ore reserves? Many of our Canadian engineers and our Mines Department men seem to be imbued with much the same idea.

While it is true that the Nova Scotia Iron and Steel companies can get unlimited supplies of ore from Wabana, N.F., other steel plants or smelters are dependent on account of the shipping distance, on other reserves.

I quite agree with Mr. Moffat in his statement that it is much easier for the Canadian furnaces to simply write any iron company in the United States where they can get any grade or class of ore desired, be sure of its prompt delivery and of its being according to the analysis guaranteed them when making their selection. They also only pay a duty of eight cents per ton and no war tax, while the local producer of ore would have to sell on the same market basis, but would pay a war tax. This might not seem patriotic on the part of the furnace man, but it is business.

On looking over the iron and steel production pamphlet issued by the Government, the following figures are very interesting:

In 1912 we imported from the United States alone, $82,658,294. worth of Iron and Steel Products;

In 1913,—$106,610,390.;

In 1914,—$76,702,283.;

In 1915,—one of the quietest trade years that Canada, had for a decade, $48,411,020.

Making a total for the 4 years of $314,381,987.—an average of over $78,000,000 annually.

That none of this was required for war products was evinced by the import from the United States in 1916, the first year that Canada actually started dealing largely in munitions, in that year we imported $95-165,875. This gradually increased until it amounted to over $150,000,000. These are staggering figures and in, as Mr. Moffat expressed it, what the Canadians point to proudly, as their growing years.

I do not know what the import will be for 1919, but we notice statements in the papers that the various Canadian steel plants are going to the Government soliciting orders. Why have they not taken care of some of this huge import in past years? Are they taking any steps to manufacture this import in future years? It seems very doubtful. They seem content to run along turning out standard grades in classes of material for which they probably require less elaborate machinery and a smaller plant than to cater to what might be termed, mixed trade, which is much the same reason why the Canadian furnace owners buy American ore, that is — a matter of convenience.

In 1916, of twenty furnaces in Canada, only fourteen were in blast for varying periods of time, yet in the years 1913, 1914, 1915, 1916, we imported from the United States, $5,496,639. worth of pig Iron. There is practically no production of structural steel in Canada and only a very small tonnage of plates. In accordance with this program, the blast furnaces and steel plants of Canada have an annual output of about $100,000,000 and we have an annual import of iron and steel products of over $78,000,000. Surely there is some remedy for this!

Very few of the Canadian blast furnace owners have made any special effort to get a supply of Canadian ore, at least as far as the Thunder Bay District is concerned. It is quite true that they need various grades which they can purchase quite easily in the American Market, also that the Canadian output might not all be quite up to their requirements, and that they would still have to import a small percentage, but there is no necessity for importing over 90%.

I might add that the Government tried the plan of paying a bonus on pigiron produced in Canada with the result that as the operator of the mines did not get any encouragement there were no new mines opened up and the furnaces imported their ore from the United States and collected the bonus.

In connection with our iron fields, the work done by the U. S. Steel on the Atikokan Iron Range was the largest amount of drilling in any one section in Canada, and in the whole of the Thunder Bay District this work would represent more than nine-tenths of the drilling done. There has not been even a close, detailed survey made of our iron ranges by Government engineers, or engineers representing outside interests except on the Atikokan Range.

The principal reason why few large iron orebodies have been found is that no one has taken the trouble to explore for them. This would necessarily mean a very expensive survey followed by a certain amount of surface and a very considerable amount of diamond drill work, and it stands to reason that neither the explorer nor the average owner can afford to do this and here I am speaking from experience. Until some special inducements are offered or Canadian furnaces and steel plants go after a supply of their own, there is little likelihood of the Canadian iron and steel industry, which should be the most important individual industry in Canada, making any great strides.

The Federal Government is now being asked to give a bounty on iron ores produced in Canada, said bounty to be paid to the operator of the mine. Almost the only adverse criticism seems to be the amount of money that the Government might be called upon to pay out for this purpose. In connection with this I would point out that the average market value of iron ore at present prices, Lower Lake Ports, is nearly $5. per ton. This would be about $4. f.o.b. at the Head of the Lake Superior, which would mean that if 50c per ton bounty were granted, eight times that amount would be spent in Canadian territory in opening up iron ranges and the Government would actually receive back manifold in taxes, etc. what they paid out, besides gaining enormously in increased traffic for the Canadian National Railways which tap 75% of the Thunder Bay and Rainy River District iron ranges, and the hundreds of miles of ranges which we have within easy shipping distance would be carefully looked over and diamond drilled. From my personal observation I feel quite

safe in making the statement that many of these ranges are quite likely to produce great tonnages of iron ore. Even this program would only partially meet the great deficiency.

Duluth solved the problem for the Western States iron and steel supply by building a $25,000,000 plant, which last year they had to increase to $40,000,000 to meet the demand. American iron and steel purchasing agents inform me that Duluth can shade Pittsburg prices. Local purchasers of heavy steel also inform me that if they could buy their material at the Head of the Lakes, they would save at least 8% on freight charges alone, even if purchased in Duluth or Sault Ste. Marie and the saving in freight charges from Eastern plants would be at least 20%.

Our steel plants must be enlarged to meet the requirements of a growing country and do away with the tremendous import in iron and steel products and the necessary tax which the community pays in duties, etc.

The policy of the men who are doing such splendid work for re-construction, headed by Sir John Willison, is the building up of Industrial Canada. Many of the war workers and also men who went overseas, have become trained mechanics. The result of this policy of re-construction would be to keep these men where they belong, in Canada, and not have them leave for points in the United States or elsewhere to find work for which they have been specially fitted and trained. The returned soldier should have the first consideration by giving him remunerative employment as well as keeping him at home. The average wage paid by the U.S. Steel Corporation is about $4.10 per day. This item alone and the immense import of iron and steel products, is sufficient argument for adding nearly 75% to the capacity of the steel plants of Canada.

A steel plant at the Canadian Head of the Great Lakes would solve the problem for the whole of western Canada, for we must consider that while the population of Ontario and Quebec in increasing very slowly, the population of the Great West is increasing by leaps and bounds and there is room for many more millions to be added to the Western Provinces. The proven iron ore reserves of the Thunder Bay district alone with its various grades, would supply a plant of any size for any number of years.

Even Government aid in the payment of a small interest on the actual expenditure would be a splendid investment.

It has been pointed out by various men that the Government would be entering into competition with private enterprise; but as an absolute offset to this statement is the fact that the Port Arhur Shipbuilding and Dry Dock Company and others draw from 3% to 3½% on a large portion of the investment for terms varying from 20 to 25 years from the Government. Moreover the steel plants in the east were heavily subsidized in the past. Why not assist the establishment of an iron industry at the Head of the Lakes to supply the present and ever increasing demands of the west, at a great saving in freight alone on any iron and steel products that could be brought in by either rail or water?

We can always get coal delivered at the Head of the lakes at a freight charge of 50c per ton or less, so the fuel problem, as connected with smelters or steel plants, is easily solved. The great Hydro electric development in the Thunder Bay District answers all questions regarding power.

Yours, etc.,

J. E. MARKS.

Port Arthur, Ont.
May 5, 1919.

Governmental Exploration for Mineral Deposits.

With regard to a scheme for governmental exploration for mineral deposits, as has been recently suggested by the secretary of the Canadian Mining Institute, there will probable be many difficulties to be encountered should such a plan be adopted.

The prospecting fraternity is made up of a type of men who may always be willing to listen to the suggestions of mining engineers, but, perhaps fortunately, do not accept such opinion as being conclusive or infallible. The average prospector would perhaps smile broadly at the suggestion, that when placing his discovery post, he should receive his instructions from a mining engineer. Among prospectors it is a generally accepted belief that mining engineers are not a success in the prospecting field. This does not infer that all due respect is not accorded the mining engineer in his capacity of being able to efficiently conduct the affairs of mining operations and systematize his efforts in endeavoring to arrive at the merits of discoveries made. But it does mean that mining engineers by the wholesale passed the Kirkland Lake area up as being worthless, many of them turned their backs upon Porcupine, as well as Cobalt and Boston Creek, and for this reason the prospectors seem justified in being guided in a large measure by their own judgment.

Geologists and mining engineers have performed genuine service in this country, in that they are able to point out areas where the geological conditions are favorable, and where certain mineral is liable to occur. Beyond this point, the prospectors have led the way. By sheer optimism—sometimes referred to as almost blind optimism, they have won out. A noteable instance of this kind is shown in concrete form in the rich Lake Shore mine where the optimism of Harry Oakes, former prospector and now president of the Lake Shore Mines, placed his every dollar and won success.

The writer is of opinion that the suggested scheme would not prove to be a success. Nevertheless, unless or until some such a scheme should receive a fair trial it would be very unfair to condemn it at this time. A careful experiment of the nature might not be remiss, as it would at once have the commendable advantage of affording employment for returned men and would determine the merits of such a plan. In the meantime prospecting along the usual lines by individual prospectors would not be interrupted.

Electric Haulage at Crown Reserve Mine.

The electric haulage system recently installed at the Crown Reserve mine is working satisfactorily, according to official information. As a result, the efficiency of underground operations has been increased considerably.

Although the electric haulage system has been in practice for several years at the Hollinger Consolidated, and for more than a year at the McIntyre-Porcupine, the present installation at the Crown Reserves is the first of its kind in the Cobalt mines.

Temiskaming and Hudson Bay.

The Temiskaming and Hudson Bay Mining Company, the first mining company to take up holdings in the Cobalt silver camp is surrendering its charter.

The company was incorporated by a number of New Liskeard men, prior to the discovery of silver in Cobalt. With an authorized capital of but $25,000 divided into 25,000 shares, and with only 7,761 shares issued, the T. & H. B. Co. has established a dividend record that probably exceeds that of any other precious metal mining company in the world. From the sale of the old Silver Queen mine, part of its holdings, it was able to disburse a first dividend of 200 per cent. on November 6th, 1905. This was the first dividend declared by any company operating in Cobalt. The subsequent successful operation of the principal holding resulted in dividends of about twenty-five thousand per cent. being paid to shareholders. Whereas at the beginning, the shares of this company are said to have changed hands at a few cents per share, they ultimately rose to around $300 a share.

In 1909 the Hudson Bay Mining Company was formed with an authorized capital of $3,500,000, as operating company, and the T. & H. P. B. Co., became the holding company. The surrender of the charter of the latter concludes the plan decided upon several years ago.

Dome Mill.

According to official information, the mill of the Dome Mines did not resume operations during the last week in April as had been hoped. It has been found that the resumption of milling operations following a period of eighteen months idleness is a task entailing much more labor than had been expected. However, within the next week or ten days the mill should be running at a moderate rate.

It is learned that very little difficulty is being experienced in securing the desired technical staff and everything points toward the probability of a rapidly increasing output following the actual commencement of milling operations.

Porcupine-Keora.

Diamond drill hole No. 6 is being started on the property of the Porcupine-Keora, situated in the northern part of the township of Whitney.

During the course of the large amount of drilling done on the property, very encouraging results have been encountered.

The Kirkland Road.

Concerning statements being made with regard to the controversy relative to the best method of transportation to the mines of Kirkland Lake, it is erroneous to say that the mines supporting the motor road propaganda in preference to a steam railway are those already equipped with mills. Indeed, one of the strongest advocates of a motor road is the Wright-Hargreaves which company has the largest construction program before it of any of the mines in the field.

The advocates of a steam railroad, for some reason or other, are composed chiefly of holders of outlying or perhaps undeveloped claims, and who are not in a position to weigh the merits of the case with equal ability as are those who are at the present moment actually faced with the problem of finding the most efficient solution.

North Dome.

Concerning reports from Porcupine that an American syndicate, composed of Buffalo interests, has acquired the North Dome mine, and that occupants of buildings on the property have been notified to vacate by May 1st so as to provide accommodation for employees that are to be engaged at once, nothing official appears to have been given out.

The North Dome was acquired several years ago by the Temiskaming Mining Company of Cobalt, and no intimation of the property having been disposed of to an American syndicate had come to the company's office here, as yet.

The James Bay Survey.

At a time when the Ontario Government is arranging to send a survey party into the James Bay district for the purpose of further looking into the advisability of extending the Temiskaming and Northern Ontario Railway to tidewater, a good deal of interest attaches to the program to be pursued, and much speculation is rife as regards the probable personnel of the expendition. The survey will be one of the most important ever conducted in Northern Ontario, and it is considered probable men well versed in the North in its untamed condition will be chosen for the work. On a matter of this kind it would be exceedingly easy to perpetrate irreparable blunder if such a task were to be committeed to men not armed with thorough and proven experience.

In that wild world of territory practically unexplored, conditions will be met that might well dampen the spirit of a tenderfoot. Muskegs, mosquitoes and blackflies, loneliness, inclement weather and a dozen other things incidental to the trip will all operate as factors contributory to discouragement.

It has taken a full century to tame a narrow fringe of Northern Ontario. The balance will not be mastered in a day. And so, on the eve of the departure of the vanguard of those commissioned to take this first important step in the search for a highway to the northern seas, interest in the undertaking, and anxiety over its thoroughness may properly be termed a virtue on the part of citizens of the North, and in no way does it reflect lack of confidence.

Broad as the Northern field already is for new enterprise, the scope thus added by the construction of a railroad through such a territory should present excellent opportunity for big important concerns which are always on the alert for fields which permit free opportunity for expansion.

Canadian Kirkland.

A meeting of the shareholders of the Canadian-Kirkland Gold Mines is to be called at an early date for the purpose of considering, and if approved, ratifying an option agreement whereby control of the company will pass to the Crown Reserve Mining Company.

It is understood the situation is such as to assure no hitch in the transaction, the directors having already agreed and now only await ratification by the shareholders.

The Crown Reserve is already proceeding with arrangements to carry out a comprehensive exploration and development programme. Effort will be centered largely on the development of vein No. 2, which shows a very substantial width, with commercial ore occuring in certain sections.

Gold Reef.

An examination of the Gold Reef mine is being made, preparatory to carrying out an exploration and development program. It is understood an engineer has been already engaged for the work.

The Gold Reef is situated in the township of Whitney, a short distance north from Porcupine lake. It is about in a direct line between the Dome Mines on the South-west and the Porcupine-Kerro on the north-east. During its early development, some spectacular ore was encountered in a narrow vein.

Dolly Varden Company Reported to Have Admitted Claim of Taylor Co.

Victoria, B.C.—The affairs of the Dolly Varden Mining Company promise to reach a settlement without loss of time. It has been reported authoritatively that the company admits the claim of the Taylor Engineering Company, which amounts to $462,628.

This was expended in the construction of eighteen miles of railway from tidewater in the Alice Arm District, British Columbia, to the Dolly Varden Mine. Payment of the sum must be made to the Engineering Company within thirty days, and it is taken that the admission of the claim is an indication of the Company's readiness to settle within that period. If this is so the title to a good mine as well as to the railroad which taps some of the richest mining country in the Northwest will be cleared, the company will be in a position to sell or to operate, and activity and prosperity should return to the section affected. The Taylor Engineering Company, too, will be able to pay its creditors, among whom are one hundred odd workmen who were engaged on construction and who have been impatiently waiting for their wages.

Government Prospecting in British Columbia.

Charles Camsell, British Columbia representative of the Dominion Geological Survey Department, who has just returned after a two months visit to Ottawa, states that interest never was keener in mining in Canada. The Dominion Department of Mines, he says, appreciates that everything possible should be done to encourage this optimism and one matter which he has under consideration, and which he is supporting, is that prospecting parties be sent into British Columbia territories which indicate the presence of minerals by their location and formation. Upon good strikes being made the Government, according to this proposal, would supply the money for the development work up to the proving point and then the property would be put on the market and the Government reimbursed out of the revenue from the sale. "In this way," Mr. Camsel explains, "many soldiers who have signified their intention of living in the open in preference to returning to offices could be supplied with work of a congenial and healthy nature. At the same time the mineral resources of the province would be developed and the country would receive direct returns for its investment." Even if the Government does not take this step Mr. Camsell predicts that there will be many independent prospectors go to the hills on their own account, prefering the freedom of the mountains to the confinement of clerical duties.

Miner Killed at Harewood Mine.

Henry Clark, a Nanaimo miner, was killed recently by a fall of coal in the Harewood Mine, Canadian Western Fuel Company.

CANADA
DEPARTMENT OF MINES

HON. MARTIN BURRELL, *Minister* R. G. McCONNELL, *Deputy Minister*

MINES BRANCH

Recent Publications

Iron Ore Occurrences in Canada, Vol. II. Compiled by E. Lindeman, M.E., and L. L. Bolton, M.A., B.Sc. Introductory by A. H. A. Robinson, B.A.Sc.

The Copper Smelting Industry of Canada. Report on, by A. W. G. Wilson, Ph.D.

Building and Ornamental Stones of Canada (British Columbia). Vol. V., by W. A. Parks, Ph.D.

Peat, Lignite and Coal; their value as fuels for the production of gas and power in the by-product, recovery producer. Report on, by B. F. Haanel, B.Sc.

Annual Mineral Production Reports, by J. McLeish, B.A.

The Coal-fields and Coal Industry of Eastern Canada, by F. W. Gray.

Occurrences and Testing of Foundry Moulding Sands. Bulletin No. 21, by L. H. Cole, B.Sc.

Analyses of Canadian Fuels. Parts I to V, by E. Stansfield, M.Sc., and J. H. H. Nicolls, M.Sc.

Clay Resources of Southern Saskatchewan, by N. B. Davis, M.A., B.Sc.

Summary Report of the Mines Branch, 1917.

The Mineral Springs of Canada. Part II., by R. T. Elworthy, B.Sc.

The Mines Branch maintains the following laboratories in which investigations are made with a view to assisting in the development of the general mining industries of Canada:—

Fuel Testing Laboratory.—Testing value of Canadian fuels for steam raising and production of power gas; analyses, and other chemical and physical examinations of solid, liquid and gaseous fuels are also made.

Ore-Dressing Laboratory.—Testing of Canadian ores and minerals, to ascertain most economical methods of treatment.

Chemical Laboratory.—Analysing and assaying of all mineral substances and their manufactured products. Copies of schedules of fees, which are slightly in excess of those charged by private practitioners, may be had on application.

Ceramic Laboratory.—Equipment is such that complete physical tests on clays and shale of the Dominion can be made, to determine their value from an economic standpoint.

Structural Materials Laboratory.—Experimental work on sands, cements and limes is also undertaken.

Applications for reports and particulars relative to having investigations made in the several laboratories should be addressed to **The Director, Mines Branch, Department of Mines, Ottawa.**

GEOLOGICAL SURVEY

Recent Publications

Summary Report. The annual Summary Report of the Geological Survey is now printed in parts. Applicants should therefore, state what particular geologist's report is required, or what subjects they are interested in.

Memoir 95. Onaping Map-Area, by W. H. Collins.

Memoir 98. Magnesite Deposits of Grenville District, Argenteuil County, Quebec, by M. E. Wilson.

Memoir. 101. Pleistocene and recent deposits in the vicinity of Ottawa, with a description of the soils, by W. A. Johnston.

Memoir 105. Amisk-Athapapuskow Lake district, by E. L. Bruce.

Memoir 106. Road materials in a portion of Vaudreuil county, Quebec, and along the St. Lawrence river from Quebec boundary to Cardinal, Ontario, by R. H. Picher.

Map 63A. Moncton Sheet, Westmoreland and Albert Counties, New Brunswick. Topography.

Map 132A. Southwestern portion of Rainy River district, Ontario. Soils.

Map 135A. Lower Churchill river, Manitoba. Geology.

Map 145A. Timiskaming county, Quebec. Geology.

Map 154A. Southwestern Yukon.

Map 157A. East Sooke, Vancouver Island, British Columbia. Topography.

Map 165A. Windermere, Kooteney district, B.C. Topography.

Map 174A. Blairmore, Alberta. Topography.

Map 179A. Onaping; Sudbury and Timiskaming districts, Ont. Geology.

Map 183A. Harricanaw-Turgeon basin; Abitibi, Timiskaming and Pontiac, Que. Geology.

Maps 1697 and 1698. Explored routes in a belt traversed by the Canadian Northern Ontario railway,—in two sheets: Sheet 1 Gogama to Missonga, Sudbury district; Sheet 2 Oatland to Penhurst, Algoma district, Ontario.

Map 1690. Whiteburn Gold District, N.S. Geology.

Map 1702. Klotassin, Yukon Territory. Geology.

Map 1710. Bothwell-Thamesville oil region, Kent county, Ontario.

May 1712. Foothills of Southern Alberta, St. Mary river to Highwood river. Geology.

May 1714. The Niagara peninsula, Ontario. Geology.

May. 1715. The Ontario peninsula. Geology.

Applicants for publications not listed above should mention the precise area concerning which information is desired.

Maps published within recent years may be had, printed on linen, at the nominal cost of ten cents each.

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.

Communications should be addressed to **The Director, Geological Survey, Ottawa.**

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The John Inglis Company.

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Northern Electric Co., Ltd.,

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Hendrick Mfg. Co.
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Northern Canada Supply Co.
Fraser & Chalmers of Canada, Ltd.

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Standard Underground Cable Co. of Canada, Ltd.

Cableways:
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Drill Steel Sharpeners:
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Canadian Miners' Buying Directory.—(Continued from page 29.)

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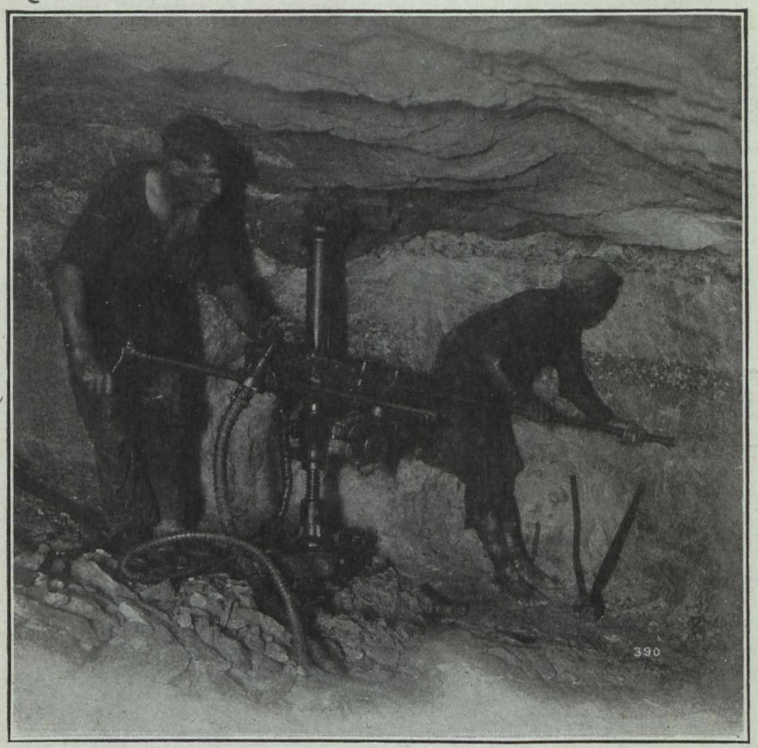
ALPHABETICAL INDEX TO ADVERTISERS



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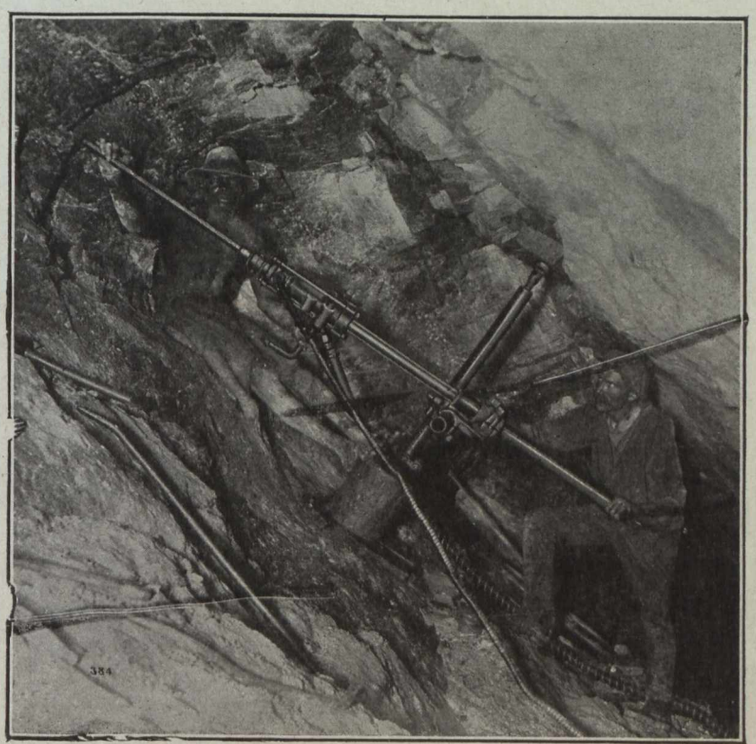

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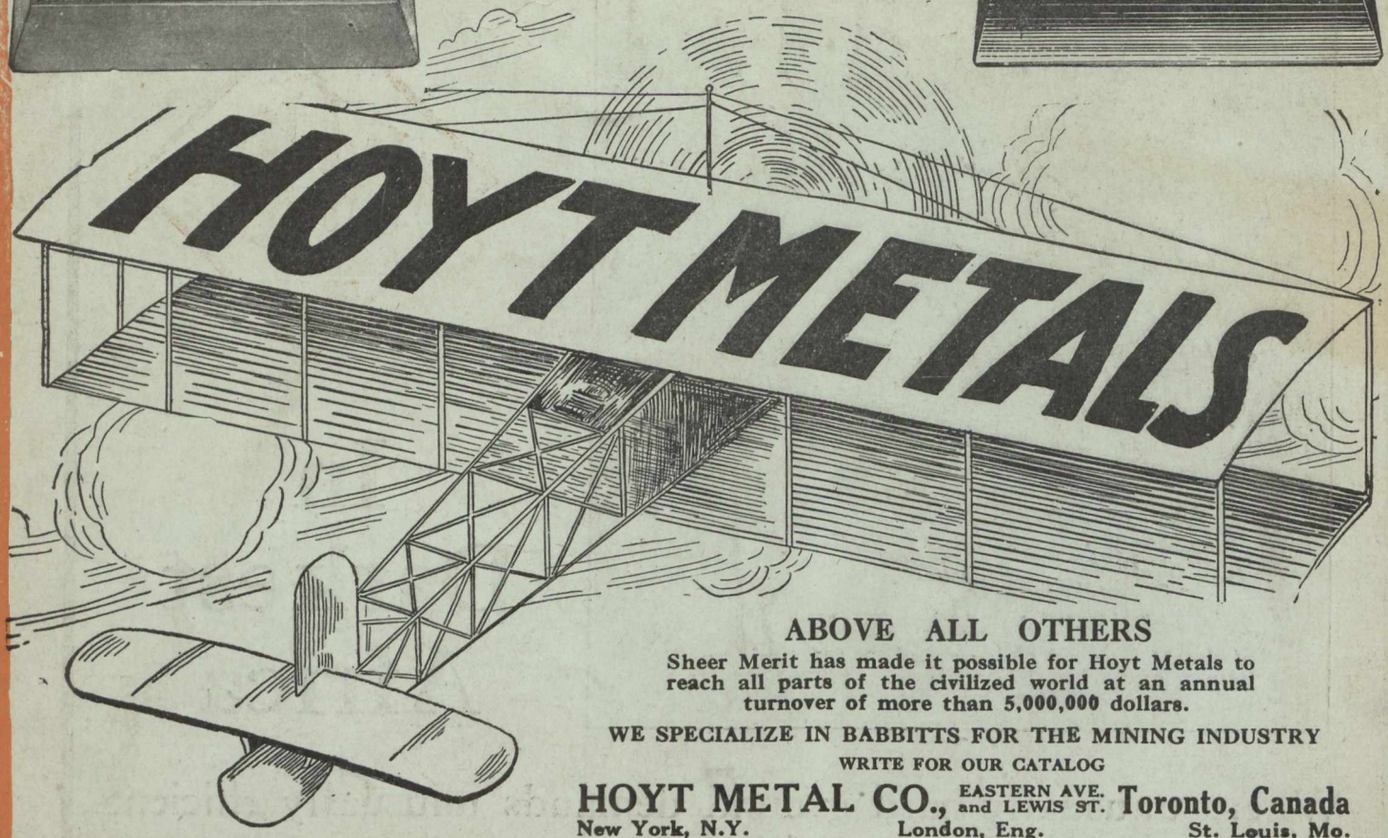

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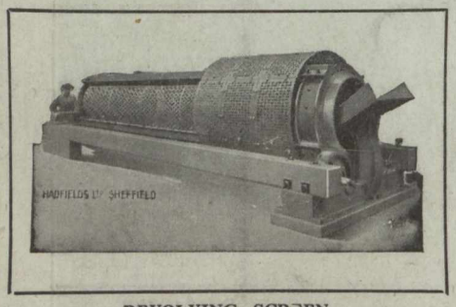

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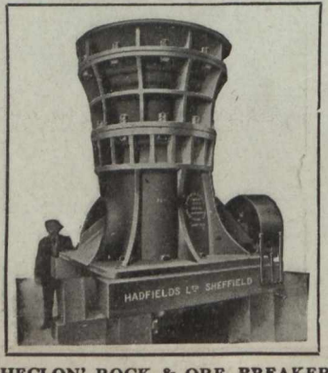

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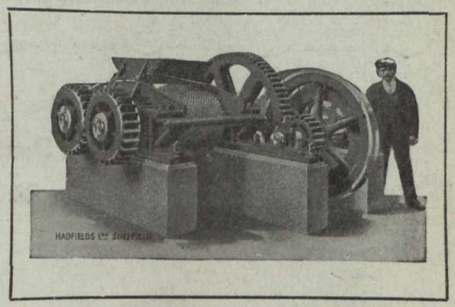

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