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CIRCULATION.

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CONTENTS.

THE ALCHEMIST.

The alchemist is not dead. He crops up ever and anon, filled with dreams of things every whit as beautiful as the elixir of life or the fountain of youth. When he butts into the domain of metallurgy his visions are weird. As they appear in the public press, touched up by the reprehensible reporter, they suggest to us the possible joint offerings of Peruna and Mrs. Eddy.

Some years ago, an enterprising Toronto dentist, yclept Dr. J. S. Island, gave up his profession and turned his resourceful mind towards metallurgical experiments. We do not know how deeply Dr. Island studied the metallurgical literature and practice of to-day. From internal evidence we are inclined to believe that he relied upon his own God-given ability, and not upon the records of work already done. He looked upon himself as truly an intellectual island, isolated, intact, unteachable.

Be this as it may, Dr. Island won ready recognition. Stirring newspaper paragraphs have appeared occasionally, until, as climax, the Canadian Courier (a National Weekly!) gave him a full page of journalese on September 9th, 1911.

Our readers are earnestly requested to consider these glittering extracts from the Courier's pages:

"For years Dr. Island has been trying to solve one "problem—the reduction of low grade ores. In Co- "balt, Porcupine, California, and Alasaka [Editor's "Note.—This applies equally well to the whole ter- "restrial sphere.] tons of mineral wealth are going to "waste. Only a fraction of the precious metals stored "there by nature has been utilized. Mining methods "to-date are inadequate. [Editor's Note.—We are "glad to learn this. It is news of the first water. We "had not suspected that our mining engineers were "not doing their duty. Shame on them!] The miner "digs out rich veins and sends these ores, containing "from 5,000 ounces of gold, silver, or copper to the "ton, to be smelted. Lower grade ores, which run "about fifteen ounces to the ton, [Editor's Note.— "Mark, pray you, the nice distinction between high "and low grade ores.] he throws on the dump, because "the cost of reduction is too great. Now Dr. Island "aims at making it worth while to salvage these low- "grade ores. Seventy per cent. of low-grade ores are "composed of insolubles. Dr. Island's method is to "make soluble salts out of them. . . . He runs them "through an ore crusher. Then he places them into "specially constructed tanks. Mixed with water they "are stirred by a propeller until a creamy lather

"arises. [Editor's Note.—The creamy lather, no doubt, " is ingeniously devised to assist in shaving profits.] "Then the mass is permeated by chlorine and sulphur "dioxide gas, prepared in generators of Dr. Island's "own design. The hard ores have now become solu- "ble salts and it is no longer a difficult job to extract "the principal metals from the baser in the salt for- "mation."

So far the technical side of things. Next the Courier touches on matters financial to this effect:—"One "day a promoter hit upon the Island building, and "saw the dentist's operations. He had insomnia for "a few days, and spent the time dogging the footsteps "of Sir Donald Mann, with whom he had a bowing "acquaintance. Sir Donald ran out to Island's place. ". . . . Now Sir Donald has formed a ten-million- "dollar company to boost Island's invention." Thus the Courier.

From all available facts it may be fairly deduced that Dr. Island is treading the road that the first-year youth travels when he is initiated into the mysteries of qualitative analysis. The "horror of odours," we quote the Courier's phrase, is one of the perquisites of the adolescent investigator.

Yet we do not wish to scoff at Dr. Island. He may be a genius, and he may be merely a misguided and mistaken inventor. The chances are largely in favour of the latter alternative. But the most serious phase of the whole business is the fact that Dr. Island permits the public press to exploit him and his process before he has given one iota of tangible proof that he can get commercial results. If Dr. Island were a professional metallurgist he would have lost caste at once. As matters stand, it is only possible to say that, whatever the improbable merits of his process, he is countenancing the worst kind of wild-catting in connection with the flotation of his company.

The Courier's statement that Sir Donald Mann "has formed a ten-million-dollar company to boost Island's invention," we disregard entirely. Sir Donald is too wise a bird to be caught with chaff. He has made a conditional offer. The condition is that Dr. Island perform up to the limit of his promises. The fulfilment of that condition would bring more than ten million dollars from any magnate.

* * * *

A commission of technical men is shortly to investigate the Island process. We do not know that the report, if unfavourable, will be made public. But, whether that report be favourable or unfavourable, the self-respect of the inventor and of those associated with him should preclude the publication of such fatuous nonsense as the Courier has spread abroad, and common honesty should prevent the promoters from selling any shares.

A COMMISSION FOR NOVA SCOTIA'S GOLD MINES.

Seven years ago the Government of Nova Scotia engaged Mr. T. A. Rickard (who as mining engineer, as editor, and as author needs no introduction to our readers) to make a cursory examination of the gold mines of the province. Mr. Rickard came and went, and no one was the wiser. His report was never published. According to the Government, the report was unpublishable. According to Mr. Rickard, the Government should have published his report. With this question, however, we have nothing to do. It is necessary only to mention that the non-publication of Mr. Rickard's report has had a most mischievous effect upon Nova Scotian gold mining. The colour of the report is not known to the public. Yet it is taken for granted that Mr. Rickard expressed a strongly adverse opinion in regard to the future of gold mining in the Province. That there is absolutely no ground for this belief, does not modify the current misconception.

As there is no probability of Mr. Rickard's pronouncement being made public, the only possible course is to disregard it altogether. It is unprofitable, at this late date, to attempt to allocate the responsibility for the fiasco. The urgent duty of the Government is to make a strong effort to appraise the present value and the future prospects of each gold producing district in the Province.

An appropriately selected commission composed of mining men whose names carry weight and whose judgment may be thoroughly relied upon. Such a commission, amply supplied with funds, and provided with every facility for examining the representative gold mines, would be in a position to learn much concerning the industry.

We believe sincerely that the report of a properly constituted commission would place Nova Scotian gold mining in a very favourable light. Of course, everything will depend upon the personnel of the commission, and upon the authority with which it is clothed.

In selecting the members of the commission it is imperative that men of world-wide experience in gold mining be selected. It is equally necessary that a Nova Scotian mining man be chosen. Everybody interested will also agree that the inclusion of Mr. Faribault, whose knowledge of the whole subject from a geological standpoint is at once complete and accurate, is necessary.

The duties of the commission should consist in making an abstract of the history of each district, in describing the present condition of every mine, in diagnosing the whole industry, and in formulating a plan whereby Government assistance can be best applied.

The open publication of the report of this commission would rouse world-wide interest. The mining fraternity is waiting for it. It is the obvious duty of the Provincial authorities to act at once. The Rickard

incident itself has committed the Government so completely that continued silence is as impossible as it is undignified.

THE EVANS-STANSFIELD DIRECT STEEL PROCESS.

At the Canadian National Exhibition, the annual function that gives fame to Toronto, there was given an unusually interesting metallurgical demonstration. On the evening of Friday, September 8th, and during the morning and afternoon of Saturday, September 9th, Mr. J. W. Evans exhibited his electric furnace in actual operation.

Under the most adverse conditions, and handicapped by an almost total absence of facilities, Mr. Evans succeeded in reducing small quantities of titaniferous iron ore to steel of the best quality. The Friday test was begun with a cold furnace and with an uncontrolled current. Nevertheless, after five hours, the small charge of ore, amounting to less than 100 pounds, was reduced and clean ingots of steel were produced. The Saturday run was much more successful.

Mr. Evans has attacked manfully the problem of making steel direct from titanium-bearing iron ores. Ever since 1904, his time and energy have been unremittingly devoted to the development of a suitable furnace. With the aid of Dr. Stansfield he has evolved a plant that is, apparently, a commercial success.

This means much for Canada. There are many known deposits of titaniferous iron ore. No serious attempt has been made to utilize these. It is known that most of these ore bodies carry a small percentage of vanadium. Sometimes, also, nickel is one of the associated elements. As the electric furnace designed by Mr. Evans is strictly controllable, the desired proportions of titanium in the alloy can always be obtained. The steel inherits nearly all the vanadium and nickel.

Physically, the steel turned out from Mr. Evans' furnace is free from defect. Occluded gases are absent. There are no flaws, neither are there signs of segregation. The product appears to be thoroughly homogeneous. In effect it is a valuable steel alloy possessing all the attributes that are required for a high-speed tool steel.

Credit is due the Canadian National Exhibition and the Ontario Bureau of Mines for assisting Mr. Evans in making his public demonstration. Credit also is due to Mr. Evans for the plucky manner in which he has stuck to the discouraging task of making people believe that there is something in his invention. For more than seven years he has been engaged in perfecting his furnace. He has reached the stage at which he is ready to submit his claims to the most rigorous examination. Unlike the average inventor, he has made no appeal to the investing public, although his process has met the approval of all who have looked into it.

That the Canadian National Exhibition should have been the first Canadian corporation to enable the inventor to exhibit his process is gratifying. It is, incidentally, a sign that the directors will succeed in their aim. Sooner or later they will make the Exhibition an international event.

The example set by Mr. Evans should be followed by others. Among the vast crowds that throng the Exhibition annually are many who are interested in mining. A "process" exhibit is always instructive. No description can carry the same meaning to the reader. The person who once sees ore being crushed and treated has always a peg upon which to hang further information. The manufacturer of machinery who does not realize this is losing a supreme opportunity.

To return to our subject, if Mr. Evans has solved the riddle of cheap direct steel, and we believe that he has, he has placed a premium upon numerous hitherto worthless ore bodies in Ontario and Quebec.

MINING IN QUEBEC DURING 1910.

A distinct improvement upon all its predecessors is the Annual Report of the Mines Branch of the Province of Quebec. Although the date of distribution has been very much delayed owing to causes beyond the control of the Department, yet it contains much material the timeliness of which is not impaired.

The total value of Quebec's mineral production during 1910 was $7,323,281, as compared with $5,552,062 during 1909 — an increase of $1,671,219. Mr. Denis attributes this increase in part to the more complete collection of data. Nevertheless, the greater part of it may be assigned to larger outputs. For instance, the value of asbestos produced during 1910 wes $2,667,829, as against $2,296,584 in the year 1909. The figure for cement was $1,954,646, as compared with $1,314,551; for brick, $906,375, as compared with $584,371; and for limestone $503,173, as compared with $457,143. Granite, marble, mica, and a few other minerals show gains. The grand total is by far the highest yet reached by the Province.

Asbestos mining was carried on very actively during the first seven months of the year. Slackening demand caused the production to fall during the remainder of the year. Mr. Denis explains that this condition is only temporary.

Titaniferous iron ore was mined for the first time since the year 1872. From the large bodies of this ore at St. Urbain, 3,596 tons were shipped. A quantity of this was used by the General Electric Company, at Lynn, Massachusetts, in connection with the manufacture of electrodes for arc lights. The titanic acid content is reported to have been from 45 per cent. to 50 per cent. The remainder of the St. Urbain shipments

were consigned to the Titanium Alloy Co., Niagara Falls, N.Y. Mr. Denis devotes considerable space to the subject of titanium-bearing ores.

The cupriferous iron pyrites deposits of the Eastern Townships are the principal sources of copper. Only 24,040 tons were mined in 1910, a fall of 10,000 tons from the output of 1909. The present year will see much larger production as the McDonald mine, near Weedon, is shipping steadily. Last year the bulk of the ore came from the Eustis mine.

Gold is being won this year from the alluvial deposits on the Rigaud-Vaudreil Seigniory, Beauce County. The operators, under the name of the Dominion Gold Fields, Limited, possess mining rights over 70,000 acres, including much rich territory from which most of the gold extracted in the sixties and seventies was obtained.

Shipments of graphite amounting to 309,400 pounds, valued at $15,896, were made from two mines in the township of Buckingham—the Buckingham Graphite Co., and the Bell Graphite Co. This is the largest yearly production on record.

Mica mining, also, became much stronger. The value of the shipments, mainly from the townships of Templeton and Portland in Ottawa county, was $58,668. This recovery is needed. In the year 1907, the value was $223,878.

The mining of chromite in the Eastern Townships was practically dead throughout the year, only 299 tons being shipped from old stock-piles.

The output of building materials and clay products was much larger than ever before. Brick increased 55 per cent. as compared with 1909; lime, more than 100 per cent.; granite, 90 per cent.; marble, 16 per cent.; limestone, 10 per cent.; and cement, 48 per cent. As mentioned above, a part of these increases must be set down to more complete collection of data.

7,923 men were employed during the year in the mines and quarries of the province. The number of fatalities was 14—a death rate of 1.76 per thousand men employed. This is a most creditable showing.

The report includes notes on the Opasatica District, a geological reconnaisance in Gaspe, and a chapter on the handling of explosives. It is well illustrated, and carefully printed. The CANADIAN MINING JOURNAL congratulates Superintendent Denis and his staff upon setting a higher standard.

THE MAGPIE MINE.

Dr. W. L. Goodwin's article in this number of the CANADIAN MINING JOURNAL should attract immediate attention. The utilization of enormous deposits of siderite, which in its natural condition carries only 40 per cent. of iron and is contaminated with nearly 4 per cent. of sulphur, is a bold stroke.

Long experimenting, conducted under the direction of Mr. R. W. Seelye, for the Lake Superior Corporation, has demonstrated that this ore can be roasted sweet. The calcined product is a strong porous lump ore, carryiing more than 50 per cent. of iron, practically free from sulphur, and of Bessemer quality.

The plant that is to be erected is fully described by Dr. Goodwin. Some millions of tons of ore have been developed by diamond drilling. The conversion of this ore into a high-grade product will be accomplished at the rate of 15 tons per hour, and at a cost not to exceed 40 cents per ton. This will be a truly notable addition to the available ore supplies of Canada.

The calcining of siderite was performed on a small scale, a considerable number of years ago, at Londonderry, Nova Scotia, near which place there are large bodies of the mixed carbonates. But the two calciners were of hardly more than experimental size, and the cost of operation was too high.

The enterprise of Mr. Seelye has made possible a revolutionary step in advance, a step that will go far towards securing the future of the Lake Superior Corporation.

KILDONAN.

One more blasted hope is on record. His Grace the Duke of Sutherland, who owns large estates in Sutherlandshire, Scotland, consented to have his Kildonan property exploited for alluvial gold. The contract was given to a man named Heath, a former Klondike prospector. Heath succeeded in stirring things up a bit. But that was the only result. No gold of any importance was found, despite the windy hopes of Heath.

The crofters and shepherds who, for the nonce, became transmogrified into miners, have now returned to their more peaceful vocations. Kildonan is no longer a name wherewith to conjure.

ONTARIO METALLIFEROUS MINES.

Returns to the Ontario Bureau of Mines for the first six months of the current year are more than usually gratifying. Whilst the production of copper and nickel has fallen off, the output of silver is greater by 2,417,142 ounces than it was during the corresponding period last year. The amount of iron ore mined is 94,803 tons, or 55,306 tons in excess of the quantity mined during the former half of 1910. Gold once more appears on the list, 2,276 ounces having been extracted up to June 30th, 1911.

EDITORIAL NOTES.

The net profits of the International Coal & Coke Company, Coleman, Alberta, for the calendar year 1910, amounted to $300,097. The company pays four quarterly dividends at the rate of 1½ per cent., or 6 per cent. per annum.

CORRESPONDENCE

A WARNING.

Toronto, September 11th, 1911.

The Editor,
CANADIAN MINING JOURNAL,
17-23 Manning Arcade Annex, Toronto.

Sir,—My attention has been called to a statement in the publicity section of the Swastika number of "The Mining Investor," refrering to me as having examined the claims of the Porcupine Swastika Mining Company, Limited, and reported favourably upon them; also referring to me as the Managing Director of that Company. I write to say that the statement that I have reported favourably upon the claims of the company is contrary to fact; and I am not, and have not, at any time, been Managing Director ,or otherwise officially associated with the company; or a shareholder therein, or otherwise interested in the stock of the company. If further reference is made to me in any of these connections, I shall be compelled to place the matter in the hands of my legal adviser, and take such proceedings against parties responsible therefor as may be necessary to protect my interest. Kindly interest. Kindly insert in your next issue, and oblige,

Yours truly,

R. B. LAMB.

Personal and General

Mr. J. W. Evans was in personal charge of the Evans-Stansfield electric smelter at the Canadian National Exhibition, and superintended the public demonstrations, of which an account will be found in another page.

Mr. Stanley N. Graham has resigned his position as superintendent of the Canada Sulphur Ore Company, Queensboro, Ont., and has accepted an appointment in connection with the Geological Survey, Ottawa.

Dr. Milton L. Hersey has been nominated as Liberal candidate to oppose Mr. H. B. Ames in St. Antoine division of Montreal.

Mr Francis H. Shepherd, of Nanaimo, B.C., has resigned the position of Chief Inspector of Mines for British Columbia to accept the nomination as Conservative candidate to oppose Mr. Ralph Smith, a supporter of the Liberal Government, in the constituency of Nanaimo, Vancouver Island.

Hon. Wm. Templeman, Dominion Minister of Mines, who at the last Federal election was defeated in Victoria by Mr. G. H. Barnard, and was afterwards elected for Comox-Atlin, also in British Columbia, is again opposing Mr. Barnard as candidate for Victoria.

Mr. A. D. Clabon, formerly of Quebec, but now of Vancouver, B.C., recently took to Princess Royal Island, B.C., a party of mining men to see a gold property he and associates are developing on that island.

Dr. R. W. Brock, of the Geological Survey of Canada, went to British Columbia about the middle of August. Late in the month he visited the Skeena district, where, in the vicinity of Hazelton, silver-lead ores have been found.

Mr. G. G. S. Lindsey went to British Columbia last month with Mr. L. Reyersbach, managing director of the Central Mining and Investment Corporation, London, England, and Mr. Hugh F. Marriott, the company's consulting engineer. Dr. R. W. Brock, Director of the Geological Survey of Canada, accompanied the party west. Messrs. Lindsey and Marriott paid a short visit to the Skeena country, and afterwards went to Sheep Creek camp, Nelson mining division.

Dr. Heinrich Ries, Professor of Economic Geology, Cornell University, Ithaca, N.Y., has been examining clay deposits in British Columbia, to obtain information for inclusion in a report on the clays of western Canada he is to make to the Canada Department of Mines. He went thence to San Francisco, on his homeward journey.

Mr. Anthony J. McMillan, liquidator of the Le Roi Mining Company, Limited, was in Chicago last month on his return trip from London to Rossland, B.C.

Mr. Byron N. White, owner of the Pueblo copper mine, near Whitehorse, southern Yukon, has returned to Spokane, Washington, from a visit to the mine, which, however, he will not again work until he shall be granted lowed freight rates on ore from mine to an outside smeltery.

Mr. J. W. Astley, mining engineer, formerly manager of several important mines in British Columbia, including Le Roi, has taken an office in one of the rooms occupied by the CANADIAN MINING JOURNAL, 17-23 Manning Arcade Annex, Toronto.

Mr. Clifford E. Smith, mining engineer, Brockville, Ont., has recovered from a severe attack of throat trouble. Mr. Smith was a patient at the Toronto General Hospital for ten days.

Mr. J. W. Rawlins, chief chemist to the Canadian Copper Company, was in Toronto on September 5.

Mr. W. J. Woolsey, consulting mining engineer, Thetford Mines, P.Q., left on August 26th for a two months' professional visit to Great Britain and Europe. His address while away will be 98 Leadenhill Street, London, E.C.

Mr. John Redington has been appointed manager of the Swastika mine in place of Mr. M. W. Summerhayes, who has resigned to take up private practice.

Mr. R. S. Lamb, mining engineer, Toronto, is making an extended series of examinations in Porcupine.

Mr. M. W. Summerhayes has resigned from the management of the Swastika mine, and will take up private practice again. Temporary address will be 76 Home Life Building, Toronto.

TOPAZ, TIN, AND GRANITES IN ONTARIO

By Willet G. Miller.*

Mr. R. W. Brock, in his interesting paper, "Tin and Topaz in New Brunswick," published in the September 1st issue of the JOURNAL, says that the recent discovery of topaz in New Brunswick is the second to be made of this mineral in Canada. It may be of interest to refer to another occurrence of this, insofar as Canada is concerned, rare mineral.

Last summer, 1910, Dr. E. S. Moore was engaged by the Ontario Bureau of Mines to make an examination of the Sturgeon Lake gold field in northwestern Ontario. In his report, now being published in the 20th annual volume of the Bureau of Mines, he has the folfowing to say concerning the occurrence of topaz in that field. Apparently Dr. Moore did not recognize the mineral in hand specimens but only on examination of a thin section under the microscope. If topaz does occur in a form in which it can be recognized in hand specimens at Sturgeon Lake or elsewhere, it may easily be passed over. Unless it occurs in distinct crystals it is apt to be mistaken for quartz or other light-coloured mineral.

Topaz and Other Minerals in Hornblende Syenite.

"Lying along the eastern shore of the upper portion of the narows on the lake, there is a large mass of rock which in appearance much resembles a light coloured gabbro and has been mapped as gabbro on the Canadian Geological Survey's map. It appears much darker in some parts than in others, but in all the specimens examined the feldspars appear to be of the potash species, and one section showed a very little quartz, so that the rock is a syenite. It has much the appearance of some nephelite syenites, though microscopic observations failed to show the presence of any nephelite.

"The megascopic characters of the rock are a grey colour, phanerocrystalline texture, crystals of pyrite, hornblende and good cleavage faces of feldspar resembling plagioclase but lacking any sign of striations due to twinning.

"Under the microscope one section is composed of the following minerals: orthoclase, microcline, green hornblende, a little biotite, and a small quantity of mica the pleochroism of which would identify it as zinnwaldite. The relation of this mica to the other minerals suggests that it has been introduced into the rock from an external source. Titanite in prismatic form and in acute rhombie sections in fairly common, and small crystals of it are frequently enclosed in the crystals of hornblende. A considerable amount of topaz is present and it shows as a colourless, slightly higher bi-refringent mineral than quartz, filling spaces between the feldspars and in places it appears to have replaced portions of these minerals. Fluorite varying in colour from blue, violet, to colourless is quite common. It is found in some cases as irregular streaks, but also as little cubes. It occurs as small crystals in orthoclase, fills holes in topaz, and occupies cracks in the other minerals or the interstices between various crystals. Apatite is found in small crystals and pyrite and magnetite in small quantity. Other thin sections show orthoclase, microcline, green hornblende, a little albite, small crystals of augite, apatite, a little tourmaline, considerable titanite, calcite, fluorite, topaz, and a small proportion of quartz.

"As mentioned in a previous section a pit in the syenite reveals a calcite vein with which are associated apatite, tourmaline, hornblende, zircon, pyrite, and chalcopyrite.

"In the presence of so many fluorine, boron, and titanium minerals we have good evidence of rather extensive fumarole action. On the cooling of the magma, fracturing on a small scale must have occurred and permitted the boron and fluorine gases to rise through the rock and replace some of the other minerals by new minerals. The quartz and calcite veins would be due to solutions filling some of these cracks.

"On account of certain petrographic similarities between them it seems probable that these syenites belong to the same petrographic province as the granites a little farther north, but represent a basic phase of the parent magma."

The New Brunswick topaz described by Mr. Brock is found in association with granite dikes (greisen) near the border of a granite intrusive mass. The British Columbia occurrence referred to by him exhibits topaz in a rock which he calls granodiorite; while, as has just been said, the Sturgeon Lake topaz occurs in syenite. The prospector, however, need not bother with fine distinctions as regards the names of rocks. Granite, granodiorite and syenite are closely related.

In so far as the writer knows, tin has been found only in two localities in Ontario, viz.: Sudbury and the township of Lyndoch in Renfrew County. At Sudbury about four per cent. of oxide of tin has been found in the rare mineral sperrylite. Fourteen years ago, in Lyndoch, the writer discovered a mineral of the rare columbite group associated with beryl, amazonite or green feldspar, tourmaline, garnets and other minerals. The columbite and associated minerals occur in a coarse-grained granite, or pegmatite, dike. The percentage of oxide of tin in the mineral, found in one analysis, was 0.92, or nearly one per cent.*

Varieties and Ages of Ontario Granites.

Since tin occurs in association with granites or related rocks, it would be of economic importance to have a more complete knowledge of the character and age relations of the granites of the province. Such knowledge would also be useful in connection with other ore deposits. For instance, in the reports and annotated maps which the Bureau has published of the Porcupine area, Mr. A. G. Burrows and the writer have expressed the view that the gold-bearing quartz veins are in all likelihood genetically associated with granite intrusions. It is not necessary to recite the various reasons which led to this theory of origin. But it may be said that as field work in that area progresses, confirmatory data as to the theory of the origin of the ores are being obtained. During the present summer Mr. Burrows, who is in charge of the field work for the Bureau, has found that there are two series of conglomerates, one of which is older than the surrounding intrusive granites and the other younger.

*Provincial Geologist, Bureau of Mines, Ontario.

*7th Report Ont. Bureau of Mines, p. 236.

In Mr. Burrows' first year's work he observed that the conglomerate, in the belt extending from near the Dome mine northeastward to the vicinity of Three Nations Lake and beyond, was much more disturbed, dipping at high angles, and more highly metamorphosed than the conglomerate in which the rich silver veins at Cobalt occur. Moreover, gold-bearing veins are found in this series of conglomerate and associated sedimentary rocks not only at the Dome mine but also near Three Nations Lake. The problem then was—if the quartz veins are genetically connected with a granite intrusive, of what age is the intrusive? Mr. Burrows has, however, found conglomerate in the southern part of the township of Langmuir which is derived by erosion from the granite in that vicinity. This conglomerate has been little disturbed, lying almost horizontally, and is much less highly metamorphosed than that in the Dome mine — Three Nations Lake belt. He therefore concludes that the granite which gave rise to the gold-quartz veins is younger than the latter conglomerate and that it is older than the Langmuir conglomerate. There may, however, be granites of two or three ages in the area.

On the shores of Lake Temiskaming and to the southward there are conglomerates which have the appearance of those at Porcupine. One series dips at high angles and shows other evidence of much greater disturbance than does a second series such as that in which the productive veins occur at Cobalt.

In the region surrounding Lake Superior, where the pre-Cambrian rocks have been closely studied in numerous localities, granites of various ages are known which intrude even the youngest of the pre-Cambrian sedimentary rocks.

At Cobalt, Elk Lake, and Gowganda there are certain types of granites, which occur as dikes and are commonly known as aplites or granophyres, which are genetically related to the quartz diabase that is associated with the cobalt-silver deposits. These rocks of the granite family are believed to represent the end product of the diabase eruption. Similarly at Sudbury granites or granophyres are closely associated in origin with the norite of the nickel-copper deposits. Those who have closely studied the Sudbury area believe that these granite-like rocks are simply a differentiation from the magma or molten mass which gave rise to the norite and the nickel-copper ores. From what has been said it will be seen that the character and age relations of our granites have an economic bearing.

Knowing that topaz and other minerals had been found at the New Brunswick locality and that these minerals are characteristic of deposits in which tinstone occurs, Mr. Brock made a search for this ore and found it. A similar search should be made in the Sturgeon Lake area. Since there are granites and related rocks of so many characters and ages in Ontario the prospector for tin may some day be rewarded.

Sizing for Plate Amalgamation.

By P. N. Nissen.

While sizing for concentration is a recognized necessity, have not possibilities in amalgamation been overlooked? There is one difficulty in saving the coarser gold or minerals, but efforts to recover the finer particles of gold are attended with but indifferent results. In many cases these finer particles are not liberated from the gangue, while in other cases, though liberated, they are of such microscopic fineness that the utmost delicacy is required in the manipulation of the process used. Over-refinement of the plant, however, can easily be the outcome of an honest desire to accomplish the best economic results; but it must always be borne in mind that enterprise in this direction should be limited by commercial considerations.

In many cases a large percentage of the gold occurs in a finely divided state, so that the losses are extreme by the methods of amalgamation now most commonly practised. But, on the other hand, the tendency to get away from amalgamation entirely is to be regretted. Should we not rather try to improve our methods by working along logical lines than entirely disregard the affinity of quicksilver for gold and the simple and easy means for their subsequent separation? While the expansion of the cyanide process has been extremely rapid it has been changed and improved only in physical details, the basic principle being unchanged in its simplicity. Similar development is possible in amalgamation; for, while the development of the cyanide process has been the most important phase of metallurgy in our generation, it has its manifest limitations.

Gold amalgamation is closely associated with stamp milling because this method of crushing is the almost universal means of reducing gold bearing ores. The tendency, however, has been to increase the duty of the stamps without providing larger plate area for the pulp. When we were crushing smaller tonnages per stamp our recoveries by amalgamation were higher. A smaller volume of pulp was run over the plates, necessitating the use of less water. Thus, the liberated gold was given more opportunity to settle to the surface of the plate and become amalgamated. With the increased volume of pulp, due to the increased duty of the stamps, the finer particles of liberated gold pass more rapidly over the plate, the larger percentage of coarser particles of sand being underneath and next to the surface. The finer sand and gold, being carried along on the surface of the stream, do not come in contact with the quicksilver. Scouring of plates, loss of amalgam, and loss of fine float gold are thus brought about.

The placer miner has long recognized that he can make no satisfactory recovery of finely divided gold without first getting rid of the larger boulders and gravel, then treating the finer sands separately. If this principle applies to the operation of the sluice-box and dredge, the same principle must necessarily be followed in the treatment of all sizes of sand and gold particles down to the most minute atoms.

Of late years the erroneous practice of merely lengthening battery plates has obtained. It is evident that no improvement in amalgamation can arise from this expedient, since, if the pulp still travels at the same speed, the conditions remain the same; or, if the

velocity be lessened, a blanket of coarse sand will form on the plate. On the other hand, the evident need is for a reduction of velocity by means of wider plates.

In some of the gold mills in the western United States it is the practice to divert all the pulp from a five-stamp battery to one side of the already insufficient apron plate, while the other portion is being dressed. This is done to avoid hanging up the stamps. A high amalgamation recovery is expected, and the management prides itself on avoiding loss. But, as a matter of fact, loss is inevitable. It is much saner to hang up all the stamps for a sufficient length of time to permit of dressing the plates properly, rather than crowd a small section of plate with more than it can handle. Indeed, this is merely equivalent to sluicing so much gold and amalgam onto the dump.

To retard the flow of the pulp in some way is necessary. The management of the great Homestake mine has attempted this by adding plates of greater width, so that they now have forty feet of plates before each five-stamp battery; but each succeeding ten feet from the battery downwards is about a foot wider than the preceding one. Thus the pulp is thinned out to a great extent, and the results have more than justified their installation and the necessary labour to care for them.

It seems reasonable, therefore, that we separate or size our pulp into several ranges of sizes, then flow each size over plates arranged with regard to area, slope, and proper amount of water to the amount of pulp of that size being made by the stamp. The accompanying table will give a fair average of the pulp from a stamp battery crushing through a 0.024 or 30-mesh screen.

Percentage of battery pulp remaining on given screens

Screen	On 50,	80, 100,	150, 200	pass 200.
Per cent. of pulp	8.5,	10.5, 7.0,	8.0, 3.0,	63.0.

It will be observed that only 8.5 per cent. of this pulp is coarser than 50 mesh. The movement of 91.5 per cent. over the ordinary plate as used is dependent entirely on the few coarser particles 8.5.

Our coarser pulp will contain our coarser gold, and will, therefore, be more easily caught on a plate having a fair grade, while each succeeding smaller size can be put over plates of greater width and less grade, thus giving the finer gold particles a better opportunity to come in contact with the mercury and be amalgamated. It is important that the grade of plates should be as slight as possible, especially for the finer sands, to allow sufficient contact with the plate to insure amalgamation. Moreover, plates set at a low angle hold the mercury much better than those set at a higher angle. It must also be borne in mind that the constant flow of sand and water downwards causes the mercury to be forced along and finally over the bottom of the plate. The numerous varieties of amalgam traps in use is justification for this statement. The steeper the plate and the larger the volume of pulp of mixed sizes flowing over it, the greater will be this tendency. Where we have loss of mercury we must have loss of gold.

While the number of amalgamating machines of all sorts is legion, and the efficiency of most of them nil, it will be observed that in a large number of these appliances any amalgamating plates used are arranged vertically. The inventors have overlooked the fact that mercury is liquid and requires a more or less horizontal plate to rest upon. The result is that most of the mercury intended to adhere to these plates will be found in the bottom of the apparatus in a foul condition.

One of the most essential features in amalgamation is clean mercury, therefore it is necessary to have the surface over which the gold is run clean and bright at all times. Copper amalgamating plates are simple and accessible for dressing and they are always under direct observation. No mechanical motion need be given them. They can be situated in a separate room or building, accessible only to the direct attendants. This fact is a consideration of no small importance. It is upon the returns from these plates that the revenue of the mine is dependent, so that the fewer individuals on which the responsibility is placed of securing all the gold that is recovered, the less liability there will be for losses. Any investment made in sufficient plates for the proper equipment is in no way extravagant, for they are always worth as much or more than they originally cost. Every ounce of gold run over them leaves a certain small portion in the plate. They do not wear out nor have to be "scrapped" as would occur with mechanical appliances.

Few small mines can afford cyanide plants which depend upon skilful, therefore high priced chemists for satisfactory extraction. The returns from these small plants in most cases represent less than the operating cost, owing to the small tonnage handled. A cyanide plant to be operated must be complete. The same number of tanks, fittings, etc., being greatly out of proportion in a small installation than in a large one. It, therefore, seems apparent that improvement in simple amalgamation is most urgently needed, and the possibilities will well warrant our most careful consideration and efforts. Since sizing has done so much for concentration the possibilities offered in its application to amalgamation seem many and most inviting.

The plates should be arranged in pairs to allow one being dressed or cleaned while the pulp is being run over the other, and thus not interfere with the proper flow of pulp. By this arrangement the plates can be kept in perfect condition by constant dressing, there being ample time for this work to be thoroughly done instead of the usual rush common in present practices where it is seldom properly performed.

On the Slate Industry in Southern Quebec.*

By John A. Dresser, Ottawa.
(Annual Meeting, Quebec, 1911.)

The slate deposits of commercial importance in southern Quebec as far as known are all of sedimentary origin. The black slate are of Ordovician, and the coloured of Cambrian age. In a number of places quarries were opened between thirty and fifty years ago; but most of them were soon closed from one cause or another, principally, it would appear, from an insufficient market at the time they were worked. At present the market conditions have apparently

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changed greatly for the better and the slate deposits might properly receive renewed attention.

General Geology.

Three anticlinal ridges of crystalline rocks, probably of Pre-Cambrian age and mainly of volcanic origin, extend in a north-easterly direction through southern Quebec, and form the Sutton Mountain, Stoke Mountain, and Lake Megantic hills. The basins between these ranges of hills, are each about 25 miles in width and are in general underlain by rocks of Cambrian age around their borders, while Ordovician strata occupy the central and greater part of the bearings. On the east side of the Sutton range a belt of serpentine and related intrusive rocks occur along or near the contact of the Cambrian and Ordovician sediments. In the Ordovician, near the contact with the serpentine, several of the most important slate deposits of the district are found. There are other deposits in the Ordovician and in the Cambrian that are not situated near intrusive rocks; but hitherto all the production of commercial importance has been from those deposits near the serpentine.

Fig. 1.—New Rockland Slate Quarry, Looking Northeast. This quarry is some 799 feet in length, 75 feet wide, and nearly 200 feet deep. The cleavage the of slate dips at a high angle to the Southeast.

Black Slates — Ordovician.—The "black" slates are all of Ordovician age, being the argillaceous part of the lower Trenton (Farnham) formation. They are of dark or bluish grey colour and generally have an excellent cleavage which dips nearly vertically and may be at any angle to the bedding planes. In general character and geological position they correspond to the slates of Montpelier and Northfield in Vermont. They have hitherto been the principal source of production in Canada, and are the only slates quarried in Quebec for several years past.

Details of Some Deposits — Four of the best known deposits of slates of this type occur near the contact with serpentine in the County of Richmond. These are the New Rockland quarry in Melbourne, range IV., lot 23; the Melbourne or Walton quarry, Melbourne, range VI., lot 22; the Steele or Bedard quarry in Cleveland, range XV., lot 6, and the Danville quarry in Shipton, range IV., lot 7. The distance between New Rockland and Danville (the extreme points) is about fifteen miles, but the slate-bearing formation continues for a much greater distance.

These quarries were most actively operated in 1889, in which year they were described by Dr. R. W. Ells,† as follows: "The largest slate quarry at present in operation in Quebec is that of the New Rockland company. This was first opened in 1868 and has been worked almost continuously ever since. It is situated on a rise with an elevation of about 500 feet above the St. Francis River, which is four miles distant to the north, and has at present a working bench 200 feet deep. The slate cleaves readily, is very free from pyrites, impervious to water and equal in every respect to the celebrated Welsh slates. . . . To the northeast of this is situated the old Melbourne or Walton quarry, on lot 22, range VI., Melbourne, about two miles distant from the St. Francis River. This quarry was opened by the late Mr. Walton in 1860 and was worked for about eighteen years, when it was closed. A very large quantity of slate was extracted of a quality similar to that of the New Rockland quarry, and the workings were of very considerable size, being stated, in the catalogue of the Paris Exhibition to be 150 feet deep, 300 feet long and 100 feet broad.

"The failure of the industry at this place was to a large extent due to the depression of the market at that time and a lack of capital necessary to carry out the work with modern equipment. Both these quar-

†An. Rept. Geol. Survey of Canada, 1889. Part K, pp. 128, et seq.

ries are in contact on the west side with large masses of serpentine. The slates here found are continuous across the River St. Francis into Cleveland and Shipton. The oldest quarry in this belt is that on lot 6, range XV. (Cleveland) formerly known as the Steele quarry, which was opened in 1854. No returns are to hand from this quarry under its new management, but the quality of the slate extracted is excellent in so far as yet tested. The output of the Danville quarry is as yet almost entirely confined to school slates, for which a ready market is obtained.

"Of all these slates it may be generally said that their quality is unsurpassed. Their chemical composition is very similar to that of the slates from Angers in France which have been in use in buildings in Montreal for considerably more than one hundred years."

The New Rockland, Melbourne, and Steele quarries are so close to the contact of the serpentine intrusion that the slate is probably altered in some measure thereby. (Fig. 2). The Danville quarry, which appears to be in slate of the same original composition, is sufficiently distant from the contact to be probably unaffected by it.

The slate of Danville, judging from evidences now available, is softer and not so strong as that from the other quarries. The original bedding planes may be detected (Fig. 3) in places and in trimming the slate often "scallops" along them. On the other hand it seems to be an excellent material for school slates and other manufactures on account of its greater softness. Also the quarry itself is freer from quartz veins, which latter in the other quarries are more numerous near the contact with the serpentine than at a short distance from it.

Nearness to the contact is thus both a favourable and an unfavourable feature. Dykes and quartz veins are more numerous near it and where the alteration has been too great, the slate becomes "sharp" or is nearly a hornstone. On the other hand, slates beyond the effects of the contact have less hardness and strength. The most favourable location for slate seems to be in the outer part of the contact zone, near enough the intrusion to secure strong slate and far enough away from it that the spaces between the "flints" are sufficiently large to be advantageously worked.

The Melbourne, New Rockland, and Danville quarries have been importantly productive; but the New Rockland only has been in operation for the past fifteen years. The major part of the production quoted on a subsequent page is to be credited to this quarry, which has been in operation since 1868.

The production at present is wholly confined to thin roofing slate. The quality is well proven by its satisfactory use for the past forty years.

The following chemical analyses give a comparative view of the composition of several roofing slates of this series and one from Germany. The analyses are quoted from various reports of the Geological Survey:

	New Rockland.	Melbourne	Danville	Westbury	Lehesten, Germany.
SiO	65.39	64.20	61.80	65.85	67.57
Al_2O_3	15.97	16.80	13.48	16.65	17.30
FeO	4.66	4.23	10.10	5.31	7.46
MnO	.39	.....	.74	.....	.....
CaO	.67	.73	1.06	.59	1.16
MgO	2.99	3.94	4.52	2.95	2.60
K_2O	3.60	3.26	1.71	3.74	1.99
Na_2O	3.33	3.07	1.46	1.31	.....
H_2O	3.26	3.40	4.86	3.10	4.62
	100.26	99.63		99.50	99.70

Slate has been worked unsuccessfully in Orford, range V., lot 2, in the County of Sherbrooke, where the slate appears to be very similar to that at Danville. The cause of the closing of the quarry some forty years ago has not been learned; but at that time the market demand was doubtless insufficient. As has been pointed out by Sir W. E. Logan, in a report of the Geological Survey on this district, published in 1863, a similar slate is well exposed in Brompton, range V., lot 29, near the village of Bromptonville. Both of these properties, though containing a soft slate, probably warrant investigation at the present time.

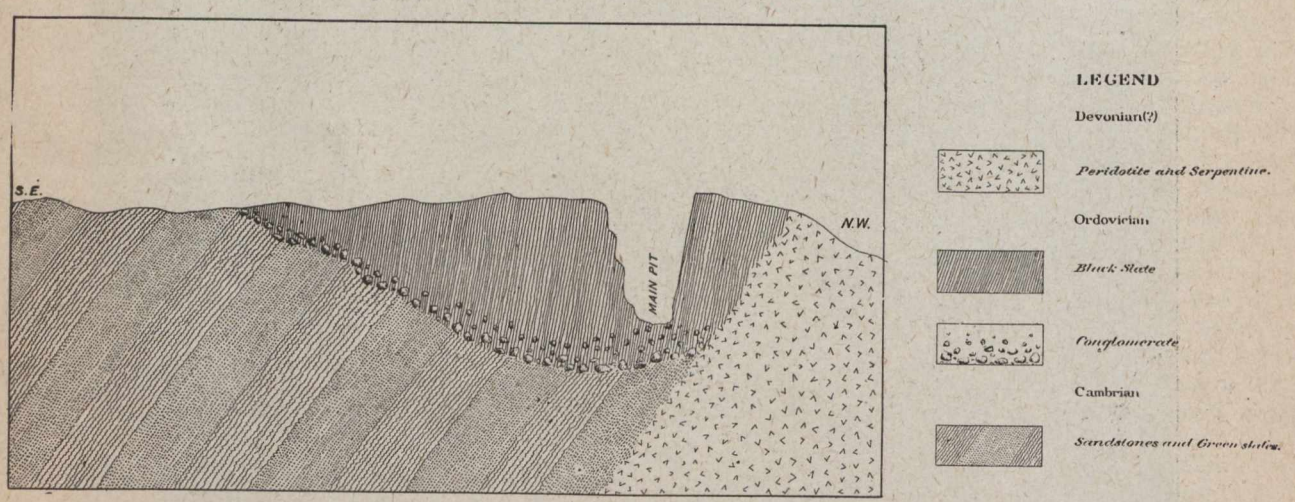


Fig. 2—Diagrammatic section across the New Rockland slate quarry. The pit is about 200 feet deep.

Other localities in which slates of this character occur are reported in range I., lot 14, the Township of Halifax, County of Megantic, in Westbury, near the St. Francis River, and near St. Victor de Tring, in the County of Beauce.

On the south side of Lang Lake, in the County of Temiscouata,* slate was exposed by a cutting on the

*Summary Report of the Geological Survey, 1908, p.

National Transcontinental Railway which promises to be of excellent quality and in ample quantity. Holdings have been purchased in the locality by Messrs. Frazer and Davies, the operators of the New Rockland slate quarry, and development operations, it is expected, will be inaugurated early during the present year. This locality is about 200 miles east northeast of the Danville slate quarry. It is not certainly known whether this slate is of Ordovician or of Silurian age.

Coloured Slates — Cambrian. — The slates usually referred to as "coloured" are red, green, mottled, or purple, and are prevailingly coarser in texture and do not split as finely as the black slates. Coloured slates have never been extensively quarried in Canada; but in the United States a considerable production is maintained. Almost the entire production of the State of Vermont at the present time is obtained from the coloured slates of Cambrian age.

Details of Some Deposits.

Coloured slates are known to occur in several localities in the Province of Quebec and between 25 and 50 years ago, some of these quarries were productive to a small extent.

	Kingsey	Peach Bottom, Penn.
SiO_2	54.80	55.88
Al_2O_3	23.15	21.85
FeO	9.58	9.03
CaO	1.06	.16
MgO	2.16	1.49
K_2O	3.37	3.64
Na_2O	2.22	.46
H_2O	3.90	3.39
	100.24	

On lot 26, range V., in the Township of Acton, County of Bagot, the Rankin quarry was operated in 1875-6, and produced some quantity of red and green slate.

Coloured slates have also been opened on lot 18, range X., of Brompton and on the IVth range of Melbourne about half a mile, southeast of the New Rockland quarry in the County of Richmond, on the 2nd lot of the Xth range of Brampton in the County of Dorchester, on the XVth range of Garthby, lots 8 and 9, County of Wolfe, at Mawcook, near Granby, in Shefford County, and at other places in the Cambrian rocks.

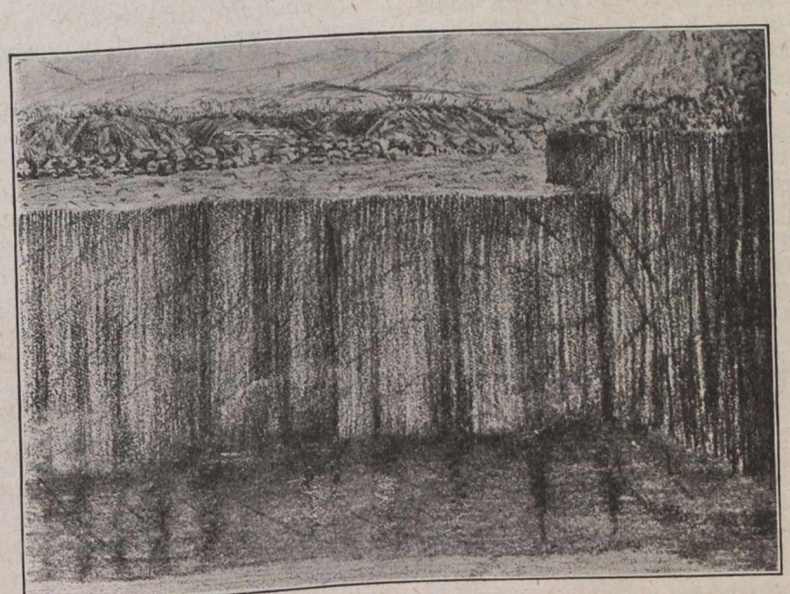


Fig. 3—Sketch of the Southwest Wall of the Danville Slate Quarry. The cleavage is nearly vertical; while the original bedding planes can be seen dipping in folds towards the Southeast.

In Kingsey, range I., lot 4, County of Drummond, a quarry was opened in 1857 and closed two years later. The slate is principally purple, although some green and mottled varieties appear. The colour is well preserved on slates split at about that time showing that they belong to the "unfading" class. The deposit is large and apparently the working conditions are favourable. A railway has been graded to the Grand Trunk Railway at a point two miles from Richmond station, and four miles from the quarry.

The following analysis of slate from this locality was made by T. Sterry Hunt in 1852 and the accompanying analysis of the Peach Bottom roofing slate of Pennsylvania, is added for comparison. These analyses are quoted from Kemp's "Handbook of Rocks."

Quarrying and Dressing.

The rock is quarried and cut down in benches in open pits, and after being assorted in the pit, material suitable for splitting is hoisted and sent to the splitting sheds. Here it is cut, split, and trimmed to the sizes required or to which it is best adapted. Slate is bought and sold by the "square," that is in quantity sufficient to cover 100 square feet after allowance has been made for all overlapping. The usual thickness in Quebec is 3-16 inch. The sizes vary from 12 inches x 24 inches to 6 inches x 12 inches.

In the coloured slate quarries of Vermont much of the roofing slate is split to a greater thickness—from

¼ inch to 1¼ inches. The price varies with the thickness, an increase of about $2 per square being allowed for each additional ¼ inch. Thus slates ¼ inch thick might be sold for $6 per square, whereas one inch slate would be worth as much as $12 per square. These thicker slates must be bored and countersunk to carry nails or bolts, while thin slates merely require to be punched.

Quarrying and dressing of slate involve handling a large percentage of rock waste. Even in the best deposits only slate that will split in a definite direction and may be cut to definite sizes can be utilized. In addition to the loss in trimming and splitting, breakage from the blasting of rock, which falls from the high benches to lower levels, must also be considered.

Again, slate once frozen, if not split while frozen, is valueless and necessitates the removal of a covering of sap rock every spring. The waste from these sources added to the large quantity of defective rock remaining to be removed reduces the percentage of slate recovered of the total rock handled to a very small proportion — probably between 5 per cent. and 10 per cent.

Review of the Industry.

Canada. — The only slate produced in Canada for some years has been obtained from the Eastern Townships of Quebec, where it has been continuously quarried since 1860. Nova Scotia, New Brunswick, and Ontario have yielded slate at different times and promising developments are reported from British Columbia; but as far as can be learned there is no production from these provinces at the present time.

The following statements of the values of the production and imports of slate into Canada during the past twenty-one years are obtained from the annual reports on the Mineral Production of Canada by Mr. John McLeish, Chief of the Division of Mineral Resources and Statistics, Department of Mines, Ottawa.

Slate Industry in Southern Quebec—Dresser.

Year	Production.	Imports.
1889	$119,161	$ 41,370
1890	100,250	22,871
1891	65,000	46,104
1892	69,070	50,441
1893	90,825	51,179
1894	75,550	29,267
1895	58,900	19,471
1896	53,370	24,176
1897	42,800	21,615
1898	40,791	24,907
1899	33,406	33,101
1900	12,100	53,707
1901	9,980	72,187
1902	19,200	72,601
1903	22,040	84,437
1904	23,247	86,057
1905	21,568	93,228
1906	24,446	112,941
1907	20,056 –9 mths	95,520
1908	13,496	131,069
1909	19,000	135,221

Some slate has been exported during the above period; but the amounts have been comparatively small and so irregular that they may be neglected in considering the industry as a whole.

The year 1889 shows the greatest production and also the largest consumption in the history of the slate industry in Canada. The exports of that year amounted to $3,303 in value. In 1909, a year of small production the imports reached the highest, and the consumption the second highest place. The value of exports in that year was $612.

Broadly speaking, production declined from 1889 to 1901, followed by a small and somewhat irregular advance. The imports decreased somewhat irregularly from 1889 to 1895, and since that date have steadily increased to the highest figures yet reached. At present, therefore, the production is scarcely more than 14 per cent. of the consumption.

Concerning the supply and demand Mr. McLeish remarks* "That there is a more extensive market in Canada than is supplied by slate from Canadian sources is shown by the following statistics of imports. The total value of the imports of slate in 1909 was $135,221, of which $71,914 was roofing slate and $34,085 school writing slate. The imports of roofing slate, school writing slates, and manufactures of slate are chiefly from the United States. Some roofing slate is also imported from Great Britain, while slate pencils come principally from Germany and the United States."

During the past twenty years the prices of slate have advanced about in proportion to the increased cost of labour.

The duty on slate entering Canada is: 25 per cent. on roofing slate—not to exceed 75 cents per square; and 30 per cent. on manufactured slate.

In the schedule of the proposed Reciprocity Agreement, the duty on roofing slate is 55 cents per square.

All the Canadian output at present is used for roofing purposes.

The United States. — In the United States official returns for the year 1908 show a production valued at $6,316,817. Of this value, $5,186,167 is in roofing slate and $1,130,650 in mill stock for various manufactures. Of this amount Pennsylvania produced nearly 62 per cent., or a value of $3,902,958; Vermont, 27 per cent., or $1,710,491; Maines, 3⅓ per cent., or $213,707. Almost the entire production comes from the eastern or Atlantic States. Vermont and Maine are the States most suitably comparable to Quebec in their geological conditions; and slate producing formations of both extend into Canada.

Uses of Slate.

The principal uses of slate are for roof covering, writing slates, floors, electric switchboards, billiard tables, blackboards, mantels, wainscotting, laboratory tables, lavatories, sinks, and similar purposes. All the Canadian output and about 80 per cent. of the production of the United States are used for roofing. Slate was formerly manufactured for other purposes than roofing in Canada at the quarries of New Rockland and Danville; but this was discontinued some fifteen years ago. The consumption in Canada for 1909 was approximately as follows:

Roofing slate	$90,914
School slate	34,085
Slate pencils	6,154
Manufactures	23,068
	$154,221

*Op. cit.

Qualities of Slate.

In a recent and exhaustive report on the slate deposits and industry of the United States, T. Nelson Dale* gives the following classification of slates:

CLASSIFICATION OF SLATE.

1. Aqueous sedimentary.
   (a) Clay slates; matrix without any or with but faint aggregate polarization.
   (b) Mica slates; matrix with marked aggregate polarization.
   (1) Fading: with sufficient Fe CO_3 to discolour.
      (a) Carbonaceous or graphitic.
      (b) Chloritic (greenish).
      (c) Hematitic and chloritic (purplish).
   (2) Unffading: without sufficient Fe Co_3 to produce any but very slight discolouration on prolonged exposure.
      (a) Graphitic.
      (b) Hematite (reddish).
      (c) Chloritic (greenish).
      (d) Hematitic and chloritic (purplish).

II. Igneous.
   (a) Ash slates.
   (b) Dyke slates.

The slates of southern Quebec as far as known belong to the following divisions of the classification given above:

I. Aqueous sedimentary.
   (b) Mica slates.
   (2) Unfading (a) Graphitic — black — Ordovician.
      (b) Hematitic—red—Cambrian.
      (c) Chloritic—green—Cambrian.
      (d) Hematitic and Chloritic—purple—Cambrian.

The black slates are strictly speaking phyllites, that is clay slates with a small percentage of mica. But as the strength of the slate depends largely on the amount present, those slates which are strong enough to be useful are conveniently classed as mica slates, to distinguish them commercially from those so poor in mica as to be of little or no value.

The mica in these slates is not an original mineral but is developed chiefly from feldspar by alteration due to pressure perhaps accompanied by heat. It is in very minute scales, only a few thousandths of an inch in thickness; but the overlapping of these scales of mica is supposed to give to slates the elasticity that enable them to be split.

The above classification is based on certain general properties that effect the commercial value of slate; but it does not take into account all the features that determine its value. A degree of cleavage such that slate may be easily split to the required thinness, strength, freedom from injurious constituents, and from excessive jointing are also important features.

Good cleavage is the first essential. Not only must there be a cleavage that will enable the slate to be readily split, but there must be an absence of cross or oblique cleavage generally called "slant" by the quarrymen, which not only interferes with the splitting, but still more lessens the strength of the slate.

Strength depends primarily on the degree of compression in a single direction with uniformity of composition and texture and in some cases on metamorphism by igneous contact. Recrystallization, especially the development of secondary mica, induced by pressure and heat, characterizes the strongest slates. Where the alteration has been insufficient, the slate trims unevenely or "scallops" often by breaking along original bedding planes.

Amongst injurious constituents carbonate of iron, or carbonate of iron, magnesium, and lime, cause discolouration when slates are exposed to the weather and so produce the "fading" slates. Iron pyrites rusts, causing spots and holes in slate. Magnetite makes slate less useful or even unsuitable for electric switchboards. Quartz veins have a similar effect even when small enough not to lessen the strength of the slate. Quartz veins, "flints" are a very common cause of poor quality in slate, and in any considerable quantity render it useless. Slates that are too siliceous (as from extreme metamorphism) even where no quartz veins are formed, become brittle and impossible to use. They are then known as "sharp" slates.

Porous slates of open texture, are unsuitable for uses that expose them to moisture, such as in making lavatories. They also shatter more readily if exposed to frost.

General Considerations and Conclusions.

Deposits of slate that may be profitably worked are comparatively few and small. The overburden of "sap" rock which must be removed before uncovering slate of real splitting qualities and strength is generally deep — fifteen to twenty feet, at least, and in places much more. Great care must, therefore, be taken in selecting a location for a quarry and a considerable outlay of capital is necessary to develop such a property. Transportation is also a very important factor to be considered in the establishment and operation of a slate quarry.

Nevertheless the extension of roads and railways, the increasing cost of lumber, the introduction of the modern class of large steel-frame fireproof buildings in cities and the consequent use of thick slates — conditions that even twenty years ago were not obtaining —afford commercial advantages to the slate industry to-day that it did not previously enjoy.

Hence, speaking generally, the steadily growing market and the successful development of a large industry in similar geological formations in the neighbouring States of Vermont and Maine, seem to warrant investigation by investors of the slate deposits of eastern Canada and especially those of southern Quebec.

Discussion.

Mr. Ferrier:—I have listened with peculiar interest to Mr. Dresser's interesting paper, and it has recalled many things I had almost forgotten since I was sent to make an examination of the New Rockland slate quarry in 1886. I notice that Mr. Dresser was exceedingly careful in his description of the peculiar terms employed by the quarrymen. I found that some of the terms used by the Welsh quarrymen were much more shocking.

I recognized after I had made my examination that much of the trouble in connection with the marketing of slate was due to a disregard to proper sorting, in consequence of which the material shipped was not always of an uniform and high grade character. I thoroughly agree that the zone from which the first-class material can be produced is a comparatively narrow one.

There is another feature to which Mr. Dresser did not especially direct attention, and a matter responsible for much trouble in the employment of slate for

*Dale, T. Nelson, and others.—"Slate deposits and slate industry of the United States;" Bull. U. S. Geological Survey, No. 275, 1906, pp. 5-6; also Annual Report U. S. G. S., Vol. XIX., 1897-8.

roofing. After purchasing slate for roofing purposes, one is at the mercy of the roofer. A careless workman may be the means of causing even the finest slate to show a bad record. With a shingle roof a defect is easily remedied; but this is not the case with slate.

I fully agree with Mr. Dresser's view that a great deal can and will be done to develop the slate industry in Canada, and bring about the more general utilization of slate as a roofing material.

Dr. Porter: There was one point in Mr. Dresser's paper which seemed to be rather significant and that was the comparatively smalfl size of the quarry which he described and apparently of the other quarries. Anyone who has visited the quarries in Wales or France, and some in Pennsylvania, will have noticed the enormous size of the workable areas, which eventually permit of installation and operation of large works. It would be interesting if Mr. Dresser could indicate whether in any parts of the Eastern Township there have been discovered slates of presumably good quality in such large masses to warant the establishment of big enterprises.

Mr. Dresser: The coloured slates occur in bodies great enough for large scale operations. The black slates of the best quality, however, are not as yet known in larger masses than those already worked.

Mr. Ferrier: As Mr. Dresser is much more conversant than myself with recent developments, I would ask him if he could bring out the point which I know was a serious one when I was connected with that investigation, namely, the difficulty experienced by local enterprises of competing with the cheaper grades of slate from some of the larger quarries abroad?

Mr. Dresser: I could not say what grades of slate are being imported in competition. They seem to find, however, a ready market and the work here is carried on at present in a rather small way. Meanwhile, the present duty on slate is 25 per cent., but not to exceed 75 cents per square. In the proposed Reciprocity agreement, this is amended to a flat rate of 55 cents per square. The importation comes largely from the United States, with the exception of a comparatively small quantity, valued at about $6,000, of slate for pencils, imported, I understand, from Germany. Our people, I believe, at present are unable to meet our own market requirements.

An Appeal to the People of Ontario and all Interested in the Gowganda District.

[Editor's Note.—The following petition, a copy of which was forwarded to the JOURNAL by Mr. G. M. Colvocoresses, manager of the Millerett Silver Mining Company, Limited, sets forth what is considered to be a genuine grievance. We may say that we feel convinced that substantial justice has not been done to the Gowganda region. The region has a well-defined claim upon the people and the Government of Ontario, a claim that cannot reasonably be ignored.]

After repeated requests by the mine owners and residents of Gowganda the Minister of Public Works has finally written that the Ontario Government positively refuse to expend any money whatever on the Elk Lake-Gowganda wagon road which at the present time is in a deporable and practically impassable condition.

The Ontario Road Inspector in a report to the Minister stated that the road was in a wretched shape and that approximately $6,000 should be expended to complete it and make it reasonably passable.

Mr. A. A. Cole, mining engineer for the T. & N. O. Railroad, who has made a thorough study of the Gowganda district since the early days of the camp, recently made a report to the Minister of Lands, Forests and Mines, in which he showed by figures that Gowganda had been and continued to be one of the most valuable feeders for the T. & N. O. Railroad and in order to assist its development he recommended that a good road should be completed and kept in condition by the Provincial Government. It is believed that every person who has visited and inspected this camp is firmly convinced that in the interest of the whole province Gowganda should be assisted to the extent of providing it with proper transportation facilities usable alike during the winter and summer months.

We believe that the people of Ontario are not aware of the existing conditions at Gowganda and do not appreciate that all the activities of this district are being handicapped most severely by the lack of proper transportation. It might be of interest to call their attention to the fact that there is at present more silver ore being mined in the camp than at any time during its history and that at the present time it is not possible to ship a good part of this production out to the railroad. The mines of the camp are now turning out 50 tons per month of high grade ore and concentrates valued in the neighbourhood of $25,000, and during the past three months the shipments have been held down to approximately half of this quantity. A heavy team of draught horses now require four days to haul 1,500 pounds of ore to the railroad, while over a fairly good road the same team would easily draw out 3,000 pounds in two days.

It might also be well to state that owing to the fact that we are in the Forest Reserve and in an unorganized territory, it is impossible to legally levy a tax for the improvement of the road, therefore in order that we should not be absolutely isolated it has become necessary for a few of the mines and citizens of the camp to voluntarily contribute funds which are being carefully expended in keeping the road in a barely passable condition. We feel that there are a great many people who would like to help in this work and we therefore make an appeal to all those interested in Gowganda and the neighbouring districts and to those who believe that these camps should be given a fair chance to develop and add their production to the mineral wealth of Canada. We ask you to give us what assistance you can by bringing this matter to the attention of your local members and requesting that they should use their influence to secure a grant from the Ontario Parliament for the completion of the government road, and in the meantime if you should feel like giving us financial help all subscriptions will be gratefully received by the Secretary of the "Gowganda Road Committee," care of Canadian Bank of Commerce, Gowganda, Ont.

Dated this 24th day of August, 1911.

Signed—The operating mines, merchants, prospectors, property holders, and citizens of Gowganda and surrounding districts.

Committee:—

Millerett Silver Mining Company, Ltd., G. M. Colvocoresses, Supt.

The Northern Mining Co., Ltd., Arm. De Buryne, Mgr.
Canadian Gowganda M. C. P. Gavan, Mgr.
Miller Lake-O'Brien Mine, W. A. Bonyun.
Henessy and Co., per W. W. Thomson, Mgr.
G. R. Crann, M.B.
The Hudson Bay Mines, Ltd., H. G. Young.

Titanium-Vanadium Tool Steel Direct from Titaniferous Iron Ore.

Written for the CANADIAN MINING JOURNAL.

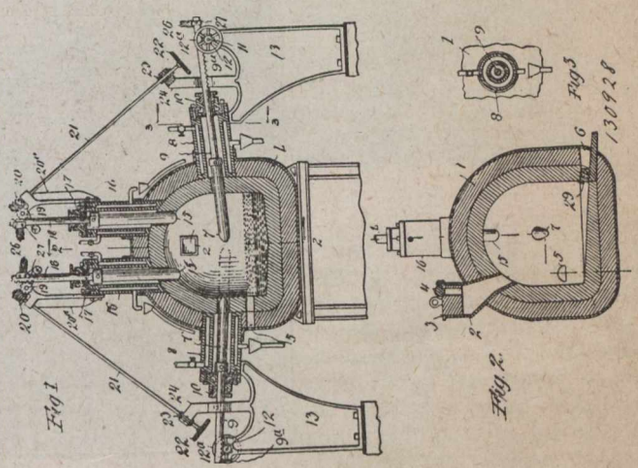
In the year 1904, Mr. J. W. Evans, of Belleville, Ont., began a series of experiments with a view to finding a use for the titaniferous iron ores of Canada. Recognizing the impracticability of smelting these ores in the blast furnace, Mr. Evans devoted his efforts altogether to devising an electric furnace that would meet the rathe runusual requirements of the case. In less than a year, he succeeded in obtaining directly from these ores a high carbon, titanium tool steel, a steel markedly superior to ordinary tool steel.

J. W. Evans

At the 1906 annual meeting of the Canadian Mining Institute, in the city of Quebec, Mr. Evans read a paper on the subject of making steel direct from iron ores. Here, also, he exhibited a few small tools made from steel of his own manufacture. At this time he was working with a small experimental electric furnace in his laboratory at Belleville The next step was to construct a larger furnace. This one proved so successful that it was found that molten steel could now be poured into moulds the size for lathe tools, and that the steel was easily superior to ordinary tool steel and approached the quality of high speed steel.

In 1909, Dr. Stansfield, professor of metallurgy, McGill University, visited Mr. Evans' plant in Belleville, and spent some time in looking into the process. During this visit several successful heats were run. The outcome was that Dr. Stansfield entered into a technical partnership with Mr. Evans, and added to the plant design a pre-heater of his own devising whereby the waste gases from the electric furnace are utilized to pre-heat and partly reduce the ores. The whole process was then re-christened the Evans-Stansfield Direct Electric Smelting Process.

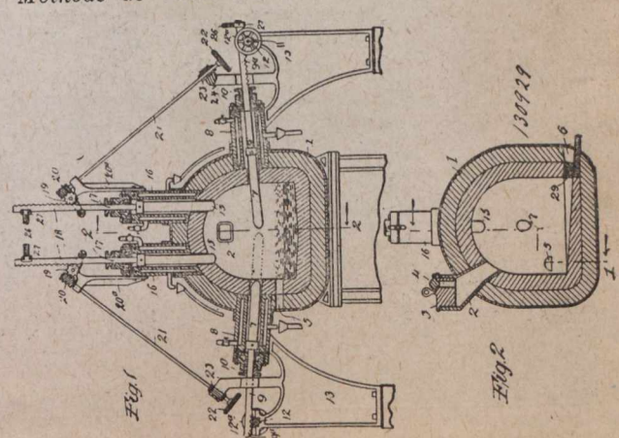
No. 130,928. Electric Furnace. *Four électrique.*

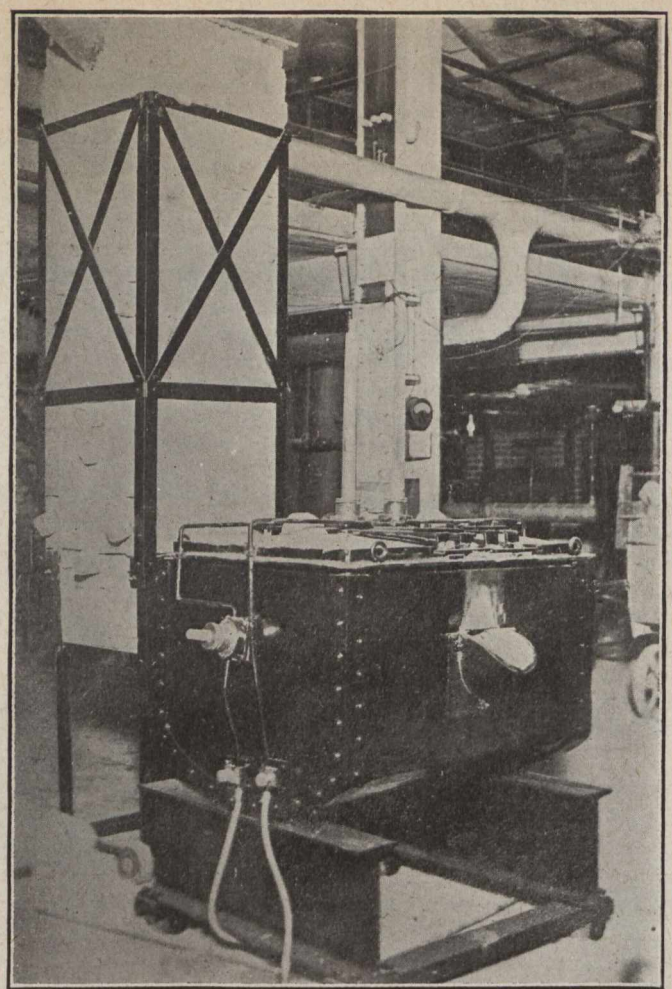


A furnace, with capacity of about one-half a ton of steel in 24 hours, was then built at McGill Univer-

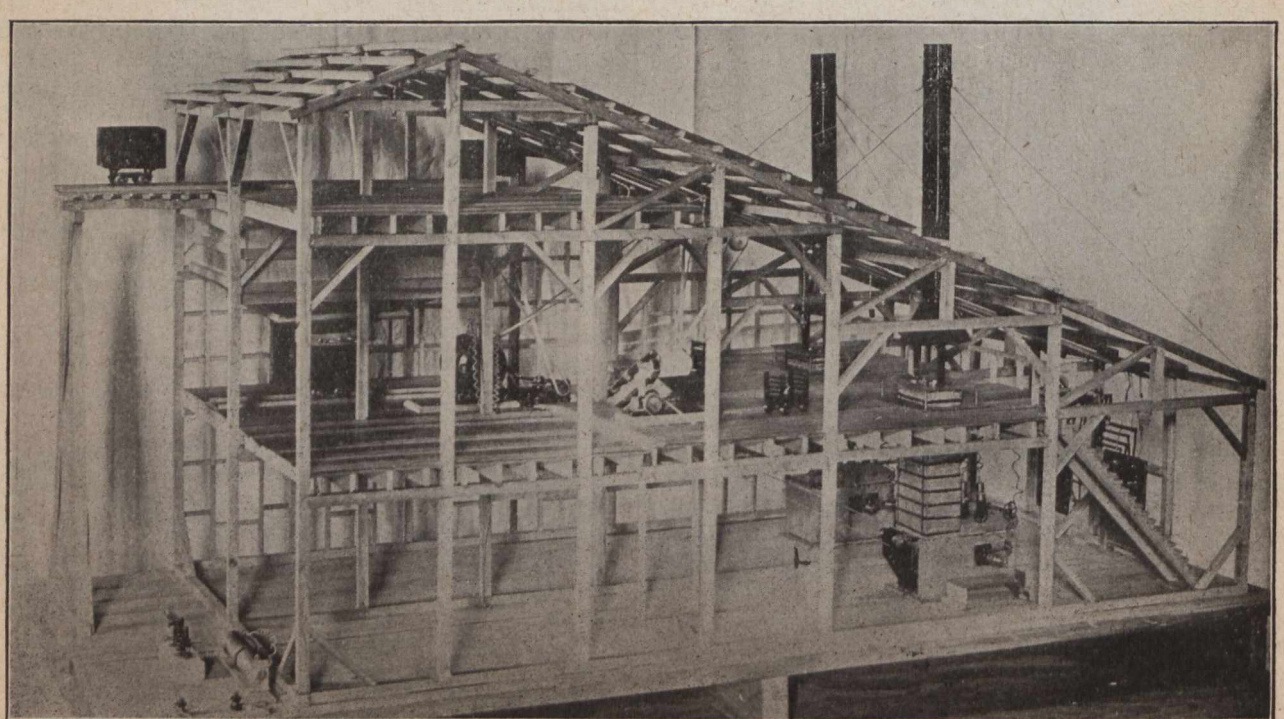
No. 130,929. Method of Reducing Refractory Materials.

Méthode de réduction de matériaux refractaires.

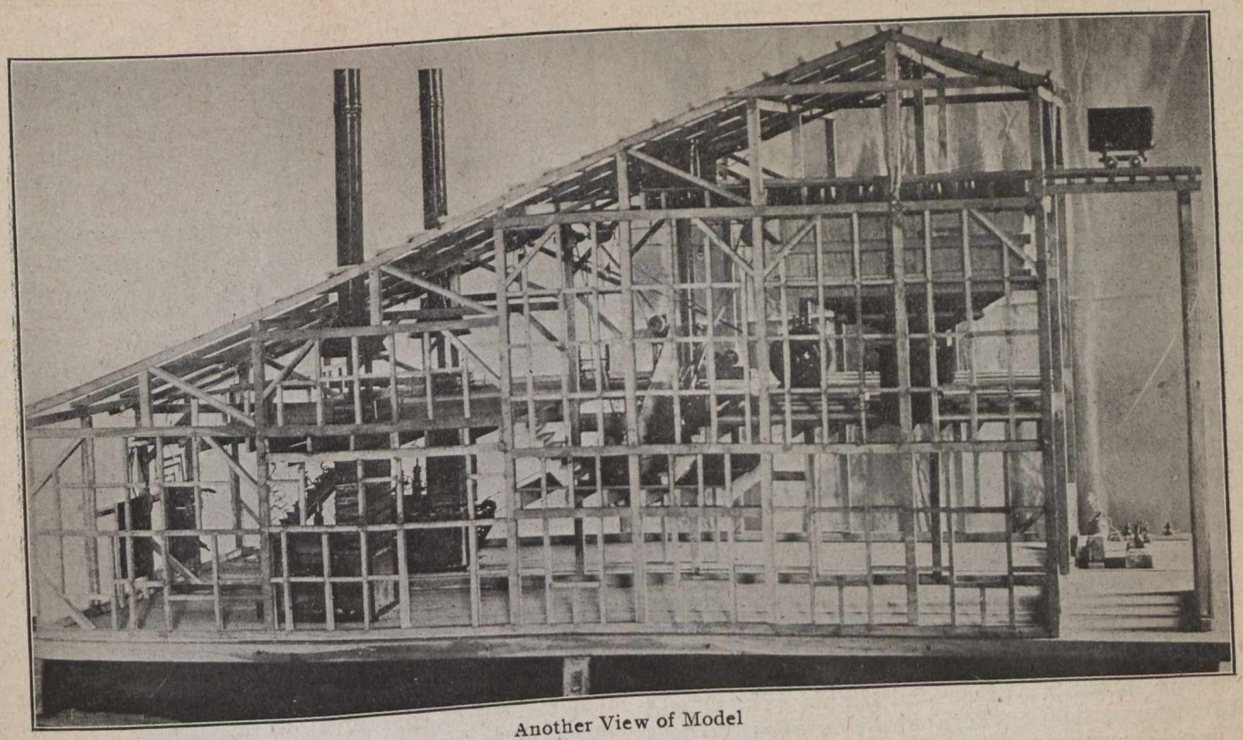




Evans-Stansfield furnace and pre-heater.



Model of Mill



Another View of Model

sity. It is this furnace that was used in the public demonstration at the Toronto Canadian National Exhibition.

The accompanying cuts show the patent sketches (for patent specifications see CANADIAN MINING JOURNAL, August 1, 1911)), and the model of a mill designed by Mr. Evans.

In actual work, the titaniferous iron ore is ground, mixed with suitable proportions of lime and charcoal, briquetted, and fed into the pre-heater. From the pre-heater it goes into the hearth of the furnace. Here reduction is completed in a few hours. The furnace is continuous in operation. Almost the theoretical quantity of metal in the ore is obtained in the form of steel, the last drop of which can be poured from the furnace into the ladle and from the ladle into the moulds.

There is reason to believe that this process will revolutionize the art of steel making. It renders feasible the manufacture of titanium-steel rails and structural steel direct from hitherto useless tianiferous iron ores. The items of cost are the strongest point. It is claimed, and apparently there is little room for doubt as to the accuracy of this claim, that the total cost per pound of steel, when the furnace is in continuous operation, will fall considerably under the present figure in existing large plants.

It is estimated that more than half the iron ores in Ontario and Quebec are titaniferous, and it has been proved that they make a better class of steel than the non-titaniferous ores. They cannot be used in the blast furnace. But they are wonderfully adapted to the electric furnace.

The Distribution and Uses of Titanium Ores.

(From the Bulletin of the Imperial Institute.)

Titanium has come into prominence largely owing to its application in the manufacture of steel, and since ores of this metal occur in many of the British colonies a resume of the information available regarding the distribution of its ores and methods for their utilization is now given.

Titanium in the metallic form does not occur in nature, but in the form of titanic oxide (TiO_2) it is one of the most widely distributed elements of the earth's crust. Rutile, the commonest natural form of titanic oxide, is rarely found in large deposits, but enormous quantities of ilmenite or titaniferous iron ore carrying varying amounts of titanic oxide are known to occur in many localities, and these two minerals are those which have been utilized as sources of titanium.

Rutile is known to occur compact or massive in igneous, sedimentary, and metamorphic rocks: it varies in colour from yellow to reddish-brown and black, and gives a pale brown streak. The hardness is about 6.5 and specific gravity 4.2 to 4.3. The mineral usually contains 98 to 99 per cent. of titanic oxide and from 1 to 2 per cent. of ferric oxide.

Ilmenite or titaniferous iron ore is an iron-black mineral occurring massive or in the form of thin plates or grains. Its hardness is 5 to 6, specific gravity 4.5 to 5.0, and lustre submetallic. The fracture is conchoidal, and streag brownish-red to black. Its composition is represented by the formula FeO, TiO_2 which corresponds to 47.3 per cent. of ferrous oxide and 52.7 per cent. of titanic oxide.

Other minerals containing a large percentage of titanium are titanite or sphene, which is calcium titanium silicate, and brookite and octahedrite, crystalline forms of titanic oxide.

Distribution of Titanium Ores.

In view of the present very limited utilization of these ores only those deposits which are or have been worked to any extent will be described in this article.

Europe—The principal rutile-producing deposits in Europe are those of Kragero, to the northeast of Kristiansund in Norway. The annual production averages about 50 tons of nearly pure rutile besides a certain amount of lower grade material (Min. Industry, 1908, 17, 823).

America.—Rutile is obtained at Roseland, near Arrington, Nelson Co., Va., U.S.A., from pegmatite dykes, of which it constitutes about 4 per cent. The dykes consist chiefly of orthoclase and albite feldspars together with blue quartz. The soil covering the deposits also contains some rutile and is utilized as a source of the mineral. The plant in operation includes a 10-stamp mill, engines, pumps, concentrating tables, and a Wetherill magnetic separator. The final concentrate contains on the average about 98.4 per cent. of titanic oxide (Min. Res., U.S.A., 1908, Part I., p. 744). Several dykes yielding ilmeno-rutile (a mineral containing varying amounts of iron and titanic oxides) and apatite occur in this locality, one being about 30 feet thick and half a mile in length. These deposits may become of value as a source of titanium for purposes where the presence of small quantities of phosphorus is not objectionable.

Well-crystallized rutile is also obtained in Chester Co., Pa., but the amount is small and is usually sold to collectors.

Other important occurrences of rutile in the United States are situated in Lincoln and Habersham Counties (Georgia), Warwick County, New York), and Warren County (Maine).

Australia.—Rutile occurs, and has been worked in a desultory fashion for many years, in the hundred of Talunga, about 6 miles north of Blumberg, A. Australia (Rec. Mines, S. Australia, 1908, 4th edition, p. 356). The workings, which are about 150 yards in length, consist of small shafts and trenches in a kaolinized dyke formation from 10 to 12 feet wide, striking slightly east of south. Rutile crystals of varying size occur distributed throughout this matrix, and can be extracted by panning. On the surface for some distance on either side of this formation fine rutile can be obtained. The mineral also occurs in a small seam of gravel about 12 inches below the surface. The average yield from these workings amounts to about 1¼ per cent. of the material treated. The deposits appear to have been prospected only to a very limited extent. Nearly 2,000 pounds of rutile were produced at Para Wira in 1907 from 2,000 tons of gravel. Rutile occurs at a number of other localities in this State, but has not been worked.

Small quantities of rutile, which is stated to be almost entirely free from iron, are also produced from time to time in Queensland.

The Utilization of Titanium Ores.

At the present time the chief use of titanium ore is probably as a source of titanium-iron alloy to be used for the purification of steel and iron. The method employed for obtaining the alloy consists in the use of molten aluminium as a reducing agent (Rossi, Electrochem. Industry, 1903, 1, 523). The titaniferous iron ore is charged into a bath of molten aluminium kept fused in an electric furnace. The iron is reduced first and in this the titanium, as it is reduced by the aluminium, dissolves, yielding ferro-titanium. If rutile is used, scrap iron is charged into the bath before the mineral.

By this means alloys containing from 10 to 75 per cent. of titanium and only 0.12 to 0.75 per cent. of carbon can be produced in quantity. Where the presence of carbon in the alloy is not objectionable, the ore can be mixed with carbon and reduced in the electric furnace. This process gives an alloy containing from 6 to 8 per cent. of carbon and suitable for treating cast iron.

Analyses of various samples of ferro-titanium are given in the following table (Mineral Industry, 1900, 9, 720):

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
	p.c.	p.c.	p.c.	p.c.	p.c.
Titanium	10.28	25.11	35.64	53.92	75.84
Carbon	0.284	0.59	0.75	0.291	0.311
Phosphorus ..	0.09	0.06	0.06	0.059	0.042
Sulphur	0.01	0.011	—	—	—

A method of concentration to produce an alloy rich in titanium from low percentage titaniferous iron ore has been tried (Electrochem. Industry, 1903, 1, 526). The ore, consisting of 15 per cent. titanic oxide, 80 per cent. iron oxide and 5 per cent. gangue, was smelted in an electric furnace with just sufficient carbon to reduce the iron and leave all the titanic oxide unreduced in the slag. By this means a good quality pig iron was produced and a slag in which all the titanic acid was concentrated. This slag was utilized as a source of titanium for the production of ferro-titanium. Analyses Nos. 4 and 5, given in the above table, refer to alloys produced in this way.

Ferro-titanium alloys of German origin are usually produced by the Goldschmidt process, which consists in mixing the oxide to be reduced with finely powdered metallic aluminium and starting interaction by means of a fuse. A rapid reaction occurs, and the titanic oxide is reduced to the metallic state, the aluminium combining with the liberated oxygen to form alumina.

The most important use of ferro-titanium is in the purification of steel, particularly for rails. The presence of certain elements in minute quantities in steel has a far-reaching effect on its quality; and of these elements nitrogen is one of the most important. According to Braune (Stahl und Eisen, 1906, 26, 1357, 1431, 1496), the effect of nitrogen is at first slightly to increase the toughness and reduce the ductility. Hard steel containing from 0.030 to 0.035 per cent. of nitrogen becomes quite brittle, whilst soft steel loses its ductility when the amount of nitrogen reaches 0.05 to 0.06 per cent. The presence of nitrogen also favours segregation of the phosphorus and sulphur, causing "cold shortness." Dr. Thorlander (Stahl und Eisen, 1909, 29, 1594) found that a steel which normally contained 0.012 to 0.022 per cent. of nitrogen, on being "overblown" in a converter, for three minutes, contained 0.032 per cent. of nitrogen.

The removal of the greater proportion of the nitrogen normally found in steel is a matter of much importance; and it is stated that this can be attained by the use of titanium, which combines with nitrogen at

a temperature of 800 deg. C. to form titanium nitrides. Titanium has a melting-point of 1,850 deg. C. and a specific gravity much less than that of iron; and these physical properties preclude the use of titanium itself, and lead to the use of an alloy of titanium and iron instead of the pure metal, which would float on the fused steel and be difficult to dissolve. Exhaustive experiments with titanium alloys have shown that the best results are obtained with an alloy containing from 10 to 15 per cent. of titanium. The numerous steel works in the United States which employ ferro-titanium specify an alloy of this composition.

The alloy is added just as the steel runs into the ladle, i.e., after recarburization and the addition of the necessary ferro-manganese and ferro-silicon. An instantaneous reaction occurs, and after a short time the slag formed by the reaction (chiefly titanic oxide) rises to the surface. According to the experience of E. von Maltitz, the addition of one-half per cent. of ferro-titanium, containing 10 to 15 per cent. of titanium, i.e., a maximum consumption of 1.7 pound of titanium per ton of steel produced, is sufficient in most cases to purify steel for rails to the desired extent. The beneficial effect of titanium alloy in preventing segregation of the sulphur, phosphorus, and carbon, and in concentrating the blowholes in the pipe cavity, has been demonstrated by the experiments of many well known metallurgists in America. Improvement was also noticed in the working of the steel in the rolling-mill. The rails produced were found to give much better service than ordinary Bessemer steel rails (American Soc. for Testing Materials, 1910, 10, 201). Tests on steel rails laid at a crossing at a New York railway station showed that in six months the steel treated with ferro-titanium had lost by flange wear less than one-third of the amount lost by the Bessemer rails which preceded them. Interesting comparative tests have been carried out by the Baltimore and Ohio Railway. The plain Bessemer rails contained 0.55 and the titanium-treated rails 0.48 per cent. of carbon; each rail weighed 90 pounds to the yard. After five months' wear on a heavy curve, the plain Bessemer rails had lost 4.18 pounds per yard, while the titanium-treated rails had only lost 1.45 pound per yard. The Bessemer rails showed excessive wear and the usual indications of segregation, whilst the treated rails were solid and homogeneous (Times, Eng., Suppl., 1909, May 26).

The following table, showing the quantities of "special" steel rails produced in the United States, indicates the growing preference for the titanium-treated steel rail (Met. and Chem. Eng., 1911, 9, 121):

	1909	1910
	Gro. tons	Gro. tons.
Titanium steel	35,945	195,940
Nichel-chrome steel	12,207	81
Nickel and electric steel	1,464	4,210
Manganese steel	1,028	390
	50,724	200,621

Of the above quantities, 70 per cent. in 1909 and 87 per cent. in 1910 were made from Bessemer steel.

Recent information states that an order for 41,500 tons of titanium-treated steel rails has been given by the New York Central lines, where rails of this type have been under trial for several years past. On these lines the rails are subject to great variations in temperature, which often falls in winter to 30 degrees below zero. The results of tests on rails employed on various sections of this line are given in the Journal of Industrial and Engineering Chemistry (1910, 2, 299).

The beneficial effects of using titanium allow for purifying basic open-hearth steel were demonstrated by experiments carried out in the Osnabruck Steel Works (Stahl und Eisen, 1910, 30, 651). In every case the bars treated with alloy showed increased strength, the fracture showing a fibrous structure similar to that of forged iron. In bending tests the titanium-treated steel also gave results superior to those obtained with untreated steel. Improvement was even seen with the addition of such a small quantity of titanium as 0.04 per cent.

In addition to the above-mentioned uses for ferro-titanium as a purifier for steel, it is stated that certain manufacturers of crucible steel in the United States are adding the alloy in sufficient quantity to retain 0.05 to 0.20 per cent. of titanium in the finished steel. This addition is said to increase the toughness and durability of the tool steel produced.

Titanium-iron alloy, containing 5.8 per cent. of carbon, is also used to some extent for improving the quality of iron by removing occluded gases and preventing segregation of subsidiary constituents. The quantity added varies from 1 to 3 pounds of 10 per cent. ferro-titanium to each 1,000 pounds of metal. It has been demonstrated by the experiments of Dr. Moldenke that the improvement is most noticeable in machinery pig (grey) iron (Trans. Amer. Mounds. Ass., 1908, 17, 57). These experiments showed that the average crushing strength of machinery pig iron was increased 52 per cent. by the use of 0.5 per cent. of the ferro-titanium alloy.

Results indicating similar improvements have been recorded when the alloy is added to metal for chilled car wheels, rolls, and to malleable iron. In the case of chilled car-wheel iron, the titanium treatment increases the crushing strength considerably.

The present price of ferro-titanium alloy containing from 10 to 14 per cent. of titanium is about £75 per ton, 150 marks per 100 kilograms (Stahl und Eisen, 1911, 31, 619).

An alloy of copper and titanium, containing from 5 to 12 per cent. of the latter element, is stated to be valuable for addition to copper castings (Min and Sci. Press, 1909, 99, 355). A. J. Rossi recommends the addition of 1 to 2 per cent. of this alloy to the molten copper, as it enables the copper to be cast in sand without difficulty, eliminates oxide and absorbed gases, and gives the metal a close-grained dense structure free from blowholes.

Another form in which titanium is used for purifying metals is that known as "titanium thermit." This consists of a finely powdered mixture of metallic aluminium, oxides of titanium and iron, enclosed in a tin, which is attached to an iron rod and introduced into the ladle immediately after the metal is run from the furnace. Its function is similar to that previously described for ferro-titanium, the oxides of titanium and iron being reduced to the metallic state by interaction with the metallic aluminium.

Alloys of titanium and silicon are also produced for use in the steel industry where it may be desirable to add both these elements. These alloys can be produced containing 5 to 70 per cent. of titanium and 20 to 75 per cent. of silicon by reduction in the electric furnace of suitable quantities of silver sand and pure titanic oxide (Journ. Soc. Chem. Ind., 1910, 29, 636).

Pure titanium, which has a melting point of about

1,850 deg. C. and a specific gravity of 5.17, does not appear to have been put to any industrial use as such.

Smelting of Titaniferous Iron Ores.

Closely connected with the general questions of the utilization of titanium ores is that of the use of iron ores containing small quantities of titanium. The objections made by iron smelters to the use of such material are not that it produces an inferior quality of iron, but that it gives pasty slag, and that the aggregations of titanium nitride and nitrocyanide in the furnaces render working difficult. It is also stated that more fuel is necessary than in the case of non-titaniferous iron ore. At the present time it is difficult to negotiate a sale in the United Kingdom of ore for iron smelting which contains even 2 per cent. of titanic oxide. In the past, highly titaniferous iron ores have been successfully smelted in various localities. An iron company which had works at Norton, near Stockton-on-Tees, many years ago smelted successfully an ore containing 39.2 per cent. of titanic oxide to yield forge iron (Trans. Amer. Inst. Min., Eng., 1882, 11, 159). The fuel and fluxes employed were about 17 cwt. of coke, 12 cwt. of limestone, and 3 to 4 cwt. of basalt, or similarly fusible silicate, per ton of ore. Owing to the uncertainty of the supplies and the small quantity of iron in the ore the work was abandoned.

The question of the smelting of titaniferous iron ore is thoroughly discussed, and the results of many important blast-furnace experiments quoted in an article by A. J. Rossi (Trans. Amer. Inst. Min., Eng., 1892, 21, 832), where he shows that it is possible to obtain a good pig iron and a fluid slag from ores containing 20 per cent. of titanic oxide. Iron ore fairly high in titanic oxide was formerly mined and smelted in Sweden, but the production is stated to have ceased in 1904. In the larger of the Swedish furnaces which smelted this ore, the consumption of fuel is stated to have averaged 275 bushels of charcoal to the ton of ore, a consumption considerably in excess of that required for non-titaniferous ore (Eng. Min. Journ., 1904, 78, 350). Ores carrying a high percentage of titanium were successfully smelted in blast furnaces during a period of 20 years in the Adirondack Mountains, New York State (Stahl und Eisen, 1909, 29, 1593). According to recent information ores from this latter locality rarely contain less than 8 per cent., and often 15 per cent., of titanic oxide (Min. R es.U.S.A., 1908, Pt. 1, 91). The iron ore smelted by the natives of the Salem district, India, by the Catalan process, is stated to carry a certain amount of titanic oxide (Rec. Geol. Sur. India, 1892, 25, 139).

From a review of the literature on this question it would appear that under suitable conditions the smelting of iron ores containing a moderate percentage of titanium should be a commercial possibility, especially as there are enormous quantities of such ore, which is usually very low in phosphorus, obtainable at a low price.

Other Uses of Titanium.

The employment of titanium carbide as an electrode for arc lighting is making progress. According to recent investigations (Trans. Amer. Electrochem. Soc., 1909, 16, 217) this substance gives a high candle-power efficiency. It has been found that the titanium carbide arcs are most satisfactory when operated on a constant current circuit. The electrodes are prepared by grinding the carbide to a fine powder, mixing with a suitable binder, and forcing the paste through a nozzle by means of a hydraulic press. The rods so produced are cut into suitable lengths and dried, first in the air, then in a gas oven, and finally in an electric furnace of the carbon-tube pattern. The electrodes are plated with copper to prevent oxidation during burning. The characteristics of the titanium carbide arc light are an extremely luminous inner path, very little light from the outer mantle, and none from the craters. The electrodes are used as the cathode, whilst the anode is a rod of copper or carbon. Electrodes of the sub-oxide of titanium prepared by the reduction of rutile have also been tried for arc lighting, but with no great success. At the present time, according to recent information (Mining World, 1910, 33, 230), the most extensively used electrode containing titanium is the so-called "magnetite" arc lamp. This electrode is composed of magnetite, 15 to 20 per cent. of rutile, and some chromite; the first-named giving conductivity to the electrode, the second being the light producer, and the last adding to the life of the electrode.

Titanium has been suggested and tried to a limited extent as a material for filaments for electric glow lamps, the processes of manufacture and use being covered by numerous patents. It is claimed that they give a high candle-power efficiency, and are less sensitive to variations in voltage than other filaments. A trial lot of about 1,000 of these lamps was produced in America in 1906 (Mining World, 1910, 33, 230). A suitable means for the production of such filaments is to force a colloidal solution of titanium hydroxide through a small nozzle, and after drying the fine thread thus produced to reduce it in hydrogen to the metallic state. It is interesting to note that should there be the slightest trace of carbon present in the filament, such as may get into it from the vaporized oil from the pump during exhaustion, the efficiency of the lamp will be so impaired as to be practically useless (Electrician, 1907, 58, 892).

A process for obtaining pigments from titaniferous iron ore, such as ilmenite, has been described (Journ. Soc. Chem. Ind., 1910, 29, 1023). The ore is roasted at a temperature below incipient fusion and crushed in water, yielding a finely divided product of a yellow to red colour.

Rutile is sometimes added to porcelain tiles to give a soft yellow underglaze colour, and it finds a similar use in the manufacture of artificial teeth. Only the purest varieties can be employed for the latter purpose (Min. Res. U.S.A., 1906, 530).

Pure titanium compounds, particularly the oxalate and the double ammonium oxalate, are used to a limited extent as mordants (Mining World, 1910, 33, 230). They are stated to give with tannin a yellow colour of great durability. Titanous chloride has been used as a mordant and the sulphate as a mordant and "stripper." The double pyrophosphates of titanium with the alkali metals are stated to be capable of application to textiles without damage to the latter.

It has been suggested that titanium nitride, which is produced during the smelting of titaniferous iron ore, should be utilized as a nitrogenous manure, but experiments do not seem to have been made to test the availability of this compound for agricultural purposes.

Commercial Value of Titanium Ores.

According to recent information one of the largest firms producing rutile concentrates in the United States is selling three grades of ore, viz.: grade A.,

containing over 95 per cent. of titanic oxide and practically free from iron, at $160 per ton (2,000 pounds). This grade is stated to be used principally for arc lamp electrodes. Grade B., containing 75 to 80 per cent. of titanic oxide, the balance being largely iron oxide, sells at $80 per ton (2,000 pounds). Grade C., (largely ilmenite), containing 55 to 60 per cent. of titanic oxide, the balance being chiefly iron oxide, sells at $40 per ton (2,000 pounds). Grades B. and C. are stated to be utilized in the production of ferro-titanium.

Manufacturers of ferro-titanium in the United States say that they are utilizing titaniferous iron ore from the Adirondack Mountains, New York State, containing from 14 to 45 per cent. of titanic oxide. The price of thi sore is nominal at $5 to $10 per ton (2,000 pounds) according to the amount of titanium present.

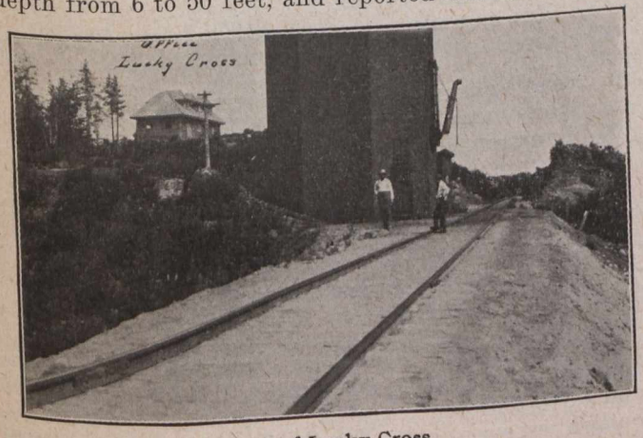
The Lucky Cross Mines, Swastika

Written for the CANADIAN MINING JOURNAL
by J. W. Vandergrift.*

The property now known as the Lucky Cross Mines of Swastika, Limited, was first staked in the year 1905, about the time of the first rush to Larder Lake. Little or nothing was done on it, except the necessary assessment work (which is usually practically nothing), till about two years later when it passed into the hands of the Crawford Mining Syndicate. Just here I would like to say a few things to the average prospector of this north country, and that is—that if he woud spend a greater part of his time, while supposed to be doing assessment work in the bush, doing some actual prospecting, instead of work that has no relation to mining, he would stand a better chance of finding something that would make his property of value. I think the story of what happened here on this property is ample proof of my statement.

* * * *

The Crawford Mining Company erected camps on the bank of Trout Creek and began mining operations at once. They either did not know, or else they ignored the necessity of doing any preliminary surface trenching, and at once began sinking shafts on some of the veins that outcropped, or had been exposed by the action of certain streams of water. In this manner they carried on operations for a part of two years, during which time they sank seven shafts, varying in depth from 6 to 50 feet, and reported having discover-



Office of Lucky Cross

ed assay values of from six to twenty-three dollars. This may possibly have been true, if the samples from which the values were recovered were picked samples, but it is not true that they discovered any veins that gave or will give (in the shafts they sank) twenty-three, or even six dollars of an assay value across their entire width.

Throughout the time that they were doing this work they were daily walking over a vein of white quartz,

Part of Townsite Swastika

six feet wide, which did and will assay from $11.20 to $18.60 per ton, and as high as $58 per ton, and which shows visible gold. This was standing right in the path, altogether uncovered and worn by the bootmarks of the people who were looking for gold.

The inevitable result followed, the work was abandoned, and quiet again reigned supreme.

The history of the Swastika mine is practically the same. Operations were started there in exactly the same manner, and in exactly the same manner several thousands of dollars were wasted; the only difference being that in their case they changed their tactics before it was too late, or in other words, before it became impossible to raise any more money, and the finding of gold at the eleventh hour was the sole cause of the activity now going on here.

As has been stated, operations ceased on what is now known as the Lucky Cross property during the year 1908, and it has been altogether idle from that time till the beginning of June of the present year. About that time it began to be a desirable piece of property because of the valuable discoveries made on the property of the Swastika Mining Company during the latter part of 1910 and the early part of 1911. About this time, also, some gentlemen from Philadelphia secured control of this abandoned property, and the writer (who had made the discoveries on the Swastika property) was placed in charge of the work of prospecting, with the result that in a very short time two distinct veins, not before explored, were opened up and shown to carry good gold values. The first was

*Manager, The Lucky Cross Mines.

the one already referred to. It is located on Claim No. T. C. 58, and is quite close to the track of the T. & N. O. Railway. The second one is located about 400 feet in a southeasterly direction from the first find; this vein is smaller than the first but is much richer. Eleven samples taken from this one, taken by cutting a groove right across the vein and for a total length of about seventy feet, gave an average assay value of $112 to the ton.

Early in July the Lucky Cross Mines of Swastika, Limited, was formed to take over this property. Prospecting was continued under the same management, with a small crew of men, with the result that at the present time there have been uncovered and prospected to a small extent 34 separate and distinct veins; six of which show visible gold. A few others give fairly good assay values and indicate that they are well worth further prospecting and proving; while several others have simply been cut in the trenches. On these latter nothing has as yet been done in the way of ascertaining their values.

The results spoken of are the work of only two months with a small crew of men, but it easily places this property in the front rank among the properties in this district.

The track of the Temiskaming & Northern Ontario Railway passes through three of the claims of the Lucky Cross Mines, Limited, thus making this property the most easily accessible in the district. The necessary machinery for mining and milling can be delivered within one hundred yards of the site where the shaft will be sunk and which is also a nice mill site for future use.

The first surveyed townsite of Swastika is also a part of this property and will be a considerable source of revenue.

A few lines relating to the course to be followed in developing this property may not be out of place. A shaft will be sunk on Vein No. 16 to the 100-foot level, where a station will be cut and crosscuts driven either way. Eleven veins will be cut in about 400 feet; one of these is about 20 feet wide and shows some visible gold on the surface.

Compressed air will be used for drilling. A six-drill compressor will shortly be installed.

Smelting with Oil Fuel

In July Mr. Thomas Kiddie, metallurgist, of Vancouver, B.C., made a brief report to the Dominion Oil Smelting Co., Ltd., Vancouver, relative to a recent additional test of the use of oil as fuel in smelting copper ore, as follows

"In compliance with your request, I proceeded to Van Anda, Texada Island, accompanied by Mr. Carlsrud, general manager, for the purpose of making a further demonstration with the oil-burning furnace. Two days were there occupied in overhauling water pipes, machinery, furnace engine, blower, and water and oil pumps, all of which were tested before the demonstration was begun.

"The ore mixture smelted consisted of Boundary district ore, iron ore as a flux, and copper slag from a previous operation. The furnace was started at 11 o'clock, a.m., using two burners until it became sufficiently heated, when two more were started. Everything went along satisfactorily and slag began to flow at 12 o'clock, noon. The slag was hot and increased in quantity until it ran a pot of slag in one minute of time up to 2.30 o'clock, p.m., during which time it smelted without trouble or interruption.

"Allowing one hour for the heating up of the furnace—a very conservative allowance—we used 157 gallons of oil in 2.33 hours, and 60 gallons for heating up the furnace, or 217 gallons in all. This gives an average of 14.6 gallons of oil per ton of material smelted, equal to 43.8 cents per ton of ore. The rate of smelting was 110 tons per 24 hours, an increase of more than 100 per cent. over the results obtained during the best previous demonstration.

"I have no hesitation in saying that these conditions can, and will, be much improved upon after certain changes shall have been carried out, so that full advantage may be taken of better and more complete combustion of the oil, when the cost of oil consumed per ton of material smelted should approximate 30 to 35 cents per ton of ore. The saving of labour costs at the furnace I estimate at nine cents per ton of ore.

"As a result of this and previous demonstrations, I strongly recommend that the furnace be remodelled along the lines already submitted by me to your company, and endorsed by at least two metallurgists of the highest standing in British Columbia."

The company has decided to proceed at once with the remodelling of the furnace, as recommended by Mr. Kiddie.

Ontario's Mineral Production

Returns to the Ontario Bureau of Mines, Parliament Buildings, Toronto, show that the output of the metalliferous mines and works of Ontario for the six months ending June 30th, 1911, was as follows:

	Quantity.	Value.
Gold, ounces	2,276	$ 42,320
Silver, ounces	15,231,969	7,644,200
Copper, tons	4,418	631,827
Nickel, tons	8,418	1,809,759
Iron ore, tons	94,803	239,114
Pig iron, tons	255,303	3,923,593
Cobalt and nickel oxides, pounds	219,584	64,876

Compared with the corresponding period of 1910 the above figures show the following increases:

Gold,ounces	2,276	$ 42,320
Silver, ounces	2,417,142	1,378,670
Iron ore, tons	55,306	126,032
Pig iron, tons	33,585	382,905

and decreases as follows:

Copper, tons	216	28,670
Nickel, tons	921	195,901
Zinc ore, tons	576	5,000

In quantity the shipments from the silver mines amounted to 12,113 tons, of which 7,733 tons were ore and 4,380 tons concentrates. In addition, 1,302,699 oz. bullion were sent out. For the first six months of 1910 there was shipped of ore 12,041 tons and 2,763 tons concentrates. There is, therefore, a considerable falling-off so far as shipments are concerned, in actual weight, but a decided gain in value. Taken in connection with the increase in shipments of concentrates, this would indicate that the mines are confining their ore shipments largely to high grade, and putting the

lower qualities through the stamping mills. Gowganda sent out 110 tons ore and 2 tons concentrates, and South Lorrain 216 tons ore, the whole containing 430,540 ounces of silver.

The yield of gold is still small, production at Porcupine being delayed by the disastrous fires, which destroyed the plants at the Hollinger and Dome mines.

Granby Company's Hidden Creek Mine

Mr. Jay P. Graves, vice-president and general manager of the Granby Consolidated Minnig, Smelting, and Power Company, Ltd., has returned to Spokane, Washington, from his second visit to the company's Hidden Creek mine at Goose Bay, Observatory Inlet, British Columbia. The Spokesman-Review quotes him as having said, in part: "The Cabin Bluff ore shoot, the smaller of the two main outcrops on our Hidden Creek property, contains a fine body of ore. We have drilled five or six holes in this ore shoot; some of these have been drilled 800 feet continuously in ore, and the cores from the lowest parts of the holes, which are about sea-level, give an average assay return of 3 per cent. copper. The last cross-cut through this ore shoot was in ore averaging 6 per cent. copper across 125 feet.

"The tunnel through the Cabin Bluff has been extended to the Mammoth Bluff. It was within 15 or 20 feet of the beginning of the ore shoot in the latter when I left the mine. This is much the larger ore body, and its grade will shortly be demonstrated. So far our operations have indicated that it will average at least 3 to 4 per cent. in copper."

(Note—This property was examined in 1909 by Mr. Herbert Carmichael, Provincial Government Assayer. In his Bulletin No. 1, published in that year, he said, in the course of his description of the property: "Prospectors were first attracted by a round-topped hill, about 1,000 feet high, which was more or less covered by a typical 'gossan' or iron cap. Prospecting showed that this gossan was thicker and more strongly marked in some places than others, and attention was specially directed to these points. The first of this work was done on a large exposure of these oxidized ores, which proved to be 5 feet thick. This gossan was cut by a number of trenches which disclosed a body of mixed pyrite and chalcopyrite ore, and this was prospected by four tunnels, aggregating 200 feet. These tunnels developed a large body of ore carrying 4 to 6 per cent. copper, which was called the 'Cabin Bluff,' and is at an altitude of 700 feet.

"About 500 feet back round the hill and 200 feet higher than the 'Cabin Bluff,' another and larger exposure of ore was discovered and named the 'Mammoth Bluff.' This has been cleared off to a large extent by surface stripping and shows a height of 300 feet of mixed pyrite and chalcopyrite ore, containing 4.5 to 5 per cent. copper. This ore deposit has been prospected by several tunnels. in all 350 feet in length.

"There are several smaller showings on this hill, and these, with the 'Cabin' and 'Mammoth' Bluffs, have been prospected by 2,000 feet of open-cut, beside the tunnels. To tap these ore bodies at depth and form a main working tunnel, a long drift has been started on the hillside 200 feet vertically below the Cabin Bluff, and when the property was visited this drift was in 732 feet. At 480 feet in, the ore seen in the Cabin Bluff above was struck, the tunnel cutting through it, the strike of the ore being N. 10 deg. W., dip 65 deg. W. The thickness of the orebody is estimated at from 25 to 40 feet, running from 4 to 5 per cent. copper. Drifts 70 feet long have been run on either side of the tunnel in ore all the way, the direction of the tunnel being 90 deg. from the strike of the ore.

"Round the hill to the south 265 feet, and at an elevation of 100 feet above, the main tunnel, a drift known as the 'Pyrites tunnel' is being driven to connect with a raise from the main tunnel. For the first 100 feet this tunnel runs through loose granular pyrites, made up of small detached iron pyrites crystals similar to those found on the Ecstall pyrites deposit, near the Skeena River. At 100 feet in, solid mixed iron and copper pyrites ore was struck, containing 4 per cent. copper for 10 feet, when a lower-grade iron sulphide ore was met with, and the tunnel is still in this ore at 200 feet from the portal.

"The vertical height between the main tunnel and the top of the Mammoth Bluff deposit is 450 feet, and with the prospecting done it is reasonable to infer that the ore shoot is continuous for this vertical distance. The horizontal boundaries of this orebody have not been clearly defined, but it is probably some 600 feet in length by 20 to 25 feet in thickness, containing 3 to 4 per cent. copper.

"At the Cabin Bluff showing there is a considerable depression in the ground, which appears to have been caused by the oxidizing and dissolving out of the pyrites ore body, and there is a large deposite of hematite in a flat of 10 acres south of the ore showings, where this dissolved out ore has been redeposited. Samples of this deposit gave the following assay returns: Iron, 60 per cent.; gold, 0.10 oz.; copper, 0.2 per cent.

"The country rock in the vicinity of the ore body is made up of altered argillites or shales, traversed by felsite, diabase and porphyry dikes, these dikes being of later origin than the ore. In some parts of the deposits there is a vein-filling of quartz, but the main body is composed of solid sulphide ores.")

It should be remembered that the report from which the foregoing extracts have been made was published before the Granby Company became interested in the Hidden Creek property, and consequently previous to the commencement of the large amount of underground exploration since done by that company. The information is here quoted, though, with the object of directing attention to the fact that particulars concerning the property, obtained by an official of the Provincial Department of Mines, and therefore quite disinterested, and published by the Government two years, indicated the occurrence on the Hidden Creek group of a large body of copper ore of commercial value. Since then the considerable exploration carried out by the Granby Company, both by ordinary underground mining and by diamond drill, has determined the occurrence here of an immensely larger quantity of ore than was previously known to exist.

Continuing the quotation from the Spokesman-Review representative's interview with Mr. Jay P. Graves, the following additional information is given:

"For the last month we have been employing 150 men, and the force is gradually being added to. All the engineering work in connection with the equipment of the property has been completed. The right of way for the tramway from the mine to the ore-bunkers on tidewater, a distance of a mile, has been

cleared, as, too, have the sites for the orebunkers and wharves. By September 1st we will have construction work well started on the 400-foot wharf, and on two orebunkers—one, of 4,000 tons capacity, at the mine, and another, of 6,000 tons, at the dock.

"A sawmill, having a capacity of 40,000 feet a day, is in operation, and an electric light plant is being installed in connection with the old water-power. The construction of a dam higher up the creek will shortly be commenced; this dam will give a head of 350 feet and will provide water for the development of 3,500 electrical horsepower for our new plant.

"The head employees of the company are still collecting data that will determine the company's policy with regard to the treatment of its ore. When all the necessary data shall have been obtained, we shall decide whether for the present we shall send the ore to a custom smeltery, or at once proceed to erect our own reduction works. It will also be decided where our plant shall be located, and whether we shall treat only our own ore or do a general custom smelting business as well. We expect to be able to reach a decision on these matters before October 1."

THE HELEN IRON DISTRICT

(Written for the CANADIAN MINING JOURNAL
by W. L. Goodwin.*)

Ontario's iron ore mining, like its gold mining, has had a somewhat chequered experience. From the early days when pig iron was made from the bog ore of Norfolk County down to the present there have been a good many iron deposit sopened up, particularly in eastern Ontario, but the Helen mine has been the only large steady producer. Other deposits have been found too small or too lean to work profitably, or they have run into too much sulphur. The Moose Mountain and Atikokan deposits are large, but it can hardly be said that they are yet on a solid basis as steady producers.

The writer can compare the present state of development of the Helen mine district with its condition in 1902. At that time the Helen was worked on a very large scale by the open pit method. The Josephine, about 10 miles to the northeast, was being prospected also. The output at the Helen was about 500 tons a day. In 1903, under the energetic management of Mr. R. W Seelye, with a much reduced working force, the output was pushed up to 1,000 tons, which has been maintained ever since. Since that date the work has been exclusively underground. The ore hoisted still consists largely of limonite and gothite, but there is a considerable proportion of hematite. The pipes of pyrite sand, so characteristic of the early stages of development of the mine, are still met with. Solid masses of pyrite are occasionally found. But both are so localized that it is comparatively easy to mine a product low in sulphur. These pipes of pyrite are very curious. When they are broken into the sand runs out like so much water. The Helen ore is easy to mine and it works well in the furnace. Mr. Haselbring, the present general superintendent, tells me that the output just now is about 1,100 tons a day, and that most of it is used in the furnaces at Sault Ste. Marie. The ore is hoisted by two skips, crushed with a gyratory crusher, loaded directly into the ore cars for transportation to Michipicoten Harbour (12 miles), where the cars are run out on the loading dock and dumped into the ore boats. The shaft has been sunk 750 feet, and drifting has been carried on down to the 700 foot level. Early in the summer the timbers began to show signs of a cave. The progress of this was carefully watched, and in July the men were all ordered up to the surface, soon after which the cave occurred, bringing down a mass estimated at 350,000 tons—a year's supply of ore, requiring only occasional block-holing to make it ready for mucking. At one place a solid block of ore came down, just filling the drift—so neatly that the rails seem to run into the unbroken ore.

When the writer was there in 1902 Boyer Lake, just west of the workings, was being pumped out, to dispose of the water, which was becoming troublesome, and to allow the bed of the lake to be prospected. D ·ifting under the bed of the lake has not revealed any large bodies of ofe. A launder has been run orund the south side of the mine and continued along the shore of Boyer Lake to Sayers Lake just below. This takes care of the mine water and also of a large part of the drainage from the hills on that side. Since this was done, it has been found unnecessary to continue the pumping of Boyer Lake. The mine pump takes care of it all.

The mine buildings are noteworthy for the evident care taken to give the men comfortable, safe, and sanitary conditions. The writer accompanied Mr. Seelye, the general manager, throughout an inspection of the camp. The minute, unsparing character of that inspection accounts in part for the admirable discipline of the camp. In 1902 "blind pigs" and other undesirable camp features were much in evidence in the district. These have completely disappeared and one hears startling tales of the drastic measures used to abolish them. With these features have disappeared much dirt, waste, and general disorder, too evident to tion of sand, common sense, and study of the best interests of the mine, managers may rid themselves of a visitor in the earlier days. By a judicious combinasuch demoralizing influences, which so seriously interfere with discipline and efficiency.

Notable features of the Helen mine to-day are the brightness and comfort of the dining and sleeping camps. With a good water supply laid on from a lake on the top of the hill east of the mine, baths and wash hand-basins are supplied for the men. Instead of large dormitories with tiers of bunks, one sees separate rooms, securing something of the privacy of the home. Electric lights are used everywhere, both power and light being supplied by the water power developed at the falls of the Michipicoten River 11 miles away. There is also a good drainage system. The largely increased output with a much smaller force of men (now about 200), is in part explained by the general briskness of the camp which accompanies this careful attention to comfort and sanitation. Many of the mar-

*Director School of Mining, Kingston, Ont.

ried men, including English, Finns, and Italians, have brought in their families, and there are enough children of school age to keep one teacher busy. It was interesting to see the tow-headed Finns and dark Italian children playing together, and all talking good Canadian English.

The Helen iron mine is then undoubtedly the largest and most important iron ore producer in Canada at present. There is still a very large known body of ore there to be taken out, and the mine has possibilities in depth. But a most interesting new development of the district is found at the Magpie mine.

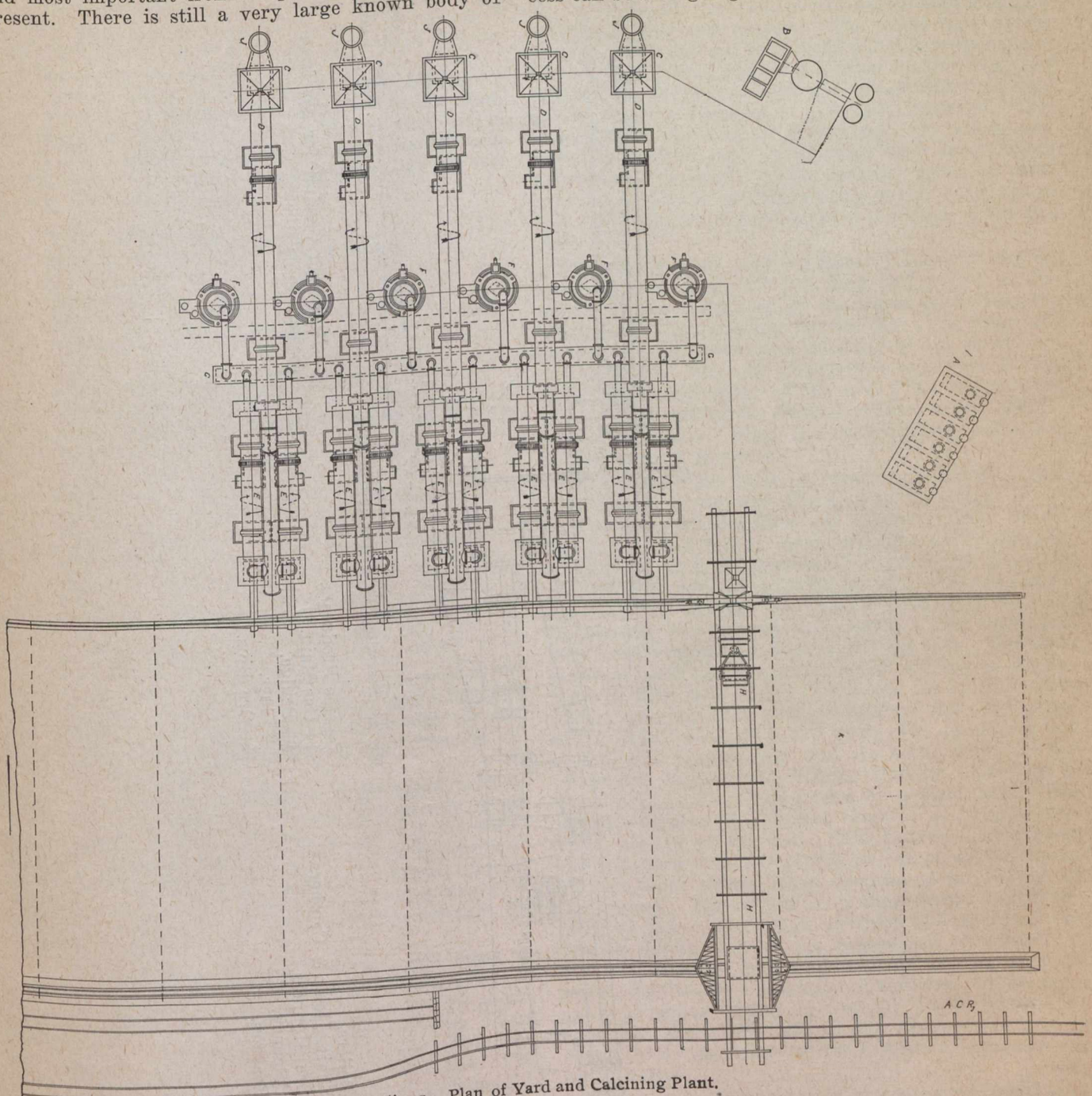


Fig. 1. Plan of Yard and Calcining Plant.

The Magpie Mine.

The character of the Helen iron formation has been made familiar by the reports of Dr. A. P. Coleman in the Ontario Bureau of Mines Reports.* (a) The most interesting feature of the Helen formation is the siderite, ankerite, etc., more or less banded with chert and sandstone, an dcontaining more or less iron pyrite. It has been conjectured that the Helen mine had its origin by a process of leaching of the carbonate material and its concentration by precipitation to the bottom of a lake after ovidation to limonite. This process can be seen going on now in the remains of Boyer Lake. The plentiful occurrence of iron pyrite in these rocks suggests another possible origin. It is quite likely that both the carbonate and the pyrite have contributed to the process. (b) Those visiting the Helen mine can see the principal features of the formation beautifully shown in the rock cuts made by the railway as it passes along Sayers Lake and crosses the very narrow ridge which separates Sayers from Boyer Lake. (c)

*1899, pp. 254-5; 1901, p. 191; 1902, p. 155; 1904, p. 221.

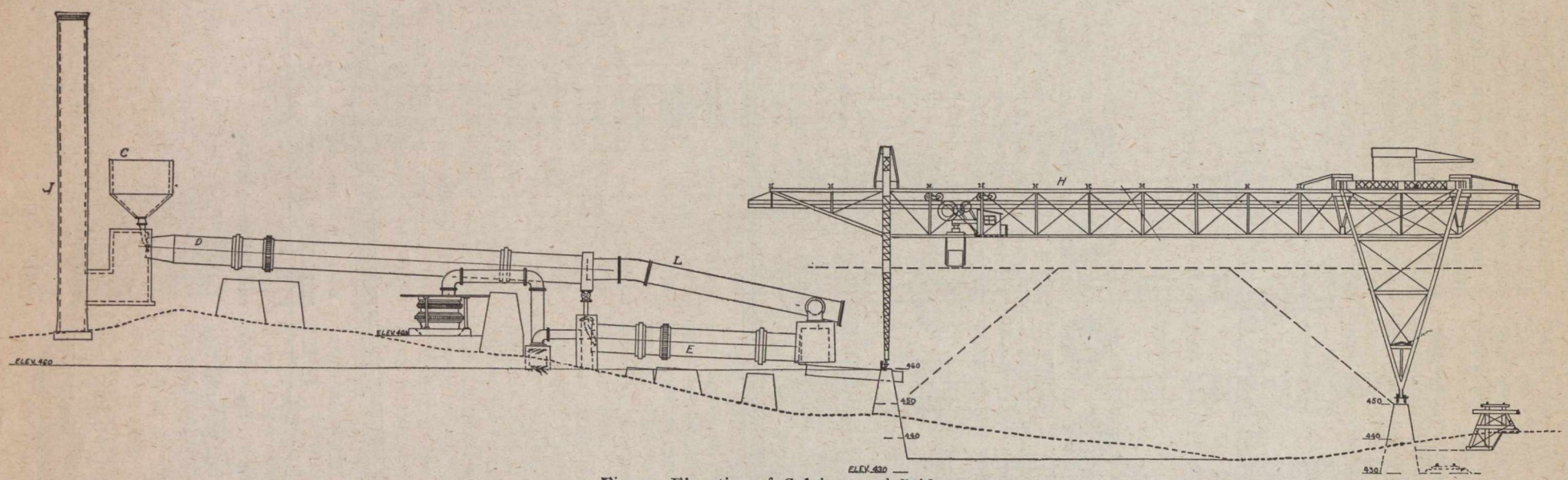


Fig 2. Elevation of Calciner and Bridge

A—Boilers.
B—Shaft, Hoist & Crushers.
C—Ore Hoppers.
D—Calciners.
E—Roasters.
F—Gas Producers.
G—Gas Main.
H—Bridge.
J—Flues.
K—Ore Bins.
L—Hood and Conduit for gas from roasters to calciners.

About twelve miles north of the Helen mine, at a point near the Magpie River, the siderite is so concentrated as to constitute a workable iron ore. Here the Mines Department of the Lake Superior Corporation have proved by diamond drilling an ore deposit 4,000 feet long, and at least 650 feet in depth. The width where a shaft is sunk and the deposit cross-cut, is 59 feet. A conservative estimate made from the drill log puts the average width at 30 feet. Some 12,000 feet of drilling were done. In parts of this deposit the ore passes into magnetite.

The fresh siderite is compact and quite white, but when exposed to the air soon weathers to the characteristic rust colour of limonite. This is well seen at Iron Knob, a jagged peak very conspicuous towards the east end of the range. In composition the ore will average about as follows:

Iron, 40 per cent.
Carbon dioxide, 18 to 20 per cent.
Lime, 7 per cent.
Magnesia, 5 per cent.
Manganese, 2 per cent.
Alumina, 1 per cent.
Silica, 8 per cent.
Phosphorus, under 0.02 per cent.
Sulphur, under 4 per cent.

For comparison, the Helen ore analysis for 1910 is given herewith:

	Dried.
Iron	57.77
Lime	0.23
Magnesia	0.14
Manganese	0.165
Alumina	.880
Silica	4.40
Phos.	0.127
Sulph.	0.136
Loss by ignition	10.40

The probabilities are that the ore will carry about two per cent. of sulphur, which occurs in the form of iron pyrite more or less disseminated through the ore, in marked contrast with the segregated masses of pyrite at the Helen mine.

The high percentage of sulphur is, of course, prohibitive to the use of the raw ore, but fortunately it can be completely removed by roasting, leaving the ore of excellent Bessemer quality. The ore is distinctly basic in character, although the silica and alumina present will balance more than half of the lime and magnesia. The high percentage of manganese also increases the value of the ore.

By a long series of large scale experiments, using up some 200 tons of ore, it has been established that it can be roasted sweet, the sulphur being reduced as low as is desired, even down to a vanishing quantity. There is no difficulty in reducing it to 0.10 per cent., and it is not necessary to bring it down below this. The ore at the same time loses about 20 per cent. in weight, with a rise in the iron content to 50 per cent. or over, mostly in the ferrous condition. After a careful reading of the reports made on these experiments, which were carried out under the superintendence of Mr. Seelye, the writer is convinced that the feasibility of the roasting process has been established beyond a peradventure.

The roasting plant is now being constructed under the superintendence of Mr. Wm. Melville, metallurgist, Detroit, and Mr. R. E. Clisdale, mech. engineer, Toronto. Through the kindness of Mr. Seelye I am able to give a general plan of the roasting plant and accessories and a short description of the process. The ore is crushed to one and a half inch. On account of its compact nature it crushes with very little fines. From the crushers it is conveyed to hoppers, which feed it to the calcining furnaces, of which five are being installed at present. It has been found advantageous to drive off the carbon-dioxide by a preliminary calcination, for two reasons. The waste heat of the roasting furnaces can be utilized for this purpose, and the ore is left in a porous condition by the escape of the carbon-dioxide, so that the subsequent oxidation in the roasting furnaces is unusually effective. This arrangement has another advantage. It makes possible the maintenance of an even high temperature throughout the length of the roasting furnaces. The experimental work established this as the most favourable condition for the complete elimination of the sulphur.

The calciners are rotating tube furnaces, of the cement furnace type, 125 feet long and 8 feet in diameter. These are heated by the waste gases from the roasters, the gases being carried by pipes from the bottom of the roaster and entering at the bottom of the calciners. The gas therefore travels against the direction of movement of the ore. The temperature of the lower end of the furnace reaches about 800 degrees Centigrade. There is no considerable reduction of the sulphur contents.

The roasters are built in pairs, each one of a pair revolving in a contrary direction to the other. Each pair receives the ore from one calciner. They are 60 feet long and 5 feet in diameter. The temperature is maintained at 1,100 degrees Centigrade by producer gas, which is introduced with air at the upper end of the furnaces, so that the flame travels with the ore. In this way it is possible to maintain a long flame and very even temperature throughout the tube. The temperature must not rise above 1,100 degrees, as sintering will then take place. There are six of these producers, one for each pair of roasters and one in reserve. The fuel used is soft coal. The producers are of a special construction and are being made by the Chapman Engineering Works, Dundas. Each producer is in two sections joined by a water seal. The sections revolve at different rates so as to give constant stirring of the fuel. This prevents blow holes and insures a constant supply of gas of uniform composition, both points being essential to the success of the process. The output from these furnaces will depend, of course, on the rate at which they are revolved. This is determined by the percentage of sulphur, a higher percentage requiring a slower rate in order to secure the desired elimination of sulphur. On an average it is estimated that the output will be 15 tons an hour per unit. This will give a total production of about 1,500 tons a day for the five units at present being installed.

The plant is designed so as to give very perfect control of the movement of the ore, of the flow and composition of the producer gas, and of the draught. The latter is controlled by a fan which gives a pressure equal to 16 inches of water. In the experimental work the waste gases after leaving the calciners were found to contain 16 per cent. of oxygen. If the gases from the roasters do not give the required temperature in the calciners, this can be secured by the introduction of a little producer gas.

From the roasters the ore is passed into the storage bins, and is there handled by an electric crane, the bridge having more play than usual so as to reach several bins without being moved along the track. The finished ore is in hard nodules, very easily handled by the clam-shell, hard enough to bear transportation and furnace burden, but so porous that it must work particularly well in the furnace.

The Magpie mine is reached by a branch of the Algoma Central Railway built from the Josephine branch at a point about 8 miles north of the Helen mine junction. The whole distance from the Magpie mine to Michipicoten Harbour is 28 miles, with grades in favour of the loaded movement. In addition to this summer route there are, or will be, two possible winter routes, as the Algoma Central Railway is being built northward to connect with the main line of the C. P. R. at Hobon. The A. C. R. is now being constructed from the "Soo" northward to the Helen mine district. The greater part of this line is already in operation.

The mine buildings for the Magpie are being erected with the same attention to solidity, comfort, and health as exemplified at the Helen. The water supply is being pumped from the Magpie River. The drainage will be piped into Camp Lake, which is a mile and a half below the intake of the supply station. Power will be obtained from Steep Hill fall on the Magpie River, which is 1½ mile from the mine. An auxiliary steam plant is being built at the mine.

As the amount of ore blocked out by the diamond drilling is calculated to be something like twenty million tons, it is quite evident that we have here an important addition to our known iron ore resources. The estimated cost of the roasting process is between 35 cents and 40 cents a ton on the production, not a heavy addition to the cost considering the character of the ore turned out.

(a) Professor Coleman (Bureau of Mines Report, 1901, p. 155) proposed the following classification of the rocks.

Laurentian—Gneisses and Granites.

Upper Huronian—Acid eruptives, Basic eruptives, Dore conglomerates.

Lower Huronian—Eleanor slates, Helen iron formation, Wawa Tuffs, Gros Cap Greenstones.

This places the Helen Iron Formation in the Lower Huronian, which has been so productive of minerals in other parts of Ontario.

(b) That this is the case is perhaps shown by the occurrence, in and near the ore, of masses of losse silicious sand corresponding in structure to the bands of sandstone in the siderite, and also of quantities of loose pyrite sand. The silicious sand was doubtless formed by the disintegration of the siderite formation with the solution and removal of the iron carbonate, leaving the insoluble silica in place, or perhaps allowing it to be carried by the streams of water and deposited near the place of deposition of the ore. If, in addition to carbonic acid the circulating waters carried oxygen, the pyrite would also be attacked and its iron carried away in solution as ferrous sulphate. The more perfect crystals and compact fragments of pyrite would resist this attack longest, and form the pyrite sand so characteristic of the Helen ore body.

(c) Analysis of surface specimens of the siderite formation and of drill cores from a depth of about 150 feet show up to 36 per cent. iron. It is obvious that if such a formation were found uniform enough, in sufficient quantity, and in other respects favourable in composition, it might constitute a workable iron ore. This was pointed out by Professor Coleman in the Report of the Bureau of Mines for 1901, p. 193:

"Analyses of specimens from the hilltop (east of the mine) and from the outlet of Boyer Lake have been made by myself, No. 1 being from the hill, and No. 2 from the west end of the lake, and the results are as follows:

	No. 1.	No. 2.
Insoluble	4.38	14.76
Carbonate of iron	78.57	74.07
Carbonate of magnesia	12.84	8.75
Carbonate of lime	4.09	0.79
Alumina	trace	trace
	99.88	98.37
Specific gravity	3.681	3.587
Iron	37.71	35.70

"The insoluble residue consists mainly of very fine particles of silica. . . . . No account was taken of the iron pyrites, which would have given a considerable amount of sulphur, perhaps even one or two per cent. . . . But for the pyrites, the rock from the hill would be accounted a fair ore of iron in some parts of Europe; and if this siderite were roasted it would yield a product having 56.57 per cent. if iron, not more than 7 per cent. below the iron contents of the ore from the mine; and, if the sulphur were all roasted out, would form a very fair ore, having 9.17 per cent. of magnesia and 3.14 per cent. of lime to serve as fluxes for 6.56 per cent. of insoluble material, mainly silica."

It thus became a question of quantity of siderite, and of a feasible process for roasting. The percentage of silica is of course a factor, as the value of the ore is increased by an excess of lime and magnesia over that required for slagging the silica and alumina. In another place Professor Coleman notes the presence of something like 2 per cent. of manganese in the siderite, and points out that it has not been carried down in the precipitation of the limonite ore.

SPECIAL CORRESPONDENCE

NOVA SCOTIA.

The Geological Survey has recently issued a Memoir on the clay and shale deposits of Nova Scotia and a part of New Brunswick. The author is Heinrich Ries, who was assisted in his investigations by Joseph Keele. Particular attention was paid to the shales and clays which are so plentiful in the Carboniferous of Cape Breton Island, and the Memoir contains much interesting reading for those interested in local industries, and incidentally corrects some erroneous impressions which are abroad.

In view of the importance of the iron and steel industry in Nova Scotia it is unfortunate that there does not appear to be any deposit of true fireclay in the province, and there is generally a decided lack of refractory material. An examination was made of a so-called fireclay deposit on Coxheath Mountain near Sydney, which proved to be a light-coloured felsite. By crushing the felsite and using a bond of clay it would be possible to make a hard brick, but not a firebrick. An interesting

Note—Memoir No. 16-E, Geological Survey Branch, 1911.

pocket of white residual clay was found in a depression near the ridge of the mountain, which the authors think may have escaped glacial erosion, but the deposit is too small to be of economic value.

There appears to be an abundance of suitable material in Cape Breton for the manufacture of ordinary red and buff brick, particularly in the neighbourhood of Glace Bay and Sydney, and near the town of Inverness.

An interesting deposit was noted in the Shubenacadie and Musquodoboit valleys, which is evidently of pre-glacial origin, as it underlies the drift. The authors tentatively class it as Mesozoic. This deposit contains material which is classed as fireclay and could be used for the manufacture of pressed brick, terra cotta, and stove linings. This deposit the authors consider could be profitably opened up.

There are clays in the Annapolis Valley which could be used for making cheap art pottery and terra cotta tiles, and some of the smoother clays in the Anapolis Valley and near Inverness could be used for the manufacture of stoneware.

The authors believe that there is room for development in the Nova Scotia industry, but the product resulting from it will have to be marketer mainly outside of the Province. There are few pressed brick works between Ontario and Nova Scotia, and this territory should afford a good field.

Although Nova Scotia appears to be lacking in deposits of fine residual clays suitable for pottery manufacture, and there is no great quantity of really refractory manufacture, yet it is quite evident that there is no lack of material for the manufacture of ordinary brick, and some of the better grades of the clay-workers' art, such as terra cotta tiles, stoneware, drain tiles and pipes, and coarse pottery. The Memoir is a very valuable one, and should be obtained by those interested in the clay industry.

It may be noted that a large business is now being done in Sydney in cement bricks made from the Dominion Iron & Steel Company's slag.

Dominion Coal Output.

The output of the Dominion Coal Company's Glace Bay collieries for August exceeded any previous monthly production. The figures are as under:

No. 1	52,770
No. 2	71,400
No. 3	17,720
No. 4	38,740
No. 5	28,540
No. 6	26,680
No. 7	18,120
No. 8	17,430
No. 10	39,470
No. 12	18,100
No. 14	27,590
No. 15	24,380
No. 16	3,920
No. 21	1,170
	1,500
	387,530

This output is 17,000 tons larger than the best previous month in the company's history. No. 2 Colliery, No. 6, No. 10, and all the Lingan mines from Nos. 12 to 16, established new records.

The output for the eight months ending August this year is approximately 2,650,000 tons, comparing with 2,259,000 tons in the same period of last year. The best previous production for this period in any previous year was 2,610,000 tons, in 1908, so that the Coal Company's output to date is 40,000 tons larger than in any former year.

The output from the Springhill Collieries for August was 30,164 tons, which is the largest production for over two years.

The output of the Glace Bay mines during August was a really remarkable one, considering that the 12th was observed as a general holiday, being the annual picnic of the P. W. A. This occasioned a decrease of 20,000 tons in the production, so that the rate of output was easily 400,000 tons for the month. To those who know the large expenditure which has been made on these collieries during the past eight years it is not a matter for surprise that the property is now showing of what it is capable. Since 1904 the Coal Company have developed No. 6 Colliery on the Phalen seam, and No. 10 Colliery on the Emery seam, on the Glace Bay side; and have on the Lingan side two new collieries in full operation, and two in course of development. In addition to this some of the older mines, such as No. 5 (Reserve), and No. 7 (Hub), have been practically remodelled. In this period also a large part of the mine machinery has been changed over from steam drive to electricity, and the large portion of the colliery pumping, ventilating, and screening plants is now operated by electric power.

Extensive prospecting operations are being undertaken by the Dominion Coal Company in the Cumberland coal field with a view to the location of new winnings near the Springhill Collieries. Diamond drill-holes are being put down to test the measures. The correlation of the contorted seams of the Cumberland basin is not by any means so simple a matter as the correlation of the seams in the less disturbed areas at Glace Bay, and the prospecting at Springhill will afford some interesting work.

ONTARIO.

COBALT, GOWGANDA, AND SOUTH LORRAIN.

Ore shipments from Cobalt for the week ending August 25 established a record for 1911, 748.22 tons being sent out, including 15 cars of high grade and 7 cars of low, from thirteen mines. During the week ending September 1, three cars less than in the preceding week were shipped, 15 of high grade and 4 of low, from eleven mines. The shipments totalled 1,167,029 pounds, or 583.51 tons. During this period of two weeks, two mines shipped bullion. The Crown Reserve sent 11 bars, worth $8,000, to London, England, and three shipments were made by the Nipissing inside five days. These consignments were of 15 bars, worth $8,738.60, and the other two, totalling 114 bars, valued at $63,483, which, for a week, is a record for the camp.

Dividend No. 19 of the Crown Reserve has been declared for August payable on September 15. It is at the regular monthly rate of 2 per cent. with a bonus of 3 per cent. Since 1908 the Crown Reserve has paid back to shareholdedrs 195 per cent., representing disbursements totalling well over the $3,000,000 mark. On August 22 this mine shipped a car of 30 tons to the government of Saxony. The ore was over 5,000-ounce stuff. Nine large machines are working underground and preparations are practically completed for further sinking on the Carson, or main, vein. The winze is now down over 160 feet below the 300-foot level and a head frame and cage are being placed in position. This winze will be sunk 150 feet, making the deepest working on the property 610 feet.

Frank L. Culver, president of the Beaver, when in Cobalt recently, said it was the company's intention to sink the main shaft another 100 feet below the 400-foot level. Shortly before the president's visit the No. 5 vein was struck at the 400-foot level of the shaft, and drifting has been started northward along the ore body.

This week saw the opening of the concentrator at the Cobalt Lake mine. It has a capacity of 75 tons a day at present but it is expected that this will be increased to 100

tons daily before long. Mining operations are being carried on in shafts Nos. 4 and 6. The former is being worked at the 170-foot level where the old vein is being opened by drifting. At No. 6 shaft work is progressing at the 285-foot level. Crosscuts will be run from a certain point at this depth and raises cut to the shaft, to connect at the 195-foot level. A new vein carrying some native silver was discovered a few days ago and a drift has been started to open it up and determine the values.

At the 200-foot level of the Coniagas a spectacular slab of silver 34 inches by 18½ inches and over an inch thick was taken out last week. The find was made in the drift on vein No. 12, one that is carrying high silver values. The vein is little more than 3 inches wide, but it is a steady producer of high grade.

Operations on "H" vein at the Trethewey on the first level between Nos. 1 and 2 shafts disclosed some high grade ore that had been overlooked when the vein was originally worked. To date over 60 feet of good ore has been opened up and in the wall rock there is plenty of milling ore. The mill is running steadily at a capacity of 100 tons a day, and nothing but high grade is being shipped.

At the 100-foot level of the Cobalt Townsite mine another vein has been encountered which gives promise of producing much good ore. This vein was found in a crosscut about 300 feet west of the shaft. Five drills are working underground. A contract with the Northern Customs Concentrator calls for 50 tons of ore daily. This ore is being trammed to the concentrator and comes from underground work only.

Developments at the Belleville, in South Lorrain, have been of the most satisfactory nature during the past few weeks, and some spectacular ore bodies have been opened up. The force of working men is being increased and shipments of high grade ore are being made regularly.

In crosscutting westward at the 575-foot level of the Temiskaming to make connections with the main shaft, a large vein of high grade ore was cut. Unless it has faulted from an upper level this is an entirely new ore body. The vein is from one foot to 2½ feet wide and in places the values are exceptionally high.

Work at the Millerett and the O'Brien mines in Gowganda is going on quietly but effectively. The latter mine recently shipped a 19-ton car of ore that netted the company over $38,000.

Porcupine, Swastika, and Cripple Creek.

Nothing has so increased interest in the Cripple Creek district as the recent transfer of the Jowsey-Wood claims in Carscallen township to A. D. Miles, consulting engineer for the Canadian Copper Company. The Jowsey-Wood claims are situated on the 3-mile post on the base line of Carscallen, two of them on the boundary line between that township and Denton. A big quartz dyke holding rich values with spectacular free gold showings runs through the entire group of claims. This deal, following so closely the transfer of the McAulay-Brydge claims for half a million dollars gives great prominence to the district west of the Mattagami.

West Shining Tree, 40 miles north of Gowganda, is the latest goal of gold seekers, and a rush of no small proportions resulted from the finds of Alfred Gosselin, who, so far, has staked the best claims yet prospected. The formation in the new district resembles greatly that found in the Porcupine area and veins uncovered run from mere stringers to 15 and 20 feet in width. On Gosselin's main discovery free gold shows in several places and assays taken from a number of veins go as high as $25.

A gang of about 20 men is busy at the Homestead mine, Swastika, stripping, trenching, and at other surface work. A shaft has been started on No. 3 vein, and it will be made the main working shaft, the first station to be at 100 feet. A new vein at least 10 feet in width was found a few days ago, carrying excellent values.

A new shot drill has been taken out to the Porcupine and Hudson's Bay gold mines. It is a Rand-Davis-Calyx drill with a 6¼-inch core, the largest in operation in the camp. Much surface work is being done and a report of two prominent English engineers, whose names are withheld, will be issued shortly. All buildings destroyed in the fire have been rebuilt.

What is considered by some engineers to be one of the most spectacular showings ever found in any camp is the rich vein uncovered on the eastern portion of the big Dome property recently. While trenching north and south a beautiful free gold showing was uncovered on a vein running east and west. This vein was then uncovered east and west for 72 feet and eight distinct spectacular showings were disclosed. Officials of the company refused to express any opinion of the values carried. The show spot of the vein is a patch of almost solid gold 2½ inches by 15 inches. In each case the gold appeared in slabs of schist in the quartz vein which is 18 feet to 20 feet in width.

Work at the West Dome is as yet confined entirely to the reconstruction of camp buildings and the replacing of equipment. A model town is being laid out with substantial structures, a modern system of sanitation and every protection against fire. Pure water is procured from an artesian well at a depth of 170 feet.

Motors and transformers have been ordered for the Plenaurum Mines, and a 10-drill compressor will be delivered in the course of a few weeks. A 6 x 8 hoist is now on the ground. A shaft is being sunk on the Jupiter vein, 200 feet from the line and another shaft on one of the four veins opened up in the corner between the Bewick-Moreing, Platt Vet, and Pearl Lake properties.

A new strike at 90 feet was made on the Pearl Lake property last week, in "A" shaft, free gold appearing in several places. In the other shaft some free gold was found at 110 feet. At 400 feet a core drill brought up good looking stuff that assayed $18.25. Machinery ordered and shipped about the end of July has not yet arrived, but is expected at any date. It includes a 12-drill compressor and two stamps which will be used for testing purposes.

Two new veins have been found on the north Hollinger lot, on of them, from 2 to 9 feet wide, being uncovered for 350 feet. Delay in the arrival of machinery has hindered development work and it will be three months yet before the motor ordered can be procured.

Somewhat less spectacular than the Dome showing was that of the North Dome uncovered about the same time. At several points on the property rich surface showings were found and at a depth of 20 feet at one point values were found to be most consistent, running entirely across the vein, which was 7 feet wide there. Mr. P. Kirkegaard said there was no paystreak in the vein, it was all paystreak.

It is reported on the best of authority that the International Nickel Company has acquired the Porcupine Imperial property consisting of three claims near the Dome. The price cannot be learned. Several rich finds have been made on the Imperial, the latest being last week, when a free gold showing was discovered on the northwest corner of the property. It is considered the fourth best showing in the camp. As no denial of the report of this transaction has yet been made, it is being

accepted as fact. The deal is an important one and work on the Imperial, it is understood, will be pushed at once to the 400-foot level.

[Editor's Note.—Our correspondent's last item has been authoritatively denied.]

BRITISH COLUMBIA.

A matter that is being seriously discussed by a number of well-wishers of the mining industry of British Columbia, is the gross exaggeration and misrepresentation frequently characterizing both promotion advertisements, in connection with so-called mining companies, and newspaper descriptions of mining properties. The earnest desire to prevent the continued publication of misleading and untrue statements by reckless or unprincipled company promoters and by other parasites on the mining industry, whose chief effort appears to be to induce the public to put money into their schemes, is finding expression in enquiry as to the best means to adopt to bring about the punishment of those guilty of trading on the gullibility or ignorance of their victims, and it is not unlikely that some action will be taken ere long, even if it be only to urge the provincial government to ask the local legislature to enact a law to meet the case if it be found that existing laws do not provide for the effective punishment of those whose nefarious operations are felt to be both harmful to the legitimate promotion of companies to engage in mining, and to the mining industry itself. The attention of the provincial Attorney-General's Department has been called to two or three glaring cases, so it is hoped some means may soon be adopted to check the reprehensible practice of publishing grossly untrue statements relative to mining properties.

General.—Among the items of mining news published lately are the following, which are given without attempt to classify under district headings: It is stated that a contract has been let for hauling 1,000 tons of ore from the Utica mine to the Kaslo & Slocan Railway. Work is to be resumed at the Deep mine, Whitewater, at which important deep-level development has already been done. A spur is being constructed dfrom the Canadian Pacific Railway at Three Forks, Slocan, to near Bear Lake, to provide railway transportation facilities for the Lucky Jim, Rambler-Cariboo, and other mines. A provisional liquidator has been appointed for the Yankee Girl Mining Company, which for two or three years was operating in Ymir camp, Nelson mining division, and which shipped to the smeltery at Trail a considerable quantity of ore containing low value, chiefly in gold. There continues to be much activity in Sheep Creek camp; good reports are being published from time to time concerning several gold mines, namely, the Queen, Mother Lode, Nugget, Kootenay Belle, Summit, and others. Rossland mines are maintaining their output of ore, in largest measure from the Centre Star group and next from the Le Roi No. 2; the Blue Bird, in the south belt of this camp, is stated to be about to regularly ship galena ore. The excitement so foolishly worked up at Nelson concerning the finding of small quantities of metals of the platinum group in gold-quartz ore from the Granite-Poorman mines, fortunately has been squelched before much harm could be done. The Granby Company has closed its copper mines at Phoenix and smelting works at Grand Forks, pending a resumption of coke-making at the Crow's Nest Pass Coal Company's ovens; the British Columbia Copper Company continues to import coke from Pennsylvania, so as to keep its copper furnaces in blast. The latter company has resumed work at the Emma mine, in Boundary district, an arrangement having been made with the other co-owners that will admit of the mine being worked, which was not practicable during several years while the joint owners failed to agree in regard to terms and conditions under which work should be carried on. It is reported that New York capitalists largely interested in the B. C. Coper Company, have arranged to prospect the Voigt group of claims, in Similkameen district (a description of which large property was printed in the Canadian Mining Journal of August 1), under a bond with right to purchase. The Princeton Coal and Land Company is stated to be mining about 100 tons of coal daily; the putting in of necessary coal-cleaning plant is reported to have been authorized by the directors in England, so the outlook for the mine is thereby much improved. Development of coal properties in Nicola Valley district is being actively prosecuted. The Nicola Valley Coal and Coke Company is adding plant and machinery and doing underground work, both adit-driving and diamond drilling, the whole involving a total outlay of $95,000 to $100,000. The Big Copper mine, in Boundary district, which had been idle several years, is being worked under a lease. The concentrating mill, aerial tramway, compressor plant, air line, and water flume for the Standard mine, Slocan Lake, are all about completed.

Slocan.—Much more interest is taken in Slocan district mines by residents in the city of Spokane, Washington, than in the coast cities of British Columbia. The headquarters of the respective managements of several of the more prominent mines are in the former city, and, too, less time is occupied in travelling between Spokanes and the mines than between the coast cities and Slocan. It follows, therefore, that more recent information concerning Slocan mines is obtainable in Spokane than is usually the case in Vancouver or Victoria. Accordingly, the Spokesman-Review, a widely circulated daily newspaper printed in Spokane, publishes more particulars of mining operations at some of the Slocan mines than do the British Columbia coast daily newspapers. Occasionally acknowledgment is made of the fact that Kootenay mining districts contribute substantially to the prosperity of Spokane, as was done on August 27, on which date the following was included in the Spokesman-Review's periodical survey of mining, written by Mr. H. W. C. Jackson, who several years ago was editor of the Rossland Miner, and secretary of the Associated Boards of Trade of Eastern British Columbia.

"There has been a notable increase in public interest both in mining investment and development enterprises during the last month in this city. This has been reflected to some extent by the transactions on the Spokane Stock Exchange, where material advances in price have been recorded in Lucky Jim, Rambler-Cariboo, and other mining stocks. On the curb dealings have been quite heavy in the shares of the Rambler-Cariboo Extension, and McAllister Mines Company, both of which are new development enterprises. . . . Old citizens of Spokane will remember that at various times in the city's history, when business was dull and things apparently at a standstill, new life was injected into the community by the activities of tributary mining camps. The Coeur d'Alenes three different times have contributed largely to a return or increase in the prosperity of the city. The Slocan, Rossland, and Boundary districts of British Columbia and the camp of Republic each has helped in the same way on at least one notable occasion. At none of these crises in the city's history, when mining rescued the community from business depression, were conditions so good in tributary mining camps as they are at present. Never before had so much new wealth been put into sight and rendered available for the employment of labour and remuneration of capital, yet little benefit has so far been derived from recent developments because capital has been indifferent and failed to take advantage of the opportunities offered. . . . The Slocan country has come to the front with a class of producers of much larger calibre than that district has heretofore been credited with. The Standard and Rambler-Cariboo silver-lead mines, and the Lucky Jim zinc mine, are

admitted to be very large tonnage propositions, at the same time that their product is recognized as being of unusually high grade. The Van-Roi is already producing on a large scale, and the Slocan Star, Utica, and other properties soon will be.''

Mr. Jackson did not exhaust the list by any means, but he wrote sufficient to direct attention to the fact that the outlook for mining in the Slocan district is distinctly satisfactory so far as concerns the producing capacity of a number of mines. The chief encouraging feature is that there is now more activity in mining in the district than in several past years, and that it is gradually extending. There does not appear to be room for doubt that there will be a substantial increase in the quantities of commercial metals—silver, lead, zinc, and a little lode gold—that will be taken from Slocan mines in the near future, in some measure this year and to a greater degree in following years.

Coast.—Seldom has mention been made in coast newspapers during recent months of the operations of the Britannia Company, which is employing a comparatively large number of men at its copper mines, situated near Howe Sound, in New Westminster mining division. It is understood, nevertheless, that the prospects of this large property are better now than for several years and that, consequently, further development on a large scale may be looked for. Metal mining in Texada Island is not as important just now as it was some time since, yet work is being continued in several mines. On Vancouver Island there is practically no productive metal mining at present; on the other hand, coal mining is flourishing, with operations expanding and production giving promise of proving larger than ever before. In Portland Canal district, two mines are shipping, namely the Portland Canal, which is sending out concentrates, containing value in gold, silver, and lead, and the Red Cliff, in which a body of copper-gold ore is being developed. Both mines are shipping to the Tyee Copper Company's smeltery at Ladysmith, Vancouver Island. The operations of the Granby Company at the Hidden Creek mine, on Observatory Inlet, are narrated in a separate contribution to the Canadian Mining Journal. Prospecting mineral claims in the Skeena country—both silver-lead in the vicinity of Hazelton, and coal in other parts of the district—is in progress. On Queen Charlotte Islands some metalliferous claims are being developed, and drilling for oil is also being done, but the chief interest in that part of the province is in prospecting coal measures occurring on Graham Island of the group. Little information comes from Atlin, but on several comparatively large hydarulic placer-gold mines, full advantage is being taken of the open season, and the expectation is the quantity of gold recovered this year will compare favourably with the yield of any of several recent years. In various other parts of the Coast district prospecting is being done, but as a rule there is not any production on a commercial scale.

GENERAL MINING NEWS.

NOVA SCOTIA.

Sydney, Sept. 1.—President Plummer, General Manager Butler, and Assistant General Manager McDougall, of the Dominion Coal Company, left last night for Wallace, N.S. The company proposes building shipping piers at Wallace or Pugwash for their output from the Springhill mines, which is now shipped from Parrsboro.

Mr. Plummer said last night that a choice between the two ports had not been made as yet. The adoption of a new port, said Mr. Plummer, would be a sequel to an increased output of coal from Springhill.

This is a striking indication that the Coal Company is not very much afraid of reciprocity decreasing its market.

Dominion Steel plant had a good month in all its departments, open hearth turned out over 27,000 tons. Its record was 28,000tons until two months ago, when a mark of 31,000 tons was reached. The Rail plant turned out 15,000 tons during August.

Yesterday the Dominion Coal Company hoisted 16,689 tons of coal. This is the biggest day's output in the history of the company. The output for the month of August, which closed to-day, will be approximately 387,000 tons. This also is a new record, the biggest previous month's output being that of July, which was 16,000 tons less.

The company has also a third record to announce to-dday, the output for the eight months to the last of August being 2,649,000 tons, or 40,000 tons better than the output for the same period in 1908, the best previous year.

Had the month not been broken with an idle day the output would have reached the 40,000; as it was the month's production was at that rate.

The month's output at the company's mines at Springhill was 30,000 tons, the best month's production in two years. If the Springhill output is included the company's total for the month will amount to 417,000 tons.

ONTARIO.

Cobalt.—While cross-cutting west to make connections with the main shaft at the 575-foot level of the Temiskaming mine the drills cut a large vein, which recent developments may prove to be one of the best on the property. The vein was located only ten feet from the shaft, and from all appearances is an entirely new ore body unless it has maulted from tne of ohe upper levels. It shows a width of from one foot to two and a half feet, and in places carries exceptionally high-grade ore. However, it is very patchy, and in places will run as high as 5,000 ounces to the ton, while in other places it will be much lower. As only 15 feet of drifting has been accomplished on the vein it is hard to estimate just what possibilities the vein offers, but should a persistent ore shoot be encountered it will be one of the largest producers on the property.

With the addition of ten more stamps about a month ago, the concentrator is now treating between 125 and 130 tons of ore daily. This, with high-grade being bagged underground, brings the Temiskaming shipments well up to two and three cars of high-grade a month. Fifteen large drills are working underground, while there is a force of 175 to 200 men on the payroll.

Cobalt, Sept. 6.—More bullion left the camp yesterday afternoon, this time the O'Brien and Drummond being the shippers. The O'Brien sent out 18 bars of the refined silver, containing 16,553 ounces, and valued at $8,773, to Mocatta & Goldsmid, London, England. The Drummond shipment consisted of two bars sent out by Campbell & Deyell's sampling works. It was consigned across the water and leaves with the O'Brien consignment on the Empress of Britain on the 8th. The two

bars were worth $681 and contained 1,288 ounces of silver. To-day a one-bar consignment from Campbell & Deyell sent out for the Wettlaufer mine of South Lorrain, goes to Bridgeport, Conn.

Porcupine, Sept. 5.—The Messrs. Drummond, of Montreal, who recently acquired control of the Jupiter property, have been in the camp inspecting the property, and have placed an order for a compressor. Two shafts on the Jupiter are down 100 feet, and cross-cutting for the veins has begun. At the 50-foot level considerable development has been done, with satisfactory results.

Porcupine, Sept. 5.—The directors of Crown Charter Mining Company have decided to go ahead with active development work on Davidson claim. They recently acquired this property, and, under advice of Engineer Lamb, they determined to push development work.

BRITISH COLUMBIA.

Ymir, B.C.—The operators of the Sterling mine have just encountered over four feet of high grade ore, showing some galena, having got in under the rich showing exposed on the surface. The vein on the Jennie Bell has been found in place and rich ore encountered, containing some galena. A recent assay gave $119.50 over all, $57 of which was in gold.

Joe. Kileen, J. B. Bremner and wife have kept the development work going along ever since the rich discovery was made and they say that ore will be sent down Wild Horse Creek as soon as the winter sets in from the Jennie Bell.

A. E. Rand, C. W. Riley, E. Nelson Fell, M.E., and other mining men of note paid the Dundee mine a visit of inspection last week and expressed themselves as well pleased.

The formations of this camp are attracting the attention of mining men and all agree that it is only a matter of time before the locality will be dotted with producing mines.

Nelson, Sept. 4.—At midnight Saturday night the huge plant of the Hill Mines Smelter, covering thirteen acres of ground, worth $750,000, and one of the largest plants of its kind in Canada, was a mass of blazing, crackling ruins. Nothing is saved except the seven miles of rail running from the smelter to the Silver King mine on Lode Mountain, the tall, blackened chimneys, and one storey buildings used as an office. Everything else, the huge smelters, the tramway terminal and dump, the assay office, the bridge house and numerous smaller buildings, are a tangle of blacking timber and twisted iron.

The disaster is the work of an incendiary, who for the past two weeks has started a dozen fires, three of which have entailedd enormous loss. On Friday night Nelson Brewery was burned to the ground with a loss of $50,000.

At noon a watchman discovered a fire in the smelter, which he thoroughly quenched, and had arranged for extra guards. At nine o'clock, just after he had hade his rounds of the buildings, fire broke out, and within a few minutes the plant was a blazing furnace, by midnight the entire plant was practically consumed. Nothing could be done to save the building.

From the assay office a few valuable chemicals were saved. The furniture in the buildings used as residences and stored in other buildings, was carried out by hundreds of willing hands, and saved. All else went up in smoke.

The Hill Mines Smelter was formerly used to treat the ores of the Silver King and other famous properties on Lake Mountain, Morning Mountain, and adjacent territory, and employed hundreds of men. It had been operated for the past five years, but a Vancouver syndicate, promoted by R. S. Lunncof, Vancouver, has lately effected a consolidation of the Lake Mountain properties, acquiring the mines and smelter. The last payment on the properties was made only last week. The smelter was insured for $50,000. There is no clue to the incendiary.

Vancouver.—The Granville Mining Company, capitalized at $8,000,000, is a new merger of Klondike properties just organized by A. N. C. Treadgold. Mr. Treadgold has just spent six months in London and New York in connection with the flotation of the big enterprise of which he is head. He says all the capital required for placing it on a sound basis is secured. The holdings have been transferred to the new corporation, which will operate on a large scale as soon as the equipment of dredges and hydraulic plants can be got on the ground and long ditches built. Included in the power plant on the north fork of the Klondike River, supplying electric power to operate dredges and plants on various creeks, also the large area of claims owned by the Dominion Mining Company, Limited, and the Treadgold holdings of placer claims on Dominion, Quartz, Flat, Hunker, and Sulphur Creeks, whence millions of dollars worth of placer gold were extracted in the early days. The claims of the Klondike Mining Company, known as the Boyle concession and embracing over ten miles of the richest dredging ground, may be included in the big merger. The total area transferred to the new company will approximate several hundred square miles. Both dredging and hydraulicking methods will be employed. Mr. Treadgold has sailed for Skagway, accompanied by H. Orr-Ewing, a London capitalist, who was associated with him in the ownership of the original Treadgold concession.

YUKON.

Dawson City.—Mining activity is general in the districts tributary to Dawson, and favourable reports are being returned from all bona fide operators. This is the substance of a lengthy report just received at the offices of the White Pass & Yukon route from their accredited agents in the north. It is rumoured in mining circles, the report states, that the properties at present controlled by the Treadgold interests are to be acquired for a wealthy South African mining company. This report can not be confirmed at this time, but material is on the ground for the construction of an electric power line to the properties from the Granville Power Company plant, and plans are under way for the renewal of mining activity in that district.

The Granville Power Company has material at hand for the installation of a second unit of power, a work that will be completed at once. The company is at present supplying power to the Canadian-Klondike Mining Company, which is operating two dredges successfully.

The Yukon Gold Company is operating a full complement of dredges and hydraulic plants and making regular shipments of bullion. The management has 150 men at work constructing the two steel dredges shipped this year, that, when completed, will be installed, one on Bonanza Creek, and the other on Eldorado. This company is making a very interesting experiment with coal as a substitute for wood fuel for the thawing of the earth covering the ore bodies.

The wood supply is becoming scarcer each year, and as they use nearly 15,000 cords of wood annually, they plan to resort to coal in future, as they can obtain a good quality in the district and find it much more easy to handle than wood.

A stampede was made recently to the lang along Britannia Creek, on the main Yukon River, a few miles from Coffee Creek. More or less actual work has been done and the verdict is that claims in that district will pay, not heavily, but better than a wage proposition for common hand mining. It is stated that with machinery or a dredging outfit the return would be large. Another stampede was made a short time ago to Mc-

Millan River, a tributary of the Pelly, but the ore is low grade, and will hardly pay the expense of working.

Nanson Creek district sends in good reports, although a small paying proposition. This district is near Carmacks, and one or two concerns with machinery are doing well.

In the Forty-mile district the Milvain people are operating two dredges very successfully. The Consolidated Gold Dredge Company has one dredge on Forty-mile River that sank this spring. The company is having some difficulty in raising it, but expect to do some work before the season closes.

The Northern Light, Power and Coal Company has closed its plant at Coal Creek and reduced the working force from 150 to 10 or 15 miners. They are getting out some coal that is being towed to Dawson by their steamer Lightning, and disposed of in that city at their local electric lighting plant, and to such other companies as they have contracted to supply.

COMPANY NOTES

WETTLAUFER DIVIDEND.

At a meeting of the Wettlaufer Lorrain Silver Mines, Ltd., the regular dividend of 2½ per cent., with 2½ per cent. extra was declared payable October 20, to stockholders of record October 10.

Several important pieces of development and construction work were decided on at the meeting. Among these were the sinking of the main shaft to the sixth level and the drifting on that level for the purpose of exploring the ore bodies in depth; the erection of a picking and jigging plant for the plant for the purpose of sorting the ore and treating the low grade material; and the construction of a house and suitable quarters for the manager.

NIPISSING BULLION.

Nipissing made another shipment of bullion last week to New York, consisting of 47 bars, containing 50,462 ounces of silver. The shipment was valued at $26,366.

LA ROSE PRODUCTION.

The following table shows the operations of the La Rose Company by months since January 1st last:

	Production, ounces.	Gross value.	Operating profit.
January	318,187	$166,468	$118,497
February	307,661	158,135	108,891
March	.....	.....	98,873
April	289,895	155,548	101,325
May	314,543	167,195	103,745
June	310,524	162,816	104,683
July	.....	172,881	105,121

MILLERETTE SHIPMENT.

An ore shipment aggregating 41,600 pounds was sent out by the Millerette mine at Gowganda last week. The consignment was shipped via Latchford and the T. & N. O.

T. & H. B. DIVIDEND.

The Temiskaming and Hudson Bay Company has just declared one of its customary dividends of 300 per cent., payable August 31. This is the fourth of the kind this year, and the third in three months. The dividend makes the 32nd that the company has declared since its inception, and means a total of 18,400 per cent., or a total of $1,428,024.

Shareholders have received d$184 a share in dividends to date.

BIG PRODUCERS OF COPPER.

For years the Calumet & Hecla was the premier copper mine of the world, both from the viewpoint of production and dividends, but having reached the limit in point of production, other mines have, within the past few years, surpassed it in both production and dividend rate, leaving the Calumet & Hecla in fourth instead of first place. The Utah Copper Company, which was an undeveloped prospect six years ago, today leads the world's copper mines in amount of dividends paid. The record of the five leading producers follows:

Company.	Production. 1910	Dividends Paid, 1910.
Phelps-Dodge & Co.	116,688,000	$4,500,000
Utah Copper Co.	84,502,475	4,619,000
Amalgamated	233,808,546	3,065,750
Nevada Con.	62,772,342	2,988,917
Calumet & Hecla	71,509,261	2,800,000

The production of the Phelps-Dodge Company comes from three mines, at Bisbee and Morenci, Arizona, and Nacozari, Mexico, while the production of Amalgamated comes from a dozen different properties on Butte Hill.

STATISTICS AND RETURNS

COBALT ORE SHIPMENTS.

Following are the shipments from the Cobalt camp for the week ending Sept. 1, and those from Jan. 1 to date:

	Sept. 1. Ore in lbs.	Since Jan. 1. Ore in lbs.
Badger		55,200
Bailey		40,000
Barber	.....	6,000
Beaver	62,200	1,340,673
Buffalo	60,750	1,861,004
Chambers-Ferland	64,000	950,000
City of Cobalt	.....	557,980
Cobalt Lake	60,300	2,757,306
Cobalt Townsite	.....	719,280

	.....	135,410
Colonial	168,690	2,829,044
Coniagas		1,733,529
Crown Reserve	.....	290,000
Drummond	.....	60,000
Green-Meehan	60,000	161,100
Hargraves	.....	1,066,340
Hudson Bay	124,350	1,867,089
Kerr Lake	61,504	40,000
King Edward	.....	4,884,928
La Rose	207,650	4,271,779
McKinley Darragh	243,915	4,271,778
Nipissing	63,400	938,358
O'Brien	.....	47,000
O'Brien, M. J.	.....	58,430
Peterson Lake, Little Nip ...	.....	151,950
Provincial	50,280	890,335
Right of Way	.....	160,680
Silver Cliff	.....	102,813
Standard	.....	1,181,892
Temiskaming	.....	834,420
Trethewey	.....	117,232
Wettlaufer	.....	

The shipments for the week were 1,227,039 pounds, or 613 tons.

The shipments from January 1 to September 1 were 34,326,430 pounds, or 17,163 tons.

B. C. ORE SHIPMENTS.

The ore shipments for the week ending August 26 totalled 17,519 tons, and for the year to date 1,273,845 tons. The smelter receipts for the same period were respectively 15,071 tons and 1,184,011 tons. The returns to date are:

Slocan-Kootenay Shipments.

Sullivan	689	12,188
St. Eugene, milled	420	18,936
Richmond-Eureka	29	1,602
Ferguson	31	352
Ruth	34	385
Queen, milled	420	14,070
Granite-Poorman, milled	250	8,510
Nugget, milled	110	3,740
Emerald	66	1,318
Knob Hill	203	2,813
Van-Roi, milled	800	25,040
Molly Gibson, milled	300	1,800
Other mines	.....	8,623
Total	3,352	99,377

Rossland Shipments.

Centre Star	4,147	132,078
Le Roi No. 2	730	18,550
Le Roi No. 2, milled	300	10,200
Le Roi	491	9,751
Other mines	.....	448
Total	5,668	171,027

Boundary Shipments.

Mother Lode	4,480	202,695
Rawhide	3,201	134,180
Jack Pot	346	19,255
Athelstan	129	4,843
Napoleon	343	6,670
Other mines	.....	635,798
Total	8,499	1,003,441

Consolidated Company's Receipts.
Trail, B.C.

Knob Hill	203	2,813
Van Roi	127	835
Centre Star	4,147	132,078
Sullivan	689	12,188
Le Roi No. 2	730	18,550
Le Roi	491	9,751
Richmond-Eureka	29	1,602
St. Eugene	25	4,218
Ferguson	31	352
Ruth	34	385
Emerald	66	1,318
Other mines	.....	36,247
Total	6,572	220,337

B. C. Copper Co.'s Receipts.
Greenwood, B.C.

Mother Lode	4,480	202,695
Rawhide	3,201	134,180
Jack Pot	346	19,255
Athelstan	129	4,843
Napoleon	343	6,670
Other mines	.....	5,618
Total	8,499	373,261

Silver Prices.

	New York. cents.	London. pence.
Aug. 26	52¼	24⅛
" 28	52⅛	24 1/16
" 29	52¼	24⅛
" 30	52¼	24⅛
" 31	52¼	24⅛
Sept. 1	52⅜	24 3/16
Sept. 2	52½	24¼
Sept. 4	..	24 3/16
Sept. 5	52⅜	24 3/16
Sept. 6	52⅜	24 3/16

NEW YORK METAL MARKETS.

Sept. 11th:—

Tin, Straits, 41.50 cents.
Copper, Prime Lake, 12.62½ cents.
Electrolytic Copper, 12.45 Cents.
Copper wire, 13.75 cents.
Lead, 4.55 cents.
Spelter, 6.05 cents.
Sheet zinc (f.o.b. smelter), 8.00 cents.
Antimony, Cookson's, 8.25 cents.
Aluminium, 19.75 to 20 cents.
Nickel, 40 to 45 cents.
Platinum, $46.50 per ounce.
Bismuth, $1.80 to $2 per lb.
Quicksilver, $47.50 per 75-lb. flask.

MINERAL MARKETS.

Acids—

Muriatic, 20°, tank cars, $1.15 to $1.50 per 100 lbs.
Nitric, 36° to 42°, $0.04 to $0.05 per lb.
Sulphuric, 66°, $0.01¾ per lb.

Chrome ore, 50 per cent., ton of 2,240 lbs, $15.

Fire Clay, $5.50 per short ton.
Fluorspar, lump, $8.50 per long ton.
Fluorspar, ground, $11 to $15 per long ton.
Graphite, lump, 4 cents to 9 cents per lb.
Gypsum, short ton ground, $4.30 to $7.50 per ton.
Magnesite, crude, 95 per cent., $7 to $9.25 per long ton.
Molybdenite, commercially pure, 25 to 30 cents per lb.
Pyrite, lump, arsenic free, 10 to 12½ cents per unit.
Pyrite, fines, arsenic free, 9 to 10½ cents per unit.
Tungsten ore, 50 per cent., $7.50 per unit.

LAKE IRON ORE SHIPMENTS.

Following are the iron ore shipments from upper lake ports as reported from month to month, with revised totals of the season movement, together with the all-rail movement by years, this not being compiled monthly, the grand totals of movement out of the region and the lake movement to September 1st. Based on the average of shipments during the preceding four years, the shipments through August indicate a total movement this season, by lake and all rail, of about 33,000,000 gross tons.

	1908	1909	1910	1911
April		55,794	1,520,305	331,645
May	285,315	3,253,275	6,081,358	3,684,819
June	2,585,682	5,393,255	7,316,592	4,826,505
July	4,364,283	6,693,025	6,945,289	5,221,373
August	4,749,655	7,193,199	6,964,381	5,548,311
September	4,646,024	7,050,985	6,273,832	
October	5,099,110	6,625,801	4,877,441	
November	3,618,095	4,899,220	2,641,886	
December	78,924	519,525		
Season, Lake	25,427,094	41,683,599	42,628,758	
Season, All-rail	587,893	903,270	813,639	
Grand total	26,014,987	42,586,869	43,442,397	
To Sept. 1st	11,984,936	22,588,549	28,827,029	19,606,068

Cobalt Stocks.

	Bidd.	Ask.
Bailey	.02¾	.03
Beaver Consolidated	.44½	.45½
Buffalo	1.60	2.00
Chambers-Ferland	.09¼	.11
City of Cobalt	.09¼	.10
Cobalt Central	off	.01
Cobalt Lake	.25	.25½
Coniagas	off	6.20
Crown Reserve	2.85	2.92
Great Northern	.11¼	.12
Green Meehan	.01⅝	.01¾
Hargraves	off	.09
Kerr Lake	3.95	4.10
La Rose	4.05	4.15
Little Nipissing	.03	.04
McKinley, x.d. 10 per cent.	1.54	1.58
Nipissing	7.95	8.10
Nova Scotia	.10	.12
Peterson Lake	.06	.07½
Right of Way	.05	.06½
Rochester	.03⅜	.03½
Silver Leaf	.02¾	.03¼
Temiskaming	36¼	.37
Trethewey	off	.75
Wettlaufer	.87	.90

Porcupines.

Apex	.15	.17
Coronation	.06½	.08
Dobie	.95	...
Northern Exploration	3.75	...
Dome Extension	.64	.64½
Eldorado	.11	.13
Foley-O'Brien	.98	1.00
Gold Reef	.18	.20
Hollinger	10.37½	10.50
Porc. Canada	.85	.95
Porc. Central	.85	.86
Porc. Imperial	.10½	.11
Porc. Northern	.64	.65
Porc. Tisdale	.05½	.10
Preston	.25	.25½
Rea	3.25	3.17
Swastika	.31	.31½
United	off	.03¼
Porc. Gold	.44	.44½
West Dome	off	1.35
North Dome	2.00	2.50

New York Curb.

Braden	4½	4¾
B. C. Copper	3¾	4
Butte Coalition	14½	15½
Ely Cent.	..	..
Ely Cons.	⅜	½
First National Copper	1	1 1/16
Giroux	4	4 1/16
Green-Can.	6	6¼
Inspiration	6½	6¾
Nevada Hills	2⅞	3
Ohio Copper	1½	1 9/16
Ray Central	1 3/16	1 5/16
Union Mines	¼	⅜
Yukon Gold	3 11/16	3 13/16
Goldfields Cons.	5½	5¾
Nevada Cons.	17⅜	17½
Miami	19	19⅛
Granby	28	29
Con. Min. & Smelt.	38	43
Davis-Daly	⅞	1
Con. Arizona	9/16	11/16
Rawhide Coal.	.04½	.05½
Ray Cons.	13⅞	14
Chino	19	19⅛
New Baltic	4⅞	5¼
United Copper	1¼	1¾