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CANADIAN MINING JOURNAL

VOL. XXXVI TORONTO No. 7

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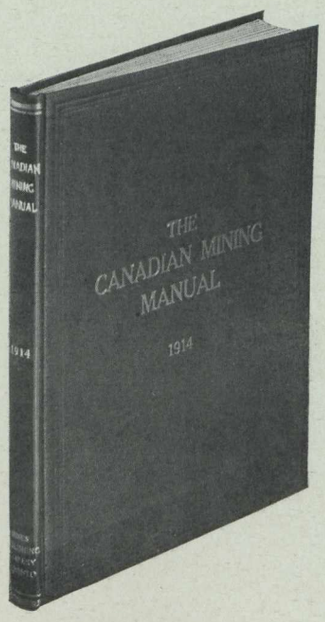
THE CANADIAN MINING MANUAL 1914



This is a handbook of information concerning the mining industry in Canada.

The first part of the book gives general information concerning the chief minerals produced in the Dominion, and reviews by provinces.

The second part "Mining companies operating in Canada," gives useful information concerning location and character of properties, capitalization, officers, results of operations, etc. Companies are listed alphabetically and also according to product.

The book of 280 pages is well illustrated, printed on good paper, and bound in cloth. The price is $2.00 post paid. Shall we send you a copy?

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Ontario's Mining Lands

There are many millions of acres in Eastern, Northern, and Northwestern Ontario where the geological formations are favorable for the occurrence of minerals, the pre-Cambrian series being pre-eminently the metal-bearing rocks of America.

The phenomenally rich silver mines of Cobalt occur in these rocks; so also do the far-famed nickel-copper deposits of Sudbury, the gold of Porcupine and Kirkland Lake, and the iron ore of Helen, Magpie, and Moose Mountain.

Many other varieties of useful minerals are found in Ontario:—cobalt, arsenic, iron pyrites, mica, graphite, corundum, talc, gypsum, salt, petroleum, and natural gas.

Building materials, such as brick, lime, stone, cement, sand and gravel, are abundant.

The output of the mines and metallurgical works of Ontario for the year 1913 was valued at $53,232,311. Ontario has the largest mineral production of any of the Provinces.

The prospector can go almost anywhere in the mineral regions in his canoe; the climate is invigorating and healthy, and there is plenty of wood and good water.

A miner's license costs $5.00 per annum, and entitles the holder to stake out three claims a year in every mining division.

For maps, reports of the Bureau of Mines, and mining laws, apply to

HON. G. H. FERGUSON,
Minister of Lands, Forests and Mines,
Toronto, Canada.

THE CANADIAN MINING JOURNAL

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The Canadian Mining Journal

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CONTENTS.

THE WORKING OF SMALL ORE DEPOSITS

In view of the number of gold deposits discovered in Northern Ontario during the past decade it is surprising that there are so few deposits being worked. Ontario, chiefly owing to the Hollinger, Dome, Acme, McIntyre and Porcupine Crown mining companies, has become a large producer of gold; but the number of mines producing is small.

There was produced in Ontario during 1914, according to the preliminary report of the Deputy Minister of Mines, Mr. T. W. Gibson, 268,942 ounces of gold, having a value of $5,529,767. Eight mines at Porcupine, and four in other parts of the Province contributed to the total. The producers were Hollinger, Dome, Porcupine Crown, McIntyre, Acme, Rea, Porcupine Pet, Porcupine Vipond, Canadian Exploration Co., Tough-Oakes, La Mine D'Or Huronia and Cordova.

The showing made by these twelve mines is a very good one and it is expected that during the present year production will be increased. It is quite certain that some of these mines will be large producers for years and that large profits will be made from their operation. Gold mining has become one of Northern Ontario's many successful industries.

But while these few companies are operating so successfully there is not the interest in the development of prospects that such results warrant. Many gold quartz veins have been found; but few of them worked. The prospects that have not fallen into the hands of companies with large resources are idle. The prospector has been told that it takes millions to make a gold mine. He has seen cases where failure has resulted from lack of capital, and he has lost hope of developing his claims himself or of having them developed by companies that are organized on a modest scale and in which he might expect to retain a considerable interest. Being without funds and unable to interest small investors, he is forced to forego his desire to work his property.

This condition of affairs is not unusual; but it need not necessarily be accepted as inevitable. Lack of public interest in mining ventures can be attributed to many causes; but the prospector is not often to blame. We know that many investors have failed to take up claims because of unreasonable terms demanded by prospectors. The real trouble in many cases, however, is that the prospector is not dealing with men who want small mines, but with men who want to develop large deposits and who want complete control. In the case of large mines control must naturally be in strong hands. But the working of small deposits in a small way, should be encouraged.

In this issue Mr. Geo. R. Rogers points out how the owners of small gold deposits in Australia were enabled to work their properties. The State Batteries unquestionably stimulated mining there and might do the same here. Increased production is demanded these days of Canada and the Empire. We will be pleased to have our readers state how in their opinion the development of properties might be encouraged.

NOVA SCOTIA METAL MINING IN 1914

The report of the Inspector of Mines of Nova Scotia for the year ending Sept. 30th, 1914, in addition to the usual statistical information, contains interesting notes by Mr. W. H. Prest on the metalliferous mines of the Province.

There was milled during the year 13,156 tons of gold ore, yielding 3,158 oz. gold. Of this Guysboro county produced 1,604 oz., Halifax, 1,245 oz., Queens, 44 oz., and Victoria 262 oz. The operators of producing mines were Donaldson Reeve, John and Alex. Greenough, Loon Brook Mining Company, Petpeswick Mining Company, Caribou Gold Mines, Ltd., George Cameron, Dominion Mining Company, Goldenville Mining Company, Stormont Mining Company, D. McAskill, Switzer Mining Company, Stillwater Mining Company, and Bras D'Or Mining Company. In addition to these operators several others did prospecting and development work during the year.

The antimony mine at West Gore was pumped out. The tin and tungsten deposits at New Ross were neglected. The manganese mines were idle.

The Nova Scotia Mines Department revenue for the year was $760,561.39, of which the royalty on coal amounted to $704,188.94. A review of the Coal Trade of Nova Scotia, by Mr. F. W. Gray, was published in our Jan. 15 issue.

NON-METALLIC MINERALS USED BY MANUFACTURERS

A very interesting account of the utilization of non-metallic minerals in manufacturing industries, written by Mr. Howells Frechette, has just been published by the Mines Branch, Ottawa. Mr. Frechette was commissioned by the Mines Branch to visit manufacturers throughout the Dominion, with instructions to obtain from them as much information as possible regarding the non-metallic minerals used by them. This work has resulted in the gathering of very valuable data. Mr. Frechette's report is an important contribution to our knowledge of the uses of the non-metallic minerals, and is full of suggestions for the guidance of those who are engaged in their production and utilization. Extracts from the report will be found on another page.

NOTES

Anaconda Copper Mining Co. will spend $6,000,000 in plant improvements and betterments at Anaconda, Great Falls and Raritan. Anaconda is making great changes in methods of treating copper ores.

The Canadian Mining and Exploration Company reports that during 1914 a large number of investigations were made and that of the properties examined several had merit and would justify exploration. Favorable terms were not obtained, however, and no business was concluded that justified a call upon the shareholders for subscriptions.

The appointment of Mr. J. R. DeLamar to succeed Mr. Ambrose Monell as president of Dome Mines, seems to be popular with the traders.

According to a despatch from Vancouver, fifty miners were killed and as many more injured on March 22, by a snowslide which swept away several houses at Britannia Beach, Howe Sound, B.C. Details of the disaster have not yet reached us. The sympathy of miners everywhere will be with the families of these unfortunate men.

The annual report of McKinley-Darragh-Savage Mines of Cobalt, Ltd., shows that during 1914, 1,660,076 oz. silver was produced. The new ore developed is expected to yield 582,896 oz. The decrease in reserves is therefore 1,077,180 oz.

Seneca-Superior reports for 1914 an increase in profits over 1913. Considerable new ore was opened up; but the ore between the third and fourth levels proved to be lower grade than expected.

The Temiskaming Mining Company's eighth annual report is an optimistic one. The results of development during the past few months have been very good.

MR. G. G. S. LINDSEY LEAVES FOR CHINA.

A meeting of the Toronto branch of the Canadian Mining Institute was held on Monday, Mar. 22, to bid farewell to Mr. Lindsey, president of the Institute, who is now on his way to China. Mr. Lindsey returned from London on Friday, March 19th, and after a few days in Toronto started on his long trip to Pekin. He is accompanied by Mrs. Lindsey and their younger son. Mr. Charles Lindsey goes to the front with the second Canadian contingent.

The sentiments of members of the local branch were voiced by Chairman A. J. Young, Mr. T. W. Gibson, Dr. W. A. Parks, Professor H. E. T. Haultain, and Lieut. B. A. C. Craig. Mr. Lindsey in thanking the members for their good wishes scolded the Council for not accepting his resignation as president of the Institute. He threatens to insist on his resignation being accepted if his sojourn in China seems likely to prove a long one.

That Mr. Lindsey will be successful on his important mission is the wish and the confident feeling of the men who know him.

SHOULD ONTARIO HAVE GOVERNMENT BATTERIES?

By Geo. R. Rogers.

Of the various causes to which the decline in prospecting can be attributed perhaps the chief of those within human control is the lack of sufficient capital to develop the many promising properties already acquired and held by the prospector. Considering the vast area of mineral lands and the large number of claims staked and in good standing, it is natural to conclude that the stimulation of prospecting is not the problem that is most urgently in need of immediate solution. What is needed now is the introduction of some scheme that will tend to stimulate mining.

The average prospector in Northern Ontario if approached on the subject of prospecting will tell you that he has more mining claims than he is financially able to take care of. He will tell you that although his prospect has merit, he cannot induce capitalists to take over the property and develop it. It is generally understood that the large financial houses will not undertake to develop small deposits. Consequently, a large number of small prospects that would become producers if capital could be found to work them are lying idle.

The conditions existing in Ontario at present are similar to those which existed in the State of Victoria twenty-five years ago. There were then in Victoria many properties held by prospectors and miners containing small, but rich veins, which were not large enough to attract the attention of the average investor.

It was believed by many that if the Government could be induced to erect a small plant at some point within a reasonable distance of these properties for the purpose of treating small quantities of ore for miners and prospectors it would be the means of adding considerably to the annual production and incidentally would stimulate prospecting. The Government of Victoria has always played a prominent part in fostering the mining industry. It did not require much agitation on the part of those interested to induce the Government to give the scheme a trial, with the result that in 1897 the first State battery was erected. The close of 1913 saw twenty-six State Batteries in operation in Victoria.

Good Results From Operation of State Batteries.

For ten years previous to the introduction of the State Battery scheme, the gold production of Victoria was sadly on the decline.

During a period of eleven years following the inauguration of the scheme there was an appreciable increase in the production.

The following year, 1898, the State Battery system was inaugurated in Western Australia. The number of State Batteries in existence in this State at the close of the year 1913 was 40. **From the inception of the scheme to the end of 1913 gold and tin to the value of twenty-one million dollars was added to the world's production.**

During the year 1913 the gold ore treated by State batteries amounted to 60.573 tons, which gave a return of 52,515.55 fine oz. of gold.

The working expenditure for plants during the year totalled $276,808.35 and the revenue $239,953.18, which after including the cost of new additions paid from revenue shows a loss of $38,558.20, on the year's operations.

The capital expenditure from the inception of the scheme was $1,161,885.70. The cost of administration is about $17,000 per year. The average cost of ore treatment is $3.25 per ton.

The following table shows the number of tons crushed, average per ton recovered by amalgamation, and value since the inception to the end of 1913.

Gold Ore Treated by Western Australia State Batteries.

Battery	Tons treated.	Gold Yield Bullion Oz.	Average Gold per ton Oz.	Value
Bamboo Creek	729.00	1,058.50	1.45	$19,050
Black Range	54,110.65	58,356.38	1.07	1,051,390
Boogardie	45,114.65	24,623.82	.54	450,195
Burtville	28,399.00	61,874.26	2.17	1,120,265
Coolgardie	55,896.75	47,670.47	.85	858,350
Darlot	32,955.25	37,446.99	1.00	691,185
Laverton	12,278.50	13,453.96	1.09	248,205
Leonora	50,219.45	52,607.89	1.04	964,340
Linden	12,644.25	13,237.29	1.04	238,270
Meekatharra	57,769.75	71,954.12	1.24	1,308,570
Menzies	54,574.25	44,199.67	.81	794,830
Marble Bar	6,076.00	7,284.15	1.19	131,110
Mt. Egerton	2,616.00	1,718.20	.66	27,260
Mt. Ida	35,674.90	49,896.16	1.40	914,640
Mt. Jackson	3,376.75	6,062.49	1.79	109,120
Mt. Keith	2,058.25	1,790.60	.87	32,230
Mt. Sir Samuel	6,839.25	5,298.40	.77	95,370
Mulline	72,424.70	94,240.85	1.26	1,692,235
Mulwarrie	29,116.40	33,842.36	1.16	625,445
Nannine	10,116.35	5,971.84	.59	107,490
Niagara	57,278.00	50,077.37	.87	912,330
Norseman	52,089.20	54,817.92	1.05	1,002,635
Ora Banda	2,841.00	1,126.72	.39	20,280
Payne's Find	5,252.50	6,199.55	1.18	111,590
Pig Well	16,666.50	16,712.53	1.00	300,830
Pinjin	16,820.15	12,743.68	.75	229,385
Quinn's	6,713.00	3,736.15	.55	67,250
20-Mile Sandy	9,187.90	16,310.02	1.77	294,080
Siberia	12,664.00	13,885.69	1.09	249,570
Wiluna	43,739.25	26,722.65	.61	481,730
Yarri	39,133.00	26,066.11	.66	469,190
Yerilla	11,318.50	10,882.40	.96	181,870
Youanme	18,897.00	7,464.69	.39	134,365
Lennonville	30,496.39	34,578.09	1.13	647,690
Tuckanarra	15,456.85	20,897.56	1.35	384,275
Widgiemooltha	5,711.00	2,413.43	.42	44,745
Ravelstone	11,993.80	11,482.32	.95	212,535
Batteries closed	31,740.80	22,859.76	.72	421,195
	960,989.44	971,565.24	1.01	17,644,095

The following table shows the number of **tons of tailings treated** since the inception to the end of 1913:

Battery.	Tons. treated.	Yield fine ozs.	Value.
Black Range	31,102	8,528.89	$179,715
Burtville	15,558¾	5,143.94	107,145
Coolgardie	27,144	4,647.69	97,285
Laverton	9,350	1,091.14	22,195
Leonora	32,368½	7,993.12	165,905
Linden	10,057	3,055.42	64,900

Meekatharra	34,190	7,019.82	146,000
Menzies	30,587½	7,891.04	165,375
Mulline	41,456	11,560.61	234,435
Mulwarrie	22,871½	4,391.24	990,065
Niagara	36,917	5,940.96	123,285
Norseman	36,206½	7,419.67	153,795
Pinjin	11,718	1,243.07	26,280
Sandy Creek	8,141¼	2,584.61	54,320
Siberia	5,550	1,201.56	25,525
Wiluna	14,349	6,156.62	130,270
Yarri	30,880	2,801.09	58,175
Yerilla	8,800	1,106.56	23,505
Youanmi	7,799	2,382.25	50,595
Mt. Sir Samuel	2,966	625.24	13,280
Payne's Find	2,805	350.92	7,500
Darlot	23,654	2,699.17	55,210
Lennonville	24,309	6,592.43	133,065
Mt. Ida	3,570	357,97	7,120
Nannine	3,650	410.12	8,710
Boogardie	29,432	7,702.28	160,930
Duketon	2,083½	250.51	5,130
Devon	261½	120.44	2,555
Southern Cross	3,471	452.75	9,075
Yundamindera	4,977	920.33	19,545
Randalls	791	56.05	1,125
Pig Well	11,379	2,373.25	49,810
	528,395	115,069.76	2,391,875

The following shows the number of **tons of slime treated** since inception to the end of 1913:

Battery.	Tons treated.	Yield fine ozs.	Value.
Mulline	21,348¾	6,833.05	$122,785
Black Range	13,040	2,604.59	55,320
Burtville	1,643	519.00	11,020
Menzies	21,905½	5,454.53	115,860
Meekatharra	1,980	462.78	9,830
Niagara	13,875	2,175.45	46,210
Sandy Creek	293½	75.00	1,590
Darlot	570	82.61	1,120
Linden	419	87.30	1,855
Leonora	12,440	2,198.09	46,695
Norseman	11,671	2,843.10	60,380
Laverton	273	45.24	960
Pig Well	340	64.65	1,370
Boogardie	1,218	284.63	6,045
Yerilla	424	44.55	954
Yarri	3,162	287.02	6,095
Wiluna	2,597	913.21	19,395
Siberia	345	104.47	2,220
	107.546¾	25,049.27	509,699

In addition to the above there was 64,919¾ tons of tin ore treated which produced tin to the value of $404,175.20.

My object in writing this article is for the purpose of inviting discussion. If the conditions in our Ontario gold fields warrant the introduction of the scheme and it could be operated to advantage, it should at least get a trial. I am of the opinion that it would stimulate mining, and it will be admitted that any scheme which will stimulate mining will incidentally stimulate prospecting.

CANADIAN MINING INSTITUTE—WESTERN BRANCH

The nineteenth general meeting of the Western Branch of The Canadian Mining Institute was held in Victoria, British Columbia, on March 11. Three sessions were held; in the absence of Mr. S. S. Fowler, chairman of the branch, who was in Ontario at the time, different members were called to preside over each session, Mr. W. M. Brewer having been in the chair at the morning session, Mr. Wm. Fleet Robertson at the afternoon session, and Mr. Thomas Graham at the evening session.

At the morning session Sir Richard McBride, Premier and Minister of Mines for British Columbia, delivered an address in which, after briefly commenting on the creditable showing the province made in its mineral production in 1914 notwithstanding the unfavorable conditions brought about by the outbreak of war in Europe, he referred to the preparation that had been made for increasing the production of coal at Vancouver Island coal mines, directed attention to the considerable advance in copper production in the Coast district of British Columbia with an output in 1914 of more than 24,000,000 lb. of copper as compared with 15,500,000 lb. in 1912, which was the highest previous yearly total, and then dwelt at some length on the important effect of railway construction on the mining industry of the province, giving as a striking example figures showing that a total of $460,000,000, which was the value of the mineral production of British Columbia for all years to the end of 1913, $253,000,000 or 55 per cent. was produced during the last ten years, that is to say the total production for the ten-year period 1904-1913, with adequate railway transportation facilities in the larger mining centres, was of greater value than for the fifty-two previous years, included in the official records. With that experience before them, it was quite reasonable to look for a further large increase in the mineral production of the province as a result of additional railway construction recently completed or approaching completion.

A brief review of mining in the province in 1914, together with an estimate of the value of the mineral production in that year, was submitted by Mr. W. F. Robertson, provincial mineralogist.

A paper by Mr. Thomas Graham, Chief Inspector of Mines, giving statistics of mine fatalities in the province in 1914, and a statement showing their causes, with some striking comment on the figures submitted and suggestions for bringing about improvement in avoiding preventable causes of accident and in the promotion of the "Safety First" movement, completed the morning programme.

The afternoon session was chiefly occupied with a discussion initiated by Mr. W. M. Brewer, who read a paper entitled "The Prospector and Prospecting," and who emphasized his view that co-operation between the prospector and the community living in the neighborhood where he is prospecting is one of the chief conditions essential to progress and success of the prospector in the mining industry of any country, and since there is to-day practically no such co-operation, the old-time prospector has disappeared.

Mr. Dudley Michel, instructor in First Aid to the Injured, on the staff of the Provincial Department of Mines, gave information concerning the work he was engaged in during seven months of 1914 in connection with giving first aid instruction to metalliferous min-

ers, and indicated the proposed policy of continuing the "Safety First" movement among the miners.

Mr. W. J. Elmendorf contributed some notes on the work done by the Portland Canal Tunnels, Ltd., in driving a long crosscut adit near Stewart, Portland Canal mining division.

At the evening session the programme was as follows: Notes on the Puntledge River Hydro-Electric Power Development in Comox district, Vancouver Island, of the Canadian Collieries (Dunsmuir), Limited, with lantern slide views, by Mr. E. Jacobs; paper on The Value of Efficiency Records in Colliery Management, by Mr. J. H. Cunningham, of Ladysmith, Vancouver island, manager of the Wellington mines, Extension; Notes on a New Method of Burning Coals, by Mr. H. N. Freeman, of Nanaimo, manager for the Vancouver-Nanaimo Coal Mining Co.; Notes on Reinforced Concrete Tipple and Head Frame at Morden, Vancouver island, by J. H. Tonkin, of Victoria, president of the Pacific Coast Coal Mines, Ltd., illustrated by lantern-slide views; notes and slides showing the tipple, Marcus screens, and power plant at the No. 8 mine of the Canadian Collieries (Dunsmuir), Ltd., in Comox district, Vancouver island; views of the Provincial Government Mine-Rescue Station at Nanaimo, and the Rescue Car of the Western Fuel Company at the same place; and a paper by Mr. George O'Brien, instructor at the Provincial Government Mine-Rescue Station at Fernie, Crowsnest district, B.C., entitled "Instruction, Organization, and Care of Rescue Parties Using Self-contained Breathing Apparatus in Mines After an Explosion and When Fighting Mine Fires."

In addition there was a short business session at which some branch matters were considered and disposed of. The several sessions were fairly well attended and interest in the proceedings was maintained throughout the meeting.

THE PANAMA CANAL.

Volume I. of the Transactions of the International Engineering Congress, 1915, will comprise a unique series of papers on the engineering of the Panama canal. The various topics and subdivisions of the work have been arranged by Colonel G. W. Goethals, Chief Engineer of the Canal, and now Governor of the Canal Zone. Colonel Goethals has also selected the author for the treatment of each paper, and he will himself contribute the introductory chapter. The various authors are in general the officers who were in direct charge of the actual work of construction, and the collection of papers thus becomes a first-hand account of the engineering of the Panama canal, written by the men who were in immediate and responsible charge of the undertaking.

There will be twenty-four papers in all, profusely illustrated, twenty-two of which deal with actual constructive and engineering problems connected with the work, one with the preliminary work in municipal engineering in the Canal Zone, and one with the commercial and trade aspects of the Canal.

This volume would in itself be a valuable acquisition for any person interested in the progress of the world's work, whether or not an engineer, and for any library, whether technical or not. It can be obtained only through enrollment in the Congress.

The transactions of the Congress as a whole will include from seven to nine other volumes, covering all important phases of engineering work.

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

GRANBY.

It is understood that January earnings of Granby Consolidated based on 14½ cent copper were close to $100,000.

January operations of the Grand Forks and Anyox smelters resulted in a production of 2,170,139 lbs. of copper against 1,616,556 lbs. in December and 2,706,595 lbs. in June, which is the highest yield from the two plants to date.

Detailed yield of the two smelters in January was as follows:

	Grand Forks.	Anyox.	Total.
Copper, lb. ..	775,786	1,394,353	2,170,139
Silver, oz. ...	12,223	19,053	31,276
Gold, oz.	2,019	506	2,525

By the middle of the current year Granby should have reached the maximum tonnage thus far planned for. This would entail full operations at the Grand Forks plant, three furnaces in blast at the Hidden Creek property and the inauguration of shipments from the Midas mine in Alaska, work upon which has been suspended for several months.

Dividends will probably not be considered before the April meeting of directors. The last disbursement was made in June, 1914, the amount being $1.50 per share.—Boston News Bureau.

The following is an excerpt from an article published in the Weekly Report of the Department of Trade and Commerce, Canada, on "Russian Trade Possibilities." Russia, commercially and industrially, is a vast reservoir as yet scarcely tapped, with an area of 8,647,657 square miles, and her population of more than 170,000,000 fast awakening to a new phase of civilization. Russia's wants are many and urgent, and she has to offer in exchange much for which the markets of the world crave. Her possibilities cannot be grasped at once, even by her own people. At present Russia is essentially an agricultural country, with vast tracts under exploitation, other regions mapped out ready for settlers, and yet more land practically unexplored. Siberia, until recently a closed region, is being opened as a fertile agricultural and pastoral country, where mining and other industries may also be organized. . . . In exchange for her metal ores we send her machinery, tools and manufactured metal goods. As regards raw materials, the chief timbers for export are pines, firs and oaks, with larch and cedar from Asia. Her minerals include gold, silver, copper, lead, mercury, asbestos, mica, coal and petroleum. Of platinum more than 90 per cent. of the world's consumption comes from the Urals. Mining still needs development, and is open to foreign capital, though there are certain reservations as regards the Amur and lands on the sea borders.

The many friends of Mr. and Mrs. J. B. Tyrrell will regret to learn of the death of Mrs. Tyrrell's mother, widow of the late Dr. G. M. Carey. Mrs. Carey died on Saturday, March 20th, in Ottawa.

THE INDUSTRIAL SERVICE MOVEMENT*

By J. Parke Channing.

These days of great industrial and social problems in America produce many suggested solutions and great changes. The practical engineer and employer of labor views these problems differently from the labor leader or the social reformer, but as never before he is sincerely interested in solving them in a way that will be just to all.

The inevitable tendency of the day is toward "industrial betterment," "safety," "industrial education," "efficiency," and the many other things which have become so familiar to progressive employers. There is no longer any question that these things are worth while from both the human and economic standpoints. They "pay" in dollars and cents.

The very center of final success in improving conditions and increasing the efficiency of workingmen must be the spirit of fairness and a knowledge on the part of the employer of how to deal sympathetically and intelligently with his employees. Every progressive employer knows how greatly he desires foremen, superintendents, managers and others who possess these qualities. On the other hand, we are all familiar with serious mistakes made by young graduates of engineering schools who have had no opportunity to develop these qualities, and who have no real appreciation of the worth of the workers. Indeed, one wonders whether much ill-feeling, labor difficulties, and many strikes could not be avoided if such men had the right attitude.

Is there any way of remedying this condition? If this particular difficulty can be solved, if these young engineers, many of whom are our coming leaders of industry, can be given the right perspective and the right understanding of these other problems in addition to fair, sympathetic methods of handling men, many of our other problems will be solved—not at once, but gradually and permanently, as these men make good and become influential in paths of industrial righteousness and industrial peace. Many progressive employers of to-day have enlarged their own perspective and realize the great importance of enlarging the perspective of those who shall follow them.

How can it be done? For seven years a movement has been making rapid progress in engineering schools with the purpose of helping to solve this very problem. It was started at Yale in 1907, by the Young Men's Christian Association, when some engineering students were led to get in touch with workingmen and boys in New Haven. The idea was to render service by teaching them English and other subjects and in turn to learn their ways, ideas, customs, and how to deal with them intelligently. Friendly, mutually helpful personal contact was the basic principle. This was the beginning. Do not confuse it with "social service"—it was this, and much more. The reaction on the engineer was the main object sought. The idea worked out so successfully that a number of men saw great possibilities in it, and the whole conception was greatly enlarged. Under the name of the Industrial Service Movement, it has spread to 200 other colleges and technical schools in the past seven years, and has justified itself from every point of view. It is really helping in a vital way to solve the special problem we have been discussing and other problems as well. It is to put it briefly:

Plan—Bringing engineering students and industrial workers together to their mutual understanding and their mutual good.

Purpose—To get workingmen educated and educated men to work. To send men out of college with a new sympathy, a new vision and a new determination to help.

Principle—Fraternity—not to go down to help others or to ask others to come up and be helped, but rather to go with them, not in any sentimental way, but in a spirit of common-sense brotherhood.

Method—Putting college students up against real opportunities for the kind of service which appeals to them, such as teaching foreigners English and citizenship; instructing American workingmen in technical subjects; leading clubs of working boys, etc. There is opportunity for every leader's peculiar ability to assert itself, in any way that is real. Other methods will be described later.

Accomplishment—During the past year 3,500 students from 200 colleges have engaged regularly in industrial service; 3,000 graduates are active in industrial betterment as a result of interest acquired while at college during the past seven years.

Leadership—The Young Men's Christian Association, through local branches, State committees and the industrial and student departments of the International Committee.

Co-operation—The movement works locally through the Young Men's Christian Associations and any other recognized agencies for industrial and social betterment in the community. Professors and students, employers and employees, engineers and social workers heartily co-operate.

Significance—Experience proves that men interested in this work at college go out into the larger world with a new vision and a new attitude and sense of responsibility. These men will largely determine whether conditions shall be good or bad and whether the human factor will be given fair consideration. How better can the problems of capital and labor be solved than by mutuality, good will, efficiency and character in business. The nation's hope is in the coming leaders who shall follow us and who possess such essential qualities of success. The development of such leaders, with their continually increasing capacity for service, is the ultimate purpose of the Industrial Service Movement.

It may seem surprising that 3,500 engineering students, each carrying a heavy course of study and with many other interests, can find an evening or two each week to engage in some form of definite service, without any financial compensation. But such is the case, and on the whole a careful survey of their work reveals efficiency and permanency in a high degree. If industrial men are at first suspicious, their suspicion soon wears away in the face of frankness and friendliness. If the employer has any doubts, they do not last long. One may travel around the country and observe students teaching foreigners in railroad box cars, stores, clubs, halls, pool rooms, restaurants, and boarding houses as well as in the more dignified meeting places—schools, churches, settlement houses, and factories. One may see American workingmen instructed in mines, shops, and labor union headquarters. One may look with interest upon recreative games, talks, first-aid and safety promotion in all sorts of places at noon, afternoon, evening, and midnight. And one may see 500 men crowded around the machinery of a huge plant listening to a straight noon-hour talk on clean living, character-build-

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

ing, and vital religion. We have looked with amazement on 50 factory boys following enthusiastically a college football captain who took enough interest in them to organize a boys' club or a factory athletic league. It has all been done in the finest kind of spirit, without patronage, with modesty and with efficiency. And during the past year those 3,500 student leaders reached over 60,000 workingmen and boys in a very personal and directly helpful way. The secretary of this movement has talked with hundreds of employers and college professors throughout the country and all seem enthusiastic over what has been accomplished.

But what has this to do with engineering? Just this—that every one of these 3,500 students would be willing to say that he has gained far more than he has given. Furthermore, a study of the situation proves that he has gained in large measure the very qualities he needs—an appreciation of workingmen, adaptability, leadership, a knowledge of how to deal with men in a way to get results and to avoid harmful labor difficulties. In general, he learns that all men are men, regardless of race, nationality, color, or creed, but that men must be dealt with very differently; he learns that it pays to win the leaders of men if one desires to win the men themselves; that the work, home and leisure life of industrial workers play a large part in determining efficiency; that a man's working associates may largely influence the quality of work he does; that helping men to concentrate on their work (though not at the expense of mental and physical welfare) increases output; that friendly competition (without driving men) helps break records; that reasonable relaxation and recreation pays both from the human and economic standpoints; that visitation of other plants and stimulation of new ideas in various ways may mean a money saving to the company; that loyalty of the men is one of the employer's greatest assets; and that character counts most of all. More than this, he learns to understand men, he learns how to sympathize with the other fellow's point of view and how to handle men successfully. Is this not worth while? Who can foresee what the future will hold for these men in the way of tremendous opportunities and responsibilities?

Let us illustrate. One engineering student apparently never took any interest in any one but himself until he was enlisted in some of this work. Two evenings each week he walked two miles to teach a class of twenty coal miners. The miners learned a great deal, but they little realized how much they were teaching the college man. His whole viewpoint was gradually changed. He learned to appreciate that all men were men, and he graduated from college with a new vision and a new sense of responsibility. He had not become a sentimental idealist. He perhaps realized the weaknesses of workingmen better than ever, but he had come to know their good points as well, and he had developed a real point of contact. It was therefore not surprising to receive a letter from him recently, indicating his growing interest and telling enthusiastically of his success with a welfare club house and other educational, recreative, and social features introduced for his miners.

It happens that I am a member of the Advisory Committee of the Industrial Service Movement, the headquarters of which is at the office of the Y. M. C. A. International Committee, 124 East 28th Street, New York. Several times I have seen letters from recent engineering graduates, which have come to the central office. These letters tell the story in no uncertain terms, and from them the following quotations are taken:

"I have organized several classes for men in our plant. I can say honestly that this friendly basis with my men helps rather than hurts discipline. The work is but a beginning of what my company hopes to do."

"You will no doubt remember that I took up this work last winter at the University. Now that I have gotten into the habit I really like it so much that I am devoting some of my time to it now, though I am very busy with my business. I have gathered together a class of about forty Italians and enjoy it immensely."

"My company is just now organizing a scheme whereby classes will be offered to young men in such subjects as relate to their work. I have consented to teach one of these groups, as this is the same sort of work I did when at college."

"I have read the literature with care and interest. I expect in the near future to be called to a position in New Mexico where I will come into close contact with foreign miners. My special work will be in the promotion of education and accident prevention."

"I consider the contact that I had with the Industrial Service Movement the most valuable experience in my undergraduate days. I would never be where I am today, without it."

THE KING OF THE BELGIANS

Albert is down by the Yser, the Kaiser's enthroned in his place;
Albert's no home but the trenches, along with a few of his race.
Teutons have ravished his country, the Vandals have sacked his Louvain;
Belgians are starving and homeless, forlorn in the cold and the rain.

Albert, a man of the Belgians, a Caesar defied for the right,
Crushed by the might of a braggart who loudly proclaims him in flight.
Lands he no longer possesses, his army is shattered or fled;
Albert's no longer a kingdom, the Kaiser's enthroned in his stead.

Albert's no longer a kingdom? But what say the men of Moose Jaw,
Glasgow and London and Belfast, of Sydney, Punjab and Mysore?
Ask where the tricolor's waving, ask of the legions of France,
Question the Sengalese trooper or swarthy Algerian lance.

Talk with the Moujiks of Moscow, their comrades, the Cossacks of Don;
Ask the Siberian Rifles from Baikal and Tomsk pressing on.
What do the peoples all answer from Cape Town to Nippon afar,
Men of the hardy Black Mountain or Sanjak of Novibazar?

Albert's the world for his kingdom, he's first in the hearts of them all.
Ally or neutral they reck not, the world is alive to his call.
Belgium's distress must be succored, her citizens nourished and then—
Lackland may call on a Kaiser along with ten million armed men.

—Boston News Bureau.

NOTES ON OMINECA MINING DIVISION, BRITISH COLUMBIA

The following notes will serve to give a general idea of the progress made during 1914 in mining in Omineca mining division, the office of the Gold Commissioner for which part of British Columbia is at Hazelton, Skeena river:

Lode Mining—Shipments of ore were made from the undermentioned properties: From the Silver Standard, on Glen mountain, 736 tons; the Victory group, on Hudson Bay mountain, 25 tons; the Harris mines, on Nine-mile mountain, 25 tons; the Colorado group, Hunter's basin, 25 tons. The ore from the Colorado group was packed out to the Grand Trunk Pacific railway in the summer, but had not been shipped to the smeltery by the close of the year.

Mining properties situated on Nine-mile mountain that were worked continuously throughout last summer, but work on which had been suspended later in the year, were the American Boy, Silver Bell, Silver Cup, and Silver Pick.

Work was continued on the Silver Standard until about the end of August, when operations were stopped for the time being. There is on this property much ore ready for shipment. The Black Prince group, also on Glen mountain, was worked steadily, under lease, all last summer, and it is stated that a lot of ore was sacked ready for shipment. The Harris Mines, Ltd., continued the development of its mine, the American Boy, until the outbreak of the European war, when it was closed, but it is intended to shortly resume shipment of ore.

On Rocher Deboule mountain there was mining activity on several properties. The Black Prince and Wonder groups were developed under bond until the war trouble came on and then work was stopped. The Great Ohio group, which last year was acquired by Portland, Oregon, interests, has been developed and it is stated some good bodies of ore have been found. The operations of the Rocher Deboule Copper Co. have been the most extensive of all in this part of the district. A 200-h.p. hydro-electric power development on Juniper creek has been completed. A transmission line has been constructed four and one-half miles from the power station to the mine where there has been installed an electrically operated compressor with a capacity of 744 cu. ft. of air per min. at 90 lb. pressure. A Leyner drill-sharpener is included in the power equipment, also an 8x10 double-cylinder single-drum geared hoist, used for hoisting men and material from the camp to the mine over an incline tramway 1,800 ft. in length at about 30 to 34 deg. An aerial tramway has been constructed to convey ore down to the main line of the Grand Trunk Pacific railway. Much underground development work has been done in the mine, with generally satisfactory results. Following the declaration of war in Europe, however, operations were stopped until such time as conditions shall be favorable to again operating the property.

Coal—Coal measures in the Bulkley valley in the neighborhood of Chicken (Kathlyn) lake, have been prospected and samples of the coal have been sent out.

Placer mining—Mr. G. W. Otterson, general manager for the Kildare Mines, Ltd., of Ottawa, which company holds several placer leases on Slate creek, a part of the district much more distant from Hazelton than the silver-lead and copper camps above mentioned, at the end of last season supplied the district Gold Commissioner with a most favorable report relative to the prospects of his company's properties. He stated that: "The paystreak found appears to be exceedingly rich, and the portion passed through the sluice-boxes gave a yield of about $30 to the cubic yard. The outlook for next season is excellent. Having discovered the paystreak and uncovered it for more than 100 ft., there is now something definite to go upon. . . The gold recovered is all coarse, with pieces varying in weight from a few grains to seven-eights of an ounce. One nugget weighing an ounce and three-quarters was picked up and was forwarded to Ottawa."

ADVANCES IN OIL REFINING.

U. S. Secretary of Interior Lane announces two chemical processes, developed after years of research by Dr. Walter F. Rittman, chemical engineer of the Bureau of Mines, one of which is expected to enable oil refiners to increase their output of gasoline by 200 per cent.; the other makes possible production from crude petroleum of toluol and benzol, bases for dyes and high explosives, for which in past United States and the rest of the world have depended almost exclusively upon Germany.

Commenting on this announcement the Boston News Bureau says: The head of one of the biggest Standard Oil refineries when questioned regarding the discoveries of Dr. Walter F. Rittman, which government officials have stated will treble the output of gasoline and will make it possible to obtain toluol and benzol from crude petroleum, said that the Standard Oil companies for years had known of ways in which they could greatly increase their output of gasoline and that the only reason these new processes had not been put into operation was that they were too expensive. In other words, the Standard Oil companies and other companies can make more money by producing a smaller quantity of gasoline from crude oil under present processes than they could by adopting the new methods and extracting an increased proportion of gasoline.

Up to date the "Burton" process, discovered by Dr. W. M. Burton, a director of the Standard Oil Co., of Indiana, has probably proved the most practicable of the new processes for refining gasoline. About two years ago the Indiana company began the manufacture of "motor spirits" under this process, but at that time it was used largely for tractors, etc., owing to its disagreeable odor. Since that time this objectionable feature has been overcome and "motor spirits" has taken the place of gasoline. Practically all plants of the Indiana company have been adapted to refine this product.

As for the manufacture of toluol and benzol from crude oil, the Standard Oil refinery head quoted above says the proportion of these products contained in crude petroleum is so infinitesimal that it is out of the question to manufacture them commercially. He says, furthermore, that if it were possible to compete with Germany, this country would produce all the toluol and benzol required from coal tar, of which a tremendous quantity is wasted each year. The only reason toluol and benzol have not been produced to any large extent in the United States, he says, is that such an industry cannot be built up without protection.

A TRIP TO GREAT SLAVE LAKE

By Gwynn G. Gibbins.

(Continued from last issue.)

Fort Resolution is about 800 miles north of Athabasca, and is situated on the south shore of Great Slave Lake a few miles west of the mouth of Great Slave river. The country here is low and marshy, and the view from Resolution is extremely dreary, nothing but flat country and marsh on the one hand and the apparently limitless lake on the other. It is about 500 ft. above sea level. Athabasca Landing has an altitude of approximately 1,700 ft., so we had fallen 1,200 ft. in less than 800 miles.

As seen from the lake, Fort Resolution is a very imposing place, with the Roman Catholic church, the Mission, R.N.W.M.P. barracks, Hudson Bay Company post, the Northern Trading Company posts, Fairweather's post and Swiggart's post, together with 50 or 60 Indian houses, some of which are cleanly and in repair.

St. Joseph's Mission has about 100 Indian boys and girls, who are quite well taught. Some are very intelligent, speaking, writing and reading English and French, and reading Latin exceedingly well.

The Indians have a curious way of paddling, whether singly or several in a canoe; they all paddle first a few strokes on one side and then again on the other side. They have the greatest respect for the lake, and seldom venture out in it, and never cut across any large bay, no matter how calm the water. They are excellent hunters and dog runners; but in the canoe they are hopeless. The Indian women do much of the hard work, though civilization has effected a notable change in their status. Many of them can do exquisite native fancy work in leather, porcupine quills, feathers and reeds.

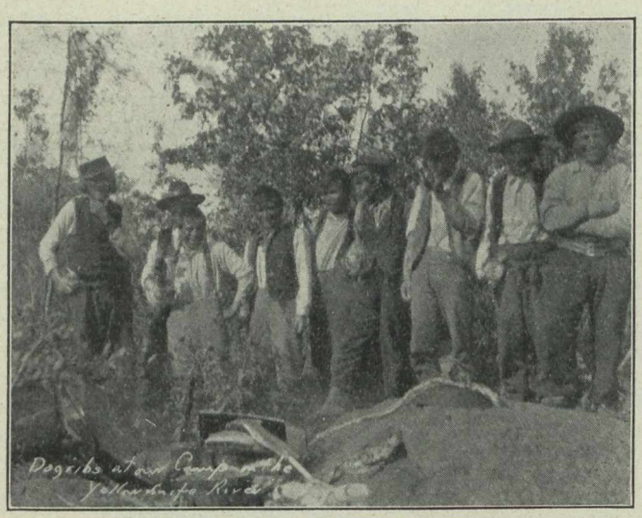
Though the summer is very short and the winter severe, averaging about 20 degrees below zero for probably three months, it is remarkable with what success the efforts of those who have tried the fertility of the soil have been rewarded. The St. Joseph's Mission and the Hudson Bay Company have large gardens, in which are grown excellent potatoes, cabbages, turnips, onions, rhubarb, lettuce, radishes, peas, beans, etc. They have also experimented with wheat, rye, barley and oats with varying success. I understand that rye and barley will ripen, but that the other cereals are uncertain. The hardier flowers, such as sweet peas, nasturtiums, asters, pansies, sunflowers, daisies, sweet william, grow very well and flower profusely.

Boiler Rapids, Athabasca River, October, 1914

"**Treaty.**"—We were, fortunately, present during, or at least very shortly after, "Treaty" last July. This is a more or less formal yearly gathering of neighboring Indian chiefs and tribes, men, women, children and dogs, to declare their allegiance and to give white men the privilege of living in their country for the coming year. In return for this, the Dominion Government gives each individual Indian, irrespective of age or sex, the sum of five dollars, with a certain amount of tea, sugar, tobacco and flour. Tobacco and tea are prime necessities with the Indians—flour being of less importance. All the chiefs get twenty dollars, with corresponding larger portions of supplies. All complaints are heard and any misdemeanor in the past year punished and likewise any praiseworthy act rewarded.

"Pay-treaty" is held at several centres each year. At Fort Resolution probably $5,000 is distributed, the most distant Indians being the Dogribs and Caribou-eaters who come from Fond du Lac at the extreme eastern part of Great Slave Lake. After pay-day and the signing of the necessary documents, which is done

with great pomp, ceremony and importance by the various chiefs, supported by their "headsmen," a great rush is made to the several trading posts, and in a few hours the Indians have parted with the greater part of their treaty money. It was surprising to me to note the quality of the goods bought and how few really useless things were acquired. The



Dogribs at Our Camp on the Yellowstone River

men bought the very best pipes, blankets, socks, etc.—the younger men also generally got a silver ring for themselves and another for the maidens of their choice. The women bought cloth of excellent quality, many of the older women a pipe of inferior quality, and a shawl or ribbon of perhaps startling design. All are very fond of a scented soap, which they keep very zealously. They make their washing soap, that is, those who indulge in such luxuries, from lye and animal fat.

Marriage takes place at an early age and the Indian seems very devoted to his offspring. The women do not have baskets in which to carry their papoose, but put him or her in a shawl and sling it across the back, the youngster apparently instictively learning how to adapt itself.

At such times as "treaty," Christmas and Easter, old friends meet, and it is a quaint sight to watch the arrival of some Indians. The men kiss the women, some with evident relish, others with diffidence, and shake hands with the men, whether strangers or not. Everyone shakes hands in this far northern country. As soon after arrival as possible, the Chief pays his best respects to the R.N.W.M.P. and gives an account of the happenings in his tribe since his last visit—sometimes bringing a delinquent Indian for summary trial and punishment.

The festivities at "treaty" extend over a period of several days. In the daytime the men spend much of their time gambling for matches. A ring is formed and the men squat down, one or two beating a pom-pom and all chanting weirdly. One man then puts some matches in his hands under cover of a blanket and all try to guess which hand contains them. From the excitement and the gestures a stranger is apt to imagine the game is very complex, and the Indians themselves enjoy it for hours at a stretch. Occasionally a feast is held, followed by a dance. A tepee is prepared and huge pots of rice, moosemeat and tea boiled. An Indian then fires several rounds into the air. Soon the men begin to gather, each man bringing with him a saucer, cup and sometimes a fork or spoon. After all the men have arrived, the women, carrying their babies, and often with several other children hanging to their skirts, take any remaining places at the main "salon," while the rest gather around as closely as possible. The men are then fed and the remains given to their wives. The chief gives a speech, which is listened to with great respect and attention, the Indians now and then voicing their appreciation by a low guttural sound. The "feasters" then depart to return again in an hour or so, after the women have made things ship-shape again, for the dance, which usually begins about nine or ten o'clock. A few Indians, men and women, form a circle and shuffle sideways, all facing the centre, to the tune of some Indian chant repeated over and over again. Other men and women swell the circle and add to the swaying. From time to time some drop out for a spell, and so the dance goes on for perhaps six or eight hours. It is a very remarkable sight, and to me at least it was quite incomprehensible how any pleasure could be obtained from it. But the Indians often get worked up to a frenzy and the roar of the weird chant can be heard at a great distance.

It was a welcome sight to see how the Indians respected and aided the aged. We saw some of the late arrivals, the Dogribs—the least civilized of them all—get their treaty money. Among them was a very aged couple, and as the men got their five crisp one dollar bills, nearly all of them thrust one or more of the bills into the hands of the poor blind man as they were passing out.

From Fort Resolution we made several trips, the most interesting of which was up the north arm of the lake to the Yellowknife river, and thence up the Yellowknife for about 50 miles, making several portages. The river here is rather a succession of lakes connected by short narrow rapids and falls. This trip took us very close to the western fringe of the "barren lands," and evidence of its proximity was not lacking. We saw very little game, one bear and

St. Joseph's Mission, Fort Resolution, 1914

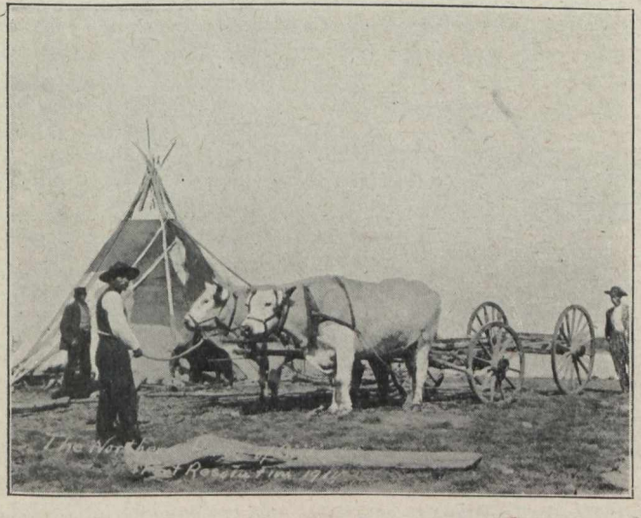
two wolverines being our total "bag." We left a little early for the caribou migration, but we saw plenty of horns.

Navigating Slave Lake.—On returning to Fort Resolution late in August, we experienced some of the winds so prevalent on Slave lake. For eight days we were stormbound on a small islet about 80 ft. wide

by 200 ft. long, on which, luckily, there was a plentiful supply of wood and cranberries. The wind gave us a hard tussle to make this haven, for we were just a little more than three hours paddling less than two miles. From this island we made Gros Cap in one long, hard day's paddle, bucking a fairly stiff breeze most of the time. Towards evening the wind freshened to a gale, and we were forced to seek shelter. Early the next morning we started to try to cross the fifty miles between the north and south shores of the lake. The swells from the night's gale were very large, so large in fact that we had no difficulty at all in weathering them. We simply apparently paddled up a steep hill and coasted down the other side. However, just as we were nearing the Caribou islands, about ten miles from Gros Cap, the wind started again, and in a very short time an ugly sea was running. We were lucky to reach the lee of these islands, because there is no other shelter between the Caribou islands and Gros cap.

The wind seemed to abate in an hour or so and we paddled along under as much shelter as possible to the outermost island. It had become much calmer and we decided to try to reach the next group of islands, about twelve miles distant, knowing that if we could make this group of islands our route for a further 15 miles or so would be behind an almost continuous chain of islands. It is essential at this time of the year to take advantage of every period of calm. Earlier in the summer the days were very long, in fact during June the sun appeared to sink a little west of north, and before the glow died away it started to rise again a little east of north. There was then no darkness at all, but now the nights were rapidly getting long, making it doubly hard to take advantage of the comparative calm usual early in the morning. With these things in view we set out, but we couldn't make it, and we had to run back to the island, getting drenched to the skin and our canoe about a third full of water.

Three days later we reached Fort Resolution and, finding the party with whom we had made arrange-



The Beast of Burden, Fort Resolution

ments to meet already there, we delayed as little as possible, and left on September 1st for the long arduous trip to Athabasca.

Great Slave river, at this season of the year, does not lend itself readily for either tracking or poling, the banks and bottom being too soft, too steep, or too thickly wooded. In the spring, while we were en route north, the prevailing winds were northerly, but last September we did not get a fair breeze all the way from Resolution to Athabasca. The weather was disagreeable, wet, squally and foggy, always very chilly and raw. So it was a relief to reach Fort Smith and there to get dried out.

Baling Furs in H.B. Co. Press, Fort Resolution

News of the war.—We found the place all keyed to a high pitch, and on enquiry we heard that an Indian had just brought meagre news about a great European war. We lost no time in getting across the portage and were lucky enough to get a tug to tow us to Fort Chipewyan, which post we reached on September 16, and were staggered with the war news—the mail bringing papers as late as August 5th or 6th, having just arrived. Fortunately, our two remaining parties were awaiting us, so we bought a scow and left in tow of the tug for Fort McMurray.

The journey out.—If we were anxious before to get out, we were almost feverish now. Comparatively late news was obtained at McMurray, and the news was not too reassuring. We pushed on with all speed, but from here our progress was necessarily slow and laborious. We had to track our scow foot by foot all the way to Pelican. Owing to the wet weather there had been a number of mudslides, of which we reaped the benefit, having literally to wade through one to three feet of slime and mud. At times the current would be very strong and our footing in the mud very insecure, so that it was no unusual sight to see one or two of us turn turtle and disappear momentarily from sight, to reappear an unrecognizable mixture of mud and arms. There were nineteen of us all told. The two cooks stayed in the scow and also a steersman. The remaining 16 were divided into two parties, one working in the tumplines for 45 minutes, while the other party rested or had their meals. When necessary one or two of those resting poled on the scow to keep off rocks, etc. In this way we made continuous progress from daylight to darkness.

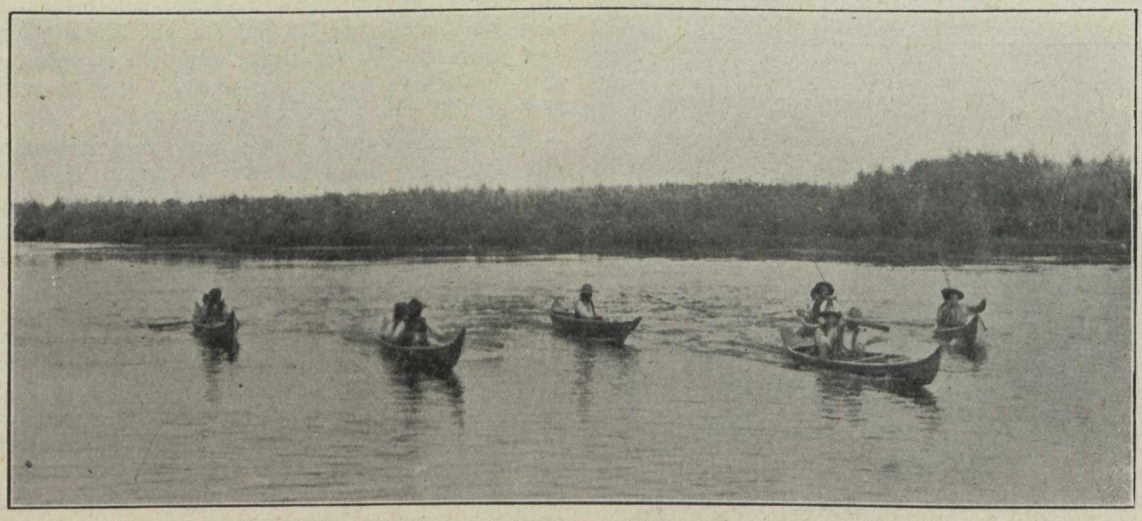
The rapids gave us plenty of excitement, which offset to a very considerable extent the hard work. We

often had to wade knee deep for an hour or more at a time in the icy, swift water. Some of the places were rather precarious, and it was no fun to get a ducking. As it was too risky to track through the rapids with the thin line, and as eight of us could not keep the heavy line out of the water, twelve and often fourteen men were on the line, while the others poled this time, since the "railway" had shut down for the winter, and loading them on another scow, which three of us had brought down from House river.

A rescue at Middle rapid.—Perhaps I will be pardoned if I describe a little incident that happened as we were tracking up into the Middle rapid. At the foot of the rapid we saw a scow, evidently heavily

Chipewyans Gambling after "Treaty," Fort Resolution, 1914

from the scow. Naturally such work was very hard on our footgear, and ere Grand Rapids were reached hardly anyone had sound feet or limbs, much less boots to wear. We had only two portages, Big Cascade and Grand Rapids. At the former we had a bad laden, with about a dozen men, women and children on board. The scow had struck a rock and had broken her back, but had held fast. We seemed to forget our weariness and soon had our lone canoe—we had sold all the others—out, and two of the boys man-



Dogribs Racing for Bread, Yellowknife River

time getting our scow over—the water was very low. Everything removable was taken out of the scow, and by means of pries and the ropes we slowly dragged it to deep water. At Grand rapids we managed to get our scow to the island, and left it there, portaging our goods to the head of the island, without charge aged to get alongside the scow. Firstly, the women and children were taken off, then the men. We learned that their scow had struck the rock through carelessness or drunkenness about 4 p.m. the previous day. One man had been drowned trying to get to shore and the others had spent a miserable anxious night on

the scow, fearing at each surge that the end had come. We fixed up a tent for them and gave them hot chocolate, etc., and then volunteered to try to save the cargo. This was a very ticklish job and the boys deserve great credit for their skill and daring. We unloaded our scow, and twice the boys got her alongside the wrecked scow and made her fast, took off a load and pulled for the bank. They drifted half a mile down stream each time, and we had to line them up. None of the rescued, save one, offered a hand whatsoever, tired though we were. Appearing helpless, we gave them our scow, beached theirs, repaired it, loaded it and went off—not getting so much as a "thank you" from them.

The track from Grand Rapids to House river was miserable. It was bitterly cold, windy and sleeting. Ordinarily the tracking here is very good, but on that day each mile seemed like ten. We all kept steadily on the line, because, wet through as we were, we could not otherwise keep from freezing, let alone keep warm.

We had hoped to get a gasoline launch at House river, but were disappointed in that the launch was already chartered. We plugged along to Pelican, but could go no further, so we accepted the hospitality of the Athabasca Oil Co. and made ourselves comfortable in their natural gas heated tents, awaiting the return of the launch. We arrived at Athabasca on the afternoon of October 10th.

I should like to add a line in appreciation of the splendid manner in which the R.N.W.M.P. perform their arduous duties and of their courtesy and kindness to us, particularly Inspector Field, Dr. Macdonald, Sergt. Mellor and Corp. Cuthbertson, and also the kindness extended us by the officials of the Northern Trading Co. and the Hudson Bay Co., Mr. Cunningham, of Fort Resolution, in particular, and Mr. Colin Fraser, an independent trader at Fort Chipewyan.

THE CANADIAN PAVILION AT THE PANAMA PACIFIC EXPOSITION

"Have you seen the Canadian Building?" "Believe me, the Canadians have some exhibit!" "Can you beat the Canadian Building?" "Canada has the whole blamed show beaten to a frazzle!" Such is the hue and cry that is being continually dinned into one's ears in the hotel rotundas, on the trolley cars, and in the streets of San Francisco, while the members of the Canadian commission and their assistants are each wearing a continual blush at the compliments hurled at them from all directions. And all this goes to show the wisdom of the government, who, notwithstanding the stress of war, has put up the finest exhibit that Canada has ever offered to the public, and, incidentally, has obtained the cheapest and most lasting advertisement for Canadian resources that could possibly be desired.

The mineral section of the exhibit probably offers the most complete display of Canadian economic minerals that has ever been shown outside of Canada, and is already attracting the attention of miners and prospectors, many of whom have declared their intention of seeing the minerals "in situ."

The ores are carefully labeled and tastefully arrayed in twenty-eight large, upright show cases and seventy small table cases, which occupy a prominent position in the central court of the big Canadian pavilion. In these cases practically every mineral, of economic importance, found in Canada has its place together with a card describing the locality in which it is found. The Mines Branch of the Department of Mines has issued a special bulletin, entitled Economic Minerals and Mining Industries of Canada for distribution at the Panama-Pacific International Exposition, which is in considerable demand, and a staff of three mineralogists is present to give detailed information on any particular mineral or locality.

In the big upright show cases large specimens are massed together, not only to give an idea of the general run of the ores, but, at the same time, to convey the notion of plenteousness of their occurrence in nature. Six cases are devoted to gold-silver-copper and gold-copper ores; these are mainly smelting ores from British Columbia that feed the three large smelters in that province. One case is given to the ores from mines operated by the Consolidated Mining and Smelting Co., of Canada, Ltd., and another to ores mined by the Granby Consolidated Mining and Smelting Co., of Canada, Ltd., and the British Columbia Copper Co. Besides ores, these cases contain products and by-products obtained from them. Asbestos and nickel ores, together with products made of, and obtained from, them respectively, each have a case, and make a very attractive showing. A large thirty foot case is given up to special specimens, such as gold nuggets from the Klondyke, nuggety gold ore from Nova Scotia and Porcupine, Ontario, very rich silver ores from Cobalt, and cut and polished semi-precious stones. The companion case to this is occupied by coals, cokes, coal briquettes, petroleum, petroleum shales, and tar sands. Typical Cobalt ores, some of which are cut and polished to better show the silver, have a case to themselves, and have, perhaps, attracted as much attention as anything in the exhibit. Two large cases, paneled with polished marble, are devoted to building and ornamental stones; and the rest of the cases are filled respectively with iron ores, chrome-iron and manganese ores; iron and steel made from Canadian ores or with Canadian coal; graphite, talc and apatite, mica, clay and cement and products made from the same, gypsum and feldspar, corundum, barite, celestite, stibnite, molybdenite, and pyrite; silver-lead ores, and zinc and silver-zinc ores. The seventy small table cases are occupied by typical specimens, and have been arranged to show, as much as possible, the geographical distribution of the ores.

QUINCY.

Quincy Mining Co. reports net profits of $205,593 from 1914 operations, against $76,160 in 1913, and $960,779 two years ago. Copper production totalled 15,356,380 pounds, secured from 22,612,460 pounds of mineral, which sold for $2,041,992. A profit of $12,630 was realized from silver sales, as compared with $20,383 in previous year.

President W. R. Todd says: "The price of copper began to improve early in November, when European nations entered the market with large orders for war material. On this buying we were able to sell copper that had accumulated, and resume dividends. We have undertaken no new construction, or renewals, that could prudently be deferred.

"Our sales of copper during 1914 were made at prices ranging from 15⅛ cents in January, to 11½ cents in November, advancing to 13½ cents at year end. The average was 13.3 cents. Our operations were seriously affected by strike, air blasts and the European war, and the company did not operate at a profit during the first six months of the year.

ELECTRICITY IN NOVA SCOTIA MINES

The report of the commission appointed by the Government of Nova Scotia to consider regulations governing the use of electricity in coal mines has been presented to the House of Assembly, and in a draft bill covering proposed amendments to the Coal Mines Regulation Act the Government asks for legislation to enable the commissioner to adopt whatever additional regulations may be considered necessary to give legal force to the recommendations of the commission.

In their report the commissioners pay a well-deserved tribute to the mining engineers of the Province, and state that, although no regulations governing the use of electricity in mines have as yet been enacted in Nova Scotia, "it speaks volumes for the regard shown by the operators for the safety of their employees and for the diligence with which the inspectors have exercised their office that safety first was the invariable rule, and that in every instance we found the greatest precautions had been taken to prevent accidents."

A reference to the great future of electricity in Nova Scotian coal mining, and the possibilities of this source of power in connection with the extraction of the vast submarine areas of coal around the shores of Cape Breton, is briefly made as follows:

"The great bulk of the coal to be won by the Dominion Coal Company and the Nova Scotia Steel and Coal Co. (and probably of other companies as well) lies below the sea. The mining of such coal must necessarily be at long distances from the source of power. Compressed air, which is now so extensively used, will be less effective owing to the loss of power in transmission, and there is no power known by which such work can be done so efficiently as electricity."

The commissioners might have gone further, and have said that in the present stage of human knowledge, there is no other form of power which can be used to extract coal at such distances from the source of power as it may be anticipated that future generations will see in the Cape Breton submarine coal field.

The commission is also numbered among the growing advocates of electric lamps for miners. One of the most interesting controversies among mining men of to-day is the respective merits and demerits of the flame safety lamp, and the electric lamp. The case for the electric lamp is well presented in the January volume of the Transactions of the Institution of Mining Engineers, by Mr. William Maurice. Mr. Maurice's paper is well worth the attention of all whom this subject interests. In this connection may be mentioned the vexed question of the causes of miners' nystagmus. Recent deliverances by medical men who have studied this matter have indicated that lack of light was the predisposing cause, and instances have been given tending to show that the ordinary miners' flame safety lamp was to blame because of the dimness of its illumination. A contributor to the discussion of Mr. Maurice's paper mentions that he had experience of two similar collieries, working side by side, one using candles and the other safety lamps, and there were more cases of nystagmus at the colliery using candles than at the safety lamp colliery. Again at another colliery employing 4,000 men, and using oil safety lamps there were no cases of nystagmus. The speaker very properly remarked that there must be some other cause than lack of light to account for the prevalence of nystagmus. Apart from the question of nystagmus, however, there is little doubt that electric lamps permit a much more effective illumination of the roof and sides than does the ordinary safety lamp. In this respect we may expect that electricity will force a similar improvement in oil safety lamps as was forced upon makers of steam driven machinery by the coming of electrical machinery. Competition is always a good thing.

The commission report that after having carefully examined the regulations adopted in many countries they decided to recommend practically the adoption of the British regulations governing the use of electricity in mines. The report states:

"In accordance with the statute under which we were appointed (Chap. 16, Acts of 1913) we have drafted regulations for the installation and use of electricity in mines, and beg to submit these as an appendix to this report (appx. B.). In drafting these we had the benefit of the experience of many other countries, as that experience had developed into rules and regulations. We examined closely the rules proposed as a standard set, after much such an investigation as we held, by the Bureau of Trade and Commerce, Washington. We had before us and very carefully considered the regulations adopted in England, Belgium, New South Wales, Pennsylvania, West Virginia and other States of the American Union. The latest word in the way of regulations came from the Province of Alberta, which only last September put into force its code. On the whole we found the English rules very much more suited to our conditions than those of any other country or state, and in the regulations we submit it will be found we have followed the English rules more closely than any others. We did this advisedly. In this Province we have not had sufficient experience in the use of electricity, either from the point of view of time or number of collieries using it, to frame with any confidence regulations based on that experience alone. The English rules are the carefully prepared result of the labors of two commissions, and embody the experience gained from longer and much greater use of electricity than we have had. So fully and well do they meet conditions usually met with in mines that they were largely followed in the set proposed as standard by the Bureau of Trade and Commerce, Washington; and the Province of Alberta adopted them practically without 'change.' They are constantly being revised and kept up to date, so that by having our regulations modelled upon them we not only have the benefit of their past experience in England, but are in a position to take advantage of any change or amendment the large and enlarging experience in that country shows to be necessary."

The commission is to be congratulated in the business like brevity of its report, which, unlike many similar publications, is compact and concise in its utterances.

The Cottonwood Coal Company has awarded to the Roberts and Schaefer Company, of Chicago, a contract for a complete fireproof coal tipple and coal washing plant to be erected at their new mine at Lehigh, Mont., the Cottonwood Coal Company being the coal department of the Great Northern Railway.

The tipple will have a capacity of 3,500 tons per day and will be built to accommodate both self-dumping cages and mine skips, and is to be equipped with modern coal screening and picking facilities, with electric motor drives throughout. The coal washery, having a capacity of 2,000 tons daily, will be built of reinforced concrete and steel, and equipped with facilities for coal drying, and will be electrically operated throughout. The contract price is $125,000.

The Roberts and Shaefer Company has recently issued an illustrated bulletin on coaling plants.

THE GREAT CHINA CLAY DEPOSITS OF CORNWALL, ENGLAND

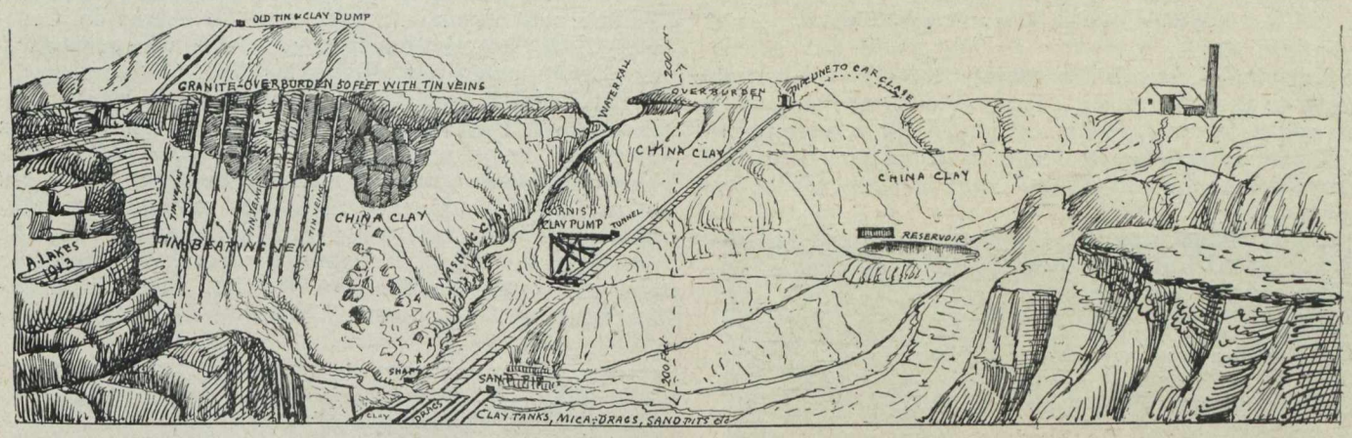
By Arthur Lakes.

On my first visit to these celebrated deposits at St. Austell some thirty years ago development was in its infancy. The evidences of prospecting work then in progress were milky streams issuing from the granite hills and whitening the waters of the rivers. Since then the china clay industry of Cornwall has grown to be the greatest and most celebrated of its kind.

On leaving the quaint little town of St. Austell we were at once in the heart of the china clay field. On either side of the valleys, and on the hills and surrounding country as far as the eye can reach, are enormous gray dumps representing the worthless debris thrown out in developing the clay from great crater-like pits or "gloryholes" two or three hundred yards in diameter and several hundred ft. in depth. The scene reminded one of pictures of the surface of the moon with its multitudinous craters and mounds.

depth reached in the pits, this by no means represents the full depth of the clay deposits. Borings have been put down 500 ft. or more without bottoming it. In some quarries a series of closely parallel tin-bearing lodes outcrop and cut down through the clay measures. It is significant of the origin and decomposition of the clays that the principal clay zones run parallel with the principal tin veins of the country. Heated solutions and gases that were connected with the formation of the tin veins, rising from great depths through fissures, doubtless decomposed the rocks adjacent to the veins and formed the china clay. Fluorspar and tourmaline minerals originating through the agency of fluorine and boracic gases, found common to both tin veins and china clay, point to the same origin for both.

In some of these quarries, clay was being broken



Ancient Carclase Tin Mine, now a Clay Pit. "Overburden" is Granite. Tin veins traverse both clay and the overlying granite

The existence of the clay has been known for over 100 years, but the industry dates over the past 50 years. The clay is derived from the decomposition of granite.

Along our road we passed several clay tanks under large sheds called "drys," and open tanks where the milky streams from the quarries and hills are allowed to settle and the impurities are removed. The clay when sufficiently dried and consistent is cut up in blocks, shovelled onto railroad cars and transported by special steamers over the world from sea ports in the vicinity.

Towards the eastern outskirts of the district were a great number of huge clay pits. Some of these quarries are worked for china-clay only, others for what is called "China Stone" or "Cornish Stone" a partially altered granite, composed mainly of quartz and feldspar. This rock is ground under millstones and the ground-up material of quartz and feldspar, resembling commercial salt, is shipped without washing. It is used exclusively for the manufacture of chinaware. Near the bottom of some of these pits was a zone of china stone stained purple by fluorspar. This "purple-rock" is in great demand for china manufacture.

Although from 20 to 300 ft. is the average available

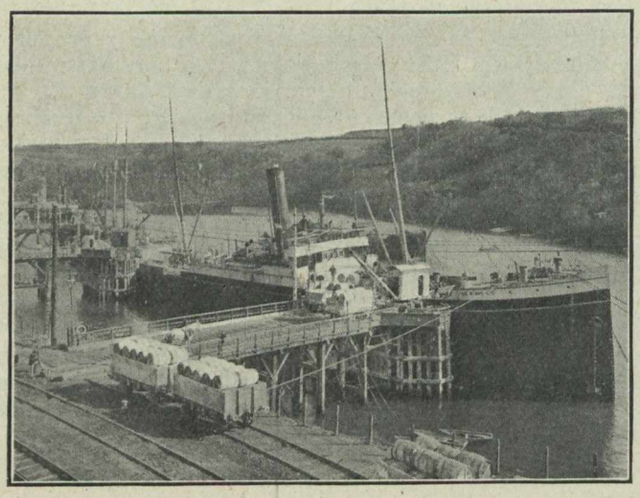
up and washed down into "sand pits" or "Micas" where after a process of purification, it was pumped to the surface by Cornish pumps which also drained the pits.

After examining the eastern section of the field in the neighborhood of Trevistock, we drove to Henbarrow district, typical of the western division. This region is the highest in Cornwall, attaining an altitude of upwards of 1,000 ft. above sea level. It consists of rolling hills and moors dotted over with clay dumps and pits, with rivulets of milk-white water pouring down into the river below.

Typical of the clay-pits is the "Carclase mine" which was worked by the Carthaginians and Phœnicians as a tin mine whilst to-day it is developed for clay alone. A number of tin leads and quartz veins appear in parallel courses on the sides of the pit, cutting through the granite 'overburden' down into the clay beds beneath.

Near the bottom men were breaking down the clay with broad-bladed mattocks called "Dubbies." The workers are aided by water-falls from a flume above. The broken-up and partially dissolved clay is washed down into a "Sand pit" where the quartz of the granite is separated by precipitation. Thence the partially purified clay passes on into long vats called "Micas"

or "Mica-drags" where the mica is precipitated and got rid of, leaving the clay nearly pure. The purified material in some cases passes down into a pit or shaft below the bottom of the workings as at Carclase, thence through a tunnel in the hill to the neighboring village or else is pumped direct to the surface by Cornish



Shipping China Clay, Fowey, Eng.

pumps and descends by gravity through earthenware pipes to the same place. There it settles in large open, as well as covered, tanks or "Drys" till it has attained sufficient consistency to admit of being broken up and shovelled on the railway cars and taken to the nearest sea-ports.

Analysis and uses of china clay.—China clay is a hydrated silicate of alumina.

An average analysis gives:

	Per cent.
Silica	46.32
Alumina	40.27
Carbonate of Lime	.36
Magnesia	.44
Water	12.67
Loss	.20
	100.00

In its natural state the clay is plastic and gritty, the latter due to grains of quartz.

About 60,000 tons of china stone is annually produced. The output of china clay in 1809, twenty-nine years after its discovery, was 1,700 tons and in 1908 721,416 tons. At the present it approaches 1,000,000 tons.

There has been great increase in the industry within the past few years. New lands are still being taken up and new clay pits opened. This industry has far outstripped in value and importance the time-honored industries for which Cornwall was formerly noted such as the mining of tin, copper and lead.

The chief shipping ports in Cornwall are at Fowey and Charleston, by special steamers, carrying each some four to five thousand tons, to American and various other parts of the world. The clay is shipped in bulk or in barrels, each barrel holding 1,000 lbs. of clay.

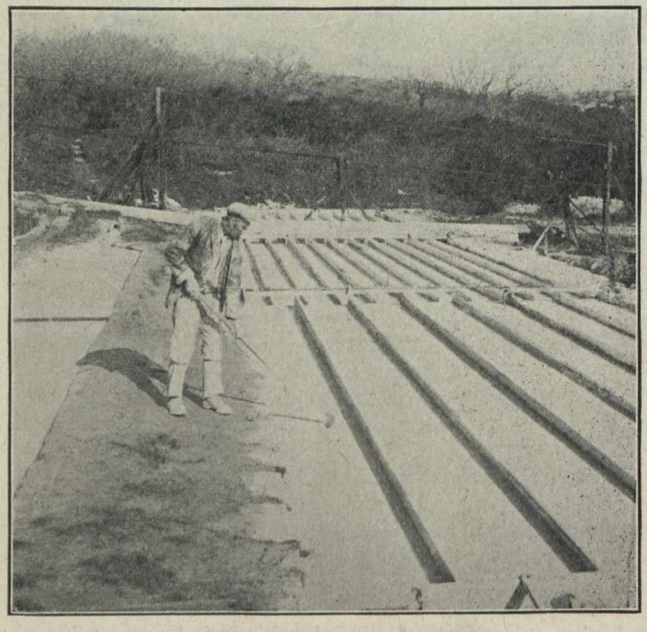
Origin of the Cornish china stone and china clay.—These remarkable deposits are derived from the subterranean decomposition of the native granite on a vast scale. This decomposition was not due as might have been supposed to surface waters percolating downwards from above; but from heated waters and gases ascending from below. This is clearly shown in many of the pits where a heavy overburden of hard massive or partially altered granite has to be passed through to reach the underlying clay.

Origin of China Clay.

At an early period, heated magmatic waters and gases arose from great depths into the granite and, whilst filling its cleavage cracks and fault-fissures with solutions of tin and silica decomposed the surrounding granite on a vast scale and to an unknown but great depth. By elimination of the alkalies and silica of the feldspars, partially altered and completely decomposed granite resulted, the one in china stone the other china clay or kaolin.

The History of china clay and the Cornish deposits.—"Kaolin," the technical name for china clay, is from "Kaolong" or "Kauling" a hill near King-tibi-chin in China, where the clay was first discovered and worked. Kauling means a lofty hill or ridge. The clay from this locality was first sent to Europe by a Jesuit Missionary in the early part of the 18th century. A similar white clay was later found at Ane near Schneeberg in Saxony and used in the manufacture of porcelain, laying the foundation of the celebrated Dresden-ware. It was also found near Limoges, France. In England kaolin was discovered in Cornwall in 1755 and "hard-paste" china was manufactured at Plymouth and Bristol in 1760.

The Chinese used the clay for domestic ware. The process was kept secret, till revealed by Jesuits. China gave the name to the clay. The word "Clay" is from the German "Klei" meaning to stick. Porcelain is an Italian word. Porcelain was unknown in England until specimens were brought from China. The possibilities of British deposits were long unknown and unrecognized. The first efforts in porcelain manufacture were from imported clay and not until Wedge-



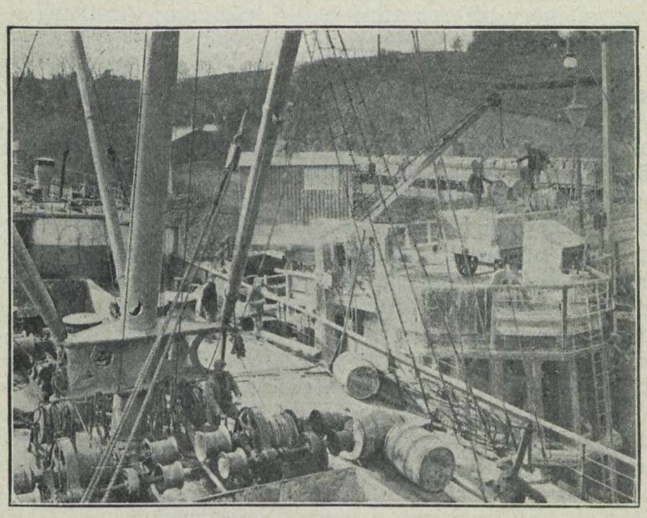
Mica Drags, North Rose Co., Cornwall, Eng.

wood's day were the natural china clay resources of Cornwall appreciated or used. Porcelain was called "Chine" in India and the East. It was also known as "Chiney," "Cheney," and "Chaney."

The discovery that the ingredients used by the Chinese abound in Cornwall was by a young Quaker,

William Cooksworthy in 1755. Being interested in the manufacture of porcelain he experimented with the stone of Cornwall and Devon and established a pottery at Plymouth in 1760.

During the fifteenth and sixteenth centuries china porcelain found its way into Europe. The Florentines



Shipping China Clay, Fowey, Eng.

copied the Chinese. The Jesuit, father Pere Entrecolles, introduced china clay into Europe in the eighteenth century.

China clays have been discovered in Pennsylvania and North Carolina, in Saxony, Bohemia, France Russia and Sweden, usually derived from decomposition of granite, but sometimes simply from that of Cretaceous strata. The better qualities of Cornish-clay are unequalled elsewhere.

Kaolin gives plasticity to the china paste and secures retention of form for the ware in the kiln. Petunzite or china stone gives translucent qualities to porcelain.

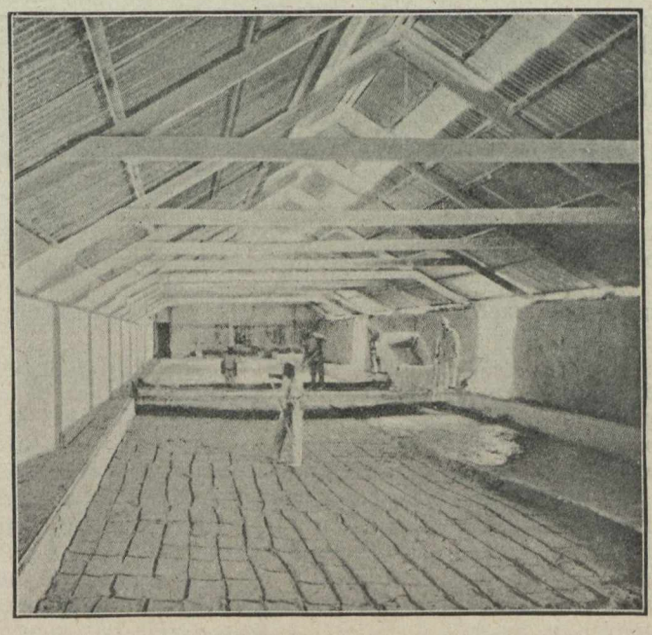
Uses of china clay.—Besides for porcelain, it is principally used in paper-making, rendering the paper smooth and opaque; it is readily incorporated in the fibre and it adheres closely to it. It is also used in cotton-sizing and bleaching, in alum-cake, linoleum, floor-cloth, ultramarine, asbestos-rubber, soap, oil, paint and chemicals. The main use of china stone is in strengthening the body of porcelain and glazing.

Modes of development and working of china clay mines.—The first thing to determine in new china clay property is whether there is sufficient depth and area of clay to be worth working. This is proven by boring and by trial pits. A shaft, called a "washing shaft" is then sunk in the centre of the clay area and to the bottom. Another called the "engine shaft" is sunk on the edge of the deposit to accommodate a Cornish pump. A tunnel is driven connecting the bottom of both shafts. The overburden, which may be from 10 to 50 ft. thick or more of "meat" earth "Killas" or granite is then removed from around the top of the "washing shaft" by tram-wagons. Water is brought in at different points to wash down the uncovered clay until the deposit is exhausted.

For washing, water is brought by wooden conduits or launders. Before turning on the stream a portion of the exposed bed is broken up by "dubbies" or large broad bladed mattocks. The track caused by this breaking up is called a "Streak." A stream of great force is let down over the area of the streak. Water separates the clay and mica from the sand and stones. At the bottom of the pit quartz sand is caught in framed pits called sand pits or drags. Some clay or mica continues its course over the drags until the washing shaft is reached, down which it flows and thence through the connecting level into the bottom of the pumping shaft. Running water holds the clay and mica in suspension. The coarser grains of quartz are deposited in the drags at the bottom of the mine. Lighter particles of clay pass on in a milky stream into the washing shaft. The clay in suspension is pumped up from the bottom of the pumping shaft to the surface and carried by earthen pipes to the entrance of the micas which occupy a series of parallel channels. These mica drags usually about 200 ft. long, 2 ft. deep and divided lengthwise, bring about total separation of the clay from the mica in suspension. Fluid clay comes out of the pipe running from the works and, entering the micas from the top end, is distributed over the whole area. The stream at the end of its course passes through copper gauze mesh 3,000 holes to the inch. Mica extracted by gravitation is used for coarse goods.

Clay tarnished by mica is of inferior quality. Sometimes when the clay it opened on the top of a steep hill it is not pumped up from the bottom of the pit, but comes out on the hillside through a tunnel from the pit bottom, the clay running in the "micas" at the lower level. The common 'Cornish-engine' pump of Bolton and Watt type of a century ago is used to a depth of 300 ft. Electric power is now being introduced in some of the mines.

The drys.—These consist of open as well as covered tanks of rectangular shape. At Charleston harbor is a good example of receiving tanks and drys and also



Drying Clay, Cornwall, Eng.

of the mode of shipping in special steamers. White clay pours down as a liquid from the hills above the port openly or through pipes into the receiving tanks. These are a series of large rectangular structures, 8 to 10 ft. deep and over 100 ft. long. In total length they are 280 ft., which is the length of the adjacent shed covering the dry tanks preparing for shipping.

In this shed the tanks are 18 ft. wide, 5 to 6 ft. deep, paved with broad fire-clay tiles resting on a series of

flues traversing the dry from end to end, cross-wise. Heat is supplied from a furnace at the end of the building. The clay from the receiving tanks just above the drys passes into the latter in a liquid stream like cream and spreads out and accumulates on top of the tiles to a thickness of 6 or 8 ins. When this layer has by drying attained the consistency of cheese or butter, it is cut up in blocks and shovelled into the railway cars below the dry and thence it is taken to a steam boat. The water contained in the liquid clay of the upper or receiving tanks is let out by wooden plugs. The clay may be left to settle in the receiving tanks for four to six weeks. When the clay in the dry is sufficiently consistent, wagons are run onto a platform, movable along the entire length of the building, so the clay can be placed at any required spot. It is divided into blocks of a suitable size for lifting on a shovel and may be removed to a linhay or store-room to admit of the moisture being driven off more rapidly. Drying takes from one to three days. Too rapid heating of the flues takes the nature out of the clay. Dry clay from the linhay is either sent away in bulk or packed into sacks or barrels. From the time the china clay is washed to the time it is dried is about six to eight weeks.

In preparing this article the writer is indebted to the various china clay companies at St. Austell and particularly to the North & Rose Co. for illustrations and other data, also to Mr. W. Cune for guidance over the area and for much scientific and geological information.

PERSISTENCE OF ORE IN DEPTH*

By J. B. Tyrrell.

I have read with great interest Mr. T. A. Rickard's paper on the "Persistence of Ore in Depth," and join in thanking him for his excellent collection of instances of decline and final disappearance of orebodies in mines in all parts of the world, and also for his record of the opinions of miners with whom he came in contact from time to time while these mines were gradually dying out; though it is a pleasure to know that during the same time more new mines were being discovered, so that at the present time the production of the mines of the world is greater than it has ever been before.

In his paper Mr. Rickard starts the battle, and does not fail to exercise the prerogative of the challenger in choosing the weapons.

His first weapon is the term 'ore,' and the primary condition imposed is that it must be extracted at a profit or it is not ore. A narrow vein containing 1 oz. of gold to the ton near the surface in a country of soft rock might pay to extract, and, consequently, would be 'ore,' while the same vein at a greater depth in a hard country might contain 2 oz. of gold to the ton but would not pay to extract, and, consequently, would not be 'ore.' In such a case, while the gold content of the vein had doubled in quantity, the 'ore' would not persist in depth.

Such an irrational definition complicates the question at issue, and will deprive the discussion of some of its value, but, nevertheless, Mr. Rickard has defined the subject, which he allows us to discuss, and we must abide by his decision.

Among the definitions it is unfortunate that the class of orebody to be discussed has been left uncertain. It would hardly be worth while for anyone to write a paper with the object of proving that orebodies formed by secondary enrichment do not persist in depth, for every miner at all conversant with his subject knows that they do not. On the contrary, there are few who would have the hardihood to assert that magmatic segregations, such as the nickel-copper orebodies at Sudbury, do not continue to great depths, for the acknowledged method of their formation would indicate persistence downwards with the margin of the norite laccolith with which they are associated, and no proof has yet been offered that would indicate a contrary set of conditions.

The title of the paper does not state whether the author intends to use the surface of the earth as the starting point from which to measure the depth to which ore persists, but the whole tone of his paper would indictate that this is his intention. Now, the present surface is an accidental or fortuitous section through the rocks which compose the earth's crust, and on account of either sedimentation or erosion, which is constantly in progress, is a different plane from the surface at the time when any orebody was formed. The difference may be slight or it may be great, but it is different. If the surface at the time had been the controlling factor in the deposition of the ore, or had been the datum plane from which the ore was deposited, that datum plane is now either above or below the position which it occupied at the time of ore deposition. In the case of most secondary enrichments, where the surface has exercised a controlling influence in their deposition, and where that surface has since been subject to erosion, the controlling datum plane was above the present surface. In the case of many primary deposits formed in fissure veins by ascending solutions, the cause controlling deposition was at an unknown but often great distance beneath the surface, and this controlling cause or datum plane may have had no relationship whatever to the surface as it then existed, and may have been far beneath it.

In some cases the datum plane, while beneath the surface at the time of the formation of the deposit, is now partly beneath and partly above the present surface.

The Cobalt Silver Deposits—An excellent example of this condition may be seen at Cobalt, in Northern Ontario, where a sill of coarse diabase, about 500 ft. thick, was intruded into pre-Cambrian rocks of Keewatin and Huronian age. Both the lower and upper surfaces of this sill were planes from which the silver-bearing veins extended more or less vertically at right angles to it, so that if the sill with the dependent veins could be lifted up these veins would be seen hanging as series of fringes from its lower surface.

Erosive agencies have removed the rock which formerly covered this sill over large areas, have bevelled off the sill itself to an edge, and have removed it completely with the over-lying rock over other large areas. Most of the veins which have been worked up to the present time are in the area from which the sill was completely removed, though they are sufficiently near its edge to indicate that they must have been close to its lower surface before its removal. Veins so situated were easily discovered, but the discovery of veins which are still beneath the sill, and have not been exposed by the removal of the sill through processes of erosion, is a much more difficult matter, because it necessitates the driving of expensive tunnels and cross-cuts through the hard underlying rock. However, some such veins have been discovered. The first one that came under my observation was in a mine just east of the Nipissing property. It terminated upwards at the lower surface of the diabase sill, and extended thence downwards into the underlying rock.

In the south-eastern portion of the Cobalt area the surface has not been eroded down to the diabase sill,

*A contribution to discussion of a paper by T. A. Rickard, published in February Bulletin of the Institution of Mining and Metallurgy.

and there the ore was found to extend upwards from the diabase sill towards the surface, but not to the surface. In this district very rich ore has been found at a depth of 650 ft. below the present surface, which is considerably deeper than the 400 ft. recorded by Mr. Rickard.

Considered generally, the mode of occurrence of silver ore at Cobalt is typical of rich veins which have been formed beneath the surface, but, as far as is known, quite independent of surface agencies. The datum planes to which the ore must be referred are the upper and lower surfaces of the diabase sill, and not the present surface, and as the ore does not persist for more than a few hundred feet from these datum planes, where these planes are close to the surface, the ore-bearing veins naturally do not extend to great depths. Whether similar veins would be found at great depths, if the upper or lower surface of the sill were followed where it dips under the overlying rock, is not known.

Even the Lake of the Woods, to which reference has been made, can furnish some evidence relative to the downward extension of orebodies, and the independence of the datum plane controlling deposition from the present surface.

One mine which I examined, and which for a time had been worked at a profit, was found to have a strong well-defined quartz vein near a contact of a porphyritic granite with green schist. This vein had been followed to a depth of several hundred feet, and several thousand feet of drifting had been done on it. It was found to contain some gold throughout with an average tenor of about 1 dwt. to the ton, or perhaps less. In its deeper portion it was in the granite, but higher up it crossed the contact into the greenstone, and at the contact was constricted. Below the constriction there was a decided enrichment of the vein forming a well-defined ore-shoot. The line of constriction was pitched at an angle of 25°-30° to the horizontal, which brought it to the surface, while at its lower end it opened up and the ore-shoot disappeared. In this case the datum plane which controlled the formation of the orebody would appear to have been the constriction at the contact, and the present surface was merely an accidental section through this constriction, without any apparent relationship to the extent of the orebody.

Extension of veins—In considering the extension of ore-bearing veins, the datum planes controlling deposition must be given first consideration, even though, for purposes of mining, these datum planes may need to be reduced to the present surface of the earth. But the conditions of vein formation have been so varied, and, in many cases, especially where the ore has originated from deep-seated sources, are so obscure, that a generalization, covering either the vertical or lateral extension of orebodies, which uses as its principal factor an artificial plane like the present surface, instead of the structural datum plane which controlled deposition, is certain to be erroneous, and deductions drawn from such a generalization will be 'scientifically untrue.'

The author's method of sweeping aside all evidence and simply asserting his belief that most ore deposits are of recent origin will hardly carry conviction to thoughtful mining engineers. Instances in which the gold, or other valuable material for which a mine may be worked, has been determined to have been deposited at but a slightly later date than the gangue of the vein in which it occurs must be known to everyone, and it is not necessary to enumerate details of evidence here. However, I might mention one of many instances. In the pre-Cambrian rocks of the Porcupine district of Northern Ontario, gold-bearing quartz veins occur in basaltic greenstones and sericitic schists. The most recent rock in this pre-Cambrian complex is a basic syenite which, in the form of a dyke, cuts across the schists with its contained gold-bearing veins, and is evidently later than the introduction of gold into the vein, showing that enrichment was confined entirely to pre-Cambrian times previous to the intrusion of this dyke.

Mr. Rickard's brilliant paper on the mortality of mines reminds one rather strongly of the sickness and death of human beings, and the general tone of his paper would suggest a farther comparison with the occurrence of human diseases, leaving one with the thought that as a man must die it is not worth while for the doctor to attempt to prolong his life by endeavoring to heal the disease from which he is suffering. As with many human beings, so with many mines, it might be found that a closer study of the diseases from which they are suffering would lead to a better knowledge of the causes of those diseases and of the means to be adopted in rectifying them where such rectification was possible. In undertaking the investigation and study of the orebodies of such mines the investigator must approach the subject in a scientific spirit of complete independence from unproved theories, whether those theories refer to the persistence or non-persistence in depth of the ore or to some of its other characteristics. After the examination is completed the honest valuator or investigator will state the results of his investigations candidly, whether those results may happen to agree with the confirmed and pessimistic opinions of others or not.

The paper will doubtless serve a useful purpose in repeating a warning to the public, a warning which has been given many times before, though rarely with such elegance and force, against the value of optimistic reports on mines and mining properties made by interested parties who are ready to certify to the indefinite extension of their orebodies in all possible directions. However, it will lose a large portion of its value to either the public or to mining engineers if it serves to encourage a cynical disbelief in sound evidence of the existence of bodies of ore, no matter where situated, until that ore has been actually raised to the surface.

ALBERTA PETROLEUM CO.

At the annual meeting of the Alberta Petroleum Consolidated Company, the financial statement presented disclosed that the company had in the bank $30,267.49; accounts collectable $3,357.02, and a $5,000 credit with the Northwest Drilling Company to be used against further drilling contracts with that firm.

In addition the company has 60,000 acres leased, seven drilling outfits, and $27,000 worth of casing.

It was announced by the president that a pooling agreement, covering 2,566,000 shares, had been arranged, and that a large number of the big shareholders had agreed to contribute a portion of their holdings to a common fund, to be sold later should occasion warrant it. He stated, however, that there were still in the treasury 6,600,000 shares for further development.

In conclusion he mentioned that the company had 8,176 shareholders, and that 24,420 certificates had been issued.—Journal of Commerce.

NON-METALLIC MINERALS USED IN CANADIAN MANUFACTURING INDUSTRIES*

By Howells Frechette.

The rapid industrial growth which Canada has been undergoing in recent years has greatly increased the demand for the non-metallic minerals and is constantly affording new uses to which they may be applied. In many of the manufacturing industries, minerals, in a more or less crude state, are used as raw material or, indirectly, as a means of producing the products of the factory.

An unduly large proportion of the mineral used in these industries is imported. In some cases the importation is necessary or advisable, since some minerals and particular grades of others are not obtainable at present in Canada, or the material may be obtained from abroad for less than the cost of production and delivery of the Canadian. In other cases, however, it is due to the fact that the domestic products are not always prepared in the form most suitable for the purposes for which they are required. Frequently the buying and selling methods in use are at fault. For example, the Canadian producer, through lack of capital, is often at a great disadvantage, being unable to advertise extensively and thus attract attention to his product and secure a trial of it, even though his price be lower and his product as good or better than the imported article. During the gathering of data for this report it was found, in many cases, that the consumers of certain minerals were not aware that these were produced in the country, often quite close at hand. In such instances a list of the producers and their addresses was furnished.

There are a number of trade journals which reach the manufacturers, and it would seem that even small advertisements judiciously placed by the Canadian producers would aid greatly in increasing the amount of domestic minerals used in our manufacturing industries.

The greatest bulk of imported minerals comes to this country from the United States. The American producers and jobbers have standardized their products and established grades with trade names, which they have brought to the attention of the consumers in this country by persistent and systematic advertising and efficient selling methods. Their goods have been tried and become known to the manufacturers, who, when satisfied with the results, have been loth to experiment further.

A great many manufacturers know little concerning some of the raw materials which they use, the selection of which is frequently left to the judgment of the supply firm with which they deal, or else is based on an original trial shipment. It is very seldom that specifications are used in purchasing. The orders are made to read "same as last shipment," or "suitable for such and such a purpose."

Since the organization of the Mines Branch, numerous inquiries have been received with regard to the demand for non-metallic minerals; the uses to which they are applied; and the requirements of consumers with regard to purity and physical properties. In many cases, these inquiries were difficult to answer, owing to the lack of an intimate knowledge of the Canadian market and its requirements. In order that such data might be available I was commissioned to visit the manufacturers throughout the Dominion, with instructions to obtain from them as much information as possible regarding the non-metallic minerals used by them; the quantity of each consumed per year; the price delivered; and the source of supply, whether domestic or imported.

Asbestos—In this country the principal manufactures of asbestos are mill board, paper and shingles, for which purpose a short fibre is used.

In the making of certain mineral flooring short fibre asbestos enters into the mixture, where it acts as a binder.

On account of its low electrical conductivity it is used as an insulator in electrical instruments. While asbestos paper and mill board are principally used for this purpose, considerable long and short fibre are also employed.

Short fibre is mixed with paints to produce a fire resisting paint. It is also used in making stove cement, pipe covering, etc.

Long fibre, besides the uses referred to above, is used in making gaskets for packing glands and pipe joints where high temperatures or acid solutions are encountered, making of chemical and water filters, and as a surfacing of gas grates.

Asbestic is a name applied to impure very short fibre asbestos. It is used by plasterers, manufacturers of roofing, and also for a number of the purposes referred to above.

Barite is used for three purposes by paint manufacturers.

1. As a "filler" for white lead and other paints. It was first employed purely as an adulterant both on account of its weight and its cheapness as compared with the white lead with which it was mixed. Later it was recognized that it had properties which gave to the paint certain advantages. For example, the fine angular grains were found to give to the surface of the paint a "tooth" which offered a good bond to subsequent coats. It also adds to the life of the paint, since it is unaffected by weather and chemical fumes.

2. As a vehicle for color in paint making. In "The Barytes Deposits of Lake Ainslie and North Cheticamp, N.S.," Henry S. Poole says: "The fitness of barytes as a pigment is due not merely to its weight and absence of color, but to its aptitude to take colorstain uniformly and make a small quantity of a decided color cover much surface, a property not equally borne by other white substances, such as gypsum and marble, which the manufacturers of barytes for the market find it desirable to remove by special treatment. Barytes acts as a base for aniline and certain other pigments."

3. For putty making. Putty is often made by simply mixing whiting and linseed oil to the consistency of dough. By substituting barite for part of the whiting a lesser quantity of oil may be used to produce the same bulk, thus saving on the price of oil.

For the above three purposes the barite is ground to the fineness of flour, and in the case of the first two it is also lixiviated, as described later, in order to remove any stain.

*Extracts from a report published by the Mines Branch, Ottawa, 1915.

Rubber manufacturing. Barite is used for "weighting" or "filling." For this purpose the mineral is very finely ground, but need not be lixiviated as the color is not of much importance. The presence of barite, it is claimed, is desirable in rubber up to a certain percentage, as it adds to the resiliency and the durability of the product.

Textile manufacturing. A very small quantity of finely powdered lixiviated barite is used in Canada for filling cotton goods.

Wall paper manufacturing. Barite is used in the preparation of certain pigments employed in the printing of wall paper. The colors are precipitated on barite. For this purpose the mineral is finely ground and lixiviated. Absence of color is essential.

Tanning industry. In the finishing of some leathers barite enters into the composition of the dressing. For this it is finely ground, but need not be lixiviated.

Chemical manufacturing. Barite is used as a source of barium in the manufacturing of various chemicals.

In addition to the above uses to which barite is put, it has been stated that it is used to some extent as an adulterant in candy making, etc. This is, of course, not legitimate. The writer is not aware of any being used in Canada for this purpose.

Limestone, dolomite, and marble are very valuable as building stones, not only on account of their strength and appearance, but because of the ease with which they may be wrought into shape. Lime, the calcined product of these stones, is also a valuable building material. In fact, the principal use of lime is for this purpose.

From the standpoint of the amount consumed and diversity of uses in the industries, no other non-metallic mineral products, except coal, can compare with limestone and its group. The various industries employing them will be dealt with individually and their requisites stated briefly.

The following table from the chapter on lime in the "Mineral Resources of the United States" serves well to show the many uses to which lime is put, and also indicates the type of lime preferable in each case.

Chemical Uses of Lime.

Agricultural industry—As a soil amendment, c, m; as an insecticide, c, m; as a fungicide, c, m.

Bleaching industry—Manufacture of bleaching powder, "chloride of lime," c; bleaching and renovating of rags, jute, ramie and various paper stocks, c, m.

Caustic alkali industry—Manufacture of soda, potash and ammonia, c.

Chemical industries—Manufacture of ammonia, c; manufacture of calcium carbide, calcium cyanimid and calcium nitrate, c; manufacture of potassium dichromate and sodium dichromate, c; manufacture of fertilizers, c, m; manufacture of magnesia, m; manufacture of acetate of lime, c; manufacture of wood alcohol, c; manufacture of bone ash, c. m; manufacture of calcium carbides, c; manufacture of calcium-light pencils, c; in refining mercury, c; in dehydrating alcohol, c; in distillation of wood, c.

Gas manufacture—Purification of coal gas and water gas, c, m.

Glass manufacture—Most varieties of glass and glazes, c.

Milling industry—Clarifying grain, c, m.

Miscellaneous manufactures—Rubber, c, m; glue, c, m; pottery and porcelain, c, m; dyeing fabrics, c, m; polishing material, c, m.

Oil, fat and soap manufacture—Manufacture of soap, c; manufacture of glycerine, c; manufactures of candles, c; renovating fats, greases, tallow, butter, c, m; removing the acidity of oils and petroleum, c, m; lubricating greases, c, m.

Paint and varnish manufacture—Cold-water paint, c, m; refining linseed oil, c, m; manufacture of linoleum, c, m; manufacture of varnish, c, m.

Paper industry—Soda method, c; sulphite method, m; for strawboard, c, m; as a filler, c, m.

Preserving industry—Preserving eggs, c.

Sanitation—As a disinfectant and deodorizer, c; purification of water for cities, c; purification of sewage, c.

Smelting industry—Reduction of iron ores, c, m.

Sugar manufacture—Beet root, c; molasses, c.

Tanning industry—Tanning cowhides, c; tanning goat and kid hides, c, m; water softening and purifying, c, m.

(Note—High calcium lime is indicated by "c," magnesian and dolomitic lime by "m.")

Aerated water and carbon dioxide making. Whiting and magnesite are used for the production of carbon dioxide (CO_2), which is principally used for the purpose of aerating beverages. On adding an acid to whiting, carbonate of lime, the acid forms a new salt with the lime and liberates carbon dioxide, which is collected under pressure. In some cases marble dust (stone flour) is used in place of whiting.

As will be pointed out later, the majority of users of magnesite employ it in the calcined form. During calcination it gives off carbon dioxide equal to about half its weight. When the calcining is done in retorts the gas may be saved and stored in iron cylinders, under pressure. Much of the carbon dioxide used in Eastern Canada is produced in this manner. It must be regarded only as a by-product of the calcining, since the calcined magnesite, or magnesia, is the more valuable of the two products.

Where the carbon dioxide is used for aerating beverages the materials from which it is made must not contain any impurities which would give off poisonous or objectionable gases during the treatment. Sulphides and arsenides should not be present except in very small quantities.

Artificial stone and mineral floor making. In the mixture of which the exposed face of artificial stone is made, crushed calcite, crystalline limestone and marble are used. The material should be crushed to pass through a twenty mesh screen. White is the color usually specified, but other colors, including black, are occasionally used to obtain the desired effect. The presence of minerals, which on weathering would produce stains, is objectionable.

Magnesia is one of the principal ingredients in one type of mineral floors. It is mixed with marble dust and other materials and bonded by means of magnesium chloride.

The presence of lime is deleterious, since it tends to bleach any coloring matter added to the mixture and to cause swelling and cracking of the finished floors. Over five per cent. of lime, three per cent. of carbon dioxide, or four per cent. of moisture renders magnesia unsuitable for this purpose. It should be very finely ground.

Terrazzo flooring is made with small chips of marble embedded in cement. Various colors of marble are used. The fragments should be of fairly uniform size. It is graded into a number of sizes, ranging from a quarter of an inch to an inch and a half in diameter.

Sand-lime brick making. Sand-lime brick is manufactured by pressing a mixture of sand and lime into

shape under great force and then subjecting the brick to the action of steam under pressure for several hours. Both high calcium and magnesian limes are used, but the better results are obtained from the former. Argillaceous matter is inert under the conditions of this process, and its presence simply reduces the quantity of available calcium, or magnesium oxide, per ton of lime. Free silica acts as the silica of the sand to which the lime is added; thus it is of no advantage and reduces the percentage of the active agents in the lime. In general, the purer the lime the better it is.

Button manufacturing—Whiting is used as a polishing material for pearl buttons. It should be free from grit and very fine.

Cement manufacturing—In the manufacturing of cement large quantities of limestone are used. The cement companies usually supply themselves from their own quarries. The limestone should not contain over five per cent. of magnesium carbonate. Ferric oxide should not be so high as to analyze over four per cent. in the cement. Free silica is objectionable. In "Portland Cement," by Richard K. Meade, M.S., he says: "In determining the suitability of a limestone to be used in the manufacture of cement, it is necessary to take into consideration the shale or clay which is to be used with it, as in every case it is the mixture of the two, made in proper proportions, which must have the right composition. . . . ."

In the manufacture of slag cement slaked lime is mixed and ground with blast furnace slag. A high calcium lime is required.

Calcium carbide manufacturing.—On heating lime to a high temperature, in an electric furnace, in the presence of a definite quantity of coke, a chemical union takes place between the calcium of the lime and the carbon of the coke, forming calcium carbide (CaC_2). As pure a lime as possible is required. Magnesia should not exceed three per cent.; some manufacturers specify one per cent., or less. The lime should be free from sulphur, phosphorus and arsenic. Iron and silica should be low. The total impurities, including magnesia, should be under five per cent.

These same specifications apply to lime used in preparing cyanamid.

Pharmacists and chemical manufacturers—Lime, chalk and magnesite are used for a number of purposes in the chemical industry. For practically all of these purposes, the purest obtainable material is demanded.

Illuminating gas works—Illuminating gas, as it leaves the retorts, carries with it certain impurities which must be removed before it is fit to turn into the service mains. The gas is passed through beds of hydrated lime, which combines chemically with certain of these impurities and removes them from the gas. The calcium oxide is the active agent in this operation, and, therefore, the high calcium limes are most desirable.

Lime is also employed in extracting the ammonia from the ammonia liquor which is a by-product of gas making.

Electrical goods manufacturing—Marble is used, in the form of polished slabs, for the mounting of instruments for switch boards. The marble for this purpose should be free from electrical defects; that is, it should be free from graphite, pyrite and other electro-conductive minerals. The presence of seams of quartz is objectionable, since they are likely to cause deflection of the drill when holes are being bored.

Marble dust is used in the mixture of plaster of Paris for cementing incandescent lamp bulbs into their metal sockets. It should be finely powdered and free from large particles. Whiting is used also for this purpose, and in the making of dry batteries.

Hydrated lime enters into the composition of the insulation for electric wires. A high calcium lime is most desirable.

Manufacturing of explosives—In the manufacturing of one kind of high explosive chalk is used. It must be very pure—absolutely free from siliceous grit.

Foundries—In many foundries limestone is added to the cupola charge as a flux for the siliceous matter of the coke ash, and the sand adhering to the pig iron. Little attention is paid to the composition of the resulting slag from the foundry cupola, and, therefore, as one might expect, little attention is paid to the composition of the limestone used. The limestone employed is almost always that which is most easily obtained. A fluid slag may be produced with either a high calcium limestone or a dolomite. The stone should be low in silica, since the silica contained will require part of the lime to slag it, thus reducing the quantity of available lime.

Glass manufacturing—Calcium oxide is one of the principal constituents of several kinds of glass. It is added to the glass mixture in the form of limestone or lime. Most producers prefer the latter, as the evolution of the carbon dioxide of the former is liable to cause flaws in the finished product. A high calcium content is essential. Magnesia, alumina and iron are objectionable. For the making of the better grades of glass there should not be over three-tenths of one per cent. of iron oxide, or the equivalent amount of iron, in the raw limestone; for lime, one-half of one per cent. is the limit.

Match manufacturing—Magnesia and whiting are used in compounding the mixture for the heads of matches. A fairly pure material is required, and should be very finely ground.

Glue and fertilizer manufacturing—In the manufacturing of glue and fertilizer lime is used. The purity of the lime is not a matter of importance, except in its effect on the percentage of calcium oxide and magnesia available.

It is said that lime for fertilizer purposes should contain sufficient magnesia to make its ratio to the calcium oxide as four is to seven.

Metallurgical works—In the extraction of metals from their ores by smelting, the metals are reduced to the metallic form or converted into sulphides, called mattes. The gangue minerals of the ore and the ash of the fuel must be removed. This is accomplished by smelting with some fluxing material and allowing the slag to flow from the furnace. The nature of the flux depends upon the chemical composition of the material to be fluxed. If they are basic, an acid flux, such as quartz, must be used, but if they are acid the flux must be basic. Being the most active of the cheap bases, lime, in the form of limestone, is most frequently used in the smelting of acid ores.

As already pointed out, under foundries, the limestone should be of low silica content. The desirability or undesirability of magnesia is determined by the particular process of smelting in which it is to be employed. Sulphur and phosphorus are most undesirable, especially in the smelting of iron and the converting of iron into steel. As a rule arsenic is a very objectionable impurity.

In the basic method of steel converting, calcined magnesite is frequently used as a furnace lining, either in the form of bricks or shaped within the furnace from

the ground material. For this purpose it should be very low in silica. Calcined dolomite is also used as a furnace lining.

Oil refining—Lime is used in the refining of petroleum for the purpose of removing acidity from the oil after treatment with sulphuric acid.

The lime may be either high calcium or dolomitic.

Paint manufacturing—Lime, magnesia and whiting are used in the paint industry for a number of purposes, especially in the making of cold-water paints. High magnesian limes are preferred and should be air-slaked or hydrated. They should be very finely ground, free from grit, and as nearly white as possible.

Whiting and finely ground marble are used for making putty and wood filler.

Polish manufacturing—Whiting and very finely ground marble are used in manufacturing certain metal-polishing pastes and creams. Freedom from coarse gritty matter is the main requisite.

The manufacturers of polishes often put up a "sweeping compound," which is principally composed either of sand or crushed calcite. The calcite should be crushed to pass through a twelve-mesh sieve and should be free from dust. The waste product from the concentration of certain ores should be well adapted to this use.

Enamelware manufacturing—Some manufacturers of enamelled metal ware use calcite in the composition of their enamel mixture. For this purpose the calcite should be very pure, containing not more than traces of iron oxide. It should be ground to one hundred mesh.

Pulp and paper manufacturing—Wood pulp is manufactured by two chemical processes, known as the sulphite process and the soda process.

In these processes the wood fibre of which the pulp is composed is bleached and freed from the resins and the cementing material of the wood by means of chemical solutions.

In the first process the solution consists of calcium and magnesium bisulphite, and is prepared by subjecting dolomitic limestone to the combined action of sulphur dioxide and water. Quick lime or hydrated lime may be substituted for the limestone. Both the calcium and magnesium are active agents. The high magnesian limestones are preferred because of the better pulp resulting from their use.

Caustic soda is the active element of the solution used in the soda process. After the treatment of the wood with this solution the soda may be recausticized by means of lime. A high calcium lime is desirable, as magnesia plays no part in the reactions.

Rubber goods manufacturing—In the manufacture of rubber goods, lime, magnesia and whiting are used as weighting materials. They should be very finely powdered (200 mesh) and free from grit.

The grade of whiting generally used is that known as "gilders'." Phosphorus is very objectionable.

Sugar refining—In the manufacture of beet and cane sugar, lime is employed as a reagent in the processes involved. The manufacturers generally calcine the limestone themselves and make use of the carbon dioxide given off.

A high calcium limestone is specified, containing very little magnesia. It should also be low in insoluble matter, iron, alumina and alkali. The alkali should not exceed one-quarter of one per cent. Oyster shells are sometimes substituted for limestone.

Tanning—Lime is used to aid in the de-hairing of pelts preparatory to tanning. A high calcium lime is the most desirable in this process for most kinds of skins, but it is said that magnesia is a valuable constituent for use on goat hides. The lime should be low in iron oxide and insoluble matter. In most cases quicklime is used, but hydrated lime is said to be more satisfactory. Quicklime is liable to become air-slaked, thus losing its caustic property. Hydrated lime absorbs carbon dioxide very slowly when properly stored, hence the loss is likely to be much less from this source.

It may here be pointed out that quicklime requires careful storing to overcome the danger of fire being started from the rise of temperature occasioned by the absorption of moisture. Hydrated lime is not subject to this rise of temperature. Insurance underwriters recognize this and take it into consideration when fixing the rate of risks.

There are a great number of other important uses to which limestone and its allied materials are put, but the above are those of major importance to the Canadian producer.

Chromite is used in the chemical industry for making chromic acid and the various salts of chromium, which in turn are used for making paint and ink pigments and other purposes.

It is also employed as a source of chromium in the manufacture of chrome steel. In this case the iron content is also utilized. Chromite is very basic in chemical reaction and highly refractory, suiting it to the manufacturing of fire bricks for certain metallurgical purposes, and also for the lining of basic open hearth steel furnaces, the only use to which it is put in Canada at present.

When used for refractory purposes silica is an objectionable impurity and should be reduced by concentration to at most five per cent.

Clays—The uses to which clay may be put depend upon its physical properties, such as its plasticity, the effect of drying, its behavior at various temperatures, tensile strength, and its color, both raw and after firing.

Very complete data on the requirements as to composition and physical properties of clays for special purposes may be found in "Clays: Their Occurrence, Properties and Uses," by Professor Heinrich Ries. The description in detail of the various clays of commerce would require more space than is available for the subject, and is outside the intended scope of this report.

In the table of minerals used, clays are divided under the following headings:

(a) Clay—Under this heading are included clays not specified elsewhere, common brick clay, unclassified clays and local clays generally.

(b) Ball Clay—This is a very plastic clay of high tensile strength used in porcelain making to give plasticity to the body of the mix. It must be very low in impurities which would tend to color the finished product, when intended for use in making white ware. It is used also as a bond in abrasive wheels.

(c) China Clay or Kaolin—This is a white clay, consisting, almost entirely, of hydrated silicate of alumina. It is not very plastic as a rule. As its name implies it is used largely in the making of china and porcelain. It is also used as a filler of cotton goods and paper, in the coating of book and wall paper, in the coating of cloth for window blinds and in the manufacture of paints. It also enters into the composition of some mineral floorings.

(d) Fire Clay—Clays possessing a very high refractoriness are termed fire clays. They differ among themselves greatly in many of their physical properties and in composition, but are always low in impurities such as lime, magnesia, iron oxide and alkalies, which are

fluxing materials. When there is a high percentage of uncombined silica in a fire clay it is called ganister. This name is also applied to a silicious rock used in making firebricks. Fireclay should not fuse below 3,000 deg. Fahrenheit.

The uses of fire clay depend primarily upon its refractoriness. It is manufactured into certain classes of firebrick, furnace and stove linings, crucibles and briquettes for gas grates. It is also extensively used for bonding the brick work or boiler settings, cupola and metallurgical furnace linings. The quantities given in the accompanying tables do not include that used for boiler setting, except in a few instances.

(e) Pipe Clay—This is a plastic white clay, relatively high in silica. It is used in manufacturing procelain and enamelware. It is used also in paint making, on which to deposit certain colors. For this purpose it should be free from grit and uniformly white.

(f) Sagger Clay—This clay is used in the mixture for making saggers, the vessels in which porcelain and pottery is placed for burning. The necessary degree of refractoriness varies according to the temperature of the heat the saggers must stand while in use.

(g) Slip Clay—This term is applied to clay used as a glaze for stoneware. It contains a comparatively high percentage of fluxing impurities, and should melt at a low temperature to a greenish or brown glass. This clay is used also as a bond in abrasive wheels.

(h) Stone Clay—This is the name given to the clay forming the body of stone ware. It is usually refractory or semi-refractory and should vitrify without losing its shape. It should be of good tensile strength and sufficiently plastic to work well on the potter's wheel.

Corundum—Owing to its hardness and to the fact that it is not brittle, corundum is admirably suited for use as an abrasive. It is employed for grinding and polishing, both in the form of powder and wheels.

In the making of wheels the grains of corundum are mixed with clay and fluxes and moulded into shape, after which the wheels are "fired" at such a temperature as to establish a strong bond between the particles.

Emery is an impure corundum. It is almost black in color and contains magnetite and hematite intimately mixed.

Its uses are the same as pure corundum, but its abrasive power is very much less.

Cryolite finds its principal use, in Canada, in the electrolytic reduction of aluminum, in which process it acts as an electrolyte. It is used to a small extent in the manufacturing of opal glass.

Feldspar—The main uses of feldspar are in the ceramic arts. Feldspar, either No. 1 or No. 2 grade, is one of the principal ingredients of the body and the glaze of the porcelain. In the body it fuses during the firing and forms a firm bond between the particles of quartz and clay. In the glaze it fuses and combines with the other ingredients to form an opalescent, glassy covering to the ware on which it is applied. Thus it will be seen that the temperature of fusion is an important factor in selecting a feldspar for these purposes. The melting point depends largely upon the percentages of alkalies in the spar. The higher the percentage of potash the lower will be the point of fusion. Where a small part of the potash is replaced by soda it will be found that the point of fusion is still lower.

The spar should be as free as possible from iron-bearing or other dark-burning minerals. "Several dark-burning minerals—hornblende, tourmaline and black mica—if not completely separated, show in the fired sample or finished ware as very fine black specks. These would hardly be noticed by the uninitiated, but contribute a grey cast to the ware." Though quartz is added to the feldspar in the various mixtures, some users specify against free silica in excess of 5 per cent. They prefer to add the quartz themselves, thus obviating the danger of irregular results arising through the fluctuation of silica contents of the high-silica spar.

Feldspar, usually No. 2 grade, is used in enameling brick and metal. The spar is one of the fluxing materials which goes to form the porcelain-like coating of the ware. For this purpose, also, the spar should be as free as possible from the dark-burning minerals.

In the making of artificial teeth only the highest grade of feldspar, containing no dark-burning minerals whatever, is used.

In the manufacturing of abrasive wheels feldspar is one of the bonding materials used. On firing the wheels, the feldspar fuses and firmly cements the grains of emery, corundum or carborundum together. For this purpose No. 3 grade is employed, and, since the color is not of importance, small quantities of foreign minerals are not objected to.

The addition of alumina to the mixture for glass-making causes opalescence. Since feldspar contains alumina in a readily fusible form it is used in manufacturing opal glass. White mica in very small quantities, and free silica are permissible, but the spar should be as free as possible from iron-bearing or other minerals which would tend to color the finished product.

Very finely ground feldspar is used in preparing certain scouring soaps and polishes.

Coarsely granular feldspar of low grade is used as a surfacer for some prepared roofings.

In making artificial stone the surface to be exposed to view is made of a mixture of some fine grained mineral and cement. In some cases feldspar is the mineral used. Generally the white spar is specified, but the red is employed to produce certain effects. For this purpose the mineral is ground to pass a twenty mesh screen. The presence of small quantities of dark-colored minerals makes little difference, but such minerals as pyrite, which on weathering would cause stains, are decidedly objectionable.

A small quantity of low grade feldspar, crushed to about one-eighth of on inch, is sold as "poultry grit."

Fluorite or Fluorspar—The main use of fluorite is as a flux in the metallurgical industries. In the manufacture of basic open-hearth steel, large quantities are used to render the high calcium slag employed more fluid. No. 3 grade, containing 85 per cent. or more, calcium fluoride and about 3 per cent, or less silica, is specified. In some cases fluorite is used as a flux in blast furnace and foundry practice. For these purposes the cheapest grades are used.

Fluorite enters into the composition of the mixture used in enameling iron and steel ware. It is used also in the making of opal glass. "No. 1 ground," containing less than a half per cent. of oxide of iron is specified. Small quantities are used in etching glass.

In the chemical industry, fluorite is employed as a source of fluorine in the manufacture of hydrofluoric acid and various fluorides. For chemical purposes the higher grades are used exclusively.

Fluorspar is employed in the electrolytic refining of lead to prepare the lead fluosilicate used as electrolyte and also in the electro reduction of aluminum.

(To be Continued.)

COAL WASTE IN CANADA AND THE COMMISSION OF CONSERVATION

By F. W. Gray.

Dr. F. D. Adams, of McGill University, addressed the Commission of Conservation at its annual meeting in Ottawa during January on "Our Mineral Resources and the Problem of Their Proper Conservation," and further addressed the Canadian Mining Institute at the annual meeting in Toronto on the same fruitful subject.

Dr. Adams' paper has been given wide publicity, and very properly so, as it is one to arrest the attention of all thinking men, and is particularly interesting to coal men, because it deals in a comprehensive and yet concise manner with the wastage of coal in Canada. both with regard to the waste in the process of extraction and in connection with the utilization of coal as a fuel and a source of light and power. Further than this the utilization of coal in Canada can hardly be said to have advanced, except in one or two instances..

The subject is an apposite one at the present time, when the stoppage of German imports has shown the world how largely it had become dependent on the by-products of coal distillation as perfected in German laboratories and factories. No one who has ever given even the most cursory attention to the matter will dispute with Dr. Adams the neglected opportunities presented by the methods of using coal which are usual in Canada and the United States to-day. The refinements of coal distillation have indeed been up to now so neglected on this side of the Atlantic as to be almost non-existent, as witness the numerous recent announcements regarding the erection of benzol recovery plants in connection with by-product coke oven plants in the United States and in Canada. For almost twenty years past it has been the practice in European by-product coke oven plants to recover benzol along with the other by-products, but it is doubtful if there is one benzol recovery plant in Canada to-day, and even in the United States, with its astonishing annual coal output, the number of benzol plants is strictly limited. In this connection it will be interesting to see whether the Rittman process of recovering benzol and toluol from the residuals of crude petroleum is likely to become a serious competitor of the coke-oven benzol.

The "fuel engineer."—There is no more promising field of endeavor open to the young scientist of to-day than that of the "fuel engineer," that is to say, the man who combines with a working knowledge of mechanics and engine design a knowledge also of the proved possibilities of coal, of the conservation of the gases of combustion, and the complete utilization of all that is in the coal. The day is rapidly coming when the designer of a power plant will consider equally with the boilers and generators the by-product recovery plant that will be installed alongside to profitably utilize the gases and smoke which to-day are worse than wasted and pollute the atmosphere. There are already in existence power plants in which the production of power is really subsidiary to the profits obtained from the by-products of the fuel consumed in raising the power, so that, paradoxical as it may seem, the "by-product" has become the preponderating factor. The so-called "chemical engineer" or "fuel engineer" is a sign of the times, and a sign moreover of much promise. Apart from the question of the recovery of by-products is the problem of the complete utilization of heat, and the interesting line of research opened up by Dr. Bone, and carried into practical effectiveness by the Bonecourt boiler, recently put into operation in Great Britain.

Wasteful methods of extraction of coal.—But while everybody will heartily agree with Dr. Adams, and will welcome his courageous utterances in regard to the haphazard and wasteful methods attending the present use of coal, some of the strictures passed upon the methods of extraction seem to be unnecessarily severe.

Several wasteful methods in the extraction of coal are specified summarily as follows:

"Thick coal seams, capable of being easily and profitably worked, are mined without reference to the extraction of overlying or closely adjacent seams. Thick seams are only partially worked, the unworked portion being rendered irrecoverable. Pillars left to support the roof are not extracted as completely as they might be. Excessive use of powder causes too great a percentage of slack."

Nova Scotia methods.—A very serious statement is that: "In the coalfields of Nova Scotia the amount of coal which has been wasted is at least as great as that which has been extracted. This is apart from and in addition to the coal necessarily left in the mines under the methods of mining employed."

The writer is not fully acquainted with the conditions that exist on the mainland of Nova Scotia, but so far as the Island of Cape Breton is concerned, the foregoing statement seems to require some little qualification.

In the first years of mining in Cape Breton the thicker and more profitable seams were naturally first attacked, and because of the operation of the coal areas by independent and rival companies, the workings were not prosecuted so economically, nor with such efficiency as they might have been had the mines been laid out and conceived in relation to the coal deposit as a whole. This statement does not reflect on the engineering or management of the former proprietors of the mines, but is a necessary corollary of a number of rival operators mining areas of coal the boundaries of which were decided by arbitrary lease lines having no relation to the physical characteristics of the coal deposit considered merely as such. The pillars left for support of the roof were in many cases too small, and the coal was extracted out to the actual outcrop. The result has been that the operators of the present day have received a legacy of pumping which might have been avoided had the outcrop been maintained intact, and areas of pillars have been lost by "creep." This condition of affairs affects however but a negligible portion of the original areas, and is partly excused by the necessary experimentation which must take place before the local peculiarities of any coal field can be accurately determined. How little the actual loss amounts to may be gauged from the fact that the thick seams first worked in the Sydney coal field are still the seams from which the major portion of the output is being produced, and

from the conservation point of view it is fortunate that the preponderating portion of the coal areas of Cape Breton are now controlled by strong companies to whose vital interest it is to work the coal areas scientifically and with a due regard to the future.

Government supervision.—Dr. Adams hints that the improvement in methods of working coal in Nova Scotia is due to more effective Government supervision, and states:

"At the present time every mining company operating under lease from the Government of Nova Scotia is required to submit in advance the plans which it is proposed to follow in opening up any coal seam. These plans must be approved by the Chief Inspector of Mines, under whose supervision the actual mining of the coal is also carried out. The waste of coal has thus been greatly diminished; and would be reduced still further, were it not that in many cases it is now very difficult to introduce the best methods of extraction, owing to the condition in which the mines have been left by the early operators."

There is a misapprehension here, as the Government of Nova Scotia only requires advance plans to be submitted for approval in the case of submarine coal areas. Advance plans are not required in the case of land areas.

Mining coal in Pictou field.—There is justice in the contention that waste of coal areas has taken place, if reference is made to the thick beds of the Pictou field, and this was pointed out many years ago by Mr. H. S. Poole. It would be difficult to state, however, how much of this waste was due to difficult conditions of mining, occasioned by very thick coal seams, pitching at angles approaching the vertical, and associated with emissions of gas almost unprecedented. Mine fires have been largely responsible for the troubles which have affected the mainland fields. In this coal field, as in the Cape Breton field, the improvement to be anticipated, and even now taking place, will come from financially strong companies able to call to their aid the latest methods and the advice of the most competent men. In some of the coal areas of the Pictou field the wonder is not that so much should have been lost, but that any coal should ever have been won, considering the extraordinary physical difficulties that the small individual coal operator has had to face.

Regarding the working of coal seams so as not to endanger the workability of other seams overlying or underlying, this is a matter which has been very carefully considered in Cape Breton. The choice of the seams which have so far been worked has been determined by their accessibility, by the demand for coal of a particular quality, and other economic factors, but in no case have the unworked seams been endangered. There are in Cape Breton untouched to-day coal seams which will remain unworked for many years to come, because these seams are too thin, or of too poor a quality, to be economically worked at the present time. Some day these seams will be worked, but there is no reason to suppose that the working of the thicker seams at the present time will prevent the extraction of the thinner seams at a future date.

The excessive use of powder in blasting down the coal has undoubtedly been the cause of much waste on this side of the water, but this fact has been much more in evidence in the United States than in Canada, unless it is a feature of mining in the Canadian West. The pernicious practice of blasting "out of the solid," and paying for coal on a screened coal basis—leaving the slack in the mine—persists to this day in many parts of the United States, but so far as Nova Scotia is concerned both these practices are non-existent. Seeing that slack coal brings a much lower price in the market than round coal, it is evident that no person has a greater interest in the lessening of the slack percentage than the operator himself. The miner and his loader in Nova Scotia are paid on a run of mine basis, and from the point of remuneration for the work performed it is immaterial to these men whether they make much slack in the process or little. In at least one of the large Nova Scotian collieries no explosives of any kind are used in the extraction of the coal, and in other collieries the system of extraction has been largely decided by the desire to keep down the slack percentage as low as possible. The coal operator in the matter of the choice of an explosive is between two stools. The safer non-flaming explosives have all a tendency to shatter the coal, whereas the formerly used loose black powder worked more slowly and with less shattering of the coal. Apparently safety against flaming is associated with quickness of action, and slowness of action in an explosive spells danger from flame. Until the powder manufacturer can do better, it is to be expected that safety against explosion will be given precedence.

It may be mentioned that from the conservation point of view, the percentage of slack coal is not important, because in these days of slack and dust-fired boilers, slack coal is just as useful as round. The days when slack coal was left in the mine, or used to ballast railroad tracks, have long since past, and there is very little in the way of carbonaceous material around a modern colliery that does not go to the colliery boilers. In fact many of the old slack dumps left by former operators have been cleaned up for use under colliery boilers.

The longwall extraction method, as pointed out by Dr. Adams, permits of a very complete extraction of the coal in the first operation, and the system has for some time been used in Nova Scotia, both in Cape Breton and on the mainland. This method, moreover, by utilizing the roof pressure to break down the coal, avoids largely the use of explosives and produces much stronger and larger coal. The system cannot be successfully used in all cases, more particularly in thick clean seams without partings, and where packing material is scarce. A properly laid out mine on the pillar and room system can moreover be worked so as to secure a very complete extraction of the coal, and in many mines of this character the pillar drawing follows so rapidly upon the room-work that no crushing of pillars takes place. At one time room-work was given first consideration and the extraction of the pillars was a secondary consideration which was left to worry posterity, but to-day the manager of a colliery knows he is expected not only to extract the room coal, but to draw the pillars also.

The assumption that the improved methods of mining coal followed in Nova Scotia at the present time are due to Government supervision is rather flattering to the Nova Scotia Department of Mines. This department has always been noted for the technical excellence of the men that had been at the head of the mining affairs of the Province, and it is no exaggeration to say that the mining practice and the mining laws of Nova Scotia have always kept pace with those of other countries, and have been decidedly in advance of many countries, but the modern mining practice of Nova Scotia is largely an instance of the survival of the fittest and the adaptation of efficient corporate organization to the mining problem.

A recapitulation of the existing plants in Nova Scotia will reveal that these include the latest type of coal washer, dust-fired boilers, exhaust steam turbines, electrically driven air compressors, electric coal hoists, by-product coke ovens recovering tar, pitch and sulphate of ammonia, creosoting plants, tar refining works, making non-corrosive paints, disinfectants, etc., a slag fertilizer works; slag brick works and other modern plant which would take too long to detail, but sufficient has been written to indicate the advances which have been made in the coal mining industry of the Province and its off-shoots. It is not Government supervision, but corporate energy that has developed this modern practice, and has brought about a conservation of money and material of the most striking character.

Supervision of coal mines in Canadian West.—With reference to what appears to be the main contention urged by Dr. Adams, namely, that the dearly bought experience of coal mining in Nova Scotia should be applied to the beginnings of the coal industry in the Canadian West, there can be but little doubt as to the wisdom of this contention, and Dr. Adams' suggestion of a Chief Mine Inspector to supervise the coal areas owned by the Dominion in the West is a good suggestion. Such a man would need to be, as Dr. Adams says, a man of undoubted capacity and integrity, and with wide experience in the mining of coal. The best man obtainable would be none too good for so responsible a position, and he would indeed have to be a very big man to measure up to his job.

PLACER MINING IN THE ATLIN COUNTRY, BRITISH COLUMBIA

Under the above caption, the Alaska and Northwest Mining Journal, published at Seattle, Washington, printed in its February number the following particulars of mining in the most productive placer-gold field in British Columbia:

Many mining men, particularly those interested in Alaska, are often heard to inquire as to the mining activities in the Atlin country, and they wonder what is doing in that section since the stampede there, shortly after the Dawson excitement. The Atlin country is contiguous to the Alaska mineral belt, and on the generally traveled route to the interior of Alaska and the Yukon Territory by the way of Skagway and the White Pass Railway. A chain of lakes from Atlin to Caribou Crossing (Carcross) on the White Pass and Yukon route, which lakes are navigable with the exception of one portage of a distance of two or three miles, makes the trip into this country an easy, as well as a most picturesque and beautiful one.

According to many old prospectors who have been pretty well over the Atlin country, gold will be discovered for many years to come, as it has never been thoroughly prospected, owing largely to the fact that the Klondyke and many parts of Alaska, which proved much richer, lured the prospectors and investors to more promising fields, the Atlin stampede having lasted but a short time. However, in addition to a number of small hydraulic plants and minor activities on the different creeks throughout the district, one of the largest, if not the largest, hydraulic plant in the North or West, is continuously operated each season within a few miles of the town of Atlin.

Mr. Frank Mickle, who recently arrived in Seattle on his way to spend the winter in California, came directly from the Atlin district, and he states that there is considerable prospect work being done in the neighborhood of the new diggings on O'Donnell river, discovered about two years ago, some 25 miles from Atlin. Tunnnel prospecting is still being prosecuted on the different creeks in the vicinity of Discovery. Bedrock in many places is too deep for the dredge, and in sinking or tunneling many good prospects have to be abandoned on account of too much water, which cannot be handled without the installation of an expensive pumping plant. Shafts have been sunk to a depth of 100 ft. on O'Donnell river, but the best prospects found so far are on the benches.

Mining men who have seen the North Columbia Gold Mining Co.'s hydraulic plant always speak of it as "big." Its water supply is obtained from Lake Surprise a body of water about 18 miles long by one wide. The company first constructed a large dam at the outlet of the lake, thereby raising the water in the lake 4 ft. and giving more than 150 ft. head with an unlimited supply of water. A huge ditch, six miles long and averaging 6 ft. in depth and 18 ft. in width, was constructed, a steam shovel having been used in this work. Three lines of 30 in. hydraulic iron pipe, tapering to 16 in., lead from the pressure box or penstock, a distance of about one-half mile to the giants. On the sluicing ground there are operated 12 to 15 giants, these ranging in size from four to seven inch nozzles, most of them of the latter size. Deflectors are used on all these giants, the tailing being stacked by the giants instead of by tailing stackers, which were tried without success on Pine creek, but abandoned as useless on ground of that character. The flume constituting the sluice boxes is four feet in width and has rail steel and heavy block riffles.

REGULATIONS GOVERNING STAKING OF "BAR-DIGGINGS" ON THE NORTH SASKATCHEWAN

Under date of January 26, 1915, the Dominion Government announced regulations governing the working of placer claims. The Privy Council report is as follows:

"Whereas the regulations governing placer mining in Manitoba, Saskatchewan, Alberta and the North-West Territories, established by Order-in-Council, dated the 8th of February, 1909, provide for the granting of entries for creek, river and inland placer mining claims, having in each case a frontage of 500 feet by a breadth of from 1,000 to 2,000 feet.

"And whereas a number of applications have been made for permission to operate, by means of 'rocker' and 'grizzly,' the bars in the North Saskatchewan River in the vicinity of Edmonton, which are known to contain gold in sufficient quantity to make the operation thereof fairly remunerative.

"Therefore the Governor-General-in-Council, in view of the demand which would appear to exist in the Edmonton mining district for small areas of placer mining ground to be operated by hand-methods, is pleased to authorize and doth hereby authorize the Minister of the Interior to grant applicants permission to acquire such ground on the North Saskatchewan river under the following conditions:

"(1) 'Bar-diggings' shall comprise lands in and along any river over which the water extends during the high-water, but which are not covered at low water.

"(2) 'Bar-diggings' shall comprise a strip of land 100 feet wide along the high-water mark of any river, thence extending into the river to its lowest water level.

"(3) Any person desiring to work bar-diggings, the property of the Crown, may upon payment of a fee of $1 to the Mining Recorder for the district in which the rights applied for lie, obtain a certificate upon the following form. This certificate will entitle the holder thereof to stake out, in accordance with the provisions of the regulations governing placer mining in Manitoba, Saskatchewan, Alberta and the North-West Territories, and work bar-diggings of the dimensions above prescribed.

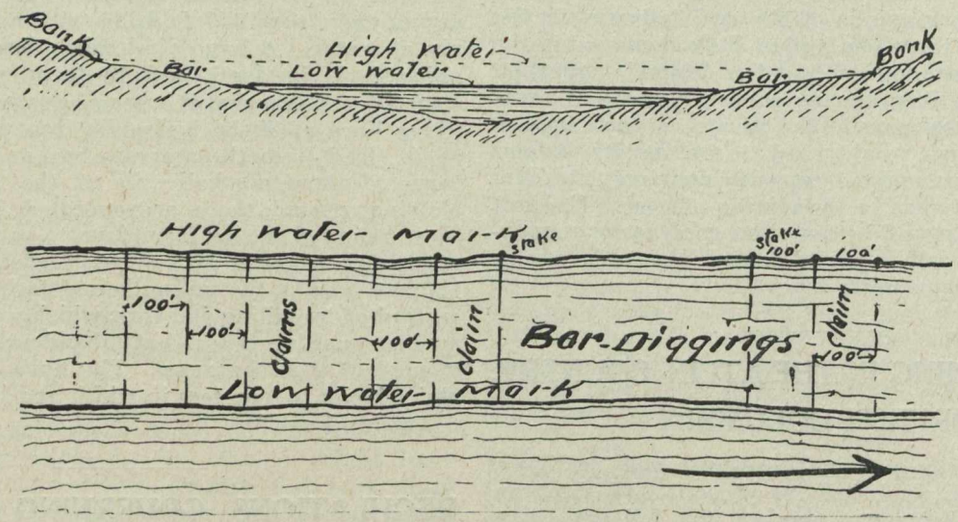
"(4) The holder of a certificate who has staked out available ground in the manner above described, may continue to hold the same as long as he continues to operate it to the satisfaction of the Mining Recorder for the district in which the rights lie, but in case a claim staked out under these regulations remains unworked for three consecutive working days, the rights acquired under such staking shall absolutely lapse, unless a lay-over has been granted by the Mining Recorder.

"(5) The holder of a certificate shall not, in the exercise of the rights acquired under such certificate, cause any damage to or interfere in any way with any roads, ways, bridges, drains or other public works or improvements, and the certificate shall be subject to immediate cancellation at any time without compensation to the holder thereof for any breach of any of the above conditions, or in case it should be shown to the satisfaction of the Minister of the Interior that the operations under the certificate are likely to cause damage, or otherwise prejudicially affect the interests of the Crown or others.

"(6) The operation of bar-diggings shall at all times be under the direct supervision of the Mining Recorder for the district in which the rights applied for lie, and to his satisfaction.

Certificate.

"This is to certify that
of has paid me this day the sum of $1.00, and is therefore entitled to all the rights and privileges prescribed by Order-in-Council governing the granting of 'bar-diggings' on the North Saskatchewan river."



Plan and Section of Bar-Diggings on North Saskatchewan

TORONTO BRANCH, C.M.I.

At a meeting of the Toronto branch of the Canadian Mining Institute, held on Feb. 27, the following resolutions were carried unanimously:

Moved by J. Murray Clark, K.C., seconded by J. B. Tyrrell, F.G.S., that the Toronto branch of the Canadian Mining Institute desires to congratulate most heartily their fellow-member, Willet G. Miller, Ph.D., LL.D., upon being awarded the gold medal of the Institution of Mining and Metallurgy. The Toronto branch appreciates the great distinction thus conferred, as the Institution of Mining and Metallurgy is the most important organization connected with mining in Great Britain, and perhaps in the world, and recalls that the gold medal of this distinguished Institution is only given on very special occasions and in recognition of great merit and signal achievements. The Toronto Branch further desires to place on record their view that in this case the award was well merited by Prof. Miller on account of his high scientific attainments and achievements and his great services to the Canadian Mining Institute and the mining industry of Ontario.

Moved by J. Murray Clark, K.C., seconded by J. B. Tyrrell, F.G.S., that the hearty congratulations of the Toronto Branch of the Canadian Mining Institute be hereby tendered to Professor A. P. Coleman, Ph.D., F.R.S., upon his election as president of the Geological Society of America. The Institute appreciates the great distinction conferred on one of their members, and believes that Professor Coleman will fulfil the duties of this high office with great advantage to the Geological Society, with credit to himself and the University of Toronto and with honor to Canada.

OVERCUTTING COAL.

The Jefferson Mfg. Co. has recently issued Bulletin No. 129-A, illustrating and describing Jeffrey "Arcwall" coal cutters for "overcutting" system of mining.

This bulletin contains valuable information about the design and construction of the "Arcwall" type of mining machine, which is built to cut anywhere above the top of the rail, and is especially adapted for cutting out dirt binders that exist in the coal seam. It also contains interesting views of some of the latest installations. Copies may be obtained by writing to the Jeffrey Manufacturing Company, Montreal, Can.

PERSONAL AND GENERAL

Mr. Chas. A. Banks, general manager for the Jewel-Denero Mines, Ltd., operating the Jewel gold mine and stamp mill near Greenwood, Boundary district, B.C., has been examining mining property in North Saskatchewan.

Mr. M. S. Davys, managing director of the Silverton Mines, Limited, which owns the Hewitt-Lorna Doone group of mines, and a concentrating mill in Four-mile camp, near Silverton, Slocan Lake, B.C., has been on a visit to Victoria.

Mr. George H. Dickson, a Kingston School of Mines man, after having been for some years engaged in mining in Alberta and British Columbia, has volunteered for active service in connection with the war in Europe.

Mr. Robert G. Drinnan, who for fifteen years or more has been closely associated with the management of coal mines in the Crowsnest district of British Columbia and others in Alberta, has been appointed general manager for the Hillcrest Collieries, Ltd., with coal mines in the Blairmore-Frank district, southwest Alberta.

Mr. S. Duncan Ellis, a Toronto University mining engineering student prior to joining the Braden Copper Co.'s staff in Chile, has arrived in England with a number of others from South America who have volunteered for army service. He was at the Falkland Islands shortly after the destruction of the German war vessels in those waters, and sent home to Victoria, B.C., some interesting particulars of that memorable sea fight.

Mr. W. J. Elmendorf, for several years general manager for the Portland Canal Tunnels, Ltd., of Victoria, B.C., was recently in Denver, Colorado. Shortly after his return to his present headquarters in Seattle, Washington, he left for Alaska, on an extended trip through the Fairbanks and other interior districts of that country.

Mr. George Watkin Evans, of Seattle, for some time engaged in examining coal areas in the Groundhog basin of northern Skeena, B.C., and later in charge of operations in getting out 800 tons of coal from the Matanuska field, Alaska, for U. S. navy tests, was among visitors to Victoria, B.C., to attend a recently held meeting of the Western Branch of the Canadian Mining Institute.

Mr. Percy F. Horton, manager of the Zincton and other lead-zinc properties in the neighborhood of Salmo, Nelson mining division, British Columbia, has been spending a week or two on the coast, having been called to Victoria after the death of Mr. H. M. Billings, one of the chief owners of the properties mentioned.

Mr. Frederic Keffer has removed from Greenwood, Boundary district, B.C., to Spokane, Washington, after having been continuously engaged in mining in that district ever since he went there in the summer of 1896.

Mr. Guy H. Kirkpatrick, a Kingston School of Mines graduate who, after some years in Africa, has been associated as a mining engineer with Capt. J. E. Leckie and Lieut.-Col. R. G. E. Leckie at Vancouver, B.C., is now officer commanding the 11th Canadian Mounted Rifles, organized in British Columbia and awaiting a call to active service.

Mr. Lewis A. Levensaler, of the Tacoma Smelting Co., Tacoma, Washington, was in Kootenay district of British Columbia a short time ago, and afterward on a business visit to Victoria.

Mr. Oscar Lachmund, general manager for the British Columbia Copper Co., left Greenwood, Boundary district, B.C., in the early part of March for New Cork City, to attend the annual meeting of the company called for March 9 last, but postponed until later in the month.

Mr. F. Chas. Merry, formerly superintendent for the Ferguson Mines, Ltd., with silver-lead mines in Lardeau district of British Columbia, has gone to Utah after a short stay at Kaslo, B.C.

Mr. L. Muller, superintendent of the John Hopp placer-gold mines near Barkerville, Cariboo district, B.C., has gone to New York to join Mr. Hopp, who has been in the East several weeks on business connected with a proposed new mining development in Cariboo district.

Mr. Ed. G. Montgomery, assistant superintendent of the Consolidated Mining and Smelting Co.'s Centre Star group of mines in Rossland camp, British Columbia, recently made a hasty trip to Moose Jaw, Saskatchewan, and return.

Mr. F. M. Sylvester, general manager for the Granby Consolidated Co., and Mr. Wakely A. Williams, the company's smeltery superintendent, have returned to British Columbia from a business visit to New York City.

Mr. Robert C. Sticht, general manager for the Mt. Lyell Mining and Railway Co., who several months ago returned to Tasmania after having spent a long vacation in the United States, has been elected president of the Australasian Institute of Mining Engineers.

A press despatch from Fernie, Crowsnest district of British Columbia, states that news has been received at Fernie that Harry Miard, late pit boss at the Crow's Nest Pass Coal Co.'s No. 3 mine at its Coal Creek colliery, now serving with the French army, and who was wounded in an engagement in the neighborhood of Soissons, France, is rapidly recovering from his wound. It is believed that Mr. H. E. Miard, a member of the Canadian Mining Institute, is the man referred to in the despatch.

Prof. H. T. Kalmus, Queen's University, has resigned.

Mr. J. M. Clark, of Toronto, has been requested by the American Institute of Mining Engineers, to again act on its committee on mining law.

Mr. G. G. S. Lindsey returned to Toronto from England, March 19, and left the following week for China, where he expects to be for some months.

Mr. S. W. Cohen is in Nicaragua superintending investigation of the Bonanza gold mine, which is under option to the Crown Reserve mining company.

Lieut. B. A. C. Craig attended the meeting of the Toronto branch of the Canadian Mining Institute on Monday, March 22. He leaves shortly for France.

Mr. Wm. McGinnis, of Calgary, is in Toronto.

Capt. De Lamar has been elected president of Dome Mines, Ltd.

OBITUARY

The Vancouver Daily Province recently published the following news: George Mitchell, who in the early Klondike days made quite a fortune in promoting the White Pass Railway, died recently at Harrison Hot Springs, aged sixty-five. He was a great friend of Sir Wilfrid Laurier and lived in Ottawa much during recent years. Last year he had financed a railway project to build from Taku to Atlin, but the coming of the war caused his arrangements to fall through.

SPECIAL CORRESPONDENCE

PORCUPINE, KIRKLAND LAKE AND SWASTIKA

More properties to be worked.—When the power situation is relieved the success of the present operating companies will undoubtedly stimulate other companies holding prospects to commence work. It is currently reported in the camp that work will be started in May on the Krist claim. This property adjoins the Porcupine Crown on the south. It was bought by an English syndicate some years ago and immediately after it was purchased some buildings were run up and a shaft put down on a wide quartz vein with very low gold assays. Nothing has been done for years. Now it is understood that operations are to be resumed when power can be obtained. There is no steam plant on the property.

The South Thompson adjoins the North Thompson which the Huronian Belt Co. is working. The Huronian Belt found some very good ore near the line between the two properties and there is no doubt that the property has good prospects.

Dome.—It is understood that the Dome will draw ore from the shaft on the Golden Stairways vein to the rock house on the surface. A system of electric locomotives for hauling ore cars over the surface is being considered. The shortage in power continues to hinder production and raise costs. The Dome mining company is now working on its own power, using the very complete steam plant that was installed before the Waiwaiten Falls power was finished. At the Hollinger the auxiliary steam plant is being run also.

Schumacher—Good progress is being made with the plans for the Schumacher mill and it is confidently believed that it will be running early in the spring.

Acme.—The Acme section of the Hollinger mill is now running and ore from the stopes on that property is being pulled for treatment every day. This will add largely to the production from the camp, as previously only a few tons of ore per month could be treated in the Hollinger mill. In the meanwhile the addition to the Hollinger mill proper is being proceeded with.

Deloro.—It is stated that the Pike Lake Gold Mining Company of Swastika have purchased some claims in Deloro township about three miles south of South Porcupine. Mr. Reeves states that both these claims and also the properties of the company at Swastika, which adjoin the old Swastika mining company, will be worked.

Dome Lake.—By the re-arrangements of the crushing plant and the installation of more tables it is planned to raise the capacity of the Dome Lake mill from 50 to 75 or 80 tons a day. The returns from the mill are now about paying operating expenses but owing to the heavy charge for development the mining costs are high.

Mining men to the front.—Both from Cobalt and Porcupine members of the staffs of many mines are still going out to join the contingents of Canadians preparing for the front. Most of these men have obtained commissions, others have been able to obtain appointments as non coms. The percentage of mining men in the fighting ranks is increasing every day. Mr. R. P. Rogers, manager of the Coniagas mine for many years, and one of the best known mining men in the north has obtained a commission as adjutant in the 97th Regiment and will go to the front. Mr. Rogers is a graduate of the Royal Military College at Kingston. Every day the train from the north carries some young member of a mining staff down to the south to the training camps.

Hollinger.—Hollinger has commenced to sink a winze on the main vein from the 850 level, where 200 ft. of ore has been opened up already, to the 925 ft. The main Hollinger shaft will be carried down to the 800 ft. level, while the new central shaft has passed the 400 ft. level.

At the Acme ore is now being run to the mill from the 675 ft. level. The shaft will be carried straight down to the 800 ft. level, from which depth a crosscut will be run to the main workings of the Hollinger itself.

McIntyre.—The great width of the No. 5 vein on the McIntyre is being well maintained. At the 400 ft. level of the shaft on the other side of the lake it is established that there is a good grade of ore for a width of 19 ft. This is by no means the average as far as can be ascertained, but at all points the ore can be stoped for more than 6 ft.

Dome.—The Dome mill run for the month of February shows that the grade put through the mill was higher than for several previous months. The tonnage treated was slightly higher and the increase was reflected in the bullion produced. The record for the month of February, although the month was shorter, was: Ore milled, 21,600 tons; value per ton, $3.91; gold recovered, $84,412.

COBALT, GOWGANDA AND SOUTH LORRAINE

Temiskaming.—Development on the extension of the ore shoot found on the top of the old Titanic stope at the Temiskaming still continues to show excellent results. It appears that the vein had been followed by the old management, but that it had been lean, and that after following it for some time work was abandoned on it for the time being. Recently seeing that the vein looked healthy the superintendent put a few shots into the calcite, with the result that there is now bonanza ore in the face. The vein, which was first found and worked on the Beaver and has been followed over the boundary, and is now being worked on the Temiskaming is now being developed on three levels of the Temiskaming mine. All faces are in good ore.

The Peterson Lake Mining Co. is now connected up along almost the entire length of the west shore of Peterson Lake. Long crosscuts connect the No. 1 shaft at the narrows with the old Kerry shaft, and the old Kerry is linked up with the No. 3 shaft, which was once the Little Nipissing. Three drills are running now; but two more will be put on shortly. One drill is sinking a winze on the vein which yielded good ore last year, and another is drifting on the extension of the "J" vein of the Nipissing. This vein is strong and carries a good deal of niccolite and some smaltite, but there are practically no silver values. Two drills will be put on soon, one at the Narrows and the other to crosscut for the extension of the Nipissing vein, from which high grade ore was mined in the earlier days of the camp.

The Miller-Lake O'Brien, the only property working in the Montreal River section, shipped a car of ore to the smelters last month.

Cobalt Lake.—Preparations for the draining of Cobalt Lake are now complete, and pumping will commence immediately the ice is off the lake. Next week the mill will close down and will remain closed down for three weeks owing to the shortage of power. Underground there is some improvement.

The sudden rise in silver to the relatively satisfactory price of 50 cents is discounted to some extent by the heavy cost of insurance of silver bullion to London. Little bullion is leaving the camp in consequence.

The Meteor Mining Co., operating on the side of Diabase mountain nearest the Savage, is doing a large amount of development work. Parallel with the Savage line crosscuts are being run from the bottom of a winze 82 ft. below the 162 ft. level. It is hoped by these crosscuts to encounter the extensions of the Savage veins.

BRITISH COLUMBIA

As more returns of mineral production in the province in 1914 come in it is seen that the preliminary estimate published at the beginning of the year was well within the mark. The estimated total value given in the bulletin issued by the Provincial Department of Mines was $26,189,020; early in March the total had increased to about $26,450,000. The final figures can not yet be stated, but it seems probable that when all the revised returns shall have been received the total will be found to be not less than the higher of the two amounts given above.

East Kootenay.

The considerable increase in the output of ore from the Sullivan mine, situated near Marysville, in Fort Steele mining division, is indicated by the following comparative figures: During ten weeks ended March 11 of this year the total quantity of Sullivan ore received at Trail was 8,042 tons, an average of 804 tons a week; in the corresponding period of 1914 it was 3,431 tons, an average of 343 tons a week. For the whole of 1914 the total was 34,935 tons, an average of 672 tons a week. On the other hand, there was shipped from the St. Eugene mine, in the same division, during the first quarter of 1914, 246 tons, while this year not any ore has been produced at that mine.

West Kootenay.

Ainsworth.—Work has been resumed at the Consolidated Mining and Smelting Co.'s No. 1 mine, near Ainsworth, and the shipment of ore is once again in progress. During eight months of 1914, up to the time of suspension of work in August, 5,076 tons of ore was shipped to Trail, but not any since then until quite recently. The company also owns the Highland mine and concentrating mill, in the same camp, and it is expected these will be in operation again ere long. The Banker and Maestro, adjoining properties in another part of Ainsworth camp, were also worked last year, up to the end of the summer, by the Consolidated Co. No announcement has yet been made relative to the prospects for work being again undertaken on the last-mentioned two mines, but it is hoped their further development will be proceeded with shortly; more than 700 tons of silver-lead ore was shipped to Trail from them last year, and it is stated there is still ore available for extraction.

Slocan—Gradually the 1915 list of Slocan mines shipping ore becomes longer. Following the outbreak of the war last year, there was nearly a general suspension of production, for of twenty properties from which more or less ore was shipped in 1914 only two or three made any output in September. Receipts of ore at the Trail smeltery during ten weeks of this year, to March 12, from Slocan mines totalled 798 tons, more than half of which was from the Rambler-Cariboo mine. Shippers of silver-lead ore or concentrates were as follows: Enterprise, 25 tons; Hewitt (Silverton Mines, Ltd.), 106 tons; Idaho-Alamo, 58 tons; Mercury, 17 tons; Rambler-Cariboo, 444 tons; Reco, 73 tons; Ruth, 48 tons; Slocan Star, 27 tons. In addition, zinc ore and concentrate was shipped; figures published by the Daily News, Nelson, follow: In January, Hewitt, 119 tons; Rambler-Cariboo, 83 tons; Surprise, 600 tons; total 807 tons. In February, Hewitt, 126 tons; Rambler-Cariboo, 84 tons; Surprise, 516 tons; total 726 tons. March figures are not yet available. Zinc ore was also shipped from two mines in Ainsworth division, namely, the Utica, 85 tons, and J. L. Retallack & Co.'s Whitewater group, 86 tons. Altogether the foregoing figures give a total of 1,704 tons, shipped to United States zinc reduction works.

While no particulars have been obtained, there does not seem to be any doubt that the Silverton Mines, Limited, has succeeded in overcoming the difficulties that attended its early efforts to save the silver-zinc content of ores from its Hewitt-Lorna Doone mine. Positive statements have been made to the effect that a saving of more than 9 per cent. of the metallic constituent of the ore is being made. The company has a concentrating mill on Four-mile creek, distant from the mine about a mile, means of transportation between mine and mill being by aerial tramway. The expectation of two or three weeks ago that the Standard Silver-Lead Mining Co., would without further delay again operate its concentrating mill to full capacity had not been realized by the middle of March, but the general manager and the head office manager were at the property about that time, so a decision as to the course to be taken in the early future may be looked for soon. Meanwhile some development work is being continued in the Standard mine, in which there are large reserves of ore available for extraction whenever market conditions for the disposal of silver, lead, and zinc shall be less unsatisfactory to the mine owner than in the recent past.

Nelson.—Production figures for mines in Nelson division for ten weeks to March 12 do not compare favorably with those for the corresponding period of 1914, so far as concerns mines that ship ore to the smeltery. The total for the first-mentioned period is but 1,143 tons, against 5,903 tons for the first ten weeks of 1914. The chief loss in quantity is attributable to the fact that the Silver King mine is inoperative, for last year its output for the ten weeks included in the comparison now made was 3,325 tons while this year no ore has been sent out from it. There has been a considerable decrease, as well, in the output of lead ore from mines near Salmo, the total for this year to March 12 having been only 820 tons as compared with 2,074 tons last year. Excepting that no ore has been received this year from the Yankee Girl mine, at Ymir, where development work only has been having attention, there has been an improvement as regards properties producing gold ore. For instance, gold concentrate was shipped from the Queen mine, Sheep Creek, this year to an extent three times larger than in the corresponding period of 1914. Then the Dundee, at Ymir, and the Granite, near Nelson, were small shippers this year, which was not the case last year, and several smaller producers are on this year's list as well.

MARKETS

TORONTO MARKETS.

Mar. 23—(Quotations from Canada Metal Co., Toronto).
Spelter, 15 cents per lb.
Lead, 5½ cents per lb.
Tin, 60 cents per lb.
Antimony, 25 cents per lb.
Copper, casting, 17 cents per lb.
Electrolytic, 17 cents per lb.
Ingot brass, yellow, 10c.; red, 12 cents per lb.
Mar. 23—(Quotations from Elias Rogers Co., Toronto).
Coal, anthracite, $8.00 per ton.
Coal, bituminous, $5.25 per ton.

NEW YORK MARKETS.

Mar. 19—Connellsville coke, (f.o.b. ovens).
Furnace coke, prompt, $1.50 to $1.60 per ton.
Foundry coke, prompt, $2.00 to $2.50 per ton.
Mar. 19—Tin, straits, 55.00 cents.
Copper, Prime Lake, 15.00 cents.
Electrolytic copper, 15.00 cents.
Copper wire, 15.87½ cents.
Lead, 4.10 to 4.15 cents.
Spelter, 10.12½ cents.
Sheet zinc, (f.o.b. smelter), 13.50 cents.
Antimony, Cookson's, 29.00 cents.
Aluminum, 18.75 cents.
Nickel, 42.00 to 45.00 cents.
Platinum, soft, $41.00 per ounce.
Platinum, hard, 10 per cent., $44.00 per ounce.
Bismuth, $2.75 to $3.00 per pound.
Quicksilver, $60.00 to $65.00 per 75-lb. flask.

SILVER PRICES.

	New York cents.	London pence.
March—		
9.	50	23 9/16
10.	51	24 1/16
11.	51½	24 5/16
12.	51⅛	24 3/16
13.	51⅛	24 3/16
15.	51½	24¼
16.	51⅛	24⅛
17.	50¾	23 15/16
18.	50⅛	23⅝
19.	50⅜	23 13/16
20.	50¼	23¾
22.	50⅜	23 13/16

STOCK QUOTATIONS.

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

March 22, 1915.

New York Curb.

	Bid.	Ask.
Alaska Gold	.34⅛	.34¼
British Copper	.00¾	.01
Braden Copper	.07¼	.07⅜
Chino Copper	.36½	.36¾
Giroux Copper	.00¼	.01
Green Can.	.27	.27½
Miami Copper	.23⅝	.24
Nevada Copper	.12½	.12⅞
Ohio Oil	134.00	136.00
Ray Cons. Copper	.18¾	.19
Standard Oil of N. Y.	218.00	219.00
Standard Oil of N. J.	393.00	395.00
Standard Oil (old)	1225.00	.....
Standard Oil (subs)	840.00	.....
Tonopah Mining	.07½	.07¾
Tonopah Belmont	.45	.45⅞
Tonopah Merger	.23	.25
Inspiration Copper	.22½	.22⅞
Goldfield Cons.	.00 11/16	.00¾
Yukon Gold	.02⅝	.02⅞

Porcupine Stocks.

	Bid.	Ask.
Apex.	.02	.02½
Dome Extension	.09	.09¼
Dome Lake	.26	.26½
Dome Mines	13.10	13.40
Foley O'Brien	.16	.18
Hollinger.	23.50	24.00
Jupiter.	.11	.11½
McIntyre.	.38½	.39
Pearl Lake	.02	.02½
Plenaurum.	...	.50
Porcupine Gold	.00¼	.00½
Imperial.	.02¼	.02½
Preston East Dome	.01¼	.02
Rea.	.12	.16
West Dome	.06	.11
Porcupine Crown	.80	.83
Porcupine Pet	.15	.20
Porcupine Vipond	.40	.42
Teck Hughes	.06	.06½

Cobalt Stocks.

	Bid.	Ask.
Bailey.	.02¼	.03½
Beaver.	.30¼	.31
Buffalo.	.65	.95
Chambers Ferland	.13	.15½
Coniagas.	4.70	5.00
Crown Reserve	.80	.85
Foster.	.02	...
Gifford.	.01	.01¼
Gould.	.00⅜	.00½
Great Northern	.03	.03¼
Hargraves.	.01	.01½
Hudson Bay	...	24.00
Kerr Lake	4.70	4.90
La Rose	.65	.70
McKinley.	.40	.43
Nipissing.	6.05	6.15
Peterson Lake	.23½	.23¾
Right of Way	.02½	.03
Leaf.	...	.02½
Silver Queen	...	.02½
Temiskaming.	.24	.24½
Trethewey.	.16	.17
Wettlaufer.	.05	.05½
Seneca Superior	1.20	1.30

PROFESSIONAL DIRECTORY.

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

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

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Cohen, S. W.
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Haultain, H. E. T.
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Smith, Alex H.
Smith, Sydney.
Maurice W. Summerhayes.
Tyrrell, J. B.

Quebec
Burchell, Geo. B.
Cohen, S. W.
DePencier, H. P.
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NELSON, B. C.

FORBES, D. L. H.
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Chuquicamata, Chile
Chief Construction Engineer for Chile Copper Co.

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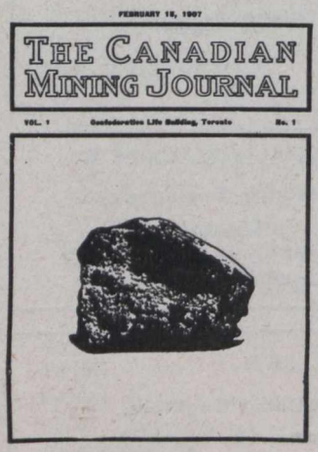

DEPARTMENT OF MINES GEOLOGICAL SURVEY.

PUBLICATIONS

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

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

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

REPORTS RECENTLY ISSUED:

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

MAPS RECENTLY ISSUED:

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

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

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

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

BUYERS AND SELLERS OF METALS

The Canadian Miner's Buying Directory.

Air Hoists—
Canadian Ingersoll-Rand Co., Ltd.

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Fraser & Chalmers of Canada, Limited.
Northern Canada Supply Co.

Assayers and Chemists—
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Ledoux & Co., 99 John St., New York
Thos. Heys & Son.
C. L. Constant Co.

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Peacock Bros.

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Peacock Bros.
Mussens, Ltd.

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Dominion Bridge Co.
Mussens, Ltd.

Belt Tighteners and Clamps—
Dodge Mfg. Co., Ltd.

Belting—Leather, Rubber and Cotton—
Mussens, Ltd.
Northern Canada Supply Co.
Jones & Glassco
Federal Engineering Co.
Can. H. W. Johns-Manville Co.
Dodge Mfg. Co., Ltd.

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Can. Ingersoll-Rand Co., Ltd.
Curtis & Harvey (Canada), Ltd.
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Fraser & Chalmers of Canada, Limited.
Mussens, Ltd.
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Boilers—
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Peacock Bros.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd

Boots—
Dodge Mfg. Co., Ltd.

Buckets—
Hendrick Mfg. Co.
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Northern Canada Supply Co.

Buildings—Steel Frame—
Dominion Bridge Co.

Cable — Aerial and Underground—
Mussens, Ltd.
Fraser & Chalmers of Canada, Ltd.
Northern Canada Supply Co.

Cableways—
Fraser & Chalmers of Canada, Limited.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Cages—
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited.
Jeffrey Mfg. Co.
Northern Canada Supply Co.

Cables—Wire—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.

Carbon (Black Diamonds and Bortz)—
Abe. Levine.

Cars—
Jeffrey Mfg. Co.
Mussens, Ltd.
Northern Canada Supply Co.

Car Pullers—
Dodge Mfg. Co., Ltd.

Cement Machinery—
Northern Canada Supply Co.
Peacock Bros.

Chains—
Jeffrey Mfg. Co.
Peacock Bros.
Jones & Glassco
Mussens, Ltd.
Northern Canada Supply Co.
Dodge Mfg. Co., Ltd.
B. Greening Wire Co., Ltd.

Chain Blocks—
Mussens, Ltd.

Chemists
Canadian Laboratories.
Campbell & Deyell.
Thos Heys & Sons.
Milton Hersey Co.
Ledoux & Co.

Coal—
Dominion Coal Co.
Nova Scotia Steel & Coal Co.

Coal Cutters—
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Mussens, Ltd.

Coal Mining Exposives—
Curtis & Harvey (Can.), Ltd.

Coal Mining Machinery—
Mussens, Ltd.
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Jeffrey Mfg. Co.

Coal Punchers—
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Mussens, Ltd.

Coal Washeries—
Jeffrey Mfg. Co.
Mussens, Ltd.
Peacock Bros.

Collars—
Dodge Mfg. Co., Ltd.

Compressors—Air—
Fraser & Chalmers of Canada, Limited.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.

Concentrators and Jigs—
Fraser & Chalmers of Canada, Limited.
James Ore Concentrator Co.
Mussens, Ltd.

Concrete Mixers—
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.

Condensers—
Fraser & Chalmers of Canada, Limited.
Smart-Turner Machine Co.
Peacock Bros.
Northern Canada Supply Co.

Conveyors—Belt—
Mussens, Ltd.
Boving & Co. of Canada, Ltd.

Converters—
Fraser & Chalmers of Can ada, Limited.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Bros.
Mussens, Ltd.

Conveyor—Trough—Belt—
Hendrick Mfg. Co.

Couplings—
Dodge Mfg. Co., Ltd.
Boving & Co. of Canada, Ltd.

Cranes—
Smart-Turner Machine Co.
Peacock Bros.
Mussens, Ltd.
M. Beatty & Sons, Ltd.
Boving & Co. of Canada, Ltd.

Cranes—Electric—
Mussens, Ltd.

Cranes—Overhead Traveling—
Mussens, Ltd.
Boving & Co. of Canada, Ltd.

Crane Ropes—
Mussens, Ltd.
Allan, Whyte & Co.
Thos. & Wm. Smith.
B. Greening Wire Co., Ltd.

Crushers—
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Lymans, Ltd.
Mussens, Ltd.
Hadfields Steel Foundry Co.

Cyanide Plants—
Fraser & Chalmers of Canada, Limited.
Roessler & Hasslacher.
Thos. & Wm. Smith.
Peacock Bros.

Derricks—
Smart-Turner Machine Co.
S. Flory Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Diamonds (for Diamond Drills)—
Abe. Levine.

Diamond Drill Contractors—
Diamond Drill Contracting Co.
Smith and Travers.

Dredging Machinery—
Peacock Bros.
M. Beatty & Sons.
Mussens, Ltd.
Boving & Co. of Canada, Ltd.

Dredging Ropes—
Allan, Whyte & Co.
Fraser & Chalmers of Canada, Limited.

Drills, Air and Hammer—
Can. Ingersoll-Rand Co., Ltd
Mussens, Ltd.
Jeffrey Mfg Co.
Sullivan Machinery Co.
Peacock Bros.
Northern Canada Supply Co.

Drills—Core—
Can. Ingersoll-Rand Co., Ltd
Standard Diamond Drill Co.

Drills—Diamond—
American Diamond Rock Drills.
Sullivan Machinery Co.
Northern Canada Supply Co.

Drill Steel Sharpeners—
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.
Mussens, Ltd.

Dump Cars
Sullivan Machinery Co.
Mussens, Ltd.

Drills—Electric—
Mussens, Ltd.
Can. Ingersoll-Rand Co., Ltd.

Dynamite—
Curtis & Harvey (Canada), Ltd.
Canadian Explosives.
Northern Canada Supply Co.

Dynamos—
Northern Electric Co., Ltd.

Electric Cranes—
Mussens, Ltd.

Ejectors—
Mussens, Ltd.
Peacock Bros.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Elevators—
Jeffrey Mfg. Co.
M. Beatty & Sons.
Sullivan Machinery Co.
Northern Canada Supply Co.
Mussens, Ltd.
Peacock Bros.

Elevator Cups—
Dodge Mfg. Co., Ltd.

Engineering Instruments—
C. L. Berger & Sons.
Peacock Bros.

Engineers and Contractors—
Fraser & Chalmers of Canada, Limited.
Roberts & Schaefer Co.
Boving & Co. of Canada, Ltd.

Engines—Automatic—
Smart-Turner Machine Co.
Peacock Bros.

Engines—Gas and Gasoline
Fraser & Chalmers of Canada, Limited.
Mussens, Ltd.
Alex. Fleck.
Sullivan Machinery Co.
Smart-Turner Machine Co.
Peacock Bros.

Engines—Haulage—
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Can. Ingersoll-Rand Co., Ltd

Engines—Marine—
Smart-Turner Machine Co.
Peacock Bros.

Engines—Oil—
Peacock Bros.
Boving & Co. of Canada, Ltd.

Engines—Crude Oil—
Boving & Co. of Canada, Ltd.

Engines—Steam—
Fraser & Chalmers of Canada, Limited.
Smart-Turner Machine Co.
S. Flory Mfg. Co.
Peacock Bros.
M. Beatty & Sons.
Mussens, Ltd.

Fans—Ventilating—
Fraser & Chalmers of Canada, Limited.
Sullivan Machinery Co.
Peacock Bros.
Mussens, Ltd.

Feeders—Ore—
Fraser & Chalmers of Canada, Limited.
Mussens, Ltd.

Fixtures—Counter Shaft—
Dodge Mfg. Co., Ltd.

Flights—
Hendrick Mfg. Co.

Floor Stands—
Dodge Mfg. Co., Ltd.

Friction Clutches—
Dodge Mfg. Co., Ltd.

Forges—
Mussens, Ltd.
Northern Canada Supply Co., Ltd.

Forging—
M. Beatty & Sons.
Smart-Turner Machine Co.
Peacock Bros.
Boving & Co. of Canada, Ltd.

Continued on page 23.

Canadian Miner's Buying Directory.—(Continued from page 22.)

Furnaces—Assay—
Lymans, Ltd.
Mussens, Ltd.

Furnaces—Electric—
Boving & Co. of Canada, Ltd.

Fuse—
Peacock Bros.
Curtis & Harvey (Canada), Ltd.
Canadian Explosives.
Mussens, Ltd.
Northern Canada Supply Co.
Canadian H. W. Johns-Manville Co., Ltd.

Gears—
Smart-Turner Machine Co.
Northern Canada Supply Co.
Boving & Co. of Canada, Ltd.

Generators—
Northern Electric Co., Ltd.
Peacock Bros.

Grease Cups—
Dodge Mfg. Co., Ltd.

Hangers—Cable—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.
Dodge Mfg. Co., Ltd.

Hand Hoists—
Boving & Co. of Canada, Ltd.
Fraser & Chalmers of Canada, Limited

Heaters—Feed Water—
Mussens, Ltd.
Peacock Bros.

High Speed Steel Twist Drills—
Mussens, Ltd.
Northern Canada Supply Co.

Hoists—Air, Electric and Steam—
Can. Ingersoll-Rand Co., Ltd
Peacock Bros.
Mussens, Ltd.
S. Flory Mfg. Co.
Jones & Glassco.
M. Beatty & Sons
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.

Hoisting Engines—
Peacock Bros.
Mussens, Ltd.
Sullivan Machinery Co.
Fraser & Chalmers of Canada, Limited
Can. Ingersoll-Rand Co.
M. Beatty & Sons.

Hoists—Gas and Gasoline—
Mussens, Ltd.

Hose—
Canadian H. W. Johns-Manville Co., Ltd.
Mussens, Ltd.
Northern Canada Supply Co.

Jacks—
Mussens, Ltd.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Jigs—
Mussens, Ltd.
Roberts & Schaefer Co.

Lamps—Acetylene—
Mussens, Ltd.
Northern Canada Supply Co.

Lamps—Safety—
Mussens, Ltd.
Canadian Explosives.
Peacock Bros.

Link Belt—
Northern Canada Supply Co.
Jones & Glassco.

Locomotives—Electric—
Mussens, Ltd.
Jeffrey Mfg. Co.

Locomotives—Steam—
Mussens, Ltd.

Metal Merchants—
Henry Bath & Son.
Geo. G. Blackwell, Sons & Co.
Consolidated Mining and Smelting Co. of Canada.
Canada Metal Co.
C. L. Constant Co.

Monel Metal—
Orford Copper Co.

Motors—
Mussens, Ltd.
Northern Electric Co., Ltd.
Peacock Bros.

Mule Stands—
Dodge Mfg. Co., Ltd.

Ore Sacks—
Northern Canada Supply Co.

Ore Testing Works
Ledoux & Co.
Can. Laboratories.
Milton Hersey Co., Ltd.
Campbell & Deyell.

Ores and Metals—Buyers and Sellers of—
C. L. Constant Co.
Geo. G. Blackwell.
Consolidated Mining and Smelting Co. of Canada.
Orford Copper Co.
Canada Metal Co.

Perforated Metals—
B. Greening Wire Co., Ltd.
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.
Hendrick Mfg. Co.

Pick Machines—
Sullivan Machinery Co.

Picks—Steel—
Mussens, Ltd.
Thos. & Wm. Smith.
Peacock Bros.

Pillow Blocks—
Dodge Mfg. Co., Ltd.

Pipes—
Boving & Co. of Canada, Ltd.
Consolidated M. & S. Co.
Peacock Bros.
Mussens, Ltd.
Northern Canada Supply Co.
Smart-Turner Machine Co.

Pipe Fittings—
Can. H. W. Johns-Manville
Mussens, Ltd.
Northern Canada Supply Co.

Pneumatic Tools—
Can. Ingersoll-Rand Co., Ltd
Jones & Glassco.

Producer—Gas—
Mussens, Ltd.

Prospecting Mills and Machinery—
Standard Diamond Drill Co.
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited

Pulleys—Iron, Wood Spit, Iron Centre Wood Rim—
Dodge Mfg. Co., Ltd.

Pulleys, Shafting and Hangings—
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.
Dodge Mfg. Co., Ltd.

Pumps—Boiler Feed—
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
Peacock Bros.
Canadian Ingersoll-Rand Co. Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Centrifugal—
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Smart-Turner Machine Co.
Peacock Bros.
Thos. & Wm. Smith.
M. Beatty & Sons.
Can. Ingersoll-Rand Co., Ltd
Fraser & Chalmers of Canada, Limited

Pumps—Electric—
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Canadian Ingersoll Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Pneumatic—
Mussens, Ltd.
Smart-Turner Machine Co.
Can. Ingersoll-Rand Co., Ltd

Pumps—Steam—
Can. Ingersoll-Rand Co., Ltd
Mussens, Ltd.
Thos. & Wm. Smith.
Northern Canada Supply Co.
Smart-Turner Machine Co.

Pumps—Turbine—
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Canadian Ingersoll-Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Vacuum—
Smart-Turner Machine Co.

Quarrying Machinery—
Mussens, Ltd.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

Roasting Plants—
Fraser & Chalmers of Canada, Limited

Rolls—Crushing—
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited

Roofing—
Dominion Bridge Co.
Mussens, Ltd.
Northern Canada Supply Co.
Can. H. W. Johns-Manville

Rope Blocks—
Mussens, Ltd.

Rope Wheels—
Dodge Mfg. Co., Ltd.

Rope Dressing—
Dodge Mfg. Co., Ltd.

Rope—Manilla and Jute—
Jones & Glassco.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.

Rope—Wire—
B. Greening Wire Co., Ltd.
Allan, Whyte & Co.
Northern Canada Supply Co.
Thos. & Wm. Smith.
Fraser & Chalmers of Canada, Limited
Mussens, Ltd.

Samplers—
Canadian Laboratories.
C. L. Constant Co.
Ledoux & Co.
Milton Hersey Co.
Thos. Heys & Son.

Screens—
B. Greening Wire Co., Ltd.
Mussens, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Screens—Cross- Patent Flanged Lip—
Hendrick Mfg Co.

Separators—
Smart-Turner Machine Co.
Peacock Bros.

Shafting—
Dodge Mfg. Co., Ltd.

Sheets—Genuine Manganese Bronze—
Hendrick Mfg. Co.

Shovels—Steam—
Mussens, Ltd.
M. Beatty & Sons.

Slime Tables—
James Ore Concentrator.

Smelting Machinery—
Mussens, Ltd.
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Spiral Conveyors—
Dodge Mfg. Co., Ltd.

Sprockets—
Dodge Mfg. Co., Ltd.

Stacks—Smoke Stacks—
Canadian H. W. Johns-Manville Co., Ltd.
Hendrick Mfg. Co.

Stamp Mills—
Mussens, Ltd.
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Steel Drills—
Sullivan Machinery Co.
Mussens, Ltd.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd
Peacock Bros.
Swedish Steel & Imp. Co., Ltd

Steel—Tool—
Mussens, Ltd.
Thos. & Wm. Smith.
N. S. Steel & Coal Co.
Swedish Steel & Imp. Co. Ltd

Surveying Instruments—
Peacock Bros.
W. F. Stanley.
C. L. Berger.

Switchboards—
Northern Electric Co., Ltd.

Take-ups—
Dodge Mfg. Co., Ltd.

Tanks—Cyanide, Etc.—
Mussens, Ltd.
Peacock Bros.
Fraser & Chalmers of Canada, Limited
Hendrick Mfg. Co.

Tramways—
Mussens, Ltd.
B. Greening Wire Co., Ltd.

Transformers—
Northern Electric Co., Ltd.
Peacock Bros.

Transits—
C. L. Berger & Sons.
Peacock Bros.

Transmission Rope—
Dodge Mfg. Co., Ltd.

Trippers—
Dodge Mfg. Co., Ltd.

Tube Mills—
Mussens, Ltd.
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Turbines—
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Turbines—Water—
Boving & Co. of Canada, Ltd.

Winding Engines—
Mussens, Ltd.
Peacock Bros.
Canadian Ingersoll-Rand Co., Ltd.

Wire Cloth—
Mussens, Ltd.
Northern Canada Supply Co.
B. Greening Wire Co., Ltd.

Wire (Bare and Insulated)—
Northern Electric Co., Ltd.
Standard Underground Cable Co., of Canada, Ltd.

Zinc Dust—
Roessler & Hasslacher.

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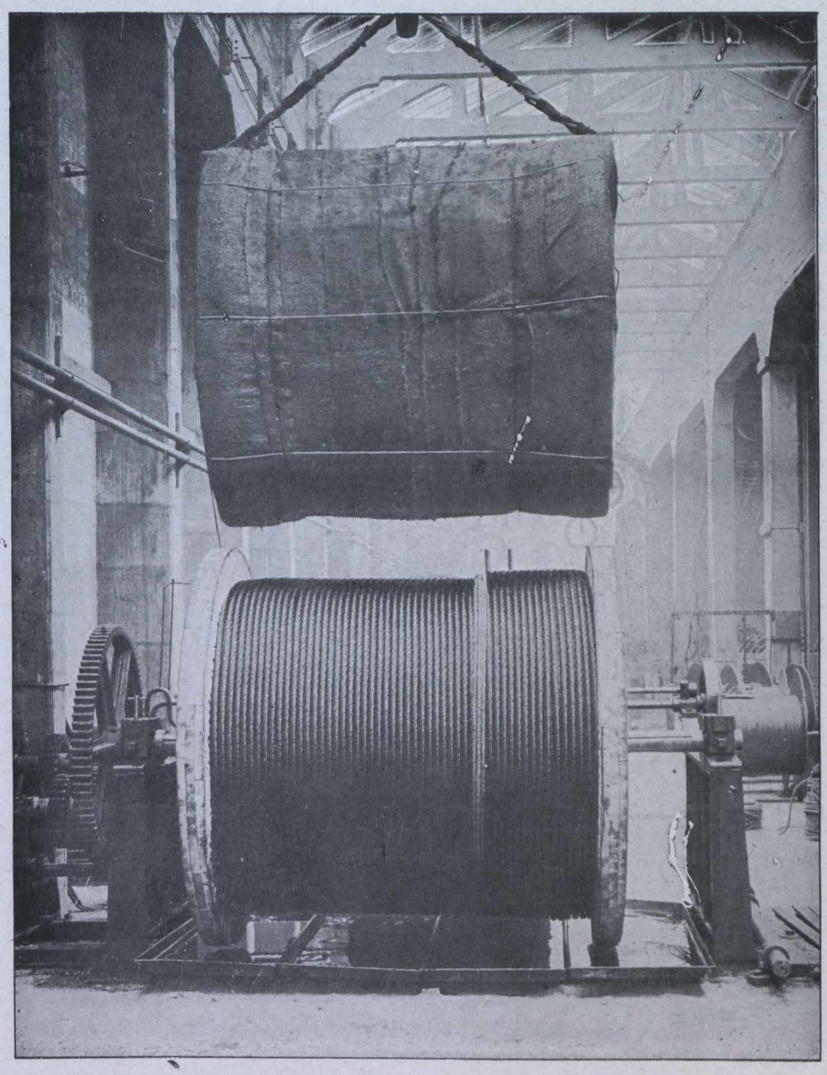

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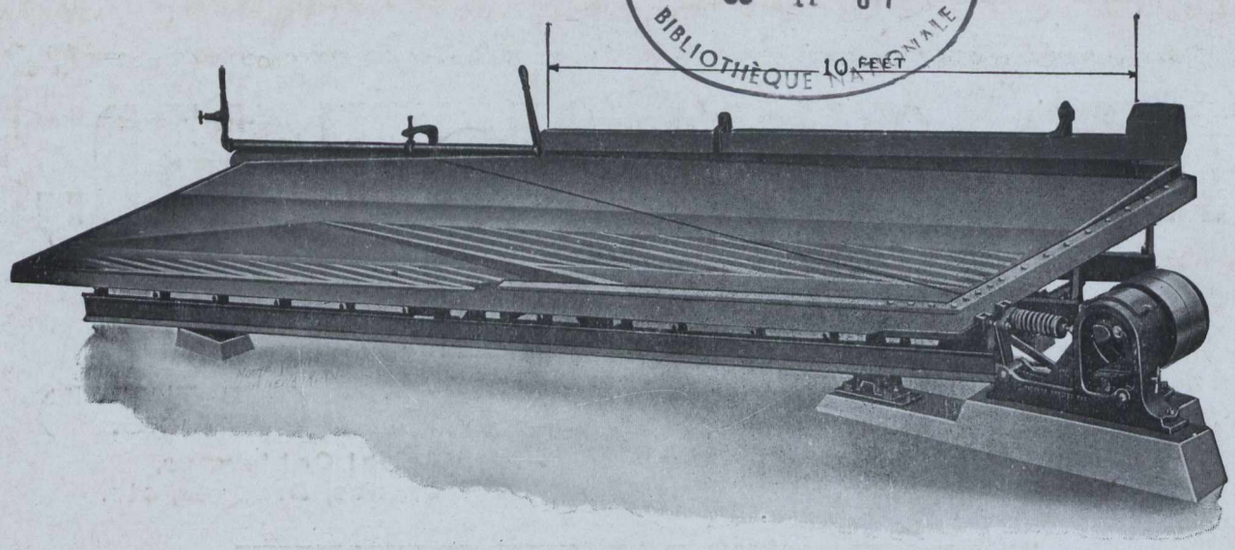

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