

**CIHM
Microfiche
Series
(Monographs)**

**ICMH
Collection de
microfiches
(monographies)**



Canadian Institute for Historical Microreproductions / Institut canadien de microreproductions historiques

© 1998

Technical and Bibliographic Notes / Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming are checked below.

- Coloured covers / Couverture de couleur
- Covers damaged / Couverture endommagée
- Covers restored and/or laminated / Couverture restaurée et/ou pelliculée
- Cover title missing / Le titre de couverture manque
- Coloured maps / Cartes géographiques en couleur
- Coloured ink (i.e. other than blue or black) / Encre de couleur (i.e. autre que bleue ou noire)
- Coloured plates and/or illustrations / Planches et/ou illustrations en couleur
- Bound with other material / Relié avec d'autres documents
- Only edition available / Seule édition disponible
- Tight binding may cause shadows or distortion along interior margin / La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure.
- Blank leaves added during restorations may appear within the text. Whenever possible, these have been omitted from filming / Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.
- Additional comments / Commentaires supplémentaires:

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- Coloured pages / Pages de couleur
- Pages damaged / Pages endommagées
- Pages restored and/or laminated / Pages restaurées et/ou pelliculées
- Pages discoloured, stained or foxed / Pages décolorées, tachetées ou piquées
- Pages detached / Pages détachées
- Showthrough / Transparence
- Quality of print varies / Qualité inégale de l'impression
- Includes supplementary material / Comprend du matériel supplémentaire
- Pages wholly or partially obscured by errata slips, tissues, etc., have been refilmed to ensure the best possible image / Les pages totalement ou partiellement obscurcies par un feuillet d'errata, une pelure, etc., ont été filmées à nouveau de façon à obtenir la meilleure image possible.
- Opposing pages with varying colouration or discolourations are filmed twice to ensure the best possible image / Les pages s'opposant ayant des colorations variables ou des décolorations sont filmées deux fois afin d'obtenir la meilleure image possible.

This item is filmed at the reduction ratio checked below /
Ce document est filmé au taux de réduction indiqué ci-dessous.

	10x		14x		18x		22x		26x		30x	
									/			
	12x		16x		20x		24x		28x		32x	

The copy filmed here has been reproduced thanks to the generosity of:

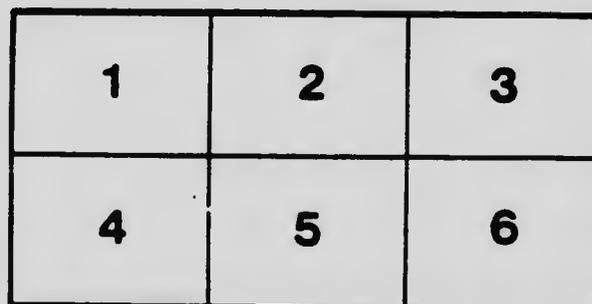
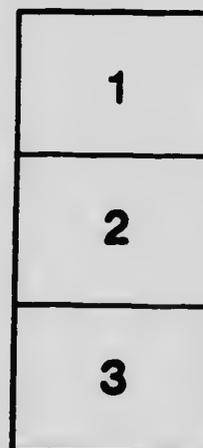
University of British Columbia Library
Vancouver

The images appearing here are the best quality possible considering the condition and legibility of the original copy and in keeping with the filming contract specifications.

Original copies in printed paper covers are filmed beginning with the front cover and ending on the last page with a printed or illustrated impression, or the back cover when appropriate. All other original copies are filmed beginning on the first page with a printed or illustrated impression, and ending on the last page with a printed or illustrated impression.

The last recorded frame on each microfiche shell contains the symbol \rightarrow (meaning "CONTINUED"), or the symbol ∇ (meaning "END"), whichever applies.

Maps, plates, charts, etc., may be filmed at different reduction ratios. Those too large to be entirely included in one exposure are filmed beginning in the upper left hand corner, left to right and top to bottom, as many frames as required. The following diagrams illustrate the method:



L'exemplaire filmé fut reproduit grâce à la générosité de:

University of British Columbia Library
Vancouver

Les images suivantes ont été reproduites avec le plus grand soin, compte tenu de la condition et de la netteté de l'exemplaire filmé, et en conformité avec les conditions du contrat de filmage.

Les exemplaires originaux dont la couverture en papier est imprimée sont filmés en commençant par le premier plat et en terminant soit par la dernière page qui comporte une empreinte d'impression ou d'illustration, soit par le second plat, selon le cas. Tous les autres exemplaires originaux sont filmés en commençant par la première page qui comporte une empreinte d'impression ou d'illustration et en terminant par la dernière page qui comporte une telle empreinte.

Un des symboles suivants apparaît sur la dernière image de chaque microfiche, selon le cas: le symbole \rightarrow signifie "A SUIVRE", le symbole ∇ signifie "FIN".

Les cartes, planches, tableaux, etc., peuvent être filmés à des taux de réduction différents. Lorsque le document est trop grand pour être reproduit en un seul cliché, il est filmé à partir de l'angle supérieur gauche, de gauche à droite, et de haut en bas, en prenant le nombre d'images nécessaire. Les diagrammes suivants illustrent la méthode.

CLASSN. *TV 27. Q3 A3*

SERIES No. *1909*

THE LIBRARY
The University of British Columbia

PROVINCE OF QUEBEC

DEPARTMENT

- OF -

COLONIZATION, MINES and FISHERIES

REPORT

ON THE

MINING OPERATIONS

— IN THE —

PROVINCE OF QUEBEC

FOR THE YEAR

1909

By *THEO. C. DENIS,*

SUPERINTENDENT OF MINES

(Translated from the French)



QUEBEC

PRINTED BY L.-V. FILTEAU

Printer to the King's Most Excellent Majesty.

1909

C

M

PROVINCE OF QUEBEC

DEPARTMENT

- OF -

COLONIZATION, MINES and FISHERIES

REPORT

ON THE

MINING OPERATIONS

— IN THE —

PROVINCE OF QUEBEC

FOR THE YEAR

1909

By THEO. C. DENIS,

SUPERINTENDENT OF MINES

(Translated from the French)



QUEBEC

PRINTED BY L.-V. FILTEAU

Printer to the King's Most Excellent Majesty.

1910

Table of Contents

	Page.
Mining operations	5
Table of Mining Statistics	6
Mining Law	7
Iron	8
Ochres	9
Chrome	10
Copper	10
Gold and Silver	12
Asbestos	13
Mica	16
Phosphate of Lime	16
Graphite	17
Magnesite	17
Portland cement	18
Building Materials	18
List and addresses of operators	20
Accidents in mines	25

Quebec, 1st May 1910.

HON. C. R. DEVLIN, M.P.P.,

Minister of Colonization, Mines and Fisheries

Quebec.

Sir,

I have the honor to submit the report on Mining Operations in the Province of Quebec during the year 1909.

The present data are chiefly statistical; having come into office, as Superintendent of Mines of the Province of Quebec, only on the 22nd January 1910, I have not yet been able to personally inspect the various mining districts.

Important changes have been made in the Mining Law of the Province since the publication of the last report, and we give the most prominent features.

At my request, Mr. J. H. Valiquette has drawn up a detailed report of the accidents that have occurred in our mines during the year with a note on the precautions to be taken to prevent them as far as possible in the future.

I have the honor to be,

Sir,

Your obedient servant,

THEO. C. DENIS,

Superintendent of Mines.



A Legal Stake

Cliché Div. des Mines, Ottawa.

REPORT ON MINING OPERATIONS IN THE PROVINCE OF QUEBEC DURING THE YEAR 1909.

The mineral production in the Province of Quebec during the year ending 31st December, 1909, amounted to \$5,552,062. This is a slight increase over the figures for the previous year which were \$5,458,998.00. Thus in 1909 we had the highest mineral production recorded so far.

It should, however, be noted that the aggregate amount for the two years cannot be fully compared with one another owing to the changes made in the method of gathering statistics of certain non-metallic substances such as: building stone, lime, bricks, etc. It is very difficult to obtain complete data regarding the production of these materials and, in previous years, the Bureau of Mines had adopted the rule of taking the figures given by the Census Bureau. These figures are given only at long intervals and meanwhile the same figures were repeated from year to year.

We attempted to get the figures for 1909 by applying directly to quarry workers lime-burners and owners of brick-yards.

This entailed considerable extra work because it was necessary to correspond with an additional number of several hundred operators. Our efforts have been successful and the results most encouraging. In the case of nearly every kind of building materials the figures collected have been higher than those given for last year. It is true that they are still far from complete, but they have the advantage of being based upon direct reports.

The following table gives the mining statistics of the Province of Quebec for the year 1909. For purposes of comparison, we have added a column showing the value of the various mineral substances produced in 1908.

Products	Wages paid to workmen	Number of workmen	Quantities	Value	Value in 1908
	\$		tons	\$	\$
Bog iron ore.....	3,082	50	3,300	4,688	30,957
Ochres.....	16,388	65	3,940	28,093	19,940
Chrome iron.....	20,000	60	2,470	26,604	83,740
Copper ore.....	69,984	175	35,100	215,530	159,588
Asbestos }	1,349,864	3,008	63,965	2,296,584	2,551,596
Asbestic }			24,801			20,468
Mica.....	35,884	176	.....	27,034	95,311
Phosphate.....	.....	.....	525	4,800	1,610
Graphite.....	11,866	39	.....	10,339	165
Mineral waters.....	1,260	5	Galls	17,246	.....
Slate.....	10,828	30	32,537	24,000	20,056
Cement.....	125,000	30	Sq.	1,314,551	1,127,335
Magnesite.....	954	6	4,000	2,508	820
Marble.....	70,000	125	barrels	130,000	.....
Flag-stones.....	2,225	10	1,011,194	8,500	3,600
Granite.....	122,780	268	tons	149,064	250,000
Lime.....	42,504	99	330	105,489	96,000
Lime-stone.....	241,269	699	.....	487,143	223,580
Bricks.....	205,764	853	M.93,891	584,371	525,000
Tiles, Drain tiles, Pottery, etc. (partly estimated)	.....	.....	.....	125,000	270,000
				\$5,552,062	\$5,468,998

We give below a table showing the value of the yearly mineral production of the Province of Quebec since 1900. It will be seen that in ten years the figures have more than doubled and it may be presumed that this increase will continue in the future.

Year	Value
1900.....	\$ 2,546,076
1901.....	2,997,731
1902.....	2,985,463
1903.....	2,712,762
1904.....	3,023,568
1905.....	3,750 300
1906.....	5,019,932
1907.....	5,391,368
1908.....	5,458,998
1909.....	5,552,062

MINING LAW

During the session of 1909, the Legislative Assembly of the Province of Quebec enacted some amendments to the Quebec Mining Law. The changes are important and we deem it advisable to give a summary of the principles. As to details regarding the steps to be followed in order to conform to them, they are given in the text of the Mining Law of the Province of Quebec and in a small pamphlet entitled: "The Miner's Guide," which may be obtained on application to the Bureau of Mines, Quebec.

Under the new provisions, a miner's certificate must be taken out which is valid from the date of its issue to the 1st January following. The price of the certificate is \$10.00.

Any holder of a miner's certificate may prospect on public lands, whether surveyed or not, or on private lands where the mines are reserved to the Crown.

Nevertheless, if such holder of a miner's certificate wishes to prospect on private lands, he must first give good and sufficient security, subject to the Minister's approval, for any damage he may cause the surface owner through his prospecting.

Every holder of a certificate has the right to mark out himself, on the ground in unsurveyed territories, one or more claims, but not exceeding five, of rectangular shape, the sides running north and south and east and west,

each claim measuring at least forty acres in area and not exceeding two hundred acres in all.

In surveyed territories the holder of a miner's certificate may stake out only one or two claims, each of one hundred acres, or of the dimensions of one lot.

The holder of a miner's certificate, who has established a claim by proceeding as above, must without delay notify the same to the Department of Colonization, Mines and Fisheries or the official at the office nearest to the place of discovery.

Within a delay of four months from the date marked on the stakes planted on the claim, he must, on pain of forfeiture of all his rights, obtain a mining license valid for one year and renewable. Such license is granted on payment of a fee of ten dollars and a yearly rental of one dollar per acre.

Or, if the holder of the certificate prefers to purchase the claim, he may do so by paying ten dollars per acre for superior metals when the lands are more than twenty miles from a railway and twenty dollars when such distance is under twenty miles. But letters-patent, giving full possession of such mining lands, are not issued until the purchaser has exhibited specimens of the ore taken from it, accompanied by affidavits by competent and trustworthy persons establishing that the specimens exhibited come from such lands and that he has spent, within maximum delay of two years, the sum of five hundred dollars in mining operations.

The steps to be taken to conform to the Mining Law are set forth in a pamphlet entitled: "The Miner's Guide", copies of which can be obtained free of charge by applying to the Department of Colonization, Mines and Fisheries, Quebec.

IRON

The Canada Iron Corporation, Limited, is the only siderurgical company operating in the Province of Quebec. That company has two blast furnaces at Drummondville and one at Radnor Forges, where charcoal pig iron is produced.

The iron industry has not been very active in 1909. The furnace of Radnor Forges alone was in blast, but it consumed only 3,300 tons of native ore. The chief source of supply is Ontario ore.

The following table contains a statement of the raw material used at Radnor Forges:

Imported ore..	Tons, 10,256
Native bog iron ore....	" 3,3000
Charcoal...	Bushels, 641,742
Pig iron produced....	Tons, 4,750

In the township of Spaulding, county of Beauce, some prospecting was done on a ferriferous belt said to be in ranges VIII and IX, lots 6 to 14.

We have no detailed reports as to the results of these operations which consisted in doing some stripping.

It is interesting to note here the progress made in Europe, within the past two years, in processes connected with the electro-metallurgy of iron. Experiments made in Sweden in 1908 and 1909 have led to the erection of an electric furnace 25 feet high which has yielded very satisfactory results according to the report made by Dr. Haanel of Ottawa, who personally examined it.

This electro-siderurgical development is very important for the Province of Quebec where there are considerable deposits of iron ore, the utilization of which is delayed through the lack of cheap fuel, for there is no doubt that our water-powers could be developed so as to supply electric power at rates similar to those prevailing in Sweden.

By a letter dated the 10th June 1909, His Britannic Majesty's Ambassador at Stockholm informed the right Honorable Sir Wilfrid Laurier that the Trollhalten Water Company had ordered the construction of three furnaces of the same type, with a capacity of 7,500 tons of pig iron per annum. The price of the electric current is fixed at \$7.45 per horse-power per annum for ten years and \$9.95 for the following ten years.

(See: "Report of the investigation of electric shaft furnace" by Dr. Eugène Haanel, Mines Department, Ottawa.)

OCHRES

Our production of ochre in 1908 amounted to 3940 tons valued by the operators at \$28,093.00 at shipping points.

The whole of the ochre came from deposits in the vicinity of Three Rivers which have been worked for a long time. A portion of these ochres is calcined and used in making mineral paints, and the remainder in purifying lighting gas. Shipments of calcined ochre amounted in 1909 to 1940 tons valued at \$25,093.00 while the gas companies took 2000 tons valued at \$3,000.00.

The ochre deposits of that region cover large areas. One of the latter, at St. Malo, has been followed for a length of several miles, its width is from 300 to 600 feet and its depth varies between one and twenty feet.

CHROME

During the year only 2,470 tons, valued at \$26,604 were shipped. This is a marked decrease as compared with the previous year. The operators say they have considerable quantities of chrome iron ore in stock.

A new company has taken over the plant and properties of the Thetford Chrome Company, lot 16, range A, Coleraine. That company is the Chrome and Asbestos Mines, Limited, which began working in June, 1909. Although there has been no production this year, preparations were being made for operations on a large scale in 1910. The whole of the concentrating works were being remodelled and twenty-five dry concentrating machines, of the Behrends system, were being put in.

It is intended to effect the concentration by crushing the ore in two jaw-crushers. It then passes into a dryer, then through rollers which crush it so that it may pass through a screen of 20 meshes to the inch. It is afterwards sized by screens, and concentrated by Behrends dry concentrators.

COPPER

We have received returns of production of copper from only one company which works the Eustis Mine.

The Albert Copper Company which owns the Albert mine at Capelton, lot 8, range IX of the township of Ascot, did no work in 1099.

Mr. A. O. Norton, who has for some years carried on development work on a small scale at his mine on lots 2 and 3, range XI, township of Ascot, has continued to develop it, but has not yet shipped any ore.

Mr. J. McDonald of Sherbrooke, has given an option on his property in Weedon, lot 22, range II, Weedon township, to a New York syndicate. A small development plant has been put up and the work of prospecting has been actively pushed. The shaft is one hundred feet deep and about one hundred feet of prospecting drifts have been run.

Some prospecting work was also done on copper deposits in the first range of St. Joseph, Beauce county.

The copper deposits of the Eastern Townships have already been the object of much study and working. One of the most recent reports dealing

with the subject is that by M. John A. Dresser, entitled: "Report on the copper deposits in the Eastern Townships, Province of Quebec", published by the Geological Survey of Ottawa.

The most important deposits are generally in lenticular form. The average ore is low grade, but some rich zones of very high grade are met with.

The copper industry in the Eastern Townships seems, to a certain extent, to turn in a circle. The ores are not very rich, but, on the other hand, it is probable that they exist in considerable deposits and that development and prospecting work would lead to the discovery of large quantities of ore containing from 3 to 4 per cent of copper. Such work, however, would entail considerable expense in sinking shafts, mining drifts, diamond drill boring, etc.

Low grade copper ores should be treated near the mines, which necessitates the erection of smelters. Consequently mine owners do not venture to incur the expense of development until they are sure that they will be able to dispose of the product of their mines to smelting works close by and, on the other hand, one can understand the hesitation of manufacturers and capitalists to build and instal a smelter without first being sure of the supply of ore.

A solution of this problem would be the amalgamation of several individual copper properties in a powerful company which might, after developing the deposits, operate smelters, as in the Boundary district of British Columbia where successful operations are carried on with large quantities of ore containing less than one and a half per cent of copper, or as in Tennessee where the ores treated contain less than two per cent.

The following extract from "The Mineral Resources of the United States" giving a summary description of the Tennessee deposits, might apply almost word for word to a great many cupriferous deposits in the Eastern Townships of the Province of Quebec.

"The ores lie in great lenticular masses of sulphides parallel to the steeply inclined foliation of schists. Both the ore and the schists are probably of precambrian age. The ore minerals are predominant pyrrhotite with chalcopyrite and pyrite. Oxidation of the copper portion of these deposits produced heavy Gossan, underlain by rich secondary chalcocite ores, long ago exhausted. The entire output now comes from the primary ores. The ores are low grade, the average recovery in 1907 having been about 35.4 pounds blister copper per ton, or 1.77 per cent. Precious-metal values are also low."

Two important companies work these deposits in Tennessee and treat them for the manufacture of sulphuric acid and the extraction of copper. The yearly production of copper of that State is about 20,000,000 pounds.

Such facts are encouraging for the future of the copper industry in the Province of Quebec, but it must be borne in mind that, in order to put it on a solid basis, considerable expense will have to be incurred in prospecting by diamond drill boring to ascertain the presence of large reserves of ore.

During the field season of 1909, Mr. A. W. G. Wilson, of the Mines Branch of the Federal Government, made a study of the copper deposits of the Eastern Townships and his report is certainly very opportune at the present moment.

GOLD AND SILVER

During the first six months of the year 1909, active work was resumed in connection with the gold-bearing lands of the Eastern Townships, but we have no production to record.

The right to mine for precious metals in the seigniory of Rigaud-Vaudreuil, formerly the scene of important work on the alluvial deposits of the Gilbert and Chaudière rivers, has been acquired by a syndicate which intends to begin operations at once. The company formed for the purpose is incorporated under the name of "The Dominion Gold Fields of Canada" with a capital of \$1,000,000.00. It is proposed to work with steam shovels or dredges and the technical direction of the work has been entrusted to a Californian engineer.

The Marsborough Gold Fields Company, which has gold-bearing lands in the Lake Megantic region, has not sent in a report on its operations. That company put up a small stamp mill in 1908 for the purpose of making assays of the ore taken from veins of gold-bearing quartz, but we have no information as to the results.

In the county of Pontiac several companies have done some prospecting of more or less importance. It is said that very encouraging indications of the presence of argentiferous ore have been found in the township of Fabre. It is too early yet to give an opinion regarding the value of the discoveries made in that township which lies on the east side of Lake Temiscamingue, opposite the Cobalt district, but everything leads to the belief that prospecting will be actively carried on during the year 1910.

The Pontiac and Abitibi Gold Mines Company is working in the township of Boischatel, to the north east of Lake Opasatica, and is stated to be

putting up mills for treating gold ores; the plant was transported over a road made by the company, connecting the mine with Larder Lake, a distance of about 18 miles. The lake is crossed in summer by a steamboat to reach Larder Lake city whence a road has been made to Boston station on the Temiscamingue and Northern Ontario railway.

We also note that the Height of Land Mining Company, whose offices are at No. 316 St. James Street, Montreal, has carried on rather extensive prospecting in the township of Villemontel, county of Pontiac. The ores found so far consist of molybdenite and bismuth.

ASBESTOS

The chief feature of the asbestos industry in 1909 was the amalgamation of several individual operators into powerful companies with large capitalization.

We note the formation of the Amalgamated Asbestos Corporation, with a capital of \$25,000,000, which absorbed the following companies:

- King Asbestos Mines, Thetford Mines.
- Beaver Asbestos Co., Thetford Mines.
- British Canadian Asbestos Co., Black Lake.
- Standard Asbestos Co., Ltd., Black Lake.
- Dominion Asbestos Co., Ltd., Black Lake.

The Black Lake Consolidated Asbestos Company, with a capital of \$5,000,000.00, absorbed the following:

- Union Asbestos Mines, Black Lake.
- Black Lake Chrome and Asbestos Co., Black Lake.
- Dominion Chrome Co., Black Lake.
- Imperial Asbestos Co., Black Lake.

It is stated that great advantages will result from the merging of the mining interest into these two companies. In the first place the cost of management will be greatly decreased by being centralized. It will be easier to establish for the trade, a methodical and standard classification of the various grades of asbestos and the importance of this feature cannot be exaggerated.

In the past, there has been no recognized standard and the various qualities of the different mines did not correspond to one another, to the great confusion of the consumer who could only judge of what he bought on seeing samples. The Amalgamated Asbestos Corporation has already taken measures towards standardizing, but some time will be needed to effect such charges

which will certainly result in advantages both to the producer and to the consumer.

The value of the total production of asbestos in Canada in 1909 is slightly below that of the previous year, but it must not be inferred from this that there has been the slightest decline in the industry. On the contrary, the decrease is rather due to the fact that some important companies have made preparations during the year to greatly increase the production of their mills in 1910, and such changes have led to periods of inactivity while the necessary changes were being made both in buildings and plant.

On the other hand, it cannot be denied that the capitalization of the two above mentioned companies is very high and, although several of the amalgamated mines are among the best and most important in the districts of Thetford and Black Lake, the high capital will certainly militate against a rapid increase in the shares of the companies.

However, the reserves of asbestos-bearing rocks are very large. Depths of 200 feet below the surface have been reached in some quarries and, at that depth, no marked change has been noted in the percentage of asbestos in the rock extracted. There is no doubt that there is no reason to fear any diminution in quality for a long while.

We have received reports of the production of nine companies representing fourteen mines in operation. The total value of the asbestos produced amounted to \$2,296,584.00, not including \$20,468, worth of asbestic which is an inferior product obtained in the course of the preparation of asbestos for the market.

But, besides these nine companies, about an equal number were preparing to produce in 1910. The companies having works and mills under construction, in 1909, were :

The B and A Asbestos Co., East Broughton.
Berlin Asbestos Co., East Broughton.
Belmina Consolidated Asbestos Co., Belmina.
Frontenac Asbestos Mining Co., East Broughton.
Black Lake Consolidated Asbestos Co., Black Lake
Jacobs Asbestos Mining Co., Thetford.

There are also three other projected mills and the Bell Asbestos Mines Company is altering its plant so as to increase its capacity to 1,000 tons of rock a day. It should be noted that the tendency is to build mills of ever increasing capacity. Some years ago model mills were fitted up to treat from 200 to 300 tons of rock per diem, while at present they are being put up with a capacity of from 1000 to 1200 tons.

Prospecting has likewise been carried on at various places in the serpentine belt. An important discovery is mentioned on lots 23 and 24, range A of Coleraine, where a new company, the Thetford Asbestos Syndicate, with its offices in the Liverpool, London and Globe building, Montreal, has had considerable work done. This company will soon be in a position to produce.

On the whole, the asbestos industry of the Province of Quebec is flourishing. Almost the whole of the world's production of this substance comes from Canada and Russia and, in 1909, Canada's proportion was nearly four and one half times greater than that of Russia. In fact, the asbestos mines of the Province of Quebec shipped 63,965 tons last year, while those of the Ekaterinburg district, in the Ural Mountains, during the same period, was 814,134 poods, equal to about 14,500 tons, according to an article which appeared lately in the commercial and industrial gazette of St. Petersburg.

The Canadian asbestos is obtained by working the deposits of the serpentine belt running through the Eastern townships of the Province of Quebec. There are three very distinct asbestos-bearing areas which are, in order of importance: The Thetford, Black Lake area, the Danville area and the East Broughton area.

The serpentine belt consists of igneous and metamorphic rocks comprising peridotites, pyroxenites, diabases, granites and serpentinous talcous schists. Although the serpentine rocks occupy a much more limited total area than the other constituents of the belt, they are much more important from the economic standpoint and are more easily recognizable through their particular characteristics. Serpentine results from the alteration of intrusive masses of peridotite or olivine rock and, in this altered rock, are the veins of asbestos which belong to the chrysotil variety. The relations between the various constituents of that belt of rocks are complicated and have not yet been established with any degree of certainty, but everything leads to the belief that they are old and it is probable that the rocks are of Cambrian age.

The percentage of asbestos in the rock extracted from the mines varies greatly in proportion to the veins running through it. It sometimes amounts to a maximum of from 12 to 15 per cent, but, as an average of mining operations extending over a period of one year, the yield does not generally exceed four or five per cent.

We give below some notes on the asbestos deposits of the Ural Mountains. (See Mineral Resources of United States, 1908.)

The presence of this mineral in the Ural Mountains was discovered about 200 years ago, but it was not systematically mined until about 25 years ago. As in Canada, the methods followed at the outset were very primitive, but the

industry has been developed and many of the mines are now provided with the most modern plant, the motive power being electricity.

The principal mines are situated about 57 miles to the north of Ekaterinburg in the Ural Mountains. According to a paper read by Mr. Kriganouski at a meeting of the Imperial Academy of Sciences, in 1903, the mining district covers an area of 18 miles from North to South and of 2 to 3 miles from East to West. The mines are limited to a mass of serpentine resting on schistose rocks to the west and cut off by a granitic intrusion on the East. The serpentine is traversed by dykes of diabase and porphyry and also by veins of quartz. Asbestos is not found everywhere in the serpentine; on the contrary the deposits are in ellipsoidal areas whose main axis invariably runs North and South and which attain a maximum length of 3,500 feet. The fibres of the veins are perpendicular to the walls as in the case of the Canadian asbestos. The richest asbestos-bearing rock yields over 50 pounds of asbestos to the cubic yard of rock, but, in other mines, the yield is from 28 to 33 pounds.

The work is done in open cuttings, the quarries not being deep; so far the depth has not yet exceeded 70 feet. The serpentine is, as a rule, soft enough to be got out without the use of explosive, but, as the depth increases, the rock becomes perceptibly harder and dynamite is used in the deeper workings.

Russian asbestos is said to be not as silky as Canadian asbestos and is not as easily woven.

THE MICA INDUSTRY

This industry has been inactive during the year 1909. The figures we have received in connection with the production show a considerable decrease from last year. The quantity of mica from the Province of Quebec for which a market was found in trade and industry in 1909, is valued at \$27,034.00 only, as compared with \$95,311.00 in 1908. Of thirty operators who sent in returns, nineteen only had worked and thirteen only had shipped products.

The figures given above represent the value of the mica shipped. There are, therefore, considerable quantities of this material in stock awaiting an improvement in the market and a rise in prices, for shipment. The conditions of the mica market have been very unfavorable during the year; prevailing prices have been below the average.

PHOSPHATE OF LIME

Phosphate of lime may be considered as a secondary product extracted while mining mica, for, at current prices, that substance could not be worked solely on its own account. The shipments in 1909 amounted to 525 tons,

valued at \$4,800.00. The whole of this quantity was used by the Chemical and Fertilizer Company of Buckingham.

GRAPHITE

Active operations have been resumed in the graphite industry of the Buckingham region. In 1908, work was limited to prospecting and experimenting, but this year products to the value of \$10,399.00 were shipped.

Operations were confined to the Buckingham district. Nothing was done in the vicinity of Calumet or Grenville.

Some work has also been begun by a Montreal syndicate, the Graphite Limited, Board of Trade Building, Montreal, which has prospected in ranges 6 and 7 of the township of Amherst.

It should be noted that a considerable amount of prospecting has been done in various places, which augurs well for the year 1910.

MAGNESITE

Work was continued in 1909 on the magnesite deposits of Grenville township, in Argenteuil county. A quantity of 630 tons, valued at \$2,508.00 was shipped to Montreal.

These deposits have attracted much attention for some years because they are the only ones in Canada capable of being worked. As mentioned in previous yearly reports on mining operations in the Province of Quebec, the most important use to which it is put is as a refractory substance for lining various high temperature metallurgical furnaces. For this purpose there would be a considerable market in the United-States and Canada for the product of the Grenville deposits.

Magnesite, when used as a refractory substance, is calcined and crushed. After undergoing this process it is worth from \$25.00 to \$37.00 per ton of 2,000 pounds in New-York. It should be noted, however, that for this use magnesite must be very pure, that imported from Greece containing an average of 95 per cent of carbonate of magnesia. The operators working the Grenville deposits assert that they can meet the consumers' demands as regards purity.

So far a depth of fifteen feet only has been reached and it is said that the magnesite at that depth is already purer than at the surface.

The present means of transportation are a serious obstacle to the rapid development of these deposits. The mine is about thirteen miles from Calu-

met, the nearest shipping station. No shipment can be made in summer over the road connecting the two points; thus the operations are limited to a few months in winter when loads can be conveyed over the snow roads.

The company operating there is the Canadian Magnesite Company, Eastern Townships Bank Building, Montreal.

PORTLAND CEMENT

The manufacture of Portland cement is one of the most flourishing in the Province of Quebec. This year we have to record a marked increase in production over 1908.

The chief feature of this industry in 1909 was the merging of the various companies manufacturing cement in the Province into an association whose influence has a national character. In fact, the Canada Cement Company has acquired the three large cement factories of our Province, together with several others in the Provinces of Ontario, Alberta and British Columbia. It is expected that the result of this amalgamation will be a considerable saving in the cost of management and especially of transportation, by which consumers will certainly benefit.

The manufacture of cement has made remarkable progress for some years past. Previous to 1904 there was but one factory in operation, whose production varied between 25,000 and 40,000 barrels a year. In 1905, the International Cement Company, of Hull, began producing and since then the figures have grown year by year as may be seen by the following table :

Year.	Quantity (barrels)	Value.
1904..	33,500	\$ 50,250
1905..	254,833	408,000
1906..	406,103	625,570
1907.....	.....	640,000
1908..	801,695	1,127,335
1909..	1,011,194	1,314,551

BUILDING MATERIALS

The figures we give this year in connection with other building materials: such as: lime, building and ornamental stone, bricks and other clay products, marble, slate, etc., are necessarily very incomplete because there are many producers of slight importance from whom it is difficult to obtain reports. The same remark applies in the case of mineral waters.



Marble quarry of the Missisquoi Marble Co., Phillipsburg, P. Q.

It will be seen by the general table that we have recorded a production of marble valued at \$130,000.00. This is the product of the Missisquoi Marble Company whose quarries are at Philipsburg. That company has installed a modern mining plant and very complete dressing works. The product is a very fine ornamental stone which finds a market in the United States and Canada. A considerable proportion of the product in 1909 was sent to Buffalo in the rough state. Some marble was also shipped from Philipsburg to Ottawa, Toronto, St. Catherines, Winnipeg, Edmonton, Victoria, Halifax, Moncton and other points in Canada.

In conclusion we give below a list of the mining companies operating in the Province of Quebec.

MAGNETIC SAND

H. C. Bossé & Co., 92 St. Peter street, Quebec.
W. Robertson, 223 St. James street, Montreal.

IRON

The Canada Iron Corporation, Ltd., Montreal.

TITANIC IRON

E. H. Duval, Quebec.
G. Gagnon, 87 Artillery street, Quebec.

OCHRE

Canada Paint Co., Ltd., 572 William street, Montreal.
Thomas H. Argall, Three-Rivers.
Champlain Oxide Co., Lucien Carignan, Three-Rivers.

CHROMIC IRON

Black Lake Consolidated Asbestos Co., Ltd., Black Lake.
Chrome and Asbestos Mines Ltd., Montreal.
Marcus Beebe and Decius Beebe, 129 South St. Boston.
J. O. Brousseau, D'Israeli.

COPPER

Eustis Mining Co., Eustis, P. Q.
Nichol's Chemical Co., Ltd., Capelton.
Albert Copper Co., Capelton.
A. O. Norton, Suffield Mine, Coaticook.

GOLD

Cie des Mines d'or de Pontiac et Abitibi, Ltée, Montreal.
Union Abitibi Mining Co., 403-404 Power Bldg, Montreal.
C. A. Parsons, 6 St. Francis Place, Brooklyn, N. Y.
Marshoro Gold Mining Syndicate, Sherbrooke.
The Dominion Gold Fields of Canada, Montreal.
The Compton Gold Dredging Co., Montreal.
G. R. E. Kennedy, Sherbrooke.
McWilliams B. Rice, Sherbrooke.

ASBESTOS

Amalgamated Asbestos Corporation, Montreal.
Black Lake Consolidated Asbestos Co., Black Lake.
Johnson's Co., Ltd., Thetford Mines.
Bell Asbestos Co., Ltd., Thetford Mines.
Asbestos and Asbestic Co., Danville.
Jacob's Asbestos Mining Co., of Thetford Mines, Thetford.
Broughton Asbestos Fibre Co., East Broughton.
Ling Asbestos Co., East Broughton.
Eastern Asbestos Mining Co., Thetford Mines.
The B. & A. Asbestos Co., Robertson.
Berlin Asbestos Co., Robertson Station.
Frontenac Asbestos Mining Co., East Broughton.
Boston Asbestos Mining Co., East Broughton.
Montreal Asbestos Co., Montreal.
The D'Israeli Asbestos Co., D'Israeli.
Coleraine Asbestos and Exploration Co. Ltd., Coleraine Station.
Premier Mining Co., Coleraine Station.
James Keen, Reedsdale.
The Chibougamou Gold and Asbestos Co., Montreal.
John N. Roberge, Thetford Mines.
Louis Mathieu, Beauceville.
Brompton Mining Syndicate, Sherbrooke.
Thetford Asbestos Syndicate, Montreal.
Belmina Consolidated Asbestos Co., Montreal.

GRAPHITE

Buckingham Graphite Co., Ltd., Buckingham.
Diamond Graphite Company, 205 Main Street W. Rochester, N.-Y.
Syndicate Iroquois Graphite, (J. A. Bigonese) Labelle.
The Bell Mines, Buckingham.

Calumet Mining and Milling Graphite Co., Calumet.
Graphite, Limited, Montreal.

MICA

The Laurentide Mica Co., Ltd., Ottawa, Ont.
Wallingford Mica & Mining Co., Ltd., 704 Tremont Bldg. Boston.
The Calumet Mica Co., Bryson.
F. A. Labelle & Co., 210 Main St., Hull.
Kent Brothers, Kingston, Ont.
A. Pritchard, Kazabazua, P. Q.
Brown Bros., Cantley, P. Q.
Canadian General Mining Co., Ltd., P. O. box 253, Montreal.
The Comet Mica Works, 398 Wellington street, Ottawa.
Wm. Argall, Laurel, P. Q.
Chabot & Cie, Ottawa.
Blackburn Brothers, 21 Sparks St., Ottawa.
Richard Moore, Picanock.
The Vavassour Mining Association, 22 Metcalfe St., Ottawa.
The Loughborough Mining Co. Ltd., Sydenham, Ont.
H. T. Flynn, 141, Brewery St., Hull.
Thomas J. Watters, box 234, Ottawa.
Jean Gagnon, Bouchette, P. Q.
Webster & Co., 274 Stewart St., Ottawa.
Bush Winning, Ottawa.

PURCHASERS OF MICA

Laurentides Mica Co., Ltd., Bridge and Queen Sts., Ottawa.
Eug Munsell & Co., 32, Wellington St., Ottawa.
General Electric Co., Ottawa.
Webster and Co., 274, Stewart St., Ottawa.

PHOSPHATES

The Capelton Fertilizer Co., Buckingham.
R. J. McGlasham, Wilson's Corners.
Blackburn Bros, Ottawa.
J. F. Higginson, Buckingham.

FELDSPAR

Bush Winning, Ottawa.

MAGNESITE

The Canadian Magnesite Co., Montreal.

KAOLIN

F. R. Lanigan, 23 Côté St., Montreal.

TALC

C. V. M. Temple, Spadina Rd., Toronto, Ont.

SULPHATE OF BARYTA

Canada Paint Co., 572 William St., Montreal.

COMBUSTIBLE NATURAL GAS

Canada Gas & Oil Co., Three Rivers.

PEAT

Imperial Light Heat & Power Co., Ltd., L. & L. & G. Bldg., Montreal.

SLATE

Fraser & Davies, New Rockland.

FLAG STONES

F. R. Bishop, Bishop's Crossing, Co. Wolfe.

Wm. Bently, Bishop's Crossing, Co. Wolfe.

CEMENT

Canada Cement Co., Ltd.

La Cie Electrique et de Ciment de Drummondville.

BRICKS (Companies producing over 1,200,000.)

Laprairie Brick Co., Laprairie.

Dr. J. Narcisse L. Auger, St. Tite.

Thos. Baird & Sons Co., Ltd., Ormstown.

Alex. Mills, Ormstown.

Victor Charland, St-Jean des Chaillons.

Alexandre Laliberté, St-Jean des Chaillons.

Mde Joseph Bernier, 755 Iberville St., Montreal.

Narcisse Blais, 12 Marie de l'Incarnation St., Quebec.

Paradis & Letourneau, Stadacona.
 The Eastern Townships Brick Co., Lennoxville.
 D. G. Loomis & Sons, Sherbrooke.
 W. & D. Bell, 1285 St. Valier St., Quebec.

GRANITE

The Laurentian Granite Co., Staynerville.
 Stanstead Granite Quarries Co., Beebe Plain.
 Samuel B. Norton, Graniteville.
 Joseph Cyr St. Canute.
 Mount Johnson Quarry Co., Iberville.
 James Brodie, Graniteville.
 Joseph Perron, Rivière à Pierre.
 North Derby Granite Co., North Derby, Vt., U. S. A.

LIME

Dominion Lime Quarry, Marbleton, Wolfe Co.
 Sovereign Lime Co., Poupart St., Montreal.
 Wright & Co., Hull.
 O. Martineau & Sons, Ltd., 600 Labelle Ave., Montreal.
 Racine & Gaucher St. Hyacinthe.
 Louis Arnaud, Joliette.
 Francis Naud, St. Marc des Carrières.

MARBLE

Missisquoi Co., Cristine Bldg, Montreal.

LIME STONE (Chief Producers)

O. Limoges Sr., 447 Papineau Ave., Montreal.
 Joseph Gravel, 488 East Duluth Avenue, Montreal.
 Damase Naud, St. Marc des Carrières.
 Ern. G. Quirk, 1701 Iberville St., Montreal.
 La Compagnie des Carrières de St. Marc, St. Marc des Carrières.
 Louis Labelle & Cie, St. François de Sales.
 Emile Labelle, St. François de Sales.
 John Dillon, 40 Hospital St., Montreal.
 Dominion Quarry Co., Montreal.
 Lord & Hebert, St. John's.
 R. Wright, Hull, P. Q.
 O. Lapierre, 830 des Carrières St., Montreal

G. C. Clermont, St. Laurent.
 Napoléon Brunet, St. Vincent de Paul.
 S. Laurin, Bordeaux.
 Grégoire Dagenais, Cap St. Martin.
 Eugène Deprés, Bélanger.
 George P. Des Roches, Joliette.

Companies using certain products of the mines to be manufactured in the Province.

The Electric Reduction Co., Buckingham (ferrochrome and phosphates).
 The Chemical and Fertilizer Co., Buckingham, (superphosphates.)
 Shawenegan Carbide Co., Ltd., Shawenegan.
 Standard Chemical Co., Coaticook, (acetate of lime.)
 The Standard Drain Pipe Co., Ltd., St. John.
 C. E. Dubord, Beauport, (refractory clay.)
 Geo. Belanger, Beauport, (refractory clay).
 The Montreal Terra Cotta Co., Ltd., Maisonneuve.

ACCIDENTS IN MINES

Notes on the precautions to be taken, by J. H. Valiquette Asst. Inspector of Mines

During the year 1909, thirteen accidents, which caused the death of 7 men and more or less serious injury to 12 others, were reported to the Bureau of Mines. In two different cases the Mining Inspector visited the localities and investigated the facts of the accidents, reports whereof were addressed to the Hon. Minister of Colonization, Mines and Fisheries.

The following are the particulars of these accidents:

I. On the 6th July at the Ling Asbestos Co., of East Broughton, a boy of 16 years was caught by a shaft and had his right arm broken in four places.

II. On 13th July, a young man named Willie Métivier had his arm broken by a machine at the Bell Asbestos Mines Co., of Thetford Mines. The surgeons had to amputate his arm above the elbow.

III. On the 21st May, 1909, at the Eustis Mine near Sherbrooke, a man named John Leach was killed by a piece of rock which fell from the roof in the 2,100 foot level. The jury at the coroner's inquest rendered the following verdict.

The juror John Leach, on 21st May, 1909, at the Eustis Mine, county Sherbrooke, district of St. Francis, died from the effect of injuries from a block of low grade ore which fell upon him while he was working for the Eustis Mining Co.; and the said jurors are of opinion that the death of the

sail John Leach was accidental, but as it was demonstrated that there was a certain amount of negligence on the part of the employees, although such negligence was not criminal, the said jurors would recommend that the said company should endeavor to prevent similar accidents in future."

Following this accident, Mr. J. Obalski, Superintendent of Mines of Quebec, paid a visit to the mine in question, where he remarked that proper precautions had been taken to assure the safety of the workmen and that the accident above described was one of the class that could not be foreseen.

IV. On 10th August, at the Standard Asbestos Co., Black Lake, two men were killed and five injured by a slide of rock and earth. The dead were Joseph Zabegski and Iwan Laetourski.

At the coroner's inquest, the jury returned a verdict of accidental death.

V. On 9th August, at the Bell Asbestos Co., a man named Napoléon Couture broke his arm by falling from a car.

VI. At the Eastern Townships Asbestos Co., of East Broughton, on 8th September, one A. Vachon had his leg broken by lumps of hard earth coming from a landslide from the surface when he was at work at the bottom of the quarry.

VII. On 14th September, at the Broughton Asbestos Fibre Co., a young man named Cliche had his leg broken by rocks from a slide of earth and rocks when working in the quarry.

VIII. At King Bros. Mine, at Thetford Mines, on 11th November, one George Nadeau was killed by falling into the quarry from a height of about 40 feet. This workman was on one of the faces of the excavation when he lost his balance in trying to catch, as it passed, the pulley of a traveller swinging over the pit.

The verdict at the coroner's inquest was accidental death.

IX. On 9th December, at the Beaver Asbestos Co., at Thetford Mines, one Belonie Fredette had a leg broken by a landslide. The leg had to be amputated.

X. On 14th December, at King's Asbestos Co., at Thetford Mines one John Jackson was frightfully mangled by an explosion of dynamite and died a few days afterwards in the hospital.

John Jackson was employed as the operator of a drill and on that day was working with a small drill on large blocks of stone; it appears that the evening before one of his blasts had missed fire without his knowledge and it was while boring a new hole into the same block that the explosion occurred owing to the violent shock of the drill. Jackson had been ordered to personally assure himself that none of the blasts had missed fire and it was due to his

own negligence and great imprudence in not performing his duty that the accident happened.

XI. On 15th December, at the Frontenac Asbestos Co., East Broughton, a man had an arm broken and received bruises through a landslide.

XII. At the Asbestos and Asbestic Co., of Danville, a man was crushed to death by a landslide into the quarry.

XIII. At the Asbestos and Asbestic Co., of Danville, a brakesman was killed by falling from a car.

A good many other accidents of a more or less serious nature happened at the mines, but were not reported to the Bureau of Mines.

Table of accidents reported to the Bureau of Mines.

Date : 1909	Mine :	Name of injured :	Nature of injury :	Cause :
May 21st	Eustis Mining Co.	John Leach	Instantly killed	Struck by a stone falling from the roof.
July 6th	Ling Asbestos Co.	Bisson	Arm broken	Arm caught in shafting.
" 13th	Bell Asbestos Mines.	Willie Métivier	Arm fractured.	Caught in machinery.
Aug 10th	Amalgamated Asb. Corp. (Standard Mines)	Joseph Zabegski Iwan Laetouraki	} Killed 5 injured	Land slide.
Aug. 9th	Bell Asbestos M.	Napoléon Couture			Arm fractured,	Fall from a car.
Sept. 8th	Eastern Township Asb. Co.	A. Vachon	Leg fractured.	Land slide
" 14th	Broughton Asb. Fibre,	M. Cliche	" "	Rock slide
Nov. 11th	Amalgamated Asb. Corp. (King's Mine)	George Nadeau	Instantly killed	Falling into quarry.
Déc. 9th	Amalgamated (Beaver Mine)	Belonie Fredette	Leg fractured.	Land slide.
" 14th	Amalgamated (King's Mine)	John Jackson	Killed	Explosion of dynamite.
" 15th	Frontenac Asb. M. Co.	Inconnu.	Arm broken and contusions,	Land slide,
	Asbestos and Asbestic	Henri Perreault	Killed	Land slide.
	" "	Xavier Gervais	Killed	Fall from a car

According to the table, 7 men were killed, which makes two men per thousand workmen. In 1908, there were 2.33 men per thousand.

In this calculation, account is taken only of the men employed in the mines properly so called, without including the men employed in the stone quarries, brickyards and the cement works. No accident was reported to the Bureau of Mines in connection with the quarrying of stone or clay for the production of building materials.

Most of the accidents above described are generally classed by the managers or owners of mines as unavoidable and inherent to mining. This is certainly true in some cases, for it is conceded that miners are more than others exposed to danger owing to the unforeseen causes of accidents, but it is very probable that some of these accidents might have been avoided by more careful supervision and a more methodical direction of quarrying and the handling of explosives.

It will be noted that most of the accidents above described, are caused by land or rock slides ordinarily coming from the surface, as the workings are more frequently carried on in open cuttings, the sides of which have been insufficiently cleared of rocks cracked or fissured by the blasts or loosened by the weather. It is deplorable to have to say that, through economy or negligence, or to increase the figure of the daily output of ore, the miners are compelled to work under blocks of hardened earth or fragments of rocks, which involve a distinct danger.

It is imprudent to let a workman look alone to his own safety, for these men become, through habit, so thoughtless of the danger that they lose all fear of it. The foremen should be experienced and sober men, always on the spot to watch over the safety of the employees, while they oversee and direct the progress of the works. It seems to me that there is no economy in allowing the earth and sometimes the rock to slide into the cuttings, for the whole has to be afterwards removed with the shovel and raised again to the surface with the derricks. It is true, that pickwork to loosen the hard soil is saved, for the whole breaks asunder in failing: but it is worth while to pay a few men to do this work and thus avoid the risk of crippling the poor shovellers working in the cutting. Moreover the cost of such work with the pick should not be higher than the cost of the labor employed to remove such debris at the bottom of the cuttings.

With respect to the mines worked by means of drifts the careful removal of the virtually detached rocks in the roof or sides shaken by the blasts or loosened by the weather, cannot be too strongly recommended.

Mine managers sometimes have an interest in stimulating competition between the night shifts and the day shifts or between two different shifts as regards the proportion of ore extracted by each daily. This certainly has a good effect and is not to be condemned, but it must not be to the detriment of the clearing of the walls, for the foremen in such cases are inclined to ca-

concentrate all the efforts of the gang upon extraction and to neglect certain essential precautions ; in such event, it is better to employ special men to look after the inspection and clearing of the roofs and walls.

Respecting accidents due to explosives, it is matter for congratulation that only one occurred in 1909. We should like to see them completely eliminated, but this, perhaps, would be to ask or expect too much. Still there are certainly some improvements to be made in the handling of explosives, for it is to our knowledge that grave acts of imprudence are sometimes committed which may provoke disasters. It is therefore well to be ever on guard, for it is better to prevent than to record calamities and losses of life which might have been avoided.

Generally speaking, explosives should not be handled except by persons of good reputation for sobriety and experience ; it would probably be prudent to have men well recommended for the special work of handling dynamite or other explosives ; these men should personally put the charges into the holes drilled during the day or half-day, fire them and carefully inspect all the spots dynamited to ascertain if none of the charges have missed, as well as to note the effects of the blasts. They should then make a report in writing to the miner or head foreman in charge of the works from whom the miners receive their instructions for the day. Blanks of such reports might be printed in advance, which would facilitate the work of the blasters.

By leaving to each miner the firing of the blasts prepared by himself, there is always danger that he will not take the time to properly make the inspection, which should be strictly insisted upon after the firing, for, tired after a long day of hard work, he would be rather inclined to go and seek rest than to descend again into the quarry or shaft to perform the inspection. This is especially true where there are mis-fires, because in that case the miner allows an hour to elapse before venturing again on the spot, while for the man set specially apart to do the firing only, he could take all the time necessary and thus deplorable accidents would be avoided.

In mines, there should always be certain rules respecting the use of explosives and the foreman should be charged with the duty of seeing that these are strictly enforced to the letter. The cartridges should always be kept in safe places removed from shocks of all kinds and especially from the detonators ; they should not be fitted with the detonators except directly on the spot where they are to be used and only just the number required for immediate use should have the detonator attached, for it is always dangerous to remove the detonator from a cartridge. Where this has to be done, no precaution should be neglected and the cartridges with the detonators thus removed should be stored away in a safe place. If a cartridge with the detonator attached has

become frozen, the detonator should only be removed after the cartridge has been thawed and in this last operation altogether special precautions should be taken.

On no account, should an attempt ever be made to untamp a mis-fire or to deepen holes from which the tamping has been blown out, when the bottom of such holes has remained intact after the explosion; when another hole is drilled in the neighborhood, it should be at a distance of at least one foot from the first and located in such a way that at least that distance from the old holes will be always maintained, and if the rock be fissured and there is reason to fear that the nitro-glycerine of the misfire has filtered through the rock by means of such fissures, the distance between the old and the new hole should be increased. After the explosion of a blast placed alongside the misfire, an effort should be made to find the unexploded dynamite in the first hole and thus avoid accidents to the men working with the pick or around the crushers, for such dynamite might be exploded by the shock of the tools.

In the same hole, only one cartridge with a detonator should be placed and this should be put over the charge with particular care.

To get a good result from a blast, the hole above the charge should be well tamped and, as far as possible, no space should be left for air or dust between the cartridge and the rock, and great precautions should be taken to avoid such spaces, for besides the loss of effectiveness in the blast, certain cartridges might not go off and dynamite would be left free in the rock, which would expose the workmen to the dangers so well known. These partial explosions are all the more dangerous that the charge might be thought to have been too weak and thus the necessary precautions would not be taken with regard to the dynamite remaining in the hole.

To prevent any air space, the cartridge should be split and then pressed carefully to the bottom of the hole with a wooden tamper. The cartridges should be thus pressed one against the other, avoiding all shocks and taking good care that no earth or dust shall fall between them; the tamping should then be done with sand or ordinary dry earth for the first six inches by pressing lightly with the tamper and then with clay upon which more force may be used in the ramming. Great precaution should also be taken in handling the fuse or the electric detonators, for any deterioration of these articles may cause a delay or greater celerity in the explosion or they may make the shot miss fire altogether.

Too much care cannot be taken in employing frozen dynamite; no frozen or partially frozen cartridge should be used in that condition; it should first be thawed out, taking all the necessary precautions. Cartridges should never be thawed by the direct action of fire or by putting them near a boiler, on steam pipes, or exposed to the direct action of the sun or by plunging them

into hot water. Too many precautions cannot be used in the thawing of explosives for, during that operation, the nitro-glycerine is very sensitive and consequently more liable than usual to explode. The best means is to have a small special building for thawing dynamite or to use the small thawers supplied by the manufacturers of explosives. In no case should the explosive be exposed to a temperature higher than 90° F.

The objection to directly exposing the cartridges to the sun's rays or to heat is that the nitroglycerine or the other nitrates which these explosives contain may then undergo decomposition which would change the effect of the explosion. On the other hand, as above stated, nitroglycerine in thawing is very sensitive and any too prompt rise in the temperature might be disastrous.

STORING EXPLOSIVES

The storing of explosive is another thing which should never be neglected; as far as possible explosives should be kept away from heat, dampness, fire, electric discharge of any kind, projectiles and thieves.

It is important therefore to have for the purpose a building protected against weather changes and it should be fire-proof, perfectly ventilated and located in a well chosen spot from which all vegetation or refuges of any kind liable to spread fire should be removed. The building should be partly underground and covered with materials proof against projectiles. Lightning rods should be erected at different points around the building. The structure should be kept scrupulously clean, by removing the dust and sweeping every day; the dust collected by the broom should be thrown into the water or conveyed to some safe spot. If it be noticed that the floor has been stained by the nitro-glycerine leaking from the cartridges, the stains should be rubbed with dry saw dust and then washed with a solution of sulphide of sodium in wood alcohol ($\frac{1}{2}$ lb of the sulphide to $\frac{1}{2}$ gallon of wood alcohol). To prevent the leaking of the nitro-glycerine, care should be taken to store the cartridges by placing them in a box in which they may lie horizontally. A box of dynamite should never be opened in the magazine and the first cartridges to hand should be always used. Before making any repairs to the store, the explosives should be first removed from it. Under no consideration should the detonators be placed in the magazine; they should be put in another safe place. Conspicuous placards, bearing in large print the words "Explosives—Danger" should be placed on the four walls of the building.

ACCIDENTS TO WORKMEN

In open workings, which are not more than 200 to 300 feet deep or less, the ascent and descent of the workmen should be effected by means of ladders

and the men should never be allowed to go down or come up in the ore buckets. These ladders should be placed in a favorable spot and as far as possible where they cannot be reached by pieces of rocks projected by the explosions. The ladders should be kept in the best order and clear of snow and ice in winter. It is astonishing to see in what bad order sometimes the ladders are kept. It would seem as if the miners believed that these may be neglected as they are only an accessory of the mine. It is to be hoped that some effort will be made to improve this state of things so that one may be able to descend into the mines by means of safe ladders.

As regards mines worked by shafts and at a great depth, the chief sources of accident in moving workmen are the insufficiency of the signals between the bottom and the surface and the breaking of the suspension cables and guiding ropes. It is absolutely necessary to have frequent inspections of this equipment made by men of unquestionable competency and on the other hand it is essential that the engineer should be able from his post to see the exact position of the cage at any moment by consulting an indicating dial.

