

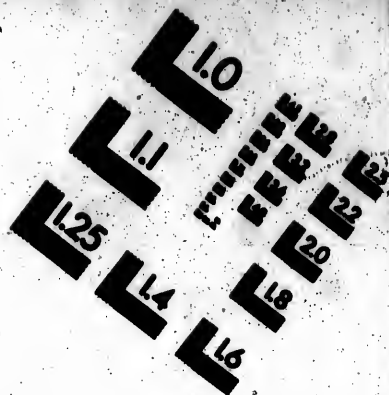


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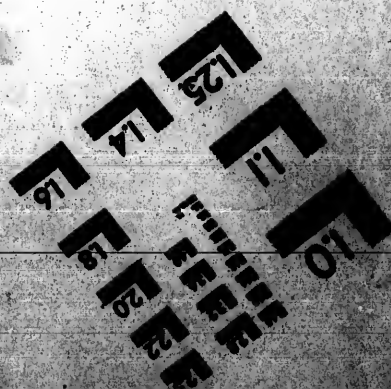
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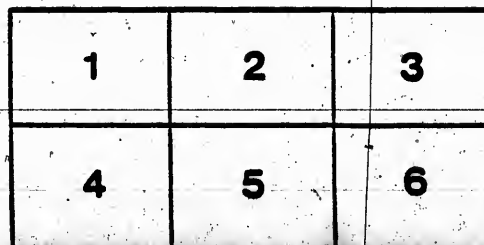
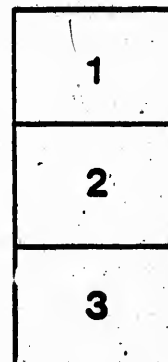
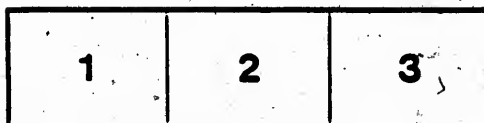
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19

102

CANADIAN FLUOR-APATITE.

COMPLIMENTS

—OF—

JOHN LAMB,
COMMISSION MERCHANT.

*Dealer in Phosphate of Lime, Phosphate and other
Mineral Lands and Mining Leases; also,
Lumber, Timber and Timber Limits.*

TORONTO.

CANADIAN
FLUOR-APATITE.

CANADIAN FLUOR-APATITE.

The following brief compilation of statistics, showing the present status of the Canadian phosphate industry, is made for the purpose of bringing to the notice of capitalists the advantages offered by judicious investments therein. The importance of the subject, as well as professional matters, has induced us to make many careful examinations, extending over several of the districts in which the Apatite occurs, and as the results of our researches have, in a great measure, been borne out by the experience of others, we have taken the liberty of embodying in the following pages, extracts from their published statements.

BENEDICT & COLE,

32 LIBERTY STREET.

New York City, March 25th, 1884.

CANADIAN FLUOR-APATITE.

The importance of a supply of Phosphates to the soil is made evident by the fact that the mineral part of the bones of animals is for the greater part Phosphate of Lime, and up to a recent period furnished a sufficient supply of this material for the demands of commerce.

Of late years, the increasing demand for Phosphates as fertilizers has drawn attention to the use of the crystalline mineral phosphate of lime, or Apatite, of which large quantities have been imported from Norway and elsewhere, into England, and attention has recently been turned to the abundant supplies of this mineral existing in Canada.

The question is sometimes asked, whether the native phosphate of lime may not be directly applied to the soil as a manure, and thus dispense with the costly process of converting it into super-phosphates.

Ground bones, which is used with great advantage as a manure, owes a portion of its efficacy to the organic matter it contains, and which, by its slow decay in the soil, gives rise to ammonia, an important fertilizer.

The more dense phosphate of the crystalline apatites is, however, much less soluble than the phosphate contained in bones, and therefore much slower in its action when applied to the soil. Hence it becomes an object to the agriculturist to apply phosphate in small quantities, and in such a form as will be immediately available to the growing crop.

For this purpose he has recourse to the super-phosphates of lime or to some other soluble phosphate. When this is applied to the soil, it is first taken into solution by the water there present and is then decomposed by the compounds of lime and other bases in the soil, so that it is converted again into an insoluble phosphate, which is

produced in a state of very minute divisions, thus exposing a great amount of surface, and is distributed throughout the soil. This enormous sub-division which is obtained by using a soluble super-phosphate, renders intelligible the great efficiency of small quantities of this substance when applied as a fertilizer.

CHARACTER AND COMPOSITION.

There are two varieties of Canadian Apatite, commonly called green and red, the former varying in color from a very light to a deep sea green, while the latter is usually reddish brown. In character it is generally massive; sometimes coarsely crystalline and often granular. It also exists, in considerable quantities, as well formed hexagonal crystals, imbedded in limestone (calcite), the crystals varying in size from a fractional part of an inch to a foot or more in diameter.

As the result of numerous analyses made by different chemists, this mineral is found to have, approximately, the following composition:

Tricalcium Phosphate,	89.70 %
Fluoride of Calcium,	7.30
Chloride of Calcium,	0.50
Carbonate of Lime,	0.90
Silica, Magnesia, Alumina, and Iron,	1.70
	100.00

*Bone Phosphate; equivalent to 41.65 per cent. of Phosphoric Acid.

Thus it will be seen it is essentially a fluor-apatite and very rich in phosphoric acid.

In appendix "B" the percentage of bone phosphate in several varieties of "raw phosphates" is given for comparison, and shows the superiority of Canadian mineral.

THE GEOLOGY OF CANADA APATITE.

The following extracts, taken from a paper written by Dr. T. Sterry Hunt, of Montreal, and read at the meeting of the American Institute of Mining Engineers, at Cincinnati, in February, 1884, briefly describe the geological occurrences of Canada Apatite. They also give a plain statement of the methods of mining that have been

5
followed; the causes that led thereto; the cost of mining and transportation to Montreal (the point of shipment to Europe); value of mineral, etc.:

ON THE APATITE DEPOSITS OF CANADA.

The presence of apatite in the Laurentian rocks of North America has long been known to mineralogists, and within a few years so much interest has been excited by the economic importance of deposits of this mineral found in certain parts of Canada that a brief history of our knowledge of these deposits may be acceptable to the members of the American Institute of Mining Engineers. It was in 1847 that the present writer was shown by a local collector of minerals some large crystals, which had been called beryl, found in North Burgess, Ontario. These were at once recognised as apatite; and after a visit to the locality, this was described in the report of the Geological Survey of Canada for that year as likely to furnish an abundant supply of a valuable fertilizer; the opinion being then expressed that the fact of "the existence of such deposits as these will prove of great importance."

I have, within the past few months, examined with some detail many of the apatite workings in Ontario, which have served to confirm the early observations, and to give additional importance to the fact already insisted upon in previous descriptions, that the deposits of apatite are in part bedded or interstratified in the pyroxenic rock of the region, and in part are true veins of posterior origin. The gneissic rocks, with their interstratified quartzose and pyroxenic layers, and an included band of crystalline limestone, have a general northeast and southwest strike, and are much folded; exhibiting pretty symmetrical anticlinals and synclinals, in which the strata are seen to dip at various angles, sometimes as low as 25 degrees or 30 degrees, but more often approaching the vertical. The bedded deposits of apatite, which are found running and dipping with these, I am disposed to look upon as true beds, deposited at the same time with the inclosing rocks. The veins, on the contrary, cut across all these strata, and in some noticeable instances, include broken angular masses of the inclosing rocks. They are, for the most part, nearly at right angles to the strike of the strata, and generally vertical, though to both of these conditions there are exceptions.

The beds and veins of apatite are often traced for from 500 to 1,000 feet and more, and there is reason to believe that they are continuous for long distances. The workings upon them have, however, as yet been very superficial, generally from twenty to forty feet, and rarely exceeding 100 feet. The deepest mine, which is in Ottawa county, is now about 200 feet.

The ordinary thickness of the bedded masses of apatite may be said to vary from one to three and four feet, though not infrequently expanding to eight and ten feet, and even more, and sometimes

contracting to a few inches; the same layer being subject to considerable variations. In some cases the apatite in a bed is found to thicken and then to diminish, or to be divided by the interposition of the accompanying pyroxenic rock.

The veins present more complex conditions; while they are often filled throughout their width by apatite as pure and as massive as that found in the beds, it happens not infrequently that portions of such veins consist of coarsely crystalline, sparry calcite, generally reddish in tint, holding more or less apatite in large or small crystals, generally with rounded angles, and often accompanied by crystals of mica, and sometimes of pyroxene and other minerals.

The thickness of the veins also, as above stated, is very variable, and the same vein in a distance of a few hundred feet will sometimes diminish from eight or ten feet to a few inches.

These, however, as already noticed, are for the most part opened only by shallow pits; a condition of things which is explained by the peculiar character, and the frequency of the deposits, and also by the economic value of the apatite. This mineral, unlike most ordinary ores, is, in its crude state, a merchantable article of considerable value, and finds a ready sale at all times, even in small lots of five or ten tons. Like wheat, it can be converted into ready money, at a price which generally gives a large return for the labor expended in its extraction. Hence it is that farmers and other persons, often with little or no knowledge of mining, have, in a great number of places throughout the district described, opened pits and trenches for the purpose of extracting apatite, and at first with very satisfactory results. So soon, however, as the openings are carried to depths at which the process becomes somewhat difficult from the want of appliances for hoisting the materials mined, or from the inflow of surface-water, which in wet seasons fill the open cuts, the workings are abandoned for fresh outcrops, never far off. In this way a lot of 100 acres will sometimes show five, ten, or more pits, often on as many beds, from twelve to twenty feet deep, each of which may have yielded one or more hundred tons of apatite, and has been abandoned in turn, not from any failure in the supply, but because the mineral could be got with less trouble and cost at a new opening on the surface near by.

These conditions are scarcely changed when miners, without capital and unprovided with machinery for hoisting or for pumping, are engaged, as has often been the case, to extract the mineral at a fixed price per ton. These, having no interest in the future of the mine, will work where they can get the material with the least expenditure of time and labor, and often will quit the opening for one which is more advantageous. The very abundance and the value of the mineral mined has thus led to its careless, wasteful,

and unskillful exploitation. It is the working of these causes, in the way just explained, which has thrown undeserved discredit on this mining industry, and, more even than the injudicious schemes of speculators and stock-jobbers, has retarded its legitimate growth.

It is evident that the proper development of these deposits will require regular and scientific mining in place of the crude plan of open pits and trenches, which, from causes already explained, has hitherto, with few exceptions, been followed.

The market value of apatite, which, as is well known, is chiefly consumed for the production of soluble phosphate by the manufacturers of artificial fertilizers, varies greatly, other things being equal, with its purity. Thus, while at present the price in England is 1s. 8d. the unit for apatite giving by analysis 75 per cent. of tricalcic phosphate, there is paid an addition of one-fifth of a penny for each unit of phosphate above that percentage, so that a sample yielding by analysis 80 per cent. is worth 1s. 3d. the unit. The price in the English market is subject to considerable fluctuations, having within the last four years been as high as 1s. 5d., and as low as 11d. the unit for 80 per cent. phosphate. The present may be considered as an average price.

The Canadian apatite shipped to England has yielded for various lots from 75 to 85 per cent., 80 being the average from the best conducted mines, through lots from mines where care has been used in the dressing and selection of the mineral for shipment have yielded 84 and 85 per cent. Many of the smaller miners to which we have alluded, selling their product to local buyers, taking little pains in dressing, and hence their product is apt to be lower in grade. It will be seen in the rule adopted by foreign purchasers, that there is great profit in a careful selection and dressing of the mineral for market. The basis being 1s. 8d. the unit for 75 per cent., with a rise of one-fifth of a penny for each unit, it follows that while a ton of 75 per cent. apatite will bring only 87s. 6d. (\$21.17); a ton of 80 per cent. will command 100s. (\$24.20); and one of 85 per cent. 113s. 4d. (\$27.42).

In the present state of the industry, it is not easy to say what would be the cost of production. At the outcrop of the large masses of apatite, and in the open cuts and quarries already described, the cost of extraction and dressing is of course very variable, estimates in different deposits giving from \$2 to \$8 the ton.

The amount of apatite shipped from Montreal has gradually increased, and according to published figures, attained, in 1883, 17,840 tons, of which, it is to be remarked, that 1576 tons were delivered in Hamburg and 650 in Stockholm, the remainder going to Liverpool, London, and other British ports. Of this, about 15,000 tons were from Quebec, and the remainder from Ontario. It should be noticed that this was, with small excep-

tions, mined in 1882, and brought to the water-side during the winter season. It is estimated that the shipments of apatite for 1884 will equal 24,000 tons.

The methods of mining hitherto generally pursued in the apatite deposits of Canada allow of many improvements which would materially reduce the average cost of production, and give a permanency to the industry which the present modes of working can never attain. The regularity and persistence of the bedded deposits and of some of the veins warrant the introduction of systematic mining by sinking, driving, and stoping, with the aid of proper machinery for drilling, as well as for hoisting and pumping. The careful dressing and selection of the apatite for the market is also an element of much importance in the exploitation of these deposits. The cost of labor in the apatite-producing districts is comparatively low, and there are great numbers of beds now superficially opened, upon which regular mining operations, conducted with skill and a judicious expenditure of capital should prove remunerative. It must be added that the areas in question have as yet been very partially explored, and that much remains to be discovered within them, and also, there is reason to believe, in outlying districts, so that in the near future the mining of the apatite in Canada, will, it is believed, become a very important industry.

THE COST OF MINING

varies according to the size of the "pay streak" in the vein or deposits, and the freedom of the apatite from impurities, such as fragments of wall rock, pyroxene, limestone, and mica. Usually the cost of "cobbing" or hand dressing is greater than that of extraction; but \$4 to \$8 (16 to 32 shillings), may be considered the ordinary limits of the cost of the mineral ready for shipment.

THE COST OF TRANSPORTATION

depends upon local facilities. It is customary to do most of the hauling in winter, when the farmers, having little or no work for their teams, are ready to transport the apatite to the railroads or water navigation for a much lower rate per ton than during the warmer months. Also the snow and frozen rivers and lakes enables them to carry much greater loads. 10 to 20 cents per ton per mile, are about the limits of the cost of transfer by sleigh and wagon.

Most of the long distance transportation is done by rail. The railway companies, as a rule, supply bins for storage free of charge, and receive 1 to 1½ cents per ton per mile. Water transportation is done by barges, and ordinarily is less expensive than by rail.

FREIGHT TO LIVERPOOL.

The rates of freight from Montreal to Liverpool vary from 5 to 15 shillings (\$1.20 to \$3.60) per ton of 2240 pounds. 10 shillings (\$2.40) is a fair average, though it may be added that there have been times when a premium has been paid for phosphate to go as ballast, and as the transportation of deals (pine and spruce planks) is beginning to be carried on by steamers, each of which requires 300 to 500 tons of ballast, low rates for phosphates seem assured for the future. In the autumn of 1883 the rates were 7 shillings or \$1.70 per ton.

OTHER CHARGES.

In addition, there are various charges at Liverpool for brokerage, sampling, analyses, etc., which, upon cargo lots of 300 to 400 tons, amount to 2s. 6d. to 3 shillings (60 to 75 cents) per ton. Also a discount of $2\frac{1}{4}$ per cent. is charged; this is equal to 2s. 6d. (60 cents) per ton for an 80 per cent. apatite at 1s. 3d. per unit.

RÉSUMÉ OF EXPENSES.

Tabulating the foregoing charges we have the following estimates of the total cost at Liverpool:

	PER TON.	PER TON.
	£ s. d.	
Mining and "Cobbing,"	1 4 9	\$6 00
Hauling to Railway,	7 3	1 75
Freight to Montreal,	6 2	1 50
Freight to Liverpool,	10	2 40
Brokerage, Sampling, etc.,	2 9	67
Discount,	2 6	60
Totals,	£2 13 6	\$12 92

VALUE OF APATITE.

It has been already mentioned that the average price paid for Canadian Apatite by the English dealers is 1s. 2d. (29 cents) per unit (each per cent.) for 75 per cent. mineral; and that higher grade apatite is paid for at the rate of $\frac{1}{2}$ d. additional for each per cent. above 75. Under ordinary circumstances it can be readily and economically dressed up to 82 per cent. and frequently to between 84 and 85 per

cent. At 82 per cent. it would be worth £5 5 2, or \$25.44 per ton. Hence the following net profit:

Value at Liverpool,	£5 5 2	\$25.44
Total Cost at Liverpool,	2 13 8	12.00
Net profit per ton,	£3 11 9	\$13.52

Finally, it may be stated that while the foregoing estimates of expenses are not absolute for all the districts in which apatite is found, they fairly represent the average outlay. From some mines the cost is less, from others more, though probably not varying \$2.00 (8 shillings) per ton from the estimates given; but with a moderately productive property and suitable management the net profit here shown may be relied upon.

It has sometimes been urged against investments in Canadian phosphate lands, that the veins and deposits are not continuous for any considerable depth; that they are merely pockets, and altogether unreliable. The principal cause of this method of reasoning is the manner in which the operations of mining have been carried on, particularly in the earlier years of this industry, and the force of this statement is much better appreciated after a careful inspection of the mode of occurrence of apatite in the different districts. The mineral is frequently found in lenticular masses, the contracted portions of which give to the vein the appearance of having "pinched out," if not entirely, at least to the extent that further mining becomes comparatively unprofitable; the pits are then abandoned and operations are transferred to other places or ceased altogether. But in numerous instances the rock or vein matter separating these "pockets" has been removed and the phosphate found again, often in larger quantities and of a better quality than before, much to the benefit of those most interested in the work. The writers have yet to learn of a single instance in which a vein has pinched out entirely, and frequently, as depth is gained, the mineral increases in quantity and purity. Familiarity with the different deposits in the district is of much value in directing operations; and ignorance of the principles of mining, and the art of breaking down a maximum amount of mineral with a minimum

expenditure of labor and explosives on the part of those in charge, makes lighter pockets for the owners of the mines. Again, no great outlay for mining machinery is required; at first simply a quarrying plant will answer, but as depth is attained a small hoisting engine can be advantageously employed, and should water be abundant, a suitable steam pump, but there is rarely any necessity for the latter.

APPENDIX A.

TITLES.

Phosphate lands, in Canada, are held in two ways. 1st. By Absolute Patent from the Crown; and 2nd. By Deed of Mineral Rights in fee simple.

In the first the property is conveyed to the grantee absolutely by a regular patent, or if already patented, by a regular warranty deed.

In the second, the mineral rights are granted. When this is the case, the grantee has the right to enter and work any mine or mines to be found on the premises, and extract all ores and minerals to be found, and remove the same, and in the work of mining and removing minerals and ores to use all the surface room required about such work, and to cut and use all the timber that may be required for mining purposes. In all cases where the mineral rights are granted, the grantor, who still retains the surface rights (except wherein they may be used by the grantee in and about the working of the mines), is the person assessed for taxes, and is liable for the same. Mineral rights cannot be assessed, and consequently are free from taxation.

Therefore Mineral Rights are a preferable purchase in a majority of instances. Transfers are made by simple deeds, which are registered in the Registry Office for the county in which the land is situated.

APPENDIX B.

MINING IN CANADA.—SULPHUR ORES AND PHOSPHATES.

(From the N. Y. Engineering and Mining Journal.)

Time works marvels in the lives and interests of individual citizens, but much more so in the history of manufactures and of states. We live on the eve of great changes, and the wisest among us, not blinded by political bias, can see that the probable reform of the tariff in the near future must bring with it certain radical alterations in our manufactures and commerce. Whether serious changes in the trade of the two countries occur or not, there are raw materials in Canada which are now valuable, and will speedily become more so as our consumption of sulphuric acid and fertilisers increases. Except coal, sulphur ores, and phosphates, the minerals of Canada possess but little interest for the American investor. Now and then he may meet with something worth notice in other directions, but not often. In the case of sulphur ores and phosphate, it is not so; for outside of our Carolina supplies of phosphate, there is none so near or so rich as the apatite of Canada, while our available sulphur ores are widely distributed.

It is not many years ago since Canada phosphate began to attract notice in the United States and Europe. Of late years, Americans have kept a steady lookout for property in Canada which they could work themselves for the requirements of their own factories. The importance of the fertilizer trade in its present condition and the proportions it promises to assume in the near future, are the principal causes of this diversion of interest. It is not many years ago that the home manufacture was expressed in five figures; now it takes seven. This change has been accomplished in the short space of ten years. What it will be in the next decade will depend mainly on the supply of the raw material, and especially on the cost of sulphur acid. When Canada apatite first came on the market, some eight years ago, practical men shook their heads at the hard and unpromising looking material. Many of the mills then in use in fertilizer-works were the buhrstones used to pulverize coprolite and other comparatively soft material. The difficulty of grinding has now been overcome, and it is no longer a source of danger to workmen and of perplexity to manufacturers. Instead of using it as they did coprolite, it is mixed largely with other softer materials, which enables the operating chemist to first saturate the apatite with sulphuric acid, and use Carolina phosphate or bone-ash as a drier. The use of these materials assist largely in lengthening the chemical action of decomposition; the carbonic acid of the softer

materials offers a mechanical agent to sustain the acid in its attack on the hard and crystalline apatite. Up to the close of June, 1881, the total export of Canada phosphate was 15,600 tons, the average value of which was about \$16 a ton. In 1882, these figures were increased by 12,000 tons, which commanded a higher average of value. Last year, the amount produced was 23,000 tons, and a slightly increased value over the year previous. Being a more concentrated phosphate than any other in the world, it has very naturally been sought for to bring up the acid phosphate fertilizer to high percentages of phosphoric acid. A statement of the analytical composition of a few of the leading phosphates of commerce will indicate the high value of Canadian apatite:

Raw Phosphates.	Content of tri- basic phosphate of lime. Per cent.
Russian:	
Government of Orsk.....	29.14
Government of Podolia.....	66.78
English:	
Cambridge coprolite.....	57.78
French:	
Ardennes coprolite.....	45.21
Bordeaux phosphate.....	77.41
Spanish:	
From two mines, from.....	74 to 85
West Indian:	
Navassa Island.....	72.43
Old Curacao Island.....	70.99
New Curacao Island.....	82.60
Sombrero.....	81.88
Redonda.....	87.73
Elroque.....	69.86
Rio Grande:	
Bone Ash.....	70 to 80
South Carolina:	
Coprolite.....	48 to 60
Phosphate.....	51 to 60
Canada:	
Apatite.....	72 to 94

Those who have secured properties in the Ottawa District have worked them most energetically for all they are worth, and their returns have been very encouraging so far. The expenses vary of course with the conditions; but as a rule range from four to five dollars per ton, often less, sometimes a little more. These figures are, however, the result of the experience of a number of workings, embracing, at least, seven large mines in the great Ottawa District. The cost of the mineral laid down in Montreal may be estimated at from \$7 to \$9 per ton. Freights to New York may be had at from \$3 up by boat, and for long contracts easy railroad rates may be secured directly from the mine to destination. Prices this season in Montreal have ranged from \$18 to \$22 for choice shipments.

The quantity of this material which our market can deal with will depend mainly on the cost of sulphuric acid. Already a

great change has recently taken place in the plant of several American manufactures and acid has occasionally touched very low figures. Among manufacturers of acid, opinion has changed in regard to the economy of pyrites over brimstone. Some of the best known pyrites contain in average samples about as follows:

	Virginia.	Capleton Ontario.	San Domingo.	Spanish.
Sulphur	47.50	45.00	49.00	48.00
Iron	44.00	45.00	43.50	43.50
Copper	2.80	4.10	3.20	3.10

Hitherto, the extraction of copper was the basis of operation at Capleton, and the sulphur was allowed to diffuse itself as disulphide (SO₂) for miles around, injuring vegetation and otherwise damaging property. If the process were reversed, and the ores were worked for their sulphur, the by-product would become a snug little profit as it is in Europe. The Capleton District could supply a very large demand for sulphur for some time to come, and its ores could be worked either in the immediate locality or at some other point more convenient for coal and distribution of the raw material.

It is an immense economy to erect fertilizer works along side the acid chambers, as it saves the cost of concentrating the acid required for superphosphate manufacture. As it is known to practical men, the acid is used at chamber strength of 1.20 sp. gr. As the competition in the manufacture of fertilizers increases, it will become necessary for almost every maker to manufacture his own acid, to secure his full share of profit. Inability to supply one's self with acid of home make has knocked many a British manufacturer out of the market in his own country. The conditions of a trade do not always remain the same; and if American manufacturers have been able to make a decent profit on well made fertilizers, it is because the amount of capital in the business was not so large that competition was ruinous. As capital increases and the consumption of fertilizers becomes more general, competition will be keener, and every source of economy, whether it promises much or little, will be squeezed to yield its best results. A few years ago, a prominent statistician gave the consumption of fertilizers for a few of the Southern States, which ran somewhat as follows:

State.	Acres.	Fertilizers in tons per year.
Georgia	6,000,000	100,000
North Carolina	4,663,000	80,000
Virginia	3,500,000	40,000

If the other States could be added, it would soon be found how large is the consumption of manufactured fertilizers. If the home work be taken at twelve hundred thousand tons, then fully half a million tons of sulphuric acid would be required to treat the raw material producing the manufactured articles and subsidiary purposes. The large deposits met with between New York and Montreal might be used to satisfy the entire wants of this business. Whether any changes are made in the tariff or not, Americans

would not be prevented from drawing supplies of sulphur from Canada. Should any alteration be made in the direction of free importation of sulphuric acid, then new circumstances may arise which may render it desirable to make the acid where the raw materials are found. Those found in Canada are likely to receive an increased share of attention from year to year, both because of their proximity and high value.

Those who have watched the quiet revolution which has taken place in the flour-milling trade during the last five years, must have noticed not merely the rapid reduction of the buhrstones and the substitution of rollers; but the very large increase of capital, which has been attracted to the business. Important as flour-milling is to a country, and the adoption of new methods, so rapid a change was not more needed in the miller's trade than it is in the manufacture of acids. If ever the United States becomes great as a manufacturing nation, it will be largely the result of cheapened sulphuric acid. So manifold are its uses apart from the fertilizing trade, that one can scarcely think of an industry which can be carried on without its aid in some one or other of its operations. Cheap acid is the basis of all chemical industry, and to be in the front rank as a manufacturing nation has long been the wish and aspiration of the country. For several years, railroad activity has not been less than it is now. There is less competition for money for this purpose than there has been for some time. Taken up by manufacturers, there is less likelihood of such a scheme falling through after a flush of excitement. With the steady growth in the fertilizer trade, and the lessened demand for capital out west for the next few years, there will undoubtedly be a larger share of it for employment east. If the home proportion of the manufacture is to increase, acid must be as cheap here as it is in Europe. The quantity of acid a country consumes is often assumed as a test of progress in the manufacturing art, and of its position in the commerce of the world. The consumption is determined by the cost of the article, and this again may be governed by the people themselves. Not consumption only, but the amount which a country can manufacture, may also be rightly regarded as a proof of its civilization.

J. G.

"The amount of apatite shipped from Canada during the last year aggregated but 17,840 tons instead of 23,000 tons as stated. The annual output of the Canadian phosphate mines during the last six years has been as follows:—1878, 3,701 tons; 1879, 11,927 tons; 1880, 7,974 tons; 1881, 15,601 tons; 1882, 17,181 tons; 1883, 17,840 tons, and it is not unreasonable to expect that the output for the present year will reach quite 24,000; probably 25,000 tons."—*Ottawa Mining Review*.



APPENDIX. C.

CANADIAN PHOSPHATES USED IN THE UNITED STATES
AFTER MAKING TWO ATLANTIC VOYAGES.

(Special Despatch to the Toronto Globe of Dec. 4, 1885.)

WASHINGTON, D. C., Nov. 30.—Mr. Thomas W. Hotchkiss, United States Consul at Ottawa, Canada, has forwarded to the State Department an elaborate paper on the apatite or phosphate of lime business of his consular district, which, though new, is likely to become an important industry. Mr. Hotchkiss says there are but two important industries affecting the interests of the United States in the Ottawa district, viz., the manufacture of white pine lumber and the mining of apatite or mineral phosphate of lime. It is only within the last ten years that the valuable deposits of apatite in the apparently barren hills of Quebec began to be developed, and for some time the operations were purely experimental. Since, however, it has been demonstrated that this mineral, mined from the earth like coal, is composed of from 70 to 90 per cent. of phosphate of lime, giving it a value many times greater than coal or iron, the interest of commercial men has been drawn towards it until it bids fair to become a powerful factor in the business of this section. Its development and productiveness are rapidly increasing, and as the profits are larger it is reasonable to expect a still more rapid growth. Crossing the Ottawa river at Ottawa city, the explorer is in the Province of Quebec. The phosphate district is comprised chiefly in the townships of Templeton, Buckingham and East and West Portland, none of these points being more than 75 miles north of Ogdensburg, N.Y. The phosphate deposits are being worked by several American companies, systematically and practically.

The section of country referred to will be found to lie in the valley of the river Lièvre, a tributary of the Ottawa. Other deposits of less extent and value are found in other parts of the Dominion. In the early stages of this mining it was conducted in a rude primitive manner, as well from want of capital as want of necessary experience. In the last few years matters have greatly improved. British and American capitalists have so increased their investments that the business has been placed in a lucrative, healthy and progressive condition. The following table shows the quantity and value of phosphates shipped from Canada during the three years mentioned:

Year.	Tons.	Value.
1882.....	16,585	\$353,019
1883.....	19,445	431,963
1884.....	23,000	519,000

The shipments for 1885 will exceed 25,000 tons. The output from the Lièvre district in 1884 was 20,333 tons, the balance being obtained from the smaller workings along the Rideau Canal in the vicinity of Kingston.

A CURIOUS MINERAL

Mr. Hotchkiss mentions that when Canadian phosphates were first introduced in the market they were looked upon with suspicion, through a want of actual and reliable knowledge of their value as a fertiliser, but to-day this state of things is entirely reversed, every pound of the output being contracted for by foreign buyers in advance of production. As mined the apatite is of every shade of color, from a light grey to nearly black, and is taken from irregular pockets in small deposits as well as in large blocks and masses in apparently inexhaustible volume, superficial, shallow, and sometimes going deep into the bowels of the hills, now mixed with pyroxenic rock, gneiss, mica, etc., which usually accompany the phosphate deposits in this country, and again in huge masses of pure phosphate. The practical mind does not ask or care how these strange deposits came where they are. It is sufficient to know that they exist, are valuable, can be removed and marketed at small cost, and readily sold at a good profit. Being a more concentrated phosphate than is known to exist in any other part of the world, the Canadian article is greatly sought after to bring up the acid phosphate fertiliser to a high percentage of phosphoric acid. Regarding the value of this apatite as a fertiliser a reliable authority states that "Canadian phosphates contain 81.91 per cent. of tribasic phosphate of lime, according to the most scientific analysis. A comparative table of the analytical composition of phosphates, recently published, shows that, with the exception of three limited deposits in the West Indies and one in Spain, the

CANADIAN APATITE RANKS HIGHEST.

Recent foreign reports also show that in those portions of Europe where the sugar beet is extensively cultivated, France, Belgium, and Denmark, no fertilizer has been found to equal the mineral phosphate of Canada. Up to the present time the demand for Canadian apatite has been almost entirely European, mainly to Great Britain and Germany, though France would take the entire output if it could be secured. But 54 tons in 1883, and 221 tons in 1884 went direct to the United States, while Great Britain exported to the United States in 1883 1,262 tons of crude, and 7,766 tons of manufactured phosphates—the latter being undoubtedly Canadian crude chemically treated and considerably re-shipped to America. A member of the Canadian Geological staff states that "much of the mineral mined in Canada, sold and exported to Europe, has been and still is, re-shipped to the United States, either in a raw or manufactured condition." Mr. Torrance, of the same staff, in his last official report says: "As 1,262 tons of crude phosphate and 7,766 tons of superphosphates were imported into the United States from Great Britain, it is highly

probable that a very considerable quantity of our Canadian apatite has been used in enriching American lands, after a voyage across the Atlantic and back to the United States." Mr. Hotchkiss asks whether the cause of this extraordinary and deplorable state of affairs is supineness or ignorance, and expresses the opinion that it suggests the possibilities of fraud and adulteration, that would be to the general consumer almost impossible of detection. "Is there not," he asks, "in this risk alone sufficient to appeal to the intelligence and shrewdness of American dealers in phosphates and other fertilizers? If not let us see what benefactors our German friends are to the agricultural interests of the United States." Here he gives a table showing that while 21,910 tons of phosphates were imported into the United States in 1884, 10,181 tons came from Germany, 8,567 tons from England, and only 221 tons from Canada. The average value of phosphates imported into the United States in 1884 was only \$11.13, while the Canadian article was worth over \$18 per ton.

WHY NOT IMPORT FROM CANADA?

Proceeding, the Consul at Ottawa urges his countrymen to buy their phosphates direct from Canada, and not by the roundabout way of England and Germany. He says: "The foreign buyers of Canadian phosphate pay from \$12 to \$18 per ton for it here, and have paid \$20 for 80 per cent. phosphate. Having shown the average value of phosphate delivered in the United States from England, Germany, etc., to be \$9.78 and \$11.13 respectively for 1883 and 1884, while the Canadian article where produced is worth \$18 per ton, I ask upon what hypothesis or by what method can this character of commercial traffic be explained other than through the medium of gross adulteration. It is a well-known fact that Germany is a liberal buyer of Canadian phosphates. Is it not a reasonable supposition that she, too, in sending up 44,000 tons in 1883 has learned her lesson from the English? Canada could have supplied the one-half of the United States' demand for phosphates in 1883 and the whole demand of 1884. But again, the average cost of Canadian crude phosphate to the foreign buyer in 1883 was \$21.67 per ton, while the average value as entered at the United States Customs imported from foreign countries was \$9.78. It was purchased in the lump, freighted to Europe, there crushed and pulverized, and returned to the United States valued at half its original cost. When we consider that Canadian phosphates yield from 75 to 90 per cent. of pure phosphate of lime, and that its equal in purity cannot be found elsewhere in any appreciable quantities, is it not surprising that its intrinsic value should be so little recognized by those who require it for agricultural purposes? And when, too, by a little effort on our part (I speak as an American) every pound needed can be mined here by American industry, placed direct in the American market in its purity, and at a largely reduced cost, quality considered." After referring to the various apatite mines worked in Ottawa County, Mr. Hotchkiss

kiss points out that the necessity for the use of proper fertilizers is limitless, and must remain so, assuring a demand

NOT SPASMODIC, BUT STEADY,

and constantly growing. The grain exported from Montreal in a single year is estimated to contain 2,574 tons of phosphoric acid, implying the total exhaustion of 75,000 acres of wheat land, and necessitating the application of 6,000 tons of phosphate of lime. "If this be true," remarks the consul, "what could be written of the steady exhaustion of the great agricultural districts of the United States and their present and future necessities, what possibilities through this crude mineral, for the redemption of those hundreds of thousands of acres of once valuable southern lands, corned to death and now going to waste in worthless sage grass, begging for buyers at one dollar per acre and even less? What possibilities also await the enterprising American who shall engage in this business of bringing the wealth now hidden in the mountains to the doors of American agriculturists? The United States Government admits it free of duty, and the Canadian people are inviting us (the Americans) to come and get, neglecting to do which, we are allowing continental Europe to gobble every pound of the production, pay the freight twice across the ocean with all the incidental expenses attached to such procedure, and with no known check upon its adulteration we complacently purchase it at last at a value that necessitates its re-sale to the agricultural community at a price that virtually amounts to prohibition." Mr. Hotchkiss thinks the present condition of the phosphate trade is not creditable to the well-known push, energy, enterprise, and business sagacity of his countrymen, and asks if there are not national as well as commercial issues involved in the matter.

THE PHOSPHATE INDUSTRY.

The business of manufacturing superphosphate from apatite will be commenced shortly by a company at Buckingham, P.Q. Arrangements have been completed for the shipment of the manufactured material to points on the southern shore of Lake Erie, where it is expected that the Carolina phosphate, as a consequence, will soon lose its popularity. The difference in transport of the Carolina fertilizer, is overwhelmingly in favor of the former. It is expected as soon as the products of the Canadian mines secure a foothold among agriculturists of the wheat-growing States, that the demand will be unlimited, thus making the industry in the Buckingham district assume enormous proportions.



