

porters, in reckoning the price paid by the consumers—an aggregate of not less than \$3,250,000. In these seven years the increase in quantity was 123 per cent., and in value 113 per cent. But a more striking evidence of the growing demand is afforded by a comparison of the imports of Portland and Roman cements for 1880-81 and 1892-93. In the former year their value was only \$45,646, and in the latter it was \$316,179, being an increase of nearly 600 per cent. in twelve years. This is a rate that perhaps has not been equalled in any other article of Canadian importation. What is the secret of it, and is the demand likely to be maintained?

The answer to these questions may be summed up in a very significant term of very modern usage on this continent, viz., good roads. The setting in of the era of good roads in this country, as well as in the United States, does not date back ten years, but in that short period much has been learned on the subject, and the street engineer is now as much of a specialist and quite as useful in his way as the military engineer or the mining engineer. The Roman roads of Europe, which have lasted out the traffic of two thousand years, have taught him the invaluable lesson that the only sure way to make a good road is to lay a good and strong foundation. But instead of using stone material, as the Romans did in constructing their great military roads, he has adopted the concrete used by them in the construction of temples and other public buildings, some of whose walls have been standing 2,400 years. The great dome built by Agrippa, the friend of Augustus, "the immortal monument of the Pantheon," as Gibbon described it—now the church of Santa Maria della Rotonda—is an edifice in concrete, and though ravaged by fire and assaulted by the Huns and Goths, it is still intact after more than 1,900 years. Concrete is the street engineer's material for street building, and his chief reliance in the making of it is not Roman or any other kind of natural cement, but the stronger and more durable Portland. In Toronto during the last five years not less than 150,000 barrels of cement have been used in making concrete for street construction, and of this quantity Mr. Rust tells me that not more than 4,000 barrels have been the native hydraulic cement. "Up to the last year or two," he says, "it was all imported Portland cement from Europe." In other towns and cities of the Dominion cement is also being used in steadily increasing quantities in building sewers and streets, and the results are so uniformly good that the material promises to grow steadily in favor. It is almost certain then that for many years yet to come the demand for Portland cement will continue as experience proves the utility and permanency of the concrete roadbed.

But why should we remain dependent on foreign sources of supply for Portland cement? We have in Ontario abundance of raw material for producing it. In scores of localities beds of white shell marl of large extent and excellent quality are found, some of them at the bottom of lakes in which myriads of fresh water shells yet survive, to add to the thickness of the deposit as one generation follows another, others of them on the sites of lakes long ago filled up with peaty mould or drained by continual elevations. This marl, if unmixed with sand, clay, peat, or other matter of mineral or vegetable origin, is almost pure carbonate of lime, and furnishes the principal material for the manufacture of Portland cement. The necessary proportion of clay is a matter of experiment, but in all cases the purer and more uniform the quality of the marl, the easier it is to get a right mixture. Our manufacturers in Ontario have acquired their experience slowly and dearly.

Mr. Rathbun told me that it cost him five years of testing, with the aid of a chemist, before he was convinced that it would be safe to start his works. Mr. Butchart also told me that it cost his company several thousands of dollars, a visit to some of the best Portland cement works in England—where he was admitted as a special favor—and the service of two experts in the construction of a suitable plant, before they could produce a commercial article. But the Rathbun Company and the Owen Sound Company have succeeded, and during the last two years they have been producing a Portland cement which satisfies every requirement.

Mr. C. H. Rust, Deputy City Engineer of Toronto, makes this statement concerning it, in a letter which I have just received from him:

"Since 1892 we have used a quantity of Portland cement made by the Rathbun Co. at Napanee mills, and by the Owen Sound Co. at Shallow Lake. Both these brands are quite equal to the majority of the imported cements, and no doubt, when their facilities for manufacturing are increased nearly all the cement used in this city will be of home manufacture."

The Owen Sound Co. has recently had the misfortune to lose its mill by fire, but it is understood that a new one is in course of erection. The company has a large supply of raw material alongside of the works, suitable clay for mixing being found immediately below the marl, and doubtless the capacity of the new mill will be made to meet the growing requirements of the trade.

The only other Portland cement works in the Province are at Marlbank in the County of Hastings. The site was chosen because of its nearness to a very large deposit of marl; but although English capital was put into the business, and presumably English experience also, the enterprise had to pass through the usual ordeal of disappointment and delay before a successful beginning was made.

The output of those three mills last year was 31,924 barrels, but one of them did not start until late in the season, and another worked only half the year. Had their capacity been six times as great they could hardly have supplied the quantity of Portland cement imported by Canada during the fiscal year 1892-3, and obviously therefore there is ample room for home manufacture to grow. With raw material so abundant and accessible, and with capital seeking new channels of investment, and labor seeking employment, why should we not produce in the country all the Portland cement that our market requires. An article of uniform quality will always be in request by customers, and with care on the part of the manufacturer there is no reason why he should not be successful in supplying a distinct brand. But as long as we are dependent on foreign makers we cannot hope to be supplied with cement of uniform quality, for where large orders have to be filled it is the common practice even of large mill owners to buy lots from other manufacturers and so make a prompt shipment. The result is that there are as many brands as makers, and with cements of different qualities, some quick setting and some slow setting, it is hardly possible to make a first-rate concrete. This is a risk which may easily be avoided if orders are placed at home, with the home manufacturer, and the good results obtained from our Ontario cements are no doubt due to the fact that orders are honestly made up, each manufacturer being jealous of his own reputation.

As regards the products of clay, it is not necessary that much should be said. Taking the various articles of common and pressed bricks, terra cotta, tile, sewer pipe, and pottery, the number of men employed in their manufacture in Ontario last year was 3,109, with earnings of \$601,686. The aggregate value of their products was \$1,684,873, or more than one-fourth of all the mineral products of the Province in the same year. This fact alone suffices to prove the importance of our clay industries; yet it is obvious that they are capable of greater development. The manufacture of pressed brick and terra cotta began here only five years ago, and last year, in spite of the collapse in the building trade, the value of the output of six works was \$217,373. It gave employment to 224 workmen and paid them wages to the amount of \$80,686. The improvement already noticeable in the architecture of our cities as a consequence of the use of pressed brick and terra cotta is bringing this material fast into favor, and it may be said that the earth affords no better building material than a properly burnt brick, and none which so readily lends itself to the production of handsome architect-

tural effects. In the strong and fine-textured shales of our Hudson river and Medina formations, conveniently situated and easily quarried, Ontario is favored above most Provinces and States in America.

The same shales are also found to be suitable for the manufacture of sewer pipe, with proper mixtures, and last year the output of two establishments employed in this industry was \$230,000.

Another clay industry is now on the eve of commencement, and if successfully established it promises to be a great boon to our towns and cities, viz.: the manufacture of vitrified brick for street paving. In Ohio, Illinois, Iowa and other American States this has now grown to be a very important industry, and it is supplying a material for street construction which on all points of merit is not equalled by any other material hitherto employed for the purpose. Many mistakes were committed by the first makers of paving brick, and there is much yet to be learned as to the clays or clay mixtures which give the best results, as well as to the proper degree and duration of heat to produce a hard, tough and impervious brick. But much is already known, and with careful experiments and close observation many works are enabled to produce with regularity a high percentage of paving brick of uniform quality from every charge of a kiln. A number of experiments have recently been made in Toronto, Hamilton and elsewhere in this Province, and although each expert will assure you that he alone knows the secret, and that no one else has the clays for a right mixture but himself, you may rest assured that in a matter of this sort the key and the ward are not so hard to match as the tribe of experts would have you believe. In several instances encouraging progress has been made, especially with the Medina and Hudson River shales.

We may, therefore, I think, look with confidence to an early beginning of the production of paving brick in Ontario; and when that time comes we shall be no longer at the mercy of trust concerns like the owners of Pitch Lake asphalt, as illustrated the other day in the case of a contract for paving in the city of Hamilton. When we are producing Portland cement from our own shell marls and clays to the full extent in which it is required for street concrete, and paving brick from our own shales to cover the concrete, we shall be as independent as we ought to be in supplying ourselves with the materials of such everyday requirements as are called for in the building of good roads. In so doing also, we shall be utilizing our raw materials of clay and lime, otherwise of no value, finding profitable investment for capital lying idle in the banks, and giving employment to hundreds, if not thousands, of men who for lack of work to do are finding it hard to win their daily bread.

With one suggestion to the professors and instructors in the School of Practical Science, Toronto, and the School of Mining, Kingston, I close. Reference has been made to the experiments conducted by the manufacturers of brick and cement, preliminary to the building of works to commence production on a commercial scale. These experiments demand patience, exactness and scientific method, as well as the use of costly appliances. Why should they not be taken up in our technical schools, where there are professors having the necessary expert knowledge and training, and the appliances for making tests and ascertaining results with unerring accuracy? The importance of the clay industry has been so well recognized by the State Legislature of Ohio, that a course of practical and scientific instruction in the art of clay-making and ceramics has been added to the educational work of the State University, and the first term of the department opened yesterday. Work of that character is as much needed in Ontario as in Ohio, and the professors of our scientific schools cannot too soon prepare to enter upon it.

DISCUSSION.

Mr. R. W. PRITTIE said he had been for a number of years interested in the brick industry, particularly in the manufacture of paving brick. This article was coming largely into use in the States, and he had seen pavements which had been down for 16, 18 and 20 years, with but little repairs. It was giving the utmost satisfaction, and made a superior pavement in every respect, being smooth, lasting, easily cleaned, and affording a good foothold for horses. He was interested in a large vitrified brick factory which had been started at the Humber, near Toronto, last year, and was got partially under way when the financial crash on the other side affected the enterprise and brought it temporarily to a stop. He hoped, however, that the operations would yet be begun. It was the company's intention to put up a plant capable of turning out 50 millions of brick per annum, and employing 400 men.

Dr. A. P. COLEMAN, in reference to a remark in Mr. Blue's paper, thought it only fair to say on behalf of the School of Practical Science, that they had begun the work of testing cement, brick and similar materials. If provided with proper appliances, the authorities of the School were perfectly willing to engage even more extensively in such work.

Mr. J. LATIMER asked if there had been any development in fire clay.

Mr. BLUE—Not in Ontario.

Mr. BELL—There are good deposits of fire clay in Nova Scotia, but they are not made use of.

Mr. J. M. CLARKE said it was well known that the manufacture of articles like vitrified brick in Ontario had engaged the attention of outsiders more than of the people of the province. Outsiders were now investigating the subject with the view of beginning the manufacture of paving brick here.

The Rainy River Gold District.

Dr. A. P. COLEMAN—Mr. Chairman, I have been unable to write out a paper as I promised to do, owing to the fact that I returned home from the trip I took this summer only yesterday at noon. In fact, I have hardly had time to throw my ideas into consecutive shape, and I must therefore ask your indulgence while I give you some rambling talk on the subject of the western gold fields of Ontario. As Mr. Blue has suggested, such humdrum things as clay and marl have no great attraction for ordinary men, and a brick of gold is looked on with a good deal more interest than even a brick made of the Don valley clay. Partly on this account, and partly because the resources of the province are of great interest to all of us, it will be worth while for me to give you a little account of the work done this summer, and of the region in which perhaps in the future some important mines will be developed.

The little expedition that was sent out by the Bureau of Mines, consisting of my friend, Dr. Burwash—who was in many ways well fitted for such work, having been assayer and mineralogist for the province of New Brunswick—myself, and three men, set out about the middle of June. We had to make a tremendous round to get at the scene of our work. Rat Portage, Lake of the Woods, Rainy River—by this circuitous route we were obliged to reach our destination on Rainy Lake. Our object was to examine specially the gold fields of the region, and also incidentally to note anything that appeared to indicate other mineral resources of importance.

The only map of the district we were able to examine is one made by Lawson and published by the Dominion Geological Survey in connection with his report on the Rainy Lake region. It is an admirable map, and I found it in constant use by prospectors, steamboat captains and all others. Even the Americans who came there had to depend upon the Canadian map, which shows part of the American territory as