and square timber have been carefully considered and supplied. Tenders will shortly be invited for the construction of the lock, etc., by the department of Public Works, and work will be begun thereon as soon as the ice leaves the river, and the spring freshets will have subsided. This will certainly, when completed, prove a great boon to the du Lievre district, and of invaluable importance to phosphate miners, as it will enable them to ship their ore during the summer months at a very much reduced cost from formerly.

Sale of a Phosphate Mine.

The most recent sale that has been reported took place during the month, when Mr. W. A. Allan, of Ottawa, purchased the phosphate lot number seven, in the first range of the township of Portland East, adjoining the "Rapids Mine," formerly known as the "Watt Mine." This recently acquired mine will be a valuable addition to the many phosphate properties owned by Mr. Allan, and in purchasing it he has displayed his usual good judgment and foresight. The openings on the lot expose extensive deposits of mineral of high grade, and the convenient location of the property is an important advantage. Being situated within a quarter of a mile of the Rivère du Lièvre, at the Little Rapids, the ore can be transported at small cost both winter and summer, an advantage possessed by but few other mines in the Ottawa district.

THE OCCURRENCE OF PHOSPHATE DEPOSITS.

Abstract of a Lecture delivered before the Ottawa Field-Naturalists' Club on the 28th February last, by Geo. W. Dawson, Esq., D.S., F.G.S. Assoc. R.S.M., etc.

Specially reported for the MINING REVIEW.

This gentleman, one of the best known and most efficient officers of the Geological and Natural History Survey of Canada, made a valuable addition to the literature of the subject of phosphate in his lecture.

He was introduced by the President of the Club, Dr. Small, and began by showing that phosphatic materials were essential to the life of both plants and animals, and that the natural cycle of rotation of these substances was interrupted by man, who withdrew from the soil, and transported to other places, large quantities of matter which would, if undisturbed, return to it. The removal of crops impoverishes the soil and prevents it from yielding as abundantly as when first cultivated unless the loss is compensated by supplying phosphatic fertilizers. The grain exported from Montreal in a single year has been estimated to contain 2,574 tons of phosphoric acid—a quantity implying the total exhaustion, in so far as phosphates are concerned, of 75,000 acres, to renew which would require the application of some 6,000 tons of apatite manufactured into super-phosphate. Under these conditions there must always be an extensive demand for phosphatic materials, and it becomes necessary to enquire where specially concentrated natural sources of supply may be found.

The occurrence of such deposits was then traced from the most recent in geological time to the oldest formation known—the Laurentian. First comes the accumulation of guano now going on wherever the climate is sufficiently dry to prevent the washing away of the bird excretions, notably on the Pacific coast of South America where rain never falls, and where not only the phosphatic, but also the nitrogenous constituents of the excrements are preserved. Next we find extensive beds of mussel shells in the estuaries of the Prince Edward Island rivers, where the deposits are known as mussel mud, and are extensively excavated by the farmers and spread without preparation over their lands. If this mud became part of a stratified deposit in the course of geological changes phosphatic nodules would be found amongst it, resulting from concretionary action, a slow process of drawing together of like particles in the mass, which is not in all cases fully understood. When the material is abundant, such concretions frequently form almost continuous layers.

In North Carolina are beds of shells, bones, and other organic remains, referable to the Tertiary period, in which this concretionary action has occurred. In some places these beds have been lifted above the level at which they were deposited, and are worked by a system of trenching and washing; in others they are yet below water, and are obtained by dredging.

Still going back in geological time, we find the coprolite beds of the South of England, in the cretaceous rocks, with new associations of animal remains. These are extensively worked, and furnish 25,000 tons of phosphate annually.

In the yet older rocks of Canada, nodules occur in the strata of the Silurian period in the Quebec group of rocks, and nodular masses are found in the primordial shales, and although these are not of economic importance in Canada, beds of similar age are worked in other countries, as Poland and Wales. These instances go to show that in whatever age large quantities of organic materials were accumulated phosphatic deposits were made from them. Following this analogy into the Laurentian series, we find vast beds of sediment deposited as in more modern formations, but these have since been so completely metamorphosed that they have entered into new chemical combinations among themselves, and become entirely crystalline—limestones crystalizing into marbles, coally materials into graphite, and phosphatic, coprolitic, or nodular layers into calcic phosphate or apatite.

Some of the Laurentian beds are found to be comparatively rich in apatite, and particularly those containing the pyroxenic rocks, in which it seems generally distributed, while certain layers, almost like beds, of nearly pure apatite occur. In other places, distinct veins and fissures are filled by processes of segregation, and frequently in connection with crystals of other substances.

The exportation from these Canadian deposits, although not fully developed, has attained considerable proportions. Dr. Sterry Hunt states that 17,840 tons were shipped from Montreal in 1883, of which the greater part went to British ports. 15,000 tons of this were mined in Quebec, the remainder in Ontario. The shipments for this year Dr. Hunt estimates will reach 24,000 tons.

The most striking fact developed in the mining of our apatite is the great irregularity of the deposits, which is easily accounted for by the extremely disturbed character of the Laurentian rocks, deposits once horizontal being folded and twisted in all directions, producing large pockets and masses of apatite, connected only by narrow and twisted seams, or entirely isolated.

Can, then, a geological survey aid in tracing these deposits? It has already been found that large tracts or zones (principally shown by Mr. Vennor) contain most of the large deposits, while intervening bands are comparatively barren, and much can yet be done in defining and mapping them down, while the further work of utilizing special deposits thus defined must always remain the work of enterprising and skilled private parties desiring to utilize them.

In the discussion which followed the lecture, Mr. Fraser Torrance, being called upon by Dr. Dawson in consequence of his long experience as a mining engineer in the neighbourhood of Ottawa, gave a very interesting description of the Ottawa Valley workings, endorsing the lecturer's statements respecting the irregularity of the deposits. He described the most productive belt as following the banks of the des Lièvres, and stated that the apatite occurred in large irregular masses, generally in connection with pyroxenic rocks, that no true veins or beds could be said to exist, the apatite in pseudo-veins gradually changing from masses to crystals scattered amongst pyroxene, while apparently well-defined beds and veins joined together to form one irregular pocket, the one passing into the other without any regular transition. No systematic attempt by sinking shafts, driving adits, or diamond-drill boring had yet been made with a view of testing the presence or extent of lower deposits, and the manner of conducting the present surface workings was calculated to throw serious difficulties in the way of any future mining of lower deposits, literally threatening to fulfil the famous prophecy of Louis XV, "Après moi le déluge."

Mr. Torrance stated, on the authority of Mr. Nimmo, Chief of the Bureau of Statistics, that during the past year the United States had imported from Canada 251 tons of apatite, from Great Britain 1,264 tons (much of which probably came originally from Canada), from Germany 11,000 tons, and 7,766 tons of super-phosphate. The speaker had some years ago examined super-phosphate manufactured in Canada, and considered that the failure of the industry was due to the lack of technical skill evinced, no thorough chemical analysis of the ingredients being made, and the products consequently varying so greatly in quality as to destroy all confidence in them. Tests with super-phosphate at the Agricultural College, Guelph, showed, he understood, great pecuniary advantage from the use of a good article.

Mr. H. B. Small stated that experiments were being made in the direction of applying, as a fertilizer, apatite and nodular phosphate, ground to an impalpable powder, without chemical preparation, and, he understood, with favourable and lasting results.

Dr. Dawson thought the experiment would not succeed, as the apatite was insoluble under ordinary conditions in soil, and that at best the method would be wasteful.

Mr. F. D. Adams, of the Survey, stated that he had detected, attached to a specimen of apatite received from Arnprior, a species of hornblendic rock, which was so intimately associated with the apatite deposits of the Laurentian rocks of Norway and Finland as to be known as the "apatite-bringer," and which had never previously been found on this continent.