

Asbestos: Its History, Mode of Occurrence, and Uses.*

By R. W. Ellis, LL.D., F.G.S.A.

To the casual observer it must almost seem like a practical application of the old saying about "Carrying coal to Newcastle," to attempt to give a lecture on asbestos, before the members of a society so thoroughly conversant with the features of this great industry as the members of the "Asbestos Club" are supposed to be. As, however, you have kindly invited me to deliver the opening lecture of the course which your association proposed to carry out, I will endeavor to place before you some facts pertaining to this mineral which may prove of interest, especially at the present time, when asbestos is assuming so prominent a place in the commercial and industrial world, more particularly as regards its origin, its distribution, composition and utility. But before doing so you must permit me to say a word or two in commendation of the enterprise which has led to the establishing of so important, and, it is to be hoped, influential a society as that which I have the honor to address on this occasion; an organization, which, I feel assured, if rightly conducted, will be a power for good in the land. So many new features are rapidly coming to the front in connection with the mining industries; so many improvements are constantly being made in methods of mining and in mining machinery by which hand labor is being rapidly superseded; so many changes in the mining laws and regulations of the several provinces are being carried out or contemplated, and so great are the changes in the mineral market, especially in the case of minerals so sparingly disseminated as asbestos, that a thoroughly organized body of men, intimately interested in all that pertains to the output, the economical handling, the shipment and ultimate disposal of this substance, is almost an absolute necessity. To a certain extent some of these points are doubtless intended to be met by the establishment of the newly organized General Mining Association of the Province of Quebec; but while that society should, from the influential position of many of its members, be able to do much good by calling attention to and correcting legislation which might be harmful to the mining interests of the province at large, and by the reading and publication of papers bearing upon special subjects connected therewith, there is, in a society such as you have so wisely inaugurated, in the very heart, probably, of the most important mining industry of this Province, much work equally as important to be done. Work of this kind, such as you should, I hold, look carefully after and take into your consideration, embraces not only the condition of the mines themselves, but the sanitary condition of your mining centres—often quite as important a branch of mining economy as the extraction of a certain number of tons of ore. Who, for instance, ten years ago, passing through this section of the country, one of the roughest, physically speaking, in the province, and, except from the mineral standpoint, of comparatively little value, would have thought that, in a very few years, such extensive mining villages would have sprung into existence. And yet you are only on the threshold of the industry. If the growth of your mining towns has been so rapid in ten years in the infancy of your development, what will it be in the next ten years, as your output increases, and when that output should have reached a five or ten-fold amount. Here then is where a club like this can make its power felt for good—viz.: in the establishment of strict sanitary regulations, in making due provision for the drainage, and for the moral welfare of the people under your influence and control; for if such provision is not made in time—and the sooner the better and easier—with the rapid growth of your town and the lack of a good water supply and proper facilities for the carrying off of the waste material for your population, you may certainly calculate upon the usual wretched experience of places which lack such sanitary appliances. Then there is the necessary protection against fire; in the construction of a complete fire system, the building of reservoirs for supply in case of sudden outburst, the obtaining of the necessary apparatus, and the placing of such fire fighting appliances under proper management. What do you suppose would be the fate of the Village of Thetford should a fire break out at one end of the place, with a strong wind blowing through the street, in the dry time of summer? How much of the town would escape destruction, and how many thousands of dollars' worth of valuable machinery would be destroyed? These questions may not seem, in the present state of this industry, of great moment to us, but they are, I hold, of the utmost importance, and this club of mining men is the one institution which can, by judiciously consulting on these subjects, and by working together harmoniously and systematically, do everything to avert possible disaster in the directions specified.

Then there is the social and mental improvement aspect of such a club, one of very great value in a place like this, where men of intelligence are thrown generally into surroundings not the most congenial, and when, unless some such society exists, which provides for an interchange of thought and comradeship, the tendency is to retrograde. And this isolation is one of the strong objections to life in a mining camp. In the present case, however, fortunately there is no necessity for such a state of things. In this district are a number of men well educated and informed, not only in the matters more directly pertaining to the work in hand, but in the wider sense men who in the exercise

of their profession of mining engineers and mine managers are familiar with many foreign countries and have a large store of the most valuable and important facts, connected not only with the profession of mining, but of great general interest as well. In such a club as this there should never be a lack of subjects for discussion, nor a meeting which should not be full of interest, for there is, as a rule, no body of men, professional or otherwise, in which one will find, or ought to find, at least, so great a spirit of good fellowship or camaraderie, and so spontaneous a feeling of give and take, as among our brethren of the mining profession. As for their hospitality, that of the true mining man is too well known to require further mention, as personally many of us can testify not only for the mining centres of Black Lake and Thetford, but in many other portions of the Dominion.

The Eastern Townships of Quebec have for nearly half a century been known for their mineral wealth in some form; but the country west of the St. Lawrence must be given the credit of having had in active operation the first great industrial works in this Dominion. I refer to the long established iron smelting forges of the Three Rivers district. Presumably the gold of the Chaudière River next came into notice, and was mined quite extensively forty years ago by the DeLery and other companies on the tributaries of that stream, while the copper mines which in connection with the asbestos form the principal sources of mineral wealth at the present day for this portion of the province, were first brought into notice about the same date, though the era of development did not take place till near the year 1860.

The principal sources of Quebec's mineral wealth, east of the St. Lawrence River, are in the slates and schists of the Cambrian, and pre-Cambrian systems, which extend across the province in a north-easterly direction, following approximately, and at a considerable distance inland, the course of that river. In connection with the slates and schists, an important area of eruptive rocks, diorites, granites and serpentines, the latter not an eruptive rock in itself personally, but an alteration from some of the varieties of eruptive rock. To the schists of the pre-Cambrian or oldest series belong, for the most part, the workable deposits of copper at the present day, though copper mines have been opened in many places in Eastern Quebec in the slate beds or dioritic masses of the Cambrian as well. These, however, with rare exceptions, notably the Acton and Huntingdon Mines, have not been productive of copper in paying quantity, but have served excellently for the expenditure of capital.

The slates and associated quartz veins of the Cambrian are apparently the source or storehouse of the gold in Eastern Quebec, and it is in the slates of this formation, on the Chaudière and the Dittion, that our richest deposits of the precious metal are known to occur, destined some day, I believe, when the conditions admit of their development, to astonish the Canadian people with their value.

In the rocks of the same system, the Cambrian, on the slate quarries of Melbourne, Cleveland and Shipton, and in the same formation also, are found most of the outcrops of serpentine which are here known so widely as the containing rock of that peculiar mineral asbestos, a mineral of comparatively recent introduction regarded from the commercial standpoint, but which in the last ten or twelve years has come into such marked prominence in certain branches of manufacture.

The asbestos mines of the province of Quebec are, at the present day, of special interest to the mining and industrial world, from the fact that in so far as now known they practically represent the only deposits where this mineral, of a quality adapted for spinning and for the finer purposes of manufacture, can be profitably obtained. So great are the advantages which these mines possess, particularly as regards their accessibility and the ease with which the asbestos is extracted, that unless fields as yet unknown and as easy of access can be discovered, this province will doubtless long enjoy the position of being the principal source of supply for this peculiar and important substance.

The rocks with which the asbestos veins are associated in Quebec constitute a somewhat distinct series, which have, for the last thirty years, been known under the name of the "Quebec group." They comprise an extensive and important development of both sedimentary and eruptive rocks, which extend throughout the eastern part of the province, from the Vermont boundary to the extremity of Gaspé peninsula. They are not recognized in their entirety in any other part of Canada, though certain portions of the group are found in their extension southward into the United States. Crossing the Gulf of St. Lawrence they, however, form a very extensive belt in the island of Newfoundland, where, more particularly at certain points on the west coast, the same series of slates, sandstones, diorites and serpentines occur, the whole presenting features both from geological and mineralogical standpoints, very similar to what are seen in this portion of Canada. While these rocks in Newfoundland have, to a certain extent, been traced out, in so far at least as the entirely unsettled and unopened character of that section of the country permitted, no systematic search for asbestos has as yet been made, though that the mineral occurs there at a number of points and in a variety of forms is clearly indicated by the specimens which have from time to time been obtained in the course of the general geological exploration of the Island. Some of these specimens belong to the group of actinolitic minerals like the deposits found in Pottou and Bolton, but among others observed from that country were samples of vein asbestos, equalling in quality any obtained at Thetford, and having a fibre from two to three inches in length. Little attention has, however, been paid to these deposits

by the people of the island, and their extent is entirely, as yet, unknown. It cannot, however, be expected that this seeming indifference will long continue, in view of the rapidly increasing demand and consequent advance in prices. And it is probable that the time is not far distant when Quebec's greatest rival as a source of supply for asbestos will here be found.

While the mode of occurrence of asbestos, and, to a limited extent, its uses as well, have been known to a few, probably for the past twenty centuries, the discovery of its true economic value and of its great commercial importance are matters of quite recent date. Under the general term "asbestos," we find included several varieties of minerals, or of rock matter, some of which present startling and somewhat anomalous features. For instance, rocks as a rule, or the ingredients of mineral veins are generally regarded as possessing a weight or density several times greater than water, yet in one form, at least, of this mineral, we have a substance so light that it will float readily upon water, and has in consequence received the name of *mountain cork*. To most people, also, in speaking of rocks, minerals, or ores generally, the impression is conveyed that these are dense, heavy bodies, which can be crushed to powder with the proper application of sufficient force, yet here we have a mineral which can be pulled apart with comparative ease, teased out into fibre, and which thereupon presents the characteristic appearance of fine floss silk or cotton, so much so that in certain places this material is familiarly known by the name of cotton rock—or as the French call it, *pietre du coton*.

We have therefore here a substance which in some respects presents features belonging to both the mineral and vegetable kingdoms.

While, however, asbestos in all its forms must be styled a true mineral it possesses certain properties which distinguish it very clearly from many others. Among these presumably the most important is that of non-conductivity or its power of resisting the action of heat, in which respect it possesses some of the properties of wood, which also is in one sense a slow conductor, though in much greater perfection; since wood under the action of sufficient friction rapidly becomes charred and even ignited, whereas friction apparently exercises very little influence upon asbestos, no matter how long it may be applied. This property of non-conductivity, or of resistance to fire or heat, is one of the principal reasons for its extensive application in certain lines at the present day.

The term *asbestos* is derived from the Greek and signifies literally *inextinguishable*, while the other term frequently applied to the same mineral, viz., *amianthus*, is also of Greek origin and signifies *undefiled*, from the property possessed by the mineral of being purified by the application of flame without injury to the substance itself. This was a property well recognized by the ancients since we read in several of the earliest authors that the custom prevailed of wrapping the dead bodies of their important personages in an incombustible cloth by which the ashes resulting from their cremation were retained intact. The process of weaving this cloth from the fibres of amianthus shows that considerable scientific skill in the textile arts had been acquired by those people, judging from the difficulty which has been experienced even in modern applications of the art, and it is supposed that the requisite degree of tenacity was imparted by the admixture of threads of flax or silk, which could afterwards, if necessary, be removed by burning. The wicks of the lamps in the early heathen temples, which were supposed never to be extinguished, were also held to have been made of this material.

The resistant action of the asbestos fibre, or of the cloth woven from this fibre, to heat, is one of its most wonderful properties. Temperatures of 2000° to 3000° are easily withstood, while with some varieties a temperature of 5000° Fahr. has apparently produced no visible effect. Its property also of successfully resisting the action of acids is one of great value, and these properties render this substance of great importance in certain chemical operations, so much so that its use in this direction is rapidly increasing.

In addition to the cloth used by the ancients in the process of cremation, napkins were also woven and specimens of these are preserved in the museums of several of the cities in Italy. The old story of the table cloth of Charlemagne is doubtless familiar to many of you, in which it is stated that he used to draw this cloth from the table, all soiled with the debris of his feasts, and in the presence of his guests, throw it upon the blazing fire, from which it was soon taken, cleansed from all impurity. This peculiarity, however, probably applies to a cloth made from the true asbestos and not from the chrysotile, the difference in which will be pointed out as we proceed, but which varies from the other somewhat in composition. To the former variety, also, probably belongs the garment described in the story so quaintly given in the book by Montpetit, concerning the French *habitant*, in which he relates that at a certain lumber camp in one of our great northern forests, one of the men, newly engaged, upon his return from his day's work in the soft melting snow, when the rest of the crew were gathered about the stove, coolly proceeded to remove his boots, and then his socks which he dashed into the open fire. He, however, speedily extricated his foot gear, now cleansed to immaculate whiteness, and proceeded to dress his feet as if nothing unusual had occurred, a proceeding which, it is needless to say, among a group of people unaccustomed to witness such marvels, resulted in something stronger even than amazement, and with a sudden accession of terror at the presence of a man who could thus perform such miracles with apparently flaming garments, they in-

* Delivered before the "Asbestos Club," Black Lake, P.Q., Feb., 1911, 1891.