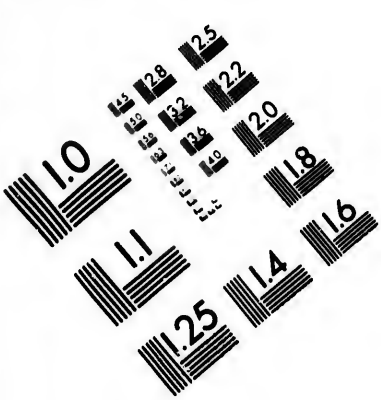

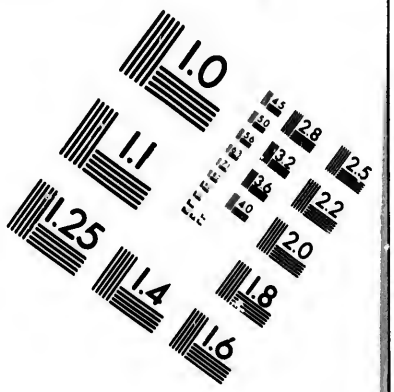

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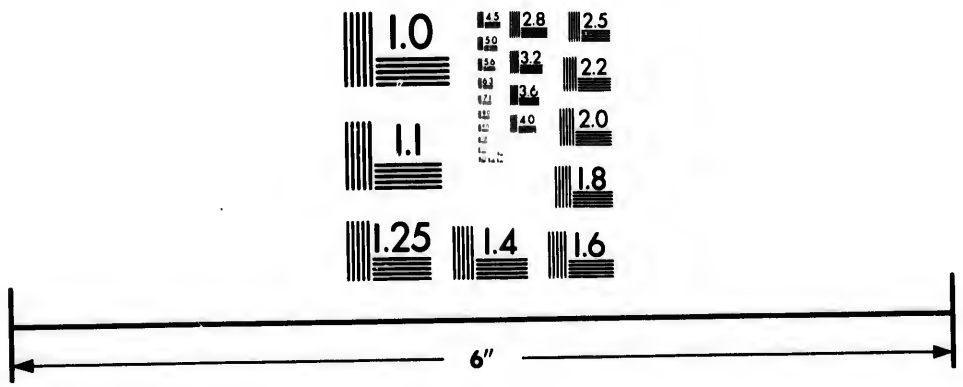

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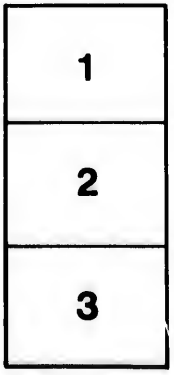

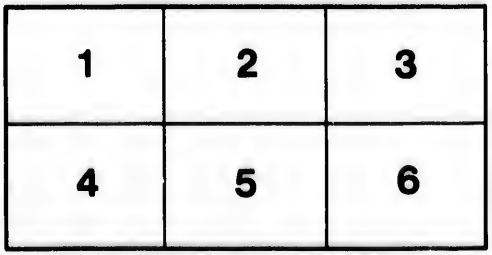

Mrs Ross –
– With the Author's
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Jan. 3. 89

GEOLOGICAL REPORT

ON

ASBESTOS,

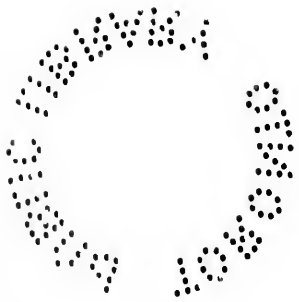
AND ITS INDICATIONS, IN

THE PROVINCE OF QUEBEC,

CANADA.

LONDON:
E. FORSTER GROOM, 15, CHARING CROSS, S.W.

1889.



GEOLOGICAL REPORT

ON

ASBESTOS,

AND

ITS INDICATIONS IN THE PROVINCE OF QUEBEC, CANADA.

HAVING been called upon to make a close and careful examination of the geological formations in the eastern townships of Garthby, Wolf'stown, and Coleraine, situated in the province of Quebec, Canada, I gave special attention to the distribution of the Asbestos-bearing rocks (serpentine), which have been, in my opinion, heretofore only partially traced. Perhaps this was owing to the difficulties which had to be encountered from the thick undergrowth which in many places rendered it almost impossible to penetrate sufficiently in order to make

a *true* report as regards the "existence," "location," and "association" of these rocks.

Admirable reports have been written by R. E. Ellis, LL.D., Dr. Hunt, and others, on the origin and distribution of the serpentines, and have been fully discussed and ventilated. Still, though various opinions have been expressed upon the subject, they appear to differ in many respects. I mention these facts as possibly one inexperienced or unacquainted with the country might consider it strange that a thorough examination of the Asbestos properties had not been followed. Yet the causes I have mentioned above, as well as the difficulties I had to contend with during the months of heavy snowfall, lead me to believe that my *confrères* (geologists) were disinclined to follow up a correct and actual prospectus of these valuable serpentinous localities.

Before locating, or going into details of these classes of rock as a mineral repository, I intend to treat on the subject as regards their mode of existence and origin.

Serpentine is diffused under the head of "metamorphic rocks," while, in the widest sense, according to Studor and others, mineral metamorphism means every change of aggregation, structure, or chemical condition, which rocks have undergone subsequently to their deposition and stratification, or the effects which have been produced by forces other than gravity and cohesion.

There fall under this definition the discolouration of the surface of, for instance, black limestone, by the loss of its carbon, the formation of brownish red crusts in rocks of limestone, sandstone, many slatestones, shales, granite, &c., by the decomposition of compounds of iron, finely disseminated in the mass of the rock, the change in rocks consequent in the absorption of water, and the crumbling of many granites and porphyries into gravel, occasioned by the decomposition of the mica and felspar.

In its more limited sense the term "metamorphic" is confined to those changes of rock which are produced directly or indirectly by

agencies seated in the interior of the earth. In many cases the mode of change may be explained by our physical or chemical theories, and may be viewed as the effects of temperature or of electro-chemical actions adjoining rocks or connecting communications with the interior of the earth, also distinctly point out the seat from which this change proceeds. In many other cases the metamorphic process itself remains a mystery, and from the nature of the products alone do we conclude that such a metamorphic action has taken place.

Serpentine is generally believed to have been originally deposited as a sediment, and to have acquired its present compact crystalline character through the subsequent action of various chemical, or mechanical, agencies. It is known to be a *hydrated silicate of magnesia* with about equal parts of silica and magnesia, and contains 12 per cent. of water with varying proportions of iron, chromium manganese, alumina and lime, has a specific gravity of 2·7, and weighs about 169 lbs. to the cubic foot. It is found both in a

soft and very compact state, of a waxy lustre, with many different shades of beautiful green which give it a mottled appearance like a serpent, hence the origin of its name "serpentine," or ophite. It is called "ranocchia" by the Italians, from the appearance it bears to the "frog," and, on account of its susceptibility to a high polish, is greatly valued as a marble for interior ornamental purposes, more than exterior, as it weathers rapidly. In Galway, Ireland, it is found in large quantities, and called "serpentinous marble," or "ophi-calcite." It is also to be found in other parts of the world, as in the Pyrenees, Alps of Dauphing, Mount St. Gothard, Italy, Sweden, Ural Mountains, Silesia, New South Wales, Savoy, Corsica, Cornwall, Scotland, and other places too numerous to mention; but in Canada the finest and most crystalline serpentine is to be found forming great belts of over 100 miles long and several thousand feet in breadth. There it associates with the dioretic, or volcanic, rocks, and is, according to Dr. Ells, without any doubt, "An

alteration product of a dioretic rock rich in olivine." It is sometimes very difficult to distinguish the mineral constituents in many of the metamorphic rocks, but diorite is always considered to be composed chiefly of felspar and hornblende, which composition enters largely into the serpentines. Actinolite, tremolite, &c., and many other minerals, are sometimes found associating with it.

There are many valuable properties attributed to serpentine, and I am of opinion that the time is not far distant when it will be commercially considered an invaluable substance, and this on account of its refractory properties. I may also mention that it can be extensively used in the manufacture of crucibles, &c. Its soft and unctuous qualities (especially where it is found associated with "steatite," or "soapstone," which is often to be seen in large quantities) renders it easy to be worked, and, if reduced to a powder, could be moulded in bricks which the most intense heat will not affect. One of the chief properties it contains, and one

which the serpentine of Lower Canada is so famous for, is the Asbestos, crysotile, or fibrous serpentine. This valuable and important mineral product is found in paying quantities only at certain points in the extensive serpentine reefs, and was first mined as an article of commerce in Canada in 1878, and has now become a regular and rapidly-developing industry.

On account of its incombustible and indestructible qualities, is extensively used in steam, hydraulic, and electrical machinery. It has been adopted by the Admiralty for engine packing, in Her Majesty's war-ships. It is spun into six-fold yarn, with a tensile strength of 40 lbs. and upwards, is manufactured into cloth, as clothing for firemen, and covering hose-pipes, in fire brigades, and also engine purposes, as well as drop-curtains, and general stage scenery, and is employed by the principal railway and steamship companies, collieries, ironworks and all classes of factories, and, in the manufacture of the new Asbestos grates and stoves, is finding for itself a large market. Messrs. Bell & Com-

pany of London, who are the largest Asbestos users in the world, have adopted it in the manufacture of over 50 special purposes in connection with steam engines and general machinery, and, as a lubricant, Asbestoline ranks in the first degree.

There have been many mines started in Canada by people of the farming class, as well as by companies, and "cotton," as Asbestos is locally termed, has been found in large quantities within a few feet from the surface, in veins from $\frac{1}{4}$ to 6 inches and more in length of fibre. In Italy, Asbestos is found, measuring up to 6 feet, in fibre, and chemically speaking, there is no difference between it and Canadian, except that the latter, though shorter in fibre, is much more compact and crystalline, and purer in every sense of the word than can be obtained in Italy, so much so, as I understand, that users of Italian material have virtually abandoned it for Canadian. Although I have no doubt but that Italian Asbestos has its own special purposes.

The greatest depth reached in Canada is 130

feet in open workings. No timbering or extensive machinery is used in the manipulation of the mines, as the "cuts"—being usually in the mountain side—afford a natural drainage, and dumpage.

Having blasted the rock, the first process of extraction is termed "cobbing," which means breaking off the adhering serpentine from the Asbestos vein, this being manual work done by boys. The fibre is packed in sacks, each weighing 100 lbs., and in some cases 200 lbs. are shipped by the local railroad company to Montreal or New York at something about 10 cents and 20 cents per sack.

Asbestos is sorted into three qualities, and priced thus:—

1st quality, selling at mine	$80	to	$200,	per	ton	of	2,000	lbs.
2nd „ „ „	60	„	70,	„	„	„		
3rd „ „ „	25	„	50,	„	„	„		

Some inferior quality, at a very low price, is used by the Asbestos Mining and Manufacturing Company of Quebec.

The workmen are principally French Cana-

dians belonging to the neighbouring villages, and the wages paid them are—

Miners (without board), $0·90 (3/9) to $1·25 (5/2), per day.
Pickers and cobbers, $0·40 (1/8) „ $0·70 (2/11), „

The cost of extraction is taken from $20 to $25 per ton; this includes local administrations and all other expenses connected with the mine, and with the adoption of machinery and the use of air-compressed drills the cost of actual mining will be reduced to at least 30 per cent.; so taking an average price of about $70 per ton, a net profit of from £8 to £9, or $45, is obtainable per ton of raw material.

In 1886 the total amount of Asbestos, taken from all the mines, may be estimated at 1,500 tons, and of the amount returned last year (1888), all but 400 tons were from the Quebec province mines, and of these Thetford turned out 2,560 tons, and Black Lake 950, or together three-fourths of the whole out-put. The 400 tons were from Bridgewater, in the province of Ontario, a somewhat different class of mineral,

which is generally used in the manufacture of fire-proof roofing.

As regards the indications of Asbestos, it is a general recognised fact, and one that may be depended on, that not alone in Canada, but indeed all other places where Asbestos-bearing serpentine is found, the existence of Asbestos, or "Amianthus," is noticed when the serpentine is exposed, and presents a rusted, sometimes greyish and broken appearance, due to decomposition or weathering, or covered with a thin layer of soil. Small veins of Asbestos are to be seen forming a network on the surface of the rock. If closely examined there may be noticed the indications of a fault which, in the eastern townships of Quebec, has generally a direction of N. 40° E., this fault appearing in all openings where a good show of mineral is to be seen, presenting a wall either in a vertical position or at an angle, which is preferred to be not greater than 30°. From this wall, at a varying distance of from 5 to 20 feet, will be found another, sometimes parallel to, or at an opposite

angle; in this latter case, if these walls be worked down, they will be found to either meet, forming a trough-like appearance, or to change their course in a downward direction, leaving only a few feet from each other at the narrowest point, and then diverge to an unlimited depth. In this case their faces will have a slicken appearance, smeared over with thin layers of imperfect Asbestos, or crysotile, now and then compact, fibrous hornblende, up to 24 inches in length, of various colours, and rich deposits of olivine, in rare cases small quantities of "ground ivory" with many other admixtures.

The condition of the serpentine within these walls is greatly distorted, containing many small veins of Asbestos varying from mere threads to 2 and 3 inches in thickness, and sometimes deposits of grains of magnetic iron or magnetite with traces of chromic iron, which in some localities break the continuity of the fibre, veins of rich white crystalline matter (perhaps calcareous) with large deposits of "soapstone," or steatite, associated with "serpentite."

Such contorted out-crops are indications of rich veins of Asbestos, which will be found to both increase in quantity and quality the deeper they are worked. And in the case where the walls are parallel and the filling matter in the same contorted condition, it is inevitable. in order to obtain a good fibre, considerable depth should be reached.

The serpentine, which constitute these walls, will also be found to proportionally become more compact, and less associated with impurities, and contain the finest quality and lustre of fibre.

A very interesting phenomenon may be noticed at some of the mines in connection with this contorted matter. It is the transposition of the serpentine into Asbestos fibre, by the action of the atmosphere. This is to be seen on the dumps where the filling matter and cobbed rock is exposed. In one or two cases I have seen large quantities of broken rock changed into fibre after a few years, by atmospherical chemical agencies.

In so many cases I find people are prejudiced

from going deeper than a few feet from the surface, as not finding a copious supply of Asbestos there, when *good* indications are shown they become disheartened.

Therefore, from these practical facts it will be seen that in order to get the best results it is necessary to work at the lowest possible level when a favourable out-crop is shown, as, possibly, working at a high elevation on the out-crop may be a mistake, where a lower point is available.

There are good indications of Asbestos where the serpentine is crossed by quartzose, gneiss, or "traverse dykes," and some valuable finds have been made at the junction with the dioretic rocks.

When the serpentine is found dark in colour, to have a granular appearance, containing many dark grains of, perhaps, felspathic crystals, the Asbestos will be of a dark, dull, translucent lustre, very compact, and easily fluffed to a fine silken fibre. The admixtures of hard and soft serpentine, where not effected by a fault, may

sometimes be regarded as a doubtful indication of an immediate find, but if its hardness increases on descending, and colour becomes more uniform, from a light emerald green with a whitish admixture, to a dark olive, and containing numerous small veins of fibre, the conclusions may be considered as favourable to rich deposits of Asbestos.

In conclusion I may add that the foregoing remarks, as regards the indications of this valuable mineral, are based on my personal geological experience, and the reliable information of the managers of the various Asbestos mines in Canada, whose opinions have greatly aided me in my recent prospection, and I trust that this pamphlet will not alone be a benefit to them, but to the Asbestos industry, which I feel assured will be one of the most prominent in the province of Quebec.

LUCIUS J. BOYD,

C.E., F.R.G.S.I.