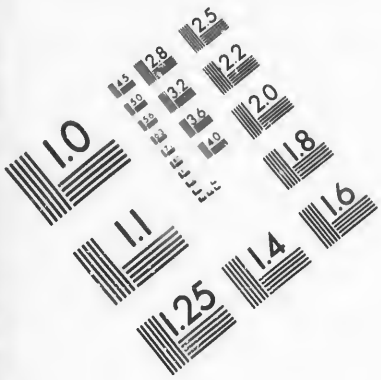

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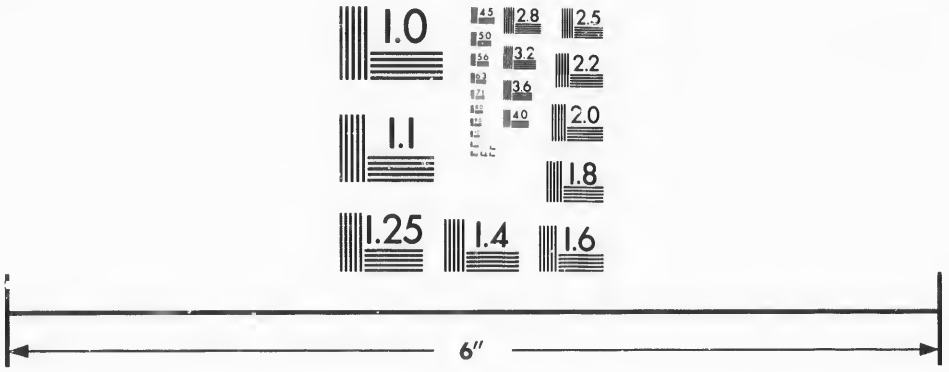

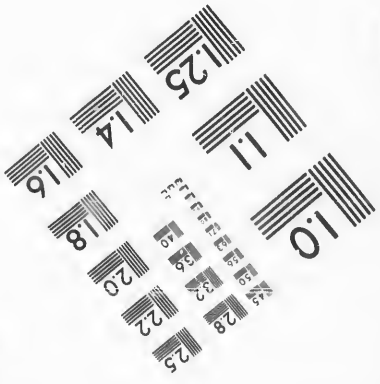

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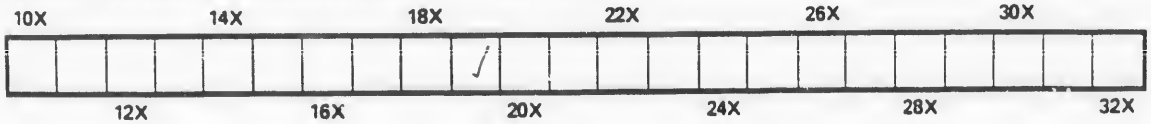

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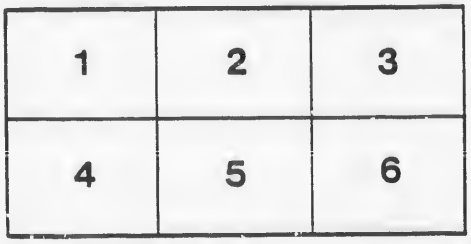

[*From the* Quarterly Journal *of the* Geological Society *for August* 1869.]

5

ON THE

GEOLOGY AND MINERALOGY

OF THE

COUNTY OF HASTINGS,

CANADA WEST.

BY

T. C. WALLBRIDGE.

Contents.

I. Introduction.

Within the last two or three years, considerable excitement has been aroused by the discovery of gold in several localities in the North Riding of the County of Hastings. Long previously, attention had been directed to the occurrence of valuable deposits of iron-ore distributed through the northern townships of the county; but although attempts have been made from time to time to explore a few of these deposits, no systematic or extensive workings have yet been undertaken, and at the present time these iron-ores remain almost entirely undeveloped, Looking, however, to the extensive mineral resources of North Hastings, and to its favourable geographical position, it can hardly be doubted that many of the townships are destined to become important mining-districts; and the object of the present communication is to lay before the Society an account of the chief mineral deposits, so far at least as they admit of description in their present undeveloped state.

Before describing these minerals, however, it seems desirable, for the better understanding of their mode of occurrence, to give a general sketch of the geological features of the country. Much information on this subject may be found scattered through the pages of the admirable Reports issued by the Geological Survey of Canada; but the following description is mainly the result of personal observation and local knowledge derived from a long residence in that part of Canada.

The County of Hastings is situated on the north shore of the Bay of Quinté in Upper Canada. It was formerly divided into the North and South Ridings, all the minerals of economic value being confined to the former division. The geological formations exposed within the limits of the county comprise, in descending order, the Drift, Lower Silurian strata, and certain Laurentian rocks.

II. Geology of Hastings.

1. *Recent Deposits.* — Before describing the several geological formations of the county, a few superficial deposits of local occurrence and of recent origin merit a brief notice, partly from their geological interest and partly from their economic value. Thick beds of a white *shell-marl*, charged with *Cyclas*, *Planorbis*, and other freshwater shells, are scattered here and there over the surface of the county. In many of the small shallow lakes this marl is still in course of deposition. The waters of such lakes often contain carbonate of lime to such an extent that any object exposed to their action is readily coated with a calcareous incrustation. From July to November many of these lakes are more or less completely dried up, and the marly deposits covering the bottoms are then exposed. "Lime Lake," a considerable expanse of shallow water in the south-east angle of Hungerford, derives its name from the calcareous deposit which it thus throws down. Marl-beds of a similar lacustrine origin often attain a thickness of several feet, and sustain a rank vegetation—cedar-swamps (*arbor vitæ*), for example, commonly standing upon such deposits. The occurrence of this freshwater marl is well exposed on the drift forming the higher banks on the west side of the river Moira above Belleville. No attention has hitherto been directed to the utilization of this shell-marl; but it obviously possesses considerable value to the agriculturist as a fertilizer, and may perhaps be useful to the metallurgist as a flux, as well as for making the cupels or hearths used in refining auriferous and argentiferous lead.

In a country which possesses no workable quantity of coal, more than ordinary interest attaches to the occurrence of *peat*. Deposits of this fuel, often of considerable thickness, are extensively distributed through the mineral regions of Canada, and must eventually play an important part in the development of its mineral resources. Nearly all the smaller lakes scattered over the Laurentian area contain, either at their outlets or in sheltered coves along their margins, considerable accumulations of vegetable remains, which have partly grown in their present position and partly been drifted thither by winds or by the current of the river flowing through the lake. Year after year these stagnant accumulations are increased, and eventually become converted into a peaty substance sufficiently compact to admit of a rich vegetable growth upon the surface.

In connexion with the occurrence of peat, attention may be directed to the deposits of *bog iron-ore*, which are widely distributed over the surface of the country, and in certain localities appear to be still in course of formation. Although bog iron-ore usually contains phosphorus, it yields an iron which from its easy fusibility is highly valued for castings. Bog-ore has been employed with most satisfactory results at the St. Maurice and Radnor forges, both in Canada East. The bog-ore of Hastings is especially abundant in the township of Marmora, but has not hitherto been brought into use.

2. *Post-Tertiary.*—Neglecting the recent formations, which are of local occurrence only, the surface of the county is for the most part covered by an extensive accumulation of sand, gravel, and clay, with boulders of northern rocks, forming a portion of that general covering of drift which overlies the greater portion of the province, and extends southwards into the United States. The upper part of these deposits consists of a series of sands, gravels, and clays, more or less distinctly stratified, and usually resting upon a tenacious unstratified Boulder-clay. The boulders are derived partly from the syenitic, gneissoid, schistose, and limestone rocks of the northern Laurentian area, and partly from the wreck of the thick-bedded limestone, which will be subsequently mentioned as forming a part of the Trenton group, and which, previously to its denudation, overspread a great portion of the Laurentian rocks of the northern townships of Hastings. Many of the blocks have a volume of several cubic yards each, and are often broken up for road-metal. A single boulder or ice-borne mass of Laurentian rock, at the Shannonville Station on the Grand Trunk Railway, covers a superficial area of about 5 acres, and has a thickness of 100 feet. Isolated boulders are not unfrequently found on the tops of hills, where they have probably been left by the denudation of the deposit in which they were originally imbedded.

The accumulations of drift are sometimes heaped up in isolated hillocks, or in ranges of hills, and sometimes spread out over the valleys. A cutting in the Court House Hill, in Belleville, exposes a good section of the drift. Upon a base of Trenton limestone, the surface of which is highly polished and grooved, there is an accumulation of deposits attaining an aggregate thickness of about 60 feet, and consisting below of a tenacious Boulder-clay, overlain by a thick bed of blue clay and a series of finely stratified sands and gravels. In the blue clay there frequently occurs the cast of a peculiar organism, supposed to be a plant, which presents either a ramified or a lenticular form and attains a size of from 2 to 3 inches in diameter, and from 1 to $1\frac{1}{2}$ inch in thickness.

A succession of deposits, similar to that exposed at the Court House Hill, may be seen in the Oak Ridge—a range of drift-hills running across the country from East to West, having a width of from 3 to 6 miles, and varying in height from 100 to 500 feet.

On removing the superficial accumulations, the subjacent rock, whether gneiss, schist, or limestone, usually exhibits distinct traces of having been subjected to glaciation. Many of the rocks are highly polished, whilst others are distinctly striated and grooved, the general directions of the markings being from N. E. by N. to S. W. by S. Some remarkably distinct ice-scratches were exhibited in the town of Belleville in the autumn of 1864, when a cutting was made in Pinnacle Street. The section exposed about 30 feet of "hard pan," or gravel, with boulders of calcareous and syenitic rocks, resting on the Trenton limestone. The surface of this limestone, when freshly-exposed, was most distinctly polished and striated, the general bearing of the marks being N. 35° E. and

S. 35° W. Other less strongly-marked striæ varied slightly from this common direction.

On the road from Belleville to Shannonville, on the first concession of Thurlow, between Lots 24 and 25, I have observed the direction of ice-marks on the outcropping Trenton limestone to be E. 85° N. and W. 85° S.

A careful study of the deposits here grouped together as "drift" would apparently lead to the conclusion that their formation is referable to the action of two distinct agencies—the one a force similar to that of land-ice pushing before it an accumulation of northern rocks, whilst it rounded, polished and grooved the country over which it swept, and the other an action similar to that of icebergs scattering their freight of gravel and angular fragments of rock over the bed of the sea. The eastern half of the township of Hungerford, and the northern ranges of Huntingdon and Rawdon, are thus covered with scattered angular blocks of limestone removed from the Laurentian area, some of the blocks exhibiting distinct glacial markings. Between the period of glacier ice and that of floating ice the stratified sands and clays appear to have been deposited in comparatively tranquil water.

3. *Lower Silurian.*—In the South Riding of Hastings is an extensive development of that division of the Lower Silurian formation distinguished as the *Trenton group*, including under that name not only the Trenton Limestone proper, but also the Bird's-eye and Black-River Limestones. The upper portion of the Trenton group consists of a series of thin-bedded shaly limestones, occasionally interstratified with beds of calcareous clay, and highly charged with the characteristic fossils of the Trenton Limestone. These rocks generally strike in an east and west direction, and are for the most part horizontally bedded, or have only a gentle dip to the south-west, with occasional evidence of a slight upheaval. In the shallow valleys of denudation which in many places intersect the county, sections of these limestones are occasionally exposed; but as a rule they are almost completely obscured by a covering of drift.

The thin-bedded fossiliferous Trenton Limestones rest conformably upon a thick-bedded limestone almost destitute of fossils, only three species having hitherto been detected. Probably this thick-bedded limestone represents the Bird's-eye and Black-River series. Sections are exposed along an escarpment, varying from 50 to 100 feet in height, which forms the junction of the Trenton beds with the underlying Laurentian rocks. This escarpment gives direction to the drainage from the Laurentian watershed of this part of Canada.

The total thickness of the Trenton Limestone at Belleville may be estimated at about 800 feet. A boring to the depth of 600 feet was sunk about 15 miles S. W. of Belleville, in the County of Prince Edward, without reaching the base of the series; and another boring, 7 miles north of Belleville, 500 feet deep, was attended with a similar result.

Whilst the Trenton group of rocks is almost confined to the southern part of the county, it is notable that two large outliers of

the thick-bedded limestone are found in the Laurentian area of Madoc, at a considerable distance from the main mass. In a lecture delivered at Madoc in 1866, I called attention to these outlying patches. One of them occurs about a mile south of the Richardson gold-mine, and the other at a distance of about 2 miles S.E. of the former mass. The N. and N.E. sides of these outliers present prominent escarpments, whilst the other sides have a gentle slope. Other smaller outliers of limestone are scattered over the Laurentian area; and all are of interest as attesting the extensive denudation which the country has suffered.

At the base of the Trenton group there is found in certain localities of the North Riding a thin band of grey limestone, having so extremely fine a texture as to render it well adapted for use as a lithographic stone.

In the township of Hungerford the Trenton limestone is occasionally underlain by an unfossiliferous calcareous sandstone, supposed to represent the *Calciferous Sand-rock* and *Potsdam Sandstone*, which form the base of the Lower Silurian formation.

4. *Laurentian.*—The Lower Silurian beds usually rest unconformably upon a very irregular surface formed by the denuded edges of a large group of highly inclined strata of metamorphic rocks, which have been referred provisionally to the Lower Laurentian formation. These rocks are exposed over a large portion of the North Riding, and consist of a very diversified series of micaceous, hornblendic, and chloritic schists, interstratified with beds of granular and crystalline limestone, and penetrated by bosses of syenitic and gneissoid rocks. Bands of conglomerate occur locally, and consist of quartzose, felspathic, and calcareous pebbles, imbedded in a matrix of micaceous schist or of dolomitic limestone. Most of the stratified Laurentian rocks exhibit evidence of having been highly disturbed, the dip being extremely irregular, and often at a very high angle. An apparent inversion of the rocks may be seen in the adjoining townships of Tudor and Madoc. Traces of an organic structure referred to *Eozoon Canadense* have been detected by the Geological Survey of Canada in the limestones of Madoc and Tudor but it is supposed that these rocks may be placed on a higher horizon than the Eozoonal limestones of Grenville. Indeed Sir William Logan admits that the stratigraphical position of the crystalline rocks of Hastings is by no means satisfactorily determined; but he adds that "it would be premature to remove them from the horizon in which they have been provisionally placed."

In addition to the extensive development of these so-called Laurentian rocks in the northern townships, domes of similar syenitic and gneissoid rocks are exposed in several parts of the Trenton-Limestone area to the south, where the overlying limestone has been planed down or removed by denudation.

It has been suggested that certain labradorite rocks forming a range in the township of Tudor, known locally as the "Hole in the Wall," may be regarded as outlying masses of the Labrador or Upper Laurentian series.

III. On the Occurrence of Gold.

All the rocks in which gold has recently been discovered in the County of Hastings are comprised within the Laurentian area, known as the Quinté Gold-mining District. The first discovery of the precious metal was made in 1866, during an unsuccessful search for copper ores. Superficial indications of the occurrence of copper in the township of Madoc had previously led to the prosecution of irregular workings in several localities; but none of the explorations had been characterized by any measure of success. At length, however, a specimen was obtained from one of these so-called mines which, although at first mistaken for native copper, was soon found to be native gold. Stimulated by this discovery, further search was prosecuted; and at the locality which subsequently became famous as the "Richardson Mine," a considerable quantity of free gold was discovered in two pockets, or irregular cavities, at a depth of about 15 feet below the surface. Considerable interest attaches to this mine, not only on account of the large amount of gold which it yielded within a very short space of time, but more especially on account of the peculiar conditions of association under which the metal occurred.

The Richardson Gold Mine is situated on the eighteenth lot of the fifth concession in the township of Madoc. The surrounding rock consists of an epidotic and chloritic gneiss, enclosing a bed of steatitic schist, and associated in certain places with a ferruginous dolomite. A peculiar character is given to this dolomite by the local occurrence of a black carbonaceous substance which, in external characters, bears considerable resemblance to a lignite, but which is regarded by Dr. Sterry Hunt as probably an altered form of bitumen. It occurs imbedded in the dolomite, in small irregular fragments, which break with a conchoidal fracture, and present a pitch-black colour and a resinous lustre. Heated in the open air, it readily ignites, burning with little or no flame, and leaving a residue which, in a specimen examined by Dr. Hunt, consisted of "carbonate of lime, with some siliceous and ferruginous matter, including a quantity of gold."

This friable carbonaceous substance, in association with ochrey oxide of iron, incrusted the walls of the gold-bearing pockets of the Richardson Mine, and formed the matrix through which the metal was chiefly disseminated. It would appear that these pockets are merely expansions of a fissure running along the plane of bedding between the highly inclined rocks of the surrounding country. The contents of these cavities have evidently been derived from the decomposition of the surrounding dolomite; for that rock, as seen by the specimens exhibited, contains the disseminated carbonaceous matter, together with free gold, whilst it appears to be sufficiently ferruginous to yield the oxide of iron on decomposition. Whether the carbonaceous substance has, by its reducing action, played any part in the genesis of the gold is a chemical question on which the writer is not prepared to enter; but their intimate association in this mine is

at least highly suggestive. Moreover the presence of the carbonaceous matter, not in cavities in the dolomite, but imbedded in the rock itself, is a point of considerable significance to the palæontologist, as indicating the existence of organic remains in rocks which have been referred to so old a formation as the Lower Laurentian.

The gold yielded by the pockets of the Richardson Mine usually occurred in a finely divided state, or in the form of small scales and dendritic fragments, but never exhibited distinct crystalline forms. It presented a reddish-yellow colour, and was remarkably pure. A specimen assayed in Toronto was between 22 and 23 carats fine, the native metal being thus quite as pure as the standard gold of this country. The auriferous material extracted from the pockets (consisting of the carbonaceous and ochreous substances) yielded from £3 to £4 worth of gold to the pound. As much of this gold-stuff the mine actually produced it is extremely difficult to estimate; for whilst the workings were in the hands of Mr. Richardson, considerable quantities were surreptitiously carried off by parties who gained access to the mine, and were distributed to so large an extent that, even at the present time (now more than two years after the discovery), specimens may readily be purchased in the neighbourhood. It is said that upwards of 60 lbs. of the auriferous material were sent to the United States by the first purchasers of the mine, and subsequently three barrels of the same material were forwarded to New York. It is commonly supposed that the total value of the gold yielded by the pockets of the Richardson Mine was not less than £10,000.

When, however, the two deposits were exhausted the supply ceased, and attention was then directed to working the surrounding "country," where the gold exists either in so finely divided a state as to escape detection by the eye, or in combination with iron-pyrites and other metallic sulphides.

It has been said that the metal was confined exclusively to the fissure, and that it could not have been derived from the adjacent rocks, as these, if not entirely destitute of gold, are impregnated with it only to a very limited extent in the immediate neighbourhood of the crevice. Such a statement however, is, entirely contradicted by a chemical examination of rocks broken at a considerable distance from the pockets. Several assays have been made by Professor T. Bell, of Albert College, who has kindly furnished me with the results. Two specimens of dolomite from the Richardson Mine yielded respectively 9 oz. 11 dwts. 16 grs., and 4 oz. 5 dwts. 17 grs. of gold per ton of 2000 lbs.; whilst the metallic sulphides, chiefly iron-pyrites, washed from these two specimens contained as much as 88 oz. of gold to the ton. The average value of the gold-stuff at present crushed at the mine is only about £1 per ton; but even this is found to be more than sufficient to cover the working-expenses. It should be noted, however, that all the gold thus obtained is extracted by amalgamation; and as the rock contains a large percentage of auriferous sulphides, it is probable that larger

returns would be yielded by a metallurgical treatment better adapted to the character of the ore.

In the same township as the Richardson Mine, gold-ores have recently been worked at several localities. The Madoc Gold-Mining Company's shaft on lot seventeen in the seventh concession of Madoc was sunk on a quartz lode, coursing through gneiss N. 15° W., and dipping about 60° W. Very little free gold was visible; but the iron-pyrites disseminated through the quartz was apparently auriferous. Samples of vein-stuff from near the surface yielded about £12 10*s.* of gold to the ton, and at a depth of between 30 and 40 feet Professor Chapman found the quartz to contain 3 dwts. 12 grs. of gold, and 1 oz. 11 dwts. 12 grs. of silver per ton; but at a depth of about 60 feet the vein became entirely barren of gold.

At the Empire Mine, also situated in the township of Madoc, both gold and silver have been obtained from a vein-stone containing arsenio-antimonial grey copper-ore, together with mispickel, iron-pyrites, and bitter-spar. According to Professor Bell's assay, the grey copper-ore contained 8 oz. 4 dwts. of gold, and 331 oz. of silver to the ton of 2000 lbs., the value of which would be £95; and this result was confirmed by Dr. Sterry Hunt, who found that the dressed ore, when holding one-fourth its weight of vein-stone, yielded 9·7 oz. of gold, and 120·7 oz. of silver to the ton of 2000 lbs.

In the adjacent township of Marmora auriferous quartz has been worked at the Feigle Mine, opened on lot sixteen in the eleventh concession. The gold is here associated, as in so many other gold-bearing localities, with a vitreous quartz more or less stained with hydrous peroxide of iron. Mr. Bell has found that one sample of this quartz yielded, by amalgamation, 3 oz. 13 dwts. 8 grs. per ton, whilst another portion contained 7 oz. 15 dwts. 12½ grs. per ton. [A specimen exhibited from the Feigle Mine showed the free gold imbedded in a large prismatic crystal of liver-coloured Eisenkiesel, or quartz charged with hydrous peroxide of iron.]

At the Barry Mine, in the township of Elzevir, a dark crystalline limestone is crushed for gold. The mean of four assays of ore, discovered in this township by Mr. Smallfield, yielded gold to the value of nearly £8 per ton of 2000 lbs.

From the township of Hungerford, quartz containing much iron-pyrites has been found to contain both gold and silver, probably in association with metallic sulphides.

Nothing would be easier than to considerably extend this list of gold-bearing localities. Indeed it appears that the metal is distributed, in greater or less quantity, through most of the schistose rocks of the gold-mining region; for I have invariably found that these rocks yield, on assay, a notable amount of metallic sulphides more or less auriferous. Probably the most advantageous mode of treating these sulphides would be to smelt them to a rich regulus, which might be then exported to England for extraction of the gold.

Note.—The following assays of gold-bearing rocks, from the Quinté gold-mining district, by Professor Chapman, of University

College, Toronto, are of value, as showing the average quality of the ores found in this locality :—

	dwts.	grs.	
No. 1. From Madoc.			
Gold = 3	12		per ton.
Silver = 7	14		„
No. 2. Ditto.			
Gold = 7	20		„
Silver=18	7		„
No. 3. Ditto.			
Gold = 5	21		„
Silver=14	9		„
No. 4. Ditto.			
Gold =19	12		„
Silver= 3	4		„

	oz.	dwts.	grs.	
No. 5. From Madoc.				
Gold =1	17		2	per ton.
Silver=0	4		14	„
No. 6. Ditto.				
Gold =1	11		17	„
Silver=0	6		12	„
No. 7. Ditto.				
Gold =1	1		9	„
Silver=0	3		8	„
No. 8. From Marmora.				
Gold =1	19		5	„
Silver=0	5		5	„

IV. On the Occurrence of Iron-ores.

It has long been known that extensive deposits of valuable iron-ores occur in the Laurentian rocks of the North Riding of Hastings. These ores rarely, if ever, occur in true veins, but are usually found in bedded masses, more or less distinctly interstratified with the adjacent rocks, and in many cases appearing at the junction of the gneiss with crystalline limestone. The ore-deposits traverse the townships of Madoc, Marmora, and Belmont in a general east and west direction, thus following to some extent the common trend of the strata. The iron is found sometimes in the form of magnetic ore, and sometimes in that of hæmatite.

As many of these beds of magnetic iron-ore have been ably described in the Reports of the Geological Survey of Canada, it is needless to give any detailed notice of them in the present paper. Such is the famous "big ore bed" of Crow Lake, situated on the eighth lot of the first concession of Belmont. This is the ore which was formerly smelted at the Marmora Iron Works. Above the surface of the ground, the bed exhibits a width of about 500 feet; but recent excavations at the base show that it attains a still greater development below.

The "Seymour ore bed," on the eleventh lot of the fifth range of Madoc, has also been described. This was at one time worked to a limited extent to supply the Seymour furnace at Madoc.

As magnetic iron-ore is very widely distributed through the county, it would be tedious to note its many places of occurrence; but I may perhaps call attention to a new locality in Madoc, on the nineteenth lot of the first concession, which yields a fine magnetic ore [of which samples were exhibited] A large deposit of magnetic iron-ore, also hitherto undescribed, is found on lot nine of the sixth range of Madoc.

Before dismissing the subject of magnetic iron-ores, it may be mentioned that the deposits of this mineral attain so extensive a development as to form, in many cases, remarkable physical features of the country. Indeed the supply of ore which might be obtained by working these deposits would be practically inexhaustible. Smelted with wood-charcoal, or with peat, which must necessarily

form the fuel employed, and which may be obtained to an almost unlimited extent from the noble forests and extensive peat-beds which still cover a large portion of the country, these ores would yield an iron admirably adapted to the manufacture of steel, and probably equal in quality to the celebrated Swedish charcoal-iron which has hitherto been so largely imported into this country.

In addition to the well-known magnetic ores, the Laurentian rocks of Hastings are rich in deposits of Hæmatite or red oxide of iron. In the discovery and development of these Hæmatites I have long felt much interest. The existence of the "Kane ore bed" was pointed out by me several years back, and the bed has already been described by the Geological Survey. It is situated on lot twelve of range five in the township of Madoc, and has a superficial development extending over several acres. Since the last notice published by the Survey, I have caused an excavation to be made in the field where the ore was originally discovered, and after cutting for a distance of 40 feet failed to reach the wall rock. The ore is a fine-grained Hæmatite, converted at the surface into a soft red ore. As races of ancient workings have been found in this deposit, it is probable that the Indians formerly visited the locality for the sake of obtaining the red ochreous substance for use as war-paint. In an excavation, at a considerable depth, I have obtained bone needles and other objects of human workmanship [which were exhibited]; whilst several shells and stag-antlers that were also found in this excavation have been transmitted to Dr. Dawson, of Montreal.

The Hæmatite from the Kane ore bed has been smelted at the Radnor forges in Lower Canada, and has yielded a pig-iron of excellent quality. It has also been treated at the Atlas Works in Glasgow by the Bessemer process with very encouraging results. According to an assay made in the Metallurgical Laboratory of the Royal School of Mines, the ore contains 51·46 per cent. of iron.

In the third lot of the fourteenth range of Hungerford, there occurs a bed of Hæmatite, to which attention has not hitherto been directed. The ore is a hard fine-grained Hæmatite, breaking with a steel-grey fracture and high metallic lustre. In its present undeveloped state, it is difficult to estimate the extent of the deposit, but it is undoubtedly considerable. An assay made in the Metallurgical Laboratory of the Royal School of Mines shows that this ore contains 65·91 per cent. of iron.

Pyrrhotine, or magnetic pyrites, although not to be regarded strictly as an iron-ore, may be most conveniently noticed in this place. An extensive deposit of this iron-bearing mineral crops out on the face of a hill on the nineteenth lot of the first range in Madoc. As this mineral not unfrequently contains cobalt and nickel, it was considered desirable to examine the Canadian pyrites for these metals; but no traces of either were detected.

V. On the other Minerals of Hastings.

Whilst the gold and iron-ores form the chief mineral wealth of Hastings, the county is by no means destitute of other minerals,

many of which possess considerable value in an economic point of view. The most important of these is *Galena*, extensive deposits of which may be traced for a considerable distance through the townships of Tudor and Lake. It is notable that the lead-ores thus enjoy a geographical distribution entirely distinct from that of the iron-ores. The Galena usually occurs in a gangue of calcareous spar, and forms veins or lodes coursing through the Laurentian Limestone or calcareous schists. *Copper-ores* have been found, as previously stated, but never in sufficient quantity to render their working remunerative. A small and unimportant deposit of *antimonite*, or sulphide of antimony, has been found in the township of Sheffield. *Plumbago*, of greater or less purity, is occasionally met with in the Laurentian limestones of the county, but has not hitherto been worked.

Finally, attention may be directed to two other minerals, which, although of no economic value, are of mineralogical interest as species that have not hitherto been described from this county. One of these is *Rutile*, or *oxide of titanium*, which I have found penetrating the quartz of Hog Lake in the form of stout prismatic crystals, striated longitudinally, and presenting a hair-brown colour and a strong lustre. The other mineral is *Schorl*, or black tourmaline, which occurs on lot fifteen of range four in Madoc, as a reticulated mass of slender prismatic crystals imbedded in quartz.

Discussion.

Prof. Ramsay inquired as to the proof of the existence of so large a boulder as one of five acres in extent. Under ordinary circumstances large boulders fell from higher rocks on to the surface of glaciers beneath, and were by them transported to the places where now found; but the fall of such a mass seemed almost incredible. He suggested that possibly it might be a boss of the Lower Laurentian beds standing out through Silurian strata.

Mr. David Forbes stated that the results of his own examination of some of the specimens from the gold-mines of this district did not quite tally with those recorded in the paper, especially those of the rocks in the neighbourhood of the veins. He considered that the gold in Canada was confined to the veins.

Mr. Prestwich cited the discovery of a boulder between Grantham and Peterborough, which was at least 400 feet in length, and consisted of a mass of Great Oolite.

Mr. Searles Wood mentioned a boulder of marl in the coast-section near Cromer upwards of 300 yards in length, and 60 feet in height.

Mr. Wallbridge, in reply, stated that the rock must have come at the least twenty miles from its original home. The surface of the Trenton limestone rock in the neighbourhood was striated in the direction of the boulder. There was no evidence of intrusion. The mass was traversed in two or three places by crevices.