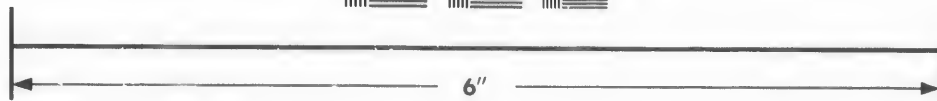
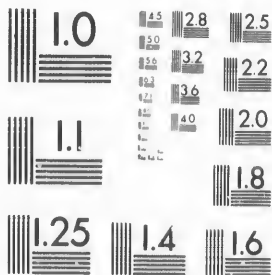
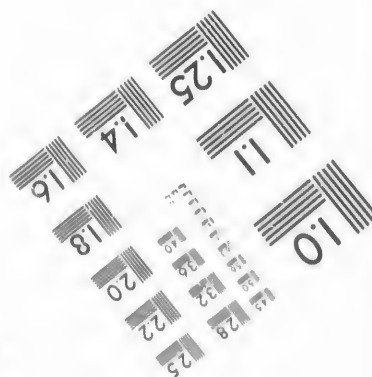


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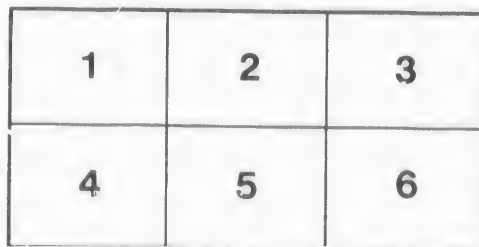
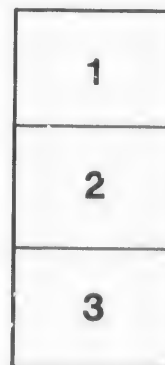
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GEOLOGICAL SURVEY OF CANADA.

ALFRED R. C. SELWYN, DIRECTOR.

REPORT

OF

MR. HENRY G. VENNOR

ON THE GEOLOGY OF

HASTINGS COUNTY, ONTARIO,

WITH A MAP OF THE REGION ;

ADDRESSED TO

SIR WILLIAM E. LOGAN, F.R.S.

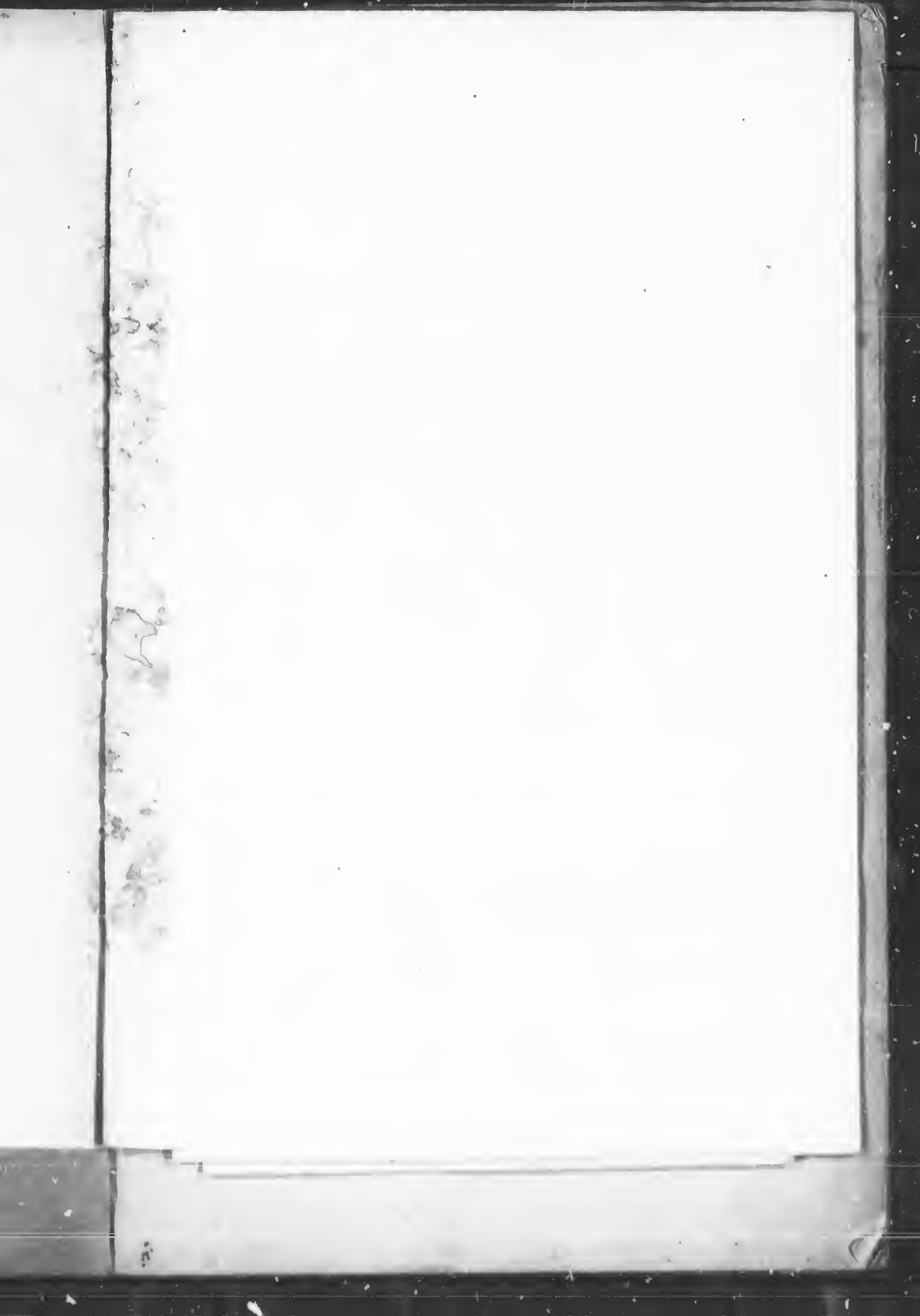
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(Extracted from the Report of Progress for 1867-68.)



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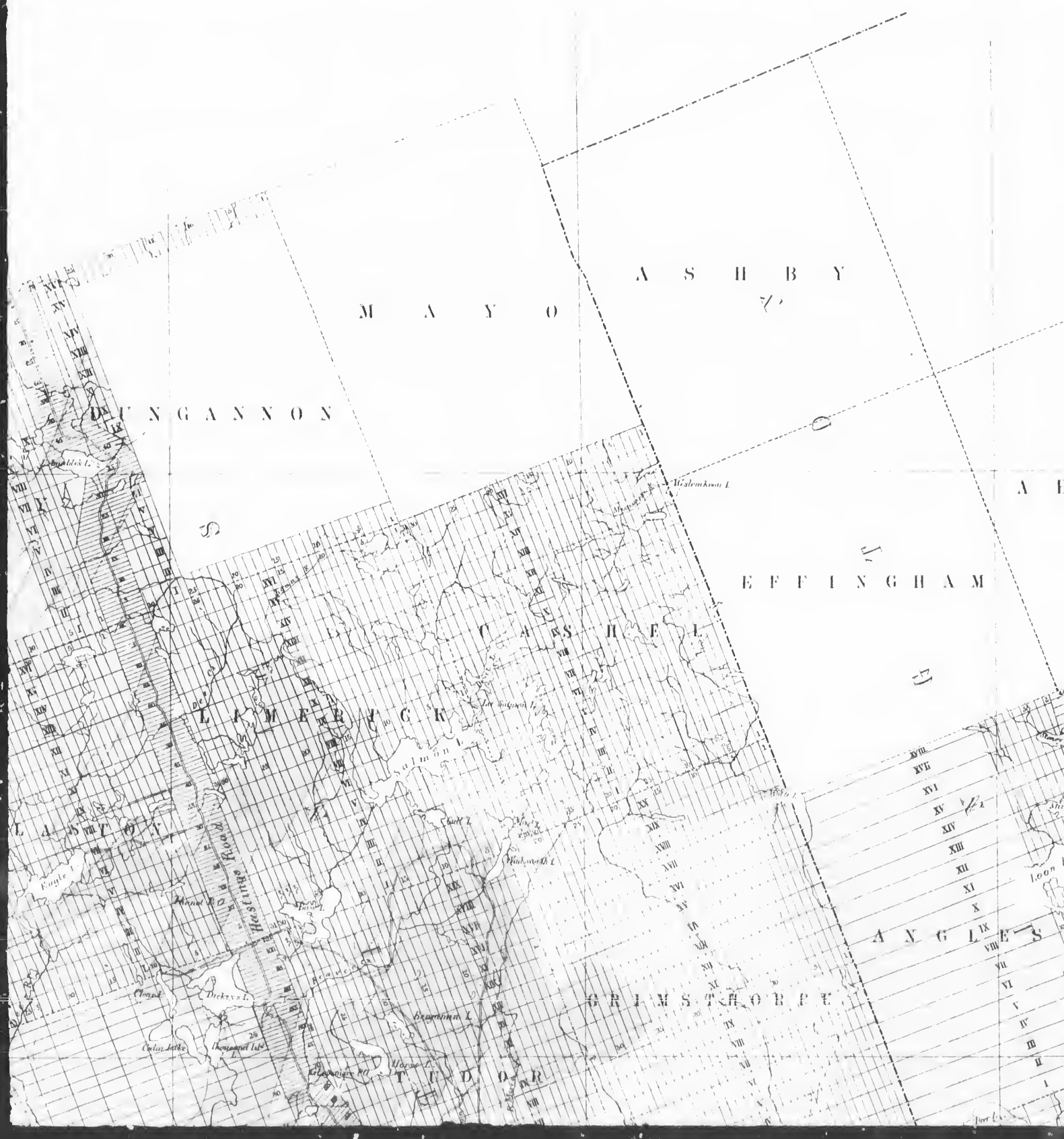
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GEOLOGICAL SURVEY OF CANADA

Sir W. E. Logan F.R.S. Director

MAP

Showing the distribution of the

ROCK FORMATIONS

in Parts of the Counties of

PETERBOROUGH HASTINGS ADDINGTON & FRONTEENAC

PROVINCE OF ONTARIO

To Illustrate the Exploration of

M^r H. G. Vennart

1868

at 1 Mile to One Inch

0 1 2 3 4 5 6 7 8 9 10 Miles



EXPLANATION OF THE COLORS



SILURIAN LIMESTONES



Calc schists with Exoon.
Mica schists and conglomerates
Limestones and dolomites with gold.



Diabase rocks with iron ores



Crystalline limestones with graphite
Syenite and gneiss

The line marked thus & in the section indicates
the position of the iron bearing belt and also
the horizon of the gold immediately above

• Gold & Silver & Lead & Copper & Iron



Sea Level

W

Red Pine Plain

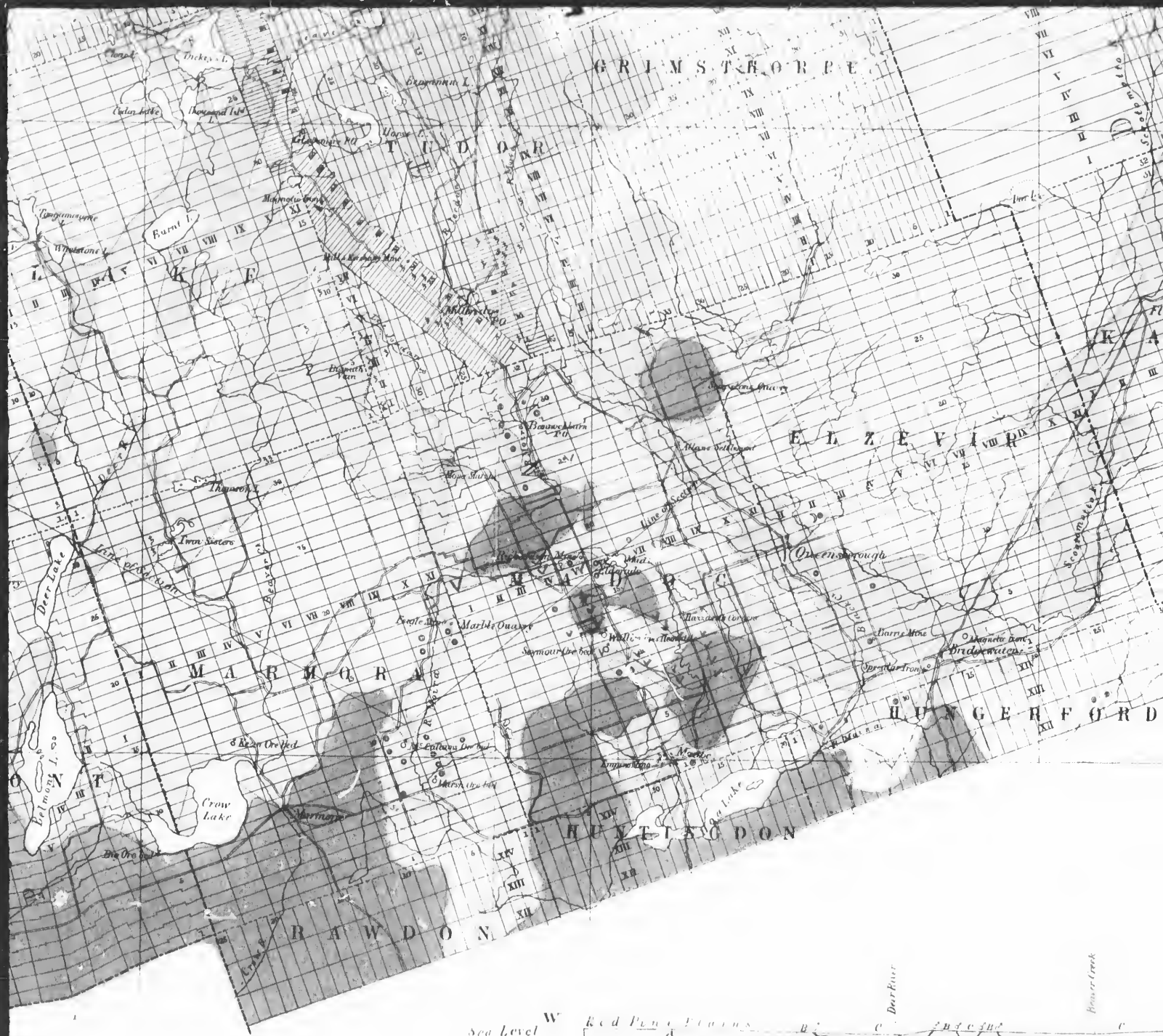
A

Edmont Basin

Marmora Basin

Section

Longitude West from Greenwich



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REPORT

OF

MR. HENRY G. VENNOR,

ADDRESSED TO

SIR WILLIAM E. LOGAN, F.R.S., F.G.S.,

DIRECTOR OF THE GEOLOGICAL SURVEY OF CANADA.

MONTREAL, May 1, 1869.

SIR,—Early in May of 1866 you were pleased to direct me to commence a series of explorations in the township of Madoc, in the North Riding of Hastings County, Ontario, and, starting from that township as a centre, to proceed to make a detailed examination of the rocks through Hastings and the adjoining counties, and to take particular note of all mineral deposits of economic value. The explorations then commenced were continued during the ensuing seasons of 1867-68, and I now beg to lay before you, in a somewhat condensed form, the substance of my Reports for those years accompanied by a colored geological map on the scale of four miles to an inch.

The country examined covers an area of about 194 square miles, being bounded on the north by the Peterson and Mississippi road lines and the Opeonga road; on the south by the Silurian limestones between the townships of Sheffield and Belmont; on the east by the Addington road running through Addington County; and on the west by the Burleigh road in Peterboro' County. Region
examined.

The townships which have been the most explored, and of which I have prepared a geological map, are Madoc, Marmora, Elzevir, Lake, Tudor and Grimsthorpe, in Hastings County; Kaladar and parts of Anglesea, in Addington County; and Belmont and Methuen in Peterboro' County, to the rocks of some of which allusion has already been made in former Reports. Geological
map, Besides those surveys I also made a traverse as far north as the York Branch of the Madawaska River, on the Hastings road, between the

31 28 3

townships of Faraday and Dungannon; on the east a survey, partly by chain and partly by pacing, of the Addington road, from the town line of Sheffield, as far north as the head of Mazinaw Lake, in the township of Abinger; and to the west a survey of the Burleigh road as far as the township of Cardiff. These last traverses were made in connection with my central work, with a view of determining, if possible, the extent of the dolomites, mica-slates, conglomerates and schistose limestones of this region, which, as you are aware, differ considerably in their lithological characters from the great mass of the Lower Laurentian rocks. Much information with regard to the geology of parts of the district is found in the Report of Mr. Murray for 1852-53, and in that of Mr. Macfarlane for 1866, and the results of these explorers have greatly aided me in my investigations.

Rocks of Hastings County.

Ascending section.

An ascending series of the rocks was prepared by me in 1866, and was published by you in the Quarterly Journal of the Geological Society of London, for 1867, and subsequently in the Canadian Naturalist; the object, at that time, being to shew the geological position of the remarkable fossil *Eozoon Canadense*, which had been found at the summit of the series in Tudor. This section, which is here repeated, was made from the results of my explorations in the townships of Elzevir, Marmora, Belmont, Lake and Tudor, the average thickness of each mass having been deduced from numerous exposures in the different townships. For reasons which will be apparent in the course of the Report it is found desirable to divide the section into three parts, which will be represented by distinct colours in the accompanying map.

DIVISION A.

		Feet.
Lower division.	1. A great mass of highly crystalline syenitic rock generally deep red, but presenting varieties in texture and in color, without apparent stratification, so far as yet observed. Thickness not ascertained.	
	2. Reddish and flesh-coloured granitic gneiss, the thickness of which is unknown; estimated at not less than.....	2000
	3. Greyish and flesh-coloured gneiss, sometimes hornblende, passing towards the summit into a dark mica-schist, and including portions of greenish-white diorite; mean of several pretty closely agreeing measurements.....	10400
	4. Crystalline limestone, sometimes magnesian, including lenticular patches of quartz, and broken and contorted layers of quartzo-feldspathic rock, rarely above a few inches in thickness. This limestone, which includes in Elzevir a one-foot bed of graphite, is sometimes very thin, but in other places attains a thickness of 750 feet; estimated as averaging.....	400

DIVISION B.*

	Feet.	
1. Hornblendic and pyroxenic rocks, including several varieties of diorite and diabase, both massive and schistose, occasionally associated near the base, with dark micaceous schists, and also with chloritic and epidotic strata, including beds of magnetite; average thickness....	4200	Middle division

DIVISION C.

		Upper division.
1. Crystalline and somewhat granular magnesian limestone, occasionally interstratified with diorites, and near the base with silicious slates and small beds of impure steatite.....	330	
This limestone, which is often silicious and ferruginous, is metaliferous, holding disseminated copper pyrites, blende, mispickel, and iron pyrites, the latter also sometimes in beds of two or three feet. Gold occurs in the limestone at the village of Madoc, associated with an argentiferous grey copper ore, and also in irregular veins with bitter-spar, quartz, and a carbonaceous matter at the Richardson mine in the township of Madoc.		
2. Gray silicious or fine-grained mica-slates, with an interstratified mass of about sixty-feet of yellowish-white dolomite, divided into beds by thin layers of the mica-slate, which, as well as the dolomite, often becomes conglomerate, including rounded masses of gneiss and quartzite from one to twelve inches in diameter.....	400	
3. Bluish and grayish micaceous slate, interstratified with layers of gneiss, and and occasionally holding crystals of magnetite. The whole division weathers to a rusty brown....	500	
4. Gneissoid micaceous quartzites, banded grey and white, with a few interstratified beds of silicious limestones, and, like the last division, weathering rusty brown.....	1900	
5. Grey micaceous limestone, sometimes plumbaginous, becoming in its upper portion a calc-schist, but more massive towards the base, where it is interstratified with occasional layers of diorite, and layers of a rusty-weathering quartzite like 4.....	1000	
In regard to the volume thus given to this series, it may be well to remark that, though allowance has been made for numerous folds in estimating it, it may still be exaggerated by many folds that may have escaped detection.		
Total thickness.....	21130	

The geographical distribution of these rocks shews a series of north-east and south-west undulations, throwing the upper division (C) into long narrow troughs in these directions. These undulations are crossed at irregular intervals by geological elevations, which separate the ends of the troughs, and by depressions which unite the sides. The anticlinal axes of the north-east undulations, which are parallel to one another, and nearly straight, appear, as far as ascertained, to be five in number, producing six synclinals; while of the transverse elevations, one runs north of west in a

* The rocks of this division are described at some length in Mr. Mactarlane's Report on Hastings Co., 1866, page 93.

somewhat curved line, and another, if it be not a final out-crop of the rocks at the base, bears rather west of north. The effect of the two series of undulations gives to the upper division, when laid down on a map, the figure of two diverging forms furnished with long projecting points running in contrary directions, and precisely opposite to one another; to the contour of which the lower divisions, B and A, conform as will be seen on the accompanying geological map.

DIVISION A.

Lower division.

Red syenites
of A 1.

Perhaps the most striking and prominent feature in the townships of Madoc and Marmora is that formed by extensive barren red syenitic rocks, which cover a large area where the two townships adjoin. Such rocks, (A 1) in which there are no apparent marks of stratification, are met with at both ends of Hog Lake, in Huntingdon, about two and a-half miles south of Madoc village, where they are immediately overlaid by the main body of the Lower Silurian limestones. On the west side of a promontory of these limestones the syenitic rocks strike northward into Madoc and Marmora, as far as the middle of the eighteenth lot on the boundary between these townships, with a breadth of about four miles, the river Moira forming their western limit, whence they spread eastward to the third range of Madoc. This mass is known as the Huckleberry rocks or Red Mountain. They are chiefly composed of flesh-red feldspar, translucent quartz, little greenish hornblende, and sometimes finely disseminated crystals of specular iron and iron pyrites.

All through this area the country is much broken up, and hardly passable, the high barren ridges alternating with extensive swamps and marly ponds. These ridges run in a northwest and southeast direction, and the rock is in many parts overlaid by outlying patches of Lower Silurian limestone. From the northern part of this area a subordinate elevation strikes southeastward across the fifth, sixth and seventh concessions of Madoc, having a breadth of from one and a-half to three quarters of a mile, pointing for a similar mass at Downey's rapids at the eastern end of Hog Lake. On the seventh range it is seen to pass under an outlying patch of Silurian limestone about the eighth and ninth lots, and is lost sight of. Several very extensive beds of magnetic iron ore, and deposits of red hematite occur in the immediate vicinity of this syenitic mass in Madoc and Marmora, such as the Seymour, McCallum and Marsh beds, which will be referred to further on in Division B, to which they belong.

On the outskirts of the area just described, and at its junction with the overlying rocks, there occurs in many places a breccia with a granitic or feldspathic base, inclosing fragments of gneiss and greenstone or diorite,

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with magnetite, as seen a short distance south of Powell's saw-mill on the river Moira, about the fourteenth lot of the tenth range of Marmora. Another similarly brecciated, but much more strongly marked mass, in some parts containing rounded fragments, crosses the Hastings road about three miles north of Madoc village, running in a south-easterly direction down the sixth and part of the seventh ranges, striking with and immediately adjoining the Seymour iron-ore bed, and forming high and broken ridges of a pale red color. The enclosed fragments are greenstone, felsite, gneiss, and translucent quartz, varying in diameter from less than one inch to eight or nine inches.

Granitic
breccia.

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In the north-west quarter of Madoc, between the village of Bannockburn and the northeast corner of Marmora these red syenitic rocks are seen forming several connected parallel high ridges, called the Red Hills, running northeast and southwest through the influence of the undulations, whose axes bear in that direction. Here they are associated with albitic granite, the feldspar being of a pale gray, mixed more or less with translucent quartz and a considerable quantity of black or brownish mica in comparatively large scales.

Red Hills,
Madoc.

High barren hills of red syenite, known as the Red Mountains, are next seen in the northwest quarter of Lako township, stretching from Tongamongue Lake northeastward to Clear Lake, which is situated on the twenty-sixth and twenty-seventh lots in the eighth range of the township, the distance across being about four miles and a-half. Northeastward these hills pass a little beyond the town line of Wollaston.

Red Mountains,
Lake.

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In Methuen township, at the western end of Trout Lake, about two miles westward of the mass last described, another north-east anticlinal bringing the syenitic rocks to the surface, extends from the neighbourhood of Kah-sey-bah-gah-mog Lake, which lies between the sixth and eleventh lots of the seventh and eighth concessions of Methuen, northeastward into the south-west quarter of Wollaston, forming an area commonly known as the Pine Plains, and occupying the country for a breadth of nearly six miles, from the twentieth and twenty-first lots of the first range of this township northwestward to South Bay on Loon Lake in Chandos.

Pine Plains,
Methuen.

North-westward again similar rocks were seen crossing the Burleigh road into Anstruther, but here they have not yet been traced. On Stony Lake, between the townships of Dummer and Burleigh, similar red syenitic rocks are seen, forming apparently the crown of a north-east and south-west anticlinal. This locality has been alluded to by Mr. Murray in his Report of 1852-53, and the syenitic rocks here may be a continuation of those of Kah-sey-bah-gah-mog Lake, but the relation has yet to be made out.

These successive parallel syenitic ridges between Madoc and the Bur-

Transverse
anticlinals.

Higher rocks
of A.

leigh road in Anstruther would appear to be brought to the surface on a north-west transverse line of elevation. A second transverse axis starts from Elzevir, and, diverging from the line already described, runs somewhat westward of north through Grimsthorpe, Cashel, Dungannon, Monteagle and Herschel townships, crossing a continuation of the same north-east anticlinals as before. On this second axis of elevation, which probably brings up the whole of the rocks of division A, the following were some of the varieties observed :

1. Coarse grained rock composed of flesh-red feldspar and translucent colorless quartz, the latter often in rudely parallel layers.
2. Coarse feldspathic masses, weathering to an opaque white, the constituents being white feldspar, translucent quartz and black mica in partially continuous layers, often determining the cleavage of the rock, which would be well suited for a durable building material.
3. Dark green hornblendic rock containing a considerable proportion of disseminated grains and crystals of magnetic iron ore, and probably belonging to the base of the next division (B).

The rocks on this second line of elevation have, as yet, been but little examined. In an area extending from the neighbourhood of Queensboro, on the one hand, to Mazin's Lake in Barrie, on the other, and transversely from the vicinity of Flinton in Kaladar to the north-west corner of Grimsthorpe, they appear to be very largely developed ; and it is probable that they will be kept at the surface in parallel ridges over four north-east and south-west anticlinals. It is conjectured that they will occupy the western half of Anglesea and the rough and unsurveyed township of Effingham. Their detailed distribution through Cashel, Limerick, Dungannon and Mayo has yet to be determined ; but on the Hastings road cliffs of similar rock were seen crossing it about a mile north of the York Branch of the Madawaska river in Dungannon, and rocks of the same description were traced as far as lots nine and ten in Herschel, where

Eagle-nest cliff.

they form part of a ridge known as Eagle-nest cliff, presenting a perpendicular face of over 200 feet. The rocks on this second line of elevation, seem, through Dungannon, Herschel, and farther north-westward, to form the watershed between the tributaries of the Ottawa and those of the St. Lawrence. The areas underlaid by them, as well as by those of the more south-western line, present a rough barren country, little suited for cultivation, being covered by a light sandy and often shallow soil, supporting pine, hemlock and occasionally beeches, the latter usually occupying sandy ridges.

Crystalline
limestone, A 4.

Bands of red granitic and gray hornblendic gneiss are seen associated with an extensive exposure of crystalline limestone, at the village of Bridgewater in Elzevir, where they have been alluded to by Mr. Macfarlane

in his Report for 1866. They become almost immediately covered up on the south by the main body of the unconformable Lower Silurian limestone, and their relative position in this direction could not be made out.

The rocks of sub-divisions A 2, A 3 and A 4, runs northward on the eastern side of A 1 along the second line of elevation, through the adjoining townships of Elzevir and Madoc, and those of Tudor and Grimsthorpe; in the latter two townships, however, they are only sparingly represented, and again proceeding northwestward at right angles to the northeast and southwest axes, in an area extending in breadth from the southeast quarter of Madoc to the northwest quarter of Lake, and in length from Belmont Lake to the southeast quarter of Wollaston are almost entirely wanting; their position being apparently occupied by the rocks of the second division, (B) next to be described. Further to the northwest, from the northwest quarter of Lake to the Burleigh road, as far as the country has been examined on each side, A 2, A 3 and A 4 assume once more an important character.

Starting from Round Lake in the seventh concession of Belmont, an important band of crystalline limestone (A 4) has been traced continuously northeastward across the lots to a position between Deer Lake and Lost Lake, where it turns northwestward to the thirty-first and thirty-second lots of the sixth range. It here covers a considerable area, and very much resembles the white crystalline limestones of Bridgewater in Elzevir. On the thirty-second lot an excavation on this band is known as Jones's marble quarry, from which specimens of marble were sent to the Paris Exhibition in 1855. From this the band has been traced northeastward across the southeast quarter of Methuen into Lake, as far as the fifteenth and sixteenth lots of the third concession. It then runs across the sixteenth, seventeenth, eighteenth and nineteenth lots of the second concession, into Trout Lake, but its farther distribution is not yet ascertained.

DIVISION B.

The hornblendic and pyroxenic rocks of this division, both massive and schistose, are for the most part distributed through the counties of Hastings and Addington. They are here seen to rest immediately upon the gneisses of A 2 and A 3, but whether conformably or not is a question yet to be investigated, as in the localities where they are best represented, the massive diorites and greenstones, which form the base of this division, do not offer any clear marks of stratification.

The rocks of B are very largely represented on the second line of transverse elevation, between the townships of Madoc and Elzevir, where

they have been described in some detail by Mr. Macfarlane in his report on Hastings in 1866.

They are here much intersected by veins of a milky-white quartz, containing sulphurets of copper, and in some instances, as at the Barry mine in Elzevir, range II lot 5, native gold. From Elzevir, they trend northward on the western border of A, and again are seen covering a large part of Tudor and Grimsthorpe townships. To the northward on this line they are but sparingly represented. From Tudor they run westward into Lake, and are there very largely exposed along the first line of elevation of division A, and are often characterized by the presence of important beds of magnetic iron ore, forming a ferriferous zone. Northwestward from the township of Lake towards the Burleigh road, on this line of elevation, they gradually diminish and are lost sight of, but stretch southeastward on the same line into the township of Madoc, where, however, the ferriferous band is almost their only representative.

The deposits of iron ore in Madoc, Marmora and Belmont, which occur in the ferriferous band at the base of the greenish hornblendic and pyroxenic rocks, have been alluded to in several of the early annual reports of the survey; they have also been noticed in the General Report on the Geology of Canada for 1863, pp. 675 and 676, and again in greater detail in Mr. Macfarlane's Report for 1866. In these various Reports, however, they have been described as separate local deposits, a sufficient number of facts not having then been accumulated to unite them in one continuous horizon. But having during the last three seasons, in accordance with your instructions, examined them more in detail, with relation to the rocks in which they are enclosed, I have been able to satisfy myself that, with one or two unimportant exceptions, nearly all the deposits of magnetic oxyd in the district will be found in the present division, being sometimes its only representative. As the deposits of iron ore already known in this zone are of economic importance, and as other yet undiscovered masses of a similar character may exist, I shall, with a view of aiding the search for them, here give a somewhat minute description of the course in which it appears to me they will be found to run.

The Seymour ore-bed is situated on the eleventh lot of the fifth range of Madoc, where the associated hornblendic and pyroxenic rocks, and certain ehlritic slates there occurring, are well displayed. Their course from this lot is about S. 65 E. (mag.), and passing through the tenth and ninth lots of the sixth range, and the eighth and seventh of the seventh range, along which course the ore is almost continuous, it becomes partially covered up by the unconformable Lower Silurian limestone; but turning over the axis of an anticlinal, it can be traced curving through the seventh, eighth and ninth lots, and part of the tenth in the eighth

range, whence it strikes N. 65—70 W. (mag.) through the tenth, eleventh and twelfth of the seventh range, and thence through the thirteenth, fourteenth and fifteenth of the fifth range. On the last named lot a deposit of magnetite occurs, perhaps next in importance only to the Seymour bed, and it is worthy of note that its place here is exactly opposite to this bed, and on the other side of the anticlinal mentioned, on the crown of which occurs a coarse red syenitic rock, (A 1) which has before been referred to.

From the seventeenth lot of the fifth range the course of the iron-bearing rocks gradually tends westerly, and would appear to pass through the seventeenth and eighteenth lots of the fourth range, the eighteenth of the third, and the eighteenth and nineteenth of the second and first ranges. On these last named lots in the first range the ore is probably again in considerable quantity, but the traces of it occur only in loose masses in the soil, the ore in place being apparently at a considerable depth beneath the surface.

From these lots the belt runs into the township of Marmora, and, changing its direction, trends southward, keeping almost immediately to the east of the Moira River, the course of which might almost be said to denote its farther run through this township. On the nineteenth and eighteenth lots of the eleventh range this iron zone is represented by rust-stained slates, holding some considerable beds of yellow sulphuret of iron with traces of magnetic iron ore, and here it is closely associated with a large mass of coarse white granular limestone. Thence it runs southward through the tenth, ninth and eighth lots of the ninth range, where the McCullum iron-ore bed, mentioned in an early report, is situated; while farther southward its course is indicated on the sixth and seventh lots of the eighth range, by the occurrence of the Marsb ore-bed.

A short distance beyond these last lots, the ferriferous belt must run under the main body of the Silurian limestone lying to the south and to the east, where it is lost sight of. But while thus covered it appears to change its course, and bearing westward, emerges at Marmora village, where the green hornblende and epidotic rocks are marked by traces of magnetic iron ore, and hold veins of red hematite. These rocks are seen running into Crow Lake, under the waters of which, and under the adjoining unconformable overlying horizontal Lower Silurian limestones, the greater part of the strata of this division are concealed. The north shore of the lake, however, gives evidence of the course of the belt, in the Kean ore-bed, which occurs on the thirteenth lot of the third range of Marmora, and in an exposure protruding through the Silurian limestone on the sixth lot of the first range of this township. The Big ore-bed; on the south shore and western extremity of the lake, in Belmont, belongs to the same belt, and is probably brought up on a third line of elevation to the westward.

Belmont.

Northeastward through Belmont no very large exposures of the ore have yet been observed; but deposits may still be found between Crow and Belmont Lakes, along the western shore of the latter, and up the valley of the Crow River, as well as on Deer Lake, about the twenty-fifth, the twenty-sixth and twenty-seventh lots of the second and third ranges. The exposure at Allan's mills, on the twenty-fifth lot of the twelfth concession of Seymour, noted by Mr. Murray in his Report for 1852-53, has probably some relation to the turn which occurs in the course of the belt in Belmont Lake, but whether united by a continuous out-crop, or separated on the opposite side of an anticlinal form, the overlying Silurian limestone prevents us from deciding.

Madoe.

Returning to the Seymour bed in Madoe, with the view of tracing this belt eastward, we find very few deposits of the ore of any extent. On the twelfth lot of the fourth range we have a small bed of magnetic iron ore, and again on the sixth lot of the third range, beyond which, southward, the belt runs under the Silurian. At the eastern end of Hog Lake, on the Moira River at Downey's rapids, magnetic iron ore is again met with, and finally in Elzevir, on the third lot of the fifth concession, where it occurs in a bed from two to three feet thick enclosed in a stoeatitic material, as mentioned by Mr. Macfarlane in the Report of 1866.

Elzevir.

Where the rocks of division B are brought up in the northwest quarter of Madoe, magnetic iron ore has been found on the twenty-fifth lot of the sixth range of Madoe, where a small bed occurs, dipping to the northeast at an angle of from forty to forty-five degrees. The only other locality is in the extension of the belt farther north, on the fifty-fifth lot, on the west side of the Hastings road, in Tudor, where it is associated with gneiss and granular limestone. (A 3 and A 4). This last locality has not been mentioned in any of the previous published annual reports, but samples of the ore were sent by you to the London Industrial Exhibition of 1862. The ore would appear to be of excellent quality, although more or less mixed with graphite. The breadth of this bed could not be determined, owing to the wood-covered condition of the country, but from the large masses of ore scattered about in the vicinity there is little doubt that it occurs in abundance.

Tudor.

It is probable that other beds of this ore will yet be found along the course of the rocks B, whose distribution has thus far been partially pointed out, and will be farther understood from the description to be given of the distribution of the next overlying division (C), at the base of which this ferri-ferous belt occurs. Rocks similar to B were again seen largely developed in the vicinity of Flinton, in Kaladar township, where they are on the eastern border of the second transverse line of elevation, which brings up division A. They here stretch with an apparent thickness

Kaladar.

of 3000 feet, northeastward along the Addington road, between Barrie and Anglesea, to Mazinaw Lake in the former township. Along the line they are intersected by numerous reticulating veins of a pistachio-green epidote, which divide the mass into rhomboidal forms, and altogether bear a strong likeness to the description given in the *Geology of Canada*, of similar diorites and slates in the Huronian system. In Addington they are also followed by a green slaty conglomerate, which at present is supposed to belong to the base of the next and highest division.

Epidotic
diorites.

DIVISION C.

The limestones, mica-schists and calc-schists of this division are spread in a very irregular manner over the country examined. As stated on page 146, they may be said to form two series of troughs running north-east and southwest, more or less connected with each other at their sides by two transverse depressions of the strata, and separated in the middle by a transverse elevation.

Upper division.

The number of these synclinal forms is five, with an average breadth of between four or five miles each. The most southeastern one is so obscured by the interference of the overlying unconformable Lower Silurian limestone that little more can be said of it than that its axis may be considered to occur somewhere near Queensboro', in the southeast quarter of Madoc. The axis of the second synclinal runs through the southwest and northeast corners of Marmora, and through the northwest quarter of Grimsthorpe. In this form the upper division has a length of about twenty-four miles from Crow Lake northeastward, and is divided into two parts of nearly equal length, which are separated from one another about a mile and a-half at the northwestern extremity of the Red Hills. The axis of the third would pass through the united corners of Belmont and Lake and the centre of Cashel. In it the upper division stretches for about thirty miles northeast from Belmont Lake, and is separated, as in the last, into two nearly equal portions about a mile and a-half apart on Beaver Creek, about two miles below the bridge on the Hastings road. This synclinal is affected by minor northeast undulations, sufficiently prominent to divide it longitudinally into several subordinate forms. The fourth axis runs through the adjoining corners of Methuen and Wollaston, and across the middle of the south line of Langannon. In it the rocks of the upper division have an extent of fifteen miles southwestward to Eagle Lake, where the summit of the underlying division B appears, but what separation there may be between this and a basin on the same axis farther to the southwest, has not been clearly made out. The axis of the fifth

Five synclinals.

Second basin.

Third basin.

Fourth basin.

Fifth basin.

synclinal runs through the adjoining corners of Burleigh and Chandos, and those of Dungannon and Carlow. The rocks of the upper division in this extend from the York Branch of the Madawaska River, for about thirty miles to the south-western end of Loon Lake in Chandos. This form is, like all the others, probably divided into two parts by the out-crop of rocks of the lower divisions (A and B) somewhere in the northwest quarter of Wollaston.

The different rock masses which fill these troughs, have already been given in the general section, and I shall now proceed to give some few local details in regard to their distribution, beginning with the lowest, (C 1).

Limestones, C 1.

of crystalline limestone, associated with dolomite. A white crystalline limestone of this horizon is very largely represented in the first synclinal in Elzevir, at the village of Bridgewater, and it has there been quarried for building purposes and used in Belleville. Westward from this the same band covers a large part of the fourteenth lot of the fourteenth range of Huntingdon, on the shore of Hog Lake, where it has been worked, and would appear suitable for constructions. It is, however, on this lot much more interstratified with white quartz, tremolite, and an impure talc-slate, all of them in thin layers, and it holds a bed of translucent quartz five feet thick. The layers of tremolite weather out in relief from the surface of the limestone and give a ribanded appearance to the rock. On this lot, near the shore of the lake, where is a considerable exposure of pale flesh-red somewhat magnetic limestone, weathering to a yellowish-drab, together with a brown-weathering dolomite cut by minute seams of magnetic oxyd of iron, which weather out into sharp edges on the surface. The flesh-red limestone, being of a compact texture, appears well suited for ornamental purposes; but both it and the dolomite are more or less micaceous, and often much interstratified with greenish dioritic slates. From this lot these bands run into Hog Lake, but are again seen about the middle of it, forming a large part of the Bridge Island.

Dolomites.

Immediately to the east of the village of Madoc, bluish and bluish-gray banded crystalline limestone belonging to this horizon (C 1) adjoins a drab or brownish-yellow dolomite. The limestone is more micaceous than in the previous locality, and the mica, being in continuous layers, at irregular distances through the mass, in most instances indicates the bedding of the rock. This limestone has been worked and used in Belleville, but does not furnish a very good building stone.

On the seventeenth lot of the sixth concession of Madoc, at and around the Desperado mine, in the vicinity of El Dorado, a beautiful compact pale flesh-red very silicious dolomite occurs, and extends east and west into the neighboring lots. On the eighteenth lot of the fifth range, on which

is situated the Richardson gold mine, the dolomite forms prominent ridges much interstratified with silicious slates.

On the line between the first and second synclinal, in the twenty-fifth and twenty-sixth lots of the sixth and seventh ranges, is a limestone of a bluish-white, which would appear well suited for building purposes; but no openings have yet been made on it in this locality.

Yellowish-drab dolomites of a compact texture are seen on the east side of the Hastings road, in the twenty-second, twenty-third and twenty-fourth lots of the sixth range of Madoc, whence they strike in a northwesterly direction into the township of Lake.

On the road running between the seventh and eight ranges of Madoc, in the fourteenth and fifteenth lots, ridges of a beautiful pinkish-white dolomite occur. It is of a rather compact texture, and appears to be very silicious, yielding much fine white sand in weathering. Veins of white translucent quartz cut this mass in many directions, holding occasional traces of copper pyrites.

On the south-east side of the second synclinal, on the sixteenth lot of the eleventh range of Marmora, and extending into Madoc, there occurs a large area of white granular limestone which, when examined in 1866, was being quarried by a marble-cutter named Feigel. This marble seemed to work well, judging from the finished samples shewn me, and might be used for ornamental purposes. In accordance with your instructions samples of this stone were prepared and forwarded to the Paris Exhibition of 1867.

In the third synclinal, at the south-western end of the north-eastern portion, a very fine grained white limestone was met with on the fifty-fifth lot, west side of the Hastings road, in Tudor, immediately adjoining the magnetic iron ore alluded to when describing the distribution of the ferri-ferous belt.

Overlying the limestones and dolomites (C 1) of this part of the upper division there occurs a series of mica-slates (C 2) grayish and sometimes greenish in color. Lighter and darker shades among these appear to be due to varying proportions of mica and in some cases of hornblende.

The limestones and dolomites (C 1) appear to be wanting in some places, and in this case the mica-slates (C 2) rest upon the rocks of division B. It is then also somewhat difficult to define the line of separation between the two, particularly when the micaslates assume a greenish color, and the limit has, in such cases, to be somewhat arbitrarily assumed.

The mica-slates of sub-divisions C 2 and C 3, are extensively developed in the south-eastern side of the first or Madoc synclinal, where they have been described, together with the rocks of division B, by Mr. Macfarlane

Mica-slates.

in his Report for 1866. From Madoc they pass into the second synclinal, and in it are seen along the southern half of the eastern side of Tudor, and the western of Grimsthorpe.

Bannockburn.

In their course along the north-west side of the synclinal, these slates are seen through the eastern portion of Lake, and southward to Bannockburn village, in Madoc township, in which last locality the rusty-weathering quartzites of the following sub-division, C 4, make their appearance, and together with the rusty mica-slates of C 3 predominate, almost to the exclusion of C 2. From thence they were traced southward, as far as Keller's bridge over the Moira river, on the Hastings road, where they were overlaid by a patch of the Lower Silurian limestones.

In Marmora, in the southern portion of this second synclinal, the slates of C 2 and C 3 are seen covering a considerable area on its north-western side, from the north-east quarter of that township to the foot or southern extremity of Belmont lake, in Belmont township; and thence along the south-eastern side of the same synclinal through Crow lake, in Marmora, beyond which they are concealed by the overlying Lower Silurian limestones.

In the third synclinal, namely that passing through Belmont and Lake townships, these slates are very largely represented in its southern part; they are seen along its north-western side through the south-east quarter of Methuen and the southwest of Lake, and form prominent ridges near the bridge over Deer river, in the twelfth and thirteenth lots of the third range of Lake township. In the last locality they strike nearly north, with a dip to the eastward of somewhat less than thirty degrees, and are here seen to rest upon the gneisses of division A.

Further on in their course, these slates reach Burnt lake, which occupies the seventeenth and eighteenth lots of the seventh, and the greater parts of the same numbered lots of the sixth range, where islands composed of these slates mark the run of the band through the lake, and belong to the northern extremity of the southern portion of the third synclinal.

At the south-western end of the northern portion of the same synclinal, slates of divisions C 2 and C 3 are seen to spread over a considerable area in the vicinity of Dickey and Clear lakes, where the prevailing color of the rocks is gray. On the southeastern side of this part of the synclinal, these slates from the chief rock on the east side of Wadsworth lake, situated in the north-east corner of Tudor, whence they run into Cashel, with a steep dip to the north-west. On the north-western side of this third synclinal these slates of divisions C 2 and C 3 are but sparingly represented, and continue to be so in the two remaining synclinals to the north-westward.

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of O'Hara and McKenzie, lots three, four and five of the fifth range, the slates of C 2 are bluish, fine grained, and somewhat argillaceous, but with a cleavage however parallel with the stratification. These have been somewhat extensively quarried, and cut for whetstones, and are referred to in the *Geology of Canada*, pp. 66, 809. Further specimens of these slates were procured by myself during 1866, samples of which, cut and prepared in Montreal by an experienced person, were pronounced to be very suitable for whetstones. This variety has not yet been met with in any of the other synclinals to the northward.

Whetstones.

In different parts of the vertical thickness of the slates of C 2 and C 3, and in many places in their distribution, occur three different descriptions of conglomerate, all of which are seen on the lots just mentioned, where they occur in the following order, ascending:

- I. A dolomite much interstratified with dark silicious mica-slates, both often holding large and well-rounded masses of quartz and syenite, which vary in diameter from one to twelve inches. Conglomerates.
- II. A black and very silicious slate holding large boulders of gneiss and syenite, and forming smooth rounded dome-like ridges.
- III. A grayish and sometimes greenish mica-slate, having small flat oval pebbles of vitreous quartz lying on their sides in the planes of bedding.

It may be remarked that while the last conglomerate is the highest in the series, it is also the most continuous of the three; the other two coarser conglomerates appear to occur in lenticular patches of a more local character. At the village of Bridgewater conglomerate layers abound in a band of mica-schist 120 feet thick, having a streaked surface from the alternation of grayish and reddish layers. The enclosed pebbles are of red and white quartz, occurring in parallel beds from two inches to five feet in thickness, which are separated by mica-schist layers holding only a few scattered pebbles.

Westward from this a similar band of conglomerate is seen on the north side of the road leading from Bridgewater to Madoc, on the third lot of the eighth and ninth ranges of Elzevir, which appears to me to be a continuation of that of Bridgewater. Here, however, it is associated with one of the coarser conglomerate bands (II) rising in large rounded ridges from the field. The matrix appears to be chiefly a black silicious slate, and it is more or less charged with well-rounded fragments of quartz and syenite. Adjoining this, but below it, there occurs a conglomerate with a schistose dolomitic matrix, the pebbles themselves sometimes being of dolomite, interstratified with similar black silicious slates. In some places the rounded fragments once enclosed have been removed from the exterior, giving to the surface of the mass a pitted and cellular appearance. Where these rounded masses are enclosed in the greatest abundance they lie in

the form of parallel beds or lenticular patches, the portion between these beds holding only a few scattered pebbles.

These conglomerates in the first synclinal are lost sight of for some distance under the horizontal Silurian limestones, but are again seen immediately to the north of the village of Madoc, forming a conglomerate ridge described in the *Geology of Canada*, p. 32. The matrix of this is a mica-slate more or less charged with grains of a dark green steatitic mineral. The enclosed fragments are in general rather angular, and of white and black colors. Similar conglomerates occur on the third, fourth and fifth lots of the fifth range of Madoc, where they are on the north-western side of the first or Madoc synclinal.

In the third synclinal, on the north-west side, conglomerates are seen associated with slates, and forming several islands, running with the strike, on Belmont Lake, where they have already been described in Mr. Murray's Report for 1852-3. They dip to the east or south of east, and are similar in character to those above mentioned.

The lower members of the upper division, thus far described, (C 1, C 2 and C 3) constitute in their distribution, the rim of the two sets of troughs into which the five synclinals of the district have been divided. The centres of these troughs are filled with the calcareous and quartzose beds which correspond to the higher members of the upper division. Later observations make it probable that the thickness of 1900 feet assigned in Madoc to the quartzites C 4, is an exaggeration, since in the second and third synclinals these quartzites are much less conspicuous, and cannot be distinguished from certain quartzose beds which appear to be interstratified with the calcareous strata of C 5. This subdivision presents many varieties of rock, some of which are repeated several times in the vertical thickness. The strata, however, are corrugated by numerous minor undulations, which often give repetitions of the variety of a special horizon, on a given line of section. It hence becomes impossible to give the sequence of these varieties, which I shall therefore describe in the order of their importance as seen in the township of Tudor, where they are as follows:—

Division C 5.

Varieties of
C 5.

1. Gray micaceous limestones or calcareous mica schists, somewhat plumbeous, with *Eozoon Canadense*.
2. White and bluish-gray compact limestone, slightly siliceous.
3. Grayish quartzite weathering to whitish and yellowish-brown, and showing these colors in alternate bands on weathered surfaces.
4. Gray impure sandy limestones with a pitted weather-worn surface, streaked and spotted with ferruginous stains.
5. Gray impure limestone, similar to the last, but in addition holding radiating concretionary forms of a greenish-black hornblende, the latter weathering out in rusty sub-globular masses, which are scattered irregularly through the rock, and vary in size from one quarter of an inch to one inch in diameter. This band seldom exceeds six feet in thickness.
6. Small interstratified bands of diorite or diabase, chiefly seen towards the base of the sub-division C 5.

Their distribution has been sufficiently pointed out in describing the slates C 2 and C 3, which, as before stated, form the rim of the troughs occupied by the higher rocks. It should be mentioned, however, that in passing north-ward from the second to the fifth synclinal, in Hastings, the slates and limestones of the subdivisions C 2—C 5, gradually diminish in amount, and only the beds of C 1 are observed in the fifth synclinal.

The schistose and plumbaginous limestones of C 5 are characterized by the occurrence of the fossil rhizopod described by Dr. Dawson under the name *Eozoon Canadense*. Unlike the specimens of this fossil found in the crystalline Laurentian limestones at several localities on the Ottawa, in which the calcareous skeleton is generally filled with serpentine or some related silicated mineral, the *Eozoon* from this region is imbedded in an impure earthy dark gray limestone, with which and with carbonaceous matter, the cavities in the white calcareous skeleton are filled. Fragments of *Eozoon* from this sub-division, were first detected by Dr. Dawson from an unknown locality in Madoc, but numerous specimens of the fossil have since been found on the fifteenth lot of the range east of the Hastings road, in Tudor. The specimens from this region like those from the Calumet on the Ottawa, are small isolated imbedded masses, unconnected apparently with any continuous reef such as exists at Grenville and the Petite Nation.

Eozoon Canadense.

Specimens of the *Eozoon* from Tudor and Madoc have been described and figured in a series of papers read before the Geological Society of London, by yourself and Drs. Dawson and Carpenter; published in the *Quar. Jour. Geol. Society* of London, for August, 1867, and reprinted in the *Canadian Naturalist*, vol. iii, No. 4.

In conclusion, I would state that, with a view of determining the further spread of the rocks of division C, explorations were carried on northward from the York branch of the Madawaska river, between the townships of Montegale and Herschel, as far as the Peterson road; thence eastward along that road through Wicklow, Bangor, Radcliffe and Brudenel, to the Opeonga road; and south-eastward through Sebastopol and Grattan to Renfrew village on the Bonnechère river, but without discovering a repetition of these higher rocks. The whole tract of country thus explored is composed of rocks similar to those of division A of the general section.

LOWER SILURIAN LIMESTONES.

To the north of the great area of Lower Silurian limestones of the Trenton group, whose limit was described by Mr. Murray in his Report for 1852-3, we find isolated, or island-like patches of these limestones for

Silurian limestones.

some distance northward in the townships of Madoc and Marmora, and often separated by some miles of country occupied by the older rocks. One of these patches of limestone, about one mile in length by one-half in breadth, occurs as far north as lots five, six and seven on the line between the townships of Lake and Methuen, ten miles distant from the boundary of the main Silurian area, where it forms a tract of good land known as the Van Senkler settlement.

Through Madoc and Marmora there occur similar but more extensive areas of these limestones, which are shown on the map accompanying the present Report, and were described by Mr. Murray in his Report already cited. These Silurian islands almost invariably present a precipitous front to the north, the strata dipping at a very slight angle southward, and gradually becoming covered by a deep soil, their ruins stretching far beyond the limit of the limestones themselves, and forming rich and fertile areas. Throughout Madoc the chief settlements are in the vicinity of these limestone islands, and are often separated from one another by tracts of land, barren and unfit for cultivation.

Where these limestone have been denuded, their surface is seen covered by numerous grooves or markings, the general trend of which is from 3° to 6° east of north, the same strike being also observed in grooves upon an exposure of red syenite crossing the Hastings road to the north of the village of Madoc.

ECONOMIC MINERALS.

The economic minerals of the district under examination, as known up to 1866, were the ores of iron, lead, copper and antimony, with whetstones, lithographic stone, building stones and limestones, to which are now to be added ores of bismuth and silver, and also native gold.

Magnetic iron ore.

Magnetic and Hematitic iron ores.—The ores of iron, both magnetic and hematitic, occurring in Hastings county have been mentioned in several of the Annual Reports, as well as in the Geology of Canada, and having been one of the special subjects of Mr. Macfarlane's Report so recently as 1866, I have little to add to what has heretofore been said about them.* The distribution of the ferriferous band, in which all the magnetic ores are contained, is no doubt a matter of economic value, but this, as far as I have been able to trace it, has been given in that part of the Report which is devoted to geological structure, page 150. All that I have to state therefore

* In giving the localities of iron ores in that report the two following typographical errors occur: page 100, 9th line from the bottom, "the ninth lot of range six," should be "the sixth lot of range nine;" page 102, 16th line from the bottom, "Madoc" should be "Marmora."

will be little more than a few facts respecting new openings in the Big ore bed of magnetic oxyd on Crow Lake.

Although the lower part of this ore bed had been previously tried, little of Belmont. that part had been excavated. In 1867 a company, composed of gentlemen from the United States, was established for the purpose of working ore from the bed, with a view to its being smelted. After trials of several parts of the band that near the base was found to be of suitable purity, and during that year 300 men were employed in mining and sorting the ore, of which, towards the end of the season, 150 tons a-day were being carried away from the locality by rail, and shipped at Colabourg. A few hundred yards south-east from the main work another excavation was made upon what is called the Sand-pit bed, supposed to be still in the band, from which a purer ore was obtained. The ore from both excavations was sorted into three qualities, of which Nos. 1 and 2 were selected for exportation, while No. 3 was left on the ground for futuro disposal.

In Mr. Macfarlane's Report for 1866 mention is made of the specular ore of iron occurring on the second lot of the fourth range of Elzevir. This deposit was opened during my stay in Bridgewater in 1867, but the ore was not found to exist in remunerative quantity. Mr. Macfarlane makes mention of the occurrence of hematite in a ploughed field, in and around Hematite. a depression on the east half of the twelfth lot of the fifth range of Madoc, Madoc. where the appearances were such that, although assured no mining had been done there within the memory of the oldest inhabitant, he could not resist thinking that the depression was all that remained of an open work from which much ore had possibly been raised and removed. This lot, I understand, is the property of Messrs. T. C. Wallbridge & Brothers; but Mr. D. L. Cumming informed me that the lot was cleared of its timber by him in 1831, when there were but thirty families in the township. He assured me also that the depression existed then as it does now, while the trees of the forest were still growing in and around it; that he was the first person to see and report the occurrence of this apparently rich deposit of hematite, and that since then eight tons extracted by him, and sent to Three Rivers to be smelted, was the whole quantity of the ore that had been removed from the place.

The ore appears to occur in loose masses, ranging in weight from one to a hundred pounds, and there seem to be no boulders of other rocks mingled with them. I was informed, however, that a large pair of antlers of some species of deer had been found imbedded in the ferruginous soil. Not only this but other deposits of hematite in Madoc and the neighboring township appear to occur in depressions in the gneiss, filled with loose masses of the ore, the geological horizon of which seems as yet to be very uncertain.

Veins of specular hematitic ore are found cutting the chloritic slates of

the feriferous belt, as along the west side of Belmont Lake, and more particularly on the eighth lot of the fifth concession of Belmont township. The ore in these veins, however, is but of minor importance.

Galena.

Galena.—Most of the localities known as affording galena have been noticed in Mr. Macfarlane's Report for 1866, but during my explorations in Tudor, having visited all the lead-bearing lodes, openings were found to have been made in some of which the localities only had been previously indicated, and one or two were in a better condition for inspection than at the time of Mr. Macfarlane's visit.

Tudor.

One of these, on the twenty-eighth lot of range B in Tudor is a vertical vein running N. 70° W*, the strata of calc-schist dipping $274^{\circ} > 76^{\circ}$. At the time of Mr. Macfarlane's visit a shaft, which had been sunk on it to the depth of thirty-seven feet, was half full of water, preventing him from doing more than to state the information he had received from others. In 1867, I found that the lode, of which the veinstone is barytes and calc-spar, had yielded on the average three quarters of an inch of galena; but the bottom of the shaft showed no more than half an inch of barytes, without galena. I was informed by Mr. W. Kesternan, of Belleville, then superintending the mine, that there had been extracted from the vein about six tons of galena, four and a-quarter tons of which were sent to New York for sale, after being simply crushed, and found to yield 66 per cent of lead.

On the thirty-first and thirty-second lots of the range east of the Hastings road, in Tudor, a lead-bearing vein runs in a vertical attitude N. 57° W., cutting the gray calc-schists with strike N. E. E. In 1867 it had been traced, in the direction given, across both the lots mentioned, with very good surface indications, and was known as the Murphy mine. The Hastings Lead-mining Company subsequently sunk a shaft on it, which, I understand, has been carried down to a depth of 125 feet, but the result being unsatisfactory, the work was abandoned.

On the twenty-eighth and twenty-ninth lots of the fourteenth range of Tudor there is a vein of red and white heavy-spar, holding galena, and cutting the gray calc-schists. Its bearing is N. 5° E., and it stands in a vertical attitude, while the enclosing rock, also vertical, strikes almost due north and south. It was discovered some eight years ago, and was first opened in 1859. In 1867 the mine was leased by Messrs. Lombard & Co., of Boston, who were working it at the time of my exploration in Tudor, and I had an opportunity of examining the shaft when free from water. The walls were regular and well defined, the width between them being in some parts from eighteen inches to two feet, and the ore appeared in scattered and irregular bunches in the gangue. When first opened this

* The bearings in these descriptions are magnetic, the variation at Madoc being 5° West.

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vein yielded some large masses of ore, but, as in a previously mentioned instance, they greatly diminished, descending, and at the bottom of the shaft, which was twenty-five feet deep, there was scarcely any ore. In 1868, at the depth of forty-two feet, the mine was abandoned. It may be remarked that many of these veins in Tudor, yielding considerable bunches of ore near the surface, shew little more than traces of galena at the depth of a few feet. Of twenty-five localities in Tudor in which galena was discovered and partially worked, but one, the Murphy mine, continued to be worked in 1868.

The west half of the tenth lot of the eleventh range of Lake is another Lake. of the localities mentioned by Mr. Macfarlane. On this lot, which was some time since bought by Messrs. Gillum & Kesterman of Belleville, occurs the Donahue vein, striking N. 50° W., and standing in a vertical attitude. Little however has here been done, and although the lode has a width in some parts of from twenty to twenty-four inches, bounded by regular walls of gray calc-schist, the galena occurs only in scattered and irregular patches and inconsiderable quantity.

On the eighth lot of the eleventh range of Lake (or possibly in the tenth range) a vertical vein, holding galena in a gangue of heavy-spar, runs through the calc-schists in the direction N. 45°—50° W. The lode varies in thickness from ten to eighteen inches, and is bounded by well defined walls. Little had been done on this lot up to 1867, but in the short distance then uncovered, I saw extracted some masses of ore at the depth of three feet from the surface, which weighed from fifteen to forty pounds, and I was informed that when first discovered much larger masses had been taken from the vein. The lode is supposed to be on the property of Mr. Wm. Sweeny of Tudor, but in consequence of the defective manner in which the township has been surveyed there at present exists a dispute as to the ownership of the lot.

The lead-bearing veins just noted I believe to be the most important in Tudor and Lake, so far as examined. In these townships there appear to be two distinct sets of these veins: one of them running north-west, and the other north-east by north, those in the former direction being the more numerous. Where such veins cross one another there appears in general a fair show of ore at the surface, which, however, as in other cases, often diminishes at the depth of a few feet.

Two sets of
veins.

There occurs a north-west and south-east lode near the south-east corner of Methuen, where, in 1868, a shaft was being sunk by Messrs. Parker & Methuen. Baker. On this lode two or more shafts have been opened on the eastern edge of the second lot of the first range, close to the boundary line of Lake. The lode cuts gray vertical calc-schist, striking N. 20° E., and is composed of calspar and heavy spar, the former being of a rose or flesh-red color, in

which there is a good shew of galena. The average width of the lode is about eighteen inches, and it has been traced in a south-easterly direction for nearly three miles into Marmora.

Elzevir.

All of the lodes above mentioned, as well as all those noticed by Mr. Macfarlane in his Report of 1866, intersect the calc-schists (C 5); but it is not to be supposed that this is the only rock in which they occur, as it has been shewn that in parts of the country to the east, lead veins parallel to those of Hastings, and no doubt of the same system, cut not only the gneisses and crystalline limestones corresponding to division A (as for example the Frontenac mine described below,) but run up into the unconformable Lower Silurian, as far at least as the Calciferous formation. It is not surprising, therefore, to find on the eighteenth lot of the first range of Elzevir a lead-bearing lode running N. E., and intersecting the diorites of the middle division (B). The gangue of this lode consists of quartz, which, in a breadth of three feet, exposed in an opening which had been made, appeared to be much mixed with fragments of wall rock. The galena is scattered through the gangue in small, irregular but somewhat abundant bunches, in which the crystals are smaller than is usual in the lodes of other parts of the district. At the time of my visit, which was not long after the discovery of the lode, but a small quantity of ore had been taken out. On the authority of assays made by Dr. Girdwood of Montreal, and Mr. J. T. Bell of Belleville, the galena is said to hold a considerable but variable quantity of silver.

Loughborough.

Frontenac Lead Mine.—In connection with my examinations of the lead deposits of the Hastings region I visited the Frontenac mine in the rear of Kingston. The mine is situated on the south half of lot sixteen in the ninth concession of Loughborough. The rock of the country consists of grayish and reddish gneiss, interstratified with thick bands of crystalline limestone, all striking N. N. E. and S. S. W., and dipping to the westward at a high angle. The vein cuts these various bands at right angles, having a course about N. 75° W., or N. 70° W. (mag). The portion worked has a slight underlie to the north, at the surface, but becomes vertical at a depth of sixty feet in the main shaft.

Frontenac
Lead mine.

From this shaft an adit has been run about 400 feet west and 50 feet east. The average width of the vein appears to be about ten feet, although at the main shaft it varies from thirteen to nineteen feet. The veinstone, which consists of calcspar only, is arranged in bands, more or less coarsely crystalline, and sometimes of a purplish or lilac color. The only other minerals observed were very small quantities of iron and copper pyrites and blende. The galena is diffused in crystals and bunches throughout the whole vein, but appears to be most abundant towards the north wall. It

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also appeared to have a disposition to run in *shoots*, having a western slope of about 45°. Between one and two thousand tons of ore had been mined. This had been sampled and portions of it assayed mechanically by Dr. Dawson, Professor Chapman and others, the mean of whose results gave from 12 to 15 per cent. of galena. A crushing mill, with washing machinery, and a smelting furnace have been erected. A quantity of the undressed ore has been crushed in this mill, and about five per cent. of galena obtained from the whole, but the work appears to have been very imperfectly performed. The pig lead produced is of an excellent quality. Professor Chapman's assays shew that it contains an average of about four ounces of silver to the ton of galena.

The vein may be traced by a series of dry depressions in the surface, or sink-holes, almost continuously for a distance of one mile to the eastward, the breadth somewhat diminishing, but the vein has still the same characters, and is in some parts rich in galena. On the eighteenth lot in the eighth concession a second vein runs parallel to the first, at a distance of about one hundred yards to the north of it. This second vein appears to be from three to six feet in width, and shews galena wherever it has been opened. It carries also a little barytes, which has not been found in the main vein. Smaller parallel lead-bearing veins have been discovered on the adjoining lots to the north. The main vein is reported to have been met with (still carrying galena) on one of the lots west of that on which it is worked.

Gold.—In the early part of August, 1866, while exploring in the neighborhood of Bannockburn village, in the township of Madoc, I was informed that a metal, suspected to be gold, had just been taken from an opening in the eighteenth lot of the fifth range of the township, on the property of Mr. J. Richardson. A visit was at once made to the locality, and the lot was found to be the same as that on which openings had previously been made for copper ore, described in Mr. Macfarlane's Report of 1866, (p. 106.) Mr. Richardson informed me that a person named Powell, and an old Dutch miner, had lately found flakes of yellow metal resembling copper, which he could beat out into thin leaves. At my request he shewed me the specimens which he had collected, and I at once informed him that the metal was gold.

The opening from which it had been taken was on the east end of the lot, the copper veins being near the south-west corner; and in it an irregular layer of chloritic and epidotic gneiss was overlaid by a siliceous ferruginous dolomite, and underlaid by a band resembling an impure steatite, the whole dipping N. 5° E. < 45°. The seat of the gold appeared to be a crevice of longitudinal ovoid form, about four feet below the surface, which was filled with reddish-brown ferruginous earth, in which were scattered

fragments of a black carbonaceous matter, the latter shewing, when broken, small flakes or scales of the metal. The crevice seemed to be in the schist, at its junction with the dolomite, and presented an attitude conformable with the stratification. This I believe to have been the earliest discovery of the metal, and samples were procured and sent to the Geological Survey office long before any reports were generally circulated as to its existence in the township. Having remained in the vicinity of the opening for a few days while some fresh blasts were made, and seeing no farther development of the precious metal, my general exploration was continued.

Richardson
mine.

Early in October, however, information was brought to me that farther discoveries of gold had been made on the Richardson lot, and returning, I found that at the depth of fifteen feet another open crevice had been struck, which, beyond doubt, had proved rich in the metal. By permission of Mr. Richardson I examined the opening, and took such samples for assay as were thought proper. The shaft, to the depth of fifteen feet, with a transverse measure of about seven feet, had been sunk the whole way on the slope of the strata, which were of the same character as those already described. The chloritic and epidotic gneiss appeared to be much intermingled with calcspar and bitter-spar, which ran in short lenticular interlocking patches, each an inch or so thick, in a total width of about eighteen inches at right angles to the stratification, and in place of them there were occasionally small openings partially filled with the ferruginous earth, in several of which gold was detected. The opening at the bottom, which was of a nearly circular shape on the plane of the bed, and about eighteen inches across the stratification, appeared to include the whole thickness of the band holding the smaller dolomitic patches and cavities above. It was partially filled with the same brown ferruginous earth as before mentioned, with which black carbonaceous matter was much intermingled. In some parts of the opening this black substance appeared to adhere to the chloritic schist, and in others to the dolomite.

From this opening* I extracted about three pints (by measure) of the ferruginous carbonaceous earth, and the following were the results of some very rude experiments tried on the spot. Taking a pint of the earth, just as it came from the opening, it was reduced by washing to one-half its bulk, and when dry the residue was pulverized. Spreading the latter in a shallow tray the lighter substances were removed by continued shaking and gentle blowing, and there remained a dark colored gold dust, in which were a few angular fragments weighing from one to three-and-a-half grains each. The whole of this dust weighed fifteen pennyweights; but there can be little doubt that by the rough method used a considerable amount must have been lost. In a second experiment two-and-a-half

* Now known as the Phoenix Mine, 1870.

pints gathered by me, yielded, by a rude washing and amalgamation, twenty-six pennyweights of pure gold. Rough as these experiments were, they afforded sufficient proof of the unusual richness of the deposit. At this time no trace of the metal was observed in the enclosing rock, but shortly afterwards some very beautiful and rich specimens from the same opening were shewn me, in which the gold was enclosed in the dolomite and calc spar.

Shortly after the examination just alluded to, in consequence of disputes connected with the mine, the shaft was closed up, and no farther examination was permitted. On the arrival, however, of Mr. Michel on behalf of the Geological Survey, some weeks later, he with difficulty obtained a hurried view of the opening, and the results of his observations subsequently appeared in a Report addressed to you on the 29th January, 1867.

The seat of the gold in the Richardson Mine does not appear to me to be a true vein, but simply a series of crevices or openings in a gold-bearing bed, formed of chloritic and epidotic gneiss holding patches of dolomite and calc spar, the openings being nothing more than such as are so often met with in the dolomites and calc-schists of this region as almost to entitle them to the appellation of cavernous. Thinking it therefore possible that the gold of the Richardson Mine might be confined to a special horizon, I proceeded to trace out the rocks at the junction of which it occurs on the Richardson lot, and it may now be stated that some recent and reliable discoveries made during the season of 1868 seem to make this conjecture probable.

The rocks of the Richardson lot are exactly similar to those which have been described as running through the farms of O'Hara and McKenzie in the fifth range of Madoc, which are, however, on the opposite side of an anticlinal, and the seat of the gold seems to be at the junction of the mica-slates (C 2) and the dolomites (C 1) of the section there described. This position would be at no great distance above the ferri-ferous band, and the course of that band, as already given, may thus become a guide not only in the search for iron, but for that of gold also.

In Elzevir, Madoc, Marmora, Lake and Tudor the number of localities in which openings have been made in the rock by prospectors in search of gold are too numerous to be mentioned. It would, perhaps, be too much to say that every lot had been tried, but it appears to me that the exceptions, particularly in Marmora and Madoc, cannot be very many. Of these localities I may say that I have visited all in which gold was reported to have been found, particularly when it was understood that an excavation of some depth had been made, and the work was still in progress. In some cases admission to the excavation was refused to me, and in others, in consequence of disputes in regard to ownership, excavations have been

filled up to prevent access by the public. A large number of specimens, however, have been brought to the Survey office for analysis, but all those localities in which, up to the present time, the occurrence of gold has been verified, appear to have the same relation to the ferriferous belt, and to be geologically above it, but never at a great distance.

Localities of
gold.

The localities on which I would rely as supporting this view are included in the following list, in all of which the occurrence of gold, in greater or less quantity, has been verified :

Marmora,	range	IX	lot	6	Gold in quartz holding iron pyrites and mispickel, and interstratified in a silicious dolomite, sometimes in association also with chlorite-schist.
"	"	"	"	7 & 8	" " " "
"	"	VIII	"	6	" " " "
"	"	VIII	"	8	" " " "
"	"	VIII	"	9	" " " "
The gold in these four lots stands in the same stratigraphical place in relation to the Marsh iron ore bed, which is on the fifth lot of the ninth range of Marmora, and thence strikes northward parallel with the gold-bearing rock.					
"	"	X	"	15	Gold in quartz and sulphurets scattered through a silicious dolomite, and sometimes in connection with an interstratified chloritic schist.
"	"	X	"	16	" " " "
"	"	XI	"	15	" " " "
"	"	XI	"	16	" " " "
On this lot is situated the Feigel mine, and the gold in it and the preceding lots is in the same stratigraphical place as before.					
Madoc	"	IV	"	18	Gold in cavities with ferruginous earth and carbonaceous matter resulting from the decomposition of small interposed layers or irregular veins of bitter-spar, etc., between layers of chloritic and epidotic gneiss, and also of dolomite, in which latter rock also gold is sometimes seen.
"	"	V	"	18	Gold in the same conditions as before. This is the Richardson mine, and in this and the previous locality the stratigraphical place of the gold is in the same relation to the iron ore of the seventeenth lot of the fifth range of Madoc as it was to the Marsh iron ore in the previous instances.
"	"	VI	"	1	Gold in antimonial gray copper ore forming small veins with calespar, bitter-spar and quartz in a brown-weathering dolomite belonging to the same band as before, and associated with chloritic and epidotic gneiss. This is the Empire mine, occurring in the village of Madoc.

Hurgenford, range 2.

These various ferriferous belt localities on the same many of them, by my own observations refer to the general opinion, afforded by the assay, being the same conclusion, the amount of

* In addition to the ring on the second of this Report, for the second and latter locality is gray and pyritic very similar to the

† The following and are given as Madoc village

Mr. Bell informed selected sample Two pounds of \$1.35 to the grain of silver

In addition to my personal survey, I now precious metal Mr. Michel and
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9. "

Hungerford, range XIV lot 9 Gold in traces in antimonial gray copper ore occurring in nests with quartz, in white and pinkish crystalline limestone, which is associated with dolomites supposed to be on the same horizon as the dolomite above the ferriferous band.*

These various localities seem to have a pretty uniform relation to the ferriferous belt, and the existence of gold is reported in many other localities on the same geological horizon. I have little doubt that it occurs in many of them, but have not yet been able to verify its presence in them by my own observation. I must refrain, therefore, from doing more than refer to the general course of the iron-bearing band, which has already been indicated, a close proximity to the summit of which will, in my opinion, afford the most probable positions for the discovery of gold.

A number of specimens from openings reputed to yield gold were collected for assay in various parts of the county of Hastings, and I give, in conclusion, the results of their assay by Dr. Hunt, the method employed being the same as that described by him in his Report for 1866, p. 80, and the amount of ore treated in each case 100 grammes (1543 grains).†

* In addition to the localities cited above, gold is mentioned by Mr. Michel as occurring on the second lot of the fifteenth range of Elzevir, and I have myself, since the date of this Report, found small quantities of gold by assay in specimens brought by me from the second and third lots of the fourth range of the same township. The rock in latter locality is a mixture of quartz and carbonate of lime, holding bunches of the gray and pyritous sulphurets of copper, and it appears to be an interstratified bed, very similar to that above mentioned in Hungerford.

† The following assays were made by Prof. Jas. T. Bell, of Albert College, Belleville, and are given as confirming of the great richness of the ore from the Empire mine:—

Madoc village, range V., lot 2.—Shaft, Empire mine; antimonial gray copper; three assays by five yielded respectively per ton, of gold and silver united, \$483, \$492, \$497.

Mr. Bell informed me that during the month of May, 1868, he visited this mine and selected samples, of which the following are assays:—

Two pounds were submitted to amalgamation, and free gold was obtained at the rate of \$1.35 to the ton. The concentrated sulphides (one ounce) were smelted, and one grain of silver and 0.034 grains of gold were obtained, being equal to

66 oz. 13 dwt. 8 gr. of silver per ton.
2 " 5 " 8 " gold "

In addition to the lists of localities in which the presence of gold has been verified by my personal examination, and by assay of specimens in the laboratory of the Geological survey, I now give, in addition, several other localities, in which the existence of the precious metal has been observed by persons worthy of confidence, more particularly by Mr. Michel and Prof. Jas. T. Bell:—

1. Madoc, Range IV., Lot 15.	10. Madoc, Range VI., Lot 29.	18. Elzevir, Range II., Lot 15.
2. " " V., " 9.	11. " " VI., " 30.	19. " " III., " 9.
3. " " V., " 24.	12. " " VII., " 18.	20. Hungerford, " X., " 19.
4. " " V., " 27.	13. Marmora, " VIII., " 10.	21. " " X., " 20.
5. " " V., " 28.	14. " " IX., " 9.	22. " " XI., " 19.
6. " " V., " 29.	15. " " X., " 8.	23. " " XII., " 23.
7. " " V., " 30.	16. Elzevir, E., " 1.	24. " " XII., " 24.
8. " " VI., " 16.	17. " " II., " 5.	25. " " XIV., " 3.
9. " " VI., " 17.		

Dr. Hunt's
assays.

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| 1. Madoc, | range V. | lot | 2.—Dolomite adjoining the veins at the Empire mine, as free as possible from sulphurets. Trace of gold, not more than 1 dwt. per ton. |
| 2. " " | " V., " | " | 2.—The ore from the Empire Mine was an antimonial gray copper (fablerz), associated with some crystals of mispickel, iron pyrites, and a little galena. The washed and dressed ore gave to analysis, besides copper, antimony and sulphur, small amounts of arsenic, iron, zinc, lead and silver with a portion of gold. 53 ounces from the vein, gave by crushing and washing 6½ ounces equal to 13 per cent. of ore, still containing about one-fourth its weight of sparry matter. The assay yielded a button of silver rich in gold, amounting, for the ton of 2,000 pounds of dressed ore, to—
9.72 ounces of gold.....\$206.50
170.74 " " silver..... 155.76
\$362.20 |
| Making allowance for the proportion of gangue, equal to one-fourth, still remaining in the dressed ore, we have for the pure ore a value of \$482.93. A trial of selected fragments from the same mine, in which the amount of sparry matter was not determined, gave as follows for 2,000 pounds:—
4½ ounces of gold.....\$ 96.46
57 1-6 " " silver..... 73.74
\$170.20 | | | |
| 3. " " | " V., " | " | 17.—Sparling's mine, Eldorado, dolomite; said to have yielded \$53 gold per ton. No trace of gold. |
| 4. " " | " V., " | " | 18.—Richardson mine, from shaft. No trace of gold. |
| 5. " " | " V., " | " | 18.—Richardson mine, gray siliceous dolomite, with some disseminated pyrites. A trace of gold. |
| 6. " " | " V., " | " | 18.—Richardson mine, ferruginous earth from cavities in the rock, yielded by amalgamation, from a trace of gold, up to \$380 per ton. (See page 166.) |
| 7. " " | " VII., " | " | 17.—Madoc Mining Co., a fine-grained, bluish dolomite, said to have yielded 13 oz. 10 dwt. of gold per ton. It gave, on assay, only a trace of gold. |
| 8. " " | " XI., " | " | 10.—Shaft; quartz from a vein, with iron ochre. Trace of gold. |
| 9. " " | " XI., " | " | 16.—Same shaft; quartz, with ochre. No trace of gold. |
| 10. Marmora, | " I., " | " | 30.—Shaft; quartz, with black tourmaline. No trace of gold. |
| 11. " " | " III., " | " | 15.—Shaft; micaceous dolomite with thin quartz seams. Trace of gold. |
| 12. " " | " V., " | " | 17.—Shaft; John's mine; vitreous quartz, with some pyrites and native copper. No trace of gold. |
| 13. " " | " VI., " | " | 18.—Shaft; quartz with bluish tourmaline, calcite, and some ochreous matter, in greenstone. No trace of gold. |

14. Marmora, ran

15. Belmont,

16. Lake,

17. "

18. "

19. Elzevir,

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14. Marmora, range IX., lot 7.—Shaft at Berry's mill, sixty feet deep, on a vein four feet wide; gangue, quartz with mispickel, pyrites and free gold. Yielded me, by fire assay, 4 dwt. 3 gr. per ton. A specimen, in which gold was visible, yielded as high as 9 dwt. to the 2,000 lbs.
15. Belmont, " II., " 18.—Specimen from shore of Belmont Lake; a reddish-weathering mica slate, with ferruginous quartz seams. No trace of gold.
16. Lake, " III., " 12.—Shaft; vein of quartz. A trace of gold.
17. " " III., " 12.—East vein; concentrated sulphurets, roasted, yielded a little over \$7 per ton.
18. " " III., " 13.—Dolomite, and Deer River. A trace of gold.
19. Elzevir, " IV., lots 2, 3.—Antimonial gray copper ore, in a calcareous gangue. A trace of gold.

In the assays 16, 18, 19, the amount of gold in no case exceeded one dwt. to the ton.

Bismuth.—The occurrence of carbonate of bismuth in the township of Bismuth: Tudor has been alluded to by Dr. Hunt in his Report on the gold region of Hastings, in 1867, (page 6). It was found on lot thirty-four of the third range of Tudor, in a vein cutting the hornblendic rocks of division B, and an overlying magnesian limestone, the dip of which was about forty-five degrees to the north of west. The vein, which is very irregular in size, sometimes attains a breadth of two feet or more, and runs north-west, dipping at a high angle to the south-westward. The veinstone was chiefly vitreous quartz, carrying near the surface small masses of carbonate of bismuth, which, lower down, were replaced by the sulphuret, with traces of metallic bismuth. Fine crystalline specimens of the sulphuret of bismuth, several ounces in weight, were sometimes met with; but this valuable ore was sparsely and irregularly disseminated in the quartzose gangue, which also enclosed irregular layers of impure graphite, and masses of radiated black tourmaline, which were sometimes found to penetrate the bismuth ore. In sinking, the quartz veinstone was in parts replaced by an aggregate of pink crystalline calcspar enclosing small crystals of yellow mica, which were also met with in the adjacent quartz. Iron pyrites in imperfect crystals and small masses was also observed in the calcareous portion of the vein. Dr. Hunt, to whom I am indebted for these notices of the minerals of this curious vein, assayed the bismuth ore for gold and silver, but found neither. After considerable working this vein was abandoned in 1868.

I have the honor to be, .

Sir,

Your obedient servant,

HENRY G. VENNOR.

