

## CIHM/ICMH Microfiche Series.

10

CIHM/ICMH Collection de microfiches.



Canadian Institute for Historical Microreproductions / Institut canadian de microreproductions historiques



#### Technical and Bibliographic Notes/Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below. L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

$\checkmark$	Coloured covers/ Couverture de couleur	Coloured pages/ Pages de couleur
٦	Covers damaged/	Pages damaged/
	Couverture endommagée	Pages endommagées
٦	Covers restored and/or laminated/	Pages restored and/or laminated/
		 rages resculters en ou princultes
٦	Cover title missing/	Pages discoloured, stained or foxed/
_	re title de convertire mandre	 rages decolorees, techetees ou piquees
٦	Coloured maps/	Pages detached/
	Cartes geographiques en couleur	Pages detachees
٦	Coloured ink (i.e. other then blue or black)/	Showthrough/
	Encre de couleur (i.e. autre que bleue ou noire)	Transparence
	Coloured plates and/or illustrations/	Quality of print varies/
	Planches et/ou illustrations en couleur	Qualité inégale de l'impression
٦	Bound with other material/	Includes supplementary material/
-	Relié avec d'autres documents	Comprend du matériel supplémentaire
٦	Tight binding may cause shadows or distortion	Only edition available/
	along interior margin/	Seule édition disponible
	distortion le long de la marge intérieure	 Penes wholly or pertially obscured by errors
_	Pt-st to see added double second to see	slips, tissues, etc., have been refilmed to
	Blank leaves added during restoration may appear within the text. Whenever possible, these	ensure the best possible image/
_	have been omitted from filming/	obscurcies par un feuillet d'errata, une pelure
	Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cele était possible, ces pages n'ont pas été filmées.	etc., ont été filmées à nouveau de façon à obtenir la meilleure image possible.
٦	Additional comments:/	
	Commentaires supplémentaires;	

This item is filmed at the reduction ratio checked below/ Ce document est filmé au taux de réduction indiqué ci-dessous.



The to th

The pose of th filmin

Origi begir the la sion, other first sion, or ille

The I shall TINU whic

Maps differ entire begin right requi meth e itails s du nodifier r une Image

8

The copy filmed here has been reproduced thanks to the generosity of:

University of Saskatchewan Saskatoon

The images appaaring here are the best quality possible considering the condition and legibility of the original copy and in keeping with the filming contract specifications.

Original copies in printed paper covers are filmed beginning with the front cover and ending on the last page with a printed or illustrated impression, or the back cover when appropriate. All other original copies are filmed beginning on the first page with a printed or illustrated impression, and ending on the last page with a printed or illustrated impression.

The last recorded frame on each microfiche shall contain the symbol  $\longrightarrow$  (meaning "CON-TINUED"), or the symbol  $\nabla$  (meaning "END"), whichever applies.

Maps, plates, charts, etc., may be filmed at different reduction ratios. Those too large to be entirely included in one exposure are filmed beginning in the upper left hand corner, left to right and top to bottom, as many frames as required. The following diagrams illustrate the method:

1 2 3

L'exemplaire filmé fut reproduit grâce à la générosité de:

University of Saskatchewan Saskatoon

Les images suivantes ont été reproduites avec le pius grand soin, compte tenu de la condition et de la netteté de l'exemplaire filmé, et en conformité avec les conditions du contrat de filmage.

Les exemplaires originaux dont la couverture en papier est imprimée sont filmés en commençant par le premier plat et en terminant soit par la dernière page qui comporte une empreinte d'Impression ou d'Illustration, soit par le second plat, selon le cas. Tous les autres exemplaires originaux sont filmés en commençant par la première page qui comporte une empreinte d'impression ou d'Illustration et en terminant par la dernière page qui comporte une telle empreinte.

Un des symboles suivants apparaîtra sur la dernière image de chaque microfiche, selon le cas: le symbole → signifie "A SUIVRE", le symbole ▼ signifie "FIN".

Les cartes, planches, tableaux, etc., peuvent être filmés à des taux de réduction différents. Lorsque le document est trop grand pour être reproduit en un seul cliché, il est filmé à partir de l'angle supérieur gauche, de gauche à droite, et de haut en bas, en prenant le nombre d'Images nécessaire. Les diagrammes suivants illustrent la méthode.



1	2	3
4	5	6

irrata to

peiure, n à





### OUR STONY RECORD.

# UNIVERSITE LIBRARY SIGNALCHEWAN OLDER GEOLOGY OF RED RIVER AND ASSINIBOINE VALLEYS.

#### Dr. Bryce's Lecture Before the Historical Society,-Explanatory Diagrams.-Occurence of Salt. Petroleum and Conl.-City Water Supply.

The Historicsl and Scientific Society of Manisoba met on Thursday evening, Novem-ber 26sh, 1891, in the city council chamber, to listen to a lecture on "The Older Geology of the Red River and Assicitoine Valleys." The lecturer of the evening was Rev. Dr.

The lectrifier of the evening was new. Let Bryce, who said: Last year the writer had the honor of lay-ing before the Historical Society many facts connected with the "Surface Geo-logy" of these valleys. To night it may serve a good purpus to bring before the socie ty, with as few technical details as possible,

has not been a stranger. Milton hits off this tendency with keen sarcasm in his description of Mammon :--

"Mammou, the least erected spirit that fell From Heaven; for e'en in Heaven bis look and

From Heaven; for e'en in Heaven bis look thoughts Were always downward beot, admiring more The riches of Heaven's pav. met., troiden goid, Than aught divine, or holy eirc enjoyed In visions beatific; by him first Men als:, and by his suggestion taught, Ransacked the centre, and, with impious hands, Rifled the bowsis of their mother earth Wor treasures."



FIG. L-North America: The Original Laurentian Island.

the characters of the underlying rocks. Our object is to describe, not so much the mineral or palacontological features of these rocks, as or palaeontological features of these rocks, as to give their general relation to the contour of our prairies, the nature of the soil, and to the economic products of the precious metals. building stone, salt, petroleum, coal, pa-tursi gas, and water. There is a craze in some quarters for diverting capital into mad speculations, and for organizing companies to reasack the rocks for hidden treasure. To this even Winnipeg in the past

There is of course another standpoint than that of Milton. We need to know the powers and resources of the good, new country in our possession, and we are bound as Western Can-

formation that we must describe. All of us the Canadian Pacific Railway, at a distance of forty or fifty miles from the city the prairie is lefs behind, and a rocky region is entered This rocky region, which we call upon. Laurentian, or in some places Hursnian, ap-pears as the surface rock dist in R. 7. Tp. 9, some thirty miles east of Winniper. This is the furthest extent of the original island stretching from Labrador, north of the great lakes, for more then 1,600 miles, and reaching its western limit at the point named. This for ation runs northward along the east thore of Lake Winnipeg and then to the Arstic Sea See (Fig. 1)

The vast wilderness represented by the dark portion of the diagram is the oldest part of the North American continent, and consists of beds of grauite, green stone, Labradorite, trap, and crystalline lim stone. These after being deposited were hardened by a metamorphic pricess through intense hear; by great pressure they have been bent and twisted. Out of such rocks, hard as they may be, the soil as also the limestones and soli and shore of our prairies have been made by the wearing down by streams, and by atmos-pheric and other sgencies. From this island the hard rocks soly d away in all directions, and for us, hundreds of feet below the spot where we are standing to-night became the rocky ocean bed, on which were deposited the limestones and standstones which we are more 7 to describe. The above diagram repre-

as we have said, the Laurentian island,

dotted outline being that of the present unticent of North America. If priority of f rmation gives any claim to the continent, Oanada has the advantage of her American cousies to the touth, in owing the whole of the optimal Leurentian idead the original Laurentian island.

#### LAKE WINNIPRO BASIN.

Of exposed rocks, lying upon the Laurentian foundation the lowest are those of the basin of Lake Winnipeg. Many parts of the west shore of the lake are solid rock, uncovered by drift. This west coast has been well ered by drift. This west coast has been well observed. An early observer, Dr. Richard-son (1851)examined it on his way to the Arctic sea. By this geologist the rock was fixed as Bird's-specimestone. Sir Henry Lefroy, for the Royal Society, also visited this shore. The best description of it yet given is that by Professor H. Y. Hind, in his report of 1857 to the Canadian government; and, by the way, this report, though made so early, is one of the most reliable sources of information we have of the Northwest. Prof. Hind describes the sandstone layers at Grindstone Point, and also the limestone, which he declares to belong to the Chazy division of rocks. Recently Mr. J. B Tyrell, of the Canadian Geological Survey, has explored the lake and published potes on its geology Lake Winnipeg is now definitely known to be a broad trough hollowed out by glasial action, on the east shore consisting of the hard gran

9

#### RED RIVER EXPOSURES.

Along the banks of the Red river in the cuttings made by streams and in quarries, beds of limestone are exposed. One of the at East Selark. Near Lower Fort Garry there are also extensive limestone deposits, and the limestone has been burnt here, and shipted as lime to Winniper. Toward the upper end of St. Androw's parish snother rock losality may be noted. The limestones along the river are often buff colored, and as they contain a good deal of magnesia belong to the Dolomitic series. They are of the same age as the Trenton rocks of Ontario, and probably include series corresponding to the Utica shale as well. These roots have been examined with some care by Mesers. J. H. Panton and A. MoCharles, members of this cociety, and by other local geologists.

#### STONY MOUNTAIN AND STONEWALL.

Stony Mountaic is the most interesting geo logical monument in the Red River Valley. It is some twelve miles northwest of Winni-per, and is an cutiller of limestone beds, sizty or seventy feet high, on its west side showing a steep eccarpment. Its stope has been extensively quarried for building stone and for making lime. The rock in view is of two kinds-the upper forty feet or so on being tested is found to be a dolomita, while the lower is a red limestone, colored by iron. The red layer abounds in fossils, contening coral remains and a great number of ancients bivalves (Brachiopods). One exceedingly bivalves (Brachiopods). One exceedingly hard and quite thin, flinty layer is seen running along the ercarpment. This will not The accepted explanation as burn into lime. to the history of Stony Mountain is that it is the survival of the vast beds of rock worn away by the glaciers; and when the two lines of glaciers, one from the northwest, the other from the northeast, met, they left Stony Mountain beund as the island remains at the junction of two rivers. About five miles northwest of Stony Mountain is the village of S'onewall, where there are quarries. This spot is considerably higher than Stony Muntain, so that between the two is the trough ploughed cut by the old N W. glacier At Stonewall is perhaps the finest glacier At Stonewall is perhaps the finest example of glaciated rock with which we are example of glacial sets fock with which we are acquainted. The glacial striase are seen on the rock surface, wherever the drift, here only eight or ten feet deep, is removed. Mr. J. H. Panton, of this society, has worked out the Stony Mountain and Stonewall geology, and while with all others he makes the lower Stony Mountain hede to be of Hudson River horizon, he is inclined to regard the higher atrata here, as well as the upper Stonewall beds, as Niagara limestone. Certainly the lithological characters of these deposits incline one to this opinion It is somewhat interesting to notice that the rocks underlying our fertile prairies along the Red River are much the same as those below the soil in the part of ite and conglomerate of the Laurentian, and Ontario stretching down to Ottawa from the on the west in its lower rocks of the Calcifer. Laurentian axis which crosses the St. Lawrence at Kingston, and those west of the same axis to Hamilton.

a d

m.

he

es, hé TY

ry te,

be

ier ....

.. Dg

ne nd

he eD H. hia

ю y ni-

ty ng X

or vo og he

be al Dt

ly

n.

Dŧ 'n

86

br

y 0

ye

.

#### THE ROSENFELD BORING.

Perhaps the most useful operation we have Ferhaps the most uncut operation we have had for obtaining an accurate knowledge of our Red River valley rocks was the boring conducted by the Canadian Pacific railway in 1886 at Recented Station, 60 miles couthwest of Winnipeg. By the use of a percussion drill, after boring a little more than a thousand feet, the Laurentian foundation was reached. The logbook kept by the drilling party has enabled the geologists to make out a complete section of the lin.estone and sandstone rocks, such as we have from no other source. It is true that these rocks at this point are thicker than had been supposed, and there are grounds for

the higher rocks extended over the whole val the higher rocks extended over the whole val-ley and basin, and that some mighty agency holl wed out this vast Silurian and Cambrian trough. Undoubtedly this powerful agent was the great glacitr or ice sheet of Lake Agassiz. The whole valley shows signs of this denuding and orushing power in the atriae which are observed. The fine drift de-posit or soil which course the volte on posit or soil which cover the rocks on our Red River prairies, if examined with the microscope will beseen to belargely of limestone rocks ground down to powder, as well as orushed rocks from the Laurentian area. The erratics or boulders found in this drift are simply larger fragments of these same rocks. Much of the material which was dug up and burried along, no doubt, went Jown the glacial lake, and was carried away by the Mississippi,



Fig. 2.-Silurian and Cambrian Rocks of Red River.

thinking that as we come northward to Win nipeg they will not be so thick. The revela-tions made by the drill quite fit in with the geological observations made of the Stony Mountain, Red River, and Lake Winnipeg exposures. It is now possible to make out a septenties. It is now possible to make out a general view of the rock formations from the boundary line to the basin of Lake Win-nipeg. Figure 2 is an attempt at this, showing the rocks of the various ages, and their localities as observed in this valley and basin. It is based chiefly on Dr. G. M. Duw-

into which the Red River then flowed. What the surface of the Laurentian, on which the later rocks rest, may be, is unknown to us. Probably is is not flat like our prairies, but is diversified by what were once great granite ridges which had lakes lying between them.

#### CHARACTER OF THE BOCKS.

We ought all to be tamiliar with the character of the rocks from the several exposures mentioned, for the limestones are largely used as building stones in our better building. aon's arbicle (Transactiona Royal society, 1886). OUR INFERENCE. From the facts indicated in the above dia-gram, it may be inferred, that at one time well. The fossils are largely of coralline formation and suggest to us that in Silurian days these rocks were a vast oursi reef, and that a tropical climate then prevailed in our northern latitudes. Our limestone in former days was used for headstones, as may be seen days was used for neasours, as may or tool in St John and Kildenan crmeteries, but it is ill suited for that purpole, beiog neisher sufficiently hard nor homogeneous The same thing applies to our vulun-teer monument erected by the people of the disp, and to the Seven Oaks memorial placed in pation last summer by the Historical Society. It will no doubt be thought unpatriotic to say that for such purposes our Red River atone is not suitable.

#### THE ASSINIBOINE BOCKS.

When it is remembered that the word As-sinibolne means in Ores the "Stone river of the Sioux," is might be supposed it would be a favorite hunting ground for geologiste. And yes this is not the case. While here and there there are gravel heds and boulders at the rapids, the rocks are generally heavily covered with drife. As Burnside, a une seven'y miles west of Win-niper, on the Canadian Pacific Railway, on the banks of what is still known as Rat Oreck, a diamond-drill was set agoing in 1874, (see Geologicsi Sarvey reports, 18745,) and the boring revealed rocks of a higher horizon than any we have yet seen. These have been made out to be Devoniau, but there is at this point a very thin layer, and this, strange to say, has no Silurian below it, but lies immedi ately on the Laurentian. To the northwest of this point, on the lakes, Devoniau rocks have been described by Mr. Tyrell and other geo-logists. To the west of this we reach the foot of the escarpment marked by the S. E. to N. W. trend of the Pembina, Riding and Duck Mountains. This secarpment marks the east-ern edge of the second great prairie steppe, which lies one, two or more hundreds of feet above our Red River prairie level. This upper level has underlying rocks of a s'ill higher horizon, and rocks with which as Canadians we had no acquaintance till we came to the Northwest. Figure 3 may show the sequence of rooks and their localities.

#### ITS MEANING.

In Fig. 3 it will be noticed, that at two different stages a gap is marked. This is the case in the lower instance at Borneide. Here the borers found, after penetrating 103 feet of drift, beds of Devonian rock 42 feet thick, lying direc ly on the hard Laurentian (or Huranian) It does not of course follow that Hurstan) It does not of course follow that everywhere in this region the Silurian rock should be missing as in the case before us The Laurentian rock struck in boring at Bornaile is nearly as high above the sea as the top of the drift at Winnipeg, so that there was evidently a great the top of the drift at so that there was evidently ridge of Laurentian rock, at this point, stand ing up as an island or cliff in the old Silurian The open and inside of the intervence of the set of th

ation of their absence is, that during those ages when the Nova Scotia and Pennsylvania great cosl heda were bring formed in the wamps, this region was an island standing above the cosen. Is will be seen also that in the Upper Oreta seous rocks occur the deposite of coal, from which are sold in Winnipeg iarge quantities of Galt Mine coal, while in the Laramie just above these are found the coal beds of the Souris River, which promise to give us cheaper coal of fair quality.

#### THE CONTOUR OF THE WESTERN COUNTRY.

er

W

80

as th

in

fo

15 aa na W

S tic M

THE CONTOUR OF THE WERTERN COUNTRY. These underground revelations which we have been enabled to make on the first prairie lavel, may be embodied in a diagram (Fig 4) showing the relation of the Lake of the Woode, the trought of the Red River, and the Buraside rocks. This figure indicates, taking a section of the country running in direction E. S. E. from Burnaide, through the Resenfeld rocks, and then to the south end of the Lake of the Woods, an enormous Laurentian trough. It shows also that while the Lawrentian at Lake of the Woods is 1,060 feet above the level of the ase, this fundamental bed descende, in the fhe ses, this fundamental bed descends in the course of 115 miles to a depth of 265 feet below course of 115 miles to a depin of 205 feet befow the sea level at Rosenfeld, or in all 1,325 feet, and rises again at Burnside, 70 miles away, to to 700 fset above the sea. The probabilisies, as has been said, are, that at Winnipeg the trough is not as deep. It seems highly probable that between the city and Lake Winnipeg there runs from east to west below the Siluman and Cambrian a sides of Louran the Silurian and Cambrian a ridge of Lauren. tian (or Huronian) rock connecting Burneide and the old Laurentian island, lying to the northeast of us. It may be explained that in the northern half of the Lake of the Woods there occur the metalliferous rocks now called Huronian. We have preferred to use the well known term Laurentian rather than Archaean, which some are now employing to include both Laurentian and Huronian.

#### PRECIOUS AND USEFUL METALS.

It may be well now to discuss the economic products of the region under consideration. It is evident that if we are to seek for gold and silver this must be done by going east-ward toward Lake of the Woods, or on the east of Lake Winniper. Many claims have been taken up on the Lake of the Woods, companies formed, and reducing works at Rat Portage begun. From assays made by Mr. Hoffman, the Government analyst at O taws, and by others, it is quite certain that there are gold and silver in that region. A number of assays have been made of rock from that district for nickel, but so far as known to the writer without result. As to iron, the deposite on Lake Winnipeg in the rocks lie near the base of the Cambrian, and are very large. Many specimes of the cambrain, and are seemingly of excellent quality, have been ex-hibited. A good deal of trouble has arisen in the development of our mines from the dispute between the Dominion and Ontario the limited means at the disposed of our people from legitimate business to this precarious industry.

#### BUILDING STONE

In the possession of the Historical Society are three collections of the building stone of the Red River valley. These almost all be-long to the linestone rocks we have been describing, which are of Trenton and Huds n River age. While this stone is perhaps our only present resource, it is plainly rather un-suisable for finer kinds of work Sands me also is found at Grindstone Point on Lake Winnipeg, but it is rather brittle. Some matbles occur on Lake Manitoba, and it is altogether likely that as our northern lakes and water courses are explored building stone of superior quality will be obtained. In the possession of the Historical Society

occur, and in the Rosenfeld boring a great flow of brine was struck. From these indica-tions we can infer that, though the rock are not visible on account if the drift, sain hear. ing strate sun across the outstry from Lake Manitoba, east of Poplar Point, east of Oakville, and near the town of Morris. Of course the lower rocks, may have brine filtered through them from above, where the upper rocks are sait bearing. This was actually the case at Resenfeld, where the strong at flow of brine was met b low the Trenton. The force of the brine at Rosenfeld was so great that it of the prine as trosented was so gras that it rose in a pipe eighteen feet ab ve the surface of the prairie. This R senfeld salt was ex-amined by Mr. Hoffman, of Ostawa, and was deelared to contain paying quantities of excellent salt. Indeed the old Fort Garry



F10. 3.-Rocks on Assiniboine and Tributaries.

SALT. Judging by the occurrence of salt in Western Onterio and looking at our Silurian rocks ern Onsario and looking as dur Sildrian Focks we should not expect is to recour until we pass some distance weat of Sucnewall, where as we have seen what apparts to be the Niagara limestone is found. Salt in Onsario and New York state is found in the Ocontaga or Salina formation lying above the Niagara. Seventy years ago as we have mere wath apping known is the latern, there were sait springs known near Pembins. The nearest sait springs to Winnipeg of y are in the valley of Riviere Saie, a few miles this side of the railway ats-tion of Oakville on the Northern Pacific Port age branch. Other springs are found on Lake Manitoba, while near the Marais river, some 55 miles south of the city well known springs try, and the fact that on the Mackenzie river

sais, which was sold twenty years sgo, shough black with impurities, was of good quality. In old Red River days, a manufactory if sails was carried on from 25 saits wells on Lake Winnipegonsis by James Mockman for the thud son Bay company. The old price was 12 shillings sterling a bushel NJ doubt sait making will become one of our industries, but have to compete with eastern sait is will probably have to be worked with saw-mills on Lake Manitoba and Lake Winnipegoosis, as is done in the Sagina w district of Michigan, where she refute from the mills is ntilized for providing a fuel without cost.

#### PETROLEUM.

there are petroleum springs, and large areas of malsha or mineral tar, has led to the specuof matthe or mineral tar, has led to the specu-lation, even among geologists, that soal oil might be fund in our province. In the east, petroleum is found in the Middle Davonia, or Erian, as it is now beginning to be called. Acordiogly it is impossible that petroleum should be found east of Lake Manitoba. As, should be found rass of Like statistics. Ar, however, Devonian rocks occur, as we have have seen, at Burgende and as a number of places on Lakes Manitoba and Winnivegoosis, is would seem worth while to search for petroleum in that westers region. Companies have been formed, one especially, of which the writer remembers, to bore for oil in the Lake Dauphic district. Theoretically it is right enough to examine this region thorough ly, but surface indications and the opinion of practical miners should be taken as well.

#### COAL.

The first determined effort to seek coal in Manitoba was made nearly twenty years ago, when a party of the Geological survey spent a sum mer in the Swau Lake district on the slope of Riding Mountains. Here geology held out hope in the gap between the Devonian and the Cretageons where the Carboniferous rocks of Eastern Canada and the United States are found. The search proved vain. But in 1872 found. The search proved vain. But in 1872 Dr. G. M. Dawson, the geologist accompany-ing the boundary expedition, came upon coal beds upon the Souris river. The writer re-members well a company of Winnipeg gentlemen shortly after taking coal claims at the Souris. The coal was unfortunately classed as poor Lignite, and was rather despised. As the west was opened up it began to dawn up-on explorers that Northwest coal had some value in it. Is was found that the 'Galt mine" at Lethbridge was of Uretaceous age, and indeed of the same horizon as the famous Nanaimo coal on Vancouver Island. The beds of the Pembina Mountains escarpment seem of the same age, but are of deep sea origin. It was noticed that the Laramie beds lying in the n-ighborhood of Blackfoot Cross-ing contained good coal, and the Souris bede proved to be of the same age. The beds on Turble Mountain, which is another deposit of Isramie age, also contain a fair coal Some years ago Mr. Hugh Sutherland brought a soow load of coal down the Souris from the coal regim, and in another season the railway will carry this coal all over Manitobs. The exposure on the Souris river is one of remarkable thickness, and is very ac cessible. No doubt as the seam is pene trated the coal will improve in quality.

#### NATURAL GAS.

A visit of the writer last year to Indiana gave him an excellent opportunity of seeing the importance and uses of natural gas as a feel and light-producer. Great use is being made of it in some parts of Ohio, and it has been found in large quantities in Oceario rear the Niegara river. It is said to arise from the Trenton beds, and is accounted for by the vast number of fossils found in that formation. Its origin is as mysterious as that of petroleum. At Langevin Station on the C.P.R. 35 miles west of Medicine Hat, the

writer saw a stream of natural gas, rising from a boring, which had been used for several years in the section house for fuel. In this case the gas has its origin in the Oretsceous So far as finding natural gas be-iow Winnipeg is concerned, our underlying rock is Trenton, and it is a perfect mass of animal remain, but there have as yet been no surface indications of there being natural gas in the Red River valley, unless it be the stream struck at Dominion City last summer, and this has not yet been clegnifically inyre and this has not yet been solentifically inves signted.

#### WATER.

WATER. A very important question for us is that of water supply. Not only comfort and conveni er co, but health also, demand that we face this question. Our city water works supply is from the Assiuboine, which contains a large proportion of chemical salts, and is somewhat trying for new comers who use it freely. Weils in a city after a few years be-come unfit for use. Many well authenticated instances are found of typhoid fever and other diseases coming from the use of water is inted by drainace. A number of our wells. emperbis drainage. A number of our wells, espec-ially those west of Colony creek, are artesian. They are all in the drift and probably gain their water supply from the area exposed by Little Soony Mountain. These can hardly be be relied on for supplying us with a plenty of water. Figure 4 is a suggestive one in this connection. Winnipeg is 764 feet above the level of the sea ; Lake of she Woods is 1,000 feet. There is consequently a difference in our favor of some 300 feet, and abould there be beds of a porcous unsture in the Laurentian, there would be a sufficient amount of pressure to give us a good head of water. There is no way of assuring ourselves of the presence of water or of natural gas except by boring. It way of assuring outselves of the presence of water or of natural gas except by boring. It is by no means certain that we should get either, but, judging from the experience, es pecially of some points in Dakota, it would be worth while trying. As to the other ob jects spoken of, viz., salt, petroleum, coal, and precious or useful metals, the probabilities are entirely against us. The absence of salt, however, is more favorable to our getting an artenian well of end water. artesian well of good water.

#### SUBSEQUENT DISCUSSION.

When the applause which greeted Dr. Bryce on resuming his seat had subsided, President MacBeth invited an informal discussion which followed in the responses of the Hart, of Manisoba C llege, Prof. Laird, of Wealey College, and Control Taylor.

It was first explained that all the formations of the Red River valley, resting on the Luur-entian development, corresponded with the upper and lower Silurian of the Eng-lish geologiate. Then, looking westward, O meni Taylor expressed his great un-willingness to believe, that the car-boniferous Devonian formation—the sets of bluminous coal in the United States — would be found wanting, or "a fault," between the Red River val-ley and the oretaceous formation clearly recognizable beyond Brandon. He t was first explained that all the formations

would rather expect that by further exploration, the true coal measures as deval oped at Pittsburgh and by deep sinking in Iowa and Missouri, would yet be traced from the Fembina to the Riding Mountains of Manitoba. A further point of interest, sione to the materials of geological science by which Dr. Bryce fully admitted, was that the great Laurentian Island was

tor In the be-

no gas the ler, ....

of mi

ply in in

be-

her

ted

by be

of this

the 060 in

ere ian, ore

- 10 of Is geb es uld

ob oal, ties

alt,

80

Dr. led, dis-

the rof. of ons the

ng-ard, un-bar-s-'a val-ion

He



FIG. 4.-Vertical Section from Burnside to L. of Woods,

succeeded northward, as he had illustrated southward through the Red River valley, by the development in even fuller extent of the Silurian and successive geclogueal strate, with the bishest probability, unless all geolegical the highest probability-unless all geological analogy elsewhere shall fail of application to the districts in the vicinity of Hudson's Bay -of the existence of bituminous coal fields and

Bryce's zeal and intelligence in eiving a popular form to a discussion of great public inberent.

On motion of Consul Taylor, seconded by Prof. Hart, a vote of thanks was heartily tendered by the audience, and appropriately acknowledged by the lecturer.

1. Mr. Tyrrell Arobæsn continents the flasurentiau Isla into Minnesota, Wi New York, and there he said to own the wh Island, but rather the use of the term I Arobæsn. to include t Huronian, is not ccre would be correct to gr as horses. Laurentia names applied by S separate geological gra they have not been sh one named cannot be both without cauring The use of Laurenti

was simply to prevent discussion of the subje followe: "We have well known term L Archæan which some include both Laurentin terms. "Laurentian isl lakes" have now becom ing as every one know distinction between Huronian is not Chapman (page stratigraph'est relation tian and Huropian has in de out. The mine especially the presence ing gnet-soid and oth doubtedly to the conci Isn beds are of later Laurentian, but as Selwyn, the Huronian to pass under the later that members of the ge opinion that the Law metamorphic sejim-n relation to the Huroni How absurd it is then more that it has be invent the coloriess w clude the Laurentian i the excent of the "L portion of the Laurent a zoic which is outsid wifting compared with our bordere.

2. Mr. Tyrreli says Lake Winnigeg does brian rocks, but, sei the writer several time schists of the Huronian known natural outercu in Manitoba, and the tem in the province is on the boring at Ross

# LIBRARY

#### APPENDIX.

SIE,—In your issue of Christmas morning appeared a letter from Mr. Tyrrell of the Ge lugical Survey criticizing my lecture on the "Oldent Grology of the Rad River and Assimbioue Valleys." I have not until the present time had an opportunity of noticing it. With your permission I shall quote the various criticisms one by one, that none may be omitted.

be omitted. 1. Mr. Tyrell says: "The original Arobes a continental nucleus, spoken of as the "Laurentiau Island," extends southward into Mincesota, Wisconsin, Michigan and New York, and therefore Cauda should not he said to own the whole of this Laurentian Island, but rather the greater part of it. The use of the term Laurentian, instead of Arobes in to include both the Laurentian and Huronian, is not correct, any more than it would be correct, any more than it would be correct, any more than it would be correct, any more than it schores. Laurentian and Huronian were names applied by Sir William Logan to separate geological groups or systems, and as they have not been shown to be the same the one named caunot be used to include them both without cauring the utmost confusion." The use of Laurentian pastes of Arohean

was simply to prevent confusion in a popular discussion of the subject. I said distinctly as follows: "We have preferred to use the well known term Laurentian rather than Archean which some are now employing to include both Laurentian and Huronian." The terms, "Laurentian island" and "Laurantian lakes" have now become well known, includ ing as every one knows the Huronian. The distinction Laurentian between and easily drawn. 298) says : Huronian is 205 Prof. " The Chapman (page stratigraph oat relations of two series. Laurentian and Huropian have not yet been clearly m de ou". The mineral characteristics and especially the presence of conglomerates holding gnei-soid and other fragments lead undoubtedly to the conclusion that the Huronian beds are of later formation than the Laurentian, but as pointed out by Dr. Selwyn, the Huronian appear in many places to pass under the latter." Is is well known that members of the geological staff form the opinion that the Laurentian series are not metamorphic sejim-ntary rocks, and their relation to the Huronian is very uncertain. How showd it is then the he doem the the How absurd it is then to be dogmatic, the invent the colucies word "Archae" to in-clude the Laurentian and Huronian. As to the ex ent of the "Laurentian island" the portion of the Laurentian uncovered by Palre zoio which is outside of Canads in utterly wifling compared with the vast area within our borders.

2. Mr. Tyrreli says: "The it:n ore on Lake Winnipeg does not occur in "Cambrian" rooks, but, as has been pointed out by the writer several times, in the highly sleered schists of the Huronian system. There is no known natural outcrop of "Cambriaa" rocks in Manisoba, and the oaly record of this system in the province is in Dr. Dawson's paper on the boring at Rosenfeld where he corel-

lates the lowest 110 feet of, his section with the Lower Magnesian Linkstonel or Calciferous, adding a (?) to indicate a certain amount of dcube in the correctness of the determination."

Here Cambrian is used to mean the lowest of what were formerly called Silurian, and must now be admitted to be at least Campro-Silurian. Dr. Dawson is correct in identifying the rocks immediately above the Laurantian at Rosenfeld as Calciferous, which is Cambrian. As in the passe of the Quebec rocks of Eastern Canada, it is difficult to separate chalky and Calciferous, and especially in Manitoba is it difficult to get a horizon corresponding exactly with that of Ontario. As to the iron bearing rates my statement was that they "lie near the base of the Cambrian," lie on the Laurentian island of which I had been speaking, very near the point of union of the Palæozoic and underlying rocks.

3. Mr. Tyrrell says: "Possibly the most unfortunate sentence in the whole paper is the following: "Lake Winnipog is now definitely known to be a broad trough hollowed out by alacial action, on the east shore consisting of the hard granite and conglomerate of the Laurentian, and on the west of its lower rooks of the Calciferous, and probably Potsdam series, now classed as Canadian rocks lying upon the Laurentian.

Lake Winnipeg is not definitely known to have been hollowed out by glacal action. It is much more protable that it is an old preglacial river valley, of the general character of that of the Missistppi of the present day, with its northern end blocked by drifs and alluvial deposits, or a depression has been formed in the bottom of this old valley by movements of the carth's crust; sevidence of these crusted warpings being seen in the high (seaches along the foot of the Manitoha secarpment. On the east shore of Lake Winnipeg there is no "conglomerate" known in the Laurentian, and in fact it is more or less doubtful whether there is conglomerate abywhere in the Laurentian. On the west shore no "Calciferoua" or "Potsdam" is known, and there is no reason to suppose that there are any pale woir cocks in that vicinity below the St. Peter's sandstone (charg) which is there found ressing directly on the actionaries.

The last first. After the explanation in regard to Laurentian it seems mere trifling to deny the presence of conglomerates. Frof. Chapman (page 297) says: "The Huronian representatives alchough distinct enough in their entirety, closely resemble in many cases the Laurentian rocks of the district, and cannot always be readily separate fr. in them. As a rule, however, the texture is less crystillue or less granitoidel, and slaty or semi-crystal line conglomerates appear among them." Mr. Tyrrell seems to especially object to Lake Winnipeg bilog so decidedly pub down as hollowed out by glacial action. In my lecture of last year I had occasion to point out the distinguished service "in geologizing Manitoba, performed by Prof. Upham, of Boston. So completely did Prof. Upham theory satisfy the conditions that impartial observers immediately set it down as a proved hypothesis. The fact of its being so is shown in the unusual course of the Oanadian Goveramens geological survey in publishing Mr. Upham's report of 156 pares, though the author belonged to a foreign service. This course seems to have displeased some members of our geological staff. To any one who examines the two pages (113 and 114) of observations as to glassial striae, and fields such an entry as "Between the Hadson bay and Lake Winnipeg, along the Severn, Fawn, Poplar and Beren's river, on almost all exposed rook surfaces (A. P. Low) the glassial striae run S.W."; and also (page 115) "Oa the east shore of Lake Winnipeg between the Narrows and the mouth of Winnipeg river at numerous localities the glassial strine are S.W.," it must be evident that in its course the tremedous ice sheet could not have done other than socop out Lake Winni peg. We may, however, admit the possibility of there having been in the pre-glasial age a river valley to begin with.

4. Mr. Tyrrell says: "Finally, it would be interesting to know if the lecturer has any or sense of the "Treaton" age of the rocks beneath the city of Winnipeg, as a specimen received from a well hored at the water works at Armstrong's point consists of a soft and argillite, the same as that at Stony mountain, and clearly indicates, in default of evidence to the contrary, the Hudson river age of the rock immediately underlying the drift and alluvium on which Winnipeg is built."

The discussion at this point was as to the occurrences of the "Trenton" rock from which natural gas is supposed to come. Dr. Dawcon shows that there is "Trenton" at Rosenfeld south of Winnipeg); it is shown by Frof. Panton and others that the Trenton is found at St. Androws (sorth of Winnipeg). Mr. Tyrrell anys probably Hudson river bed immediately underlying the drift at Winnipeg; and since Trenton underlies Hudson river is as Janost a certainty that the Trenton lies below Winnipeg and can be reached by horing.

5. Mr. Tyrrell asys: "It is also stated that 'some marbles occur on Iske Maniaba,' whereas it is quite certain that nc such rock is found anywhere around that lake, sud, in fact, there is no orystalline limestone or 'marble'known anywhere in Manisoba up to the present time."

Prof. Hind states that he found on St. Martin's lake, which is connected with Lake Manitobe by the short Parwidge Orop river, and which is also connected with Lake Winnipeg, "partially metamorphos:d sandstone rocks," at one point the "rock approaches the oharacter of gneise, "'an inland consists of gneise with large quartz veins meandering through it," while further on were found "fragments of silicious limewone." It is locally believed that there is crystalline limestone in that region, and certainly the conditions described by Prof. Hind favor this view. These are all the matters raised in Mr. Tyrrell's criticiam, and it will be seen that they are almost all debatable points. GENERGE BRYCE.

Manitoba college, Winnipeg, Dec. 81.

-

bibe bich moon feld moon And-says tely fuoe st a mni-

bbs,', in pools p to Sh, ake ver, Vin-some sof ring und is me-adi-stais een

