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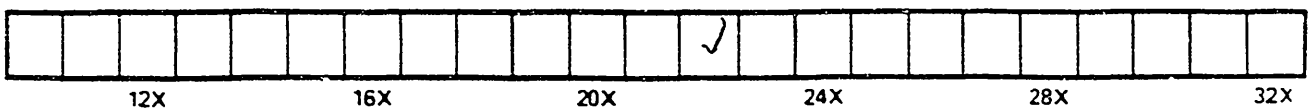

THIRD SERIES. VOL. V. FASCICULUS No. 2.

PROCEEDINGS

OF

THE CANADIAN INSTITUTE,

TORONTO,

BEING A CONTINUATION OF THE "CANADIAN JOURNAL" OF SCIENCE, LITERATURE AND HISTORY.

APRIL, 1888.

Whole No. Vol. XXIII.] [No. 149

CONTENTS:

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THIRD SERIES. VOLUME V., 1886-87.

TORONTO:
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BY THE COPP, CLARK COMPANY, LIMITED, COLBORNE STREET.
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(Royal Charter granted November 4th, 1851.)

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W. H. VANDERSMISSEN, M.A. 1886-87

CONTENTS.

PAPERS.

PROCEEDINGS

OF

THE CANADIAN INSTITUTE,

SESSION 1886-87.

EIGHTEENTH MEETING.

Eighteenth Meeting, 19th March, 1887, the President in the chair.

Exchanges since last meeting, 33.

The following were appointed auditors for the year:—D. B. Dick by the President, and T. B. Browning by the members.

The following were elected members:—Frank Rolph, Jos. Kilgour, R. T. Blatchford.

Rev. Father Laboureau, of Penetanguishene, read a paper entitled "Reminiscences of the Huron Missions." He also presented to the Institute a photograph of a letter by Father Chaumonot, Missionary to the Hurons, written on birch bark, and dated "Ste Marie des Hurons, 1645," the original being in the possession of a gentleman of Dijon, France; a brass ring found near the supposed site of the Huron town of Ossossane; and a tomahawk taken from the ruins of the French Fort of Ste. Marie; for which a vote of thanks was passed.

Dr. P. H. Bryce read a paper on "Diphtheria and Scarlatina in their various aspects."

After some discussion,

On motion by Mr. Marling, seconded by Mr. Creelman, it was resolved, "That the Council of the Institute be requested to make such representations to the City Council on the subject under discussion as they may think fit."

NINETEENTH MEETING.

Nineteenth Meeting, 26th March, 1887, the President in the chair.

Exchanges since last meeting, 38.

Charles Potter and M. O'Connor were elected members.

Prof. J. Hoyes Panton, M.A., read a paper on "Places of Geological Interest near Medicine Hat," illustrated by diagrams and Geological specimens.

MR. PRESIDENT AND GENTLEMEN:—To-night, I purpose taking you with me in imagination, to the banks of the majestic Saskatchewan, that wooer of many a stream in the North-west; there we shall examine some places of geological interest, and glean something from the fragmentary records, as we find them at that place and in some ravines of more than passing interest not far from that locality.

Before directing your attention to the places under consideration, allow me, in a few words, to outline the striking geological characters of that vast stretch of country extending from the Western Boundary of Ontario to the Rocky Mountains.

The geology of the great North-west, like its vast plains and immense rivers, is on a magnificent scale. To the eye of the geologist, a grand vision appears, as he contemplates the marvellous panorama, that rolls before him, portraying the geological features of the country lying between the Laurentian rocks to the east, and the lofty mountains of the west; the former, representatives of the first rocks to triumph over the universal waters of primeval days, the latter belonging to a period comparatively near the summit of the geological series. Between these great natural boundaries we see stretching before us, the three vast prairie steppes of the North-west, rising in succession above each other and distinguished by characteristic physical features.

FIRST PRAIRIE STEPPE.

This fertile region well known as the Red River Valley, is about fifty miles wide at the boundary line which separates Canada from the United States, but widens to the north. It has an elevation

of 800 feet above sea level and embraces an area of 6,900 square miles. Being the last of that country to emerge from water, it has received the drainage of the North-west for countless years and has thus become enriched by an alluvial deposit of almost inexhaustible fertility.

Some sixty feet beneath the surface solid rock is reached, but in some places, Selkirk, Stony Mountain and Lake Winnipeg, the rock reaches the surface and is usually a magnesian limestone, rich in fossils belonging to the Silurian period.

SECOND PRAIRIE STEPPE.

This is well marked off from the preceding by the Pembina, Riding and Duck Mountains, along its eastern side; it has an elevation of 1,600 feet above the sea, is about 260 miles wide at its southern limit and narrows slightly towards the north. Within this large area, are 10,500 square miles of land more rolling in character than that of the former district, but also containing extensive stretches of prairie land.

The underlying deposits here differ from those of the Red River Valley, both in character and age. In this area you find Cretaceous clays, some bearing very interesting fossils, while in the preceding, Silurian limestones characterize the deposits.

THIRD PRAIRIE STEPPE.

The so called Dirt Hills indicate the eastern limit of a vast region, some 465 miles wide on the forty-ninth parallel, with an elevation of 3,000 feet above sea level and embracing some 134,000 square miles. In this immense area are located the vast coal fields of the North-west; here too, we find the localities, that are to occupy our attention to-night. The underlying deposits of this region are also Cretaceous. the surface is more rolling than in the other steppes referred to, and in many places lakes and ponds occur with waters strongly alkaline, As this great scene sweeps before us showing in succession these marked natural steps, each full of interest, we can readily perceive what an attractive country the North-west is to a student of geology.

The rich ores of the Laurentian rocks to the east, the level lands of almost exhaustless fertility in the Red River Valley, the rolling districts of the second plateau, with a drier and warmer soil and the

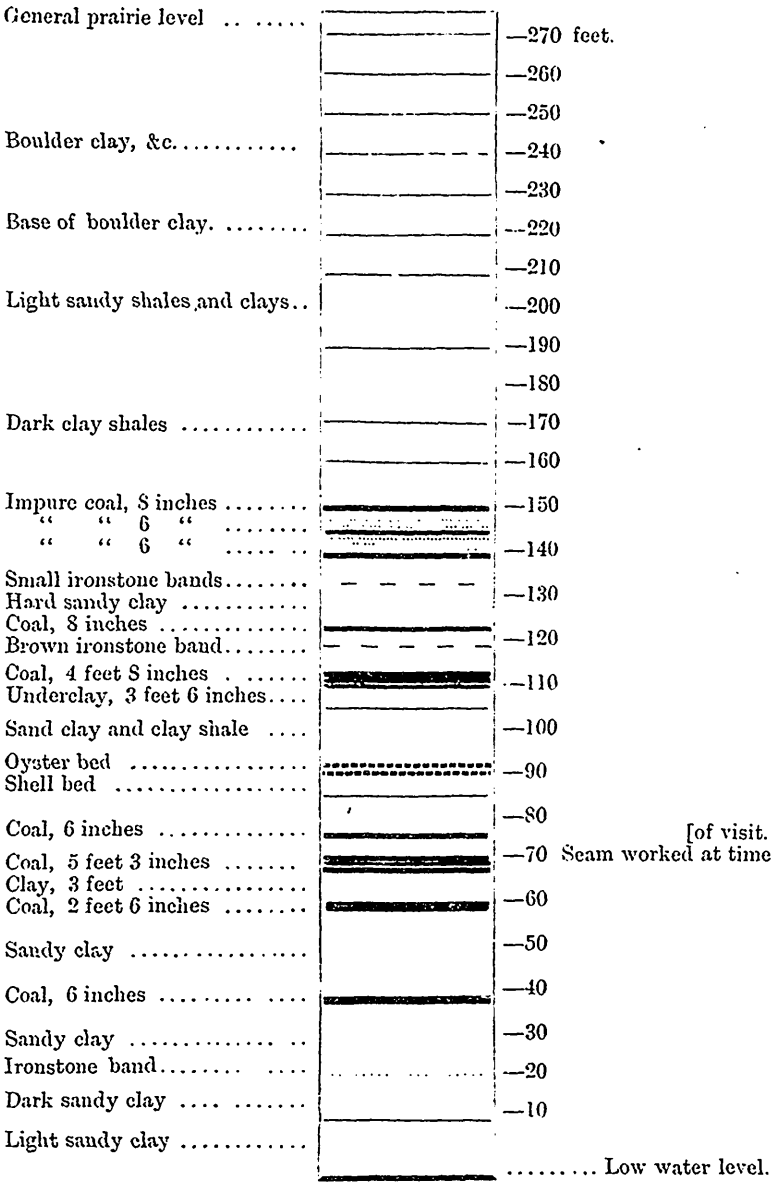
third region more vast than the preceding, bearing an inexhaustible store of fuel, all offer attractions to those, who are interested in the development of our great Dominion.

MEDICINE HAT.

This somewhat progressive town is situated 660 miles west of Winnipeg on the banks of the Saskatchewan River over which the Canadian Pacific Railway passes at this place. This is about half-way across the third prairie steppe. Proceeding westward by rail, after a short run of seven miles the station Stair is reached, about one and a half miles from the Coal Mines of that district. As you walk from the station across the prairie, in the direction of the mines, you see no indications of the great ravine, through which the river passes, and from which you are but a short distance. It is only when you come directly upon it, that you see the work nature can perform through the agency of water. As you stand upon the bank of that majestic river, 290 feet above the level of the water and observe, not only the channel worn out by the river, but also the immense lateral excavations made by streams no longer seen, and spring freshets of modern times, you are astounded at the impressive examples of denudation before you.

There being but little solid rock in this region, running water very soon wears immense cuttings through the clays. The coal mine in this vicinity is not located directly on the banks of the river, but on the sides of one of these great ravines leading to it.

The following section of the deposits at this place was prepared by J. P. Lawson, Esq., Manager of the Company mining coal in that district. On the occasion of my two visits to this place I had the pleasure of meeting Mr. Lawson who was very ready to give any information sought.



Section of deposits near Medicine Hat, showing the seam of coal worked by the Saskatchewan Coal Mining Co.

A mine could scarcely be more favorably situated for access than this; the coal comes to the edge of the ravine and has a slight dip to the southeast.

It can either be rolled down to the river's edge, and transported by boat to Medicine Hat, or drawn up an incline to the prairie level and taken by train to points east and west; the latter plan has been followed. During the past year active work in the mines at Lethbridge has affected operations at this place. It is not likely after this that Medicine Hat coal will be used much beyond that locality; for it is found that coal from localities nearer the mountains is superior to that obtained farther east.

Before the opening up of other mines the coal from Medicine Hat was used in considerable quantities in Winnipeg. It is easily kindled, burns with an intense heat and leaves no clinkers. Consumers considered that $1\frac{3}{4}$ tons were equivalent to 1 ton of anthracite.

The following analysis taken from the report of the Geological Survey gives the composition of this coal.

	Slow coking	Fast coking
Hygroscopic water	16.82	16.82
Volatile combustible matter	29.54	31.90
Fixed carbon	46.34	43.98
Ash	7.30	7.30
	100.00	100.00
Coke per cent	53.64	51.28

Ultimate analysis

Oxygen and nitrogen	17.52
Carbon	54.35
Hydrogen	3.34
Sulphur	.67
Ash	7.30
Hygroscopic water	16.82
	100.00

Calorific power—determined by experiment.

Indicated power of fuel in * calorics	51.44
Indicated evaporative power of water (at 100°c) per pound of fuel.	9.57 pounds

* A caloric—one grain of water raised through 1°C of temperature.

Specific gravity—1.3972. the weight of a solid cubic foot being 87.32 pounds

The composition of this coal indicates that it is a lignite, showing a considerable proportion of water and ash and a tendency to disintegrate when exposed to the air. A comparison of this coal with that derived from seams nearer, and in the Rocky Mountains, shows the latter to be freer from water, gives less ash and a much higher percentage of carbon, in other words the quality of the coal improves as you approach the mountains. In the iron-stone band near the river several interesting fossil plants were found in the fragments of stone. These are well defined and in many respects can be readily observed to be closely related to the genus Brosenia and the species has been given the name Brosenia antiqua by Sir William Dawson to whom some specimens were shown. These before you were obtained near the river's edge. On account of the gradual slope from the prairie level down the ravine to the river's edge, it is an easy matter to examine the different layers of deposits indicated in the section already referred to. The fossils from the bed almost two hundred feet below the level of the prairie can be readily identified as allied to the oyster family. They are not imbedded in solid rock, but form a layer of loose shells lying between beds of clay; they are exceedingly fragile, usually small and require to be handled very carefully, or they crumble to pieces on examination.

From many gathered, the specimens before you are the only ones, which have remained at all complete.

The presence of oyster shells so far below the prairie level, in a region now removed 2,000 miles from the sea is very suggestive of the wonderful changes which that country has undergone in the ages long receded into the past. At several places along the banks of the river, the remains of petrified trees are very common; some of these belong to types entirely different from those which now grow on the banks of the Saskatchewan.

The clay band 110 feet above the river in some places presents a very attractive appearance, being almost as red as vermilion; a condition which has likely resulted from the burning of coal in the seam below.

This clay seems to have little or no lime or magnesia in it, possesses a fine compact texture and may yet be of economic value as a supply for the manufacture of pottery.

Leaving the mine and passing down the river, the banks do not present the appearance of an escarpment, but immense piles of gravel; these great heaps or hills are covered with grass and the deposits seem to have assumed this condition, long after those seen in the vicinity of the mine. These large mounds of gravel are no doubt comparatively recent in their origin, glacial or post-glacial, while those of the mine are decidedly Cretaceous, belonging to the Belly River series of that system.

IRVINE RAVINE.

Proceeding by rail eastward from Medicine Hat for a distance of 20 miles you reach Irvine station, on the Canadian Pacific Railway. There is very little at this point calculated to prove of interest to a geologist, but on looking to the south, about two miles, in the distance a comparatively high hill appears, with a pecular flat-like summit. This indicates the entrance to a ravine or "Coulee" of more than ordinary attraction. At almost any point it teems with interest to a student of palaeontology; if he desires, and time permits, it can be followed up until the Cypress Hills are reached; a place where during the past few years members of the Geological Survey have made some startling discoveries regarding the extinct fauna of the North-west.

In the Spring of '83, Mr. Lawson, Manager of the Medicine Hat Coal Mine, while prospecting for coal in the region of Irvine, discovered the remains of what appeared to be an animal allied to reptiles

On his return to Winnipeg, he was interviewed by a reporter, and a short notice in the daily papers appeared, describing the pecular remains, found among those lonely hills. In July of the same year, Sir William Dawson, while visiting the North-west heard of this discovery, and set out to find the remains after having obtained directions as to their location from Mr. Lawson; but his efforts were in vain. On his return to Winnipeg, having learned that the writer was preparing to search the same locality in August, he kindly gave the sketch of the locality that he had used, and

advised, if possible, to see Mr. Lawson, for he (Sir William Dawson) was under the impression that there was a mistake in the directions given him.

On reaching the Coal Mine in August, I at once communicated to Mr. Lawson the results of Sir William Dawson and asked him to examine carefully the sketch and make any corrections he saw necessary.

Some changes were made and in a few days in company with a gentleman from Medicine Hat, I started with considerable enthusiasm to seek this fossil, around which so much of interest was gathering. It was a very bleak day, when we reached Irvine station and began to wend our way across the flats to the entrance of the ravine. We followed the directions and gradually ascended the hill on the trail, which leads to the Cypress Hills. As soon as the summit was reached, and we beheld the complicated nature of the place, an immense central ravine, and innumerable lateral ones, we began to feel that we had undertaken an almost forlorn hope, in setting out to find a particular spot among such hills. The sketch was frequently consulted, but all was obscure in this wild spot. Among the rugged ravines, we climbed hour after hour, seeking in vain the reptile, that had lain so long among these peculiar hills. Though apparently unsuccessful at first, still much was seen that was exceedingly interesting and instructive. The effect of "weathering" upon the rocks of this place is astonishing. So striking is the result, that my companion frequently observed, "It looks as if some of these hills had been pounded to pieces." Among the debris, we observed numerous crystals of Selenite, which appeared to have been in the upper layers of the clay. Some of these were very perfect and of all sizes and in some parts very numerous indeed. From their occurrence in these argillaceous strata, this mineral seems to have resulted from the decomposition of some iron compound and its reaction on the carbonate of lime in the clays.

Sulphide of iron may have been present and oxidized into the sulphate of the protoxide of iron, which becoming decomposed by the bicarbonate of lime, would give rise to sulphate of lime and carbonate of iron, the former separating out in the form of the crystals already referred to, and the latter remaining as ironstone.

We also found many fragments of large shells resembling the

genus Corbula but they all seemed exceedingly fragile and no complete forms were observed. In several parts of the ravine, layers of ironstone intercalcated among the strata of grey sandstone, are of common occurrence and at some points exposures of coal appear, but the seams are comparatively thin, and experience has shown that they are of too irregular a nature to pay to work.

When the hope of finding reptilian remains was beginning to lessen, and my companion becoming disheartened; (for he had come expressly to see the interesting relics of past life,) our energies were revived by finding four fragments of thoroughly petrified bones: these lay on the side of the hill, and appeared as if they had fallen from layers higher up the exposure. Our fallen hopes much revived by this discovery, with renewed vigor we climbed the hill-side, where we expected to find more remains in their original position. Though this seemed on consulting our sketch, to be near the spot we sought, still, we were forced to abandon further search for the reptile, cross over to another part of the ravine and confine our attention to the lofty sides of the escarpment there.

Here a magnificent exposure appeared, largely made up of beautiful sandstone comparatively soft interspersed with bands of stone more or less ferruginous and in some places seams of inferior coal.

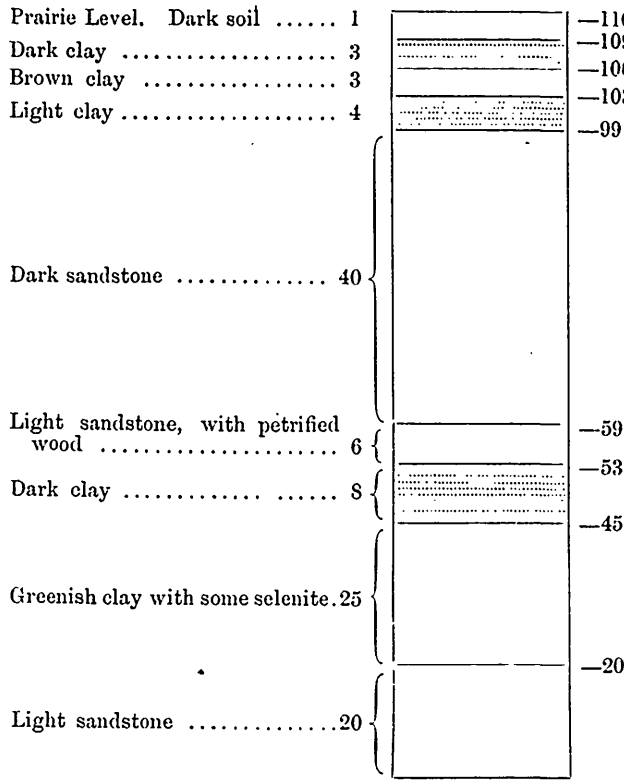
The effect of the weather upon this soft sandstone was very marked much of it appeared to have crumbled away leaving shelves of the ironstone, along which we could walk.

In some places the crumbling sand had fallen down the sides and covered over cave-like spaces, into which we sometimes fell, as we walked along the sides of the ravine, the sandy covering, which appeared to bridge over these holes, proving too thin to sustain our weight.

Along the face of this escarpment, and usually near the layers of coal, we saw several bones protruding from the rock, but as often as we attempted to dig them out, all crumbled away except the portion we saw, and which seemed to have hardened by weathering. A visit to the same place the next year and many attempts made to secure fossils from this sandstone, have convinced me that we can obtain only fragmentary fossils at best from this rock; its porous nature allows the water to percolate readily through, and thus affect

any bones imbedded in the sandstone. This is a striking contrast to the condition of fossils found in some of the Cretaceous clays of the North-west, where they possess all the lustre and beauty, which characterize some shells of modern seas. On some of the elevated shelves, excellent fragments were found, which the weather, through long periods had prepared. Almost anywhere in this vicinity upon the ironstone bands, fragments of bone could be secured. There was no longer doubt in our minds, that the remains of extinct animals would be found among the deposits of this wild and dreary place, that the bones belonged to creatures of immense size and that they thronged the Cretaceous seas in which these deposits had been formed. We felt amply repaid for all our exertions in this wild, rough and lonely spot, although we found no skull bones or teeth. Some of the bones were very large, apparently portions of thigh bones and vertebrae; all of which were presented to the Historical and Scientific Society of Winnipeg, with the exception of the specimens placed before you, for examination at the close of the evening's proceedings.

At one place, in particular, where the escarpment was very marked, large quantities of petrified wood lay about at the base and bore a marked resemblance to a pile of ordinary wood, so much so that at first sight, an ordinary observer would naturally consider it such; portions of the trees from which these had been derived could be seen in the sandstone. As this place the strata were so well defined, that a sketch was taken, a vertical section of which may be represented as follows; but it must be remembered, that this is not a uniform condition in the ravine, for the strata vary much in different parts: while a general arrangement may be observed, such as sandstone, ironstone, clay and seams of coal, yet a wonderful difference occurs, when you compare one series of deposits with those in other parts.



On the occasion of a second visit to this place the following year '84, better results followed my investigations. Many fragments of fossil bone were secured but all of little use in identifying the animals to which these remains belonged. However I had the good fortune to discover some teeth. These with some fragments of peculiar bones were forwarded to Prof. Cope, of Philadelphia, who identified the teeth as belonging to a large deinosaur of the genus Lælaps allied to the Megalosaurus, and the peculiar bones as fragments of the carapace of a Cretaceous land turtle of the genus Trionyx.

Portions of other teeth were obtained ; but not comple'e enough for identification ; in addition to these, a vertebra was found which in all probability belonged to a fish.

The specimens, some of which are on the table for your examination, would seem to indicate that these deposits among the "weathered" hills of this locality are of absorbing interest to a student of Science. The district is extensive and days could be spent in examining it. Further south beautiful ammonites are readily found, while in the Cypress Hills deposits of a most interesting character occur.

Regarding the geological horizon of the deposits in Irvine Ravine, the subject has received considerable attention by some members of the Geological Survey, who place them in the Cretaceous of which the Belly River series and Pierre Shales are represented in the escarpment near Irvine Station, the Pierre Shales being uppermost and represented by clay banks of a more or less dark color, below follows the Belly River series composed of sandy clays and layers of ironstone nodules among them. The beds are readily acted upon by the weather producing the striking appearance already referred to. Seams of coal appear in these deposits at some places; that mined at Medicine Hat being at the base of the upper division of this series of deposits, while the seam at Irvine Ravine lies at the base of the Pierre Shales. Irvine Ravine thus becomes of more interest than Medicine Hat, the former affording an excellent section in which the Pierre Shales and Belly River series are well illustrated, the latter being largely made up of the Belly River deposits; both groups belong to the Cretaceous system in the geological system.

Having thus directed your attention to these attractive geological hunting grounds in the vicinity of Medicine Hat, I shall close this paper with the following diagram which will enable the reader to compare the Cretaceous deposits of the North-west with those of the same system in some parts of the United States and England.

ENGLAND.	MISSOURI.	NORTH-WEST.
Eocene or latest Cretaceous....	Fort Union.	Laramie.
Maestricht	Fox Hill.	Fox Hill.
White Chalk	Pierre.	Pierre.
Chalk Marl.....	Niobrara.	Belly River.
Upper Greensand..	Benton.	Benton.
Gault.....	Dakota.	Dakota.

TWENTIETH MEETING.

Twentieth Meeting, April 2nd, 1887, the President in the chair.

Exchanges since last meeting, 82.

The Council announced the admission of Ernest M'Craken as an Associate.

A communication was received from the Council recommending the formation of a House Committee, a Museum Committee, and an Archaeological Committee.

The following were elected members:—W. J. Cooper, Geo.

Graham, Robert F. Scott, P. K. Stern, Thomas Pinkney and Thomas McCraken.

Dr. W. B. Nesbitt read a paper on "The Volumetric System in Materia Medica."

In bringing the following paper before you I am conscious of its many imperfections, and that it is not as yet a perfect system, yet I hope you will bear with me, and that in the discussion which I hope it will be its merit to engender, I may receive such hints and criticisms as will enable me to place my system on a still more practicable basis.

The first thing that the student of Materia Medica is struck with, is the almost illimitable number of drugs and preparations, whose number is only comparable with the likewise illimitable and varied doses. It is this heterogenous system of dosage that I would try to place on a more satisfactory basis. We will just glance at a few of the preparations and their doses. We will commence with the inorganic salts. This is what we find :—

Potassic Carbonate	10—30 grs.	Potassic Bromide	5—30 grs.
" Bicarbonate	10—40 "	" Citras	20—60 "
Liquor Potassæ	15—60 "	" Acetas	10—60 "
Potassic Permanganate	1—2 "	" Chloras	10—30 "
" Iodide	2—10 "	" Sulphurate	3— 8 "
" Tartras acid	20—60 "	" Nitras	10—30 "
		" Sulphas	15—60 "

I have chosen the salts of Potash simply because they come first in the book most used by students, *i. e.* Mitchell Brown's Materia Medica. All these preparations when prescribed by the Physician, are first triturated in the mortar for such as are in the form of xtals, and then dissolved in water, water being almost invariably the medium for holding the different drugs in solution, sometimes as in the case of Quinine, a little sulphuric acid is added to assist the dissolving.

Now if these drugs were kept in solution by physicians and pharmacies, and the strength of *each* so graduated that the dose of *all* would be the same, you have the principle of the system. For instance, we will take two or three of the above mentioned salts,

Potassic Carbonas 10—30 grs.
" Permang 1— 2 "
" Iodide 2—10 "

We will keep these on our shelves already dissolved, and we will have the dose for all 1 drm. In order to do this we will make up say one quart, 40 ozs, of each solution. In 40 ozs. there are 320 drms. therefore to have the maximum dose of

Potassic Carbonas in one drm. we must have 320×30 or 9600 grs.
" Permang. " " " " " 320×2 " 640 "
" Iodide " " " " " 320×10 " 3200 "

Now we see by the above, that in 320 drms. of the Pot. Carb. solution we have 9600 grs., or in 1 drm. of solution we have $\frac{9600}{320} = 30$ grs.: in the Pot. Permang., in 320 ozs. we have 640 grs. *i.e.* in 1 drm. we have $\frac{640}{320}$ or 2 grs. which is the requisite dose.

Leaving the inorganic we next come to the organic portion of Materia Medica, this like organic chemistry, has a little more system in it, for we find here the majority of the tinctures have a dose of from 1—2 drms. Still we have such discrepancies as

Tinct. opii 5—40 m.	Tincture opia ammoniata ½—1 drm. m.
" Camp. Co. 15—60 m.	Liquor morphine Hydrochloratis 10—60 m.
Fluid Ext Pilocarpine 10—60 m.	Tinct. Pilocarpine 5—20 m.
Tinct Tolutana 15—30 m.	Tinct. Lobelia 10—30 m.

Also there are the various infusions, decoctions, wines, elixirs and every manner of fluid preparation, with doses varied for each class and the doses for any class varying among themselves.

What possessed the originators of our Pharmacopœia to have the doses so varied, when they might just as well and as easily have had them the same, is to me incomprehensible. The same system and principle will serve here as in the previous instance, by adjusting the amount of the principles taken it would be very easy to have the dose for all ½—1 drm.

In this plan there would also be much less liability to poisoning. The *Modus operandi* of poison cases is as follows: A druggist receives a prescription which calls for Quina Sulph. xxx grs.; now Sulphate of Quinine, as well as the salts of many other alkaloids, have a great resemblance to each other in external appearance, so much so,

that the Druggist just looking at the contents, can easily mistake Morphine for Quinine. He gives xxx grs. of Morphine by mistake for Quinine, the man dies; the stomach is sent to Dr. Ellis, and the Druggist appears at the next assizes to answer to the charge of manslaughter. Now, had these been in volumetric solution, with dose for each 1 dr., the Physician would have written Quinine Sulph. 6 drs. and then, as the dose for morphine would been exactly the same, a poisonous quantity would not have been administered.

The above are the principal features of the system, but what would I think still further improve it, would be the introduction of the metric system of measures. The dose for all being the same, there would not be the danger of misplacing decimal points as in the metric system as now applied. Taking for the standard dose 1 to 2 cubic centimetres and having our bottles in sizes of 100 and 200 C. C.'s, there would be much greater facility of reckoning than at present.

By having a uniform dosage system, not only would much unnecessary work for the student be abolished and enable him to devote more of his time to the much more essential study of therapeutics, but for therapeutic purposes we would have a most complete scientific system, as the standard dose ½—1 dr. or 1—2 C.C.'s as the case may be the therapeutic unit, as 1 dr. of tinct. aconite would produce maximum therapeutic effect of the drug, and so likewise the 1 dr. of tinct. opii. the 1 dr. of tinct. digitalis, etc., *ad infinitum*.

Mr. Charles Hill Tout, read a paper on "The Study of Language."

In the May Volume of the Popular Science Monthly of last year, is an article from the pen of Mons. Havelocque in which he puts forth the astounding statement that language is an organism. Now, as this touches upon an extremely important point in linguistics, and is propounded, presumably, in support of the views held by the school Mons. Havelocque represents, it will be well worth while to consider the grounds on which he makes this assertion.

He begins his paper by telling us that the faculty of language stands in close relation with a certain one of the frontal convolutions of the brain which the inferior monkeys do not possess, and which is found in a rudimentary state in the anthropoids, but the full acquisition and most complete development of which has made man

what he is—the master of articulate speech—and from this physiological fact alone, he claims a place for that purely conventional medium of thought—language, among the Natural Sciences.

But seemingly conscious of the weakness of this argument, he brings in another by way of strengthening it, viz., in the fact, to use his own words, that no man or group of men is competent arbitrarily to change the structure of its language. The morphological evolution of language defies all convention, all encroachment; it goes on by virtue of its own force, more or less slowly or speedily, but without the fancy or the pleasure of men having any power to divert it from its course. On these two facts, the former at best true only of *the faculty* or *power* of speech, and the latter less than half true, he sweepingly puts aside all objections to his theory and declares that the study of language must be classed among the Natural Sciences. Having got so far he now finds no difficulty in *asserting language* to be an organism. What (he asks in effect) are the characteristics of an organism Formation, growth, development, decay, these are just the characteristics of language; ergo language is an organism. Frivolous as this kind of reasoning may appear it is just what Mons. Havelocque used. Languages, he says arise, are developed, pass on to decadence and perish like other organised beings, and there can be no doubt that language behaves in reality like an organism, and that it is in a constant state of evolution, that is to say, because language has a *birth, growth, development, decadence* and because these are the identical terms used in speaking of the evolution of an organism, terms borrowed indeed from the nomenclature of Physiology, language forsooth must be an organism.

This I contend is the only fair deduction that one can make from his statement. Following on this, he goes on to show the successive evolutions of this new organism, running somewhat superficially through the principal phases of linguistic development. Basing his remarks on the theory proposed by Wm. Schlegel in 1818, viz., that all languages first pass through a monosyllabic period, which the result of later research and study has confirmed and strengthened and which although we are not acquainted with any language in its embryonic or even strictly speaking monosyllabic stage, notwithstanding is undoubtedly the first phase of linguistic life, he tells us that existing monosyllabic languages have greatly improved upon

their primitive processes, all of which is incontestably true. The only remark we would offer here is that the term *monosyllabic* when applied as above to *existing* languages should be qualified in some way; as we have *no* example on record of a purely monosyllabic language and that to bring forward the Chinese, as he does, as an example of this class is to talk about a matter we are ignorant of and to put ourselves in conflict with the authority of those whose scholarship in that tongue is beyond dispute. I refer here, in particular, to such men as Prof. Douglas, of British Museum, and Professor of Chinese, at King's College, London, the author of an exceedingly interesting History of the Chinese people, who in this connection states that the Chinese language like most others has suffered loss through phonetic decay. Even at the present day it is as I have shown, he says, less purely a monosyllabic language than has generally been supposed, but in bygone ages there are evidences that it was *poly-syllabic*. We find for instance many words with aspirates in them which point to the loss of a syllable, for example, such a word as K'an leads us to the conclusion that in all probability it was originally Kahan. But there are other combinations of characters which are unmistakably representations of polysyllabic words, and a close examination of any of the dialects shows that these words bear no inconsiderable proportion to the entire number of words. In Pekingese these polysyllabic words are very numerous, partly owing no doubt to the introduction of Manchu and Mongolian words into the vocabulary. But there are also quite enough native polysyllabic words to redeem the spoken language at least from the charge of monosyllabism. A study of a few pages also of Sir Thos. Wade's Tzu Erh Chi is instructive reading on this head. But to return. From this point Mons. Havelocque goes on to show how the agglutinative stage is evolved out of the monosyllabic, but confesses to a difficulty in the evolution of the agglutinative into the flexional or synthetic, and as this has long been felt to be a difficulty we would beg to call attention here to the numerous tongues of the American group or family of languages as offering and affording the very evidence we need to show how the monosyllabic or agglutinative or incorporative may pass into the flexional or synthetic.

Humboldt who first called attention to this family believed that we could clearly discover in them the origin of the tense and

mood signs, that is to say, the *process* by which the higher phase is evolved or developed out of the lower; and he cites several good examples in successive stages of transition, for instance, he says that the actual process of transition from the incorporated, the distinguishing feature of the American family, to the inflexional is presented to us in the Mbaya tongue where we find such verbal forms as "*dalavli*" which means, thou wilt throw; "*nilabuite*" which means, he has spun, where the *d* is the sign of the *future* and *n* of the *perfect*. At first sight they look like *true* infl xions, but on closer examination we find that *d* is in fact simply a relic of the word "*quide*" meaning, hereafter or later, and *n* stands in the same relation to the word "*quine*" which means, "*and also*" and both have their independent signification at the present time. But it is quite conceivably and highly probable that at no distant date, the independent signification of these abbreviated words will gradually slip, as has actually been the case in the Mexican and Tamanaca tongues, from the mind of the speaker and be lost and the letters will then become purely formal elements denoting the tense of the verb and nothing more. Indeed some of the American tongues may be said to have already reached the inflexional stage, their primary tenses ending in different letters, for example in the Mexican language there are the terminals "*ya*" or "*a*" in the imperfect and the augment "*o*" in the preterite and others in the future. In the Tamanaca also the present ends in *a*, the preterite in *e*, the future in *c*, and in speaking of these Humboldt says "there is nothing in either of these tongues to show that these tense signs have independent meanings as they once undoubtly had; and there is no reason why they should not be classed with those of the Greek and Sanskrit as true inflexional elements." It is clear then from this that a study of the American tongues is absolutely necessary in order to a right understanding of the process by which the inflexional is developed from a preceding stage and if there were any doubt about this the labors of Dr. Brinton in this field would soon remove it. But as it was not the intention of my paper to demonstrate the processes by which the several phases of language pass into one another although the subject is a most enticing and attractive one, we will return to the point from which this digression on the sythetic process has led us. What most astonishes us then in reading through Mons. Havelocque's paper is

the extraordinary confusion of terms he is guilty of in trying to put the study of language upon the foremost pedestal in the Temple of the Natural Sciences. He distinctly in the earlier part of his paper draws attention to the common habit which confuses the *art* of speech with that of the *faculty* and yet in the same breath uses the two terms interchangeably. We are altogether at a loss to see, unless this is so, why one who speaks at one moment of speech as an *art*—a thing to be acquired—can at the next call it an *organism*, and this is even more striking when we remember that Mons. Havelocque claims to be treating language exclusively from the scientific point of view. That the *faculty* of speech is in close relation with a certain convolution of the brain no one will dispute I suppose; nay we will go farther and say with him that this same faculty is hereditarily transmitted and goes down with the structure, nature and qualities of the brain, but by what process of reasoning I am to arrive at the conclusion that the *art* of speech, a man made thing, is an organism I am at a loss to conceive. One might as well say that the conventional signs of our methods of recording knowledge, or that the art of painting or sculpture are organisms, all are equally the products of human effort, preseverance and labor. Language is to put it briefly and clearly, simply and purely an instrument for the conveyance of thought, the use of which depends entirely on the skill of him who handles it, in exactly the same manner as the pencil, brush and chisel depend upon the skill of their several users. This seems to me to be so demonstrably obvious and the error and confusion of terms Mons. Havelocque has fallen in to be so plain that it is not worth while to spend more time over it, but go on at once and examine his second argument which because it contains a partial truth may seem for the moment slightly more convincing. Here he says that his *reason* for including the study of language among the Natural Sciences lies in the fact that no man or group of men is competent arbitrarily to change its structure, etc. Here we perceive in a brief glance that the fallacy of his second argument lies in the peculiar and unscientific notion, which he in common with his school holds, concerning the *origin* of language. Though he does not say so in so many words it is abundantly clear from his argument that he pre-supposes man to have started on his career fully equipped with a ready-made and to a certain extent perfect medium for the

communication of his wants and thoughts, whereas a study of the phenomena of language on sound inductive principles proves beyond doubt, to use Prof. Whitney's language, that there was a time when man was as destitute of language—*i.e.*, articulate speech as a medium for the communication of his wants and thoughts—as the dog, that is to say, that man, as man, had to acquire by patient and labored effort, a medium of expression in precisely the same way as every child has since, with this important difference, that primitive man had to do it wholly unaided while the child receives the assistance of those around it. The closer one examines the phenomena of speech the more irresistibly is one drawn to this conclusion, a conclusion I may add now held by the majority of the most eminent of modern philologists, and hence in accordance with this supposition Mons. Havelocque most unhesitatingly asserts that language is altogether beyond the control of man or groups of men, whereas experience even within the historical period goes to show that this statement is only partially true, and if we can show the reason why the growth and development of language is, in a measure, outside of the control of man on a more scientific basis than Mons. Havelocque has attempted to do, we shall have taken away the only argument he uses that carries any force with it and this with the light modern research has thrown upon the subject we shall have no difficulty in doing.

In examining the phenomena of language then, one of the most obvious features always confronting us is the different families or groups as we term them into which language is divided, a method of division rapidly growing less fixed and clear, and assuredly pointing to a time when the science shall be a little older and our knowledge of the subject a little more extensive, when we shall be able to trace with comparative clearness all the various existing families or groups to one primitive source. The whole tendency of modern research leading in that direction; and this being so it will then become a comparatively easy task to put one's finger upon the law or force which differentiates the offspring one from another and all from the common parent, and if we turn to the older science of physiology we shall there discover a law or tendency at work which if we borrow and set in motion within the province of language will clearly demonstrate the processes that developed all existing groups of language from one

primitive and common source. In citing an example of this law or tendency, to be seen in its operations in physiology it will suffice for us to take the human face. Now it is an incontestable fact that the facial features are greatly influenced by a force at work upon them from the moment of their embryonic existence down to their full development and decay, known as the Law of Conformity to Type. To take the nose for an example we know that in certain families and even peoples this is invariably the most marked and striking feature of the face, and which has been known to persistently run in that family or people for many generations, and when we ask the reason of this phenomenon we are told and we have proved the force of this tendency in many of our domestic animals, of which the pug-dog is a noted instance, that some remote ancestor of this particular family or people possessed a remarkably developed nasal organ, which by the unique force and strength of his character, he conferred in perpetuity so to speak on his favored descendants.

And as it is with the nasal feature so is it with all the others. Now in precisely the same way in primitive times when men were splitting up into families and clans and struggling hard with the difficulties that naturally then in the early stages of language, beset the expression of their wants and thoughts, certain of them stood out like Nimrods above their fellows in mental capacity and power, and so left the impress of their individuality upon their language, giving it just that tendency, setting it just on those lines within that certain groove that would start it on the plane of its development and characterise it through all the phases of its existence.

In the operation of this law of Conformity of Type we maintain that we can discover why we have found it is necessary in the first place to group languages into families; and secondly, and here is our point of divergence from the notion held by Mons Havelocque and his school, that this and this alone, is the reason why language is in a limited sense beyond the direct control or power of man, not because it is an organism given to him in the same way as his nose or his eyes, but rather acquired in the way in which he gets his teeth, if the figure is allowable, by much vexation of spirit, multiplying and developing as do his teeth in corresponding ratio with his needs. Every growth, change and development in speech is due and indeed must be in the first place to an initiatory action of some one individual

sanctioned and accepted by his community. Man has absolute power and control over the changes and developments of language, so long as he lets it run on its own peculiar lines. He is powerless only when he would seek to turn the course of its growth and development into some channel other than that it started from and which is invariably laid down and marked out, more often unconsciously than not, while its speakers are uncultivated and in a primitive condition of being. And when it is asked why one language is is superior to another, why one is much better adapted to the uses to which we desire to put if we ask a counter question. Why is the nose of the Jew for instance in general a more striking feature in him than in most other people? And the answer to this question carries by inference the answer to the other, viz., because of some remote ancestor of this people whose individuality and personality of character was so remarkably strong as to leave one of its chief features on all his descendants. Language may be said to resemble organisms in other ways than mere similarity of formation, growth, development, etc. As it is dominated by the law of its type so it is also in much the same way by the law of the Survival of the Fittest: That language which had the good fortune to be sent rolling down the vistas of future ages by a superior master-hand, will by its intrinsic merit and force be best able to adapt itself to all the varying changes of its environment, and will undoubtedly live and flourish while others less favored either remain stunted and deformed, or else drop out of existence altogether.

But while language is dominated by laws identical with some of those running through the Organic Kingdom, and we are obliged for lack of better to fall back upon the nomenclature of physiology to mark its various changes and developments, it is only a warped, prejudiced and unscientific mind that can possibly mistake a mere superficial resemblance for a deep-rooted living reality.

Mr. CHAMBERLAIN referred to the different theories that had been advanced to account for the origin of language. Noiré (whose theory has been partially endorsed by Max Müller) ascribed the origin of roots to the sounds simultaneously used in social acts, as when people work together in digging, threshing, spinning, rowing, &c. These sounds become signs of repeated acts, continuing in the memory as signs of such acts, and so became roots embodying a concept, and being uttered by persons engaged in a common work are understood by all. He (Mr. C.) was of the opinion that language was

originally polysyllabic, and was developed according to man's wants. The Chinese was referred to in opposition to this opinion, but this was not a fair example to cite, besides there were indications in Chinese of a polysyllabic structure.

Mr. TOUT thought the mistake was in supposing any one theory contained the whole truth. There was no one individual way in which language was formed. He imagined that language was first formed partly dissyllabic and partly syllabic.

TWENTY-FIRST MEETING.

Twenty-First Meeting, April 9th, 1887, the President in the chair.

Dr. Ellis was appointed representative of the Institute at the next meeting in Ottawa of the Royal Society of Canada.

A donation was announced of 83 species of plants, from Mr. G. Montague White.

Exchanges since last meeting, 44.

Mr. Goodwin Gibson was elected a member.

Mr. H. R. Moore, on behalf of Mr. A. C. Lawson, M.A., Geologist to the Geological Survey of Canada, read a paper on

THE DIABASE DYKES OF RAINY LAKE.

The most recent of the crystalline rocks of the Rainy Lake region are comprised in a series of strong dykes of comparatively fresh diabase which are observed to cut, at different localities, the various members of the Archæan complex of formations. These dykes are not infrequent throughout the country lying between the eastern confines of the first prairie steppe, which forms the basin of the Red River of the north, and the western border of the area of Animikie and later formations of the Lake Superior basin. Their occurrence and some of their characters are briefly referred to in my report on the Lake of the Woods region.* As there observed, the occurrence of these dykes cutting the older folded rocks, which in their eastward geographical continuation, pass under the flat-lying Animikie and Keweenawan formations, is suggestive of their

* Geological and Natural History Survey of Canada, Annual Report, 1885, p. 41 CC., p. 47 CC.

possible connection with the bedded traps that form so large a part of the two latter geological series. With the question of the possible identity of character and age of these dykes with the traps of the Animikie or Keweenawan, or of both, is associated the equally interesting one of the extent of the earth's surface, over which, in early geological times, were in simultaneous operation, those particular volcanic forces which appear to have had their focus in the Lake Superior basin.

The more notable field characters of these dykes are : their common strike throughout the region from N.W. and S.E. to N.N.W and S.S.E. ; the sharp, well defined nature of the gash or fissure which they fill, no matter what may be the character of the country rock ; the absence of inclusions of the country rock, or of apophyses of the dyke running into it, except in very occasional instances ; their generally uniform width under different conditions of occurrence in different localities, the limits being as a rule 60 and 150 feet; their continuity for one or several miles where exposures permit them to be traced ; their passage from a very compact, aphanitic, black rock at the immediate contact with the dyke walls, by insensible gradations to a very coarse-grained, mottled, dark gray rock in the middle of the dyke ; an occasionally observed peculiar pitting of the weathered surface, arranged in straight, more or less uniformly spaced lines transverse to the strike of the dyke ; their prominent, steeply rounded, or domed, glaciated surfaces in contrast to the more gently inclined *roches moutonnées* of the schists and gneisses ; their assumption of brownish tints on surfaces aerially weathered ; (surfaces beneath high water mark of the lakes are generally quite fresh and black).

These dykes have as yet only received a preliminary study, and it will require a much more extended examination of the country in which they occur and a much more elaborate investigation of their petrographical characters before a comprehensive statement of their geological relations can be formulated. A few notes regarding the microscopic features of these dykes, taken together with what has been said of their field occurrence, may however, be of interest, and will serve as a report of progress of what is being done in this line of investigation in the field west of Lake Superior.*

* These rocks were studied microscopically in the laboratory of the Johns Hopkins University, Baltimore, under the guidance of Prof. G. H. Williams, for whose kind advice and assistance the writer desires to express his grateful acknowledgments.

One of the most characteristic of these dykes is one that traverses the coarse granitoid gneiss of the west arm of Jackfish Lake, which lies to the north-west of Rainy Lake. Its width is 135 feet and its contact with the country rock is well exposed as a sharp line. From a macroscopic examination the gneiss does not appear to have been altered perceptibly towards the contact. Specimens for microscopic examination were taken from different parts of the dyke, viz., at 60 feet, 20 feet, and 6 feet from the contact, and at the contact. At 60 feet from the contact, the rock is a coarse-grained mottled gray rock in which dirty white feldspar and black pyroxene are the prominent constituents. Under the microscope it presents the characters of a coarse-grained, comparatively fresh diabase. Augite of a pale mauve tinted gray colour is abundant and often occurs in masses that fill the field of the microscope when low powers are used. Sometimes these plates of augite are individual crystals. For the most part however, they are not single individuals. When examined between crossed nicols the plate of augite is seen at once to be resolved into an intimately interlocking mosaic of irregularly shaped grains of diverse optical orientation. In ordinary light the boundaries between the different members of these "polysomatic"* masses of augite are traceable only with difficulty and uncertainty. There is no interstitial matter whatever, the different grains being as intimately associated as in the case of interpenetration twins of feldspar. That they are not twins is shown by the fact that there are often as many as half-a-dozen grains all of different orientation thus combined in the same mass. The cleavage, by its lack of continuity over the field of course indicates a difference of orientation in different parts of it, but the cleavage traces are not strongly marked, and attention is only directed to the discordance of the cleavage after the polysomatic character of the mass has been rendered prominent by the analyser of the microscope. This polysomatic structure of augite does not appear to be common. Rosenbusch does not mention it in his last comprehensive summary of the present state of petrographical knowledge.† The nearest approach to this structure that is at all well known is the polysomatic character of some chondri of olivine in certain

* Adapted from Tschermak's use of this word as applied to a similar structure in the olivine of certain meteorites.– V. Die Mikr. Beschaff. der meteor. Stuttgart, 1885.

† Mikr. Phys. der Mineralien und Gesteine Stuttgart, 1886

meteorites such as are figured by Tschermak‡ and Wadsworth.§ Olivine in a similar condition in terrestrial rocks has recently been described and figured by Renard in specimens from Kerguelen Island in the Indian Ocean.‖ The polysomatic structure in augite is not so well known. Renard notes that the augites of the feldspathic basalt of Heard Island, Indian Ocean, are grouped together at certain points,** and again in the same rocks in Marion Island that the augite is characterize l by a tendency to form groups of individuals having their vertical axes parallel.†† Teall mentions "Granular Aggregates" of augite in the Hett and the High Green dykes in the north of England.‡‡ Some of these appear from the figures given to be aggregates of grains of augite not in close juxtaposition with an interstitial base, although that figured in Plate XII, Fig. 5, would seem to be a polysomatic augite, and if so is the only strictly parallel instance that I can find of this structu ? so common in this dyke and in others of the region.

The augite is generally altered to hornblende at its periphery and occasionally the latter mineral entirely replaces the former. The process of alteration does not appe ? to proceed along the almost or quite imperceptible lines of demarkation between the different individuals of the polysomatic augite, but extends from the periphery of the mass as a whole in towards its centre.

The plagioclase appears in two general forms, a rather stout or tabular form which is the larger and usually the more cloudy with decomposition products, and a small long lath shaped feldspar which appears quite fresh and in which the polysynthetic lamellae are much more distinct than in the former.

Magnetite occurs in irregularly bounded masses or is disseminated, often quite thickly, through the augite as inclusions of dusty or finely granular aspect. Pyrite also occurs and is discernable macroscopically. Apatite is seen in occasionally colorless hexagonal sections and in slender prisms with rounded terminations. Water-clear quartz, with inclusions of apatite microlites and liquid inclusions

‡ Die Mikr. Beschaff. der Meteor. Stuttgart, 1885, Taf. xv. Fig. 1 and 2.

§ Lithological Studies, Mem. Mus. Comp. Zool. Harvard, Vol. x., pl. 1.

‖ Notice sur la geologie de l ile de Kerguelen, Bul. Mus. Roy. Hist. Nat. Belgique, Tome IV. No. 4., p. 233, fig. 1, pl. v.

** Notice sur les roches de l' ile Heard. Bull. Mus. Roy. Hist. Nat. Belgique, 1886, S p. 260.

†† Notice sur les roches de l' ile Marion. Ibid. p. 250.

‡‡ Petrographical Notes on some north of England Dykes, Q. J. G. S., 1884, 158. p. 229 and 242

with dancing bubbles, forms a considerable proportion of the mineral constituents of the rock and. is characterised by having a common orientation for isolated sections over a wide area of the microscopic field. as in the micropegmatite structure. .A few colorless garnets are also present. The rock, such being its characters, may be classed as a uralitic quartz diabase.

At 20 feet from the contact the rock is very similar to that at 60 feet but is much less coarse in texture. It differs from the latter in mineralogical composition in the fact that there is present an abundance of white or colorless garnets, all perfectly isotropic. They have a well defined border indicative of a high index of refraction and a perceptibly rough surface. Their shape is for the most part rounded, or, when rectilinear outlines are observable, they are hexagonal sections of the rhombic dodecahedron. The larger grains have a curved parting which may be demarkation lines between different i dividuals. The treatment of the slide with hydrochloric acid cold or hot, leaves them unaffected. The occurrence of garnets in basic dykes is by no means unique. They are however regarded as a product of contact metamorphism within the dyke. Speaking of the "Iron District of Lake Superior," Wadsworth says, "Most of the "diorites" (uralitic diabases) here (at Republic Mt.) contain garnets, this mineral being found principally along the edge of the intrusion while the centre was nearly if not entirely free from it. The schist in like manner near the "diorite" frequently contains garnets both rocks appearing to have mutually reacted upon each other." * The garnets in the Jack Fish Lake dyke do not appear to be a product of contact metamorphism since they are found in the middle of the dyke and very much more abundantly at 20 feet from the contact than at 6 feet from it, or immediately at the contact, where their presence has not been detected. Beyond the abundance of garnets, the dyke at 20 feet has the same characters as at 60 feet. The polysomatic structure of the augite is pronounced.

At 6 feet from the contact the rock is fine grained and the ophitic structure of typical diabase is much more characteristically developed than in the coarser grained parts of the dyke. In this part of the

* Notes on the Geol. of the Iron and Copper Districts of Lake Superior. Bull. Mus. Comp. Zöol. Harvard, 1880, pp. 45, 46, 47.

dyke there is first observed a differentiation of the rock into constituents of different periods of crystalization, the order being first plagioclase in more or less idiomorphic* lath-shaped individuals lying in all positions, then augite generally allotriomorphic,* sometimes hypidiomorphic* and finally a base or matrix of both these minerals in a very much more finely crystalline state together with magnetite. The structure of the base is rather obscure, the chloritic substance usually present in diabase rocks being more prominent here than in the coarser grained part of the dyke when it is almost or perhaps entirely wanting. Quartz is present but in smaller quantities than in the coarser grained portions of the dyke. The augite occurs both in simple individuals and in polysomatic masses. The uralitization of the augite, which is generally observable, is much more pronounced in the irregularly bounded polysomatic masses than in the simple allotriomorphic development of the same mineral. A few garnets are present as inclusions in the feldspar but were not identified with certainty. In this respect this portion of the dyke differs markedly from the more central portions examined. The most interesting constituent of this portion of the dyke remains, however, to be mentioned. It is the non-pleochroic colorless rhombic pyroxene, enstatite; it occurs in idiomorphic development showing the characteristic obtuse domes in some of the sections. It shows regular cleavage parallel to ∞ P (110), upon which the angle of extinction is zero, and characteristic cross parting along which partial alteration of the mineral to bastite or serpentine is apparent. This enstatite is not abundant and plays the role of an accessory mineral. Its occurrence in a rock of well marked diabase structure is interesting. Rosenbusch remarks that it is present in only a few diabases which have a gabbro-like structure,† and Teall has recorded the occurrence of the allied rhombic pyroxene bronzite in the Whin-Sill of the north of England as an accessory.‡ Enstatite also occurs in a variety of the allied rock diabase porphyrite from Schaumberge, which has been described by Laspeyres and Streng under the name Palatinite. This enstatite was not observed in the coarser parts of the dyke but occurs, as will be noted, in the still finer grained diabase at the contact.

* Terms introduced by Rosenbusch. Cf. op. cit. p. 11.
† Mik. Phys. der Massigen Gestine, 2nd Ed., 1886, p. 188.
‡ Q. J. G. S., 1884, p. 652.

At the immediate contact the dyke assumes microscopically the characters of a very compact grayish black aphanitic rock in which can be occasionally detected minute glistening facets of porphyritic crystals. With low powers of the microscope the matrix is not resolvable but appears as an uniformly yellowish to greenish gray ground thickly dotted with grains of magnetite. Under the higher powers this is seen to be made up, in addition to magnetite, of a fine felt-work of minute lath-shaped crystals of plagioclase imbedded in hazy, somewhat yellowish green flocculent chlorite substance derived presumably from the alteration of the augite, since that mineral cannot with certainty be identified in the base. The porphyritic character of this part of the dyke is well marked, though the imbedded crystals are small. These are augite in small irregular polysomatic masses, with a hazy margin or fringe of greenish decomposition product, and long lath-shaped plagioclase and occasionally stouter broken fragments. Besides these there are porphyritic crystals of enstatite much more altered and less plentiful than at 6 feet from the contact. Neither quartz nor garnets are observable in the contact rock.

Considering then the dyke with reference to its variation in structure and mineral composition the points of interest to be noted are: The passage of the coarse grained central portions of the dyke to the compact aphanitic rock at the contact; the absence of porphyritic structure in the middle of the dyke as contrasted with the well marked development of the same as the rock becomes finer grained towards the dyke walls; the absence of the characteristic chloritic substance of diabase in the centre of the dyke and its abundance towards the contact; the presence of quartz in greater quantity in the coarse grained middle portions than at the sides; the presence of garnets in the coarsest parts of the dyke, their abundance in the medium grained parts and their rarity or total absence in the neighborhood of the contact; the presence of the rhombic pyroxene enstatite in typical idiomorphic porphyritic crystals in the fine grained parts near the contact and its absence in the coarser central parts; the diminution in size of the porphyritic crystals near the contact in coextension with the increasing fineness of the ground mass; and finally the "polysomatic" structure common to the augite throughout the dyke.

Three quarters of a mile from the exposure where the specimens whose characters have just been given were collected, there occurs, on the opposite side of the bay in the line of the strike of the dyke, another exposure of the same dyke. On the islands of the bay which lie intermediate between these two localities the outcrop of the dyke is observable, so that there is no doubt of their both being exposures of the same dyke. The rock here was not studied in so great detail as at the last exposure. The specimens taken were of the same grade of coarseness as those taken at 20 feet from the contact on the north side of the bay. The feldspars are more decomposed and the twinning lamellae often obscure, and the small quantity of quartz which is associated with them appears to be of secondary origin; whereas the origin of the quartz noted in the same dyke on the north side of the bay seemed much more problematic. In the latter case the common micropegmatitic character of the quartz and the occurrence in it of needles of apatite, which in no way differ from those in the feldspar, together with the not infrequent occurrence of one individual of apatite partially included in quartz and partially in an adjacent feldspar, would argue for the primary character of the quartz. The augite in the dyke on the south side of the bay resembles that already described occurring both in simple individuals and in polysomatic masses. It is largely altered to uralite. Titanic iron with its alteration product leucoxene shows characteristic barred structure of the cleavage traces parallel to the planes of the rhombohedron. The leucoxene is frequently accompanied by a margin more or less extensive, of secondary brown mica. Apatite is present in comparative abundance. Chlorite occurs in vaguely defined masses and the garnets which, as before, are present, are associated with it.

On the south-east shore of Pipestone Lake about a mile west of Stone-dam Portage occurs another of these dykes cutting transversely schists which have a strike of N.E. to E.N.E. The specimen taken from the middle of the dyke has the characters of an uralitic quartz diabase. The feldspar as a rule is remarkably fresh and occurs in the usual lath-shaped twinned crystals of plagioclase. The crystals are commonly observed to be cracked transversely and the cracks filled with a brownish yellow material which shows aggregate

polarization. The augite occurs more commonly in polysomatic masses than in simple individuals. The magnetite is often surrounded by rims of secondary brown mica. The quartz is apparently original and has numerous inclusions of an opaque granular character together with fluid inclusions with dancing bubbles, gas pores with black borders and glass inclusions oval and circular.

Fig. 1.

Section of diabase, from Pipestone Lake dyke, showing large polysomatic grain of augite in three granules of diverse orientation *a b c* ; *d* uralitic hornblende ; *e* magnetite. X 28.

On the south shore of the North-west Bay of Rainy Lake, a similar dyke cuts both the biotite gneiss of the region and the red granite which is intrusive through it. It is an uralitic quartz diabase. The feldspar is in rather stout crystals in the coarser grained part of the dyke, though usually lath-shaped. It is much decomposed and is partially replaced by quartz and chlorite. The polysomatic character of the augite is not prominent but this may be due to the fact that it is about half altered to hornblende and to chlorite. The augite individuals are often twinned and the cleavage traces are unusually well defined. The magnetite shows a tendency to peripheral arrangement around the altered augite indicative of its secondary origin. Quartz is present which is probably original besides that which is clearly secondary. Apatite in long slender needles and leucoxene in irregular masses, are the accessory constituents.

In the same dyke, nearer the contact where the texture is fine grained, the rock is much more uralitized, traces of augite being observable only in cores of the compact green hornblende, which has almost entirely replaced it. Apatite appears more abundant, as do also the secondary quartz and chlorite. Garnet of a pale yellowish color occurs sparingly.

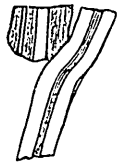


Fig. 2. Plagioclase fr'm diabase dyke, Northwest Bay, Rainy Lake, sh'wing effect of pressure of one crystal against another.

At the contact the dyke rock is a compact aphanitic base in which can be detected minute porphyritic crystals. Under the microscope the base is seen to be made up of minute lath-shaped crystals of fresh plagioclase augite grains, magnetite and chloritic substance. The porphyritic crystals are lath-shaped feldspars occasionally broken and showing the lamellae in some instance bent, as the result of pressure of one individual against an angular part of another, and augite generally surrounded with an irregular border of secondary hornblende, which, in turn, has an outer girdle or wreath of granules of magnetite that have separated out in the process of uralitization as in fig. 3.

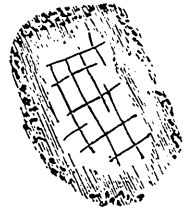


Fig 3. Augite from diabase dyke, Northwest Bay, Rainy Lake, showing marginal alteration to green compact hornblende with an encircling wreath of secondary magnetite.

In the south part of the Rainy Lake and on the Rainy River a number of these dykes have been observed. One cuts the coarse granitoid gneiss of the river between Couchiching and Fort Frances on the south side of the river, and another crosses the river at the Manitou rapids. Neither of these have yet been examined microscopically. On the lake near the extremity of Gash Point one of these dykes cuts the schists with a strike of N. W. and S. E. across the whole breadth of the point and traverses the islands on both sides of it. Here it is traceable on the point and on the islands for a distance of a mile. Three miles to the south east in the line of the strike of the dyke, a dyke occurs cutting the schists on the islands off the south shore of the lake which is probably a continuation of that of Gash Point. From this point it is traceable for two miles across the islands to the main shore on the south side of Grassy Narrows. Thus, this dyke has a length of at least six miles and has an extension to the north-west and south-east of the points observed, for a distance that is probably very much greater. A specimen from the central part of this dyke, proved on examination to have the characters of a uralitic quartz diabase. The plagioclase occurs in long, rather stout, lath-shaped crystals, which are generally so cloudy as to obliterate the twinning

in most cases. The augite occurs both in simple individuals and in polysomatic masses. It exhibits the usual marginal alteration to hornblende and there is besides a certain amount of chlorite. Original magnetite is frequently surrounded by a margin of secondary biotite. Micropegmatitic quartz is abundant. It is often intimately intergrown with the feldspar, and as the latter is much decomposed, would seem to replace it as a partial pseudomorph, but apatite needles of the same aspect as those which occur as inclusions in feldspar, augite, and quartz, are often seen to be inclosed partly in a feldspar and partly in quartz grain. The primary origin of the quartz in spite of its micropegmatitic character, is however, not beyond doubt. It is to be noted that were the quartz original we would hardly expect to find it in such close association with the feldspar. The plagioclase of these rocks affords unmistakable evidence in its idiomorphic character of its having first crystallized from the magma. The augite crystallized next, enclosing the lath-shaped plagioclase; and the quartz, which would be the last to crystallise, we would expect to find separate from the plagioclase by the augite, *i.e.*, to fill in the interstices between the augite. Again although single apatites are often found extending from a quartz grain to a feldspar grain, a condition of things favoring the notion of a common primary origin of both the latter minerals, yet such a phenomenon is not incompatable with a secondary origin for the quartz, since the replacement of feldspar by quartz must necessarily be a slow operation and proceed particle by particle. Further, if the quartz were original we should hardly expect to find in it inclusions of crystals of the first generation like apatite, which would be liable to be enclosed for the most part in the earlier secretions like feldspar and augite, rather than in the residual silica of the magma. The non-existence, however, of quartz in some diabases which are very much decomposed and its presence in fresh ones, militates against the theory of the secondary origin of the quartz in these rocks, so that the question of how much of the quartz is primary and how much secondary in an old diabase is a

Fig. 4.
Polysomatic grain of augite—Grassy Narrows dyke Rainy Lake, *a* and *b* are twins —the other granules are of diverse optical orientation. X 28.

question that as yet does not appear susceptible of definite settlement.

About a mile to the west of this dyke where it crosses Grassy Narrows Island is another nearly parallel dyke converging on the former at a small angle towards the south. The rock is an uralitic quartz diabase and in its coarser portions, near the middle, the texture is more granular than that of typical diabase. The plagioclase is cloudy with decomposition products and quartz is abundant. The augite is entirely replaced by compact green hornblende the only indication of the augite that remains being the light colored character of the central portion of the hornblende and the abundance of magnetite granules that have separated out in the process of alteration. Apatite occurs in slender hexagonal needles mostly in the quartz, but also in the feldspar and hornblende; and a number were observed which were common to both feldspar and quartz. A few zircons showing parallel extinction, deep black border and brilliant polarization colors also occur. A few colorless, rounded, isotropic grains probably garnets were observed. Nearer the contact where the rock is much finer grained the typical diabase structure is much better developed, the feldspar having its usual lath-shaped character with augite in allotriomorphic structure around it, although the character of the latter is obscured by its extensive alteration into hornblende. The augite so far as it is revealed in the cores of the hornblende occurs both in simple individuals and in polysomatic masses and it is interesting to note that the hornblende derived from a polysomatic aggregate of augite is of uniform orientation throughout. Magnetite or titanic iron with associated leucoxene is generally distributed. The quartz is in small grains proportioned to the finer grained texture of the rock. In the central part of the dyke the quartz is in large grains commensurate with the increased size of the feldspar and augite. In neither case does it occur in the mosaics which are so characteristic of the secondary or vein quartz. In addition to the minerals enumerated in this part of the dyke, there is in prominent porphyritic development an altered rhombic pyroxene. The alteration has proceeded very far and the mineral is now represented only by a mass of yellowish green serpentine with perhaps some of the intermediate alteration product bastite. The cleavage is, however, well defined

and the extinction in the several cases noted is sharply parallel to it. These characters together with the traces of the obtuse dome so characteristic of sections of enstatite are sufficient to identify it as that mineral in an altered state. The occurrence of the enstatite in this dyke in its finer grained parts towards the contact is analogous to, and an interesting confirmation of the similar occurrence of the mineral noted in the Jack Fish Lake dyke also in the vicinity of its contact.

To summarise, the main points of interest are, briefly: 1. Post Archæan age of dykes. 2. Their problematic relationship to traps of Animikie and Keeweenawan. 3. Their uniform strike and width. 4. Sharp contact. 5. Passage from coarse texture at centre to aphanitic at sides. 6. Granular character towards centre, porphyritic at sides. 7. Prevalence of quartz and garnets towards centre and absence near contact. 8. Presence of enstatite at sides, absence towards centre. 9. "Chloritic substance" abundant at sides, absent towards centre. 10. Polysomatic character of augite throughout. 11. Uralitization of augite. 12. Very marked contrast of texture of two different parts of a rock mass which solidified under practically the *same pressure* but at *different rates of cooling*.

Mr. James T. B. Ives, F.G.S., read a paper on "Iron and the other Ores of Ontario."

The Secretary of the Bureau of Industries, Ontario, Mr. Archibald Blue, in applying himself to the task of compiling a report of the mines for the year 1884, wrote: "the only records we have for the whole province are those of the censuses taken by the Federal Government, for the first time in 1871 and again in 1881." "These," he adds, "are very meagre, for the only information they give, relates to the quantity of raw mineral products for the year preceding the one in which the enumeration is made." The opening words of that report are: "A country so rich in mineral resources as Ontario should be able to exhibit a good record of operations from year to year." However, Mr. Blue succeeded in compiling a report in which fourteen iron mines are noticed; and the following year, 1885, some others were reported upon by the same official writer. Those notices include statements as to the depth and underground extension of the workings the quantity of ore obtained, the number of men employed and in several cases analyses of the ore. Moreover, it is stated in

nearly every case whether the ore is Hematite or Magnetite. These reports of the Ontario Bureau of Industries are the fullest account we have of the mines of the Province.

Next to these ranks the report issued in 1882 by the Department of Agriculture, Ottawa, on the mineral resources of the Dominion, in which each province is treated separately in reference to its own minerals. In that report about twenty localities in Ontario are mentioned, where iron was then being, or had previously been worked.

I only find five mines of iron ore mentioned in the Geological Survey Reports. A catalogue was, however, compiled last year of the minerals exhibited at the Colonial Exhibition, and the iron ores included in that list represent about a dozen different mines.

In Professor Chapman's Outline of the Geology of Canada, describing the Laurentian formation, he states that it contains "beds of magnetic and specular iron ore." In reference to the Gananoque and Northern Townships District he says: "Although not favourably adapted, as a rule for agricultural occupation, the district contains valuable economic minerals. The principal of these comprise: The iron ores of McNabb, Bedford, Crosby, Sherbrook, Madoc, Marmora, Belmont, Limerick, Minden, Snowdon." Again, describing the Huronian strata in the region of the Upper Lakes, enumerating their more important economic minerals, the same author mentions "the iron ores of Echo Lake, Michipicoten River, Pic River, etc."

Of course the notices of one writer often refer to the same mines as those of another. I have, however, jotted down the localities on the map now exhibited and find that the total number of mines recorded is thirty, as follows:—In the County of Haliburton, Lutterworth, Minden, Glamorgan and Snowdon; in Peterborough, Galway, Silver Lake, Balsam Lake, Blairton, Marmora; in Victoria, Digby; in Hastings, Wollaston, Madoc, Tudor; in Renfrew, Bagot, McNab; in Lanark, Darling, Lavant, Sherbrooke, Bathurst, Perth; in Frontenac, Palmerston, Bedford; in Northumberland, Seymour; in Algoma, Bruce Mines; also bog iron at Sarnia and Normandale. The map I have colored to represent the various formations of the Cambro-Silurian, Silurian, and Devonian systems, which overlie the Archean rocks of this area. My object in doing so is this: I wish to show that all these iron deposits appear to occur in the Archean rocks, with the

exception of two localities, where bog iron occurs, which is not a deposit in the same sense. In a paper on the economic minerals of Canada, which Mr. W. Hamilton Merritt, M.E., F.G.S., read before the British Association at their Montreal meeting in 1884, he enumerated the localities in which the various ores occurred, and the Geological formations in which they were found. In reference to the iron of Ontario, he stated that in the Lake Superior District it occurred in one instance in the Devonian, and that in the Lake Ontario and St. Lawrence District it occurred in four cases in the Silurian. These particulars he subsequently stated he had obtained from a mineral map of the Dominion displayed at the Paris Exhibition of 1878. That map is not published and in the absence of it I find no evidence of the existence of Devonian strata on the Canadian side of Lake Superior, and the apparent occurrence of iron in the Silurian rocks of the eastern part of the province may perhaps be explained away. I think it will be found that the iron deposits proper are all pre-Silurian.

The Geology of my map is based on the very small map published by Sir William Logan in 1866, to illustrate the Geology of Canada, and revised by the present director, Dr. Selwyn for the Dominion Atlas in 1876.

According to that map it appears that the mines at Blairton and Seymour, and also that at Gros Cap on Lake Superior occur in, or are overlaid by Silurian strata. Unless, indeed, and it is a perfectly legitimate alternative, there be at the points where those mines occur *inliers* of the Archean rocks. This is, of course, a matter of observation in the field. In the case of Blairton and Seymour it is the more probable as those localities appear by the map to lie within the valley of the River Trent, whilst the Gros Cap Mine occurs so near the outcrop of the Archean rocks that it is probable the ore is obtained therefrom.*

How meagre do these references seem when one thinks of the beautiful and voluminous census returns and monographs devoted to the Geology of the same formations on the opposite shores of our own lakes! Or, without soaring to the Monographs of the United

* Although engaged during the whole of the summer months in exploring geologically the Huronian and Laurentian regions lying between these extremes the author did not visit either Blairton or Gros Cap and cannot therefore speak from personal observation, but is satisfied from analogy that his conclusion is correct.

States Survey, if we compare the fragmentary information we possess in reference to the economic resources of this Province with such complete and practical publications as the annual report of the Mineral Statistics of the State of Michigan, a convenient, portable volume full of information and profusely illustrated with actual sections of the mines, we cannot but sigh for the *good time coming*. As a new comer desirous of informing myself as to the geology of the Province in which I reside I look, anomalous as it may seem, to the publications of our neighbors having reference to the formations of the adjacent states for instruction, for on this side it is not to be found. British soil may be separated politically from that of the United States, but the Archean and Silurian rocks are older than the Declaration of Independence, and the laws by which they are governed do not recognize the boundary.

In view of the undeveloped mineral wealth of the country and the necessity for securing information and preventing the loss of that which is often obtained at great cost to individuals or communities, how important it is that records should be preserved! On this point abundant testimony was afforded by men of science and experts of the highest standing in their evidence before a select committee of the House of Commons at Ottawa in 1884.

Dr. George M. Dawson, D.S., A.R.S.M., F.G.S., one of the Assistant Directors said: "The difficulty in the way is, that the mines of the various provinces are under the control of the provinces themselves, and, consequently, in some provinces there are departments of mines, Nova Scotia and British Columbia, I think, are the only two, and those departments collect for their own provinces all the mineral statistics, probably as fully as necessary, and they have the authority to do so. In the other provinces, there is no authority to collect statistics and if they are collected by the Geological Survey, they must be collected as a matter of favor from the owners of mines, and that takes a good deal of trouble, and in some cases actual personal visits, as it is not possible to accept a report without some supervision."

Dr. Robert Bell, C.E., M.D., LL.D., one of the Assistant Directors, stated that an attempt was made in 1870 to collect statistics by means of a circular addressed to mine owners or managers, accompanied by a blank schedule to be filled up. When the survey aban-

doned the attempt, he continued it privately, a conclusive way of proving how important he thought it. He found that the only way to secure the information was to interview the parties personally.

Dr. T. Sterry Hunt, F.R.S., etc., etc., formerly President of the Institute of Mining Engineers of the United States and of the Chemical Society of the United States, speaking of the position of things eighteen years ago, stated: "The work of the Survey was, in the first place, to determine the geological relations of coal, iron and copper deposits, and around them the stratigraphical geology of the country grew up. There were special memoirs prepared on the questions relating to the metallurgy of iron and steel, and these were published in the reports of the Survey; these were of value to Canada in utilizing the iron of the country."

He explained that in Great Britain the collection of mineral statistics is under the control of the Home Office, having until recent years been in the hands of a keeper of Mining Records, Mr. Robert Hunt, F.R.S., who undertook to get mining statistics as volunteer contributions. In France, he stated all these economic questions came in the front rank, there being a regular corps of mining engineers, part of the civil service, to inspect mining districts and keep the public informed. They visit and report upon the mineral resources of other countries, and have published valuable memoirs respecting Canada. But the State surveys of Ohio, Alabama, Kentucky, Pennsylvania, and New Jersey were those which Dr. Hunt thought should afford models to the Dominion. He stated that Pennsylvania had of late years been expending "about $50,000 annually, in a careful survey of all the points relating to the distribution of its rocks, and the geological relation of its iron deposits, of its salt and petroleum, and of the bituminous and anthracite coal, the results of which have been published in small volumes at the cost of paper and printing. Each mineral is dealt with in a separate volume."

Mr. R. W. Henneker, D.C.L., Commissioner of the British American Land Company and President of the Eastern Townships Bank, urged the desirability of securing careful and trustworthy statistics, which "would do an enormous amount of good to the country, as it is hard to find out from private sources any information of this kind."

Mr. William McIntosh said, "That it would be of the greatest

advantage to practical miners like himself, to get a report of what had been done in each of the mines, and that it would be just the thing to induce capitalists to invest their money."

Professor Chapman said: "People even come to me from the States and say, Where can I find a Geological report and map of such a district? I am obliged to say that it cannot be found, except in detached portions." He considered that small maps should be published, accompanied by plain reports explanatory of the map and giving lists of economic minerals, with their analyses, current values, etc., accompanied if possible by a few plates, showing commonly occurring distinctive fossils.

Mr. Raphael Pumpelly, Director of the Northern Trans-Continental Survey, Newport, R. I., recommended the collection of such statistics, and considered that the "work should begin with a thorough canvas, similar to the one carried on for the tenth census of the United States, that is, every known locality containing mineral of economic value, whether worked or not, should be visited, and commercial samples taken of its products and these samples should then be subjected to the processes of testing or analysis, according to the requirements of the case. At the same time the statistics of production where workings exist, should be a part of the work."

Professor Dana, the author of the well-known Manuals of Geology and Mineralogy, wrote that he believed "it to be very desirable that mineral statistics should be collected and preserved under government direction."

"This work," said he, "does not necessarily come within the duties of a State Geologist. But it could be connected with a survey, provided it be entrusted to a separate agent, who should make it his special business. Such information is often collected with difficulty on account of the unwillingness of owners to make known the state of their affairs, and it is in danger of being largely erroneous, as a consequence of interested misrepresentations, the fluctuations in the conditions of mines, and the uncertainties of ordinary methods of obtaining values, or estimates of values, by samples. The work, therefore, requires special qualifications, very different from those needed in a geological survey."

I trust I shall be excused for using so largely the words of others,

but these testimonies are scattered throughout a long and tedious report, which few are likely ever to read and they appear to me so important that I venture to submit them to your consideration.

Mr. HAMILTON MERRITT said if he understood Mr. Ives aright, he stated that all the iron deposits were archean and none of them Silurian. There was no question, however, that there were large deposits of iron ore in the silurian in the other Provinces. Mr. Merritt then alluded to the difficulty of obtaining information in regard to mines and minerals. It was necessary to travel round the country, and obtain the required information from personal inspection. The importance of collecting this information was recognized by every civilized country, as it was of the greatest value to the projectors, the investor, and the man of science. In England this information was collected under a statute. In the United States it was chiefly collected by the Central Government, though in many of the States there were mining bureaus. It was a matter of great regret that there should be such a great disparity in the amount of capital invested in mines in Canada and the United States. The excess in favor of the latter country was enormous. It was not correct to say as Dr. Selwyn had concluded, that we had not the minerals, as was abundantly proved by the different exhibitions. No country showed a more creditable display of large masses of ore than Canada had done at the late exhibition. Government supervision in the matter was greatly needed. Not merely mining statistics, but every kind of information should be collected that would be useful to persons working in the locality. This valuable information that other countries had seen the necessity of collecting, would give us the same advantages that they enjoy.

Mr. A. BLUE was sure that the views just presented by Mr. Merritt, would commend themselves to the attention of all. Few were aware of the extent and value of the mineral deposits of this Province. He called attention, especially to the petroleum deposits, and the copper mines. He was strongly in favor of steps being taken to collect statistics, and to present the information to the public from year to year.

Mr. SHUTT knew from his own experience that Mr. Miller had collected very much valuable information respecting the phosphates, some of which had been preserved, but much was lost beyond recovery.

Mr. BOYLE asked how the information had been hitherto collected. He did not think that persons owning mines would give the required information, and he did not see how the Government could compel them to give it. He could not see how a law could compel a man to divulge knowledge that would benefit others and injure himself. He thought that other means could be employed to obtain the information required.

Mr. NOTMAN in reference to the discrepancy between the favorable show that Canada had made at the different exhibitions in mineral products, and the little that had been done in developing them, said that it should be recollected

that Canada was a young country, and though there was much mineral wealth, there were not the same facilities in working it as in older countries.

Dr. HAMILTON thought that the Government should make explorations. It would be more useful than collecting mere statistics.

The PRESIDENT referred to the number of geological papers read this session, as showing the necessity for the formation of a geological section.

On motion of Mr. W. Hamilton Merritt, seconded by Mr. Charles Armstrong, it was resolved, "That a Committee consisting of the President, Messrs. Notman, Blue, Ives, Wood and the mover, with power to add to their number, be formed, to report at the next meeting of the Institute on the advisability of forming a Geological and Mining Section, that this Committee in view of the facts laid before this meeting, shall take what measures they deem advisable to call the attention of the Dominion Government, or the Government of Ontario, or both of these Governments to the necessity of some improved method of collecting correct returns of mineral statistics, and information regarding mines and mining locations."

Mr. A. B. Macallum presented a paper on "The Origin of Haemoglobin."

TWENTY-SECOND MEETING.

Twenty-Second Meeting, April 16th, 1887, the President in the chair.

Exchanges since last meeting, 41.

The Committee appointed at last meeting presented a report recommending the presentation to the Dominion Government of a memorial regarding the collection and publication of mineral statistics, which was adopted.

The following were elected members :—William Burns, J. Blackstock, B.A.

Dr. A. M. Rosebrugh read a paper on "Photographing the

Living Fundus Oculi," illustrated with diagrams and photographs.

Dr. HAMILTON referred to accounts of murderers having been taken, and convicted by means of their picture remaining some time in the retina of the murdered man. He had seen this denied. Could Dr. Rosebrugh give any information on the subject?

Dr. ROSEBRUGH.—As to the popular opinion that the image of the last object the person looked at remained in the retina; if an examination were made five or ten minutes after death no image would be seen.

Mr. Boyle read a paper, prepared by Sheriff McKellar, on "A Bragh or Stone Flour Mill," presented to the Institute by the Sheriff.

Mr. Clougher spoke in favor of the establishment of a mining journal.

TWENTY-THIRD MEETING.

Twenty-Third Meeting, April 23rd, 1887, the President in the chair.

Exchanges since last meeting, 26.

The following were elected members:—Thos. R. Clougher, Charles M. Dobson, James Mason, David Spence.

On motion of Mr. Ives, seconded by Mr. Merritt, it was resolved, "That in view of the remarks of Mr. Clougher at the last meeting of the Institute, in reference to the publication of a mining and scientific journal, the Institute do refer the matter to the Geological and Mining Section, with authority to enquire into, and report on a project for the establishment and maintenance of such a journal."

Mr. J. B. Williams read a paper on "Canadian Woodpeckers," illustrated by specimens.

Mr. Dion C. Sullivan, LL.B., read a paper on "Fortuitous Events."

On motion of Mr. Shaw, seconded by the President (Dr. Workman having taken the chair,) it was resolved, "That the Canadian Institute cannot allow this first meeting, since the death of the Rev. John McCaul to pass, without expressing its sorrow at the loss, though in the fullness of years and honours of that eminent scholar and teacher, to whose great abilities and force of character, not only our Provincial University and this Institute, of which he was so bright an ornament, but also the City of Toronto owe so much."

TWENTY-FOURTH MEETING.

Twenty-Fourth Meeting, April 30th, 1887, the President in the chair.

Exchanges since last meeting, 23.

The Council announced the admission of the following as associates:—J. H. Lowe, Wm. Murdoch, S. Beckett.

The following were elected members:—J. C. Forbes, R. Moodie, Alexander Macnabb, Thomas Shortiss, S. Macklem.

Nominations for officers and members of Council for the ensuing year were then made.

Mr. Alfred Baker, M.A., read a paper on "Some Experiments in Connection with the Doctrine of Probabilities."

I. *The problems that had been treated experimentally were three* in number. The first may be stated thus: A number of equidistant parallel lines are drawn on a plane, and a rod whose length is equal to the distance between two consecutive lines is thrown at random on the plane, to determine the chance of its falling on one of the lines. This chance is readily shewn by the theory to be $\frac{2}{\pi} =$ ·6366.....; *i. e.*, in 10 throws it should cross a line 6 times, in 100 throws 63 times, or in 1,000 throws 636 times, etc. In the experiment a large drawing board had formed the plane, and a fine glass

rod had been used. In all, 3,800 throws had been made. Taking any 10 consecutive throws, the widest possible divergences from the 6·366 of theory were observed, the incidents on the ruled lines varying from 3 to 10. The following are numbers selected from ten consecutive decades:

3, 4, 8, 8, 8, 7, 10, 5, 4, 6,
And again, 6, 7, 4, 7, 7, 9, 5, 4, 4, 6,

When any 100 consecutive throws were considered, a much closer relative agreement between experiment and the 63·66 of theory was observed, in the first 1,000 throws the incidences on the ruled lines varying from 59 to 74; in the second 1,000 from 59 to 71; in the third 1,000 from 55 to 75.

Taking 1,000 consecutive throws, a wonderfully close agreement between experiment and the 636·6 of theory was observed. Thus in the first 1,000 there were 633 incidences on the lines.

And finally for the entire number of throws (3,800) while theory gave 2,419 incidences on the lines, experiment gave 2,423.

II. The second problem was: Two points being taken at random in any triangle: to determine the chance that the line joining them shall cut two particular sides of the triangle. This chance is by the theory shewn to be $\frac{1}{3} = \cdot 333\ldots\ldots$; *i.e.*, in 10 locations of the points, the line should cross the sides 3 times; in 100 locations 33 times; in 1,000 locations 333 times, etc. For the experiment, a perfectly level triangular board with elevated rim about it had been used. For points, five small shots were placed on the board, so that after each agitation of them (which was effected by means of a whisk) by joining them two at a time, 10 lines were obtained. In all, 1,000 events were produced.

Taking any 10 consecutive events the widest possible divergences from the 3·33.... of theory were observed, the number of times the joining line crossed the sides varying from 0 to 8. The following are numbers selected from 10 consecutive decades:

3, 2, 7, 5, 4, 1, 5, 4, 0, 4.
And again, 4, 3, 8, 4, 2, 5, 2, 2, 2, 4.

Considering 100 consecutive events, a much closer relative agreement between experiment and the 33·33.. of theory was observed, in the 1,000 the intersections varying from 26 to 37.

Taking 1,000 consecutive events, a remarkably close agreement

between experiment and the 333.33.... of theory was observed, there being by experiment 332 intersections.

III. The third problem was: Two points are taken at random on a given line of length, a: to determine the chance that the distance between them shall exced a given length c. This chance is by the theory readily shewn to be $\left(\frac{a-c}{a}\right)^2$, *i. e.*, if $a = 00$, we have, according as $c = 25$, 50 or 75,—probability required $= \frac{56\frac{1}{4}}{100}$, $\frac{25}{100}$ or $\frac{6\frac{1}{4}}{100}$. So that

(1) In	10	trials	distance	bet.	points	shd.	exceed	25,	5·625	times,
"	100	"	"	"	"	"	"	"	56·25	"
"	1000	"	"	"	"	"	"	"	562·5	"
(2) In	10	"	"	"	"	"	"	50,	2·5	"
"	100	"	"	"	"	"	"	"	25	"
"	1000	"	"	"	"	"	"	"	250	"
(3) In	10	"	"	"	"	"	"	75,	·625	times.
"	100	"	"	"	"	"	"	"	6·25	"
"	1000	"	"	"	"	"	"	"	62·5	"

For the experiment a perfectly level rectangular board with an elevated rim about it had been used. Paper divided into 100 equal spaces by lines drawn parallel to two sides of the board, was pasted down on it. Five small shots were placed on the board, so that after each agitation (effected as before) there were furnished 10 sets of two points each, located on a line, which was any line running the length of the board. The ruled lines running across the board assisted in immediately locating the points on such (any) line extending along the board. In all 1000 events were produced.

Taking any 10 consecutive events, the widest possible divergences from the 5·625, 2·5 and ·625 of theory were observed; the number of times the distance between the points exceeded 25, 50 and 75, varying from 0 to 8, 0 to 6 and 0 to 6 respectively. The following are numbers selected from ten consecutive decades:

$c = 25$.....	6,	7,	6,	6,	6,	8,	6,	8,	3,	0.
$c = 50$.....	5,	0,	1,	6,	0,	2,	6,	0,	1,	1.
$c = 75$.....	0,	0,	0,	0,	3,	2,	0,	0,	1,	2.

Considering 100 consecutive events a much closer agreement

between experiment and the 56·25, 25 and 6·25 of theory was observed, in the 1000 the number of times the distance exceeded 25, 50 and 75, varying from 55 to 63, from 16 to 33 and from 2 to 10 respectively.

Taking 1000 consecutive events a singularly close agreement between experiment and the 562.5, 250 and 62.5 of theory was observed; there being by experiment 577, 253 and 66 occasions on which the distance between the points exceeded 25, 50 and 75 respectively.

The conclusion so far as these problems were concerned was that the hypothesis on which the theoretical solutions were based was correct; and this hypothesis was that the rod and the points located themselves by chance, that all positions were equally likely, and that in a great number of throws the rod and the points would be equably distributed in various positions. Of course the objects had not located themselves by chance; their every movement was guided and controlled by fixed and definite laws—gravity, resistance of air, friction, elasticity, etc., but no one cause operated to constrain them into constancy of position. We might be disposed to think that where uniform determining cause was absent—where, as we might express it, chance reigned; there would be, when a large number of events occurred, an utter unevenness of distribution, accumulating in heaps at one place and leaving another quite blank. Such, however, had not occurred in these experiments; and with respect to them the assertion could be made that, where complex forces are acting so that determining cause is absent, what might be termed a law of equable distribution held.

Mr. John Notman, Queen's Printer for Ontario, read a paper on "The Manufacture of Paper."

Men have in all ages been proud of their own achievements, while labor, a certain amount of self-conceit and a desire to seek a equaintance with primitive and past events, form the basis of progress and promote civilization.

Men who have recorded their own thoughts and actions, or those of others, are the ones who have exerted the greatest influence for good, or for evil, in all ages.

The hieroglyphic form of description is said to have been used in Egypt as early as the third dynasty, the date of which is placed about 4,000 years B.C. by some chronologists; but the markings and engravings upon rocks have been mostly rubbed out by the hand of time and we have to come down to the times when they wrote or modelled in soft clay and baked it with fire. In that grand store-house, the British Museum, many such indestructible terra-cotta specimens may be seen from the ruins of Nineveh and Babylon and whose decipherment reveal much concerning Chaldea, Babylonia and Assyria.

There is something about those tablets of clay that forbids any desire on our part to discredit them. They seem to appeal to our practical understanding and the tendency to doubt them is not so strong as with some modern written histories. The word paper is derived from the Greek word "Papyrus" and it was derived from the Egyptian word "Papu" which name was given to a very useful plant belonging to the family of the sedges. It grew, and still grows on the marshy banks of rivers in tropical climes.

The plant has large and abundant rootstocks which spread in the mud and throw up numerous stems from five to ten feet high. The stem is triangular and smooth.

The right of growing and selling the plant was a government monopoly in Egypt. It was used for a great variety of purposes besides paper.

Its graceful plumes, or drooping flower-tufts, crowned the statues of the Gods and decorated their temples; its pith was eaten as food; wicker-work boats, boxes, and baskets were woven of its stalks; while sails, cordage, cloth, mats and sandals for the priests were made of its bark. It was applied as medicine to the cure of ulcers and swellings; it furnished material for torches and candles, while its roots were used for fuel and manufactured into furniture and household utensils.

In making paper the inner cuticle of the stalk was cut into very thin slices. The finest slices were those next to the pith and decreased in quality as they approached the outer integument.

The slices were laid side by side on a smooth flat surface and covered with a second layer placed at right angles to them, after which they were pressed so as to cause the different laminae to

adhere to each other and form a single sheet, which was then dried in the sun. The glutinous sticky sap of the material was sufficient to bind and hold the slices together in a firm and compact sheet. In the Roman times, a thin sizing was brushed over the sheets, when they were beaten smooth with a mallet and polished with a piece of ivory or a shell.

Various qualities were manufactured and used as occasion required, from the finest writing to wrapping paper.

In the reign of Claudius, fineness, strength and color were imparted by putting a new layer of the best slices over a sheet of coarser quality. Paper found on mummies recovered from the Pyramids, Egyptian tombs, Catacombs and overwhelmed cities indicate an antiquity of 2,000 years before Christ, and through decipherment of the writings thereon much information has been obtained as to the history, manners, customs and literature of the Egyptians.

Papu, or papyrus, was usually made into rolls fifteen inches in width by one hundred and fifty feet in length, and cut off as required.

In the seventh century the conquest of Egypt by the Saracens put an end to the export of Papyrus, and Western Europe was obliged to supply its place with Parchment and Vellum, until the introduction of paper.

Parchment was in use about 500 years B.C. and about a century B.C. it was the chief material for writing upon, when its use spread all over Europe. Parchments were made of the skins of sheep and goats while Vellum was made of the skins of young calves, kids and lambs.

Animal parchment has been superseded by vegetable parchment, or parchment paper, first known in 1854, which resembles animal parchment so closely that it is not easy to distinguish the difference. It is made by immersing unsized paper in a bath of oil of vitriol, or sulphuric acid. The exactness of the bath and the time of immersion are of the greatest importance to the success of the result and several apparently trifling points must be carefully attended to, or the operation will not succeed. The alteration which takes place in the paper is very remarkable. No chemical change is effected, nor is the weight increased, but a decided molecular change takes place. Insects do not like it, and it is valuable for Land Patents, Deeds, Diplomas and valuable documents deserving preservation.

The Chinese were the first to make paper from vegetable fibres about the beginning of the Christian era.

The Hindoos and Arabs carried the art thence to Spain and from there it found its way to all parts of Europe. Paper made from cotton, dates in Europe, from the tenth century, and from linen, from the thirteenth century, when it took the lead and maintained it to the end of the eighteenth century.

In the establishing of a papermill it is necessary to select a site where water of good quality and in great quantity can be had.

It may also be necessary to construct filter-ponds so as to have plenty of clean water when freshets and heavy rainfalls soil the rivers. Then a solid stone foundation should be built, for the machinery is ponderous and hardworking and the foundation on which the paper machine is to be mounted must be solid and firmly united, so that not the least vibration or change in position of any of its parts can take place.

Timbers that will best withstand the influence of water, such as white oak, or hard yellow pine should be used.

Rubber belting is always preferable to leather as it withstands the influence of water and moisture so certain to be in every papermill.

875 different materials of a vegetable, fibrous and cellulose nature have been worked into paper pulp, but only a few are worthy of special consideration.

Esparto-grass is a spontaneous product of sandy soils, is abundant in Eastern Spain and Northern Africa, makes a beautiful paper and yields 48% of pulp

Manilla grass is a product of Eastern Asia, is extensively made into ropes and bagging and reaches in due time, like rags, the papermill. It is considered the strongest of all known fibres, and furnishes the well known tan colored wrapping paper. Competition, large demand and skillful manipulation, have produced manilla paper, however, with much straw, old paper, some jute and very little manilla grass in it.

Jute is another East Indian fibre very similar to manilla, is much cheaper and makes a good substitute in appearance, though not nearly so strong.

Cane:—In the Dismal Swamp and along the rivers of North and South Carolina, as well as in the low lands of the Mississippi the

country is covered for many miles with the spontaneous growth of a reed or cane. This cane is a hollow tube about twelve feet high, nearly white and apparently composed of tough, strong fibre.

The territory covered with it is so vast and unfit for any other useful growth that the supply of cane seems to be nearly inexhaustible, especially if it is considered that a new crop can be cut every three years. The dried fibres have a strong resemblance to oakum and make a strong spongy paper.

The woods give a good per centage of pulp and are most easily obtained in large quantity.

The per centage of fibre obtained from the woods runs from 26 to 38, the least being from walnut and the greatest from horse-chestnut.

All the grasses are reduced to a very small proportion of their original bulk by the time they leave the pulpmill and nothing but the clean fibres are contained.

Out of 100lb of flax or hemp, as it comes from the soil, only about two and a half pounds of good white linen can be obtained. Papermakers unanimously agree that "Rags are King" over everything for making the best qualities of paper.

The everchanging prices and demands of the markets, and the difference of raw materials, together with keen competition, tempt the makers to their utmost skill to use inferior stuff for good papers.

The great bulk of the news and cheap bookpapers is now made of woodpulp, and after the dissipating of many supposed and imaginary obstacles as to the propriety of using such paper, it has come to be preferred. Printers' ink is an oily, little fluent substance which does not spread beyond the limits given by the type on any common paper, so that a better impression is made by a fast running printing press on woodpulp paper.

Whatever products are used, the art of paper making consists in the reduction of all into their primitive fibres and forming them into felted sheets, and the less the fibres are cut or broken the stronger and better will the paper be.

There are some 1,500 trade definitions and commercial classifications relating to papers, such as sizes, qualities, materials, clays, chemicals, coloring stuffs, etc., too numerous to be retained in the memory, so that quite a reference pamphlet has to be consulted.

The essayist then gave a minute and detailed description of paper-

making by hand; still continued, but mostly due to the conservatism of the people, though good for Bank Notes. He described the production of water marks and showed some beautiful specimens. He explained the disinfecting of rags by a machine which takes in a bale, bores it throughout and disseminates sulphurous acid to a sufficient extent. The rag trade and its tricky dealers. The mill operations in cleaning, sorting, cutting, boiling and bleaching. Before the discovery of chlorine for its powerful bleaching, the color of the rags determined the color of the paper. Rags to be kept dry and in moderate heaps, for fear of spontaneous combustion. Wood is received at the mill as cordwood, is freed from bark and dead-knots and piled up to dry. It is then fed on to a machine which grinds it to dust; or better, which cuts it into small chips; the best is to cut it into blocks, as the fibres are but little broken. The wood is then boiled at a high temperature and with strong chemical agents to soften the wood, toughen the fibres and lessen their adhesion, after which they are soon ground to pulp. The object of boiling all papermaking substances is, to decompose the fatty, glutinous and coloring substances and remove everything but pure fibre.

The alkaline substances used are fresh burned quick-lime or the milk of lime, carbonate of soda and caustic soda.

The boiling is continued for about twelve hours, but ropes and bagging require twice that time.

The materials must then be washed from all impurity, most surely from all traces of chlorine.

They are next put into the Beating-engine and macerated into fibre by knives and friction. Everything to be added to the fibre must be put in here, such as china-clay, sizing or coloring.

Animal sizing is obtained from skins, ligaments, cartilages, tendons, hoofs and ears of animals, steamed and strained until only 5% of matter is left; alum is added to prevent fermentation or decomposition of the gelatine. Paper run through this is known as tubsized paper.

Vegetable sizing is composed of resin, carbonate of soda and alum, this mixture is added to the pulp in the Beating-engine and such paper is known as engine-sized.

There are two degrees, viz. soft-sized and hard-sized and are mostly applied to printing and book papers.

Writing papers are commonly coated with animal size. Papers put through vegetable sizing and then through animal sizing are known as "Double-sized" also as "Hard-sized" which paper has superior hardness, lustre, enamel and smoothness of surface.

The reader detailed the calendering of papers and enumerated quite a variety of papers made for special purposes.

He referred to the great Chicago fire in 1871 when ten thousand houses 16 x 20 feet were built in one day, of paper boards both waterproof and fireproof, and served speedy shelter for thousands of homeless people.

He referred to the different movements of the paper machine and the various improvements made until such perfection has been attained that paper can be made in one continuous web of any length, and before leaving the machine can be made, sized, dried, calendered, hot-pressed and cut into sheets, and at the rate of 125 feet long by 100 inches wide per minute.

At present there are 3,500 papermills in Europe.

The Dominion of Canada occupies but an insignificant position among the paper making countries, while the United States occupies a very high one. Great Britain occupies the highest position and the total production of all the mills there, is not less than 3,500 miles of paper daily.

THIRTY-EIGHTH ANNUAL MEETING.

Thirty-Eighth Annual Meeting, May 7th, 1887, the President in the chair.

Exchanges since last meeting, 33.

The following were elected members :—T. G. Williamson, W. Williamson, W. Canniff, M.D., C. Egerton Ryerson, B.A. George Cox, A. W. Murdoch.

The following reports of sections were read :

1. Philological Section.

1. The first meeting of the Section was held on March 15th, 1887, when the following officers were elected :—Chairman, Rev. J. F. McCurdy, Ph. D. ;

Vice-Chairman, D. R. Keys, B.A. ; Secretary, George E. Shaw, B.A. Committee :—J. Squair, B.A. ; M. L. Rouse, J. H. Cameron, B.A. ; J. Cunningham Dunlop, Ph.D. ; W. H. VanderSmissen, M.A. ; Wm. Houston, M.A.

2. The first two meetings were held on Saturday afternoon, March 5th and March 12th, at 16 o'clock, all the subsequent ones on alternate Mondays, beginning March 28th, 1887.

3. The Section has 18 members.

4. The following papers have been read before the Section :

1. "How we Speak," by A. Hamilton, M.D.

2. "The Science of Language in Popular Education," by Rev. J. F. McCurdy, Ph.D.

3. "Umbrian Inscriptions," by Rev. Neil McNish, B.D., LL.D.

All which is respectfully submitted.

GEO. E. SHAW,
Secretary of Philological Section.

2. Architectural Section.

This section consisting of five regular and nineteen associate members of the Canadian Institute, has held eleven meetings since its formation, of which the following is a list :

Monday, January 10th, 1887, Discussion on "What Style of Architecture is Best Adopted to this Country."

Monday, January 17th, 1887, Discussion on "The Use and Abuse of the Romanesque Style of Architecture."

Monday, January 24th, 1887, Paper on "Foundations," by Henry Steele.

Monday, January 31st, 1887, Lecture on "Wood Floors," by S. G. Curry.

Monday, February 7th, 1887, Paper on "Style," by J. C. Horwood

Monday, February 14th, Lecture on "Columns," by Alan Macdougall.

Monday, February 28th, 1887, Paper on "Hints to Young Architects," by Henry Langley.

Monday, March 7th, 1887, Lecture on "Arches," by W. L. Symons.

Monday, March 14th, 1887, Paper on "The Doric Temple in its Religious and Artistic Aspects," by J. W. Gray.

Monday, March 21st, 1887, Receiving the judge's report on, and describing the competitive drawings.

Monday, March 28th, 1887, Paper on "Masonry," by A. F. Wickson.

J. D. HYNES,
Secretary.

3. Photographic Section.

The first meeting of the Section for the purpose of organization, election of officers, &c., took place on the evening of February 23rd, when the following

were elected:—Chairman, H. Neilson; Vice-Chairman, R. Ewing; Secretary-Treasurer, A. Gaunt. Executive Committee—E. R. Parkhurst, W. W. Fox, F. D. Manchee, C. F. Wagner, W. A. Forbes. The number of members now on the roll is 28; associates, 5. Total, 33.

Meetings for the transaction of business, &c., have taken place on the first Tuesday in each month, but so far no papers have been read. The first exhibition of the Section took place in the Library of the Institute, on April 12th and 13th, and was very successful, considering the short time given for the preparation of pictures.

ARTHUR GAUNT, Secretary.

4. Biological Section.

FROM JUNE 1886 TO APRIL 1887.

During this period eighteen meetings of the Section have been held, with an average attendance of 18⅞ (say 19) members. The Section has 36 ordinary members and 12 associates. Twelve papers have been read at the meetings, and nine short communications received. Two of the meetings were set apart for microscopical exhibition and discussion under the able conduct and superintendence of Professor Ramsay Wright.

In June a branch of the Audubon Society was organised in connection with this Section, and Mr. Hollingworth was appointed Local Secretary. There are now 106 members in the Toronto Branch.

In October a special vote of thanks was passed to W. H. Doel, J.P. (one of our members,) for his earnest efforts made during the summer, for the protection of insectivorous birds, by fining all violators of the law that were brought before him.

During the same month an offer of the Section to provide the interest for two years on a loan of $1,000, led the Council of the Institute to decide on at once, fitting up the attic of the building as a museum, instead of leasing a part of it to the Art School, and since the completion of the new rooms, the members of the Section have assisted in moving the objects and cases from the various places in which they lay, to the top of the building.

J. B. WILLIAMS,
Secretary of the Biological Section.

5. Geological and Mining Section.

SIR,—I have the honor to report that, proceeding under authority conferred by the Canadian Institute, a meeting of members was held on the 20th of April, ult., when a Geological and Mining Section was duly organised, and that at an adjourned meeting, on 30th April, regulations and by-laws were adopted, which have since been approved by the Council of the Institute, and that the following officers have been elected for the incoming year. W.

Hamilton Merritt, Chairman ; Alexander Macnabb, Vice-Chairman ; Archibald Blue, Secretary ; George T. B. Ives, Assistant Curator. Messrs. Boyle, Dobson, Notman, Phipps and Dr. Bryce, Executive Committee.

The first regular monthly meeting of the Section was held on Thursday evening, 5th inst., at which the Chairman gave his inaugural address. The Section is composed of 15 members.

Your obedient servant,

A. BLUE, Secretary.

ALAN MACDOUGALL, Esq.,
Secretary Canadian Institute.

The President read the 38th Annual Report.

ANNUAL REPORT OF THE COUNCIL OF THE CANADIAN INSTITUTE.

SESSION 1886-87.

The Council of the Canadian Institute have the honor to lay before the members their thirty-eighth Annual Report.

During the past session twenty-six meetings, including the annual conversazione, have been held, at which forty-nine papers have been read, in addition to twenty-three read at section meetings. This number is largely in excess of that of any previous year in the history of the Institute. The character of these communications is fully equal to the standard of previous years, and the range of subjects (as shown in the appendix) is unprecedently large. The average attendance at the regular weekly meetings also shows a considerable and steady increase.

The distinguishing feature of the year has been the successful establishment of no less than four new sections, in addition to the Biological section, incorporated at the end of last session, viz.: (1) A Photographic section; (2) an Architectural section ; (3) a Philological section and (4) a Geological and Mining section. The creation of these sections has extended the benefits of the Institute to new classes of the citizens, and has been the chief cause of the large increase of membership. Their annual reports, which are appended, show a gratifying spirit of activity in every branch of the Institute.

A further evidence of this increased activity is seen in the number of memorials presented to the Provincial Government, with successfull results in many cases, as follows: In February last the Committee of Ways and Means waited on the Minister of Education and urged him

to increase the annual grant to the Institute from $750 to $1,500, for general purposes, and to enable us to give courses of public lectures on scientific subjects, especially in connection with industrial pursuits. While gratefully acknowledging the increase of the grant to $1,000 for general purposes, the Council regrets that the Government did not see fit to comply with the latter part of the application.

In the same month the Archæological Committee urged the Minister to make a yearly grant of $1,500 for Archæological research in Ontario, and the passing of an Act for the protection of Archæological remains founded upon Sir John Lubbock's "Ancient Monuments Act of 1882." The Council again thankfully acknowledge the liberal grant of $1,000 for this purpose, but regret that the heavy work falling upon the Minister this session in connection with educational matters should have made it impossible for him to bring in an Ancient Monuments bill, which would have greatly enhanced the value of the grant. It is hoped, however, that such an Act may become law in the next session of the Legislature.

In March a deputation waited on the Commissioner of Crown Lands to urge the establishment of a large park reserve in the district of Nipissing, for the protection of wild animals and of timber, and were assured of the Minister's sympathy. An Act for this purpose will, it is hoped, be the result of this application in the near future.

In April a Committee urged upon the same Minister the propriety of some improved means of collecting information on matters connected with the mining interests of the Province, and received assurances of co-operation.

Another pleasing feature of this year's work is the partial completion of the Museum of Natural History and Archæology in the third story of our building, which will, it is confidently expected, enable us, for some time at least, to properly accommodate our collections and donations. In this direction the Council desires to acknowledge the liberality of the Biological section in guaranteeing the interest for two years on the $1,000 borrowed for this purpose.

The Library has been increased by the addition of 124 volumes of bound exchanges; but further shelf accommodation is urgently needed.

While congratulating the Institute on the increase in membership, in income and in activity, the Council feel that it is necessary to impress upon the members the fact that the current expenses are greatly

increased, especially in printing and gas, while there is a falling off in the rentals; and also that, in order properly to fulfil the objects for which it exists, the further extension of the Museum and Library and the completion of the building by the erection of a commodious lecture hall is highly desirable. They therefore urge upon the members the necessity of supporting the present efforts of the Committee of Ways and Means by every means in their power, by contributions, by presenting the claims of the Institute to the public in every possible way, and by endeavouring to obtain new members.

During the past year the Institute has lost by death one of its most distinguished honorary members, the Rev. John McCaul, LL.D., late President of University College, and President of the Institute from 1862 to 1864. The deceased was for nearly half a century one of the leading figures in social and educational affairs in this city, and his articles on Roman Inscriptions in the *Canadian Journal*, which formed the basis of his great work on that subject, had much to do, not only with the establishment of his own claims to be called the first English scholar in Latin epigraphy, but with the high standing attained in those early years by our journal.

[Signed.] W. H. VANDERSMISSEN,
President.

ALAN MACDOUGALL,
Secretary.

APPENDIX I.

MEMBERSHIP.

Number of Members April 1st, 1886	233
Withdrawals and deaths during the year	14
	219
Elected during the year	71
Total members April 1st, 1887	290
Composed of :—	
Honorary Members	5
Life Members	13
Ordinary Members	272
Total	290
Associates	30

APPENDIX II.

TREASURER IN ACCOUNT WITH THE CANADIAN INSTITUTE FOR THE YEAR ENDING MARCH 31st, 1887.

To Summary—		
" Balance on hand	$	63 05
" Annual subscriptions		919 00
" Rents		218 00
" Government Grant		750 00
" Proceeds Wallace Lectures		107 42
" Journals sold		29 29
" Periodicals sold		32 61
" Mr. Sanford Fleming's proportion of printing		62 41
" Interest		2 65
" Natural History Society, balance of funds		8 73
" Subscriptions to bust of Dr. Wilson		25 00
" Proceeds of note discounted		300 00
" Proceeds of Mortgage due 1892		3,000 00
		$5,518 16
By Summary—		
" Salaries	$	373 50
" Printing Journal		338 76
" " Miscellaneous		7 50
" Binding		124 60
" Stationery		32 89
" Postage		201 95
" Freight and express charges		20 91
" Repairs, stoves		4 30
" Gas		43 12
" Water		24 00
" Show cases for specimens		100 00
" Advertising		3 00
" Periodicals, 1886		120 36
" " 1885		60 55
" Discount on cheque		25
" Consul's certificate and Custom's expenses		3 50
" Sweeping chimneys		2 00
" Fuel		109 90
" Painting		104 13
" Interest		194 39
" Mortgage due August, 1886		3,411 00
Carried forward		$5,280 61

Brought forward		$5,280 61
" Taxes		10 21
" Bust of Dr. Wilson		25 00
" Legal expenses		25 00
" City Directory, 1887		3 00
" Repairs to building		60 47
" Matting for reading room		26 80
" Housekeeper's expenses		10 00
" Journals purchased		50
" D. Boyle, disbursements and expenses		20 17
" Balance, Imperial Bank	$50 00	
" " Cash on hand	6 40	
		56 40
		$5,518 16

Examined and found correct.

April 22nd, 1887. (Signed) T. B. BROWNING, D. B. DICK, } Auditors.

BUILDING ACCOUNT.

1886.			
Dec. 1,	To Donation Natural History section		$ 50 00
1887.			
Jan. 8,	" Mortgage due 1892		1,000 00
	" Interest		48
			$1,050 48
1887.			
Feb. 9,	By Law expenses		$ 12 65
	" Carpenters' contract, Certificate	No. 1...	300 00
Mar. 11,	" " " "	No. 2...	75 00
	" Balance Imperial Bank		662 83
			$ 1,050 48

Examined and found correct.

22nd April, 1887. (Signed) T. B. BROWNING, D. B. DICK, } Auditors.

ASSETS.

Building	$11,500 00
Warehouse	720 00
Ground	3,000 00
Library	5,500 00
Specimens	1,300 00
Personal property	600 00
	$22,620 00

LIABILITIES.

Mortgage, No. 1, due 1892	$ 3,000 00
" No. 2, "	1,000 00
Note discounted	300 00
Balance in favour of the Institute	18,320 00
	$22,620 00

Appendix III.

Donations and Exchanges.—Books and pamphlets received from April 1st, 1886, to April 1st, 1887:—From Canada, 190; United States, 398; Great Britain and Ireland, 310; India and Australia, 82; all other countries, 1,250; total, 2,230.

Total number received in 1882-3, 280; ditto. 1883-4, 800; ditto 1884-5, 730; ditto 1885-6, 1,502; ditto 1886-7, 2,230.

Appendix IV.

The number of societies and publications with which the Institute exchanges is 341.

Appendix V.

To the periodicals subscribed for last year the following have been added:— *English Historical Review, Scottish Review, Hardwicke's Science—Gossip, Science.* There have been discontinued:—*British Quarterly Review, Brain, Times* (Weekly), *English Medicine, American Journal of the Medical Sciences.*

Appendix VI.

Classification of papers read by subjects:—General, 3; Psychology, 1; Archæology, 5; Sociology, 2; Mathematics, 2; Chemistry, 5; Mineralogy and Geology, 7; Jurisprudence, 1; Philology, 8; Meteorology, 1; Geographical Science, 2; Electricity, 1; Biology, 5; Astronomy, 2; Medicine, 2; Photography, 1; Industrial Science, 1; total, 49.

Read at section meetings, 23; total, 72, as follows: Biological section, 12; Architectural section, 8; Philological section, 3.

The election of officers for the ensuing year resulted as follows:

President—W. H. VanderSmissen, M.A.

Vice-President—E. A. Meredith, LL.D.

Treasurer—James Bain, jun.

Secretary—Alan Macdougall, M. Inst., C.E.

Editor—George Kennedy, M.A., LL.D.

Curator—David Boyle, Ph.B.

Librarian—G. E. Shaw, B.A.

Members of Council—W. H. Ellis, M.A., M.B.; Alexander Marling, LL.B. with the Chairman of Sections and Secretary of Biological Section.

On motion of Mr. Boyle, seconded by Mr. Browning, it was resolved, "That in the opinion of this meeting it is advisable to form a Historical and Archæological Section in connection with the Institute, and the President and Secretary are hereby empowered to make all preliminary arrangements for the purpose of forming a Section forthwith."

On motion of Mr. Shaw, seconded by Rev. Dr. McCurdy, it was resolved, "That the thanks of the Canadian Institute be tendered to the city daily papers and especially the *Mail* for their kindness in publishing reports of the proceedings of the Institute."

On motion of Dr. McCurdy, seconded by Mr. Keys, a vote of thanks was tendered to the retiring councillors.

A paper was presented by A. McGill, B.A., on "Tartaric Acid in Admixtures."

LIST OF COLEOPTERA COLLECTED BY MR. BRUCE BAILEY, IN KICKING HORSE PASS, ROCKY MOUNTAINS, C. P. R., 1884.

From a paper read before the Biological section by Mr. Brodie.

Mr. Bruce Bailey a member of this section, while on the Engineering staff of the mountain section of the C. P. R., made a large collection of Natural H story objects, consisting of Mammals, Birds, Reptiles, Fish, Insects and plants. Several species of the Diptera and Hemiptera, have not yet been satisfactorily identified, and it is believed there are a few new to science. The following is a nearly complete list of the Coleoptera.

I am indebted to the eminent coleopterologist Mr. H. Ulke, of Washington, for the identifications, with a few exceptions. The species marked * are new to the Canadian list.

Carabidæ:—Cicindela longilabris, *Say.*
" 12-guttata, *Dej.*
Nebria trifaria, *Lec.**
" Mœsta, *Lec.*
Platynus bembidioides, *Kirb.*
" quadripunctatus, *Dej.*
Agonoderus lineola, *Fabr.*
Bembidium Grapii, *Gyll.**
" nigripes, *Kirb.*

Dytiscidæ:—Colmybites sculptilis, *Harr.*

Dermestidæ:—Anthrenus scrophulariæ, *Lec.**
Orphilus glabratus, *Fabr.**

Cucujidæ—Cucujus clavipes, *Fab.*

Trogositidæ:—Tenebrioides sinuata, *Lec.*
Calitys scabra, *Thun.*

Coccinellidæ:—Coccinella trifasciata, *Linn.*
Hippodamia 13-punctata, *Linn.*
Adalia frigida, *Schn.*
Anisocalvia 12-maculate, *Gebl.*
Scymnus lacustris, *Lec.*

Byrrhidæ:—Bryrrhus cyclophorus, *Kirb.*

Lucanidæ:—Platycerus depressus, *Lec.*

Scarabæidæ:—Dichelonycha subvittata, *Lec.*
" Sulcata, *Lec.**
Serica frontalis, *Lec.**

Diplotaxis trevicollis, *Lec.*
Lachnosterna errans, *Lec.**
Trichius affinis, *Gory.*

Buprestidæ:—Dicerca tenebrosa, *Kirby.*
Buprestis Langii, *Marin.**
" radians, *Lec.**
Melanophila Drummondi, *Kirb.*
Anthaxia inornata, *Rand.*

Elateridæ:—Adelocera profusa, *Cand.*
Dolopius lateralis, *Esch.*
Corymbites furcifer, *Lec.**
" pulcher, *Lec.*
" insidiosus, *Lec.*
" morulus, *Lec.*
" æripennis, *Kirb.*
" umibripennis, *Lec.**
" fallax, *Say.**

Lampyridæ:—Eros mundus, *Say.*
Photinus lacustris. *Lec.*

Telephoridæ:—Podabrus puncticollis, *Kirb.*
" Sp.———undetermined.*
Telephorus, Sp.———undetermined*
" Sp.———undetermined.
Silis difficilis, *Lec.**

Malachidæ:—Melyris, Sp.———known not described.*

Cleridæ:—Trichodes ornatus, *Say.**
Cierus undulatus, *Say.*

Spondylidæ:—Spondylis upiformis, *Mann.*

Cerambycidæ:—Asemum mœstum, *Hald.*
Hylotrupe ligneus, *Fab.*
Callidium janthinum, *Lec.*
Clytus 3-vittatus, *Meb.**
Xylotrechus undulatus, *Say.*
Neoclytus, Sp.———probably new.*
Rhagium lineatus, *Oliv.*
Acmæops pratensis, *Laich.*
" longicornis, *Kirb.**
Leptura sex-maculata, *Linn.*
" sanguinea, *Lec.*
" chrysocoma, *Kirb.**
" canadensis, *Fab.*
Monohammus maculosus, *Hald.**
" scutellatus, *Say.*

Chrysomelidæ:—Orsodachna atra, *Ahr.*

Syneta ferruginea, *Germ.*
Pachybrachys femoratus, *Oliv.**
Adoxus vitis, *Linn.*

Tenebrionidæ :—Iphthinus serratus, *Mann.*
Phellopsis obcordata, *Lec.*

Melandryidæ :—Allopoda lutea, *Hald.**
Phryganophilus collaris, *Lec.*

Mordellidæ :—Anaspis atra, *Lec.**
Mordella scutellaris, *Fab.*

Œdemeridæ :—Ditylus cœruleus, *Rand.*

Pythidæ :—Pytho niger, *Kirb.*

Otiorhynchidæ :—Evotus naso, *Lec.*
Scythropus elegans, *Coup.*

Rhynchitidæ :—Rhynchites bicolor, *Fabr.*

Curculionidæ :—Anthonomous musculus, *Say.*

Scolytidæ :—Dendroctonus terebrans, *Oliv.*

INDIAN LANGUAGES AND LITERATURE IN MANITOBA, NORTH-WEST TERRITORIES AND BRITISH COLUMBIA.

Dr. Rae in a lecture delivered at the London Institution stated that in the Northern part of Canada there were five hundred different Indian languages, divisible into seventy-five ethnical groups.

I am unable from my reading and observation to corroborate this statement, but give the results of my studies and experience in the following notes.

I. *List of Languages in Manitoba, Keewatin and North-West Territories.*

1. The Sioux Language—A small band of these Indians is located near Portage la Prairie

2. The Stony Language—This is a dialect of the Assiniboine or Dakotah Indians. They are located at Morley, on the C.P.R. forty miles west of Calgary and on a reserve near Edmonton.

3. Ojibway Language—Some of these Indians may be found around Lake Superior.

4. The Saulteaux Language—This is a dialect of the Ojibway. These Indians are to be found in the vicinity of Hudson's Bay and near Norway House.

5. Sarcee Language—This is the same language as the Castor or Beaver. These Indians are located on a reserve about eight miles south of Calgary. There is not a white man in the country conversant with the language, and all interpreting is done in Blackfoot or Cree which these Indians understand.

6. The Beaver Language--These Indians are found in Athabaska.

7. Cree Language—Divided into Plain Cree, Wood Cree and Swampy Cree. These Indians are numerous and are located on the plains and in the forests, all over the North-west and Keewatin.

8. Blackfoot Language—Spoken by the Bloods, Piegans and Blackfeet.

9. Nez Percé Language—A few of these Indians occasionally reside at Pincher Creek, thirty miles west of Macleod. They are United States Indians.

10. Slave Language.

11. Dog Rib Language.

12. Chippewayan Language.

13. Dinje or Loucheux Language.

14. Hare Language—These all belong to the Tinné family and are found in Athabaska and Alaska.

15. Eskimo Language.

16. Tukudh Language.

II. *Languages in British Columbia.*

1. Bella Bella.
2. Bella Coola.
3. Tsimpshean.
4. Nimpkish.
5. Hydah.
6. Chinook Jargon.
7. Cowichan.

III. *The Languages of which Vocabularies and Grammars have been published, the Authors and place of publication.*

1. Sioux—A Grammar and Dictionary of the Dakotah Language. Edited by Rev. S. Rigg, D.D., Washington, 1852, $10. A new edition is now in course of preparation.

2. Ojibway—A Grammar and Dictionary of the Otchipwe Language By R. R. Bishop Baraga, new edition, 1879, $3. Beauchemin and Valois, Publishers, 256. 258. St. Paul Street,

Montreal. There are several grammars and dictionaries prepared for the Ojibway of Ontario, etc.

3. Cree Language—(1) A Grammar and Dictionary of the Cree Language in French by Rev. Pere Albert Lacomb, O.M.I. $3. Beauchemin and Valois, Montreal. (2) A Cree Dictionary by Rev. E. A. Watkins, published by the Society for Promoting Christian Knowledge, London, England. (3) A Grammar of the Cree Language by Right Rev. Bishop Horden, published by the Society for Promoting Christian Knowledge, London, England. (4) Grammar of the Cree Language by Henry Howse, London, England, 1815, now out of print. This is said to be the best Cree Grammar published. (5) A Lecture on the Grammatical Construction of the Cree Language by the Ven. Archdeacon Hunter, M.A., 1875, by the Society for Promoting Christian Knowledge, London, England. This contains Paradigms of the Cree Verb with its various conjugations, moods, tenses, inflections, etc.

4. The Blackfoot Language—A small phrase book was published as a money speculation by C. Lanning, but it is full of mistakes and of very little use. Nearly all the missionaries have MSS. vocabularies for their own use. I can only speak positively of my own work on Grammar and Dictionary which I have been working at for years, and will take three years at least to finish.

5. Eskimo—Paradigm of the Verb, by Dr. A. Pfizmaier, Vienna. "The Eskimo Dialects as serving to determine the relationship between the Eskimo Tribes," published in the journal of the Anthropological Institute, by Dr. Rink. Both of these are on the Greenlandic Dialect.

6. Addendum re Cree Language—Rev. Archdeacon John McKay, Prince Albert College, N. W. T., has a MSS. grammar in Cree which he is preparing to publish.

7. Addenda re Languages in British Columbia.

Kwakiute.
Bilhoola.
Clallam.
Lummi.
Snohomish or Nisqually.
Chehalis.
Twana.

These last five are found on Puget Sound, W. T., and in British Columbia. There are very many dialects of these.

8. Bella Coola or Viloula—Dr. Frank Boaz is making a special study of these Indians at present. See Mittheilungen aus der Ethnologischen Abtheilung der Museum zu Berlin.

9. Chinook Jargon—(1) "Dictionary of the Chinook Jargon or Indian Trade Language of the North Pacific Coast," 1883, 35 pages. T. N. Hibben & Co., Victoria, B.C. (2) Dr. George Gibbs, Report on Chinook, etc., published by Smithsonian Institute, 1863, Vol I. Contributions to North American Ethnology.

10. Bilhoola—A brief grammatical sketch of this dialect is found in "Science," of New York, March 5th, 1886, by Dr. Frank Boaz.

11. Nisqually—A Vocabulary was prepared by Dr. George Gibbs and published in Vol I. Contributions to North American Ethnology.

12. Clallam and Lummi—A Dictionary prepared by Dr. George Gibbs and published in Shea's Library of American Linguistics.

13. Snohomish and Chehalis—Comparative Vocabularies of the Tribes of British Columbia by Tolmie and Dawson, 1884, published in Montreal.

Further study and observation may be productive of more information on this subject.

JOHN MCLEAN, M.A.

Blood Reserve.

Macleod, Alberta.

SYNOPSIS OF A PAPER READ BEFORE THE BIOLOGICAL SECTION BY DR. GARNIER ON A NEW SPECIES OF MENOBRANCHUS.

Dr. Garnier presented an account of a species of Menobranchus which he believes to be new, and dedicates to Mons. F. Lataste as *M. Latastei*. Prof. Cope, to whom a sample was submitted, regards it as a well-marked variety of the ordinary northern Menobranch *Necturus lateralis*, Baird, which would accordingly bear the name *N. lateralis var. Latastei*. Garnier.

The following are the points which Dr. Garnier thinks entitle the

Menobranchus under consideration to rank as a separate species. (1) Smaller size. (2) Colouration, the body being entirely black except the gular fold which is white, the abdomen which is soot and the toes and an occasional present band at the base of the tail which are olive brown. (3) Proportionately greater size of the head. (4) The smaller number of teeth, especially on the vomers, superior maxillaries and mandibles, and (5) habitat, the form under consideration being always found in swift streams, not in sluggish waters.

Dr. Garnier gives some particulars as to his observations of the habits of the Menobranchus he has studied. He finds they do not survive more than two or three hours out of water; they swim rapidly, compressing the limbs against the trunk; and shelter themselves in crevices and under stones; they eat small living fish and cray-fish by preference, and do not readily take meat in captivity; they spawn towards the beginning of May, laying eggs which measure in the ordinary s[illegible] quarter of an inch in diameter but in the *var.* *Latastei* three-sixteenths; during the spawning time the cloaca becomes swollen and the tail stiffer as in Proteus. The ordinary lake Menobranchus are often taken by fishermen in the winter in lake St. Clair, and like the dog-fish (Amia) and like sheepshead are regarded as unwelcome additions to the catches in seines.

The variety *Latastei* has been found by Dr. Garnier in the Maitland river, the ordinary Menobranchus with which he has compared it having been obtained from the Don and lake St. Clair, where they are common.

UMBRIA CAPTA.

READ BEFORE THE PHILOLOGICAL SECTION BY REV. N. MACNISH, B.D. LL.D. APRIL 25TH, 1887.

I have the honour to present to the Canadian Institute a new interpretation of the Umbrian portion of the Eugubine Tables. I have to remark at the outset, that I have derived very great assistance, as well in the interpretation of the Tables as in the preparation of the geographical and ethnological notes which are appended, from

the Rev. Professor Campbell, of Montreal, whose learning and researches in this particular field of investigation have been conspicuously exhibited in his *Etruria Capta*. It will be possible, I believe, to adduce satisfactory evidence to show that Gaelic is the language of the Umbrian Tables; and that, accordingly, they present to us altogether the oldest specimen that has hitherto been discovered, of Irish and Scottish Gaelic. As even the learned and laborious Celtic Grammarian Zeuss was not led to turn his attention to the Gaelic characters of those Tables, no material assistance is furnished by his elaborate Grammar in determining the grammatical forms of what has to be regarded now as the oldest Gaelic composition in the world. Mr. Whitley Stokes who has given extensive and scholarly attention to old and early middle Irish Glosses, enables us to perceive, *e.g.*, in his *Goidelica*—that the Turin Glosses, etc., and the Irish Hymns in the *Liber Hymnorum*, forming as those do some of the oldest Irish compositions of which we have had hitherto any knowledge—present fully as large combinations of words and peculiarities of grammatical construction as are to be found in the Umbrian Tables. The same remark may be made regarding the very old specimen of Scottish Gaelic which is contained in the Book of Deir; and also regarding the first book which was printed in Scottish Gaelic; viz., the Gaelic translation of John Knox's Liturgy, by Bishop Carswell of Argyll. It was published in 1567.

In his History of Rome (Vol. I. p. 160), Mommsen states that "our information regarding the migration of Umbrian stocks comes to us like the sound of bells from a town that has been sunk in the sea." Niebuhr in his History of Rome (Vol. I. p. 143) thus writes: "It is certain that the Umbrians were a great nation before the time of the Etrurians in the age of the Sicilians, and that they have the right to the name of a most ancient and genuine people of Italy." The same learned writer remarks in his Ethnography and Geography (Vol. II. p. 209) "that people have been extremely anxious to discover the Etrurian language, and who should not be so? I would readily give a considerable part of my property as a prize to any one who should discover it. An entirely new light would thereby be thrown upon the character of the nations of Italy."

The *Tabulae Eugubinae* were discovered in 1444 among the ruins of a Theatre in the neighbourhood of Gubbio in Umbria. Gubbio

is the modern name of Iguvium. It has been maintained that those Tablets which were made, as Concioli asserts, *ex aere purissimo*, were originally nine in number. Two of the Tablets which were conveyed to Venice in 1540, have, it is to be feared, been irrecoverably lost. The seven that remain are preserved in the Palazzo Municipale of Gubbio. Tablets I., II., V. and VI. are engraved on both sides. A blank space is left on one side of Tablet II. and V. A few lines merely are engraved on one side of Tablet VII. The Inscriptions on Tablets VI. and VII. and nearly all the Inscriptions on one side of Tablet V. are in Roman letters.

According to the computation of Aufrecht and Kirchoff:

Table VI., *a*, has 59 lines.
Table VI., *b*, has 65 lines.
Table VII., *a*, has 54 lines.
Table VII., *b*, has 4 lines.
Table V., *b*, has 11 lines.

There are thus 193 lines in the Umbrian portion of the Eugubine Tables.

In his preface to his *Les Tables Eugubines*, Professor Bréal gives an interesting account of the various efforts which have been made to interpret those Tables. It is noteworthy, from a Celtic point of view, that there appeared in 1772 a work by Stanislas Bardetti, in which he endeavoured to explain the Umbrian Inscriptions principally by the aid of Anglo-Saxon, old High German and Celtic. In an article on the Eugubine Tables which occurs in the Encyclopaedia Britannica, it is stated among other things that "Aufrecht and Kirchhoff, summing up the labours of their predecessors and working according to strict scientific method, brought the interpretation of the Tables to a degree of perfection that could hardly have been hoped for, though there still remained in matters of detail sufficient scope for such investigators as Bréal, Ebel, Corssen, etc." Professor Bréal's *Les Tables Eugubines* was published in 1875. As, in addition to his own unambiguous asseverations, he has come to be regarded as having at last succeeded in giving an intelligible and satisfactory solution of the Umbrian Inscriptions, it is advisable to insert here the conclusions at which he has arrived. "The Eugubine Tables are the acts of a Corporation of priests who had their seats at Iguvium, and whose authority appears to have extended over a some-

what large extent of the adjacent country. They call themselves the Attidian Brethren, and the name of the Confraternity is given to the College. They are twelve in number. Different names of magistracy such as questor and fratrecks are mentioned. The person who plays the principal part has the title of *adfertur*. . . . It does not appear that the Attidian Confraternity was specially devoted to the service of a single divinity. We perceive that it offered sacrifices to an entire series of gods and goddesses. Thanks to that circumstance, the Eugubine Tables furnish us with precious indications of the Pantheon of an Italian people. Certain names coincide exactly with Roman names. Such are Jupiter, Sancus and Mars. Other names present a resemblance more or less remote as Fiscus, Grabovius. Cerfius. Other names, again, were entirely unknown, as Vofonius. Tefer, Trebus, etc. We have here, then, the monuments of an indigenous worship which the Roman religion had not yet effaced."

I have taken from the Umbrian Inscriptions certain words which any one who has even a moderate knowledge of Irish or Scottish Gaelic, can have no difficulty in admitting to be Gaelic. The combinations which are formed between prepositions and personal pronouns in Gaelic, present a striking peculiarity of the Gaelic languages. Pictet in his *De l' affinité des Langues Celtiques avec le Sanscrit* (pp. 170. 171.) virtually maintains that the points of difference between the Celtic languages and the other members of the Indo-European family of languages are confined, " to the permutation of initial consonants, and to the composition of personal pronouns with prepositions." " Quant aux composés pronominaux. . . . s'ils sont étrangers aux autres branches de la famille ils offrent une analogie tres curieuse avec les langues finnoises." In his *Grammatica Celtica* (p. 324.) Zeuss writes " Pronominum in utraque lingua, tam Hibernica quam Britannica ea proprietas est, ut non semper ut in aliis linguis Indeuropaeis per se posita plenam formam servent, sed etiam. . . . si sunt personalia post praepositiones suffigantur." It thus appears that Scholars like Pictet and Zeuss regard the composition of personal pronouns with prepositions as a peculiar feature in the Celtic languages.

I have chosen to consider the prepositional pronouns which I am about to cite and which occur repeatedly in the Inscriptions, *in* and *by* themselves, and apart from the particular meaning which they

may bear in the place which they occupy in the Tables; in order that thus their purely Gaelic character may appear in its simplest manner.

Esto, as iad, asta, out of them.
Este, aiste, out of her.
Eesteso, aiste so, out of this one, *an deigh so,* after this.
Est, asad, out of thee, *asda,* out of them.
Eso, as so, out of this.
Dersva, dar iad, thar iad and *tharta,* over them.
Dersas, dar thar iadsan, thartasan, over them.
Dersaus, thar iadsan, thartasan, over them or over these very persons.
Versa, air ais, back and backwards.
Erus, air ais, back and backwards.
Eno, ann e, ann, in him.
Eam, annam, in me, and agam with me *aig mi.*
Erer, air ear, air an ear, on the east.
Erar, air iar, air an iar, on the west.
Enom, ann mi, annam, in me.
Ero, air e, air, in him, *air thu, ort,* in thee.
Erom, air mi, orm, on me.
Esome, asmi, asam, out of me.
Aso, as thu, asad, out of thee.
Ouse, o or *bho thusa uait uaitse,* from thee.
Ose, o bho se e uaithe, from him.
Etru, eatorra, between them, *eadar thu,* between thee.
Deitu, do thusa, duit, duitsa, to thee.
Difne, do sibh, duibh, duibhse, to you.
Fri, (Irish) with by.
Frif, fri sibh, with and by you.
Frite, fri iad, iadsan, by and with them.
Treif, tre sibh tromhaibh, through you.
Vovse, bho sibhse, bhuaibhse, uaibhse, from you.
Pusi, bho si i, from her.
Puse, bho se e, from him.
Reste, ri or *ris ise iadsan,* to her, to them.
Riutha, riuthasan, to them, themselves.

I shall now cite several words which reveal their Gaelic lineage at a glance, and which along with the prepositional compounds that have

been enumerated, go far to establish the Gaelic character of the Umbrian Inscriptions.

Enetu, an Aite, in place of.
Nesimei, a m' ionnsuidh, to or towards me, *ionnsaighim*, I attack.
Ficla, fo cheile, asunder.
Hondra, aon trath, one time, *an trath*, the time, when.
Screihtor, sgriosadair, a destroyer.
Verisco, fearachas, manhood.
Esona, easaon, without one, disagreeing.
Socair, quiet.
Ferine, fearran, ainn, land.
Arvio, arbhar, corn.
Heri, or oir, gold.
Vini, fainne, ring.
Poni, bonn buinn, coin coins.
Scalseto, sgaoil, scatter.
Tases, pl., *Tasetor, toiseach*, a leader, the *Intosh* in MacIntosh, the *Toiseach* of Mediaeval times in Scotland.
Suront, saor, free, *aonta*, consent.
Serse, srac, tear.
Seritu, saruich, harass.
Esisco, sasuich, satisfy.
Paca, bac, restrain.
Osatu, osadh, osaim, I desist.
Fetu, faighteadh, faigh, get.
Covertor, cobhartach, booty.
Prestotu, brisdeadh, brisd, break.
Portatu, furtaich, help.
Eine, feadhainn, people, *fine*, a tribe.
Cuirnase, cuir, put.
Meke, maoidh, threaten.
Ote, eadhon, even.
Mucatu, mothuich, perceive.
Arsir, aithris, tell.
Porsi, purr, push.
Trebeit, tearb, separate.
Ehcleir, ath-ghlac, capture again.
Sent, sannt, desire.

Tote, tath, tathaim, (Ir.), unite.
Tuer, taobh, side with.
Naratu, an iarruidh, iarr, ask.
Strusla, sruthail, streachlaim, I tear.
Farsio, bris, break.
Tenitu, thig, thainig, come.
Persontu, brosnuich, incite.
Efrar, tabhair bheir, give.
Aitu, aidich, confess.
Turse, tuirse, tuir, lament.
Eiscrent, Eascaraid, enemy.
Fratrus, brath, betray.
Ocrer, acarach, kind, gentle.
Peracri, furachair, watchful.
Pihafi, bho bhuaidh, buadhmhor, victorious.
Tertiu, deireadh, last.
Sir, sir, ask.
Sorsalem, surdail, surdamhail, active.
Mescapla, mishiobhalta, uncivil.

Another strong argument in favour of the contention that Gaelic is the language of the Umbrian Tables can be extracted from the numerous words or verbs that terminate in *mu, me, am, om, e. g.*

Arsmo, arsa mi, said I.
Carsome, greasaim, I hurry.
Hondome, aontuighim, I assent.
Spahmei, spochaim, I rob.
Persnimu, brosnuighim, I incite.
Purome, tabhairean, tabhraim, I give.
Pertome, bhruthaim, I bruise.
Tettome, dithighim, I crush.
Todcome, tudhchaidhim, I come.
Vocucom, boghaighim, I beseech.

Those verbs readily disclose their Gaelic character. The terminations *mei, me, mo, am, mu,* are merely the first personal pronoun which is appended to Gaelic verbs. I have given the Irish equivalent of the verbs which have just been cited. A *present* tense is recognized by Irish Grammarians, while in Scottish Gaelic the tenses are, the *past* and the *future* merely; the other

tenses, the present among the rest, being compounded of the substantive verb and of portions of the verb that is under consideration. It is the *present* tense of the Irish verb that I have given as the equivalent of the verbs which I have taken from the Inscriptions. Several, indeed all, of the verbs in question could easily assume a Gaelic form and preserve the distinctive termination of Gaelic verbs, e. g.

Hondome, dh-aontaich mi, I assented.
Carsome, ghreas mi, I hurried.
Persnimu, bhrosnuich mi, I incited.
Pertome, bhruth mi, I bruised.
Purome, bheir mi, I will give.
Tettome, dhithich mi, I destroyed.
Todcome, thainig mi, I came.
Spahmei, spoch mi, I robbed, etc.

It is thus the past tense of the Gaelic verb that represents the present tense of the Irish verb. It may be well to observe that the aspiration of words in Irish Gaelic is effected by placing a dot over them, and that in Scottish Gaelic aspiration is effected by inserting the letter *h*. It may be remarked here, that the evidence which the verbs under consideration furnish, is in favour of the contention of Irish Grammarians respecting the antiquity of the *present tense*, and against the opinion of Gaelic Grammarians, that Scottish Gaelic is more ancient than Irish Gaelic, because it has a past and future tense merely, and because it is thus on the same level with the Semitic languages so far as the number of tenses is concerned.

Stahmei, stad mi, shuidhich mi, I settled.
Asame, asam, I make.
Smuirsime, smuais mi, I break to pieces.
Tertiamne, tairthi/him, I save.
Randeme, raonaim, I defeat.
Totam, tathaim, I unite.
Proman, pronnaim, I give.
Pesnimu, beascnaighim, I grant.
Eturstahmu, dh- eadar shuidhich mi, I interposed.
Termnome, thearmunnaich mi, I protected.

Here are additional verbs which occur in the Inscriptions, and which corroborate the argument that I have sought to extract from

the termination *mu, me, am, om,* representing as those monosyllables do the first personal pronoun in Gaelic.

The preterite tense, Indicative, Active, of modern Irish verbs is thus declined, *e. g., mol-aim,* I praise

Singular.	Plural.
1. *Mhol-as.*	1. *Mhol-amar.*
2. *Mhol-ais.*	2. *Mhol-abhar.*
3. *Mhol-se.*	3. *Mhol-adar.*

There are to be found in the Umbrian Tables several words with terminations similar to those of the plural which has now been given *e. g.*

Fisier, bhiomar, we were, or *bhiobhar,* you were.

Arsmor, arsa mar, we said.

Totaper, Totar, tath-abhar, you joined.

Surur, shaor-abhar, you freed.

Tuer, thaobh-abhar, you sided.

Serfiur, shearbh-abhar, you embittered.

Motar, mhoid-abhar, you vowed.

Nomneper, dh-aom-abhar, you inclined.

Nomneper is a verb that occurs frequently in the Inscriptions. It is doubtless the second person plural, past indicative, active of *aom,* I incline, *aomaim.* Zeuss contends that *nu* or *no* prefixed to a verb is the mark of a completed action. In this manner, the presence of *n* in *nomneper,* standing as it does for *nu* or *no,* can be satisfactorily explained. Pictet in his well-known book to which reference has been made already, remarks (p. 152.) "that the second person plural of Irish verbs has two suffixes which are commonly used, *thaoi* and *bhar.*" The second Irish form *bhar* which has, I believe, no analogy in any other European language is employed in the *present,* the *past* and the *future, e. g., Mealabhar,* you deceive ; *Mealfabhar,* you will deceive ; *thangabhar,* you came." According to the high authority of Pictet, therefore, *bhar* as the termination of the second person plural of verbs is confined to the Celtic languages. The words which have been already adduced along with other words in the Inscriptions that may fairly be construed and expanded in a similar manner, clearly lead to the conclusion, that *bhar* as the termination of the second person plural of verbs is to be found frequently in the Umbrian Tables, and that additional evidence is thereby furnished in favour of their purely Gaelic character.

Fisi, fisim, fisiem, fisie, fisier, fisio, futu, pifi, bue, sei; here are words which occur very often in the Umbrian Tables. They are doubtless parts of the Celtic substantive verb, and present to us, therefore, very old forms of that verb. The very sound of those words will convince any one who has even a slight acquaintance with Gaelic as it is spoken, that their Gaelic character is unmistakable; for they call up several forms of the substantive verb as it is known in Gaelic, *e. g.*

Fisi; bha e or *i bha esan* or *ise*, he or she was.
bhidhis, thou wast, *bhi se*, he was, *bhidheas*, I was.
bhidheadh e or *bhiodh e*, he would be.
bi thusa or *bisa*, be thou.
bitheadh e or *i*, let him or her be.
bithidh e or *i*, he or she will be.

Fisim; bitheam, let me be, *bha mi*, I was.
Fisiem; bithidh mi, I shall be.
bidhim, I am accustomed to be.
bhidhinn, I used to be.
bhithinn, I would be.

Fisie; bithidh e he will be, *bitheadh e*, let him be.
bhitheadh e, he would be, *bhiodh i*.
bhidheas, I was, *bhi se*, he was.
bia or *biaidh se*, he will be.
bidhir, bir, thou usually art.

Fisier; bhiomar, we were, *bhiobhar*, you were.
bhiodar, they were, *biair*, thou shalt be.
bheithi, you could be, *beidhir*, thou shalt be.
bhatar, bhathar, was; *bitear bithear*, will he.
bhitheadh iad, they would be; *bha iad*, they were.

Fisio; bithibh, be ye, *bha sibh*, you were, *bithidh sibh*, you will be, *bhitheadh sibh, bhiodh sibh*, you would be.
bithi, you are; *bhidhis*, thou art; *bidhidh*, be ye; *bhithi*, you were.

Futu; bha thu, thou wast, *bu thu*, it was thou.
bhitheadh thu or *bhiodh tu*, thou wouldst be.
bhidhthea, thou wast wont to be, *bhithi*, you were wont to be
biathaoi, you will be, *bheidhthea*, you would be.

Pifi ; bu mhi, it was I, *bithibh*, be ye.
bithi, you are, *bhithi*, you used to be.
Bue ; bu e, it was he, *b' e*.
Budh ; ba h-e, it was he, *ba*, it was, *budh*, it was.
fa, it was, *bhus, budh, bidh, pu*, it will be.
Sei ; is e or *is i*, it is he or she, *s e, 's i*.
is he or *it e*, it is he.
is si, it is she.

It is thus abundantly evident that there is a close correspondence between *fisi, fisim, fisiem, fisier, etc.*, and numerous portions of the Irish and Gaelic Substantive verbs. There is likewise a close correspondence between some of the words in question and certain parts of the substantive verb in Armorican, *e. g.*

Imperative Mood.	*Bez*, be thou.
	Bezet, let him or her be.
	Bezomp, let us be.
	Bezit, be ye.
	Bezent, let them be.
	Bezinn, I shall be.
Future Indicative.	*Bezi*, thou shall be.
	Bezo, he shall be.
	Bezimp, we shall be.
	Bezot or *biot*, you shall be.
	Bezint, they shall be.

In consideration of the conclusive evidence that has been adduced that *fisio, fisi, fisim, etc.*, belong to the Substantive verb in Gaelic ; is it not a little surprising that *fisi* has been magnified into a Divinity *Fisus* by Bréal and others, and that *ocre Fisi* has been metamorphosed into *Colli Fisio*, the Fisian Hill ? Can elaborate ingenuity go to a more untenable extreme, or expend itself in more unlikely and indefensible conjectures ?

As Umbrian Gaelic is so very much older than any Gaelic writings of which there has hitherto in modern times been any knowledge, it is from the Inscriptions themselves that all grammatical rules and forms must be derived. A few Grammatical references will not here be inappropriate, as bearing on the Gaelic character of the Tables, There are various terminations of the nominative singular of nouns *e. g., ei, ne, a, tor, as, re, te, us, u.* Forms of the genitive singular are

is, no, a, o. Forms of the dative singular are *a, ef, o, etc.* The nominative plural of proper names generally terminates in *er, ir, ar, e. g.*

Pelmner, the Flamonenses.	*Aseriater*, the Asseriates.
Perscler, the Perscli.	*Peihaner*, the Vicumniae.
Rufrer, the Orbii.	*Nonair*, the Nannes.
Salier, the Salassi.	*Hoier*, the Euganei.
Atiersir, the Taurisci.	*Paveller*, the Medulli.
Popler, the Populonii.	*Serser*, the Isarci.
Treblanir, the Triumpiliui.	*Tesonocir*, the Ticinates, etc.

The common termination in modern Irish and Scottish Gaelic for patronymics and national and tribal names is *ach e. g. Albannach*, a Scotchman; *Eirionnach*, an Irishman; *Sasunnach*, an Englishman; *Frangach*, a Frenchman; *Caimbeulach*, a Campbell; *Camaronach*, a Cameron. There is thus a marked difference between the Umbrian and the modern method among Gaels of expressing patronymics and tribal names. In his minute examination and collation of the Celtic languages, Pictet was led to conclude, "En Irlandais, *ara, aire, ar, air, oir*, et en gallots *awr* forment principalement des appellatives et des noms d' agents." I believe that the endings *er, ir, ar* of the plural nouns which I have cited, represent *feara, fir*, the Gaelic words for men. Very common in Gaelic is the combination of *fear* with other nouns to indicate a trade or calling, *e. g.*

Clachair, a mason.	*Seoladair*, a sailor.
Saighdear, a soldier.	*Sgoilear*, a scholar.

Figheadair, a weaver, etc

The plural of such nouns as those ends in *an* or *ean*.

Fear, a man, is thus declined:

Singular.	Plural.
N. *Fear*,	*Fir, Feara*,
G. *Fir*,	*Fhear*,
D. *Fear*,	*Fearaibh*,
S. *Fear*,	*Fear*,
V. *Fhir*,	*Fheara*,

In the numerous proper names which occur in the Inscriptions with the endings *er, ir, ar*, in the nominative plural: the Gaelic *fir, feara* is present; so that the words will signify, *Perscler*,

the men of the Perscli, *Popler*, the men of Populonia, etc. Those terminations are eminently Gaelic; and though the collocation or composition of the proper names in question has no exact counterpart in modern Irish or Scottish Gaelic, resemblances there are of such strength and clearness as to establish the Gaelic character of those Umbrian syllables or endings.

In Irish and Scottish Gaelic, in Manx and Welsh though not in Armorican, adjectives are declined, and, therefore, undergo inflection as nouns do. The same peculiarity attaches to adjectives in the Umbrian Inscriptions, *e. g.*

Avvei mersta,	*Aveif merstaf,*	*Mersta uncla,*
Ocrer peihaner,	*Ocre fisie,*	*Ocriper fisiv,*
Ocrem fisiem,	*Ocre fisim,*	*Totar ijovina,*
Totar ijovinar,	*Tote jovine,*	*Totam ijovinam,*
Toteme jovinem,	*Tote tarsinate,*	*Totar tarsinater,*
Totam tarsinatem,	*Trifo tarsinatem,*	*Trifor tarsinater,*
Trifo tarsinate,	*Tote ijovine erer nomne,*	
Nomner Naharcer Tapuscer,	*Tuscom Naharcom Tapuscom nome.*	
Purdito fust	*Capif purdita,*	*Purditom fust,*
Peracrei,	*Peracrio tursituto,*	*Acre tlatie,*
Acre casilos,	*Casilis Herti,*	*Casilate diram Herti.*

Mersta, ocre, tote or *tota, trifor, nomne, purdita, peracrei, casiler:* Here are adjectives, whether verbal or otherwise which indicate conclusively in the connection where they are found, that they fulfil the condition of Celtic adjectives, and undergo inflections in the same manner as the nouns that they qualify do. I am disposed to regard *ocriper* and *ocreper* as a comparative form of *ocre (i. e. acarach).* Zeuss indeed calls attention to a rare termination *thir* of the comparative degree of adjectives. There is a resemblance between the *per* of *ocriper* and the *thir* which is mentioned by Zeuss.

The Infinitive of verbs in Irish and Scottish Gaelic generally ends in *adh.* In the Umbrian Inscriptions *tu* is the common ending of the Infinitive, corresponding thus very closely to *te* and *ta,* the ending of the past participle of Gaelic verbs. It is evident that the form of the verb which indicated the Infinitive in the Umbrian language, now appears in the past participle of Gaelic verbs. The correspondence between the Infinitive forms of the Inscriptions and the past participles of modern Gaelic verbs, is so apparent as not only to

be readily recognized in the case of several verbs but also to furnish another argument in favour of the Gaelic character of the Umbrian Tables, *e. g.*

	Past Participle.
Merstu, to err, *mearaighim*,	*mearaighthe.* (Irish)
Ehveltu, to revenge, *aichbheilich*,	*aichbheilichte.*
Serse, to tear, *srac*,	*sracta, srachdta.*
Seritu, to harass, *saraich*,	*saraichte.*
Esisco, to satisfy, *sasaich*,	*sasaichte.*
Carsitu, to hurry, *greas*,	*greasta.*
Habitu, to desist, *ob*,	*obta, air obadh.*
Paca, to hinder, *bac*,	*bacta, air bacadh.*
Pihatu, to conquer, *buadhaich*,	*buadhaichte.*
Naratu, to ask, *iarr*,	*iarrta.*
Fetu, to get, *faigh*,	*faighte, faighteadh.*
Trebeit, to separate, *tearb*,	*tearbta.*
Ditu, to press, *dith*,	*dite.*
Osatu, to desist, *osaim*,	*osta, air osadh.*
Tenitu, to come, *thig*,	*air tighinn.*
Stiplo, to go, *siubhail*,	*siubhailte.*
Stiplatu, to cast out, *stapla.* (Armorican)	
Covertu, to assist, *cabhair*,	*cabhairte.*
Amboltu, to hinder, *amail*,	*amailte.*
Portatu, to help, *furtaich*,	*furtaichte.*
Stahito, to arrange, *suidhich*,	*suidhichte.*
Prestotu, to break, *brisd*,	*briste.*
Etuto, to refuse, *eitich*,	*eitichte.*
Vesticatu, to hire, *fasdaidh*,	*fasdaidhte.*
Aitu, to confess, *aidich*,	*aidichte.*
Combifiatu, to vow together, *comhbhoidich*,	*comhbhoidichte.*
Tefruto, to give, *tabhair*,	*tabhairt, toirt.*
Furo, to bend, *fiar*,	*fiarta.*
Tesedi, to cut, *teasgaim*,	*teasgta.*

It is vain at this distance of time, and in the absence of any trustworthy guide whatsoever, to entertain the hope, that it will be possible to reproduce with accuracy the peculiar method which the Umbrians followed in pronouncing their language, or to ascertain the exact value which they attached to any given letters or syllables.

An internal argument which admits of great elaboration can be drawn from the Inscriptions themselves in support of their Celtic character, inasmuch as several interpretations of given phrases present themselves with instant readiness;—interpretations that are purely Celtic and that have to do with Celtic roots and words, and with those alone. A few illustrations will suffice:

Table VI. *a.*

Line 1. *Curnase, chuirinn se,* I would place him.
Chuir iade, They place him.
Chuir iad esan, They placed him, i. e., that very person.

2. *Eesteso, An deigh so,* after this.
aiste so, out of this one.

5. *Stahmei, stahmeitei.*
Eisidhim—amaoid I decide, we decide.
Stad mi, I stopped.
Shuidhich mi, I settled.
Esmei, aicme, tribe.
Is mi, it is I.
'Us mi, and I.

6. *Stu. sosda,* a city.
aisde, out of her.
stigh, inside.
stuth, substance.

7. *Sue. suaip,* exchange.
so e, this is he.
shuidh e, he sat.

8. *Verfale. buair fala,* tempt in vain.
fir a' bhaile, townsmen.

9. *Nesimei. a m' ionnsuidh,* towards me.
ionnsaighim, I attack.
thionndaidh mi, I turned.
Somo. seasaim, I stand.
sheas mi, I stood.
so mi, here I am.
suidhidh mi, I will set.

11. *Eine. fine* a tribe.
feadhainn, people.

12. *Foserclome. fiosrachailim*, I knowing.
Bha sireadh leam, there was seeking by me.
Bha aircill leam, there was lying in wait by me.

13. *Smursime. smuais mi*, I broke to pieces.
smur chum, to the dust.

19. *Vasor verisco. bhasmhor fearachas*, deadly manhood.
fasmhor fearachas, thriving manhood.

20. *Paca ostensendi eso iso ostendu.*
bac ioc dean cain a siad ioc dean.
To withdraw the tribute which they paid.
bacadh an staonachaidh a bha iad a' staonachadh.
checking the inclination to which they were tending.

21. *Teio-subocav suboco,*
Tiom-suighim suibhich, To gather together, a gathering.
Tha sibh subhachas subhach,
You are cheerful in your happiness.

22. *Fos sei pacer sei,*
Fos ise feochair ise, Still let your valour appear.
Fos sibh bhacar sibh, also you, you were hindered.

24. *Tio-esu, Daimheach*, a relative.
Bha esan, he was.
Tha esan, he is.

27. *Virseto avirseto fas est,*
farsuing anfharsuing fas aisde,
From near and from far pour out.
Fearachas so am fearachas so fas aisde.
This manhood growing out of that manhood.

55. *Sevom surur purdovitu,*
Suaip saorsa furtaich-baidh.
In exchange for independence, helpful alliance.
'Se bhuam shaorar furtaichte.
It is from me the assisted men saved.
Mefa spefa,
Meas easba, little respect, disregarding.
fo mi, fo sibh, under me, under you.
By means of me, by means of you.

Table VI. *b.*

Line 5. *Ape sopo postro peperscust.*
a bho sabh bho eadar bibhsaigh siad.

By which they were deprived of mutual help.
fein sheap bho stri a dh-fhabradh cuis, etc.:
He himself went stealthily from the strife to favour the cause, etc.

35. *Sehemo atropusatu.*
Cenomani aithre barc.
The Cenomani repenting desertion.
Cenomani bhatar a putadh,
The Cenomani they were pushing.

47. *Crinca trohatu, gairm gu trei treig*, to summon to withdraw.
crion cath ro bhadar, they were (men) of small fight.

48. *Efrar. Tabhair,*
A bheirear that will be given.

52. *Ehesu—nosne ier ehesu*
ach—an suaip foir ach.
But (the Populonans) who refuse to exchange help.
ach a so nuas bha iad ach a so.
But hereupon down they were, but hereupon.

63. *Simo. Team*, to warn.
Is iomadh. There are many.

Table VII. (*a*)

Line 2. *Atrof, aoibh er ibh*, ye tribes.
abraibh, say ye.

3. *Tiom-plener. daimh-fhlann*, blood relations.
D'am bheilear, to whom there is.
De'm bheilear, of whom there is.

Evidence is furnished by their Tables that the Umbrians were for a long time in possession of their alphabet, whether it was borrowed by them from the Romans or not. The process of phonetic decay from which the Gaelic language has suffered so severely that the orthography is no safe guide to the pronunciation of Gaelic words, had already manifested itself. Thus Anderse, Marte, and Martier represent Ancherse, Marche, Marchier. Had the alphabet been a recent acquisition, it would have been employed phonetically. Happily for the philologist, the Umbrian orthography like that of all the Celtic languages, with the exception of Manx, is historical.

Fortunately the name of the author of the Umbrian inscriptions is given in Tables V. b. and VII. b. He is Herti, King of Umbria,

and Suzerain over all the Celtic as well as over many Ligurian tribes from the Rhaetian Alps to the northern border of Umbria, and from the confines of Gaul to Istria. His name contains the root of the well-known word *Arthur*, and corresponds with Art, the name of more than one king in Irish legendary history. There are even some curious coincidences between the story of his Tables and the history of Art Aonfhir, who is said to have reigned in Ireland in the middle of the second century A. D. (Keating, p. 248.)

Table VII. b. ends with the words *sins a ccc.*, which may be interpreted "the 300th year of the age or era." The question at once suggests itself, "Who can tell when the Umbrian era began?" The other Tables mention Marcius Philippus, Valerius Flaccus, L. Porcius Licinus and Hasdrubal, but not as contemporaries: so that our only safe inference must be that the events recorded must have been later than 186 B. C., when Marcus Philippus made his unfortunate campaign in Liguria. (Livy xxxix, 22.)

The Umbrian Tables are rhetorical in the extreme, and abound in repetitions that are apparently unnecessary and indeed useless. Some valuable fragments of history are to be found in the Tables. The enumeration of tribes and peoples is of great importance to the Ethnologist, *e. g.* the three divisions of the Tyrrhenians, the five divisions of the disloyal Perscli, the fourteen tribes of Ijovine, and the five tribes of the Insubres.

Liguria, Cisalpine Gaul and Venetia are the three regions with which the Tables deal. There is much difficulty in identifying the names of the places that are mentioned, as well because the information which can be gathered regarding such places from classical historians and geographers is very meagre, as because the Romans either translated the native Celtic name, or so adapted it that it became significant and euphonious to Latin ears.

Concordia, Patavium, and Verona in Venetia were Celtic settlements, which in the Umbrian Tables were called Andersa, Hebetafeben and Purdin. The well-known cities Cremona and Placentia were in Umbrian, Crabove and Fiso-Sansie. Though, with the changeful circumstances of those old Celtic tribes, the names of places must have disappeared, the Italian topographer may find some of the ancient names still lingering in obscure portions of the region with which the Tables deal.

Summary of the Umbrian Narrative.

The Perscli, a generic title, embracing most of the tribes of Western Venetia and Transpadana, who did not belong to the Cenomani or to the Insubres, formed the Umbrian army of occupation in those regions. The tribes composing the Perscli appointed the general of the whole army by rotation. When the turn of the Asseriates of Venetia to elect a general came round, they nominated one of themselves who bore the name Parfa. The other tribes were not pleased at the election of Parfa, because they wished to retain their former general, whose name was Appei. The army revolted under Appei, and was favoured in so doing by the city Concordia, which though Celtic in origin, was under the joint jurisdiction of Pisa and Luna. Appei and his insurgents, joined by the Taurisci, Flamonienses, Isarci, Cenomani, and other tribes eager to be free from paying tribute to Herti, sacked Tarvisum in Venetia, which stood in friendly relations to Parfa, as a matter of revenge; and then passing into Transpadana took possession of Tetellus where they established themselves. Encouraged by this revolt, the Insubres who had joined Appei and had doubtless been incited by him, marched southward to the Padus, pursuing the fugitives from Tetellus. Herti, gathering an army in Umbria, marched northward and defeated the ravagers at Brixellum. Nevertheless, the subsequent history shows that a large body of the Insubres still remained in Cispadana, north of the country of the Apuans.

The time was one of general upheaval. The Populonians of Etruria took advantage of it to extend their colonial system, attempting to gain the Apuans and Vicumnians of Liguria and succeeding in detaching from Umbria the Adrians and Fiscaglians of Venetia, and in taking possession of Edro; at the same time inciting the mischievous Concordians to make trouble in the north. One of the tribes most hurtful to Umbrian interests was that of the Triumpilini who dwelt north of Brixia. They endeavoured to withdraw from their allegiance, but with very partial success the Vicumnians, Ticinates, and Boii. However, they succeeded, in withdrawing Brixia and its colony Verona.

The Crabovian tribes, in whose country the Roman colony of Cremona was situated, thought the time favourable for reconquering their ancient seat, and besieging Cremona, called for the aid of the

Triumpilini. The whole of the revolted Perscli, from Eporedia, Brixia, Ateste, and Vicetia, with the Vocontii, who dwelt about Vercellae, responded. Herti summoned the faithful tribes of Ijovine or the race of Feinne, to the relief of Cremona, and apparently succeeded in raising the siege, though in his rhetoric he forgets to state the fact.

Taking advantage of Gallic dissentions, the Genoese of Liguria either took Placentia, or taking possession of the surrounding country, besieged it. Herti, alluding to this result of disunion, summoned the Ticinates and the faithful Fenians to aid him in delivering this city from its invaders. He next turned his attention to Bergomum which was similarly besieged by the rebellious Perscli. Through the loyal Boii, he succeeded in winning back Verona. The people of this city and Vannia endeavoured to get Arnipo,—the Nahepara of the Etruscan Tables, who had been sent from Umbranum in the country of the Boii to quell rebellion in Venetia, but who had himself rebelled—to join them in loyalty. He refused to do so, and going westward tried to incite the people of Comum to deeds of violence. The example of Verona, however, was contagious and many disloyal tribes even among the Perscli and the Cenomani, returned to their allegiance. The original inhabitants of Bononia and the Claternians gave assistance.

Appei made his way towards the Apuan border, and Anovi-himu, the Annovi-gabe of the Etruscan Tables, whom Herti ordered to repel the invasion of Appei, was won over by the rebel general. Thus the Albans were added to Umbria's enemies. Yet Bobium, the Apuans, and the lord of Compiano remained faithful. Herti protected the Ligurian border by the Etruscan forces, and by the Trian tribe about Clastidium. He placed the Anamani in Umbranum to guard the Umbrian border proper, and sent the Umbranians to guard the Venetian border at Patavium. As a reward for their loyalty, he granted independent union to the Anamani, Ædui and Umbranici. In the Table he enumerates fourteen loyal tribes, half of whom seem to have dwelt in Liguria, and the other half in Venetia and Transpadana.

After this, he turned his attention to Venetia where the Populonians were carrying on war with the aid of the Adrians and Fiscaglians; while the Salluvii, Marici, and Albans in Western Transpadana

and Liguria were acting in concert with them. He called Ravenna on the north and the Epanterii of Liguria on the west, to aid him, and commissioned two Vetulonian generals Marte Ijorsi and Honde Serfie, to exterminate the Saluvii and the Marici who were special objects of his hatred. Again, we find him at Sesterno on the borders of Liguria, engaged in expelling the Insubres with the aid of the peoples of Comum and Cameliomagus. The Taurini in Dertona were wavering, but the Inscription ends before the result of his appeal to them can be stated.

The two short Tables VII. b. and V. b. contain, the one an injunction to have no dealings with Appei, with the Taurisci, Populonia and the lord of Concordia; the other, a statement of the tribute, which the Taurisci, Cenomani, Tigurini, Flamonienses and Isarci refused to pay, and of the larger tribute imposed upon them by the new masters.

The Umbrian Tables, therefore, form an historical document, dealing as they do with a very important period and with very important circumstances in the history of that portion of Italy which is embraced by them. From the ethnological and geographical notes which are appended, it can readily be seen, that powerful evidence of a corroborative kind in favour of the interpretation of the Tables which is now advanced, can be gathered from Greek and Latin historians and geographers. An interpretation, then, which presents an important and continuous narrative and which furnishes an intelligible and sufficient reason for the preparation of such Tables at all, is *a priori* to be regarded as more sensible, and as possessed of a much larger measure of verisimilitude than the interpretation which Bréal and others have offered. To contend that words denoting lapwings, and magpies, and ravens, and crows, etc., occur in the Umbrian Tables; to be told that such words as smurrim, tettum, rantim, pertum, etc., are Latin words, while it is clear that if they are Latin words they have the very questionable merit of being original and altogether unintelligible to the ordinary Latin scholar; to be told by Bréal that such interpretations as these are to be put on some of the phrases that occur in the Tables (though no one has elsewhere ever heard of a Fisian Hill, and of deities bearing the designation Die Grabovie, Trebo, Jovio, Marti Grabovie, Fiso Sancio) Die Grabovie piato collen Fisium, sues altiles tres facito Trebo Iovio pro

colle Fisio; tres boves facito Marti Grabovie pro colle Fisio, sues lactentes tres facito Fiso sancio pio colle Fisio:—such considerations are of themselves *a priori* not very acceptable, and do not deserve to be regarded as offering a satisfactory explanation of a serious document. The honest contention must be strengthened as it can be, and is, by any amount of cumulative evidence, that such an interpretation as Bréal has advanced, intangible and chimerical in many of its forms and explanations, must be regarded as altogether inferior to the historical interpretation of which a somewhat full summary has been given.

NOTE:—It has not been found possible to print *in extenso* the decipherment of the Umbrian Inscriptions, together with the Geographical and Ethnological notes, that are appended, all of which are in readiness.

GEOLOGICAL AND MINING SECTION.

A Committee of the Geological and Mining Section, consisting of Wm. Hamilton Merritt, F.G.S., Chairman; Archibald Blue, Secretary; Dr. P. H. Bryce, Mr. John Notman and Mr. R. W. Phipps, have made a Report on the Mining Industries of Canada, which states:

1. That as shown by successive annual reports of the Geological Survey, extending over a period of more than forty years, the known mineral resources of our country are a vast and valuable possession. In precious metals there is reason to believe that we have rich occurrences of gold and silver; while in the economic minerals the country is pre-eminently rich in iron, copper, gypsum, apatite and coal. We have also manganese, barytes, antimony, plumbago, asbestus, salt, petroleum, slates, building stone, marbles, limes, cements, mineral pigments and minerals applicable to the fine arts in proved abundance.

The recent discoveries of copper and gold in the vicinity of Sudbury, of new silver lodes in the district of Port Arthur, of anthracite and bituminous coals on the eastern slope of the Rocky Mountains, as well as various new discoveries of gold, silver, lead and coal in the heart of British Columbia, now accessible by means of the Canadian Pacific Railway, encourage the hope that a systematic survey of the country will reveal stores of vast extent and richness, the existence or locality of which is not now suspected.

2. Your Committee have obtained information relating to the mineral and metallurgical products of the United Kingdom of Great Britain and Ireland from the annual reports prepared by Her Majesty's Inspectors of Mines, and to the same in the United States from returns compiled by the "Division of Mining Statistics" of the United States Geological Survey.

From one of the first-mentioned reports a good deal of information has been obtained concerning the trade between the United Kingdom and her colonies, and also the production of the principal colonies.

The data for the tables illustrating the trade between the Dominion and the United Kingdom has been obtained from our Trade and Navigation Returns, and the trade with the United States from the same source, and also from the Commerce and Navigation Returns of the United States.

While these latter tables have been made up to the year 1886, though it is feared more or less imperfectly owing to varying and incorrect returns, much of the trade of Great Britain, both with her colonies and the rest of the world, is from the returns of the year 1883, which was the only report available to your Committee until quite recently, when the returns for 1884 and 1885 were received; but it is found that in the aggregate the variation between the returns for the years 1883 and 1885 is so small, and the work of sifting out the special returns for the colonies (which are not kept separate) so laborious, that it was thought the returns above mentioned would serve every requisite on this occasion. For example, the general summary of the mineral product of the United Kingdom for 1883, was about fifty-six million pounds sterling, for 1884 about sixty-one million pounds sterling, and for 1885 about fifty-eight million pounds sterling.

3. The tables accompanying this report reveal to us at the first glance the small mineral production of Canada, not only in contrast to the United Kingdom, and to our neighbor the United States, but as compared with the other leading colonies.

Taking the figures collected by Her Majesty's Inspectors of Mines for 1884 we have for—

African Colonies	$15,905,181
Asiatic (including India)	5,532,089
Australasia	47,885,069
British North America	6,108,995

The following table makes a brief comparison between ourselves and our neighbors showing the total number of miners employed in both countries and the production of copper, iron and salt in the last census years respectively :—

	Canada. 1880.	United States. 1879.	Ontario. 1880.	Michigan. 1879.
No. of miners.....	6,541	234,228	493	6,978
Copper ore, tons.....	8,177	1,007,490	170	938,960
Iron ore, tons	223,057	7,974,806	91,887	1,837,712
Salt, bbls.....	472,000	3,521,221	472,000	2,485,177

In 1886, according to the Report on Minerals in Canada by the Geological Survey, the total value of mineral production vas $10,529,361 (or $11,529,361, errors corrected) while the total value of mineral production in the United States in the same year, according to the Report on Mineral Resources by the Geological Survey of that country, was $459,327,888—being a proportion of about 1 to 40.

Your Committee are emphatically of opinion that this great disproportion does not exist in the mineral resources of the two countries.

4. From Table "A," accompanying this report, it will be seen that for the year 1886, the imports into Canada of mining and crude metallurgical products from the United Kingdom were $6,880,103 and from the United States $9,448,776, while the exports from Canada in the same year to the United Kingdom were $591,632 and to the United States $3,187,163.

The above figures are from the Trade and Navigation Returns of the Dominion. We give a separate table "Aa," compiled from the United States Trade Returns in order to show the remarkable difference there is in the returns of the same article given by the two countries.

In each case there was a balance against us of about six millions of dollars, but it will be borne in mind that the tariff of the United States is in many productions practically prohibitory.

Again, taking Canada's exports of produce of the mine to Great Britain, the United States and all other countries for the ten fiscal years 1877-1886, we have the following figures :

Year.	Great Britain.	United States.	Other Countries.
	$	$	$
1877	1,061,201	2,413,525	169,314
1878	142,374	2,472,979	200,994
1879	265,305	2,636,334	181,261
1880	216,867	2,495,624	164,860
1881	253,652	2,346,529	167,648
1882	311,456	2,418,021	284,096
1883	443,831	2,198,014	329,041
1884	519,672	2,505,501	221,919
1885	485,408	2,898,518	255,611
1886	589,832	3,115,696	245,619
	4,289,598	25,500,741	2,220,363

5 Believing it would be of interest to ascertain the trade of the United Kingdom and of the United States as well as that of Canada with the world at large in minerals and metallurgical products, your Committee have prepared two sets of tables with this in view.

The first set "B" take the exports and imports for the years 1881 to 1884 inclusive. They shew that on the average the values of exports were, from

Great Britain	$228,908,727
The United States	72,500,654
Canada	3,338,231

and that the values of imports were, to

Great Britain	98,801,964
The United States	72,887,652
Canada	24,349,898

The second table "C" treats more fully with the detail and takes into consideration only the crude metallurgical products.

From this we get values of exports of

	United Kingdom.	United States.
Ores	$ 54,149,094	$13,770,477
Metallurgical Product	176,560,594	65,262,079
Total	$230,709,688	$79,032,556

While the values of imports were:

	United Kingdom.	United States.
Ores	$33,512,356	$ 9,033,986
Metallurgical Product	33,433,902	54,775,490
Total	$66,946,258	$63,809,476

The first table shows us that the United Kingdom exports three times as much of minerals and their products as the United States, while she imports one-third more than the United States.

From the second table we gather that the United Kingdom imports about four times as much ore matter as the United States and a little more than one-half the crude metallurgical product.

The imports of ores to the United Kingdom are chiefly copper ores and regulus, silver ore, iron ore, iron pyrites and phosphates, with lesser quantities of ores of lead, manganese and gold; while the United States imports her largest quantities in coal, silver and iron ores and salt, with smaller quantities of clays, copper ores, phosphates and asbestus, and a small quantity of most other economic minerals.

In crude metallurgical productions the United Kingdom imports very large amounts of copper, lead, tin and zinc, while the importation of the United States is chiefly made up of iron and steel, with tin, earthen and China-ware next in importance, and lesser amounts of fertilizers, lead, zinc and marbles.

6. A Table "D" has also been prepared shewing the trade carried on by the United Kingdom with Canada, with her other colonies and also with the rest of the world in mining and crude metallurgical product.

This shews that the colonies do as yet but a small proportion of business compared with that carried on by the United Kingdom with

foreign countries, the imports to the United Kingdom in 1883 being:

From Canada	$ 512,471
From Colonies (other than Canada)	8,137,274
From other Countries	58,281,835

While exports from the United Kingdom were:

To Canada	$ 7,765,344
To Colonies (other than Canada)	51,616,930
To other Countries	170,975,358

A.

From Dominion Trade and Navigation Returns.

EXPORTS, 1886.

	VALUE IN DOLLARS.	
	To United Kingdom.	To United States.
	$	$
Coal, bituminous	76,304	1,127,677
Gold	450	1,210,864
Gypsum		112,271
Mineral oil		27,742
Antimony ore	35,320	3,000
Copper ore		291,397
Iron ore		23,039
Manganese ore	29,853	13,001
Silver ore		25,134
Phosphates	407,314	6,817
Plumbago	1,481	
Salt		26,714
Sand and gravel		23,195
Slate		4,256
Stone and marble (unwrought)		59,888
Other articles	40,588	159,670
Gypsum (ground)		18,485
Lime		18,552
Stone and marble (wrought)	328	15,461
	$591,638	$3,187,163

IMPORTS, 1886.

	VALUE IN DOLLARS.	
	From United Kingdom.	From United States.
	$	$
Salt—Bags fine, coarse ; bags coarse and bulk	206,262	14,348
Brass—Tubing, bars, strips, wire clots, scrap, sheet and wire	88,625	298,960
Cement—Hydraulic, bulk and bags, and Portland	104,592	15,441
Coal—Anthracite		4,095,966
" Bituminous	199,661	2,527,807
Coke	6,037	37,798
Copper—Bars, rods, scrap, pig, sheet and wire	92,600	132,611
Earthenware	413,223	32,367
China and porcelain	76,859	9,372
Iron and steel—Dutiable and free, including scrap and wire	4,625,841	1,091,986
Lead	149,107	5,439
Marble	3,138	78,575
Britannia metal, type and babbit metal, pewter	12,295	75,226
Asbestos (manufactured)	548	6,283
Mineral substances and ores (not otherwise specified)	5,995	23,882
Plumbago—Raw and manufactured	118	5,663
Mineral oil		421,730
Products of shale, petroleum, etc	1	59,374
Gypsum (manufactured)	2,469	6,034
Diamonds and precious stones—Unset	60,634	15,970
Paint—Fireproof		2,143
Slates	1,060	25,651
Building stone, granite, flagstone and grindstone	16,312	85,513
Tinware and block tin	154,649	190,529
Zincware and block zinc	53,434	16,584
China—Fire, pipe and other clays and chalk	18,690	16,558
Brimstone		2,809
Tin plates	619,971	124,849
Litharge, lime and whiting	35,106	15,446
Nickel and bismuth	70	289
German silver and silver sheets	2	9,981
Sand and gravel		22,692
	$6,880,103	$9,448,776

Aa.

From Commerce and Navigation Returns of the United States.

EXPORTS (TO CANADA), 1886.

ORE OR METAL.	VALUE IN DOLLARS.
	$
Coal—Anthracite	2,564,340
" —Bituminous	751,895
Copper—Ingots, bars, old, sheets and other manufactures	27,080
Copper ore	4,680
Earthen and stoneware	68,310
Chinaware	8,145
Iron—Pig, bar, carwheels, castings, plates and sheets, railroad bars or rails, iron and steel; wire, iron and steel	374,182
Iron ore	1,122
Lime and cement	25,047
Marble and stone, unmanufactured; roofing slate and other manufactures	228,639
Mineral oil—Naphthas, illuminating and lubricating	479,576
Quicksilver	3,666
Salt	4,873
Tin, manufactures of	38,893
Zinc—Pigs, bars, and manufactures of	11,439
	$4,591,887

IMPORTS (FROM CANADA), 1886.

ORE OR METAL.	VALUE IN DOLLARS.
	$
Coal—Bituminous	1,014,116
Copper ore	332,240
Gold bars and bullion	687,705
Silver bullion	1,827
Unspecified mineral substances	3,646
Iron ore	25,731
Stone, slates, etc	92,756
Mineral oil	15,204
Salt	53,317
Phosphates	6,740
Gypsum, unground	115,003
Plumbago	2,405
Precious stones and imitations	65,637
	$2,416,327

B.

EXPORTS OF THE UNITED KINGDOM.

ARTICLES.	1881.	1882.	1883.	1884.
	£	£	£	£
Cement	753,392	804,601	925,474	871,015
Coals	8,785,950	9,564,616	10,645,919	10,851,130
Products of coals (except dyes)	565,693	781,412	1,017,767	1,068,900
Metals:				
Iron, old	488,647	507,161	337,995	223,422
Iron, pig & puddled.	4,104,776	4,962,185	4,077,456	2,945,223
Iron, bar, angle, etc.	2,013,133	2,298,533	2,034,667	1,942,294
Iron, railroad	5,666,446	6,387,219	6,014,264	4,142,063
Iron, wire	1,000,844	1,330,544	926,797	692,607
Iron, hoops, sheets, and boiler plates	3,404,790	3,943,806	3,899,774	3,693,001
Iron, tinned plates	4,163,132	4,642,125	4,705,403	4,746,923
Iron, cast or wrou't, and all other mfrs.	3,964,268	4,549,860	4,616,660	4,580,671
Steel, unwrought	1,871,161	2,034,339	1,396,556	1,127,481
Steel, mfrs. of	914,311	942,534	580,644	402,380
Telegraph wire	1,983,663	1,042,561	1,237,893	2,509,153
Copper, unwrought:				
Ingots, cakes or slabs	1,228,378	909,241	1,143,034	1,053,135
Wrought or prtly. w	2,208,189	2,424,837	2,426,439	2,513,894
Brass, of all sorts	384,792	444,383	432,033	452,998
Lead, pig, sheet and pipe	675,828	577,325	533,144	422,178
Tin, unwrought	460,506	579,557	524,049	469,210
Zinc, wrought and unwrought	118,296	125,969	98,741	100,356
Salt	585,838	568,715	645,009	611,537
Totals	£45,341,433 = $220,359,364	49,421,523 = 240,188,602	48,219,718 = 234,347,829	45,419,571 = 220,739,115

IMPORTS OF THE UNITED KINGDOM.

ARTICLES.	1881.	1882.	1883.	1884.
Metals:	£	£	£	£
Copper ore & regulus	2,427,761	2,609,836	2,936,208	3,175,066
Unwrought, p't w'rt and old copper	2,166,383	2,522,393	2,413,793	2,329,175
Iron ore	2,349,411	3,063,091	2,750,870	2,114,600
Iron in bars	1,140,509	1,396,457	1,236,735	1,165,948
Iron and steel, wro't or manufactured	2,564,823	2,474,898	2,870,813	2,693,422
Lead, pig and sheet	1,388,109	1,266,999	1,305,388	1,222,325
Silver ore	688,176	750,079	1,030,542	1,089,768
Tin in blocks, ingots, bars or slabs	1,873,472	2,538,577	2,442,959	2,123,799
Zinc, crude in cakes	755,666	708,877	640,302	700,154
Zinc, manufactures	414,813	396,936	408,206	390,157
Petroleum	1,952,444	1,721,019	2,170,298	1,711,313
Pyrites, iron or copper	1,202,281	1,422,684	1,356,083	1,244,871
Totals	£18,923,848	20,871,846	21,562,197	19,660,598
	$91,969,901	101,437,171	104,792,277	97,008,506

B.

EXPORTS OF THE UNITED STATES.

ARTICLES.	1881.	1882.	1883.	1884.
	$	$	$	$
Brass and mnfrs. of	216,057	322,439	287,847	301,014
Coal—Anthracite	2,091,928	2,589,887	2,648,033	3,053,550
" —Bituminous	739,532	1,102,898	1,593,214	1,977,959
Copper and mnfrs. of	876,395	748,456	2,348,004	5,595,859
Iron and steel and manufactures of *	16,608,767	17,551,322	140,427 19,024,894	18,369,148
Lead and mnfrs. of	39,710	178,779	43,108	135,156
Marble and stone and manufactures of	629,795	614,430	541,553	503,260
Mineral oils	40,315,609	51,232,706	44,913,079	47,103,248
Quicksilver	1,124,955	959,128	1,020,827	427,219
Salt	14,752	18,265	17,321	26,007
Tin and mnfrs. of	198,524	198,608	191,947	166,819
Zinc and mnfrs. of	148,212	138,374	82,490	31,107
Totals	$63,004,236	$75,655,292	$73,652,744	$77,690,346

* Sewing machines and agricultural implements not included.

IMPORTS OF THE UNITED STATES.

ARTICLES.	1881.	1882.	1883.	1884.
	$	$	$	$
Brass and mnfrs. of...	494,249	668,136	570,666	470,435
Coal and coke.. ...	2,008,967	2,192,689	2,084,151	2,589,958
Copper and mnfrs. of.	564,923	317,172	191,285	291,603
Iron and steel & mfrs. of (including ore)...	51,454,574	53,898,267	40,837,376	42,917,747
Lead and mnfrs. of...	163,742	211,935	170,198	92,861
Marble and stone and manufactures of....	749,763	798,542	819,567	950,217
Metals and mnfrs. of, not elsewh'r specif'd	1,162,913	1,429,918	1,489,445	2,248,814
Mineral oils and other mineral substances..	112,152	187,248	141,532	89,154
Platinum.....	294,635	334,183	391,766	373,110
Salt	1,900,610	1,561,132	1,476,946	1,527,455
Slate and mnfrs. of...	46,864	45,928	49,919	
Tin and mnfrs. of....	18,685,903	21,838,261	22,903,572	5,482,909
Zinc and mnfrs. of...	262,218	949,041	802,933	251,476
Totals.....	$77,901,513	$84,432,452	$71,929,356	$57,285,739

B.

EXPORTS OF CANADA.

ARTICLES.	1881.	1882.	1883.	1884.
	$	$	$	$
Coal.....	1,123,091	1,078,704	1,087,411	1,201,172
Gold.....	767,318	930,951	911,383	952,131
Gypsum, ground and unground.....	132,787	138,180	160,794	172,928
Lime	....	.....	.....	.....
Mineral oils.....	631	136	368	7,546
Antimony ore.....	3,921	4,733	11,842	4,855
Copper ore.....	150,412	139,245	150,479	214,044
Iron ore and products of iron and steel....	445,707	571,700	556,100	354,667
Manganese...	38,738	37,485	29,417	15,851
Silver	34,494	15,110	14,200	12,920
Phosphates.....	239,493	327,667	302,716	453,322
Salt.....	39,566	36,418	17,511	17,408
Sand and gravel.....	12,511	13,789	17,755	14,152
Stone, marble & slate, wrought & unwrou't	95,726	115,167	94,880	82,392
Total.....	$3,084,395	$3,409,285	$3,354,856	$3,504,388

IMPORTS OF CANADA.

ARTICLES.	1881.	1882.	1883.	1884.
	$	$	$	$
Brass and mnfrs of..	276,958	362,581	383,106	393,544
Coal	4,094,294	4,696,007	6,389,804	7,503,871
Copper and mnfrs of..	160,329	222,219	243,222	235,510
Gold and silver and mnfrs. of	233,806	333,820	345,515	230,614
Iron and steel and mnfrs. of *	12,224,180	16,378,344	18,253,179	13,464,742
Lead and mnfrs. of...	150,292	181,354	203,100	166,804
Marble, slate and stone and mnfrs. of	220,323	236,440	265,491	265,594
Metal, composition and other	368,967	462,286	649,236	611,909
Oils, mineral	280,638	453,250	460,728	427,641
Salt	494,633	323,807	422,367	360,192
Zinc and mnfrs. of....	126,469	99,736	22,599	99,742
Tin and mnfrs. of....	413,924	946,522	1,258,136	1,001,769
Total	$19,044,813	$24,696,366	$28,896,483	$24,761,932

* Not including sewing machines and agricultural implements.

C.

Ores.	Exports.		Imports.	
	From United Kingdom, 1883.	From United States, 1886.	To United Kingdom, 1883.	To United States, 1886.
	$	$	$	$
Clays, except ordinary	935,404	9,978	.....	225,323
Coal, anthracite	.....	2,707,590	.....	20,140
" bituminous	51,739,166	1,480,940	.....	2,551,954
Coke	.....	18,327	.....	.....
Cobalt and nickel ore and matter	.....	11,687	.....	.....
Copper ore & regulus	.....	3,068,879	2,387,926	417,449
Gold ore	.....	34,160	21,384	1,397
Silver ore	.....	.....	5,008,434	1,263,257
Iron ore	.....	144,652	13,369,228	1,306,033
Iron pyrites, chiefly cuprous	.....	.....	6,590,563	.....
Lead ore	16,524	.....	983,129	.....
Manganese ore	.....	.....	496,217	.....
Phosphates	.....	.....	3,955,189	426,243
Quicksilver	.....	219,259	.....	.....
Salt	1,458,000	29,827	.....	1,499,182
Tin ore	.....	.....	3,474	.....
Zinc ore	.....	24,951	696,812	.....
Mineral oil, crude	.....	5,859,577	.....	15,581
Marble and stone, unmanufactured	.....	159,553	.....	.....
Platinum	.....	.....	.....	356,041
Plumbago	.....	.....	.....	164,111
Aluminum	.....	.....	.....	5,298
Bismuth	.....	.....	.....	117,768
Gypsum	.....	.....	.....	116,202
Buhr stones, unmnfd.	.....	.....	.....	40,772
Lithographic stone	.....	.....	.....	73,884
Mica	.....	897	.....	43,107
Charcoal	.....	.....	.....	35,544
Emery	.....	.....	.....	83,214
Pumice	.....	.....	.....	30,128
Talc	.....	.....	.....	25,394
Mineral subs, not elsewhere specified	.....	.....	.....	123,864
Asbestos, crude	.....	.....	.....	91,089
Total ores	$54,149,094	$13,770,477	$33,512,356	$9,033,986

C.

Metals.	Exports. From United Kingdom, 1883.	Exports. From United States, 1886.	Imports. To United Kingdom, 1883.	Imports. To United States, 1886.
	$	$	$	$
Brass and mnfrs. of	.....	150,807	.....	404,678
Bronze and mnfrs. of	.....	.....	.....	714,473
Cement	.....	123,103	.....	722,576
Asbestos, mnfd	.....	29,303	.....	.....
Copper, unwrought, partly wrought, pigs, bars and sheets	23,660,224	2,498,898	8,679,717	57,651
Copper, mnfrs. of	45,527	108,975	362,293	122,985
Earthen, stone and chinaware	.....	163,908	.....	4,947,621
Fertilizers	.....	1,107,657	.....	1,680,473
Iron — Pig	.....	.....	.....	4,041,366
Iron — Mfrs. of iron and steel	138,948,439	15,745,569	.....	33,278,088
Lead, pig, mnfrs. of	2,765,937	114,098	7,423,354	865,820
Lime	.....	.....	.....	41,107
Mineral oil — Refined	.....	44,340,267	.....	.....
Mineral oil — residuum	.....		.....	.....
Slates	1,216,098	605,261	.....	.....
Terra alba, etc	.....	.....	.....	25,878
Tin plates	.....	.....	.....	.....
Plaster Paris, ground and calcined	.....	.....	.....	38,852
Tin, bars, blocks or pig	9,042,163	.....	11,872,790	5,873,752
Tin, mnfrs. of	.....	157,724	.....	.....
Marble and stone and mnfrs. of	.....	.....	.....	872,036
Zinc, blocks and pig	882,206	64,410	5,095,748	119,425
Zinc, mnfrs of	.....	12,749		49,406
Nickel, mnfrs. of	.....	35,302	.....	.....
Platinum, mnfrs. of	.....	4,048	.....	.....
Other metals, metal compts & mnfrs, not elsewhere specified	.....	.....	.....	1,920,103
Total metals	$176,560,594	$65,262,079	$33,433,902	$54,775,490
Total ores (carried forward)	54,149,094	13,770,477	33,512,356	9,033,986
	$230,709,688	$79,032,556	$66,946,258	$63,809,476

D.

From Report H. M. Inspectors of Mines, 1883.

Articles.	Exports from United Kingdom.			Imports to United Kingdom.		
	To Canada.	To Colonies, (other than Canada.)	To Other Countries	From Canada.	From Colonies, (other than Canada).	From Other Countries
Clays (except ordinary)	.....	.....	$ 935,404	.....	.....	.....
Coal	$397,445	$7,490,270	43,851,449	.....	.....	.....
Copper, unwrought, wrought, yellow metal and manufactures	266,814	8,241,082	15,152,347	.....	2,316,276	6,725,734
Copper ore	.....	.....	.....	and Newfld. 166,909	354,425	1,851,834
Iron ore	.....	.....	38,014	.....	.....	13,369,228
Iron—Pig, bar, angle, bolt, rod, railroad, Tin plates and sheets, hoops, sheets and boiler plate, wire (except telegraph), cast and wrought, steel, unwrought, iron and steel combined	6,735,474	33,705,135	98,507,840	.....	.....	.....
Lead—Pig, rolled sheet, piping and tubing	145,493	1,093,014	1,527,629	.....	.....	7,423,354
Lead ore	.....	.....	16,524	.....	96,665	886,464
Salt	120,712	400,566	930,131	.....	.....	.....
Slates	.....	104,762	1,111,336	.....	.....	.....
Tin	98,726	31,794	8,573,465	.....	5,022,285	6,850,505
Tin ore	.....	.....	.....	.....	3,474	.....
Zinc	680	550,307	331,219	.....	.....	5,095,748
Zinc ore	.....	.....	.....	.....	208	696,604
Gold ore	.....	.....	.....	.....	.....	21,384
Iron pyrites	.....	.....	.....	.....	.....	6,590,563
Manganese ore (1882)	.....	.....	.....	21,252	24,951	450,014
Phosphates	.....	.....	.....	324,230	278,473	3,352,486
Silver ore	.....	.....	.....	.....	40,517	4,967,917
Total	$7,765,344	$51,616,930	$170,975,358	$512,471	$8,137,274	$58,281,835

SNAKE POISONS.

ABSTRACT OF PAPER READ BEFORE THE CANADIAN INSTITUTE BY DR. J. H. GARNIER, NOVEMBER 5TH, 1887.

Snake poisons have riveted the attention of mankind from the earliest ages, and the Hindoos likely used snakestones even before the first historical mention of men. Snake charming is a profession in all the Indo Malay countries as well as Hindostan proper, and the secrets of their profession are carefully handed down from father to son. All things go by caste in that country and the secrets of a profession never are allowed to pass out of the family and its proper descendants. In North America there are three well marked varieties of poisoning; first, by the Colubrine snake, "elaps fulvias" and the local varieties of it that exist in various regions of the Southern States; second, by the Copper head and Cotton mouth, Ancistrodon Contortrix and Ancistrodon Piscivorus. thirdly, by the true rattlers. In Canada there may be two or three species, but they are now becoming very scarce. The only variety in Ontario is the little prairie rattle snake or Massissauga, the Caudisoma Tergemina of Baird and Girard. The symptoms of the bite of rattlesnakes, are extreme pain in the bite, yet with a dead or numb-feeling; swelling of the adjacent regions; rapidity of pulse; laborious breathing; congestion of the lungs; spitting blood or rusty sputa; then gradual syncope and failing pulse; extreme drowsines; faintings and death. The poison is absorbed from the bite, and disseminated through the entire body, blood, nerves, veins, arteries and every tissue is affected.

We need a remedy that will follow this death dealing poison into every cranny and corner of the system, and neutralize it the moment they meet, there and then. Such a remedy I propose to lay before you to-night, and from the extreme ease of giving it and as, both portions of it being easily procured, it is at everybody's command, I hope sincerely it may be given a fair and honest trial. The ingredients are first Iodide of Potash say one dram to be taken in two ounces or more of cold water, tea, coffee or any similar fluid. Then let it have about ten minutes to get absorbed into the blood and circulation. It is very rapidly passed through the coats of the stomach into the circulation and system. This had best be repeated twice to make sure and have the entire system impregnated. Then use an incom-

patible or another substance that at once resolves the iodide into its elements, and sets the iodine free. Sweet spirits of Nitre does so. Give an ounce in water or mucilage or syrup of any sort. It is far best to give a large dose and make sure. The Nitric Ether is even more rapidly absorbed than the iodide of potash and the instant they meet in solution the iodine is freed and at once attacks and neutralizes the venom.

I had received a large jar from India, with many poisonous snakes, and the jar was broken on its route, the snakes consequently on arrival were withered and dried. These were placed with the heads down in a large vase and a quart of water and a pint of proof spirit poured over the heads to soften them. In the vase were two gnans Hamadryas Elaps, (Cantor). These are the most deadly of the cobra family, and the largest. The first was 9 feet 1 inch, the smaller 7 feet 8 inches. This herculean cobra fears nothing and flies from nothing. Mr. Theobald mentions a case of an adult young male elephant that was struck between the eyes by a large gnan, and died in three hours and of a snake charmer who was bit in the wrist and died in a few minutes. The reason of dwelling on this species will be seen on reviewing my own personal case, and I do not wish to endure such extreme agony again.

There were two adult cobras, one sixty and the other fifty-six inches long.

One Trimesurus Carinatus half-grown eighteen inches long.

Two Echis Carinata, one adult sixteen inches, the other twelve and half inches very deadly from Bushere, in Persia.

Two Bungarus Fasciatus, one five feet four a grand specimen, and a smaller twenty-nine inches but large enough to kill anybody.

Three Bungarus Cœruleus—the Krait, adults forty-four, forty-three and thirty-six inches respectively.

Two Daboia Russellii, the famous Tic Polonga killed in the Botanic gardens of Calcutta, thirty-seven and thirty-four inches long, about half-grown.

It is a well established fact, that snake poisons lose nothing of their virulence by the addition of water or spirit though a rather larger quantity is required to be injected to kill.

What came from all these heads was comparatively small of necessity, but even a small portion of it produced the symptoms of

this terrific poison as I found to my cost. In February, 1883, I read a paper before the Institute, "On the poisonous snakes of North America," pointing out in theory the use of iodine as a remedy and little deemed I should be personally the first on whom it was to be tested.

After the above mentioned snakes heads had been duly softened I very cautiously manipulated them, opening their mouths and examining the fangs with a powerful hand glass. Previously, that morning in lifting a stove-stick I received a small abrasion and some slight scratches on the ring finger of my right hand. I worked away among this fluid for about three hours, the abrasions being constantly immersed, and at first smarted a little, but this soon subsided, and I continued my investigations and my notes. I then drove into the country for a couple of hours and was unconscious of any pains or annoyance whatever from the poison. About six in the evening there was a dead numbness and great pain in the ring finger and all up my arm, but I took little notice of it. At no time did it extend above the shoulder. Then I became dizzy and squeamish, but these symptoms were transient, but the pain and numbness were continual and persistent and I asked myself what had produced it. I was asked if I had got my arm hurt? No, I had not.

Were you working with strychnine or other poisons? No, I was not. What were you doing with the snakes' venomous heads? Has that caused it? No. Yes! Yes perhaps. I felt very heavy. I belittled the matter but felt truly alarmed. I then mixed a dram of iodide of potash in two ounces of cinnamon water and swallowed it. In ten minutes I did so again. Then in a few minutes more I took an ounce of spirit of nitre in water and mucilage and a glass of whisky. The relief was very rapid and I cannot have been mistaken in attributing the quick relief to the remedy I took. It was no fancy. It was a fact. I took some more whisky and a little after nine o'clock I took a glass of strong brandy punch and went to bed. The pain decreased but my arm felt as if recovering from a heavy blow. I began to perspire and soon fell asleep. Next morning I was nearly all better, and in a few days I was quite well.

In snake bites a deal depends as to deadliness, on the size and species of snake, the season of the year, autumn and extremely hot weather being worst, and the part bitten. A bite in the throat, an artery or

vein being worst, then the extremities and glandular portions etc. Dr. Jefferies, of Cain City, near Elsworth, Kansas, was requested by me to try my plan and gave me three cases in which he was most successful. He says, "The first was the case of a young farmer, aged nineteen, Mr. Sweicher, who was bitten on the left foot by a large rattesnake on September 23d, 1884. I saw him two hours and a half after as he had to drive fifteen miles. The foot was much swelled with intense pain up the leg. I gave him a glass of whisky. Then one dram iodide of potash in rose water. In ten minutes I gave him an ounce spirit ether nitre. I repeated these doses three times, and gave him several doses of whisky. He was at once wonderfully relieved, and feeling greatly better soon went away. On leaving I gave him a mixture of iodide of potash three drams to an eight ounce mixture, and directed a desert-spoonful thrice a day. He went to Southern Kentucky for a time and thoroughly recovered and used no other remedy, nor had he the recurrent symptoms.

The second was the case of Mr. Labrodaire, aged thirty-five. On May 9th, 1887, was bitten by a rattlesnake, just above the ankle. I saw him about an hour after the accident. He was weak, pulse 112, face anxious and livid, ankle swelled, and great pain extending into the leg and up the thigh. I at once gave him a drachm and a half of iodide in solution, and in ten minutes half an ounce of sweet spirit of nitre. I also gave about three ounces of brandy. I repeated this treatment for an hour and a half, but I greatly reduced the doses every twenty-five minutes, and gave a little more brandy. He was at once relieved, indeed astonishing so, and on his going I prescribed for him, Iodide Potash, 4 drams; Fluid Extract of Sarsaparilla, 2 ounces; Carbolic Acid, 20 drops; Rose water to 8 ounces, mix and direct a tea-spoonful three or four times a day. He quickly recovered and never experienced any recurrent troubles to any amount.

But the most notable case was of a valuable collie dog which was the property of a Mr. Burt, who lived two miles from my office. He was ploughing and saw a large rattlesnake strike his dog in the leg. He at once unhitched, put his horses to his waggon and brought his dog to me in it. He was most anxious about his dog. I gave the animal two drams of iodide in solution and had some

difficulty in getting it down his throat. In ten minutes I gave him an ounce of sweet spirit of nitre. We then went into the office intending to repeat the dose diminished, in half a hour or so, and left the dog in the waggon. I had little faith in any remedy in this case, as the creature was greatly paralyzed and exhibited great suffering. His life was ebbing fast and he seemed to be dying, with no hope of recovery. Mr. Burt was very sorry and did not wish to see his faithful dog die, in agony, in the waggon. In half a hour we intended to repeat the dose and then went out to d . But you may guess at our astonishment when we found that our canine patient had disappeared, where we could not tell, and we searched and whistled for him in vain. Mr. Burt and myself were puzzled, and he was anxious and started for home. On arriving he was more astonished still to find that the dog had arrived first, and was quietly awaiting his master's return. He came to my office next day, and informed me, the dog was alive and doing well, and was tied up for a few days that he might have a perfect recovery and rest. When I reflect on the prostrated condition he was in on arrival, and knew for a fact, that he had received a full dose of poison from the fangs of a large rattlesnake, I cannot but express the greatest amazement, at the almost miraculous rapidity, with which this seemingly simple remedy acted. "Dr." said Mr. Burt to me, "that dog is worth hundreds of dollars to me, as he does two or three men's work, in herding my cattle."

This animal throughly recovered and seemingly had none of the paralysis and pain, so often left as a souvenir of rattlesnakes' bites, both to man and beast.

I have had other minor cases but these are the most noteworthy, and in all cases the iodide of potash given first and then followed in ten minutes by the spirit aether nitre has been eminently successful. Judging then, by my own experience, I believe if your method of treatment is carried out, in cases similar to these that a failure is impossible and that a speedy restoration will always follow.

(Signed) B. GRANT JEFFERIES, M.D."

I am not the first to point out iodine as a cure for snake bites, as twenty-five years ago Mr. Viaud Marais did so, but he used metallic iodine and failed.

Snake bites cannot well be tested in Canada except foreign poisonous snakes be procured for this purpose. But trivial dependence can be placed on experiments on dogs and other animals. We need positive trials on the human subject and nobody will voluntarily undergo such a test.

But it would be an easy matter for the executive authorities to sanction such an ordeal, and have it carried to completion on the human body without annoying the feelings of the most sympathetic. Are there not very many persons yearly condemned to death, all over the world? What good is obtained for society by hanging or guillotining these miscreants? They have forfeited the sympathies of mankind, and are, so to speak, beyond the human pale. Why not utilize such desperadoes in the causes of science? In testing the efficacy of this, so far, seeming cure, in a legitimate manner on the carcase of a murderer, it should outrage nobody's feelings and humanity heeds little the distorted sympathy of a foolish crank. If all mankind be benefited and a remedy for snake poisons proved effectual by this means, even though a miscreant be sacrificed in the trial, such a life already condemned to be extinguished, is little to be regarded. I most unhesitatingly assert that if the bodies of parties who had forfeited their lives, were employed for scientific research, it would be a grand step in the march of civilization, a step in moral improvement, and must tend to the elucidation of our knowledge in the treatment of very many obscure diseases. Is it not fit that a few cast-aways should suffer to save the living masses of society?

Other assistants to the treatment here presented are snakestones and ligatures.

Snakestones are applied at once to the puncture made by the fang of the snake and adhere and draw out the poison, and as soon as they become filled drop off and hold the venom so extracted; they are then thrown into milk or water and the venom swims on the top. Milk is the better to use, as the poison turns green and is easily seen. I recommend a cut to be made over the puncture and several folds of blotting paper to be introduced, so as to suck up the serum and poison at once. Absorbing cotton or any similar article is always readily obtained.

Ligatures delay circulation and absorption and give more time

for action, and thus help. Nevertheless ligatures alone, no matter how tightly applied, do not prevent the poison getting into the circulation and causing death. But in case of a finger or toe being bitten, amputate at once. It is the King of all cures. In case it is practicable cut out the part bitten at once and delay no time.

Next to the knife I certainly think the iodide of potash and followed in a few minutes by sweet spirit of nitre, is the best remedy we have. In all cases whisky and spirits are a very great help. If a person is truly under the influence of snake poison, it is scarcely possible to make him drunk.

A most careful series of researches have yet to be made on the action of snake venom on the blood, on the nerves, on the muscular coats of the arteries, and veins, and the tissues, and glands. This must be done in the near future, and every part be brought upon the field of the microscope.

If Iodine be a remedy in general for snake bites and their venom which I am strongly led to believe, then I think I have pointed out a scientific mode of distinguishing it, when bona fide in circulation. It will be admitted that my own case, and the cases stated by Dr. Jefferies bear a powerful evidence in its favor that none can lightly cast aside. Be it the iodine, be it the nitrate of potash or the the spirits, mixing in the blood, and reacting on this venom and poison in the serum, fibres or blood-corpuscles, there seems little doubt that the action and destructive energy of this venom on human or animal life is quickly stayed and the subsequent recurrent and most distressing symptoms are greatly alleviated. I claim no specific for snake bites in this my treatment, as I know full well that such a claim is futile "*just now*," but I do claim that it is well worthy of a fair and honest trial, and if it prove a success in treating such deplorable and terrible accidents, I shall feel heartily glad to know that I have been of some use to my fellow men.

INDEX OF AUTHORS.

INDEX TO PAPERS, &c.

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THE CANADIAN INSTITUTE.

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Provincial Board of Health	"
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Royal Society of Canada	"
Ottawa Field Naturalists' Club	"
Entomological Society of Ontario	London.
Hamilton Association	Hamilton.
Natural History Society of Montreal	Montreal.
Canada Medical and Surgical Journal	"
Canadian Society of Civil Engineers	"
Celtic Society of Montreal	"
Literary and Historical Society of Quebec	Quebec.
Le Naturaliste Canadien	Cap Rouge, Que.
Natural History Society of New Brunswick	St. John, N. B.
Nova Scotia Historical Society	Halifax, N. S.
Nova Scotia Institute of Natural Sciences	"
Manitoba Historical and Scientific Society	Winnipeg, Man.

—24.

(2.)—UNITED STATES.

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Technical Society of the Pacific Coast	"
Western Scientist	San Diego, Cal.
Colorado Scientific Society	Denver.
Bridgeport Scientific Society	Bridgeport, Conn.
American Journal of Science	N. Haven, Conn.
Connecticut Academy of Arts and Science	"
Yale College Observatory	"
Georgia Historical Society	Savannah, Ga.
Chicago Historical Society	Chicago.
Illinois State Laboratory of Natural History	Champaign, Ill.
American Antiquarian and Oriental Journal	Chicago, Ill.
Brookville Society of Natural History	Brookville, Ind.
Indiana Historical Society	Indiana.
Academy of Natural Sciences	Davenport, Iowa.
State Historical Society of Iowa	Iowa City.
Kansas Historical Society	Topeka.
Kansas Academy of Science	"
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Peabody Institute	Baltimore, Md.
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American Academy of Arts and Sciences	"
Observatory of Harvard College	Cambridge, Mass.
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American Antiquarian Society	Worcester, Mass.
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Academy of Natural Sciences	Minneapolis.
Geological and Natural History Survey of Minnesota	"
Academy of Sciences	St. Louis, Mo.

Missouri Historical Society	St. Louis, Mo.
Sedalia Natural History Society	Sedalia, Mo.
Nebraska State Historical Society	Lincoln, Neb.
New Jersey Historical Society	Newark, N.J.
E. M. Museum of Geology and Archæology, Princeton College.	Princeton, N.J.
New York Academy of Sciences	New York.
American Museum of Natural History, Central Park	"
American Society of Civil Engineers	"
Journal of Speculative Philosophy	"
Journal of Comparative Medicine and Surgery	"
Linnean Society of New York	"
New York Microscopical Society	"
School of Mines Quarterly, Columbia College	"
Magazine of American History	"
American Geographical Society	"
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American Chemical Society	"
Electrical Review	"
Electrician and Electrical Engineer	"
Association of Engineering Societies	"
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Political Science Quarterly	"
"Christian Thought"	"
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New York State Museum of Natural History	"
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Oneida Historical Society	Utica, N.Y.
Rensselaer Society of Engineers	Troy, N.Y.
Elisha Mitchell Scientific Society	University of North Carolina.
Ohio Mechanics' Institute	Cincinnati, O.
Historical and Philosophical Society of Ohio	"
Cincinnati Society of Natural History	"
Magazine of Western History	Cleveland, O.
Denison University, Laboratories of Biology and Natural History	Granville, O.
State Geological Survey of Ohio	Columbus, O.
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American Catholic Quarterly Review	"
American Naturalist	"
American Philosophical Society	"
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Franklin Institute of the State of Pennsylvania .... Philadelphia.
Historical Society of the State of Pennsylvania ..... "
American Catholic Historical Society of Philadelphia ..... "
Wyoming Historical and Geographical Society .... Wilkesbarre, Pa.
Rhode Island Historical Society ..... Providence, R.I.
Newport Natural History Society ... . Newport, R.I.
University of Virginia .. .. Charlottesville.
Tennessee Agricultural Experiment Station ..... Knoxville.
Wisconsin Academy of Science, Arts and Letters ..... Madison.
State Historical Society of Wisconsin..... " —109.

(3.)—MEXICO.

Museo Nacional de México .... México.
Sociedad Cientifica, "Antonio Alzate"..... "
Sociedad Mexicana de Geografica y Estadisca..... ..... " —3.

(4.)—CUBA.

Sociedad Antropologica de la Isla de Cuba..... Habana. —1.

(5.)—SOUTH AMERICA.

Instituto Historico, Geographico, e Ethnographico do Brazil.. Rio de Janeiro.
Annaes da Escola de Minas de Ouro Preto ..... "
Sociedade de Geographia de Lisboa no Brazil..... "
Club de Engenharia ..... "
Academia Nacional de Ciencias en Córdoba (Republica Argentina.) —5.

II.—EUROPE.

(1).—GREAT BRITAIN AND IRELAND.

ENGLAND.

Birmingham Natural History and Microscopical Society.... Birmingham.
Journal of Microscopy and Natural Science..... Bath.
Scientific Enquirer..... .... "
Bristol Naturalists' Society..... Bristol.
Cumberland and Westmoriand Association for the Advancement of Literature and Science ..... Carlisle.
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British Museum, Natural History Section ..... "
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Patent Office..... .... "
Trübner's American, European and Oriental Literary Record. "
Physical Society of London .... "
National Association for the Advancement of Social Science. "
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Somersetshire Archæological and Natural History Society . Taunton. —47.

SCOTLAND.

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IRELAND.

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(2.)—AUSTRIA-HUNGARY.

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(3.)—BELGIUM.

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(4.)—DENMARK.

Kongelige Bibliotheket..... Copenhagen.
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(5.)—FRANCE.

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Bulletin d'Histoire Ecclésiastique et d'Archéologie Religeuse des Diocèses de Valence, Digne, Gap, Grenoble et Viviers. Romans. —29.

ALGERIA.

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(6.)—GERMANY.

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Zeitschrift für Physiologische Chemie ..... Strassburg.
Nassauischer Verein für Naturkunde ..... Wiesbaden.—37.

(7.)—ICELAND.

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(8.)—ITALY.

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"Cosmos" di Guido Cora.... .... Torino.
Archivio di Letteratura Biblica ed Orientale .... "
Notarisia Commentarium Phycologicum .... Venezia.—24.

(9.)—NETHERLANDS.

Koninklijke Akademie van Wetenschappen ..... Amsterdam.
Koninklijke Zoologisch Genootschap "Natura Artis Magistra" "
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Société Hollandaise des Sciences à Harlem .... Harlem.
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Nederlandsche Dierkundige Vereeniging .... "
Recueil des Travaux Chimiques des Pays-Bas ..... "
Koninklijk Nederlandsch Meteorologisch Instituut ..... Utrecht.—10.

(10.)—NORWAY.

Musée de Bergen .... Bergen.
Polytekniske Forening ..... Kristiania.
Forening til Norske Fortidsmindesmerkers Bevaring ..... "
Videnskabs Selskabet ... . "
Kongelige Norske Frederiks Universitetet ..... "
Nyt Magazin for Naturvidenskaberne..... .. .. "
Norwegische Commission der Europæischen Gradmessung.... " —7.

(11.)—PORTUGAL.

Sociedade de Geographia de Lisboa .... Lisboa.
Académie Royale des Sciences de Lisbonne.... . ..... " —2.

(12.)—RUSSIA.

Kharkow Mathematical Society..... Kharkow.
Société des Naturalistes à l'Université Impériale de Kharkow "

Société des Naturalistes à l'Université de St. Wladimer .... Kiew.
Societas Scientiarum Fennica Helsingfors..... Helsingfors.
Tifliser Observatorium ..... Tiflis.
Société Impériale des Naturalistes de Moscou..... Moscow.
Société Physico-Chimique Russe à l'Université de ..... St. Petersbourg.
Comité Géologique ..... St. Petersbourg.
—8.

(13.)—SPAIN.

"Crónica Cientifica" ..... Barcelona.
Real Academia de Ciencias Morales y Politicas ..... Madrid.
Real Academia de la Historia .... "
Sociedad Geográfica de Madrid ..... " —4.

(14.)—SWEDEN.

Kongliga Universitetet ..... Lund.
Kongliga Fysiografiska Sällskapet ..... "
Kongliga Svenska Vetenskaps Akademien ..... Stockholm.
Kongliga Biblioteket ..... "
Kongliga Universitetet ..... "
Svenska Sällskapet för Antropologi och Geografi..... "
Geologiska Föreningens i Stockholm ..... "
Acta Mathematica ..... "
Kongliga Universitetet .... Upsala —9.

(15.)—SWITZERLAND.

Geographische Gesellschaft von Bern ..... Bern.
Naturforschende Gesellschaft in Bern ..... "
Société de Physique et d'Histoire Naturelle..... Genève.
Société de Géographie de Genève ..... "
Société Neuchateloise de Géographie..... Neuchatel.
Naturforschende Gesellschaft in Zurich ..... Zurich.—6.

(16.)—TURKEY.

Syllogue Littéraire Grec de Constantinople..... Constantinople.
Institut Météorologique de Roumanie ..... Bucarest.—2.

III.—ASIA.

(1.)—INDIA.

Asiatic Society of Bengal..... Calcutta.
Geological Survey of India ..... "
Survey of India Department ..... "
"Indian Antiquary"..... Bombay.
"Orientalist"... ..... Kandy, Ceylon.
—5

(2.)—JAPAN.

University of Tokio ..... Tokio.
Asiatic Society of Japan ..... "
Deutsche Gesellschaft für Natur-und Völkerkunde Ostasiens.. "
Literature College of Imperial University of Japan .... " —4.

(3.)—JAVA.

Bataviaasch Genootschap van Kunsten en Wetenschappen... Batavia
Nederlandsch-Indische Maatschappij van Nijverheid en Landbouw ..... " —2.

(4.)—CHINA.

China Branch of the Royal Asiatic Society ..... Shanghai.—1.

IV.—AUSTRALASIA.

(1.)—AUSTRALIA.

Royal Society of New South Wales ..... Sydney.
Department of Mines, New South Wales ..... "
Linnean Society of New South Wales ..... "
Board of Technical Education ..... "
Royal Society of Queensland .... Brisbane.
Royal Society of Victoria..... Melbourne.
Public Library of Victoria .... " —7.

(2.)—NEW ZEALAND.

New Zealand Institute .... Wellington —1.

(3).—TASMANIA.

Royal Society of Tasmania .... Hobarton. —1.

Total, 394