JOURNAL AND PROCEEDINGS

—OF THE—

Hamilton · Association

FOR SESSION 1888-9.

PART V.

CONTENTS.

AUTHORS OF PAPERS ARE ALONE RESPONSIBLE FOR THE STATEMENTS MADE AND THE OPINIONS EXPRESSED THEREIN.

PRINTED FOR THE HAMILTON ASSOCIATION BY THE TIMES PRINTING COMPANY.

1889.

JOURNAL AND PROCEEDINGS

OF THE

Hamilton Association

FOR SESSION 1888-9.

PART V.

AUTHORS OF PAPERS ARE ALONE RESPONSIBLE FOR THE STATEMENTS MADE AND THE OPINIONS EXPRESSED THEREIN.

PRINTED FOR THE HAMILTON ASSOCIATION BY THE
TIMES PRINTING COMPANY,
1889.

OFFICERS FOR 1888—9.

President.

REV. SAMUEL LYLE, B. D.

Vice-Presidents.

T. J. W. BURGESS, M. B., F. R. S. C. W. A. CHILD, M. A.

Secretaries.

H. B. WITTON, B. A. A. ALEXANDER, F. S. Sc., Lon. Eng.

Treasurer.

RICHARD BULL.

Curator and Librarian,

ALEXANDER GAVILLER.

Council.

J. ALSTON MOFFAT. T. W. REYNOLDS, M. D. S. J. IRELAND.
B. E. CHARLTON. WILLIAM KENNEDY.

Museum and Library.

ARCADE BUILDING, James St. North, Hamilton, Ontario.

NOTICE.

THE HAMILTON ASSOCIATION was instituted on 2nd November, 1857, and continued its regular meetings to the close of the year 1860. During the period between 1861 and 1871, the meetings were held at irregular intervals, the office bearers of 1860 holding office in the meantime. During the years 1871, 2, 3, 4, and 5, the Association was more active in its work, regular meetings being held. An interregnum of four years ensued from 1875 to 1880, during which time the Council met at stated intervals. From 1880 to the present time the Association has been in active operation, during which period, in addition to the regular monthly meetings, special meetings have been held under the direction of the Council, the Annual Meeting held in May, 1889, being the one hundred and fifty-sixth meeting of the Association.

The Association was incorporated in 1883.

OFFICE-BEARERS.

	President.	1st Vice-Pres.	2nd Vice-Pres.	Cor. Sec.	Rec. Sec.	Treas.	Libr. and Cur.
1857	Rev. W. Ormiston, D. D.	John Rae, M. D., F. R. G. S.	J. B. Hurlburt, M.A., L.L.D.	T. C. Keefer, C. E.	Dr. Craigie....	W. H. Park...	A. Harvey.
1858	John Rae, M. D., F. R. G. S.	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M.A., L.L.D.	T. C. Keefer, C. E.	Dr. Craigie....	W. H. Park...	A. Harvey.
1859	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M.A., L.L.D.	Chas. Robb.....	T. C. Keefer, C. E.	Dr Craigie....	W. H. Park...	A. Harvey.
1860	Rev. W. Inglis, D.D.	T. McIlwraith.....	Rev. W. Ormiston, D. D.	Dr. Craigie....	Wm. Craigie...	W. H. Park...	Chas. Robb.
1861	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M.A., L.L.D.	Rev. W. Inglis, D.D.	Dr. Craigie....	Wm. Craigie...	W. H. Park...	T. McIlwraith.
1871	W. Proudfoot.	Judge Logie.....	R. Bull.....	J. M. Buchan, M. A.	I. B. McQuesten, M. A.	W. G. Crawford	T. McIlwraith.
1872	Judge Logie.....	H. B. Witton, M.P.	R. Bull.....	J. M. Buchan, M. A.	I. B. McQuesten, M. A.	W. G. Crawford	T. McIlwraith.
1873	H. B. Witton, M. P.	J. M. Buchan, M.A.	A. T. Freed.....	Geo. Dickson, M. A.	Geo. Dickson, M. A.	R. Bull.....	T. McIlwraith.
1874	H. B. Witton, M. P.	J. M. Buchan, M.A.	A. T. Freed.....	Geo. Dickson, M. A.	Geo. Dickson, M. A.	R. Bull.....	T. McIlwraith.
1875	H. B. Witton.....	J. M. Buchan, M.A.	W. H. Mills.....	Geo. Dickson, M. A.	Geo. Dickson, M. A.	A. Macallum, M. A.	T. McIlwraith.
1880	T. McIlwraith.....	Rev. W. P. Wright, M. A.	H. B. Witton.....	R. B. Hare, Ph. D.	Geo. Dickson, M. A.	R. Bull.....	A. T. Freed.
1881	J. D. Macdonald, M. D.	R. B. Hare, Ph. D.	B. E. Charlton.....	Geo. Dickson, M. A.	A. Robinson, M. D.	R. Bull.....	W. H. Ballard, M. A.
1882	J. D. Macdonald, M. D.	B. E. Charlton.....	J. A. Mullin, M. D.	Geo. Dickson, M. A.	Wm. Kennedy.	R. Bull.....	W. H. Ballard, M. A.

1882	J. D. Macdonald, M. D.	B. E. Charlton.....	J. A. Mullin, M. D.	Geo. Dickson, M. A.	Wm. Kennedy.	R. Bull.....	W. H. Ballard, M. A.
1883	J. D. Macdonald, M. D.	B. E. Charlton.....	H. B. Witton.....	Geo. Dickson, M. A.	Wm. Kennedy.	R. Bull.....	W. H. Ballard, M. A.
1884	J. D. Macdonald, M. D.	H. B. Witton.....	Rev. C. H. Mockridge, M.A., D.D.	Geo. Dickson, M. A.	A. Alexander..	R. Bull.....	Wm. Turnbull.
1885	Rev. C. H. Mockridge, M.A., D.D.	Rev. S. Lyle.....	W. Kennedy.....	Geo. Dickson, M. A.	A. Alexander..	R. Bull.....	A. Gaviller.
1886	Rev. C. H. Mockridge, M.A., D.D.	Rev. S. Lyle.....	Matthew Leggat...	Geo. Dickson, M. A.	A. Alexander, F. S. Sc.	R. Bull.....	A. Gaviller.
1887	Rev. S. Lyle, B.D..	B. E. Charlton.....	W. A. Child, M. A.	H. B. Witton, B. A.	A. Alexander, F. S. Sc.	R. Bull.....	A. Gaviller.
1888	Rev. S. Lyle, B.D..	T. J. W. Burgess, M.B., F.R.S.C.	W. A. Child, M. A.	H. B. Witton, B. A.	A. Alexander, F. S. Sc.	R. Bull.....	A. Gaviller.
1889	B. E. Charlton.....	T. J. W. Burgess, M.B., F.R.S.C.	J. Alston Moffat...	H. B. Witton, B. A.	A. Alexander, F. S. Sc.	R. Bull.....	A. Gaviller.

LIST OF

Corresponding, Honorary, & Life Members

—OF THE—

HAMILTON ASSOCIATION.

ELECTED.

CORRESPONDING MEMBERS.

1881 Clark, Chas. K., M. D., Rockwood Asylum, Kingston, Ont.
1881 Van Wagner, P. S., J. P., Stoney Creek, Ont.
1884 Bull, Rev. George A., M. A., Niagara Falls, S., Ont.
1882 Lawson, A. C., M. A., Geological Survey of Canada, Ottawa, Ont.
1881 Spencer, J. W., Ba. Sc., Ph. D., F. G. S., Columbia, Mo., U. S.
1870 Wright, Prof. W. P., M. A., Santa Barbara, California.
1871 Seath, John, M. A., High School Inspector, St. Catharines, Ont.
1885 Frood, T., Sunbury, Ont.
1889 Yates, William, Hatchley, Ont.

HONORARY MEMBERS.

Grant, Lt-Col., Bay St. South, Hamilton, Ont.
Macoun, John, M. A., Government Botanist and Naturalist, Geological Survey of Canada, Ottawa, Ont.
Dawson, Sir J. William, F. R. S., F. G. S., F. R. S. C., Principal McGill College, Montreal, Que.
Fleming, Sanford, C. E., C. M. G., Ottawa, Ont.
Wilson, Sir D., L.L. D., Principal, University of Toronto, Ont.
Farmer, William, C. E., New York, U. S.
Ormiston, Rev. Wm., D. D., New York, U. S.
Rae, John, M.D., F.R.G.S., L.R.C.S., L.L.D., London, Eng.
Hurlburt, J. B., M. A., L.L. D., Ottawa, Ont.
Small, H. B., Ottawa, Ont.
Charlton, Mrs. B. E., Hamilton, Ont.
Keefer, Thomas C., C. E., Ottawa, Ont.
Symons, S., Hamilton, Ont.

LIFE MEMBERS.

Proudfoot, Hon. Wm., Q. C., Vice-Chancellor, Toronto, Ont.

MEMBERS OF COUNCIL.

1857—Judge Logie; Geo. Lowe Reid, C. E.; A. Baird; C. Freeland.

1858—Judge Logie; C. Freeland; Rev. W. Inglis, D. D.; Adam Brown; C. Robb.

1859—Rev. D. Inglis, D. D.; Adam Brown; Judge Logie; C. Freeland; R. Bull.

1860—J. B. Hurlburt, M.A., L.L.D; C. Freeland; Judge Logie; R. Bull; Wm. Boultbee; Dr. Laing.

1871—Geo. Lowe Reid, C. E.; Rev. W. P. Wright, M. A.; A. Macallum, M. A.; A. Strange, M. D.; Rev. A. B. Simpson.

1872—Judge Proudfoot; Rev. W. P. Wright, M. A.; John Seath, M. A.; H. D. Cameron; A. T. Freed.

1873—Judge Logie; T. McIlwraith; Rev. W. P. Wright, M. A.; A. Alexander; I. B. McQuesten, M. A.

1874—Judge Logie; T. McIlwraith; Rev. W. P. Wright, M. A.; A. Alexander; I. B. McQuesten, M. A.

1875—Judge Logie; T. McIlwraith; Rev. W. P. Wright, M. A.; A. Alexander; I. B. McQuesten, M. A.

1880—M. Leggatt; I. B. McQuesten, M. A.; A. Alexander; Rev. A. Burns, M. A., L.L.D., D. D.

1881—T. McIlwraith; H. B. Witton; A. T. Freed; Rev. W. P. Wright, M. A.; A. F. Forbes.

1882—T. McIlwraith; H. B. Witton; A. T. Freed; A. F. Forbes; Rev. C. H. Mockridge, M. A., D. D.

1883—A. Alexander; A. Gaviller; A. F. Forbes; T. McIlwraith; R. Hinchcliffe.

1884—A. Gaviller; A. F. Forbes; T McIlwraith; R. Hinchcliffe; W. A. Robinson.

1885—W. A. Robinson; S. Briggs; G. M. Barton; J. Alston Moffat; A. F. Forbes.

1886—J. Alston Moffat; Samuel Slater; Wm. Milne; James Leslie, M. D.; C. S. Chittenden.

1887—J. Alston Moffat; James Leslie, M. D.; P. L. Scriven; Wm. Milne; C. S. Chittenden.

1888—J. Alston Moffat; B. E. Charlton; T. W. Reynolds, M.D.; S. J. Ireland; Wm. Kennedy.

1889—T. W. Reynolds, M. D; S. J. Ireland; William Turnbull; A. W. Hanham; Lt.-Col. Grant.

ABSTRACT OF MINUTES

OF THE

HAMILTON ASSOCIATION.

SESSION 1888—89.

FIRST MEETING—Thursday, 8th November, 1888.

The President, the Rev. Samuel Lyle, B. D., in the chair.

The minutes of the previous meeting were read and confirmed.

The Corresponding Secretary reported the receipt of a large number of exchanges during the recess, and also read letters—the gift of Mr. J. B. Smith—from Bishop Strachan, Dr. Draper, and Charles Merival.

The Curator reported a gift of old engravings from Mr. T. C, Mewburn, through Mr. Alexander, the Secretary; of a very old book entitled "A Supplement to the Lives of the Cæsars," and a volume of "Monumental Effigies in the Temple Church, London," from Mr. Richard Haigh.

A cordial vote of thanks was passed to these donors.

Mr. John Cape was proposed as a member of the Association on the recommendation of Mr. Bull and the Secretary.

The Secretary reported what had been done during the recess, especially referring to the Field-day held at Beamsville on the 30th of June, and calling attention to the kindness of Mr. Wm. Gibson, of that place, who gave us the invitation and contributed so much to the pleasure of the day, by his thoughtful kindness in conveying us to and from his extensive Quarries, where we spent the most of the

day. In the absence of Dr. Reynolds he also gave a brief report of what had been done in the Biological Section during the summer.

The President then read the Opening Address of the Session, his subject being "The Hittites." The history of this remarkable but little known nation, was sketched, and their great power shown from the fact that for centuries they maintained their position and independence though situated between two such strong empires as those of Egypt and Assyria.

Several members spoke on the subject at the close, bearing testimony to the great amount of research and knowledge displayed in the treatment of this most interesting theme.

It was suggested that our Association should take the publications of the Palestine Exploration Fund. It was so agreed.

The meeting then adjourned, to meet on the second Thursday of December.

SECOND MEETING—Thursday, 13th December, 1888.

The President, the Rev. Samuel Lyle, B. D., in the chair.

The minutes of the previous meeting were read and approved.

John Cape, Customs Clerk, was elected a member of the Association.

The Secretary then read a Paper prepared by Mr. William Kennedy on "Notes on Primitive Man." The conclusions arrived at were briefly these :—

Period of his appearance—Miocene Period.
Locality—South-western Asia..
Condition—Low.
Parents—Unknown.

The matter of the Free Library By-law was discussed at some length, and a motion was unanimously carried, pledging the members present to do their utmost to promote the passage of the By-law.

The meeting then adjourned.

THIRD MEETING—Thursday, February 14th, 1889.

The President, the Rev. Samuel Lyle, B. D., in the chair.

The minutes of the previous meeting were read and approved.

A letter from the Secretary of the Hamilton Chess Club was read, requesting the use of the Room for one night in the week, and suggesting that the members of the Club become members of the Association, the Club to pay a proportion of the gas. The request of the Club was acceded to, on these conditions, and the following names were proposed for membership, viz :—

W. H. Judd, Guy Judd, Kerwin Martin, P. H. Punshon, F. Maw, Alfred Powis, A. E. Morson, M. Herald, J. E. Lister, R. H Green, H. N. Kittson and Dr. Ryall.

The Corresponding Secretary announced the receipt of several "Blue Books" and Reports and Proceedings of several learned Societies.

The Rev. Dr. Mockridge then read the second part of his "Notes on the Waverley Novels." These notes were arranged chronologically as in the first part. The second part of the notes commenced with "Woodstock" and ended with "St. Ronan's Well," comprehending twelve books. The principal characters of each book were passed in review, and the plan and purpose of each work set forth, shewing much careful study.

At the close many members expressed their high appreciation of the manner in which the subject had been presented.

The meeting then adjourned.

FOURTH MEETING—Thursday, 14th March, 1889.

In the absence of the President Mr. B. E. Charlton presided.

The minutes of the previous meeting were read and approved.

The members of the Chess Club, who were proposed for membership in the Association at the last meeting, were unanimously elected.

Mr. Wm. Yates, of Hatchley, who has contributed so many valuable and interesting letters on Biological subjects to the Section, was proposed as a Corresponding Member.

Specimens of copper, an Indian epaulette, and several geologi-

cal and other specimens and curiosities were reported from Mr. T. C. Mewburn, Inspector of Customs ports; also, a kangaroo from Mr. Samuel Briggs.

The thanks of the Association were passed to these gentlemen for their gifts.

Since the previous meeting a very handsome President's chair, in rep and carved, with a fine table to match, had been placed on the platform at the upper end of the room.

A very cordial vote of thanks was passed to the gentleman, Mr. Samuel Symons, for his valuable gift.

The request of the Wentworth Pioneers and Historical Society, for the use of the room for a general meeting of the members of that newly formed Society, was granted.

Mr. S. J. Ireland, Principal of the Hamilton Art School, then gave a very instructive lecture on "The History of Pottery and the Ceramic Art."

The history and progress of the art was traced from the earliest times down to the present. The lecture was illustrated by many beautiful specimens of China and fine ware kindly lent for the occasion by Messrs. J. A. Skinner & Co., Mr. A. T. Wood, and others. Mr. Ireland also described the mode of manufacture and decoration of these various examples. The lecture was listened to with great attention.

The meeting then adjourned.

FIFTH MEETING—Thursday, 11th April, 1888.

J. D. Macdonald, M. D., presided in the absence of the President.

The minutes of the previous meeting were read and confirmed.

Mr. William Yates, of Hatchley, was elected a Corresponding Member of the Association.

Commander Cheyne, of H. M. Royal Navy, who was present, was introduced by Mr. Alexander, the Secretary.

Contributions to the Library and Museum were reported by the Curator and Corresponding Secretary.

Mr. H. B. Witton, Sr., then read a very valuable paper on "Selenography." The paper gave a historical sketch of the re-

searches into the nature of the moon's surface and the various theories that have been held in regard to it, and its present condition and appearance. He also minutely described the mountains, craters, plains, crevasses and other physical features of the surface of the planet, all of which were well illustrated by the famous Rutherford photographs, which were exhibited by Mr. Hugh C. Baker.

The paper was an excellent one, showing a very intimate knowledge of the subject. The attendance at this meeting was the largest present at any meeting of the Association for many years, the room being crowded to the door. Nasmith's splendid photographs of the moon's surface were also on view, through the kindness of Commander Cheyne.

The meeting then adjourned.

SIXTH MEETING—Thursday, 9th May, 1889.

The Rev. Samuel Lyle, B. D., presided.

The minutes of the previous meeting were read and confirmed.

Mr. S. Symonds was elected an honorary member.

Colonel Grant then read two papers entitled "The Colored Lingulæ of the Silurian Rocks" and "The origin of Chert (flint) in the Niagara Rocks near Hamilton." These papers exhibited the writer's intimate knowledge of these subjects. They were well received, and will appear in the Transactions of the Association.

At the close of reading Colonel Grant's papers, and the complimentary remarks made thereon, Mr. Witton, Sr., moved that the general meeting do now adjourn in honor of the memory of Mr. C. S. Chittenden, a member of the Association and Chairman of the Biological Section, who died suddenly on the previous day. Mr. Witton, who had known the deceased gentleman for thirty years, paid a beautiful but deserved eulogy to his character and abilities.

The Secretary was instructed to convey the expression of sympathy of the members to Mrs. Chittenden and the family.

The annual meeting of the Association was then held, the President in the chair.

The minutes of the previous annual meeting were read; they had previously been confirmed. The Secretary, Mr. Alexander, read his Annual Report of the operations of the Association. Dr.

Reynolds read the Annual Report of the Biological Section, and Mr. Richard Bull, Treasurer, read the Financial Statement. All these Reports were received and adopted, and will be found at the end of this volume of the Association's Proceedings.

The election of officers for the ensuing year, 1889-90, was then proceeded with, resulting as follows :—

President, B. E. Charlton.

1st Vice-President, T. J. W. Burgess, M. B., F. R. S. C.

2nd Vice-President, J. Alston Moffat.

Corresponding Secretary, Henry B. Witton, B. A.

Recording Secretary, A. Alexander, F. S. Sc., London, Eng.

Treasurer, Richard Bull.

Curator and Librarian, Alexander Gaviller.

Council—T. W. Reynolds, M. D., Colonel Grant, S. J. Ireland, Principal of the Art School ; William Turnbull, A. W. Hanham.

After votes of thanks to the retiring officers the meeting then adjourned.

A. ALEXANDER,
Secretary.

SAMUEL LYLE,
President.

HAMILTON ASSOCIATION.

SESSION 1888-89

IS SPECIES A NATURAL OR ARTIFICIAL DIVISION IN NATURE?

A Paper read before the Biological Section, December 7th, 1888,

BY J. ALSTON MOFFAT,

(Member of the Council of the Entomological Society of Ontario.)

Is Species a natural or an artificial division in Nature? This is a question that will bear a good deal of discussion; for, although volumes upon volumes have been written about the origin of Species—what a Species is, and the correct use and application of the term has been left in the most nebulous condition imaginable, whilst, for practical value, this is of ten-fold more importance than the other, and ought to have been definitely settled before ever the other was discussed.

Violent controversies have been and are being carried on about Species with no profitable result, because the combatants are using the same term whilst meaning quite different things.

Wearied with the confusion, I found it necessary, for my own comfort, to settle the question to my own satisfaction at least. So I herewith give you my conclusions, and my reasons for them.

We are often reminded that we should take Science exclusively as our guide in the interpretation of Nature. I most unhesitatingly and unreservedly accept the condition. The question immediately arises, What is Science? As defined by Webster, it is, first, "certain knowledge," and second, "knowledge arranged and systematized." The only thing in which all men are born absolutely equal, is in the matter of knowledge—that is, in the utter absence of all knowledge. Time, opportunity and capacity is required for the obtaining of knowledge—by our own observation and experience,

or by the observation and experience of others communicated to us, which, when perfectly reliable, should be accepted by us and be as useful to us as our own. The observations and experience of several persons, agreeing on some particular thing, is confirmatory; this, continued for generations, becomes absolute certainty. It is thus that we have attained to our knowledge of the laws of Nature, on whose stability we confidently rely. Long continued observation and experience having demonstrated that, given a certain condition and combination, a certain result will follow, and that that condition and combination will inevitably produce that result every time; change the condition or the combination, and a change in the result will assuredly follow. This we call a law of Nature, and it is the absolute stability of these that has made Science possible.

The next question is, what is Nature? I reply, all matter and life that we can investigate in time and space. Anything beyond this must belong to the supernatural, of which, by no natural powers in our possession, can we discover anything. We may draw inferences about it from what we know, but these will be always open to question; or, we may believe what we have been told about it, but there our knowledge on the whole subject ends, and our belief in the statement will be in exact proportion to our confidence in the source from which it came.

The term "Species," or its equivalent, is no doubt an ancient one, and would be in use long before classification was thought of.

When man at first began to observe the forms of life around him, he saw them separated into a great many different kinds. These kinds did not commingle and lose their identity. Each came from ancestors of its own kind, and its progeny was in its own likeness. This he concluded had been going on since their origin, and would go on to the end of their history. These kinds he called "Species," and associated with it the idea of permanence. Common names were early given by men to the common forms of their country, but it was discovered that different names had been given to the same form in different parts of the same country; so, to avoid confusion, it became necessary to describe the form and give it a name that would distinguish it in that and all other countries. As investigation became more general, and the students of one country travelled into others, their attention was arrested by the fact that some of the familiar forms had changed their appearance, and as he

progressed this became yet more apparent, until at length the description of one would not apply to the other, and it began to be suspected that the old idea of permanence was incorrect, and would have to be abandoned.

Different conditions had produced different results.

Systematic classification is the progressive work of time.

Our present system of Nature is but of recent origin; that it is not perfect is but to say that it is human in its origin. Still, it is an improvement on the past; it grasps all Nature, and divides it into the celestial and terrestrial. In the terrestrial it finds the organic and inorganic; of the organic it has constituted two kingdoms, the animal and the vegetable, [and here let me remark that I am going to deal exclusively with the animal kingdom]; this it has separated into sub-kingdoms, classes, orders, families, genera and species.

Now these divisions, which it is so necessary for man to make, that he may the better understand and study his subject, has no clear dividing lines in Nature. There is an elasticity and a blending of parts in Nature, that, from the limited character of man's intellectual grasp, and the barrenness of his language to express what he may intellectually perceive, no human system has ever yet attained to. We know, as a matter of fact, that this Ball, which we call terrestrial, is as much a part of the celestial as any of those we term such; that the organic is depending on, and inseparably connected with the inorganic. Who can say where the vegetable ends and the animal begins? And just so it is through the whole list; it is at the point of divergence and not that of contact that any of them is clear.

It is upon structure that the divisions in the animal kingdom are principally founded—size, form and color. By a single bone may the class to which the animal belongs be known; by certain resemblances its family relationship is established; upon some points of difference, peculiar to it, its genus is found, and by minuter ones is its specific character determined.

It is now a well known fact that there are opposing influences at work in nature affecting the appearance of every living creature; the one tending to uniformity and the other to diversity. Prof. Huxley says: "The one end to which, in all living beings the formative impulse is tending, seems to be to mould the offspring into the likeness of the parent."

Prof. Louis Agassiz, after premising that all animals, even the

highest—men not excepted—are produced through eggs, says: "It is a marvellous process, that of the inner life of the yolk, leading to a result so extraordinary as the formation of a new living being. Here is something wonderful; not only the simplicity of the process by which the change is brought about, but still more marvellous is the fact that all this goes on from within. There is a principle acting by the aid of the substance which holds it, never deviating from its course, and always leading to the production of a being like the parent."

Now it is clear that if this principle or law of nature was always acting unopposed, there would be no difficulty in deciding (by structure) to what Species any form belonged, for there would be little or no diversity in a Species. But this, we know, is not the case. Herbert Spencer says: "Every Species spreading into a new habit, at coming in contact with new food, exposed to a different temperature, to a dryer or moister air, to a more irregular surface, to a new soil, etc., has its members, one and all, subject to various changed actions, which influence its muscular, vascular, respiratory, digestive and other organs." Now this is simply a clear and comprehensive statement of a fact, which we may see with our own eyes, but we must remember in connection with it, that all animals are not equally sensitive to these influences; some may show it, little, if at all, whilst in others it will be quite perceptible; and again, that the migrant or its descendants will attain to the maximum of change which that locality is capable of producing, and never any more. That a further migration is needed to produce more change, that these changes will invariably be in the same direction in the same kind of animal, that migrants going in opposite directions on the globe will come in contact with different influences that will produce different results in the same kind of creature; and that these influences under which it is living are performing their work and bringing it into harmony with its surroundings, wholly independent of the creature's will or inclinations. Of these operations the animal may be utterly unconscious, and even if it were conscious it would be as utterly unable to resist them.

Now all the living creatures of the present are, more or less, given to migrating, according as they can accommodate themselves to altered conditions in soil, climate and food, and the ancestors of these did the same ever since they were first originated. What

an immense diversity of influences then must some of them have been in contact with during their continuance in time and space, and, if sensitive to these, what a diversity in size, form and color is to be expected as a result. This helps to account for much of the marvellous diversity which we actually do find in nature everywhere around us.

It is specially desirable to note here, that these influences we have been considering, which accomplish the change in organisms, are wholly external, acting from without, just as we saw that those which make uniformity were internal, acting wholly from within.

But there are several other influences at work in Nature producing variety in organisms, some of which we as yet know little or nothing about, hence the expression, "accidental variation." But as accident is not recognized in science, every effect having unquestionably an efficient cause, whether within the range of our ken or no, I prefer "individual variation" to express the idea associated with these peculiarities that unexpectedly show themselves, and which are often seized upon by breeders for the improvement of stock, and for the production of fancy and ornamental forms. This has been carried to an astonishing length in some departments, and these varieties may appear in Nature as well.

Here then the question arises, do these variations, by whatever cause produced, or by whatever name called, going off in opposite directions, ever attain a point of complete separation: that is, when individuals that have come from a common stock are brought together from the extremes of unlike, will Nature in them fail to acknowledge their original relationship. Consideration is required here. We know that many animals go in flocks, herds, coveys, swarms, &c., and that each of these aggregations incline to keep by themselves, and do not readily mingle in Nature; that an individual from one of these will be refused admission into another of the same kind, and can only obtain it by conquering a position. This we see frequently amongst domestic animals, and if the external forms are diverse the trouble is all the greater, so that it may require time, restraint, compulsion even, to get them at first to live together. This being accomplished, all our information goes to prove that no matter what external difference separates them, internally they are yet one. Mr. Tegetmeyer, the celebrated writer on poultry, when describing how he had bred the golden, the silver and

the common English pheasants together, said:—"After this the "reader will be ready to inquire, what constitutes a Species? All "that I can do is to echo the question, what constitutes a Species?" He had contemplated his birds and marked their great and striking dissimilarity, and concluded that they must be separate Species; he turned to his books, and the authorities pronounced them separate Species; he brought them together and they commingled freely, nature in them asserting they were not separate Species, they were but distinct varieties of one Species. Illustrations might be multiplied indefinitely, but one is sufficient to point the direction.

Another inquiry we have to make is: If separation for a sufficient length of time will completely extinguish all evidence of original relationship? There is the so called genus Bos. How long have the humped cattle of the East been separated from the bison of the West? Is it a thousand years, or five, ten, twenty or a hundred thousand, who can say? But bring them together, from any distance or in any of the multitudinous forms of which the genus is composed, and they commingle freely. Their distinctive peculiarities merge and blend until finally lost, proving them to be not Species of a genus, but varieties of a species, and that time and distance have failed to extinguish their original relationship.

The possibility is that at one time in the world's history, all these various forms of a Species of the present, were represented on the earth by a single form—and that form may have been quite unlike anything of the present—and if it lived under entirely different conditions it undoubtedly would be. But whether the Species originated in single ones or pairs, in a single locality, and spread from there over the globe, or came into existence singly or in pairs, in various localities, or in groups, or in multitudes, is not now possible to prove, and does not seem to be of any consequence. For if they were one in Nature, and identical in internal organization, the result would be the same. If then no amount of divergence in size, form and color, and no length of separation in time, places any obstacle in the way of the ordinary laws of generation, we have got a clear, definite, dividing line for Species, and one that proves Species to be a real and natural entity, quite different from Structure. For seeing that all life of the present, as well as that of the past, is, and has ever been, surrounded by, and in constant contact with, those influences that tend to produce change in Structure,

according to its susceptibility to receive the impression, we have no right to look in that direction for dividing lines between Species, and the torture of conflicting uncertainty endured by conscientious men, in their efforts to arrive at a correct conclusion by that method about various forms. Whether they are Species or Varieties, and which is the Species and which is the Variety, and where the line is to be drawn between them, is really deplorable, and is well voiced in the vigorous language of Darwin, when he says:—"After describing a set of forms as "distinct Species, tearing up my manuscript and making them one "Species, tearing that up and making them separate, and then "making them one again—as has often occurred to me—I have "gnashed my teeth, cursed Species, and asked what sin I had com-"mitted to be so punished?" And thus it is made abundantly manifest, that determination by structure is not necessarily a determination of Species at all, but only the defining of the differences between various forms, which may be improperly called Species; and that all this misery and conflict that is endured by Species-makers is quite uncalled for and unnecessary, for the differences are there, visible to the eye, and are easily described. The trouble comes in when the effort is made to decide just how much difference should be considered enough to make a Species, which is merely a matter of individual opinion, and of which there is an abundant diversity; and so it appears perfectly plain to me that the contention which has been going on for so many years under the head of the origin of Species is a misnomer; it is the origin of varieties that has been brought to view, and the ages yet to come will have ever to acknowledge their indebtedness to Darwin for the vast stores of facts which he has accumulated for their use on this subject.

In the *American Naturalist* for April, 1888, is an article by Mr. Chas. Morris, entitled "Intelligent Selection," in which he contends that man may have produced, in that way, as true Species as nature does by natural selection, and says "that Species have not "been produced by man is more an assertion than a demonstrated "fact," then claims that certain forms of pigeons and dogs might be "regarded as of specific value, or even generic, and says "if we take "the varieties of the dog, such wide differances in size, form and "habit, if found in Nature, would be at once accepted as well "defined Species." A perfectly true statement I believe, but one

that does not prove his contention; but I think it does prove most conclusively the extreme probability there is that we have in our catalogues an abundance of so called Species, that are not one whit better Species in Nature than those varieties of the dog.

So I conclude;—that Species is a natural division in Nature, and absolutely permanent in the line of descent.

That fertile progeny is an unmistakable evidence of oneness of Species.

That a Species is not necessarily one in size, form and color. True, it may be an individual form that has maintained its appearance, from its first origin to the present, unchanged, but that it is far more likely to be a great number of various forms that have been moulded, modified and diversified, in a thousand ways since its first origin, and no one of these various forms is entitled to claim the term to the exclusion of any one of the others, for each and all of them are required to complete the Species as it is in Nature.

That determination of Species by structure is artificial, and, from the very nature of things, uncertain. So a Species may generally be regarded as a group of more or less distinct forms, the origin of whose diversity may be involved in obscurity at the present day.

The question of origin belongs to the domain of philosophy rather than that of science, but science has demonstrated that no spontaneous origin of life has been found. Yet there was a time when life did not exist on this globe, so that it must have originated in some way; but life being granted, Species has to be as a matter of course, if life is to be permanent, for every form, no matter how low in the scale of being it may be, is perpetuated by ordinary generation in some way, and each Species perpetuates its own kind only, and never any other. But whether the Species of the present originated by a miracle of creation, and have been modified by the external influences of ages, eras and epochs, until they appear as we see them; or by a progressive succession of miracles of transmutation, until they have arrived at what they are, does not seem to matter much, for miracle it would be in either case, because transmutation is in just as direct violation of the laws of Nature, as we know them, as creation is. But if science can say negatively that Species is not self originating, it can never say positively they originated by miracle, for that belongs to the supernatural, of which science can

discover nothing. The most it can say is that it knows of nothing else that will account for it.

Unquestionably, the conditions and combinations were vastly different in various periods of the world's history, producing greatly different results, but we have not a shadow of a reason for supposing that the laws of Nature were different. It is certain knowledge that constitutes science, not uncertain opinion that has not yet crystallized into knowledge.

We have heard a great deal about "missing links." If the authorities fail to discriminate correctly between Species living and moving before their eyes, what are they likely to do with the crushed remains of extinct forms? If the links were all in their hands would they recognize them? If the skeletons of the widely divergent forms of our dog were found in the rocks they would hardly be taken for the same kind of animal, let alone the same Species.

We have also heard a good deal about the breaking down of barriers between species and species, genus and genus, order and order, kingdom and kingdom. What were these barriers? Artificial ones, erected by man at the limit of his knowledge, which with an increase of that, he found it necessary to remove, as he had put them up in the wrong place; but Nature's one and only barrier, found in the whole breadth of the animal kingdom, stands just where it did before ever man began to investigate it, and as firmly as ever it did, and that is the one between Species, no other having any existence in Nature whatever.

"THE HITTITES."

Read before the Association, November 8th, 1888,

BY REV. SAMUEL LYLE, B. D.

The discovery of the lost Hittite Empire may be regarded as the great historical surprise of the nineteenth century. Awakening from a sleep of two thousand years, the Hittites claim to be recognized as a powerful, learned and warlike people. A few able critics refused, on what seemed good grounds, to admit the claims put forth by the friends of the discovery. Was it likely that a nation, powerful almost as ancient Egypt, could be entirely lost and that no trace of it had appeared for two thousand years, save a doubtful reference or two in the Sacred Books of the Hebrews? How could this be, when the nation in question was linked, and that most closely, to the three ancient, oriental peoples most familiar to us—the Hebrews, the Egyptians, and the Assyrians? If, a priori, ideas could settle the point in dispute, then we would be forced to conclude that no such people as the Hittites ever existed. But, happily, we live in an age that has learned to place a high value on facts, and so to use them as to unlock the mysteries of the past and the present; and, happily too, the love of truth has induced men of great ability to go out to the fields once tilled by races now extinct, and to dig up the relics that have thrown so much light on the history of the Ancient Orient. Through the labors of such men the most startling results have been reached, and we are brought face to face with the long lost Hittites.

Upwards of seventy years ago Burckhardt, in his work on Syria, declared that he had seen in the corner of a house of one of the bazaars a stone with hieroglyphics differing from those of Egypt. Many declared that Burckhardt was mistaken, and that no antiquities existed in Hamah. From the nature of the case the general public took no interest in finding out the truth. This state of mixed incredulity and indifference was brought to an end through the discov-

eries made by two Americans, the Rev. S. Jessup and Mr. J. A. Johnson. Their announcement of the discovery of the Hamah inscriptions awoke a profound interest in the minds of antiquarians, linguists and historians. Soon rude copies of the stones were procured, and given to the world through the medium of the American Palestine Exploration Society. Captain Burton's explanations of the stone, and of its strange writings, deepened the growing interest in the Hamah inscriptions. Dr. Wright and Mr. W. R. Green, working through the Sublime Pasha, at last succeeded in securing these stones, thus opening the way to the discovery of the lost Empire of the Hittites. When the natives found that their treasures were about to be removed, they threatened to destroy them rather than permit them to be taken away. Let me quote Dr. Wright's words:—"I saw "now that a crisis was reached. For hundreds, perhaps thousands "of years these mute inscriptions had waited for some one to hear "their story. Egyptian, Assyrian, Greek, Selucedæ, Roman, Saracen, "Crusader and Turk had passed them by as unworthy of even a "passing notice; and now, that travellers from the Isles of the Sea, "eager to learn their secrets, had arrived, their voice was to be "hushed for ever. A greater calamity than the Moabite stone "tragedy was imminent—a mighty empire was about to claim its "rightful position among the great nations of the ancient world, and "a few fanatics were about to push it back into the outer darkness "to which classic history had assigned it." Happily for the cause of truth, and for the right understanding of the past, the designs of ignorant zeal were frustrated, and the Hamah stones secured.

But what is the import of these inscriptions? By some they were regarded not as writings, but as the vagaries of ornamentation. But the shape of the sharply cut figures, their resemblance to the Cypriote Syllabary, and the discovery of writings similar, have established the fact of their being literature on stone.

This admitted, how are they to be read? Captain Burton thought the key to unlock the inscriptions was to be found in the rude tribe marks of the Bedawi. But the location of the inscriptions belonging to the family of which the Hamah stone are a specimen, the finish of the characters of the writing—a finish clearly indicating good instruments, well used by the skilful hands of ready scribes—are against the supposition that much light to their discipherment is

to be found in "the scratchy tribe marks of the uncultured Bedawin."

Mr. Hyde Clarke thought he could see the clearest traces of resemblance between the Hamah inscriptions and the Himyaritic and Libyan. But Mr. Clarke's theory is at war with the facts of the Hamah writings, both in the matter of time and of space.

Mr. Johnson, the discoverer of the inscriptions, suggested that they might be the work of Assyrians, of Egyptians, or of Hebrews? "We should naturally" he says, "expect to find in the vicinity some trace of the Assyrians and Egyptian conquerors, who ravished the Valley of the Orontes, and of their struggles with the Hittites on this ancient field, and of Solomon, who built stone cities in Hamah. The arrow-headed characters are suggestive of Assur-Nasir-Pal."

Captain Conder, drawing attention to the similarities of the Hittite and the earliest Egyptian hieroglyphics, is inclined to think that they are akin, if not actual representations of early Phœnician. But the ablest and soundest specialists inform us that the Hamah writing is not Hebrew, not Egyptian, not Phœnician, and not Assyrian.

Dr. Wright, Prof. Sayce, Dr. Taylor, and others, regard the Hamah inscriptions, and the others of similar character subsequently found, as Hittite remains. The following extract, taken from Dr. Wright's able work on the Hittites, gives a good idea of the Hittite writings:—

"The Hamah inscribed stones were four in number, and "those contained five inscriptions, one of the large stones being "inscribed on the side and on the end. All the stones were close-"grained basalt (fully ripe, as the Arabs say) doubtless brought "from the basaltic region east of the city. Many similar stones "were lying about or built into the walls, some of them with Greek "and Arabic inscriptions, and some of them having the figures of "animals carved upon them.

"The Hittite inscriptions differ from the inscriptions of Baby-"lon, Egypt, Assyria, Greece and Rome, in that they are all, except "that of Tyana and the Babylon Vase, in raised character. The "lines of inscriptions and their boundaries are clearly defined by "raised bars about four inches apart. The interstices between the "bars and characters have been cut away. The faces of the stones "had been dressed smooth before the inscriptions were carved upon

"them, and the stones, as I have already pointed out, were dressed "narrow towards the inscribed points, their bases being left un- "dressed for several feet. They are clearly intended to be inserted "in masonry with the inscribed parts standing out so that the inscrip- "tions might be publicly read, and these were doubtless in the lan- "guage of the people of Hamah. The inscriptions begin at the top "of the right side, and read along the line between the bars to the "left. The next line is read from left to right, and thus the reader "proceeds from right to left and left to right, *boustrophedon* style, or "as an ox ploughs. The flow of the line is always in the opposite "direction from that in which the speaking figures in the inscriptions "look."

These historic treasures have a tongue, and speak, though the ears of the learned are perplexed as to what they say. Doubtless the key to their understanding is to be found in the thorough mastery of the ancient and mysterious scripts of Asia Minor. In the Hittite Hamah inscriptions we have the central stem of which the Cypriote and Asia Minor scripts are the branches. Speaking of the Hamah treasures, and of others of similar nature, Dr. Taylor says:— "These monuments are those of a people who have been identified "with the Hittites of the Old Testament, the Kheta of the Egyptian "monuments, the Rhatte of Assyrian records, and the *Ketetoi* of "Homer (Od. XI. 521). They were one of the most powerful "peoples of the primeval world, their empire extending from the "frontier of Egypt to the shores of the Ægean, and, like the Baby- "lonians and the Egyptians, they possessed a culture, an art, and a "script peculiar to themselves, and plainly of indigenous origin. " * * * It is now admitted that the primitive art, the mythol- "ogy, and the metrical standards of Asia Minor were, to a great "extent, obtained from the Hittites, and the independent system of "picture-writing which they possess, offers an obvious source from "which the Asiatic Syllabary might have been obtained."

Prof. Sayce, who is at work on these Hamah inscriptions, has given a clue to their meaning, and in a short time the historic world will have the satisfaction of knowing what light they throw on the past of a great people long in darkness and in the shadow of death. In the meantime Egypt and Assyria have much to say of the Hittites, and their testimony is confirmed by the witnesses of Jew and of Greek. If the amount of evidence is not so great as we could wish, still

it is ever increasing as the work of the explorer advances, and what is of more importance, the character of the evidence is of the highest order. Three distinct peoples through their literature—a literature written on stone, and secure from the tampering hand of the scribe—tell us of the greatness and glory of the Hittite Empire. And since the literature of stone has risen from the grave of centuries, and told the world of the heroic nations of the dead past, a seemingly meaningless passage in the Eleventh Book of the Odyssey of Homer becomes clear and pregnant with meaning. Mr. Gladstone, who was the first to detect the passage and show its bearings on the Hittites, in a letter to Dr. Wright, says :—"Your "account of the local extension of Hittite influence is in complete "conformity with the idea which conceives them as within the circle "of possible Trojan alliances. I may add to the suggestion, which "I first published in fear and trembling, that the manner of the "mention in Homer is completely in accord with your doctrines as "to the greatness of the Hittites. (1) Because the slaughter of their "chief seems to be the crowning exploit that has been performed by "the son of Achilles. 'I will not,' says Odusseus, 'name all that he "slew, but only the hero Eurupulos.' (2) Because the *Keteioi* are "named without epithet, description, or indication, which accords "with the idea of their being a famous and well known race." Thus we have voices from Egypt, from Assyria, from Palestine, and from Greece, telling us what they know of the Hittites, and all in harmony.

Look at some of the facts brought to light during the last few years. Listen to Egypt's account of her neighbors and rivals in art, in literature, in statesmanship, and war—the Hittites. She is constantly threatened on the north by a people called Amu, which in Egyptian means herdsman. Doubtless the Egyptians used the term to express their contempt for this foe, for we learn from the Good Old Book, that "every shepherd is an abomination unto the Egyptians." Regarding the shepherd's calling as the lowest, the Egyptians would naturally use the word herdsman much in the same way as the Greek spoke of the Barbarian. Among these hordes that were ever hovering around the north of Egypt two nationalities stand out as the most powerful—the Akharru and the Kheta. The Akharru are the Phœnicians, to whom we owe so many elements of our civilization. The Kheta or Khatti are the Hittites, who cross the path of the Bible student as he reads the story of the

Hebrews from the days of the founder of the nation, Abraham, to those of the Captivity. The first Pharaoh who ruled Egypt—the Pharaoh of the twelfth dynasty—destroyed Hittite towns and palaces which were built on the northern frontier of Egypt, and by their destruction crippled the energies of a dangerous rival daring to come so near. If Mariette Bey is right in his conjectures, one of the early Egyptian dynasties was Hittite. May this not explain why Egypt was so sensitive on the subject of Hittite encroachment? May this not in part account for the long succession of wars extending over a period of nearly six hundred years—the war begun by Thothmes I., and continued till the days of Rameses III., who defeated the Hittite invaders in the great "naval engagement near Megdol, at the Pelusiac mouth of the Nile."

When Thothmes III., Egypt's greatest monarch, came to the throne in 1600 B. C., he put forth all his vast powers to crush his north-western rival. But though Thothmes III. made his influence felt to the centre of Africa, where he fought and triumphed; though able to force the borders of India to bow before him; though great in his day as Alexander was centuries later, still he was not powerful enough to crush the Hittites, who stubbornly and successfully resisted him. Indeed, the Hittites had influence with their neighbours, and used it to band together the disjointed peoples, and hurl them in compact form against the might of Egypt. Thus the Hittite king of Kadesh called on the kings, and on their subjects "from the water of Egypt to the river land of Mesopotamia," and they answered his call, obeying "him as their chief." Taking his stand in the strongly fortified city of Megiddo on the Kishon, he awaits the advance of Thothmes, the powerful champion of Egypt. Arriving at Megiddo at midday, the Egyptian monarch instructs his men to hold themselves in readiness for action, to look after their arms, for early on the following morning they must meet the foe. Thothmes, no doubt, chose this time because it was the twenty-fifth anniversary of his coronation. Confident of victory, he would thus link his coronation and Egypt's glory in the web of history. The Hittites, unable to withstand the furious attacks of the Egyptians, reeled, broke their ranks, and fled, leaving their war chariots and their baggage on the field, and taking refuge in Megiddo, as the Russians did in Sebastopol after their defeat on Alma. And as the allies failed in not following up their well fought battle of Alma with the capture of

Sebastopol, thus giving the Russians time to strengthen their position, so the Egyptians, though led by the ablest general of the age, fell into the same fatal blunder, and that through the temptation to plunder the deserted camp, and instead of marching against Megiddo and taking it, gave, by their delay, the Hittites the chance of making their stronghold stronger. This mistake cost Egypt much, and like the mistake of the French and English at Alma, had to be atoned for in suffering and blood. The Egyptian account recognizes the blunder at Megiddo, and in earnest, sensible language, says, "Oh! "that the warriors of the King had not yielded to the desire to "plunder the goods of the enemy, for then had Megiddo been taken "in that same hour." But what might easily have been done, if the tide of Egyptian success had been taken at the flood, became hard a little later, because Megiddo was greatly strengthened, and the might of a thousand cities stood behind its walls to beat back the proud invaders, and to fight for home and all the heart holds dear. But patience, valor and courage never to submit or yield, at last reduced Megiddo, and humbled the Hittites. From the inscriptions we learn that representatives of one hundred and nineteen cities and nations were present in the Hittite camp, assisting them against Egypt; that the Egyptians were greatly enriched by the spoils of war—precious stones, golden dishes, a two handled flagon of Phoenecian work, 925 war chariots, one of which was gold-plated, and belonging to the Hittite King.

This heavy blow stunned but did not crush the Hittite power, and place it under the feet of Egypt. The two Hittite capitals still stood, Carchemish on the Euphrates, and Kadesh on the Orontes. To reduce these Thothmes III. was forced to engage in two long and exhausting campaigns. In the thirty-third year of his reign Thothmes invaded Mesopotamia, and, defeating those opposed to him, brought back spoils from many lands, and tributes from the vanquished. Conspicuous among all was "the tributes of the great land of the Hittites." But the north-western foe still holds out; defeated at one point the Hittites rally their forces at another. "Thus campaign followed campaign, and though the triumphal "records boast in oriental style of Pharoah's victories over the Hitt-"ites, and give long details as to the plunder borne back in triumph "to Egypt, the Hittite resistance was not broken, and succeeding

"years saw new expeditions, and Egyptian armies marching through "the length of Syria against the hereditary foe."

When Thothmes III. died 1566 B. C., the Hittites are still a powerful people, able to force their rivals to respect them. Brugsch says, "Their importance grew from year to year in such "a way, that even the Egyptian inscriptions do not hesitate to "mention the names of the Kings of the Rheta in a conspicuous "manner, and to speak of their gods with reverence." About half a century after Thothmes' death Rameses I. and Saphel, the Hittite King, entered into an agreement to live at peace, and to defend each other from the attacks of outside parties. This treaty led to a breathing time in the long wars waged between Egypt and the Hittites—led the two peoples to respect each others rights and interests.

But the coronation of Seti I. changed the face of Egyptian affairs, renewed the war spirit, and created in the breasts of his subjects the desire for conquest and plunder. Nor was it without cause that Egypt girt on arms and went out to the battle plain; for "the "Bedawin and the Syrians had again begun with impunity to make "incursions over the Egyptian border." Seti I. assembled a large army with numerous chariots, and drove back the invaders from his frontiers, and in his two horse chariot he led his army in pursuit of them as far as the fortress Kanaan, which he stormed. Thence he pursued the retreating foe to Samnia in Phœnicia, where he overthrew, with great slaughter, the kings of the land of Phœnicia. Having humbled the tribes daring to make incursions into Egypt, Seti, without a hint, attacked the Hittites in their stronghold Kadesh, and took it by surprise, while the inhabitants were in the fields engaged in their peaceful pursuits as honest husbandmen. This Seti did as the avenger of broken treaties. It is more than likely that the inhabitants of Kadesh had assisted the enemies of Egypt, and that this was Seti's idea of teaching them a needed lesson. The scene of battle is represented on the north side of the famous temple of Karnak, and in the representation you can see the Hittites, prince and peasant, slain and lying on the ground before Seti and his triumphant hosts.

Rameses II., the son of Seti, figures prominently in history. He is likely the Pharaoh who oppressed the Children of Israel—likely the Sosestris of the ancient Greeks. During his reign the

Hittites mustered all their forces and called to their aid all their allies from the remotest parts of the empire, in order to check the advance of the Egyptians. The scene of conflict was the famous Kadesh on the Orontes—Kadesh inured to the shock of battle. Dr. Wright says: "There were present under the banner of the King of "the Hittites his allies and satraps, from Mesopotamia to Mysia, and "from Arvad in the Sea. Pharaoh set out by the old royal road along "which so many Egyptian armies had marched to the land of the "hereditary enemy. His route lay along the coast of Syria by the "great sea, through Joppa, Tyre, Sidon, and Beyrout. Passing through "the Elenthems Valley, he bronght his army once more before the Hit-"tite city, Kadesh. A great battle was fought, and the special re-"porters of those days have given us full details, in pen and picture "sketches, of all the leading incidents of the fray."

The poet-laureate of Egypt, who accompanied the king, has celebrated the achievements of that day in a heroic poem which has come down to us in several editions. It is found on a papyrus roll, and in conjunction with splendid battle scenes on the walls of temples at Abydos, Luksor, Karnak and Ibsamboul. This oldest extant heroic poem—this first specimen of war correspondence—is too long to quote, but I must give a passage or two. Take his spirited description of Pharaoh:—"King Pharaoh was young and "bold. His arms were strong, his heart courageous. He seized his "weapons, and a hundred thousand sunk before his glance. He "armed his people and his chariots. As he marched towards the "Hittites the whole earth trembled." The enraptured war correspondent describes Pharaoh as deserted, and in his hour of need praying to his Father, the God Amon, who holds out his hand to the great delight of the king. After this Pharaoh is likened to a God hurling darts with his right hand, and at the same time fighting with his left. Making due allowance for the orientalisms, and remembering that the writer is poet-laureate to the King of Egypt, the following has its merits, though not of the highest order. Representing Pharaoh as dashing 2,500 horses to pieces, he says: "That the hearts of the Hittites sank within them. Their limbs "gave way, and they had no courage to thrust the spear. And Pha-"raoh swept them into the Orontes like crocodiles. He slew the "Hittites at his pleasure, and no one resisted him. The King of 'the Hittites sent eight of his brother kings, with armed chariots

"against Pharaoh. With 2,500 horses they rushed on Pharaoh's 'flaming countenance, but he dashed them down and killed them "where they stood. Pharaoh rallied his warriors by his acts of "valour. He cheered his charioteer, almost dead with fear. Six "times he charged the unclean wretches who did not acknowledge "his God. He killed them; none escaped. Then Pharaoh upbraids "his worthless warriers, not one of whom stood by him, and calls "the foreigners to witness that his own right hand had won the "battle." After this the Hittites seek peace, and the Egyptians implore their King to grant it. Pharaoh mercifully grants it, returning to Egypt in the best humour, and resting in his palace like the sun on his throne.

The results of the treaty of peace entered into at this time were all that could be desired. Dynastic alliances sprang out of the state treaties, the most kindly feeling resulted, and love tokens passed between the old rivals and foes. If Mineptah II. is the King of the Exodus, as Brugsch affirms, then he showed a better side to the Hittites than he did to the Israelites, for he sent wheat in ships to preserve the lives of the Hittites. But a hundred years later the old war spirit revives, and Egypt and the Hittites have each other by the throat. Rameses III. in a great naval engagement near Migdol, at the mouth of the Nile, crushed the forces opposed to him, taking the King of the Hittites prisoner.

Dr. Wright thus sums up the story of the Hittites as looked at in the light of their connection with Egypt:—"We see the Hittite "Kings the rivals of the Pharaohs in peace and war from the twelfth to "the twentieth dynasty. The shock of Egyptian invasion exhausted "itself against the frontier cities of Kadesh and Carchemish, but the "mighty empire of the Hittites extended beyond, on the broad "plains and highlands of Asia Minor, and so there were always fresh "Hittite armies, and abundance of Hittite wealth, to enable the "Hittite empire to withstand the might of Egypt for a thousand "years."

Having seen the relation of Egypt to the Hittites, let us now consider the relation of Assyria to the lost Empire.

If the decipherment of the astrological tablets of Sargon of Agane is to be depended on, the Hittites were a powerful nation in the nineteenth century, B. C. Indeed Mr. Pinches, of the British

Museum, places the appearance of the Hittites as early as 3800 B. C. From the inscription of Tiglath-Pileser I. we learn that the Hittites were then threatening Assyria, and that they had to be beaten back through a series of extensive campaigns. In one part of this inscription Tiglath-Pileser I. says that he captured "one hundred and twenty chariots fitted to the yoke," and in another, "there fell into my hands altogether, between the "commencement of my reign and my fifth year, forty-two countries "with their kings, from beyond the river Zab to beyond "the river Euphrates, the country of the Khatte (Hittites), and the "upper ocean of the setting sun. I brought them under my gov-"ernment. I placed them under the Magian religion, and I im-"posed on them tribute and offerings."

Great as was Tiglath-Pileser's victory, his stubborn foes did not quietly submit to Assyrian dictation. Tiglath-Pileser's successors were less fortunate, and were forced to continue the struggle against the Hittites for four centuries. From the abundant materials handed down to us, and throwing much light on the reign of Assur-Nasir-Pal, we learn that this monarch conquered Lebanon, Tyre and Sidon. The references to the Hittites are numerous, clear and important. From them we learn that Assur-Nasir-Pal defeated Carchemish, enriched himself with its booty, laid Gaza under tribute, besieged Kanulua, which was unable to withstand the attack of Assyria, and willingly paid a large ransom and gave hostages as a pledge that it would keep the peace in days to come. The careful reader of these inscriptions is struck with the fact of the Hittite power being divided, and on the wane.

This could scarcely be otherwise, because the Hittites were divided into petty kingdoms, whereas their rivals, Egypt and Assyria, were united forces, acting from central and intelligent motives. Assyria seems to have attacked and subdued each of the Hittite Kings in detail. It may have been local jealousies that led to this result, or it may have resulted from the fact that no separate Hittite State was powerful enough to force the others to gather around it, and unitedly, as in the great battle of Megiddo against Egypt's hosts, to oppose Assyria.

Shalmaneser, the son and successor of Assur-Nasir-Pal, prosecuted the war against the Hittites. Most of his thirty campaigns were conducted against the Hittites—campaigns that must

have impoverished the Hittites and almost decimated their lands. Crossing the Euphrates he captured Dabigu and the cities dependent on it. Learning by defeat one of the sources of their weakness, the Hittites enter into a confederacy to oppose the Assyrians. Benhadad, of Damascus, Irkhulina, of Hamatte, and others, join the Hittites, in the hope of crushing the might of Assyria. Shalmaneser declares, "by the command of Assur, the great lord, my "lord, with them I fought A destruction of them I made. Their "chariots, their war carriages, their furniture of battle I took from "them. Twenty thousand five hundred men with arrows I slew." It becomes tiresome to read the accounts of the annual attack and defeat of the Hittites.

When Sargon came to the throne in 721 B. C., the Hittite power was in its death throes. In 717 B. C., they make their final stand at Carchemish, and are crushed beyond all hope of recovery. Listen to the story of their ruin, as told by their spoiler Sargon: "In the fifth year of my reign, Pisiri of Carchemish sinned "against the great gods, and sent against Mita the Moschian, mes"sages hostile to Assyria. He took hostages. I lifted my hands to "Assur, my lord. I made him leave the town. I sent away the "holy vases out of his dwelling. I made them throw him into "chains of iron. I took away the gold, silver and treasures of his "palace. The Carchemish rebels who were with him and their prop"erty I transplant d to Assyria, I took among them fifty cars, "two hundred riders, three thousand men on foot, and I augmented "the part of my kingdom. I made the Assyrians to dwell in "Carchemish, and I placed them under the dominion of Assur, my "lord."

Whatever may be our views as to the part played in the great battle-field of the world by the Hittites, we must admire their valour and be impressed with a sense of their greatness—a greatness that held Egypt at bay on the south and Assyria on the east—a greatness that defied all foes, and manfully maintained a national existence for a longer period than Babylon, Assyria, Greece or Rome.

This wonderful nation stood in very close relation to the Hebrews. In different ways they pass and repass on the stage of Old Testament history. Does Abraham look for land for himself and for his descendants? Part of it is in the possession of the Hittites. How does he secure his first possession of this land?

By purchasing a grave, in which to bury Sarah, from the Hittites of Hebron. Where was the body of this distinguished patriarch laid after death? It was lovingly placed by his two sons, Isaac and Ishmael, by the side of Sarah, "in the cave of Machpelah, in the field of Ephron, the Son of Tohar the Hittite. From what stock did Esau take his wives? From the Hittites. Who are declared to be the occupants of Canaan in the days of Moses? The Hittites and others. Who are the foes most to be dreaded by the Israelites? The Hittites, the hardy mountaineers. What is the extent of the land given to Joshua? "From the wilderness and this Lebanon, "even unto the great river, the river Euphrates, all the land of the "Hittites, and unto the great sea, toward the going down of the sun, "shall be your coast." Who are the foes Joshua is called on to face as he crosses the Jordan? It is the Hittites, and their companions from the mountains, the Amorites. Who oppose him every step and are in great force at the decisive battle of Merom, in the hope of driving back the invader? The Hittites. Who, though crushed, continued to influence the Hebrews, link themselves in marriage, and gain respect for their gods? The Hittites. Who, though aliens, made a name for themselves in David's army? The Hittites. With what alien people was Solomon most closely connected? With the Hittites, for his Mother Bathsheba was the wife of Uriah, the Hittite, and in his harem were Hittite women. What two peoples bought horses in Egypt in the days of Solomon? The Hittites and the Hebrews? What caused the Syrians to fly panic stricken from the siege of Samaria? Because they thought the King of Israel had hired the Hittites and sent them against the Syrians. From the Biblical references we infer that the Hittites were a powerful and warlike people—an inference confirmed by the monuments of Egypt and Assyria.

But here let us try to get some light on Hittite nationality, learning and religion.

Who were the Hittites is a question not so easily answered as some would suppose. Before an answer can be given we must study the story of the Bible, of the Egyptian and Assyrian monuments, of the Hittite names and literature. From Genesis, x, 15, we learn that the Bible regards the Hittites as a branch of the Canaanite stock: "And Canaan begat Sidon his first born, and Heth." According to this the Hethites or Hittites descended from Canaan,

and are to be ranked among the Hamite race. In the narratives of the purchase of the cave of Machpelah the Hittites are called, in the original Hebrew, "Bene-Cheth," sons of Heth. This explains the language of Abraham in relation to those dwelling in Canaan in his day—the Canaanites and the Hittites. He speaks of them as neither of his country nor of his kindred. How natural in case the Hittites are descended from Ham! The names of the Hittites found in the monuments might point to a Semitic origin. The same might be said of Hittite names found in the Bible. Thus the names of Esau's wives are Hebrew. Genesis, xxvi, 35, represents Esau as taking to wife Judith, the daughter of Beeri the Hittite, and Bashemath, the daughter of Elon the Hittite. Here the nationality is Hittite, and the names in every instance Semitic. Judith means "the praised," Beeri "the fountains," Bashemath "the fragrant," and Elon "the strong hero." But in Genesis, xxxvi, 2, Judith is called Aholibamah and her father Anah. Dr. Wright suggests an idea which seems to me the right explanation of those double names—the idea that Aholibamah and Anah are the Hittite names. What can be more natural than that the Hebrews should give Hebrew names to their Hittite friends and relations? The fact of having a Semitic name does not warrant the conclusion that the bearer is of Semitic nationality. Besides most of the Hittite names are not Semitic. We have the high authority of Professor Sayce for saying that "the Hittite proper names pre-"served on the Egyptian and Assyrian monuments show that the "Hittites did not speak a Semitic language." As an evidence of this the Hittite proper names, used to define some quality in those bearing them, have the defining word first, whereas the Hebrews place it last. The term Melchisedek means king of righteousness—the Melchi meaning king and the sedek righteousness. Here the Hebrew method is followed by the placing of the qualifying word last—a method reversed by the Hittites. But the fact of the Hittite mode of using grammatical suffixes is even more significant. Instead of using both suffixes and affixes, as in the case of the Semitic languages, the Hittites used affixes, and affixes alone.

The Hittite sculptures show that they are not to be ranked in the list of Semitic peoples. In type and feature they are the children of the north; in the moccasin sandals with upturned toes, such as are worn by the mountaineers of Asia Minor and Greece at present, and in the fingerless glove worn only in cold countries, we

have hints of their old home being in the north, and in mountainous regions. The Bible places them in the mountains in the north. Thus when the spies return to Moses, and tell what they saw, as we learn from Num., xiii, 29, they say "that the Amalekites dwell in the "land of the south; and the Hittites, and the Jebusites, and the Amor-"ites, dwell in the mountain; and the Canaanites dwell by the sea "and by the coast of Jordan." Captain Conder, in his recent work entitled "Syrian Stone Lore," inclines to the belief that the Hittites may be a branch of the early Turanian stock. He says that they "were certainly not a Semitic race, nor do they appear to have been "closely akin to the old Egyptian stock. * * * * They were, "indeed, the overlords who ruled Semitic tribes, just as the Elam-"ites ruled Semitic tribes in Babylon; but the Egyptian sculptors "of the fourteenth century B. C., who have given us representations "of the Hittite warriors in their chariots, have carefully distinguished "them by a lighter complexion from their brown Semitic allies. The "general effect of the representation of the Hittites on the sculp-"tures of Karnak bears a striking resemblance to the Tartar type, and "the wearing of boots in place of sandals appears possibly, as Pro-"fessor Sayce has remarked, to point to the northern derivation of "the tribe, which is thought to have come from the Caucasus." The Hittites are generally represented on the monuments as almost hairless, their pig-tails giving them a Chinese appearance.

From the country they inhabited, we are led to infer that they may have been closely linked to the ancestors of the modern Georgian. The Assyrians and the Egyptians used the term Kheta, in a somewhat loose sense, to designate all the peoples living in Northern Syria, but not to designate any tribe north of the Taurus Chain. The Hittites are found as far south as Hit on the Euphrates, as Tell Hatteh near Kadesh, as Hatta and Kefr Hatta in Philistia, and as Hebron in Palestine. "The Hittites," to use the language of Conder, "may perhaps be considered at one time to have advanced "to the borders of Egypt, though in 1600 B. C. they were already "only found in the north. Thus in the time of Joshua and "Solomon the land of the Hittite is Northern Syria. Mariette Bey "proposed to identify the Hyksos with the Kheta;" and, in case this can be done, an explanation of the noticeable non-Semitic trace on the Hyksos will be given.

Professor Sayce in his work on the Ancient Empires of the

East designates the Hittites as the most important branch of the Proto-Armenian race. He thus puts his views: "As Asia Minor "was but a prolongation of Armenia, so too, originally, its popula- "tion was the same as that which in pre-historic days inhabited the "Armenian plateau. From thence it spread westward and south- "ward, down the slopes of the mountains, under the various names "of Hittites, Moschi, and Titareni, Komagenians, Kappadokians, "and the like. We may term it Proto-Armenian, and see in the "Georgians its modern representatives, though doubtless the Circas- "sians and other half extinct races, which, before the Russian con- "quest, found a refuge in the fastnesses of the Caucasus, once had "share in populating the neighboring regions."

Turn now to the evidence of the literary and artistic standing of the Hittites. Their enemies sneer at them as the lovers of books, and one of the towns in Southern Palestine is called Kirjatte-Sepher or book town. Before the introduction of the Phœnician alphabet into Asia Minor a Hittite syllabary was used, the syllabary now termed Asianic. In Cyprus as late as the fourth century B. C. this syllabary was used. Through Hittite sources the philosophic ideas of the east poured into the west, and gave a colouring to the early Ionic thinking. The resemblance between the Hittite writings and those of Egypt show close contact and intercommunion. Through this Europe was linked to Egypt; for the Hittites touched Greece on the west, as we learn from the works of Homer. On the supposition that one of the Hyksos dynasties was Hittite it may be inferred that the Hittites were not ignorant of astronomy or of mathematics. Professor Eisenlohr tells us that the Hyksos princes did study such questions. In art the Hittites made considerable progress. As their literature was founded on, and powerfully moulded by their neighbors, the Egyptians and early Babylonians living before the rise of the Assyrian empire, as in like manner was their art. They seem to have taken the artists of early Babylon as their models, and, having added new ideas from Egypt, introduced the Eastern forms into Asia Minor, and through the gate-way of Asia Minor into Europe. Professor Sayce says of Hittite art, "it "was characterized by roundness and work in relief. The mural "crown was a Hittite invention; the animal forms, in which Hittite "artists specially excelled, were frequently combined to form compo- "site creatures, among which may be mentioned the double-headed

"eagle, afterwards adopted by the Seljukian sultans, and carried by "the crusaders to the German States. This Hittite art is the source "of the peculiar art of Asia Minor, which forms a well marked "element in that of primitive Greece." In the cylinders, sculptures and seals found in Asia Minor and in the islands of the Archipelago; in the raised silver boss characters and in the gold rings designed after ancient Babylonian models, we have proofs of the skilled hand of the Hittite artist.

Before concluding, I wish to state in a few words what is known of Hittite religion. And here again the Hittites take their first lessons in Babylonia, and, having made some progress, they communicate what they have received from Babylonia, and modified, to the west. The gods of Babylonia appear on Hittite soil with new names, retaining their old faces and forms. Even the legends, forms of worship, and images are imported, almost without a change. In the Amazon of the Greek, we have the reproduction of the Hittite priestess. Prof. Sayce notices a very peculiar and interesting fact in this connection—that the cities founded by Amazons—Ephesos, Smyrna, Kyme, Myrina, Priene, Pitane—were all of Hittite origin. In early art the Amazons are robed in Hittite costume and armed with the double-headed axe, and the dances they performed with shield and bow in honor of the goddess of war and love, gave rise to the myths which saw in them a nation of warriors. The debasing rites of the Babylonish religion were introduced into the Hittite system, and mutilation and torture were practised to please the cruel Attys. Istar and Set were their chief gods. Set, whom they called king of heaven and earth, appears to be the ancient god of Egypt of the same name. Conder says that the Egyptians regarded Set as the great god of night, at once the brother and foe of Horus; that Set assuming the form of a boar swallowed the eye of the god of day. The priestesses ministering at the Hittite altars were mere ritualists, and religion was in their case, as it too often is, divorced from morality. At Kadesh, Hittite girls were devoted to wickedness, and that in the name of the Hittite religion. Many were the forms of worship, and most of them repulsive in the extreme. "Devotees "surrendered their children to Baal in the flames, and the children's "screams were drowned by trumpet and drum; and the rites of

"Astarte were equally vile, though accompanied by the cooing of "doves and clouds of incense."

But going hand in hand with this base ritual, there were in the Hittite faith elements of the old nature worship of Armenia and of Asia Minor. Hence the wild dances, the mystic wanderings through the woods, the clanging of cymbal and of tambourine. Conder shows that the general character of the religion of the Turanian tribes, of which he supposes the Hittites to be one, is in its main features like that of the Hottentots. Indeed the Hittites grafted the Babylonian and Egyptian ideas on the animism of the Turanian—the invocation of mountain, river, cloud and storm, and the more abstract ideas of Babylonia and of Egypt were mixed, and thus grew up a system that gave to Greece ideas and forms familiar to the students of Greek and Roman literature.

THE LAKE ERIE SHORE AS A BOTANIZING GROUND.

Read before the Biological Section, February 15th, 1889,

BY T. J. W. BURGESS, M. B.; F. R. S. C.

Perhaps few, if any of you are aware that almost at our very doors, certainly within easy reach of the members of this Association, lies what is probably the best botanizing ground in Ontario, I might even say the best in Canada if we exclude British Columbia and the Rocky Mountains. I refer to the shores of Lake Erie, a region less known botanically than any other part of the Dominion, except the parts I have mentioned. While the counties immediately adjoining the lake constitute the district to which I specially refer, it may be said to include the banks of the Niagara, Detroit and St. Clair Rivers, and the border of Lake St. Clair.

Forty-nine years ago Sir Wm. J. Hooker published his great work, the "Flora Boreali Americana," and in it recorded all then known, through the early travellers and explorers, of our species and their distribution. In 1840 to 1843 appeared the "Flora of North America" by Torrey and Gray, and in 1878, the latter gentleman published the first volume of his "Synoptical Flora of North America," comprising the Gamopetalæ after Compositæ. These works virtually contained all that was known of Canadian botany, except occasional lists which had from time to time appeared in scientific publications, up to 1883, when the first part of Professor Macoun's "Catalogue of Canadian Plants" was brought out. This part, which comprised the Polypetalæ, was followed in 1884 by a second, treating of the Gamopetalae, and in the same year appeared the second volume of Gray's "Synoptical Flora," completing the Gamopetalous Dicotyledonous plants. In 1886 and 1888, two other parts of Prof. Macoun's great work were issued, treating, respectively, of the Apetalæ and the Endogens. This wonderfully comprehensive catalogue is now our standard work on the number and distribution of Canadian species, and forms a lasting monument of the good work done by Mr. Macoun for the science he loves so well, and which he has done so much to foster in this country. It has thrown the first

great light on our Canadian flora, but even it, as the author on several occasions remarks in its pages, is woefully deficient as regards the flora occupying the region along Lake Erie, in which, no doubt, there are many varieties still to be brought to view.

One of the earliest explorers to leave any special notes on the vegetation of the Lake Erie district, was the famous Franciscan monk, Father Hennepin, who accompanied LaSalle on his voyages, extending from 1679 to 1682. Hennepin explored the country through the region of the St. Lawrence and great lakes, westward into Wisconsin, where he was carried as a captive by the Indians. He appears to have made no collections, nor did he give any special account of the botany of these regions, but on more than one occasion he speaks of the prevalence of walnut, chestnut and plum trees about Lake Erie.

Following Hennepin, the Jesuit, Charlevoix, who reached Quebec in 1720, travelled by way of the St. Lawrence and great lakes and thence descended the Mississippi. His journals contain some notes of interest, and he speaks particularly of the fine timber in the Erie region, mentioning the white and red oaks (*Quercus alba* and *Quercus rubra*) and three kinds of walnut, two of which, from his description, evidently are the butternut and one of the hickories.

Peter Kalm, a pupil and correspondent of Linnæus, in 1749; Frederick Pursh, the celebrated author of the "Flora Americæ Septentrionalis," in 1806; Michaux, the younger, in 1807; and Drummond and Douglas, distinguished botanical explorers, about fifteen or eighteen years later made expeditions to the Niagara River and eastern end of Lake Erie, but can hardly be said to have explored any of its northern shore. The result of their labors was recorded in Hooker's Flora.

The first real investigators of the Flora of this district were Mr. Goldie and Drs. Todd, Maclagan and Nichol, and they have recorded many interesting plants, some of which have not since been seen. Professor Macoun has explored to a limited extent the Niagara Peninsula, Pelee Island and the country along Lake Erie westward from that point and up the Detroit River; while, personally, I have examined the districts about Point aux Pins and Point Pelee. Mr. David F. Day, President of the Buffalo Natural History Society, has carefully explored the Canadian side of the Niagara River

and the shore of Lake Erie as far as Point Abino. The shore, however, between Point Abino and Point aux Pins, a stretch of about 175 miles, remains practically unexplored, with the exception of a little work done by Dr. Nichol and Mr. Wm. Yates in Norfolk County, by Prof. Macoun in the same district about Port Dover, and by the last named gentleman and myself about St. Thomas and Port Stanley in Elgin County. That much is still to be done is evidenced by the discovery during the past season by one of our members, Mr. Hanham, who makes no claim to even the slightest knowledge of botany, of the beautiful and showy *Phlox coronopifolia* introduced at Port Dover, an addition to our Canadian Flora. The island known as Long Point lies about the centre of the unexplored district, and I have no doubt would yield a generous harvest of new plants to any one with time to visit and work it up.

What I have called the Erie District is chiefly remarkable for the southern nature of many of the species, some of them being so much so that one would scarcely dream of finding them within our boreal confines. The large size and plentitude of the Kentucky coffee-tree, the pawpaw, mulberry, blue ash and sour-gum trees, clearly show them to be indigenous, and would indicate that they are not merely chance survivors, but that the soil and climate fully meet their requirements. To this region having been but scantily investigated may be attributed the seemingly extraordinary fact that on a trip made to Point Pelee, in the summer of 1882, by Prof. Macoun and myself, in one day we noted no less than eleven species not before recorded as occurring in Canada, and ten additional ones but very rarely met with. In the week preceding our joint trip the Professor had found, about Amherstburgh and on Pelee Island, eight others, which then for the first time found a place in our flora. The vegetation in many respects resembles that of the northern parts of Pennsylvania and Ohio, lying on the opposite or southern shore of the lake, but whether this points toward proving that what is now water was formerly land and connected the two countries I do not pretend to say. In some instances, notably that of the three-thorned acacia (*Gleditschia triacanthos*) some fine specimens of which grow in the sand-dunes on Point Pelee, I have no doubt but southern plants have been introduced through seeds drifting across the lake. The short distance inland to which some of the species extend has always seemed to me a strong argument in favor

of this view, there being seemingly no difference in soil or climate sufficient to account for it. The forest of this region differs markedly from that of any other part of Canada, for while the trees, elsewhere the chief components, occur, the bulk of it is made up, in addition to those I have already named, of chestnut, black walnut, tulip-tree, buttonwood, white-heart and broom hickories, butternut, chestnut oak, scarlet oak, and black oak.

From Prof. Macoun's Catalogue I have prepared two lists; one giving the names, localities and authorities for the occurrence of the Phænogamous species peculiar (so far as known) to the Lake Erie region; the other those very rarely noted as occurring elsewhere in Canadian territory. The former includes 108, the latter 26 species. These combined lists give us 134 plants, out of a total of 2955, restricted, or almost restricted, to this district, that is, a twenty-second part of all the plants known to occur over our vast territory, from the Atlantic to the Pacific, are confined to it, and I have no doubt that quite a number of additional ones will be brought to light when the country is fully worked up.

113 out of the 737 genera known in Canada, or rather more than one-seventh, are represented in the same region, while very nearly one-half the orders, or 54 out of 118, occur. The orders most largely represented in these two lists, as one might naturally expect from their size, are the Leguminosæ, Rosaceæ, Compositæ, Labiatæ, Liliaceæ, Cyperaceæ and Gramineæ, but, if we go by the proportion of the species to those forming the order in Canada as a whole, the ones best represented are Caryophyllaceæ, Umbelliferæ, Juglandaceæ and Cupuliferæ. Ranunculaceæ and especially Ericaceæ, judged by the same standard are, by all odds, the lowest in the scale of numbers. Four of our Canadian orders find their sole representatives in the Lake Erie District, viz: Magnoliaceæ *(Magnolia Family)* by Magnolia acuminata and Liriodendron Tulipifera, Anonaceæ *(Custard-apple Family)* by Asimina triloba, Bignoniaceæ *(Bignonia Family)* by Tecoma radicans, and Hemodoraceæ *(Blood-root Family)* by Aletris farinosa; while of the two representatives in Canada of the Illecebraceæ *(Knawel Family)* one, Anychia dichotoma, occurs here, the other, Paronychia sessiliflora, in the Northwest Territory.

A very curious fact that cannot but strike one forcibly in glancing over these lists is the large number of species, noted by the

older writers, such as Pursh, Hooker and Goldie, which have not since been seen. This is possibly due to two facts, first, that the region has been but comparatively little explored by botanists, and second, that these writers did not give any very definite localities to aid one in the search. In many cases the sole reference to guide us is Canada or Western Canada, both of which, as you are well aware, are pretty extensive localities to cover. It is possible, also, that some of the species have been incorrectly named. The number of such species is 22, and it is to these I would now particularly call your attention. Indeed, such is the main object of this paper, for it is very necessary in the interests of botanical research that these species, if existing, should be more definitely relocated. Any of you, interested in botany, and having a holiday, cannot do better than spend it on some part of the Erie shore. You are liable to come across some of these, or new, floral rarities at any moment, and, even if you do not, I can promise you that you will be amply repaid with vasculums or presses stocked with some of the least common of Canadian plants. Do not let the fact that such plants have been so long hidden deter you or make you doubt their occurrence there. In even comparatively well botanized districts, with almost an army of scientists engaged in the search, it is possible for a plant to remain concealed for years. A notable example of this is seen in the rare American shrub Shortia galacifolia. Over a hundred years ago, viz. in 1788, the elder Michaux, on a journey into the mountains of North Carolina in search of living plants of the rare Magnolia cordata, collected somewhere on those mountains a specimen of an Ericaceous plant, out of flower but with immature fruit. In 1839 Dr. Gray found and examined, in Michaux's herbarium, this specimen, the exact locality for which was unfortunately not recorded, and on it founded, in 1842, a new genus, Shortia, so called in honor of Dr. Chas. W. Short of Kentucky. Lyon, Curtis, Gray, and a host of less noted botanists, in vain traversed the Carolina mountains to rediscover Michaux's locality for the species, but it was not until May, 1877, that Mr. Geo. Hyams found it on a hillside in McDowell County, North Carolina, east of the Black Mountain. For several years after this was supposed to be the only station for the species, and, to the regret of all botanists, the plants were few in number. In 1886, however, a new station was discovered by Mr. Kelsey on the banks of the lower Whitewater River, in Jocassee

Valley, Oconee County, about 33 miles from Highlands. Here there were rods of the banks covered with it and it extended up and down the river, more or less, for three miles, so that this formerly rarest of plants was at last found in sufficient abundance to assure its continuance.

Another instance of the rediscovery of a plant is that of *Nymphæa elegans*, which was originally collected, by Dr. Charles Wright, in a pond near the head of the Leona River, Texas. Neither Lindheimer, Fendler, nor any other Texan collector or botanist was able to find it again, and for nearly forty years it stood in the North American flora on the strength of a single collection at a single vaguely described station on the broad plains of South-western Texas. In 1887, however, it again came to light near Waco in the same State, Messrs. Trimble and Wright having found it abundant in one place there. These are only two of several such instances, and I trust will encourage the various members of this Association to aid in hunting up some of the lost or doubtful species mentioned by Professor Macoun as occurring in the Lake Erie region. The following is a list of them, some, as you will note, being actually recorded as found by Mr. Buchan and Judge Logie at Hamilton here.

1. *Nelumbium luteum*, Willd., (Water Chinquepin) Reported as found in the Detroit River, at the Erie entrance to the Welland Canal, and near Burnham's Island in Grand River a few miles from Dunnville. Neither Prof. Macoun nor myself have seen Canadian specimens of this plant, but believe the stations named to be authentic.

2. *Polygala incarnata*, L. Found in rocky places on the Niagara River, near the Falls, by Douglas in 1823, and not since detected.

3. *Silene stellata*, Ait. Also found by Douglas in 1823 in dry stony places on the Niagara River and not since seen.

4. *Silene nocturna*, L. Observed growing near Fort Erie in 1881 by Mr. Day, but not collected since.

5. *Hypericum Sarothra*, Mx. Recorded in Torrey and Gray's Flora as a native of Canada, but we have no proof of its occurrence. As Prof. Macoun says, however, it may be found in sandy soil along Lake Erie.

6. *Baptisia leucantha*, T. & G. Not detected since the time

of Goldie, who records it as occurring in rich alluvial soil on the shore of Lake Erie. I am myself of the opinion that *Baptisia tinctoria*, which occurs as described, is the species referred to, but am at a loss to understand how such an error could have been made. It is of course quite possible that I am wrong in my conjecture and that *Baptisia leucantha*, which is a native of Ohio, may yet be rediscovered.

7. *Sedum ternatum*, Mx. Rocks in the Niagara River and Lake Erie (*Douglas*, 1823); vicinity of Hamilton, Ont. (*Buchan*) Prof. Macoun says this is a doubtful species and should be carefully looked for and verified.

8. *Ludwigia alternifolia*, L. In swamps, Canada. (*Hooker*, Fl. Bor. Am.—*Torrey and Gray*, Fl. N. Am.) Another doubtful species. No exact locality is ascribed for it by these authors, but if it occurs with us at all it will probably be along the Lake Erie shore.

9. *Archangelica hirsuta*, T. & G. Both Pursh and Michaux credit this species to Canada, but do not say to what part. If found it will almost certainly be in the neighborhood of Lake Erie.

10. *Liatris squarrosa*, Willd. Dry gravelly or sandy soil, Western Ontario (*Gray*) Neither this species nor its variety *intermedia*, D C., which occurs in the same situations as the type, have been noticed by any of the late collectors.

11. *Helianthus parviflorus*, Bernh. Thickets in alluvial soil in Western Ontario (*Goldie*, vide *T. and G.*, Fl. N. Am.)

12. *Cacalia atriplicifolia*, L., (Indian Plantain) Canada (*Cleghorn*, vide *Hooker*) Moist woodlands, Western Ontario (*T. and G.*) Not collected recently.

13. *Krigia Virginica*, Willd. Sandy ground, Western Ontario (*Gray*)

14. *Sabbattia angularis*, Pursh. Rich soil, Western Ontario (*Gray*) Prof Macoun says that this species as a Canadian plant is unknown to him. My friend, Mr. Yates, of Hatchley, Ont., tells me he once found a Sabattia in the Erie district but did not know the species and had lost the specimen. It is probable that it was the same as Gray refers to.

15. *Pycnanthemum incanum*, Mx. Dry soil, Canada (*Goldie*) New England to Western Canada (*Gray*) Hamilton, Ont. (*Logie*)

Prof. Macoun says he has never seen a Canadian specimen, nor have I myself.

16. *Monarda Clinopodia*, L. Western Canada to Illinois (*Gray*) Prof. Macoun knows nothing of this species as a Canadian plant. It is to be looked for in the Lake Erie region.

17. *Scutellaria canescens*, Nutt. River banks, Western Ontario (*Gray*) Canada (*Goldie*) Prof. Macoun has no knowledge of Canadian localities for this species. If found it will probably be along Lake Erie.

18. *Anychia dichotoma*, Mx. Shore of Lake Erie, Norfolk Co., 1867 (*Dr. Nichol*) Has not been since reported.

19. *Corallorhiza odontorhiza*, Nutt. Woods along Lake Erie, Norfolk Co. (*Dr. Nichol*) It is also recorded from Halifax, Montreal, and Hamilton, but it is more than likely that all these references should be to *Corallorhiza innata*, as all the specimens, so-called, seen from those localities by Prof. Macoun have been that species. If it really occurs with us it will be in the Erie District only, I think.

20. *Pogonia pendula*, Lindl. Damp woods, Canada (*Goldie*, vide *Hook.*, Fl. Bor.-Am.) Prof. Macoun has never seen a Canadian specimen. Must inhabit the Erie region if it occurs at all.

21. *Melanthium Virginicum*, L. Upper Canada (*Hooker*) Prof. Macoun has never seen a Canadian plant of this species either. It is to be looked for along the Lake Erie shore.

22. *Aristida dichotoma*, L. Port Colborne, Lake Erie (*McGill Coll. Herb.*) Another, and the last, of these plants of which Mr. Macoun has seen no Canadian specimen.

Species restricted in Canada (so far as known) to the Lake Erie District.

1. *Ranunculus ambigens*, Watson. In inundated places or mud. Southern part of Ontario (*Goldie*) Vicinity of Port Colborne (*McGill Coll. Herb.*)

2. *Magnolia acuminata*, L., (Cucumber-tree) The only recorded station for this is Falls of Niagara on the authority of

L'Abbé Provancher. Whether he considers it introduced or not I am unable to say, but I should most certainly judge that it is.

3. *Asimina triloba*, Dunal, (American Papaw) Rich low woods near the railway below Queenston Heights; very abundant on Pt. Pelee and in the townships bordering Lake Erie between that point and Amherstburgh; doubtless not rare along Lake Erie but not reported (*Macoun*)

4. *Nelumbium luteum*, Willd., (Water Chinquepin) Reported as found in the Detroit River, at the entrance from Lake Erie to the Welland Canal, and near Burnham's Island in Grand River, a few miles from Dunnville, Ont.

5. *Corydalis flavula*, D C., (Yellow Corydalis) Abundant around the stone quarry on the north end of Pelee Island, and on Pt. Pelee (*Macoun and Burgess*). Pt. Abino on Lake Erie (*Day*)

6. *Sisymbrium Thaliana*, Gaud. Pt. Abino, Lake Erie. This is our only recorded station, but Mr. Day, who discovered it, says it is abundant and he thinks indigenous.

7. *Viola pedata*, L., (Bird-foot Violet) The sole known locality we have for this very handsome species is Tp. of Charlotteville, Norfolk County, Ont., where it is very abundant in open sandy soil (*Burgess*) My specimens exhibit both the type and the var. *bicolor* of Pursh. All other recorded references to this species refer to *Viola delphinifolia* of Nutt., which is common on the western prairies.

8. *Viola palmata*, L. This, the *Viola cucullata*, var. *palmata* of Gray's Manual, is recorded only from damp woods near Amherstburgh, Ont. (*Macoun*)

9. *Polygala incarnata*, L. Found in rocky places on the Niagara River, near the Falls, by Douglas in 1823.

10. *Silene stellata*, Ait. Also found by Douglas, in 1823, in dry, stony places on the Niagara River.

11. *Silene nocturna*, L. Observed growing at Fort Erie, Ont., in 1881 (*Day*)

12. *Dianthus armeria*, L., (Deptford Pink) Introduced into the waste ground between Niagara Falls and the Canada Southern Railway (*Macoun*)

13. *Cerastium oblongifolium*, Torr. Low sandy woods close to Amherstburgh; Pt. Pelee and Pelee Island (*Macoun and Burgess*) A rare and beautiful species.

14. *Hypericum Sarothra*, Mx. In Torrey & Gray's Flora this species is recorded as a native of Canada, but we have no proof of its occurrence.

15. *Hibiscus moscheutos*, L., (Swamp Rose-Mallow) It is one of the handsomest flowers I know. Bright rose color or white, the blossoms often measure from 3-6 inches in diameter. Islands in the Detroit River (*Maclagan*) Marsh at the junction of Pt. Pelee to the main land (*Macoun and Burgess*) Roadside near Windsor, Ont. (*Dr. Kemp*) Islands in Niagara River (*Day*)

16. *Ptelea trifoliata*, L., (Shrubby Trefoil) Pelee Island (*Macoun*) West side of Pt. Pelee (*Macoun and Burgess*) A few specimens on the lake shore above Fort Erie, Ont. (*Day*)

17. *Euonymus atropurpureus*, Jacq., (Burning Bush) In shady woods and open thickets. White Island, opposite Amherstburgh (*Macoun*) Amherstburgh, Ont. (*Maclagan*)

18. *Trifolium reflexum*, L., (Buffalo Clover) Islands in the Detroit River (*Maclagan*) About Sandwich and Amherstburgh (*Douglas*)

19. *Tephrosia Virginiana*, Pers., (Goat's Rue) Covering acres of sandy soil along the Lake Erie shore on the 1st and 2nd Concessions of Charlotteville Tp., Norfolk Co. (*Burgess*)

20. *Onobrychis sativa*, Lam. Introduced at Pt Abino, near Fort Erie, Ont. (*Day*)

21. *Desmodium canescens*, DC. Amherstburgh, Ont. (*Maclagan*) Abundant in low sandy thickets at Pt. aux Pins and Pt. Pelee, Lake Erie, Ont. (*Burgess*)

22. *Desmodium ciliare*, DC. Dry sandy thickets, Queenston Heights, 1877 (*Macoun*)

23. *Baptisia leucantha*, T. & G. Not detected since the time of Goldie, who records it as occurring in rich alluvial soil on the shore of Lake Erie.

24. *Gleditschia triacanthos*, L., (Three-thorned Acacia) A number of trees of this species were found by Prof. Macoun and myself, in the summer of 1882, growing in the sand dunes on Pt.

Pelee. The Professor's surmise is that the seeds had drifted across the lake from Ohio, as sand is not the true habitat of this species. It is quite a common tree in cultivation throughout Ontario.

25. *Geum vernum*, T. & G. Open, damp woods, Amherstburgh, Ont. (*Macoun*)

26. *Agrimonia parviflora*, Ait. Woods near Amherstburgh, Ont. (*Maclagan and Macoun*) This is probably the form referred to as *Agrimonia Eupatoria*, var. *parviflora* by Hooker in his "Flora Boreali-Americana."

27. *Rosa setigera*, Mx., (Climbing Rose) Borders of thickets and along fences about Amherstburgh, and on Pelee Island (*Macoun*)

28. *Cratægus Crus-galli*, L., (Cockspur Thorn) Abundant on Queenston Heights and westward to Amherstburgh, where also it was recorded by Maclagan (*Macoun*) About Lake Erie (*Douglas*)

29. *Saxifraga Pennsylvanica*, L. Low places near Fort Erie, Ont. (*Day*)

30. *Heuchera Americana*, L. Woods near Amherstburgh, Ont. (*Maclagan and Macoun*)

31. *Ludwigia alternifolia*, L. In swamps, Canada (*Torrey and Gray*, Fl. N. Am. *Hooker*, Fl. Bor.-Am.) A species of very doubtful occurrence in Canada.

32. *Lythrum alatum*, Pursh. Amherstburgh, Ont. (*Maclagan*) Low wet sandy places at Pt. Edward, Ont. (*J. M. Macoun*) In ditches along the G. W. Railway, four miles east of Windsor, Ont. (*Macoun*)

33. *Opuntia Rafinesquii*, Englm. In the sand at the southern end of Pt. Pelee (*Macoun and Burgess*) Said also to grow on Long Pt., Lake Erie.

34. *Thaspium barbinode*, Nutt. Foster's Flats, Niagara Falls, and on the Canada Southern Railway, between Colchester and Amherstburgh (*Macoun*) Chippewa and Detroit River (*Maclagan*) Pt. aux Pins, Lake Erie (*Burgess*) The referring of this species to London, Ont., on my authority by Prof. Macoun in Part I. of his Catalogue is a mistake, the specimen should have been placed under *T. aureum*.

35. *Berula angustifolia*, Koch. Near Port Colborne, Ont., July, 1882 (*Day*)

36. *Chærophyllum procumbens*, Crantz. Abundant on White Island, in the Detroit River, opposite Amherstburgh (*Macoun*)

37. *Archangelica hirsuta*, T. & G. Both Pursh and Michaux credit this species to Canada, but do not say where found.

38. *Archemora rigida* DC., (Cowbane) Sandy swamps near Colchester Station on the Canada Southern Ry. (*Macoun*) Amherstburgh (*Maclagan*) Leamington, Ont. (*Burgess*) Port Colborne, Ont. (*McGill Coll. Herb.*)

39. *Cornus asperifolia*, Mx., (Rough-leaved Cornel) Growing in sand on Pt. Pelee, Lake Erie (*Macoun and Burgess*)

40. *Nyssa multiflora*, Wang., (Pepperidge) One tree was seen in a field at Bismarck on the Canada Southern Railway (*Macoun*) Abundant in a swamp near Leamington, Ont. (*Macoun and Burgess*) Common report makes this a plentiful tree in many swamps, hence called "pepperidge swamps," in Essex Co., Ont.

41. *Galium pilosum*, Ait., (Hairy Galium) Vicinity of Queenston, Ont., and in sand at the southern extremity of Pt. Pelee (*Macoun*) Amherstburgh (*Maclagan*) Pt. aux Pins, Lake Erie (*Burgess*)

42. *Fedia olitoria*, Vahl. Sparingly introduced along Lake Erie, near Port Colborne, Ont. (*Day*) Amherstburgh (*Maclagan*)

43. *Vernonia Noveboracensis*, Willd., (Iron-weed) Canada (*Pursh*) Close to the railway station at Essex Centre, Ont. (*Macoun*) Amherstburgh (*Maclagan*) Prof. Macoun states that the Essex Centre reference should possibly be to *Vernonia altissima*, as only the leaves were obtained.

44. *Vernonia altissima*, Nutt. In damp places, St. Clair Flats (*J. M. Macoun*) Along the G. W. Railway and margins of fields, near Windsor, Ont. (*Macoun*)

45. *Mikania scandens*, L., (Climbing Hemp-weed) Moist shady places along streams. Amherstburgh (*Maclagan*)

46. *Liatris squarrosa*, Willd. Dry gravelly or sandy soil, Western Ontario (*Gray*)

47. *Liatris spicata*, Willd. Not uncommon in marshy meadows between Pt. Edward and Sarnia, Ont. (*J. M. Macoun*) Abundant in low sandy soil at Leamington, Ont. (*Burgess*)

48. *Aster ericoides*, Ait., var. *villosus*, T. & G. Port Stanley, Ont. (*Burgess*) Windsor, Ont. (*Macoun*)

49. *Silphium perfoliatum*, L., (Cup Plant) Rich soil along streams. Islands in Detroit River (*Maclagan*) In thickets along margins of fields, Windsor, Ont. (*Macoun*)

50. *Heliopsis lævis*, Pers. Dry thickets. St. Catharines and Amherstburgh, Ont. (*Maclagan*)

51. *Helianthus parviflorus*, Bernh. Thickets in alluvial soil in Western Ontario (*Goldie* vide *T. and G.*, Fl. N. Am.)

52. *Actinomeris squarrosa*, Nutt. Islands in Detroit River (*Maclagan*) Roadsides and along banks of River Thames, Chatham, Ont. (*Macoun*)

53. *Coreopsis trichosperma*, Mx., var. *tenuiloba*, Gr. Islands in Detroit River (*Maclagan*) Edge of marsh at junction of Pt. Pelee to main land (*J. M. Macoun*) Border of marsh at Rondeau, Lake Erie (*Macoun*)

54. *Coreopsis tripteris*, L. Amherstburgh and islands in Detroit River (*Maclagan*) Around marshes and along the G. W. Railway, near Windsor, Ont. (*J. M. Macoun*)

55. *Coreopsis verticillata*, L. Moist places and margins of swamps, Western Canada (*Gray*) On the beach near a marsh, a little west of Rondeau, Lake Erie (*Macoun*)

56. *Dysodia chrysanthemoides*, Lag. Rare. A railroad weed at Fort Erie, Ont. (*Day*)

57. *Cacalia atriplicifolia*, L., (Indian Plantain) Canada (*Cleghorn* vide *Hooker*) Moist woodlands, Western Ontario (*Torrey and Gray*)

58. *Krigia Virginica*, Willd. Sandy ground, Western Ontario (*Gray*)

59. *Lactuca Floridana*, Gærtn. Islands in Detroit River (*Maclagan*)

60. *Fraxinus quadrangulata*, Mx., (Blue Ash) Pelee Island (*Macoun*) Pt. Pelee, Ont. (*Macoun and Burgess*)

61. *Asclepias purpurascens*, L., (Purple Milkweed) Amherstburgh and islands in the Detroit River (*Maclagan.*)

62. *Sabbatia angularis*, Pursh. Rich soil, Western Ontario (*Gray*)

63. *Gentiana Saponaria*, L. Moist woods, Western Ontario (*Gray*) Fort Erie, Ont. (*Day*)

64. *Phlox subulata*, L., (Ground or Moss Pink) Sand hills near Simcoe, Norfolk County *(Dr. Nicholl)* Near Cayuga, Ont. *(Wilkins)* Very showy and abundant in sandy soil near Lake Erie, Charlotteville Township, Norfolk County, Ont. *(Burgess)*

65. *Gilia coronopifolia*, Pers. Introduced at Port Dover, Ont., 1888 *(A. W. Hanham)*

66. *Mertensia Virginica*, DC. Alluvial banks. Pt. Abino, Lake Erie *(Day)*

67. *Ipomœa pandurata*, Meyer, (Man-of-the-Earth) Dry ground, Western Ontario *(Gray)* In warm gravelly soil toward the southern end of Pt. Pelee *(Macoun and Burgess)*

68. *Cuscuta compacta*, Juss. Credited to Canada by Dr. Gray. Amherstburgh *(Maclagan)*

69. *Solanum Carolinense*, L. Sandy and waste grounds near Fort Erie, Ont. *(Day)*

70. *Gerardia purpurea*, L. Low and moist grounds, Canada *(Gray)* Niagara Falls and Pt. Pelee *(Burgess)* Windmill Point, Lake Erie *(Day)* The var. *paupercula* is common from the Province of Quebec to the Saskatchewan.

71. *Tecoma radicans*, Juss. (Trumpet Creeper) This species is either indigenous on Pelee Island and Pt. Pelee, or it has become so naturalized as to run wild and appear to be native. It is cultivated in other parts of Ontario as a garden flower for covering trellis-work.

72. *Pycnanthemum linifolium*, Pursh. Low wet meadows. Pt. Edward, Ont., 1884 *(J. M. Macoun)*

73. *Pycnanthemum muticum*, Pers., var. *pilosum*, Gr. Pt. aux Pins and Leamington, Lake Erie *(Burgess)*

74. *Melissa officinalis*, L. (Common Balm) Waste ground, Pelee Island *(Macoun)* Well established in two or three places at Niagara Falls, Ont. *(Burgess)*

75. *Monarda clinopodia*, L. Western Canada to Illinois *(Gray)*

76. *Lophanthus scrophulariæfolius*, Benth. Borders of thickets along the slopes of Queenston Heights, one mile beyond Queenston Station *(Macoun)*

77. *Scutellaria canescens*, Nutt. River banks, Western Ontario *(Gray)* Canada *(Goldie)*

78. *Plantago cordata*, Lam. Along streams. Canada *(Pursh)* Amherstburgh (*Maclagan*) Ditches and swamps along the Canada Southern R'y. at Colchester Station, near Amherstburgh (*Macoun*)

79. *Anychia dichotoma*, Mx. Shore of Lake Erie, Norfolk Co., 1867 (*Nicholl*) Has not been reported since and should be looked for in South-western Ontario.

80. *Amarantus blitoides*, Wat. Well established at Pt. Edward, near Sarnia, Ont., 1884 (*J. M. Macoun*) Probably a railway introduction.

81. *Chenopodium ambrosioides*, L., var. *anthelminticum*, Gray. Lake shore, Fort Erie, Ont. (*Day*)

82. *Morus rubra*, L., (Red Mulberry) Rich woods bordering Lake Erie. Not uncommon from Niagara along the river to the Whirlpool; common on Pelee Island and frequently met with in the woods at Amherstburgh and northward to Windsor (*Macoun*) Sandy soil, Leamington, Ont. (*Burgess*)

83. *Morus alba*, L., (White Mulberry) Niagara Falls (*Macoun*) Sandy plains, Sarnia, Ont. (*Burgess*)

84. *Carya tomentosa*, Nutt., (White-heart Hickory) Rather rare in the Niagara Peninsula from Lake Ontario to Lake Erie (*Macoun*)

85. *Carya porcina*, Nutt., (Pig-nut or Broom Hickory) Not uncommon in the Niagara Peninsula in woods along base of Queenston Heights, about Niagara Falls, and at many points along Lake Erie to Amherstburgh and northward as far as Windsor, Ont. (*Macoun*)

86. *Juglans nigra* L., (Black Walnut) Once the commonest wood in the district of which we are speaking, and still plentiful in places from Niagara Falls to Amherstburgh (*Macoun and Burgess*)

87. *Quercus Prinos*, L., (Rock Chestnut-Oak) From the Niagara River, along Lake Erie, to Amherstburgh (*Macoun*) Common at Pt. Pelee (*Burgess*) Pt. Abino (*Day*)

88. *Quercus palustris*, Du Roi, (Pin Oak) Abundant in wet woods below Queenston Heights and along Lake Erie and the Detroit River to Windsor (*Macoun*) Pt. Abino (*Day*) Leamington (*Burgess*)

89. *Corallorhiza odontorhiza*, Nutt. Woods along Lake Erie, Norfolk Co. (*Nicholl*)

90. *Pogonia pendula*, Lindl. Damp woods, Canada (*Goldie* vide *Hook.*)

91. *Habenaria ciliaris* R.Br. Canada (*Goldie*) Low sandy soil, Leamington, Ont. (*Burgess*)

92. *Aletris farinosa*, L., (Colic root) Sandy thickets, Leamington, Ont., 1887 (*Burgess*)

93. *Smilax quadrangularis*, Pursh. Thickets in damp woods, Pt. Pelee (*Macoun*) Low woods near Leamington (*Burgess*)

94. *Camassia Fraseri*, Torr. White Island in the Detroit River opposite Amherstburgh, 1882 (*Macoun*)

95. *Erythronium propullans*, Gr. Rich soil, near St. Thomas, Ont., 1882 (*Macoun*)

96. *Melanthium Virginicum*, L. Upper Canada (*Hooker*)

97. *Juncus acuminatus*, Mx., var. *legitimus*, Englm. Shore of Lake Erie at Pt. Pelee and at Essex Centre (*Macoun*)

98. *Potamogeton pauciflorus*, Pursh., var. *Niagarensis*, Gray. Rapids above Niagara Falls (*Burgess*) Niagara River, near the brink of the "Hog's Back" (*Tuckerman*)

99. *Cyperus erythrorhizos*, Muhl. Pt. aux Pins, Lake Erie, Ont. (*Burgess*)

100. *Carex Steudelii*, Kunth. On banks along the lake at Port Stanley, 1882 (*Macoun*)

101. *Carex cephalophora*, Muhl., var. *angustifolia*, Boott. Abundant in rocky, grassy thickets on Pelee Island, Lake Erie (*Macoun*)

102. *Carex virescens*, Muhl. Open woods, Niagara Falls, Essex Centre and Amherstburgh (*Macoun*) Low woods, Leamington (*Burgess*)

103. *Carex triceps*, Mx. Abundant in rocky thickets, Queenston Heights and Foster's Flats, Niagara Peninsula (*Macoun*)

104. *Carex grisea*, Wahl. Damp thickets, Port Dover Junction, Elgin Co., Ont. (*Macoun*)

105. *Aristida dichotoma*, L. Port Colborne, Lake Erie (*McGill Coll. Herb.*)

106. *Triplasis purpurea*, Chap. Sandy shore, Pt. Pelee and Pt. aux Pins (*Burgess*)

107. *Eragrostis major*, Host. Introduced along the railway at Pt. Edward, near Sarnia, Ont. (*J. M. Macoun*) Windsor, Ont. (*Macoun*)

108. *Eragrostis Purshii*, Schrad. Introduced along the railway. In fields at Port Colborne and Windsor (*Macoun*)

Species in Canada almost restricted (so far as known) to the Lake Erie District.

1. *Cimicifuga racemosa*, Nutt., (Black Snake-root) Rich woods, Cayuga, Haldimand Co. (*Maclagan*) Norfolk Co. (*Nicholl*) Squaw Island, Niagara River (*Day*) Also found by Mr. Geo. Prescott in the vicinity of Galt, Waterloo Co., Ont.

2. *Liriodendron Tulipifera*, L., (Tulip-tree. White-wood) Though extending throughout the western peninsula of Ontario, from Hamilton to the Township of Tuckersmith, Huron Co., it is really only found plentiful and in perfection in what may be called the Lake Erie District, where, with the black walnut, it once formed the great bulk of the forest. When covered with its large tulip-shaped blossoms, about the first of July, it forms an object of beauty that once seen can never be forgotten.

3. *Lechea major*, Mx., (Greater Pinweed) Sandy woods near Port Dover Junction (*Macoun*) Sandy soil, Windsor, Ont. (*J. M. Macoun*) Pt. Pelee (*Burgess*) Also found by myself in sandy woodlands at London, Ont.

4. *Polygala sanguinea*, L. Sandy ground, Sandwich, Ont. (*Maclagan*) Pt. Pelee, Ont. (*Burgess*) Windsor, Ont. (*J. M. Macoun*) Also reported by Logie and Buchan as occurring in dry ground at Hamilton, Ont.

5. *Silene Virginica*, L., (Fire Pink) Islands in the Detroit River (*Maclagan*) but also reported from Lake Huron by Dr. Todd. This is probably the species referred to by Hooker, in his "Flora Boreali-Americana," as *Silene Pennsylvanica*, occurring on rocky islands on the north side of Lake Erie, he not having seen the specimens.

6. *Vitis æstivalis*, Mx. Abundant on Pelee Island and Pt. Pelee; Foster's Flats below the Whirlpool, Niagara River; and in thickets around Queenston Heights (*Macoun*) Vicinity of Hamilton, Ont. (*Buchan*)

7. *Baptisia tinctoria*, R.Br., (Wild Indigo) Sandwich, Ont. (*Maclagan*) Sandy thickets near Leamington, Ont. (*Macoun and Burgess*) Oak-wooded plains of Charlotteville Tp., Norfolk Co. (*Yates*) Windsor, Ont., in sandy thickets (*J. M. Macoun*) Vicinity of Hamilton, Ont. (*Logie*)

8. *Poterium sanguisorba*, L. Well established at Pt. Abino on Lake Erie (*Day*) This species was detected during the past summer by our fellow-member, Mr. J. Alston Moffatt, in Halton Co., where he reports it as becoming quite a troublesome garden weed.

9. *Sedum ternatum*, Mx. Rocks along the Niagara River and Lake Erie (*Douglas*) Vicinity of Hamilton, Ont. (*Buchan*) As Prof. Macoun says this is a doubtful species and should be carefully looked for, and, if possible, verified.

10. *Aster dumosus*, L. South-western Ontario (*Maclagan*) Dry thickets, Windsor, Ont. (*Macoun*) Vicinity of Hamilton, Ont. (*Logie*)

11. *Gnaphalium purpureum*, L. Abundant amongst grass at Port Colborne, Ont. (*Macoun*) Common about Victoria, B. C. (*Fletcher*)

12. *Silphium terebinthinaceum*, L., (Prairie Dock) Open woods and grassy banks, Cayuga and Amherstburgh, Ont. (*Maclagan*) Along the G. W. Railway, east of Paris, Ont. (*Prescott*)

13. *Artemisia caudata*, Mx. Half-way Island, Detroit River, Ont. (*Maclagan*) Gravel ridge, west of Fort Ellice, Manitoba (*Macoun*)

14. *Krigia amplexicaulis*, Nutt. Damp grassy thickets around Amherstburgh (*Macoun*) Islands in Detroit River (*Maclagan*) Near Lake Winnipeg (*Dr. Houghton*)

15. *Vaccinium stamineum*, L. (Deerberry) Whirlpool below Niagara Falls (*Maclagan*) Dry rocks, Thousand Islands in St. Lawrence River (*Macoun*)

16. *Steironema lanceolatum*, Gr. Low grounds and thickets, Western Ontario (*Gray*) Pt. Abino, Lake Erie (*Day*) London, Ont. (*Burgess*)

17. *Acerates longifolia*, Ell. Sandy shore, Pt. Pelee (*Macoun*) Sand beach at Pt. Edward, Lake Huron, Ont. (*J. M. Macoun*)

18. *Hydrophyllum appendiculatum*, Mx. Abundant in thickets at Pt. Pelee (*Macoun*) Amherstburgh (*Maclagan*) London, Ont. (*Burgess and Saunders*)

19. *Lithospermum latifolium*, Mx. Open ground and borders of thickets, Western Ont. (*Gray*) Bois Blanc and other islands in Detroit River (*Maclagan*) Alluvial flats of Thames, London, Ont. (*Burgess*)

20. *Veronica Virginica*, L., (Culver's Physic) Moist woods and banks from Canada and the Winnipeg valley southward (*Gray*) Islands in Detroit River (*Maclagan*)

21. *Pycnanthemum incanum*, Mx. Dry soil, Canada (*Goldie*) New England to Western Canada (*Gray*) Hamilton, Ont. (*Logie*)

22. *Chamælirium Carolinianum*, Willd. Swamp near Brantford, Ont. (*Yates*) Canada (*Gray*) Niagara River (*Day*)

23. *Eriophorum lineatum*, Benth. & Hook. Pt. aux Pins (*Burgess*) Low ground at the southern end of Pt. Pelee (*Macoun and Burgess*) Gravelly river flat, London, Ont. (*Burgess and Millman*)

24. *Panicum scoparium*, Lam. Sandy woodlands, Pt. Pelee (*Burgess*) Pacific Coast (*Macoun*)

25. *Cenchrus tribuloides*, L. Port Colborne, Ont. (*McGill Coll. Herb.*) Pt. Pelee and Pt. aux Pins (*Burgess*) G. W. Railway, a mile east of Dundas (*Logie*)

26. *Muhlenbergia diffusa*, Schreb. Above the canal at Port Colborne, in grassy woodlands (*Macoun*) Pt. Pelee (*Burgess*) Hamilton, Ont. (*Buchan*)

SYNOPSIS OF A LECTURE ON POTTERY, PORCELAIN AND KERAMIC ART.

Delivered before the Hamilton Association, March, 1889.

BY. S. JOHN IRELAND,

Principal of the Hamilton Art and Technical School.

Introduction (*Ancient*)—Among the early nations of antiquity, before the art of writing had come into general use, tradition was the only mode of preserving and spreading a knowledge of remarkable events. Hieroglyphic writing followed, and from the hieroglyphs of ancient Egypt, in the most remote period of that country's history, we see reference to the potter's art. Later we have the picture writing on the vases of the old Greeks.

Many circumstances contributed to give the early traditions a fabulous character—the love of the marvellous, a natural tendency of the mind to employ symbolical and allegorical images to express ideas for which no definite words had been appropriated, and a disposition to eulogize and exaggerate the exploits of ancestors, all conspired to load history and fact with a mass of fiction, so that it became impossible for later enquirers to distinguish accurately between the true and false. One thing with regard to Egyptian art, not of Pottery only, but of every other section, we find it at the highest stage of development then known; no incubative period, few gourd and vegetable shapes, for the potter's wheel was known; not so with the Mexicans, the Hindoos and other races considered by ethnologists as belonging to the pre-historic period.

Introduction (*Modern*)—The singular interest displayed and excited in late years on the subject of pottery, is at this time bearing remarkable fruit, in the shape of a widespread effort to produce forms and surface decoration on forms that shall rival those done in such old times as are regarded as being peculiarly rich in artistic light and insight. The rivals of the ancient works are seen daily in increasing numbers, in varying beauty, and of diverse colors and characters. Scarcely a month passes now without some addition being made to the number of vases decorated by new methods, which take the im-

press of the individual minds that have invented them. We have thus had revivals in Majolica, Faience, Lustred-ware, etc., and with all we may say truly, that as examples of pottery, that is, more especially in the mechanical and material construction of the new wares, they greatly excel the old ones in perfect finish, durability and chemical composition of their parts, both in body and glaze. But this is not everything, and it is well known and seen that the ancient works and those of the Renaissance excel our own in their taste, artistic freedom and wealth of ideas. In these particulars we have much to do to equal, and still more to do to excel, these old world productions of the potter's art.

What Pottery is.—At the risk of saying what nearly all already know, I wish to make clear what pottery is. A pot is a vessel made of clay, and clay is that natural substance produced by the grinding and washing down into hollows, or places where it can settle, of many sorts of rocks, and as the rocks are of many qualities and consistencies, so are the clays. But to take a familiar example—the clay which I have in my hand if thrown on the potter's wheel, then made into a flower pot, for instance, and allowed to dry, would keep its form in every particular, except having shrunk by the evaporation of the moisture from the clay. This pot if exposed to the sun, in a hot climate, would have still more water drawn from it, and in consequence would become harder and closer in texture, and might be used for many indoor purposes, but would not allow of any use that involved the contact with water as it still would be a mere clay pot; if, however, it be put in the fire so that so much more of the water be driven out as will change its hardness to that of a tile or brick, then fluid might be put into it without any risk of its receding to the clay state, or crumbling into bits or flakes. When water has once been driven out of clay by the action of fire it remains a piece of pottery for ever. It is not, however, the mere expelling of the water from the clay which turns it into pottery, but the action of fire fuses some of the more readily fusible particles of the clay formation into an indissolvable homogeneous mass; but with most clays this ware is absorbent, a brick, for example, will suck up a pint of water and not dissolve.

A bit of clay, after firing, may be either white, yellow, red, grey, bluish, black, or any or all of these together—color being a condition solely due to the presence of other qualifying minerals or metals in the vicinity of the clay bed. For example—clay from an iron district

would be somewhat the color of iron chemically treated by natural causes, mostly by oxidation; or from the vicinity of springs containing sulphur, iron and copper, would be of a *greenish* tint; when these mix with cobalt, hæmatite or manganese, *black* is the result. In white clay, cobalt or black neutralizes and has the effect of whitening, as the blue does in the laundry. The white clays are found near silver beds, quartz, silicate of lime, felspar and oxides of tin and silver.

Terra Cotta.—Now our flower pot or piece of Terra Cotta has certain characteristics; it is somewhat brittle, porous, gives a dry, adhesive sensation to the tongue, is more or less gritty to the touch, and on the whole not a very useful thing for the higher purposes of civilized life. But for many ages the pottery was of this rough kind, as seen by the drawings, photographs and diagrams hung around the room to illustrate the lecture. It is very doubtful if the Greeks ever, or the Romans up to the time of Augustus, knew of any other kind of pottery. The next stage was to find out either a clay which would fuse, so as to be non-porous, or to coat a porous body with a non-porous coating of glaze (glaze simply meaning a film of glass) The former process, that of rendering the body impervious, applies mainly to two kinds of ware: 1st, *China*, or as it is sometimes called *Porcelain*, made from Kaolin clay; and 2nd, *Stoneware.*

It will be seen, therefore, that the potter's art is progressive. The "sun dried," gave place to "fired earthenware" or terra cotta, and this in turn gave place to "glazed earthenware," which was impervious to moisture, dirt and ordinary chemicals, including most acids, which practically means the ware was quite indestructible.

Antiquity of Glazed Ware.—Certainly the potters of Babylon knew the process of glazing, as the fragments of tiles still in existence show; but many centuries elapsed before the secret of manufacture was transmitted to the western world. Specimens of glazed pottery of decidedly moresque origin have been found in Spain, and could not have been later than the 9th century.

Glaze.—Glaze and glass are made out of the same materials. Flint, sand and soda, when fused together, make glass; the addition of a metallic oxide gives color, opacity and the better power of cohesion to glass; and these are precisely the conditions of glaze as applied to pottery. Some writers try to distinguish between "pottery" and

"porcelain" by the opaque body of the former, and the semi-translucent body of the latter; but as the history of both arts is so intimately blended and they naturally result from each other, we shall by noticing them together prevent confusion.

Origin of Porcelain.—This kind of ware was known in China B. C., but is believed to have been perfected about A. D. 1000. Marco Polo describes it, in the 14th century, but it was only generally introduced into Europe by the Portugeese, in the beginning of the 16th century, who called it *porcellana*, meaning "little pig." This name had been given to the cowrie shell from the similarity of its shape to the back of a little pig, hence when they saw this remarkable pottery of white color, glazed like the surface of shells, they gave it the same name, with the idea of conveying to their countrymen some notion of its beauty, or possibly from a persuasion that it was made from such shells, but in fact from Kaolin.

Kaolin.—Kaolin, or, as it is called in England, china or Cornish clay, is the result of the natural decomposition of granitic rocks. When used alone it is opaque, but is made translucent by the addition of "petrunse" or "china-stone," containing much unchanged felspar, known as "flux"; the felspar in the Kaolin having lost its alkali and become converted into earth. It is somewhat curious to observe that all the old potteries were in close proximity to rivers, and to rivers more or less subject to periodical inundations—for example, the Nile, the Euphrates, the rivers of Italy and Greece, and even the Thames and Seine. Countless theories have been propounded and hundreds of volumes written respecting the discoveries of pottery, but it is only when we review a collection such as is in the Historical Museum of fictile productions at Sevres, that an analysis of known stages and gradations, affords a basis for a sound theory respecting those early steps of advancement, concerning which we can obtain little or no information in a definite form, and for which we must to a great extent rely on conjectural evidence. The collection of Greek and Etruscan vases in the British Museum, London, is not only a history of these countries through their glorious epochs, but actual scenes are depicted, which to the modern scholar are classified in the world of myth.

Ancient Vases.—The names of ancient vases, according to Gerhard, were next given, and their forms and uses explained from

drawings, diagrams and photographs. Reference was also made regarding the value of the study of pottery, to the economist, the chymist, the historian and the ethnologist.

The earliest specimens of prehistoric pottery, in shape, resemble vegetable forms—for example, the gourd, the pitcher plant and the acorn cup, also bulbous plants—so much so, that from some specimens of pottery which have stood the ravages of time, we can trace some aboriginal plant forms. The diagrams of prehistoric pottery were then explained, particular attention being called to the Pueblan and Mexican as being a connecting link between earthenware and stoneware. An animal form, which was either a toy whistle, or one used as a signal in times of war was specially commented on. Certainly this instrument, which is the property of Mr. Kennedy, produces a volume of penetrating sound quite out of proportion to its size, and would probably be heard two miles distant.

A diagram showing the potter's wheel and kiln was then shown, such as was used by the Egyptians nearly 3000 years B. C., taken from the sculpture on the tomb of Beni Hassan. It would seem that however universal the production of vessels of baked clay (terra cotta) the art of applying to them a vitrous covering was an invention which emanated from the East; Egypt, Assyria or Babylonia glazes being of two kinds, "Silicious" or glass glaze, and "Plumbaceous" or lead glaze. The use of tin for a white enamel, as recently discovered in the enamelled bricks and vases of Babylonia and Assyria, anticipated by many centuries the rediscovery of that process in Europe during the 15th century, and shows the early application of metallic oxides, which for centuries was the secret of the East only.

Egyptian.—In Egypt and Assyria, enamelling is frequently more used than glazing, and their works are a kind of "faience," consisting of a loose frit or body to which an enamel adheres, after only a slight fusion. Specimens of enamel turquoise, never before or since equalled, have been found in the tombs of Egypt, but only on small articles which could be used as jewellery.

Grecian.—Greek wares are characterized by perfect form, such as modern potters would give all their worldly possessions to even reproduce. They may have been glazed with a thin coating of aluminous soda-glass (without any trace of lead in its composition)

the greater part of which was absorbed into the substance of the "piece," thereby increasing its hardness and leaving only a faint polish on the surface of the ware.

Slip or Engobe.—Pesseri instances the use of glaze on tiles upon a tomb in Bologna, opposite San Domenico, dated about 1100, and further states—but it is not known on what authority—that it was about the year 1300 that the method of covering clay with a "slip" or "engobe" of pipe clay on the coarser earth of Verona was first adopted.

Glaze.—Slightly baked it was glazed with "Marzo Cotto" (oxide of lead and glass) applied wet, and then fired; this glaze was variously colored, yellow, green, black and blue by antimony, iron, manganese and cobalt. A similar method of glazing seems to have been known in Germany, England and France from a remote period, but was not in general use.

Tin Glaze.—It was found by the addition of a certain portion of oxide of tin, to the composition of glass and oxide of lead, that the character of the glaze entirely alters, and instead of being translucent it becomes, on fusion, an opaque and beautifully white enamel (the intervening process of covering the coarse clay with a stratum of white earth being unnecessary) it moreover was found to afford a better ground for the application of ornament. The process of application was the same as for slip. After immersion in the enamel bath and subsequent drying, the painting is applied on the absorbent surface, the piece being then subjected to the fire, which at one application fixes the colors and liquefies the glaze. This enamelled pottery is by far the most important group of glazed wares, being susceptible of decoration by the lustre pigments, as well as by painting in colors, with great delicacy; it comprises the "Hispano-Moresque," the "real Majolica" and the perfected earthenware of Italy and other countries.

Lustres.—The earliest traces of the use of Stanniferous enamel glaze in Europe known to us, is always in connection with a decoration produced by the reduction of certain metallic salts in the reverbatory furnace, leaving a thin film on the surface and giving the beautifully rich effect, known as "reflet metallique," "nacre-cangienté," "Rubino," "Reverberato," and, in England, as "lustred wares." In Italy the use of metallic lustres was apparently known and

practised previous to the introduction of the tin enamel, for we have abundant examples of mezza-majolica from the potteries of Pessaro or Gubbio, glazed only with oxide of lead and glass, which are brilliantly lustred with the metallic colors. None of these can, however, be referred to an earlier date than the latter half of the fifteenth century, when taken from Italian records, which means with us the sixteenth century. The Italians appear to have learned the art from the Moorish potters of Majorca, and named their ware after that island. This seems a reasonable conclusion. Many countries claim the honor of inventing the tin enamel glaze; it undoubtedly came from the East, but Succa della Robia, born 1400, was the first to execute it on a large scale in Europe, hence its name; the secret was kept for two succeeding generations.

Gubbio Ware.—"Gubbio ware" is of the same nature, but different in glaze. Gubbio is a small town in the territory of the Dukes of Urbino and is one of the most famous in the art of pottery. This excellence is chiefly attributed to the talent of one man, Maestro Georgio Andreoli, under whose direction the works at Gubbio produced examples of a special nature. The pieces were decorated with lustre pigments; flashing, brilliant, metallic, ruby, golden and opalescent tints, which vary in every specimen, as they reflect the light directed at varying angles upon the surface.

Faience.—The choicest works of Italian pottery were produced between the years 1480 and 1530. Some of the productions at this time actually bring their weight in gold, and they were not made as thin—far from it—as a specimen of "eggshell." The various names by which the Italian pottery of the "Renaissance" has been known, have in some instances arisen from the names of the places of manufacture, but this fact is often misleading—for example, "Fayenza ware" doubtless derived its appellation from the town of that name, although in French the equivalent "faience" may be either a translation of the Italian or may be derived from a town near Cannes called Fayence.

A description of the Italian "gift pieces" was then given, which cannot be well rendered without the aid of expensive wood cuts or chromo lithographs, and so is omitted.

As no lecture on pottery would be complete without reference to

the prince of potters, Bernard Pallisy, a short biography of this illustrious man was read and reference made to his struggles and the present prices of his wares; only a few months since a small salt cellar being sold for $1,010.

French Ware.—The "Oiron" or "Henri Deux" ware is the most chaste of any yet made; there are but 86 known pieces, and each is worth $5,000—present prices. Very marvellous works in Porcelain, especially flowers and bouquets, were made early in the 17th century at Vincennes, under the patronage of Louis XV. An amusing incident which occurred, at the residence of Madame de Pompadour, with these porcelain flowers was given, showing how perfect was the imitation, even to their being perfumed.

English Potters.—The English potteries were next briefly described. The first earthenware made after the time of Josiah Spode was far from being so good as that at present produced, and several attempts were made to bring out pottery which should be intermediate between earthenware and porcelain. The most successful was that made by Mr. Mason, at Fenton, who, in 1813, took out a patent for "ironstone-china," the body of which was fluxed by the scoriæ of ironstone and the ordinary Cornish stone, but eventually the latter was found sufficient for the purpose. The name "ironstone" remained attached to that class of pottery, which is strong and resistive, but since then earthware has so much improved that *ironstone* has gone out of fashion. The nearest approach to this ware is the *white granite* made for the Canadian and American markets. This ware is richly glazed, is thick, and is manufactured to compete with the French hard porcelain. About fifty manufacturers are specially engaged in making it, and those worked by Messrs. Powel, Meakin, Shaw, Bishop and G. Jones may be considered the largest. It is a curious state of things that the best earthenware is still made for the English home market, while as yet but small quantities of it have been in demand in Canada, the other British colonies and the United States. This statement was made in 1877 by Monsieur Arnoux, the chief director of Messrs. Minton's works at Stoke on Trent. At the present time some of the English ware is so perfect that if it were not opaque it might be mistaken for porcelain, when richly decorated and gilt like that by Messrs. Minton, Wedgwood, Copeland, Furnival, and Brown-Westhead. To give some idea of the extent of the potteries the lecturer said that Messrs. Minton alone employ two

thousand hands, and have about thirty kilns in blast ; in fact in ten square miles in the pottery district one hundred and eighty-five thousand people are employed.

Perhaps the climax of the potter's art may be said to have been reached in Messrs. Doultons' "salt glaze coils" for chemical works, and their ornamental earthen and stoneware. The latter is made from a clay or frit which fuses at white heat, and when the kiln is at this stage a large quantity of common salt is thrown in at the top, which immediately vaporizes and chemically reacts on the surface of the ware, which, on being cooled, presents a perfect glaze; the finest scratches are not filled up, and yet the ware will withstand the action of most acids. Messrs. Doulton, from the first, saw the value of not only making good ware, but that it was necessary to have good artistic decoration on pottery to ensure its demand by the public. They founded the Lambeth Art School expressly to train designers for their works, and engaged the services of Mr. J. Sparkes, the worthy Head Master of South Kensington Art School, to superintend and direct the labors of their staff of already well-trained artists.

The subject of pottery is such a vast one that it is impossible, Mr. Ireland said, to treat of it in a popular way, or to do justice to it in a couple of hours, and mentioned for those who wished to pursue the study, that "Chaffer's Marks on Pottery and Porcelain" was a reliable work for collectors, while "Marryatt's History of Pottery," "Hamilton's Greek and Etruscan vases," "Dennis' cities and cemeteries of Greece and Etruria," should also be read. To enter into the different means of producing colors would more than fill a paper by itself.

Ludwig Ritter, a modern, celebrated writer says: "It is no very easy thing to make intelligible to those who have no love for pottery, who take no delight in the curious and beautiful pieces of china and earthenware, how it is that very many of their fellow mortals, not altogether despicable persons, are possessed of an enthusiastic liking for these things. The truth is that the prevailing love for old china is both deep and wide to the antiquary and to the student of past history. There is this attraction in the Keramic art, that its productions more perfectly adapt themselves to the fashion of thought, to the fancies and ideas of each successive generation of men, than those of any other human industry."

About one hundred specimens of pottery—some of them very valuable—had been loaned by Messrs. J. A. Skinner & Co., A. T. Wood, Esq., and the lecturer, who described when and where each typical specimen was made and how decorated. Several specimens were shown, illustrating an absence of true taste, both on the part of the producer and purchaser—for example, a jug in the form of a fish—who could drink water from the stomach of such a monster without fancying there might be either a nauseous taste or smell with it? Also a pitcher made like a wicker basket—whattle work has its use, but is out of keeping when made of brittle pottery, and pottery, too, to hold fluid.

The process of printing on pottery was then minutely described, also painting over and under glaze, gilding and burnishing, sgraffitto, etc.

The most interesting part of the lecture has, of necessity, to be omitted from this abstract, as it would be unintelligible without chromolithographic illustrations.

NOTES ON THE ORIGN OF CHERT (FLINT) IN THE LOCAL NIAGARA ROCK,

BY COLONEL GRANT.

Read before the Hamilton Association, 9th May, 1889.

I confess I am unable to accept a belief entertained by some members of our Association as well as others also, viz.: that our local "chert" on the brow of the escarpment here was derived from the great number of sponges found in this "band."

Sponges of the Hexactinellid type doubtlessly possessed the power of secreting the silex held in solution in the Primeval Sea to build up what we may call the "skeleton," but it seems quite impossible that a soft, jelly-like organic substance can, *of itself*, produce the hard, flinty matter in our "Macadamizing band" (12 feet in thickness at the head of the Jolley Cut, but eight feet of the upper part was ground down and removed in the "Great Ice Age")

All decaying animal matter appears to me to have possessed the same property of attracting to itself, during the deposition of "the chert band," *silex in solution.* There is scarcely a fossil found in the lower Niagara limestones which does not present a stunted representative of a like individual enveloped in cherty matter. "Stricklandinia" (Billings) and "Pentamerus" may be named as exceptions, flourishing, probably, at a certain depth of water on or contiguous to "Coral Reefs."

I wish to call particular attention to an Echinus of the English chalk (in one of your cases) presented to the Museum by your Curator, Mr. Gaviller, for I think even a hurried examination of this interesting specimen may impress on the memory facts which no words can so clearly convey.

In this "Sea Urchin" we find the entire interior filled with hard flint (chert is merely an impure member of the same family) and since the outer crust is preserved (although the spines are absent, as they usually are now in dead ones) is it not evident that, *the silex filling the interior could only have entered by the minute apertures in a soluble state?* I may be permitted to call attention to remarks made

by Sir Wm. Dawson, in chapter 1, pages 14 and 15, of a recent work, "The Chain of Life," on mineralization by the process of infiltration. The conditions assumed by a Clinton "Farosites" here, is precisely that of the tabulated coral represented in figure 2, when the wall is silicified and the cells filled with silica. It seems more difficult to understand why the spiral coils of some of "the Silurian" and "Carboniferous" Brachiopods, "Spirifera," "Atrypa," etc., are so beautifully displayed in a silicified condition, while the remainder of the interior of the shell is often perfectly hollow.

The Director-General of The Ohio State Survey (Dr. Newberry) mentions a very remarkable instance where a modern plant (or lichen) had stamped its impression on a quartz (silex) pebble by dissolving the flinty material with which it came in contact. The following paragraph occurs, page 111., vol. XI., "Proceedings of The Ohio Survey:" "Some years since, at a meeting of The American Association, the Geologists present were much puzzled by some specimens of the Conglomerate (carboniferous) exhibited by Prof. Brainerd, of Cleveland, in which the impressions of the stems of plants were as distinctly transmitted to the quartz pebbles as to the interspaces of sand."

Prof. Brainerd argued from these specimens that the pebbles were of concretionary origin, and that they bore the marking of the bark of plants because they had been formed in contact with such bark. The recent experiments of THENARD which show that numic acid renders silica readily soluble, afford an easy solution of the problem, and confirm the view taken by the writer upon the occasion referred to above, viz; "that the pebbles had been dissolved away where in contact with the plant." Here we have apparently a well authenticated instance of a modern plant possessing an acid sufficiently strong in its *natural state* to corrode and eat its way into "the quartz." Professor Sollas, now of Trinity College, Dublin, some years ago, pointed out how the silica of sponges was rendered easily soluble and often replaced by "calcite." Unfortunately, I cannot find the paper, which has been mislaid or lost. I am quite satisfied that such is the case. The impure limestones of "The Burton Niagaras" which overlie "the chert band," frequently display a mere outline of the form of *a sponge*, which had disappeared and been replaced by a softer mineral.

On the left bank of the Thames River, near Komoka, I noticed a spring in a wood close to the stream holding silica in solution. There were some fresh-looking chips of hardwood lying at the bottom, and, on fishing them out, I found they were silicified. This spring arises from "Corniferous drift." I cannot say whether it has a deeper origin. "The drift" itself contains a good many white sandstone boulders. So, acidulated waters, percolating through it may carry off a certain portion of the silex overlying.

Origin of Chert or Flint.—In my younger days the view entertained by geologists, respecting the origin of the flint in the English Chalk, was, that it was derived from mineralized heated springs at the bottom of the "Primeval Seas"—there were few found hardy enough to dispute what was almost universally supposed. Now, as I never had an opportunity of examining "the English chert of the chalk in situ," I can form no opinion with regard to it, but I may say I have failed to obtain any evidence whatever of "Thermal Springs" arising from the sea bottom, when our local chert band was deposited. And I would venture to remark it was more probable that the silica was originally derived from acidulated water carrying down the matter from "*The Laurentian Highlands*," quartzites and the granitic rocks which formed the northern boundary of this Silurian (Mediterranean) Sea. That this continent possessed such, is admitted by leading geologists in Canada and the States. It is well known that the succeeding rocks of the "Devonian" and "Carboniferous Ages" also contain a large amount of cherty limestone. A striking characteristic of these and some other limestones of the "coal measures," remarks Dr. Newberry, is the quantity of silex they hold locally. The Zoar limestone becomes so cherty as to be called flint or burr-stone. In other portions of the coal field the higher beds exhibit the same phenomena.

The origin of the silex in these flinty limestones, he adds, has never been satisfactorily explained. It has sometimes been attributed to hot springs, of which the water contained much silica, but the general distribution of the flint and the number of fossils contained in it, seem to me insurmountable objections to this view. It is more probable that the silica was derived from microscopic organisms, such as the "diatoms." It seems to me quite possible the individual forms have disappeared by solution, and that the moss has been converted into compact silica, such as we find in "chert beds."

I agree with Dr. Newberry, that, if the chert had been furnished by hot springs, we must find it accumulated around the source of supply—but we discover nothing of the kind.

Admitting that diatoms are soluble and may be consolidated in the manner described, I doubt very much if this explanation can be deemed satisfactory. It fails to meet many objections that could readily be made, I think.

In a recent communication from a friend of mine in Chicago, who has already named three new genera of Hamilton sponges (not yet described) he mentions that he had obtained, in Tennessee, recently, about twenty specimens of sponges very similar to the ones discovered here from the same geological horizon, but fossilized in an entirely different condition. It is probable the sea near the "Laurentian Hills" contained more silica than the same water so far south.

The absence of Niagara chert was very noticeable in the Island of Anticosti. Although I obtained a very large number of fossils, there was not a sponge among them.

I do not think either the "Clinton" or "Medina" rocks are represented there (although a few fossils of the series may occur in the limestones) These beds, perhaps, were confined to the inland sea. The rocks at Anticosti were deposited under different conditions, in an open sea.

NOTE.—Since the above was written, I find from a paper published by Sir Wm. Dawson, in the "*Quarterly Journal of the Geological Society*," for Nov., 1888 (a copy of which he kindly sent me) that he holds the same opinion as the late Mr. Billings, viz: that the Clinton rocks are represented by limestones underlying the Niagara beds in Anticosti.

This view, perhaps, may have originated in the discovery of similar fossils, which I failed to obtain. Fossils, however, are scarcely safe guides there,—they are so mixed up. For instance,—*Graptolithus Clintonensis*, a characteristic Clinton Graptolite elsewhere, is found well up in the Niagaras there, near the S. W. Point Lighthouse.

NOTES ON COLORED LINGULÆ—SILURIAN.

Read before the Hamilton Association, 9th May, 1889.

BY COLONEL GRANT.

Among the oldest forms of "organic life," known both in Europe and this continent, are the brachiopods called "Lingulæ" or "tongue shells."

Found in rocks from "The Lower Cambrians"—inclusive—upwards, partaking both of the nature of a "Mollusc" and "Annelid," surviving all changes, their fossilized remains present to the chemist the same phosphatic constituents as the modern shell when subjected to chemical analysis.

There has been no *advance*, and seemingly no *degradation* since they first appeared in the "Primeval Seas"—a remarkable fact, as the family approaches, in modern times, probably, extinction. Any one who has examined the valves of a modern Lingula (L. Anatina of the Philippines, for instance) must be struck with the close resemblance this Phosphatic Brachiopod bears to its fossil predecessors of our local Silurian. This, and a different species (said to be brought from Carolina) are the only ones I have ever seen, although others, perhaps, are known to conchologists.

"Observations," remarks the author of Manual of the Mollusca "are much wanted on the living Lingulæ. The oral arms, probably, extended as far as the margin of the shell. The pedicle is often 9 inches long in preserved specimens, and is doubtless much longer and contractile when alive. The shell is horny, flexible, always of a GREENISH color. The recent species," he adds, "have been found at small depths, even low water, half buried in sand."

As far as I know the Silurian Lingulæ of Hamilton are *the oldest colored shells* yet discovered.

The British Museum possesses a colored Nerite of the "Devonian age," and the late W. H. Baily, Palæontologist to the Irish Geological Survey, informed me several years ago that they had just obtained some Fossil Ferns (Carboniferous) which retained

a portion of their original color, and a beautiful Aviculapecten, with wavy lines, deep umber, from the "Mountain limestone," Ireland.

The best preserved specimens of the Lingulæ here are found at the bluff or cliffs a little beyond the "Reservoir." They occur in a large flag near the summit, "upper red band." The flag in question is about 4½ inches thick, and, on splitting, it presents a ripple or "wave mark" in the interior, clearly proving its deposit in very shallow water.

Casts of the detached valves of other shells (undescribed) "Modiolopsis," "Posidonia" and "Avicula," are frequently obtained associated with the Lingulæ. An Eichwaldia valve (unusually large as compared with one in the "chert beds") was also noticed.

Casts of the single valves of "Lingula Oblonga" (color blue) are very numerous. "Lingula Oblata" (pink) is rare, and "Lingula Perorata" (brown shading to blue at the beak) rarer still. All, however, occur on the inside of the slab, occasionally *close together*. They represent casts of detached valves of dead shells washed up and heaped together by the waves. Only in a few instances I noticed both valves complete, and twice I found "Lingula Oblonga" fossilized seemingly in its burrow. The question arises: do the shells possess any portion of the *original* coloring matter, or is the difference of color now seen due to the influence of chemical agents? On this point some Palæontologists differ, while others hesitate to commit themselves to any opinion on the subject. Now granting that recent Lingulæ are green—may not such be the survivors of a family group that at one period of its existence was represented by other species quite different in color? This seems worth investigation. The Common Mussel (Mytilus Edulis) of the North Atlantic is blue; Mytilus Smaragdinus (Ceylon) is green; Patella Vulgata (British Seas) is colorless; while the Patella of the Adriatic is deep blue.

The colored Lingulæ are not altogether confined to a single horizon. In a few instances I found "Lingula Oblonga" retaining a portion of blue coloring matter in an impure limestone near the base of "the Clinton," and also in "the sand beds" capping the series.

A lingula (L. lamellosa) probably, from "the blue building beds," Niagara limestone, also retains part, at least, of what I am inclined to think was the original color of the Brachiopod. In "the

Iron band" (Clinton) close to and above the "Upper Reservoir," we find "a Lingula" which Sir Wm. Dawson thinks may be a variety of "Lingula Oblata." It differs from the latter, chiefly, in being abruptly bent near the extremity of the posterior margin. At first I imagined it was distorted by pressure, but I now think this view erroneous, as the peculiarity has been remarked in several specimens from *different* beds. Another small Lingula from the same horizon and locality, displays "brown spots on a white surface," the beak being rather like that of "Lingula Cuneata" (Conrad) It may be asked, have we reason to suppose that colored fossils may yet be discovered in older rocks than our local ones here. I think they will be found in the "*Cambro-Silurians*," for in a "Hudson River" drift pebble at Burlington Beach I noticed a fragment of a *crimson* Lingula, while several years ago another fragment was obtained at Anticosti corresponding in color. I recollect extracting from a rock on the north shore of that island "a Pleurotomaria," retaining its nacreous lustre precisely like a fragment of an Ammonite (Am. biplex) in my possession, which was obtained from the upper Oolite Kimmeridge clay, England. I know the belief is usually accepted that Tropical shells owe (as a general rule) their greater brilliancy to the sun's influence in the regions they inhabit—"that the mantle of the shell possesses the power of decomposing light and of secreting or appropriating color." This may be true enough, however, in the case of "Ianthina fragilis" (the Violet Sea-snail) many naturalists, who have closely studied the subject, stating that the shell's color is derived from "*the blue Velella*" it feeds upon. If this fact was clearly established it would be but natural to suppose that it is not the only Mollusc which is indebted to the plants or minute creatures which they live upon for at least *a portion* of their brilliant hues. Dealers, for instance, can discriminate between "the natives" (green oysters feeding on "Confervæ" in artificial parks) and the same bivalves from the natural oyster-beds, by the shells themselves. With reference to the colored shells of the later Palæozoic Rocks, I find at page 410 Boston Edition "Lyell's Elementary Geology" the following remarks under the head "Mountain Limestone":—

"The mere fact that shells of such high antiquity should have "preserved the pattern of their coloring is striking and unexpected; "but Professor Forbes has deduced from it important geological

"conclusions. He infers that the depth of the Primeval Seas in "which the Mountain Limestone was formed, did not exceed fifty "fathoms. To this opinion he is led by observing that in the exist- "ing seas, "The Testacea," which have colors and well defined "patterns, rarely inhabit greater depths than fifty fathoms, and the "greater number are found where there is most light in very shallow "water, not more than two fathoms deep."

There are even examples in the British Seas—"Testacea" are always white or colorless when taken from below one hundred fathoms, yet individuals of the same species if taken from shallow zones are vividly striped or "banded."

"Lingula Ingrus" of the Niagara limestones, described and figured by Dr. Spencer, is black or horny in the only three specimens collected. Strictly speaking it belongs to the "chert beds." Now, as a general rule, the fossils of these beds present a *dwarfed* appearance like many contained in shales, even the Trilobites being quite stunted in growth. We know when the chert was deposited, there was an unusual quantity of silex held in solution in the water, and this or heated springs, derived from the Laurentian Highlands, may have exercised much the same unhealthy influence as the brackish water of the Baltic of our own day does on its inhabitants. The late lamented Dr. Carpenter examined many of the specimens brought to light by the deep sea explorations of the recent Challenger Expedition. Live specimens, he remarks, were obtained from depths verging on three miles; the result was to show that, while there is no depth at which animal life cannot exist, the deeper you go, the more scanty such life becomes. Temperature has a great deal more to do with animal life than the pressure of water resulting from depth of the sea, and, while in the cold underflow the same forms of life are found as elsewhere, the specimens are *greatly dwarfed.*

It seems a little singular that such a large Lingula as "Lingens" should make its appearance during the deposition of "the chert," and that one of the most minute members of the same family occurs in a true limestone layer here. It may be imagined that the latter is merely the young of a more fully developed Lingula, but as it seems confined to certain beds and has apparently no larger one associated with it, scattered as it is through three or four distinct layers of con-

siderable thickness, we may infer that it was a minute form fully developed and not a young shell.

The ravine below the "Albion Mills" is another locality near Hamilton to which I would call attention. I have not been there for many years, but the Lingulæ are of much interest. In many instances the thin outer valves are retained, but they are white or colorless, even in layers corresponding in position with the colored Lingulæ beds near the Reservoir.

The Burton shales resting on the chert beds here (although very fossiliferous) hold few specimens of Phosphatic shells. The Lingulæ (three species) are in good preservation, usually retaining both valves, which are black or horny. They appear to be confined to the lower beds; however, only in a few places are the upper ones exposed, so it is possible they may have hitherto escaped detection.

I am unable to state what induced Professor Morse, during the course of his experiments, to arrive at the conclusion that the living Lingula was a "specialized worm." It may seem perfectly natural to an evolutionist for an Annelid that found itself exposed to the attacks of enemies in the rear to evolve some shelly protection for the part exposed. Perhaps, in the words of Voltaire, "the first step was the only difficulty." A friend of mine suggested a different solution, but I doubt whether it can be seriously entertained by any naturalist, viz.: that the worm may have accidentally introduced the extreme end of its tail into the open valves of the Mollusc, and that the latter, indignantly resented the intrusion by closing the doors of its habitation on its unwelcome visitor, and then, to use the words of "Ingoldsby," slightly altered—

> "In vain did it strain every muscle—
> The valves held it fast
> From that hour 'til the last—
> It could never get rid of its comfortless bustle."

How the Mollusc or worm transmitted to its posterity the marked characteristics of both combined I am unable to say. In the larval stage, Lingula, it is said, closely resemble the larva of an Annelid; this two-fold nature of early organisms has frequently been noticed by naturalists.

The mystery of life, however, remains an unsolved problem to

science. No satisfactory evidence has ever been adduced to show that dead matter of itself can give birth to living organisms.

As regards the fossilized remains now before us, which were embedded in the sediment of ancient seas—that they existed as living things can scarcely be disputed. In the words of a recent writer:

> "Once they were not,
> And now they are not,
> And this is the sum we know."

BRIEF NOTES ON THE LAND AND FRESH WATER SHELLS OF THIS DISTRICT, SUPPLEMENTED BY GENERAL NOTES ON CONCHOLOGY, GATHERED FROM DIFFERENT SOURCES,

Read before the Biological Section of the Hamilton Association, April 5th, 1889.

BY A. W. HANHAM.

Little more than a year ago I received a letter from England from one greatly interested in Land and Fresh Water Shells, asking me to keep any that might come in my way, the writer being anxious to secure representatives from this part of the world. I wrote back that I would do the best I could, but remarked at the same time, that I did not expect to get a great variety, and, that the shells, alluding especially to the land shells, would not compare in size and beauty with some species that were common in England. These remarks showed how little I really knew about the shells which were to be taken here I do not profess to know much more now. No land shells yet found by me here will compare with English species in markings or bright colours, but a few walks abroad soon brought to light things not noticed before during a residence of some seven years in Canada, and, seeing that during all these years I have been exploring the woods and country in general in search of Entomological specimens, it goes to show how blind it is possible to be.

In taking up anything new I find it is absolutely necessary to find the eyes, so to speak, before the eyes are in a fit state to aid one in the study or undertaking. To make more clear my meaning;—for various reasons of late years I have confined my collecting almost entirely to the Coleoptera; now a large proportion of beetles are found only on or in the soil, under leaves, logs and debris, and as far as I can now see, the best spots or localities for these beetles are also the best for many species of land shells, but, till lately, I never used to see the shells. This remark applies also to aquatic species.

Conchology has its advantages over Entomology; for instance,

you turn over a log for specimens, and, unless the air is frosty, every live thing present, that has legs or wings, uses them to seek safer quarters—some are sure to get away—but any shells, dead or alive, may be gathered without any unseemly haste and speedily transferred to bottle or box. Of course, it is possible to overlook some, which often agree exactly in colour with their surroundings, and which, if they did move, would be easily seen. Others, again, are easily overlooked owing to their small size and a habit they have of hiding away in the crevices of logs, or in any inequalities that may be present.

Land shells inhabit nearly every country of the globe. They are found in woods, gardens, and hedges—the last named unfortunately conspicuous by their absence here;—I speak from a Conchologist's point of view, for they make splendid retreats for snails.

Where they take up their abode in the hollows of trees and stumps, under bark, in crevices of rocks, under stones, amongst moss, nettles or other weeds, especially in damp places, or adhere to boughs and leaves of trees, shrubs, &c., it is during the day that they retire to these situations, and in the evening they are to be met with crawling about; also sometimes during the day when the weather is moist and rainy.

Fresh water shells are to be met with in almost every lake, pond, river and stream, either lurking in the mud at the bottom, or feeding on leaves of aquatic plants, or along the shores or banks. Some species, which burrow deep in the mud, as Anodonta and Melantho, have to be dredged for, and others may be found by raking along the surface of the sand and mud at the bottom of ditches and ponds. Shells can only be expected perfect when they are got with the animal in them. Fine specimens of water shells may be found on the beach, or shores of our lakes, after a storm, but should they be thrown up out of the reach of the water, they are exposed to the continued heat of the sun, by which their colours become faded. A large proportion of the shells seen in collections have been picked up on the beach, and are seldom very perfect, being either worn or broken. River and land shells are mostly thinner than those of the sea, though there are exceptions to this rule. Some land shells are very beautifully coloured or marked, and elegant in their form, especially those found in tropical climates. In Africa they

grow to an amazing size, and would be very unwelcome guests in our flower and kitchen gardens, as they commit great havoc among the esculent plants. You will better realize this fact when I state that one species, Archatina Zebra, is very frequently found measuring seven inches from apex to base of shell.

When shells are found with the animal alive in them, boiling water should be poured upon them. The animal may then be easily taken from bivalves, but caution is required with the univalves, as should part of it be left in the volutions, it will be almost impossible to extract it, and to prevent the shell from becoming offensive it would be necessary to leave it for a considerable time in alcohol, where too long an immersion might change the colour of the shell somewhat. I have also heard the use of salt mentioned as a means for killing the occupants of land shells, but have not tried the process myself. Shells of any size should be oiled, not varnished, to preserve the natural color and to keep the epidermis from cracking. Worn and old shells may be restored almost to their original beauty by this means.

The Rev. Geo. W. Taylor, now of Billings Bridge, near Ottawa, lately of Victoria, B. C., has very kindly named all the shells I took last season, and some I have already added to my list this year. Mr. Taylor is also an Entomologist of some standing. In one of his letters to me, he says:—"I have collected for some years on the "Pacific Coast, and am now collecting here, so that your shells from "an intermediate station are very interesting to me. The number "of Canadian land and fresh water shells known to me is as follows: "fresh-water bivalves, 72 species; fresh-water univalves (operculate) "13 species (non-operculate) 45 species; land shells, 82 species—total "212. No doubt many additions will yet be made, and your posi- "tion is an especially favorable one." In another letter he remarks: "your collection is interesting, but I notice it is deficient in the "small land shells. Look carefully under leaves, amongst ruins, in "woods and under logs everywhere, and you will find lots of treas- "ures. Take a long series of fresh water shells from every piece of "water you come to, and I have no doubt you will add to the Can- "adian list." Again he says:—"land shells can be named without "much trouble, but fresh water shells are much more difficult to deter-

"mine, as they run one into another to an alarming extent, the "generas Linnæa and Physa being especially so."

Since I received these letters I have taken six or eight species of these small land shells, to which he referred; and, as you can see, there is no doubt about some of them being decidedly tiny. One species, Pomatiopsis lapidaria, is new to the Canadian list, but is common in some localities in the United States.

Through the kindness of Mr. and Mrs. Billings, of this City, I have come into possession of a small collection of land shells from Jamaica. They are from the cabinet of Mr. Wm. Roy, a resident of that island. If such large and strikingly beautiful and graceful species were to be found about Hamilton, there would certainly be more excitement in the actual collecting than there is now.

The Report of the Conchological Branch of the Ottawa Field Naturalists' Club for 1883-4, gives over 100 species taken in that district, and no doubt that number has heen considerably increased since then. Mr. Latchford, in an able paper, read at one of their soirees, gave descriptive notes of 27 species of the Unionidæ. I have taken only 7 species here as yet, but see no reason why this district should not be as rich as the Ottawa when properly worked, and I think we should exceed them in the number of land shells.

The Report of the Geological Survey of Alabama for 1876 contains a list of the shells of that State:—land shells, 76 species—fresh water, 612 species—total 688. This list shows the amazing number of 263 different species of Unionidæ, and 155 species of Goniobasis; of the latter I have but a single representative.

Numbers of our fresh water shells when in good condition, chiefly among the Unionidæ, attain a large size, and some are very handsome. Referring to the Unionidæ, the late Dr. Isaac Lea, who studied this order for fifty years, computed that a large specimen of Unio Multiplicatus contained upwards of three million embryonic young. Of course nearly all these perish early, being devoured by fishes, crustaceans and the larvæ of insects, few attaining maturity, which is reached in from six to ten years. The young of Unionidæ are for a time provided with hooks, by which they can attach themselves to contiguous objects, as for instance a fish or a water bird, being in this way transported to great distances. I

have seen it stated that some land shells are so minute that a good glass is necessary to see them at all;—I draw the line at these. Such forms are to be found in and under moss on rocks and shady hillsides, under dead leaves and loose bark on old stumps, and under and in decaying wood, stumps and logs. It is especially during late autumn, and in open weather in winter and early spring that these little species can be found in great numbers in their winter quarters. Dr. Sterki, of New Philadelphia, Ohio, writes:—"It may not be "generally known that many small land shells are fond of "animal matter for food; the fact that they have been found "accidentally in considerable numbers in skulls, &c., makes it "advisable to place large pieces of bone with open cavities, "such as the head of a sheep, in suitable localities, well "secured by heavy stones or logs against rapacious animals, "thus forming traps as it were, to be visited from time to time, "for the small Hyalinas, Pupas, &c., living upon and in them. "Pieces of wood covered with lard will answer the same purpose. "In collecting shells never fail to look for them under plants with "broad or numerous leaves spread on the ground and about the "roots. A few [illegible] since upon a single stalk of Iris, standing "on a dry, gravelly [illegible] I collected in half an hour more than 200 "Pupa Armifera, b[illegible]s specimens of 5 other species. Many "small species, living in moist places, have to be looked for along "the very edge of waterways of all kinds; some of them like to "ascend reed grass, &c."

In Woodward's Manual mention is made of a snail which got entangled in a nutshell when young, and the shell growing too large for it to escape, it had to endure the encumbrance to the end of its days.

Mr. John Ford, of Philadelphia, writes that:—"Certain fresh "water species will live for months without food or even water, while "many species of Helix will endure the same apparent hardships for "years, as I have good occasion to know, having on one occasion "found a number of Syrian species alive and active when taken from "the box-prison in which they had been packed with dry sand on "the Arabian desert quite two and a-half years before; in each case "the usual air-tight curtain had been drawn across the aperture of the

"shell, but a drop or two of water quickly dissolved this, and a few "minutes later the animal awoke from its deathlike sleep, as fat and "vigorous as though only a night had passed since its incarceration."

In England the largest "snail," only too common in gardens, makes a very rich and nourishing broth. I remember an old lady, a neighbor of ours, very kind to the poor and sick, whose favorite prescription for many ailments was a broth made from these snails, but I do not think she ever told her patients what it was made of, unless it was a long time afterwards, I could never be prevailed upon to taste it, and so cannot say from experience if it was really as nice as she made it out to be.

On the banks, under hedges, along country lanes, land shells, especially Helices, are very plentiful, and as some of the larger ones are very handsome, the shells both dead and alive are very noticeable. The moister climate, no doubt, accounts for the great abundance of snail life in England. I hope before the year is over to get specimens of some of these species, and I shall be most happy to produce them at one of our meetings.

I believe over 40,000 species of marine, fresh water and land shells are known. The late G. W. Tryon, Jr., whose death occurred in February last, was, since the death of Mr. Lea, perhaps, the most prominent Conchologist of the day. His collection, in the Academy of Natural Sciences, Philadelphia, is stated to be one-third larger than that of the British Museum, the only other collection with which it can be compared. Andrew Garrett, another noted Conchologist, died in November, last year. He lived on the Island of Huahine, Society Group, South Seas. His private collection of shells (lately for sale) consisted of over 8,000 species, comprising over 30,000 examples, representing almost every known part of the globe. Of this large collection Mr. Garrett had himself gathered some 4,000 species. Mr. Horace F. Carpenter, in his interesting work, entitled, "The Shell-bearing Mollusca of Rhode Island," referring to clams, says :—"It is said that if clams are placed in a basin of sea water "containing indigo, they will in a short time render it perfectly clear, "by collecting the minute particles of the impurity and condensing "them into solid form; and not only indigo but whatever particles "may be contained in the water, organic or inorganic, animal, vegeta-"ble or mineral are thus removed, and the water purified. The

"thousands who visit our shores every summer to partake of the "luscious clam-bake of Rhode Island, may not be aware that they "are filling-up on the sewage of the city, but as no one was ever "known to be injured by eating any amount of them, concentrated "and refined sewage obtained in this way must be healthy." Again he writes :—"The term clam is applied to this species (Mya arenaria) "only in New England. In New York and farther south a clam "means what we call "a guahog" Venus Mercenaria, but the origiual "owner of this name is a ponderous bivalve of the Pacific Coral "Lagoons, Tridacna Gigas, a small valve of which may be seen hang-"ing over the door of an oyster saloon on College Street, in Provi-"dence. I have seen a pair of valves of this species, measuring two "feet across and weighing about 500 lbs., used for a holy water "font in a church in Paris."

I wish I could prevail on some of the working members of this Section, or members of the Hamilton Association, to take up the study of Conchology, or at any rate to become collectors of shells. There is much to be done. I think I am correct in saying that this district has never been worked—by this I mean that our woods and waters have not been systematically examined to see what they may contain in the "snail" line. The study is a very interesting one, and the mere collecting not the least enjoyable portion of it. Many arguments might be advanced in favor of collecting, not particularly shells, but specimens, entomological, botanical, geological, &c;—I will be content with one. It is necessary in order to secure good specimens and a large collection, and at the same time to acquire some knowledge of the habits and habitat of one's captures, to often go abroad into the woods and along or on our water courses and to explore our surroundings thoroughly. The mere exercise of walking in the fresh country air is very beneficial, especially so to one whose business or occupation keeps him much in doors. I think any one who has once commenced to collect in any branch of science will find it very difficult to entirely give it up, there is so much to be learnt, so much to be seen by the careful observer; the lover of nature and nature's beauties will indeed see much to interest and instruct whenever he takes his walks abroad. I should like to see a numerous band of workers in every branch this coming season, then I feel sure that the result by the end of it would be one of which this Association might be proud.

FRESH-WATER CONCHIFERA.

UNIO PRESSUS, *Lea.*

A few specimens from Dundas Marsh, May 6th.

UNIO LUTEOLUS, *Lam.*

Common in Hamilton Bay. A very variable species.

UNIO COMPLANATUS, *Sol.*

Very common in Hamilton Bay.

UNIO NASUTUS, *Say.*

A few specimens taken from Hamilton Bay.

ANODONTA OVATA, *Say.*

A few specimens found in Dundas Marsh, May 6th.

ANODONTA FLUVIATILIS, *Dillwyn.*

Common in Hamilton Bay.

ANODONTA BENEDICTII, *Lea.*

Hamilton Bay.

Several of these species were taken in abundance after the severe storm of Jan. 9th last, along the shore of one of the inlets of the bay near the city, and especially imbedded in the ice near the shore; specimens secured having to be chopped out with a knife. Some single valves taken at the same time and some on the shore at Port Dover were of different species, but in too poor condition for determination.

SPHŒRIUM SULCATUM, *Lam.*

Hamilton Bay. A few specimens, differing somewhat, were returned labelled S. SULCATUM, var.

SPHŒRIUM RHOMBOIDEUM, *Say.*

SPHŒRIUM STRAMINEUM.

The latter two species were taken plentifully on May 6th, from a muddy little creek running into the marsh near Dundas. At an angle in its course there had been a wash-out, and the bank just there was covered with these tiny bivalves. A number of univalves were also found here.

SPHŒRIUM OCCIDENTALE, *Prime.*

Plentiful in a small stream or run in open woods, May 13th. Late in the summer more were taken alive from the dried up bed of the same stream.

FRESH-WATER GASTEROPODA.

(OPERCULATE)

MELANTHO DECISUS, *Say.*

Hamilton Bay. Some very fine specimens from Dundas Marsh on May 6th.

PLEUROCERA SUBSULARE, *Lea.*

Hamilton Bay. Not common.

GONIOBASIS LIVESCENS.

Hamilton Bay.

VALVATA TRICARINATA, *Say.*

Common in Hamilton Bay.

VALVATA SINCERA, *Say.*

Common in Hamilton Bay.

AMNICOLA ———.

I have at least three species of Amnicola from Hamilton Bay not yet named.

(NON-OPERCULATE.)

LIMNŒA PALUSTRIS, *Mull.*

A very variable shell, common in all streams and the inlets of Hamilton Bay.

LIMNŒA CAPERATA, *Say.*

Taken in the same stream as *Sphærium occidentale.*

LIMNŒA HUMILIS, *Say.*

From torrent in Chedoke Ravine, May 13th; Dundas Ravine, May 24th.

LIMNŒA STAGNALIS, *Linn.*

Common in inlets of Hamilton Bay and in Dundas Marsh. This species appears to be found in many different parts of the world.

LIMNŒA DESIDIOSA, *Say.*

Taken abundantly in September at Isle D'Orleans, near Quebec.

LIMNŒA CATASCOPIUM, *Say.*

A single specimen was found in the same locality as the last.

Some specimens of *Limnœa* taken in our district this season may

prove to be different to the above, while *Limnæa catascopium* will, I expect, be found in Lake Ontario.

PHYSA GYRINA, *Say*.

Scarce in different pieces of water in this neighborhood.

PHYSA ANCILLARIA.

A few specimens were picked up on the shore at Port Dover, and it may be found here in the Lake.

The Rev. G. W. Taylor has retained nearly all my *Physas* for further examination. I expect to get at least two more species from among them.

BULINUS HYPNORUM, *Linn.*

Abundant in small streams running through open woods. Some fine specimens have been secured this year.

PLANORBELLA CAMPANULATA, *Say*.

HELISOMA TRIVOLVIS, *Say*.

HELISOMA BICARINATUS, *Say*.

The last three species abound in stagnant pieces of water in our district.

SEGMENTINA ARMIGERA, *Say*.

A single specimen was taken in Dundas Marsh on May 6th. A peculiarity of this shell is that it has five small teeth at some distance from its mouth; in fact to see these teeth plainly it is necessary to break away a portion of the shell.

GYRAULUS ———.

Several species from Hamilton Bay and Dundas Marsh have not yet been determined. *G. deflectus* and *G. hirsutus* should be among them.

ANCYLUS RIVULARIS, *Say*.

A few specimens were found attached to the valves of dead *Unios*, cut out of the ice after the storm of Jan. 9th.

TERRESTRIAL GASTEROPODA.

(OPERCULATE.)

POMATIOPSIS LAPIDARIA, *Say*.

A terrestrial species of a fresh-water genus. This shell is new

to the Canadian list, but is comman in some parts of the United States. It was first collected on Nov. 15th, last year, in a ravine running down to the Marsh, and has been found this year to be generally distributed around the Marsh, but has not been taken in abundance.

(NON-OPERCULATE.)

HYALINA NITIDA, *Say.*

Common everywhere in damp places, under logs, etc.

HYALINA INDENTATUS, *Say.*

A few specimens only have been found under moss on decaying stumps and logs, along the side of the Mountain.

One or two species of *Hyalina* are still to be determined.

PATULA ALTERNATA, *Say.*

PATULA STRIATELLA, *Anthony.*

These two species are common everywhere in woods and damp spots.

PATULA PERSPECTIVA, *Say.*

This shell appears to be rare here, a few only having been found along the side of the Mountain.

MESOMPHIA FULIGINOSUA.

Taken May 5th, on a mossy bank, at the mouth of a ravine running down to the Dundas Marsh. One specimen only was found last season.

TRIODOPSIS PALLIATA, *Say.*

Not common. Along the Mountain side.

TRIODOPSIS TRIDENTATA, *Say.*

In same locality as the last species, but more abundant.

STENOTREMA MONODON, *Rackett.*

A variable shell. One or two specimens only have been taken.

STENOTREMA MONODON, *Rackett.* var. FRATERNUM.

This is considerably larger than the type and has the umbilicus closed. It is common in woods.

MESODON ALBOLABRIS, *Say.*

MESODON THYROIDES, *Say.*

Both the above species are abundant throughout this district.

MESODON SAYI.

A rare shell, only one specimen having been taken here last season, the exact locality being unknown. This species, at first sight, somewhat resembles *M. thyroides*, but has a much larger umbilicus, also a small tooth on the lip which may be easily overlooked. On Good Friday, April 19th, a dead specimen was obtained in the ravine, under the Albion Mills, showing one locality, at any rate, where it may be found.

FRUTICICOLA CANTIANA.

Observed in thousands along the heights overlooking the St. Lawrence River, near Quebec, last September. This Helix has been imported from England or Europe, and perhaps it is only a question of time before it has travelled this way.

FERRUSACIA SUBCYLINDRICA, *Linn.*

Common on banks and in open woods under logs.

STROBILA LABYRINTHICA, *Say.*

A few specimens were taken from a stream in woods, March 16th.

PUPA CONTRACTA, *Say.*

Found in a stream in woods.

PUPA CORTICARIA, *Say.*

Found in a stream in woods and also under loose bark on logs.

PUPA ARMIFERA, *Say.*

Very common on a dry, sunny bank overlooking Hamilton Bay, towards the Valley Inn, March 17th.

PUPA FALLAX, *Say.*

In same locality as last species, but much more rare. Only once previously reported from Canada.

CARYCHIUM MINIMUM.

Common everywhere in damp spots under logs. This is the smallest shell yet taken.

SUCCINEA OBLIQUA, *Say.*

SUCCINEA AVARA, *Say.*

These two Succineas are common in woods near streams.

SUCCINEA OVALIS.

Common along the shores of the Dundas Marsh and some parts of Hamilton Bay.

Two species of *Pupa* and three other varieties of small land shells, taken this season, have not yet been determined.

GEOLOGICAL NOTES.

BY D. F. H. WILKINS, B. A., BAC. APP. SCI., PRINCIPAL, HIGH SCHOOL, BEAMSVILLE.

Read before the Hamilton Association.

Among the many interesting features of the rocks of Western Ontario are some to which, it is believed, attention has not as yet been directed. One of these may be noted as occurring on and near the Credit River, Streetsville, Peel County, Ontario, and as presenting to us as nearly as possible the junction between the Hudson River or Cincinnati Group, the highest member of the Upper Cambrian or Lower Silurian of Murchison, and the Medina Group, the lowest but one member of the true Silurian or Upper Silurian of the famous geologist referred to. The flat, generally clay country of Peel county slopes gradually south-westward to the Credit River at Streetsville, and on the north-east bank of this stream may be seen, below some six to ten feet of clay, a series of greenish gray sandstones and argillo-arenaceous shales, some of the former being sufficiently thick-bedded to afford good flagstones. The series extends, as may indeed be clearly seen, under the river, and has a thickness exposed on the bank of from eighty to ninety feet. Moreover, from the more weathered shales and sandstones may be procured the following fossils typical of the Hudson River or Cincinnati Group;—*Tetradium fibratum*, *Columnaria alveolata*, *Favistella stellata*, *Favosites hemispherica*, *Petraia Canadensis*, *Ambonychia radiata*, *Modiolopsis modiolaris*, *Avicula demissa*, *Strophomena alternata*, *Orthis testudinaria*, and more rarely, *Orthis occidentalis* and fragments of an undetermined *Orthceras*. The river here has a well defined trend, south, twenty degrees east, or nearly so, and thus nearly conformable to the strike of the strata, this latter being more accurately south, twenty-five degrees east, the dip being, of course, south of west, at a very low angle. The flood-plain of the river varies from a hundred feet to a hundred yards in

width; and the south-west bank rising from this is composed of brown, unstratified clay, concealing the shales and sandstones. The slope of the bank is sometimes steep and sometimes gradual, and upon its flat summit stands the village, extending in a direction parallel to the river for a distance of one mile and a-half in length, and in a direction at right angles to this of one-eighth of a mile in breadth. Carrying a section from the river bed to the south-west, we find, after crossing the main street of the village a slight fall, nowhere greater than fifteen feet to the Canada Pacific Railway (Credit Valley Branch); then a slight rise and fall to a small creek, a feeder of the Credit, and finally a rise, gradual at first, succeeded by a low escarpment of about forty feet in height. The lower part of this rise is clayey, while in the middle part is exposed, at a distance of not more than a quarter of a mile south-west of the river, about twenty feet of red Medina shale, with here and there a thin layer of sandstone, striped and spotted with green as usual, destitute of fossils, except a few obscure fucoids. This rock, it may be added, is largely quarried in the manufacture of terra-cotta. Following the strike of the rock a lower layer of red shale may be seen about twenty-five feet below the just mentioned exposure. Finally, near the railroad station, are exposed, in the bed of the creek above referred to, some grey, brown weathering, unfossiliferous sandstones, distant about one-eighth of a mile north-east from the last mentioned outcrop of Medina rock. These are probably transition beds, revealing to us the gradual shallowing of the sea bottom with the consequent destruction of the organic life of the period. Thus we see that although the actual line of junction between the two groups of rock is not so far visible, yet its position may be approximately found.

In finding this we perceive another interesting fact, namely, the height of these beds above Lake Ontario. The heights are here given:—

Height of the uppermost bed of Hudson River sandstone on the north-east bank of the Credit..... 240 feet.
Height of the unfossiliferous gray, brown weathering bed, one eighth of a mile south-west of the above, and near the railway station..... 245 "

Height of station..... 252 feet.
Height of main street of village..... 275 "
Height of lowest Medina bed..... 270 "
Height of lowest layer or section, quarried for terra-cotta 295 "

From the above it may be reasonably inferred that the height of the line of junction between the two groups of rock (Hudson River and Medina) is about *two hundred and sixty feet* above Lake Ontario.

The most interesting fact of all, however, appears, when we remember that this same line of junction reaches the north shore of Lake Ontario, near Oakville, at a distance of eleven miles from Streetsville, and in the direction S. 24° 8′ 32″ E., or approximately S. 25° E. This being, as has been already said, the line of the strike of the formations, it follows that the difference of level gives us the side of a low flat anticlinal of dip S. 25° E., and rate of 25 feet to the mile nearly, the axis of the anticlinal lying in the direction of the dip of the strata, and nearly parallel to the well-known, striking Cincinnati anticlinal arch. So far, the other side of this anticlinal fold, or even its summit, has not yet been found, but more thorough search may reveal it in the river beds of the counties of Peel or of Dufferin.

ANNUAL REPORT

SESSION 1888–9.

HAMILTON ASSOCIATION

HAMILTON, ONTARIO,

(For the Promotion of Literature, Science and Art.)

Presented May 9th, 1889.

The session just closed has been, on the whole, a successful one, whether the character of the work done, or the interest of the members therein, be considered.

Six general meetings of the Association have been held during the Session, at which the following papers have been read, viz. :—

"Notes on Primitive Man," by W. Kennedy.

"Notes on the Waverley Novels" (2nd part), by Rev. C. H. Mockridge, D. D.

"History of Pottery and Ceramic Art," by S. J. Ireland.

"Selenography," by H. B. Witton.

"Notes on the Lingulæ of the Silurian Rocks," and "Notes on the Origin of Chert (Flint) in our Local Niagara Rocks," by Col. C. C. Grant.

Since last annual meeting the Association has held one general field day. Through the kindness of Mr. William Gibson, the members of the Association and their friends were invited to visit his extensive quarries near Beamsville; so, on the morning of the 30th of June last, a party of about thirty found themselves in a *special car*, through the kindness of Mr. Chas. Stiff, Superintendent of the Southern Division of the Grand Trunk Railway. On arrival at Beamsville the car was detached from the train and awaited us for the return jour-

ney. We found Mr. Gibson in waiting to receive us, and a number of carriages to convey us to the quarries on the top of the escarpment. Here we arrived about 12 o'clock, and after partaking of lunch under the shade of the trees, and being photographed by Messrs. Charlton and Baker, we divided up into sections, to examine the botanical, entomological and geological character of the locality, after which we gathered near the quarries and reviewed the various specimens which had been collected. Some time was spent in examining the mode of blasting, splitting and raising the enormous blocks of stone, and placing the same upon trucks for conveyance to the main line of the Grand Trunk Railway, by means of the tramway which connects the quarries with the railway at Beamsville Station. Mr. Gibson arranged that the party should return by a different route, calling on the way at his handsome residence, where refreshments were generously served. The drive was a very beautiful one, and a hearty vote of thanks was passed to Mr. Gibson for his kindness in affording the members of the Association the opportunity of spending such a pleasant day.

As this field day was not so well patronized as it should have been, your Council deemed it unwise to make arrangements for a second in the same season, though we hope one or two successful ones will be arranged for this summer.

The thanks of the Association are also due to Messrs. John Fisher & Sons, of Dundas, for permission for the members to visit the ravine for botanical purposes.

We cannot close this report without referring to the death of two members of the last Council of this Association.. We mean the late William Milne, who, from the time of his becoming a member, took a deep interest in all relating to the welfare of our Society, and contributed a very valuable paper on "The Public Treatment of Crime and Criminals," which was published in our Transactions; and Dr. Chittenden, whose sudden death yesterday shocked the community, by whom he was so much respected. His taking away comes near to us in this Association, for he was deeply interested in all our operations, and was ready to do all he could for its success. It is not the place or occasion to speak of his kindly and cheer-

ful disposition, and of his other personal qualities, so highly appreciated by all of us. We would also put on record our regret at the removal from our city of the Rev. Dr. Mockridge, an ex-President of this Association, and one who, when in office, contributed much to its success. Our best wishes attend him in his new home.

All of which is respectfully submitted.

A. ALEXANDER,
Secretary.

FINANCIAL STATEMENT.

Statement of Receipts and Disbursements for Year Ending 9th May, 1889.

RECEIPTS.

Balance as per Statement, 1888	$ 63 53
Government Grant	400 00
Subscriptions	165 00
Sale of Books	31 50
	$660 03

DISBURSEMENTS.

Postage and Commission	$ 55 00
Gas	9 84
Books, Stationery, Printing and Advertising	192 90
Rent	200 00
Insurance	12 50
Furniture	12 50
Balance	163 49
	$660 03

RICHARD BULL,
Treasurer.

I have examined and compared the vouchers with the above, and find it correct.

A. T. NEILL,
Auditor.

May 9th, 1889.

Report of Curator and Librarian.

DONATIONS TO THE MUSEUM.

Presented by Mr. T. C. Mewburn.
- Indian shell epaulet.
- Indian mallet.
- Old gun-barrel and hatchet found under an upturned tree.
- Iron lance of ancient date and small swivel-gun used in Hudson Bay Co's. forts.
- Old Canadian Government Seal for land patents.
- Cut and polished specimen of a large Ammonite.
- Old musket-lock from battle ground (Nov. 1812) of Queenston Heights.
- Old engravings and maps.

Presented by Mr. C. Hardy.
- Bayonet from battlefield (June, 1866) of Ridgeway.

Presented by Rev. A Belt.
- Fenian musket from same locality.

Presented by Mr. S. Symons.
- Specimens of silver and copper ores.
- Model of hull of ship.

Presented by Miss Savage.
- Chimney swallow's nest.

Presented by Mrs. R. Thomson.
- Diamond in its native clay dug from Kimberly Mine, South Africa.

Presented by Mr. S. Briggs.
- Stuffed kangaroo.

Presented by Mr. J. Turnbull.
Large bust of Shakespeare.

Presented by Mr. R. Russell.
Specimen of Galena from the Iron Mountain.

Purchased by the Association.
Five cases Canadian insects.

Special mention must be made of the generosity of Mr. S. Symons, who kindly presented to the Association a handsomely carved chair and table for the use of the President, also four beautiful stands for glass cases in the Museum.

BOOKS ADDED TO THE LIBRARY.

3 vols. "U. S. Government Report of Geological Surveys," 1882-85.

2 vols. "Three cruises of the U. S. Steamer Blake," an account of deep sea dredgings, 1877-80. Presented by Harvard College.

16 parts "Natural History of Victoria," with colored engravings. Presented by Australian Government.

Vol. VI. "Transactions Royal Society of Canada." Presented by the Royal Society of Canada.

Vol. I. "History of America," by Justin Winsor. This completes this valuable work, which is in seven volumes.

"Lives of the Cæsars." Presented by Mr. Haigh.

"Monumental Effigies of Temple Church," London, England. Presented by Mr. Haigh.

ALEX. GAVILLER,
Curator and Librarian.

ANNUAL REPORT

—OF THE—

Biological Section (Botany and Zoology)

HAMILTON ASSOCIATION,

SESSION 1888-89.

C. S. Chittenden, D. D. S., Chairman. T. W. Reynolds. M. D., Secretary.

During the past session the work of this section has been carried on with much enthusiasm by the members, and it is hoped with much profit to themselves, the Association and the community at large.

It was originally intended that regular monthly meetings should be held during the summer, and bi-monthly during the winter; however, owing to the absence of members from the city during the months of June, July and August no monthly meetings were held, but on September 7th, 1888, the bi-monthly meetings were resumed and continued throughout the winter.

The meetings in September and October were devoted to the examination of specimens collected during the summer, and the reception of reports on the work done. At the meeting on October 19th, Mr. McIlwraith reported for the Orinthological division, while Mr. J. Alston Moffat reported for the Entomological, showing that he had obtained about twenty-five specimens during the summer that were new to him, and some of them possibly new to Canada.

At the meeting on October 5th, it was decided that the field of operations, to be called the Hamilton district, should be that portion of country included in a circle, with a radius of twelve miles, extending from the City Hall, Hamilton.

The annual meeting of the section was held on November 2nd, when the officers were elected and the Secretary's report was pre-

sented. Dr. Burgess also then presented a report of the work done by the Botanical division, stating that of the 812 plants recorded in Logie's and Buchan's lists, over 300 had been noted and verified, while 6 or 7 not there recorded had been added to the list.

Although but few formal papers have been read during the winter, yet informal, but none the less profitable, discussions have been held at all the meetings. The following are the titles of the papers:—

Dec. 7th, 1888.—"Is Species a Natural or Artificial Division in Nature?"—J. Alston Moffat.

Dec. 21st, 1888.—"Notes of a Trip to the West Indies."—B. E. Charlton.

Feb. 15th, 1889.—"The Lake Erie Shore as a Botanizing Ground."—T. J. W. Burgess, M. B., F. R. S. C.

March 8th, 1889.—"Plant Colour."—A. Alexander, F. S. Sc.

March 15th, 1889.—"Notes of a Trip to South Carolina during February, 1889."—T. W. Reynolds, M. D.

April 5th, 1889.—"The Land and Fresh Water Shells of the Hamilton District."—A. W. Hanham.

At the meeting on March 8th, 1889, the Herbarium was fully inaugurated, Dr. Burgess on that evening placing in it specimens that he had mounted, which represented 42 orders, 74 genera, and 87 species, and, at the meeting on March 15th, Mr. Alexander contributed specimens representing 48 additional species.

It might be also mentioned, as showing the work done in a field new to the majority of the members, that Mr. Hanham's paper was illustrated by his collection, made in this district, containing 10 bivalves, 16 non-operculate and 10 operculate univalve shells, and 29 land shells.

In speaking of the work done during the winter, mention must also be made of a valuable series of notes on various subjects in Natural History, contributed by Mr. William Yates, of Hatchley, a corresponding member of the Association, which were read at different meetings of the Section and much appreciated by all who heard them.

The various meetings have been fully reported, not only by the Hamilton papers, but also by the correspondents of the Toronto papers, thus bringing the work of the Section prominently before the notice of the public.

In conclusion, reference must be made to the various excursions made by parties varying in number, which were all much enjoyed by those enabled to participate. The first one was a general field day of the Section, held in the Dundas ravine on May 24th, 1888, in which a large number of members and friends joined; succeeding this were a number of smaller ones, but mention must be particularly made of the Association field day held at Mr. Wm. Gibson's Quarries, Beamsville, on June 30th, 1888, in which many members of the Section participated. Amongst the smaller parties may be mentioned an excursion by four of the members on September 25th, 1888, along the creek leading from the Sulphur Springs, near Ancaster, and another made by six of the members on April 19th, 1889, when Mount Albion was visited, and the ravine leading from the Mills explored. This latter excursion may be considered the opening of the work for 1889, and it is to be hoped is only the forerunner of many others as enjoyable and profitable as those held during the summer of 1888, the results of which have already been pointed out. Much still remains to be done in the Hamilton district, and the officers and members of the Biological Section hope that the members of the Association will give their hearty support to them in their undertaking.

ENTOMOLOGICAL DEPARTMENT.

REPORT ON LEPIDOPTERA BY J. ALSTON MOFFAT.

The season of 1888 was not altogether a favorable one for the Lepidopterist in this locality, its prevailing characteristics being coolness and dryness, yet I secured 25 moths new to me.

During the winter months I obtained from various sources, 16 names that prove to be new to the Canadian list. Some of them belong to insects of former years' captures, whilst several very attractive moths secured last season, are yet undetermined, indicating how much has yet to be done before we have obtained a full knowledge of the lepidopterous fauna of our district.

The following are the new names referred to:

Nonagria fodians, Guen.
Glaea inulta, Grote.
Plusia ni, Hub.
Cymatophora humaria, Guen.
Glaucopteryx caesiata, Borkh.
Botis adapaloides, G. R.
Eurycreon sticticalis, Linn.
Conchylis flocosana, Walk.
Eccopsis olivaciana, Fern.
Steganoptica fasciolana, Clem.
Gelechia bilobella, Zell.
" vagella, Walk.
" alacella, Clem.
Carposina crescentella, Wism.
Blabaphanes dorsistrigella, Clem.
Ypsolophus flavivittellus, Fitch.

The first in this list, *Nonagria fodians*, is one of those insects of peculiar habits, which frequent marshy places, and whose larvæ feed inside of water plants.

Some interesting information has been brought out in correspondence recently, about a closely allied species—*Arzama obliquata*—which may in great measure apply to this one also.

The following is a summary:—The food plant is *Typha*, Cattail Flag, which grows in such abundance in our marshes. The female deposits her eggs about the middle of the stalk, and when hatched the young caterpillars at once eat their way into it, feeding downwards, growing as they feed, until, reaching maturity at the end of the season, they have arrived near the bottom of the stalk, where some of them prepare for passing the winter; they enlarge their burrow, lining the bottom with fine cuttings, hibernate in the caterpillar state, change to chrysalids in the spring, and to moths soon after.

Some have been taken from the stalk in the fall, under the level of the water, and in winter, when the ice had to be cut to secure them. Others of them prefer passing the winter on dry ground, and will leave the stalk on which they have fed and swim ashore, if it is necessary to do so, seek out for themselves a hibernacula behind the bark of a decaying stump, under sticks and stones, or some such place, where they make a smoothly rounded cavity in which to pass the winter and undergo their transformations in the spring. Thus, bit by bit, we are learning the interesting and wonderful processes in the life histories of those creatures around us, of whose very existence the vast majority of mankind have no knowledge, but, "they are sought out by all those who take pleasure in them."