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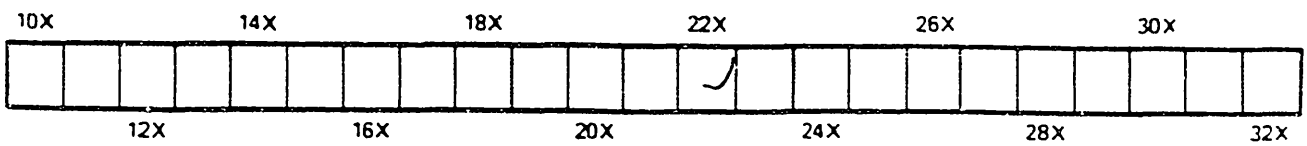

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PROCEEDINGS

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MARCH, 1887.

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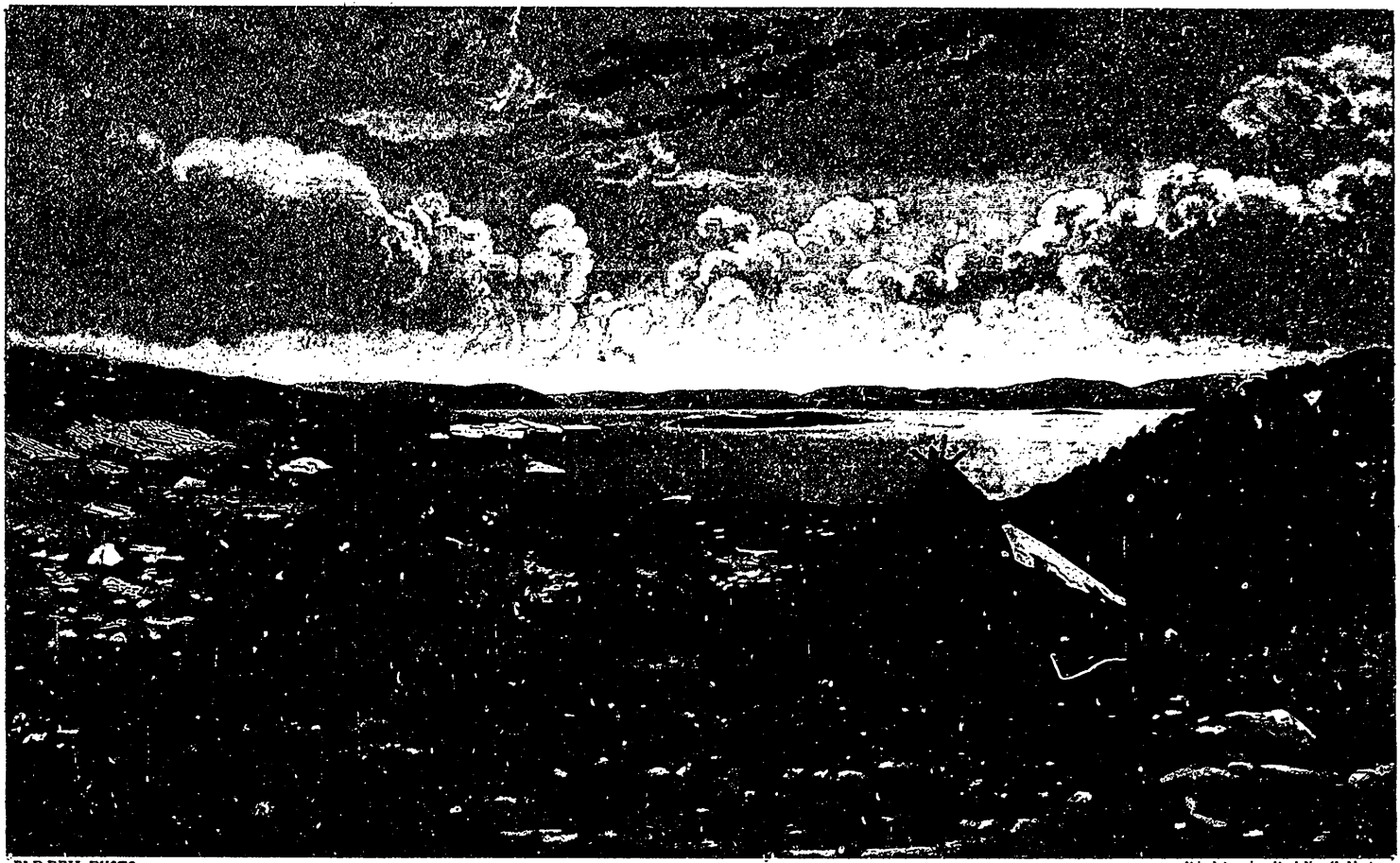

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PROCEEDINGS

OF

THE CANADIAN INSTITUTE,

SESSION 1886-'87.

FOURTEENTH MEETING.

Fourteenth Meeting, 6th March, 1886, the President in the Chair.

The following list of donations and exchanges was read :

1. The Canadian Practitioner, March, 1886.
2. The Spectator, December 5, 12, 19, 26, 1885, and January 9, 1886.
3. Electrical Review, February 27, 1886.
4. Pennsylvanian Magazine of History and Biography, Vol. IX., No. 4, January, 1886.
5. Transactions of the American Society of Civil Engineers, December, 1885.
6. Bulletins of the United States Geological Survey, Nos. 15—23.
7. American Journal of Science, March, 1886.
8. Proceedings of the Academy of Natural Sciences of Philadelphia, Part III, August to December, 1885.
8. Proceedings of the United States Naval Institute, Annapolis, Md., Vol. XII., No. 1.
10. Magazine of American History, March, 1886.
11. The Electrician and Electrical Engineer, March, 1886.
12. The Chemical News, February 19, 1886.
13. Scottish Geographical Magazine, Title Page and Contents, Vol. I., 1885.
14. Journal of the Royal Microscopical Society, Series II, Vol. V., Part 6, December, 1885 ; Series II., Vol. VI., Part 1, February, 1886.
15. Illustrated Journal of Patented Inventions, No. 59, February 19, 1886.
16. Monthly Notices of the Royal Astronomical Society, Vol. XLVII., No. 3, January, 1886.
17. Transactions of the Institution of Engineers and Shipbuilders of Scotland, 29th Session, 1885-86.
18. Correspondenz-Blatt der deutschen Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, Januar und Februar, 1886.
19. Electricité, 13 Février, 1886.
20. Cosmos, 15 Février, 1886.

21. Nordisk Tidskrift for Filologie, Vol. VII., Hæfte I, II, Copenhagen.
22. Tijdschrift voor Nijverheid e Landbouw in Nederlandsch Indië, Deel XXXI, Aflevering VI, Batavia, 1885; Billiton Opstetten door P. H. Vander Kemp III.
23. Monatliche Mittheilungen des naturwissenschaftlichen Vereines des Regierungsbezirks Frankfurt-a-O., 3 Jahrgang, Nos. 9, 10.
24. Wochenschrift des österreichischen Ingénieur und Architekten Vereines, Wien, 12 Februar, 1886.
25. Cronica Cientifica, Barcelona, Año IX, Num. 196. Feb. 10, 1886.
26. Compte Rendu de la Société de Géographie, Paris, No. 4, pp. 113-150.
27. Journal des Sociétés Scientifiques No. 7, Title Page and Contents for 1885.
28. Verhandlungen der Gesellschaft für Erdkunde zu Berlin, Band XIII, No. 1.
29. Real Academia de Ciencias Morales y Politicas, Madrid, Resumen de sus Actos y Discursos 1862, 1866, 1871, 1876, 1883, 1884, 1885, Estatutos y Reglamentos de la Academia, Anuario de 1886.

Total 57.

Mr. J. B. Williams read a paper on "The Destruction of Wild Animals and the Means that should be Taken for Their Preservation," of which the following is an abridgment:

If we walk through the forest on some bright spring morning, all nature seems to rejoice around us. Squirrels are sporting, birds are singing, insects flitting in every direction.

It is difficult then to realize, or remember, what a struggle for existence all these creatures pass through at some period or other of their life. Every creature naturally increases at so high a rate, that if multitudes were not destroyed, the earth would soon be covered by the progeny of a single pair. This applies to the more slowly breeding, as well as to those that increase annually by the hundred or the thousand.

What are the means employed by nature to keep in check this too superabundant life?

To eat and *to be eaten* is the end and object for which multitudes of creatures seem to exist. Almost every creature serves as food for some other creature, and the struggle for existence causes a continual destruction of old forms by new and more highly developed races.

The causes which determine the survival and distribution of each species are very often complex and unknown to us.

Climate, the supply of food, and, in recent times, the influence of the human race, are some of the causes which have determined the existence and the range of our present species.

Just as the advent in America of a superior race of men has driven the Indians from their ancient power and position, so it has been with the races of animals; the new and more highly organized forms have supplanted, and often destroyed, prëexisting races.

The opossum is, in America, the sole surviving representative of the marsupial animals, which once probably were spread as the leading race over the whole world.

They still occupy a supreme position in Australia, because they have been protected from severe competition with higher forms by separation from the mainland within recent geological times.

Instances occur in several other islands of survival by protection, of birds and reptiles representing families, now almost extinct, but which once were the predominant races.

Thus nature has preserved some records and examples of her past work. Shall we not act wisely, if we also try to preserve for the benefit and instruction of future generations some of those creatures which will, before long, be entirely destroyed unless special means are taken for their protection?

Within recent times the extinction of the Moa in New Zealand and of the Dodo in the Mauritius has been brought about largely by human destructiveness.

The Apteryx still survives in the unsettled portions of New Zealand, but it will soon disappear unless special means are taken to protect it from advancing civilization.

In North America during the last thirty years two birds have become extinct; viz., the great Auk, whose principal breeding places were the banks of Newfoundland and Labrador; and the Pied Duck, a bird nearly related to the Eider Duck; one of the last specimens was killed in Halifax harbour in 1852.

A startling decrease in the numbers of some of our most beautiful birds has been brought about, of late years, by the unceasing war raged against them in order to supply the demands of fashion.

If we turn now to the large mammals, we find the Moose and the Buffalo, or Bison, are being gradually driven from their ancient haunts, and will probably be extinct in a few years' time.

The Buffalo is now nearly extinct in the States. Where thousands used to be met with, it is a rare thing to meet with one or two hundred. The cause has been the relentless and indiscriminate slaughter of whole herds.

The results of the destruction of the Buffalo in Canada were predicted with remarkable accuracy in 1879, when a proposal was laid before the Dominion Parliament by Dr. Schultz to prevent their destruction during the winter months. A report then presented stated that, unless the Buffalo were protected, in ten years at the very furthest, the whole number of Indians in the Northwest, who then relied on those animals for subsistence, would have to be fed and maintained, principally at the expense of the Dominion Government; and that, compelled by hunger, they would be driven to commit outrages which would result in an Indian war.

During that year—1877—about 160,000 Buffalos were killed in Canada alone, but no effective measures were taken to stay the slaughter.

The Moose once ranged as far south as Ohio, now it is almost driven out of the Eastern States, but is still common in unsettled portions of New Brunswick and Nova Scotia. Its range in Canada extends north as far as the McKenzie River, and west to the Rocky Mountains.

It would be a great pity for this magnificent creature to disappear, as it certainly must do if the forests are all destroyed. Animals as large have become extinct in Europe since the historic period. The great Wild Ox, described by Julius Cæsar in his Commentaries, no longer roams in the Hercynian Forest. The white cattle preserved by Lord Tankerville at Chillingham are the last remnants of a British wild ox.

The European Bison, or Aurochs, is now only found in the forests of Lithuania, and some parts of the Caucasus. Those in Lithuania are carefully protected by the Emperor of Russia.

The European Moose, or Elk, was at one time numerous in most parts of Sweden and Norway, but owing to increased population and other causes, it is now only met with in particular districts.

Beavers were found in England and Scotland in the 12th century, and remains of their dams still exist in some parts of Wales.

A certain amount of protection is afforded to some of our wild animals by the existing game laws, but as the country becomes settled something more will be necessary, and considerable areas of prairie and forest must be maintained in their native wildness and grandeur, if future generations are to gaze upon the Moose and Buffalo.

Such reservations could be easily created now. If left for another generation they could only be formed at very great expense.

Our neighbours across the line have set a good example in this respect. The Yellowstone National Park or Reservation in the United States was set apart by Act of Congress in 1872. It is under the control of the Secretary of the Interior, who is authorized by the Act "to provide for the preservation from injury or spoliation of all timber, mineral deposits, natural curiosities or wonders, within the said Park; and against the wanton destruction of the fish and game found within the said Park, and against their capture or destruction for the purposes of merchandise or profit."

The Park lies between Wyoming and Montana Territories. Its length north and south is sixty-one miles, and its breadth fifty-three miles, its total area being a little over 3,000 square miles. The district comprised within its boundaries is 6,000 feet above the sea level and the greater portion of the land is covered with magnificent pine forests. A report recently presented to Congress recommends that *all* shooting be prohibited within the Park, and that visitors to it shall not even be allowed to carry firearms.

It would, perhaps, be better to form in Canada several such Reservations of moderate size, rather than one very large one; for there is another object in making these reservations besides that of protecting wild animals—the rainfall of a country or district is considerably affected by the destruction of its forests.

The gradual diminution of forests in the Adirondack Mountains has seriously affected the water supply of New York State. The volume of some of the rivers has decreased from thirty to fifty per cent. within the memory of man.

The Yellowstone Park is a watershed whence several large rivers have their source, hence one reason for its selection as a permanent forest.

Look at a map of Canada and you will find several districts about fifty miles square, from each of which a number of important rivers have their source.

There is one such in the northern part of New Brunswick; one in Ontario about one hundred miles northwest of Lake Nipissing; one near the Kicking Horse Pass in the Rocky Mountains.

These would seem to be appropriate spots for forest reservations.

It may not be possible to carry out all that is suggested here, but something may be done, I trust, if the subject can be brought prominently before the public and the Government.

Mr. Marling thought a representation should be made to the Government by the Institute on the subject of providing a suitable reservation.

Mr. Bain directed attention to the tract known as the Barren Grounds as affording a suitable place for a good natural reservation.

Mr. Rouse thought that such a reservation should be easy of access.

The President was strongly in sympathy with the views expressed by Mr. Williams, and agreed on the necessity of a reservation. He was in favour of additional security being provided by law, especially in the case of birds. He did not know the exact reading of the law, but thought it should not only prohibit the killing of the animals in certain seasons, but also having them in possession or exposing them for sale. He had seen barrels of brook-trout exposed for sale by fishmongers on Yonge street during the protected time of the year. The delicate flavour of the trout was destroyed, and they were of no more value than any coarse fish. This exposure for sale could be prevented in the centres of population. Thus the law should be strictly enforced, and examples made of all offenders In the case of birds, they should not be allowed to be killed, nor exposed for sale, nor the feathers worn on the person. This would protect the birds effectually. He was in favour of the Institute bringing the matter before the Government and asking for the additional restrictions he mentioned.

Mr. Purvis suggested that the matter be referred to a Committee.

Mr. Pursey and Mr. Noble explained the views of the Natural History Society on the subject.

On motion of Mr. Livingston, seconded by Mr. Browning, it was resolved that the President be asked to appoint a Com-

mittee to co-operate with the Committee appointed by the Natural History Society in carrying out the views set forth in Mr. Williams' paper.

FIFTEENTH MEETING.

Fifteenth Meeting, 13th March, 1886, the Second Vice-President in the Chair.

The following list of donations and exchanges was read :

1. Le Naturaliste Canadien, Mars, 1886.
2. The Canadian Entomologist, Vol. XVIII, No. 1.
3. Journal of the Franklin Institute for March, 1886.
4. Electric Review, March 6, 1886.
5. Science, Vol. VII., Nos. 160 and 161.
6. West American Scientist, Vol. II., No. 1.
7. Journal of the New York Microscopical Society, Vol. I., No. 9.
8. Magazine of American History for February, 1886.
9. "Huguenots and the Edict of Nantes," from the Rhode Island Historical Society.
10. Transactions and Proceedings of the Technical Society of the Pacific Coast, Vol. II., No. 14 and Vol. III., No. 1.
11. Transactions of the American Institute Mining Engineers, Vols. I.–IX., and Vols. XI.–XIII., with Index Vol. I.–X., May, 1871 to June, 1886.
12. Imperial Federation, March 1, 1886.
13. The Chemical News, February 26th, 1886.
14. Transactions of the Cambridge Philosophical Society, Vol. III., Part I, 1886.
15. Wochenschrift des oesterreichischen Ingénieur und Architekten Vereines, 19 Februar, 1886.
16. Electricité, 20 Février, 1886.
17. Cosmos, 22 Février, 1886.
18. Boletin de la Real Academia de la Historia, Vol. VIII., No. 1, Madrid.
19. Mémoires et Comptes Rendus des Travaux de la Société des Ingénieurs Civils, Octobre, 1885.
20. Gazetta Chimica Italiana, Anno XV., Fas. 10.

Total 35.

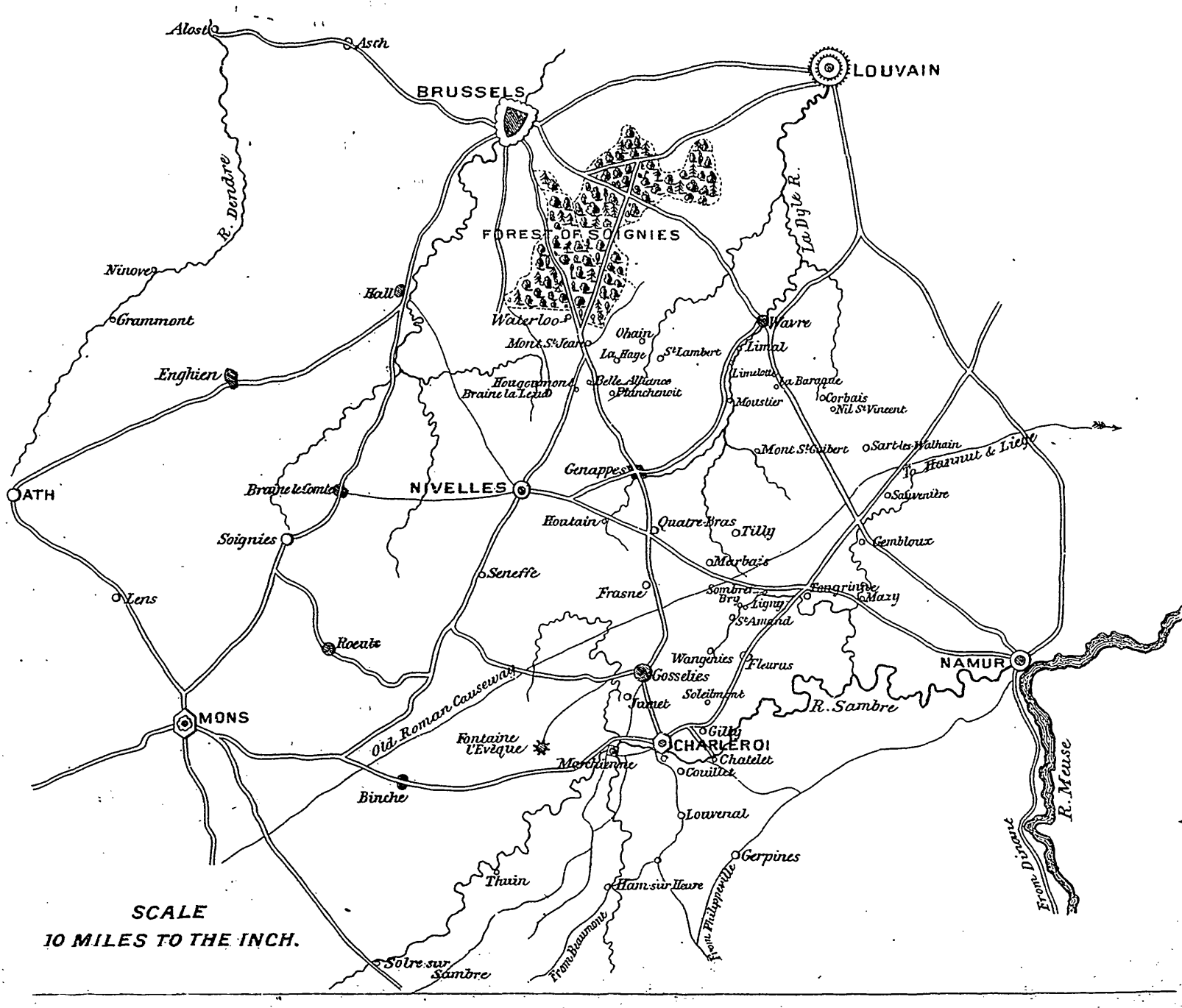
Rev. Th. Laboureau of Penetanguishene was elected a member. Mr. J. A. Livingston read a paper on "The Desirability of giving Currency to all Convertible Securities."

SIXTEENTH MEETING.

Sixteenth Meeting, 20th March, the President in the Chair. The following list of donations and exchanges was read:

1. Canadian Entomologist, Vol. XVIII., No. 2.
2. Monthly Weather Review, Dominion of Canada, February, 1886.
3. Annual Report of the Library Commissioners and Librarian for 1885. Halifax, N.S.
4. Second Annual Address before the Oneida Historical Society of Utica, by William Tracy.
5. Science, Vol. VII., No. 162.
6. The Electrical Review, March 13th, and 20th, 1886.
7. Annals of Mathematics, University of Virginia, Vol. II., No. 2.
8. The Old Lodge, from the Georgia Historical Society.
9. Report of Proceedings of the Eighteenth Annual Convention of the American Railway Master Mechanics' Association, June 16th, 17th, 18th, 1886, presented by G. Davies Barnett, Esq.
10. Chemical News, March 5th, 1886.
11. Proceedings of the Royal Geographical Society, Vol. VII., No. 3, March, 1886.
12. The Midland Naturalist, No. 99, March 1886.
13. Trübner's American, European and Oriental Literary Record, Nos. 219, 220.
14. Quaritch's Catalogue, No. 365.
15. Proceedings of the Literary and Philosophical Society of Liverpool, Vol. XXXVIII., 1883-84.
16. Wochenschrift des österreichischen Ingenieur und Architekten-Vereines, Wien, 16 Februar.
17. Annalen des K. K. naturhistorischen Hofmuseums, Jahresbericht für 1885. Band V., No. 1.
18. Electricité, 27 Février, 1886.
19. Cosmos, 1 Mars, 1886.
20. Boletin de la Sociedad Geografica de Madrid, Tome XX., Numero 1.
21. Bullettino della Sezione Fiorentina della Società Africana d'Italia. Volume II., Fascicolo 1.
22. Compte Rendu de la Société de Géographie. No. 5, pp. 153, 176. Paris, 1886.
23. Journal des Sociétés Scientifiques, 3 Mars, 1886.
24. Jahrbücher des Nassauischen Vereines für Naturkunde, Jahrgang 38, Wiesbaden.
25. Allgemeine Bibliographie der Staats und Rechtswissenschaften XIX. Jahrgang No. 1, 2, 1886.
26. Bullettino di Bibliografia e di Storia delle Scienze Matematiche e Fisiche Tomo XXIII, Maggio 1885. Roma.

Total 28.



MAP OF PART OF BELGIUM TO ILLUSTRATE THE

CAMPAIGN OF 1815.

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DE LA

CAMPAGNE DE 1815.

Mr. R. E. Kingsford, M.A., read a paper on "The Campaign of 1815."

The Rebellion of the French nation against Louis XVI. was the protest of humanity against oppression. The French, that lively, courageous and industrious race, deserve the world's thanks for their desperate resolution to inaugurate a new system. Their thoroughness in carrying out the resolve brought upon them the enmity of almost all other nations, but those very nations profit this day by the Revolution, to punish which they invaded France. Even the insular English, then politically a century in advance of the Continent, found that they had much to learn. An impulse was given to aspirations for freedom which was communicated to each of the Continental nations in succession, and this impulse, though impeded from time to time, has never ceased in its action. But just as, in the case of individuals, men suffer in their own persons the consequences of originality, so the French nation bitterly paid for its generous self-sacrifice on the altar of Freedom. A sacred cause was defiled; enthusiasm was replaced by fanaticism; fanaticism gave way after a struggle to charlatanism; charlatanism supported itself by murder. The end was chaos. Out of chaos sprang Napoleon. A man of the sword, he smote with the sword, and he crushed the vermin who, daring to crawl on the statue of liberty, had stained it with their filth. But the statue itself he overturned, and he placed himself on the pedestal. From that eminence he was in turn struck down, but he long held the position by virtue of extraordinary genius, courage and energy. We shall see him make a supreme effort to recover himself, almost succeed, then sink, baffled and exhausted, into a Slough of Despond, from which he was destined never to emerge.

We propose to give a succinct account of the military operations of the 15th, 16th, 17th and 18th of June, 1815. A careful examination of the authorities has led us to the opinion that the popular belief of Englishmen and men of English descent with regard to this campaign requires revision, and that there are salient features which have been ignored by most English writers.

The general English idea is that "The Duke" drubbed the French well, and that he never was in serious danger.

The Prussians think, on the other hand, that the English would never have beaten the French but for their help, and that they are,

equally with the English, entitled to the credit of victory, perhaps more so.

The French, again, believe that their idol would have annihilated both English and Prussians had there not been treason. They know that the Prussians were defeated and the English surprised, and why they themselves were ultimately beaten they have never understood.

Examination of the facts should inform us which of the two first opinions is correct and give us an explanation for the third. This examination we propose to make briefly, but fairly and dispassionately.

The story we have to tell may be called the "Drama of Waterloo." It consists of a Prologue and Four Acts. We propose to narrate it in that manner.

PROLOGUE.

Napoleon left Elba on the 26th February, 1815. He landed at Cannes on the 1st March. He arrived at Fontainebleau on the 20th March. That is, in three weeks he was master of France. The first prominent man who joined him was General Labedoyère. We shall meet his name again.

The army and the Marshals declared for the Emperor on the 22nd of March.

But the Bourbons had been in power since the preceding May. A few of the Marshals and a portion of the superior officers remained true to them. In the interval, also, they had broken up the old Napoleonic organization. They had replaced the Tricouleur by the White Lilies. They had changed the designations of the various regiments, studious in every thing, Mrs. Partingtons as they were, to use their feeble broom against the tide of modern feeling. But there were with the colours on the 1st April 223,972 men, 155,000 of whom were ready to take the field.

The evidence as to the condition of these men seems to establish that they were well uniformed and armed. Napoleon claimed that they were not so, but it seems that his statements were incorrect on this point.

Here is afforded the opportunity of presenting the real obstacle in the way of forming a fair judgment of the occurrences we are about to relate.

Napoleon published two versions of the campaign of 1815: the first, by General Gourgaud, in 1818; the second in 1820, as *Mémoires*

pour servir à l'histoire de France en 1815, subsequently re-published in 1830 as Volume IX. of the Memoirs dictated at St. Helena. These volumes, according to certain French authorities, are full of mistakes, misrepresentations and inexact statements. For some years, however, they passed unquestioned. In 1840 the Duke of Elchingen, second son of Marshal Ney, with the view of restoring his father's memory, which he deemed unjustly assailed by Napoleon, gave the first shock to their authority by publishing a collection of the orders and letters of the Emperor to the Marshal, and also the result of enquiries made by himself among officers then surviving as to what actually happened. Other memoirs, such as those of Grouchy and Gérard, were also published. Between 1839 and 1842 appeared Alison's Europe. Siborne's account of the Waterloo Campaign, which, although trustworthy, contains too much fulsome eulogy of the "Great Duke," was published in 1844. The German, or Prussian, view of the matter, as given by Von Damitz and Von Clausewitz, had been published in 1837 and 1835. Thus conflicting materials accumulated. At last, in 1857, there appeared the "*Histoire de la Campagne de* 1815," by Lieut.-Colonel Charras, which, although not as commonly known to English readers as it ought to be, must ever be consulted as an elaborately minute account of the campaign. It must be read with caution, as it is very unfair to Napoleon in many points, while its author claims an eager desire to do him justice. A critical examination will lead to the conviction that the desire, if it really existed, was not carried out. M. Edgar Quinet's "*Histoire de la Campagne de 1815*" was published in 1862. He follows in Charras' footsteps. Thiers also gives a version of the events, which should be read as a corrective of Charras. If Napoleon threw the blame of the disaster upon others, a certain school of French writers, of whom Charras and Quinet are types, have not been slack in retorting on him. He is made responsible, as far as possible, for the unfortunate issue of the campaign, and in his shortcomings is found some solace to wounded French pride. In using both Charras and Quinet this fact must be borne in mind, and even-handed justice will be forced to modify their conclusions on many points in Napoleon's favour.

The divergence comes up first with reference to Napoleon's actions after he had landed in France. The anti-Napoleonic school minimize in every way what was done, but the general impression on this subject is that the Emperor displayed wonderful genius and energy.

Siborne says:—"Never, perhaps, in the whole course of the extra-"ordinary career of that extraordinary man did the powerful energies "of his comprehensive mind shine forth with greater brilliancy and "effect than in his truly wonderful and incredibly rapid development "of the national resources of France on this momentous occasion." We cannot here enumerate all that Napoleon effected between the time of his landing at Cannes in March and his taking the field in June. A discussion of his political measures during this time is foreign to our purpose.

It may be pointed out that the French complain that Napoleon did not lay before them as a nation the peril in which they stood. In May 800,000 foreign troops were on their borders. But Napoleon deceived the people by constant assurances of peace. His war measures, they urge, were not taken with the determination necessary under the circumstances. On the 25th March the Congress of Vienna had formally declared a united war of Great Britain, Russia, Prussia and Austria against Napoleon. He knew of this declaration, the country should have known of it too. But Napoleon felt his personal danger. His only line of policy in his own interest was that of not alarming the French too soon, or they would have perceived the effects of their sudden revolution in his favour and would have risen against him. He therefore declared no general levy of the National Guard. But the fact remains, that while Napoleon on the first of March was an exile, on the first of June he had a thoroughly equipped regular army of 200,000 men. He had a reserve of another 200,000. By the 15th June he would have had the conscription of 1815, producing 77,500 more, besides another hundred battalions of National Guard, or 70,000 more; in all, 555,000 soldiers. When in addition to these figures we take into consideration the immense mass of material, cannon, equipment for horse and man, provided by Napoleon during this time, the fortresses he garrisoned, besides the thinking out and preparing for the campaign with the necessary movements of troops, whatever some French writers may say, the world will not withhold from him its admiration. It should be remembered also that nothing has been said of his complete reorganization of the civil administration in all its aspects, social, financial, and political; nor of his negotiations with foreign states, alone enough to tax the greatest powers. The man who accomplished such results in so short a time now threw down the gauntlet to Europe.

ACT I.

SCENE:—CHARLEROI.

Time:—15th June, 1815.

Nothing marks more clearly the immense progress the world has made since 1815, than the advance in the means of communicating intelligence. To-day, if Russia masses her Cossacks at a point on the Indian frontier, all England knows it the same day, and explanations are demanded forthwith.

In June, 1815, Napoleon threw 130,000 men on the Flemish frontier, and neither Wellington nor Blücher knew of it until the blow struck them. Of his 200,000 men, Napoleon could at this point only avail himself of 130,000. In Alsace, Savoy, the Pyrenees, and La Vendée were 52,800 more; the remainder of the 200,000 were in garrison at Paris, Lyons, and other places. It is with the fortune of these 130,000 men that we have to deal. Napoleon, having decided to try the issue of war in Belgium, directed his efforts towards masking the movements of his troops. He had divided his army into six corps, which, on the 1st June, were at Valenciennes, Avesnes, Rocroi, Metz, and Laon. The Guard was at Compiègne. The total strength of the army was 128,088 men, with 344 guns. All this mass was quietly moved in such a manner that on the 14th of June the whole stood in front of Charleroi, ready to strike, the emperor being personally in command. Opposed, were the Anglo-allied and Prussian armies.

The Duke of Wellington had at his disposal 105,000 men and 186 guns.

Blücher had about 120,000 men and 312 guns: in other words, 130,000 French and 344 guns, against 225,000 allies and 498 guns: Napoleon against Blücher and Wellington. The Anglo-allied and Prussian armies lay side by side. The highway between Charleroi and Brussels was the dividing line. It was the English left, the Prussian right, except close to Charleroi, where the Prussians overlapped. From it Wellington's forces stretched to the sea. From it Blücher's extended to Liége, considerably over one hundred miles from the sea. Wellington had named Enghien or Nivelles as his point of concentration, as he might be attacked on his right or left centre. Blücher had chosen Sombref and Namur for the same purpose. It will be seen that, while Wellington or Blücher could each concentrate his own troops on their own respective centre within a

comparatively short time, yet, if they were attacked on either flank it would take a much longer time to collect them. The readiest mode of attacking Wellington from France was on his right, that is, by way of Mons and Ath, as will be seen by looking at the map of France and Belgium. He expected to be so attacked. His secret orders of the 30th April, 1815, are a proof of this statement. Having premised that he had received intelligence that Napoleon was about to visit the northern frontier, he proceeds :—

"In this case the enemy's line of attack will be either between "the Lys and the Scheldt, or between the Sambre and Scheldt, or "by both lines."

It was neither. It was between the Sambre and the Meuse, and on his extreme left, not on his right or left centre. But Wellington's mind was pre-occupied with his own idea, and even when the attack came on his extreme left he gave orders for concentration on Nivelles, which, fortunately for his reputation, were disobeyed. Had they been followed, Napoleon's left wing would probably have been in Brussels on the 16th of June.

Napoleon struck the allies precisely where they were weak, just at the point where it took them longest to concentrate. His strategy deserved to succeed, and the impartial student, however much he may find it necessary to blame Napoleon in his career, can only come to one conclusion on this master stroke. Unquestionably Napoleon did surprise Wellington and Blücher, his plan was well laid, ably executed, and only miscarried from a series of strange accidents, which, as one reads of them, seem as if they were the result of supernatural interference.

The campaign being one of attack, it will be best understood by following the attacking force. The French army, being collected in three divisions, advanced during the night of the 14th in three columns, the left from Solre-sur-Sambre (see map) by Thuin upon Marchiennes; the centre from Beaumont by Ham-sur-Heure upon Charleroi: and the right from Philippeville (not on map) by Gerpines upon Châtelet.

Now happened the first check. General De Bourmont, a General of Division, with some of his staff, deserted. The effect was most depressing. The confidence of the soldiers in their officers, of the officers in each other, of Napoleon in his lieutenants, was shaken. It is difficult to speak calmly of such an act. The strangest part of

the matter is that this same De Bourmont, being honored by the Bourbons, became Minister of War under Charles X., organized the expedition which resulted in the capture of Algiers, and was made a Marshal of France. He died in 1846, having passed his latter days in obscurity, owing to the fall of Charles X. But his reception by sturdy old Blücher must have shown him what honest men thought of him. That stout old hero turned on his heel when he was presented, and when attention was called to the white cockade De Bourmont had mounted, all he said was: *Einerlei was das Volk fur ein Zeichen aufsteckt. Hundsfott bleibt Hundsfott.* "What has the "cockade to do with it? The man is a scoundrel." Quinet says of this event: "After half a century, in which we have honoured and "crowned every man who has succeeded, this desertion is perhaps "the only one which has not found apologists among us." How different was the feeling of Berthier! He refused to join Napoleon, and retired to his palace at Bamberg. But when he heard the drums of the Russian troops on their march to invade France, in an agony of shame and remorse he threw himself from one of the palace windows and was taken up dead.

But the advance continued. The first enemy met was by the left, which struck part of the Prussian division of Pirch II. (so called to distinguish him from another general of the same name, who is called Pirch I.), belonging to Ziethen's corps, one of the four of Blücher's army. News of the French advance had by this time been conveyed to Wellington and Blücher. The latter at ten o'clock on the night of the 14th, had ordered Ziethen to wait the attack and slowly retire towards Fleurus. The other three corps of the Prussian army were ordered to move. Bülow from Liége to Hannut, Pirch I. from Namur to Sombref, Thielmann from Ciney* to Namur.

As the French divisions successively came up on the left and centre they were pushed forward, driving the Prussians back, but the latter stubbornly held every position, both on the Brussels and on the Namur roads. The French had to fight their way. The Pirch II. division was gaining time for the other divisions of Ziethen's corps to concentrate at Fleurus. Charleroi was taken by one o'clock, and the French passed through, some towards Gosselies, others towards Gilly. At five o'clock, Marshal Ney came up to take command on the Brussels road. On the 11th

* Liége, Hannut and Ciney are east of the limits of the map.

he had been in Paris. He had received a message from Napoleon: "If Ney wishes to take part in the first battle, let him be on the 13th at Avesnes (not on map), which will be my head-quarters." He had started on the 13th, had arrived in Beaumont on the 14th, was detained by want of a horse, had bought a couple from Marshal Mortier on the 15th, and found Napoleon at about half-past four. Napoleon welcomed him, put him in command of the 1st and 2nd corps, D'Erlon's and Reilles' (44,300 men), and some cavalry, and concluded his instructions by ordering him to advance and *drive the enemy.*

From this point commences a division of Napoleon's army, part under Ney on the left along the Brussels road, the other part under the emperor along the Namur road. Ney ordered his men to push on. The Prussians, who were on the west of the Brussels road, had by this time all crossed it, making for Fleurus, and the way was clear to Frasne. There the advance struck the extreme left of the Anglo-allied army. It was now half-past six. The allied troops at Frasne were part of the first corps of Wellington's army, and belonged to the 2nd Dutch-Belgian division, 7,500 strong, under the command of General Perponcher. The battalion actually in position, about 4,000 strong, was under the command of Prince Bernhard of Saxe-Weimar. It held its ground firmly against the attacks of such troops as Ney brought up. The latter thought it better not to run any risk, and therefore resolved not to attempt anything more, but to hold Frasne and await orders. Frasne is between five and six miles north of Charleroi; Solre-sur-Sambre fifteen miles from Charleroi. The left had, therefore, advanced some twenty miles. They had started at three in the morning, commenced to fight at four, crossed the Sambre at ten, pushed on north to near Gosselies, and there waited for orders, which they received about three o'clock, that is, they had three or four hours rest. They then had advanced to Frasne, where, as above stated, Ney took command about five. It is not easy to understand why he was now so cautious. He had the cavalry division of Piré in hand, and Bachelus' infantry corps in support, and some artillery. If he had pressed Prince Bernhard, who had only four thousand men, he could probably have occupied Quatre Bras, instead of Frasne, that night. If he had done so, he would have commanded the line of communication between the English and Prussian armies. The road from Namur to Nivelles crosses

the Brussels road at Quatre Bras. It was, therefore, of the greatest consequence to Napoleon to take it, and to the allies to hold it. A glance at the map will show that such was the case. If, then, Ney had seized Quatre Bras on the evening of the 15th, Napoleon's tactics would have been perfectly successful. His not doing so was the first failure in the campaign. Charras says Ney was right in not attempting to attack Quatre Bras. The reasons he gives are cogent, but the fact seems to be that Ney was imposed upon by the strong front shown by Prince Bernhard, and could, if he had pressed on, have carried Quatre Bras with ease.

On the centre, owing to a mistake in the transmission of orders, Vandamme's Division, instead of marching at three in the morning, did not march until seven o'clock. The Young Guard took their place in the column. But the result of the delay was that the advance guard of the centre, which appeared before Charleroi about eight o'clock, was not supported until twelve. The Young Guard then came up, and by their assistance Pajol, who led the advance, entered Charleroi, passed through and pressed the Prussians, until the latter stood firm at Fleurus. Grouchy, who subsequently came up, halted with Napoleon's approval, and the latter returned to Charleroi at eight o'clock, worn out with fatigue. The right, having started later, reached Châtelet at three o'clock, and remained in front of that place. Such were the results of the first day's operations. The Sambre was crossed, Charleroi taken, the French centre and right lay on the Namur road in front of Fleurus. Was the day successful or not? The answer to this question depends on how far the allies had made use of the time in concentrating their forces. We have seen what Ziethen did. He concentrated his corps at Fleurus, where he stood prepared to dispute the passage.

We have seen that orders were given by Blücher on the night of the 14th to his army to close up.

By midnight on the 15th, Pirch I. had his whole corps (31,758 men) at Mazy, near Sombref, while Thielmann was a mile or two in front of Namur. At ten o'clock at night of that day, Bülow was still at Liége, far off. Thus Blücher by midnight of the 15th had three corps, or nearly 80,000 men, within sixteen miles of the enemy. What had Wellington done? We have seen that news of the French advance was sent to him on the 12th. Sir Hussey Vivian, whose Brigade of Cavalry was near Tournai, reported to him on that day that

the French were preparing to attack. He made no change in his dispositions. On the 15th, at nine in the morning, he received a dispatch from Ziethen, written from Charleroi, announcing that the advanced posts on the Sambre were attacked. Still no movement was made. The first order for concentration came from General Constant de Rebecque, the Chief of Staff of the Prince of Orange, at two o'clock in the afternoon. It was a partial order to the Second Dutch-Belgian division, which was the extreme left of Wellington's army, to concentrate at Nivelles and Quatre Bras. Information of these orders was sent to Wellington at Brussels, but he still ordered no general movement. Siborne says that the Prince of Orange, who was in command of the First Anglo-Allied Corps, also forwarded to Wellington a report which he had received from his outposts, stating that the French had attacked the Prussian advanced posts on the Sambre, and that this report reached Wellington at five o'clock p.m.

Between eight and nine o'clock that evening came a letter from Blücher, saying that Thuin had been attacked, and that Charleroi appeared to be menaced. Then Wellington gave his first general order for concentration. Siborne says this order was given about five o'clock in the afternoon, but Charras has proved conclusively that it was not sent until between eight o'clock and half-past nine in the evening.

There was, at the same time, a special order to the corps of the Prince of Orange. It prescribed that the Perponcher Division, part of which had been since noon disputing the Brussels road with the French at Quatre Bras, a fact of which Wellington was unaware, should go to Nivelles. At ten o'clock, further news had come in. "After orders" were issued, with the view of completing the concentration. It was this news which broke up the Duchess of Richmond's ball, so well known from Byron's lines. We cannot repeat the orders, from want of space, but they can be seen in Siborne. If they had been carried out, the Anglo-allied army would have drawn away from the Prussian. The extremity of the left wing would have been five miles west of the Brussels road, and eleven miles from Sombref, where the Prussians were collecting.

At eleven o'clock at night, more precise intelligence came in, and fresh and more urgent orders were sent out. But through all appears the idea that the French would strike at Brussels, by way of Nivelles or Braine-le-Comte, not by the Charleroi road.

The result of this delay and false movement of Wellington was favourable to Napoleon. It left him free to deal with Blücher alone. He had counted justly on Wellington's slowness and Blücher's rashness. His *coup* appeared, therefore, to have all the elements of success. The heroes of the day were, however, the brave Prussians of Ziethen's Corps, who had stopped the French at Gilly, and Prince Bernhard and his Nassauers, who had stopped them at Frasne.

ACT II.

SCENE :—LIGNY AND QUATRE BRAS.

Time:—16th June, 1815.

At nine o'clock on the evening of the 15th Napoleon had returned to Charleroi. Wearied out, he threw himself on a bed to get some rest. About ten o'clock Ney left Gosselies, and reached Charleroi about midnight. He and the emperor had supper together, and a long conversation. It was two o'clock on the morning of the 16th when they separated. Some topics, unpleasant to both, were doubtless avoided, and their old friendship seemed completely rëestablished. So far as anybody heard, the emperor had no reason to complain of the marshal. The plan of campaign must necessarily have been talked over, but no definite decision seems to have been communicated to Ney. It would have been better for France if both Napoleon and Ney had rested, instead of talking over old times.

In June the nights are short, and the day dawned shortly after Ney went to his outposts. For the bulk of the army, military operations had ceased at seven or eight o'clock of the evening before. The troops had had time to rest. They were, moreover, in good spirits, and anxious to advance. On the 15th they had started at half-past three. On the 16th the divisions in rear of the left could have been closed up to the front very early in the morning. Ney would then have had 22,254 men in hand, and D'Erlon's 20,000 close behind. If he had pressed on at any hour from four o'clock in the morning up to ten or eleven, with his 22,000 men, he would have overwhelmed all before him. Prince Bernhard and his 4,000 Nassauers held their position all night, and were not reinforced till about four in the morning, when General Perponcher marched the rest of his brigade there, making in all about 7,000 men, with sixteen guns. The Prince of Orange, who was the general in command of the first corps, to which Perponcher's Division belonged, arrived about six o'clock,

but brought no reinforcements: in fact, no more came up at all, until three or half-past three o'clock in the afternoon. The Duke of Wellington was on the ground at eleven o'clock, but brought no troops. When Ney did attack, at two o'clock, he only attacked with not quite 10,000 men of all arms. By three o'clock he had 17,615 in action, but during the whole of the rest of the day, he only had 22,000 men engaged, and of these only 15.750 were infantry, one of his infantry divisions (Gérard's, 4,297 strong) having been withdrawn from him by Napoleon. He made no use of D'Erlon's corps, 20,000 strong. The delay on the left was most disastrous to the French. What was the situation elsewhere?

We have seen that at midnight of the 15th the only Prussian corps in the immediate front of the French centre and right was Ziethen's – 32,692 men, less the loss of the 15th, say 1,500—say 31,000 men with 96 guns. The nearest corps to Ziethen was that of Pirch I., three divisions of which were at Mazy, nine miles from the front. These three divisions arrived there from Namur, in obedience to Blücher's order of the evening of the 14th, at three in the afternoon of the 15th, and halted at that place. They did not advance to Sombref, face to face with the French, until about ten o'clock in the morning of the 16th, when they were joined by their fourth division, and that was the time when Ziethen received his first immediate support. Up to that hour he had been alone in front of the French, and subject to be attacked by Napoleon with the centre and right of the French army, except such part as had not crossed the Sambre. The result of such an attack could not be doubtful. The next nearest corps to Pirch I. was that of Thielmann, but he was close to Namur, twenty miles distant, during the whole night of the 15th, and only commenced to advance from Namur about seven o'clock on the morning of the 16th. He arrived at Sombref about twelve o'clock of that day.

Three cannon-shots were heard from Fleurus at half-past two in the afternoon. They were Napoleon's signal for attack. By that time he had to deal with 90,000 Germans. Three-fourths of Blücher's army were concentrated and well posted for defence.

Ney; as we have seen, had waited until two o'clock to commence his attack on the left. What caused the delay?

The French army was anxious and ready to fight. Everything depended on prompt action. Had such been the case, Ney with

40,000 men would have overthrown 7,000 troops, many of whom were doubtful, being Dutch Belgians suspected of French sympathies, and with no supports at hand. Napoleon with 83,000 would have had to attack 31,000, true, with another 31,000 to support them, but that support nine miles away. The object of the sudden attack was therefore possible of accomplishment. The question is, did Napoleon display the energy which the crisis demanded, or did he press the advantages so far in his favour? It must be remembered that fully 25,000 of the French centre and right had not crossed the Sambre on the night of the 15th. It required two or three hours at least to get these troops over, and as they were the reserve artillery and heavy cavalry, besides Lobau's infantry, 10,000 strong, it was absolutely necessary to wait for them. Again, Gérard's corps was at Châtelet, and had to be moved up to Fleurus, about seven miles, while Vandamme had five miles to cover. The Guards had nine miles to march from Charleroi to reach the front.

In view of these facts, and bearing in mind that Napoleon had to wait for the reports of his various reconnoitering parties, any charge of too great delay on his part on the morning of the 16th appears unreasonable and unfair. He rose at five o'clock. His orders to his right to concentrate were sent out before eight o'clock, those for Ney before nine o'clock. He himself reached the front about noon. The French left and centre were in position by one o'clock, and the attack on the Prussians began at two. It is not easy to see how it could have begun much earlier in the day. At the same time he was doing all he could to bring up his left without actually going over in person. He sent Ney a dispatch early in the morning, asking for exact information as to the position of his various corps. As above stated, he sent a general order of movement, and also a personal letter, giving full explanations of the plan of operations before nine o'clock. He sent another dispatch at ten o'clock in reply to a hesitating message from Ney. He sent another at two, and another at three, or a little after. All were urgent expressions of his desire that Ney should advance, and if possible manœuvre to join the right. But Ney, or rather Ney's subordinate, Count Reille, for reasons satisfactory to himself, did not think fit to obey at once the first order to advance, which reached him about half-past ten. Having asked further instructions from Ney, the order to advance was repeated, but he did not come into the field until one o'clock.

Napoleon judged correctly enough that the dispersed Anglo-allied forces could not be collected in time for serious resistance to his own forces properly handled, but Ney's want of perception of the necessity for a strenuous advance lost the emperor the advantages which should have been gained on the left.

Ney on the left and Napoleon on the right were simultaneously engaged from about two o'clock. Napoleon defeated Blücher. What then did Ney effect? All that can be said is that he prevented Wellington from joining Blücher. This was no small achievement. Wellington, after arriving at Quatre Bras at half-past eleven, rode over to Blücher and promised him that by three or so in the afternoon the English army would join the Prussians. A vain promise never kept. The Duke found Ney in his road and the way was barred. Could Ney have done more than he did? It has been shewn that he could, had he acted on his orders more promptly. But it has been shewn further that the Marshal's whole force engaged was never more than 22,000 men, and that he made no use of D'Erlon's Corps of 20,000 men.

This episode is the most inscrutable in the whole campaign. The absence of these twenty thousand men alone prevented Ney from inflicting a decisive defeat upon Wellington at Quatre Bras. Siborne, who is the Duke's most uncompromising admirer, explicitly admits this fact. How did it happen?

It seems impossible to give a satisfactory answer. But the facts seem to be as follows: When Ney got his orders from Napoleon at half-past ten o'clock in the morning to advance, D'Erlon was at Jumet. (See map.) He was ordered by Ney, as part of the general movement, to advance as far as Frasne, detaching one division to Marbais. At twelve o'clock he commenced his march. Hearing the action going on in front, he left his column and rode on in advance to Frasne. He drew rein there, and while conversing with some of the superior officers was joined by General Labedoyère, who had come from Napoleon. That general showed D'Erlon a pencil note which he was taking to Ney, and which ordered the Marshal to detach D'Erlon's Corps towards Ligny. He added that he (Labedoyère) had already given the order for the change of direction of D'Erlon's column, and pointed out to D'Erlon himself the direction in which to go to join it.

Ney, in a letter dated the 26th June, 1815, complains that Napoleon had taken away D'Erlon's Corps without notifying him (Ney), and having, therefore, to act without D'Erlon, the battle of Quatre Bras was lost. D'Erlon's account of the matter seems to contradict Ney's statement. Col. Heymes, Ney's Chief of Staff, confirms D'Erlon's account, but says that Col. Laurent, not General Labedoyère, was the aide who carried the message. As D'Erlon was put in motion by Ney about eleven o'clock, in obedience to Napoleon's letter and second despatch, and as the distance from Jumet to Frasne is a little over nine miles, and as D'Erlon galloped on in advance of his column, he must have met General Labedoyère in about an hour and a half, or two hours, after eleven o'clock—say one o'clock. Now any order sent from Napoleon to Ney by the hand of General Labedoyère, and which reached Frasne by one o'clock, must have left Charleroi very shortly after half-past ten, as Charleroi is about ten miles from Frasne—if sent from Fleurus it would be eight miles. The order which Labedoyère is said to have carried, and to have shewn to D'Erlon, was contradictory of Napoleon's third despatch, and not only of that despatch, but of the whole of the previous second despatch. What had happened so early in the day to induce Napoleon to take away the first corps from Ney? The only reason which appears at all satisfactory is, that Napoleon, as he descended from his carriage at Fleurus, at twelve o'clock, saw that there was urgent need in that part for D'Erlon just then. Instead of having only a part of the Prussian army, he found three-fourths of it in front of him. And yet this explanation is not quite satisfactory, because later on in the day, namely at two o'clock and three o'clock, Napoleon sent two more despatches to Ney. The first repeated the order to attack, and informed Ney of the arrangements for Grouchy's attack at half-past two on Ligny, and stated that there was a corps of troops (not an army) to attack. The second informed Ney that the action was at its height, and ordered him to manœuvre towards the emperor. Neither of these despatches says one word about D'Erlon, or intimates in any way that he had been withdrawn from Ney. It could not be either of these which Labedoyère shewed D'Erlon, because the first says nothing about D'Erlon's moving toward Ligny, and the second was sent too late to have reached D'Erlon at the hour he and his division were on the road to Frasne.

Again, in a despatch written by Napoleon to Ney the next day

(the 17th), Napoleon complains that the marshal had not united his divisions. He says: "If the corps of D'Erlon and Reille had been "together, not an Englishman would have escaped of the corps which "attacked you." The despatch then goes on: "If Count D'Erlon "had executed the movement on St. Amand which the emperor "ordered, the Prussian army would have been totally destroyed, and "we should have taken perhaps 30,000 prisoners."

This incident of the turning aside of D'Erlon's column is one of the enigmas of history. We have stated all that we have been able to ascertain about it. We cannot accept any of the published explanations as satisfactory; and now the actors in the drama are dead, there is no hope of any solution of the difficulty.

Where did D'Erlon go when he left his proper line of march? If the commencement of the incident was singular, its conclusion was still more so. The new line of march of D'Erlon led him towards Napoleon. The heads of his columns showed themselves in Napoleon's left rear about half-past five in the afternoon. They must either have been longer on their cross-march than the length of the march warranted, or they must have been very much later than eleven o'clock in starting from Jumet. Whatever the truth may have been, there is no doubt on one point: their arrival was unexpected. Nobody knew who they were. Napoleon sent an aide-de-camp off at full gallop to find out, and postponed a threatened attack on the Prussian centre until the messenger should return. At half-past six the aide-de camp came back with the information that it was D'Erlon's column, about two miles from St. Amand, exactly where it was needed for Napoleon's purpose. Charras says: "Let the order be given. In an hour twenty "thousand men of all arms will debouche on Wagnelée, on Bry, rolling "up in rear Blücher's right wing on his centre, while he is assailed "in front by Vandamme and Gérard, reinforced by the whole reserve. "The plan conceived by Napoleon will be realized. There will not "escape 20,000 Prussians. The order is not given, D'Erlon is not "summoned." But the fact seems to be, according to the best evidence, that Napoleon did summon D'Erlon more than once, but that Ney, at the same time, also repeatedly and urgently ordered D'Erlon to return to him, being in the very throes of his struggle at Quatre Bras, and that D'Erlon thought it best to obey the marshal under whose immediate command he had been placed, and not the emperor. It seems, at first sight, unlikely that such should be the

case, and Charras disputes the fact; but, on a fair examination of the whole evidence, the conclusion just stated is the most probable.

Instead of advancing to assist Napoleon, D'Erlon having been summoned by Ney to return to him, countermarched his men and arrived at Frasne too late to help Ney, as the battle of Quatre Bras was over before he got there. Twenty thousand of Napoleon's best troops marched and countermarched on this memorable day. Their absence from one field robbed the French of what undoubtedly would have been a decisive victory. Their presence on the other field would have turned an indecisive advantage into a complete triumph. Ligny would have been a second Jéna. It would have been to the Prussians what Waterloo was two days afterwards to the French. Napoleon's calculations were correct. His left wing found at first practically nothing to oppose them. His right wing and centre were sufficient to defeat the Prussians. He was not responsible for the false movement which so fatally weakened both wings without benefiting either. Had Ney swept the Brussels road clear of the Anglo-allied army, Napoleon's anticipations of being in Brussels that night would probably have been realized. That it was not so was partially Ney's fault. It was not Napoleon's.

ACT III.

SCENE:—ON THE ROADS TO WATERLOO AND WAVRE.

Time:—17th June, 1815.

The morning sun of the 17th June, 1815, rose on two ghastly fields. At Quatre Bras over nine thousand combatants had been either killed, wounded or missing, while at Ligny about twenty thousand represented the loss to both sides. Perhaps altogether 30,000 men *hors de combat*. We have set forth the actual results of the previous day. Ney had blocked Wellington, Napoleon had defeated Blücher. All had been over by ten o'clock. How had the night been passed? To appreciate what took place it will be necessary to consult the map. Blücher, being forced to retire from Ligny, had two courses open to him. He could retreat by way of Namur, but that would separate him from Wellington, or he could retire to Wavre, from which place it would be comparatively easy for him to rejoin Wellington either before or behind Brussels. With desperate tenacity he, or rather his Chief of Staff, Gneisenau, chose the latter, and the whole Prussian army, including Bülow's corps, which came

up too late for Ligny, was massed upon Wavre by the next afternoon after their defeat at Ligny. Their retreat was not only not harassed by the French, but its very line was unknown to them. That it was so was a cardinal error which led directly and conclusively to Napoleon's overthrow. The more the campaign is studied, the more it appears that all other mistakes on both sides are dwarfed before this one. On Napoleon's side, Ney's inaction, D'Erlon's countermarch, were almost compensated for at the end of the 16th. On Wellington's part, his want of penetration was made up for by the intelligent disobedience of General Perponcher, and the stubborn courage of the British infantry. This error was so serious that its consequences are plainly visible in the grand catastrophe. We are quite unable to account for Napoleon's course of action. We have seen him mass his troops on the 14th, cross the Sambre on the 15th, fight Ligny, and urge on Ney at Quatre Bras on the 16th. We have seen him recognize instinctively the true situation of the Anglo-allied force, and with superior calmness quiet Ney's hesitation. We have seen him hurl at the Prussian army his old guard, a thunderbolt which laid it prostrate. Up to this point he may be said to have been quite successful enough to satisfy the demands of his proposed campaign, although not so completely successful as his plans deserved. Why did he not press his advantage? There is a mournful interest in contemplating him. We see pass before him his former glories. The Bridge at Lodi, the Pyramids, Austerlitz, Marengo. We hear the chant of the Marseillaise as they lead the van of the avenging people. We see a cruel system of despotic bondage torn away, a wakening of the fresh young life of freedom. The brave soldiers, whose bodies lie scattered in far distant fields, come before us in spirit. We see them approach their chief as he lies asleep, and with mute gesture attempt to rouse and save him from his coming fate, then pass away with dumb anguish as they perceive his lethargy. Brave children of France! Your zeal for liberty ofttimes outran discretion. You were guilty of many crimes, many follies, but you were faithful to the flag under which you fought, and to the general who led you to triumph. You came in spirit from your graves to congratulate him on his last victory and vainly to warn him of his coming defeat. There is no picture in his history so painful to our mind as the one we contemplate. The mighty emperor, surrounded by his victorious army, justly proud of themselves and him, flushed

by success, confident of complete triumph; and on the next day but one, at the same hour, behold these very troops, that mighty emperor, flying in panic-struck confusion before their defeated foe, now become a pursuing fury. Although we recognize that the result was probably better for the human race, we cannot help feeling that species of gnawing regret which eats at the heart when it recurs to what might have been, but is not.

Napoleon, instead of sleeping on the field, went back to Fleurus about eleven o'clock. It is generally admitted that before he lay down, he gave orders to Grouchy to send Pajol's light cavalry and Teste's infantry after the retiring Prussians. Thiers says he also sent orders to Ney to be under arms at daybreak, to press the English again. These latter orders are stated by no other author, but are referred to in Soult's despatch of the next morning reiterating them. Even admitting the genuineness of the other orders, those for the pursuit of the Prussians appear to be utterly inadequate. With every disposition to be chary of criticising such a man as Napoleon, we must confess that the inadequacy of these orders is a mystery to us, for which we can find no satisfactory solution. Napoleon must have miscalculated the effect of the battle. Perhaps he undervalued Blücher. Some authors attribute his lethargy to his enfeebled bodily condition—it seems to us very wrongly, on a fair consideration of all Napoleon did achieve. But whatever the reason, the fact is there that the Prussians were allowed the whole night and the next morning to retire on Wavre, and no sufficient attempt was made to follow up their traces.

Napoleon was perfectly justified in turning his whole strength immediately against the English. His plan was to throw his centre where it was needed, and he was quite right to transfer it at once from his right to his left. But why he did not ascertain more exactly what his right had to do, is very difficult to explain. He seemed to have thought that the Prussians would retire towards their own base, namely, Namur, not towards Brussels by way of Wavre, as they did. His first orders were to follow them towards Namur, and there appears to be little doubt but that, in this instance, he was mistaken in the inference he drew from his success. The person to whom is due the credit of the masterly Prussian retreat, which unquestionably saved the campaign, is Gneisenau, whose name is com-

paratively unknown. Napoleon's mistake, for it seems to us that it can be called by no other name, undoubtedly contributed to Waterloo.

The events of the day were as follows: Napoleon rose at five, and sent off orders for Lobau's Corps to march towards the left, followed by the Guard, and then the heavy cavalry. About six o'clock, General Flahault returned from Ney, and reported the result of Quatre Bras. Napoleon immediately sent a written order through Soult to Ney, explaining the position of affairs, and urging him to advance. Charras says this order was not sent off until eight o'clock; Thiers says about seven o'clock. Napoleon left Fleurus for the front about eight o'clock. Other orders were sent out at the same time for a review of the troops who had fought at Ligny. This review began about nine o'clock, and lasted till nearly noon. Meantime Lobau, the Guard, and the heavy cavalry were moving to the left, and reports from the reconnaissances were coming in. It seems to have been Napoleon's plan that Ney should advance, on the theory that the English could not oppose him, in view of the fact that the Prussians were in retreat. Ney could not advance, because Wellington was in front of him with about forty thousand men. They were not withdrawn until about one o'clock. By noon, Napoleon sent out an order by Soult to Ney to advance, and followed it immediately himself. This fact, which is important, is fixed by the despatch from Soult to Ney, which bears the date *à midi*. Before he started Napoleon gave his famous orders to Grouchy. The latter must, then, have received them between twelve and one. These orders were verbal. Thiers gives a version of them which contradicts that of Grouchy. The historian appeals to Marshal Gérard, and other witnesses, and they appear to us exactly the orders which Napoleon would have given. The *fons et origo mali* was undoubtedly the impression which the staff had, if Napoleon himself did not share it, that the Prussians were in retreat upon Namur; and from this time to the end of the campaign we see Grouchy wasting his strength hunting for Blücher exactly where he was not, and entirely ignorant as to what line he ought to take. For the present we leave him, and follow Napoleon. The latter was delayed in the advance by the resolute front shown by the English cavalry, who were protecting Wellington's retreat. He retreated as soon as he ascertained Blücher's disaster, but only to make a better stand. The English horsemen gave the French a taste of what they

might expect the next day. Between the effect of their charge at Genappes and a terrible thunder-storm, it was evening before Napoleon came face to face with Wellington at Mont St. Jean. The emperor deployed his cavalry and guns to feel whether he had a rear guard to deal with, or Wellington's whole army. When he ascertained that it was the latter, we read that he was pleased. He was destined to be more than satisfied, but the question is, was he justified in his opinion that the game was now in his own hands? We will endeavour to give a fair answer to this question, founded on the statement of the position of the various armies, as stated in the sequel.

ACT IV.

SCENE:—WATERLOO AND WAVRE.

Time:—18th June, 1815.

It is half-past eleven in the morning, Marshal Grouchy is sitting at breakfast in the garden of the notary Halbaert, at Sart-les-Walhain. With him are Gérard, Vandamme, Valazé, an engineer officer, and Baltus, in command of the artillery. Suddenly Col. Simon Lorrière enters and says: "I hear firing." The party go out to the garden, and there heavy reports are heard, so heavy that the ground seems to tremble. "It is the emperor, he is fighting the "English, let us join him," says Gérard, "We should march "towards the guns." "No," says Grouchy. "My orders are to "move to Wavre, and to Wavre I am going." The decision was fatal to France, disastrous to Napoleon, and damning for Grouchy's reputation. To correctly appreciate the situation it is necessary to retrace our steps to the position of matters after Ligny, that is on the evening of the day before the one of the incident above related.

We have seen that Napoleon sent out Pajol's cavalry in pursuit of the Prussians. Pajol took the Namur road, that is eastward towards the French right. The Prussians however were by that time in retreat towards Wavre, that is northwards, so as to join Wellington. There has never been so masterly a retreat, or so determined a strategy, as that of Gneisenau. It is impossible to give the Prussian army too much credit for their steadiness and courage during this retrograde movement. While retiring they at the same time used their cavalry in constant and vigilant patrolling, and in this respect were as active as their descendants were in 1870, while the French

were equally inactive. The result of their movement was that by nightfall of the 17th the whole Prussian army of ninety thousand men were in and around Wavre.

The Duke of Wellington only received news of the disaster at Ligny the next morning. He then commenced his retreat, also ably managed, from Quatre Bras about ten o'clock, and arrived at Waterloo about five in the afternoon.

Napoleon on the 17th, after moving off Lobau's Corps and the Guards from his right to his left, about one o'clock in the day, perhaps a trifle earlier, entrusted his right wing to Grouchy, and gave him at first verbal, then at two o'clock written orders. These latter directed Grouchy to march to Gembloux. This dispatch is said to have been suppressed by Grouchy in the controversy which arose. It was first printed in 1842. Its closing sentence is: "In all cases "keep constantly your two corps of infantry united in a league of "ground, having several avenues of retreat, and post detachments of "cavalry intermediate between us, in order to communicate with "headquarters."

Owing to a combination of circumstances entirely beyond Grouchy's control, and for which he can in no way be held responsible, he with his men on the evening of the 17th was only at Gembloux. He was, moreover, quite ignorant of where the Prussians were. He had, however, been at fault in not leaving detachments of cavalry between himself and the emperor, as the latter had ordered.

Napoleon himself had moved off to the Brussels road and followed the advance of his troops, delayed by a tremendous thunderstorm, which turned the country into a sea of mud, and reached the Caillou farm, in front of Mont St. Jean, about half-past six, to find the English in position and ready to give battle. He reconnoitered their position, the reconnaissance lasting until ten o'clock, then returned to his headquarters, which were established at the farm of Caillou above referred to. We are now in a position to appreciate why Napoleon was delighted that the English were going to make a stand alone. Apparently a puzzle why it should have pleased him, it is accounted for from his point of view. He had succeeded in his plans. He had separated the two allies. He had beaten one, not quite so thoroughly as he thought, but so far as he knew sufficiently to keep him out of any fighting for some time. He had left enough of his own army with Grouchy to watch the defeated enemy, and had given

him sufficiently plain instructions what to do. Now he had with himself his whole centre and left, with superb cavalry, enormous force in artillery, and the very *élite* of his infantry, and he was not personally aware, although some of his generals were, what the British soldier can do. He knew however that the Duke of Wellington's army was a very composite one, and he had good grounds for knowing that at least a third of it could not be trusted. When all these considerations are taken into account, it is not wonderful that Napoleon was glad that before him lay Wellington alone.

On his return to his head-quarters he issued the necessary orders for the battle of the next day, and, if his own statement is to be believed, he sent a special order to Grouchy. This order Grouchy, to his dying day, protested he never received. Many writers assert that Napoleon never sent it; but, on considering the orders known to have been sent, and Napoleon's plan of operations, we cannot believe but that it was sent. It was the very thing which Napoleon would be likely to do—keep touch with his right. We also believe that Grouchy did not receive it.

Napoleon, having retired to rest, rose again at two o'clock, and re-commenced his reconnoitering, which he kept up during the remainder of the night. The rain continued, but cleared up about four or five o'clock. If it had been possible, Napoleon would have attacked then, or very soon after, but the ground was wet for artillery. It was therefore necessary to wait. Moreover, Napoleon, as he alleged, expected Grouchy to close up to him, such being the substance of the order of the evening before, and a later one sent off about three in the morning. At ten in the morning, he sent an aide-de-camp to Grouchy, with a third order to the same effect. On these two considerations, he decided to postpone the attack on the British, and after sending off the aide-de-camp to Grouchy at ten o'clock, he slept for an hour. Then, waking at eleven, he gave the signal for attack, and at half-past eleven the Battle of Waterloo began by the discharge of one hundred and twenty guns. This cannonade lasted half an hour, and these were the guns heard by Grouchy, and towards which Gérard begged him to march.

We have thus ascertained the position of Napoleon, Wellington, and Grouchy. Where was Blücher at this time?

Communications passed between Wellington and Blücher on the 17th, in which the latter promised that he would assist Wellington, not only with two army corps, but with his whole army. He added that if Napoleon did not attack on the 18th, they would attack him on the 19th. Such was the spirit in which the men of that day fought for their homes. In pursuance of this promise he started his four corps early on the 18th. Bülow's was the leading division. Its advance reached St. Lambert (see map) about noon, but its main body not until three o'clock. Ziethen's Corps had to cross the line of Bülow's march, and, owing to the delay thus caused, did not reach Ohain (see map) until six o'clock. Pirch had to leave half his corps for the defence of Wavre against Grouchy, and joined Bülow with the other half about half-past seven in the evening. Thielmann was held at Wavre by Grouchy.

Thus, at half-past eleven, Bülow's was the only Prussian column near Wellington, and he was at St. Lambert, five miles from the fighting. From that time to half-past four, this corps was straggling through horrible roads in the valley of the Lasne, in order to seize a position on the French right. At that hour they entered into the operations of the field of Waterloo.

The reader will now understand (if he consults the map) what influence Grouchy could have had by advancing towards Planchenoit, instead of on to Wavre. It is, perhaps, only curious speculation, but it is worth following out, as the turning incident in the campaign. There is not much doubt upon one point, at all events: Grouchy could have considerably delayed, if he could not have prevented altogether, Blücher's junction with Wellington on the 18th. Granting that he was where he was in obedience to his orders; granting that Napoleon was as much responsible as he was for the waste of strength, and useless cavalry marches on the wrong flank; granting all this, giving him every credit for every possible effort hitherto; now, at all events, he should have seen the mistake. There was the firing, there were the Prussians plainly seen on the road towards it,—the very privates saw what was to be done, but the general was blind.

It is useless to fight the Battle of Waterloo over again. Thanks to the old stubborn valour of the British soldiery, and to the tenacity of the British commander-in-chief, who knew his men, and did not spare them, the British held their own. They had all they could do to manage it. It is easy to appreciate the influence which the

Prussians had, when we recollect that, at one o'clock, Napoleon had to detach two divisions of cavalry; then, somewhat later, two infantry divisions—in all, over ten thousand men; that he had to follow these by the Young Guard, and by part of the Old Guard; and that he was really fighting two battles at once.

The strength of the Prussian army actually engaged at Waterloo alone was over 51,000 men.* Their loss there was 6,998, while at Wavre they lost in addition 2,476, in all 9,474 men. The British loss proper was 6,936. That of the King's German Legion and other German troops under Wellington's command was 4,494. The Dutch-Belgians lost 4,147, of which 1,627 were "missing." Exclusive of the Dutch-Belgians, Wellington's total loss was 11,430. These figures shew that the Prussians must have done as severe fighting as the British, and prove they did not come on the field merely to witness an English victory. If Napoleon had had his whole army, and, what is more, his undivided attention to bestow upon Wellington, it is difficult to believe that he would not have been successful. Even as it was, with a large part of his force detached to one flank, and with his attention continually distracted to that flank, he captured one position, La Haye Sainte, he almost annihilated Wellington's cavalry and decimated his infantry. He drove the Dutch-Belgian contingent clear off the field. But he could not shake the British squares. Once more steadiness was more than a match for dash.

Had Grouchy obeyed the dictates of common sense and good judgment, he would probably have secured for Napoleon the opportunity of dealing with Wellington single-handed. He failed to do so, although it seems to us he might and ought to have done so. The result was that by eight o'clock in the evening Napoleon was overmastered, his army was in flight. The glories of the Republic, of the Consulate, of the Empire were for a time effaced by so crushing a disaster. History however will be more just than contemporary depreciation. The candid student will perceive that Napoleon was worthy of his reputation. His general plan of operations was capable of accomplishment, and its defeat is attributable primarily to the useless countermarch of D'Erlon, then to the delay in following up

* By half-past four o'clock, 15,906 men and 64 guns.
By six o'clock, 29,244 men and 64 guns.
By seven o'clock, 51,944 men and 104 guns. —*Siborne.*

the Prussians, for which as General-in-Chief he must be held more than partially accountable. But even the D'Erlon *contretemps* and the delays of the 17th were remediable on the 18th. Had Grouchy been equal to the occasion, the plan of campaign would have been successfully carried out. It was not to be. The sun of Waterloo set, "and the "land had rest forty years."

The President said that the paper that they had just listened to was one of great value. Though a long period had elapsed since the battle of Waterloo and much had been written respecting it, Mr. Kingsford had done wisely in again opening up the subject. The one-sidedness of historians was well known, and there were still several points that required to be settled. He himself had been present at an excited discussion between a number of English and Prussian officers; each party contending that it was purely a victory for their respective nationality.

SEVENTEENTH MEETING.

Seventeenth Meeting, 27th March, 1886, the President in the Chair.

The following list of donations and exchanges was read:

1. Canadian Entomologist, Vol. XVIII., No. 3.
2. Transactions of the Field Naturalists' Club, No. 6, Ottawa.
3. Science, Vol. VII., No. 163.
4. The American Antiquarian and Oriental Journal, Vol. VIII., No. 1, Chicago.
5. Johns Hopkins University Circulars, Vol. V., No. 47.
6. Thirty-Second Annual Report of the State Historical Society of Wisconsin.
7. Fifth Annual Report of the United States Geological Survey, 1883-84.
8. West American Scientist, Vol. II., Nos. 13 and 14.
9. Bulletin of the Buffalo Society of Natural Sciences. Vol. V., No. 1.
10. The American Naturalist, April, 1886.
11. The Electrical Review, March 25, 1886.
12. The Chemical News, March 12, 1886.
13. Journal of the Liverpool Astronomical Society, Vol. IV., Nos. 3, 4, 5.

14. Wochenschrift des österreichischen Ingenieur und Architekten Vereines No. 10, März 5, 1886.
15. Cosmos, March 8, 1886.
16. Electricité, March 6, 1886.
17. Bollettino della Società Geografica Italiana, Serie II., Vol. XI., Fasc. 2.
18. Boletin de la Real Academia de la Historia, Tomo VIII., No. II.
19. Boletin da Sociedad de Geografia de Lisboa, 5 Serie, No. 7.
20. Berichte über die Verhandlungen der K. Sächsischen Gesellschaft der Wissenschaften zu Leipzig, Mathematisch-Physische Classe, 1885, 37 Band, Heft III.
21. Journal des Sociétés Scientifiques, 10 Mars, 1886.
22. Bulletin de la Société Impériale des Naturalistes de Moscou, Anneé 1885, No. 2.
23. Tydschrift voor Nyverheid en Landbouw in Nederlandsch Indië, Deel XXXII., Aflevering I, Batavia.
24. Bulletin de la Société Mathématique de France. Tome XIV, No. 1, Paris.
25. Verhandlungen des naturhistorischen Vereines der preussischen Rheinlande und Westfalens, 41ster Jahrgang, 2te Hälfte, Bonn.

Total 28.

Messrs. Browning and Henderson were appointed Auditors.

Mr. R. R. Baldwin was elected a member.

Mr. T. B. Browning read a paper on "The Fishery Question."

Mr. Rouse thought that the limit should be increased to nine miles.

Mr. Bain referred to the scarcity of books on this subject. When the Halifax Fisheries' Commission investigated the matter they could not find any works in the English language on the natural history of the cod. They had to hunt up books in other European languages. They found one in Norwegian, these people, it seems, having paid more attention to the subject.

The President thought that the Gulf of St. Lawrence should be considered an inland water, bounded as it was by British territory. It was almost as much within British territory as Lake Winnipeg. He hoped that the care and preservation of these waters would receive that consideration from the British people that the importance of the subject demanded.

EIGHTEENTH MEETING.

Eighteenth Meeting, 3rd April, 1886, the President in the Chair.

The following list of donations and Exchanges was read :

1. From W. A. Douglas, Esq., B.A:
   (1) Ontario Loan & Savings Companies.
   (2) Harmonies and Antagonisms in the Social Forces.
   (3) John and his Master.
2. On the proposed change of time to a decimal system, by R. C. W. Goodridge.
3. Canadian Practitioner, April, 1886.
4. The Spectator, February 20th., 27th., and March 6th., 1886.
5. Science, Vol. VII., No. 164.
6. Magazine of American History, April, 1886.
7. Transactions and proceedings of the American Society of Civil Engineers, January, 1886.
8. Journal of the New York Microscopical Society, Volume I., No. 1, January, 1886.
9. American Journal of Science, April, 1886.
10. Journal of the Franklin Institute, April, 1886.
11. The Electrician and Electrical Engineer, April, 1886.
12. The Electrical Review, April 3, 1886.
13. Annual Reports of the Provost and Treasurer of the University of Pennsylvania for the year ending Oct. 1, 1885.
14. The Chemical News, March 17th., 1886.
15. Illustrated Journal of Patented Inventions, No. 61, March 18th., 1886.
16. Monthly Notices of the Royal Astronomical Society, Vol. XLVI., No. 4.
17. Proceedings of the London Mathematical Society, Nos. 253, 257.
18. Transactions of the Institution of Engineers and Shipbuilders of Scotland. 29th Session, 1885-86.
19. Transactions and Proceedings of the Botanical Society of Edinburgh, Vol. XVI., Part 2.
20. Records of the Geological Survey of India, Vol. XIX., Part 1, 1886.
21. Wochenschrift des österreichischen Ingenieur und Architekten Vereines. Wien, Nos. 11, 12, Mars, 1886.
22. Zeitschrift für Physiologische Chemie, X. Band, 3 Heft, Strassburg, 1886.
23. Electricité, 13 and 20 Mars, 1886.
24. Cosmos, 18 and 22 Mars, 1886.
25. Archivio di Letteratura Biblica ed Orientale, Anno 8, No. 2, Febbraio, 1886.
26. Verhandlungen der Gesellschaft für Erdkunde zu Berlin, Band XIII, No. 2.
27. Compte Rendu de la Société de Géographie, Paris, No. 6.

28. Bullettino di Bibliografia e di Storia delle Scienze Matematiche e Fisiche, Tomo XVIII. Giugno, 1885.
29. Bericht über die Senckenbergische Naturforschende Gesellschaft, Frankfurt a. M. 1885. Reiseerinnerungen an Algerien und Tunis, von Dr. W. Kobelt, Frankfurt a. M.

Total 36.

Mr. William Haldane was elected a member.

Dr. A. M. Rosebrugh read a paper on "Telegraphing to and from Railway Trains."

He said the first public test of the new railway telegraph, or the "air telegraph," as it is now called, took place on the Staten Island railroad on Monday, February 1st., when many messages were sent to and from the train while in motion, with an ease and speed which left nothing to be desired. The second public test was made on March 19 between Chicago and Milwaukee on the Chicago, Milwaukee & St. Paul railroad, when over 300 messages were interchanged during the trip to Milwaukee and back, and the test was quite as satisfactory as that on the Staten Island railroad. (The writer here explained the arrangement of the apparatus and the philosophy of the device by two drawings, one representing the arrangement on the cars and the other the arrangement at the railway station.) On the train, one wire is connected with the metallic roof of the cars, while the other is connected with the rails by means of the axle and wheels. At the station, one wire goes to the ground, while the other divides into branches, and is connected with three or more telegraph wires. A condenser is interposed in each of these branch lines, not as a necessary part of the air telegraph, but as a protection to the telegraph wires. Both on the train and at the station an induction coil, together with a vibrating reed, is used as the electric generator and a magneto-telephone as a receiver. The signals are given with the ordinary Morse key, which is inserted in the local circuit. When the key on the train is operated, the roofs of the cars become charged with electricity; this charges the adjacent telegraph wires by static induction, and this in turn charges the receiving telephone at the station through the branch wires and condensers. On the other hand, the generator at the station charges the telegraph wires and the telegraph wires charge the roofs of the cars, which in turn charge the telephone on the train. The several factors that contribute to make the "air telegraph" a possibility are divided

into four parts, namely, (1) the electric generator; (2) the receiver; (3) the inductive device, and (4) the line protectors. (1.) The electric generator consists of a local battery, a rheotome or automatic vibrator, an induction coil, and a transmitting key. The wire of the induction coil is short and of comparatively low resistance. This apparatus is sometimes called "the buzzer." The key is inserted in the local circuit, and when it is closed a strong interrupted primary current charges the induction coil, which in turn charges the condensers and line by induction. (2.) The receiver is the ordinary magneto-telephone, but is made small and light, and is secured against the ear of the operator. The signals cause a buzz or humming note in the telephone—a short buzz representing a dot, and a prolonged buzz a dash of the Morse alphabet. (3.) The inductive device consists simply of the metallic roofs of the cars connected together by metallic conductors on one side, and the railroad telegraph wires on the other, the one forming practically the positive and the other the negative plate of an electrical condenser. When one plate is charged by an electrical current the other becomes charged by induction, just as when a Leyden jar or a condenser is used. The writer was aware of Mr. Edison's suggestion that the intervening air becomes alternately polarized and depolarized by the alternating induced current and that it becomes actually a conductor of said current, but, to his mind, the laws of static induction seemed to sufficiently explain the action of the so-called air telegraph.* (4.) The line protectors have a three-fold object, firstly, to prevent crossing or grounding of the telegraph wires; secondly, to provide an unbroken circuit for the induced current during the opening and closing of the keys in the main line; and thirdly, to protect the main line instruments from being injuriously affected by the strong induced currents of the air telegraph. This is accomplished by the use of condensers. A condenser is inserted in each branch line and a condenser is used to bridge the Morse instruments at each way station. In a condenser two metallic plates, separated by some insulating material such as mica, or waxed paper, are pressed closely together, one plate forming one pole and

* Since the reading of this paper before the Canadian Institute Prof. A. E. Dolbear, of Tufft's College, Mass., claims to have invented a system of electrical communication without wires. From the descriptions of the system that have been made public I infer that it is simply a modification of the Air Telegraph. Condensers are used on the one side in lieu of the metallic roof of the car, and on the other side in lieu of the adjacent telegraph wires. The two condensers are only a few rods apart. A. M. R.

the other plate the other pole of the condenser. The condenser is a block to the passage of the primary currents from the telegraph wire, but permits the passage of secondary currents by induction. The condenser renders it possible to superimpose induced currents upon telegraph wires without interference, and the use of the condenser renders simultaneous telephony and telegraphy not only possible but practicable. Turning to the question of priority of invention, he doubted not the members of the Canadian Institute would receive the announcement with satisfaction when he stated that the so-called "air telegraph" was largely a Canadian invention. The facts are as follows:—In September, 1877, a private telephone line was constructed in this city from King street up Church street to Charles street. This was before the magneto signal bells were introduced, and as there was no battery upon the line until some time after the line was constructed, it was necessary to devise other means for signalling. This resulted in the adoption of the ordinary Faradic medical battery for the generator, and the telephone diaphragm for the receiver. This was called the "buzzer," as it gave a buzz or humming sound in the telephone. A month or two later a telegraph system was devised in Toronto on this principle, namely, using an induction coil, a vibrator, a local battery and key as a transmitter, and a magneto-telephone as a receiver. In the spring of 1878 Mr. George Black of Hamilton made the important discovery that a telephone circuit may be established through an electrical condenser. This at once opened the way for using the telephone and other telephonic apparatus as a duplex on the ordinary telegraph wire, as it was found that by means of condensers an artificial or phantom circuit could be established for the telephone instruments independent of the telegraph signalling—the condensers acting in a threefold capacity: firstly, they prevented grounding or crossing of the telegraph lines; secondly, they bridged the interval of the opening of the telegraph key, and thirdly, they suppressed induction.

This discovery forms the basis, not only of the air telegraph, but also of the Edison duplex "Phonoplex" and "Way Telegraph," as well as of the Van Rysselberghe "Telegraph *cum* Telephone" system now in extensive use in France and Belgium.

In all these cases induced electrical currents are superimposed upon the telegraphic circuit by means of condensers and both the primary

currents of the telegraph system and the induced currents of the telephone system are used simultaneously and without interference. An application for a patent covering this invention was filed at Washington in June, 1878, and the patent was issued in February, 1879. Among the claims in this patent are the following:—1st. In a branch line, or a derived line of a voltaic circuit, the combination of a condenser, a telephone and apparatus for generating induced currents for signalling purposes. 2nd. The combination of two or more parallel telegraph wires with a branch line and condenser attached to each of said telegraph wires and with a common ground wire and with telephonic apparatus inserted in said ground wire. He did not wish to detract in the least from the credit due to Mr. Smith on the one hand for conceiving the idea, or from Mr. Edison and Mr. Gilleland, on the other, for developing it. His desire was simply to put the actual facts on record. With regard to the commercial value of the "air telegraph" and the possible position it is destined to take in commercial economy, he was not in a position to speak, he simply knew that it had excited much interest among railway men.*

The President said that it was gratifying to learn that in the improvements that had been made in the applications of electricity and the patents that had been obtained much was due to a Canadian. That Canadian was, though his modesty did not permit him to mention it, Dr. Rosebrugh himself.

NINETEENTH MEETING.

Nineteenth meeting, 10th April, 1886, the President in the Chair.

The following list of donations and exchanges was read:

1. Das Echo, July 25th, 1885, August 7th, 1885, December 18th and 25th, 1885, January 15th, 22nd, 28th., 1886; February 11th, 18th, and 25th, 1886; March 4th, 11th, and 18th, 1886.
2. The Spectator, March 20th, 1886.

* A second paper by the same author, in continuation of this subject, was read before the Institute on the 8th January, 1887.

3. Science, Vol. VII., Nos., 165, 166.
4. Bulletin of the Philosophical Society of Washington, Vol. VIII.
5. Electrical Review, April 16, 1886.
6. Annual Report of the American Museum of Natural History for 1885-86.
7. The Chemical News, March 26th., 1886.
8. Transactions of the Manchester Geological Society, Vol. XVIII., Parts 14, 15, 16.
9. Proceedings of the Royal Society, Vol. XXXIX., No. 241.
10. Proceedings of the Cambridge Philosophical Society, Vol. V., Part 5.
11. Minutes of Proceedings of the Institution of Civil Engineers, Vol. LXXXIII., Series 1885-86, Part 1.
12. Wochenschrift des österreichischen Ingenieur und Architekten Vereines, No. 12, 19 März, 1886.
13. Journal de la Société Physico-chimique russe, Tome XVIII., Nos. 1, 2, St. Petersburgh, 1885.
14. Boletin de la Real Academia de la Historia, Tome VIII., Cuaderno III.
15. Journal des Sociétés Scientifiques, 17 Mars, 1886.
16. Abhandlungen des Tokio Daigaku, No. 10.
17. Revue des Langues Romanes, 3me Serie, Tome 14me, Juillet, Août, Septembre, Octobre, Décembre, 1885, Montpellier.

Total 37.

Messrs. Henry Holgate and Frederick B. Hodgins were elected members.

The President read the following paper :—

NOTES ON THE EARLY DEVELOPMENT OF ABORIGINAL WOMEN IN ALL LATITUDES.

BY PERCY W. P. MATHEWS, LL.D., M.R.C.S.E., ETC.,

Dominion Coroner for the N. W. Territories, and Medical Officer to the Honourable Hudson's Bay Company.

It is for the purpose of drawing attention to the early marriages of the more precocious natives of tropical climates, as well as to the marriages of mere children here, in the sub-arctic regions, that I pen these few notes, and also to become enlightened myself, by possibly giving rise to some discussion in connection with a subject that cannot be otherwise than interesting.

In the first place I will allude to the only statistics I can obtain on the subject in reference to the Tropics, and will advance those collected by Dr. Robertson, of England, and published in his Essays and Notes on the Physiology and Diseases of Women, in which he states that "the ordinary age at which women in Bengal commence to menstruate is twelve years;" and again Dr. Goodene, Professor of Midwifery at Calcutta, asserts that a large portion of Hindoo women bear children before they are fourteen years old, and the earliest age at which he has known a Hindoo woman bear a child is ten years. Dr. Curtis relates the history of a girl aged ten, who was delivered of a healthy child at the full term of pregnancy.

It will, I am sure, be thought unnecessary to adduce further instances, in support of the precocious development of children of the tropics, as it is greatly known and acknowledged; and I merely mention here that it is equally understood to be mainly owing to natural causes, insomuch as they refer to custom and to climatic influence.

It is to the early development of children of these northern climes, that I wish now particularly to draw attention, and to point to it as a full exemplification of the trite old saying, "extremes meet." Before passing on to the natives of the far north (the Eskimo), I will allude to the data that I have collected from various sources and mention, *en passant*, how trying an undertaking it is to make the "old Indian wife" disclose anything approaching trustworthy information; for assertions are made that will, on a little cross-examination, be utterly refuted; and further, their method of computing events by a species of incidental comparison necessitates their passing through a process of logical deduction before they can be settled upon. For instance, C. B. was "a wife" for the first time, "the year the Great Stone Chief (Dr. R. Bell) visited the settlement." We remember when that event took place, then refer to the register, and find the date of her birth; that is simple, but when you are informed that M. F. was a wife the year the wavies (snow-geese) were so thick on the East Coast of Hudson's Bay, as that was several years ago, and the occasion had not been particularly noted, the result is apt to be conjectural. But from my own notes of some years past, together with some intelligent help from the several Indian settlements, I have been enabled to compile a table on the subject; which leads me to infer, that if the histories of 500 women were

taken, it would be found that the catamenia first appeared in these at the following ages:—

Between the	Tenth	and the	Eleventh	year in	22
"	Eleventh	"	Twelfth	"	150
"	Twelfth	"	Thirteenth	"	185
"	Thirteenth	"	Fourteenth	"	78
"	Fourteenth	"	Fifteenth	"	40
"	Fifteenth	"	Sixteenth	"	17
"	Sixteenth	"	Seventeenth	"	3
"	Seventeenth	"	Eighteenth	"	2
"	Eighteenth	"	Nineteenth	"	1
"	Nineteenth	"	Twentieth	"	1
"	Twentieth	"	Twenty-first	"	1
					500

I have myself noted only one case in which conception undoubtedly took place before the age of eleven, that of Lavinia Wastasicott, who gave birth to a fully developed child at the age of eleven years and six months, and another child within the year following. Another case that I was called upon to attend was that of C.G., aged twelve years, who was delivered of a fine child at the full period. Another, that of Ellen Wosie—about twelve years old—who gave birth to a child equally at the full period. I have noted three other cases at and before the age of thirteen, and there are several cases of between thirteen and fourteen. In short, I know of so many thoroughly well authenticated cases of conception having taken place between the ages of eleven and fourteen that I think them sufficiently interesting to note, as evidencing the precocious development of the Indian in the Sub-arctic regions of North America.

And further, as regarding precocious maternity, we observe the same to be the case when we travel northward. Indeed, among the Eskimo, early marriage, or rather co-habitation (a synonym for marriage), is more generally noted than among what may be termed Sub-arctic Indians. This fact has, I believe, been referred to by Arctic writers, but I am without authorities on the subject. It is, however, certainly borne out by facts which I myself have been able to gather. One Eskimo lad aged about sixteen, who was a constant companion of mine for upwards of two years, told me that he had been married for many years, and that such was the custom among the people of his tribe, who dwelt beyond Chesterfield Inlet, and, as may be expected, early puberty is equally met with in the male.

This is well borne out by information I have personally obtained from Churchill, a settlement on the West Coast of Hudson's Bay, which the Eskimo often visit for the purposes of trade.

The few foregoing remarks are advanced as an illustration of a fact which I would wish to explain; and in the first place, I may instance local natural causes; as playing a part in influencing this early development among the Indians of Hudson's Bay.

In olden times, before the advent of the missionary and his restraining influence, marriage was, as far as I can learn, a mere form, and ofttimes the possession of a blanket of sufficient amplitude to cover two substituted itself for any rite,—the phrase "married under a blanket" being but another rendering "of taking to wife." And again, it is a common saying throughout the Indian Territory, that a man cannot hunt well until he takes a wife, which verifies itself upon examination; for does not the wife tend the camp, fish, snare rabbits and partridges, cook, and in short almost wholly provide for 'her man,' and so enable him the more fully to occupy his time in hunting the fur-bearing animals? It may be interesting to note here, not only as an evidence of polygamy in these parts, but as an illustration of the foregoing, a remark made to me by an old Indian chief, Beardy, in reference to his poor hunt—"I have done nothing since I became a Christian." The resident missionary had made it a *sine qua non* that he should put away *five* of his wives before he could be baptized—a bitter pill indeed to poor chief Beardy, who had but lately realized the one ambition of his life, to be ahead of his late father in the matter of wives—but for conscience' sake he gave way, kept his youngest, prettiest, and most useless wife, and has since but lived to mourn her incapacity and his perversion.

When it is understood what a helpful mate the Indian woman usually is to her husband, it can be realized that the doctrine of early marriage is inculcated, and indeed considered necessary to the common weal. Touching upon this I will relate an occurrence that took place here, some few years since, inasmuch as it bears upon Indian marriage custom, based on ancient tradition: A young couple were married, and after going around and making a collection, or rather a requisition, started off to the woods for their honey-moon. Whereupon I questioned an old Indian in reference to this, and asked him, if he thought this taking of a holiday after marriage was possibly copied from the white people (though I must say I have never

noted it at York Factory, where contracting parties, immediately after the ceremony is over, return all their borrowed finery, and set about their ordinary work, as if nothing unusual had happened). In answer to my question, the old man somewhat indignantly replied "No, no, it was so long ago." Now is it possible to trace some analogy between the origin of our own honey-moon and that of the Indian, and to refer it to a common source "When a man hath taken a new wife, he shall not go out to war, neither shall he be charged with any business; but he shall be free at home one year, and shall cheer up his wife which he has taken."—DEUT. xxiv. 5.

It is some 2200 years ago since Aristotle taught of the dangers of premature wedlock to the woman, and certainly the result of these precocious unions is disastrous to the child; since it is to this, together with other well recognized causes, which I treat of more fully in my "Notes on Diseases among the Indians frequenting York Factory," that I attribute the universal prevalence of scrofula (it may be here noted that Scrofula is equally prevalent in the Tropics), and early development is here indicated as a most marked symptom, for we observe in the Indian babe, among other peculiarities, the long black silky hair at birth, the very early and regular cutting of teeth, though this only holds conversely good as to Darwin's teaching, as he notes the tardy cutting and irregularity of teeth and diseased condition of hair as typical of some tribes of Indians. Again the Indian child walks very early, grows rapidly, and is very precocious generally, as a very natural consequence of this early development; the girl soon merges into the marriageable female, and very shortly the child-wife becomes the child-mother; and this baneful disease is perpetuated. But these natives, like those of tropical climes, age early, according to the laws of compensation, or as Goethe expressed it: "Nature, in order to spend on one side, economised on the other side." And when we examine into the tent life of the Indian, or even the "herding and pigging" in houses around a settlement, it is not difficult to realize, irrespective of physiological causes, why the Indian child should develop early. For they are treated by their parents even as one of themselves, and the very nature of their lives, putting aside all questions of morality, or rather the utter lack of it, again teaches and induces independence, and that independence, thus early taught by their associations and surroundings, bids them to seek a mate, and go forth in their world, "a very sorry pair of phenomena."

With the exception of the fact that the life of the Eskimo is possibly a more healthy one than that of his Indian brother, the foregoing remarks may equally and perhaps more especially apply to him, and when it is taken into consideration that for some nine months of the year he is breathing an air condensed and supercharged with oxygen, it must directly and indirectly account for his rapid and sturdy growth as a child. Under such circumstances the animal combustion must be necessarily great; still the vital waste is more than retarded by the carbon taken into the system by the draughts of warm blood from recently killed animals, and by the enormous amount of fatty and oily food which he consumes. The continued existence of the Eskimo in the Arctic regions, with a vigour exceeding that of the natives of the Tropics, proves that the human species is independent of temperature, while the equally early development of aborigines under these opposite conditions shows that we must look for its cause in something else than the climate.

We can localize the animal and vegetable kingdoms, but as Agassiz says: "Man alone is complete. His domain is the whole world." Even were this not so, any application of uniformity to man could only be maintained on the principle of double negation, for the Eskimo contrasts with his sub-arctic brother, as the Mongol contrasts with the sub-tropical Asiatic.

In briefly reviewing what I have advanced upon this subject, I cannot, in all deference, think it mere illusion to refer the solution of a phenomenon so essentially identical in nature, affecting alike peoples of diametrically opposed nationalities, temperaments, customs and associations, to other influences than the unconscious operation of local conditions and admit this remarkable fact of precocious development, physically characteristic, as it is, of people of a common descent, to be an intermediate link connecting the two extremes, and to adapt to this higher organization the accepted apophthegm in botany of "species keeping true in either one marked particular or another, although living under most opposite climes."

TWENTIETH MEETING.

Twentieth meeting, 17th April, 1886, the President in the Chair.

The following list of donations and exchanges was read:

1. Report of the Minister of Education (Ontario), 1885.
2. Literary Bulletin of Cornell University, Vol. II., No. 1.
3. Thirty-second Annual Report of the State Historical Society of Wisconsin.
4. Transactions of the American Society of Civil Engineers, February, 1886.
5. Appleton's Literary Bulletin, No. 44.
6. Journal of the Cincinnati Society of Natural History, Vol. IX., No. 1.
7. Proceedings of the American Philosophical Society, Vol. XXIII., Nos. 121. 122.
8. Twenty-third Annual Report of the State Board of Agriculture of Michigan.
9. Annual Report of the Smithsonian Institution for 1883.
10. Proceedings of the Rhode Island Historical Society, 1885-86.
11. Journal of the Trenton Natural History Society, Vol. I., No. 1.
12. Transactions of the Royal Geological Society of Cornwall, Vol. X., Part 8.
13. Transactions of the National Association for the Promotion of Social Science, 1884.
14. The Scottish Geographical Magazine, Vol. II., No. 4.
15. The Midland Naturalist, No. 100.
16. Illustrated Journal of Patented Inventions, No. 62, April 2nd, 1886.
17. Chemical News, April 21, 1886.
18. Transactions of the Royal Scottish Society of Arts, Vol. XI., Part 3. 2 copies.
19. Imperial Federation, Vol. I., No. 4.
20. Memoirs of the Manchester Literary and Philosophical Society, 3rd Series, Vol. VIII. Proceedings of the Manchester Literary and Philosophical Society, Vols. XXIII and XXIV.
21. Electrical Review, April 17th, 1886.
22. Memoirs of the Geological Survey of India, Vol. XXI., Parts 3 and 4; Palæontologia Indica, Series IV., Vol. I., Part 5, Series XIII, Vol. I., Part 4, Fas. 5, Series XIV., Vol. I., Part 3, Fas. 5.
23. Journal of the Proceedings of the Royal Society for New South Wales for 1884, Vol. XVIII.
24. Centenary Review of the Asiatic Society of Bengal from 1784 to 1883. Calcutta.
25. Annales des Ponts et Chaussées, Mémoires et Documents. Personnel, 1886. 6e Série 1er Cahier, Janvier, 1886.
26. Boletin de la Sociedad Geográfica de Madrid, Tomo XX., Numero 2°.
27. Cosmos, 29 Mars, 1889.
28. Electricité, 27 Mars, 1886.

29. Wochenschrift des österreichischen Ingenieur und Architekten Vereines. Wien, No. 13, 29 März, 1886.
30. Tijdschrift voor Nijverheid en Landbouw in Nederlandsche Indië, Deel XXXII, Aflevering I.
31. Compte Rendu de la Société de Géographie, No. 7, 1886.
32. Bollettino della Società Geografica Italiana, Serie II., Vol. XI., Fas. 3.
33. Monatsblätter des wissenschaftlichen Club in Wien, VII Jahrgang, No. 6. Ausserordentliche Beilage zu No. 6.
34. Sitzungsberichte und Abhandlungen der Naturwissenschaftlichen Gesellschaft Isis in Dresden, 1885.
35. Compte Rendu des Séances de la Société de Physique et d'Histoire Naturelle de Genève, II, 1885.
36. Archives du Musée Teyler, Ser. II., Vol. II. 2e et 3e Parties, Catalogue de la Bibliothèque 1e et 2e Livraisons.
37. Anales del Museo Nacional de México, Tome III., Entrega 8a, 1885.
38. Bulletin de la Société Royale Belge de Géographie 9e Année, 1885, Nos. 1, 2, 3.
39. Jahrbuch der K.K.Geologischen Reichsanstalt, Jahrgang, 1885, XXXIII. Band, 2 und 3 Heft. Wien.
40. Sitzungsberichte der Naturforschenden Gesellschaft zu Leipzig, II. Jahrgang, 1884.
41. Jahresbericht der Naturhistorischen Gesellschaft zu Nürnberg, 1884.
42. XXVIII., XXIX., XXX., XXXI. Berichte des Vereines für Naturkunde zu Cassel. Catalog der Bibliothek des Vereines für Naturkunde in Cassel, 1875. Repertorium der Landeskundlichen Litteratur.
43. Tijdschrift der Nederlandsche Dierkundige Vereeniging, Deel V., V½., Supplement, Deel I., Aflevering I., II.,, 2de Serie, Deel I., Aflevering I.

Total 66

Mr. Arthur Cox was elected a Member.

On motion by Mr. Houston, seconded by Mr. Browning, it was resolved: "That a Committee composed of Messrs. Notman, Boyle, Shaw, Browning, and the mover be appointed with instructions to ascertain and report what steps have been taken by Governments, Universities, Colleges, and Learned Societies to secure the general introduction of a more simple and phonetic system of spelling English words than the one at present in force."

Mr. Houston said that he had had frequent occasions of presenting his views on this subject in other places. As a rule the scheme of spelling in a more logical and simple manner had been approved of by teachers and others familiar with the subject. The first movement in the direction of a more practical and scientific method of spelling had been

made about forty years ago by Messrs. Ellis and Pitman. Since that time much progress had been made. In Spain the subject had been taken up and something done in the matter some time ago. In Germany at the present time efforts were being made to have a spelling reform. In Holland they had reformed their spelling to some extent a number of years ago. In France no steps had been taken in the matter. This reform if carried out would revolutionize the spelling of 10,000 words, or about 5,000 of those constantly used, without greatly changing their appearance.

Mr. Browning in seconding the resolution said he thought that it did not go far enough. He would prefer that the Institute should take a more active part in the matter.

Dr. Cassidy spoke against the reform. He said that he had already gone to the trouble of learning how to spell and did not want to have to learn over again. The change would partake considerably of the grotesque. In reading the works of our great writers we had become familiar with their thoughts presented in a certain style of spelling and associated with the appearance of the words. To change that style would to a great extent mar the effect of the thoughts. He would prefer to see the motion laid on the table.

Mr. Houston replied. He said that the art of acquiring our present mode of spelling was mere drudgery, and the time devoted to it could be more profitably bestowed on far more important subjects.

TWENTY-FIRST MEETING.

Twenty-first meeting, 24th April, 1886, the President in the Chair.

The following list of donations and exchanges was read:

1. From the Manitoba Historical and Scientific Society:
   (1) Annual Report for 1885-86.
   (2) Transaction 19. The Old Settlers of Red River.
   (3) Transaction 20. Notes on the Geology of some Islands in Lake Winnipeg.
   (4) Transaction 21. Change in Time Marking.
2. Monthly Weather Review, March 1886.

3. Canadian Entomologist, Vol. XVIII., No. 4.
4. Science, Vol. VII., No. 167 and No. 168.
5. Journal of the Trenton Natural History Society, Vol. I., No. 1.
6. Journal of the New York Microscopical Society, Vol. II., No. 2.
7. The Electrical Review, April 24, 1886.
8. Annual Report of the Buffalo Historical Society, January 12, 1886.
9. Proceedings of the American Association for the Advancement of Science. 33rd Meeting, Philadelphia, September, 1884, Parts I and II.
10. Proceedings of the Royal Geographical Society, Vol. VIII., No. 4.
11. The Chemical News, April 9, 1886.
12. Monthly Notices of the Royal Astronomical Society, Vol. XLVI., No. 5.
13. (1) Proceedings of the Asiatic Society of Bengal, Nos. IX. and X. November and December, 1885.
    (2) Journal of the Asiatic Society of Bengal, Vol. LIV., Part I., Nos. 3 and 4, 1885; Vol. LIV., Part 2, No. 3, 1885.
14. Geologiska Foreningens i Stockholm, Forhandlingar. Band VIII., Häfte 1, 2, 3 Januari, Februari, Mars, 1886.
15. Gazetta Chimica Italiana, Anno XVI., Fasc. I, Palermo.
16. Electricité, 3rd and 10th April, 1886.
17. Cosmos, 5th and 12th April, 1886.
18. Programme of the International Competition for Designs for a new Façade to the Cathedral of Milan, with six Illustrations.
19. Annables des Mines, Huitiéme Série Tome VIII., 6e Livraison de 1885.
20. Historisches Jahrbuch der Görres-Gesellschaft, VII. Band, 2 Heft.
21. Wochenschrift des österreichischen Ingenieur and Architekten Vereines, No. 14 u 15, April 2 and 9, 1886.
22. Archivio per l'Antropologia e la Etnologia, Vol. 15, Fas. 3; Vol. 15, Vol. Fas. 1 e 2, 1885; Quadri Statistici, Serie Prusia.
23. Reale Istituto Lombardo di Scienze è Lettere, Reudiconti, Serie II.
24. Boletin de la Sociedade Antropologica de la Isla de Cuba, Tomo 1, Numero 1, 2 3, 4, 5, 6, Habana.
25. Revista da Secçao da Sociedade de Geographia de Lisboa no Brazil, 2 Serie, No. 3.
26. Società Storica per la Provincia di Como, Fas. 18.
27. Journal des Sociétés Scientifiques, 7 Avril, 1886.
28. Monatliche Mittheilungen des Naturwissenschaftlichen Vereins, Frankfurt a. Oder, 3 July, No. 11, 22, 4 Jahrgang, No. 1.
29. Verhandlungen der Berliner Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, 17 Octr., 1885; 25 Octr., 21 Nov. and 19 Dec. Chronologisches Inhaltsverzeichnis der Verhandlungen.
30. Cronica Cientifica, No. 199, 200, Barcelona.

Total 571.

Mr. Thos. B. Speight was elected a member.

Nominations for officers for the ensuing year were then made.

Mr. Roche read a paper on "The Precipitation of Iron in Saline Solutions."

ANNUAL MEETING.

The Thirty-Seventh Annual Meeting was held on Saturday, 1st May, 1886, the President in the chair.

The minutes of the last Annual Meeting were read and confirmed.

The following list of Donations and Exchanges was read :—

1. Le Naturaliste Canadien, Avril, 1886.
2. Report of the Minister of Education (Ontario) for the year 1885.
3. Canadian Record of Science, Vol. II., No. 2.
4. Historical Collections of the Essex Institute, Vol. XIII, No. 7, 8, 9, 1885.
5. Bulletin No. 1 of the American Ornithologists' Union.
6. Magazine of American History, May, 1886.
7. The American Naturalist, May, 1886.
8. Electrical Review, May, 1886.
9. American Catholic Quarterly Review, No. 42, April, 1886.
10. Science, Vol. VII., No. 169.
11. School of Mines Quarterly, Vol. VII., No. 3.
12. Journal of Speculative Philosophy, Vol. XIX., No. 4, October, 1885.
13. Journal of the Transactions of the Victoria Institute, Vol. XIX., No. 76.
14. Chemical News, April 16, 1886.
15. Illustrated Journal of Patented Inventions, No. 63, April 16, 1886.
16. Paper and Proceedings of the Royal Society of Tasmania for 1885.
17. Bulletin de la Société d'Anthropologie de Paris, Tome Huitième (III. Série) 4e Fascicule.
18. Verhandlungen der Gesellschaft für Erdkunde zu Berlin, Band XIII, No. 3e
19. Journal de la Société Physico-chimique Russe, Tome XVII
20. Mémoires et Compte Rendu des Travaux de la Société des Ingénieurs Civils, 4e Série, 11e Cahier, November, 1885.
21. Journal des Sociétés Scientifique, 14 Avril, 1886.
22. Compte Rendu de la Société de Géographie de Paris, No. 8.

Messrs. H. B. Spotton, George S. Bean, B. A., Charles Hill Tout and William H. Huston, M.A., were elected members.

Dr. Daniel Wilson read a paper on "Ancient Celtic Art," which has since been published elsewhere.

Mr. VanderSmissen, on behalf of the author, read the following paper :

MARBLE ISLAND AND THE NORTH-WEST COAST OF HUDSON'S BAY.*

BY ROBERT BELL, B.A.Sc., M.D., LL.D.

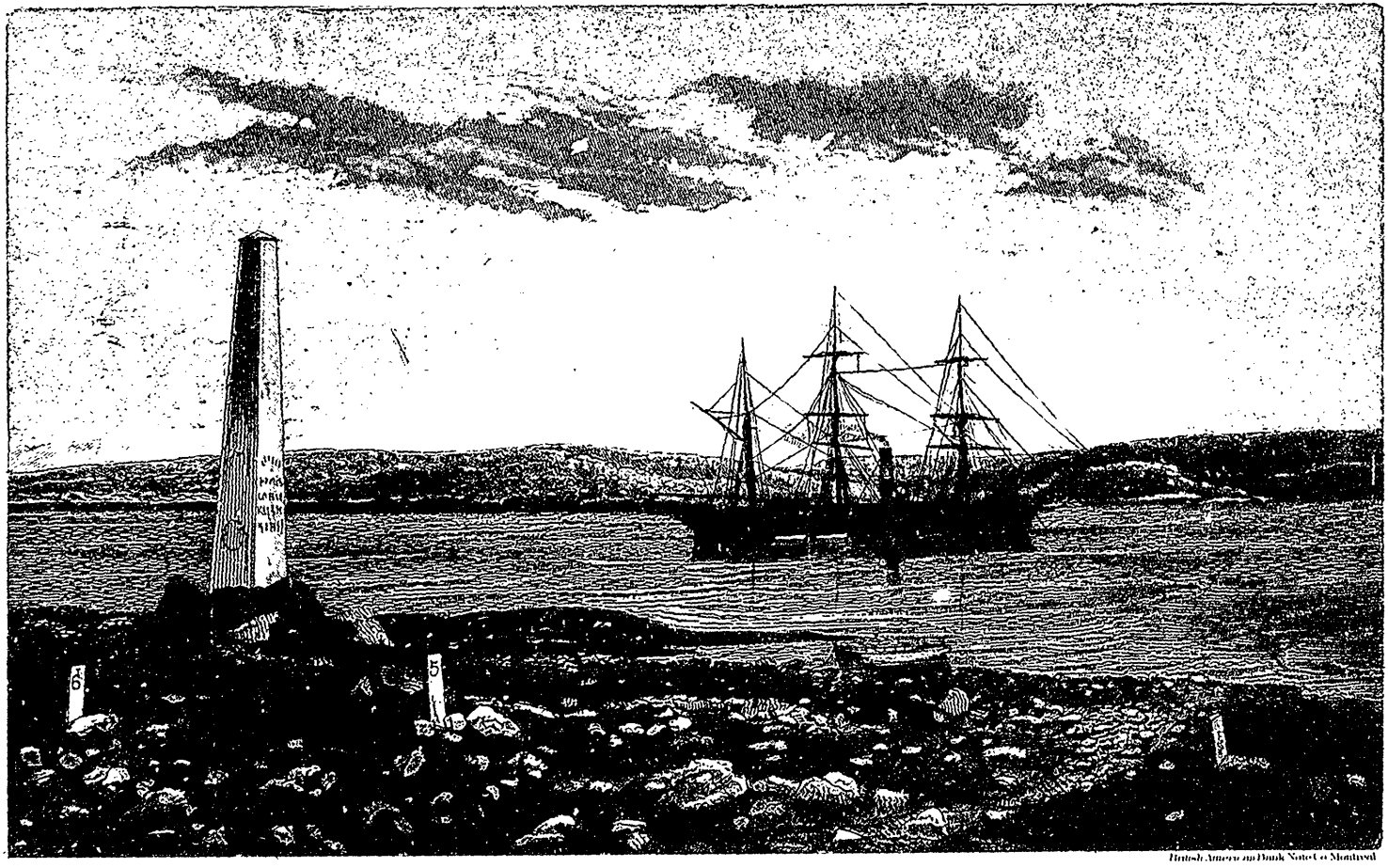
ASSISTANT DIRECTOR OF THE GEOLOGICAL SURVEY OF CANADA.

Marble Island, in the north-western part of Hudson's Bay, is better known than any other spot in that part of the world, mainly owing to the fact that it has long been the rendezvous of the American whalers who frequent our great inland sea. But it has some very interesting historical associations as well, and its extraordinary appearance has helped to bring it into notice. Although it was first called Marble Island, the name was changed to Brook-Cobham, by Fox, the discoverer of the great Channel which constitutes the north-westward continuation of Hudson's Straits, and which bears his name. However, the original name is now generally adopted.

The island lies about sixteen miles out from the north-western shore of Hudson's Bay, in latitude 60° 40′, and between longitude 91° and 92° west. It has a length of about twenty-five miles by a breadth of five or six. The surface has an undulating outline with long, gentle slopes; and its general elevation is a few hundred feet above the sea. The harbour used by the American whalers is situated on the south side and near the west end. It consists of an outer and an inner harbour. The outer one is formed by a small island called Deadman's Island, and from it, a narrow channel, with no great depth of water, which has been cut by nature through a ridge of rocks, leads to the inner harbour, a land-locked basin measuring fully a mile in its greatest diameter.

Perhaps the best way to give an idea of the appearance and characteristic features of Marble Island will be to describe our own impressions on first visiting it during the summer of 1884 by the S.S. *Neptune*. No one connected with the expedition had been in this quarter before. At the time when we were nearing this side of the bay, we had lost our reckoning owing to thick weather, and although

* The illustration accompanying this paper is inserted by the kind permission of Dr. Alfred R. C. Selwyn, C.M.G., F.R.S., Director of the Geological and Natural History Survey of Canada, as is also the illustration accompanying Mr. Stupart's paper in this volume on "The Eskimo of Stupart's Bay.



British American Bank Note Co Montreal

PHOTOGRAPH BY DR BELL

we happened to be going straight towards the island, none of us at first recognized it on account of the very singular appearance which it presented. All the other shores we had been visiting looked nearly black, but we had also become accustomed to plenty of whiteness in the form of snow, ice and fog-banks. On approaching it in the early morning, at first sight we naturally supposed, from its extent and whiteness, that what we saw before us must be one of these objects; but still, on closer observation, it did not correspond with any of them in shape or other characters. It was too large for an ice-berg (even if there were any in Hudson's Bay, which is not the case), too stationary in position and outline for a fog-bank, and too high for field-ice. Then the extraordinary dark lines and patches which we saw here and there, puzzled us very much. As we drew nearer to it, however, we concluded it must be the far-famed Marble Island, but we had not anticipated seeing such a gigantic mass of marble; and its clean, smooth, white appearance was as wonderful as its extent, for the weathered surface of marble is seldom smooth and white. When within a short distance of the shore, the morning sun shone out and the gorgeous appearance of the steep slopes of pure white rock, washed by the bright sea, with screaming gulls sailing about in the air, was beautiful in the extreme. On entering the harbour behind Deadman's Island, the evidences of the work of civilized man which met the eye, were in singular contrast to the monotony of nature in these desolate regions of the north. A bank of shingle, rising a few feet above the spring tides, forms the highest part of the island. Along this ridge is a row of recently erected white monuments, which stand out in bold relief. Some of them are high columns, but the majority resemble ordinary headstones. They looked like white marble, and where this material was so abundant, it was natural to suppose that they had been formed from it. But appearances, as well as names, are sometimes very deceptive. On going ashore, we found the marble monuments and headstones only painted wood and the marble hills solid white quartzite, as hard as flint. But in spite of the fact that this rock proved to be something very different from white marble, yet even on close inspection, every detail in its appearance was still that of marble. All the most beautiful varieties were there—the pure white, dove-colored, veined, mottled and streaked, lovely lilac and pink, and delicate tints of green and rose color and many other shades, which would charm the most æsthetic eye.

Around both harbours we noticed various discarded articles which had been used in the whale-fishery, and in two or three places on the steep walls of rock overlooking the inner basin were painted lists of the names of many men whose bones are buried among the gravel near by. These, as well as the poor fellows who lie under the wooden monuments of Deadman's Island outside, were seamen and whalers who had died of scurvy, consumption, and other diseases, or from accidents and shipwreck in prosecuting the whale-fishery. The short notes accompanying some of their names suggest many a pathetic history of brave and adventurous men who had gone to these northern waters to earn, by honest toil, the means of bettering their condition. No doubt they must have endured great sufferings from sickness, cold, hunger and pain, during the dark days of the long dreary winter before they died a miserable death, unseen by any, save their equally miserable companions.

In carrying on the whale-fishery around Marble Island the American captains call to their assistance the Eskimos of that region, who are willing and industrious workers, already trained to the business; but it is said they receive very little remuneration for their services. The black whale is stated to be the commonest species taken, but other kinds are met with. In addition to killing the larger whales, our neighbours are reported to collect from the natives considerable quantities of the oil or blubber of the small white whale, the walrus, the narwhal, the polar bear and various kinds of seals. As Hudson's "Bay" is really an inland sea of the Dominion, it is questionable if this business may not be a violation of our treaty rights. The Russian government is understood to exact a very heavy license fee from vessels whaling in the White Sea, which is by no means so land-locked as the Canadian Mediterranean. In this matter we may be allowing a source of revenue to go unimproved.

The Whalers' Harbour in Marble Island is an excellent place for ballasting ships. The beach is steep, so that boats can lie against it at all stages of the tide, and it is almost everywhere covered with small boulders or coarse shingle derived from the white quartzite. While the *Neptune* was lying here the captain availed himself of these advantages and took in a large quantity of ballast to compensate for the weight of fuel we had burnt. When the voyage was over, the vessel went to Sydney for coal, and here these beautifully white

rounded stones from Hudson's Bay, which were now put ashore, attracted considerable attention and were much admired.

Marble Island and the mainland opposite are entirely destitute of timber, which, near the coast, does not extend further north than Seal River, 280 statute miles to the south. From Seal River, the northern limit of the forest, which at the verge consists of only small spruce and tamarac, runs in a north-westerly course almost directly to the mouth of the Mackenzie River, thus leaving two or three hundred miles of the Barren Grounds between this line and the coast opposite to Marble Island.

Although no trees grow on the island, there is an abundance of sub-arctic vegetation. The large ponds or small lakes among the hills in the interior are encircled with green, and they have become the breeding places of swans, arctic and red-throated divers, and other water-fowl. Many species of smaller birds were noticed, and owing to the open nature of the country they probably fall an easy prey to the peregrine falcon which also breeds on the island. The reindeer, or barren-ground carriboo, and the musk-ox, are found on the mainland opposite, which is the southern limit, on the coast, of the latter animal, but it ranges further south in the interior.

The American whalers and others constantly speak of Marble Island as if it were really composed of marble. Although I had not an opportunity of personally examining it before 1884, I had long been aware that the white rock of this island was quartzite, having received specimens of it through friends in the Hudson's Bay Company's service. It appears to be identical with the quartzites of the Huronian series, so largely developed on the north shore of Lake Huron between Killarney and the Spanish River. The Marble Island quartzite must have a very great thickness, and it is unlikely that this is the only locality in the region where similar rocks occur. Indeed we have statements from both Hudson's Bay Company's officers and Indians that similar white rocks are found in abundance on the mainland opposite, and at various places for a long way into the interior in a south-western direction. I have obtained a specimen of quartzite of a light or delicate pink color, said to have been broken from the rock *in situ* on the south side of Nevil Bay, about 150 miles south-westward of Marble Island. Continuing the same course inland, white rocks are reported as occurring around White Rabbit Lake, between Nevil Bay and Hatchet or Wollaston

Lake, and boulders of white quartzite are very numerous at the Methy or Long Portage, still further to the south-west.

Our visit to Marble Island was so short that I had only time to examine the western part, the whole of which consisted of different varieties of light-colored quartzites. The rocks being free from lichens or staining, both the shores and the hills in the interior have a uniform white appearance, which might be taken for that of snow, but for the strong contrast due to the dark brown of the peaty depressions. The stratification is usually very massive. Ripple-marks, varying from coarse and wide to fine and narrow, were observed on the surfaces of many of the beds, especially the thinner ones.

Near the south-western point of the island the quartzite presents beautiful lilac colors of various shades. Here the direction of the dip is N. 5° E., *true* (the magnetic variation being 5° W.), and the inclination 80° from the horizontal plane. At the north-western point the direction of the dip is N. 80° W., *true*, and the inclination 45°. This is also the prevailing direction and angle in the interior of the west end of the island. But on the north shore, opposite the harbour on the south side, the direction is N. 65° W., *true.*, and the inclination 40°. It will thus be seen that the strike of the bedding varies considerably in different places. It was further observed that although the general course of the rocks might be tolerably straight locally, the lines of stratification undulated a good deal, the minor sinuosities appearing on smooth sections as mere corrugations of the lamination.

On Deadman's Island, the white quartzites pass into grey, and these rocks are associated with a dark glossy micaceous schist, all striking N. 80° W., *true*, or dipping N. 10° E., at an angle of 90°.

In the course of my examination of Marble Island, I observed the debris of a variety of Huronian rocks, including the brown-weathering dolomite of that series, strewn upon the surface, from which it was inferred that these rocks would be found *in situ* at no great distance in the direction from which the drift had come. Since my visit to the island I have received from a friend a most interesting collection of lithological specimens, representing the fixed rocks of the coast from Chesterfield Inlet south-westward to Eskimo Point (where the rocky shore terminates), embracing a distance of about 180 statute

miles in a straight line. They include a considerable variety of species, and from them it is manifest that the Huronian series is well developed and occupies a large area on the north-west side of Hudson's Bay. This would be a highly important fact, even if the collection referred to contained no direct evidence of the existence there of economic minerals, because we already know, from an extensive examination of these rocks in other parts of the Dominion, that they constitute the repositories of numerous metallic ores and other useful minerals, while the primitive Laurentian rocks are almost destitute of them. But in this collection there are eleven specimens of granular iron pyrites, from different parts of this coast, all of which apparently contain small quartz grains. Most of the specimens are angular, and their aggregate weight is about fifty pounds. Mr. Hoffmann, chemist to the Geological Survey, has made an assay of one of these specimens from a bay south of Cape Jones, which forms the southern horn of Rankin Inlet, and found it to contain traces of both gold and silver. A good sized angular piece of similar pyrites, which I obtained from the Eskimos in 1879, and which they brought from a place called Iõari, described as being about two-thirds of the distance from Churchill Harbour to Marble Island, had a small quantity of light bluish-grey magnesian limestone adhering to it. Some of the other specimens of this pyrites have small pieces of soft dark-greenish schist attached to them.

The specimens from the above-mentioned 180 miles of the north-west shore of Hudson's Bay embrace the following rocks: Chloritic schist, dark cherty schist, hard dark argillaceous slate, finely ribboned hornblende and quartz schist, imperfect gneiss, dark silicious breccia with calcspar, dark-green crystalline pyroxene rock, dark chocolate-coloured silicious argillite with conchoidal fracture, calcspar vein-stones, semi-translucent white quartz, red aplite of medium texture, rather fine-grained grey granite, grey diorite, consisting of light-coloured felspar and dark hornblende in small distinct crystals, giving it an even and finely speckled appearance, fine-grained hornblende schists, greenstones, quartz and epidote rock, light grey coarse grained sandstone altered to quartzite and holding fragments of indurated red shale, compact banded white quartz-rock with crystals of iron pyrites in some of the layers, light quartzite like that of Marble Island, grey felsites, crystalline hornblende-rock, diorite, consisting of compact white felspar with long crystals of dark horn-

blende, banded grey hornblende and quartz-rock with some layers approaching chert, mica schists of different kinds, mixed hornblende and mica-schist, chocolate-coloured porphyry with flesh-coloured crystals of felspar and grains of clear quartz, granulite, red jasper with dull fracture, hard brownish-red sandstone, grey felsitic quartzite with lenticular patches of dark mica-schist, chloritic schist, the granular iron pyrites associated with dark-greenish schist above referred to, several hundreds of cubes of iron pyrites, mostly small, taken from a dark glossy schist, quartz veinstone with large scales of light-coloured mica together with garnets, calcspar veinstone with embedded crystals of quartz and having grey steatitic rock adhering to it, also a veinstone of quartz containing silky radiating aggregates of hornblende and a few specks of calcspar and iron pyrites; some greenish schist is attached to this specimen. A loose piece of brown-weathering dolomite with reticulating strings of white quartz was found on Marble Island.

The granular quartziferous iron pyrites of this collection bears a strong resemblance to that of the mines at Capelton, in the Township of Ascot, Province of Quebec, and to that of the more cupriferous pyrites of the Tilt Cove Mine in Newfoundland, as also to the equally rich copper-bearing pyrites more recently discovered among the Huronian rocks at Sudbury, in the Province of Ontario. The specimen of pyrites from Iñari did not show the presence of copper, but elsewhere in working pyrites veins it has been observed that although this metal may be present only in small quantities at the surface, the proportion increases rapidly in going downward.

The resemblance between the pyrites of the three localities above mentioned is interesting, not only from an economical, but also from a geological point of view, especially in connection with the question of equivalency in age, or otherwise, of the different sets of rocks in which they are found.

At the south-west point of Marble Island, large green stains of carbonate of copper occur on the surface of the quartzite, some of them being three or four feet in diameter. They are probably due to the decomposition of sulphide of copper in the rock.

In 1850, James Tennant, Esq., Professor of Mineralogy, in King's College, London, examined seven rock-specimens which had been brought from the north point of Rankin Inlet, directly opposite to and in sight of the west end of Marble Island, and among them he men-

tions "quartz, enclosing chlorite and copper-pyrites; carbonate and silicate of copper, with copper-pyrites on argillaceous slate; ditto, with a thin coating of green carbonate of copper."

Judging from what Professor Tennant says as to a few rock-specimens which were submitted to him from Repulse Bay and vicinity, 300 miles northeastward of Marble Island, the Huronian rocks would appear to occur there also. One specimen from this bay, he describes as "quartz coloured by oxide of iron and containing minute particles of gold." The existence of visible gold in quartz at Repulse Bay is an important fact. It has been already mentioned that gold and silver were found by assay in a specimen of iron pyrites from a bay south of Cape Jones, not far south-west of Marble Island. Both gold and silver have been discovered by assay in specimens of quartz or pyrites which I have brought from various parts of Hudson's Bay and Straits. In 1877, Dr. Harrington, who was then chemist to the Geological Survey, detected both gold and silver in iron pyrites which I had collected from a small vein cutting gneiss on a point about one mile south of the mouth of Great Whale River, and also in pyrites from veins in the dolomite which forms Dog Island, close to the main shore, a few miles north of the Cape Jones of the East-main coast. The galena of the old mine, about three miles north-east of Little Whale River trading post, was found to contain 5·104 ounces of silver to the ton of 2,000 lbs., and that from the south side of the inlet of Richmond Gulf, 12·03 ounces to the same quantity of ore. More recently, Mr. Hoffmann, now chemist to the Survey, has found small quantities of gold and silver in quartz which I obtained from a thin vein on one of the Ottawa Islands, in the north-eastern part of Hudson's Bay. He has also proved the occurrence of the precious metals in quartz veinstones, which I brought from Cape Prince of Wales, about the middle of the south side of Hudson's Straits; Cape Chudleigh, on the south side of the eastern entrance to the Straits; and Nachvak Inlet, on the Labrador coast, about 140 miles south of the last mentioned cape.

From the data I have gathered at Marble Island and that afforded by the valuable series of specimens which I have referred to, as well as from the fact that Laurentian types of rocks are absent from the collections, it is to be inferred, as already stated, that we have a great development of the Huronian series along the 180 miles of coast from Chesterfield Inlet to Eskimo Point, both in regard to the variety of

the rocks themselves and their geographical extent. The information afforded by the materials of the drift and that derived from the other sources I have alluded to, all indicate that these rocks likewise occupy a very large area of country extending inland from this part of the coast. This unexplored region would, no doubt, prove a highly interesting field for research both to the geologist and the miner.

In my various reports on Hudson's Bay and Straits, I have had occasion to refer to the indications everywhere to be met with, of the great changes which have taken place in the relative levels of the sea and land in comparatively recent geological times. Similar phenomena have been observed in Baffin Land and on the northern shores of the American continent, as well as on all the islands north of the mainland, by the officers of the numerous Franklin search expeditions, and other explorers. This change in the relative levels of the land and water has not, therefore, been limited to "an area of upheaval," but has been general in all these northern regions of the earth.

The evidence of the rapid rise of the land, or perhaps more correctly speaking, of the recession of the sea, is strikingly manifested on Marble Island. The smooth pebbles and rounded stones of the ancient beaches, being snowy white, the horizontal lines of the latter are rendered conspicuous in the naked landscapes by their contrast with the yellowish-grey or brown color of the vegetable matter which occupies the intervals between them. They occur at numerous different levels, up to 200 or 300 feet, and some at still greater elevations.

The solid rocks of Marble Island are pretty thoroughly glaciated and the striæ are very distinct. At the north-west point of the island their course is S. 25° E. *true*, and on Deadman's Island it is S. 15° E. *true*. It may be mentioned in connection with this subject that at Fort Churchill the course of the glacial striæ is S.S.W., and at the first solid rock seen in ascending the Hayes River it is S.S.E., with an older set at the same place, running nearly east and west. To the west and south of James' Bay the general course is south-westward; along the southern part of the East-main coast, westward, and toward the northern part of this coast, northward; while in Hudson's Straits it is eastward. From these facts it might be inferred that during the glacial period, the ice which formed in the basin of Hudson's Bay, or flowed into it from the high lands to the north-west and those of the Labrador peninsula to the east, found outlets

towards the south and south-west, and also to the north-eastward into Hudson's Straits. The glacial debris, found all around the Bay and in the Straits, has been transported in directions corresponding with this view of the general conditions during the drift period.

At the east end of Marble Island there is a bay or harbour, with which a very sad history is associated; and as the events connected with it form an interesting chapter in the progress of discovery in these parts, I may be here allowed to devote a little space to the subject. When the Hudson's Bay Company first established a trading post at the Churchill River, in 1715, the Indians who ranged over the Barren Grounds to the westward of Marble Island frequently brought samples of native copper to the settlement, and stated that they were found near a large river, which afterwards proved to be the Coppermine, flowing into the Arctic Sea. At that time, however, the Company's people believed the river referred to emptied into Hudson's Bay, as they did not suppose these savages could wander or trade as far as a great river discharging into another sea. In addition to this pure copper, it was supposed that "gold and other valuable commodities" were to be found "to the northward." To prove this and to discover the North-west Passage, the Company, in 1719, sent out two vessels, the *Albany* frigate, George Barlow, master, and the sloop *Discovery*, David Vaughan, master, under the command of Mr. James Knight, "who had been many years governor at the different factories in the Bay, and who had made the first settlement at Churchill River."

Mr. Knight was then nearly eighty years of age, but nevertheless he appears to have been full of enthusiasm; and Hearne says "he was so prepossessed of his success and of the great advantage that would arise from his discoveries, that he procured and took with him some large iron-bound chests to hold gold-dust and other valuables which he fondly flattered himself were to be found in these parts."

Neither of the vessels having returned to England, and the Company feeling alarm for their welfare, in 1722 a sloop called the *Whalebone*, John Scroggs, master, was sent from Churchill in search of them, but he returned the same season without having ascertained anything definite as to the whereabouts of the vessels.

The story of the unhappy termination of this expedition is graphically told by Samuel Hearne in the account of his "Journey from

Fort Prince of Wales to the Northern Ocean, in 1769 to 1772," and as it is not long, I shall quote what he says:—

"The strong opinion which then prevailed in Europe respecting the probability of a North-west passage by the way of Hudson's Bay, made many conjecture that Messrs. Knight and Barlow had found a passage and had gone through it into the South Sea by the way of California. Many years elapsed without any other convincing proof to the contrary, except that Middleton, Ellis, Bean, Christopher and Johnson had not been able to find any such passage. And notwithstanding a sloop was annually sent to the northward on discovery and to trade with the Eskimos, it was the summer of 1767 (forty-eight years) before we had positive proofs that poor Mr. Knight and Captain Barlow had been lost in Hudson's Bay.

"The Company were now carrying on a black-whale fishery and Marble Island was made the place of rendezvous, not only on account of the commodiousness of the harbour, but because it had been observed that the whales were more plentiful about that island than on any other part of the coast. This being the case, the boats, when on the lookout for fish, had frequent occasion to row close to the land, by which means they discovered a new harbour near the east end of it, at the head of which they found guns, anchors, cables, bricks, a smith's anvil and many other articles, which the hand of time had not defaced, and which, being of no use to the natives, or too heavy to be removed by them, had not been taken from the place in which they were originally laid. The remains of the house, though pulled to pieces by the Eskimos for the wood and iron, are yet very plain to be seen, as also the hulls, or more properly speaking, the bottoms of the ship and sloop, which lie sunk in about five fathoms of water, toward head of the harbour. The figure-head of the ship, and also the guns, &c., were sent home to the Company, and are certain proofs that Messrs. Knight and Barlow had been lost on that inhospitable island, where neither stick nor stump was to be seen, and which lies sixteen miles from the mainland. Indeed, the main is little better, being a jumble of barren hills and rocks, destitute of every kind of herbage except moss and grass, and at that part, the woods are several hundreds of miles from the sea-side.

"In the summer of 1769, while we were prosecuting the fishery, we saw several Eskimos at this new harbour, and perceiving that one or two of them were greatly advanced in years, our curiosity was

excited to ask them some questions concerning the above ship and sloop, which we were the better enabled to do by the assistance of an Eskimo, who was then in the Company's service as a linguist, and annually sailed in one of their vessels in that character. The account which we received from them was full, clear and unreserved, and the sum of it was to the following purport:

"When the vessels arrived at this place (Marble Island), it was very late in the fall, and in getting them into the harbour, the largest received much damage; but on being fairly in, the English began to build the house, their number at that time seeming to be about fifty. As soon as the ice permitted in the following summer (1720), the Eskimos paid them another visit, by which time the number of the English was greatly reduced, and those that were living, seemed very unhealthy. According to the account given by the Eskimos, they were then very busily employed, but about what, they could not easily describe, probably in lengthening the long-boat, for at a little distance from the house there is now lying a great quantity of oak chips, which have been most assuredly made by carpenters.

"Sickness and famine occasioned such havoc among the English that by the setting in of the second winter their number was reduced to twenty. That winter (1720) some of the Eskimos took up their abode on the opposite side of the harbour to that on which the English had built their houses, and frequently supplied them with such provisions as they had, which chiefly consisted of whales' blubber and seals' flesh and train oil. (I, Hearne, have seen the remains of those houses several times; they are on the west side of the harbour and in all probability will be discernable for many years to come). When the spring advanced, the Eskimos went to the continent, and on their visiting Marble Island again in the summer of 1721, they found five of the English alive, and those were in such distress for provisions that they eagerly ate the seals' flesh and whales' blubber quite raw, as they purchased it from the natives. This disordered them so much that three of them died in a few days, and the other two, though very weak, made a shift to bury them. Those two survived many days after the rest and frequently went to the top of an adjacent rock and looked earnestly to the south and east, as if in expectation of some vessel coming to their relief. After continuing there a considerable time together, and nothing appearing in sight, they sat down close together and wept bitterly. At length

one of the two died and the other's strength was so far exhausted, that he fell down and died also in attempting to dig a grave for his companion. The skulls and other large bones of those two men are now lying above ground, close to the house. The longest liver was, according to the Eskimo account, always employed in working of iron into implements for them; probably he was the armourer or smith."

The Annual Report was read and adopted as follows:

ANNUAL REPORT.

SESSION 1885-86.

The Council of the Canadian Institute have the honour to lay before the members their 37th Annual Report.

The most noteworthy event in the history of the Institute during the past year has been the formation of a Biological Section and the incorporation into the Institute of the Natural History Society of Toronto. The alterations in the regulations rendered necessary by the change come into force for the first time at this meeting. It is to be hoped that the Union now consummated will prove of benefit to all those interested in it.

An earnest effort has been made during the year to awaken public interest in the subject of local archæology—the study of the records, now so quickly being obliterated, of the aboriginal races of this country. It is much to be desired that the Provincial Government will see their way to assist in some manner this important object.

We have lost during the past year by withdrawals and deaths 37 members, among whom is our lamented former President, Mr. J. M. Buchan, whose untimely death last summer fell on us with startling suddenness. During the year 26 new members have been elected; so that we now number on our roll 233 members, 11 less than last year. In this connection it seems proper to call attention to the large number of gentlemen who, after permitting themselves to be nominated and elected members of the Institute, have apparently performed no other function in connection with our body. On examining the statistics of the past three or four years, it appears that nearly one-third of these gentlemen elected as members never really became such.

With regard to the list of exchanges it will be seen that the number has been doubled during the past year, and is now five times what it was four years ago.

All of which is respectfully submitted.

(Signed) W. H. ELLIS, *President.*

JAMES BAIN, JR., *Secretary.*

APPENDIX I.

MEMBERSHIP.

Number of Members, April 1st, 1885	244
Withdrawals and Deaths during the year	37
	207
Elected during the Session, 1885-86	26
Total Members	233
Composed of :	
Honorary Members	5
Life Members	15
Ordinary Members	213
Total	233

APPENDIX II.

TREASURER IN ACCOUNT WITH THE CANADIAN INSTITUTE—SESSION OF 1885-6.

To Summary :	
" Balance on hand	$ 23 63
" Annual Subscriptions	584 00
" Rents	285 00
" Journals sold	2 51
" Books and Periodicals sold	41 65
" Interest on Deposits	1 30
" Government Grant	750 00
	$1,688 09

By Summary :

" Salaries		$344 00
" Periodicals		69 90
" Interest on Mortgage		238 78
" Printing		593 84
" Fuel		94 00
" Gas		43 57
" Water		24 00
" Postage, Post Cards and Delivering Proceedings		117 01
" Express charges		19 04
" Stationery		12 07
" Caretaker		10 00
" Taxes		11 07
" Discount on Cheque		25
" D. Boyle for Specimens		15 00
" Refreshments (opening night)		13 00
" Repairs		19 51
" Balance on hand, cash	24 74	
" in bank	38 31	63 05
		$1,688 09

Examined and found correct. Signed W. HENDERSON, T. B. BROWNING, } *Auditors.*

ASSETS.

Building	$11,000 00
Warehouse	720 00
Ground	2,500 00
Library	6,100 00
Specimens	1,300 00
Personal Property	500 00
	$22,120 00

LIABILITIES.

Mortgage	$ 3,411 00
Balance in favor o Institute	18,709 00
	$22,120 00

APPENDIX III.

DONATIONS AND EXCHANGES—BOOKS AND PAMPHLETS RECEIVED FROM APRIL 1ST, 1885, TO APRIL 1ST, 1886, AS COMPARED WITH THE THREE PRECEDING YEARS.

	1882-83	1883-84	1884-85	1885-86
Canada	30	90	110	129
United States	60	300	200	510
Great Britain and Ireland	100	200	160	344
India and Australasia	20	40	80	30
Foreign	70	170	180	489
Total	280	800	730	1502

APPENDIX IV.

The number of Societies and Publications with which the Institute now exchanges is 328, shewing an increase of 168 during the year. They may be classified as follows :—

From	Exchanges
Canada	20
United States	97
Mexico	
Island of Cuba	1
South America	4
England	36
Scotland	11
Ireland	6
Austria-Hungary	15
Belgium	4
Denmark	4
France	26
Algeria	1
Germany	32
Iceland	1
Italy	19
Netherlands	8
Norway	5
Portugal	1
Russia	4
Spain	4
Sweden	8

Switzerland	5
Turkey	1
Japan	3
Java	2
India	3
Australia	4
New Zealand	1
Tasmania	1
Total	328

APPENDIX V.

The number of Volumes bound during the year, including a set of the JOURNAL sent to the Colonial Exhibition, 124.

APPENDIX VI.

The number of Books and Periodicals issued to members, 1885-86. 1,129.

APPENDIX VII.

The Periodicals subscribed for are the same as last year.

APPENDIX VIII.

REPORT OF CURATOR FOR 1885-86.

In the additions made to the Institute during my term of office, specimens illustrative of aboriginal and pioneer life occupy the first place.

In April, 1885, with the consent of the Council, I prepared a circular, of which about one thousand copies were addressed to representative men of all classes throughout the Province, asking for information relative to localities connected with prehistoric and early historic events, and requesting persons in possession of relics to forward them to the Institute for the purpose of enabling us to form an archæological exhibit worthy of the Province of Ontario.

In reply to that circular a large quantity of exceedingly valuable information has been collected relating to ancient village sites, battle grounds, portages, etc., and to persons in whose hands there are private collections of more or less value.

In company with other members of the Institute, as well as alone, I visited a few of the places within easy reach of the city, and was enabled to add several hundred excellent specimens to our collection.

A number of gentlemen also who had small collections kindly presented them to the Institute, and, by an arrangement made with the York Pioneers, our Society became custodian of a large number of Indian and other specimens which are now in our cases.

Owing to the rapid expansion of our knowledge as to a number of places that are worthy of examination and survey, as well as because of the many objects we have discovered in the hands of collectors, it is to be deplored that our lack of funds precludes us from proceeding in a systematic and scientific manner in the formation of an archæological museum that would ultimately prove valuable to the Canadian student, and it is to be regretted that the Provincial Legislature failed to respond to our application for assistance in the prosecution of this national work.

The following is a list of the specimens that have been secured during the year, and which are now in cases supplied by the Institute at a cost of $100. The cases have an area of 100 square feet and contain :—

104 Pipe Heads and Stems.
92 Fragments of Pottery.
3 Clay Cups.
4 War Clubs.
18 Strings of Beads.
200 Loose Stone, Bone and Shell Beads.
8 Small Stone Disks—Perforated.
13 Perforated Stone Tablets.
19 Pieces of Shell.
1 Piece Carved Bone.
1 Small Animal—Stone Carving.
2 Horn Gouges.
1 Piece of perforated Horn.
1 Complete Turtle Shell.
1 Perforated " "
1 Piece of Human Skull, perforated.
5 Skulls, almost perfect.
1 String of Bone Beads.
44 Bone Needles.
460 Arrow Heads—(flint).
7 " mounted (iron).

121 Stone Axes, Gouges and Chisels.
9 Pieces of Sheet Copper.
1 Whole Copper Kettle.
12 Iron Knives—rusted and worn.
9 Indian Ornaments (various.)
3 " Medals (silver.)
6 Brass and Copper Rings.
14 Iron Tomahawks.

Besides these there are several articles of a miscellaneous kind—the whole numbering fully one thousand.

The principal contributors were :—

Rev. T. T. Johnston, of Ancaster.
Mr. A. F. Hunter, Flos.
Mr. Loughead, Sunnidale.
Mr. B. Jackes, Toronto.
Mr. A. Elvins, "
Mr. A. McKnight, Kirkwall.
Mr. James Rae, "
Mr. James Dwyer, Beverley.
Mr. George E. Laidlaw, The Fort.
Mr. J. Long, Eglinton.
Mr. J. Welbone, Myrtle, and
The Curator.

There are many fine geological specimens that ought to be attended to immediately, but with which it is impossible to do anything for the want of case room.

Before the close of another year it may be reasonably honed that the whole collection in possession of the Institute will be put in proper shape for study.

All of which is respectfully submitted.

DAVID BOYLE, Ph.B., *Curator.*

On motion of Mr. Keys, seconded by Mr. Kerr, the report was adopted.

The following gentlemen were elected officers for the ensuing year :—

PRESIDENT—W. H. VanderSmissen, M.A.
VICE-PRESIDENT—E. A. Meredith, LL.D.

THE FOOD PLANTS OF PLATYSAMIA CECROPIA.

BY WM. BRODIE.

(Read before the Natural History Society of Toronto.)

In December, 1880, I read a paper before the Natural History Society on the food plants of *Platysamia cecropia*. The paper was a synopsis of observations extending over 17 years, made in the County of York and contained a list of 49 species. This list was afterwards published in the February number of "Papilio" for 1882.

To this list I have made several rather important additions which are included in the following revised list:—

MAGNOLIACEÆ.

Liriodendron tedipifera, L.

LILIACEÆ.

Lilia Americana, L.
" Europæa, L.

SAPINDACEÆ.

Staphylia trifolia, L. in W. Lean's orchard.
Aesculus hippocastanum, L.
Acer Pennsylvanicum, L., Muskoka.
" spicatum, Lam.
" saccharinum, Wang.
" dasycarpum, Ehr.
" rubrum, L.
Negundo aceroides, Moench.

ROSACEÆ.

Persica vulgaris, D.C.
Prunus Americana, Mar.
Prunus domestica, L.
" pumila L., Harbor Island, Georgian Bay.
" Pennslyvanica, L..
" Serotina, Ehr.
" Virginiana, L.
Cerasus vulgaris, L.
Spiræa opulifolia, L.
" salicifolia, L.
" tomentosa, L.
Crataegus coccinea, L.
" tomentosa, L.
" cruxgalli, L.
Pyrus malus, L.
" communis, L.
" coronaria, L.
" arbutifolia, L.
" Americana, s.c.
" aeuparia, Gaer.
Amalanchier Canadensis, Torr, Gray.

SAXIFRAGACEÆ.

Ribes lacustre, Poir. Tobermorey.
" floridum, L.
" floridum officinale, L.
" rubrum officinale, L.
" Aureum, Pursh.

CAPRIFOLIACEÆ.

Symphoricarpus vulgaris, Mich.
Diervilla trifida, Moench.
Sambucus Canadensis, L.
" pubens, Michx.

COMPOSITÆ.

Lappa officinalis, Alli.

OLEACEÆ.

Fraxinus Americana, L.

URTICACEÆ.

Ulmus fulva, Michx.
" Americana, L.
" racemosa, Thorn.

JUGLANDACEÆ.

Carya tomentosa, Nutt.
" porcina, Nutt.
" alba, Nutt.

CUPULIFERÆ.

Quercus alba, L.
" macrocarpa, Michx.
Quercus obtusiloba, Michx.
Castanea vesca, L.
Fagus ferruginea, Ait.
Corylus Americana, Walt.
" rostrata, Ait.
Ostrya virginica, Willd.
Carpinus Americana, Michx.

BETULACEÆ.

Betula excelsa, L.
" lenta, L.
" lutea, Michx.
" alba, Spach.
" papyracea, Ait.
" glandulosa, Michx., Tobermorey
Alnus viridis, D.C., Manitoulin.
" incana, Willd.
" serrulata, Ait.

SALICACEÆ.

Salix humilis, Mar.
" sericea, Mar.
" viminalis, L.
" lucida, Mühl.
" alba, L.
Populus tremuloides, Michx.
" grandidenta, Michx.
" balsamifera, L.

On the morning of June 5th, 1885, I found eight Cecropia larvæ, just out of the egg, in one of my breeding boxes. I immediately placed them on a plant of burdock which was growing in the garden. About two weeks afterwards I was somewhat surprised to find four larvæ feeding on the leaves, and from a rather peculiar shade of color I at first took them to be *C. promethea*. From this time I watched them closely; when about half-grown, one left the plant and was lost, the remaining three reached a fair average size, and two when mature left the plant to spin up elsewhere, and were lost. But I succeeded in securing one cocoon. Very possibly we may yet find that Cecropia larvæ will feed and mature on the leaves of many herbaceous plants.

During the summer of 1883 I had over 50 Cecropia larvæ feeding on a plum tree in my garden. At a short distance grew a peach, the upper branches of which nearly touched those of the plum. On the

leaves of this peach I had often placed young cecropia larvæ, invariably they refused to eat and starved to death. Twice I put larvæ about half grown, with the same result.

When the larvæ on the plum were about half grown, a gale of wind blew the branches of the trees together. A few days afterwards I noticed the upper shoots of the peach denuded of leaves. On close inspection I found four cecropia larvæ—having evidently worked over from the plum—feeding greedily and thriving well. These all matured and spun upon the peach.

The horse-chestnut is entered from finding eight cocoons so situated that the larvæ could not have fed on any other tree.

The *Symphoricarpus vulgaris* is entered from one convincing example—the shrub was isolated a long distance from any other shrub or tree—the cocoon was found soon after completion, and several shoots denuded of leaves gave evidence of the presence of the larvæ.

Some doubts have been expressed as to the elm being a food plant. The repeated finding of cocoons, often 30 ft. or more from the ground, seems quite conclusive, but for several seasons I have reared a large number of larvæ on an elm tree in my garden and the only noticeable difference was the generally small size of the cocoons. Cocoons are sometimes found on the common privet, but, although it is most probably a food plant, in absence of sufficient evidence it is omitted from this list.

I have no doubt it will be found that the larvæ feed indiscriminately on all our species of willow and poplar.

In all our northern lumbering sections, a few years after the sweep of a bush fire, you find a dense growth of sambucus birch and willow. Thus, with abundance of food and absence of parasites, this would be the Cecropia's paradise, were it not for the woodpeckers which perforate the cocoons and feed on the pupæ during the winter.

I am indebted to Mr. R. Morey and Mr. W. Squires for valuable assistance in the collection of material for this list.

TANNIN IN CLOVES.

By W. HODGSON ELLIS, M.A., M.B.

(Read before the Canadian Institute, Nov. 27, 1886.)

Some time ago, while examining cloves adulterated with farinaceous matter, I was struck by the fact, that in testing for starch with solution of iodine, it was necessary to add a considerable quantity of iodine before a blue colour appeared. The quantity of iodine required could even be used as an approximate measure of the quantity of pure cloves in the sample. Some preliminary experiments led me to attribute this action to tannin, and I made, with the assistance of Mr. F. T. Shutt, a number of determinations of tannin in pure cloves by means of Löwenthal's process.

Our manner of working was as follows:—2 grms. cloves were exhausted by boiling under an inverted condenser, filtered, and the filtrate made up to 500 c.c.; 50 c.c. of the filtrate was then titrated with a solution of permanganate (1 grm. to the litre). In 100 c.c. of the filtrate the tannin was precipitated by gelatine and acid salt solution, made up to 250 c.c. filtered, and 50 c.c. titrated with permanganate. Indigo carmine was used as an indicator. The titration was carried out in a porcelain basin. The liquid operated on was diluted to about 750 c.c., and the permanganate was allowed to run into the basin at about the rate of one drop in a second, with constant stirring. The method was essentially that described by Proctor (Chem. News, xxxvi., 58).

We then made determinations of tannin in clove stems and in allspice. I have subsequently, with the assistance of Mr. F. W. Babington, made a number of similar determinations in commercial cloves and allspice, both pure and adulterated. The following table gives our results, stated in c.c. decinormal permanganate, required to oxidize one gram of cloves before and after the precipitation of the tannin. In calculating these results to tannin, I have used Neubauer's factor, viz., 6.3 grm. oxalic acid will require for oxidation as much permanganate as will oxidize 4.157 grm. gallotannic acid. The solution of permanganate used was titrated against oxalic acid and checked by pure tannic acid. In using this factor I do not, of course, intend to assert that the tannin of cloves is identical with

gallotannic acid. The factor is only used provisionally to afford a means of comparison.

	C.C. Decinormal Permanganate required to Oxidize one Gram.			Percentage of tannin calculated as gallotannic acid.
	Before the precipitation of the tannin.	After the precipitation of the tannin.	Required for tannin.	
Cloves I.	69.54	42.66	26.88	11.17
" II.	74.76	49.33	25.43	10.55
" III.	74.59	45.35	29.24	12.16
" IV.	75.22	46.50	28.72	11.91
Clove stems	37.65	18.86	18.79	7.01
Allspice	24.83	11.33	13.50	5.61
Commercial ground cloves	63.26	39.26	24.00	9.98
Ground cloves adulterated with peas	23.51	15.83	7.68	3.19
Ground cloves adulterated with flour	19.36	12.58	6.78	2.82

It appears from these experiments that cloves contain about 10 or 12 per cent. of tannin calculated as gallotannic acid, that clove stems contain about 8 per cent., and that allspice contains 5 or 6 per cent. of tannin so calculated. It is also evident that the quantity of tannin is a valuable criterion of the quantity of cloves contained in an adulterated sample.

The large quantity of permanganate required by the oxidizable matters other than tannin is remarkable in the case of cloves. It is in every case much larger than that required to oxidize the tannin. I hope to be able to make a further investigation on the nature of these substances at a future time.

The Canadian Institute exchanges with the following Societies and Periodicals:

I.—AMERICA.

(1.)—CANADA.

Canadian Practitioner, Toronto.
Meteorological Reports, Toronto.
Public Library, Toronto.
Education Department, Toronto.
Provincial Board of Health, Toronto.
Publications of the Provincial Government.
Geological and Natural History Survey of Canada, Ottawa.
Parliamentary Library, Ottawa.
Royal Society of Canada, Ottawa.
Ottawa Field Naturalists' Club, Ottawa.
Entomological Society of Ontario, London.
Hamilton Association, Hamilton.
Natural History Society of Montreal.
Literary and Historical Society of Quebec, Quebec.
Le Naturaliste Canadien, Cap Rouge, Que.
Natural History Society of New Brunswick, St. John, N. B.
Nova Scotia Historical Society, Halifax, N. S.
Nova Scotia Institute of Natural Sciences, Halifax, N. S.
Manitoba Historical and Scientific Society, Winnipeg, Man.—19.

(2.)—UNITED STATES.

Bureau of Steam Engineering, Navy Department, Washington, D. C.
Smithsonian Institution, Washington, D. C.
Bureau of Ethnology, Washington, D. C.
United States Geological Survey, Washington, D. C.
Philosophical Society of Washington, Washington, D. C.
United States Coast and Geodetic Survey, Washington, D. C.
United States National Museum, Washington, D. C.
Department of Agriculture (Division of Chemistry), Washington, D. C.
California Academy of Science, San Francisco, Cal.
Technical Society of the Pacific Coast, San Francisco, Cal.
Western Scientist, San Diego, Cal.
Colorado Scientific Society, Denver.
Bridgeport Scientific Society, Bridgeport, Conn.
American Journal of Science, New Haven, Conn.
Connecticut Academy of Arts and Science, New Haven, Conn.
Yale College Observatory, New Haven, Conn.
Georgia Historical Society, Savannah, Ga.
Chicago Historical Society, Chicago.
Illinois State Laboratory of Natural History, Champaign, Ill.

American Antiquarian and Oriental Journal, Chicago, Ill.
Brookville Society of Natural History, Brookville, Ind.
Academy of Natural Sciences, Davenport, Iowa.
State Historical Society of Iowa, Iowa City.
Kansas Historical Society, Topeka.
Kansas Academy of Science, Topeka.
Academy of Natural Sciences, New Orleans, La.
Peabody Institute, Baltimore, Md.
Johns Hopkins University, Baltimore, Md.
United States Naval Institute, Annapolis, Md.
Boston Society of Natural History, Boston, Mass.
American Academy of Arts and Sciences, Boston, Mass.
Observatory of Harvard College, Cambridge, Mass.
Harvard University Library, Cambridge, Mass.
Museum of Comparative Zoölogy at Harvard College, Cambridge, Mass.
Peabody Museum of Archaeology and Ethnology, Cambridge, Mass.
American Association for the Advancement of Science, Cambridge, Mass.
American Society for Psychical Research, Cambridge, Mass.
Essex Institute, Salem, Mass.
Peabody Academy of Science, Salem, Mass.
American Antiquarian Society, Worcester, Mass.
Worcester Society of Antiquity, Worcester, Mass.
Agricultural College, near Lansing, Mich.
Academy of Natural Sciences, Minneapolis.
Geological and Natural History Survey of Minnesota, Minneapolis.
Academy of Sciences, St. Louis, Mo.
Missouri Historical Society, St. Louis, Mo.
Sedalia Natural History Society, Sedalia, Mo.
New Jersey Historical Society, Newark, N. J.
E. M. Museum of Geology and Archaeology, Princeton College, Princeton, N.J.
New York Academy of Sciences, New York.
American Museum of Natural History, Central Park, New York.
American Society of Civil Engineers, New York.
Journal of Speculative Philosophy, New York.
Linnean Society of New York, New York.
New York Microscopical Society, New York.
School of Mines Quarterly, Columbia College, New York.
Magazine of American History, New York.
American Geographical Society, New York.
New York Academy of Anthropology, New York.
American Chemical Society, New York.
Electrical Review, New York.
Electrician and Electrical Engineer, New York.
American Institute of Mining Engineers, New York.
Political Science Quarterly, New York.
New York State Library, Albany, N. Y.

New York State Museum of Natural History, Albany, N. Y.
Buffalo Society of Natural Sciences, Buffalo, N. Y.
Buffalo Historical Society, Buffalo, N. Y.
Cornell University, Ithaca, N. Y.
Vassar Brothers Institute, Poughkeepsie, N. Y.
Oneida Historical Society, Utica, N. Y.
Rensselaer Society of Engineers, Troy, N. Y.
Ohio Mechanics' Institute, Cincinnati, O.
Historical and Philosophical Society of Ohio, Cincinnati, O.
Cincinnati Society of Natural History, Cincinnati, O.
Denison University, Laboratories of Biology and Natural History, Granville, O.
University of Pennsylvania, Philadelphia.
American Catholic Quarterly Review, Philadelphia.
American Naturalist, Philadelphia.
American Philosophical Society, Philadelphia.
Academy of Natural Sciences of Philadelphia, Philadelphia.
Franklin Institute of the State of Pennsylvania, Philadelphia.
Historical Society of Pennsylvania, Philadelphia.
Wyoming Historical and Geological Society, Wilkesbarre, Pa.
Rhode Island Historical Society, Providence, R. I.
Newport Natural History Society, Newport, R. I.
University of Virginia.
Wisconsin Academy of Sciences, Arts, and Letters, Madison.
State Historical Society of Wisconsin, Madison.—89.

(3.)—MEXICO.

Museo Nacional de México.—1.

(4.)—CUBA.

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

(5.)—SOUTH AMERICA.

Instituto Historico, Geographico, e Ethnographico do Brazil, Rio de Janeiro.
Annaes da Escola de Minas de Ouro Preto.
Sociedade de Geographia de Lisboa no Brazil.
Academia Nacional de Ciencias en Córdoba (Republica Argentina).—4.

II.—EUROPE.

(1.)—GREAT BRITAIN AND IRELAND.

ENGLAND.

Birmingham Natural History and Microscopical Society.
Journal of Microscopy and Natural Science, Bath.
The Scientific Enquirer, Bath.
Cambridge Philological Society.
Cambridge Philosophical Society.
Royal Geological Society of Cornwall, Penzance.
Literary and Philosophical Society of Leeds.

Literary and Philosophical Society of Liverpool.
Liverpool Astronomical Society.
Liverpool Polytechnic Society.
Royal Geographical Society, London.
Royal Astronomical Society, London.
Royal Microscopical Society, London.
Royal Society, London.
Victoria Institute, London.
Quekett Microscopical Club, London.
Society for Psychical Research, London.
Anthropological Institute of Great Britain and Ireland, London.
Royal Colonial Institute, London.
Linnean Society of London.
London Mathematical Society, London.
Institution of Civil Engineers, London.
Financial Reform Association, London.
British Museum, London.
British Museum, Natural History Section, London.
Palestine Exploration Fund, London.
Patent Office, London.
Trübner's American, European, and Oriental Literary Record, London.
Physical Society of London.
National Association for the Advancement of Social Science, London.
The Sanitary Institute of Great Britain, London.
The Chemical News, London.
Royal Antiquarian Society, London.
Meteorological Office, London.
Literary and Philosophical Society of Manchester.
Manchester Geological Society, Manchester.
Manchester Association of Employers, Foremen, and Draughtsmen of the Mechanical Trades of Great Britain.
Society of Antiquaries of Newcastle-upon-Tyne.
Somersetshire Archæological and Natural History Society.—39.

SCOTLAND.

Royal Society of Edinburgh.
Royal Society of Antiquaries.
Royal Scottish Society of Arts.
Royal Physical Society.
Edinburgh Botanical Society.
Edinburgh Geological Society.
Scottish Geographical Society.
Royal Philosophical Society, Glasgow.
Glasgow Geological Society, Glasgow.
Natural History Society of Glasgow.
Institution of Engineers and Shipbuilders of Scotland.—11.

IRELAND.

Royal Irish Academy, Dublin.
Royal Dublin Society, Dublin.
Royal Geological Society of Ireland, Dublin.
The Institution of Civil Engineers of Ireland.
Naturalists' Field Club, Belfast.
Belfast Natural History and Philosophical Society.—6.

(2.)—AUSTRIA-HUNGARY.

Siebenbürgischer Verein für Naturwissenschaften in Hermannstadt.
K. Böhmische Gesellschaft der Wissenschaften, Prag.
K. K. Universitäts-Sternwarte, Prag.
Naturhistorischer Verein "Lotos," Prag.
Civico Museo di Storia Naturale di Trieste.
K. K. Geologische Reichsanstalt, Wien.
K. K. Geographische Gesellschaft, Wien.
K. K. Zoologisch Botanische Gesellschaft.
K. K. Naturhistorisches Hofmuseum.
K. K. Central Anstalt für Meteorologie und Erd-Magnetismus.
Anthropologische Gesellschaft in Wien.
Wissenschaftlicher Club in Wien.
Oesterreichischer Ingenieur-und Architekten Verein, Wien.
Ornithologischer Verein, Wien.—14.

(3.)—BELGIUM.

Académie Royale des Sciences, des Lettres et des Beaux Arts de Belgique.
Société Royale de Botanique de Belgique.
Société Royale Belge de Géographie.
Musée Royal d'Histoire Naturelle de Belgique.—4.

(4.)—DENMARK.

Kongelige Bibliotheket.
Kongelige Danske Videnskabernes Selskab.
Kongelige Nordiske Oldskrift Selskab.
Nordisk Tidskrift for Filologi.—4.

(5.)—FRANCE.

Académie Nationale des Sciences, Arts et Belles-Lettres de Caen.
Société Nationale des Sciences de Cherbourg.
Société Géologique de Normandie.
Société Géologique du Nord.
Société pour l'Étude des Langues Romanes, Montpellier.
Académie des Sciences, Inscriptions et Belles-Lettres de Toulouse.
Annales des Mines, Paris.
Annales des Ponts et Chaussées, Paris.
Société des Ingénieurs Civils, Paris.
Société Nationale des Antiquaires de France, Paris.
Societé Géologique de France, Paris.

Société Académique Indo-Chinoise de France, Paris.
Société d'Ethnographie, Paris.
Société Américaine de France, Paris.
Société d'Anthropologie de Paris, Paris.
Bibliothèque Nationale, Paris.
Société de Géographie, Paris.
Cosmos, Paris.
L'Électricité, Paris.
Association Française pour l'Avancement des Sciences, Paris.
Journal des Sociétés Scientifiques, Paris.
Revue de Linguistique et de Philologie Comparée, Paris.
Société Zoologique de France, Paris.
Société Mathématique de France, Paris.
Bulletin d'Histoire Ecclésiastique et d'Archéologie Religieuse des Diocèses de Valence, Digne, Gap, Grenoble, et Viviers.—22.

ALGERIA.

Société de Géographie et d'Archéologie de la Province d'Oran.
Académie d'Hippone.—2.

(6.)—GERMANY.

Königliche Preussische Akademie der Wissenschaften, Berlin.
Gesellschaft Naturforschender Freunde, Berlin.
Gesellschaft für Erdkunde, Berlin.
Berliner Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, Berlin.
Bibliographie der Staats-und Rechtswissenschaften, Berlin.
Archiv der Mathematik und Physik, Berlin.
Naturhistorischer Verein für die Preussischen Rheinlande und Westphalen, Bonn.
Naturwissenschaftlicher Verein, Bremen.
Naturwissenschaftlicher Verein "Isis," Dresden.
Senckenbergische Naturforschende Gesellschaft, Frankfurt-am-Main.
Naturwissenschaftlicher Verein, Frankfurt-an-der-Oder.
Oberhessische Gesellschaft für Natur-und Heilkunde, Giessen.
Königliche Gesellschaft der Wissenschaften, Göttingen.
Naturwissenschaftlicher Verein, Hamburg.
Verein für Naturwissenschaftliche Unterhaltung, Hamburg.
Naturhistorisches Museum zu Hamburg, Hamburg.
Geographische Gesellschaft, Hannover.
Naturhistorischer Verein für Niedersachsen, Hannover.
Historischer Verein für Niedersachsen, Hannover.
Naturhistorisch-Medicinischer Verein, Heidelberg.
Verein für Naturkunde, Kassel.
Ostpreussische Physikalisch-Oekonomische Gesellschaft zu Konigsberg.
Naturforschende Gesellschaft zu Leipzig.
Königlich Sächsische Gesellschaft der Wissenschaften zu Leipzig.
Verein für Vaterländische Naturkunde in Würtemberg.
Naturhistorische Gesellschaft zu Nürnberg.

Königlich Baierische Akademie der Wissenschaften, München.
Deutsche Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, München.
Görres Gesellschaft (Historisches Jahrbuch), München.
Verein für Naturkunde, Offenbach-am-Main.
Zeitschrift für Physiologische Chemie, Strassburg.
Nassauischer Verein für Naturkunde, Wiesbaden.—32.

(7.)—ICELAND.

Islenzka Fornleifafélags, Reykjavik.—1.

(8.)—ITALY.

Ateneo di Brescia, Brescia.
Società Storica per la Provincia e Antica Diocesi di Como.
R. Istituto di Studi Superiori in Firenze.
Società Italiana di Antropologia, Etnologia, e Psicologia Comparata, Firenze.
Sezione Fiorentina della Società Africana d'Italia, Firenze.
Società Entomologica Italiana, Firenze.
Società di Lettura e Conversazione Scientifiche, Genova.
R. Accademia di Belle Arti, Milano.
R. Istituto Lombardo di Scienze e Lettere, Milano.
Società Veneto-Trentina di Scienze Naturali, Padova.
Società Toscana di Scienze Naturali, Pisa.
Gazetta Chimica Italiana, Palermo.
Circolo Matematico di Palermo, Palermo.
Società Siciliana per la Storia Patria, Palermo.
R. Accademia di Scienze, Lettere, e Belle Arti di Palermo, Palermo.
Direzzione del Giornale del Genio Civile, Roma.
Società Geografica Italiana, Roma.
R. Comitato Geologico d'Italia, Roma.
R. Accademia dei Lincei, Roma.
Bullettino di Bibliografia e di Storia delle Scienze Matematiche e Fisiche, Roma.
"Cosmos" di Guido Cora, Torino.
Notarisia Commentarium Phycologicum, Venezia.—22.

(9.)—NETHERLANDS.

Koninklijke Akademie van Wetenschappen, Amsterdam.
Koninklijke Zoologisch Genootschap "Natura Artis Magistra," Amsterdam.
École Polytechnique de Delft.
Société Hollandaise des Sciences à Harlem.
Fondation de P. Teyler van der Hulst, Harlem.
Nederlandsche Botanische Vereeniging, Leiden.
Nederlandsche Dierkundige Vereeniging, Leiden.
Recueil des Travaux Chimiques des Pays-Bas, Leiden.
Koninklijk Nederlandsch Meteorologisch Instituut, Utrecht.—9.

(10.)—NORWAY.

Polytekniske Forening, Kristiania.
Forening til Norske Fortidsmindesmerkers Bevaring, Kristiania.

Videnskabs Selskabet i Kristiania.
Kongelige Norske Frederiks Universitetet, Kristiania.
Nyt Magazin for Natur Videnskabernes, Kristiania.—5.

(11.)—PORTUGAL.

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

(12.)—RUSSIA.

Kharkow Mathematical Society.
Société des Naturalistes à l'Université Impériale de Kharkow.
Société Impériale des Naturalistes de Moscou.
Société Physico-Chimique Russe à l'Université de St. Petersbourg
Comité Géologique, St. Petersbourg.—5.

(13.)—SPAIN.

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

(14.)—SWEDEN.

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

(15.)—SWITZERLAND.

La Société d'Histoire Naturelle, Bern.
Geographische Gesellschaft von Bern.
Naturforschende Gesellschaft in Bern.
Société de Physique et d'Histoire Naturelle, Genève.
Société de Géographie de Genève.
Société Neuchateloise de Geographie.—6.

(16.)—TURKEY.

Syllogue Littéraire Grec de Constantinople.—1.

III.—ASIA.

(1.)—INDIA.

Asiatic Society of Bengal, Calcutta.
Geological Survey of India, Calcutta.
Survey of India Department, Calcutta.

The Indian Antiquary, Bombay.
The Orientalist, Kandy, Ceylon.—5.

(2.)—JAPAN.

University of Tokio.
Asiatic Society of Japan, Tokio.
Deutsche Gesellschaft für Natur-und Völkerkunde Ost-Asiens, Tokio.—3.

(3.)—JAVA.

Bataviaasche Genootschap van Kunsten en Wetenschappen, Batavia.
Nederlandsch-Indische Maatschappij van Nijverheid en Landbouw, Batavia.—2.

IV.—AUSTRALASIA.

(1.)—AUSTRALIA.

Royal Society of New South Wales, Sydney.
Department of Mines, New South Wales, Sydney.
Linnean Society of New South Wales, Sydney.
Royal Society of Queensland, Brisbane.—4.

(2.)—NEW ZEALAND.

New Zealand Institute, Wellington.—1.

(3.)—TASMANIA.

Royal Society of Tasmania, Hobart Town.—1.

Total, 331.

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1.—The First Series has for title, "The Canadian Journal: a Repertory of Industry, Science and Art; and a Record of the Proceedings of the Canadian Institute." The Second series has for title, "The Canadian Journal of Science, Literature, and History." The title of the Third Series is, "Proceedings of the Canadian Institute." Parts 1 & 2, Third Series, are entitled "The Canadian Journal: Proceedings of the Canadian Institute."

2.—By inadvertence, No. 85 (November, 1873) of the "Canadian Journal," 2nd Series (Vol. XIV.) immediately follows No. 79. There is, however, no *lacuna* between these two numbers, as is shown by the fact that the paging is consecutive.

3.—Societies wishing to exchange back numbers of their Proceedings can be supplied with complete sets of the Publications of the Canadian Institute, except Vol. XV., No. 5, Second Series, and Vol. I., Part 1, Third Series.

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