Royal Society of N.Z.

TRANSACTIONS

AND

PROCEEDINGS

OF THE

NEW ZEALAND INSTITUTE,

1868.

VOL. I.

EDITED AND PUBLISHED UNDER THE AUTHORITY OF THE BOARD OF GOVERNORS OF THE INSTITUTE,

BY

JAMES HECTOR, M.D., F.R.S.

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SECOND EDITION.

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PREFACE.

The original edition of the first volume of the Transactions and Proceedings of the New Zealand Institute having long been exhausted, the Government, at the request of the Board of Governors, undertook its republication.

As will be seen, the arrangement of the first edition has been somewhat changed. No extensive alterations have however been made in the Papers as originally published; and whenever at the request of authors any corrections have been made which were not merely verbal, the words added have been put in italics after those to be omitted, which are in square brackets.

Wellington, 31*st* *May*, 1875.

PREFACE TO FIRST EDITION.

In issuing the first volume of the Transactions of the New Zealand Institute, the Editor has to acknowledge the many imperfections of the work, both in the typography and in the general arrangement, inseparable from a first effort to publish in a combined form the Reports of Societies only recently organized.

It will be observed that the size of the volume has been very considerably increased by the insertion of matter which does not properly belong to the proceedings of the current year, such as communications of earlier date to the various Societies, and by the publication of eight essays which were written originally in connection with the New Zealand Exhibition, 1865. In future, therefore, the volume will be less bulky and expensive, and it is hoped free from the errors which, unavoidably, have crept into the present issue, from various causes.

The volume is divided into three parts—the first part consisting of the Proceedings of the various Societies which are now affiliated under the New Zealand Institute Act, derived principally from the newspaper reports of the meetings, corrected and forwarded by the Secretaries, with abstracts of the papers not printed in the Transactions.

In most instances the authors, at the request of the Board, furnished the abstracts of their several papers when required; but in some cases it was found impossible to communicate with the authors in time for publication, in which case the Editor, on his own responsibility, made the necessary abstracts.

The second part of the work consists of the Transactions of the Institute, containing the papers read at the various meetings which were considered worthy of being printed *in extenso*. In making this selection, the Governors have dealt liberally with the various authors, in order to encourage future efforts.

Many of the papers are of a most important character, and all are valuable contributions to scientific literature, particularly those bearing on the natural history and resources of the colony.

The Governors regret that two very learned and important papers, both by Captain Hutton, viz. "On Sinking Funds," and "Flight of Birds," could not be printed, owing to the impossibility of procuring, in Wellington, the type for the algebraic formulæ which they contain.

It is necessary also to explain that, owing to the difficulties of communicating in time, only those authors who resided in the neighbourhood of Wellington could be furnished with *proofs* for revision, but every opportunity was afforded to make corrections consistent with the due progress of the work through the press.

In future it is intended to have extra copies of the papers printed off for the various authors, as is customary in other scientific societies, provision for the purpose having been inadvertently omitted from the printer's contract this year.

In the third part will be found the essays already alluded to as having been written for the New Zealand Exhibition, 1865. Five of these—viz. "On Ornithology," by Mr. Buller; "Geology," by Mr. Crawford; "Trees and Plants," by Mr. Ludlam; "The Maori Races," by Mr. Shortland; and on "Botany," by Mr. Colenso—appeared in print shortly after that period, and were circulated to a certain extent among scientific persons; the remainder of the edition was purchased by the Government from the Exhibition Commissioners, and has been placed at the disposal of the Board of Governors for incorporation with this volume. The remaining essays now appear in print for the first time, and constitute a very important addition to the work: that by Mr. Colenso, "On the Maori Races of New Zealand," being especially worthy of attention under the present circumstances of the colony.

A few statistical tables, which are not generally available, have been added, giving information on subjects referred to in the body of the work.

The Editor has also been desired to give publicity to the following list of subjects on which special information is desirable, which has been circulated among the Members of the Auckland Institute, in the hope that it may be found useful, as suggesting future communications to the various Societies:—

1. History, mythology, ethnology, &c., of the Maori race.
2. Fisheries—best localities, and seasons for fishing.
3. Extraordinary meteorological phenomena.
4. Hot springs, landslips, wearing away of coast lines and river banks, and other natural phenomena.
5. Formation and progress of sand dunes.
6. Formation of sandbanks in rivers, and bars to harbours.
7. Occurrence of rare plants, animals, and minerals.
8. Habits of animals, especially of those destructive to trees and cultivated plants.

9. Mineral and metalliferous deposits.
10. Localities for fossils.
11. Naturalization and diffusion of introduced plants and animals.
12. Resources of the colony in cements, concretes, plasters, building stones, &c., &c.
13. Resources of the colony in materials used in the manufacture of glass and pottery.
14. Substances found in the colony available for dyeing or tanning.
15. Machines and processes for the extraction and treatment of ores, and for the preparation of flax.
16. Duration of native timber under various circumstances.
17. Plans and descriptions of mines.
18. Cause of failure of introduced grasses on some of our soils.
19. Effect as manure of various substances found in the colony.
20. Plants suitable for live fences in this country.
21. Medicinal plants.
22. Trees available for timber.
23. Arboriculture.
24. Proposed lines of railway.
25. Harbour improvements.
26. Experiments in the improved breeding of stock.
27. Experiments in this colony on the culture of the vine, the hop, sugar-beet, rice, barley, European flax, New Zealand flax, &c.
28. Adulteration of food.
29. Sanitary condition of our cities, and means of improving them.
30. Effects of our climate on diseases.
31. Machines and processes for the washing of sheep, and on boiling-down establishments.

In conclusion, the Editor begs to acknowledge the great assistance he has received in the publication of this work from the Governors, and especially from Mr. Travers, who kindly superintended the revision of a large proportion of it.

The acknowledgments of the Board are also due to the Secretary, Mr. R. L. Holmes, for the efficient and painstaking manner in which he has performed the duty of passing the volume through the press; and to Mr. John Buchanan for his valuable assistance in the preparation of the illustrations.

JAMES HECTOR.

WELLINGTON, *5th May*, 1869.

NEW ZEALAND INSTITUTE.

MINUTES OF MEETINGS.

Inaugural Meeting, *4th August*, 1868.

The New Zealand Institute was opened by a *conversazione* at the Colonial Museum on the evening of 4th August, 1868, when many members of various local societies for the promotion of Art and Science assembled to listen to the Inaugural Address of His Excellency the Governor.

In a few prefatory remarks His Excellency referred to the presence of so many members of the legislature, while an important debate was in progress in the House of Representatives, as a proof that the attractions of intellect and science could even triumph over the excitement of politics.

His Excellency's address. (*Vide post.*)

Mr. Fox, M.H.R., rose at the conclusion of the address. He did so, he said, with diffidence, and would much rather that some gentleman more accustomed to academic and scientific subjects had been selected to perform the pleasing task which he had consented to discharge. He was glad, although it took him somewhat by surprise, to behold such an assemblage as he now saw filling that place. Such an assemblage for such a purpose would have been impossible in the early days, though even then there was a William Swainson, and other men of his stamp. *They* made attempts to do something more than simply to colonize these islands; but there was no union for the prosecution of scientific pursuits. Science in those dark and distant days had no voice, and the finer arts were a dead letter. Thus, shortly after his return from Europe, he was gratified beyond measure to be one of such an assemblage, presided over by His Excellency the Governor. Glad he was on returning from the old countries, and from travelling in remote parts of Europe and Asia, where he had seen evidences of the rapid strides which modern science and enterprise had made in some of the Old World's formerly most benighted places,—where he had seen the telegraph wires crossing wastes and deserts, the iron horse in his mighty strength, and the Archimedean screw upon Old Nilus. Everywhere the mighty developments of Western civilization were marvellous; it was something to see in Egypt,—the cradle of learning, and the tomb of a past civilization,—Western Europe taking back to her the results of a little seed which ages ago had been sown on the banks of the mighty Nile. In Greece the same metamorphosis was in progress. Rome, too, was being elevated from its ruins. This truly was a great fact,—it was also gratifying. We in New Zealand were not behindhand, but were engaged in the "heroic work" described by Lord Bacon in the words quoted by His Excellency;—we were here to lay the basis of a true civilization; not only to subdue nature and till the soil, but, impelled by Anglo-Saxon ardour and energy, to develop all that was worthy of development. It was not usual to offer a vote of thanks on such occasions, but as Sir G. Bowen had evinced so deep an interest in the Institute, he (Mr. Fox) would call on the assembly to express their gratification by acclamation; which was cordially responded to.

His Excellency thanked Mr. Fox heartily for his eloquent speech, and referred to the gratification which he (Sir G. Bowen) had felt in examining a most valuable series of sketches which Mr. Fox had lent to the Museum, as one of the results of his recent travels. It gave him great pleasure to take part in reunions of that kind, and to meet the members of all political parties on the neutral ground of Science and Literature. He was sure that all present rejoiced with him at the presence among them that evening of an officer of the Imperial Navy of France,* of that great navy which had sent forth to the exploration of the Southern Seas a La Perouse, a Baudin, a Bougainville, a D'Entrecasteaux, and other famous seamen worthy to stand in history by the side of our own immortal navigator Captain Cook. He (the Governor) would remind the audience that next year a hundred years would have elapsed since Captain Cook first set his foot on the shores of New Zealand, and he would suggest that some celebration of this centenary should take place under the auspices of the Institute. As he had said before reading his inaugural address, he was glad to see present so many of the fair votaries of science, and he would address them in all seriousness in the words of one of the greatest thinkers as well as soldiers and statesmen that the world had ever seen: one, too, who was not liable to be swayed in matters of thought by the charms of female society. Napoleon Buonaparte had said, "Almost everything in the future man depends on his mother." If, then, study is requisite for the men who are to rule the world, is it not also requisite for those who are to form the men?—whose blessed duty it is to instil those early habits of industry and lessons of virtue on which the future destiny of life depends. It is thus that women will best discharge

* Capt. Villemseus, H.I.M.S. "Dorade."

the holy mission of their sex, and regain in their homes that paradise which a woman once lost.

This ended the formal portion of the proceedings. The company proceeded to promenade the Museum, and to examine objects of interest. A most attractive subject was the interior of the Maori house, which was lighted up for the first time; and Mr. Fox's sketches taken during his recent tour in Palestine, Egypt, Greece, and Italy; while microscopes and geological specimens engaged the attention of those of a more scientific disposition.

SECOND MEETING, 11*th August*, 1868.

The Hon. W. B. D. Mantell, F.G.S., in the chair.

Dr. James Hector, F.R.S., delivered a lecture on "The Geology of New Zealand." *(Vide post.)*

THIRD MEETING, 18*th August*, 1868.

His Excellency the Governor in the chair.

Among the audience, which numbered nearly three hundred, were his Lordship the Bishop of Lichfield, the Bishop of Wellington, and many members of both Houses of Parliament.

His Excellency introduced the lecturer, Mr. J. E. FitzGerald, with a few appropriate remarks. The subject chosen was "The Nature of Art." *(Vide post.)*

At the close of the lecture his Lordship the Bishop of Lichfield gave a short address.

FOURTH MEETING, 1*st September*, 1868.

His Excellency the Governor in the chair.

His Excellency stated that the business for the evening was the second of a series of lectures on "The Geology of New Zealand," by Dr. Hector. It had however been suggested that, as the evening would be broken by other special business, it would be advisable to postpone that lecture till a future occasion, and in place of it he would request Dr. Hector to give them an account of the recent tidal phenomena, which had excited so much interest in all parts of the Australian Colonies.

Dr. Hector then stated that he had received some interesting details from other localities, since his communication to the Philosophical Society, which would help to throw some light on the subject; and such a remarkable occurrence should be discussed, and the fullest particulars recorded whilst they were still fresh in the memory. (See *Proceedings* of Wellington Philosophical Society, and *Transactions.*)

In reply to Mr. Travers, asking for some particulars of the great tidal wave at Japan in 1854, Dr. Hector gave an account of that terrible catastrophe.

The Hon. W. B. D. Mantell, F.G.S., read some quaint extracts from "Holinshed's Chronicles," Vol. II., published in 1577, describing earthquakes that had occurred in England between the years 1077 and 1575; and stated that we were too much given to look upon the colony as peculiarly an earthquake country, but by dipping into such records as the above, we find frequent reference to the occurrence of earthquakes and sea waves like those just discussed as having taken place even in England. He concluded by pointing out that, notwithstanding the advance of science in the colony, he believed we were not in a position to hand down to posterity any clearer or more exact account of such phenomena than Holinshed had recorded, and urged that steps should be taken, by the use of proper instruments, to supply this want.

His Excellency the Governor then presented to Sir George Grey the following valedictory address from the Governors of the Institute, remarking that it was to Sir George Grey that the colony is indebted for the foundation of nearly all its scientific institutions.

"Wellington, New Zealand, 1st September, 1868.

"Sir George Grey, K.C.B.,

"Sir,—We, the Governors of the New Zealand Institute, which was founded last year, under your auspices, for the promotion of Science, Literature, and Art in this country, and which has been established on a statutable basis for carrying out the objects in view on the formation of the New Zealand Society, originated and founded by yourself in 1851, avail ourselves with much satisfaction of the opportunity afforded by your presence here this evening, on the eve of your departure for England, of acknowledging the obligations which the people of the colony owe to you for the cordial interest you have ever taken in the promotion of Science and Art in New Zealand. We desire especially to recognize the influence which you have exercised in this respect, not only in your capacity as a Governor of the colony, but also from the high position which you have earned amongst the learned societies of Europe by your practical advancement of knowledge. For, amidst the cares incident to your high political position, you have not only found leisure to aid in the formation of Scientific Institutions, but have given the practical example of your own labours, more especially in those directions which have a special bearing on our knowledge of the history and progress of the human race. On behalf of New Zealand we, as representatives of its Scientific Institutions, beg especially to thank you for the great work which you have achieved in collecting and preserving the early traditions and poetry of its aboriginal inhabitants, thereby securing the permanence of valuable records for the future study of Ethnologists. In bidding you a hearty farewell, it is our earnest hope and prayer that all honour, health, and happiness may attend you."

Sir George Grey replied, and stated that he was not aware until just before the meeting that such an address would be presented to him. He felt very grateful for the honour His Excellency and the Governors of the Society had done him, and hoped that though about to leave New Zealand he might still have it in his power to be of some assistance in advancing scientific pursuits in the colony. He then spoke at some length as to the interesting field open in this colony for contributing to science important observations bearing on the study of the human race. Sir George Grey gave some interesting examples of the curious results likely to ensue from a comparison of the traditions and history of the Maori race with that of the early inhabitants of Britain, and concluded by expressing his earnest thanks for the address, and the great interest he would always feel in all matters affecting the colony.

After a few observations from the Bishop of Wellington as to Sir George Grey's academic career, and his acquaintance with the hard work by which he had attained his present high political and scientific position, the meeting adjourned.

Fifth Meeting, 19*th September*, 1868.

His Excellency the Governor in the chair.

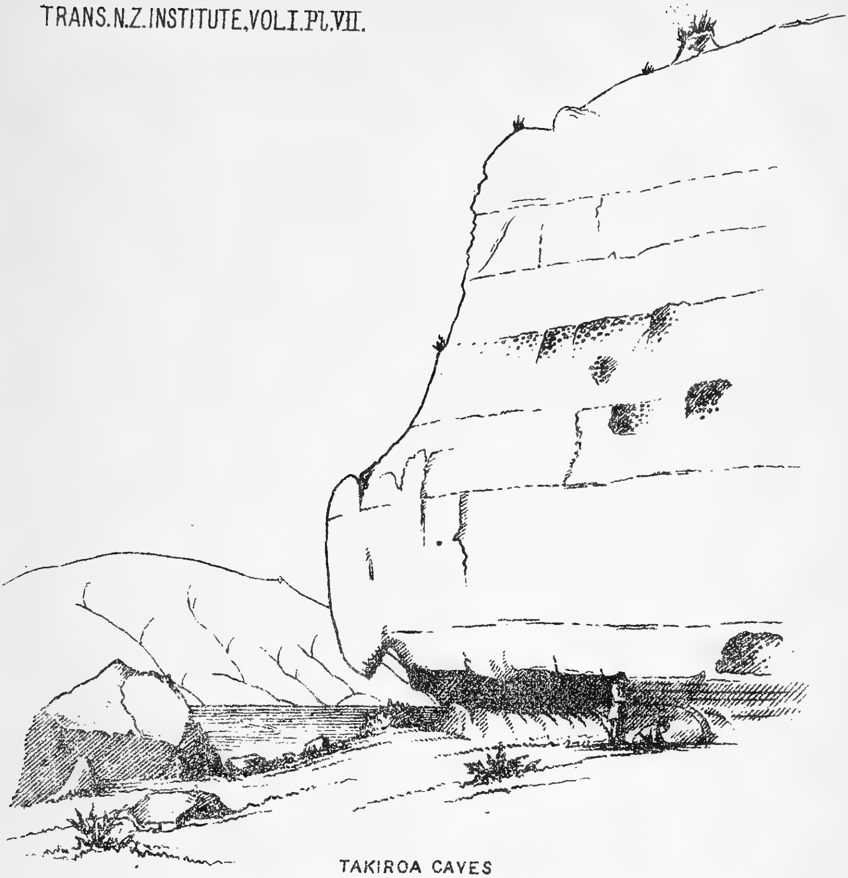
Address by the Hon. W. B. D. Mantell, on the Moa.

(Abstract.)

After a few appropriate remarks from His Excellency, the lecturer commenced by saying that the subject was of too extensive a character to be dealt with fully in one lecture, as it involved the consideration of difficult questions in comparative anatomy, geology, and archæology, and in the traditional history of the Maoris. After instancing examples to show that New Zealand was not peculiar in the circumstance that huge birds without the power of flight were the highest form of life previous to the arrival of man in the islands, he proceeded to describe the different circumstances under which the remains of the Moa are found, assigning the highest antiquity to those that are found under the stalagmite in certain limestone caves similar to the bone caves in which traces of the early animals which inhabited Great Britain are preserved to us. He drew attention to the fact that in the British caves, among the great variety of animals represented, there is always evidence that they were dragged into these caves by beasts of prey; but New Zealand caves have failed to show any such cause for the presence of Moa bones in them, or that any animal existed beyond larger forms of those now inhabiting the islands. These cave Moa bones, and probably those found in certain alluvial deposits, he considered to belong to a period before the arrival of the aborigines. He then described the several circumstances under which the remains of the Moa are found associated with works of man in such a manner as to leave no doubt that they co-existed with the earliest aborigines, and were largely used as food, along with seals and a variety of other animals. From the examination of the *umus*, or Maori ovens, there was evidence that cannibalism prevailed at the time the Moas were used for food, but only in the North Island. Certain works of art associated with bones in these early deposits appeared to indicate a period when many of the implements in common use among the Maoris, and supposed to have been brought with them from Hawaiki, were unknown to these early aborigines. The highly prized *pounamu*, or greenstone, appears also to have been discovered in New Zealand at a later date. The most ancient of these ovens which he had examined were scooped out in the surface of marine deposits, generally blue clays or sands, such as those deposited in estuaries or tidal lagoons, and were never covered by other than fresh water or blown sand deposits.

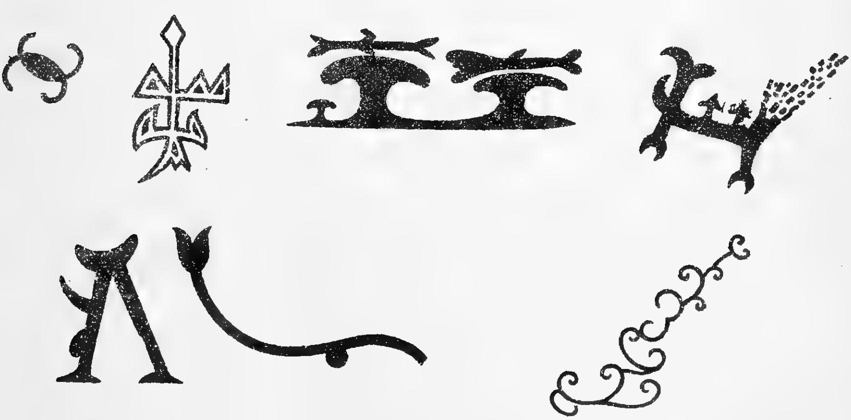
Those at Waingongoro, in the North Island, and at Awamoa, in Otago, were the oldest he had seen, and contained fragments of stone used as cutting implements, of kinds which showed that even at that early period the natives had extensively explored the interior of these islands. In Otago, especially, it is probable that the interior was their usual dwelling place, and that they only paid occasional and periodical visits to the sea coast. He referred to certain rude figures which he discovered drawn on the walls of a cave in the Waitaki Valley (*see illustrations*)—among which was rudely depicted the likeness of a Moa by some early aboriginal artist—and proceeded to describe the causes which led to the extermination of those birds. The lecturer said that this must have taken place within a very short period after the appearance of man, adducing the very slight and obscure allusions in the most ancient Maori traditions to their existence as proof of this.

After alluding to the probable habits and mode of life of the Moa, and to the present representatives of the class of birds to which they belong, Mr. Mantell concluded by saying that in his lecture he confined himself to the subject of the Moa, the native word including these birds as a whole, leaving the different species of *Dinornis*, *Palapteryx*, and other genera which have been made, to those who believe that they have the necessary data. For his part he did not believe that, with the exception of the very fresh skeleton



TAKIROA CAVES

Looking N. to Punaamokatore, across the river.



Ngatimamoa paintings. Takiroa caves.

found in Otago, and now in the York Museum, of which the integuments and feathers are partly preserved, there was yet a single skeleton restored in such a manner as would be at all suited to the wants of the bird if it were alive. He therefore strongly urged the careful collection of specimens, and that those persons who discovered bones, if they did not consider themselves well acquainted with the subject, should leave them untouched until they could be exhumed by properly qualified collectors.

Dr. Hector, in proposing a vote of thanks to the lecturer, remarked that it was highly important to have obtained the expression of his opinions respecting the association of the Moa with the aborigines of this colony, as Mr. Mantell had arrived in this country well qualified for the task by previous training, and had enjoyed favourable opportunities as the first explorer of a large extent of the colony where these birds formerly abounded. The collections in the museums in Europe and America show how well he availed himself of those opportunities. He (Dr. Hector) understood Mr. Mantell to incline to the opinion that the Moa owed its destruction to a race of aborigines different in their habits and savage attainments from the Maoris of the present day, though perhaps having the same origin; but while agreeing in this, he stated that he did not attach much importance to the alleged absence of greenstone, and other implements of an advanced stage, from the early Maori ovens; and explained how the use of chert flakes would naturally suggest itself, as they would be abundantly formed when chert stones were heated and quenched with water in the process of cooking according to the Maori fashion. It would seem as if, when one of these flakes had a convenient shape, such as a knife, cleaver, or spear-head, it was trimmed and sharpened in the same manner as a gun flint, rather than cast away when the edge became defective, and that a race advanced far beyond such rude works of art might yet find it convenient under certain circumstances to employ them. Dr. Hector alluded to the profusion of Moa eggshells in the ovens of the interior, which showed that the eggs must have been prized as food, and that their consumption must have soon led to the extinction of the birds.

Mr. Travers remarked, with regard to the origin of the aborigines by whom the Moas were exterminated, that he considered them to be a distinct race, now represented by the Morioris of the Chatham Islands. He impressed on the attention of the meeting the important field which New Zealand offered for ethnological research, and related as a circumstance requiring explanation, that in a circular pit in the Waikato, a number of human skeletons were found in an erect position, arranged round the side, each with a block of wood on its head, and hoped that some one would investigate the matter.

Sixth Meeting, *29th September*, 1868.

His Excellency the Governor in the chair.

Lecture by W. T. L. Travers, F.L.S., on "The Botany of New Zealand." (*Vide post.*)

Seventh Meeting, *20th October*, 1868.

His Excellency the Governor in the chair.

Lecture by Felix Wakefield, on "The Progress of Geographical Discovery." (*Vide post.*)

INAUGURAL ADDRESS

OF

HIS EXCELLENCY SIR GEORGE F. BOWEN, G.C.M.G.,

TO THE NEW ZEALAND INSTITUTE, AS ITS FIRST PRESIDENT. 4TH AUGUST, 1868.

GENTLEMEN,—

Seventeen years—a period of great changes and of rapid progress in this country—have elapsed since my able and accomplished predecessor Sir George Grey, in 1851, opened, as its first President, the New Zealand Society. That Society may be regarded as the precursor of the New Zealand Institute, which has now been founded and endowed by the wisdom and liberality of the Colonial Legislature. The Board of Governors, over whom I have the honour, by virtue of my office, to preside, having conveyed to me a wish that I should deliver the Inaugural Address at the first public meeting of this Institute, I felt much satisfaction in complying with their request. In a colony possessing all the powers and privileges of parliamentary government, the representative of the Sovereign shares in that "dignified neutrality" which belongs to the Crown itself. I assure you that it will always be one of my highest pleasures, as well as one of my most important duties, to meet, as on the present occasion, members of all religious communions, of all social classes, and of all political parties, on the common ground of education, science, and literature.

I will begin by briefly explaining the character and objects of the Association which we now inaugurate. Those objects are concisely stated in the preamble of the Act of the Session of 1867, (31 Victoriæ, No. 36), which recites that "it is expedient to make provision for carrying out the geological survey of the colony, and to establish and incorporate a public institution in the City of Wellington, to be called 'The New Zealand Institute,' which Institute shall comprise a public museum and laboratory, and a public library;" and that "it is also expedient, by means of lectures, classes, and otherwise, to promote the general study and cultivation of the various branches and departments of art, science, literature, and philosophy."

Moreover, provision has been made by law for the appointment of a director to superintend and carry out the general purposes of this Institute and of the affiliated Societies, the establishment of which it will encourage in all our chief centres of population. And here I must observe that the Government has been very fortunate in securing for this important office the proved ability and judgment, the wide experience, and the untiring energy of Dr. Hector, F.R.S. It is to him that we are mainly indebted for the valuable collections of art and science already accumulated in these halls; and he will always be ready to give his advice and assistance in the formation of Museums in our principal towns. Co-operation is the secret of success in all scientific pursuits; and the New Zealand Institute, while leaving its affiliated Societies unfettered in the performance of their separate functions, will publish their chief transactions on a uniform plan, thereby concentrating the information collected by local observers throughout the country, and providing for the preservation, in a permanent and accessible form, of the result of their labours. It should not be forgotten that the New Zealand Exhibition of 1865, held at Dunedin, was an effort in the same direction; and that, if we may judge from the reports, it appears to have been very successful in procuring much novel and accurate information respecting the natural resources of this colony.

And now, gentlemen, I congratulate you on already possessing, in this Public Museum and Library, facilities for that moral and intellectual culture without which no advantages of genius or of wealth can confer personal happiness, and no political privileges can secure immunity from national decay. Lord Bacon, the prince of philosophers, "*il gran Maestro di color che sanno*" in the modern, as Dante said of Aristotle in the ancient world, has pronounced that "Knowledge is power," and also that "Knowledge is pleasure." So too, Milton, the prince of modern poets, has sung,—

> How charming is Divine Philosophy!
> Not harsh and crabbed as dull fools suppose,
> But musical as is Apollo's lute:
> And a perpetual feast of nectared sweets,
> Where no crude surfeit reigns.*

Still, let me remind you that the main object of the Legislature in founding this Institute was not merely to make provision for healthy intellectual recreation, but rather to provide guidance and aid for the people of New Zealand in subduing and replenishing the earth,—in the "heroic work" of colonization.

The field of science may be compared to a clearing in one of our primeval forests, where the more trees a settler fells, the greater appears the expanse of wood around him; and it might almost be said that every colonist in a new and unexplored country is, unconsciously, more or less of a scientific

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* Milton's "Comus."

observer. For example,—the first discovery of the mineral treasures which are now fast yielding up their riches to us,—of our coal, our gold, our copper, and our iron,—is due, not so much to scientific research, as to chance, if that term can be properly applied to any of the great dispensations of Providence. When such a variety of valuable minerals has been presented to our view, almost without design or exertion on the part of the earliest discoverers, what rich harvests of knowledge, what vast practical aid to the industrial arts, may be expected from the systematic exploration of the geology and mineralogy of this country! Our extensive coal fields are storehouses of wealth, which even now contribute in no slight degree towards our material welfare and our expanding commerce. What the future may bring forth it is not for man to foretell with confidence; but certainly coal has been the instrument by which the steam engine and others of the most wonderful inventions of modern times have been enabled to triumph over time and space. Again, I trust that industry, guided by science, will develop still further our gold fields. It should never be forgotten that, while the gold discoveries have accelerated by at least a hundred years what without them would have been the comparatively gradual progress of the Australasian group of colonies, they have also powerfully facilitated the removal of commercial restrictions and the advancement of social improvement in the parent State, adding immensely at the same time to the general trade and wealth of the British Empire and of the entire civilized world.

The geological survey of New Zealand, in addition to the practical advantages thereby secured to the existing settlers and their successors, will assist materially in solving many important and interesting problems in general science. To quote from the authoritative work of Dr. Hochstetter: "Not inhabited, probably, till within late centuries of the history of man, and then but thinly populated, and only along the coasts and along the banks of navigable rivers, New Zealand has fully preserved within its interior the originality and peculiarity of its remarkable animal and vegetable kingdoms up to our present time. No monuments of any kind, no tombs of kings, no ruins of cities, no time-honoured fragments of shattered palace domes and temples, are there to tell of the deeds of ages or nations past and gone. But Nature, through her mightiest agencies—through fire and water—has stamped her history in indelible characters on the virgin soil of the islands. The wild Alpine heights of the South, towering in silent grandeur to the sky, their lofty summits crested with fields of ice and decked with glacier robes; the volcanoes of the North, looming up into the regions of perpetual snow, glisten from afar, dazzling the wondering eyes of the mariner as he approaches the coast. Fertile and well watered alluvial plains are there awaiting the enterprising settler; a virgin soil, on which he founds a new home; a land blessed with the most genial climate, where he has but to battle with and subdue the wilderness to reap the never-failing fruits of his labours.*

Next to Geology, botanical research will command the attention of the Institute. Here we have an admirable model for our guidance in Dr. Hooker's "Handbook of the New Zealand Flora," a work which proves how much cordial co-operation furthers the advancement of science. The author was enabled, through his genial spirit and personal influence, to secure the zealous assistance of numerous independent observers labouring in harmony with his own efforts, and thus to produce a book which, if we look to the sparse population and the inaccessible nature of a large portion of these islands, is regarded by all competent judges to be almost marvellously complete. Still, much remains to be done by the help of botanical research, especially in comparing the various kinds of timber supplied by our forests, and in ascertaining the qualities of the fibre-bearing plants of our valleys, for which there is a large and growing demand on the part of British manufacture. Again, our attention may be profitably directed to facilitating the introduction and cultivation of the valuable and ornamental fruit trees, plants, grasses, and flowers of other countries. The indigenous vegetation is fast disappearing before the progress of settlement, and it is alike the interest and the duty to their successors of the present generation to replace it by a new and remunerative growth. And here it is to be observed that the establishment of a botanical garden in connection with the Institute would much facilitate its operations.

In respect to Zoology, though New Zealand is generally deficient in animal life, there are many interesting fields open to the observer, especially with regard to the marine fauna of our coasts. Several of our shells and fishes present singular anomalies, and represent forms of life found in other parts of the world only in a fossil state. The progress of acclimatization, already so successful, will gradually replenish this portion of the earth with every domestic animal and bird profitable and useful to man. It will stock our woods with game and our rivers with fish; while it will bring the feathered songsters of our mother country to delight the ears of our children with their sprightly melody.

Let us consider, moreover, the interest which was excited throughout the civilized world by the discovery in New Zealand of the remains of a gigantic race of wingless birds, which appear to have become extinct only in modern times. It is the opinion of the highest authorities on this subject that at no distant period it will be impossible to procure a collection of many species

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"New Zealand," by Dr. F. von Hochstetter, Chap. II.

even of the common birds now found in this country. Before long, these too will have disappeared with the Moa. But local observers and collectors still have it in their power to place on record accurate information respecting their numbers, habits, and distribution.

With regard to the Physical Sciences, the study of Meteorology will prove of much practical benefit in these tempestuous latitudes; for the discoveries of Sir W. Reid and his followers have enabled science to encircle with definite laws the apparently capricious phenomena of the atmosphere, and to set at defiance the terrors of the storm. Already, weather indications are obtained throughout this colony, and are published for general use on a uniform system. Moreover, the importance of New Zealand as a station for magnetical observations is everywhere recognized. It will be our duty, as members of the Institute, to contribute to the general stock of knowledge, not only of terrestrial magnetism, but also of geodesy, or the exact measurement of the form of these islands, upon which many problems of high interest depend.

The irregularities of the seasons, the oscillations of the level of the coast line, the connection between the variations of magnetic currents and volcanic force, as manifested by earthquakes, all these and many other kindred subjects are of great scientific and practical interest at the present day, while our transactions respecting them will afford valuable materials for future philosophers and historians.

I have now glanced, in these imperfect remarks, at the practical advantages of the study of Geology, Botany, Zoology, and of the Physical Sciences. I firmly believe that the New Zealand Institute contains within itself a sure principle of vitality, because it contains a sure principle of usefulness.

And now, gentlemen, we must not forget that the halls in which we are assembled contain numerous and valuable illustrations, not only of the natural history and geology of this country, but also of the manners and customs of its aboriginal inhabitants. It will be one of the main objects of this Institute to collect all records that can help to throw light on that very complicated and difficult but highly interesting subject, the past and present condition and future prospects of the Maori race. My predecessor, Sir George Grey, has done much for the preservation of the poetry and traditions of the Maoris, and I know that I shall gratify you by quoting the eloquent words with which, in his inaugural address, he called the attention of the New Zealand Society to this part of its duties. He said,—

"We who stand in this country occupy an historical position of extraordinary interest. Before us lies a future already brilliant with the light of a glorious morn, which we are to usher in to gladden unborn generations.

Behind us lies a night of fearful gloom, unillumined by the light of written records, of picture memorials, of aught which can give a certain idea of the past. A few stray streaks of light, in the form of tradition, of oral poetry, of carved records, are the only guides we have. And, in the gloom of that night, are fast fading out of view, although dim outlines of them are still visible, some of the most fearful spectres which have ever stalked amongst mankind in the hideous shapes of idolatry, human sacrifice, and cannibalism, mixed up with which, in uncouth unison, is much of real poetry and of actual grace of fancy. Future generations will almost doubt that such gloomy forms of thought have haunted their highly cultivated and civilized homes, or that a people debased by such barbarities could yet have felt and cherished so much of the poetic and good; and if they could then question us who have seen these now fading superstitions ere they wholly vanished, what eager questions they would propose to us regarding their monstrous shapes, their horrid aspect, the rude and inharmonious voices with which, with horrid shouts and yells, their orgies were fulfilled! How eagerly the poet, the painter, the sculptor, would seek to recover some traits of their terrible lineaments, or of their softer outlines when they related to scenes of the gentler passions or of domestic life!—that either a stern grandeur or the romantic glow of a primitive state of existence might be imparted to some work of art."

To these graphic and striking words I will only add that no problem of ethnology, no question of political economy (in its best and most practical sense), can be regarded as alien to us Britons, who, throughout our vast Empire, are brought into contact with so many and such diverse nations. The noble exhortation addressed to the Romans of old by their greatest poet is, in its spirit, equally applicable to our own Imperial race, which now rules those Indian realms that baffled the arms of Alexander, and is fast peopling and replenishing that Australasia, or "Great Southern Land," which lay beyond the charts of Nearchus and Strabo, of Marco Polo and Columbus:—

> Excudent alii spirantia mollius æra,
> Credo equidem, vivos ducent de marmore vultus;
> Orabunt causas melius, cœlique meatus
> Describent radio, et surgentia sidera dicent;
> Tu regere imperio populos, Romane, memento;
> Hæ tibi erunt artes.*

If I did not feel that I had already trespassed too long on your attention, I would, in conclusion, urge the expediency of the encouragement, in some departments of the colleges and schools in this new land, of that technical and scientific education which is now year by year asserting a higher place

* Virgil, Æn. VI., 848–853.

among the studies of our fellow-countrymen in the old world. It would, indeed, ill become me, as a grateful son of the University of Oxford, to utter a single word in disparagement of the study of ethics, mathematics, history, and classical literature; or of the intellectual vigour and grace derived from the contemplation of the pure models of antiquity. Still, in common with the foremost philosophers, scholars, and statesmen of the present day, I am convinced that it is no longer wise, or even politically and socially safe, to cultivate exclusively those branches of learning. The intellect of the existing generation appears to be most progressive in the physical and natural sciences; and the treasures won from them seem the richest heirlooms which we can bequeath to our posterity. It has been powerfully argued, moreover, that if we look to what should be the grand object of all study, the formation, namely, of the mind and the character, it will be found that there is scarcely any mental or moral faculty which science cannot develop and discipline. It was said of old that "there is no royal road to knowledge;" and it has been said of late, with equal truth, that "there are no false keys to the book of Nature." The successful student of that book must possess an almost ignominious love of minute details, as well as that sound and practical judgment which can arrange and classify the mass of facts and observations which he has stored up with patient and conscientious toil. But the reward is great; above all, for those who "look through Nature up to Nature's God." An able writer has remarked that "at the close of all labour a man must ask to what good end he has given himself. There are few who will find the answer so easy as those who have contributed even the smallest help in widening our knowledge of the order of Nature, and in revealing for our adoration the Divine ideas which are at the basis of all things. In the generous efforts they are called to make, they have a hope, better founded than most human expectations, that they will find that education of their faculties for the future, which we may reasonably suppose to be the most important object of our present existence." In a like spirit, knowledge has been compared to that mystic ladder in the Patriarch's dream, the base of which rested on the primeval earth, while its crest was lost in the glory of Heaven.*

* Genesis xxviii. 12.

TRANSACTIONS.

TRANSACTIONS

OF

THE NEW ZEALAND INSTITUTE,

1868.

Art. I.—*On Boulders and Travelled Blocks in the Wellington Province.* By J. C. Crawford, F.G.S.

[*Read before the Wellington Philosophical Society, 7th April,* 1868.]

It is proposed to confine the remarks in this paper, firstly, to those boulders which are of considerable size; or secondly, those which appear to belong to rocks not found *in situ* in this part of the country.

Under the former head we find in numerous localities—as, for instance, on Belmont Hill, on the Porirua Road between the Tutaemanu Peninsula and Duck Creek, at Makara, &c.—large blocks of dioritic sandstone apparently deposited in lines, and generally resting upon decomposing sandstones.

Several theories may be propounded as to the mode of deposition of the blocks.

Firstly, they may be the hard nuclei of strata the softer parts of which have decomposed.

Secondly, they may show the lines of old watercourses before denudation had worn down the valleys to their present depth.

Thirdly, they may be ice-carried. Although the dioritic blocks are of the nature and character of rocks *in situ* in the neighbourhood, yet rocks of the same character abound on the opposite side of the Strait, as also generally throughout the Tararua range; so that there is no *primâ facie* reason why these boulders may not have travelled from a distance, as well as those of the second class, which we propose afterwards to consider.

The second class of boulders consists of rocks not found in this vicinity and which must have been brought from a distance. Of these not many have yet been discovered. I have myself found the following:—

1. A block of granite about a foot long, found between Evans and Lyall Bays, several hundred feet from and about twelve feet above high

watermark. This block bears the character of a rock from the Nelson Province, and has no marks of human workmanship upon it.

2. A boulder of garnet-schist from the same locality, five or six inches long, and partially rounded or water-worn. The original locality of this boulder would also appear to be the Nelson Province.

A piece of decomposed micaceous granite was brought to me from the Hutt some years ago, exact locality where found not known; and in the Museum there is a fragment of a piece of granite which was found near the Tinakori Road, but of which, it having been broken up, I have not been able to obtain sufficiently reliable intelligence to put in evidence. It appears, however, that it is a New Zealand specimen, apparently from the west coast of the South Island.

There are at least three ways by which these foreign specimens may have been carried.

1. By canoe or ship.
2. By seaweed.
3. By floating ice.

The dioritic blocks may have been carried by a fourth moving power, viz., by glacier; but that power could hardly apply to the granite or schists, as the distance whence they must have come is so great.

To suppose the existence of a climate in these latitudes sufficiently cold to infer the presence of glaciers and of floating ice, it is not necessary to bring in the idea of a secular cooling of the globe, nor even of a greatly increased mass and height of mountains. A prolongation of the New Zealand plateau as dry land in the direction of Mounts Erebus and Terror or other parts of the Antarctic continent, would, by blocking and deflecting the polar current, probably cause the refrigeration necessary to produce the effect.

I shall not at present venture to decide upon the cause which has placed either description of boulders in their present position. There is an absence of marks of ice action on the rocks of our mountains, but the rocks are in general too soft for us to expect in them the retention of striated marks; I am therefore not prepared to decide upon the effect of the action of ice. The boulders from Lyall Bay were found some twelve or fourteen feet above high watermark, and had they been deposited by seaweed, it must have been when the land was at a lower level. They were also too far from the water's edge to render it probable that they were brought as ballast, either by canoe or by ship.

I shall content myself by thus calling attention to the subject, in the hope that, before long, fresh evidence may be procured. More boulders may be found, and their nature and position carefully noted; and probably *striæ* may yet be discovered.

ART. II.—*On the Measurements of* Dinornis *Bones, obtained from Excavations in a Swamp situated at Glenmark, on the Property of Messrs. Kermode and Co., up to* 15*th February*, 1868. By JULIUS HAAST, Ph.D., F.R.S., Government Geologist, Canterbury, N.Z.

[*Read before the Wellington Philosophical Society*, 28*th July*, 1868.]

THE locality in question, situate on the property of Messrs. Kermode and Co., north of the river Waipara, has long been celebrated for the great number of Moa bones found there, and which have been dug out of drainage channels cut in various directions through the swamp. The New Zealand partner, G. H. Moore, Esq., at my request, not only handed over all the bones in his possession to the Canterbury Museum, but allowed me, moreover, to make extensive excavations, the results of which exceeded my most sanguine expectations. Last October, when sending a collection of Moa bones to W. H. Flower, Esq., F.R.S., the Conservator of the Hunterian Museum, for exchange with the British Museum, I gave a list of the measurements of the different species of *Dinornis* and *Palapteryx* for publication in England. Since then some more excavations have been undertaken for the Provincial Government of Canterbury; and as I consider that the exact measurements of the bones found will not be without interest to scientific societies in New Zealand, I have the honour to forward a copy of the list sent previously to England, after adding to it the results of the latest excavations made since that time. Next winter I hope to embody the results of my observations on *Dinornis* in a more extended paper, with a full description of the ground in which the bones were embedded, the probable causes through which the numerous specimens were destroyed, and to which they owe the preservation of their osseous remains.

Before proceeding to the main subject of these notes, namely, to give the measurements of the different species and their varieties, I wish to state that it was on very few occasions only that I was able to obtain all the bones of a specimen lying together *in situ*, as in general a great quantity of the remains of different species were mixed together. In fact, as I shall show in some future notes, there were often twenty-five to thirty specimens so closely embedded and packed together that the whole formed one mass, rendering it impossible to separate the bones of each bird from the rest. Consequently I was compelled, with the active co-operation of my assistant, Mr. F. Fuller, to select, first, all the bones belonging to the same species, and afterwards to articulate each specimen from the whole material, a work which required much time, as the quantity of excavated bones was so great.

Dinornis casuarinus, Owen.

When classifying the large material at my command, I found that the leg bones belonging to this species were of three distinct sizes, and that a transition never occurred between them.

Although the bones of each subdivision showed small and unimportant differences when compared one with the other, they have, nevertheless, a very close resemblance in every other respect.

After having placed together all the bones bearing the same general character, I found that we possessed portions of at least forty-five specimens, arranged in the three subdivisions following, namely :—

No. 1, largest size, 15 specimens.
No. 2, middle size, 16 specimens.
No. 3, smallest size, 14 specimens.

It may be here observed that this number represents only a portion of the specimens buried in the swamp, as many of the bones were either lost, broken into fragments, or they were altogether inaccessible, so that without doubt many odd leg bones were matched together, being exactly of the same size and character, although they belonged originally to different individuals.

No. 1. *Din. casuarinus.*—Largest size.

On examining the tarsus-metatarsus of this subdivision, I found that it corresponded best with one figured by Professor Owen as *crassus*, (Plate 48, p. 324, Vol. III., "Trans. Zool. Society,") although the measurements of *crassus* given by Professor Owen further on in his excellent memoirs, differ slightly from the specimen in question, and, as it appears to me, from his own figured metatarsus.

	Length of bone.	Girth of proximal end.	Girth of shaft, thinnest part.	Girth of distal end.
Tarsus metatarsus	8·8 in.	9·2 in.	5·1 in.	10·8 in.
Tibia	18·7 „	14·9 „	4·8 „	10·5 „
Femur	11·0 „	12·4 „	5·6 „	13·0 „

It will be seen that, when compared with Professor Owen's monographs, the metatarsus of this subdivision or variety is a little larger, the tibia exactly of the same size, and the femur a little larger than his *casuarinus.*

No. 2. *Din. casuarinus*, Owen.—Middle size.

	Length of bone.	Girth of proximal end.	Girth of shaft, thinnest part.	Girth of distal end.
Tarsus metatarsus	8·4 in.	8·8 in.	4·5 in.	10·3 in.
Tibia	18·5 „	12·7 „	4·4 „	10·1 „
Femur	10·8 „	11·4 „	5·5 „	12·6 „

Thus the metatarsus is a few lines longer; the tibia resembles the former closely, except that it is slightly thinner and one-tenth of an inch shorter; the femur is exactly like Professor Owen's *casuarinus*, so that it may be said that this size fully agrees with the specific character of his species.

The articulated skeleton in the Canterbury Museum is taken from this subdivision.

No. 3. *Din. casuarinus*, Owen.—Smallest size.

The bones of this variety agree in every respect with those of the foregoing subdivisions, except that they are somewhat smaller.

Compared with Professor Owen's drawings, the metatarsus is more slender, as is also the case with the tibia, which is three-tenths of an inch shorter, and the same may be said of the femur. Moreover, the bones are altogether smoother, and the line of coalescence of the proximal epiphysis is still sometimes faintly indicated: they belong, therefore, without doubt, to specimens which were not yet full grown. May I therefore suggest that Nos. 1 and 2 represent, perhaps, male and female, while No. 3 consists of specimens of either sex which have not yet attained their full development.

Dinornis didiformis, Owen.

According to my measurements, the same difference of size is also strikingly shown by the specimens of this species, of which a great quantity of bones was excavated under my direction.

When put together, these formed also three distinct sizes, like the preceding species, with no gradations between them.

We obtained from our excavations portions or complete leg bones of

No. 4, largest size, 17 specimens.
No. 5, middle size, 12 specimens.
No. 6, smallest size, 8 specimens.

No. 4. *Din. didiformis.*—Largest size.

The femur of this subdivision resembles very much that of *dromioides*, Owen, both in shape and size. It is somewhat larger than Professor Owen's figured specimen of *didiformis* ("Trans. Zool. Society," Vol. III., plate 24, p. 249). The tibia is identical with Professor Owen's figured tibia, while the metatarsus is two-tenths of an inch shorter than his, although identical in all other characteristics:

	Length of bone.	Girth of proximal end.	Girth of shaft, thinnest part.	Girth of distal end.
Tarsus metatarsus	7·5 in.	7·3 in.	4·4 in.	9·2 in.
Tibia	15·6 ,,	11·1 ,,	3·9 ,,	8·9 ,,
Femur	9·6 ,,	10·0 ,,	5·0 ,,	10·8 ,,

The skeleton articulated for the Canterbury Museum, has been selected from this subdivision.

No. 5. *Din. didiformis.*—Middle size.

The femur is larger than Professor Owen's *didiformis,* but smaller than his *dromioides.*

The tibia is about three-tenths of an inch shorter than Professor Owen's, and comparatively more slender.

The metatarsus exhibits the same characters as the figured one, but is shorter by nearly an inch:

	Length of bone.	Girth of proximal end.	Girth of shaft, thinnest part.	Girth of distal end.
Tarsus metatarsus	7·0 in.	7·2 in.	4·0 in.	8·6 in.
Tibia	15·3 „	10·1 „	3·7 „	8·6 „
Femur	9·0 „	9·5 „	4·3 „	9·8 „

No. 6. *Din. didiformis.*—Smallest size.

Femur still a little larger generally, tibia and metatarsus smaller than Professor Owen's figured bones; but I may observe that I articulated this subdivision only after great hesitation, and that I do not feel at all satisfied about its correctness. However, several of the bones were found lying close together, and may therefore have really belonged to one bird; and the general character of the bones may lead us again to the conclusion that they were young specimens of the two former:

	Length of bone.	Girth of proximal end.	Girth of shaft, thinnest part.	Girth of distal end.
Tarsus metatarsus	6·9 in.	7·3 in.	4·0 in.	8·8 in.
Tibia	14·6 „	11·1 „	3·8 „	9·0 „
Femur	9·0 „	9·1 „	4·7 „	10·9 „

No. 7. *Dinornis,* sp.

We possess only the three principal bones of one leg and odd bones of two other specimens; they are larger and slightly thicker than those of *Dinornis struthioides.* On the other hand they are much smaller than those of *Palapteryx ingens.* There is no dent or depression on the back of the metatarsus, for the attachment of the back metatarsal trachlea. This bird was bow-legged, and resembled most *Dinornis struthioides* in its principal characteristics, although of larger dimensions:

	Length of bone.	Girth of proximal end.	Girth of shaft, thinnest part.	Girth of distal end.
Tarsus metatarsus	12·9 in.	10·8 in.	4·7 in.	13·2 in.
Tibia	24·8 „	14·8 „	5·2 „	12·7 „
Femur	12·3 „	14·3 „	6·4 „	14·8 „

The bones belong evidently to adult birds. Three specimens.

No. 8. *Palapteryx ingens*, Owen.

We obtained only portions of one single specimen from Glenmark, which agree closely with the figures and measurements given by Professor Owen. It is remarkable that there were no more, considering the large quantity of bones of other species dug out.

Well preserved parts of another species of the same were obtained at Heathcote, near the foot of Banks Peninsula, from a drain five or six feet deep, cut in sandy loam (silt). The bones are a little smaller than Professor Owen's figure, but still they are larger than those found in a cave in the Province of Nelson, and from which Dr. Jaeger, in Vienna, constructed his cast. For comparison I append the measurements of the Heathcote specimen:

	Length of bone.	Girth of proximal end.	Girth of shaft, thinnest part.	Girth of distal end.
Tarsus metatarsus	15·1 in.	11·5 in.	5·7 in.	13·6 in.
Tibia	29·5 „	17·6 „	6·0 „	15·0 „
Femur	14·2 „	15·2 „	7·6 „	17·0 „

The metatarsus has the hollow for the attachment of the back trachlea well marked, and the general character of the bones shows clearly that they belonged to a well-developed strong (male?) bird.

No. 10. *Dinornis gracilis*, Owen.

Of this elegant species, three more or less complete specimens were found amongst the excavated bones, which agree in every respect with Professor Owen's figures. For comparison I shall give the measurements of the best preserved specimen:

	Length of bone.	Girth of proximal end.	Girth of shaft, thinnest part.	Girth of distal end.
Tarsus metatarsus	12·6 in.	10·3 in.	4·6 in.	12·0 in.
Tibia	23·0 „	13·9 „	4·7 „	11·3 „
Femur	11·4 „	11·3 „	5·4 „	12·7 „

No. 11. *Dinornis struthioides*, Owen.

This species, of which I obtained portions of six specimens, agrees also perfectly with Professor Owen's drawings; only the tibia is generally a trifle longer. It is rather remarkable that *Pal. ingens* and *Din. struthioides* and *gracilis* are of such rare occurrence, when we consider what a great quantity of bones of the other species were found associated with them:

	Length of bone.	Girth of proximal end.	Girth of shaft, thinnest part.	Girth of distal end.
Tarsus metatarsus	11·9 in.	10·0 in.	4·6 in.	11·4 in.
Tibia	21·2 „	12·5 „	4·6 „	11·2 „
Femur	11·3 „	12·2 „	6·0 „	12·7 „

No. 12. *Dinornis elephantopus*, Owen.

Of this remarkable species, bones of at least nine, more or less complete, individuals were excavated, of which four were of the same size as those figured by Professor Owen, while the five others decrease gradually to the size of No. 13, without my being able to find any line of demarcation between them. Of one of these large specimens which were found together in their natural position, I give here the measurements: they represent, at the same time, the character of the three large specimens excavated.

Of the Glenmark bones, the metatarsus is generally larger than Professor Owen's, according to his measurements: the tibia, between the two measurements he gives; the femur is also slightly smaller than the one Professor Owen figures:

	Length of bone.	Girth of proximal end.	Girth of shaft, thinnest part.	Girth of distal end.
Tarsus-metatarsus	9·8 in.	12·3 in.	6·8 in.	15·2 in.
Tibia	22·8 „	18·7 „	6·3 „	14·5 „
Femur	12·8 „	15·5 „	7·7 „	17·4 „

When examining the back of the metatarsal bones of these and of the following Nos. 13, 14, 15, and 16, which form, probably, one distinct genus of the *Dinornithes*, I observed in most of them distinct and sometimes rough grooves, which appeared to have been caused by the attachment of the rudimental metatarsus of the back toe. At the same time, the numerous back metatarsal trachleas, back phalanges, and spurs of different sizes, suggested the probability that they belonged to those remarkable birds, which in every respect are quite distinct from the species of which I gave, before, the measurements, as well as from the larger forms of *Dinornis giganteus* and *robustus*, about which I shall speak in the sequel. As I have sent a complete set of these back metatarsal bones to Professor Owen for examination, I have no doubt that the conclusion I arrived at will be fully verified, and that thus another subdivision has to be made, to which all the *elephantopus* and *crassus* species may belong. Moreover, the form of the skulls of these remarkable species, having all the same characteristic features, differs so much from those of the other *Dinornithes* that it offers us confirmatory evidence of their being quite a distinct genus.

No. 13. *Din. (elephantopus ?)*—Smaller size.

We obtained the leg bones of seven specimens, which agree in size and form in every respect. They are the smallest size of the *elephantopus* species, in the gradation downwards. There is then a distinct break between this No. 13 and the next size, No. 16, *Din. (crassus ?)*.

The eight leg bones forwarded to London are those which articulated well together, but as they were mixed up with a great many others, I am not quite certain that they belong to the same birds.

The specimen articulated in the Canterbury Museum is of the same size as this No. 13, and they were found together *in situ.*

	Length of bone.	Girth of proximal end.	Girth of shaft, thinnest part.	Girth of distal end.
Tarsus metatarsus	8·2 in.	10·1 in.	6·0 in.	13·0 in.
Tibia	19·2 „	15·6 „	5·2 „	12·8 „
Femur	12·0 „	14·0 „	6·6 „	15·4 „

The metatarsus is longer and in every respect larger than Professor Owen's *crassus*, according to his list. The tibia has the length of Professor Owen's *crassus* (in list), but it is thicker round the shaft and at both extremities. The femur is also a little longer and thicker.

No. 14. *Dinornis (elephantopus?).*

Of this remarkable species (or variety) we obtained only the bones of two specimens: they were lying close together, but mixed with those of No. 13:

	Length of bone.	Girth of proximal end.	Girth of shaft, thinnest part.	Girth of distal end.
Tarsus metatarsus	8·8 in.	10·3 in.	5·5 in.	13·2 in.
Tibia	21·0 „	16·2 „	5·7 „	13·4 „
Femur	11·8 „	13·8 „	6·4 „	15·0 „

The metatarsus is of the same length as Professor Owen's measurements of *crassus*, but it is thicker in every respect. The tibia is larger and longer, whilst the femur agrees in length but is a little thicker.

No. 15. *Dinornis (elephantopus?).*

Of this species, or variety, which is somewhat similar to the former, we obtained bones belonging to four specimens (one incomplete). They were also mixed with bones of Nos. 12, 13, 14, and 16, so that we articulated them to the best of our knowledge:

	Length of bone.	Girth of proximal end.	Girth of shaft, thinnest part.	Girth of distal end.
Tarsus metatarsus	9·2 in.	10·0 in.	5·7 in.	12·6 in.
Tibia	19·25 „	15·7 „	5·2 „	11·3 „
Femur	11·7 „	12·6 „	6·1 „	14·6 „

According to this list of measurements, this metatarsus is larger and thicker than Professor Owen's *crassus.* It is of the same length as *elephantopus*, but it is thinner; altogether it has quite a different character from the last-named species. The tibia is of the same length as *crassus*, but thicker. The femur is shorter than *crassus*, but a little thicker.

No. 16. *Dinornis crassus (?).*

Of this species we obtained fourteen more or less complete specimens, so that I had ample material to assure myself of the correctness of its specific character.

	Length of bone.	Girth of proximal end.	Girth of shaft, thinnest part.	Girth of distal end.
Tarsus metatarsus	7·9 in.	9·0 in.	4·8 in.	11·1 in.
Tibia	16·7 „	14·2 „	5·0 „	10·6 „
Femur	10·8 „	12·9 „	6·0 „	15·3 „

The metatarsus is shorter than Professor Owen's *crassus*, the circumference larger, but the proximal end is somewhat smaller.

The tibia is shorter, but again thicker, than Professor Owen's *crassus.*

The femur is also shorter, whilst the circumference is the same as Professor Owen's species. An examination of the general character shows that it is a somewhat smaller but stouter bird than Professor Owen's *crassus.* The bird articulated in the Canterbury Museum as *crassus* is this No. 16.

No. 17. *Dinornis.........(?)*

A species smaller than No. 16, but partaking still of the same character.

	Length of bone.	Girth of proximal end.	Girth of shaft, thinnest part.	Girth of distal end.
Tarsus metatarsus	7·4 in.	7·5 in.	4·5 in.	10·3 in.
Tibia	15·7 „	14·4 „	4·4 „	9·5 „
Femur	9·3 „	10·5 „	5·3 „	11·4 „

We obtained three specimens of this interesting small bird, which closes the *elephantopus* family.

No. 18. *Dinornis* (*maximus,* Owen ?).

Of this specimen we obtained the perfect pelvis, the right femur, tibia, and fibula, and the first two dorsal vertebræ, lying still in their original position. We dug all round these bones, but our researches were not rewarded by finding any more remains belonging to the same specimen. A fragment of a metatarsus, however, which was lying in a drain not far from the spot, seemed from its size to have belonged to this or to a similar bird. I may here observe that, judging from the size of the two dorsal vertebræ, still larger specimens of *Dinornis* are entombed in the same swamp, because we obtained a nearly complete neck of one of still larger dimensions than that belonging to No. 18, the other portions of which have not been found.

	Length of bone.	Girth of proximal end.	Girth of shaft, thinnest part.	Girth of distal end.
Tarsus metatarsus	...	...	8·1 in.	...
Tibia	39·2 in.	22·5 in.	8·7 „	17·6 in.
Femur	18·4 „	19·0 „	9·6 „	21·7 „

The metatarsus, of which, as before observed, we have only a fragment, is remarkably flat and broad, and does not narrow towards the middle like *Din. giganteus.* When restored according to the metatarsus belonging to No. 19, it would be about twenty-three inches long.

We obtained also parts of a specimen of No. 19, which have all the characteristics of this species, but somewhat smaller in all the dimensions.

The tibia is remarkably thick round the shaft, and presents altogether a very different appearance from that of *Din. giganteus.*

No. 20. *Dinornis giganteus.*

Bones were obtained belonging to six distinct birds of this species, one of the most perfect of which, when articulated, measured nine feet ten inches, and of which I send a photograph. The character of its bones is identical with those given by Professor Owen, except in some small details.

	Length of bone.	Girth of proximal end.	Girth of shaft, thinnest part.	Girth of distal end.
Tarsus metatarsus	18·9 in.	13·1 in.	6·8 in.	16·6 in.
Tibia	34·0 „	21·0 „	6·9 „	17·5 „
Femur	16·5 „	16·1 „	8·7 „	18·6 „

No. 21. *Dinornis robustus*, Owen.

The measurements given are those of the specimen articulated for the Canterbury Museum. Besides which we obtained a few bones belonging to another bird, very little inferior in size. Both correspond well with the figures and descriptions of Professor Owen.

	Length of bone.	Girth of proximal end.	Girth of shaft, thinnest part.	Girth of distal end.
Tarsus metatarsus	16·2 in.	12·6 in.	6·2 in.	15·2 in.
Tibia	30·4 „	19·1 „	6·8 „	14·5 „
Femur	14·6 „	15·5 „	7·7 „	17·5 „

TABLE OF MEASUREMENTS OF SOME CRANIA IN THE CANTERBURY MUSEUM.

—	Breadth of cranium across the mastoids.	Length of cranium from supra-occipital crest to premaxillary fossæ.	Breadth of cranium across the temporal fossæ.	Foramen magnum.	Depression between the two tuberosities below basi-occipital to parietal.
	ins.	ins.	ins.	ins.	ins.
No. 1. *Dinornis giganteus*, belonging to our articulated skeleton ...	4·55	3·70	2·90	·70 vert. ·65 across	2·10
No. 2. *Dinornis giganteus* ...	4·40	broken	2·95	·85 vert. ·75 across	2·0
No. 3. *Dinornis giganteus* ...	4·25	3·65	2·80	·65 vert. ·65 across	1·90
No. 4. *Dinornis robustus* ...	4·10	3·55	2·85	·60 vert. ·70 across	1·77
No. 5. *Dinornis* ... ... (probably *gracilis*)	2·85	2·95	1·85	·57 vert. ·54 across	1·52

LIST OF DINORNIS BONES, BELONGING TO THE FOLLOWING SPECIES, ACCORDING TO THE PRECEDING MEASUREMENTS:

No. 1	15	45	Din. casuarinus
„ 2	16		
„ 3	14		
„ 4	17	37	„ didiformis
„ 5	12		
„ 6	8		
„ 7		3	„ sp.
„ 8		1	Pal. ingens
„ 10		3	Din. gracilis
„ 11		6	„ struthioides
„ 12		9	„ elephantopus
„ 13		7	„ ditto (smaller size)
„ 14		2	„ ditto (?)
„ 15		4	„ ditto (?)
„ 16		14	„ crassus
„ 17		3	„ (?) sp.
„ 18		1	„ maximus (?)
„ 19		1	„ ditto (smaller)
„ 20		6	„ giganteus
„ 21		2	„ robustus
Total		144	adult birds
		27	young birds of different species
Grand Total		171	

Art. III.—*On Hybridization, with reference to Variation in Plants.* By W. T. L. Travers, F.L.S.

[*Read before the Wellington Philosophical Society, 28th July,* 1868.]

Amongst the plants indigenous to the Middle Island of New Zealand, there are none which range more widely, both in altitude and in latitude, nor which present a greater amount of variation, than the *Veronicas.* Indeed, as Dr. Hooker remarks, in the notes to the Conspectus of this genus, published in his "Handbook of the New Zealand Flora," so numerous are the intermediate forms between very distinct looking species, as to render the species excessively difficult of discrimination, and to compel the adoption, for the purposes of an *interim* classification, of purely arbitrary characters founded on "prominent prevalent differences only." Dr. Hooker, in a communication to myself in reference to a large and varied collection of specimens which I forwarded to him in the early part of 1864, whilst he was engaged in compiling the "Handbook," remarked on the possibility that the variation referred to might be due to natural hybridization, and asked me whether I thought this was the case. In reply, I expressed an opinion against the supposition, and the following paper contains the substance of the grounds urged by me against it.

Before, however, entering upon the special question under discussion, I will venture to call attention to the two principal theories now prevalent respecting the origin of the various species of organic life found within particular areas. The first is, that the surface of the globe, at an early period, became divided into a number of great areas of population, each of which contained a distinct fauna and flora, distinguishable by characteristics proper to that particular area only; and that the various species now found within it have from time to time been since created in order to supply the place of representative species which have died out. The second is, that every group of organisms has a purely derivative origin, and that each existing species is but the modified descendant, preserved by means of natural selection, of some other species: whilst, probably, in most cases so great a divergence has taken place from the original type, as to transgress the conventional circle which we draw round generic type, and induce us to refer it to some other genus than that to which it would originally have been assigned. It has been well observed that if the first of these theories be true, all attempts to trace the origin of present and past faunas and floras must necessarily be futile, for their origin would be sufficiently elucidated in the dogma that "they were created on the spot," and that such a theory would render palæontology a useless study, and reduce it to a mere leviathan catalogue of fossils. Notwithstanding, therefore, the "weighty difficulties which surround the theory of natural selection," (as observed by the great expounder of that theory), I have found it necessary, in order to account for the facts which have passed under my own comparatively limited observation, to assume, as a postulate, the derivative origin of species, and to accept with little reservation the explanations afforded by the theory of "descent with modification by means of natural selection." Now, at the time I wrote to Dr. Hooker, I had, partly as the result of reading and partly from observation, arrived at certain opinions on the subject of plant variation, which may be stated in the following propositions:—

1st. That certain classes of plants exhibit a greater tendency than others to acquire modifications as the result of changes in the conditions of life.

2nd. That variation resulting from this cause may be sudden, or may result slowly from the operation of this cause acting continually and regularly upon the same species in the same locality.

3rd. That the acquired modifications will be transmitted to posterity whether acquired suddenly or slowly.

4th. That, under domestication, variation exhibits itself the more readily, because the plant is usually subjected to a more rapid succession of changes in the conditions of life, many of which are specially applied analogically in order to produce some particularly desired result.

In arriving at these general conclusions, I assumed that the fertilized ovule is essentially a bud, and that it embodies to the fullest extent, and is a perfectly natural expression of, all the incidents, if I may use the term, for the time being acquired by the parent plant. The actual condition of the fertilized ovule and bud has recently been the subject of a provisional hypothesis by Mr. Darwin, termed Pangenesis, in his great work on the subject of Variation under Domestication, in which he supposes that the whole organization, in the sense of every separate atom or unit, reproduces itself —that each ovule or bud, as the case may be, is an absolute epitome of the whole parent organism, or, to use his own words, "includes and consists of a multitude of germs thrown off from each atom or unit of the organism." The assumption which I ventured to make in my communication to Dr. Hooker had reference, however, to the offspring of a single species only.

In the production of hybrids, or the offspring of two different though allied species, on the other hand, I conceive that a violence is done: that an attempt is made to fuse together two organisms each of which has, for the time being, acquired all the modifications necessary to enable it to continue the struggle for existence under the peculiar conditions of life to which it is exposed, even though ultimately destined to disappear before some more powerful type. The result of such a union, therefore, would be that the fertilized ovule would produce a plant partaking of the character of both parents, accompanied by a tendency to eliminate the characters belonging to the one or the other, in order to resume a normal homogeneous structure; whilst this tendency would, as it appears to me, be most readily and successfully ministered to by fertilizing the ovule of the hybrid with pollen from one of the parents. I conceive that, unless so fertilized, the chances are infinitely great against the production of fertile ovules at all. In cases where fertile ovules happen to be produced by the self-fertilization of hybrid plants, I assume that the pollen engaged in the act of fertilization is either normal or so nearly so in structure as to effect fertilization almost as perfectly as pollen from one of the parent plants would do; and that such normal or nearly normal pollen, as well as a sufficiently perfect stigmatic surface, are produced as the result of the tendency, before alluded to, to revert to the parental type.

In fact, I take it to be a law of nature that modifications acquired either suddenly or slowly as the results of the operation of external causes, become essentially and naturally incorporated into the organism, and will, the conditions of life remaining the same, be transmitted to the offspring; whilst it is equally a law of nature that the offspring arising from the union of organisms generically allied but specifically distinct, tends to throw off the peculiar characteristics derived from the one parent or the other. I conceive also that unless this tendency to reversion be aided or ministered to by impregnating the ovule with perfectly normal pollen from one of the parents, the hybrid would rarely produce ovules capable of fertilization.

Now, in applying the above views to the case of the New Zealand *Veronicas*, I take into consideration the peculiar physical characters of the country.

The Middle Island contains a mountain district some hundreds of miles long by fifty or sixty broad, washed by the sea on three sides, and yet attaining, on a base of twenty or thirty miles, a summit-level in many parts above the limit of perpetual snow. This mountain district is composed of a great variety of rocks, and is broken up in a manner probably without precedent on the surface of the globe at any similar elevation above sea level. For example, the Waiau River, flowing in a valley separated by a chain of mountains only five or six miles through from the nearly parallel valley of the River Clarence, has for about forty miles of its course a uniformly lower level of nearly twelve hundred feet. Besides this difference in altitude, the western side of the Waiau Valley is bounded by the Spencer Mountains, fully nine thousand feet high, sheltering it from the north-west winds, which break with terrific violence over the lower mountain ridge dividing it, on its eastern side, from the valley of the Clarence. The climates of these two valleys are consequently perfectly dissimilar. The dividing ridge, however, is covered

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on both sides with alpine forms of *Senecio, Dracophyllum, Veronica, Gaultheria, Pimelia*, etc., amongst the shrubs, and of *Celmisia*, grasses, sedges, etc., amongst the herbaceous plants. This is certainly a somewhat extreme case, and I only quote it in order to show within what narrow limits large differences may exist in the climatal and other conditions to which the same plants may be exposed. Besides being so much broken, these mountain ranges are usually very steep, and their flanks are furrowed by innumerable streams. Land slips are frequent, and indeed every facility exists for the transport, not only of seeds, but also of growing plants from higher to lower levels.

It may easily be understood that these peculiarities in the mountain chains referred to give rise, all over the region, to great variations of soil and climate, and (putting out of the question the extreme case above quoted) the differences in these respects which are ordinarily observed between the northern and southern slopes rising from valleys having an east and west course, and the eastern and western slopes of valleys running north and south, are very great indeed. The Hurunui Valley, for example, runs nearly east and west, and whilst on the one side there is a comparatively rich vegetation, including, in the wooded gullies up to two thousand five hundred feet, such ferns as *Lomaria vulcanica, Asplenium hookerianum*, and *Hymenophyllum scabrum*, on the other side, at the distance of only a mile or so, far below this altitude, we find nothing but stunted alpine growth.

As I have before observed, the *Veronicas* especially have a very wide range, both lateral and ascending, sundry forms of this plant being found all over the Middle Island from sea level up to great altitudes. I find that the purely alpine forms at alpine elevations vary very little indeed, preserving everywhere an almost perfect similarity in their prominent prevalent characters. I find, moreover, that those species which affect low altitudes vary also but little, and that in fact it is only in the intermediate zone, amongst the innumerable gullies and valleys which occur in the mountain districts, that any great number of varieties are found.

In such valleys and gullies we see clumps of *Veronicas* sometimes upwards of an acre in extent, at times composed of but one species, and at others consisting of several species, *all the plants of each species, however, presenting a perfect identity in general appearance and structure*, or, at all events, only exhibiting such small anomalies as constantly occur in the separate plants of any dominant species, without the necessity of supposing them to result from hybridization.

Moreover, each of the several species thus found in society, will also be found growing separately in widely distant localities which happen to possess similar climatal and other physical conditions, and always presenting the same general appearance.

I therefore believe that even should a complete suite of all the *Veronicas* found in this country exhibit a gradual and almost imperceptible passage from one extreme to the other, this may properly be referred to the fact that we have, condensed within the narrow area of the Middle Island, a variety of geological and of resulting climatal and other physical conditions only to be found in an immensely wider area elsewhere, and that hence all the observed varieties may in great measure be assigned to the modifying influences of varying external causes.

The above observations will apply equally to *Pimelias*, *Veronicas*, *Celmisias*, and *Epilobiums* at least. In none of these have I seen that tendency to "sport" which results from hybridization under domestication. In all, where the external conditions are the same, I observed a nearly perfect identity in the more prominent specific characters of the plants, however distant the localities in which they may be found, and whether associated with other species or not, and for these reasons I ventured to express my opinion that the varieties observed did not result from hybridization.

The foregoing was the general argument used by me in addressing Dr. Hooker on the subject under discussion, and I may now add that although we cannot, consistently with observed facts and with the laws fairly deducible from those facts, reject hybridization as one of the agents concerned in the production of new forms in a state of nature, we are not warranted in assuming that it is an active agent. That, on the contrary, we are rather justified in believing that, except under domestication, hybridization plays but a very small part in producing permanent modifications of structure.

ART. IV.—*On the recent Earthquakes and Wave Phenomena observed in New Zealand.* By JAMES HECTOR, M.D., F.R.S., Director of the Geological Survey of New Zealand.

(Plate I.)

[*Read before the Wellington Philosophical Society, 25th August,* 1868.]

ONE of the most important duties of the members of a local scientific society such as this, is to obtain accurate records of phenomena of a transient character, like the disturbances of the tides and the earthquakes by which this Colony was visited between the 14th and 18th of August, 1868. I have, therefore, attempted to collect together, in the following communication, the observations which were made in different places, so far as they have been already ascertained; and although they are deficient in many respects for purposes of exact scientific inquiry, I trust that their discussion may lead to the adoption of instrumental means for recording such phenomena in future, as it is in this manner alone that sufficient accuracy can be obtained.

In the first place I will explain, in a few words, the exact nature of the recently-experienced phenomena, concerning which there is a good deal of misconception.

Notwithstanding the apparent rigidity of the rocks which form the crust of the globe, they are nevertheless truly flexible and elastic; and, for the propagation of earthquake shocks, those which appear to us to be most compact and stubborn, are really the most elastic and susceptible of rapid vibratory motion.

The manner in which earthquake shocks affect the surface of the earth, and the secondary phenomena by which they are accompanied, is now well understood; but only a few of the many causes which may lead to their production are yet ascertained.

Earthquakes occur, and perhaps originate, in every part of the earth's crust; and, from the researches of Mallet, there is good reason to believe that the surface is, in some part or other, continually being subject to the jarring motion which they produce. Volcanic regions are particularly liable to them; but there they seem to be only local phenomena, that fail to produce very distant effects. Volcanic energy has indeed been generally adopted as the cause of earthquakes; but applying the term to those forces by which masses of molten and chemically altered materials are heaped up on the surface of the land or poured out beneath the ocean, it is more probable that such convulsions are not originated, but only set loose, by the passage of waves of motion through the crust of the earth, which in their origin are quite independent of the local tension or constrained force which gives rise to the volcanic eruption.

We are rather led to look on the passage of earth-waves as the normal state of things, depending, like the ocean tides, on cosmical causes exterior to our planet. When their passage is interfered with they become perceptible to our senses: when they interfere with and let loose pent up forces or tensions in some portions of the earth they lead to sudden convulsions, which in their turn give rise to secondary phenomena that produce the most terrific and appalling catastrophes. These great convulsions appear to occur, nearly in every case, at the bottom of the ocean, and where it has a profound depth at no great distance from land.

The phenomena which attend such convulsions in the order they would appear to an observer on the shore of the neighbouring land, have been described by Mallet as follows:—

First, the low, hollow sound of the concussion carried through the earth which has been calculated to travel, on the average, at the rate of 10,000 feet per second. Following this, at very slightly inferior velocity, comes the earthquake or shock, which, in its passage underneath the ocean, causes what is termed the *forced ocean wave*, which is a slight vibration communicated vertically to the water directly over it during its progress. It is this forced wave that causes the concussion on board ships by which the occurrence of an earthquake is recognized by mariners.

Along the shore the *forced wave* causes a gentle rise of the waters for a short time.

If not too distant, the sound of the concussion conveyed through the water of the ocean next reaches the observer, like the low, murmuring growl of distant thunder, followed in some cases by the sound carried through the air at the ordinary velocity of 1,140 feet per second.

Last of all, and after a comparatively long interval, the great sea wave caused by the mechanical displacement of the waters immediately over the seat of the disturbances reaches the land, causing, as it approaches the shore, a marked and sudden retirement of the waters. According to the height of the original wave and the depth of water as it nears the shore, the wave, which may be quite unnoticed on board a ship in the offing, rises into several secondary waves, which advance with diminished velocity but increasing height, until they sweep over the low lands far beyond the reach of the usual tides. A series of waves of oscillation following in the train of the great sea wave, varying in magnitude according to the form of the coast line, closes the series of phenomena.

The rapidity with which the ocean wave travels depends, of course, on the depth of water, but in the open sea it has been found in some cases to be as much as 600 feet per second (420 miles per hour).

Although the slowest moving of the different impulses which originate from submarine convulsions, the oceanic waves appear to extend their influence to the greatest distance. In the case of the recent wave, this movement of the ocean was the only evidence which reached us of the occurrence of what will, I have little doubt, prove to have been a terrible convulsion in some part of the southern seas.

From careful consideration of the various accounts which have been received, it appears that the irregularity of the usual flow and ebb of the tide was experienced along the whole of the east coast of the islands and also in Foveaux Straits and Cook Straits, and that it was due to the influence of three distinct oceanic waves, which reached the coast from the eastward on the forenoon of Saturday, the 15th inst., at about the following periods:—First, between 3 to 4 a.m.; second, between 7 to 8 a.m.; third, between 10 to 11 a.m. These waves were in each case followed by smaller waves, and the irregularities did not altogether cease for forty-eight hours after their first appearance. The exact time at which the three great waves were observed, and also their distinguishing features, were modified at different points of observation by local peculiarities due to the outline of the land, the depth of the water, the exposure of the coast line to the direction in which the wave reached the shore, and lastly to the local time of tide.

The intervals between the smaller oscillations appear to have been generally remarked at from fifteen to thirty minutes, and to have gradually declined in extent and frequency until the next great wave supervened.

The earliest notice of the wave which we have recorded—beyond allusions to an extremely high tide the previous evening—was at Kaiapoi, where it was reported that at 3 a.m., the tide having ebbed for two hours, a wave four feet in height rushed up the Waimakariri River, and swept the vessels which were lying at the wharf from their moorings. This was at a distance of four miles from the mouth of the river.

At Lyttelton and Pigeon Bay the time reported was at least half an hour later, and for the other places no exact time is reported for the occurrence of the first wave, while at several localities it appears to have escaped observation.

From this time until 7.30 o'clock only lesser waves were remarked, but about that hour a great disturbance seems to have been observed at all the stations, being described at the Bluff as a terrific rush of water; at Kaiapoi, sweeping up a line of breakers which would have been disastrous to the town had it not passed up the south branch; and almost simultaneously at Nelson as having caused a reflux of the tide, at that time half-ebbed, so that it rose beyond the limits of high watermark, and flowed into the harbour over the Boulder Bank.

A third great rush of water appears to have been everywhere distinguished from the smaller oscillations, which went on continuously, the time being variously stated from 10 to 12 o'clock, there being great irregularity in the hour reported.

In this harbour (Wellington), where I caused exact observations to be taken at frequent intervals—as might be expected from the wide expanse of water, and the narrow entrance—these waves could not be so clearly distinguished as on more exposed parts of the coast, but there is a general agreement among all the observations taken at the different stations which leads to the above conclusions.

In the diagram (Plate I.) it has been endeavoured to reduce to an intelligible form the observations which were made at different parts of the coast; but from the manner in which the observations were recorded, it must not be expected that they can express the facts in a very reliable manner.

The smaller diagram shows the results of exact observations obtained in this harbour, at the end of Brown's wharf, during twenty-four hours after the phenomenon was first observed.

The altitude of each wave, as compared with its amplitude or breadth, has not been ascertained, irrespective of the degree to which it was modified by the local form of the shore upon which it expended its energy; and this element is absolutely necessary for the purpose of determining the distance at which it originated. Nevertheless, as compared with the ordinary effects of the tidal wave, we can form some conception of the gigantic force which must have influenced the ocean along the coast, when we find that the ebb and flow which these waves caused in most cases, appear to have exceeded the ordinary local rise and fall of the tide at the different localities. This leads me to expect that waves of such magnitude must have been observed at many points beyond this colony, such as the coast of Australia to the westward, and the Chatham Islands to the eastward; and that we shall receive information from these and probably other localities which will enable us to determine, with tolerable exactness, the focus from which they originated.*

An earthquake shock appears to have been felt throughout the colony, a few minutes before 10 o'clock on Monday morning, the 17th inst., of a character very different from the local shocks to which we are accustomed in this place. From the appended record of telegraphic announcements, it appears to have occurred about three minutes earlier in the north-east, at Napier, than at Hokitika on the west coast of the Middle Island. Napier is situated in lat. 39° 29′ S., long. 176° 55′ E.; Hokitika, in lat. 42° 41′ S., long. 170° 59′ E. This gives a horizontal distance of 402 miles, but as we do not know whether the wave was travelling from the east or the north-east, it is impossible to infer its velocity.

The following table shows the times at which the shock is reported to have been felt in various parts of the colony:—

* The following information appears to have escaped the notice of the journals in the colony; it is an extract from "Principles of Geology," by Sir Chas. Lyell, 10th edition, 1868, Vol. II., p. 409:—"Even in the present year (November, 1867) a submarine volcano has burst out in the South Pacific, at a point 1,200 geographical miles from New Zealand and 1,800 miles from Australia, between two of the most easterly islands of the Samoa or Navigator's Group, an archipelago where there had been no tradition of an eruption within the memory of man. The outburst was preceded by numerous shocks of earthquakes. Jets of mud and dense columns of volcanic sand and stones, rising 2,000 feet, and the fearful crash of masses of rock hurled upwards, and coming in collision with others which were falling, attested the great volume of ejected matter, which accumulated in the bed of the ocean, although there was no permanent protrusion of a new volcano above its level."

EARTHQUAKE, MONDAY, 17TH AUGUST.

	Hour. a.m.	Latitude, South.	Longitude, East.	Distance from Napier.	Westing from Napier.
Napier	9h. 55m.	39° 29′	176° 55′	—	—
Waipukurau ...	9h. 55m.	—	—	—	—
Castle Point ...	9h. 56m.	40° 54′	176° 13′	106 miles	37 miles.
Greytown	9h. 55m.	—	—	—	—
Featherston ...	9h. 55m.	—	—	—	—
Wellington ...	9h. 56m.	41° 17′	174° 49′	169 miles	111 miles.
White's Bay ...	9h. 55m. and 9h. $56\frac{1}{2}$m.	—	—	—	—
Blenheim	9h. 55m.	—	—	—	—
Nelson	9h. 57m.	41° 15′	173° 17′	229 miles	195 miles.
Kaiapoi	9h. 57m.	—	—	—	—
Christchurch ...	9h. 57m.	43° 32′	172° 38′	367 miles	225 miles.
Lyttelton	9h. 57m.	—	—	—	—
Hokitika	9h. 58m.	42° 41′	170° 59′	402 miles	315 miles.

This shock was also preceded and followed by minor shocks felt in Wellington at the times shown in the following table:—

Friday,	August	14th,	at	10.45 a.m.	
„	„	„	at	3.10 p.m.	
Saturday	„	15th,	at	3.0 a.m.,	tidal disturbance.
Sunday	„	16th,	at	3.15 a.m.	
„	„	„	at about	11.0 a.m.	
Monday	„	17th,	at	9.56 a.m.	great shock.
Tuesday	„	18th,	at	daylight.	
Wednesday	„	19th,	at	daylight.	

Telegraph station-masters reported the shock as from the south, but for mechanical reasons we may conclude that their sensation would suggest the opposite of the true direction.

The periodical character of these shocks was at once evident, and they appear to be in some degree dependent on the period of maximum and minimum pressure, as indicated by the hourly fluctuations of the barometer.

In conclusion, I may add that I have attempted to state facts in a collected form, deferring any fuller discussion of the matter until further details are obtained from Auckland and other places, where, no doubt, the tidal disturbances have been observed.

Second Communication on the recent Earthquakes and Wave Phenomena.
[*Read* 1*st September*, 1868.]

We have now evidence, in addition to that which I formerly collected, that the first wave reached from the Chatham Islands to New Zealand in about an hour and a half, and that it passed on to the coast of Australia,

Tidal Disturbances on Saturday 15th August 1868.
as observed at Browns Wharf Wellington.

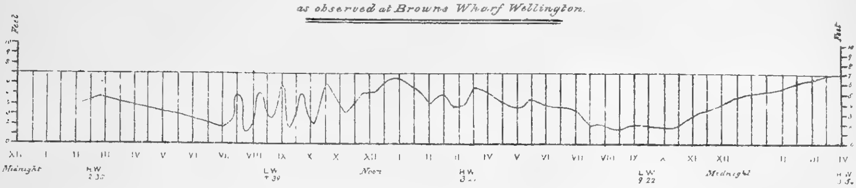
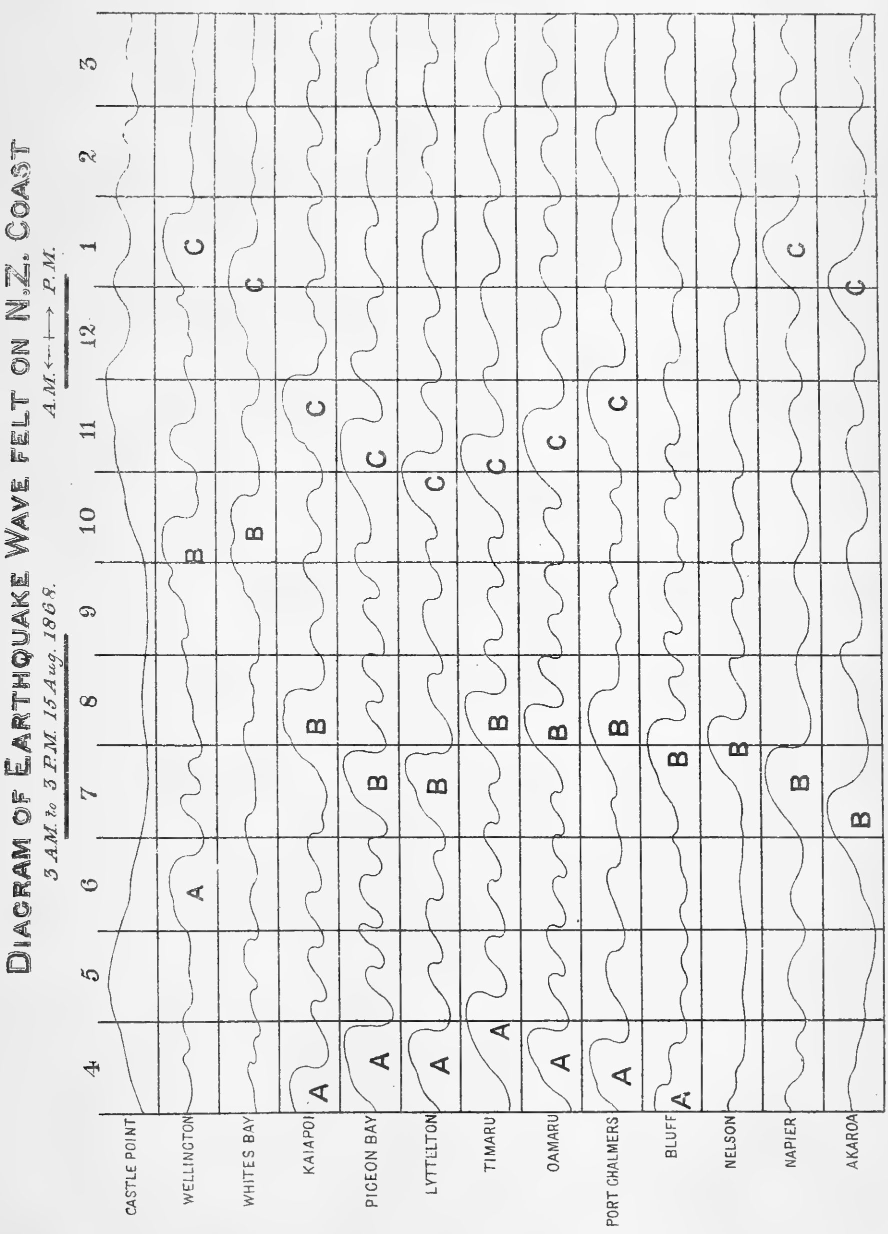


DIAGRAM OF EARTHQUAKE WAVE FELT ON N.Z. COAST
3 A.M. to 3 P.M. 15 Aug. 1868.
A.M. ← → P.M.



with slightly abated intensity, in five hours more. This gives the average velocity at a little over 290 feet per second between the Chatham Islands, and 360 feet per second from New Zealand to Australia, supposing that these places lie in the direct line of its progress.

From the ratio which this shows of increased velocity and diminished amplitude of the wave, a rough approximation of the distance from New Zealand at which the wave originated is obtained, and indicates it at over 3,000 miles. If the earthshock, which originated at the same time with the wave, had reached us, owing to its greater velocity it would have travelled the same distance in less than half an hour, and been felt about ten hours before the sea wave was observed.

As compared with the speed at which oceanic waves have been discovered to cross the Northern Pacific, this velocity is much less, and may be due to the Southern Ocean having an inferior average depth.

I may remark that if efficient means were provided for the exact observation of such phenomena, we should be able to arrive at the solution of very important facts in physical geography, as from such waves we might determine the depth of the ocean and from the earthquake shock we could arrive at the nature of the rocks which form its floor. It is by the latter means alone that we can ever hope to learn anything of the geological structure of the great proportion, amounting to nearly three-fourths, of the whole surface of the earth which is covered by the waters of the sea.

With respect to the direction in which the wave we are considering appears to have travelled, the reported circumstance of its reaching Sydney and Adelaide at the same time, while it does not seem to have been observed at Melbourne, (most likely owing to the expanded form of the harbour, and the shelter afforded by Tasmania, where it was severely felt from the south-east), and lastly, its not having affected the inner parts of Auckland Harbour, indicate that its course was from south of east.

I wish further especially to call attention to the rumours that there has been a recent rise of the land in this harbour, and that the tide does not now rise to its proper limits; on the other hand, that it falls lower than it formerly did with the same state of the tides. This has been connected with the occurrence of the ocean waves, but it is to the slight earthquake shock which we experienced that we must refer as the cause of the change in the level, if it has really taken place. I have carefully examined many points of the shore of the harbour, but have failed to satisfy myself that a change has recently taken place; but the subject is one requiring further exact observations, extending over several periods of spring tides, before any conclusions can be arrived at.

Any elevation, however slight, occurring in such a mild manner, will confer a great benefit to the country, when we reflect on the great advantages the Province derived from the previous elevation of land, as large tracts of the most valuable land were rendered available, which could not otherwise have been drained without a very large expenditure of capital.

Third Communication on the same Subject.

[*Read* 12*th October*, 1868.]

In America there appear to have been two distinct shocks of great magnitude, although smaller ones were felt at frequent intervals between the 13th and 16th, as was the case in New Zealand. The first great shock was experienced in Peru at 5 p.m. on the 13th of August, which time corresponds in Wellington with 9.30 a.m. on the morning of Friday, the 14th. This shock is described as coming from the south and west, and there is no doubt that it was the result of a great submarine eruption at a considerable distance from the coast, as within a short time it was followed by three ocean waves, which destroyed the towns along the coast of Peru for a distance of 1,000 miles, between lat. 12° and 23° S. There is no reason to doubt that it was the westerly propagation of the same three waves the first of which reached New Zealand at 2.30 on the Saturday morning, having traversed the width of the South Pacific Ocean (over 6,000 miles) in seventeen hours, giving an apparent average velocity of six miles per minute. This agrees with the velocity formerly calculated for the wave from the difference between the time at which it broke on the Chatham Islands and the Australian coasts. A wave having its origin a few hundred miles from the coast of Peru, say in lat. 25° S., as appears to have been the case in this instance, would reach the Australian seas by the shortest route, following what is termed a great circle, and would appear to reach us, not from the north-east, as might be expected, but from the south-east; the reason of which can be readily understood by examining a globe. The force which originated such a wave must have been tremendous, and there is no instance on record in history of any earthquake wave of equal extent and magnitude. The second calamitous event, as far as we yet know, only affected the Province of Ecuador, where, at 1.20 on the morning of the 16th, or at 6.10 on the evening of Sunday, the 16th, in Wellington, a tremendous earthquake shock passed *slowly* from east to west, devastating the districts lying on the western slopes of the Andes, between the Equator and lat. 5° S. There is no reason to suppose that this shock, although its direction was the same, had any connection with the shock which was experienced in New Zealand on the following morning of Monday, the 17th, at 9.56; but it is interesting to find that at that particular period the cause which gave rise to earthquakes was in activity at wide distances apart on the earth's surface, giving strong support to the view advanced in the lecture before the New Zealand Institute, that the primary cause of earthquakes is an influence external to our planet, so that earthquakes are to be considered as the remote cause rather than the effect of volcanic phenomena.

The following remarks on the earthquake wave were communicated by Captain Hutton, F.G.S., to the *Daily Southern Cross* newspaper:—

"The earthquake wave that crossed the Pacific Ocean in August, from Peru to Australia, is, I believe, the largest wave of its class yet recorded; the only ones that can at all compare with it being the one caused by the earthquake at Lisbon in 1755, which was propagated across the Atlantic to the West Indies, a distance of 3,500 miles; and the more recent one of December, 1854, caused by the great earthquake in Japan, and which traversed the North Pacific to San Francisco, a distance of 4,500 miles.

"The wave that lately visited our shores appears to have originated somewhere about lat. 20° S., and long. 70° W., at 5 p.m. on the 13th of August, according to the reckoning at the place, or at 9 a.m., 14th of August, according to our time. The first wave reached New Zealand at 4 a.m. on the 15th of August, having therefore travelled about 6,700 miles in nineteen hours, or at the rate of 5·87 miles a minute. The three waves reached us at three-hour intervals, and must, therefore, each have been about 1,000 miles in breadth. The velocity at which waves travel over the ocean depends upon the depth of the water, and varies as the square root of the depth, so that the deeper the water the quicker the wave will travel. The wave raised by the earthquake at Lisbon travelled to the Barbadoes at the rate of 7·8 miles a minute, while it went to London at very little more than two miles a minute. Professor Airy has shown that a fixed relation exists between the breadth of a wave, its velocity of progress, and the depth of the water on which it travels. The earthquake wave of December, 1854, was 217 miles in breadth, and travelled at the average rate of 6·1 miles per minute, from which Professor Bache concluded that the mean depth of the North Pacific was 2,365 fathoms, or 14,190 feet. In the same way, by the progress of the tidal wave, the Atlantic from 50° N. to 50° S. has been calculated to have a mean depth of 22,157 feet.

"Applying the same theory to the late wave, we find that the South Pacific has an average depth of only 8,721 feet, or not quite 1,454 fathoms; or, in other words, the South Pacific is much more shallow than either the North Pacific or the Atlantic. This fact, if it should hereafter be established, has a very important bearing both on geology and the geographical distribution of plants and animals, which, however, it would be quite out of place to enlarge upon here.

"Auckland, 6th October, 1868." "F. W. HUTTON."

In the above estimate of the depth of the South Pacific, as deduced from the breadth and velocity of the earthquake waves of 15th August, it will be observed that while the velocity is the same as that of Bache's wave of December, 1854, or six miles per hour, Captain Hutton assumes that the wave had a width of 1,000 miles on the ground that they occurred at three hours' interval. This is, however, hardly correct, as at the Chatham Islands the great waves followed at intervals of half an hour, and at different parts of the New Zealand coast at very unequal intervals, amounting generally to four hours. From this I infer that we have not the data for ascertaining the width of the wave in crossing the Pacific, as it appears to be modified to a great extent as it approached the New Zealand and Australian coasts. The deduction respecting the depth of the ocean must therefore, in this case, be accepted with great caution.

James Hector.

Tidal Disturbances in New Zealand, 15*th August*, 1868.

[*Abstracts from local Newspapers, Letters, &c.*]

Bluff.—Tide rose higher last night (14th) than ever known before. Between 8 and 9 this morning terrific rush of water, rose very high, although the time of high water was not till 10.27. At 11 a.m. the tide fell nineteen inches in twenty minutes, and rose again a short time after.

Port Chalmers.—At 10 a.m. water rose one foot, and fell again in a few minutes. Large ships in the harbour swung round their anchors three times in one tide. Ordinary high tide at 1.40 p.m., water then rising and falling continually, at the rate of two inches per minute.

Oamaru.—At 11.50 a.m. extraordinary change in the sea level, the tide rising and falling fifteen feet perpendicularly at intervals of fifteen minutes, and receding eight or nine feet perpendicularly below low watermark. Agitation continued all day.

Timaru.—At about 5 a.m. sudden rise of the sea of about six feet, which in the course of five minutes fell to a lower level than has been ever witnessed in Timaru. Sea rose and fell on the beach rapidly for the space of four hours, with a strong current, changing with the rise and fall of the tide. Succession of whirlpools in the offing, very distressing to ships.

Pigeon Bay (Banks Peninsula).—At about 4 a.m. loud rumbling noise from the sea—first waves were not witnessed otherwise. At 7 a.m. water considerably lower than ordinary low watermark; great rush of water—in ten minutes it was a foot higher than ordinary high watermark. Fish of all descriptions were thrown up by the water. Water kept rising and falling about five feet every half hour, until ten minutes to 10 a.m., when it rushed in very quickly and rose four feet above highest high watermark. At 10.20

a.m. it fell equally fast, and was at its lowest point at 10.35. Again at 11.15 the water came in with a *great rush*, carrying away a small jetty and some garden fencing which was about four feet above high watermark. At 11.50 it retired to its lowest point. Advancing again, it came in with greater force than any of the previous waves, carrying away a boat house, more garden fencing, and 40,000 feet of timber stacked five feet above highest high watermark. At 12.5 the water retired once more. At 12.40 the water having risen seven feet above the ordinary high watermark, carried away another jetty, also the ketch "Courier," thirty tons, which was brought back within a few feet of her old berth by the next rush at 1.5 p.m. After this the water continued to rise and fall at intervals of about three-quarters of an hour, each wave getting smaller as the tide retired.

Port Lyttelton.—At 4 a.m. the harbour was observed to be quite dry from the wharf to Officer's Point, and the vessels lying on their sides. In a few minutes an immense wave came up the harbour, tearing the vessels from the wharves, and breaking their warps and 8-inch hawsers. Much injury was done to vessels. Water rose and fell for hours. At 6 a.m. the tide was below low watermark, and in a quarter of an hour it was above high watermark. At 9.30 a.m. another roller came in. The water sometimes rose and fell three feet in five minutes.

By other observers: At 11.30 p.m. on Saturday (15th) the water was half-flood; stood at this some time; at 12.30 a.m. on Sunday it rose to the usual high watermark; at 1 a.m. it fell back to half-ebb; at 4.30 it was half-tide again. After this the water gradually fell back. At 6 a.m. it was down to low watermark, making three times high water in six hours. At noon it was high water. At 1 p.m. the water dropped suddenly four feet. At 2 p.m. the tide rose higher than usual, covering the Reef. The agitation is still (6 p.m.) going on.

Hokitika (West Coast).—No particular disturbances of the tide noticed.

Kaiapoi.—Four miles from the mouth of the Waimakariri, at 3 a.m., two hours after ebb, an immense wave, four feet high, rushed up the river, doing much damage to the ships lying at the wharf. First wave at about 3 a.m., followed by two others at intervals of about fifteen minutes. Up to 4 o'clock seven in all, but not of such magnitude as the first two or three, had rushed up the river. The greatest force of the waves went up the south branch of the river, thus saving the town from disastrous consequences. Waves continued to come up at intervals during the day.

Picton.—Nothing unusual in the tide.

White's Bay.—At 10 and 10.20 a.m. sudden recession of the sea about forty yards down the beach from the usual tide mark. It rose again suddenly, with a heavy swell and surf. High and low tides all the morning alternately.

Nelson.—Time of ordinary high water, 6.30 a.m., the tide receded in its customary way. At 7.54 a.m. water suddenly returned, rising rapidly until 8 a.m., rushing in, in all directions, over the Boulder Bank, which appeared to have then more water upon it than at the time of high water. Estimated height of wave, four feet. About noon there was another considerable rise and fall of the water; also at 5.10 p.m., with a sudden fall of about two feet. Sunday morning (16th), high water, ordinary, at 7.40. Ebbed for about ten minutes, then suddenly returned and covered former high water-mark. Sunday afternoon further irregularities, which continued till Monday, in a slight degree.

Wellington.—See page 38, *et seq.*

Castle Point.—Tide last night higher than it has been for ten years, with one exception. Time of ordinary high water, 2 p.m. At 11.53 a.m. tide was as high as ordinary high water.

Napier.—At 10 a.m. tide rose higher and fell lower in ten minutes, in the "Iron Pot," than has ever been known before. Water continued to ebb and flow every hour from three to six feet.

Opotiki.—Tidal disturbances on the 15th August. First appearance at 8.30 a.m. It was then low water, and a wave about six feet high rushed up the river at the rate of six or seven knots, filling the river up to high water-mark. Remained thus for a few minutes, then rushed back, and in fifteen minutes it was low again. Several smaller waves followed. Next day slight oscillations still continued.

At *Opape* and *Tirirua,* similar disturbances.

At *Cape Runaway,* great wave between 4 and 5 a.m., doing much damage. Indications on the beach show this wave to have been nearly ten feet high.

Auckland Harbour.—No perceptible difference in the tides, but at

Orewi and *Port Charles,* tide rose to an unprecedented height, rising and falling about six feet several times.

Mongonui.—Great tidal disturbances, which continued in a minor degree till the 17th. Water frequently rose and fell from four to five feet between 9 a.m. and 2 p.m. Such an occurrence never observed here before.

Sydney.—The tide-water rose and fell repeatedly fully four feet. No serious damage done.

Melbourne.—Marine disturbances were not observed in or about Port Phillip.

Chatham Islands.—Early on the 15th three immense waves rushed in, causing great destruction of property and the loss of one life (a Maori). At Tupanga, on the northern side of the island, the phenomenon was felt with the greatest force, the settlement being entirely destroyed. Similar disasters occurred at Waitangi, and great loss was occasioned.

ART. V.—*On a new Mode for the direct Desilvering of Argentiferous Gold.* By WILLIAM SKEY, Analytical Chemist to the Geological Survey of New Zealand.

[*Read before the Wellington Philosophical Society, 25th August,* 1868.]

THE tedious nature of the method at present employed to desilver argentiferous gold, was particularly forced upon my attention a few weeks ago, on reading an account of a new patent process by which the silver is removed from the alloy by chlorine ejected into the mass while in a molten state, dependence being placed on borax as a preventative to the volatilization of the chloride of silver thus formed. Having doubts as to the complete prevention of this volatilization by borax, doubts which grew into positive disbelief before the results of experiments made in this direction, and thinking that there must be a want felt for a shorter method than that now in use, I sought for one which should, as in this patent process instanced, also effect a direct desilvering, but without producing a silver compound so volatile as to necessitate similar precautionary measures.

The most promising course apparent was in some way to take advantage of the powerful basic properties of oxide of silver as compared to those of oxide of gold. Silver is, however, I believe, still considered to be quite unoxidizable in the dry way, its oxide, indeed, and its salts, with volatile acid, suffering complete decomposition at elevated temperatures; but it occurred to me if, together with nascent or feebly-combined oxygen, a free or loosely-combined fixed acid were presented to the molten alloy, that the oxidation of the silver would be then effected.

The well-known fact of the absorption of oxygen by molten silver, and its liberation as the metal cools, was assuring; for though the quantity thus absorbed is so small as to forbid the idea of this absorption being a chemical one (27 equivalents of silver only absorbing 1 of oxygen), still I was convinced from this that any oxygen I might liberate in contact with the silver would to a certain extent be retained by it, and in a condensed form, consequently in a manner most favourable for subsequent chemical combination therewith.

Acting on these suggestions, after several preliminary trials I selected bichromate of potash as being able singly to supply both these desiderata, namely, nascent oxygen and a loosely-combined acid of some fixity; this salt being slowly decomposed at a white heat, with liberation of oxygen, sesquioxide of chromium, and chromate of potash.

A piece of stout silver wire was ignited with this salt for one quarter of an hour, the fused mass allowed to cool, and then examined, when an abundance of chromate of silver was discovered to have been formed, while the wire had been greatly corroded and reduced to half its bulk.

A second piece of silver wire was completely dissolved in a subsequent fusion with the chromate for an equal time.

Gold (and platinum) treated in like manner refused to dissolve, at least to any perceptible extent.

It is therefore certain that in bichromate of potash we have a means of separating silver from native gold, at least to some extent, but to what extent could not well be determined in the Laboratory. In any case, the method is well worth a trial by assayists and bank managers.

The manner of application is simply to place the salt upon the surface of the molten metal. I should not consider it at all necessary to attempt their mechanical admixture, as the silver being taken up from the top, currents would be produced in the metallic mass, and kept up with gradually decreasing force until the whole of the silver was removed. Possibly an intermittent agitation of the saline portion might be found advantageous.

To prevent loss of silver by volatilization, it is indispensable that the bichromate should be free from chlorides.

Besides the separation of silver from auriferous alloys, this method is equally effective in removing copper and iron when present. To insure, however, the continuous fluidity of the saline stratum, the application of borax might be continued, but nitrates or caustic alkalies must be rigorously excluded.

The silver is easily recoverable, as the chromate, being soluble in water, may be dissolved therein, the silver precipitated by hydrochloric acid, and the resulting chloride of silver finally decomposed by soda.

The quantity of bichromate theoretically required to oxidize the silver and form with it this salt, is 5 equivalents to every 3 equivalents of silver, or, weight for weight, one pound of silver would require two and thirty-four-hundredths of a pound of the bichromate; but in practice the quantity required would no doubt be more, as some of the oxygen would be liberated out of contact with the alloy. For this reason it would be best to add the salt in successive portions, and for the same reason it is probable that the process would be found more adapted to the separation of silver when present in proportionally small quantities.

Allowing, however, an equal weight of the salt for loss of this kind, and taking its retail price at 1s. 6d. per pound,—as per *Jackson and Townson's Price List*,—every pound of the silver would incur a cost, on this head, of 7s. for its removal.

Art. VI.—*Notes on Herr Finsch's Review* of Mr. Walter Buller's Essay† on New Zealand Ornithology.* By the Author.

[*Read before the Wellington Philosophical Society, 25th August,* 1868.]

Herr Otto Finsch has done me the honour to produce an unabridged German translation of my Exhibition "Essay on the Ornithology of New Zealand," and has appended thereto some valuable notes on the nomenclature and synonymy, together with some more precise information as to the geographical range of several of the species. (See "Journal für Ornithologie," 1867, pp. 305–357.)

In the views advanced by the learned reviewer, in treating of the New Zealand avifauna, I need hardly say I generally agree; but there are some points on which, as a local ornithologist, I feel bound to join issue with him.

I would, first of all, observe that the reviewer does not appear exactly to comprehend the object or purpose for which the essay was written. He expresses regret that the author did not enter more fully into the natural history of the various species enumerated; and refers to the importance—which, of course, no one will deny—of original observations on the manners and habits of birds, &c.

It is scarcely necessary for me to explain that in producing the essay I did not pretend to give an exhaustive account of the birds of New Zealand, or a purely scientific dissertation on the subject. The narrow limits to which the essay was necessarily confined, precluded the possibility of anything like a history of the species; while, on the other hand, it was the desire of the Exhibition Commissioners that the essayists should popularize their subjects as much as possible.

From the very favourable notice which it has received from the leading scientific reviews, it is gratifying to find that it has proved acceptable to ornithologists in Europe; but the chief object of the treatise (as correctly stated in the notice of it in Dr. Günther's "Zoological Record," 1866) was "to convey to unscientific persons in the colony some idea of the peculiarities of the New Zealand *ornis*."

The reviewer disapproves of my "determined adherence" to Gray's list of 1862. It is sufficient to say that in giving an enumeration of the recorded species, I availed myself of the most complete synopsis that had appeared. As stated in the introductory part of the essay, I considered Mr. G. R.

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* A translation of Herr Finsch's critique on Mr. Buller's paper has been appended for the information of the New Zealand readers.—Ed.

† "Essay on the Ornithology of New Zealand," by Walter Buller, Esq., F.L.S., Wanganui. (*Vide post.*)

Gray's list by far the most complete and satisfactory synopsis that had hitherto been produced.

The information which for many years past I have been assiduously collecting, on the habits and economy of the various species, is reserved for future elaboration, and will, I trust, ere long be presented to the public in the form of a general work on the birds of New Zealand, illustrated by numerous coloured drawings by an eminent zoological artist.

As Dr. Haast fairly observes, in his letter covering the translation, since the date of the "Essay" (February, 1865) many important additions have been made to the list of our avifauna. Many corrections have also been made in the synonymy. I may add that even since the publication of Herr Finsch's notes, many new species have been added to the list. (See list of fourteen new species at end.)

I beg to offer the following remarks on certain portions of Herr Finsch's notes:—

1.* Herr Finsch complains that I have not brought forward "conclusive matter" as to the specific identity, or otherwise, of *Hieracidea brunnea.* In a paper forwarded to the Philosophical Institute of Canterbury in June, 1864, and again in the "Essay," I stated my belief that on a further acquaintance with the species it would be found necessary to expunge *Hieracidea brunnea* from our list of species, and to regard it as *H. novæ-zealandiæ* in an immature state. I have always held that one naturalist has no right to condemn a "species" set up by another and duly characterized, unless he can prove to demonstration that it has no real existence. There has already been sufficient confusion in this section of our ornithology, and I was unwilling to alter the nomenclature till I could do so with absolute certainty. Since the publication of the "Essay" I have been able to determine satisfactorily this disputed point.

In December last, during a visit to the Taupo district, I was fortunate enough to discover a nest of this hawk, containing three young ones. The parent birds were beautiful specimens of *H. novæ-zealandiæ.* The young birds, which I brought away, were covered with a thick growth of down of a bluish-grey colour. One of them shortly afterwards died, but the others (which are still alive in my aviary) developed in due time into perfect examples of the so-called *H. brunnea.*

It will be seen, therefore, that this form is the young of *H. novæ-zealandiæ*, and not the female, as suggested by Herr Finsch.

Falco subniger and *Milvus isurus*, which are quoted by Mr. Gurney as New Zealand birds, have never been found in this country.

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* The references are marked in numerals in the appended translation.

2. In speaking of the distribution of *representative species*, north and south, as being a "hitherto unnoticed fact," I referred, of course, to the New Zealand birds alone. I did not intend to imply that the fact was new in geographic ornithology; on the contrary, I referred particularly to an instance mentioned by Darwin as occurring in the Galapagos Archipelago. As a further example of this peculiar local distribution, I may instance the Piopio. *Turnagra crassirostris* is a South Island species, while *Turnagra hectori*, Buller, ("Ibis," 1868), is confined exclusively to the North Island.

Bearing on this subject, Dr. Hochstetter has the following interesting remarks:—"New Zealand was perhaps a large continent when the Moas were first created. And if we suppose this, or at least that the two islands were formerly contiguous to each other, we of course suppose also that the separation took place so long a time ago, that the originally identical species, after the separation of the two islands, may have been changed in the course of time into the present varieties or species. According to Professor Owen the birds of South Island present stouter proportions, a compact, rather bulky frame of body, such as *Dinornis robustus, elephantopus, crassus*, and *Palapteryx ingens*, while those of North Island are distinguished by more slender and lengthy forms, like the *Dinornis giganteus* and *gracilis*. ("New Zealand," p. 191.)

3. A small swallow has occasionally made its appearance in New Zealand. In the summer of 1851 Mr. F. Jollie observed a flight of swallows at Wakapuaka, in the vicinity of Nelson, and succeeded in shooting one. A specimen "shot by Mr. Lea, at Táupata, near Cape Farewell, 14th March, 1856," I have identified with *Hylochelidon nigricans* (*Chelidon arborea*), Gould, the "tree swallow" of the colonists. The specimen is slightly larger than Australian examples with which I have compared it; but we are informed by Gould that considerable difference exists both in size and in the depths of colouring of specimens killed in New South Wales, Swan River, and Tasmania. ("Handbook," I., p. 111.) It is a migratory species, visiting the southern portions of Australia and Tasmania, arriving in August and retiring northward as autumn approaches.

Wonderful as it may appear, there can be no doubt that the New Zealand examples are visitants from the continent of Australia, and that to reach this country they have performed a journey, on the wing, of fully 1,000 miles!

4. It will be seen, on reference to the "Essay," that when I noticed the absence of *Picidæ* as a remarkable fact, I was speaking of the peculiarities of the zoological province as a whole, and not of New Zealand birds particularly. It is admitted by our leading ornithologists that the total absence of this important tribe in the Australasian fauna is one of its most prominent ornithological features.

5. It is to be regretted that Herr Finsch does not cite some examples of the "many birds from the highest latitudes of the eastern hemisphere," which, as he states, "touch on New Zealand as their southern resting-place in their winter migrations," especially as the reviewer adds that "the known number of these is continually augmenting under recent investigations." I am at a loss to know to what species these remarks are intended to refer.

6. Whether *Circus gouldi* and *Circus assimilis* are identical is still, I believe, a disputed point with ornithologists; and as I have not been able to compare specimens, I cannot offer an opinion upon it. Mr. Gould ("Handbook," I., p. 58) does not attempt to settle the question, although he expresses an opinion in favour of their identity.

7. The two owls introduced by Herr Finsch into the New Zealand list, namely, *Strix delicatula* and *Scops novæ-zealandiæ*, must be held in abeyance till we have more precise data.

My *Strix haasti* was only entered provisionally on the authority of Dr. Haast's communication, as quoted in the "Essay."

8. Herr Finsch, while admitting that the real native country of *Halcyon cinnamominus*, Swainson, does not appear to be fully determined, asserts very positively that it does not occur in New Zealand. Local ornithologists are surely better authorities on such points. I have never met with the species, and have always considered it of doubtful authenticity as a New Zealand bird; but it must be borne in mind that many parts of the country are as yet unexplored, and that consequently one is scarcely justified in expunging, on merely negative evidence, a species introduced on apparently good authority. Dr. Hector is strongly of opinion that he shot a specimen of *H. cinnamominus* in the wild west coast region of the South Island. I submit, therefore, that the question of its existence in New Zealand is simply undetermined.

9. Herr Finsch admits to the rank of a distinct species *Anthornis ruficeps*, Pelzeln, while he seems inclined to doubt the specific value of *Anthornis auriocula*, which he has never seen.

Specimens of the former were sent to me by Dr. Haast, before being forwarded by him to Vienna, for examination. I hesitated to pronounce it a new bird, as the rufous colouring on the head appeared to be the result of flower stains. On communicating my doubts to Dr. Haast, he admitted that (when freshly killed) the feathers of the head were more or less stained with the yellow blossoms of *Senecio cassinioides*, on the nectar of which the birds had been feeding.

Of the specific distinctness of *Anthornis auriocula* I never entertained any doubt. Independently of the golden irides, which at once distinguish it from *A. melanura*, it is much larger than the last-named species, and the tints of the plumage are altogether lighter. The following are the measurements of this species:—

Extreme length, $9\frac{1}{2}$ *inches; wing, from flexure,* $4\frac{3}{8}$; *tail,* $4\frac{1}{2}$; *tarsus,* $1\frac{1}{2}$; *middle toe and claw,* $1\frac{1}{2}$; *hind toe and claw,* 1; *bill, along the ridge,* $\frac{5}{8}$; *along the edge of lower mandible,* 1.

10. It would unquestionably be wrong to separate, generically, the two species of Popokatea, *Mohoua albicilla* and *M. ochrocephala*, in the manner proposed, for they are closely allied. In form they resemble each other although their plumage is different, and their habits are precisely the same. They are representatives of each other in the North and South Islands respectively.

In the same division (*Certhiadæ*) the addition of a new species, *Xenicus haasti*, Buller, is recorded. (See "Ibis," 1869.)

11. Mr. Gould, in his recent "Handbook," has retained the specific title of *Zosterops cærulescens;* but there can be no doubt that, following the law of priority, *Zosterops lateralis*, Latham, is the correct appellation.

The family *Luscinidæ* has recently received another addition in *Sphenœacus rufescens*, Buller, from the Chatham Islands. (See "Ibis," 1869.)

12. If our *Rhipidura flabellifera* is to be regarded as identical with *R. albiscapa*, Gould, it must at any rate take the rank of a well-defined local variety. A comparison of specimens presents several appreciable points of difference, and these distinctive marks being constant, the species, according to the generally accepted rule, is entitled to recognition. But ornithologists are not agreed, and probably never will be, as to what amount of difference constitutes a "species," and what a "local variety" or race. In treating of the Australian species, Gould remarks:—"Specimens from Tasmania are always much darker than those of the continent, and have the tail-feathers less marked with white; others from Western Australia, again, are somewhat lighter in colour, and have the white markings of the tail more extensive than in those I collected in South Australia or New South Wales." The species from Western Australia has been characterized as new by the learned Berlin professor, M. Cabanis, under the name of *Rhipidura preissi;* and I consider that the New Zealand bird has quite as good a claim to rank as a distinct species.

13. We must accept Herr Finsch's conclusions with respect to *Strigops greyi*, but it must be remembered that the species rests entirely on the authority of a single skin in the British Museum, which may yet prove to be a mere variety of *Strigops habroptilus*. Dr. Haast writes me that he has obtained scores of kakapo on the west coast of the Canterbury Province, and that they all belonged to the last-named species. I have compared specimens from the South Island with an example brought to me by the natives from Taupo (North Island), and cannot detect any difference.

14. Herr Finsch's notes on the *Platycerci* are very valuable, as they contain the results of careful research among that section of birds.

With regard, however, to *Platycercus fosteri*, Finsch, I may observe that the absence of the red spots on the sides of the uropygium can scarcely be deemed a sufficient specific character, for the extent of these markings varies considerably in different examples. In very young birds they are scarcely apparent.

Admitting the specific validity of *Platycercus unicolor*, Vig., I doubt very much whether it can be regarded as a New Zealand bird. Herr Finsch allows that it is of "unknown origin," and none of the collections in this country contain specimens of it.

Platycercus alpinus, Buller, from the wooded heights of the South Island, has recently been added to the list of species. (See "Ibis," 1869.)

15. The statement by Mr. Gould, referred to in the "Essay," (p. 13), will be found in Gould's "Introduction to the Birds of Australia," as published in the separate form. The following is the passage:—"The family *Cuculidæ* is very fairly represented in Australia, since we there find species belonging to the greater number of the Old World genera, and one *Scythrops*, which has not hitherto, I believe, been found elsewhere; each of which, *with the exception* of *Centropus* and *Eudynamys*, like their prototypes, are parasitic in their nidification, and depend upon other birds for the hatching of their eggs and the feeding of their offspring." (Page 67.)

16. The remarks in the "Essay" on *Chrysococcyx*, although they may coincide with Mr. G. R. Gray's views, were the result of an actual examination and comparison of specimens. Mr. Gould, the best authority on Australian birds, has the following observations on the subject, in his recent "Handbook," (Vol. I., p. 623):—"The New Zealand *Lamprococcyx lucidus* being now considered distinct from the species found in New South Wales, it becomes necessary to determine which specific appellation was first applied to the latter: this I believe to be *Chrysococcyx plagosus* of Latham, which I therefore adopt;" and again (page 627), "After a careful examination, I have come to the conclusion that the stout-billed bird is the *C. plagosus* of Latham, and that the narrow-billed one is identical with the Javan species, to which Horsfield gave the appellation of *C. basalis.* Having the type specimen of *C. basalis*, New Zealand skins to which the specific term *lucidus* was originally applied, and examples of *C. plagosus*, wherewith to compare it, I am the more certain of being correct in these conclusions."

17. Dieffenbach was in error in supposing that *Eudynamis taitensis* lays its eggs in the nest of *Rhipidura flabellifera;* and Mr. Ramsay is equally mistaken in accommodating to this species the nest of *Anthornis melanura.* Both species of cuckoo in New Zealand avail themselves of the large pear-

shaped nest of *Gerygone*, and leave the care of their young entirely to the little foster-parent. Ramsay reports an egg of *Chrysococcyx lucidus* taken from the nest of *Anthornis;* but his information was received third-hand at Wellington, and from inquiries I have since made on the spot I am inclined to doubt the authenticity of the discovery. We are informed, however, in Bennett's "Wanderings of a Naturalist," (p. 207), that a fan-tailed flycatcher (*Rhipidura albiscapa*) was shot at Ryde, near Sydney, in the act of feeding a solitary young bird in its nest, which, when examined, was found to be the chick of the bronze cuckoo of the colonists, and that both the specimens are preserved in the Australian Museum.

18. The extent of range to be accorded to *Ardea flavirostris* will manifestly depend on the acceptance or rejection of Herr Finsch's views as to its specific identity with *Ardea intermedia*, Wagl., and *Herodias plumifera*, Gould, (*egrettoides*, Bonap.). I am disposed to adopt that view, although the examples I have examined present some diversity.

Ardea novæ-hollandiæ, Latham, of which I have obtained several specimens in the North Island, is a fresh addition to this section of our ornithology.

19. A remarkably small species of bittern, "standing only 7 inches high," has recently been discovered on the west coast of the South Island, and two specimens (male and female) have been received at the Canterbury Museum; but I have not yet had an opportunity of examining this bird. It is probably the diminutive bittern referred to by Ellman in the notes on New Zealand birds, which appeared in the "Zoologist" of 1861.

20. In the section *Scolopacidæ*, a new bird from the Chatham Islands, *Gallinago pusilla*, Buller, has recently been added (*vide* "Ibis," 1869). *Himantopus leucocephalus*, Gould, may also be added to the list. Several examples which have fallen under my notice are clearly referable to that species.

The mark of doubt may now be removed from *Recurvirostra rubricollis*, as there can be no question about the specific identity of the two birds.

21. With reference to the remarks on *Notornis*, it is sufficient to observe that Herr Finsch has been entirely misled by the report of Mr. D. Mackay, who, in writing of the *Strigops habroptilus*, misnamed it *Notornis mantelli*. The only two known examples of *Notornis*, both of which were obtained by Mr. Walter Mantell many years ago, are now deposited in the British Museum. I am far, however, from considering the species extinct, having recently obtained reliable information of its present existence in certain remote districts of the South Island.

22. There can be no doubt whatever as to the specific distinctness of *Ocydromus earli*, and *O. australis*, the former of which inhabits the North Island, whilst the latter is confined to the South. I agree, however, with

Herr Finsch in the opinion that *Ocydromus brachypterus* has no real existence. Individuals vary, to a considerable extent, both in size and in the colouration of their plumage.

Two specimens, however, brought by Dr. Hector from the south-west coast of the South Island belong unmistakably to a new species, which I propose to name *Ocydromus nigricans.* The following is the diagnosis of this new species:—

General plumage, brownish-black, each feather margined with rufous; throat, cinereous, tinged with brown; tail, black; under coverts, transversely barred with pale rufous; primaries obscurely banded with rufous. The rufous colouring prevails on the breast, but shades into dark cinereous brown on the abdomen.

Extreme length (stuffed specimen), 20 inches; wing, from flexure, 7; tail, $5\frac{1}{2}$; tarsus, $2\frac{1}{4}$; middle toe and claw, $2\frac{1}{2}$; hallux and claw, 1; bill, along the ridge, 2; along the edge of lower mandible, $1\frac{3}{4}$.

In one of the specimens (apparently a young bird) the colours are altogether darker, and the markings on the under tail-coverts are wanting.

Dr. Hector found this species frequenting the sea beach, and feeding on shell-fish and other marine productions. He never met with it at any distance from the sea shore.

23. There is no observable difference between our *Rallus assimilis* and some examples of the Australian *Rallus pectoralis.* The species is liable to great variation of plumage. *Hypotænidia dieffenbachi* must, however, be regarded as a distinct species, and peculiar to the Chatham Islands. My specimens of *Ortygometra affinis* differ somewhat from the Australian *O. palustris*, Gould.

24. Another interesting species of duck (*Anas gracilis*, Buller) has recently been added to the New Zealand list. (See "Ibis," 1869.)

25. I have never met with *Larus schimperi* in this country, nor is there a specimen in any of our collections. The authority on which it rests as a New Zealand bird—a label in the Mayence Museum—is wholly insufficient.

By *Larus pacificus*, Latham, Mr. Layard evidently meant the common black-backed gull (*Larus dominicanus*, Licht.).

Larus (*Bruchigavia*) *melanorhynchus*, Buller, has recently been added to the list. (See "Ibis," 1869.)

26. On a more careful examination of the specimen from which my original notes were taken, and on comparison of the description in Gould's "Handbook," (I., p. 536), I am induced to consider this bird not only a true *Anthochæra*, but also identical with *Anthochæra carunculata*, Gould, in which case the name proposed by Herr Finsch, *Anthochæra bulleri*, must of course sink into a synonym of the former.

From a hasty examination of the unique specimen in the Auckland Museum, made thirteen years ago, I concluded that it belonged to the genus *Mimus*, and entered it under that head in my note-book. Some years afterwards, when writing a paper for the Philosophical Institute of Canterbury, (June, 1864,) I included this bird under the provisional title of *Mimus caruncululatus*, and it found its way under the same name into the "Essay."

It was only very recently that, through the kindness of Captain Hutton, Curator of the Auckland Museum, I had an opportunity of making a further examination of the specimen.

27. The two species of *Creadion*—*C. carunculatus* and *C. cinereus*—are totally distinct.

Herr Finsch is therefore wrong in his surmise that the latter is the young of the former.

Creadion cinereus has never been found in the North Island, where *C. carunculatus* is comparatively common. I have seen the young of the latter species, which differs in no way from the adult except in the paleness of the tints and in the smaller size of the caruncles.

28. Another species of *Nestor* from the west coast of the South Island, *Nestor occidentalis*, Buller, has recently been described. ("Ibis," 1869.)

29. In addition to the species enumerated in the above notes, I may mention the diminutive penguin, *Spheniscus undinus*, Gould, (smaller than *S. minor*,) of which I have obtained specimens on the west coast of the Wellington Province.

The following is a list of the additional species referred to in the above notes as occurring in New Zealand, which have been added to the avifauna since the publication of Herr Finsch's critique :—

1. *Hylochelidon nigricans*, Gould.
2. *Xenicus haasti*, Buller.
3. *Sphenœacus rufescens*, Buller.
4. *Turnagra hectori*, Buller.
5. *Nestor occidentalis*, Buller.
6. *Platycercus alpinus*, Buller.
7. *Ardea novæ-hollandiæ*.
8. *Botaurus* . . . . . ?
9. *Himantopus leucocephalus*.
10. *Gallinago pusilla*, Buller.
11. *Ocydromus nigricans*, Buller.
12. *Anas gracilis*, Buller.
13. *Spheniscus undinus*, Gould.
14. *Larus melanorhynchus*, Buller.

Art. VIa.—*Notes on Mr. Walter Buller's "Essay on the Ornithology of New Zealand."* By Dr. Otto Finsch, Bremen.* Translated from the German by R. L. Holmes, F.M.S., Assistant Secretary, New Zealand Institute.

[*Read before the Wellington Philosophical Society, 25th August*, 1868.]

The short treatise of twenty pages, with the above title, appeared at the time of the New Zealand Exhibition, 1865. A silver medal was awarded to the author by the Commissioners, "For his interesting Essay on the Ornithology of New Zealand, and the collection of admirably preserved specimens of New Zealand birds exhibited by him."

This first publication on the birds of that distant land appeared to the friends and students of exotic ornithology to be of sufficient interest to justify an unabridged translation of this remarkably scarce pamphlet † being rendered; the more so as it contains a great deal of interesting information, and some new and original matter on the birds of New Zealand and their habits.

At the same time it becomes the duty of the translator to make some criticising remarks, ‡ since during the last two years our knowledge of the birds of that isolated land has been enlarged in many particulars, and corrections have to be made here and there in consequence.

A careful perusal of the "Essay" shows clearly that it has been compiled almost exclusively from G. R. Gray's "List of the Birds of New Zealand and the adjacent Islands," ("Ibis," July, 1862,) and "Birds of New Zealand," in Voyage of 'Erebus' and 'Terror,' 1855; and we may remark that the author has followed these praiseworthy works much too closely.

One might have expected from an ornithologist established in New Zealand itself, some more decided information on many disputed species.

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* A translation of Mr. Buller's Essay was published in Germany by the distinguished ornithologist, Dr. Otto Finsch, with the following notes and criticising remarks appended. A copy was sent by the author to Dr. Haast, Canterbury, at whose request these notes were translated into English and forwarded to the Wellington Philosophical Society. The original Essay was distributed among Naturalists in 1865, and is included in the present volume. (*Vide post.*)—Ed.

† The only copy that has yet reached Europe was received by the publisher of the "Ibis," Prof. Alfred Newton, in Cambridge, who with the greatest kindness and courtesy sent it to me for my use, for which I now publicly return him my best thanks. The treatise was first reviewed in the January number of the "Ibis," 1867, p. 131.

‡ Dr. Finsch draws attention to the fact that the names of the translators of different portions of Mr. Buller's Essay, with their respective observations on the same—for which they are solely responsible—are appended to each section. As I can find no other name so placed except Dr. Finsch's own, I have omitted it altogether.—R. L. H. [Dr. Finsch has since written that he alone was translator.—Ed.]

To give an example: the question concerning *Falco novæ-zealandiæ*, and whether this species does not in reality include several others, remains without a satisfactory solution (1).* Here, as in many other instances, the author has failed to produce conclusive evidence, or close observations on the habits (*freileben*) of the birds, so much required.

In this respect there remain open to his zeal and to his acknowledged power of observation a wide field of discovery, and the task of placing such matters beyond dispute. And let us hope that our knowledge of the ornithology of Mr. Buller's adopted country will yet progress as we desire, and many a gap be filled up.

The merit of describing in detail the species already known to science, and in particular with respect to the change caused by age or season of the year, is far greater than the superficial description of new species.

To his determined adherence to Gray's catalogue of the year 1862 may be chiefly attributed the blame that so many species, which have not been proved to be distinct up to the present time, remain undetermined; whilst, on the other hand, the catalogue has been increased by a few new discoveries made during the last few years. The total number of New Zealand birds—of which I append a catalogue at the end of this paper—is now estimated at about 144. Of these, eight species remain doubtful.

Moreover, as regards the general remarks of the author, they require in some instances additions, in others corrections; for in my opinion all the principal characteristics of the ornithology of New Zealand have not yet been described. And, further, the author does not appear to be well informed on the geographical distribution of some species; for instance, the *Waders* and *Swimmers*.

The remarkable distribution of some birds, comparatively speaking, spread north and south in species so nearly connected, is by no means an isolated instance, but is met with everywhere, only the fact is more observable in insulated zones (2). It would be premature to lay down any exact rule on the subject from the few instances mentioned by the author. A better acquaintance with the birds of New Zealand will prove, doubtless, that they spread wider over their confined territory than appears from Mr. Buller's quoted examples.

The fact that the avifauna of New Zealand, of which we now take into consideration only existing species, is very peculiar, has not received from Mr. Buller the consideration which it deserves. More than half (eighty) of the species are indigenous, and of the sixty-four species of land birds, there are only eight that have a wider range. But more remarkable still is the

* The numerals in parentheses refer to Mr. Buller's notes in reply (*vide* Art. VI.)

comparative number of indigenous genera, of which not less than nineteen are confined exclusively to the New Zealand region, viz., Heteralocha, Prosthemadera, Anthornis, Pogonornis, Xenicus, Acanthisitta, Mohoua, Certhiparus, Turnagra, Callæas, Creadion, Nestor, Strigops, Apteryx, Thinornis, Notornis, Ocydromus, Nesonetta, and Hymenolaimus. Taking into consideration the comparatively narrow limits of this country, it contains more peculiar forms than any other, and for that reason occupies a very prominent position. In the Sandwich Islands *alone* can any comparison be made with New Zealand in this respect.

To this originality may also be attributed the fact that the ornithology of New Zealand stands in far more intimate connection with that of Australia than one would suppose from the geographical position of the two countries.

The family *Meliphagidæ* proves this assertion more than any other. This family, so peculiarly characteristic of Australia, is represented in New Zealand by seven species only, of which only one (*Anthochæra bulleri*, Finsch, *Mimus carunculatus*, Buller) belongs to an Australian genus.

Of the most remarkable genera of the family, as Ptilotis, Meliphaga, Tropidorrhynchus, Glyciphila, Melithreptus, Myzomela, Myzantha, and others, the species of which are so numerous in Australia, New Zealand, strange to relate, cannot produce a single example. Among parrots, the peculiar honey-sucking Trichoglossi are entirely absent, for which, nevertheless, the Nestors might possibly be the representatives. Other families are no less remarkable, as, for instance, Alcidinidæ, Silviadæ, Muscicapidæ, Lanidæ, Corvidæ, Columbidæ, and Tetraonidæ, which are very poorly represented. We are astonished to miss species from amongst the Malurus, Cisticola, Sericornis, Acanthiza, Acrocephalus, Pardalotus, Monarcha, Myiagra, Micrmisca, Eapsaltria, Pachycephala, Artamus, Campephaga, Cracticus, Ptilinopus, Turnix, &c., examples of one or other of which one might very naturally expect to meet with.

The scarcity of birds of prey is in a great measure explained by the total absence of mammalia. Still it is worthy of note that on the coasts which abound so in fish, specimens of the genera *Haliaëtos* and *Pandion* have not been discovered up to the present time.

Nevertheless these are not by any means the most remarkable features which characterize the ornithology of New Zealand. Some other peculiarities must be brought forward which Mr. Buller has not touched on at all, but which remain the more incomprehensible to us as they do not receive even a passing allusion from him. I allude to the great poverty of the swallow tribe of birds (3), *Granivores* proper, the shrike family, and true crows.

The limited number of the order *Scansores* is well accounted for by the geographical position and physical features of the country. The family *Psittacidæ* appears to be particularly well represented. It contains two genera and ten species, all peculiar to and very characteristic of the ornithology of the country. The scarcity of true *Trichoglossi* is remarkable. On the other hand the absence of woodpeckers is not at all to be wondered at, as it is well known that this family does not extend further than Celebes, and is not known to occur even in the Moluccas, New Guinea, Australia, or Polynesia (4).

The remarkable family of *Apterygidæ*, so peculiar to the ornithology of New Zealand, is sufficiently well described by Mr. Buller, and can therefore be passed over by me.

I have already alluded to the remarkable absence of pigeons and of the *Gallinæ* tribe.

Among Waders, and especially among Swimmers, certain peculiarities can only be glanced at, as the birds of passage belonging to this country have, it is well known, a very wide range. We know now, for instance, that many birds from the highest latitudes of the eastern hemisphere touch on New Zealand as their southern resting-place in their winter migrations, and recent investigations show that the known number of these is continually augmenting (5). We miss with some surprise that first cosmopolitan of the bird tribe, *Strepsilas interpres*, Linn., also *Actitis incanus*, Gml., and some other kinds which we might have expected to find here. Among Swimmers we meet with five natives of Europe, and others which form the connecting link between the African and American ornithology.

The abundance of ducks and cormorants is remarkable, and particularly worthy of notice. Of these a very large number are peculiar to the country.

The seven specimens described as new by Mr. Buller—but of which, nevertheless, three are more or less doubtful, or at least demand closer investigation—I have added to the end of the list at the close of this treatise, together with two newly-described species of Herr Von Pelzeln.*

I considered it advisable to append the name of the authority after each species.

General remarks (page 2, line 22).—Up to the present time no true meliphagous bird is known to belong to this country (India).

Fam. FALCONIDÆ.—We are, up to the present time, acquainted with only one species of *Falconidæ* for certain in New Zealand, namely, *Falco* (*Hieracidea*) *novæ-zealandiæ*, Gml., (*harpe*, Forst.)—which has already been

* "On a recent Remittance of Bird Skins from New Zealand." By Dr. Julius Haast. 'Transactions of the Royal Zool. and Bot. Society," Vienna, 1867. Read at a meeting, 6th February, 1867.

described by Forster—with its different male and female plumage. *H. brunnea*, Gould, resembles the female in colour.

Circus gouldi is a synonym for *C. assimilis* (Jard. and Selb.), a species which is spread over all Australia and Tasmania, as far as Celebes, and eastward to the Viti Islands.

See Finsch and Hart, "Ornithology of Central Polynesia," p. 7, and Von Pelzeln, "Transactions of the Royal Zool. and Bot. Society," 1867 (6).

Fam. STRIGIDÆ.—Of *Strix haasti* we must wait for a more accurate description before we can enrol it as a new species. It appears not quite impossible that it may be identical with a known species. Besides the two species described by Mr. Buller, viz., *Athene novæ-zealandiæ* and *albifacies*, a "dwarf horned owl;" *Scops novæ-zealandiæ*, Bp., occurs also in New Zealand [and *Strix delicatula*, which ranges over the whole southern hemisphere]. See "Ornith. of Cent. Polyn.," p. 11. The supposed small and still unknown owl of Mr. Buller is perhaps referable to *Scops novæ-zealandiæ* (7).

Fam. ALCEDINIDÆ.—The real native country of *Halcyon cinnamominus*, Sws., does not appear to be yet fully determined, and Lesson's account makes the matter still more doubtful; but we may assume it for certain that the species does not inhabit New Zealand at all. The Leiden Museum possesses specimens collected during the expeditions of Coquille and Von Dorch, at New Guinea, and the Marianne Island, Guam. In all probability the last-named group is its true habitat (8).

Fam. UPUPIDÆ.—Concerning the Huia, compare, besides Dieffenbach's "New Zealand," I., p. 167, also Layard's interesting notes in the "Ibis," 1863, p. 244.

Fam. MELIPHAGIDÆ.—A new species of *Anthornis* (*ruficeps*) has been lately described by Herr Von Pelzeln. The number of *Meliphagidæ* includes seven species, since *Mimus carunculatus*, Buller, belongs also to the family under the name of *Anthochæra* (9).

Fam. CERTHIADÆ.—*Mohoua albicilla* appears to be properly a *Certhiparus*, as G. R. Gray intimated formerly (10).

Fam. LUSCINIDÆ.—The sudden appearance of the little *Zosterops*-kind of bird in New Zealand has already been mentioned by R. Taylor ("Ann. and Mag. Nat. Hist.," March, 1866). The bird is in reality a *Zosterops*, namely, *lateralis* (Lath.), *dorsalis* (Vig. and Horsf.); the same species which inhabits also Australia and Tasmania. The Museum at Vienna received specimens of it from Dr. Haast, New Zealand, (Pelzeln, "Trans. of Zool. and Bot. Society," 1867, p. 316), (11).

Fam. MUSCICAPIDÆ.—The Australian *Rhipidura albiscapa*, Gould, *is quite different from* [corresponds with] *R. flabellifera*. *R. melanura* is identical with *Muscicapa fuliginosa*, Sparrm., which latter comes from New Zealand,

and certainly not from the Cape. *R. tristis* was received in the Vienna Museum lately from Dr. Haast (12).

Fam. CORVIDÆ.—A third species of *Callæas* (*olivascens*) has lately been described by Pelzeln.

A close comparison between *Aplonis obscurus* and *caledonicus*, Bp., in Bremen Museum, convinces me that the two species are one. Specimens from New Zealand and New Caledonia show no such difference as to entitle them to belong to different species; another proof that there is a connection between the ornithology of the two islands.

Fam. PSITTACIDÆ.—These (*Nestor superbus*, Buller) must be regarded as great curiosities. So far as I am aware, there have as yet been no pure albinos found among the parrots.

Nestor norfolcensis, Pelz., from Norfolk Island, deserves mention here also as an extinct bird.

After my examination of the original specimens in the British Museum, I must look on *Strigops greyi*, Gray, as a well-established species. It differs from the common species (*habroptilus*, Gray) by the broad, well-defined, greenish-blue borders of the feathers on the upper portion, the whitish bands on the head feathers, the greyish-white feathers on the forehead and cheeks, the nearly white stern and thighs, and the whitish diagonal spots on the inner feathers and first pinions. (See Finsch, "The Parrots," Vol. I., p. 254.) According to Mackay ("Ibis," 1867, p. 145), the *Strigops habroptilus* abounds still on the west coast of the Middle Island, and in former times inhabited also the Chatham Islands (Travers, "Journal of the Linn. Soc.," Vol. IX., 1865, No. 35) (13).

Mr. Buller was not fortunate in his description of the *Platycerci*. As it is precisely in this direction that I have made special examinations, namely, on the typical specimens in the British Museum, I feel myself constrained to make the following observations:—

The longest known and commonest species in New Zealand is,—

1. *Platycercus novæ-zealandiæ*, Sparrm.

= *Pl. pacificus*, Gml.
= *Pl. erythrostis*, Wagl. (Macquarie Island).
= *Pl. rayneri*, Gray (Norfolk Island).
= *Cyanoramphus novæ-guineæ*, Bp.
= *Pl. cooki*, Gray (New Zealand).
= *Pl. aucklandicus*, Bp. (Auckland Islands).
= *C. saisseti*, Verr. (New Caledonia).

It has a wide range, and inhabits, besides New Zealand, also the Chatham Islands, Macquarie, Norfolk Islands, and New Caledonia. I can compare specimens from all these localities, which have been ranked as distinct species, with those in New Zealand, without being able to discover any constant difference sufficient to establish them as new species. The remarkably small specimens from Auckland Islands might claim a place as a first defined species, were it not for the, comparatively speaking, great contrast they exhibit to each other in transition. The species differs in measurement to an extraordinary degree. The length of wing sometimes varies as much as 16‴.

2. *Platycercus auriceps*, Kuhl.
= *Cyanoramphus malherbi*, Sou.

abounds in the Middle and North Islands (Ramsay), South Island,* and Auckland Isles (Antarctic Exped.) The specimens from the last-named district form, according to De Souancé, a distinct species (*Pl. malherbi*), which, however, according to my examinations, agree perfectly in kind.

3. *Platycercus forsteri*, Finsch ("Parrots," II., p. 287).
= *Pl. pacificus*, Forst. ("Descr. anim.," p. 73, No. 80).

differs from *Pl. novæ-zealandiæ*, Sparrm., in the absence of red spots on the tail. The future will show whether this difference is in reality always constant. Very little, in fact, is known as yet about this parrot; I know of only one specimen in the British Museum, which agrees almost perfectly with Forster's description. Perhaps it is *Pl. novæ-zealandiæ*, changed by age.

The remaining allied species, which belong to the sub-genus *Cyanoramphus*, are—

Platycercus unicolor, Vig., of unknown origin, but for the present by no means to be effaced, according to Mr. Buller's intention.

Platycercus pacificus, Forster, ("Descr. anim.," p. 238), from the Society Islands (Tahiti); and

Platycercus ulieteanus, Gml., New Hebrides (Tanna), or Society Islands (14).

Fam. Cuculidæ.—I cannot find out where Mr. Gould made this remark. In his "Birds of Australia" (folio), he expresses his regret that the nest of the *Eudynamys flindersi* is still unknown, and again in his "Handbook of the Birds of Australia," Vol. I., p. 632. Nevertheless, in describing the genus *Eudynamys*, he says explicitly, "all species are parasitical."

Since we are tolerably well acquainted with the range of *Eudynamys taitensis*, we can say, approximately, where it hibernates. In any case it must be on some of the warm islands, the Friendly, Society, Marquesas, Viti, and Samoa group, which hitherto have been known to be frequented by the species.

Chrysococcyx lucidus, on the other hand, must frequent other districts

* Stewart Island.

during the winter, Tasmania, Australia, New Caledonia, etc., consequently, north-westwards, since up to the present time it has not been observed on the islands of Polynesia proper.

Mr. Buller's views with regard to the specific differences of the New Zealand gold-cuckoos, copied from G. R. Gray ("Voy. of Ereb. and Terr."), do not hold good. New Zealand specimens, compared with Australian, do not exhibit any difference sufficiently well defined to class them separately. So also Verreaux's specimens from New Caledonia agree with the Australian. According to Schlegel, the range of *Chr. lucidus* extends over New Guinea as far as Java and Sumatra.

The marking of the tail-feathers, the number of bands and dots on the same, differ clearly in these as well as on the allied species (16).

According to Dieffenbach, *Chr. lucidus* lays its eggs in the nests of *Rhipidura flabellifera. Eu. taitensis* also makes use of the nest of that bird for the same purpose, as well as the nest of *Anthornis melanura* (Ramsay, "Ibis," 1865, p. 154), (17).

Fam. COLUMBIDÆ.—The dearth of the pigeon tribe in New Zealand deserves particular mention, as characteristic of the ornithology of the country.

Fam. TETRAONIDÆ.—In this family also New Zealand is wonderfully deficient. We miss, with astonishment, representatives of the genera *Turnix* and *Synoicus*, of which there are so many species in Australia and Tasmania.

According to Hutton, pheasants are very numerous in the neighbourhood of Epsom, Auckland, and they brood twice in the year. *Ortyx virginiana* increases also wonderfully fast.

Fam. APTERYGIDÆ.—Our knowledge of *Apteryx australis* (Shaw), is not confined to the two specimens referred to by Mr. Buller. The Leiden Museum possesses one also, and there is a very fine specimen in the Imperial collections at Vienna.

With regard to their nidification, the accounts given by the natives do not appear to be quite correct. From observations made in the Zoological Gardens in London (on a female, *A. mantelli*), the bird itself tries to hatch the egg. Mr. Webster states, in his communications, that the egg is deposited in a hollow log.

Gould has given an account of all that is yet known of the nidification of *Apteryx*. ("Handbook, Birds of Australia," II., p. 570.)

Fam. CHARADRIIDÆ.—There is a specimen of *Charadrius bicinctus*, from Lord Howe's Island, in the Leiden Museum. *Hæmatopus longirostris* ranges as far as New Guinea. *Charadrius xanthocheilus* (*fulvus*, Gml.)—which resembles our European *Chr. pluvialis* to an extraordinary degree—has a very extensive range, extending over Australia, the Indian Archipelago, the Polynesian Islands, northwards to Siberia and Kamschatka, where it rears its young. (See Hartl. and Finsch, "Ornith. of Central Polynesia," p. 196.) *Hæmatopus unicolor* is found also in Australia, according to Schlegel.

Fam. ARDEIDÆ.—The white crane (*Ardea flavirostris*, Wagl.) is by no means restricted to New Zealand, but spreads itself over Australia as far as Java and the Philippines. It is identical with *A. intermedia*, Wagl., and *Herodias plumifera*, Gould.

Ardea matook (*sacra*, Gml.; *jugularis*, Forst.) has a still more extended range. (See "Ornith. Cent. Polyn.," p. 205.) The remarkable variety in colour (white and slate-coloured), and the important difference in size, were the reasons why the species has been described so often under various names (18).

Botaurus poicilopterus is found also in Tasmania and Australia (19).

Fam. SCOLOPACIDÆ.—The various grades of colour in *Himantopus novæ-zealandiæ* are found in one and the same species, attributable either to age or the time of year. A beautiful change of plumage in a specimen in the Bremen Museum, where the white parts beneath are still mingled with black feathers, leaves this beyond a doubt.

Limosa novæ-zealandiæ, Gray (*uropygialis*, Gould; *baueri*, Natt.), is the eastern representative of our *L. rufa*, Briss. (*lapponica*, Linn.) It only visits these southern lands on its winter wanderings, since it breeds in high latitudes of Eastern Asia. (See "Ornith. Cent. Polyn.," p. 177), (20).

Fam. RALLIDÆ.—Concerning the existence of *Notornis mantelli*, Mr. D. Mackay has recently contributed some very interesting details in the "Ibis," 1867, p. 144. The bird is still living in considerable numbers in some districts on the west coast of the Middle Island of New Zealand. Those parts were first explored by the miners, after the discovery of the gold fields in 1865, who often lived for days together on the flesh of what they called "ground parrots," or the *Notornis mantelli*. Since the bird is so very helpless, and can be caught so easily by men and dogs, it appears certain that within a short time the number will have greatly diminished, if not died out altogether.

I may add, by the way, that *Gallinula alba*, Latham, from Norfolk Island, the original specimen of which I have lately examined in the Vienna Museum, belongs much more to the genus *Notornis* than to *Porphyrio*, as has lately been determined by Pelzeln ("Trans. Impl. Acad.," 1860, p. 331), (21).

Our knowledge of the genus *Ocydromus* is still very imperfect; moreover, the number of its species has not yet been established with certainty, particularly since we know so little of its change of plumage through age and sex. Von Pelzeln has lately discovered that *O. australis* and *brachypterus* cannot be specifically different; whilst Schlegel acknowledges the last as a distinct species, and on the other hand is inclined to class *O. earli* as the same species with *O. australis.* The difference in size, which, according to him, is the principal distinguishing feature, is nevertheless of an inconclusive nature. *O. brachypterus* should thus be distinguished from *australis* by remarkable difference in size: nevertheless the measurements which Lafresnaye has given agree throughout with those of *O. australis.* According to Gray's measurements, *O. australis* is larger even than Schlegel's *O. brachypterus.* Also, with regard to colour, it is very difficult to show a decisive difference in the three species. In my opinion, *O. brachypterus* is the immature plumage of *O. earli,* which latter species is distinguished by the brown colour of the bill and legs, the prevailing rust-red colour of the whole, and the almost unobservable gray marks on the head, chin, and throat (22).

Rallus assimilis, Gray, together with *R. dieffenbachi, celebensis,* Quoy, and some other allied species, belong to the genus or sub-genus *Hypotœnidia.* Their specific independence is nevertheless very doubtful; in any case it would be well for the present not to separate them from the Australian *R. pectoralis,* Less., (*philippensis,* Finsch). Concerning the latter, we know from Peale's account that the cinnamon-coloured band on the breast is sometimes absent. It has an extensive range over Australia, Celebes, many of the South Sea Islands—Viti, Samoa, Tahiti—as far as the Philippines. (See "Ornith. Cent. Polyn.," p. 157.)

Concerning the habits of *Ortygometra tabuensis,* which embraces all Australia and most of Eastern and Central Polynesian Islands, see "Ornith. Cent. Polyn.," p. 169.

Ortygometra affinis can scarcely be classed as a distinct species from *O. palustris,* Gould (23).

Fam. ANATIDÆ.—Of the seven species of duck which we know to frequent New Zealand, only one, *Anas superciliosa,* has a wider range; the remaining six species are peculiar to the islands. This richness in the duck tribe must be recorded as a remarkable peculiarity of the New Zealand ornithology. The total want of *Anseres* is less to be wondered at, since Australia also is very poor in native species (24).

The specific differences between *Podiceps rufipectus* and the Australian *P. poliocephalus,* Jard., (*nestor,* Gould,) must remain doubtful until we possess distinguishing features of a more decided character than those hitherto described. The bird drawn by Gray ("Erebus and Terror," pl. 19) has certainly not yet attained its adult plumage.

Fam. PROCELLARIDÆ.—Gould gives, in his "Birds of Australia," a list of only thirty-four species belonging to this country, of which, however, some are more or less doubtful. Still, the number of long-winged *Natatores* which visit New Zealand occasionally may perhaps be greater, since nearly all the species belonging to the country have notably a very wide range, extending in many cases over both hemispheres.

The following species must be added to the ornithology of New Zealand as new:—*Procellaria incerta*, Schleg., and *Pr. mollis*, Gould (Pelzeln, "Novara Exp.," p. 146); also, *Diomedea chlororhyncha*, Gml., and *melanophrys*, Boie; and a *Thalassidroma sp.?* (Layard, "Ibis," 1863, p. 245.)

Fam. LARIDÆ.—*Lestris antarcticus* may be set down, without further consideration, as a synonym for *L. catarractes*, Ill.; Gould himself has lately declared them to be the same.

Larus antipodum is, without doubt, the same as *L. dominicanus*, Licht. The species ranges over the whole southern hemisphere. *L. scopulinus* has also a very extended habitat. Whether *L. schimperi* really belongs to New Zealand is still a doubtful question, since the proof of this rests only on a label in the Museum at Mayence. On the other hand, the Leiden Museum possesses a specimen which comes, without any doubt, from China. Layard observed also *Larus pacificus*, Lath., in New Zealand. ("Ibis," 1863, p. 245), (25).

Sterna strenua, Gould, is known to be the same as our *St. caspia*, Pall.; *St. frontalis*, Gray, is *St. longipennis*, Nordm., in its winter plumage. It spreads itself over the whole Indian and Pacific Oceans (see "Ornith. Cent. Polyn.," p. 222). *St. antarctica*, Forst., is the same species as our *St. minuta*, Linn. (*nereis*, Gould). *Hydrochelidon albostriata* is, according to Schlegel and Blasius, no other than our *hybrida*, Pall. (*fluviatilis*, Gould).

Fam. PELICANIDÆ.—New Zealand, of all countries in the world, is the richest in cormorants: no land of the same size can produce so many species. Three of the eight cormorants known in New Zealand are peculiar to the country, *Graculus brevirostris*, Gould; *punctatus*, Sparrm.; and *chalconotus*, Gray. The remainder are scattered over Australia, as far as the Moluccas and Sunda Islands.

Graculus carboïdes cannot be separated as a species from our European *Gr. carbo*, Linn. It belongs to the most wide-spread *Natatores* with which I am acquainted. *Gr. stictocephalus* is the same as *sulcirostris*, Brandt, and is found also in the Moluccas and Sunda Islands.

Gray mentions, besides *Dysporus serrator*, also *Dysporus piscator*, Linn., as an inhabitant of New Zealand.

NEW SPECIES.

1. ANTHORNIS AURIOCULA.

We wish very much that Mr. Buller had given the comparative measurements of the new species with *A. melanura*, for it is scarcely possible to distinguish between them. The difference in the colour of the irides is, as is well known, no safe starting-point, and is certainly a very hazardous method to determine the principal specific characteristics. I have found in one and the same species the irides coloured differently; for instance, *Plictolophus leadbeateri*, *Plictolophus sulfureus*, &c. Mr. Zelebor describes the iris of *A. melanura*, "light cherry-red," (Pelzeln, "Novara Journ.," p. 57,) which is already somewhat different from Mr. Buller's description.

It is not uninteresting to mention here the melodious notes of *A. melanura*, which Zelebor compares to our *Sylvia cinerea*. The bird is also a good mimic.

2. ANTHORNIS RUFICEPS.

Without doubt a well-defined species, which I had the pleasure to see, among other rare objects from New Zealand, in the Imperial collections at Vienna, through the kindness of my friend Mr. A. Pelzeln.

3. GERYGONE ASSIMILIS.

It is difficult, and scarcely safe, to decide on this new species from skins alone, as it differs so slightly from *G. flaviventris*.

4. MIMUS CARUNCULATUS, Buller.
ANTHOCHÆRA BULLERI, Finsch.

With regard to the generic character of this bird, Mr. Buller must be wrong in his decision; for, as the description reads, we have here to do with a genuine *Anthochæra*, but in nowise with a *Mimus*. The latter, it is well known, is confined to America. Buller's new species seems to correspond in size and colour very closely with the Australian *A. carunculata*, Lath. (Gould, "Birds of Aust.," 11, pl. 55); and since the name has been already given up, it must be re-named (26).

6. CREADION CINEREUS, Buller.

This new species may be the common *Cr. carunculatus* in immature plumage. In any case, the description reminds one of a young bird. Forster has informed us, in Latham's "Gen. Hist.," that the bright-brown back colouring is wanting in the female, and that the young are of one colour, viz. brown. The greyish-brown colouring of Buller's bird may be that of a still younger plumage (27).

7. NESTOR SUPERBUS, Buller.

I cannot agree with Taylor's supposition ("Ann. and Mag. Nat. Hist.," 3 ser., xviii., p. 140) that this species belongs perhaps to *N. meridionalis*. Better consider it as a *variety* of the latter, especially since Mr. Buller describes how those parrots are very liable to vary; which, however, is again contradicted by the fact that several specimens of it have been procured (28).

8. Rallus featherstoni, Buller.

There is no doubt about the specific character of this species.

9. Podiceps hectori, Buller.

A genuine crested diver, closely allied to *P. cristatus*, Linn., (*C. australis*, Gould,) from which it is easily distinguished, as Mr. Buller says very properly, by the uniformly dark colour of the wings and shoulders. This diver corresponds probably with *Podiceps cristatus (?)* which was mentioned by Haast ("Ibis," 1862, p. 103).

LIST OF NEW ZEALAND BIRDS (29).

The species marked with an (*) are indigenous; those marked with a note of interrogation are doubtful.

	*	1.	Falco novæ-zealandiæ, *Gml.*
		2.	Circus assimilis, *Jard.*
	*	3.	Athene novæ-zealandiæ, *Gml.*
	*	4.	albifacies, *Gray.*
	*	5.	Scops novæ-zealandiæ, *Bp.*
		6.	Strix delicatula, *Gould.*
	*	7.	Halcyon vagans, *Gray.*
	*	8.	Heteralocha gouldi, *Gray.*
	*	9.	Anthochæra bulleri, *Finsch.*
	*	10.	Prosthemadera novæ-zealandiæ, *Gml.*
	*	11.	Anthornis melanura, *Sparrm.*
	*	12.	melanocephala, *Gray.*
?	*	13.	auriocula, *Buller.*
	*	14.	ruficeps, *Pelzeln.*
	*	15.	Pogonornis cincta, *Dubus.*
	*	16.	Xenicus longipes, *Gml.*
	*	17.	stokesii, *Gray.*
	*	18.	Acanthisitta chloris, *Sparrm.*
	*	19.	Mohoua ochrocephala, *Gml.*
	*	20.	Sphenœacus punctatus, *Quoy* and *Gaim.*
?	*	21.	fulvus, *Gray.*
	*	22.	Gerygone igata, *Quoy* and *Gaim.*
	*	23.	flaviventris, *Gray.*
	*	24.	albofrontata, *Gray.*
?	*	25.	assimilis, *Buller.*
	*	26.	Certhiparus novæ-zealandiæ, *Gml.*
	*	27.	albicilla, *Less.*
	*	28.	maculicaudus, *Gray.*
	*	29.	Petroica macrocephala, *Gml.*
	*	30.	dieffenbachi, *Gray.*
	*	31.	toitoi, *Less.* and *Garn.*
	*	32.	longipes, *Less.* and *Garn.*
	*	33.	albifrons, *Gml.*

* 34. Anthus novæ-zealandiæ, *Gml.*
35. Zosterops lateralis, *Lath.*
* 36. Turnagra crassirostris, *Gml.*
* 37. Rhipidura flabellifera, *Gml.*
* 38. fuliginosa, *Sparrm.*
* 39. tristis, *Hombr.*
* 40. Callæas cinerea, *Gml.*
* 41. wilsoni, *Gray.*
* 42. olivascens, *Pelzeln.*
* 43. Aplonis zealandicus, *Quoy.*
* 44. obscurus, *Dubus.*
* 45. Creadion carunculatus, *Gml.*
* 46. cinereus, *Buller.*
47. Platycercus novæ-zealandiæ, *Sparrm.*
? * 48. forsteri, *Finsch.*
* 49. unicolor, *Vig.*
* 50. auriceps, *Kuhl.*
* 51. Nestor meridionalis, *Gml.*
* 52. esslingi, *Sou.*
* 53. notabilis, *Gould.*
* 54. superbus, *Buller.*
* 55. Strigops habroptilus, *Gray.*
* 56. greyi, *Gray.*
57. Eudynamys taitensis.
58. Chrysococcyx lucidus, *Gml.*
* 59. Carpophaga novæ-zealandiæ, *Gml.*
* 60. Coturnix novæ-zealandiæ, *Quoy.*
* 61. Apteryx australis, *Shaw.*
* 62. oweni, *Gould.*
* 63. mantelli, *Bartl.*
* 64. maxima, *Verr.*
65. Charadrius bicinctus.
66. fulvus, *Gml.*
* 67. Thinornis novæ-zealandiæ, *Gml.*
* 68. rossi, *Gray.*
* 69. Hæmatopus obscurus, *Gml.*
* 70. frontalis, *Quoy.*
71. longirostris, *Vieill.*
72. unicolor, *Forst.*
73. Ardea intermedia, *Kuhl.*
74. sacra, *Gml.*
75. Botaurus poicilopterus, *Wagl.*
76. Nycticorax caledonicus, *Gml.*
? 77. Platalea flavipes, *Gould.*
* 78. Himantopus novæ-zealandiæ, *Gould.*
79. Limosa uropygialis, *Gould.*
* 80. Scolopax aucklandica, *Gray.*
? 81. Recurvirostra rubricollis, *Temm.*
82. Rallus pectoralis, *Less.*
* 83. dieffenbachi, *Gray.*
* 84. featherstoni, *Buller.*
? * 85. Ortygometra affinis, *Gray.*
86. tabuensis, *Gml.*
* 87. Ocydromus australis, *Sparrm.*

* 88. Ocydromus earli, *Gray.*
? * 89. brachypterus, *Lafr.*
* 90. Notornis mantelli, *Owen.*
91. Porphyrio melanotus, *Temm.*
* 92. Casarca variegata, *Gml.*
93. Anas superciliosa, *Gml.*
* 94. chlorotis, *Gray.*
* 95. variegata, *Gould.*
* 96. Fuligula novæ-zealandiæ, *Gml.*
* 97. Nesonetta aucklandica, *Gray.*
* 98. Hymenolaimus malacorhynchus, *Gml.*
? * 99. Podiceps rufipectus, *Gray.*
* 100. hectori, *Buller.*
101. Aptenodytes pennanti, *Gray.*
102. pachyrhynchus, *Gray.*
103. antipodes, *Hombr.*
104. Spheniscus minor, *Forst.*
105. Pelecanoides urinatrix, *Gml.*
106. Puffinus assimilis, *Gould.*
107. Thalassidroma sp. ?
108. Procellaria gigantea, *Gml.*
109. æquinoctialis, *Linn.*
110. parkinsoni, *Gray.*
111. glacialoïdes, *Smith.*
112. capensis, *Gml.*
113. cooki, *Gray.*
114. gavia, *Forst.*
115. ariel, *Gould.*
116. cerulea, *Gml.*
117. incerta, *Schl.*
118. mollis, *Gould.*
119. Prion vittatus, *Gml.*
120. Diomedea exulans, *Linn.*
121. fuliginosa, *Gml.*
122. chlororhyncha, *Gml.*
123. melanophrys, *Boie.*
124. Lestris catarractes, *Ill.*
125. Larus pacificus, *Lath.*
126. dominicanus, *Licht.*
127. scopulinus, *Forst.*
128. schimperi, *Bruch.*
129. Sterna caspia, *Pall.*
130. longipennis, *Nordm.*
131. minuta, *Linn.*
132. Hydrochelidon hybrida, *Pall.*
133. Anoüs stolidus, *Linn.*
134. Graculus carbo, *Linn.*
135. cirrhatus, *Gml.*
136. melanoleucus, *Vieill.*
137. varius, *Gml.*
* 138. punctatus, *Sparrm.*
* 139. brevirostris, *Gould.*
* 140. chalconotus, *Gray.*
141. sulcirostris, *Brandt.*

142. Dysporus serrator, *Banks.*
143. piscator, *Linn.*
144. Fregata aquila, *Linn.*

ART. VII.—*On the Celtic Origin of the English Vowel Sounds.* By the Right Reverend C. J. ABRAHAM, Bishop of Wellington, Vice-President.

[*Read before the Wellington Philosophical Society, 15th September,* 1868.]

THE English pronunciation of the vowels is unique. The English language mainly consists of Saxon words, and yet our pronunciation of those words does not accord with that of our Teutonic kinsfolk. Evidently we did not get our vowel sounds from the German. I believe that we derived them from the Celt, and I arrive at this conclusion through the French mode of pronouncing Latin words.

I take the vowels in order, and observe—(1.) That our vowel sound of *a* in "*table*" corresponds with the French mode of pronouncing the following words, which I give as specimens merely, *e.g.* :—

LATIN.		FRENCH.	LATIN.		FRENCH.
Pater	...	Père	Pagus	...	Pays
Mater	...	Mère	Pacare	...	Payer
Frater	...	Frère	Placere	...	Plaire
Talis	...	Tel	Tacere	...	Taire
Qualis	...	Quel	Carus	...	Cher
Pavor	...	Peur	Lana	...	Laine
Labrum	...	Lèvre	Caballus	...	Cheval
Castanea	...	Chêne	Caminus	...	Cheminèe

(2.) The English sound of *e* in "*we*" :—

LATIN.		FRENCH.	LATIN.		FRENCH.
Decem	...	Dix	Deus	...	Dieu
Bene	...	Bien	Vetus	...	Vieux
Tene	...	Tiens	Legere	...	Lire
Veni	...	Viens	Senior	...	Sire
Pejor	...	Pire	Lepus	...	Lièvre
Melior	...	Mieux	Meus	...	Mien

This head admits of a remarkable illustration from the lately-discovered "Codex Sinaiticus," which gives the original Greek of a Latin translation of a letter of Barnabas, in which Latin version he is made to quote a text of Scripture, and to add the words "*ut Filius Dei dicit.*" It now is seen from the original Greek that the reader was probably a Celt, who said as we do, "*ut filios Dei* decet," which the copyist, being an Italian, understood to be *dicit*, and so he altered the word *filios* to *filius*.

(3.) Our sound of *i* in "*bite*" is a modification of the French corruption of Latin words in *i* into *oi;* and I would premise on this point that any one who has heard and watched the *provincial* pronunciation of *oi* in French, would detect a clear sound like our *i* in those words that have *re* following *oi.*

Latin.		French.	Latin.		French.
Liger	...	Loire	Mihi ...	...	Moi
Niger	...	Noir	Pyrum	...	Poire
Sinus	...	Soin	Frigidus	...	Froid
Bibere	...	Boire	Digitus	...	Doigt
Videre	...	Voir	Minus	...	Moins

Valcknaer says of various readings of MSS., "*Maximam partem nihil esse quam pronuntiationem librariorum diversam,* ai *et* e — oi *et* i *promiscue pronuntiantium.*"

(4.) I have no need to make any remarks on the vowel sound of *o* in "*not.*"

Latin.		French.	Latin.		French.
Bona	...	Bonne	Collum	...	Col

The difference between English and foreign pronunciation is slight.

(5.) Our sound of *u* is peculiar, as in the words "*tune,*" "*puny,*" &c., and is much nearer to the French than to the other continental languages, which sound it as "*oo*" in "*fool.*"

Latin.		French.	Latin.		French.
Luna	...	Lune	Una	...	Une
Tu	...	Tu	Mula	...	Mule
Utor	...	User	Natura	...	Nature

I may, in passing, just illustrate this French pronunciation of Latin vowels from other Celtic races, and then explain how it seems to me that the French have now lost their Celtic pronunciation of vowel sounds while we have preserved it.

I would observe, then, that a Gaelic Highlander pronounces our *a* (in the word "table") soft, even in words where we use the broad *a; e.g.*, he says "faytherˮ for "father," "raytherˮ for "rather;" also, "biled" for "boiled," "pison" for "poison." A Devonshire man and an Irishman will say "tiu" for "two" or "too;" and a Highlander will say "gude" for "good," "bluid" for "blood." I just throw out these hints for others to follow up who are more competent than I am to do so; and I proceed now to answer the question, "How comes it that the French have lost their pronunciation of Latin vowels, which was once like ours, and why did they write it after the continental pronunciation of vowel sounds, and not after their own?" My answer to those questions is, that the Celts or Gaels of Southern France were the people who pronounced the vowels as we do, as may be seen, for instance, in their corruption of the town *Dea* (Augusta) in Dauphiny, into *Die.* These were overrun and subjugated by the Kymry;

and afterwards the Franks and Normans, with the Kymry, (who occupied the north side of France more particularly), imposed their pronunciation and orthography on the whole of France. The distinction of character and appearance between the Gaels and Kymry of France is well described in Merivale's "History of the Romans under the Empire," Vol. I., chapter 5; and amongst other points he quotes from Tacitus the fact confirmed by Cæsar, that the Kymry "affected to have a German origin," and imitated the Germans. This would agree with the theory I have propounded, that the Kymry as well as the Teutonic Franks and Scandinavian Normans introduced the present "continental" pronunciation of vowels into France, and controlled the orthography.

The Kymry who followed the Celts into Britain seem to have been a different horde from the Belgic Kymry who "affected Germanism" in France; and their numbers would seem almost to have been smaller, for the Gaels held their own in Scotland, Ireland, and great parts of Wales.

With some diffidence, but on the whole with a reasonable expectation of approval, I offer my theory, that the English vowel sounds come through the Celtic portion of our mixed race, to the criticism of philologists; and I am rather encouraged in the view I have taken by the success which has attended the labours of such men as Dr. Guest and Mr. Matthew Arnold, in ascribing much more of our language and civilization than used to be conceded to the Celtic inhabitants of Great Britain.

ART. VIII.—*On the Island of Rapa.* By Captain JOHN VINE HALL.

Plates II.-IV.

[*Read before the Wellington Philosophical Society, 12th October,* 1868.]

I MAY commence my notes by saying that the island has been hitherto erroneously called Opara, but on my recent visit to it I inquired particularly as to its proper native name, which I found was pronounced nearly as if spelt with an L and two p's, or Lappa. Opara, they said, was "English name." In future it will be called Rapa.

This island, like other places one might mention, has acquired a temporary and adventitious value principally from its position and the possession of a harbour. It was first discovered by the English navigator Vancouver, since which time it has apparently been very little visited except by small trading vessels from the neighbouring islands. Vancouver described it truly as rugged, formed of craggy mountains, with very little level ground; the narrow valleys between the precipitous hill sides affording the only space for a limited cultivation.

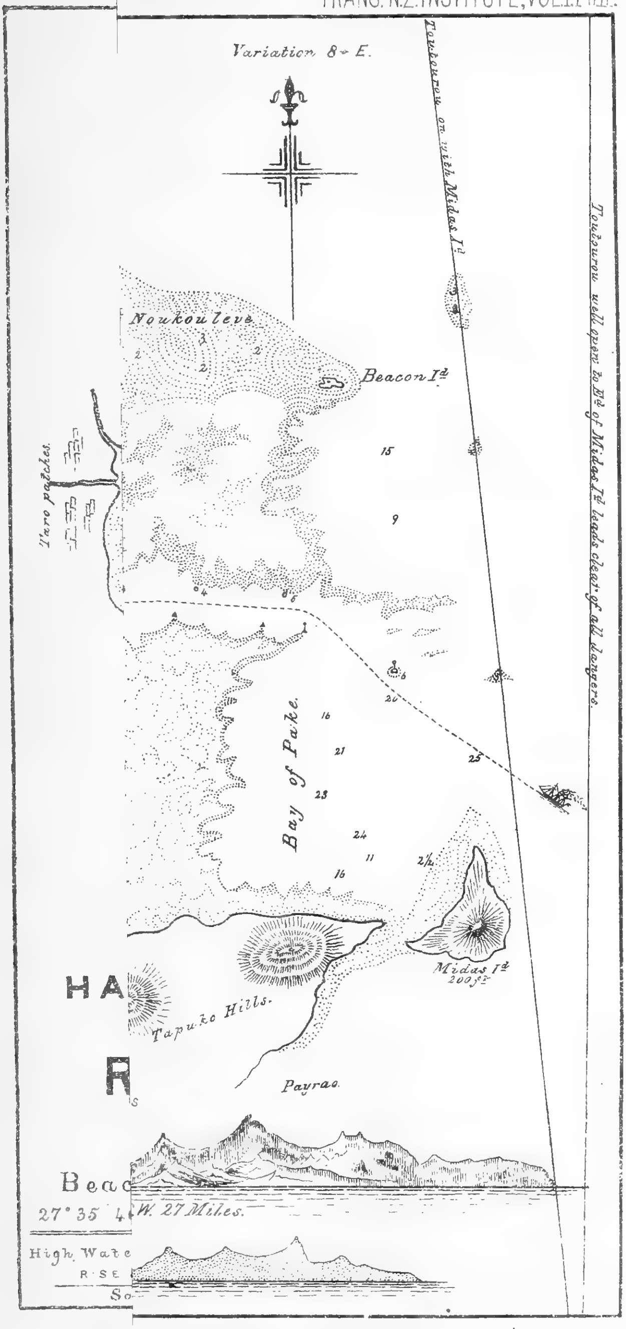
The position of Rapa is in 27½° S. latitude, and 144° W. longitude; about 700 miles S.E. of the Society group, and some 4° S. of the tropic of Capricorn, and as nearly as possible two-thirds of the distance between Panama and Wellington.

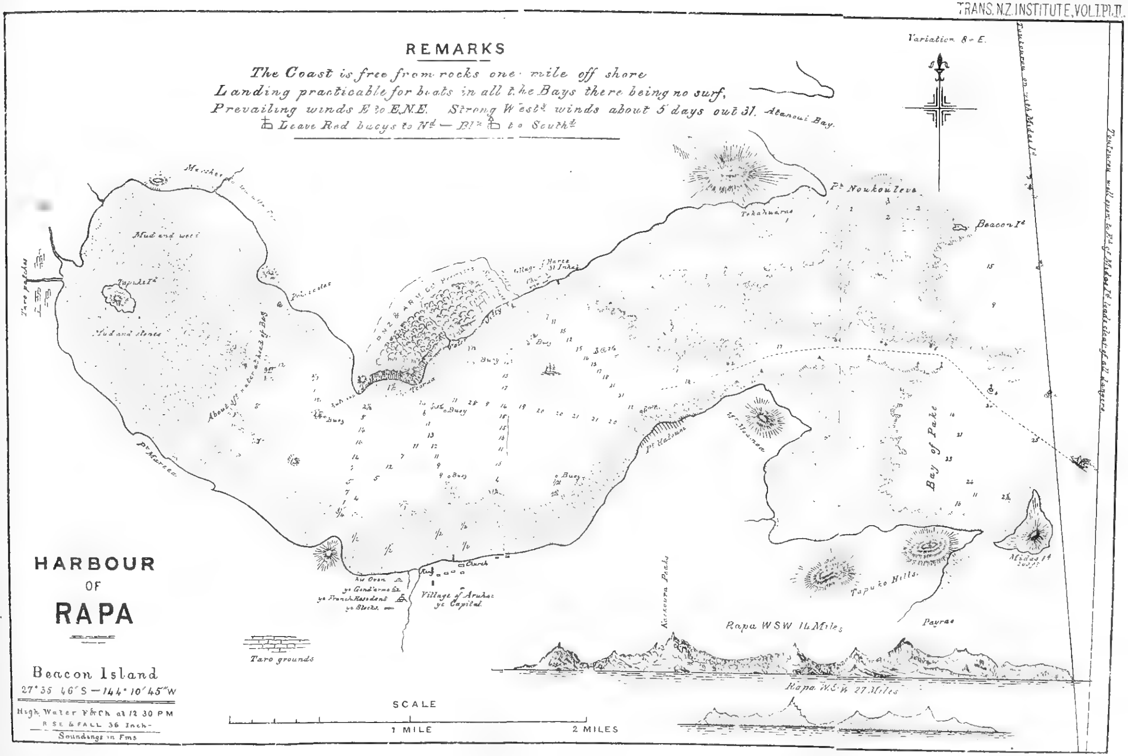
Very little was generally known about the island till lately, and nothing of its being favoured with so perfect a harbour. The finding it out was the result of very many inquiries I made from every one I could hear of who had been to the South Sea Islands, as to the existence of some suitable spot where we might have a coal depôt; for, on the establishment of the Panama service, I was so impressed with the desirability, if not necessity, of some stopping-place near the route, that I used every effort for months endeavouring to find one. At last I was rewarded for my pains by hearing of Rapa. Its situation, just on the outer verge of the Southern Archipelago and in the direct track (not the direct line) between Panama and New Zealand, makes it particularly advantageous as a place of call in case of accident or deficiency of fuel.

And, speaking of the track of the steamers between New Zealand and Panama, I will for an instant advert to the difference of route in going towards Panama and returning from it.

Leaving Wellington we adopt what is called the "great circle" course, which, though apparently roundabout, is in reality the direct and shortest line to Panama. Now, in returning from Panama to Wellington we appear to adopt a much straighter course, but it is really somewhat longer. This is readily explained by reminding you that we are not sailing upon a level but a curved surface. Take a round body to represent the earth, a thread stretched between any two points is evidently the shortest distance between them, and, viewed in a line with the centre, is straight. This should be the ship's course. But on the chart generally used this straight line will appear a curve, and all the straight lines (meridians excepted) are really curves. And although Mercator's projection, as it is called, is the most simple for the ordinary purposes of navigation, yet it has led many people, and even seamen, to have confused ideas upon this very simple subject. In the track upwards to Panama the winds are frequently found favourable, because the course lies principally in the well-known belt of westerly winds. From Panama we keep further north, through the heart of the easterly or trade winds prevailing generally, though varying with the seasons, between the equator and the southern tropic. In this part of the voyage the winds are less favourable than the other, and particularly in the latter part. Trying to avoid the westerly or adverse winds which prevail further south, we adopt this track, which brings us close to Rapa, from which, I fear, you will think I have made too long a digression.

TRANS. N.Z. INSTITUTE, VOL. I. PL. II.





REMARKS
The Coast is free from rocks one mile off shore
Landing practicable for boats in all the Bays there being no surf,
Prevailing winds E to E.N.E. Strong Westd winds about 5 days out 31.
Leave Red buoys to Nd — Blk to Southd
Variation 8° E.
Atanoui Bay
Pt Noukouleva
Tekahuarua
Beacon Id
Mud and weed
Tapuke Id
Mud and stones
Taro patches
Pt Maréa
Bay of Pake
Pt Hakuma
Village of Aruhai ye Capital
Church
ye Gend'arme
ye French Resident
ye Stocks
Tapuko Hills
Midas Id
Rapa WSW 14 Miles
Rapa W.S.W. 27 Miles
Taro grounds
Payrae
HARBOUR
OF
RAPA
Beacon Island
27° 35′ 46″ S — 144° 10′ 45″ W
High Water F&Ch at 12 30 PM
RISE & FALL 36 Inch
Soundings in Fms
SCALE
1 MILE
2 MILES

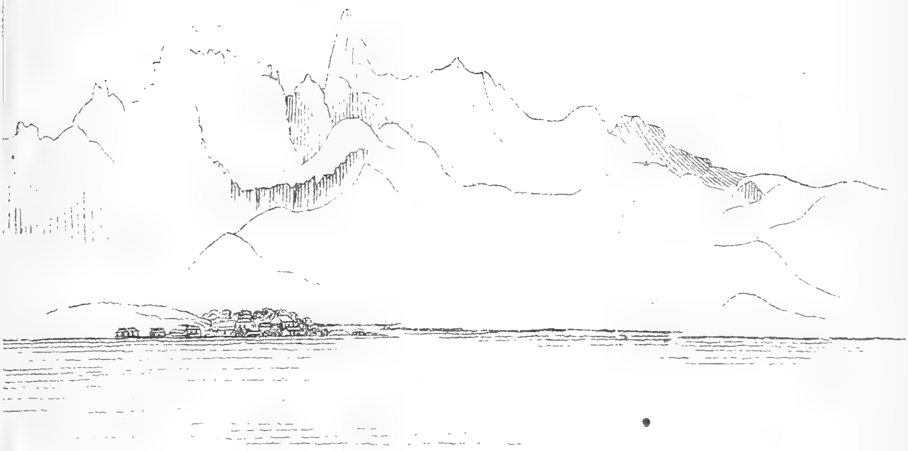
The island is of very irregular form, with several indentations in the coast, two of which are considerable bays, having each its little village, whilst the third and largest is the harbour. It is about twenty miles round, though, from the irregularity of its outline, it is difficult to estimate this exactly. The coast is bold, with no outlying reefs beyond half a mile.

The French have assumed the protectorate of it—on the ground, I believe, that it is a dependency of the Tahitian group—but looking, a day or two ago, at a recent French map of the world dedicated to the Emperor, I saw a circle described round the Society group as the limits of their protectorate. Now this line happens to be more than 300 miles distant from Rapa, and had we not established a station there, I fancy they would never have gone near it. But the French, having made an effort to induce the Company to adopt Tahiti as the half-way house, of course unsuccessfully, and hearing that we were in search of a place more in the track than Tahiti, fancied it must be at one of the Gambier Islands, lying considerably to the N.E. of Rapa, and included in the protectorate circle. Accordingly they sent a Resident there to watch our proceedings. Finding, after some time, that we did not appear there, but had selected Rapa for our port of call, the same Resident was sent to that island, in the early part of the present year, on board the French war transport "La Dorade." A few months previous to this, and subsequent to our appearance at the island, another French steamer, "La Touche Treville," called at the island. They make out for the first time that Rapa—though nearly, as I said, 300 miles out of the magic circle drawn by themselves round the Society group—belongs to the Tahitian protectorate. Some three months ago the French war steamer "La Touche Treville" called at the island, as I am informed, made nearly all the inhabitants drunk, and got the King, Tapanua (a most powerful toper), and two chiefs, Miroto (the man who betrayed the Tahitians to the French) and Eiton, to sign away the island to the French. This Eiton told me himself. Many of the influential chiefs, being absent, kept sober on the occasion, and deny the King's right to alienate any lands not his personal property. His dusky majesty having drunk all the rum, now begins to repent his bargain, and hopes the English will come to the island and preserve him from all intruders. The object of the French was, as one of their captains told us, simply to embarrass the operations of the Company, or they certainly would not incur an expense of about £600 per annum to watch our coaling merely.

It is only due to the supineness of the English Government that this fine harbour is not under their control; for, three years ago, on my representation, application was made to the Admiralty to send a man-of-war there. However, nothing was ever done in the matter.

The appearance of Rapa, as we approached in the "Ruahine," was very picturesque, with its sharp peaks thrust up, as it were, into the air through the irregular but more rounded forms of the mountainous hills of the island. The harbour lay just before us, with two coal ships securely moored about two miles off, there being, seemingly, no obstruction between us and them; but beneath the quiet-looking surface lay the treacherous reefs, which, difficult and dangerous as they are to approach heedlessly, form the security of the harbour. We stopped some time close to the entrance, waiting for the boat to come off, the captain prudently hesitating to enter lest the buoys might by accident have become displaced; and the event proved how wise this precaution was, for we found afterwards that one of the principal buoys had been driven, by a recent gale, quite across the channel. At length the expected boat came, with the captain of the Company's coal ship and a native pilot. We moved cautiously ahead, and very soon the bottom was clearly visible under us. Then we approached the entrance of the narrow, tortuous channel among the reefs, the rocks glistening just below the surface, ominously close to the ship at times. The captain and our two pilots were all on the *qui vive* as we threaded the crooked passage, appearing as a blue line amid the black and green patches of the reefs. It was with a feeling of relief we at length saw that we were safely through the lines of buoys, and found ourselves in the most romantic, snug harbour imaginable, the land rising on three sides like the walls of an amphitheatre, and protected by the reefs and a beacon islet on the fourth or eastern side, with the advantage of having fresh air from the open sea. Twenty ships might moor safely there, and small craft innumerable. The endless variety of form and colour around us was most enchanting. Near our anchorage was a very small village, rejoicing in thirty-one inhabitants; but further off, on the opposite side, was another larger village, which we call the capital—where the King and the French Resident live. We only regretted to see the French flag waving there instead of the English, and there is not the slightest doubt but that the natives would themselves have preferred it. It is perhaps matter of legitimate regret, that the simple manners and customs—the primitive feudal sway of the native chiefs—should be interfered with by either flag.

Our coaling, of course, was proceeded with at once, and the greater part of the passengers, anxious to escape for a while from their iron prison, gradually dispersed on shore; whilst those who remained made bargains with the natives for coral, tropic birds' feathers, bananas, &c. I began doing a little sketching, and after securing some of the very peculiar features of the land, my next object was to determine with a moderate degree of accuracy the height of the most prominent of the remarkable *aiguilles,*



HARBOUR AT RAPA ISLAND.

Capt. Vere Hall del.

which jut up in this curious island. This had never been done, and, previous to arrival, I had heard so many different guesses at the height of the Rapa peaks, varying from 400 to 1,400 feet, &c., that I was the more anxious to arrive at something definite. The difficulty was to secure a sufficiently level space to measure a base line (not the most easy thing to do with precision, even under favourable circumstances). However, finding the shore was impracticable, I selected a spot on the beach, nearly in a line with the ship and the mountain. Then I ascertained the length of this in three ways. One by measurement from the chart, another by sound, and thirdly by the angle subtended by the ship's whole length, with sextant. The average of these gave me a tolerable base, and, of course, by the angles at each end of the same, and a little triangulation, I arrived at the height of the peak I selected, viz., 2,100 feet.

My short experience of the inhabitants, together with the testimony of others, gave me a very favourable impression of their peaceful simplicity of character and honesty. They number now only about 125 to 130 men, women, and children. Formerly it was thought, and indeed according to their own account, they were 1,200 to 1,500 in number; but it is said that internal wars in the first instance, and then the ravages of various epidemics brought amongst them, have reduced the inhabitants to the present limited number. They are, in appearance, a fine, manly, well-made race, and looked very Maori to me. The wonder is, that living as they do principally upon an esculent root called "taro," somewhat tasteless and insipid to us, with a scanty supply of meat and fish, they keep up so good an appearance.

The language generally, the names of the points of land, mountains, &c., seemed to my ear also very Maori-like. However, I cannot speak very positively on this head, as my Maori lore is not great. Almost the only word of Maori which I know (and that they tell me is wrong), is *Tenako.* Of course I tried the effect of this, but I was responded to by *Uronnah!* sounding very much like "Your honour," which I thought properly respectful and somewhat Irish.

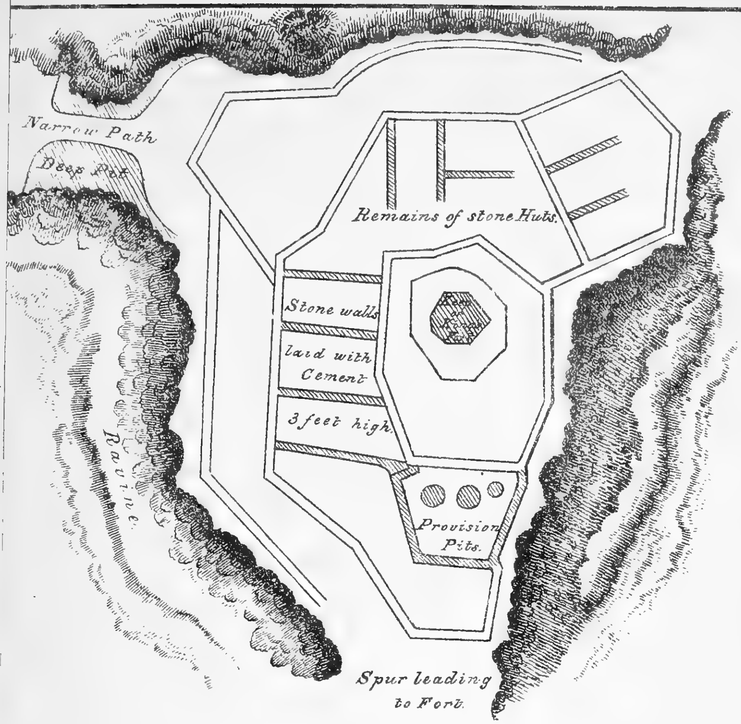
The climate of the island must be to a European very delightful, for, surrounded as it is by the sea, the temperature is very equable, and though close to the tropics, the thermometer seldom shows more than 75° in the height of summer. The weather, though mostly fine, is changeable, with occasional sudden showers, as might be expected from the effect of the high peaks arresting the clouds, and causing them to precipitate their suspended moisture. The winds are for nearly nine months of the year from S.E. to N.E., and westerly the remaining part; for of course, lying so near the tropic, the trade wind is swayed southward by the sun in the summer time

(November, December, January, and February), when the island is embraced by it, and left, in the winter, to the northern limit of the regular westerly current of air, which then extends more northerly.

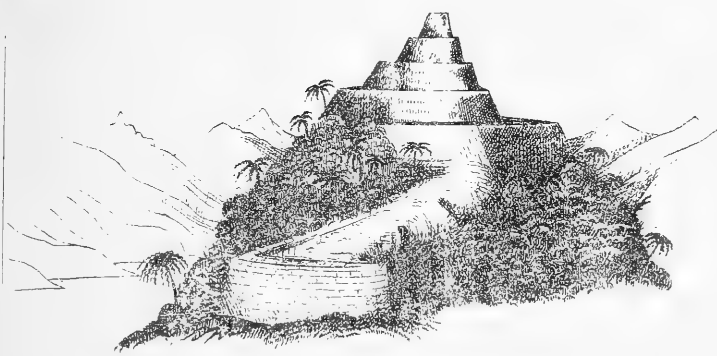
I have arranged with the Meteorological Department in England to make it a station for those observations, and very shortly the instruments will be there, so that Rapa may become a point of great scientific interest and utility. In fact, the Southern Pacific being an almost unknown sea to us meteorologically, the importance of this fixed station of Rapa, in conjunction with the observations on board the Panama ships and in New Zealand, cannot be too highly estimated. We have already a tide gauge there, showing the extreme rise and fall to be 2 feet 6 inches, and the establishment of the port, or time of high water after full and change, 12 hours 15 minutes. The wave which in August swept along these coasts was felt also at Rapa, indeed it partly washed away our coal wharf. There was also a slight earthquake—the impulse of which came from the south—coinciding very nearly in point of time with the disturbances felt here and those which have desolated Peru—all which effects confirm very significantly the sagacious predictions of our friend Dr. Hector, of the locality of the principal eruption. Further particulars, and more exact information relative to the time of those occurrences, will invest these phenomena with yet greater interest.

The peculiar, irregular forms of the land, with precipitous mountains and deep gullies, cause sudden gusts and eddies of wind in the harbour varying continually in direction, so that it is difficult to say exactly what wind is blowing outside, unless it happen to be from the eastward or directly in. There is a remarkable absence of surf, I am informed, which is not easily accounted for; my correspondent saying that "landing is easy anywhere, and boats can lie alongside precipitous cliffs exposed to a swell which rolls in unchecked for thousands of miles without breaking." I am quoting from a letter to me from our representative.

The resources and products of the island are at present but few in number or quantity, excepting perhaps goats, which abound, and are to be seen everywhere, delighting in the most inaccessible places, where, with a glass, their forms moving to and fro on some razor-edged mountain, stand out in relief against the sky. Small vessels occasionally take a cargo of them away to Tahiti. I was told that the Governor of that island had ordered the French Resident at Rapa to have them all destroyed; upon what enlightened principle it is difficult to say: but the Resident had too much good sense to comply with the order. The "Ruahine" had, the previous voyage, landed on trial some sheep, but they did not seem to thrive. A few pigs are procurable—good, but dear. There are a few fowls wild in the bush: some widgeon, and of course sea-gulls. There are no reptiles,



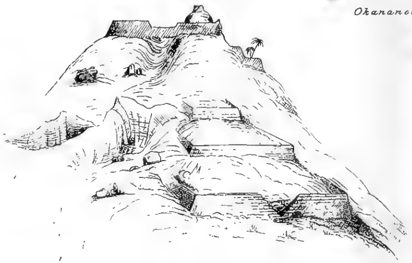
Ground plan of Native Fort



Markatea

Ancient Native Stone Fort on one of the Hills of Rapa.

The four Crowns (marked doubtful in the Chart) distance O.M. NE.½E. Rapa W by N½N distance 45 Miles.



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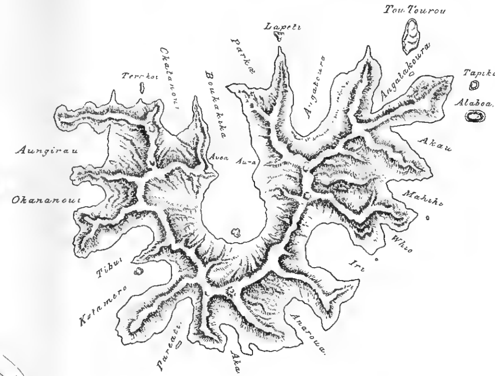
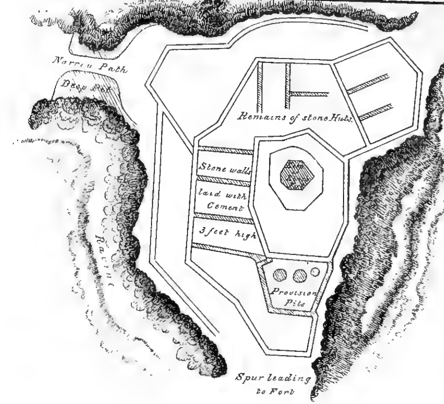
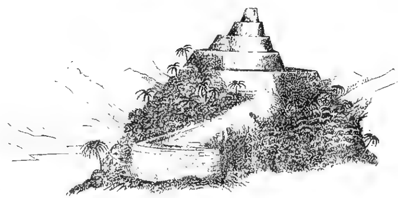


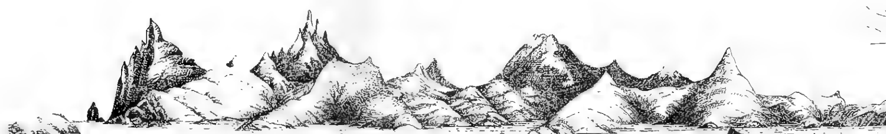
BIRDS EYE VIEW OF RAPA.



Ground plan of Native Fort



Markatea
Ancient Native Stone Fort on one of the Hills of Rapa



RAPA Lat. 27°37′ Long 144°12′W. THE ISLAND OF OPARA OR RAPA as seen at a distance of 6 Miles N.W. by N

although one of our passengers told me he had been in bodily fear of them all day, and his enjoyment had thus been very unnecessarily marred. Rats are very numerous. It is curious that when our coal ship first went there they were troubled with mosquitoes, though none were found on shore. They were, in fact, taken there in the ship, and have now disappeared. There is an abundance of fish, some very beautiful, especially the parrot and gold and silver fish; good mullet and some other kinds are readily procurable; of sharks, plenty.

The taro root, the chief support of the inhabitants, grows abundantly, but requires attention to its culture, as it will not grow without plenty of water. We left a quantity of English vegetable seeds, and we hope they will do well. Water-melons are plentiful and cheap; bananas grow well and are very good; oranges are produced, but of very poor quality; pine-apples also very inferior. The sugar-cane likewise grows well, and there were cocoa-nuts formerly on the island, but a blight destroyed them all some years ago. I could not ascertain if they throve well; but I believe the cocoa-nut tree is a great discerner of latitude, and will not flourish out of the tropics. Our representative told me he was very successful with his cabbages; tolerably so with maize; less so with his potatoes, doubtless owing, as he said, "to his ignorance of gardening."

Coal of a very inferior quality has been found in the interior: the natives use it occasionally for cooking, &c., but it is useless for steam purposes.

The land is generally covered with thick scrub and fern, showing here and there clear spaces of a kind of coarse grass which grows five or six feet high. There are a few beautiful flowering shrubs, and whilst the tree- and smaller ferns abound, trees of tolerable size are found in the northern part of the island, but only small ones near the harbour. The cultivation is limited because the requirements are so small; still, vegetation is most luxuriant, and the soil appeared to me of the richest kind. True, the level ground is comparatively of small extent, but there are many hundreds of acres which might readily be cultivated.

Religion.—Captain McKellar, our representative there, in one of his letters to me, says, "They are good Protestants, and firm haters of the French, or the 'Wee-wees' as they call them, and only await the arrival of a British ship of war to surrender their island to England. However, the French have been beforehand, and will stick to their protectorate, as they term it, but which in plain English means taking what they like and compelling the natives to work without paying for either. They have a king and half a dozen chiefs, but with little authority—in short, they live like one happy family, or did so before the French came."

In the "Ruahine" we were at Rapa two days nearly—the second of which being Sunday, it was not without interest to find the day strictly kept, and that, in that quiet place, it was sensibly quieter than the previous day. Women and men donned their best attire, and the former what little fineries they had to display. There is a building set apart as a church at each village, that at the larger one being in very good condition; but at our village, as per chart, of thirty-one inhabitants, it was in a sadly dilapidated state. Being on shore close to this, about seven in the morning, I heard some singing inside, and at once entered (stooping under the projecting thatch) by one of the numerous breaches—only too practicable—in the walls. At a sort of rude reading-desk was a native conducting the singing—he only having a book—a dull monotonous chant, in which the congregation (seated crouchingly on the rush-covered ground) joined. The congregation consisted of thirteen females of all ages, and two men, and although in the census of Rapa women are sadly in the minority, yet they have the advantage of being at a premium, and, as it seemed to me, had the privilege of doing the religion for their husbands. The service was very simple, consisting of reading, singing, prayer, and an address. The Bible used was that translated by the missionaries at Tahiti and printed in England. I was told that the people of the larger village had, not long ago, managed to purchase an harmonium for their church, and waited for the lucky chance of some one coming in due time to play it.

In the afternoon I was on shore again near the same spot, and hearing a bell ringing continuously, I found it was the summons for church. Almost at the same time a horn was blown at the opposite village—the capital—as their summons also to afternoon service.

There are curious remains of apparently fortified places at Rapa, said to be the defences of the earlier warlike times. On the summits of many of the steep hills are to be seen these square fortresses, some of very elaborate construction; but what is very singular, they are mostly solid within. The stones are well squared, of very large size, and well cemented. Around or on the top of one in the interior are still the bones and skulls of a number of warriors to be found, who, they say, were starved out by their opponents. I regretted much that I had not time to make an exploration of those and other places myself. I felt I could have readily stayed a week on the island, with plenty of interest and amusement. Indeed, one enthusiastic young lady, to whom, before our arrival, I was jokingly suggesting the possibility of being wrecked going in, with the alternative of living in tents and doing a little of primitive life while waiting for the next steamer said, "she should enjoy it beyond measure." However, we were not indulged in this, but our visit was a great break to the voyage, and I think we all enjoyed the novelty of the scene and the quiet retreat very much.

I may just mention that the remarkable group of rocks called the "Four Crowns," and which on many charts are marked doubtful, not only exist, but may be seen on a clear day from Rapa, some forty miles off.

The French Resident, Mons. Caillet, gave me one piece of information which is generally interesting, and to navigators, valuable. It is that Easter Island, the natives of which have hitherto been found fierce and treacherous, rendering any attempt at communication dangerous, may now be visited without apprehension, and supplies obtained. This happy change has only recently been effected by the influence of some courageous and benevolent French priests, who ventured upon the difficult task of endeavouring to civilize these hitherto savages.

But the coaling is done, the signal gun is fired, and the "Ruahine," by the fiercely blowing-off steam, seems impatient to be away again; so the stragglers get on board, with their spoils of coral and fern, &c., we cast off from the hulk, and with captain and pilots once more at their posts, we move slowly ahead towards the sinuous pathway amid the reefs, and which, at a distance, is only indicated by the buoys on either side of it, looking like small red spots on the north of the channel, whilst black ones mark the limit of safety on the south side.

I took my post in the fore-top, that I might the better see the reefs mapped out, as they beautifully were, below and around us. The light gleams again on the scarcely covered rocks, here and there, which we have to pass, and the general interest in this short but intricate bit of navigation is greater than ever. We at length pass between the last of the black and red buoys, and are once more in clear water. We bid adieu to our skilful pilots, their boat returns to the harbour, we again go "full speed ahead," and then have a capital view of this interesting little island as we sail and steam round it.

It was a beautiful sight watching the many varied and varying forms, and tints of colour, too, of the needle-like peaks and crags, and deep valleys, with their exuberant vegetation, and here and there a dark precipitous cliff, having a sparkling stream of water, like a silver thread, running down its face. But we rapidly left behind this our last stopping-place, becoming very soon too distant for us to admire any more; and Rapa at length melted away from our view, absorbed in the purple haze of sunset, leaving us to turn our thoughts, hopes, and expectations exclusively to New Zealand.

ART. IX.—*Notes on Plants observed during a Visit to the North of Auckland. April*, 1868. By T. KIRK.

[*Read before the Auckland Institute, 4th May*, 1868.]

THE beaches and landing-places at the Kawau show traces of the traffic formerly connected with its copper mines in the many introduced plants which have become naturalized — *Chenopodium*, *Polycarpon*, *Coronopus*, *Erysimum*, *Amaranthus*, *Portulaca*, and many other genera which follow the footsteps of man, are most abundant. The fine evergreen beech *Fagus fusca* finds here its northern limit; *Sapota costata* attains larger dimensions than usual, one fine specimen having a trunk nearly 5 feet in diameter, its branches reaching the height of 60 feet. A *Pittosporum* (*P. intermedium*, Kirk) having the much branched, twiggy habit of *P. tenuifolium*, with leaves which scarcely differ, except in their larger size and stouter petioles, has much larger capsules on longer peduncles, which are terminal, and usually solitary; capsules 2- to 3-valved, globose, acuminate. As with other Pittosporæ to be mentioned in this paper, flowering specimens will be required before its position and specific value can be satisfactorily determined. A small umbelliferous plant, *Apium leptophyllum*, F. Muell., (*Helosciadium leptophyllum*, DC.), is found on and near a forest track in the interior, and might be considered indigenous were it not for its occurrence with naturalized plants at the Bay of Islands, which suggests the propriety of further examination before adding it to the list of native plants. It was not, however, observed on the Kawau beaches, where naturalized plants are so common, and where it would have been most likely to occur had it been introduced. It is easily identified by the narrow, almost capillary, segments of its small leaves, and numerous small, axillary, and terminal umbels of minute white flowers and small fruit. A native of Eastern Australia and South America, easily overlooked from its small size and inconspicuous habit.

A *Pittosporum* (*P. ellipticum*, Kirk) differing from any described species was found on Mount Manaia. A small erect tree, 25 feet high, with black bark, branchlets very short, stout, puberulous, ascending, leaves close set, ovate-lanceolate or elliptic-lanceolate, coriaceous, with the midrib curiously flattened beneath, acute or obtuse, partially clothed with ferruginous pubesence beneath, petioles $\frac{1}{3}$ inch long, stout, erect; flowers not seen; peduncles terminal, usually solitary, stout, $\frac{1}{2}$ to $\frac{3}{4}$ inch long, decurved. Capsules 2-valved, ovate, acuminate at both ends, with slightly flattened sides, valves faintly 2-lobed, granulated, tips erect. Allied to *P. crassifolium*, but differing in habit and foliage, in the 2-valved acuminate capsule, and the smaller seeds. An undescribed *Coprosma* is found here, and is probably identical with a tree found by Mr. Colenso at Waipu; observed also in the

Hunua, Kaipara, and elsewhere, but only immature fruit obtained. Height, 20 to 40 feet, branches fastigiate or widely spreading, leaves not fetid, ovate, obtuse, rarely apiculate, suddenly narrowed into a winged petiole, purple beneath; fruit in small clusters, in the immature state, white and nearly transparent, veins distinct, reticulated, bark dark brown.

Near the summit of the mountain a *Celmisia* with rather broad leaves was collected. The leaves are covered above with a thin pellicle, below with dense white tomentum. It is perhaps allied to *C. monroi*, an alpine species not hitherto recorded in the Northern Island, but flowering specimens will be required before its identity can be ascertained. The only noteworthy plants on the summit of the highest peak were *Pomaderris edgerleyi* and *Angelica rosæfolia*.

At the Bay of Islands, an *Elatine*, with the leaves mostly sessile and slightly serrate, was obtained. It is probably a form of *E. americana*. The serratures become partially obliterated under pressure. A solitary specimen of *Prasophyllum pumilum* was picked, and other plants well known to the locality. Naturalized plants are found in great abundance at Kororarika; thirty species may be collected in a five minutes' walk.

On cliffs in the Cavalhi passage, at Whangaroa, and various points on the extreme northern coast, *Ipomæa tuberculata* displayed its erect, showy, bright purple flowers and 5-foliate leaves in the greatest abundance. It is more attractive than many of its cultivated congeners, and would prove a welcome addition to the garden. In the "Handbook of the New Zealand Flora" it is erroneously described as having rosy-red, drooping flowers.

At Matauri Bay, the introduced *Œnothera stricta*, so frequent on the volcanic hills about Auckland, forms a compact turf on the sands, just beyond high watermark. Many other plants are naturalized here.

At Whangaroa, a fine Taxad, originally discovered in the north by Mr. Colenso, and more recently in this and other localities by Dr. Hector and Mr. Buchanan, was identified with a tree lately observed on the Great Barrier Island, and which has been confused with *Dacrydium colensoi*. The Whangaroa specimens are of somewhat larger size than any observed on the Great Barrier, some of them having trunks nearly 4 feet in diameter, and attaining the height of 80 feet. Many of the clusters of seeds have their receptacles lined with a bright orange-coloured alveola, in which the faintly-ribbed nuts are imbedded: the receptacles destitute of this curious lining were invariably filled with nuts of a lesser size.

The wood of this tree is extremely durable. Mr. Bell, of Whangaroa, stated that round stems, the thickness of a man's arm, driven into the river-bed at Waimate as palisades to a native pa, eighty years ago, were still perfectly sound.

Many other plants of interest were collected at Whangaroa. A fine new *Melicytus* attains the height of 15 feet, with glossy, laurel-like leaves 4 to 6 inches long, apparently identical with a form observed in the Hunua and other districts, where it forms a remarkable object when in flower, the flowers being densely crowded on the branches in fascicles of from 5 to 12 for the length of a foot or more, perianths large, campanulate, fleshy; berries large, changing from white, through purple and violet, to black, as they approach maturity. A curious and interesting *Panax*, allied to *P. lessonii*, unites the simple and compound-leaved sections of the genus. As a shrub or small tree it attains the height of 10 to 15 feet, with whitish bark, leaves of two kinds, intermixed; 1-foliolate on petioles, ½ to 2 inches long; lamina, 1½ to 2 inches; ovate-acuminate; 3-foliolate on petioles 3 inches long, leaflets sessile, 1½ to 2½ inches long, ovate-acuminate or ovate-lanceolate, both forms distantly serrate, coriaceous, petioles exstipulate. Flowers not seen, umbels terminal, of 3 to 5 slender rays, fruit globose, racemed, styles 5. Another undescribed *Pittosporum* (*P. ellipticum*, Kirk, *var. ovatum*) was obtained here. An erect tree, 20 to 30 feet high, with spreading, obovate, obtuse, coriaceous leaves, 1½ to 2 inches long, pubescent beneath. Flowers not seen, peduncles solitary or in 2- to 4-flowered terminal umbels, stout, ½ to ¾ inch long, pubescent, capsules globose, clothed with ferruginous down, 2-valved. An undescribed *Pittosporum*, (*P. virgatum*, Kirk), with the globose capsules and short peduncles of *P. colensoi*, but terminal, and frequently in 2- to 4-flowered umbels, instead of solitary and axillary, and differing in all other respects, is found on high ranges, and is precisely identical with a slender tree found on the Great Barrier. *Panax anomalum*, *Libocedrus doniana* were also collected. Many noble specimens of *Dracophyllum latifolium*, 30 feet high or more, were observed; and one of *D. squarrosum*, 25 feet, contrasting strongly in recollection with the diminutive specimens, some 3 to 4 feet high, which are not unfrequent in the vicinity of Auckland. The normal form of *Haloragis tetragyna*, Labill., was found sparingly, although long past flowering. In exposed rocky habitats it formed a small, compact, erect bush, 2 feet high; but amongst fern it assumed the prostrate habit of the var. *diffusa*, still, however, preserving the long and sharply-toothed leaves without modification. *Colensoa physaloides*, which was first discovered here, is not unfrequent, and attains a large size, its leaves being sometimes met with a foot long or more.

Many naturalized plants abound at Mongonui, the most conspicuous being *Asphodelus fistulosus*, *Solanum virginianum* (?), *Scabiosa atropurpurea*, and above all, *Verbena officinalis*, which covers large patches of ground with a dense vegetation 4 to 5 feet high. Two solitary specimens of *Prasophyllum* *pumilum* were obtained here, and another new *Pittosporum*, belonging to a different section of the genus to the forms already noticed.

Pittosporum gilliesianum, n.sp., a small shrub 1 to 3 feet high, with slender branches, leaves linear-lanceolate, acute, rarely obtuse, densely crowded, entire, slightly membranous, erect or spreading, scarcely petioled, $\frac{3}{4}$ to $1\frac{1}{4}$ inch long, $\frac{1}{16}$ to $\frac{1}{8}$ inch wide, branches and leaves downy when young. Flowers terminal in small clusters of 3 to 6, rarely solitary; peduncles very slender, $\frac{1}{4}$ to $\frac{3}{8}$ inch long, clothed with incurved hairs, 1-flowered; sepals subulate, with membranous margins, finely hairy; petals subulate, reflexed, slender, yellow with a purple stripe down the middle; capsules erect, ovoid-acuminate, or conical, not compressed, downy, 2-valved, valves membranous, at length deciduous, the nuts usually retaining their position on the peduncle long after the valves have fallen, tips of the valves straight.

The branches are rarely whorled; a singular and unique specimen picked by Mr. Gillies has the branches dichotomously whorled, with capsules in the vortices of the secondary whorls. It is allied to *P. reflexum*, from which it differs in the peduncles being uniformly 1-flowered in the erect clustered peduncles, which are never compressed or have the tips recurved.

I have named this interesting plant in compliment to my esteemed friend T. B. Gillies, Esq., who was my companion at the time of its discovery, and at whose suggestion and partly by whose advice the excursion was undertaken.

The country between Parengarenga and Spirits Bay is for the most part of an uninteresting character. *Pomaderris edgerleyi* and *Prasophyllum pumilum* were observed sparingly in several distant localities, and a showy *Hibiscus*, with very large bright yellow flowers, was abundant in Spirits Bay. This plant is not mentioned in the "Handbook," but I am informed it was originally discovered by the Rev. W. Taylor and Mr. Colenso many years back. It may have been introduced by a vessel wrecked on the coast. At Tapotopoto Bay a dwarf *Melicytus*, allied to *M. macrophyllus*, and identical with a plant picked on Mount Camel by Mr. Buchanan (found also on the Great Barrier), was collected. *Coprosma petiolata* (?) and a procumbent species allied to *C. cunninghami*, but without flower or fruit, were found on the sands, also *C. baueriana* and *Sapota costata*.

A diminutive form of *Gleichenia flabellata* formed large patches amongst the stunted *Leptospermum* which clothed the hill sides and elevated open ground, and the rare *Todea africana* was abundant in open but sheltered gullies between Hooper's Point and Parengarenga. Its rigid character made it of easy recognition at some distance, and reminded one forcibly of the European *Osmunda*, to which it is nearly allied.

Perhaps no part of the island has been so closely examined for plants as the district between Whangarei and the North Cape. It is, therefore, not improbable that some of the forms which I have attempted to discriminate in this paper may have been observed by other botanists, although I am ignorant of such observations having been published.

Art. X.—*On the Botany of the Great Barrier Island.* By T. Kirk.

The Great Barrier Island presents but few physical features calculated to exercise a marked influence on the character of its flora: the central and northern parts of the island are excessively broken into deep gullies and ravines, by the low mountain ranges which intersect them in various directions, nearly the whole of which are covered with forest to their highest peaks, 2,300 to 2,400 feet, leaving but small patches of open country. The hills in the southern part of the island are of much lower elevation, and there is a larger extent of fern land. Much of the land, however, is of barren quality, and, on the whole, offers a less varied vegetation than in the north.

On the eastern coast there is a considerable tract of sand dunes and swamps, where a few peculiar plants may be found.

The general character of the bush greatly resembles that of the main land north of Auckland, its chief points of difference being the scarcity of the Tarairi, *Nesodaphne tarairi,* and the great abundance of *Panax sinclairii,* which is found from the sea level to the crests of the ranges. The prevalent trees are *Nesodaphne tawa, Dammara australis, Persoonia toro, Weinmannia silvicola, Dacrydium cupressinum, Metrosideros lucida, M. tomentosa, Leptospermum ericoides, Vitex littoralis, Corynocarpus lævigata, Elæocarpus dentatus, Dysoxylum spectabile, Knightia excelsa,* &c., &c., with the arborescent ferns *Cyathea medullaris* and *C. dealbata.*

On the higher parts of the ranges, *Ixerba brexioides, Dacrydium colensoi, Dacrydium,* n.s., *Phyllocladus glauca, Epacris sinclairii* (which here attains the height of 12 feet), *Metrosideros albiflora, Olearia,* sp., and *Dracophyllum latifolium,* are chiefly found. *Archeria racemosa,* which is supposed to be peculiar to the island, is very local, and only found between 800 and 2,000 feet of elevation.

Most of the ordinary sand plants are found on the eastern coast: *Convolvolus soldanella, Desmoschœnus spiralis, Spinifex hirsutus, Coprosma acerosa,* are abundant; as is also the naturalized *Raphanus sativus. Atriplex billardieri* and an undescribed [*Melicytus*] *Hymenanthera* with finely reticulate leaves are also found here.

A very few species of plants form nearly the whole of the vegetation of the extensive swamps on the eastern coast: *Cladium glomeratum*, *C. teretifolium*, *C. junceum*, *C. articulatum*, *Typha* "*angustifolia*," *Gleichenia circinata*, *Drosera binata*, *Lomaria procera*, *Schœnus*, n.s., *Eleocharis sphacelata*, *E. gracilis*, *Sparganium simplex*, *Triglochin triandrum*, with three or four orchids or other small plants, and occasional tufts of *Phormium tenax*, comprise the whole.

In the immediate vicinity of the Hot Springs, in the centre of the island, *Gleichenia flabellata*, *Pteris incisa*, and *Paspalum scrobiculatum* attain a high degree of luxuriance—the ferns being frequently from 5 to 7 feet in height when growing close to the stream, but at a few yards' distance may be seen in their ordinary condition.

Of about four hundred species of indigenous plants collected on the island, fully two-thirds are of general distribution, the remainder being confined to the higher parts of the ranges, paludal, arenarian, or of extremely local distribution, from causes unknown.

But little has been done in the way of utilizing the vegetable productions of the island. The Kauri is almost entirely confined to the district in which the palæozoic rocks occur, only isolated trees or small clumps being found south of the Hot Springs. On the eastern side it could only be got out of the forest with great difficulty; but at Wairahi and Kaiarara it can be procured with comparative ease, and has been largely cut to supply the saw-mills of the Great Barrier Company. The Pohutukawa, (*Metrosideros tomentosa*), so valuable for ship timbers, has scarcely been used except for firewood, although it is most abundant and attains unusual dimensions. *Vitex littoralis* and *Leptospermum ericoides* have been largely cut for fencing and firewood, and are now becoming comparatively scarce in some districts. The bark of the Towai (*Weinmannia silvicola*) does not appear to have been collected for tanning purposes, although it is abundant in many places, with other trees whose bark might also be applied for tanning or dye uses.

The following plants appear to find their south limit on the island:—

Metrosideros diffusa.
Pisonia umbellifera.
Gleichenia flabellata.

The following appear to reach their northern boundary here:—

Panax [*sinclairii*] *discolor.*
Celmisia longifolia.
Vittadinia australis.
Olearia [sp.] *apetala.*
Utricularia [sp.] *novæ-zealandiæ.*
Phyllocladus glauca.

Prasophyllum colensoi.
Microlæna polynoda.
Hymenophyllum lyallii.

Ozothamnus glomeratus, usually found on dry hills, is most abundant at the sea level, but has not been observed above 1,600 feet.

Hymenophyllum lyallii attains its greatest elevation, 2,000 feet.

Loxsoma cunninghamii observed slightly under 1,000 feet.

Naturalized plants are found in abundance from the sea level to the crest of the ranges. Nearly one hundred species were identified, only one of the number, *Nepeta cataria*, which is abundant at Whangapurapura Bay, not having been previously seen on the main land. In some localities, *Cyperus ustulatus*, and one or two plants of equally coarse growth, are the only forms able to hold their ground against the mallows, chamomile, thistle, docks, and grasses of the northern hemisphere.

New or Critical Species, Variations, etc.

Clematis indivisa, Willd.—A form with decompound leaves is not uncommon.

[*Melicytus* ?] *Hymenanthera latifolia*, var. *tasmanica*.—A dwarf bush or straggling shrub, 2 to 10 feet high. Leaves close set, obovate, narrowed into rather stout petioles, 2 to 3 inches long, distantly crenate, or serrate, finely reticulate on both surfaces; peduncles in axillary fascicles, $\frac{1}{4}$ to $\frac{3}{8}$ inch long, with two minute opposite bracts about the middle, erect or decurved; calyx persistent, 5-lobed; lobes obtuse; fruit nearly globose, tipped with the remainder of the style, 2-seeded; flowers not seen.

Originally discovered in the Northern Island by Mr. Colenso; possibly a form of *M. macrophyllus*.

Pittosporum [n.s.] *huttonianum*, n.s.—A somewhat irregularly-branched shrub or small tree, 12 to 25 feet high, with black or dark brown bark; young branches slender, and with the leaves and petioles clothed with white floccose tomentum; leaves alternate, oblong or ovate, obtuse or acute, rarely acuminate, 3 to 5 inches long, slightly coriaceous when old; petioles slender, $\frac{1}{2}$ to $\frac{3}{4}$ inch long; flowers not seen; peduncles very slender, erect, $\frac{1}{2}$ to $\frac{3}{4}$ inch long, solitary, axillary, downy, rarely on a short leafy pedicel; capsules 2- to 3-valved, downy.

Very distinct from any described New Zealand species.

Pittosporum [n.s. ?] *virgatum*, n.s.—A slender tree, 20 to 25 feet high; branches twiggy; leaves alternate, lanceolate, or ovate, or obovate, acute, margins entire, or irregularly crenate, or sinuate, or variously lobed; leaves and young branches clothed with silky ferruginous hairs on both surfaces; flowers not seen; peduncles very short, coarsely pubescent, terminal, solitary, or two or three together; capsules small, globose, downy, 2-valved; valves 2-lobed, granulated on both surfaces.

Allied to *P. colensoi* by the globose capsule and short peduncle, which are, however, terminal and pubescent; differing in all other respects.

Pittosporum [n.s.?] *kirkii*, H.f., n.s.—A handsome, laxly-branched shrub, 8 to 15 feet high, without flower or fruit, but differing widely in habit and foliage from any described New Zealand species of this genus, was observed at an altitude of 1,600 to 1,800 feet; branchlets stout, bark red-purple, leaves alternate or whorled, crowded, ascending, narrow, linear-obovate, acute or obtuse, 2 to 5 inches long, gradually narrowed into rather broad purple petioles, excessively coriaceous, pale green on both surfaces, glabrous, with mid-rib stout, and prominent beneath.

Pittosporum crassifolium, Banks and Sol.—This is a common tree on the coast, with invariably terminal, solitary, *decurved* peduncles; and very large fruit with somewhat concave valves. I have seen no other form north of Auckland, except on the Little Barrier Island, where a spreading bush with terminal, umbellate, *erect* peduncles, appears to be confined to a solitary habitat. This plant bears exposure well, and is worthy of a place in every shrubbery.

Pittosporum umbellatum, Banks and Sol., *var.?*—A small tree, which in the absence of flowers may be referred to this species, is found in the northern part of the island, and may be readily distinguished by its narrow leaves, which are sharply tapered downwards, and by the truly cordate capsules, the valves of which are not lobed. The capsules of *P. umbellatum* have the valves excessively *lobed*, and produced so as to give a square outline with concave sides.

Lepidium [?] *oleraceum, var.*—A much-branched plant, 1 to 2 feet high, branches and root stock stout, leaves 1 to 2 inches long, narrowed into petioles, fleshy, linear-spathulate, deeply incised at the tips. Flowers numerous, tetrandrous, pods ovate, cordate, keeled at the back, and finely reticulate.

Leptospermum ericoides, A. Rich, *var. pubescens.*—A prostrate or sub-erect shrub, sometimes 3 feet high, at others appressed to the rock, like an alpine plant; leaves more or less pubescent and ciliated; flowers fragrant, produced in immense profusion, sometimes concealing the leaves; pedicels and calyx downy. This would make a valuable bedding plant for the culturist. It was originally observed on the island by the late Dr. Sinclair, but I am not aware of its occurrence elsewhere.

Metrosideros ?—A striking plant belonging to this genus, but without flower or fruit, occurs in the central parts of the island, usually a small bush, not exceeding 20 feet in height, with straight ascending branches, and smooth light-brown bark; leaves elliptic-lanceolate, acuminate, excessively coriaceous, and clothed, when young, with long silky hairs. A solitary specimen of large size made a forcible contrast, from its long straight branches and pendulous branchlets, with *M. lucida*, which grew in close proximity.

Fuchsia [*procumbens*, R. Cunn., *var.?*] *kirkii*, H.f., n.s.—A procumbent plant, which is doubtfully referred to this species, has rounded ovate-cordate leaves, on long petioles; flowers [large] *erect*, $\frac{3}{4}$ inch long, axillary; calyx tube bright yellow, with reflexed segments; anthers oblong; ovary ovate; stigma 4-lobed.

Hydrocotyle, n.s.—A stout, erect plant, pilose, 6 to 10 inches high; leaves large, coarsely crenate, 5- to 7-lobed with an open sinus; petioles stout; peduncles longer or shorter than the petioles; stipules large, membranous; umbels, 8- to 15-flowered. Fruit large, compressed; carpels slightly keeled with 2 ribs on each face.

Allied to *H. novæ-zealandiæ*, from which it is distinguished by its large size, stout erect habit, many-flowered umbels, and large keeled fruit.

Olearia [?] *allomii*, n.s.—A small shrubby form, usually from 3 to 15 inches high (rarely 2 feet), much branched from the base, allied to *O. haasti*, but differing in its remarkably dwarf habit, uniform oblong keeled leaves, which are close set and excessively coriaceous, and in the loosely imbricated scales, which are usually acute and downy; florets of the ray about 8, very broad, white; achenes downy; pappus brown, spreading.

Senecio ?—A remarkable plant, resembling a branched *Sempervivum* in habit and colour, appears to be confined to the palæozoic rocks in the north part of the island; flowers not seen; leaves crowded, succulent, obovate, sometimes 2 inches or more in width, with a few irregular obtuse serratures, narrowed into slender petioles. The ordinary broad-leaved form of *S. glastifolius* is frequently found growing with it, and offers a marked contrast in habit and colour of foliage. Still, although so widely different in appearance, they may prove forms of the same species.

S. glastifolius is found in all parts of the island, and from its noble corymbs of large white flowers, tipped with rose, ought to find a place in every garden. It is erroneously represented on t. 39, "*Fl. N. Z.*," i., with yellow rays.

Sapota costata, A. DC.—An abundant tree in the northern part of the island, but always found close to the sea, and rarely seen at an elevation of more than 100 feet. The fruit is oval in shape, and contains three nut-like seeds when perfect: sometimes the berry is clavate, and presents an abortive appearance from the non-development of one or two of the nuts. Flowers open, not globose, corolla lobes twice as long as the sepals. Wood very hard and heavy. The seeds are said to have been formerly worn as necklaces by the chiefs. Native name on the Great Barrier, *pau*—a favourite food of pigeons.

Olea [n.s.?] *apetala*, Vahl.—A very handsome umbrageous shrub or small tree, 12 to 25 feet high; branches spreading, often tortuous; bark brown, sometimes deeply furrowed and corky; leaves opposite, 3 to 4 inches long, 1 to 2½ inches wide, ovate, acute, or acuminate, very coriaceous and glossy, midrib prominent, and with veins distinct beneath; racemes of female flowers stout, 1 to 1½ inch long, spreading, 12- to 18-flowered, flowers on rather long pedicels; male flowers not seen. The foliage of this fine species greatly resembles that of *Camellia japonica*, and differs widely from its nearest ally, *Olea cunninghamii.*

Utricularia ?—A small species, allied to *U. novæ-zealandiæ*, but differing in the 3-nerved linear, spathulate, entire leaves, and in the 1- or rarely 2-flowered scapes, which have four minute bracteoles, arranged cross-wise at the base of the peduncle; sepals very broad, inflated, entire, upper lip of corolla rounded, waved, lower tip fan-shaped, but the margin flattened in the middle, entire; seeds rugose.

Veronica ?—This is a fine shrub, apparently intermediate between *V. ligustrifolia* and *V. parviflora*, sometimes attaining the height of 15 feet or more, with the stem measuring 2 feet 8 inches in circumference, and producing its small dense-flowered racemes in the greatest profusion; leaves linear-lanceolate, sessile, flat or keeled; racemes scarcely longer than the leaves; sepals small, acute, with membranous margins; corolla small, white; capsules more than twice the length of the calyx.

Astelia "*grandis*," H.f., n.s.—A noble plant, imperfectly described, and referred to "*A. nervosa*, or a near ally," in the "Handbook of the New Zealand Flora," p. 744.

Astelia [n.s.] *trinervia*, n.s.—Allied to *A. banksii*, but readily distinguished by the triple nerve on each side of the leaf, and by the crimson fruit.

Dacrydium, n.s.—A diœcious tree, 40 to 60 feet high or more, 2 to 3 feet in diameter; bark reddish brown, slightly flaky; wood red, durable; branches spreading below, fastigiate above. Leaves of two kinds: on immature trees, and frequently on the lowest branches of old trees, up to 40 feet high, linear-lanceolate, 1 to 1½ inch long, distichous or scattered, narrowed into a very short petiole; costa slender, acute, not pungent. Small leaves broad, rhomboidal, membranous on the upper edge, densely imbricated, and appressed to the terete branchlets, $\frac{1}{12}$ to ¼ inch long. Male catkins sessile, terminal, solitary, ⅛ to ¼ inch long, of minute, loosely imbricated scales; anthers not seen. Female catkins terminal, solitary, ¼ to ½ inch long, of few tumid green scales, ultimately bearing 2 to 5 faintly-ribbed compressed nuts, with rounded edges.

I am informed that this was one of the many good things originally discovered in the Northern Island by Mr. Colenso, and more recently by Dr. Hector and Mr. Buchanan, but I am ignorant how far these gentlemen may agree on the question of its distinctness from *D. colensoi*, with which it has been confused, and from which it differs (according to the description of that species in the "Handbook of the New Zealand Flora") in its larger size, red wood, large linear leaves (which greatly resemble a *Picea*), in the appressed small leaves, and in the aggregated faintly-ribbed nuts, which are uninverted in all stages of growth.

Phyllocladus glauca, n.s.—A remarkably distinct and handsome diœcious tree, 20 to 30 feet high, rarely higher, sparingly branched, branches often whorled, very stout. Phyllodes distichous or scattered, 1 to 3 inches long, often arranged in a rachis 6 to 12 inches long, and thickly clustered at the tips of the branches, broad, excessively coriaceous, with large coarse teeth, or waved or lobed, margins slightly recurved: male catkins 1 inch long, on stout erect peduncles, 1 to $1\frac{1}{2}$ inch long, thickly set amongst the recurved scales and phyllodes at the tips of the branches; receptacles aggregated in shortly-stalked rounded clusters of from 5 to 18, the size of a hazel nut, with a minute scale on the rachis, or more rarely a depauperated phyllode; usually distichously arranged, in from 6 to 16 clusters on a main rachis, with or without one or more phyllodes at the apex. Nuts from 5 to 18 on each cluster, rounded on the back and polished, with compressed edges. A very distinct species: certainly the most handsome of the New Zealand pines. Fruiting specimens, collected at the sea level at Omaha, were forwarded to Dr. Hooker somewhat more than a year ago. He at once indorsed the collector's opinion as to its distinctness, although its diœcious character was not even suspected at that time, and is only established by the present specimen from the Great Barrier, where it occurs at an elevation of 2,000 feet.

Schœnus [n.s.] *tenuis*, n.s.—A slender-growing species, apparently intermediate between *S. tendo* and *S. pauciflorus*, is found on several places on the island and elsewhere, but specimens have not been procured in a fit state for description.

Gahnia [?] *pauciflora*, n.s.—A plant apparently allied to *G. procera*, is found in woods, height 1 to 3 *feet*, sparingly branched, branches pendulous; nut very large, shining, red, transversely grooved within.

Gahnia ebenocarpa, H.f.—Imperfectly described in the "Handbook" as *G. xanthocarpa*, often attaining the height of 9 to 12 feet, with long involute leaves and drooping branches, nuts large, black, transversely furrowed within. A noble lawn plant.

CATALOGUE OF PLANTS OBSERVED ON THE GREAT BARRIER ISLAND.

Clematis indivisa, *Willd.*
,, ,, *var.*
,, fœtida, *Raoul.*
,, parviflora, *A. Cunn.*
Ranunculus plebeius, *Br.*
,, australis, *Benth.*
Drimys axillaris, *Forst.*
Stellaria parviflora, *Banks and Sol.*
Nasturtium palustre, *DC.*
Cardamine hirsuta, *Linn.*
,, stylosa, *DC.*
Lepidium oleraceum, *Forst.*
,, *sp.*
Melicytus ramiflorus, *Forst.*
Hymenanthera latifolia, Br. var. tasmanica.
Pittosporum tenuifolium, *Banks and Sol.*
,, *huttonianum, n.s.*
,, *virgatum, n.s.*
,, crassifolium, *Banks and Sol.*
,, umbellatum, *Banks and Sol.*
,, ,, *var. cordatum.*
,, eugenioides, *A. Cunn.*
,, cornifolium, *A. Cunn.*
,, *kirkii, Hook. f.*
Hypericum japonicum, *Thunb.*
Plagianthus divaricatus, *Forst.*
Hoheria populnea, *A. Cunn.*, *a* and *b.*
Hibiscus trionum, *Linn.*
Entelea arborescens, *Br.*
Aristotelia racemosa, *Hook. f.*
Elæocarpus dentatus, *Vahl.*
,, hookerianus, *Raoul.*
Linum monogynum, *Forst., a.*
Geranium carolinianum, *Linn., a, b,* and *c.*
,, microphyllum, *Hook. f.*
,, molle, *Linn.*
Pelargonium clandestinum, *Willd.*
Oxalis corniculata, *Linn.*
,, ,, *b.* stricta, *Linn.*
,, ,, *d.* ciliifera, *A. Cunn.*
Phebalium nudum, *Hook.*
Melicope ternata, *Forst.*
,, simplex, *A. Cunn.*
Dysoxylum spectabile, *Hook. f.*
Pomaderris phylicifolia, *Lodd.*
Dodonæa viscosa, *Forst.*
Alectryon excelsum, *DC.*
Corynocarpus lævigatus, *Forst.*
Coriaria ruscifolia, *Linn.*
Carmichælia australis, *Br.*
Clianthus puniceus, *Banks and Sol.*
Sophora tetraptera, *Aiton.*
Rubus australis, *Forst., a, b,* and *c.*
Acæna sanguisorbæ, *Vahl.*
Quintinia serrata, *A. Cunn.*
Ixerba brexioides, *A. Cunn.*
Carpodetus serratus, *Forst.*
Weinmannia silvicola, *Banks and Sol.*
Tillæa verticillaris, *DC.*
Drosera binata, *Labill.*
,, auriculata, *Backhouse.*
Haloragis alata, *Jacq.*
Haloragis tetragyna, *b.* diffusa, *Labill.*
,, depressa, *Hook. f.*
,, micrantha, *Br.*
Myriophyllum elatinoides, *Gaud.*
Callitriche muelleri.
Leptospermum scoparium, *Forst, a, b, c, d.*
,, ericoides, *A. Rich.*
,, ,, *var.*
Metrosideros florida, *Sm.*
,, lucida, *Menzies.*
,, *n.s.?*
,, albiflora, *Banks and Sol.*
,, diffusa, *Smith.*
,, hypericifolia, *A. Cunn.*
,, tomentosa, *A. Cunn.*
,, scandens, *Banks and Sol.*
Myrtus bullata, *Banks and Sol.*
Eugenia maire, *A. Cunn.*
Fuchsia excorticata, *Linn. f.*
,, procumbens, *R. Cunn.*
,, [,, *var.?*] *kirkii, Hook. f., n.s.*
Epilobium nummularifolium, *A. Cunn.*
,, alsinoides, *A. Cunn.*
,, tetragonum, *Linn.*
,, junceum, *Forst.*
,, pubens, *A. Rich.*
,, billardierianum, *Seringe.*
,, pallidiflorum, *Sol.*
Passiflora tetrandra, *Banks and Sol.*
Sicyos angulatus, *Linn.*
Mesembryanthemum australe, *Sol.*
Tetragonia expansa, *Murray.*
Hydrocotyle elongata, *A. Cunn.*
,, americana, *Linn.*
,, asiatica, *Linn.*
,, novæ-zealandiæ, *DC.*
,, *n.s.?*
,, moschata, *Forst.*
Crantzia lineata, *Nutt.*
Apium australe, *Thouars.*
,, filiforme, *Hook.*
Angelica rosæfolia, *Hook.*
Daucus brachiatus, *Sieber.*
Panax crassifolium, *Dcne and Planch.*
,, lessonii, *DC.*
,, arboreum, *Forst.*
,, sinclairii, *Hook. f.*
Schefflera digitata, *Forst.*
Griselinia lucida, *Forst.*
Corokia buddleoides, *A. Cunn.*
Alseuosmia macrophylla, *A. Cunn.*
,, quercifolia, *A. Cunn.*
Coprosma lucida, *Forst.*
,, grandifolia, *Hook. f.*
,, ,, *var.?*
,, baueriana, *Endl.*
,, cunninghamii, *Hook. f.*
,, spathulata, *A. Cunn.*
,, *sp.*
,, propinqua, *A. Cunn.*
,, acerosa, *A. Cunn.*

Nertera cunninghamii, *Hook. f.*
,, dichondræfolia, *Hook. f.*
Galium tenuicaule, *A. Cunn.*
Olearia furfuracea, *Hook. f.*
,, cunninghamii, *Hook. f.*
,, *allomii, n.s.*
,, virgata, *Hook. f.*
Celmisia longifolia, *Cass.*
Vittadinia australis, *A. Rich.*
Lagenophora forsteri, *DC.*
,, petiolata, *Hook. f.*
Bidens pilosa, *Linn.*
Cotula coronopifolia, *Linn.*
,, australis, *Hook. f.*
,, minor, *Hook. f.*
,, dioica, *Hook. f.*
,, minuta, *Forst.*
Cassinia leptophylla, *Br.*
,, retorta, *A. Cunn.*
Ozothamnus glomeratus, *Hook. f.*
Gnaphalium keriense, *A. Cunn.*
,, luteo-album, *L.*
,, involucratum, *Forst.*
,, collinum, *Labill.*
Erechtites arguta, *DC.*
,, scaberula, *Hook. f.*
,, quadridentata, *DC.*
Senecio lautus, *Forst.*
,, glastifolius, *Hook. f.*
,, ,, *var.?*
Brachyglottis repanda, *Forst.*
Picris hieracioides, *L.*
Sonchus oleraceus, *L.*, *a* and *b.*
Wahlenbergia gracilis, *A. Rich.*
Lobelia anceps, *Thunb.*
Pratia angulata, *Hook. f.*
Selliera radicans, *Cav.*
Gaultheria antipoda, *Forst.*
Cyathodes acerosa, *Br.*
Leucopogon fasciculatus, *A. Rich.*
,, fraseri, *A. Cunn.*
Epacris pauciflora, *A. Rich.*
Archeria racemosa, *Hook. f.*
Dracophyllum latifolium, *A. Cunn.*
,, squarrosum, *Hook. f.*
Myrsine salicina, *Heward.*
,, urvillei, *A. DC.*
Samolus repens, *Forst.*
Sapota costata, *A. DC.*
Olea lanceolata, *Hook. f.*
,, cunninghamii, *Hook. f.*
,, *n.s.*
Parsonsia albiflora, *Raoul.*
Geniostoma ligustrifolium, *A. Cunn.*
Convolvulus sepium, *L.*
,, tuguriorum, *Forst.*
,, soldanella, *L.*
Dichondra repens, *Forst.*
Solanum aviculare, *Forst.*
,, nigrum, *L.*
Veronica macroura, *var.*, *Hook. f.*
,, salicifolia, *Forst.*
,, macrocarpa, *Vahl.*
,, parviflora, *var.? Vahl.*

Rhabdothamnus solandri, *A. Cunn.*
Utricularia, *n.s.*
Vitex littoralis, *A. Cunn.*
Avicennia officinalis, *L.*
Myoporum lætum, *Forst.*
Plantago raoulii, *Decaisne.*
Pisonia umbellifera, *Seemann*, Arid Island.
Chenopodium triandrum, *Forst.*
,, urbicum, *L.*
,, ambiguum, *L.*
Atriplex billardieri, *Hook. f.*
Salicornia indica, *Willd.?*
Scleranthus biflorus, *Hook. f.*
Polygonum decipiens, *Huds.*
,, aviculare, *L.*
,, *var.* dryandri, *Spr.*
Muhlenbeckia adpressa, *Lab.*
,, complexa, *Meisn.*
Rumex flexuosus, *Forst.*
Tetranthera calicaris, *Hook. f.*
Nesodaphne tarairi, *Hook. f.*
,, tawa, *Hook. f.*
Atherosperma novæ-zealandiæ, *Hook. f.*
Hedycarya dentata, *Forst.*
Knightia excelsa, *Br.*
Persoonia toro, *A. Cunn.*
Pimelia longifolia, *Banks and Sol.*
,, virgata, *Vahl.*
,, arenaria, *A. Cunn.*
,, prostrata, *Vahl.*
Santalum cunninghamii, *Hook. f.*
Euphorbia glauca, *Forst.*
Epicarpurus microphyllus, *Raoul.*
Parietaria debilis, *Forst.*
Elatostemma rugosum, *A. Cunn.*
Peperomia urvilleana, *A. Rich.*
Piper excelsum, *Forst.*
Dammara australis, *Lambert.*
Podocarpus ferruginea, *Don.*
,, totara, *A. Cunn.*
,, spicata, *Br.*
,, dacrydioides, *A. Rich.*
Dacrydium cupressinum, *Sol.*
,, colensoi, *Hook.*
,, *n.s.?*
Phyllocladus trichomanoides, *Don.*
,, glauca, *Carr.*
Earina mucronata, *Lindl.*
,, autumnalis, *Hook. f.*
Dendrobium cunninghamii, *Lindl.*
Bolbophyllum pygmæum, *Lindl.*
Gastrodia cunninghamii, *Hook. f.*
Acianthus sinclairii, *Hook. f.*
Corysanthes oblonga? *Hook. f.*
,, rivularis, *Hook. f.*
Microtis porrifolia, *Sprengel.*
Pterostylis banksii, *Brown.*
,, trullifolia, *Hook. f.*
Thelymitra longifolia, *Forst.*
Prasophyllum colensoi, *Hook. f.*
Orthoceras solandri, *Lindl.*
Libertia ixioides, *Sprengel.*
,, grandiflora, *Sweet.*
,, micrantha, *A. Cunn.*

Freycinetia banksii, *A. Cunn.*
Typha latifolia, *L. var.* "angustifolia," *not* T. angustifolia, *Linn.*
Sparganium simplex, *Huds.*
Triglochin triandrum, *Michaux.*
Zostera marina, *L.*
Rhipogonum scandens, *Forst.*
Cordyline australis, *Hook. f.*
,, banksii, *Hook. f.*
,, pumilio, *Hook. f.*
Dianella intermedia, *Endl.*
Astelia cunninghamii, *Hook. f.*
,, grandis, *Hook. f.*
,, solandri, *A. Cunn.*
,, *trinervia, Kirk.*
,, banksii, *A. Cunn.*
Arthropodium cirrhatum, *Br.*
Phormium tenax, *Forst.*
,, colensoi, *Hook. f.*
Areca sapida, *Soland.*
Juncus vaginatus, *Br.*
,, australis, *Hook. f.*
,, maritimus, *Lamarck.*
,, communis, *E. Meyer.*
,, planifolius, *Br.*
,, bufonius, *L.*
Luzula campestris, *De Cand.*
Leptocarpus simplex, *A. Rich.*
Cyperus ustulatus, *A. Rich.*
Schœnus axillaris, *Hook. f.*
,, tenax, *Hook. f.*
,, tendo, *Banks and Sol.*
,, *n.s.*
Scirpus maritimus, *L.*
,, lacustris, *L.*
Eleocharis sphacelata, *Br.*
,, acuta, *var.* platylepis
,, gracillima, *Br.*
Isolepis nodosa, *Br.*
,, prolifer, *Br.*
,, riparia, *Br.*
Desmoschœnus spiralis, *Hook. f.*
Cladium glomeratum, *Br.*
,, teretifolium, *Br.*
,, articulatum, *Br.*
,, gunnii, *Hook. f.*
,, junceum, *Br.*
,, sinclairii, *Hook. f.*
Gahnia setifolia, *Hook. f.*
,, lacera, *Steudel.*
,, ebenocarpa, *Hook f.* (xanthocarpa, *Hook f.* in "Handbook Fl. N.Z.")
,, arenaria, *Hook. f.*
Lepidosperma tetragona, *Labill.*
,, concava, *Br.*
Uncinia banksii, *var., Boott.*
,, australis, *Persoon.*
Carex virgata, *Solander.*
,, ,, *b.* secta, *Boott.*
,, ternaria, *Forst.*
,, pumila, *Thunberg.*
,, forsteri, *Wahlenberg.*
,, breviculmis, *Br.*
,, neesiana, *Endl.*

Carex dissita, *Solander.*
,, lambertiana, *Boott.*
,, vacillans, *Sol.*
Microlæna stipoides, *Br.*
,, avenacea, *Hook. f.*
,, polynoda, *Hook. f.*
Hierochloe redolens, *Br.*
Spinifex hirsutus, *Labill.*
Paspalum scrobiculatum, *L.*
,, distichum, *Burmann.*
Panicum imbecille, *Trinius.*
Isachne australis, *Br.*
Echinopogon ovatus, *Palisot.*
Dichelachne stipoides, *Hook. f.*
,, crinita, *Hook. f.*
Sporobolus elongatus, *Br.*
Agrostis æmula, *Br.*
,, billardieri, *Br.*
,, quadriseta, *Br.*
Arundo conspicua, *Forst.*
Danthonia semi-annularis, *Br.*
Trisetum antarcticum, *Trinius.*
Poa anceps, *Forst.*
Festuca littoralis, *Br.*
Bromus arenarius, *Lab.*
Triticum multiflorum, *Banks and Sol.*
,, scabrum, *Br.*
Gleichenia hecistophylla, *A. Cunn.*
,, cunninghamii, *Heward.*
,, flabellata, *Br.*
Cyathea dealbata, *Swartz.*
,, medullaris, *Swartz.*
Dicksonia squarrosa, *Swartz.*
,, lanata, *Col.*
Hymenophyllum tunbridgense, *Smith.*
,, multifidum, *Swartz.*
,, rarum, *Br.*
,, dilatatum, *Swartz.*
,, javanicum, *Spreng.*
,, sanguinolentum, *Swartz.*
,, demissum, *Swartz.*
,, scabrum, *A. Rich.*
,, flabellatum, *Labill.*
,, lyallii, *Hook. f.*
Trichomanes reniforme, *Forst.*
,, elongatum, *A. Cunn.*
,, humile, *Forst.*
Loxsoma cunninghamii, *Br., a* and *b.*
Lindsæa linearis, *Swartz.*
,, trichomanoides, *Dryander.*
,, ,, *b.* lessoni, *Bory.*
Adiantum hispidulum, *Swartz.*
,, affine, *Willdenow.*
,, æthiopicum, *L.*
,, cunninghamii, *Hook.*
,, fulvum, *Raoul.*
Hypolepis tenuifolia, *Bernhardi.*
Cheilanthes sieberi, *Swartz.*
Pellæa rotundifolia, *Forst.*
Pteris esculenta, *L.*
,, tremula, *Br.*
,, scaberula, *A. Rich.*
,, incisa, *Thunberg.*
,, macilenta, *A. Rich.*
,, endlicheriana, *Agardh.*

Lomaria filiformis, *A. Cunn.*
,, procera, *Sprengel.*
,, fluviatilis, *Sprengel.*
,, membranacea, *Colenso.*
,, lanceolata, *Sprengel.*
,, discolor, *Willdenow.*
,, fraseri, *A. Cunn.*
Doodia media, *Br.*
Asplenium obtusatum, *Forst.*
,, lucidum, *Forst.*
,, flabellifolium, *Cavanilles.*
,, falcatum, *Lamarck.*
,, hookerianum, *Colenso.*
,, bulbiferum, *Forst.*, *a* and *b.*
,, flaccidum, *Forst.*, *a*, *b*, and *e.*
Aspidium richardi, *Hook.*
,, coriaceum, *Swartz.*
Nephrodium velutinum, *Hook. f.*
,, decompositum, *Br.*
,, hispidum, *Hook.*
Polypodium australe, *Mettenius.*
,, ,, *var.* ciliata, *Col.*
Polypodium grammitidis, *Br.*
,, tenellum, *Forst.*
,, pennigerum, *Forst.*
,, rupestre, *Br.*
,, cunninghamii, *Hook.*
,, pustulatum, *Forst.*
,, billardieri, *Br.*
Nothochlæna distans, *Br.*
Leptopteris hymenophylloides, *Presl.*
Lygodium articulatum, *A. Rich.*
Schizæa dichotoma, *Swartz.*
,, bifida, *Swartz.*
,, fistulosa, *Lab.*
Ophioglossum lusitanicum.
Botrychium cicutarium, *Swartz.*
Lycopodium billardieri, *Spring.*
,, densum, *Labill.*
,, laterale, *Br.*
,, cernuum, *L.*
,, scariosum, *Forst.*
,, volubile, *Forst.*
Tmesipteris forsteri, *Endlicher.*

Naturalized Plants.

Ranunculus acris, *L.*
,, repens, *L.*
Barbarea præcox, *Br.*
Nasturtium officinale, *Br.*
Erysimum officinale, *L.*
Senebiera coronopus, *Poiret.*
,, didyma, *Persoon.*
Capsella bursa-pastoris, *DC.*
Lepidium ruderale, *L.*
Sinapis arvensis, *L.*
Brassica rapa, *L.*
,, napus, *L.*
,, oleracea, *L.*
Raphanus sativus, *L.*
Silene quinquevulnera, *L.*
Stellaria media, *L.*
Cerastium vulgatum, *L.*
,, viscosum, *L.*
Spergula arvensis, *L.*
Portulaca oleracea, *L.*
Hypericum perforatum, *L.*
Malva rotundifolia, *L.*
Erodium cicutarium, *L.*
Ulex europæus, *L.*
Trifolium repens, *L.*
,, pratense, *L.*
,, procumbens, *L.*
,, minus, *Sm.*
Melilotus arvensis, *Wallroth.*
Medicago lupulina, *L.*
,, maculata, *Sibthorp.*
,, denticulata, *Willd.*
Amygdalus persica, *L.*
Lythrum hyssopifolium, *L.*
Cucurbita, *sp.*
Petroselinum sativum, *Hoffm.*
Fœniculum vulgare, *Gærtn.*
Pastinaca sativum, *Benth.*
Torilis nodosa, *Scop.*
Sherardia arvensis, *L.*
Erigeron canadense, *L.*
Bellis perennis, *L.*
Matricaria chamomilla, *L.*
Chrysanthemum leucanthemum, *L.*
Senecio, *sp.*
Carduus lanceolatus, *L.*
Centaurea solstitialis, *L.*
Lapsana communis, *L.*
Hypochæris glabra, *L.*
,, radicata, *L.*
Helminthia echioides, *Gærtn.*
Crepis virens, *L.*
Taraxicum dens-leonis, *Desf.*
Anagallis arvensis, *L.*
Physalis peruviana, *L.*
Lycopersicum esculentum, *Mill.*
Verbascum thapsus, *L.*
,, phœniceum, *L.*
Veronica arvensis, *L.*
,, serpyllifolia, *L.*
Verbena officinalis, *L.*
Mentha viridis, *L.*
Nepeta cataria, *L.*
Stachys arvensis, *L.*
Prunella vulgaris, *L.*
Plantago major, *L.*
,, lanceolata, *L.*
Rumex obtusifolius, *L.*
,, viridis, *Sibth.*
,, crispus, L.
,, acetosella, *L.*
Euphorbia peplus, *L.*
Colocasia antiquorum, *Schott.*
Gastridium lendigerum, *Gaud.*
Phleum pratense, *L.*
Phalaris canariensis, *L.*
Holcus mollis, *L.*
,, lanatus, *L.*
Anthoxanthum odoratum, *L.*
Panicum sanguinale, *Scop.*

Cynodon dactylon, *L.*
Agrostis vulgaris, *With.*
Avena sativa, *L.*
Poa pratensis, *L.*
„ annua, *L.*
Briza minor, *L.*
Dactylis glomerata, *L.*
Festuca bromoides, *Sm.*
Bromus unioloides, *Humb.*
„ sterilis, *L.*
„ mollis, *L.*
„ racemosus, *L.*
Hordeum, *sp.*
Lolium perenne, L.

CATALOGUE OF PLANTS FOUND ON THE SOUTH AND SOUTH-EAST COASTS OF THE LITTLE BARRIER ISLAND, DECEMBER, 1867.

Clematis parviflora, *A. Cunn.*
Drimys axillaris, *Forst.*
Cardamine hirsuta, *L.*
„ stylosa, *DC.*
Melicytus ramiflorus, *Forst.*
„ *n.s.*
Pittosporum crassifolium, *Banks and Sol.*
„ „ *var. strictum.*
„ umbellatum, *Banks and Sol.*
„ „ *var. cordatum.*
„ cornifolium, *A. Cunn.*
Stellaria parviflora, *Banks and Sol.*
Hoheria populnea, *A. Cunn.*
Entelea arborescens, *Br.*
Elæocarpus dentatus, *Vahl.*
Linum monogynum, *Forst.*, *a.*
Oxalis ciliifera, *A. Cunn.*
Melicope ternata, *Forst.*
Dysoxylum spectabile, *Hook. f.*
Alectryon excelsum, *DC.*
Corynocarpus lævigatus, *Forst.*
Coriaria ruscifolia, *L.*
Carmichælia australis, *Br.*
Rubus australis, *Forst.*
Quintinia serrata, *A. Cunn.*
Ixerba brexioides, *A. Cunn.*
Weinmannia silvicola, *Banks and Sol.*
Haloragis alata, *Jacq.*
Leptospermum scoparium, *Forst.*
„ ericoides, *A. Rich.*
Metrosideros florida, *Sm.*
„ lucida, *Menzies.*
„ diffusa, *Smith.*
„ hypericifolia, *A. Cunn.*
„ tomentosa, *A. Cunn.*
„ scandens, *Banks and Sol.*
Fuchsia excorticata, *Linn. f.*
Epilobium alsinoides, *A. Cunn.*
Sicyos angulatus, *L.*
Mesembryanthemum australe, *Sol.*
Tetragonia trigyna, *Banks and Sol.*
Hydrocotyle asiatica, *L.*
Angelica rosæfolia, *Hook.*
Apium australe, *Thouars.*
Panax lessonii, *DC.*
„ arboreum, *Forst.*
„ sinclairii, *Hook. f.*
Schefflera digitata, *Forst.*
Griselinia lucida, *Forst.*
Alseuosmia macrophylla, *A. Cunn.*
Coprosma grandifolia, *Hook. f.*
Coprosma baueriana, *Endl.*
„ robusta, *Raoul.*
„ *sp.*
Olearia cunninghamii, *Hook. f.*
Lagenophora forsteri, *DC.*
Bidens pilosa, *L.*
Ozothamnus glomeratus, *Hook. f.*
Gnaphalium keriense, *A. Cunn.*
„ luteo-album, *L.*
„ involucratum, *Forst.*
Erechtites scaberula, *Hook. f.*
Senecio lautus, *Forst.*
„ glastifolius, *Hook. f.*
Brachyglottis repanda, *Forst.*
Sonchus oleraceus, *L.*, *a* and *b.*
Wahlenbergia gracilis, *A. Rich.*
Lobelia anceps, *Thunb.*
Leucopogon fasciculatus, *A. Rich.*
Dracophyllum latifolium, *A. Cunn.*
Myrsine salicina, *Heward.*
„ urvillei, *A. DC.*
Samolus repens, *Forst.*
Sapota costata, *A. DC.*
Geniostoma ligustrifolium, *A. Cunn.*
Convolvolus sepium, *L.*
„ tuguriorum, *Forst.*
„ soldanella, *L.*
Dichondra repens, *Forst.*
Solanum aviculare, *Forst.*
„ nigrum, *L.*
Veronica salicifolia, *Forst.*
Rhabdothamnus solandri, *A. Cunn.*
Vitex littoralis, *A. Cunn.*
Myoporum lætum, *Forst.*
Plantago raoulii, *Decaisne.*
Pisonia umbellifera, *Seemann.*
Chenopodium triandrum, *Forst.*
Salicornia indica, *Willd.?*
Muhlenbeckia complexa, *Meisn.*
Tetranthera calicaris, *Hook. f.*
Nesodaphne tarairi, *Hook. f.*
„ tawa, *Hook. f.*
Knightia excelsa, *Br.*
Santalum cunninghamii, *Hook. f.*
Euphorbia glauca, *Forst.*
Parietaria debilis, *Forst.*
Peperomia urvilleana, *A. Rich.*
Piper excelsum, *Forst.*
Dammara australis, *Lambert.*
Podocarpus ferruginea, *Don.*
„ totara, *A. Cunn.*

Earina mucronata, *Lindl.*
Dendrobium cunninghamii, *Lindl.*
Bolbophyllum pygmæum, *Lindl.*
Microtis porrifolia, *Sprengel.*
Libertia grandiflora, *Sweet.*
Freycinetia banksii, *A. Cunn.*
Rhipogonum scandens, *Forst.*
Cordyline australis, *Hook. f.*
„ banksii, *Hook. f.*
„ pumilio, *Hook. f.*
Dianella intermedia, *Endl.*
Astelia cunninghamii, *Hook. f.*
„ solandri, *A. Cunn.*
„ *trinervia, Kirk, n.s.*
„ banksii, *A. Cunn.*
Arthropodium cirrhatum, *Br.*
Phormium tenax, *Forst.*
Areca sapida, *Soland.*
Cyperus ustulatus, *A. Rich.*
Isolepis nodosa, *Br.*
„ riparia, *Br.*
Gahnia setifolia, *Hook. f.*
Uncinia australis, *Persoon.*
„ banksii, *var., Boott.*
Carex lucida, *Boott.*
„ ternaria, *Forst.*
„ dissita, *Solander.*
„ vacillans, *Sol.*
Panicum imbecille, *Trinius.*
Dichelachne crinita, *Hook. f.*
Agrostis æmula, *Br.*
„ billardieri, *Br.*
Arundo conspicua, *Forst.*
Danthonia semi-annularis, *Br.*
Poa anceps, *Forst.*
Triticum multiflorum, *Banks and Sol.*
Cyathea dealbata, *Swartz.*
„ medullaris, *Swartz.*
„ cunninghamii, *Hook. f.*
Hymenophyllum tunbridgense, *Smith.*
Hymenophyllum dilatatum, *Swartz.*
„ javanicum, *Sprengel.*
„ polyanthos, *Swartz.*
„ demissum, *Swartz.*
Trichomanes reniforme, *Forst.*
Lindsæa lessonii, *Bory.*
Adiantum cunninghamii, *Hook.*
Hypolepis tenuifolia, *Bernhardi.*
Cheilanthes sieberi, *Swartz.*
Pellæa rotundifolia, *Forst.*
Pteris esculenta, *L.*
„ tremula, *Br.*
„ endlicheriana, *Agardh.*
Lomaria filiformis, *A. Cunn.*
„ procera, *Sprengel.*
„ membranacea, *Colenso.*
„ lanceolata, *Sprengel.*
„ discolor, *Willdenow.*
„ *n.s.?*
„ fraseri, *A. Cunn.*
Doodia media, *Br.*
Asplenium obtusatum, *Forst.*
„ lucidum, *Forst.*
„ falcatum, *Lamarck.*
„ bulbiferum, *Forst.*
„ flaccidum, *Forst, a, b,* and *c.*
Aspidium richardi, *Hook.*
Polypodium australe, *Mettenius.*
„ grammitidis, *Br.*
„ tenellum, *Forst.*
„ pennigerum, *Forst.*
„ rupestre, *Br.*
„ cunninghamii, *Hook.*
„ pustulatum, *Forst.*
„ billardieri, *Br.*
Leptopteris hymenophylloides, *Presl.*
Lygodium articulatum, *A. Rich.*
Ophioglossum lusitanicum, *L.*
Lycopodium billardieri, *Spring.*
„ volubile, *Forst.*

INTRODUCED PLANTS.

Brassica oleracea, *L.*
„ campestris, *L.*
Stellaria media, *L.*
Amygdalus persica, *L.*
Erigeron canadense, *L.*
Siegesbeckia orientalis, L.
Rumex viridis, *Sibth.*

CATALOGUE OF NATURALIZED PLANTS OBSERVED AT KORORARIKA, BAY OF ISLANDS.

Ranunculus *muricatus.*
Nasturtium officinale, *Br.*
Erysimum officinale, *L.*
Senebiera coronopus, *Poiret.*
„ pinnatifida, *DC.*
Capsella bursa-pastoris, *DC.*
Lepidium ruderale, *L.*
Brassica campestris, *L.*
Silene quinquevulnera, *L.*
Stellaria media, *L.*
Cerastium viscosum, *L.*
Portulaca oleracea, *L.*
Polycarpon tetraphyllum, *L.*
Spergula arvensis, *L.*
Malva rotundifolia, *L.*
„ *sp.*
Pelargonium quercifolium, *Ait.*
Erodium cicutarium, *L.*
„ „ *var.* littorale.
„ moschatum, *L.*
Trifolium repens, *L.*
„ pratense, *L.*
„ minus, *Sm.*
Melilotus arvensis, *Wallroth.*

Medicago lupulina, *L.*
„ maculata, *Sibthorp.*
Rosa rubiginosa, *L.*
Lythrum hyssopifolium, *L.*
Apium leptophyllum,* *F. Muell.*
Erigeron canadense, *L.*
Senecio vulgaris, *L.*
Carduus marianus, *Gærtn.*
„ lanceolatus, *L.*
Hypochæris radicata, *L.*
Xanthium spinosum, *L.*
Anagallis arvensis, *L.*
Physalis peruviana, *L.*
Lycium barbarum, *L.*
Veronica serpyllifolia, *L.*
Mentha aquatica, *L.*
Stachys arvensis, *L.*
Marrubium vulgare, *L.*
Prunella vulgaris, *L.*
Plantago major, *L.*
Rumex obtusifolius, *L.*
„ acetosa, *L.*
Chenopodium murale, *L.*
Amaranthus blitum, *L.*
„ retroflexus.
Euphorbia peplus, *L.*
„ helioscopia, *L.*
Iris germanica, *L.*
Agave americana, *L.*
Phalaris canariensis, *L.*
Holcus mollis, *L.*
Anthoxanthum odoratum, *L.*
Panicum sanguinale, *Scop.*
Cynodon dactylon, *L.*
Agrostis vulgaris, *With.*
Poa annua, *L.*
Dactylis glomerata, *L.*
Festuca bromoides, *Sm.*
Lolium perenne, *L.*

ART. XI.—*On some Experiments in Hydraulic Mortar, in Auckland.*

By JAMES STEWART, Assoc. Inst. C.E.

[*Read before the Auckland Institute, 6th July,* 1868.]

THE importance of obtaining, in Auckland, a lime of sufficient hydraulicity to enable it to be used in mortar intended for wet situations, has long impressed the writer. The absence of such, in regular supply, leads to great expense in the employment of cement, which is always, when obtainable, very dear, and, so far as has come within the writer's experience, of not more than one-half the value of the best as used in England.

The lime commonly used in the making of mortar in Auckland, is obtained from sea shells, or limestone from Mahurangi. The shell lime is, of course, rich lime, and possessing no hydraulicity more than that from pure chalk. The stone lime usually worked is not in any appreciable degree hydraulic, neither is it so rich as the shell lime. If properly used, however, it is preferable to shell lime for all work. In dry situations it sets very hard, and takes a good surface by the gradual reversion to the state of carbonate of lime. The writer has never seen an analysis of this lime, but he has tried, mechanically, several samples of it in the state of hydrate of lime, by separating the sand mechanically combined, and has usually found about 20 per cent. of sand present.

Having ascertained that lime had, on several occasions, been obtained at Mahurangi and Whangarei, possessing some qualities very different from

* This plant was observed in the forest at Kawau, and is not unlikely to prove indigenous. It is found in East Australia and North and South America.

the ordinary Mahurangi lime, the writer was induced to investigate the properties of some limestone from Mahurangi, but obtained on the opposite side of the river from whence that commonly used is procured.

A freshly-burnt sample was obtained, as also a portion of the unburnt stone. The latter was analyzed by Mr. Strehy, then in Auckland. The result was,—

Carbonate of lime	78·0
„ iron	4·2
„ magnesia	0·4
Silicate of alumina	13·5
Water	3·9
	100·0

The above analysis indicates a moderately hydraulic lime, and it agrees well with the practical tests to which the sample was put. The rock as then worked was, however, by no means homogeneous, so that neither test could be depended on as fairly representing the whole. It will be observed that the silicate of alumina, or clay, is 13·5 per cent. of the whole, and it is now pretty well agreed that it is this which is the active substance in giving hydraulicity to lime. Also, that even in the most highly burnt limes and cements, the lime and silicate of alumina are only mechanically combined until the formation of a hydrate takes place.

The practical tests to which the lime was subjected were,—

(1.) The slaking, by immersing a piece in water for about half a minute, and observing the time which elapsed before it became powdery. This was generally about ten minutes.

(2.) A strong paste was formed by the addition of water, and a saucer was filled and immersed in water. The hardening process was observable in about three weeks, and in two months it required considerable pressure to force a penknife into the mass.

(3.) A portion was made into mortar with common sharp sand, and it exhibited middling setting powers under water.

(4.) Another portion was mixed with sifted volcanic sand, in various proportions, and made into mortar. This showed a considerable improvement in the hardening under water. The best proportions were found to be equal parts of sand and lime.

The above investigations were undertaken about three years ago, and were mainly instigated by the scarcity of Portland cement in Auckland, £2 to £3 being asked for this per barrel at the time, and some of the samples, to the writer's knowledge, were about as much worth as so much road dust. The railway was then in progress, and the contractor for the first section had failed to procure a supply of cement in time. The results of the trials of the lime induced the writer, as engineer in charge of the works, to authorize the employment of the above lime and pure volcanic sand as mortar in the construction of the tunnel. The lime was brought to the works unslaked, and used as soon as possible. No more water was used than sufficed to work the mortar, and the working up of mortar that had partially set in the heap was forbidden. The best proportions were found in practice to be five parts of lime to four parts of sand. This was owing to the extreme sharpness of the volcanic sand, and also to the fact that it was often sifted too large. The same cause renders the joints of the brickwork too large for sightliness, but the result so far as strength is concerned is very satisfactory. If the sand were obtained from volcanic gravel ground by edge runners, it is likely that the common proportions of lime and sand would suffice.

It is to be regretted that a regular supply of this lime was not obtained after all the trouble about it. It was also often not well burnt, causing great waste in slaking and sifting. Hence, common lime was often smuggled into the work, and where such was the case it has not failed to show itself.

During the progress of the works specimens were regularly taken and tested. They showed more of the properties of cement than of mortar made by lime; and the writer is confident that, with further investigations and with due precautions, hydraulic lime equal to the bulk of the imported Portland cement may be obtained.

Most of the foundations of the stone work in the viaduct in Mechanic's Bay are laid in the above lime. Often, however, common lime was used with a small mixture of cement. When both these materials are good, this has always been found, in the writer's experience, to produce hydraulicity to an extent proportional to the quantity of the latter.

The writer regrets that all the specimens of the test bricks were not carefully preserved. They were commonly left on the works in some pool of water or running stream, and often broken for examination. One only has been retained, and that more by accident than design. It is now produced. The bricks are joined by the mortar used in the foundation of the sea abutment of the viaduct. The materials then being used were the hydraulic lime two parts, volcanic and common sand each one part. The specimen was laid at once in a pool of water, and a short time afterwards circumstances caused it to be looked for and preserved. Samples of the volcanic sand mentioned are also here shown of the black and red. The latter is more abundant in the necessary fineness, but both were used as they could be procured.

It is not believed that this sand possesses properties in the same degree as the Puzzuolanos of Italy, but it is possible that, on analysis, it may be shown to possess a somewhat similar composition.

The limestone of Whangarei is believed by many to be eminently hydraulic. It is of great importance that such should be ascertained by careful and complete analysis of fair samples of the stone. The importance of the subject to hydraulic engineering and to the colony at large cannot be overrated. Should the above remarks prove of interest or use to any one, the writer will feel amply repaid for the trouble of collecting them; he only regrets that they are so crude and incomplete.

Art. XII.—*Notes on the Birds of the Great Barrier Island.*

By Captain F. W. Hutton, F.G.S.

[*Read before the Auckland Institute, 6th July, 1868.*]

Having spent two months this summer in exploring the Great Barrier Island, I am enabled to lay before the Society what I consider to be a tolerably complete list of the birds found there.

I have given the English names of those birds that I know to possess one, but many, of course, are known by their scientific names only. The native names were obtained from Maoris on the island.

* 1. *Hieracidea novæ-zealandiæ.* Sparrow-hawk.
* 2. *Circus gouldi.* Hawk. Common.
* 3. *Athene novæ-zealandiæ.* Morepork. Heruru. Koukou.
4. *Halcyon vagans.* Kingfisher.
* 5. *Prosthemadera novæ-zealandiæ.* Tui. Very abundant.
* 6. *Pogonornis cincta.* Ihi. Not uncommon.
* 7. *Anthornis melanura.* Bell-bird. Korimoko. Abundant.
* 8. *Acanthisitta chloris.* Mirumiru. At Harataonga.
* 9. *Mohoua albicilla.* Popokotea. Very common.
10. *Sphenœacus*, sp. Matata. Kaitoke Swamp.
* 11. *Gerygone flaviventris.* Common.
12. *Certhiparus novæ-zealandiæ.* Riro-riro. Seen by Mr. Kirk on Arid Island.
13. *Zosterops dorsalis.* White Eye. I did not see this bird, but Mr. Allom informed me that it had been on the island for the last four years.
* 14. *Petroica longipes.* Totowai. Robin. Common.
* 15. „ *toitoi.* Miromiro.
16. *Anthus novæ-zealandiæ.* Pihoihoi. Lark. Common.
* 17. *Rhipidura flabellifera.* Piwakawaka. Fantail. Common.
18. *Callæas cinerea.* Kokako. New Zealand Crow.
* 19. *Creadion carunculatus.*† Tieke. Saddle-back. Not uncommon.
* 20. *Platycercus pacificus.* Kakariki. Parrakeet. Common.
* 21. „ *auriceps.* Parrakeet. Common.
* 22. *Nestor meridionalis.*† Kaka. Not common.

† Very common on Little Barrier.

23. *Eudynamys taitensis.* Long-tailed Cuckoo. Koekoea.
24. *Chrysococcyx lucidus.* Shining Cuckoo. Pipiuwaroa.
* 25. *Carpophaga novæ-zealandiæ.* Pigeon. Kuku.
26. *Charadrius obscurus.* Tuturiwata. East Coast. Common.
27. *Thinornis novæ-zealandiæ.* Kukuruatu. At Whangapoua.
* 28. *Hæmatopus unicolor.* Torea. Red-bill. East Coast.
29. *Ardea matook.* Heron. Matuku. Port Fitzroy.
30. *Botaurus poicilopterus.* Matukunurepo. Bittern. Kaitoke Swamp. Rare, not seen by me.
31. *Limosa novæ-zealandiæ.* Kuaka. Godwit. East Coast.
32. *Anas superciliosa.* Parera. Duck. Not numerous.
* 33. *Spheniscus minor.* Korora. Penguin. Very numerous.
34. *Pelecanoides urinatrix.* Titi. Very numerous.
35. *Puffinus assimilis* (?). Hakoakoa. Very numerous.
36. *Thalassidroma melanogastra.* East Coast. A specimen is also in the Auckland Museum from the Great Barrier.
37. *Thalassidroma nereis.* Hauraki Gulf. Several.
38. *Procellaria gigantea.*
* 39. „ *parkinsoni.* Toanui. Very common.
40. „ *capensis.*
41. „ *cookii.* Very common.
42. „ *lessonii.* I saw this bird in June, 1866, between the North Cape and the Great Barrier.
43. *Prion turtur.* Whale bird.
44. *Diomedea exulans.* Toroa. Albatros.
45. „ *melanophrys.* Molly-mawk.
46. „ *chlororhyncha.* A specimen of this bird is in the Auckland Museum, caught off the Great Barrier.
47. *Larus antipodum.*
48. „ *scopulinus.*
49. *Sterna strenua.* Two seen at Whangapoua.
50. „ *frontalis.* Tara. Abundant.
* 51. *Sula serrator.* Takapu. Breeds on Mahuke Island.
* 52. *Graculus varius.* Kawau. Shag. Abundant.

The chief point of interest in this list is the entire absence of the Kiwi (*Apteryx*) and the whole tribe of *Rallidæ*, including the Pukeko, although the island is very well adapted for all of them.

With regard to the Kiwi, the natives assured me that they never heard of a Kiwi having been seen there; nor do they ever remember their old men or fathers mentioning such a thing. The presence also of only one species of duck, and that not numerous, is also peculiar, for the large swamps of Whangapoua and Kaitoke are well suited for them.

On the other hand, the Great Barrier differs from the main land in the abundance of Bell-birds (*Anthornis melanura*) and *Mohoua albicilla*, and the presence of *Pogonornis cincta*.

About two years ago Mr. Allom turned out four Chinese pheasants, two cocks and two hens; and about four years ago, a number of small finches, supposed to be Java sparrows. None of these birds have been seen since.

I have been informed by Mr. Barstow, of the Bay of Islands, that he remembers the Quail (*Coturnix novæ-zealandiæ*) common on Flat Island, close to the Great Barrier. It is quite extinct there now, and has been so for several years.

Art. XIII.—*Notes on the Birds of the Little Barrier Island.*

By Captain F. W. Hutton, F.G.S.

[*Read before the Auckland Institute, 6th July,* 1868.]

During last December I spent four days on the eastern side of the Little Barrier Island, and noticed the following birds.*

Another bird also lives on the island, apparently in the cliffs, and comes out only in the evenings. Its cry is a peculiar kind of laugh, in a descending scale, and is very ridiculous to hear. I saw it twice by the light of a fire. It appeared to be rather larger than a Morepork (*Athene novæ-zealandiæ*), with rounded wings, and soft flight like an owl or a parrot. It was light-coloured underneath. I did not see the back. What kind of bird it was I cannot even conjecture.

It will be noticed that the Kiwi (*Apteryx mantelli*) does not appear in this list; and, notwithstanding current reports, I am inclined to think that it is either very rare or else does not exist on the island. I was accompanied by a very good dog, but we neither heard nor saw a Kiwi during the whole time we were on the island. I am also informed by Mr. Barstow, of the Bay of Islands, that in 1842 Captain Wood, of H.M.S. "Tortoise," spent three or four days on the Little Barrier with the express object of catching Kiwis, but did not see one. Sir George Grey told me that he also spent a day or two on the south-west side of the island, looking for Kiwis, but found none.

Art. XIV.—*Notes on the Basin of Te Tarata, Rotomahana.*

By Captain F. W. Hutton, F.G.S.

Plate V.

[*Read before the Auckland Institute, 6th July,* 1868.]

On the 3rd of March last, in company with Colonel Haultain, Mr. H. Clarke, and Mr. Traill, I visited the celebrated hot spring of Te Tarata, at Rotomahana. As we crossed Lake Tarawera in a canoe, large volumes of steam were seen issuing from the crater, but on reaching it, about an hour afterwards, it was much quieter, very little steam ascending, and the water

* See names of 22 species, marked with an asterisk, in the list of birds found on the Great Barrier Island, pages 104 and 105.

only half filling the basin, and evidently sinking. In about an hour's time the basin was empty, and in half an hour more the water had receded about 10 feet down the central pipe, where it remained during the rest of our stay. The wind was light and westerly.

This phenomenon appears to be of not very frequent occurrence, as Mrs. Spencer, of Tarawera, informed me that, although she had visited the spring some fifty times, she had only once seen it empty. A few notes, therefore, on the shape and dimensions of the basin will not be uninteresting.

After the water had descended into the pipe we were enabled with safety to go down into the basin, and approach close to the edge of the pipe, and walk all round it. Unfortunately I had no means of measuring it accurately, and the following dimensions are partly from pacings, and partly estimated. (See Plate V.)

The basin is situated about eighty feet above the level of the lake, and lies in a crateriform hollow cut out of the hill behind it. This hill is composed of felspathic tufa, decomposed into yellow and red clays where acted upon by the steam and gases exhaled from the spring. It is a slight admixture of these red clays with the siliceous sinter that gives to the terraces of some of the springs their beautiful pink colour.

The sinter-basin is irregularly circular, and about twenty-six yards in diameter and five deep. The upper lip is smooth and flat, and from four to six feet broad. The sides and bottom of the basin are very irregular and rough, and apparently fissured, as steam escapes in two or three places on the western upper edge of the basin. The north and west sides are much steeper than the others, the easiest point of descent being on the east. The pipe is placed a little to the west of the centre of the basin, and is irregular in shape; the west and south sides being circular, while the north-east one is flat. The average diameter is about eight feet, and the sides are quite perpendicular and smooth.

The deposit from this spring is at first soft and granular, like very fine, fresh-fallen snow, and the foot sinks in it to a depth of about a quarter of an inch. In time it hardens and becomes more compact, probably partly from the pressure of other layers, and partly from the infiltration of fresh siliceous matter. The microscopical structure of the freshly-deposited sinter is extremely peculiar, and deserves a careful examination. It is, for the most part, composed of small elongated particles very variable in shape, but presenting, generally, the appearance of small sticks, and is altogether much more like organic than mineral matter. These sticks, of which I have figured a few (see Plate V.), are about 0·002 inch in length, and 0·0002 inch in breadth, and are mixed with larger angular grains of transparent silica, but without any crystals or crystalline particles.

Small deposits of sulphur were seen in two or three places round the upper edge of the basin, on which we also found many insects, such as beetles and dragon-flies, as well as some feathers of a lark, and the whole body of a hawk, incrusted with the siliceous sinter.

The water in the pools on the terraces was of very opaque light-blue colour; and when we first arrived, I noticed that the water in the basin and the lower portion of the column of steam ascending from it were also of the same hue.

Art. XV.—*Description of Arid Island, Hauraki Gulf.* By Captain F. W. Hutton, F.G.S., and T. Kirk.

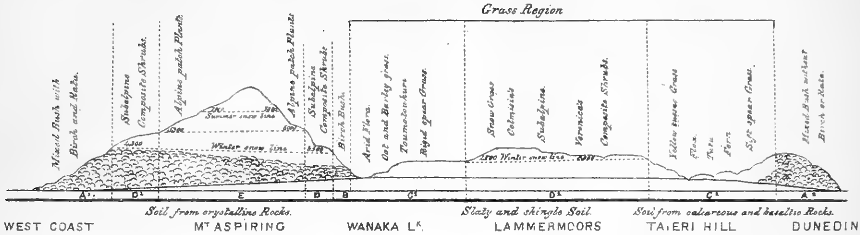
Plate VI.

[*Read before the Auckland Institute, 3rd August,* 1868.]

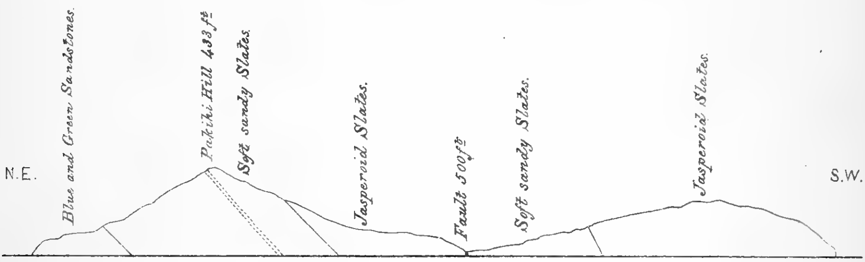
Arid Island lies about three miles from the north-east coast of the Great Barrier. It is rather less than one mile and a half long, by about three-quarters of a mile broad, and contains nearly 600 acres. Its highest point is about 700 feet above the sea level.

In December, 1867, in company with Mr. A. J. Allom, we spent several hours in examining this island, which, owing to its out-of-the-way position and its rugged cliffs, is seldom visited except by Maoris in the Mutton-bird season—the end of November. The accompanying map (Plate VI.), which we then made, will serve to show its principal features; although, being merely an eye-sketch, and made without any instruments, it has no pretensions to strict accuracy.

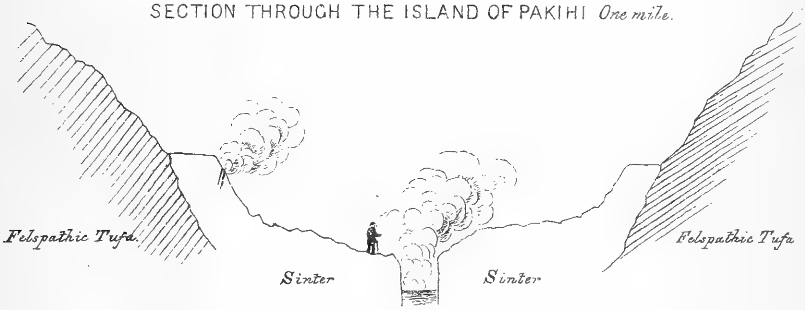
Arid Island certainly does not deserve the name bestowed on it by Captain Cook. The high, rugged, desolate-looking cliffs that encircle the greater part of the island, hide within them beautifully-sheltered valleys, covered with luxuriant fern and bush, and watered by streams which, uniting, empty themselves into the small boat harbour on the west coast. This harbour, although too small for a cutter to swing at her anchor, and exposed to north-westerly winds, is well adapted for boats, as it terminates in a fine, sandy beach, up which they can be easily hauled. It is the place where the Maoris always land when they come to eat Mutton-birds. These Mutton-birds, or Oii, as they call them, are a kind of petrel, of a dark brown colour, belonging, we suspect, to the genus *Puffinus.* We were not able to procure a specimen, the season being too far advanced, and saw nothing but the feathers lying about, where the Maoris had been eating them. These birds live in holes which they burrow into the soft hill sides. We were informed by the natives of the Great Barrier that formerly they used to be very numerous, but that latterly they had become scarce, having



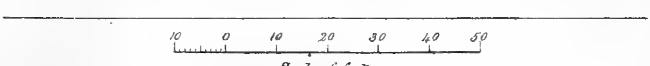
SECTION SHEWING BOTANICAL DISTRIBUTION IN ALTITUDE ACROSS OTAGO PROVINCE.

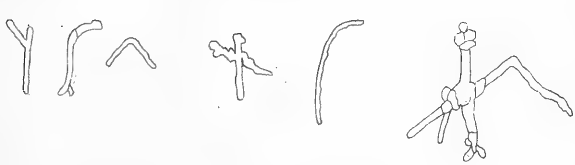


SECTION THROUGH THE ISLAND OF PAKIHI *One mile.*



SECTION THROUGH THE BASIN OF TE TARATA.





Particles of newly deposited sinter
Magnified 380 diameters.

been killed off by the rats. The other birds that we saw on the island were the Tui (*Prosthemadera novæ-zealandiæ*), the Bell-bird (*Anthornis melanura*), the Fantail (*Rhipidura flabellifera*), the Ground Lark (*Anthus novæ-zealandiæ*), the New Zealand Titmouse (*Certhiparus novæ-zealandiæ*), the little Miromiro (*Petroica toitoi*), and the Pigeon (*Carpophaga novæ-zealandiæ*). The greater part of the island is surrounded by high precipitous cliffs; the harbour, one point on the eastern, and possibly another on the northern side, being the only places from whence the island seems to be accessible. On the north and south the sea has eaten back the cliffs into mere ridges, only a foot or two wide in some places.

GEOLOGY.

The high ridge that surrounds the depressed interior of the island proclaims at once that it is the summit of an old volcanic cone, and an examination of the rocks confirms the supposition, and shows that it belongs to the trachytic class of volcanoes. The shape of the crater is singular, its length being more than twice its breadth, and the northern part being divided into two by a ridge running from the edge of the crater towards the centre of the island, and directed nearly to the boat harbour, or that point where the wall of the crater is lowest. This configuration is probably owing to there having been two craters, the southernmost of which was the last in activity, and filled up the northern one with ashes; and the two valleys have been subsequently scooped out by subaërial denudation. The direction of the dividing ridge, and the termination of the north-western valley in a narrow gorge, prove the correctness of this view.

Nearly the whole of the island is composed of trachytic tuffs and breccia, generally either white or of a pale yellow or violet colour, and enclosing here and there fragments of trachyte and obsidian. These tuffs are arranged in the cliffs that formed the wall of the crater, more or less horizontally, although of course much confused in places, and are but little intermixed with lava streams. To find these latter we must go to the adjacent coast of the Great Barrier, about three miles distant, where, at the south side of Wangapoua Bay, we see thick beds of trachyte and trachydolerite, interstratified with tufa, dipping away from Arid Island at an angle of 35°; and farther inland, on the top of the dividing ridge of the island, we find tufa and agglomerate, most probably derived from Arid Island, at an elevation of 1,550 feet from the sea level.

Now these facts lead to some interesting deductions, which bear on one of the great questions of the day, in geology, viz., Are volcanoes connected with a central fluid interior of the earth, or are their lavas derived from comparatively shallow depths below the surface?

It is evident that Arid Island, in its present condition—only 700 feet above the sea—could not have distributed tufas at an elevation of 1,550 feet, neither could lava streams flowing from it now have, at the same level as the crater, and at a distance of three miles, a dip of 35°. It follows, therefore, that either some other crater, in the direction of Arid Island, and much higher than it, but which has now quite disappeared, was the origin of these lavas and tufas; or, that Arid Island was once at a considerably higher elevation, not only above the sea, but with respect to the main land of the Great Barrier. The depth of the intervening sea, 12 to 17 fathoms, makes the latter supposition much the most probable; and assuming that it was so, we see that Arid Island must have sunk down at least 2,000 feet below the level of the Great Barrier, because the tufa, at a level of 1,550 feet, is evidently a submarine formation; while the shape and preservation of the crater of Arid Island shows that it was formed under the air, so that the bottom of the crater must have been above the highest level of the tufa. Now it appears most probable that the sinking of Arid Island was produced either by the breaking of the roof of the cavity from which the lava and ashes had been extracted, or by slipping down in mass of that part between it and the Great Barrier. If, therefore, we suppose that Arid Island was the centre of the subsided portion, we have a district six miles in diameter, which has broken or sunk through by its weight into a cavity below; and it appears to be impossible that such should have been the case, unless the thickness of the crust broken or sunk down was considerably thinner than the diameter of the cavity. For if not, it would have been strong enough to have resisted the fracture, and the friction along the sides would have been too great to allow it to slip; so that it seems impossible that the region from which Arid Island derived its lava was so deep as six miles below the surface, and therefore it would be unreasonable to infer that it was connected with a fluid interior; for most astronomers and geologists are now pretty well agreed that the solid crust of the globe is at least a thousand miles thick.

BOTANY.

Our visit to Arid Island was not made under favourable conditions for the investigation of its botany, most of the vegetation of the open land having been burnt off by a party of Maoris a few days before we landed, and our stay being limited to a few hours by the unsettled state of the weather.

Although it was impossible to make even an approximate list of the plants of the island, sufficient was observed to show it possessed a flora which comprised a greater number of forms than could be collected on the islets off the west coast of the Great Barrier, and that the general character of its flora approximated closely to that of the Little Barrier Island, which it so nearly resembles geologically. A complete examination of Arid Island and the Little Barrier would probably result in the discovery of other plants common to both but absent from the Great Barrier besides those observed by us.

The flora of the island may be roughly divided into Ericetal, or plants of the open land; Sylvestral, or forest plants; Littoral, or beach plants; and Uliginal, or marsh and swamp plants. It need scarcely be remarked that these terms are not always capable of precise application.

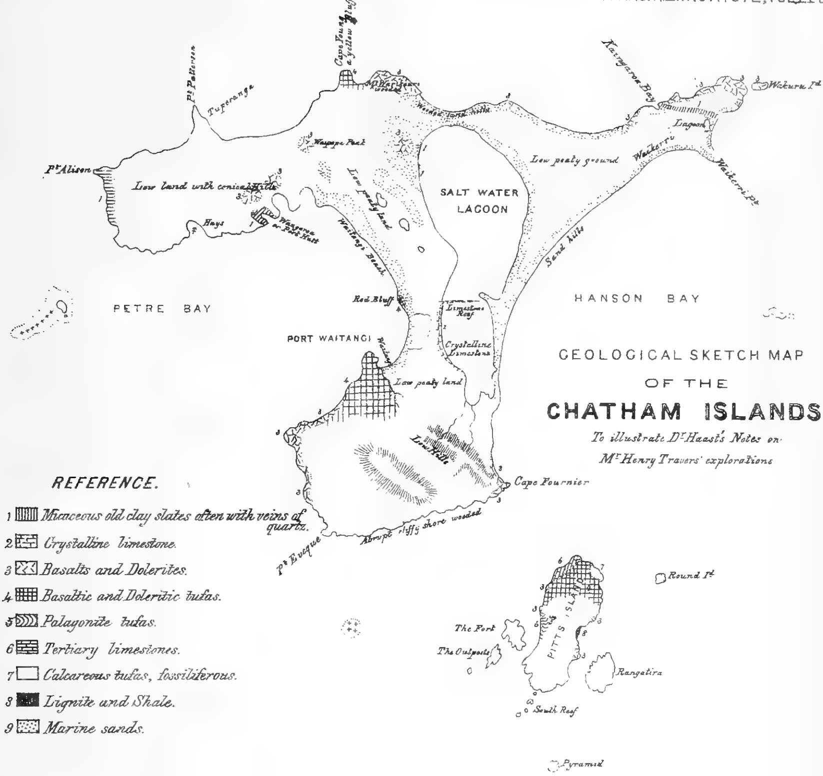
The greater portion of the central area of the crater and its rim is occupied by Ericetal plants; in the lower parts, a dense growth of *Pteris esculenta*, which often attains the height of six feet, intermixed with occasional tufts of *Phormium tenax*, renders all progress slow and laborious. On higher parts and in open places the fern is supplanted by *Leptospermum scoparium* and *Pomaderris phylicifolia*, sparingly intermixed with bushes of *Coprosma robusta*, *C. lucida*, *Carmichælia australis*, *Leucopogon fasciculatus*, *Veronica salicifolia*, *Coriaria ruscifolia*, and other small shrubs. *Agrostis æmula*, *Leucopogon frazeri*, *Drosera auriculata*, *Lobelia anceps*, *Haloragis micrantha*, *Lagenophora forsteri*, &c., &c., were common amongst open fern, together with the ubiquitous introduced plant *Erigeron canadensis*. The pretty *Ophioglossum lusitanicum* was seen on tufaceous ledges, and was afterwards observed in exactly similar habitats on the Little Barrier, but appeared to be entirely absent from the Great Barrier. Many specimens had two or more scapes springing from the same root, a peculiarity it shares with other forms of the genus in New Zealand, although all the forms collected in the northern hemisphere have invariably solitary scapes. On the highest points of the island, as in fact of all islands and headlands in the north of New Zealand, *Astelia banksii* and *Metrosideros tomentosa* were invariably found. *Astelia banksii*, we may remark, is always rupestral in its habitat, never epiphytal; nor is it found at any great distance from the sea, so far as our experience extends. From personal observation, we can testify it is abundant on rocks at Mercury Bay, where we sought for it in vain "on the limbs of trees," as reported in the "Handbook of the N. Z. Flora." *Astelia cunninghamii* is both epiphytic and rupestral, and is most frequently found inland.

The sheltered open spaces at the base of the cliffs on the exterior of the crater, and large portions of the northern and southern sides of the interior, are occupied by the Sylvestral portion of the flora in the crater itself, forming a somewhat open bush, although few of the trees attain large dimensions. As might be expected, the Pohutukawa (*Metrosideros tomentosa*), is abundant, although greatly inferior in size and appearance to the fine specimens of this tree on the Great Barrier, and which are probably unsurpassed. In the crater, this tree resembles *M. robusta* in its free and erect habit of growth, but on the cliffs it presents the distorted appearance so commonly seen about Auckland. The principal trees of large size are the Rimu (*Dacrydium cupressinum*) and the Tarairi (*Nesodaphne tarairi*). Amongst smaller trees and shrubs are *Dysoxylum spectabile, Melicytus ramiflorus, Corynocarpus lævigatus, Dodonæa viscosa, Coprosma grandifolia, Panax lessonii, P. arborea, Schefflera digitata, Corokia buddleoides, Olearia cunninghamii, Brachyglottis repanda, Geniostoma ligustrifolia,* and many others; but perhaps the most remarkable is *Pisonia umbellifera,* a few trees of which were found growing amongst young and large-leaved specimens of *Corynocarpus lævigatus,* which it closely resembles in the shape and colour of its leaves; and in the absence of its flower and fruit presented an anomalous appearance,—" like, yet unlike." Some of its leaves measured fully eighteen inches in length and seven inches in breadth. It was subsequently collected in a curiously similar habitat on the Little Barrier Island, but was not found on the Great Barrier.

The Littoral and Uliginal plants present nothing worthy of special notice, nor indeed had we sufficient time to examine them closely. *Samolus repens, Salicornia indica, Selliera radicans,* and others of rupestral habitat, are abundant at the base of the cliffs. Amongst the Arenarian plants are *Coprosma acerosa, Convolvulus soldanella, and Spinifex hirsutus.* The last named curious grass formed large tufts, with prostrate culms, sometimes 30 feet or more in length, which throw out roots at the joints, and aid in binding the shifting sands. The cultivated radish (*Raphanus sativus*) is also found growing with the above on the sands at the head of the little harbour.

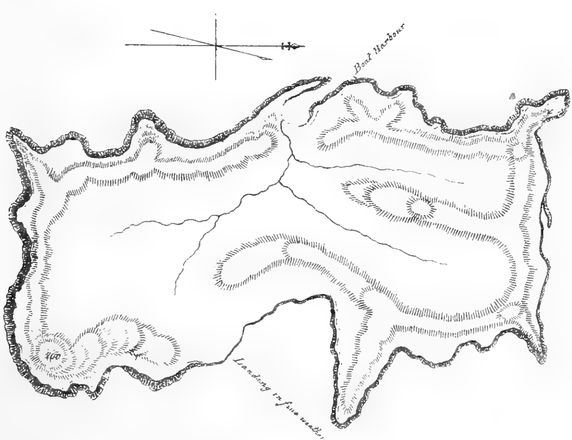
The Raupo (*Typha latifolia* var. *angustifolia*) and other Uliginal plants find a suitable habitat, although of limited extent, near the centre of the island.

The notes just read must be considered as merely a contribution to the botany of Arid Island. We venture to express the hope that some member of the Institute may visit the island under more favourable circumstances than fell to our lot, and be able, at least, to make a complete catalogue of its phænogamic plants and ferns; not only on account of the interesting nature of the locality, but because of the positive value possessed by an exact and minute knowledge of the local distribution of plants, as an element in the ultimate circumscription of their specific limits.



GEOLOGICAL SKETCH MAP OF THE CHATHAM ISLANDS

To illustrate Dr. Haast's Notes on Mr. Henry Travers' explorations



ARID ISLAND

4 inches = 1 mile.

ART. XVI.—*On the Geology of the Island of Pakihi.*

By Captain F. W. HUTTON, F.G.S.

Plate V.

[*Read before the Auckland Institute, 5th October,* 1868.]

THE Island of Pakihi lies between the Island of Punui and the mainland, at the north-west end of the Firth of the Thames. It is rather more than a mile in length and a third of a mile broad, the longer axis lying about north-east and south-west. Both extremities of the island are high, the north-east end forming a conical-shaped hill 433 feet high, known as "Pakihi Hill," while the centre is a low, fertile valley.

The whole of the rocks found on the island belong to the Upper Palæozoic period.*

The north-eastern extremity is composed of hard blue and green sandstones, brecciated in places, and much jointed, the fissures of the joints being filled with peroxide of iron. These sandstones dip about 40° W., and are overlaid by a series of soft, blue, sandy slates, 1,000 feet thick, containing blocks of the harder sandstones, which lie under them. They decompose very easily to a soft reddish-yellow clay, in which state they are almost always found at the surface. Near the upper part a band about six feet thick occurs, of a friable green schistose rock, containing small rounded pebbles. (See Plate V.)

This series is covered by a mass of red or brown jasperoid slates, containing large quantities of manganese ore. These jasperoid slates are more than 1,300 feet thick. The manganese occurs in numerous bands, about an inch thick, generally running parallel to the cleavage of the slates, but occasionally at right angles with it. The ore appears to be almost entirely psilomelane, little if any pyrolusite being mixed with it. On the west coast large quantities could be obtained at a very small expense.

Across the centre of the island runs a fault, which throws up the south-western portion about 500 feet, again exposing the series of soft sandy slates. The dip, however, is increased to about 70° W., which soon brings the jasperoid slates down to the sea level, and the whole of the south-west portion of the island is composed of them.

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* Perhaps also partly Triassic.—ED.

ART. XVII.—*On the Utilization of the* Phormium tenax.

By W. T. L. TRAVERS, F.L.S.

[*Read before the Philosophical Institute of Canterbury,* 1864.*]

IN considering the natural resources of this colony, there is nothing more calculated to arrest attention than the abundance and general distribution of the plant popularly known as the New Zealand Flax; and we find, in effect, from a perusal of the various works which have been published on New Zealand, that this plant has always been looked upon with very great interest both in the colony and in Europe. The interest thus created is due to the presence in the leaves of the plant of a large quantity of woody tissue, analogous to that produced from the hemp; and many attempts have accordingly from time to time been made to utilize this tissue. I will not venture to go into the causes which have hitherto rendered these attempts abortive, but I may remark that they have had the unfortunate effect of checking further enterprise, by creating an opinion that the fibre cannot be separated from the leaves, in a state fit for manufacturing purposes, except at a cost far exceeding its value. One cause of failure, however, I will notice, namely, that the capital hitherto employed in our local flax-works has been too small to test its value in a satisfactory manner; for it may be laid down as a postulate, that no article of commerce requiring new appliances to render it useful will find a market in England unless manufacturers there can be assured of a large and continuous supply.

In using the word "flax," as applied to the *Phormium tenax*, it must not be supposed that the plant belongs to the natural order *Linaceæ*. It belongs to the order *Liliaceæ* of Jussieu, and is botanically described by Dr. J. D. Hooker in his work on the flora of New Zealand. In this description, Dr. Hooker particularly notices the existence of the fibre which gives its principal interest to the plant, and the gummy exudation which has been looked upon as a detrimental quality in the leaf. Now, in considering whether this fibre can be turned to useful commercial purposes, we are led to inquire, in the first place, into the question of supply of the raw leaf. Those who have had any opportunity of travelling over these islands, cannot fail to have been struck with the extensive distribution of the *Phormium tenax*. In almost every locality, whether on the mountain side or in the river bed, in the narrow valley or on the broad plain, we see it growing more or less abundantly. In many places, thousands of acres continuously are covered with it; and it would not be too much to say that within a few miles of Christchurch

* The exact date of the reading of this and the two following papers before the Philosophical Institute of Canterbury had not been ascertained at the time of their being sent to press.—ED.

alone it occurs in great abundance, growing with more than average luxuriance. There cannot, in fact, be the least doubt of its abundance as a mere natural production; and we may confidently assert that if the fibre can be economically separated in a condition fit for the English market, the natural supply is not likely to be exhausted for many years to come. I may add, moreover, in reference to supply, that from actual experiment I have ascertained that average flax land in its natural growth will yield from ten to twelve tons of raw leaf per acre without injury to the plants. I have also ascertained, from actual experiment, that the average quantity of fibre obtainable from full-grown leaves is little less than one-tenth of the weight of the leaves themselves; or, in other words, that the acre of ordinary flax land in its natural state would yield close upon twenty-four hundredweight of pure fibre per annum without any outlay whatsoever for cultivation.

This fact alone shows the importance of endeavouring to turn the fibre to account. You have now before you the fibre separated from leaves of various lengths, as shown in the following table:—

Number of Specimen.	Number of Leaves.	Weight when cut. lb. oz.	Length of Leaf. feet.	Weight of Clean Fibre. oz.
1	2	1 6	6	2 and a fraction
2	2	0 12	6	$1\frac{1}{2}$
3	2	0 10	4	1

You will observe that the weight of fibre in each case bears a nearly average proportion to that of the leaf from which it was extracted; and as the leaves grew on various kinds of soil, we may fairly assume that this proportion is not liable to much variation. Assuming, then, that the supply from natural sources would be sufficient to meet demand for some years to come, it still remains to be considered whether the fibre can be economically separated from the leaf, and whether, when separated, it can be turned to profitable account.

The first point is one which has long excited attention, and the General Government of the colony, some time ago, offered a considerable reward (£2,000, I believe) for the production of one hundred tons of fibre in a state to be merchantable in Europe. I am not aware that the reward has ever been claimed, and it is not my place here to inquire whether the conditions attached to it were calculated to produce the results aimed at. I cannot help thinking, however, that these results could have been equally well attained had the quantity required been limited to ten or twenty tons instead of one hundred tons, provided it were at the same time shown that an unlimited supply of the article produced could afterwards have been procured.

Returning to the question whether the fibre can be economically extracted from the leaf, I think I shall be able to show that this can be done by a process similar in effect to that by which the fibre before you has been obtained.

You are doubtless aware that beneath the epidermis or outer covering of the leaf we find a layer of cellular tissue, technically termed the parenchyma, by which the fibrous tissue is surrounded. You are also probably aware that the fibrous tissue may be separated from the cellular tissue by maceration; and, indeed, it is by this means that the fibre of the European flax is usually separated from the bark of the plant which produces it. Of course it is important that the fibre should be separated without injuring its strength. Now, the method by which the fibre before you was obtained was as follows:—

The leaves were boiled for two hours with a small quantity of washing soda. After becoming cold they were bruised so as to break up the parenchymatous tissue, and render it easily separable from the fibrous tissue. When well bruised, the leaves were agitated in running water, until, as you will observe, the whole of the epidermis and the greater part of the parenchyma were removed, leaving the fibre as you now see it.

In order to carry out the same process on a large scale, we should require to use machinery.

In the first place, the leaves should either be boiled or subjected to the action of steam in a close vessel. After boiling, they should be loosely twisted or plaited into an endless rope, some ten or twelve yards in length and from three to four inches in diameter. Two coils of this rope should then be passed between grooved horizontal rollers, eighteen inches long and about fourteen inches in diameter, one above the other, the lower one moved by machinery, and the upper one pressed on to the lower one by a sufficient weight to secure its contemporaneous but slower revolution, and also to secure the effectual crushing of the parenchymatous tissue. About ten feet below the rollers should be placed a trough, in which the loose part of the rope should lie previous to its passing through the rollers, and through which a stream of clear water should run. Every part of the crushed ropes would thus lie in the trough for some time after passing through the rollers, and the running water would gradually remove nearly every particle of the epidermis and parenchyma, leaving nothing but the fibre in the condition in which you now see it. When this process has been completed, the ropes should be hung up to dry, and when dry be broken into lengths or packed whole in bales, as the case might be.

This process, as you will observe, is a very simple one, but still two questions arise,—

1. Is it economical?
2. Is the fibre injured by it?

The first question involves a matter of mere calculation.

The machinery is of a very inexpensive character, and if worked by water-power, the cost of working is reduced to the minimum.

In order to prepare the ropes for passing through the rollers, we should have to provide,—

1. For cutting the flax and tying it into bundles of, say, 112 lbs. each.
2. For collecting these bundles together for carting.
3. For the carting to the mill.
4. For boiling the leaf.
5. For plaiting or twisting it when boiled, and for watching the further operations.

I am of opinion, taking the present value of labour and fuel into account, that the fibre can be produced at the mill at a gross cost of from £9 to £10 per ton, in condition equal to that now before you.

I will now proceed to make a few remarks upon the question whether the fibre produced by the above process can be turned to profitable account. In this question are involved both local and foreign demand. As regards local demand, I know that some hundreds of tons of *Phormium* flax, in the condition of the imported sample marked A now before you, are annually used in this colony for stuffing mattresses, and other upholstering purposes. I know, also, that flax in similar condition to that which I have prepared for your inspection, has been long and largely used in neighbouring provinces in the manufacture of rope and lines of various kinds, and that it commands a ready sale for those purposes.

From inquiries that I have made amongst upholsterers in Christchurch, I find that the flax at present consumed by them in the manufacture of mattresses, &c., costs them on an average £35 per ton, and that they reckon not less than 5 per cent. as waste. From former inquiries in other parts of the colony, I am led to believe that fibre in the condition of that before you would be readily purchased at from £26 to £28 per ton for the same purposes and for manufacture into rope and lines; and I believe that a still larger quantity would be used for these several purposes, if the raw material could be regularly supplied at £25 per ton.

I also believe that if a large and continuous supply, of a quality similar to that now shown to you, were guaranteed to English manufacturers, it would command from £25 to £28 per ton in England for rope-making purposes alone; for although the rope manufactured from it might not possess the same excellent qualities, in all things, as that made from the fibre of the European hemp, there can be no doubt of the applicability of the rope to various useful purposes, for which its comparative cheapness would greatly recommend it.

I find the following notice, in reference to the applicability of this flax to textile manufactures, in Volume V of the *Transactions of the Royal Society of Victoria,* in a letter addressed by Dr. Mueller to the Governor of Victoria, in October, 1860 :—

"Sir,—I have the honour to acknowledge the receipt of your letter dated 15th October, accompanied by a copy of a despatch from the Under Secretary of State for the Colonies, desiring information on such plants yielding textile fibre as are indigenous to the Colony of Victoria, and are likely to supply a want of raw material for British manufactures.

"Whilst, in compliance with His Excellency the Governor's request, I beg to submit such information as I possess on the indigenous vegetable fibres, I regret that I cannot point to any native plant extensively available for the desired purpose, or holding out the prospect of successful introduction into British manufactures.

"But it appears to me that the two varieties of New Zealand flax *(Phormium tenax)* are deserving of especial attention, as likely to supply the wanting material to British weavers, the strength of the *Phormium* fibre being almost equal to that of silk, and little doubt being entertained that, finally, the genius of invention will overcome the hitherto experienced difficulty of separating, by an easy method, without sacrifice of the material's strength, the fibre from the leaves.

"I beg further to draw attention to the extreme facility with which this plant might be reared on places not available for any other cultivation (such as margins of swamps, periodically inundated margins of lakes, &c.); further, to its great vigour of growth, to the probability of its proving quite hardy in the southern parts of England and Ireland, and to the certainty of its cultivation being attended with full success in South Europe, and therefore in proximity to the British market, and under the advantage of cheap labour."

Such an opinion is of extreme value, and shows that we have hitherto underrated the importance of this source of wealth.

The real difficulty in regard to the application of the *Phormium* flax to manufacturing purposes generally, has hitherto been the limit in supply; but I have reason to believe that if a constant and large supply could be insured, it would, as I have before stated, be worth at least from £25 to £28 per ton in London.

It will thus be seen that both for local use and for exportation this article affords an opportunity for the profitable employment of capital; but I am satisfied that profit can only be derived where its production is undertaken on a large scale.

Upon the question whether the strength of the fibre is injured by the process of separation mentioned in this paper, I have no means of stating anything conclusive. I am of opinion that it is not in any degree injured; and I found that opinion upon the following passage from a recent work detailing the progress of useful inventions:—

"Recent schemes for preparing flax have excited great attention. Those of Chevalier Claussen are the most important. The first attempt was to prepare long flax fibre for ordinary linen manufacture. Four hundred-weight of flax in the straw was boiled in a stone vat, in water containing caustic alkali. The boiling lasted four hours, which was said to 'ret' or separate the fibres as effectually as an ordinary steeping of a week's duration. It is asserted also that the fibre is developed in uniform strength, that it is less discoloured than by the old process, and that much more of the glutinous or gummy matter is removed. The flax was removed from the alkaline liquid and steeped for two hours in water slightly acidulated with sulphuric acid. This effected the cleansing of the flax and at the same time rendered the straw a more valuable manure than it would otherwise be. The flax was then in a fit state to be scutched and prepared by the ordinary flax apparatus."

It would be interesting and satisfactory, however, if some person qualified to do so would undertake the experiments necessary to determine this point.

ART. XVIII.—*On the Chatham Islands.* By H. H. TRAVERS.

Plate VI.

[*Read before the Philosophical Institute of Canterbury.*]

THE following letter addressed to Mr. W. T. L. Travers, F.L.S., by his son, Mr. Henry H. Travers, on the return of the latter from a phytological exploration of the Chatham Islands, was read before the Philosophical Institute of Canterbury, and is now published as part of their Transactions:—

"In accordance with your instructions, I proceeded to the Chatham Island Group in a schooner, the "Cecilia," of 40 tons, which sailed from Lyttelton on the 12th of October last. Our voyage was slow and somewhat uninteresting, and it was not until the 19th that we sighted the Horns, two conical-shaped hills at the south-western extremity of Chatham Island. On the way down we met large numbers of right whales, humpbacks, and porpoises, and were, as usual, accompanied by albatrosses and Cape pigeons. After sighting the main island we proceeded directly to Pitt's Island, and came to anchor off a rocky point forming the eastern extremity of a small bay at the north end of the island, and at the head of which is the residence of Mr. Frederick Hunt, an Englishman, who has been settled there for nearly twenty years. Immediately opposite Mr. Hunt's house is a rock called the Flower-pot, which forms a shelter for boats engaged in landing or shipping goods. Mr. Hunt's house is close to the beach, and is surrounded by about two hundred and fifty acres of cleared land, mostly laid down to English grasses, and divided into paddocks, forming a very compact and well-cultivated farm. With the exception of these clearings, and of insignificant patches of open land in various parts of the island, the whole of Pitt's Island is covered with bush. I was received with much civility by Mr. Hunt and his family, who invited me to stay with them during the time I should be engaged in collecting plants, &c. On this occasion, however, I remained on Pitt's Island for a week only, having been detained by a tremendous gale from the north-west.

"We left on the 26th, and reached Waitangi (a Maori settlement on Chatham Island) on the following day. Here I presented my letters to Captain Thomas, the Collector of Customs, by whom I was treated most courteously, and who promised to give me every assistance in his power in carrying out the objects of my journey. Waitangi is the chief Maori settlement on the Chatham Islands, and is situated at the south-eastern extremity of Petre Bay, which forms an indentation some forty miles broad on the south-west side of the island. But for this bay the shape of the island would have been nearly that of an isosceles triangle, of which the south-western side would have formed the base. A small but deep river flows into the bay close to Waitangi, washing on its western side the foot of some low ridges of reddish sandstone. The river drains a considerable tract of hilly ground on the south side of the bay, and is also fed by a stream running from a lagoon close to the settlement. Were it not for a bar at its mouth, vessels of from forty to fifty tons burthen might enter it, as inside the bar the water is deep for a considerable distance inland.

"The huts of the Maoris and the residence of Captain Thomas are situated on low ground on the east side of the river. The Maori huts are built of fern posts lashed together with supplejacks, and thatched with toi grass, resembling in all respects those found in the old pahs in New Zealand. Captain Thomas's residence is built in the same way with the exception of the roof, which is shingled; but it is plastered inside and out with clay, and whitewashed. A chapel belonging to the Church of England natives is a very handsome specimen of their style of building: the inside walls are lined with fronds of tree ferns, from which the pinnules have been stripped, and which are interwoven in a curious manner with leaves of *Phormium tenax*. The roof is braced with boards having white scrolls painted on a red ground, The outside walls and roof are closely and smoothly thatched with toi grass. The building is about fifty feet long and nearly thirty broad, and about the same height to the top of the roof. There is a smaller building used as a church by the Roman Catholic natives, built in the same style, but more highly decorated and more neatly kept.

" The population of Waitangi, including a few Moriori slaves, numbers about one hundred and fifty, all told. Their huts are surrounded by well-fenced paddocks, laid down to English grasses, but now almost smothered by the common daisy, mustard, and dock, which are spreading rapidly over the whole island. The natives generally possess considerable numbers of horses, cattle, and pigs, which run, in common, on the open lands and in the bush. They cultivate large quantities of potatoes, maize, pumpkins, and onions, which they supply to American whaling ships resorting to the islands, and occasionally export to New Zealand. I did not find that they cultivated any European fruits, but they use largely that of a small species of *Solanum* indigenous to New Zealand, and which they had introduced to the Chathams. There are also Maori settlements at Tubong, on the western side of the island, and at Warikauri, Taupeka, and Kaiangaroa, on the north side, having altogether a population of some four hundred souls, all told. The remnant of the Morioris (the name given to the aboriginal inhabitants), exclusive of the few who are still retained in slavery, is settled at Ohangi, on the south-eastern side of the island. They do not exceed two hundred in number, and are said to be rapidly decreasing. I believe this to be the case, for during my six months' stay, not less than eight deaths occurred amongst them. In their habits of living they now assimilate to the Maoris, and speak a language compounded of their own original language and that of the New Zealanders. Before the invasion of the islands by the New Zealanders, which took place about the year 1832 or 1833, the Morioris were very numerous, numbering little short of fifteen hundred people. They are much shorter, but stouter built, than the New Zealanders, and have darker skins, but the same straight coarse hair. Their faces are rounder, and more pleasing in expression. Their noses are Roman in shape, resembling those of the Jews. They never tattooed, and although they originally practised cannibalism, they had discontinued it before the arrival of the New Zealanders. They appear to have been a very cheerful people, fond of singing, and of telling laughable stories. Their habits of living, however, were originally very rude and improvident. They built no huts, merely using a few branches of trees stuck in the ground as a shelter from the wind. Their chief food consisted of fish, birds, shell-fish, and fern root, which latter they prepared in the same way as the New Zealanders, but the women always eat apart from the men.

"Like many other savage tribes they were very indolent, seldom seeking food until pressed by hunger. They had no canoes, there being no timber on the islands sufficiently large for constructing them; but they formed rafts of the flower stalks of the *Phormium tenax* lashed together, and having an upright wooden stem ingeniously carved. The paddles were shaped like a spade, and were used at the stern, very much in the same manner as a spade would be used in digging. They made stone axes, similar to those of the New Zealanders, and these, with clubs, &c., constructed from the harder woods growing on the islands, formed their weapons. In their own quarrels it was understood that the first blood drawn terminated the battle. Such fights were uncommon, and were generally for the possession of a seal carcass, or of some mass of whale-blubber which happened to be cast ashore, both of which were esteemed choice luxuries. They had no hereditary chiefs, the most successful fisherman, or bird-catcher, or any member of the tribe distinguished by extraordinary stature, being looked upon as an authorized leader. They had no idea of a God in our sense of the term, nor, so far as I could learn, of evil spirits; but they looked upon a good fishing or birding ground as being the gift, or rather under the charge, of an "Atua," or good spirit. Their mode of disposing of their dead had special reference to the particular vocation or fancy of the living subjects. If the dead person had been a good fisherman, for example, his body was lashed in a sitting posture to a raft, and sent adrift with a baited line in his hand. If he had been a noted bird-catcher, he was fixed in a stooping position between two trees facing the particular hill or other spot which he usually frequented. If he had no particular vocation, he was put, in a sitting posture, into an open hole in the ground, generally about eighteen inches deep, with any favourite piece of carved wood stuck up before him. Mr. Alexander Shand, son of the late Collector of Customs at Waitangi, is, I believe, well acquainted with their traditions and customs, and will no doubt be able to give you full information upon the various subjects to which I have thus shortly referred.

"So far as I could learn, their chronology, unlike that of the New Zealanders, is very defective, and consequently they are unable to fix, even proximately, the date of their first arrival in the islands. They say, however, that they came in two canoes, one of which drifted to sea again, but the other was preserved for a considerable period. They are quite in the dark as to where they came from originally; but as they resemble the Mangaia Kanakas, who form a large proportion of the crews of the American whaling vessels, I conceive it not improbable that they have the same origin.

"The islands were invaded in 1832 or 1833 by the New Zealanders, by whom large numbers of the aborigines were killed and eaten. In fact, their expedition may be said to have been undertaken solely for the latter purpose, a Maori who happened to have visited the islands whilst engaged as a seaman in a vessel trading from Sydney, having reported the aborigines as a plump, well-fed race, who would fall easy victims to the prowess of his countrymen. By a refinement of cannibal cruelty, the unfortunate wretches were compelled to carry the wood and prepare the ovens in which they were to be cooked. Such of them as were destined to be eaten were then laid in a row upon the ground adjoining the ovens, and were killed by blows from a *méré* by one of the Maori chiefs. It is not more than twenty years since the Maoris gave up these feasts. Although I found the remains of numerous skeletons in the woods on Pitt's Island, I was unable to get one in good condition: I have, however, brought over several authentic skulls, which will probably be interesting for ethnological purposes.

"As I had determined to make Pitt's Island my head-quarters, in consequence of its offering greater advantages as a collecting ground, I took the opportunity of my first visit to Chatham Island to travel round it. Accordingly, on the 2nd November, accompanied by Mr. Hunt, (who had come over with me from Pitt's Island), I started for the Red Bluff, about twelve miles from Waitangi. The road led partly through a belt of bush, which, for a depth of two or three miles, forms a fringe round a large portion of the island, and partly along the sea shore. The weather unfortunately was extremely wet, as indeed it was during the whole of my stay on the Chatham. The bush consisted principally of *Eurybia*, *Coprosma*, *Laurus karaka*, *Dracophyllum*, &c., with tree ferns, amongst which were *Cyathea dealbata*, the whole so interwowen with our old friend the supple-jack as to be almost impenetrable. In this bush I found a *Lomaria*, closely allied to, if not identical with, *Lomaria discolor*, *Polypodium billardieri*, and several other ferns. On the beach the *Myosotidium nobile* grew with rank luxuriance where not invaded by the pigs, which fed upon the roots. The Maoris dry the leaves, and use them as tobacco. Where the sea shore is sandy, I noticed a sand grass identical with one of those which occurs upon the sand-hills near Christchurch.

"From the Red Bluff we proceeded to Wangaroa, on the north side of Petre Bay, and from thence, leaving a large tract of sand-hills between that place and Tubong on our left, we crossed to Warikauri, on the north side of the island. This route led us past three small lagoons, destitute of water plants, but fringed in part with rushes and in part with bush similar to that before described. The country here is low, and is now covered with a young growth of grasses and sedges, mixed with the common *Pteris esculenta*, and with occasional patches of *Phormium tenax*. On the sandy tract before alluded to, between Wangaroa and Tubong, I noticed large quantities of a small but beautiful shrub, apparently belonging to the *Epacrideæ* (*Leucopogon richei*), the sand grass above referred to, and fern. From Warikauri we proceeded to Taupeka, where we slept.

"From thence, on the next day, we proceeded to Kaingaroa, travelling along a sandy beach fringed with bush, into which we occasionally passed in order to avoid rocky places projecting into the sea. With the exception of a *Eurybia* and *Dracophyllum* I found no plants in flower, and the weather was so extremely wet that I was unable to enter the bush. We remained at Kaingaroa three or four days, one of which I spent at the residence of Mr. Shand, at Wakuru, by whose family I was hospitably entertained. From Kaingaroa we went to Okawa, formerly the principal Maori settlement, and the chief scene of their cannibal festivities; and from thence we returned to the Red Bluff, passing across the great lagoon along a reef which lies about a foot below the surface of the water, and intersects the lagoon from east to west. This reef is generally from twenty to thirty yards broad, but occasionally narrows to less than ten, with a sloping bank on each side. The lagoon is nearly forty miles in length from north to south, and from eighteen to twenty broad at the north end, narrowing to five or six at its southern extremity. It almost intersects the island, the space between the north bank and the sea shore being little more than three or four miles, whilst at the south end it is only separated from the sea by a sand-bank a hundred or a hundred and fifty yards wide. This sand-bank is periodically broken through by the accumulated waters of the lagoon; the beach, after the lagoon has sunk to high watermark, being repaired by the wash of the sea from the south-east. The lagoon is in some places bordered by extensive spongy tracts, in others by grasses, sedges, and rushes, and in others by bush similar to that which occurs on the sea shore. I did not notice any water plants such as *Potamogeton*, &c., in any of the lagoons; though in the centre of one of the smaller lagoons, on the north side of the island, I saw some plants spread upon the surface of the water. In consequence, however, of the depth of the water, and of their distance from the edge of the lagoon, I was unable to obtain any specimens.

"The general surface of Chatham Island, except of that part which lies to the south of Petre Bay, is low and slightly undulating, with occasional hills. For example, on the tract to the north of the bay there are three or four conical hills attaining an elevation of five or six hundred feet, and composed of volcanic or igneous rock. These hills are clothed with bush from top to bottom. The country to the eastward of the Great Lagoon is very low, scarcely rising in any part more than fifty feet above sea level.

"The peninsula to the south of Petre Bay is more hilly, the hills presenting abrupt escarpments to the sea. The soil is peaty, and often fifty feet deep. In several parts of the island this peat has been on fire for years, burning at a considerable depth below the surface, which, when sufficiently undermined, caves in, and is consumed. I have seen the loose ashes arising from these fires, upwards of thirty feet deep. In one place I noticed, in the burning peat, at a depth of six or seven feet from the surface, trunks of trees of a growth evidently far exceeding any that are now to be found on the islands. I was, I am sorry to say, unable to obtain any specimens, in consequence of the great height of the wall of peat, and the mass of ashes below. The surface growth (exclusive of bush) consists principally of grasses and sedges, with small patches of fern; but I have little doubt that large numbers of indigenous herbaceous plants have been destroyed, partly by the constant firing of the surface by the natives, and partly by the pigs, cattle, and horses. Nearly the whole country had, in fact, been burnt shortly before my arrival.

"There are at present but few land birds either on this or on Pitt's Island. Formerly the White Crane (*Herodias flavirostris*), the Bittern (*Botaurus poicilopterus*), an *Apteryx*, said by the Maoris to have been identical with a New Zealand species, and also, according to their accounts, a smaller species of the same bird, the Weka (*Ocydromus australis*), and the Kakapo (*Strigops habroptilus*) were found on both islands, but have become extinct since their invasion by the New Zealanders. Mr. Hunt informed me that the last time he saw the Bittern was about three years ago. The land birds now found are a large Kite, the Pigeon, the Tui or Parson Bird (*Prosthemadera novæ-zealandiæ*), the Pukeko (*Porphyrio melanotus*), the Parakeet (*Platycercus, sp.*), the Fan-tail (*Rhipidura*), the Lark, and a small Titmouse, all identical with the birds of the same genera found on New Zealand. I was told by Mr. Hunt that the Pigeon was first seen on the islands within the last eight years, and that the Titmouse appeared shortly after the occurrence of the great fires in Australia, known as the Black Thursday fires. Mr. Hunt is a very careful and trustworthy person, and as his statement relative to the Pigeon was confirmed by the Maoris, I have full reason for believing what he told me in regard to both birds. Of aquatic birds I saw the Gray Duck, Brown Teal, and two species of Shag common in New Zealand, and a large number of Gulls and other sea birds similar to those which frequent the coast of that country. Mutton-birds were extraordinarily numerous on a rock known as the Fort, lying between Chatham and Pitt's Island. During my journey round Chatham Island, of which I have given an account above, I saw a peculiar Teal on one of the lagoons near the Red Bluff. This bird had bright scarlet markings on the wings. I fired at it, but owing to the great dampness of the weather, the gun I had with me hung fire, and I missed the bird. I never saw another specimen, and was informed that it is very uncommon. The number of land birds of all kinds, however, is extremely limited. Indeed, it is rare to meet with any at all during a whole day's walk in the bush. I attribute their destruction principally to wild cats, the progeny of imported animals, although I was informed that a species of gull also attacks the land birds, and is especially destructive to poultry.

"Besides wild cats, which are common on both islands, there are on Chatham Island swarms of the Norway rat and English mouse. I believe there were no indigenous terrestrial mammals on either island, not even a bat; but seals of several kinds, and whales, and porpoises are abundant on the coasts, the former frequenting reefs at some distance from the shore. In connection with the recent introduction of the New Zealand pigeon, I may mention that in a small tract of bush on the margin of the great lagoon, I found three trees of the *Edwardsia microphylla* all growing close together, and being the only specimens of that plant which I saw on either island. They were not in flower or fruit at the time. They were apparently all of equal age, and were about five inches in diameter and fifteen feet high. Mr. Hunt, to whom I pointed them out, stated that he had never seen the plant before. During my residence at Pitt's Island I was in the habit of examining the coast of the Bay in which Mr. Hunt's house is situated twice a day for some months, and on one occasion I found a sawn plank of Totara, and on another a seed of the *Edwardsia*, which had evidently been washed from New Zealand. The seed was hard and apparently sound. I gave it to Mr. Hunt, who sowed it, but I have not yet learnt the result. I also saw on the beach logs of White and Red Pine, and of the Totara, which had been washed ashore some time previously.

"I left Chatham Island about the 20th November, and proceeded to Pitt's Island, and took up my residence with Mr. Hunt. As I have before mentioned, the whole of Pitt's Island, with but a very trifling exception, is covered with bush. I was struck with the perfect identity of the great majority of the plants with those of New Zealand, but, as you will observe from the collections I made, I felt it my duty to take even those about which I had no doubt whatsoever. There is but one hill on the island which exceeds six hundred feet in height. It is perfectly flat-topped, the summit having an area of about eighty acres. This is covered with peat to the depth of five or six feet, supporting a mixed growth of grass, fern, *Phormium tenax*, and shrubs. From the summit of this hill a good view of the whole group of islands is obtained.

"I was unfortunately unable to visit South-east Island, which appears to be the highest land in the group, and which, I was informed, contained several plants not to be found either on Chatham or Pitt's Island. I had one opportunity of visiting it, but owing to the great dampness of the season, I was afraid to leave my collections, which required unremitting attention.

During one short absence, I lost a very large collection of plants, (including my only specimens of *Euphorbia glauca*, *Edwardsia microphylla*, and *Mesembryanthemum australe*), which, on my return, I found to be one mass of mildew. The several members of Mr. Hunt's family were, during the whole time of my stay, so busily employed in their various duties, that I felt I could not impose upon them the extra task of attending to the plants, and this prevented me from visiting the various outposts and reefs.

" In regard to insects, &c., my knowledge is too limited for me to venture upon any detailed observations respecting those which occur in the islands. I noticed, amongst others, the common New Zealand bluebottle and yellow flesh flies, and the European house fly. Mosquitoes and sandflies were abundant. In the bush I saw a considerable number of spiders, including one very large *Mygale*, which also frequented buildings, making its nest in the thatch. I found several beetles, but moths and butterflies were rare, the few I met with being apparently identical with New Zealand species.

" Several introduced plants are spreading rapidly, for example, white clover, the English daisy, the dock, the mustard (*Sinapis arvensis*), the English burr, (which grows with the utmost rankness in the bush on Pitt's Island, often to the height of three feet and upwards,) the *Polygonum* (*aviculare ?*) found on the Canterbury Plains, the wild strawberry, and others. Indeed, from the luxuriance and rapidity with which those plants grow, I have little doubt that, if not checked, they would soon overcome and replace the indigenous herbaceous vegetation. Since the introduction of bees, European fruit trees have produced freely, and all kinds of vegetables grow with great vigour.

" Should any other person be tempted to visit the islands for botanizing purposes, I recommend the months from December to April inclusive as the best season."

ART. XIX.—*Notes on the Rock Specimens collected by H. H. Travers, Esq., on the Chatham Islands.* By JULIUS HAAST, Ph.D., F.G.S., F.L.S.

[*Read before the Philosophical Institute of Canterbury.*]

THE Chatham Islands consist of different formations, some of high geological interest; showing, on the one hand, that in their geological relations they are nearly allied to New Zealand, and on the other hand, that they belong to a separate volcanic axis, of which we shall, in the course of time, be able to trace the continuation north and south.

The principal island is of volcanic origin, and consists chiefly of basaltic and doleritic rocks and tufas, although older rocks are certainly not wanting.

Several cones with a crater-like character show us the different centres of eruption; whilst around them, and extending from one to the other, marine sands have formed barriers, enclosing tracts of low land favourable to the formation of peat swamps.

Pitt's Island is formed of the same volcanic rocks, but it is more hilly, and does not present the same strange aspect as the main island.

The rocks submitted to me, with the necessary explanations, by Mr. H. H. Travers, afford a clear insight into the structure and formation of these islands, and to them I shall refer when speaking of the different characters of the rocks.

The oldest rocks visible occur near Kaingaroa, and stretch in a west and east direction towards the north-eastern corner of Chatham Island. They dip towards east at an angle of about 30°, and consist of micaceous clay-slates, silky, and of a pale green colour. They are traversed by veins of quartz which has the appearance of being auriferous. Similar rocks occur in our Southern Alps of New Zealand, on the eastern slopes of the Moorhouse range, and on the south-western slopes of Mount Cook. Smaller outcrops of this rock occur at the north-western corner of the large salt-water lagoons, and at Wangaroa or Port Hutt. Some beds of limestone fringe the south-western shores of that lagoon, to which, judging by their mineral character, we may assign a very high age. This limestone is of a white colour, and very crystalline; its structure is somewhat vesicular, but as the specimens submitted to me are rather small, it is difficult to assign to this limestone its true age, although, in its general character, it has all the appearances of a palæozoic limestone.

As before stated, the main eminences of the principal island are formed by basaltic rocks, which contain often large concretions of hornblende, augite, and chrysolite. At their base, basaltic rocks, which often form perfect cones, and tufa beds, are met with, which in lithological character are identical with those of the same age in New Zealand.

The collection of rocks from Pitt's Island is far more complete, enabling me to examine the fossils which they contained, and thus assign to them their true age.

The lowermost rocks resemble those from the main island, already described, of a basaltic and doleritic character. On them, and on the western side, repose palagonite tufas, identical with those associated with our tertiary doleritic rocks in the Malvern Hills, Mount Somers, &c. On them, again, we meet with calcareous fossiliferous tufas, changing by degrees from an agglomerate containing large pieces of volcanic breccia cemented together by a sandy matrix, with a slight admixture of carbonate of lime and only traces of fossils, to a tufaceous whitish limestone, enclosing great quantities of fossils. The latter are of the same species as those found in similar beds in the Province of Canterbury, namely, a *Pecten*, a large smooth *Terebratula* (*Waldheimia*), and some large corals allied to *Pelagia*, which prove them to be of older tertiary age. These beds are overlaid by very fine limestones, semi-crystalline, and identical with similar beds lying in the same horizon in New Zealand.

On the western side of the island the occurrence of lignite beds amongst these strata show that during the formation of these marine deposits oscillations of the ground took place, which favoured the growth of terrestrial plants, burying them afterwards below new marine deposits.

Amongst the specimens collected is a very fine-grained limestone, closely resembling some coral-rag beds of Europe; also a specimen of brown-iron ore, and another of psilomelane.

Thus clear evidence is offered us, that in an early part of the tertiary period volcanic action took place in this part of the Pacific Ocean; and although we meet, on the main island, some signs of the existence of old sedimentary rocks, there is no doubt that these volcanic eruptions gave birth to this archipelago.

Art. XX.—*On the present State of Applied Science in the Canterbury Province.* By Edward Dobson, C.E., Provincial Engineer, and Vice-President of the Philosophical Institute of Canterbury.

[*Read at the Annual Meeting of the Philosophical Institute of Canterbury*, 5*th November,* 1866.]

Our esteemed president, Dr. Haast, being more than usually occupied at present in the preparation of maps and drawings for the Paris Exhibition, I have been requested to address you in his place this evening, and I have thought that it would be most in accordance with your wishes that the subject of my address should be connected with the public works of Canterbury, to which so many years of my life have been devoted. I propose, therefore, to occupy your time, for a short half-hour, with a brief review of the progress of applied science in the Canterbury Province; and in doing so, my object will not be so much to call for gratulation in respect of what has been already successfully accomplished, as to point out how much yet remains to be done, and to direct the attention of the members of the Institute to subjects of inquiry in which they may engage with equal interest to themselves and advantage to the colony in which we have fixed our homes.

Telegraphic Communication.—Let me first call your attention to the present state of telegraphic communication throughout New Zealand.

It is but twelve years ago that public meetings were held in Otago to discuss the possibility of establishing an overland mail between Dunedin and Christchurch, the country lying between the two towns being then a *terra incognita.* Within the last few weeks we have witnessed the successful laying of the Cook Strait cable, connecting the seat of Government in the North Island with all the principal towns of the Middle Island, and have had laid on our breakfast tables the printed reports of the debates with which the walls of the legislative chambers at Wellington were echoing but a few hours previously.

It may be interesting to record the dates of the successive steps by which this result has been attained.

The first telegraph line opened in New Zealand was a short line, constructed under the direction of the Provincial Engineer, between Lyttelton and Christchurch, which was opened to the public 1st July, 1862.

The line between Port Chalmers and Dunedin was opened a few days afterwards.

These first efforts were followed by the construction of the main line through the Middle Island, from Bluff Harbour to Nelson, under the direction of Mr. A. Sheath, the Telegraphic Engineer to the General Government, the communication between the extreme points just named being completed 23rd March, 1866.

Next in order must be recorded the erection of the line between Christchurch and Hokitika, which was commenced in August, 1865, and opened to Hokitika, one of the ports of the western gold fields, 14th February, 1866. This line has since been extended northwards along the coast as far as Greymouth, another gold fields port, the connection between Hokitika and Greymouth having been established 9th July, 1866.

And, lastly, the whole scheme of telegraphic communication in the Middle Island has been connected with the seat of Government by a cable laid across Cook Strait, the first official message between the Middle and North Islands having been flashed across the Straits 26th August, 1866. The total length of telegraph now open in the Middle Island, including the line across Cook Strait, is 986 miles, of which 199 belong to the communication between Christchurch and Greymouth.

Every new country presents special features which affect the character of its public works: this is well exemplified by the working of our telegraphs. There are two special causes of interruption to our lines which are worth recording. First, the breakage of the wire by falling trees. The trees of the New Zealand forests have no tap-roots, and depend upon each other for support; hence, if the edge of the forest is abruptly exposed, as when a river cuts for itself a new line through the bush, or when a wide clearing is made for a road, the wind soon lays prostrate the decayed trees, as well as all those which may happen to have grown with an outward inclination.

So many breakages have taken place from this cause, that it would appear to be a safer method of construction to erect the telegraph wires in the forests at a short distance from the road clearings, merely removing enough of the undergrowth to allow of the wires being strained from tree to tree. Of course, the lines would be somewhat crooked, and the points of support greatly multiplied, but the risk from falling timber would be reduced to a minimum.

The other special cause of breakage lies in the necessity for fixing the telegraph poles in many places in the shifting shingle of the river beds. The only remedy for this appears to be to sink the foundations of the points of support below the limits of the shifting shingle, either by driving in piles or by bedding the posts in blocks of concrete, and to diminish their number as much as possible.

By elevating the points of support to such a height that there shall be no undue strain, the Provincial Telegraph Manager, Mr. G. Bird, has succeeded in erecting with common No. 8 wire, and maintaining without accident, spans much larger than those commonly used.

The following are the largest spans in the Hokitika line :—

River Porter	...	1,848 feet.
Valley of the Seven Springs	...	2,122 „
Valley of the Broken River	...	3,498 „

In the latter instance, the telegraph poles are placed on the cliffs at the edge of the valley, which is so deep that there was no difficulty in giving a safe curvature to the wire ; and although the action of the wind on this immense span is considerable, the wire appears perfectly equal to the strain.

Although the Hokitika line is carried across two high ranges, the passes through which are covered with snow for several months in the year, very little inconvenience has been experienced from this cause ; but the working of the line has been occasionally delayed, in the winter months, by the thawing of the frozen snow which has accumulated round the insulators, by the heat of the sun, thus causing a current to earth, the insulation being restored in the afternoon, as soon as the temperature fell below freezing point.

The construction of the western portion of the line to Hokitika was attended with many serious difficulties. Upwards of fifty miles were through forests inaccessible to horses, and intersected by dangerous rivers ; whilst the weather in the Alpine ranges was so severe that during one month there were only nine days on which it was possible to work.

The cost of carriage of materials alone amounted, in many parts of the line, to upwards of £80 per ton, whilst wages at the rate of two shillings per hour were hardly sufficient to induce the workmen employed to continue the work in the face of the hardships and privations to which they were unavoidably exposed. Under these circumstances, the successful completion of the line across the New Zealand Alps is a work reflecting very great credit on the Provincial Telegraph Manager, Mr. George Bird.

With the exception of the delay caused by the failure of the lines at the river crossings, the New Zealand telegraph lines may be said to have worked well since their erection; the vexatious interruptions which occasionally have occurred being caused chiefly by the great distances between the stations, and not by defective construction.

I would call your attention to the efforts now making in England to abolish retardation in the working of submarine cables. Should these efforts be successful, it is a question whether their greater efficiency would not far more than compensate for the extra cost of using land cables, instead of suspended wires, at the crossings of our wide shingle-bed rivers, and in exposed situations, where the maintenance of a suspended wire is liable to interruption from violent storms, heavy falls of snow, or other causes.

Postal Communication.—I referred just now to the defective state of our postal communication twelve years back. It is pleasant to compare our then with our present condition. We have now about fifty offices open for the receipt and delivery of mails in our own province alone; morning and evening deliveries of letters in the principal towns, and constant communication, by powerful steamers, with the adjoining provinces and with Australia.

The recent opening of the Panama route is a great boon to New Zealand, as it not only puts us in direct communication with America, but brings us practically a fortnight nearer to England; and the announcement of the authorities that all letters and newspapers shall be sent *viâ* Panama, unless otherwise directed, is an earnest of the desire of the Government to avail itself to the utmost of the advantages offered by the new route.

The success which has attended the first voyages of the Panama steamers, the distance of 7,000 miles from land to land being run under twenty-seven days, is further proof, if proof were needed, of the perfection to which marine engines have been brought, although it may be doubted whether the proportions usually given to the steamers employed in long sea voyages are not calculated to insure speed at the sacrifice of other considerations equally important.

It must be a matter of deep regret to all, that up to the present time the advantages that our province ought to derive from the visits of the intercolonial steamers are, to a considerable extent, neutralized by the want of proper wharfage in Lyttelton Harbour. It is to be hoped that this urgent want may shortly be supplied by the works now in progress.

Roads.—The level character of the Canterbury Plains, and the abundance of gravel suitable for road metal, has made the construction of the main roads through the eastern portion of the province a very easy task, respecting which there is little to record of scientific interest. Some few exceptions may be here noticed.

Thus, in the construction of the Sumner Road, between Christchurch and Lyttelton, the original gradient of the ascent to Evans Pass from Sumner Valley was altered to correspond with the slope of the lava streams of which the mountain is formed, by which means full advantage could be taken of the natural terraces formed by the projecting edges of these streams, whilst the road was made wider and straighter than it would have been as first laid out, and the amount of rock blasting was reduced to a minimum.

It may be interesting to glance at the nature of the channels through which the great rivers of the Canterbury Plains find their way from the hills to the sea, as they all possess, to a greater or less extent, the same features, which govern the selection of points of crossing, and, as a consequence, the direction of the main lines of road running parallel to the eastern seaboard.

The general section of the Canterbury Plains, taken in a direct line from the sea to the hills, may be described as a curved line, differing but little from a dead level near the coast, but rising at a gradually increasing gradient until it reaches the foot of the hills, which, in most places, rise abruptly from the plains. On the other hand, the river beds themselves rise from the sea to the mountain gorges at a tolerably regular slope of from twenty to thirty feet per mile, running from the gorges between terraces of great height, which gradually diminish until they die away altogether, leaving the rivers to run on the surface of the plains for a short space, after which they again sink below the level of the country, and run to the sea between high cliffs of shingle, whose height varies with that to which the edge of the plains rises above the sea beach.

Thus, with few exceptions, every one of these rivers presents a point at which it may be crossed on the general level of the country: below which it is either inaccessible on account of the cliffs by which it is bounded, or difficult to cross on account of the number and depth of the channels into which it spreads on the surface of the plains, and above which it can only be approached by long sidling descents cut in the terraces.

Between Christchurch and the Waitaki, a distance of 143 miles, the position of the southern lines, both of road and railway, has been determined by considerations of this nature, and with the following result, viz., that the main route to the south forms a tolerably accurate line of division between the swampy and well-watered belt of agricultural land on the seaboard, and the dry shingle plains which are only suitable for pasturage. In many places the agricultural land does not extend up to the road. Thus, whilst for a distance of twenty-five miles from Christchurch, along the Leeston Road, the country is fenced in and mostly under cultivation, producing largely both grain, dairy produce, and live stock, the Southern Railway, which is laid out so as to cross the Rakaia River as near to the sea as practicable, is yet two or three miles from the edge of this cultivated district, and runs for miles across a desolate-looking plain, without water, trees, or human habitations. It has been questioned whether it would not have been better to have laid out the Southern Railway with a series of curves running down towards the sea between the great rivers, to intersect the agricultural districts. This course would, however, have been open to very many objections. The direct line across the shingle plains is, with the exception of the river crossings, the most inexpensive that could well be imagined; whereas the construction of a locomotive line nearer to the sea, across a swampy country intersected with a network of creeks, would have greatly increased the cost per mile, besides adding greatly to the total mileage.

It appears to me that this is precisely one of those conditions of country suited to the combination of light horse tramways with a main locomotive line, and I trust that before our next annual meeting we may see the experiment fairly tried in the Selwyn district, by the construction of a light tramway leading from the heart of the district to the main trunk line now in course of construction to the Selwyn. The line of the South Road between Timaru and the Waitaki possesses an interest as being a record of the great change which has been going on for some years past in the conditions of the country. In many places the road takes a circuitous course to avoid what some years ago were dangerous swamps, but which are now dry pastures. Whether this is due to the gradual rising of the land, to a diminution of the rainfall, or simply to increased evaporation, arising from the destruction of the original rough vegetation through burning and feeding off by stock, is a question which deserves attentive examination.

It may be thought worthy of being put on record that four-horse mail coaches were first put on the North and South Roads, running throughout the whole length of the province, a distance of about 200 miles, on the 10th of October, 1863.

But if there is little of scientific interest connected with the construction of the roads through the eastern portion of the province, the public works of Westland make ample amends for the deficiency. Amongst them stands prominent the new road, just constructed, by the gorge of Otira, across the

New Zealand Alps, connecting the City of Christchurch with Hokitika and Greymouth, the ports of the western gold fields.

The Otira Road is a remarkable work in every point of view. Whether we consider the grandeur of the scenery through which it passes, the geological interest of the Alpine districts which it traverses, the engineering difficulties attendant on its construction, or the hardships manfully endured by those engaged on the undertaking, it is in every way a work reflecting credit, not only on the Canterbury Province, but on all New Zealand.

Up to the commencement of the year 1865 there was no road from the Canterbury Plains to the West Coast, except a very rough and dangerous path cut across the Hurunui saddle by Mr. Charlton Howitt, in 1862, by means of which, at considerable risk, horses could be taken as far as Lake Brunner. Mr. Howitt was engaged, at the time of his death, in 1863, in cutting a track from Lake Brunner to the mouth of the Greenstone Creek, but it was not practicable for horses. It is true that horses had been taken down the Teremakau to the beach, but this could only be done when the river was low, and then not without considerable risk.

Up to the date last mentioned, but little attention had been paid to the fact that, notwithstanding the inaccessible nature of the country, a very large number of diggers had found their way into Westland, and were pursuing their vocation with considerable success.

About the beginning of 1865, however, the reports sent by the miners to their friends were of such a favourable character that a violent rush set in from Eastland to the new El Dorado, and the attention of the Government was directed to the best method of opening up a communication with the gold fields. To this end, Messrs. Edwin and Walter Blake were sent to improve Howitt's track by the Hurunui and Teremakau to Lake Brunner, and to explore for a line of road, in continuation, across the country between the Teremakau and Hokitika.

At the same time Mr. George Dobson and the Provincial Engineer were charged with the examination of the Waimakariri and its tributaries, to ascertain whether there were any passes which might afford greater facilities for constructing a road across the Alps, than that by the Hurunui saddle.

The results of these explorations were published in a report from the Provincial Engineer, dated 15th May, 1865, amply illustrated with maps and sections.

In accordance with the recommendations of this report, the Government at once took steps for the construction of a bridle road over Arthur's Pass, descending into the Teremakau by the gorge of the Otira. It was at first intended to construct a mere bridle track, but the importance of the new gold fields developed itself so rapidly, that within a few weeks of the commencement of the works it was decided to construct a coach road throughout. From the date of this decision the works along the whole line of road, from the plains to the sea beach, were put in hand as rapidly as possible, and pushed forward with such energy that by the 20th of March, 1866, the road was open for traffic from end to end, and has been regularly travelled, ever since, by four-horse coaches running twice weekly each way; the distance of 150 miles between Christchurch and Hokitika being completed in thirty-six hours, including a night stoppage of twelve hours at the half-way station.

It is very difficult, by a verbal description, to give any idea of the obstacles that presented themselves to the construction of this road. Perhaps the greatest of all arose from the inaccessible character of the country; the only way of getting tools and stores to the central portion of the work being either by poling canoes up the Teremakau from the beach, or by pack-horses travelling over the Hurunui saddle from the edge of the plains—a journey of seventy miles; and, moreover, this had to be done in a densely timbered country, in the depth of the winter.

No pen can describe the sufferings endured by both man and beast during that terrible winter, exposed to sleet and snow and bitter frost, hardly lodged and scantily fed, whilst the working parties were liable at any moment to be cut off from communication with each other by the rising of the rivers. By the end of July, however, a pack-horse track was opened through the Otira Gorge, which enabled supplies to be taken into the Teremakau Valley with comparative ease, and the works in the latter valley were greatly facilitated by the use of drays, which were carried in pieces across Arthur's Pass and put together in the Teremakau river-bed, which was used as a temporary road whilst the bush clearings were being made. As, with the opening of the tracks, greater facilities were given for the conveyance of stores to the works, the number of men employed was increased, until it amounted to upwards of a thousand.

Since the opening of the road the work has gone steadily on, and may now be said to be completed, although, from the nature of the country through which it passes, it will always require constant attention to keep it in repair, especially in the valley of the Teremakau, which is periodically visited by dangerous floods.

The total distance from Christchurch to Hokitika by the Otira route is 150 miles, as above stated, of which about one hundred miles of road from the eastern foot of the hills to the sea beach at the mouth of the Arahura, have been made and metalled between 1st May, 1865, and 31st October, 1866, at a cost, in round numbers, of £145,000, or something under £1,500 per mile.

The engineering works upon this line are of a very varied nature. In some places the cliffs are scarfed out for a portion of the width of the road, the remainder being carried on timber brackets, in the fashion of Trajan's celebrated road on the bank of the Danube; in others, the line is carried across ravines on embankments faced with walls made of timber cribbing, filled with blocks of stone.

The fords in the rivers have been protected by wing dams formed of large trees backed with boulders; whilst in many places the mountain torrents have been made passable by building timber weirs across them, and filling up their beds to a uniform level with stones and gravel. Through the swampy forest the ground has been drained and fascined for many miles, whilst the whole length of the road has been thoroughly metalled. Amongst the bridges, that over the Taipo, 270 feet long, built upon piles, with steel shoes, driven into a mass of granite boulders, deserves mention as being a difficult work successfully executed, and which has, up to the present time, resisted the heaviest floods, although the stream has been at times blocked with drift timber from bank to bank.

The explorations of Dr. Haast at the head-waters of the Molyneux, the Waitaki, the Rangitata, and the Rakaia, and those of the Provincial Engineer in the upper valley of the Waimakariri, have fully established the fact that throughout the entire length of the province there are only three real passes, viz., the Hurunui Saddle, dividing the sources of the Hurunui and Teremakau; Haast's Pass, at the head of Lake Wanaka, which leads over a very low saddle into the valley of the Haast River, which falls into the sea near Jackson Bay; and Arthur's Pass, which is nothing more than a great fissure, running in a tolerably direct line from the valley of the Waimakariri to that of the Teremakau. The so-called North Rakaia Pass has no real claim to the title, its eastern face being simply a wall rising abruptly from the valley to a height of 1,500 feet, and being quite impracticable for horses or cattle, besides being at so great an elevation as to be buried deep in snow during eight months in the year. An inspection of a good map of the province will help to explain this absence of passes throughout so great a distance. The rocks comprising the central chain have at a very early period been crumpled up into huge folds, the upper portions of which have been denuded, leaving the remaining portions of the strata standing up in vertical or highly inclined positions, the axis of the foldings having a tolerably uniform bearing of N.N.E.

Now, it will be seen, on looking at the map, that the central chain exhibits two distinct systems of valleys, the one radiating from a common centre situated about fifty miles north of Mount Darwin, which includes all the rivers from the north to the south of the province, giving the idea that the country has been starred, just as a mirror is starred by a violent blow, or as in rock blasting a set of radiating fissures is sometimes produced by a single shot; the other running parallel to the axis of the foldings of the strata, or rather following a compound course, partly on the lines of strike, and partly on the lines of the joints of the strata, like a line struck diagonally across a chess board, but following the sides of the squares, and giving to the cliffs which bound these valleys a peculiar rectangular appearance, resembling ruined masonry on a gigantic scale.

Now, it will be observed that, with the exception of that of the Hurunui, none of the radiating valleys run directly across the main chain, which, at the heads of the Rakaia and Waimakariri, stands up like a wall, barring all further progress. Haast's Pass, the lowest and probably the easiest of all, does not extend across the northern branch of the chain, but leads to the coast by following the westerly course of the Haast River. Arthur's Pass does not, as it were, cross the range in a direct line, as does that by the Hurunui, but leads along it from one radiating valley to another; the Waimakariri and the Teremakau overlapping each other to the extent of about twenty miles.

Thus it will be understood that these three passes occur under three distinct sets of conditions. Haast's Pass, at the head of the Wanaka Lake, is both in the line of one of the great radiating valleys, and also in the direction of the axis of the great foldings of the strata, these two causes in combination having formed an unusually low gap in the mountains. The Hurunui Pass, on the other hand, is one of the fractures running directly across the range, whilst Arthur's Pass is simply a fissure parallel to the planes of stratification, from which the rock, already bruised and shattered when the surface of the country was crushed up into the huge foldings before referred to, has been gradually removed by glacial action, and by the weathering process constantly going on over the whole face of nature.

The depth to which the great valleys have been filled up with shingle and debris, may be inferred from the interesting sections, prepared by Dr. Haast, of the comparative fall of the Canterbury rivers, and from those prepared by the Provincial Engineer in connection with the Otira Road. These sections show that the river-beds form beautifully regular curves from their sources to the rock-bound gorges through which they issue to the plains, which would not be the case if the rock bottom were sufficiently near the surface to check the downward flow of the wet shingle.

Before leaving the subject of the Otira Road, I would call your attention to the great value of the aneroid barometer as an instrument for ascertaining altitudes. During the Provincial Engineer's explorations of the West

Coast routes, a set of flying levels across the country was taken by aneroid observations, a single instrument only being used and the weather being exceedingly unfavourable; yet the results compared very satisfactorily both with the altitudes afterwards obtained with great care by Dr. Haast, and with the actual heights as determined by the spirit level after the opening of the Otira Road. In laying out the line across Arthur's Pass, where the road descends 750 feet in a very short distance measured in a straight line, the gradients were determined entirely by the aneroid, the observer creeping through the dense scrub on his hands and knees, and fixing the position of the line, at every few chains, by the reading of the aneroid; the line thus laid out requiring but little subsequent alteration, when the clearing of the timber had given an opportunity for the correction of any irregularity in the gradients.

Railways.—Passing from ordinary roads to railways, we have to record the completion of a first instalment of the Southern Railway, constructed under the superintendence of Mr. W. T. Doyne, M.I.C.E., which was opened for traffic as far as Rolleston, about fifteen miles from Christchurch, on the 15th October, 1866. On the Lyttelton and Christchurch Railway, which has been open for traffic between Christchurch and the Heathcote Wharf since December, 1863, the works of the Moorhouse tunnel have made steady progress, only about 240 yards remaining to be driven at the present time, out of a total length of 2,838 yards.

Independently of the interest attached to these tunnel works in a geological point of view, as affording a complete section through the side of an extinct volcano, they are of importance as an example of engineering difficulties successfully overcome.

The syphon employed for the drainage of the upper half of the tunnel is probably the longest of which there is any record in the history of tunnel works, being upwards of half a mile in length; whilst the system of ventilation employed, viz., that of conducting the smoke and foul air through a flue, formed by a horizontal brattice, into an upcast shaft near the tunnel mouth, has proved perfectly effective. It is worth remarking, that the engineers of the Mont Cenis tunnel have at last found it necessary to employ a similar means of ventilation, the supply of compressed air forced into the face of the work being insufficient to drive out the smoke which filled the tunnel like a series of walls of dense fog.

It may be laid down as a leading axiom with regard to the ventilation of drives mined with gunpowder, that although fresh air may be driven in by machinery, so as to produce a healthy atmosphere for the miners, the smoke from the shots cannot be driven out, but must be drawn out by creating a vacuum in the direction in which the smoke is to be drawn; the attempt to force smoke by an air-current in the rear producing generally a dense fog, in which candles are of little use.

A very curious fact connected with the bratticing in the Lyttelton tunnel may be here mentioned. The brattice is formed of inch boards laid on joists running across the width of the tunnel, and housed at each end into the solid rock. Both joists and boards rapidly became covered with fungus, and required to be replaced from time to time with new material. Although, after the first year, portions of the brattice repeatedly fell from decay, these falls invariably happened on Sunday, when the men were absent from the work, no fall having taken place whilst the men were at work until quite recently, when the decay of the timber had rendered necessary an extensive renewal of the brattice. The explanation of this curious fact is probably the difference in temperature on week days and Sundays, the furnace fire at the foot of the upcast shaft being allowed to go out on Saturday night, and not being lighted again for twenty-four hours; the hot smoke which occupied the flue during the working days being replaced on Sunday by a comparatively cool atmosphere.

I may here mention that a tunnel is now being driven in France, on the new line of railway between Lyons and Roanne, under Mont Sauvage, which divides the valleys of the Rhone and the Loire. This tunnel will be two miles in length, and will be driven from five shafts, of which the deepest will be upwards of 600 feet in depth. From the geological character of the district, it is anticipated that the rock to be bored through will be of the hardest description; and it is stated in scientific journals that in one of the shafts the difficulties met with are such that a progress of two inches in twenty-four hours is all that can be accomplished.

It will be interesting to watch the progress of this work, especially in reference to the question of how far boring machinery can be introduced with advantage in tunnelling through rocks of equal hardness with those met with in the Lyttelton tunnel.

Some curiosity has been expressed as to the correctness of the alignment of the two ends of the Lyttelton tunnel, and the method employed for checking any error that might be committed in the direction of the work.

The system employed is very simple. A permanent mark is fixed in the centre line of the tunnel, on a tower built on the dividing range, nearly midway between the two ends. A transit instrument being placed on the meridian of the tunnel, in a position to command a view into the tunnel as well as of the tower on the hill, it can be seen at once whether the flame of a candle placed on the centre line of the work, inside the tunnel, is in a vertical plane with the mark on the tower. But it is also desirable, in case of error, to have the means not only of correcting, but of calculating the amount of such error, and this can readily be done. The permanent mark on the central tower consists of a batten six inches wide, with a black stripe one inch wide down its centre. The eye-piece of the transit instrument, being furnished with five vertical wires, placed at equal distances apart, the value of the space between any two wires, at a distance equal to that of the mark on the tower, can be ascertained by reference to the width of the batten, which thus gives a scale by which the error in the position of a light, placed in the tunnel under the tower, can be rated with great exactness.

Although it is not probable that any important extension of our railway system can be undertaken at present, it is satisfactory to know that the surveys of the Southern Railway have been carried down to the Waitaki, and connected with those made by the Railway Engineer of the Otago Province, and that the necessary reserves have been made so far as the lines run through land belonging to the Government.

RIVERS.—During the last few years great changes have taken place in the channels of some of our large rivers, both on the East and West Coasts. The Rangitata has for some years past been scouring out for itself a new channel down what is known as the Deep Creek, the original main river-bed being now almost deserted by the water. It is worth putting on record that this great change, which seriously affects a large extent of pastoral country, had its origin in the cutting of a ditch to form a sheep boundary, and the run of water thus established has gradually attained such dimensions as to cause the diversion of the greater part of the river from its original bed. The Waimakariri, which used to deliver the great bulk of its waters through the channel on the south side of the Kaiapoi Island, has shifted its course into the north channel, (the quantity of water in the latter stream being shown, by gauging, to be three times that in the former one), overflowing its banks in many places, and seriously injuring the navigation of the river by the amount of shingle brought down by the freshes. At the same time the river has threatened to break through its banks about nineteen miles from Christchurch, and to flow down to that town along channels which, although long since dry, at some distant time have carried no inconsiderable quantity of water.

It is impossible to over-estimate the value of a continued series of observations made from year to year to ascertain the nature and extent of the changes going on in the courses of our rivers, and I would earnestly request each of the members of the Institute to assist, so far as lies in his power, by making careful measurements, from permanently fixed points, of all alterations taking place in his own immediate neighbourhood.

ARTERIAL DRAINAGE.—Passing from natural to artificial watercourses, there is but little progress to record with regard to arterial drainage. With the exception of the Rangiora Swamp, (which has been partially reclaimed by a carefully planned system of drains, calculated, when completed, to reclaim 7,000 acres of swamp land), the drainage works of the province are of no interest, in a scientific point of view, except as showing the mischief that may be done by attempting to drain extensive districts without keeping distinct outfalls for the upland and lowland waters.

I would wish to direct the attention of the members to the efforts being made in England to enable landowners to obtain powers for draining through private properties, and for the relief of districts which have been water-logged, to use an expressive term, by the injudicious erection of dams and weirs for obtaining mill power, often to the infliction of great injury upon the surrounding properties.

Such legislation is no less needed here than in England; and I may remark upon a peculiar feature of our low-lying lands, which introduces unusual difficulty into the question of main drainage.

It is, that the natural watercourses through the swamps and half-dry lagoons are in most cases above the level of the adjoining land, running between embankments which appear to have been formed by the gradual deposition of silt in comparatively still water. So generally is this the case, that in the neighbourhood of Christchurch it will almost always be found that a rise in the ground marks the position of an old watercourse, the original source of which has been cut off by the gradual deepening of the beds of the rivers by which it was fed.

It will, therefore, be readily understood that the natural watercourses cannot be used for the drainage of our swamp lands, but that new lines must be cut for that purpose; and it is precisely the interference with private property involved in this course, that has led to so much difficulty and litigation in the attempts to reclaim the swamp lands in the province.

For some years past the Provincial Engineer has been engaged in recording the levels of the country, as ascertained during the progress of the various road and railway surveys, the several sections having been all taken with reference to a common datum, viz., ordinary high-water springs at Sumner Bar. It is proposed gradually to extend these levels over the whole province, as opportunity offers, and to establish permanent stone bench-marks in every road district, for future reference. It is interesting to observe that a similar work is now in progress in France, for the purpose of affording accurate data for engineering surveys of all kinds, and it would be difficult to overrate the value of the information thus given to the public, or the facilities it affords for ascertaining, almost at a glance, the difference of level between distant points which it is required to connect for the purpose of drainage, water supply, or other engineering works, in which the rate of fall is an important element.

Health of Towns.—From the drainage of the country we pass, by a natural transition, to that of the towns, and to those questions which may be classed under the general head of sanitary engineering. And here it must be confessed with regret that, beyond the abolition of the cesspool nuisance, there is no progress whatever to record.

Although numerous schemes of drainage have been proposed for the two principal towns, viz., Lyttelton and Christchurch, nothing has yet been done towards their realization. This is the more to be regretted, as the Municipal Councils of both towns having approved of the system of removing the solid sewage, at short intervals, by scavengers, the question is narrowed to that of the disposal of the house slops, the outfalls for which would be the sea in the one case, and the Rivers Avon and Heathcote in the other.

Practically, therefore, the only question to decide is, whether they shall be carried down the streets in the open side channels, or in underground pipes.

Now, it is worth while to glance for a moment at the physical conformation of the two towns, as they may be considered extreme types of exactly opposite cases.

Lyttelton is built in the crater of an extinct volcano, on a series of spurs and gullies, the streets stretching up the steep hill-side to the height of 200 feet above the sea, to which there is ample fall from every part of the town. But Lyttelton, unfortunately, has no water supply beyond what is derived from a few deep wells near the beach, which are exhausted in the summer months, making it necessary, at times, to bring water in coasting vessels for the use of the town. In this case, the work to be done is to provide and raise an ample supply of water to the upper part of the town, and to flush the gutters from the street mains, the fall in the gutters being so great that they can be effectually cleansed by this means. The water might be taken from the artesian springs in the tunnel, or from the Heathcote River; in the latter case being brought from the plains, through the tunnel, in pipes.

Christchurch on the other hand, is an example of a totally different combination of circumstances. The town may be said, in general terms, to lie on a plain, sloping gently to the eastward; the western side of the town being about 23 feet, and the eastern side about 9 feet, above high watermark.

But although the fall of the ground to the eastward is ample for underground drainage, which can be brought to a regular gradient, the irregularities of the surface are so great, that the fall of the street gutters is in many places barely sufficient to allow the water to run, much less to allow them to act as channels for offensive matters.

Here, then, the proper course is to lay underground pipes to carry off the surface drainage, instead of allowing it to become stagnant and putrid in the back yards of the houses, or to form offensive pools in the street gutters. And, by way of compensation for this expense, Christchurch has a magnificent and unfailing water supply in her artesian wells, the water being met with at from 60 to 90 feet below, and rising to a tolerably uniform level of 25 feet above, high watermark; the artesian water throughout the greater part of the town rising several feet above the surface. It is worth noticing, that the artesian water was tapped first in Christchurch, 10th February, 1864.

If, however, we can say but little in praise of the sanitary arrangements of our towns so far as drainage is concerned, there are other points on which satisfactory progress has been made. A fair number of the streets in our towns are formed to their permanent levels, and metalled either with shingle or broken stone; and in Christchurch and Lyttelton the principal streets are provided with paved gutters, and raised footpaths paved with gas tar concrete, which appears to answer well, and not to be injured by the heat of the sun as is the case in hotter climates.

Near most of the towns of the province, suitable plots of ground have been set apart for cemeteries, so as to avoid, from the first, the evils attendant on intramural burials, and the care taken of these cemeteries is a pleasing circumstance connected with their management.

Introduction of Gas.—It may be mentioned that the streets of Christchurch were first lighted with gas, 13th December, 1865.

Lighthouses.—The lighthouse at Godley Head, at the entrance of Port Lyttelton, was first illuminated] 31st March, 1865. This makes the seventh light on the New Zealand coasts, in addition to the harbour lights.

I have extended this address so much beyond my original intention, that I can only now glance at a few miscellaneous subjects.

Iron Founding.—It is worth recording, that iron-founding was commenced in Christchurch, by Mr. John Anderson, in May, 1857, at his establishment in Cashel Street, which has now attained considerable importance in New Zealand, and offers great facilities for the construction of almost all kinds of mill work and machinery.

Employment of Steam Power.—Steam power has been employed to a very considerable extent for some years past, for various purposes.

The necessities of the Western gold fields have led recently to the erection of several powerful engines in the neighbourhood of Hokitika, which are employed in draining the deep sinkings, and raising water for gold washing.

The *Lyttelton Times* [has been printed by steam power since October, 1864; and the *Press*, another daily paper, is printed by one of Ericsson's caloric engines.

Steam cranes have been in use upon the railway wharf at Heathcote for nearly three years.

It may be mentioned, that amongst the items of intelligence brought by the last September mail, is the erection of steam cranes on the quays at Paris.

A powerful steam engine is in use on Timaru beach, for hauling up the cargo boats used in the lighterage service.

And here I must conclude this brief but, I trust, tolerably comprehensive sketch of the present state of applied science in Canterbury. If, on the one hand, there are many shortcomings to be regretted, I think it may also be said that, as yet, we have made few mistakes; whilst with scanty means, and a comparatively small population, we have succeeded in introducing amongst us, and making familiar as "household words," most of the great inventions of the civilized world. We have our telegraph through the country, and our submarine cable connecting our capital with the seat of Government in the Northern Island. We have our great tunnel in construction, and our road across the New Zealand Alps. We have our gold fields, our coal mines, our foundries, our broad acres tilled with the steam plough, our clipper steamers, our mail coaches, and our locomotive railways, and we have all this in a country which fifteen years ago was an almost unknown land, but which is now, by God's blessing, the happy home of prosperous thousands of our fellow-men. And let me impress on your minds that this measure of success has been due in no small degree to the superior education of Canterbury men, as compared with that of the usual class of settlers in a new country, and to the stimulus given to applied science in Canterbury by the prosecution of the trigonometrical survey, the establishment of permanent departments of public works, of geology and natural history, and the appointment of a board of education as one of the departments of the Provincial Government; and, in conclusion, let me earnestly hope that every member of the Institute will endeavour to realize the responsibility which rests upon him, to do all in his power to carry on the work so well begun, and that each succeeding year will bring fresh subjects of interest to record, and fresh successes to incite us to greater exertions in behalf of science and of our adopted country.

ART. XXI.—*On the Wave Phenomena observed in Lyttelton Harbour, 15th August*, 1868. By Captain FRED. D. GIBSON, Chief Harbour Master.

[*Read before the Philosophical Institute of Canterbury, 9th September*, 1868.]

THE evening of the 14th August was calm and clear, the aneroid stood 29·90. An unusual stillness prevailed during the night.

At 3.30 a.m., the tide being half-ebb, the water suddenly receded from the harbour, rushing past the shipping lying in the stream, and vessels anchored near the entrance of the harbour, at a supposed velocity of twelve knots. The water continued falling until 4.30 a.m., when the end of the breakwater was dry, at which position the average depth at low water is 15 feet. At the before-mentioned hour, with a loud roar, a wave of about 8 feet in height rushed up the harbour with great velocity, and at 4.50 the water was within 3 feet of the railway level; in other words, 3 feet above the highest spring tide, having risen 25 feet perpendicular in twenty minutes.

The water at about 5 a.m. rapidly receded the second time, and at 6 the bottom was again visible beyond the end of the Government jetty; at 7·15 it again rushed up in the form of a heavy ground swell, and rose rapidly to 16 feet, and immediately commenced to fall again. At 9.30 the inner end of the screw-pile jetty was dry, when the reaction again took place, the water returning with even more velocity than at 7 a.m., until it resumed the level of high-water springs. Off in the stream, the water was very thick and discoloured, boiling up as it were from the bottom.

At 10.15 the water rushed out with the same force for about half an hour, and rose again shortly after 11 a.m. to 18 feet; throughout the remainder of the day the water rose and fell without any regularity, sometimes at the rate of 3 feet per hour. Aneroid, 30·5.

During the whole of Sunday, the 16th, there was no regularity of tide, the water ebbed and flowed three times in six hours; at 2.16 p.m., the proper time of high water, there was $17\frac{1}{2}$ feet, and after ebbing an hour, it rose again to about 17 feet at 4.15.

Aneroid, 30·10, stationary; weather calm and clear; water very thick, and continuing to boil up in large eddies.

Monday and Tuesday, the 17th and 18th, tides still very irregular, flowing one foot higher, and ebbing one foot and a half lower than the usual springs.

Wednesday, 19th, nothing unusual perceptible.

Art. XXII.—*On the recent Earthquakes on Land and Sea.*

By Julius Haast, Ph.D., F.R.S.

[*Read before the Philosophical Institute of Canterbury, 9th September,* 1868.]

[abridged.]

Before proceeding to make a few remarks upon the contents of the valuable paper of Captain Gibson, to the reading of which we have just listened, I think that some general observations on earthquakes, as experienced on land and sea, their causes and effects, would not be here out of place.

I should also like, with your consent, to test, by the observations which we were able to make in New Zealand, some of the theories by which the origin and propagation of these most formidable and greatest phenomena of nature have been explained.

* * * * * * * * *

The first sign of disturbance experienced in Christchurch was a slight shock of an earthquake felt by several of our fellow-citizens in the early morning of Saturday, the 15th of August, amongst whom, Mr. A. T. W. Bradwell gave me, the same day, the best account. It was about 3 o'clock in the morning that he felt a slight shock of an earthquake, travelling apparently from S.W. to N.E., accompanied by a slight subterranean rumbling sound. As buildings move generally in the direction from which the vibratory movement reaches them, it is highly probable that this earthquake came from the N.E., from which direction the earthquake waves in the sea appeared also afterwards on our coasts.

There is no doubt in my mind that we can associate the earthquake waves, in the sea at least, with the minor shocks experienced on the land. Unfortunately, we do not yet possess the necessary data to calculate the velocity of these minor shocks, which are without doubt the last pulsations of a very severe volcanic earthquake, the focus of which is situated in a N.N.E. or N.E. direction from New Zealand.

And I may observe here, that a volcanic central or linear earthquake may be very severe at or near its focus, although its effects are confined to a comparatively limited area round about it. Thus the slight earthquake shock experienced in the early morning of the 15th of August, might have been of a very local character only, although the disturbance on the sea bottom, near its focus, was so enormous that the effects were felt, as far as we know already, on the coasts of New Zealand, Australia, and the Chatham Islands. And whilst the disturbance in the level of the sea, from the impetus given, was such that it was felt over a tract of country several thousand miles in diameter, the oscillations of the earth's crust may have been confined to as many hundred miles only. Supposing that the Chatham

Islands are situated near the centre where the disturbance of the sea level originated, and the coast of South Australia as one of the most westerly points where it was perceptible, and allowing it the same power, which without doubt it possessed, to move as far in an easterly direction, we shall then find that its effects were felt over more than ninety degrees of longitude, or a fourth of the circumference of the globe.

From the valuable communication of Captain Gibson, we obtain reliable information of what took place in Lyttelton Harbour. It appears that four distinct waves, of which the second was the smallest, entered that harbour:

	Hour. A.M.	Intervals. H.M.
The first and highest wave reached the Lyttelton wharf at	4.30	—
The second and smallest	7.15	2.45
The third	9.30	2.15
The fourth and last	11.0	1.30

after which only minor disturbances took place. It will also be seen, from this list, that the difference in time became less as these waves succeeded each other.

The next bay of which we possess reliable accounts is Pigeon Bay, in which Mr. G. H. Holmes has recorded the principal facts.

Here, the first rush of water entered about 4 o'clock, but no exact time was observed, the overseer of Messrs. Holmes and Co. only hearing the rumbling noise as if of rushing water. Therefore, we may fix it at the same time as it arrived in Lyttelton, 4.30 a.m., rising 4 feet above spring tides. The second wave was observed at 7.15 a.m., giving an interval of 2h. 45m.; the rise of water above spring tides was 1 foot. The third rush came at 9.45 a.m., giving an interval of 2h. 30m.; the rise of water above spring tides was 4 feet. So far, the observations agree with those of Lyttelton Harbour, but instead of now only showing minor oscillations, the water continued its rush into that smaller bay with even greater velocity. Thus, about midday a fifth wave came with still more force and velocity, rising 5 feet. The sixth and highest arrived forty minutes later, at 12.40 p.m., rising 7 feet above spring tides. And lastly, the seventh, at 1.5 p.m., after which the waves diminished considerably, arriving at intervals of three-quarters of an hour. These facts are corroborated by Mr. Robert Townsend, District Surveyor, who happened to be in Pigeon Bay at the time, and who measured the vertical height of the water above spring tides.

Advancing towards the south-east, along the Peninsula, we reach Okain Bay, where the earthquake waves were also high and destructive. I owe the information which I possess about that locality to Mr. George Bishop, who resides there. This gentleman did not observe the early waves, but obtained the information from several of the inhabitants living close to the sea shore.

The first wave came about 3 o'clock, but there is no certainty about the exact time. It was followed by three others, with intervals of about a quarter of an hour between them, and of which the last was the highest.

A fifth wave came about 8 o'clock, but it was not so high, nor was the rush of water so violent, as of those which entered the bay afterwards. Between 10 and 12 o'clock in the forenoon another succession of waves, at intervals of fifteen to thirty minutes, was experienced. They were irregular, but were quite as high as those in the early morning.

A very high wave rushed in about 2 o'clock in the afternoon, which Mr. Bishop considers to be the most formidable and highest of all, and which rose 6 feet above the highest spring tides; the altitude of the Government bridges above high watermark offering the necessary data for that assertion. My informant considers this wave 2 to 3 feet higher than any of the previous ones. All the succeeding waves which entered the bay were smaller, and continued to flow in until Tuesday afternoon, when the tides took their regular course. It appears, therefore, assuming the time kept in Pigeon and Okain Bay to be the same, that in the latter locality the highest and most destructive wave arrived three-quarters of an hour after it had been observed in Pigeon Bay.

Not having, as yet, authentic accounts from the other bays of Banks Peninsula, I may only observe that the highest rise of the water in Akaroa was towards 12 o'clock, midday, on Saturday, the 15th August, but it did not enter the harbour in the form of a high wave, and altogether did not occasion so much damage as in the smaller and more exposed bays.

The position of Akaroa Harbour, opening to the south, being narrow at its entrance, and the water being deeper than in the more northern bays, may easily account for this. Before leaving Banks Peninsula I may observe that the principal cause of the earthquake waves being there so much higher than on other portions of the New Zealand coast, may be sought in the form and shallowness of the sea bottom around it. For a long distance easterly the sea is comparatively so shallow that the fifty fathom line lies more than forty miles from the land.

The 100 fathom line, beginning south of the Kaikouras, close in shore, makes a great curve round Banks Peninsula, approaching the coast again a little to the north of Otago Peninsula, where, as at the Amuri Bluff, the older palæozoic rocks reach the east coast. From these two points they recede gradually inland, so that to the westward of Banks Peninsula they are at a distance of forty miles from the coast. The lower portion of that volcanic system below the level of the sea, sloping gently down in all directions, has at the same time formed a favourable locality for the deposition of enormous masses of shingle, sand, and silt brought down by the large glacier rivers from the Southern Alps. Consequently we find that even as far as Timaru the 100 fathom line lies about 100 miles from the shore. The fact that the set of the currents is in a northerly direction, or nearly opposite to that of the earthquake waves, may perhaps account for the great disturbances experienced in Pigeon and Okain Bays long after they had reached their maximum in Lyttelton Harbour. This is confirmed by the observations of the "Stormbird" on her passage from Lyttelton to Timaru. This steamer, in the early hours of the 15th of August, was struck by two or three heavy seas, the sea being calm at the time, and was driven about ten miles to the northward by such a strong current that it was impossible to make headway against it. The effects of these disturbances of the sea were felt severely in Timaru. From the accounts published in the newspapers, it appears that a huge wave, which has been variously estimated at 6 or 8 feet perpendicular height, rushed upon the shore at 4.45 a.m., and rose several feet above the highest spring tides. Just as quickly as it appeared, it retreated, leaving the bottom of the sea exposed for a long distance. Another wave rushed in at 5.4 a.m., which was followed during two hours by several others, but of a lesser size.

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In Hokitika, on the western side of this province, nothing unusual was observed during the day; but at Westport, towards the time of low water, several bores (as the newspaper of that place calls them), or waves of unusual size, were seen to ascend the river, running in rapidly from the sea. The largest and heaviest bore, 4 to 5 feet in perpendicular height, occurred between the hours of five and six in the evening, ascending the river rapidly, and causing a vessel to break from its moorings at the wharf, and travellers going by Cobb's coaches along the beach observed the tide to rush very far back and to come up again in very high rollers.

What is here very important is the fact that also there the heaviest wave was the last, and occurred so late in the afternoon. We are therefore compelled to believe that the earthquake waves passing round Cape Maria van Diemen, in the North Island, and round the southern point of Stewart Island, and in a minor degree through Cook and Foveaux Straits, united, only some distance from the west coast of New Zealand, on their westward course, and that they sent some waves back to invade, although in a minor degree, the opposite side of these islands.*

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* Since these notes were written, I have visited Lake Ellesmere, which is separated from the sea by a bank of shingle and sand. This bank is lowest at its south-western end, and is there about 8 feet above high watermark. Consequently, when the lake rises to such a height, it breaks through this shingle wall and empties itself rapidly. There is a Maori

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Before, however, leaving this part of the subject, I wish to state a few facts observed in or near Lyttelton Harbour, so as to preserve them from oblivion.

A skeleton buoy, placed near the breakwater in course of construction, and attached to an anchor of 4 cwt., was removed up the harbour, during the rush of the water, for a distance of half a mile, with anchor and chain, thus showing the enormous force of the wave.

I may observe at the same time that it would be interesting to find, by soundings in well known spots, if that harbour has not been deepened to some measurable extent, as the vehemence with which the water rushed in and out must have been able to remove a great quantity of the fine silt or mud of which the bottom of that harbour is formed. It appears from the accounts given to me by some of the passengers of the steamer "Taranaki," which arrived in the morning of that memorable day in Lyttelton Harbour, that when about thirty miles from that port, and approaching the peninsula, the water of the sea became very muddy; moreover, it was covered with driftwood, cut timber, and now and then with what they supposed to be portions of wrecks. Except a very strong N.E. swell, the steamer had not experienced the least disturbance of the usual movement of the surface of the sea, and therefore crew and passengers did not know how to account for this strange and unusual appearance of the sea. At last they came to the conclusion that a tremendous and destructive flood must have taken place inland, similar to that which visited the interior of this island in February last, when the sea had a similar discoloured appearance near land, carrying at the same time an enormous amount of driftwood and remains of human habitations and industry.

Entering now into a consideration of the second subject of this paper—the earthquakes experienced on the morning of the 17th—it would appear, at least at a first consideration of its direction, that the focus of this disturbance on land was situated near the spot where the earthquake waves in the sea had radiated, as the direction of both was apparently the same.

But when we examine the subject more closely, with the aid of the exact time at which that shock was felt in different localities in New Zealand, we shall at once find that it will not answer. We shall observe that the vibrations of the ground advanced at such an enormous velocity, that the

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kainga near this spot, forming a favourite fishing station. The natives informed me that the earthquake wave in the sea had not crossed this shingle bank; in fact, they had not observed any disturbance, but they felt distinctly the earthquake shock of the 17th August. The lake, being near its highest level at the beginning of this month, broached the shingle bank on the 8th or 9th.—18th Sept., 1868. J. H.

usual explanation of a central or linear earthquake, the focus of which would be situated in a N.E. direction from New Zealand, cannot be adopted, and that we have to seek for another explanation which will satisfy us more fully.

But before entering into a consideration of this subject, I will first offer a short description of that phenomenon as observed in Christchurch and its neighbourhood. According to a communication of Mr. Bird, the Telegraph Inspector residing in this city, the shock was felt at the Christchurch Telegraph Office as nearly as possible at 9.56½ a.m. on 17th August. It lasted, according to the generally received reports, about four seconds, although it appeared to me that all was over in about two seconds. It consisted of two slight shocks, moving apparently from north to south, with an easterly tendency, but opinions about its direction are greatly divided. I myself stated that it had advanced from south to north, without doubt owing to the fact that the movement of my house, in which I was sitting at a writing table, was in the direction opposite to the shock, as this is generally the case. Many observers state that the oscillations came from the east, and pointed to pendulums and other objects which were able to swing in the direction imparted to them by the shocks; but we ought to remember that the vibratory jars are very often turned locally from their main direction by a difference in the physical features of the country.

No damage was done by these oscillations of the ground, although they were powerful enough to cause the ringing of bells and the cracking of the timbers in the houses, to such an extent that many of their inhabitants ran into the streets, expecting some still greater convulsions.

It is a fortunate circumstance that the clocks in the telegraph offices throughout New Zealand keep Wellington time, because we have thus the ready means of knowing, with some degree of certainty, the exact moment when the shocks were felt in different parts of the colony.

Thus, the Wellington shock is noted as having occurred at 9.56 a.m., whilst the observations of the Christchurch station fix it at 9.56½ a.m., and consequently only thirty seconds elapsed between them. Mr. Bird made me a very interesting communication, which shows not only that the shock was first felt in Wellington, but also that the intervals as stated must be correct, at least within a few seconds.

The Wellington operator was at that time sending a telegram to Christchurch, when he suddenly stopped for a short time, which, as the Christchurch operator thinks, was about a quarter to half a minute. When beginning again after that interval, he asked, "Did you feel that?" after which the shock reached the Christchurch office. The transmission of the four words "Did you feel that" takes about eight seconds; if, consequently, we take the mean between a quarter and half a minute, and add the eight seconds, we shall obtain as nearly as possible the results of the clocks, namely, half a minute. Dr. Hector, in his lecture upon the same subject, gives the exact time when the earthquake vibrations were experienced at all the different stations, and also the distance of some of them from each other. (See p. 40). To the latter I have added a few more, in order to obtain more data for calculation.

From the results obtained by other observers as to the velocity of the usual earthquake vibrations, which in the mean may be stated to be about 1,800 feet per second, it will become evident, from my own calculations which I am going to give, that the New Zealand earthquake has had some unusual features. It will be seen that it moved, on the average, about five times as quick, and therefore we can neither call it a central nor a linear shock, the velocities of which we know with a moderate degree of certainty.

It thus appears that the points most distant from each other at which the earthquake was felt were, Napier (9.55 a.m.) in the Northern, and Hokitika (9.58 a.m.) in the Southern Island, the distance being 402 miles, the difference of time three minutes, or, per second, 11,791 feet.

Napier to Christchurch, 1½ minute.
9.55 9.56½
Distance, 367 miles, or 21,530 feet per second.

Wellington to Christchurch, 30 seconds.
9.56 9.56½
Distance, 172 miles, or 33,455 feet per second.

Christchurch to Hokitika, 1½ minute.
9,56½ 9.58
Distance, 102 miles, or 5,984 feet per second.

Wellington to Nelson, 1 minute.
9.56 9.57
Distance, 76 miles, or 6,688 feet per second.

I think these results are sufficiently clear to show, in the first instance, that these vibrations were not the result of a volcanic earthquake, either central or linear, because, irrespective of the question of direction, they travelled much quicker than the vibrations of those forms of earthquakes are usually propagated.

It will be seen that the N.E. to S.W. direction is that in which the shocks were felt almost simultaneously along the whole line. Should we even adopt the east and west direction as more correct, the fact will appear at a glance that although more time elapsed between the shocks, also in that case the velocity of the shocks was far too high for such origin.

Another point of importance not to be lost sight of is the absence of similar news from Auckland, and from Dunedin and the Bluff, so that we may fairly conclude that no shocks were experienced in the northern portion of the Northern, and in the southern portion of this Island. Consequently, a broad belt running in a N.E. and S.W. direction across New Zealand, and following the direction of the central chain in both islands, appears to have been visited simultaneously by the vibratory movement.

There is, however, one form of propagation, and of a truly plutonic nature—the transversal earthquake—which, if admitted in this instance, will satisfactorily explain all the apparent anomalies.

If, therefore, we accept the hypothesis that an earthquake has reached the surface of the earth simultaneously along a line several hundred miles in length, and running parallel with the central chain in both islands, and through a fissure deep below the earth's crust, we shall be able to find sufficient explanation of all New Zealand occurrences. Let us therefore draw a line passing through New Zealand, so that Napier, Waipukurau, Greytown, Featherston, (White's Bay?), and Blenheim, in which the vibratory jar was experienced at the same time (9.55), are situated at an equal distance, either on the same or on both sides of it; we shall then find that the other stations, such as Wellington, 9.56, Nelson, 9.57, Christchurch, 9.56½, and Hokitika, 9.58, may be grouped along with it at greater or less distances. Owing to the occurrence of mountain chains, across which the shocks have to pass, a change of rocks, &c., many other causes of retardation or acceleration may arise by which they may arrive at greater or lesser speed at the station where they have been registered; and a calculation for each station from such an adopted line would show that in every case the shocks moved from it, laterally, in a much diminished ratio, and more in accordance with the velocity of such class of earthquakes observed in other parts of the world.

It is also evident, from the occurrence of an earthquake shock in Sydney, experienced on the 18th August, where such phenomena are of such rare occurrence, that a deep-seated disturbance in or below the solid crust of the earth must have occurred over a great portion of the globe, and for which a volcanic eruption cannot account.

Thus the abysso-dynamic forces, or tides, may have acted upon the earth's crust at any given spot more readily, owing to its weakness, when compared with others. They may have been able to form a vent, from which volcanic eruptions of unusual magnitude took place on the 15th, and probably on the following days. But such a catastrophe could not happen where the crust of the earth was too solid: nevertheless, at many of such localities, the fluid magma below the former was sufficiently disturbed to act upon the interior of the shell by vibratory jars, and principally in those lines where, as along the axis of the longitudinal mountain chains or their declivities, weaker zones were exposed to that influence.

ESSAYS.

ON THE

GEOGRAPHICAL BOTANY OF NEW ZEALAND.

Explanatory of a Series of Essays by

SIR DAVID MONRO AND MESSRS. TRAVERS AND BUCHANAN.

BY JAMES HECTOR, M.D., F.R.S.

(Plate V.)

[*Read before the Wellington Philosophical Society, 15th September,* 1868.]

In communicating the following essays, I will take the opportunity of explaining briefly, by a single example, the chief physical peculiarities which regulate the distribution of the vegetation in the South Island.

The accompanying diagram (pl. V.) is an ideal section across the island, between latitudes 40° 30′ and 46° 30′ S. The greatest altitude met with in such a section will be 10,000 feet, but the mean elevation of the ridges that connect the various summits is barely 5,000 feet, while in these occur breaks, or "passes," in the mountain chain, which, by permitting the passage of the western winds, give rise to local modifications of the flora at the points where they lead out on the eastern slope. The best known of these are the pass from the head of the Wanaka Lake, by which Dr. Haast crossed to Jackson Bay; and the Greenstone Pass, leading from the Wakatipu Lake to Martin Bay. Another pass, only a few miles in length, crosses the narrowest part of the Southern Alps, between the head of the sounds and arms of Te Anau Lake.

These breaks in the mountain chain have all about the same altitude of less than 2,000 feet above the sea level, which is sufficiently low to admit of the transfusion of many species of plants.

From the fact that these passes follow longitudinal valleys with a succession of short gorges at right angles to their general course, and do not coincide with straight transverse depressions, the influence which in the latter case they would have exercised on the climate of the interior is greatly reduced; nevertheless, the mild and genial climate that is experienced in the neighbourhood of the Wanaka and Wakatipu Lakes, is to be attributed, in a great measure, to the existence of these deeply-cut notches in the mountains.

From comparative meteorological observations, it would appear that four times more rain falls on the west than on the east coast; and this, as may be expected, produces a marked difference in the character of the flora. Moreover, owing to the influence of the mountains which thus intercept the moist winds, a comparatively *arid* district occurs in the interior of the province, which approaches to within a variable distance of the east coast, according to the form of the surface and the prevalence of dry, shingly soils.

Whatever may have been the original botanical features of this district, it is now, at least, characterized by an almost total absence of forest. That heavy timber at one time grew upon the ranges is indicated by the occurrence of large half-consumed logs; but it is very improbable, from the nature of the soil on the flat basin-like plains, that they ever supported any other kind of vegetation than grasses and low scrub.

In addition, therefore, to the division of the flora into zones according to altitude, it is intended, in the diagram, to represent the three parallel districts of the west, central, and eastern parts of the province.

Zone A—consists of mixed bush. A1 is the forest of the West Coast, that clothes steep slopes and confined valleys which open directly on the sea without the intervention of open or alluvial land. It presents no essential difference of character between the sea level and an altitude of 4,200 feet, (which is the highest limit ever reached by the sylvan zone in any part of Otago), while in many instances it ceases, without obvious reason, at a much lower elevation.

As indicated by the prevalence of certain trees, the western forest may be subdivided as follows:—

(*a.*) Along the shore there is a profusion of shrub *Veronicas* and *Olearias*, and large Ironwood trees with gnarled branches.

(*b.*) The flat land and low spurs are covered with the common species of Pines and Birch, such as Rimu, Totara, *Weinmannia* (Karmahi), and *Fagus* (Tawai), with a dense undergrowth, and many tree ferns, among which the most remarkable is the Mamaku (*Cyathea medullaris*), a Tree-fern only found in Otago, on the West Coast, though common in the northern provinces.

(*c.*) From 1,000 feet upwards the Pines diminish in number but are still well grown; and in addition to the common kinds, the Toatoa, or Celery Pine (*Phyllocladus alpinus*), becomes abundant. The Rata (called Ironwood in the south) acquires an immense size on the loftier ridges; but, on the whole, the trees which predominate are the Red and White Birches, which gradually become dwarfed, and form, along with the heath-like and composite shrubs, the belt of dense scrub which always marks the upper limit of the forests. The most striking feature of this western bush is, however, the wonderful luxuriance of cryptogamic plants, every shrub and tree being loaded with damp lichens, mosses, and fungi, which rapidly destroy the timber.

A2.—The mixed bush of the East Coast presents a marked difference from that on the west: on the whole, the timber is better grown and of larger size, and there is a much greater variety of Pines. Its most characteristic development is around Dunedin, where it is rare to meet any Ironwood, Karmahi, or Birch, which are so common on the west, Black and White Birch being wholly wanting.

Zone B.—In crossing the alpine ranges to the eastern side, the upper limit of the forest is at a less elevation, reaching to only 3,500 feet, and along the eastern slope of the mountains consists nearly wholly of Birch trees, with patches of mixed bush in favourable situations by the sides of the larger lakes. The valleys in this district are generally occupied by a dense scrub, consisting of *Veronicas*, *Cassinias*, and *Olearias*, resembling somewhat the sub-alpine flora, while the woods are skirted by a luxuriant growth of the handsome Lace-bark tree (*Plagianthus lyallii*), with its delicate green leaves and large white flowers.

Zone C1.—As has been already observed, the influence of the mountains in intercepting moist westerly winds, has given to the district in the central part of the island a flora which possesses almost a continental or arid type.

Cryptogamic plants, which are generally so abundant in New Zealand, are almost wanting, being largely reduced in relative percentage to the phanerogamic flora.

The plains are covered with grasses, the roots of which are gathered into tufts or tussocks, intermixed with the Bayonet grass or "Wild Spaniard" (*Aciphylla colensoi*), Toumatakuru (*Discaria toumatou*), and a great variety of the New Zealand brooms (*Carmichælia*), with small *Orchids*, *Pimelias*, and ericaceous plants.

Advancing towards the east, the grasses acquire a different character, indicating the influence of moisture derived from the eastern sea-board.

The yellow tussock predominates, and is intermixed with a rank growth of fern (*Pteris aquilina*, var. *esculenta*), Tutu (*Coriaria*), several species, Flax (*Phormium tenax*), and the soft-leaved Spear-grass (*Aciphylla squarrosa*), all of which latter plants rarely occur in the interior or lake district.

Zone D1.—This is the zone of sub-alpine plants, which is especially distinguished by the prevalence of large bunches of Snow-grass, which term includes various species of *Danthonia* and *Agrostis*, intermixed with scrubby patches of *Dracophyllum* and other heaths, many beautiful *Veronicas*, and a great variety of composite plants, principally *Celmisias*, *Senecios*, and *Cassinias*. It is comparatively narrow on the western slope, where it ranges from 4,200 to 5,500 feet; but on the opposite side of the mountains it expands so as to embrace from 3,500 to 6,000 feet, its lower limit conforming to the winter snow line of the region, which, in accordance with meteorological laws, declines in altitude as we advance from the western sea-board into the interior of the island, while on the other hand the summer snow line rises in elevation.

It is in this zone of the western ranges that the large species of *Ranunculus*, with their magnificent peltate leaves and flowers, form such a striking object in the alpine landscape (*R. lyallii* and *R. traversii*).

D2.—Where the open country of the eastern plains rises above an altitude of 3,000 feet, there also Snow-grass, *Veronicas*, *Celmisias*, and other plants characteristic of this zone displace the more nutritious pasturage of the lower grounds.

Zone E—is the alpine region, which for a great part of every year is completely covered with snow, and where, in consequence, all the flowering plants (of which there are many species of great beauty) that form wood are nearly stemless, and in most cases are aggregated in the form of hard, hassock-like patches, in consequence of the slipping action of the snow on the sides of the mountains, forming what are known as *patch plants*.

This zone ranges from 6,000 feet upwards, the highest plants having been obtained at a little over 8,000 feet, but which, however, is probably not the extreme limit of vegetation in this latitude.

ON THE LEADING FEATURES

OF THE

GEOGRAPHICAL BOTANY

OF THE

PROVINCES OF NELSON AND MARLBOROUGH, NEW ZEALAND.

BY SIR DAVID MONRO, M.D.

[*Written for the New Zealand Exhibition*, 1865.]

In his admirable introductory essay to the Botany of the Antarctic Voyage, Dr. Hooker writes thus of the physiognomy of the New Zealand flora:— "The traveller from whatever country, on arriving in New Zealand, finds himself surrounded by a vegetation that is almost wholly new to him—with little that is at first sight striking, except the Tree-fern and *Cordyline* of the northern parts, and nothing familiar except possibly the Mangrove; and as he extends his investigations into the flora, with the exception of *Pomaderris* and *Leptospermum*, he finds few forms that remind him of other countries. Of the numerous pines, few recall, by habit and appearance, the idea attached either to trees of this family in the northern hemisphere, or to the *Callitris* of New Holland, or to the *Araucariæ* of that country and Norfolk Island; while of the families that on examination indicate the only close affinity between the New Zealand flora and that of any other country, (the *Myrtaceæ*, *Epacrideæ*, and *Proteaceæ*), few resemble, in general aspect, their allies in Australia. A paucity of grasses, an absence of *Leguminosæ*, an abundance of bushes and ferns, and a want of annual plants, are the prevalent features in the open country; whilst the forests abound in Cryptogamia, and in phænogamic plants, with obscure green flowers, and very often of obscure and little-known natural orders."

In a subsequent part of the same essay, in drawing a comparison between the floras of New Zealand and Tasmania, he goes on to say:— "In the neighbouring island of Tasmania, the grasses everywhere form a prominent feature; the *Cyperaceæ*, from their size, strength, and cutting foliage, arrest the traveller's progress through the forest; *Orchideæ* of many kinds carpet the ground in spring with beautiful blossoms; the heaths are gay with *Epacridæ;* herbs, trees, and shrubs of *Compositæ* meet the eye in every direction; whilst the *Myrtaceæ* and *Leguminosæ* are characteristics both of the arboreous and shrubby vegetation. The difference is so marked that I retain the most vivid recollection of the physiognomy of the Tasmanian mountains and valleys, but a very indifferent one of the New Zealand forest, where all is, comparatively speaking, blended into one green mass, relieved at the Bay of Islands by the symmetrical crown of the Tree-fern, the pale green fountain of foliage of the *Dacrydium cupressinum* and the poplar-like *Knightia* overtopping all. It is true that there is more variety in the latter country than is expressed by the selection of a few individuals, and a little reflection recalls a vast number of noble and some beautiful botanical objects; but with the exception of groves of the Kahikatea Pine (*Podocarpus dacrydioides*) on the swampy river banks, the *Pomaderris* and *Leptospermum* on the open hill sides, and *Dammara* on their crests, there is little to arrest the botanist's first glance; and nothing in the massing or grouping of the species of any natural order renders that order an important element in the general landscape, or gives individuality to any of its parts by flowers and gaiety or by foliage and gloom. The same features prevail even so far south as Lord Auckland's group, where *Dracophyllum*, *Coprosma*, *Metrosideros*, *Panax*, and a shrubby *Veronica* unite to form an evergreen mantle: and I suspect, from the accounts I have heard and read, that they are repeated on the damp cool coasts of Chili, to the north of the region of the sombre beech forests which cloth the Fuegian Islands."

The colonist of the South Island of New Zealand, if he happens to visit the Province of Auckland, and more particularly its northern portions, will not fail to recognize, in this beautiful and striking language, a vivid picture of the forest scenery of the Northern Island. But it does not apply to the vegetation of Nelson, Canterbury, or Otago. The fact is, that in this respect Dr. Hooker has fallen into the same mistake as all other writers upon New Zealand until within a very few years. From, say, about the year 1830 until 1850 the Bay of Islands and Auckland were considered to be New Zealand, and a variety of works were given to the world descriptive of this country, founded upon a visit to its northern extremity. Until the settlements of Canterbury and Otago were founded, the South Island of New Zealand was hardly known at all. It is true that the great navigator Cook selected two of its harbours, Queen Charlotte Sound and Dusky Bay, as his favourite resting-places; and the celebrated botanists who accompanied him, Banks, Solander, and the Forsters, collected their specimens in the neighbourhood of these harbours, and saw and studied its flora there. But of the intervening portions of the country they appear to have seen hardly anything, and the plains and grassy downs of the South Island, now the chief field of settlement, and constituting the great bulk of the country over which the flood of colonial enterprise is spreading, were to them unknown. Dr. Hooker himself, with the antarctic expedition, visited the Bay of Islands for a short time; but unless we are mistaken, the ships did not touch at any port in the South Island.

The characteristic features of the vegetation of the South Island of New Zealand may be largely stated thus:—The eastern and central portions of the country are covered with grass; the western side with forest. It is not unreasonable to conjecture that at a former period, possibly not very remote, the whole of the surface of the island was clothed with continuous forest. On many of the sheep-runs, now lamentably destitute of growing timber, the settlers find an available substitute in logs of sound, fresh wood lying plentifully scattered on the hill sides; and in travelling over perfectly treeless plains, where nothing woody at present grows loftier than a "Wild Irishman" (*Discaria toumatou*, Hook. f.), stumps are frequently encountered, with their roots spreading out laterally just as they grew when the tree was living; and the swamps and hollow places on these plains contain an immense abundance of prostrate logs and large branches, affording a supply of firewood sufficient to last for many years. The great agent in the destruction of the primitive forest has undoubtedly been fire. Unlike the *Eucalyptus* of Australia, the New Zealand forest tree is at once killed by excessive heat. A fire may pass through an Australian forest, clearing up the dead fallen timber and scorching and blackening the living; but the gum trees (many of them even if burnt to the ground) still retain their vitality, and, Phœnix-like, send forth new foliage and branches. I cannot call to my memory a single New Zealand tree that does the same. As the New Zealand forest is generally much more dense and humid than that of Australia, fires running through it are not so frequent, and occur only in the very driest seasons, when the moss which carpets the surface has parted with all its moisture, notwithstanding the shade of its leafy canopy. Such, however, was the case two years ago, when immense quantities of valuable timber in the neighbourhood of Wellington and Banks Peninsula were destroyed in this manner. When this happens, the forest is completely killed. Melancholy skeletons of dead trees represent what were formerly masses of cool foliage. No growth takes place either from the stems or roots. But a secondary growth of shrubs arises. Various species of *Veronica*, *Aristotelia*, *Pittosporum*, *Aralia*, *Coprosma*, *Fuchsia*, *Leptospermum*, and others, soon form dense copses, and with these are blended, according to climate and nature of the soil, varying proportions of ferns and grasses. The larger forest trees will also make their appearance occasionally, growing from seed—more especially the varieties of the birch of the colonists (*Fagus*), and the totara (*Podocarpus totara*). But as fires are now the rule, lighted either by the Maoris—where there are any Maoris—or by the colonist, to increase the extent of his pastures, the vegetation is soon reduced to the grasses, ferns, and those other families of plants which maintain their ground, though annually scorched.

By a process of this sort it is reasonable to suppose that the forest has been cleared away from the great breadth of the eastern and interior portions of the South Island. Groves of trees and even forests are still met with there; but they occur in localities which favour the above hypothesis. For where they now exist, the surface is either so broken and mountainous as to be worthless for occupation; or they are surrounded by swamps and running water; or, as in the southern portions of the country, the climate is so humid as to be unfavourable to the spreading of bush fires. Proceeding, for instance, from Cape Campbell southwards, the country is treeless until the ground begins to rise rapidly towards the flanks of the Kaikoura Mountains, the seaward aspect of which is clothed with forest. The limestone downs which skirt the coast to the south of the Kaikouras are entirely without timber. On the Canterbury Plains a few groves survive, surrounded by swamps. The ragged surface of Banks Peninsula is almost equally divided between forest and open country, the former, however, chiefly occupying the hollows and moister portions. Proceeding still further south, for a distance of 200 miles, no timber to speak of is met with until we reach the promontory which contains the harbour of Otago, where a broken surface and the prevalence of rain have combined to preserve a noble breadth of forest. To the same cause the wooded ranges which border the coast between the Clutha and the Mataura appear to owe their existence, while the picturesque groves and masses of wood which are sown broadcast over the fertile plains of Southland still live, I should say, by virtue of the superior dampness of the soil and the corresponding humidity of the climate.

While the characteristic feature of the eastern half of the South Island of New Zealand is a grassy surface, now feeding several millions of sheep, that of its western mountains and sea-board is almost unbroken forest. Of the character of that forest at the level of the sea I have had but limited means of judging; but in the interior, and more especially at the higher levels, one genus of trees, the *Fagus* or birch of the colonists, occupies the ground to the exclusion of almost everything else, and impresses its peculiar physiognomy upon the landscape. In the Provinces of Nelson and Marlborough, with which I am more especially acquainted, I should say that of those portions clothed with wood, certainly nineteen-twentieths are covered with the different varieties of *Fagus*. It appears to be, as in the Fuegian Islands, the characteristic tree of the country. A fringe of land bordering the coasts, and more particularly on the western side of the island, will doubtless show a very considerable variety of those trees which are met with in the warmer valleys of the Northern Island of New Zealand. On the plains and the alluvial soils there will be found an abundance of pines, and the flora will bear what may be called the ordinary New Zealand aspect. But no sooner do we leave the lower levels and rise a few hundred feet along the mountain sides, than we find ourselves in a peculiar forest, which occupies the ground as exclusively as the pine in the colder parts of the northern hemisphere, or the *Eucalyptus* in the Australian ranges. We are surrounded by evergreen beeches of various sorts; and nothing breaks the monotony of the forest save here and there the pale-green rimu, which mostly loves the hollows, or the cypress-like foliage and red stem of the hardy *Thuja doniana*, which grows on the summits of the ridges.

Blind Bay is enclosed between two lofty ranges, which, separated at their seaward extremities by a distance of some forty miles, gradually approximate, as we trace them southwards, until they coalesce in the elevated region of the Spencer Mountains. Upon the flanks of these, the principal rivers of the northern part of the South Island—the Wairau, the Buller, the Clarence, and the Dillon—take their rise. The eastern arm of these two ranges divides Blind Bay from the valley of the Wairau, widening as it advances northward, and enclosing between its broken and deeply indented fingers the estuaries of the Pelorus and Queen Charlotte Sound. The western arm, wider and loftier, sinks down to the north upon the shores of Massacre or Golden Bay, enclosing between its spurs the valleys of the Takaka and the Aorere Rivers. These two great ranges are clothed with an almost unbroken monotony of evergreen beeches. A botanist landing at the head of Queen Charlotte Sound, or where the Pelorus River enters the sea, would find a considerable variety of noble trees and many most beautiful evergreen shrubs. Where the ground was moistest, and indicated the existence of stagnant water, he would be surrounded by the grand mast-like stems of the White Pine (*Podocarpus dacrydioides*), generally green with moss, and often festooned with climbing parasites. On the drier ground he would find the Mai, or Red Pine (*Podocarpus spicata*), cleaner in the bark, less mast-like than the former, and carrying a greater head of foliage. On the still drier ground there would be the noble Totara (*Podocarpus totara*), ten feet, perhaps, in diameter, or even more, with its brown bark scaling off in long vertical strips, and its branches shooting athwart one another with the picturesqueness of the old English Oak. Mixed up with these he might find the Pukatea (*Atherosperma novæ-zealandiæ*), with its bright green foliage, its pale grey bark, and deep parietal buttresses; the Tawa (*Nesodaphne tawa*), and the Kowhai (*Edwardsia* *microphylla*);* mostly near the running water; the former pale-green, branching, and umbrageous; the latter tall, slender, and scant of shade, but gay in the early spring with an abundance of its leguminous yellow blossoms.

Other well-known forms of New Zealand trees would meet his eye: the Hinau, for instance, the Miro, the Maire, and more abundant than these, perhaps, the beautiful Titoki. In the wooded glens and on their banks he would see the black rough stem and the symmetrical fronds of the Fern-tree. He might find (though they are not abundant) the true and only palm of New Zealand, the *Areca sapida*, nestling in the most sheltered spots. So long, in fact, as he confined himself to the lower levels and alluvial valleys, he would find himself surrounded by a noble forest of varied and striking vegetation. But if he now leave the valleys and commence the ascent of the mountain ranges, he will soon find himself surrounded by the characteristic vegetation of the country. The conifers, the laurels, and the Myrtles remain beneath him; and stretching away on all sides in unbroken and monotonous continuity, extends a forest of evergreen beeches, carpeted with moss, and unencumbered by that entangled cordage of parasitical climbers, which renders the forest of the richer bottoms almost impenetrable without the aid of the billhook.

But higher than the beech forests there is a flora of great interest and beauty. In this portion of the South Island the species of *Fagus* do not ascend to a greater elevation than at the most 5,000 feet. Before we leave them in our upward progress, they have dwindled down to dwarf shrubs, shorn by the mountain blasts, and streaming with hoary lichens. At length they are altogether beneath us. Pushing through a zone of no great width, of shrubs belonging to the orders *Dracophyllum, Senecio, Veronica, Gaultheria*, and others, we emerge upon the open mountain summits, where in winter snow lies to the depth of many feet; where even in the height of summer it still holds its ground in the hollows in large dazzling masses; and where not a month of the year passes over that it does not fall and whiten the entire surface. The flora of this region is widely different from anything which we have met with at lower levels, and bears its own peculiar physiognomy. We have here none of those monotonous masses of foliage, unrelieved by the colour of blossoms, which Dr. Hooker speaks of as characterizing the vegetation of the Bay of Islands. We tread upon a short dense alpine grass which clothes those portions of the surface that are not occupied either by bare masses of rock or slopes of gravel. We have but few shrubs about us, and of a different character from those we left beneath; and the ground is gay with a great profusion of blossoms.

* *Sophora tetraptera*, var. *b. microphylla*, Hook. f.—Ed.

Large and handsome *Ranunculi* spread out their glossy yellow petals to the sun. Different varieties of Gentian show their spikes of whitish flowers. The *Wahlenbergia saxicola* recalls the Harebell of our native woods. The quaint-looking *Craspedia* exhibits its ball of blossoms on the top of a tall and slender stem; and the silvery petals of the *Raoulia* are seen studded like stars over the surface of compact masses of vegetation that might be taken at the first glance for moss. But the characteristic plants of this zone are the different varieties of *Celmisia*. The number of these is immense; and as they all carry conspicuous, daisy-like flowers, from the *Celmisia coriacea*, the blossom of which is as large as a five-shilling-piece, down to the slender *Celmisia gracilenta*, the alpine heights during the long days of summer are really quite gay with colour.

In enumerating the blossoming plants of that zone, we must not forget the shrubs. There is the *Hoheria*, for instance, growing in the gullies, a most graceful shrub, carrying a great abundance of conspicuous drooping white flowers. There is the *Gaultheria*, the closest relative to our native heath of anything that grows in the country; various species of shrubby *Senecios;* the dwarf *Carmichælias*, with the large pea-shaped blossoms, lying close to the ground; the quaint-looking *Ozothamnus* with its glossy green tuberculated branches and terminal yellow flowers; and chief of all, a great variety of most beautiful dwarf *Veronicas*, symmetrical in the extreme, bright in their foliage, some bearing spikes, others flat heads of blossoms, but all of them conspicuous and charming objects. Higher than most of the others are the different species of *Thlaspi*, plants of the cruciferous order, some of them deliciously fragrant; and highest of all is that strange looking plant of the composite family, the *Haastia*, which is seen where nothing else grows, on the bare slopes of gravel, looking like a large globular mass of white felt, not unfrequently mistaken for a stray sheep.

In addition to those I have mentioned, the botanical explorer of the alpine regions will find, of course, a great number of other plants of interest, and doubtless some still new to science. I have said nothing of the *Gnaphaliums*, of the varieties of the Violet, the *Epilobium*, the Spear-grass (*Aciphylla*), the *Euphrasia*, or the different species of *Orchis*, which are to be found on the mountains; but I trust I have said enough to satisfy the reader that the alpine botany of New Zealand possesses its own special characteristics, has a physiognomy entirely different from that of the sea levels, and offers to the lovers of natural objects a most interesting field of exploration.

I find it impossible to refer to the subject of the alpine botany of New Zealand apart from the memory of the late Dr. Andrew Sinclair. In company with that gentleman, whose friendship it was my privilege to enjoy during several years, I ascended several of the mountain ranges of the Wairau and Upper Awatere in search of alpine novelties. It was impossible to have a pleasanter companion, and no one could be more enthusiastic in the cultivation of natural science, or bring to the task a mind better stored with all the requisite knowledge. Seated round the camp fire at night, his extensive and minute acquaintance with a wide range of subjects, his knowledge of art and science, and his experience, both of men and things, derived from enlightened observation in many countries, combined, with a cheerful temper, a large fund of anecdote, and a genial philosophy, to render his conversation most entertaining and instructive. While he lived he was one of the chief contributors to our knowledge of the botany of the country. What he did in this way he accomplished chiefly during intervals of leisure snatched from the duties of a responsible office. With his time entirely at his disposal, as it latterly was, and the whole energies of his mind given to the task, a great deal more might have been looked for from his researches; and an irreparable calamity befell the cause of science in this colony when Dr. Sinclair, then engaged in exploring the botany of the central portions of this island, lost his life in the Rangitata River.

Regarded as a whole, I should say that the vegetation of the South Island was less luxuriant than that of the North. In the former, we miss altogether some of the most handsome and striking plants which are to be met with in the latter, more particularly in its northern portions. That species of *Metrosideros*, for instance, called by the natives Pohutukawa, so beautiful an object in the middle of summer, bending over the salt waters of some sheltered harbour, and gorgeous with its bundles of crimson filaments, is not to be met with in the South. The noble Kauri, one of the stateliest and commercially the most valuable of the New Zealand forest trees, is not found to the south of Mercury Bay. The Puriri (*Vitex littoralis*), wider in its range, and abundant about Taranaki, I have never met with on the south side of Cook Strait. Charmed with its rich green foliage, and the beauty alike of its pink blossom and cherry-like fruit, I have carried with me young plants, and endeavoured to naturalize it in my shrubberies at Nelson, but could not succeed, for the frosts of our winter nights proved fatal to its delicate organization. Another familiar form which one misses in the south is the shrubby *Pomaderris*, which clothes the ground so abundantly in the neighbourhood of Auckland and elsewhere. But if the South Island be less abundantly furnished with trees and shrubs than the North, it possesses, in its wide extent of pasture, and in the abundance of grasses which clothe its eastern plains, and the downs and hilly slopes of its interior, a more than ample compensation; for these pastures are a source of great wealth to it. They furnish food for multitudes of cattle and several millions of sheep, and they are probably not yet stocked to more than one-third of their capability.

In an economic point of view, the chief trees of the South Island are the red and white pine, respectively called by the Maoris, the former the mai or matai (*Podocarpus spicata*),* the latter the kahikatea (*Podocarpus dacrydioides*). These trees furnish the timber which is chiefly used in the framework of houses. The mai furnishes the more valuable wood of the two, harder, more durable, and more ornamental; and it is accordingly used in those parts of the structure where durability and strength are chiefly required, as in wall-plates and joists. The white pine yields a softer wood, easily worked, and of great utility for inner work and situations in which it is not exposed to damp. It is asserted, and I believe correctly, that this timber is much more durable and in every respect more valuable in the South Island than in the North, owing in all probability to the difference of climate. For doors and window sashes the wood that is commonly used is that of the totara (*Podocarpus totara*). This is an exceedingly valuable timber. In appearance it is somewhat like cedar. It works with equal freedom, and, according to the testimony of the Maoris and the experience of the settlers, it resists the evil effects of damp better than any other timber with which we are acquainted. Where abundant and easily obtained, it is preferred for every part of a wooden house with the exception of those portions in which strength and toughness are the qualities chiefly sought for, for the totara is rather a brittle wood. In the older trees, large warty excrescences are frequently met with, which, when cut into, have a highly variegated and mottled appearance. These are in great request among furniture makers, the wood being very much admired. Not only is the totara sought for by the sawyer to be cut into boards and scantling, but the men who split fencing for agricultural purposes prefer it to every other wood. There is no other timber in New Zealand which rends before the wedge with such facility and truth; and no description of timber stands so well in the ground as the heart of totara. In consequence of its splitting properties, it is the timber out of which all the best and most durable roofing shingles are made. By the Maoris the totara has always been recognized as one of the most useful of the forest trees. It is of this tree that their largest canoes are made, the tree being felled in the forest, it may be at a very considerable distance from the beach, and, when hollowed out, dragged down into what the penny-a-

* Black rue of Otago, *Hook. f.*; matai, black rue or black pine in Otago, *Hector*; miro, often confounded with black pine, *Balfour*; mataii, *Colenso*; mai or matai, *Taylor*. —ED.

liner calls "its native element." I have been informed that the ownership of some of the largest trees is known and recognized years before they are ever made use of; and I have had totara trees pointed out to me which, while yet comparatively young, have been subjected to an operation which had for its object the lightening of the subsequent labour of hollowing them out. This operation consists in taking off the bark and a portion of the wood from one side of the tree to a height equivalent to the projected length of the canoe. As the tree grows after this operation, the bark and young wood swell up on either side of the wound, so that when the tree is ultimately cut down it presents a longitudinal depression, with a gunwale on either side formed by nature. One cannot but admire the ingenuity thus shown by savages, provided with no better tools than stone hatchets, in taking advantage of the operation of nature to lighten their work.

The rimu (*Dacrydium cupressinum*) yields a very useful timber, strong and handsome, but, unless thoroughly seasoned, much given to shrinking and warping. Always of a rich brown, the fibre of this wood sometimes approaches the colour of mahogany, and is beautifully veined. It is thus much in request among furniture makers, and, in consequence of its strength and toughness, is preferred by some of them to every other New Zealand timber. A considerable variety of handsomely-grained and showy woods for cabinet-makers' purposes is obtained from many of the smaller trees of our forests. The titoki (*Alectryon excelsum*), the akeake (*Dodonæa viscosa*), the ngaio (*Myoporum lætum*), and above all, the rewarewa (*Knightia excelsa*), yield wood out of which some very beautiful pieces of furniture have been made. In the hands, for instance, of Mr. Seuffert, of Auckland, these woods, worked up with others, have contributed to the construction of tables, cabinets, work-boxes, and other similar articles, which for general richness of appearance cannot be surpassed anywhere.

The rata (*Metrosideros lucida*) is not very common in the South Island, but, occurring as it does in several places in tolerable abundance, it must not be passed over in any enumeration of the economical woods of the country. The timber it yields is very hard, heavy, and tough, and is prized by wheelwrights and manufacturers of agricultural implements. To similar purposes is applied the timber of the maire (*Eugenia maire*). Where strength and durability are required, lightness being a secondary object, this timber is superior to any other.

The various species of *Fagus*, which have been described as the characteristic tree of the island, are hardly ever cut into boards and scantling. The timber is excessively tough and hard to cut, to such an extent as to necessitate the repeated sharpening of the saws. A very intelligent and well-educated owner of a saw-mill informed me that this was so much the case that he had to come to the conclusion that the juices of the wood contained some free acid which acted upon the iron, a supposition by no means extravagant or improbable. Owing to this circumstance, the timber of the *Fagus* is not so commonly seen as its quality might warrant. The wood of that most remarkable work, the bridge over the Waiauua, or Dillon River, in the Amuri, in the Province of Nelson, is from that variety of *Fagus* termed emphatically by the colonists the *black* birch, a tree with a sooty, rough stem, and minute, heart-shaped leaves, growing at low levels. Mr. Handyside, the gentleman who superintended the erection of the bridge, and to whom the greatest credit is due for the manner in which he carried out a work requiring very considerable engineering skill and great ingenuity and courage, assured me that as regarded strength, toughness, and apparent durability he could desire no better wood. It was subject, however, to the great drawbacks of rending in the sun and warping. By more careful drying, and selection of the proper season for felling the trees, (a point hardly ever attended to in this country), it is possible that these objections might be obviated, and if so, we have in the country a boundless supply of a timber admirably suited to purposes of the greatest utility.

Although not much operated on by the sawyer, the different varieties of *Fagus* split readily enough before the wedge, and a great quantity of fencing materials is constantly being obtained in this manner. The posts, if they contain a fair proportion of heart-wood, are found to last many years in the ground, and the rails are durable and tough. The city of Nelson is now almost entirely dependent for its supply of firewood upon the beech forests which clothe the mountain range to the eastward of the sunny nook in which it nestles. The timber is cut into convenient lengths for loading in the forest, and is then run down, by the force of gravitation, upon the rails of the Dun Mountain railway.

In the southern portions of this island a tree, which is but sparingly met with in the north, occurs much more abundantly, attains much larger dimensions, and is conspicuous for its economical applications. I refer to the kowhai, or, as it is called in the south, the gowhai (*Edwardsia*). The southern settlers assure me that, for posts and rails and a great variety of useful purposes, no timber can compare with that of the kowhai for strength, toughness, and durability.

I shall not be expected, in an essay of this sort, to present an elaborate or detailed account of all the useful purposes to which various members of the indigenous flora of New Zealand are applied, and must of necessity omit the mention of various trees which yield timber of more or less value. It may be sufficient to say that in the article of timber New Zealand has been richly endowed by nature; for there are few purposes to which timber is applied that may not be accomplished by having recourse to the indigenous trees of the country. And it must not be forgotten that in most European countries the timber which is operated on by the carpenter, shipwright, or furniture maker, is either grown in the country, the produce of exotic species naturalized, or else—as to take, for instance, the teak and mahogany—is directly imported from foreign countries.

Of the other substances useful to man which the vegetable kingdom yields, comparatively little is known. The gum of the kauri (*Dammara australis*) is exported from the northern parts of the North Island in considerable quantities, and its collection furnishes employment to a considerable number of Maoris. Of the gums or extracts yielded by the trees of this island hardly anything is known, for they have not as yet been the object of any direct observation or experiment.

In plants yielding fibre the country appears to be unusually rich. There is the well-known *Phormium tenax*, which, though not yet utilized as an article of export,—chiefly, in all probability, in consequence of the very high remuneration of labour that has hitherto prevailed,—is nevertheless daily applied, in its crude state, to an endless variety of useful purposes, both by the Maoris and the settlers. There is the ti of the Maoris (*Cordyline*), the fibre of which is as strong as that of the *Phormium*, while the leaf, when used green, is considerably tougher and more lasting. On account of these qualities it is the substance used by the natives in the construction of the sandals which they extemporize upon a journey; and various species of the natural order of the Malvaceæ, the *Plagianthus*, and the *Hoheria*, termed by the colonists ribbon-wood, yield barks admitting of being torn into strips of great tenacity, and admitting, probably, of useful applications in the arts. While upon this subject, I may mention that when in the Province of Otago in the year 1844, I saw excellent strong fishing-lines which were made of the epidermis which clothes the under surface of the leaf of the *Celmisia corixcea* twisted up into a string, and I saw at the same time another application of the same material in the shape of an excellent pair of soft mocassins or leggings, of native manufacture, which were made out of a cloth formed by using the aforesaid string as a yarn, and rudely weaving it. The leggings had very much the feel and consistence of soft buff leather.

I hardly consider it necessary to apologize for mentioning this circumstance, as I am sure most people will agree with me that it is desirable to place on record those little incidents of native habits and resources which otherwise, owing to the great changes that have taken place in the Maoris within a few years, would soon be altogether forgotten.

Of the native grasses of New Zealand several are considered by the flock-owners to possess high nutritive powers; but it is universally remarked that they are thin upon the ground. The explanation of this fact appears to me to lie in the circumstance that the number of species is very small. In some of the alpine regions especially, the grasses appear to grow luxuriantly, and yet they are only met with in tufts, with intervening patches of bare ground. Where this is the case, it will generally be found that the species over a given area are not above two or three in number; and the explanation is to be found in the general law of vegetable physiology, which prescribes change and rotation as a necessary condition of the healthy existence of most plants.

But whatever may be thought of the existing flora of New Zealand in a utilitarian point of view, there is no doubt that it is destined to undergo a very great amount of change. Already in the gardens of the New Zealand settlers the fruits and vegetables of Great Britain prosper and bear abundantly, and in addition to these, fruits of still warmer countries. But I will not enter upon this subject, understanding that my friend Mr. Ludlam, of Wellington, has promised to write an account of his experience in the acclimatization of exotics; and every one who has seen his garden, and the wonderful collection of plants which it contains, drawn from all quarters of the globe, will admit that no one is in a better position to write with authority on this subject.

What has taken place with regard to the gardens of the country may well take place with regard to its meadows, hill-sides, and forests. There are many noble specimens of the vegetable world peculiar to New Zealand and deserving of the utmost care; but there are also deficiencies which may be filled up by judicious introductions, and for this operation the mild and equable climate of the colony is particularly favourable. There is no reason whatever why there should not be seen growing together in one and the same wood in New Zealand its own peculiar evergreen Conifers, contrasted with the deciduous trees of our native country, the pines of Europe and Asia, the *Eucalypti* and *Acaciæ* of New Holland, the Proteaceæ, of South Africa, and other trees and shrubs from all but strictly tropical latitudes.

And so with regard to its pastures. The progress of settlement is daily introducing not only English meadow-grasses but grasses from other countries, and other useful forage plants. So far as present experience goes, perfect success follows upon all but the poorest and driest soils; and the consequence is that the resources of the colony in the production of animal food and wool are being largely increased. The process has but just commenced: half a century hence, when these operations have had time to develope their results, the South Island of New Zealand will present a richer and more varied appearance.

Never having had an opportunity of botanizing in the Provinces of Canterbury or Otago, I have felt unable to meet that portion of the Commissioners' request which embraces a comparative view of the floras of the different provinces of the South Island. Under these circumstances, I considered myself extremely fortunate in persuading my friend Mr. Travers, lately of Christchurch, who is well known to all students of New Zealand botany as one of its most zealous and active promoters, to place at my disposal the result of his observations in this direction. Mr. Travers has botanized both in Nelson and Canterbury, and to his explorations among the mountains of both provinces, the scientific world is indebted for the discovery of some very beautiful and remarkable novelties. I cannot do better than append to this essay of mine the letter which he has kindly written me on the subject.

I forward also an account which I have received from Dr. Hector of the most striking features of the flora of the Province of Otago, more especially having reference to the grouping of plants in certain zones shown to be dependent on climatic conditions, these in their turn dependent upon altitude above the sea level, and the position and arrangement of the mountain masses, as affecting above all the amount of humidity in the atmosphere. I am sure that this communication will be read with great interest. The ground it enters on has been hitherto untrodden, and the well-merited reputation of the author, not only as a distinguished geologist but an acute and accurate observer in every department of natural science, must give to his remarks a more than ordinary interest, and be a guarantee for their scientific accuracy.

Remarks on a Comparison of the general Features of the Flora of the Provinces of Nelson and Marlborough with that of Canterbury; in a letter addressed to Sir David Monro.* By W. T. L. Travers, F.L.S.

[*Dated at Nelson, 17th October,* 1864.]

I feel some hesitation in entering upon so difficult a subject as a comparison of the floras of the Provinces of Nelson and Marlborough on the one hand and that of Canterbury on the other; and but for the fact that you permit me to confine myself to the question in its very broadest aspects, I should at once have pleaded my inability to enter upon it.

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* This letter by Mr. Travers was furnished by Sir David Monro, as supplementing the foregoing essay.—Ed.

In the remarks I am about to offer I propose to treat the united Provinces of Nelson and Marlborough as the "Nelson district," and the Province of Canterbury as the "Canterbury district;" and in order to make my remarks intelligible, I must briefly sketch the physical features of each district.

Upon dividing the Nelson district longitudinally, we find the western half covered with dense forest, whilst the eastern may be considered as almost exclusively a grass country; but the whole district is composed of mountain spurs radiating from the Spencer mountains, with small intervening valleys, the ranges on each side of the dividing line presenting a considerable uniformity in altitude.

The western part of the Canterbury district is also composed of mountain chains continuous with the Spencer mountains, the eastern slopes of which are almost entirely grassed, whilst the western slopes, like those of the Nelson district, are also covered with dense forest. But at the foot of the Canterbury mountains, on the east side, and at a short distance south of the boundary between the two districts, we find extensive plains, apparently level, bounded by the sea shore, and having an average breadth of about thirty miles. These plains extend from north to south about one hundred and fifty miles, and are succeeded by low undulating downs and occasional flats until we reach the Waitaki River, at the southern extremity of the district. At the northern end of the plains we also find low downs, stretching from the Kowhai River (where the plains properly commence) to the Hurunui, after crossing which and entering the Nelson district we almost immediately come upon mountain ranges of considerable altitude.

In drawing this short description of the two districts I must not omit to notice Banks Peninsula, which, as you are aware, is composed almost exclusively of volcanic rocks, contains about 260,000 acres of land, all mountains and hills, much broken in character, in some parts attaining an elevation of 4,000 feet, and nearly equally divided into forest and pasture land.

As you are also aware, the plains above referred to are intersected by great rivers flowing from the mountain ranges, and it has been ascertained, as the result of carefully-taken levels, that these rivers fall at rates varying from twenty-eight to thirty-five feet per mile, between the foot of the mountain ranges and the sea. These plains, therefore, although apparently level, are actually as a rule 1,000 feet above sea level at the base of the mountain range, falling away very gradually from that altitude to the level of the sea.

It will be evident to you, then, that although the two districts under consideration present certain marked distinctions, as well as resemblances, in physical character, and might, if separated by an effectual barrier to free distribution, have presented some differing conditions of life, yet as the whole area is continuous, and the physical conditions of each district graduate away somewhat insensibly into those of the other, we cannot expect to find any more material differences in their natural productions than such as may be attributed to modifying influences produced by difference of climate.

The Canterbury Plains before alluded to are generally well grassed, and contain, here and there, extensive tracts of what is termed swampy land, covered with a luxuriant growth of *Phormium tenax*, various species of Junceæ and Cyperaceæ, and other plants common in similar localities all over the island; whilst in moist but less swampy places we find clumps of *Cordyline australis* breaking the otherwise absolute monotony of the scenery.

The plains as a rule are destitute of timber, although to the north of Christchurch, and in the neighbourhood of Timaru, we still find small patches of forest. In the swampy lands bordering the sea, moreover, at depths varying from four to twenty feet, a vast amount of buried timber is found, evidently the remains of forests once continuous with the isolated patches still growing; but it is remarkable that although amongst this buried timber considerable quantities of pukatea (*Atherosperma novæ-zealandiæ*) occur, I was unable to find a single tree of that species in any part of the living forest. The latter, however, still comprises *Elæocarpus hinau*, *Podocarpus ferruginea*, *P. spicata*, *P. dacrydioides*, and *P. totara*, scarcely inferior in size or general appearance to the same trees in the Nelson district. Banks Peninsula also produces an abundance of the same timber, but the wood is found to be coarse in texture, and applicable only to the commoner uses, carpenters and cabinet-makers rejecting it in favour of wood from the northern parts of the Colony.

But whilst these trees produce inferior timber, we find the *Edwardsia grandiflora* (which in the Nelson district is merely a small tree) attaining on Banks Peninsula the dimensions of a timber tree, yielding valuable wood, remarkable for its durability, particularly when used for fencing and other purposes exposing it to the action of the weather. In the small trees and the general undergrowth of the forest we are not struck, at first sight, with any very marked change, but closer examination reveals the entire absence of some genera, and that those which are common to both districts are not represented in that of Canterbury by so many species as in that of Nelson.

For example, while the *Nesodaphne tawa*, and some of the more beautiful species of Malvaceæ, are common in the warm, wooded valleys of the Nelson district, we do not find the former, and only different species of the latter in the Canterbury woods. *Myoporum lætum*, which grows to a large size (twenty-five feet high and twenty inches in diameter) in the northern parts of Nelson, is reduced almost to a shrub, growing only in warm, sheltered spots on Banks Peninsula. *Araliaceæ*, *Pittosporeæ*, and *Rubiaceæ* are little represented as compared with the numbers of species and varieties in the Nelson district. Many *Veronicas* usually found at considerable elevations in the latter, are frequent in the lower grounds of Canterbury. The number of composite plants of the same species is apparently more equal, and little if any difference is to be found in a large proportion of *Myrtaceæ*, which are common to both districts. The *Areca sapida* grows in some parts of Banks Peninsula, but by no means in the numbers or so luxuriantly as in the palm groves of Wakapuaka or Massacre Bay. Of the tree-ferns, *Cyathea medullaris* is not found there, and I was particularly struck by the absence of all those beautiful species of *Trichomanes* and *Hymenophyllum* which abound in and adorn the warm, sheltered woods of the Nelson valleys.

In these remarks I have confined myself to the forest vegetation of the eastern parts of the two districts, and indeed it is chiefly in these localities that we detect any very marked differences in that portion of the two floras. As before observed, the western sides of the mountain chains in each district are covered with dense forest, and except that in Canterbury the line of the *Fagus* does not reach a greater altitude than about 4,200 feet, whilst in Nelson it attains, if it does not even exceed, 5,000, the only difference I observed in the forest as we proceed to the south is, that it becomes more homogeneous in character, various species of *Fagus*, with occasional but rare patches of *Metrosideros* and *Dacrydium cupressinum*, there forming the greater bulk of the whole. A line of a species of *Dracophyllum* (the specific name of which is unknown to me) stretches from Mount Arthur spur on the western side of Blind Bay, down to the Teremakau saddle in the Canterbury district, the trees, however, gradually diminishing in size to the southward, notwithstanding a gradual diminution in the altitude at which they grow.

It is found, too, that except in very favourable localities the size and durability, in its economical applications, of the *Fagus* timber is far less in the Canterbury district than in the northern parts of Nelson.

On the whole, however, it may be said that, with the exception of such variations as are likely to be due indirectly to the influences of climate, the great forests on the western side of the two districts present very little difference in composition or other character.

There is also a specific identity in the principal grasses and in many other of the herbaceous plants found in the pastoral lands of both districts, considered in regard to horizontal or latitudinal distribution, though in respect to vertical or altitudinal range there are, exclusive of those presented by alpine plants, peculiarities which it is difficult to account for. For example, we find on the Canterbury Plains, so high as the latitude of Christchurch, large, well-developed specimens of the narrow-leaved variety of *Aciphylla squarrosa*, a plant only found at truly sub-alpine elevations in the Nelson district; whilst on the other hand *Discaria australis* is common, as a low, straggling shrub, to the dry, low grounds of both districts, presenting perfect similarity in each, and yet attaining in sub-alpine regions, where it is mixed with the same grasses and the same variety of *Aciphylla*, the dimensions of a small tree. Except in this and analogous cases, and in the presence of some plant in the one district not found in the other, there is little difference in their respective herbaceous vegetation at the lower levels.

In the alpine vegetation, above the forest line, however, much greater differences are found, but I may here remark that I have not (nor, so far as I am aware, has any other explorer) ascended our mountain ranges beyond 7,000 to 7,500 feet. My observations, therefore, must be deemed to apply to the alpine vegetation below these altitudes.

In our mountains, too, we find the same peculiarities in distribution which characterize the alpine vegetation of other mountains of great elevation. Some plants extend over the whole system, others again have a more limited longitudinal range, and still others are confined to single localities. As examples of the first, in the districts under consideration, I may mention species of *Gaultheria*, *Dracophyllum*, *Veronica*, *Celmisia*, *Ranunculus*, *Anisotome*, *Senecio*, *Eurybia*, and others; of the second class, other species of each of these genera, and more particularly *Ranunculus lyallii*, found by me on the Canterbury side of the Hurunui, and common throughout the alpine and sub-alpine districts of that province, but not found further north; and of the third class, a beautiful *Ranunculus*, also found by me, associated with *R. lyallii*, on the Canterbury side of the Hurunui, and never yet found elsewhere, and a handsome *Celmisia*, hitherto only found on a spur of the range bounding the Upper Waiau Valley.

Seeing, then, the apparently arbitrary distribution of merely alpine plants, it is useless to attempt any comparison of that section of the floras of the two districts. I may, however, remark that whilst in the southern parts of the Nelson district a luxuriant forest vegetation is often found to the height of 5,000 feet, succeeded by dense but large-growing scrub for several hundred feet more; on the other hand, in the mountains of the Canterbury district, a stunted and strictly alpine vegetation almost always occurs when we reach an altitude exceeding 4,200 feet.

In summing up I may say that whilst neither of the two districts possesses species, genera, or families of plants giving it any distinctive features not common to the other, each nevertheless possesses species attaining a more full development in the one than in the other, each possesses distinct species belonging to genera common to both, and in each we find species belonging to natural orders not at all represented in the other. In each we find the native vegetation apparently well adapted to the surrounding physical conditions, but in both we see symptoms which lead us to the supposition that the peculiar native vegetation will one day disappear and be replaced by foreign plants, under precisely the same circumstances which have led to such changes in the Canary and other islands long colonized by Europeans.

SKETCH OF

THE BOTANY OF OTAGO,

By JOHN BUCHANAN,

OF THE GEOLOGICAL SURVEY OF NEW ZEALAND.

[*Written for the New Zealand Exhibition*, 1865.]

The Province of Otago possesses an equable climate, and to this cause may be ascribed its evergreen flora. The mountain ranges, also, by influencing the humidity of the climate, cause a great variety in the flora by forming humid and arid districts.

The general facies of the vegetation of the province, on its eastern watershed, is grassy, the greater area being open grass land, with comparatively smaller areas of bush along the coast line and in the gullies of the mountain ranges; whereas, on the western watershed the whole country from the sea to an altitude of 3,000 feet, on the mountains, is covered with bush.

It is evident that at no distant time the greater part of the province was covered with forest. On many of the grassy ridges may still be found the remains of large trees, and over large areas the surface is dotted with the little hillocks and corresponding hollows produced by the upturned roots of trees which have been blown over, generally in the line of prevailing winds, after their destruction by fire, and no doubt there have been many denudations and reproductions of bush.

At the beginning of the settlement large tracts of the province were being reclothed with bush, but as the country was opened for cattle and sheep runs, this new growth was again burnt off, and a luxuriant growth of native grasses appeared without seed being sown.

In 1852, much of what is now the finest grass country on the Clutha, Tuapeka, Waitahuna, Pomahaka, and Wyndham districts was covered by an impenetrable growth of shrubs and young trees.

The further extension of bush, therefore, has been arrested by settlement; and the still existing portion will gradually disappear in the process of clearing the land for cultivation, and for use as fuel, building, and fencing.

The grasses of Otago are numerous and valuable for fattening stock; and they would probably repay the trouble and expense of being improved by cultivation, as they might prove more suitable to the climate, and more nutritious than English grasses.

So much depends on the nature of the soil and humidity of the climate, that the finest grass is often found at considerable altitudes. Thin clayey soil, or light soil on recent gravel terraces, under the influence of arid winds, will produce but a poor pasture of very few species; while in the little valleys of mountain ranges of the primitive rock formations, at altitudes even exceeding 2,000 feet, the pasture will be abundant and consist of many species of grasses.

Nothing can show greater ignorance of grass conservation than the repeated burning of the pasture in arid districts, which is so frequently practised. The finer species of grass, having fine fibrous roots ramifying near the surface, are either destroyed by the fire or afterwards by sun or frost; while the coarser tussock grasses, spear-grass (*Aciphylla*), and many plants worthless as pasture, having large succulent roots, strike deep in the soil and are preserved. Much of the grass land of Otago has been thus deteriorated, since its occupation, by fire, and it is no wonder that many of the runs require eight acres to feed one sheep, according to an official estimate. It is a fallacy to suppose that grass country requires repeated burning to clear the surface of the excess of plants, as the old and withered grass forms shelter to the young shoots, protecting them from parching winds, sun, and frosts. It is no doubt owing to the protection afforded in a similar manner by the snows of winter and spring, that the most mountainous parts of the province up to the line of perpetual snow, if free from bush, are valuable as summer pasture.

At an altitude of from 2,000 to 4,000 feet, according to latitude, will be found a belt of coarse, unnutritious tussock grasses; but above this, in the alpine zone, many alpine grasses are found, which though short are succulent and nutritious. This alpine zone is much frequented by sheep in summer, the highest ridges having sheep tracks on them. On Mount Alta, near the Wanaka Lake, sheep feed at an altitude of 6,000 feet, and on the Kaikouras, in the Province of Marlborough, at an altitude of 8,000 feet.

Grasses.—The following grasses have been collected in Otago, and most of them were named by Dr. Hooker.

For the present purpose they are divided into three classes:—

First quality,—as forming, naturally, the best pasture.

Second quality,—those inferior in quality and restricted distribution.

Third quality,—alpine grasses.

First quality :—

Poa australis, }
Poa breviglumis. } Valuable small tussock grasses.

Hierochloe redolens. A fragrant solitary grass, abundant in the river valleys.

Dichelachne crinita. A very valuable grass, forming fine tussocks where few other species exist, but solitary in thick swards of other grasses.

Agrostis avenoides, }
" *quadriseta*, } Valuable small tussock grasses.
" *parviflora.* }
" *pilosa.*
" *æmula.*

Kœleria cristata. A good grass, resembling foxtail, shining, solitary.

Trisetum antarcticum. A tufted grass, common in good pasture.

" *subspicatum.*

Second quality, several being good cattle grasses :—

Deschampsia cæspitosa.

Alopecurus geniculatus. Foxtail, found also as an alpine.

Echinopogon ovatus.

Dichelachne stipoides.

Agrostis æmula.

" *pilosa.*

Danthonia cunninghami, }
" *raoulia.* } Snow-grasses.

" *semi-annularis*, }
" *buchanani.* } Good cattle grasses.

Arundo conspicua. A grass more ornamental than useful, although horses eat it.

Gymnostichum gracile. Not common.

Hordeum marinum. Wild barley.

The third quality are alpines, found from 4,000 to 8,000 feet :—

Poa exigua, }
" *foliosa*, }
" *colensoi*, } Some of these are small grasses forming the highest vegetation.
" *lindsayi*, }
" *anceps.* }

Hierochloe alpina.

Agrostis canina.

" *canina*, var. *b.*

" *parviflora.* This species is also found as an alpine.

Alopecurus geniculatus, Linn.

Festuca duriuscula, Linn.

Triticum scabrum, Br.

Schœnus pauciflorus, although strictly not a grass, forms grass-like tussocks, and is considered the true snow-grass. It is sub-alpine.

A variety of small flowering plants find their natural habitat in the open grass land, some species being very minute in size and hidden among the grass: in many places they form the chief part of the vegetation, choking out the grasses.

Species of the following genera may be found among them:—*Ranunculus*, *Hydrocotyle*, *Discaria*, *Carmichælia*, *Coprosma*, *Rubus*, *Crepis*, *Taraxacum*, *Mentha*, *Lepidium*, *Spergularia*, *Cassinia*, *Senecio*, *Veronica*, *Pimelea*, *Aciphylla*, *Hypericum*, *Raoulia*, *Vittadinia*, *Lagenophora*, *Gnaphalium*, *Orchideæ*, *Leucopogon*, *Herpolirion*, *Anthericum*, *Nertera*, *Dichondra*, *Galium*, *Mimulus*, *Epilobium*, *Gunnera*, *Oxalis*, &c.; and, in addition, three important plants well known in Otago—the common fern (*Pteris esculenta*), a plant which occupies large areas of ground almost exclusively; flax (*Phormium tenax*), a plant certain to become so important in the manufacture of cloth fabrics, ropes, and paper, that the time will come when the farmer will be as anxious to secure crops of this plant as he is now to get rid of it; and the tutu.

[There are probably three varieties of the *Phormium tenax* in Otago—two on the east coast, and one of limited distribution on the west. The two varieties near Dunedin will be best distinguished by their seed vessels, the most robust plant having an erect 3-angled seed vessel, while the other has a drooping twisted seed vessel without angles.] *Two species are found in Otago,* Phormium tenax *and* P. colensoi, *the former distinguished by an erect triangular capsule, and the latter by a drooping twisted capsule.* The tutu (*Coriaria ruscifolia*) is only too well known from its destructive poisonous qualities, as it is probable that the amount of the losses sustained by the stock-owners and farmers in cattle and sheep, if realized, would have eradicated the plant from the grazing districts. The tutu is chiefly confined to the south-west of the province, being little known inland. Nothing is yet known of its poisonous principle, and much mystery prevails on the action of the poison. Those three plants, unfortunately for the farmer who has to clear the land for cultivation, attain their maximum of growth and number in the settled districts.

The bush or forest flora might compare favourably, in variety, with that of a tropical climate, as it exceeds the northern forests of temperate Europe in number of species. This variety of species produces considerable diversity of colour, although no evergreen vegetation can possibly offer to the eye the varied tints of the autumn sere leaf, seen in countries with a deciduous vegetation; but when many of the Otago trees are in flower, such as the *Metrosideros lucida* with its brilliant scarlet covering, and the *Weinmannia*, *Leptospermums*, *Sophora*, *Aralias*, *Pittosporums*, and a host of others, mix their masses of white and yellow blossoms, few persons could adopt the idea of some writers on New Zealand, that its vegetation is sombre and uninteresting. This view of the subject only applies to the places first visited in the North Island, which nowhere can compare, in brilliant freshness or varied colouring, with Otago.

The following genera, many of which are represented by more than one species, compose the Otago bush:—

Podocarpus, *Dacrydium*, *Phyllocládes*, *Libocedrus*, *Fagus*, *Griselinia*, *Metrosideros*, *Leptospermum*, *Panax*, *Schefflera*, *Pittosporum*, *Myrsine*, *Melicytus*, *Plagianthus*, *Hoheria*, *Pennantia*, *Sophora*, *Carpodetus*, *Weinmannia*, *Fuchsia*, *Drimys*, *Aristotelia*, *Elæocarpus*, *Coriaria*, *Myrtus*, *Coprosma*, *Olearia*, *Senecio*, *Dracophyllum*, *Veronica*, *Myoporum*, *Epicarpurus*, *Ascarina*, *Hedycarya*, *Cordyline*, and, as forming a marked feature everywhere in the bush, the tree-ferns, *Cyathea dealbata*, *C. medullaris*, *C. smithii*, *Dicksonia squarrosa*, and *D. antarctica*.

Shrub species of the genus *Coprosma* are most commonly found as an undergrowth in the forests,—most of the New Zealand shrubs preferring the open,—but a dense undergrowth of ferns is often seen of the genera *Lomaria*, *Aspidium*, *Leptopteris*, and *Polypodium*, many of which acquire trunks two or three feet high. The forest is often rendered impassable by climbing plants, the *Clematis indivisa* [or supple-jack] climbing the highest trees, and spreading its masses of showy white flowers to the light, the *Rubus australis*, the common bramble or "bush-lawyer," forming impassable thorny masses on the ground, or interweaving the branches of fallen trees; this plant also climbs the highest trees, clothing them at top with foliage, flowers, and fruit; the strong fragrance of its flowers is felt at a great distance—and, again, the *Rhipogonum scandens*, [or black vine,] with its numerous smooth black stalks, dark green shining leaves, and bright scarlet berries, festooning the bush, is also a very striking plant. The parasitic mistletoes will also attract attention, some of the genus *Loranthus* having bright crimson flowers. Those species are generally found on the *Fagus* (beech trees), while one species, *Loranthus micrantha*, is often found on the *Leptospermum ericoides* (manuka), forming large round masses of ovate leaves, which contrast with the finer foliage of the manuka. The *Tupeia antarctica* may be found on almost every species of tree and shrub round Dunedin, and sometimes parasitic on its fellow parasite, *Loranthus micrantha*. The genus *Viscum* has two species in Otago, one of which is very abundant on manuka trees, often occupying a fair share of the branches.

Various small flowering plants assist to fill up the details of bush scenery, such as the *Orchideæ;* while the Cryptogamia, including ferns, mosses, liverworts, lichens, and fungi, cover trees, rocks, and ground with a wonderful variety of vegetable form, and present a luxuriance of growth that can only be found under the same conditions of heat and moisture.

On the margins of forests numerous shrubs are found which never penetrate into their dark recesses, preferring strong light with partial shelter.

The shrubs, however, often form independent patches, covering subalpine areas, filling gullies, or fringing water-courses.

Among them will be found plants of great beauty, many of which might be introduced with effect in the ornamentation of landscape gardening.

The snow valleys of the central mountains are seldom timbered on their bottoms, from the shifting nature of the surface from floods, the larger trees being driven to the slopes of the mountains, while a more rapid reproducing plant-growth of shrubs occupies the flats.

This scrub, as it is termed, is often found impenetrable, both from the closeness of the growth and the presence of spinous plants, such as *Discaria toumatou* (the wild Irishman) and *Aciphylla squarrosa* (spear-grass). Some species of shrubs attain their maximum of growth at an altitude where the trees become stunted, such as *Senecio cassinioides, Olearia moschata, O. nummularifolia, Veronica hectori,* &c.

The shrubs of Otago are included under the genera *Clematis, Ranunculus, Hoheria, Aristotelia, Coriaria, Carmichælia, Leptospermum, Metrosideros, Myrtus, Aciphylla, Panax, Corokia, Coprosma, Olearia, Rubus, Ozothamnus, Cassinia, Senecio, Gaultheria, Cyathodes, Leucopogon, Archeria, Dracophyllum, Myrsine, Parsonsia, Mitrasacme, Logania, Exarrhena, Convolvulus, Solanum, Veronica, Muhlenbeckia, Pimelea, Urtica, Freycinetia, Rhipogonum, Phormium.*

In the geographical distribution of the Otago plants, one striking feature only can be noticed.

The difference between the flora of the east and west divisions of the province seems to mark them as two distinct regions of plants. The Clutha River forms the natural boundary between, and although one or two genera, such as *Fagus,* push outposts across the boundary, it can be distinctly traced from the Wanaka Lake to the Nuggets, on the line of the river.

Some peculiarity seems to exist in the climate of the eastern or Dunedin region, which may perhaps be explained by meteorological observations.

The character of the Dunedin flora is more of a negative nature, wanting many species which encircle it in a belt, west, south, and east, forming the boundary line of the two regions.

Under circumstances of adaptation the New Zealand species are wide spread, and the bush on the east is extensive enough to have retained every species from accidents of fire-denudation, if they ever existed there. Latitude does not account either for the difference, as several of the species absent on the east, range from the North Island to Riverton on the west coast.

The following plants of the western region will not be found on the east except a few isolated individuals, and those generally young plants :—

Metrosideros lucida, *Weinmannia racemosa*, *Pittosporum rigidum*, *Panax anomalum*, *P. lineare*, *P. arboreum*, *Olearia operina*, *O. colensoi*, *O. angustifolia*, *O. cunninghamii*, *O. moschata*, *O. hectori*, *Plagianthus lyallii*, *Sophora tetraptera* var. *microphyllum*, *Senecio bifistulosus*, *S. rotundifolius*, *S. cassinioides*, *Archeria traversii*, *Hedycarya dentata*, *Ascarina lucida*, *Fagus fusca*, *F. solandri*, *F. menziesii*, *Freycinetia banksii*, *Cordyline indivisa*.

Many of the sub-alpine plants of this list are also found in the valleys, such as *Olearia moschata* and *O. hectori*, the latter attaining its maximum of growth in the Wyndham Valley. Alpines could not be fairly represented on the east, and are not included. If the eastern climate of Otago be not adapted for the growth of so many species as the west, it seems to be the best adapted of any portion of New Zealand for the full development of certain other species.

The following species attain their maximum of growth on the east of Otago :—

Griselinia littoralis—trunks measuring from 4 to 8 feet in diameter,—*Melicytus ramiflorus*, *Fuchsia excorticata*, *Panax crassifolium*, *P. colensoi*, *P. edgerleyi*, *Pittosporum colensoi*, *P. eugenioides*, *Drimys colorata*, *Plagianthus betulinus*, *Hoheria angustifolia*, *Elæocarpus hookerianus*, *Sophora tetraptera* var. *grandiflora*, *Rubus australis*, *Carpodetus serratus*, *Leptospermum ericoides*—old trees of this having been cut 4 feet in diameter,—*Myrtus pedunculata*, *Coprosma rotundifolia*, *C. linariifolia*, *Olearia nitida*, *O. dentata*, *O. ilicifolia*, *O. avicenniæfolia*—these four last growing to timber trees 3 feet in diameter near the ground, and generally branching into three or more branches 18 inches in diameter and 25 feet high,—*Dracophyllum longifolium*—attaining a diameter of 18 inches,—*Myrsine urvillei*, *Veronica salicifolia*, *Veronica elliptica*, *Libocedrus doniana*—a tree was cut of this near Dunedin nearly 4 feet in diameter,—*Cordyline australis*—2 to 4 feet diameter,—*Cyathea dealbata*, *C. smithii*, and *Dicksonia antarctica*.

This comparison of maximum growth applies not only to the western region of Otago, but to all New Zealand where these species are found. In the smaller flowering plants this maximum of growth is not so easily observed, but many of the Cryptogamia show both greater growth and variety of species. Nowhere in New Zealand can so large a representation of certain genera be found as on Mount Cargill, near Dunedin: as two instances of this, fourteen species of *Hymenophyllum* ferns out of fifteen species known in New Zealand have been collected there, and thirteen species of *Hookeria* moss out of sixteen species known in New Zealand.

A descriptive sketch of the leading botanical features that occur in passing up one of the principal valleys of the province, and the ascent of a mountain on the central range, with the knowledge acquired by the previous lists of plants known to exist there, will give an average idea of how they are distributed over the whole, and the changes that take place by altitude. For this purpose the valley of the Clutha will be selected.

Before starting from the coast the littoral plants may be examined. The principal plants of a large size, peculiar to the coast line, are *Veronica elliptica* and *Myoporum lætum*. *Linum monogynum*, although a littoral plant, is often found inland with other littoral species, probably lingering on old sea-margins.

Sand-hills on the coast line have a peculiar vegetation of a remarkable sameness in species all round New Zealand. The following are always found there :—*Euphorbia glauca*, *Pimelea arenaria*, *Scirpus maritimus*, *Desmoschœnus spiralis*, *Convolvulus soldanella*, *Senecio lautus*, *Coprosma acerosa*, *Mesembryanthemum australe*, *Cassinia leptophylla*, *Geranium microphyllum*.

In little swamps near the mouths of rivers and along the coast will be found such plants as *Samolus littoralis*, *Salicornia indica*, *Lepidium oleraceum*, *Juncus maritimus*. Again on banks will be found *Tetragona expansa*, *Apium australe*, *Selliera radicans* [*Ruppia maritima*], and many other small plants. There is one fern remarkably abundant on the Otago coast, both east and west, forming by its close growth little mounds (*Asplenium obtusatum* var. *obliquum*).

Proceeding up the river, the country for the first twenty-five miles consists either of plains or undulating low hills of open grass country, with patches of forest near the river or on the islands. Bush is also found in patches on the slopes of the higher hills which bound the valley. The bush here is a fair representation of that of the western region, consisting of species of *Podocarpus*, *Dacrydium*, *Metrosideros*, *Weinmannia*, *Fagus*, *Sophora*, *Panax*, *Pittosporum*, and a sprinkling of all the lesser plants.

Patches of scrub are also found along the river, composed chiefly of *Olearia virgata*, species of *Coprosma*, *Discaria*, *Leptospermum scoparium*, and *Carmichælia*.

Swamps are frequent along the valley, in some places fringed by raupo (*Typha angustifolia*). This plant continues encroaching and filling up lagoons, and forming a bottom for many others, such as *Carex gaudichaudiana*, *Carex ternaria*, *Cyperus ustulatus*, *Luzula campestris*, *L. pumila*, *Carex virgata* (nigger-head of the settlers), and mosses, all playing an important part in the economy of nature, by raising the land and making it fit for the growth of superior plants, the ground being soon taken possession of by *Phormium tenax* and other shrubs. These raupo-fringed lagoons are the favourite haunts of ducks.

The *Phormium tenax* is abundant in this district, where it finds good soil and moisture, so essential to its full development. Areas are also covered by the fern *Pteris aquilina* var. *esculenta*, growing in some places six feet high. The tutu (*Coriaria ruscifolia*) is abundant on the Lower Clutha: it is generally found in gullies, where it finds the deepest soil for its large ramifying roots.

Perhaps the most striking plant of the district is the cabbage-tree (*Cordyline australis*). It is abundantly scattered over the ridges, having, from its non-inflammable nature, escaped burning. Ridges dotted with cabbage-trees, and filled in between with the graceful plumose toitoi grass (*Arundo conspicua*), present one of the most singular features in New Zealand vegetation.

The grasses are numerous in species and of good kinds, and the conditions of sufficient heat and moisture, with good soil, being present, the pasture is superior.

From the Tuapeka to the junction of the Manuherikia, eighty miles, the river is more or less closed in by mountains, with forest on the slopes and scrub on the flats, although considerable portions are now burned and under grass.

At the junction of the Manuherikia River with the Clutha, the country opens out into a large, terraced, ancient lake basin, through which the Clutha River runs from its leaving the Dunstan Gorge, twelve miles. Over this large district the country is open grass, and, when first visited, of a remarkably sparse growth, consisting of three species on the terraces, but richer in the small valleys. A little scrub was at that time found on the banks of the Manuherikia, chiefly *Olearia virgata*. The parching winds and light dry soil of these interior basins must have always been an obstacle to a luxuriant vegetation, and from the same causes, they would be continually liable to be cleared by fire.

The river passes fifteen miles through the Dunstan Gorge, hemmed in on each side by the mountains, with a narrow terrace on both sides. The slopes of the mountains here are steep, but carry a good pasture of numerous species of grass.

At the termination of the gorge, upwards, the Clutha is joined by the Kawarau River, and the country opens out again into another ancient lake basin, fringed by terraces, and stretching forty-five miles to the Wanaka and Hawea Lakes. The whole of this district is similar to the last, with poor pasture on the flats and terraces, but superior in the little valleys falling from the mountains.

In the lake district the pasture is superior, consisting of the finest grasses in the province; and as the mountain region is fairly entered by any of the snow valleys that pour their waters into the lakes, a profusion of botanical beauty appears, unknown in the lower parts of the province. The shrubs in the river flats and sub-alpine slopes attain their maximum of growth and variety of species. On a few acres of the Matukituki River valley may be collected eight species of *Olearia*, six species of *Coprosma*, *Discaria toumatou*, with a stem eight inches diameter, *Senecio cassinioides*, eight species of *Veronica*, *Aristotelia fruticosa*, &c.

In ascending Mount Alta, 7,000 feet altitude, the first 2,000 feet above the lake is covered with beech (*Fagus fusca*, *Fagus menziesii*, and *F. solandri*). The undergrowth of this beech bush is composed chiefly of *Coprosma lucida*, *Plagianthus lyallii*, *Carpodetus serratus*, *Senecio elæagnifolius*, *Drimys colorata*, and numerous young beech plants. Although the bush is composed principally of beech, occasional patches of *Dacrydium*, *Podocarpus*, *Phylloclades*, and other large trees are also present. Where the forest terminates on the mountains, which it always does in Otago under 4,000 feet altitude, numerous shrubs are still found higher, in the shelter of the gullies. Up to 5,000 feet may be classed as the sub-alpine zone, characterized by a belt of coarse tussock grasses, *Celmisia*, *Veronica*, and *Ranunculus*. It is in this zone, at the lakes, that *Ranunculus lyallii* attains its greatest growth.

At the altitude of 6,000 and 7,000 feet, great slopes of dry *débris* prevail, and the true alpine zone is reached. The plants here are small, although many are fine flowerers. The species found are *Pachycladon novæ-zealandiæ*, *Mitrasacme novæ-zealandiæ*, *Logania tetragona*, *Ranunculus sinclairi*, *R. buchanani*, *Caltha novæ-zealandiæ*, *Colobanthus acicularis*, *Claytonia australasica*, *Hectorella cæspitosa*, *Coriaria angustissima*, *Epilobium purpuratum*, *Pozoa exigua*, *Aciphylla lyallii*, *A. monroi*, *Ligusticum haastii*, *L. piliferum*, *L. imbricatum*, *Coprosma pumila*, *Celmisia densiflora*, *C. haastii*, *C. incana*, *C. laricifolia*, *C. hectori*, *Brachycome sinclairi*, *Abrotenella inconspicua*, *Craspedia alpina*, *Raoulia grandiflora*, *Gnaphalium youngii*, *Haastia sinclairi*, *Forstera sedifolia*, *Helophyllum clavigerum*, *H. colensoi*, *H. rubrum*, *Wahlenbergia saxicola*, *Dracophyllum uniflorum*, *D. rosmarinifolium*, *D. muscoides*, *Gentiana saxosa*, *Myosotis pulvinaris*, *M. hectori*, *Veronica buchanani*, *V. hectori*, *Ourisia cæspitosa*, *O. glandulosa*, *Euphrasia revoluta*, *Drapetes lyallii*, *Agrostis canina* var. *b.*, *Poa foliosa*, *Plantago lanigera*. This list does not exhaust the flora of Mount Alta; and as many alpines in this district are very local and not included in it, the richness of the alpine flora of Otago is clearly shown.

The flora of the West Coast is almost entirely forest, consisting of trees and shrubs. In its general features it differs considerably from the bush flora of the East Coast. In addition to the pines which are distributed over every part of New Zealand, *Metrosideros lucida*, *Weinmannia racemosa*, *Fagus fusca*, *F. menziesii*, and *F. solandri* are the most prominent and abundant in numbers, the two first being remarkable for beauty when in flower.

In the sounds and harbours along the coast, the bush comes down to the sea in some places where not so steep, having a belt of shrubs on the shore. In ascending a mountain at Dusky Bay, this belt is first passed through, consisting of many rare and beautiful shrubs: *Olearia operina*, with its star fascicles of leaves centred by large white flowers (this plant is only found between Milford Sound and Preservation Inlet); *Archeria traversi*, a large, ornamental heath-shrub, with racemes of red flowers; *Senecio rotundifolia*, a large, ornamental shrub-tree; as also species of *Veronica*, *Pimelea*, *Coriaria*, *Plagianthus*, *Sophora*, and *Olearia*.

For the first 1,000 feet altitude the principal trees are species of *Dacrydium*, *Podocarpus*, *Fagus*, *Metrosideros*, and *Weinmannia*, with several of the smaller shrub-trees of the western region, as also *Cyathea medullaris*, *Dicksonia squarrosa*, tree-ferns; the latter being the furthest south tree-fern in New Zealand. At 2,000 feet altitude many of the trees have disappeared, and others become stunted from the severity of the climate. At 2,500 feet altitude the trees cease, and a belt of stunted gnarled shrubs are passed through, to the bald mountain top. This belt is sometimes found to consist of *Olearia colensoi* only, and is very difficult to pass through, from the branches interlacing.

The open mountain top is covered with a growth of coarse grass, tracked all over by the kakapo parrot. The alpine vegetation at 3,500 feet altitude consists of the following plants, many of which are only sub-alpine on Mount Alta, at the Wanaka Lake:—

Ranunculus lyallii (abundant), *Celmisia ramulosa*, *C. verbascifolia*, *C. lyallii*, *C. laricifolia*, *Claytonia australasica*, *Caltha novæ-zealandiæ*, *Epilobium purpuratum*, *Aciphylla monroi*, *A. lyallii*, *Ligusticum*, *Coprosma pumila*, *Brachycome sinclairi*, *Craspedia alpina*, *Senecio lyallii*, *S. bifistulosus*, *Forstera sedifolia*, *Wahlenbergia saxicola*, *Pentachondra pumila*, *Dracophyllum rosmarinifolia*, *D. menziesii*, *Gentiana montana*, *G. saxosa*, *Myosotis capitata*, *Veronica lævis*, *V. buxifolia*, *Ourisia macrophylla*, *O. cæspitosa*, *Anthericum hookeri*.

POPULAR ARRANGEMENT OF THE OTAGO FLORA.

Many of the most prominent plants have been named by the settlers of Otago from certain apparent affinities of likeness or quality of wood: this popular grouping has been, in general, correct, although in some cases, such as the ribbon-woods, plants of different genera are included in one group. The method will be adopted here as likely to make the description of species more interesting.

Pine Family.—Among the numerous surface changes of the past, this family has had representatives as far back as Miocene times, fossil impressions of *Araucaria* and *Dammara* leaves and branches being found in that formation at Shag Point, showing that Otago had at that period forests of pines the species of which are now extinct. Ten species of pine, and a few varieties, are found in the province at the present day.

The most valuable for sawn timber are black pine, or matai (*Podocarpus spicata*), having red, hard, durable wood. A variety of this is found on the West Coast, with large fern-like branches, and large dark green leaves, the whole plant having a black appearance.

Black rue pine, or miro (*Podocarpus ferruginea*), a tree similar in size and form to the last. Wood white, tough, not so hard or durable in wet places as matai.

Totara (*Podocarpus totara*), a most valuable timber tree, being very durable and easily worked. A variety of this is often found over the province, especially on the West Coast, with short obtuse leaves.

Red pine, or rimu (*Dacrydium cupressinum*), another valuable building timber, found abundant everywhere. A variety is found on the West Coast, with long, drooping, pale-coloured foliage, white wood, and whitish bark. Another very distinct variety, if not a species, is also found there, with erect bright green foliage and close-grained heavy timber.

The pines of less value for building purposes are,—

Cedar (*Libocedrus* [*doniana*] *bidwillii*), a handsome conical tree, with reddish wood, fit only for inside work.

White pine, or kahikatea (*Podocarpus dacrydioides*). This is a straight, narrow, sometimes conical tree, growing on wet flats; wood of little value. The male or barren tree has distichous leaves, while the female tree, bearing bright red berries, has imbricate leaves.

A large, round-headed tree, also called white pine in Otago and silver pine in Nelson, is not uncommon near Dunedin. It is probable that the male and female plants differ in their leaves, similarly to the kahikatea. The timber is valuable for boat-building. This plant is more like a *Dacrydium* than a *Podocarpus*. Flowers and fruit not seen.

Manoua (*Dacrydium colensoi*). A small tree, found at an altitude of 1,000 to 2,000 feet at Dunedin, and at the sea-level on the West Coast. Leaves of two kinds, spreading and imbricate. Wood close-grained and durable, but could not be found in any quantity.

Manoua (*Dacrydium laxifolium*) is a very doubtful species, being difficult to distinguish from the last.

Toatoa (*Phyllocladus alpinus*). Celery-leaved Pine. A small tree, common on the central mountains, and at Dunedin on the tops of the hills. Wood heavy, very durable, but could not be got in quantity. Bark used in dyeing by the Maoris.

Totara (*Podocarpus nivalis*). A mountain shrub resembling totara, of no economic value.

BEECH FAMILY.—This is another ancient family of plants, having existed before the Brown Coal formation. There are three species in Otago, chiefly confined to the western botanical region.

Red birch of Otago, black birch of Nelson, beech, &c. (*Fagus fusca*). A valuable timber tree, found from the sea-level to 4,000 feet altitude, sometimes attaining a diameter of 12 feet. Timber useful for many purposes.

Black birch of Otago, beech, &c. (*Fagus menziesii*), [another valuable timber tree, attaining a great size; most] abundant on the central ranges up to 2,000 feet. [Good fence stuff.]

White birch of Otago, beech, &c. (*Fagus solandri*). This has the greatest distribution of the three. Wood of young trees white, soft, decays easily, and from having been used in some parts of the island for bridges and telegraph poles, has brought the family into bad repute. Heartwood of old trees valuable.

MYRTLE FAMILY. — Cook's tea-tree, scrub-manuka, or kahikatoa (*Leptospermum scoparium*). A very ornamental shrub, sometimes attaining a diameter of 18 inches. Wood, red, hard, durable.

Manuka (*Leptospermum ericoides*). A large tree, attaining a diameter of 3 feet. Wood white or red, in old trees nearly black in the centre, sometimes variegated. It is generally used as firewood, piles, and fence stuff, but from its great breaking power would be well adapted in building where great strength and durability were required. Common at one time near Dunedin, but now nearly exhausted.

Iron-wood (*Metrosideros lucida*). Wood hard, heavy, and well adapted for knees in ship-building. Common in the western botanical region.

Myrtles (*Myrtus obcordata* and *pedunculata*). Two handsome shrub-trees, common near Dunedin.

Some fine creepers of the *Metrosideros* genus are also found in the bush, with red or [yellow] *white* flowers.

RIBBON-WOOD FAMILY.—Ribbon-wood (*Plagianthus betulinus*). A very ornamental tree, especially when in flower, being covered with small white flowers. Common at Dunedin. Wood soft, white, splits freely, but not durable. Flowers in October.

Ribbon-wood (*Hoheria populnea* var. *angustifolia*). A tree with all the beauties and faults of the last. Common near Dunedin. Flowers in January.

Ribbon-wood (*Pennantia corymbosa*). This tree and the two former are often confounded, being very similar in general appearance, and in soft, white, easily splitting, worthless wood; in the season being covered with masses of small, white, fragrant flowers; and not very dissimilar in the leaves. Common near Dunedin. Flowers in December.

Ribbon-wood (*Hoheria populnea* var. *cratægifolia*). A very ornamental tree, found on the West Coast. Similar to the former, but with larger flowers.

Ribbon-wood, or lace-bark tree (*Plagianthus lyallii*). A very ornamental shrub-tree, with large leaves and flowers. Common on the central ranges and West Coast.

Mapau Family.—White mapau; tarata (*Pittosporum eugenioides*). One of the most beautiful trees in New Zealand; grows to a comparatively large size in Otago, with a trunk 18 inches to 2 feet diameter. Leaves shining, silvery. Flowers in large, pale yellow corymbs, very fragrant. The leaves, when bruised and mixed with fat, are used by the Maoris as a perfume. Wood soft, white, worthless. Bark exudes a resin.

Black mapau, or tipau (*Pittosporum colensoi*). A shrub-tree, very ornamental in contrast with the last; the whole tree very dark coloured. Flowers solitary, dark purple. Wood soft, white, worthless; 12 inches diameter.

Black mapau, or tipau (*Pittosporum tenuifolium*). A smaller-leaved species, probably a variety of the last. Leaves smaller, pale green, shining. Wood soft, white, worthless; 12 inches diameter. *Pittosporum rigidum*, a straggling shrub of the West Coast.

Aralia Family.—Kaiwhiria (*Panax simplex*). A small, dark-foliaged, 1-foliolate shrub-tree. Leaves of young plants, and lower branches of old plants, 3-foliolate, sometimes deeply lobulate when young (seldom so at Dunedin), slightly fragrant when bruised. This is probably only a variety of the next.

Raukawa (*Panax edgerleyi*). A good-sized tree at Dunedin, 18 inches to 2 feet diameter. Large, shining leaves, 3-foliolate in the young plant, and deeply lobulate; leaves of lower branches of large trees retain the 3-foliolate form. Leaves fragrant when bruised, and, when mixed with fat, used by the Maoris as perfumery.

Panax anomalum. A small shrub found at Waikawa.

Panax lineare. A pretty little shrub, found on the West Coast.

Horoeka (*Panax crassifolium*). A singular-looking plant in all stages of its growth. Three varieties are found at Dunedin, only distinguishable in the young state and method of inflorescence. Young plants with narrow, rod-like stems, from 1–12 feet high, topped with a few reversed long linear leaves, the varieties having different markings and amount of serrations. The full-grown tree has a long, naked trunk, 12 inches diameter, round-headed, erect foliage, and half umbellate branches. Wood hard when dry.

Gum-tree (*Panax colensoi*). A showy, small tree, with large, shining, 3-foliolate leaves in all stages of growth. Wood soft, white; burns well when dry. Bark exudes gum when wounded. Branches half umbellate.

Panax arboreum. A small tree, similar to the last, with 5-foliolate leaflets petioled. Found on the West Coast.

Pate (*Schefflera digitata*). A small tree, common everywhere in Otago. There is probably a variety of this plant in Auckland, as young plants there have the 7 leaflets deeply lobulate, which they never have in Otago. Wood soft, white, useless.

LIME-TREE FAMILY.—Makomako (*Aristotelia racemosa*). A small, beautiful, quick-growing shrub-tree, with large leaves, and large panicled racemes of pink flowers and berries. Wood soft, white, light; makes pretty veneers.

Aristotelia colensoi. A small shrub-tree, similar to the last, common on the Clutha.

Aristotelia fruticosa. A small, sub-alpine shrub, common in hilly districts.

Hinau (*Elæocarpus dentatus*). A large tree, with fastigiate branches; and a variety with foliage in a round, dense head, leaves also differing in length, and amount of recurved margins. Wood of both whitish, heavy, [not] *heart wood* durable.

Pokako (*Elæocarpus hookerianus*). A large, round-headed tree, near Dunedin; common also on the West Coast. Young plants are very ornamental, differing entirely in foliage, till 4–6 feet high, often forming flat, table-topped shrubs. Wood not durable.

TUTU FAMILY (*Coriaria ruscifolia* var).—The plant known as tutu on the pasture lands of Otago is a strong, robust shrub 3–6 feet high, dying down to the ground every year. The roots creep and interlace below the surface, forming sometimes considerable masses of spongy wood, which, when dried, have been used as fuel.

In the spring, stems spring up from any part of the root, forming often a close growth, impenetrable to everything but pigs.

Tree tutu (*Coriaria ruscifolia*). A small shrub-tree, with a trunk 6–8 inches diameter, growing often solitary in the bush. As this plant is only found in the shelter of bush, it may probably be the same as the last, although, as on the margins of the West Coast sounds, where the plants are numerous, each has an independent root.

Thyme-leaved tutu (*Coriaria thymifolia*). The varieties of this are so numerous that it is difficult to determine the size of the species. A gradation of intermediate forms may be found between *C. ruscifolia* and the small alpine, 6 inches high.

Alpine tutu (*Coriaria angustissima*). A very distinct species, found only in sub-alpine localities. Its branches are never arranged on planes, and the leaves are reduced to needles, the whole plant being similar to a bottle-brush.

Legume Family.—Kowhai (*Sophora tetraptera* var. *grandiflora*). A splendid tree, with laburnum-like flowers: the trunk often attains a diameter over 2 feet. Var. *microphylla* is only found on the West Coast: a small tree with weeping branches and few flowers. Wood valuable as fence stuff, being very durable: it is also prettily marked, and adapted for cabinet work. A remarkable variety of this plant is found in Marlborough Province, 6–12 inches high, spreading, and covering patches of the ground, and so rigid that it may be walked upon.

Carmichælia crassicaulis. A most singular plant, from its grooved, cylindric stems, and leafless habit.

Carmichælia nana. A curious dwarf plant, found on grass river-flats and on mountains, with rigid flat leaves.

Carmichælia grandiflora. This may be called the New Zealand broom, being generally found with leaves. Habitat: the lakes.

Carmichælia odorata. Old plants leafless, forming a mass of round, rush-like branches.

Carmichælia flagelliformis. Found on the West Coast.

Carmichælia juncea.—Common in the Waitaki Valley, forming patches that might be mistaken for rushes.

Coprosma Family.—Karamu. This is one of the most numerous and wide spread in the province. Many of them are very ornamental shrubs, forming in many places the greater part of the scrub and undergrowth of the bush. Alpine species are also found a few inches high. The most ornamental found near Dunedin are,—

Coprosma linariifolia. A shrub-tree, trunk 4–8 inches diameter. Bark rough, wood yellow.

Karamu (*Coprosma robusta*). With large, shining leaves and red berries.

Coprosma rotundifolia. A pretty shrub 8 feet high. The distribution of the others will be given in the appended list.

HEATH FAMILY.—This beautiful family has several fine representatives in Otago. The *Gaultherias* cover large areas of ground on the mountains the fruit being eaten by the kaka parrots. The *Cyathodes* genus are very ornamental; and the *Dracophyllums*, with their singular, grass-like foliage, and racemes of waxy, white flowers, would prove fine additions to garden shrubbery. Trunks sometimes attain a diameter of 12–18 inches. Wood soft, white, finely marked, making pretty veneers.

VERONICA FAMILY.—Koromiko. One of the largest in Otago, and forming a prominent feature in the New Zealand flora. Many of them are remarkable for great beauty and novelty in their imbricated foliage. Some of the finest are sub-alpine, and the family is well represented in Otago. (See list of plants.)

COMPOSITE FAMILY.—This, the largest family of plants in the world, retains its proportion in Otago. The principal are,—

Tupari (*Olearia operina*). Trunk 6–8 inches diameter, very ornamental, found only on the West Coast, but grows well at Dunedin, transplanted.

Olearia nitida. A very ornamental shrub-tree, with showy, fragrant, white flowers. Trunk 12–18 inches diameter; wood white, with yellow markings.

Olearia dentata. A very ornamental small tree, when in flower covered with white, fragrant blossoms. Trunk 2–3 feet diameter; wood white, with yellow markings.

Olearia ilicifolia. Very similar to the last.

Akeake (*Olearia avicenniæfolia*). A very ornamental shrub-tree, covered with white, fragrant blossoms, in the season. Trunk 6–12 inches diameter. Wood finely marked with yellow and brown streaks; makes pretty veneers.

Olearia moschata. An ornamental shrub, as also—

Olearia nummularifolia.

Olearia hectori. A very ornamental shrub-tree, covered in season with white blossoms, of a strong, peach fragrance; common between the Clutha and Mataura Rivers, and in the Wanaka Lake district.

Olearia virgata, with several varieties, which probably pass into the last; extreme form, with needle-shaped leaves, found at Dunedin. These varieties form in many places a large part of the scrub.

Cotton plant (*Celmisia*). Several of this numerous genus would make pretty additions to the garden. *Celmisia coriacea*, from its abundance on the Lammerlaw Ranges, might be used in the manufacture of paper, having a large amount of fibrous material on the back of the leaves.

Cassinia. The species of this genus are widely distributed, forming the greater part of the hill scrub everywhere common round Dunedin.

Ozothamnus. Some of the species would be very ornamental on garden rock-work, as they are very pretty in their natural state, creeping over stones.

Puheritaiko (*Senecio rotundifolius*) and *S. elæagnifolius* are very ornamental shrub-trees, having large, leathery leaves, covered on the back with white wool.

Lily Family.—Cabbage-tree (*Cordyline australis*). A beautiful tree, especially when in flower. Trunk 1–3 feet diameter, dividing about 10 feet from the ground into three to four main branches, which fork into lesser ones, each ultimate branch terminating in a large bunch of sword-shaped leaves; flowers form dense oval masses, 12 inches or more long. The juice of the roots contains a small quantity of sugar, and the whole plant, being fibrous, might be used in the manufacture of paper.

Cordyline indivisa. This species has only one head of leaves, which are longer and broader than the last; found only on the West Coast of the South Island.

Flax (*Phormium tenax*), the next in importance of the lily family. The variety most common in Otago is a large-leaved plant, on rich, wet soil, but probably inferior on that account as a fibrous material. The tihore, or silky flax, cultivated in the North Island by the Maoris, is a finer-leaved variety, and [having long, narrow, rounded and twisted drooping capsules,] might be introduced to Otago if fine silky fibre was essential. The Otago variety would no doubt be valuable in the manufacture of paper or rope.

Astelia nervosa, *A. solandri*, and a small swamp species, *A. linearis*, are found in Otago, but seldom on trees. The [two] former [are] *is* common on the ground near Dunedin, forming large, flax-like tufts of long linear leaves, with three stout ribs.

Anthericum hookeri.—Very abundant near Dunedin, in paddocks. Flowers in long yellow spikes; leaves have a strong odour when bruised.

The Liane Group (climbers). There are several very ornamental plants in this group belonging to different genera. They are found everywhere,—climbing trees, rambling over rocks, and interweaving shrubs; sometimes on open ground, twisting and forming masses of interlaced stems of themselves.

Clematis. Four species.

Rubus. One species and several varieties.

Metrosideros. 4 species.

Fuchsia. 1 species.

Parsonsia. 1 species.

Convolvulus. 2 species.

Muhlenbeckia. 3 species.

Rhipogonum. 1 species.

MISCELLANEOUS GENERA WHICH HAVE ONLY ONE SPECIES IN THE PROVINCE.

Pepper-tree (*Drimys colorata*). A handsome, small tree, more especially so when growing on hills in open ground; the foliage is then coloured reddish. Whole plant pungent and aromatic. Wood prettily marked, and adapted for cabinet work.

Hinahina, or mahoe (*Melicytus ramiflorus*). A very variable tree in size of leaves and shape of trunk, the latter angled or round. Trunk 1–2 feet diameter. Wood soft, white, worthless; foliage nourishing to cattle.

White mapau, or piripiriwhata (*Carpodetus serratus*). An ornamental shrub-tree, with mottled-green leaves and large cymose panicles of white flowers. The branches are arranged on planes. Wood white, tough.

Towai, or kamahi (*Weinmannia racemosa*). A beautiful, large tree, especially when in flower. Trunk 2–4 feet diameter. Bark valuable in tanning. Wood close-grained, heavy, often used in wooden tramways.

Fuchsia, or kotukutuku (*Fuchsia excorticata*). This tree sometimes attains a diameter of 3 feet in the trunk, which is generally crooked. Wood heavy and wet. The juice is astringent, forming shades of purple to black, with iron.

Broad-leaf (*Griselinia littoralis*). A large tree, with large, ovate, shining leaves. Trunk 4–8 feet diameter. Wood white and red, close-grained, heavy, durable.

Red mapau (*Myrsine urvillei*). A small tree, common at Dunedin. Trunk 6–12 inches diameter. Wood dark-red, very astringent, used as fence stuff, but subject to the attack of a boring beetle.

Hedycarya dentata. A dark-foliaged small shrub-tree, with large red berries, found on the West Coast.

Milk-tree, or tawaapou (*Epicarpurus microphyllus*). The milk-tree of the settlers, from the bark exuding a vegetable milk when wounded. Trunk 12–18 inches diameter. Wood white, not durable.

Ascarina lucida. A shrub-tree of the West Coast.

Ngaio (*Myoporum lætum*). An ornamental shrub-tree, useful as shelter, being of rapid growth.

The following is a list of all the flowering plants found in Otago; with their proportionate geographical distribution in the two botanical regions of the eastern and western slopes of the province, as defined by a line extending from the Wanaka Lake to the Nuggets, at the mouth of the Clutha, along the course of that river.

The numerals in the respective columns, for each of the districts, indicate,—

1. The mere occurrence of a few individuals of the species;
2. The tolerable abundance of individuals in a few localities; and
3. The universal occurrence of the species, wherever the condition for its growth prevailed within the district.

The letters a b c in the first column refer to the altitude to which the species extend above the sea-level:

(a) From sea-level to 1,500 feet.
(b) From 1,500 feet to 4,000 feet.
(c) From 4,000 feet upwards.

LIST OF FLOWERING PLANTS FOUND IN OTAGO.

English and Maori Names.		Alt.	East Region.	West Region.
	DICOTYLEDONS.			
Traveller's Joy Family.	1. RANUNCULACEÆ.			
Puwhananga.	Clematis indivisa, *Willd.*	a	3	2
	„ fœtida, *Raoul.*	a	1	1
	„ fœtida *var. b*, depauperata	a	1	1
Pokopokonuiha-ura.	„ parviflora, *A. Cunn.*...	a	1	2
	„ colensoi, *Hook. f.*	a	2	2
	„ leafless species, (undescribed) ...	a	1	
Crowfoot Family.	Ranunculus lyallii, *Hook. f.*	b c		2
	„ buchanani, *Hook. f.*	b c		1
	„ sinclairi, *Hook. f.*	b c		1
	„ plebeius, *Br.*	a	2	2
	„ lappaceus, *var.* multiscapus, *Hook. f.*	a b	1	1
	„ subscaposus, *Hook. f.*	a b c	1	1
	„ macropus, *Hook. f.*	a	1	1
	„ rivularis, *Banks and Sol.* ...	a	2	2
	„ acaulis, *Banks and Sol.* ...	a b	1	1
	„ gracilipes, *Hook. f.*	a b		1
	„ pachyrrhizus, *Hook. f.*	c		1
Marsh Marigold.	Caltha novæ-zealandiæ	b c		1
	2. MAGNOLIACEÆ.			
Horopito. Pepper tree.	Drimys colorata, *Raoul.*	a	2	1
	3. CRUCIFERÆ.			
	Nasturtium palustre, *DC.*	a b	1	1
Panapana.	Cardamine hirsuta, *var.*	a b	1	1
Ladies' smock.	„ depressa, *Hook. f.*	a b	1	1
	Pachycladon novæ-zealandiæ	c		1
Eketera.	Lepidium oleraceum, *Forst.*	a b	1	1
Pepperwort.	„ sisymbrioides, *Hook. f.*	a b		1
	4. VIOLARIEÆ.			
Violet.	Viola filicaulis, *Hook. f.*	a b	1	1
	„ cunninghamii, *Hook. f.*	a b	1	1
Mahoe, Hinahina	Melicytus ramiflorus, *Forst.*	a	3	1
	5. PITTOSPOREÆ.			
Mapau, Tipau.	Pittosporum tenuifolium, *Banks and Sol.* ...	a	3	1
Mapauriki.	„ colensoi, *Hook. f.*	a	2	1
	„ rigidum, *Hook. f.*	a		1
	„ fasciculatum, *Hook. f.*	a	1	2
Tarata.	„ eugenioides, *A. Cunn.*	a	3	1
	6. CARYOPHYLLEÆ.			
	Gypsophila tubulosa, *Boiss.*	a	2	1
Stitchwort.	Stellaria parviflora, *Banks and Sol.* ...	a	1	1
	„ gracilenta, *Hook. f.*	a b	1	1
	Colobanthus billardieri, *Fenzl.*	a b	1	2
	„ subulatus, *Hook. f.*	a b c		1
	„ acicularis, *Hook. f.*	a		1
	Spergularia rubra, *Pers.*, *var.* marina ...	a	2	2

English and Maori Names.		Alt.	East Region.	West Region.
	7. PORTULACEÆ.			
	Claytonia australasica, *Hook. f.*	a b c	1	1
	Montia fontana, *Linn.*	a b	1	1
	Hectorella cæspitosa, *Hook. f.*	c		1
	8. ELATINEÆ.			
	9. HYPERICINEÆ.			
St. John's Wort.	Hypericum gramineum, *Forst.*	a	2	1
	„ japonicum, *Thunb.*	a	1	1
	10. MALVACEÆ.			
Whauwhi. Ribbon-wood.	Plagianthus betulinus, *A. Cunn.*	a	2	1
Houhere. Lace-bark Tree.	„ lyallii, *Hook. f.*	a b		2
Houhere.	Hoheria populnea *var.* angustifolia	a	1	1
Ribbon-wood.	„ „ *var.* cratægifolia	a		1
	11. TILIACEÆ.			
Makomako.	Aristotelia racemosa, *Hook. f.*	a	3	1
Lime Tree.	„ colensoi, *Hook. f.*	a	1	
	„ fruticosa, *Hook. f.*	a b	1	2
Hinau.	Elæocarpus dentatus, *Vahl.*	a	2	1
Pokako.	„ hookerianus, *Raoul.*	a	2	1
	12. LINEÆ.			
Rauhuia, Kaho, Flax.	Linum monogynum, *Forst.*	a	2	1
	13. GERANIACEÆ.			
Matuakumera.	Geranium dissectum *var.* carolinianum, *Linn.*	a	2	1
	„ microphyllum, *Hook. f.*	a b	1	2
	„ sessiliflorum, *Cav.*	a b	1	1
	„ molle, *Linn.*	a		1
Ropata.	Pelargonium australe *var.* clandestinum, *L'Hér.*	a	1	2
	Oxalis corniculata, *Linn., varieties* ...	a	3	3
	„ magellanica, *Forst.*	a b	1	1
	14. RUTACEÆ.			
	Melicope simplex, *A. Cunn.*	a	1	
	15. MELIACEÆ.			
	16. OLACINEÆ.			
Kaikomako. Ribbon-wood.	Pennantia corymbosa	a	2	1
	17. STACKHOUSIEÆ.			
	18. RHAMNEÆ.			
Toumatoukuru.	Discaria toumatou, *Raoul.*	a	3	2
	19. SAPINDACEÆ.			
	20. ANACARDIACEÆ.			
	21. CORIARIEÆ.			
Tupakihi.	Coriaria ruscifolia, *Linn.*	a	3	1
Tutu.	„ thymifolia, *Humb.*	a b c	2	1
Tutuheuheu.	„ angustissima, *Hook. f.*	b c		1
	22. LEGUMINOSÆ.			
Native Brooms.	Carmichælia crassicaulis, *Hook. f.*	a	2	
	„ nana, *Col.*	a b c	1	1
	„ grandiflora, *Hook. f.*	a b	1	1
Makaka.	„ australis, *Br.*	a	1	1
Moukaro.	„ odorata, *Col.*	a b		1
	„ flagelliformis, *Col.*	a	2	1
	„ juncea	a	1	
Kowhai.	Sophora tetraptera *var.* grandiflora, *Aiton*	a	3	
	„ „ *var.* microphylla ...	a		2

English and Maori Names.		Alt.	East Region.	West Region.
	23. ROSACEÆ.			
Tataramoa.	Rubus australis, *Forst.*, *varieties*	a	3	2
Bramble.	Potentilla anserina, *Linn.*	a	2	1
Kopata.	Geum urbanum *var.* strictum	a	1	1
Avens.	,, parviflorum, *Comm.*	a	1	1
Piripiri, Hutiwai.	Acæna sanguisorbæ, *Vahl.*	a b	3	1
	,, adscendens, *Vahl.*	a b		1
	,, microphylla, *Hook. f.*	a	1	1
	,, buchanani, *Hook. f.*	a		1
	24. SAXIFRAGEÆ.			
	Donatia novæ-zealandiæ, *Hook. f.*	b c	1	1
Piripiriwhata.	Carpodetus serratus, *Forst.*	a	3	1
Towai, Kamahi.	Weinmannia racemosa, *Forst.*	a	1	3
	25. CRASSULACEÆ.			
	Tillæa moschata, *DC.*	a	1	1
	26. DROSERACEÆ.			
Sun-dew Family.	Drosera stenopetala, *Hook. f.*	a		1
	,, arcturi, *Hook.*	b		1
	,, spathulata, *Labill.*	b		1
	27. HALORAGEÆ.			
	Haloragis alata, *Jacq.*	a	2	1
Piripiri.	,, depressa, *Hook. f.*		1	
Water Milfoil.	Myriophyllum elatinoides, *Gaud.*	a b	2	1
	Gunnera monoica, *Raoul*	a	2	1
	,, prorepens, *Hook. f.*	a b	1	2
	28. MYRTACEÆ.			
Kahikatoa, Pia, Manuka.	Leptospermum scoparium, *Forst.*	a b	3	2
Manuka.	,, ericoides, *A. Rich.*	a	2	1
Ratapiki.	Metrosideros florida, *Sm.*	a		2
Rata.	,, lucida, *Menzies*	a b		3
Iron-wood.	,, hypericifolia, *A. Cunn.* ...	a	1	2
	,, colensoi, *Hook. f.*	a	1	2
Akakura.	,, scandens, *Banks and Sol.* ...	a b	2	2
	Myrtus obcordata, *Hook. f.*	a b	2	1
Hutu.	,, pedunculata, *Hook. f.*	a b	2	1
	29. ONAGRARIEÆ.			
Kohutuhutu,	Fuchsia excorticata, *Linn. f.*	a b	3	2
Konini.	,, procumbens, *R. Cunn.*	a	1	
Kotukutuku.	Epilobium nummularifolium, *A. Cunn.* ...	a b	2	3
Willow Herb	,, purpuratum, *Hook. f.*	b c		2
Family.	,, linnæoides, *Hook. f.*	b	1	2
	,, macropus, *Hook.*	b c	1	2
	,, confertifolium, *Hook. f.*	b c		1
	,, crassum, *Hook. f.*	b c		1
	,, alsinoides, *A. Cunn.*	a	2	1
	,, microphyllum, *A. Rich.*	a	3	1
	,, rotundifolium, *Forst.*	a	1	1
	,, glabellum, *Forst.*	a b	1	2
	,, melanocaulon, *Hook.*	b c		1
Hinatoli.	,, tetragonum, *Linn.*	a b		1
	,, junceum, *Forst.*	a	1	1
	,, pubens, *A. Rich.*	a	1	1
	,, billardierianum, *Seringe* ...	a b		1
	,, pallidiflorum, *Sol.*	a	2	1
	30. PASSIFLOREÆ.			
	31. CUCURBITACEÆ.			

English and Maori Names.		Alt.	East Region.	West Region.
	32. FICOIDEÆ.			
Fig-Marygold.	Mesembryanthemum australe, *Sol.*	a	3	3
Kokihi.	Tetragonia expansa	a	2	2
N.Z. spinach.				
	33. UMBELLIFERÆ.			
Pennywort.	Hydrocotyle elongata, *A. Cunn.*	a	2	2
	„ asiatica, *Linn.*	a	1	1
	„ muscosa, *Br.*	a	1	1
	„ novæ-zealandiæ, *DC.*	a	1	1
	„ moschata, *Forst.*	a	1	1
	„ microphylla, *A. Cunn.*	a	1	1
	Pozoa exigua, *Hook. f.*	c		1
Celery.	Apium australe, *Thouars*	a	2	2
	„ filiforme, *Hook.*	a	1	
Eryngo.	Eryngium vesiculosum, *Labill.*	a	1	
	Oreomyrrhis ramosa, *Hook. f.*	a	1	2
Kurikuri, Spear-grass.	Aciphylla squarrosa, *Forst.*	a b	3	2
Taramea.	„ colensoi, *Hook. f.*	a b	3	2
	„ lyallii, *Hook. f.*	b c		1
	„ monroi, *Hook. f.*	b c	1	2
	Ligusticum intermedium, *Hook. f.*	a	1	1
Maori parsnip.	„ lyallii	a		1
	„ haastii, *F. Muell.*	b c		1
	„ brevistyle, *Hook. f.*	a		1
	„ piliferum, *Hook. f.*	b c	1	1
	„ aromaticum, *Banks and Sol.*	a b c	3	2
	„ imbricatum, *Hook. f.*	b c		1
	Angelica gingidium, *Hook. f.*	a		1
	„ geniculata, *Hook. f.*	a	1	1
Carrot.	Daucus brachiatus, *Sieber.*	a b	1	2
	34. ARALIACEÆ.			
Kaiwhiria.	Panax simplex, *Forst.*	a b	3	1
Raukawa.	„ edgerleyi, *Hook. f.*	a	2	1
Wawapaku.	„ anomalum, *Hook.*	a		1
	„ lineare, *Hook. f.*	a		1
Horoeka.	„ crassifolium, *Dcne. and Planch.*	a	3	1
Gum tree.	„ colensoi, *Hook. f.*	a b	3	1
Whawhaupuku.	„ arboreum, *Forst.*	a b	1	2
Patete.	Schefflera digitata, *Forst.*	a	2	3
	35. CORNEÆ.			
Broad leaf.	Griselinia littoralis, *Raoul*	a	3	1
Kapuka.	Corokia cotoneaster, *Raoul*	a	1	2
	36. LORANTHACEÆ.			
Misletoe Family.	Loranthus colensoi, *Hook. f.*	a	1	3
	„ flavidus, *Hook. f.*	a		1
	„ micranthus, *Hook. f.*	a	3	1
Pirita.	Tupeia antarctica, *Cham. and Schl.*	a	3	2
	Viscum lindsayi, *Oliver*	a	1	
	„ salicornioides, *A. Cunn.*	a	3	
	37. CAPRIFOLIACEÆ.			
	38. RUBIACEÆ.			
Karamu.	Coprosma lucida, *Forst.*	a	1	2
Papaumu.	„ grandifolia, *Hook. f.*	a	1	2
Karamu.	„ robusta, *Raoul.*	a	2	3
	„ cunninghamii, *Hook. f.*	a	1	
	„ rotundifolia, *A. Cunn.*	a	3	1
	„ rhamnoides, *A. Cunn.*	a	3	3
	„ [divaricata, *A. Cunn.*]	a	3	3

English and Maori Names.		Alt.	East Region.	West Region.
	38. RUBIACEÆ—*continued.*			
	Coprosma parviflora, *Hook. f.*	a	3	3
Karangu.	„ fœtidissima, *Forst.*	a b	3	3
	„ cuneata, *Hook. f.*	a b	3	3
Tataraheke.	„ acerosa, *A. Cunn.*	a b	3	3
	„ linariifolia, *Hook. f.*	a	2	1
	„ tenuicaulis, *Hook. f.*	a	2	1
	„ divaricata, *A. Cunn.*	a	2	1
	„ pumila, *Hook. f.*	c		2
	Nertera depressa, *Banks and Sol.*	a	2	1
	„ dichondræfolia, *Hook. f.*	a	3	2
	„ setulosa, *Hook. f.*	a	2	2
Bed-straw.	Galium tenuicaule, *A. Cunn.*	a	3	2
	„ umbrosum, *Forst.*	a	2	1
Woodruff.	Asperula perpusilla, *Hook. f.*	a	2	2
	39. COMPOSITÆ.			
Tupari.	Olearia operina, *Hook. f.*	a		1
Starwort Family.	„ colensoi, *Hook. f.*	a b c		1
Starworts.	„ nitida, *Hook. f.*	a b	2	1
	„ dentata, *Hook. f.*	a b	2	2
	„ ilicifolia, *Hook. f.*	a b	2	1
Wharangipiro. Ake wharangi.	„ cunninghamii, *Hook. f.*	a		1
	„ moschata, *Hook. f.*	a b		1
	„ nummularifolia, *Hook. f.*	a b c	1	2
Akeake.	„ avicenniæfolia, *Hook. f.*	a b	3	3
	„ virgata, *Hook. f., varieties*	a b	2	2
	„ hectori, *Hook. f.*	a b		1
	Celmisia holosericea, *Hook. f.*	a b c		1
	„ densiflora, *Hook. f.*	b c		1
	„ hieracifolia, *Hook. f.*	b c		1
	„ haastii, *Hook. f.*	b c		1
	„ incana, *Hook. f.*	b c		1
	„ lindsayi, *Hook. f.*	a	1	
	„ verbascifolia, *Hook. f.*	a		1
Tikumu,	„ coriacea, *Hook. f.*	b	3	1
Cotton plant	„ lyallii, *Hook. f.*	a b c	3	3
	„ viscosa, *Hook. f.*	b c		2
	„ petiolata, *Hook. f.*	b c		1
	„ longifolia, *Cass.*	b c	3	3
	„ laricifolia, *Hook. f.*	b c		2
	„ hectori, *Hook. f.*	b c		1
	„ sessiliflora, *Hook. f.*	b c		2
	„ ramulosa, *Hook. f.*	b c		1
	Vittadinia australis, *A. Rich.*	a	3	2
	Lagenophora forsteri, *DC.*	a b	2	2
	„ petiolata, *Hook. f.*	a b	2	2
	„ pinnatifida, *Hook. f.*	a	1	1
	Brachycome sinclairi, *Hook. f.*	b c		2
	Abrotanella inconspicua, *Hook. f.*	c		1
	Cotula coronopifolia, *Linn.*	a	2	
	„ australis, *Hook. f.*	a	1	
	„ pectinata, *Hook. f.*	a b	1	2
	„ pyrethrifolia, *Hook. f.*	b c		1
	„ dioica, *Hook. f.*	a b	3	2
	Craspedia fimbriata, *DC.*	a b c	3	3
	„ alpina, *Backhouse*	a b c	3	3
	Cassinia fulvida, *Hook. f.*	a b	3	3
	„ vauvilliersii, *Hook. f.*	a b	3	3

English and Maori Names.		Alt.	East Region.	West Region.
	39. COMPOSITÆ—*continued.*			
	Ozothamnus glomeratus, *Hook. f.*	a	2	1
	„ microphyllus, *Hook. f.* ...	a	1	2
	„ depressus, *Hook. f.*	a	2	1
	„ selago, *Hook. f.*	a	1	1
	Raoulia australis, *Hook. f.*	a b	1	2
	„ tenuicaulis, *Hook. f.*	a		1
	„ subulata, *Hook. f.*	b c	1	2
	„ hectori, *Hook. f.*	b		1
	„ glabra, *Hook. f.*	a b		2
	„ subsericea, *Hook. f.*	a b c	1	2
	„ grandiflora, *Hook. f.*	b c		1
Everlasting Family.	Gnaphalium bellidioides, *Hook. f.*	b c		1
	„ youngii, *Hook. f.*	b c		1
	„ trinerve, *Forst.*	a	1	1
	„ keriense, *A. Cunn.*	a		1
	„ filicaule, *Hook. f.*	a	1	2
	„ luteo-album, *Linn.*	a		1
	„ grandiceps, *Hook. f.*	b c		1
	„ involucratum, *Forst.*	a	1	1
	„ collinum, *Labill.*	a	1	2
	Haastia sinclairi, *Hook. f.*	b c		1
	Erechtites prenanthoides, *DC.*	a	2	2
	„ arguta, *DC.*	a	1	1
	„ quadridentata, *DC.*	a	1	1
Groundsel Family.	Senecio bellidioides, *Hook. f.*	b c		2
	„ haastii, *Hook. f.*	a b c	3	2
	„ lautus, *Forst.*	b c		1
	„ lyallii, *Hook. f.*	b c		1
	„ bifistulosus, *Hook. f.*	b c		1
	„ elæagnifolius, *Hook. f.*	a b	1	2
Puheritaiko.	„ rotundifolius, *Hook. f.*	a		3
	„ cassinioides, *Hook. f.*	a b		2
	Microseris forsteri, *Hook. f.*	a b	1	2
	Crepis novæ-zealandiæ, *Hook. f.*	a b	3	3
	Taraxacum dens-leonis, *Desf.*	a b c	3	2
Pororua, Puwha, Sow thistle.	Sonchus oleraceus, *Linn.*	a b	3	3
	40. STYLIDIEÆ.			
	Forstera sedifolia, *Linn.*	b c	1	2
	„ bidwillii, *Hook. f.*	b c		2
	„ tenella, *Hook. f.*	b c		1
	Helophyllum clavigerum, *Hook. f.*	c	1	2
	„ colensoi, *Hook. f.*	c		2
	„ rubrum, *Hook. f.*	c		2
	41. CAMPANULACEÆ.			
Harebell.	Wahlenbergia gracilis, *A. Rich.*	a	3	2
	„ saxicola, *A. DC.*	a b	3	2
	„ cartilaginea, *Hook. f.* ...	b c		1
	Pratia angulata, *Hook. f.*	b c	1	1
	„ linnæoides, *Hook. f.*	b	1	1
	Selliera radicans, *Cav.*	a	3	2
Heaths.	42. ERICEÆ.			
Koropuku.	Gaultheria antipoda, *Forst., varieties* ...	a b c	3	3
	„ rupestris, *Br., varieties*	b c	2	3
Mingi.	Cyathodes acerosa, *Br., varieties*	a b	3	2
	„ empetrifolia, *Hook. f.*	b	1	2
	„ colensoi, *Hook. f.*	b	1	3

English and Maori Names.		Alt.	East Region.	West Region.
	42. ERICEÆ—*continued.*			
Mingimingi	Leucopogon fasciculatus, *A. Rich.*	a b	2	2
Patotara.	„ fraseri, *A. Cunn.*	a b c	3	3
	Pentachondra pumila, *Br.*	b c	2	2
	Archeria traversii, *Hook. f.*	a		2
	Dracophyllum menziesii, *Hook. f.*	a b		2
	„ strictum, *Hook. f.*	a b	2	2
Grass tree.	„ longifolium, *Br.*	a b	3	1
	„ urvilleanum, *A. Rich.* ...	a b	2	2
	„ uniflorum	b c		2
	„ rosmarinifolium, *Forst.* ...	b c	2	2
	„ muscoides, *Hook. f.*	b c		1
	43. MYRSINEÆ.			
Mapau.	Myrsine urvillei, *A. DC.*	a	3	2
Tipau.	„ divaricata, *A. Cunn.*	a b	2	2
	„ nummularia, *Hook. f.*	b		2
	44. PRIMULACEÆ.			
Primrose.	Samolus littoralis, *Br.*	a	3	3
	45. SAPOTEÆ.			
	46. JASMINEÆ.			
	47. APOCYNEÆ.			
Kaikou.	Parsonsia albiflora, *Raoul*	a	3	2
	„ rosea, *Raoul*	a	2	
	48. LOGANIACEÆ.			
	Mitrasacme novæ-zealandiæ, *Hook. f.* ...	b c		1
	Logania tetragona	a b c	1	2
	49. GENTIANEÆ.			
Gentian.	Gentiana montana, *Forst.*	b	2	2
	„ saxosa, *Forst.*	b c	1	2
	„ pleurogynoides, *Griseb.*	a b c	3	3
	Sebæa ovata, *Br.*	a	1	
	50. BORAGINEÆ.			
Forget-me-not Family.	Myosotis pulvinaris, *Hook. f.*	c		2
	„ hectori, *Hook. f.*	c		2
	„ antarctica, *Hook. f.*	b c	1	1
	„ australis, *Br.*	b c	2	2
	„ forsteri, *Rœm. and Sch.*	a	2	1
	„ capitata, *Hook. f.*	a b	1	1
	„ traversii, *Hook. f.*	b c		2
	„ albo-sericea, *Hook. f.*	a	1	1
	Exarrhena macrantha, *Hook. f.*	b	2	
	„ lyallii, *Hook. f.*	a b		1
	51. CONVOLVULACEÆ.			
Panahi.	Convolvulus sepium, *Linn.*	a	2	1
Convolvulus or	„ tuguriorum, *Forst.*	a	3	1
Bindweed	„ soldanella, *Linn.*	a	2	2
Family.	„ erubescens, *Br.*	a	2	2
	Dichondra repens, *Forst.*	a	2	1
	52. SOLANEÆ.			
Poroporo.	Solanum aviculare, *Forst.*	a	2	1
	53. SCROPHULARINEÆ.			
	Mimulus radicans, *Hook. f.*	a	2	1
Koromiko.	Veronica salicifolia, *Hook. f.*	a b	3	3
Kokomuka.	„ parviflora, *Vahl.*	a	1	1
Speedwell	„ macrocarpa, *Vahl.*	a	1	1
Family.	„ ligustrifolia, *A. Cunn.*	a	1	1
	„ traversii, *Hook. f.*	a b	2	2
	„ vernicosa, *Hook. f.*	a b	2	1
Koromiko.	„ elliptica, *Forst.*	a	3	1

English and Maori Names.		Alt.	East Region.	West Region.
	53. SCROPHULARINEÆ—*continued.*			
	Veronica buxifolia, *Benth.*	b	2	3
	,, buchanani, *Hook. f.*	b		1
	,, tetragona, *Hook.*	b	1	2
	,, lycopodioides, *Hook. f.*	b	2	2
	,, hectori, *Hook. f.*	b c	1	2
	,, salicornioides, *Hook. f.*	b c	2	1
	,, cupressoides, *Hook. f.*	a b	2	2
	,, lyallii, *Hook. f.*	a b	2	2
	,, bidwillii, *Hook. f.*	a b	2	2
	,, cataractæ, *Forst.*	a		2
	Ourisia macrophylla, *Hook.*	b c		2
	,, macrocarpa, *Hook. f.*	a b		2
	,, sessilifolia, *Hook. f.*	b c		2
	,, cæspitosa, *Hook. f.*	b c		2
	,, glandulosa, *Hook. f.*	b c		1
Eyebright Family.	Euphrasia cuneata, *Forst.*	a b	2	2
	,, revoluta, *Hook. f.*	b c	1	2
	,, antarctica, *Benth.*	a b c	1	2
	54. GESNERIACEÆ.			
	55. LENTIBULARIEÆ.			
	56. VERBENACEÆ.			
Ngaio.	Myoporum lætum, *Forst.*	a	3	1
	57. LABIATEÆ.			
Mint.	Mentha cunninghami, *Benth.*	a	3	2
	58. PLANTAGINEÆ.			
Plantain.	Plantago lanigera, *Hook. f.*	c		1
	,, raoulii, *Decaisne*	a	2	1
	59. NYCTAGINEÆ.			
	60. CHENOPODIACEÆ.			
Goose-foot Family.	Chenopodium triandrum, *Forst.*	a	2	1
	,, ambrosioides, *Linn.*	a	2	2
	Sueda maritima, *Dumortier*	a	1	1
Glasswort.	Salicornia indica, *Willd.*	a	3	3
	61. AMARANTHACEÆ.			
	62. PARONYCHIEÆ.			
Kohukohu.	Scleranthus biflorus, *Hook. f.*	a	3	2
	63. POLYGONEÆ.			
Persicaria Family.	Polygonum aviculare, *Linn.*	a	2	2
	Muhlenbeckia adpressa, *Lab.*	a	2	1
	,, complexa, *Meisn.*	a	3	2
	,, axillaris, *Hook. f.*	a b c	2	2
	,, ephedroides, *Hook. f.*	a	1	
	Rumex flexuosus, *Forst.*	a	2	2
	64. LAURINEÆ.			
	65. MONIMIACEÆ.			
Poroporokai-whiria.	Hedycarya dentata, *Forst.*	a		2
	66. PROTEACEÆ.			
	67. THYMELEÆ.			
	Pimelea gnidia, *Forst.*	a		2
	,, traversii, *Hook. f.*	a b c	1	2
Autetaranga.	,, arenaria, *A. Cunn.*	a	2	2
	,, urvilleana, *A. Rich.*	a	1	
	,, prostrata, *Vahl.*	a	3	2
	,, lyallii, *Hook. f.*	a b	3	2
	,, sericeo-villosa, *Hook. f.*	a b	2	1
	Drapetes dieffenbachii, *Hook.*	b	2	2
	,, lyallii, *Hook. f.*	b	2	2

English and Maori Names.		Alt.	East Region.	West Region.
	68. Santalaceæ.			
	69. Euphorbiaceæ.			
Waiwatua Sun spurge.	Euphorbia glauca, *Forst.*	a	3	3
	70. Cupuliferæ.			
Tawhai. *Beech Family.*	Fagus menziesii, *Hook. f.*	a b c	1	3
Tawhai.	„ fusca, *Hook. f.*	a b		2
Tawairauriki.	„ solandri, *Hook. f.*	a b c		3
	71. Urticeæ.			
Tawaapou. Milk tree.	Epicarpurus microphyllus, *Raoul*	a	1	
Ongaonga. Nettle.	Urtica incisa, *Poiret*	a	2	
Ongaonga. Nettle tree.	„ ferox, *Forst.*	a	1	
	72. Chloranthaceæ.			
Hutu.	Ascarina lucida, *Hook. f.*	a		2
	73. Piperaceæ.			
	74. Balanophoreæ.			
	75. Coniferæ.			
Cedar. Kawaka.	Libocedrus doniana, *Endl.*	a b	3	1
Miro. Black Pine.	Podocarpus ferruginea, *Don*	a	3	3
	„ nivalis, *Hook. f.*	b c	1	2
Totara.	„ totara, *A. Cunn.*	a	3	3
Mataii. Black rue Pine.	„ spicata, *Br.*	a	3	2
Kahikatea. White Pine.	„ dacrydioides, *A. Rich.*	a	2	2
Silver Pine.	„ *sp. undescribed*	a	2	
Rimu. Red Pine.	Dacrydium cupressinum, *Sol.*	a	3	3
	„ colensoi, *Hook.*	a b	2	2
Manoua.	„ laxifolium	a b		2
	„ *sp. undescribed*	a		1
Toatoa. Celery-leaved Pine.	Phyllocladus alpinus, *Hook. f.*	a b	2	3
	MONOCOTYLEDONS.			
Orchis Family.	1. Orchideæ.			
	Earina mucronata, *Lindl.*	a	3	3
	„ autumnalis, *Hook. f.*	a	3	3
	Dendrobium cunninghamii, *Lindl.*	a	3	3
Piripiri.	Bolbophyllum pygmæum, *Lindl.*	a	1	2
Perei.	Gastrodia cunninghamii, *Hook. f.*	a	1	1
	Corysanthes triloba, *Hook. f.*	a	2	2
	„ oblonga, *Hook. f.*	a	2	2
	„ macrantha, *Hook. f.*	a	2	
	Microtis porrifolia, *Spreng.*	a	3	2
	Caladenia minor, *Hook. f.*	a	2	2
	„ lyallii, *Hook. f.*	a	2	2
	„ bifolia, *Hook. f.*	a	2	1
	Pterostylis banksii, *Brown*	a	3	2
	„ graminea, *Hook. f.*	a	2	2
	Lyperanthus antarcticus, *Hook. f.*	a b	3	1
	Thelymitra longifolia, *Forst.*	a	2	2

English and Maori Names.		Alt.	East Region.	West Region.
	1. ORCHIDEÆ—*continued.*			
	Thelymitra pulchella, *Hook. f.*	a	2	2
	„ uniflora, *Hook. f.*	a	3	2
	Prasophyllum colensoi, *Hook. f.*	a	3	3
	2. IRIDEÆ.			
Turutu.	Libertia ixioides, *Spreng.*	a	3	2
Iris Family.	„ micrantha, *A. Cunn.*	a b	2	3
	3. HYPOXIDEÆ.			
	4. PANDANEÆ.			
Kiekietawhara.	Freycinetia banksii, *A. Cunn.*	a		2
	5. TYPHACEÆ.			
Raupo.	Typha angustifolia, *Linn.*	a	3	1
Cat's tail.	„ latifolia	a	3	
	6. NAIADEÆ.			
Duck-weed.	Lemna minor, *Linn.*	a	2	1
Arrow-grass.	Triglochin triandrum	a	2	2
Pond-weed.	Potamogeton natans	a	2	2
	„ heterophyllus, *Schreber* ...	a	2	2
	Ruppia maritima, *Linn.*	a	2	2
	7. LILIACEÆ.			
Kareao, Black Vine.	Rhipogonum scandens, *Forst.*	a	3	2
	Callixene parviflora, *Hook. f.*	a	1	3
Houka, Ti, Cabbage tree.	Cordyline australis, *Hook. f.*	a	3	2
Tikapu.	„ indivisa, *Kunth.*	a		2
	Astelia linearis, *Hook. f.*	a	2	2
	„ nervosa, *Banks and Sol.*	a b	3	3
Kahakaha, Horahora.	„ solandri, *A. Cunn.*	a b	3	3
	Anthericum hookeri, *Col.*	a b c	3	2
Harareke, N.Z. Flax.	Phormium tenax, *Forst.*	a b	3	2
	Herpolirion novæ-zealandiæ, *Hook. f.* ...	a	2	2
	8. PALMEÆ.			
	9. JUNCEÆ.			
Rush Family.	Juncus vaginatus, *Br.*	a	2	1
	„ australis, *Hook. f.*	a	2	2
Wiwi.	„ maritimus, *Lamarck*	a	2	2
	„ communis, *E. Meyer*	a	2	2
	„ planifolius, *Br.*	a	3	2
	„ bufonius, *Linn.*	a	3	2
	„ scheuzerioides, *Gaud.*	b c	1	2
	„ novæ-zealandiæ	a b	2	3
	Luzula campestris, *DC.*	a	3	3
	„ oldfieldii, *Hook. f.*	a	3	3
	„ pumila, *Hook. f.*	b c	2	2
	10. RESTIACEÆ.			
	Leptocarpus simplex, *A. Rich.*	a	2	2
	Calorophus elongata, *Lab.*	a b	2	2
	Gaimardia setacea, *Hook. f.*	a	2	2
	11. CYPERACEÆ.			
Toetoewhatumu.	Cyperus ustulatus, *A. Rich.*	a	3	2
Bog Rush.	Schœnus pauciflorus, *Hook. f.*	a b	3	2
	Carpha alpina, *Br.*	b c	1	2
Ririwaka. Club Rush.	Scirpus maritimus, *Linn.*	a	3	3
Kopoupou.	„ lacustris, *Linn.*	a	2	2
	„ triqueter, *Linn.*	a	2	2

English and Maori Names.		Alt.	East Region.	West Region.
	11. CYPERACEÆ—*continued.*			
Spike Rush.	Eleocharis gracilis, *Br.*	a	3	3
	Isolepis nodosa, *Br.*	a	2	2
	„ prolifer, *Br.*	a	2	2
	„ riparia, *Br.*	a	3	3
Pingao.	Desmoschœnus spiralis, *Hook. f.*	a	2	2
	Cladium gunnii, *Hook. f.*	a	2	2
	Gahnia procera, *Forst.*	a	2	2
	„ arenaria, *Hook. f.*	a	2	2
	Oreobolus pumilio, *Br.*	a b	1	1
	Uncinia compacta, *Br.*, *var.* divaricata ...	a		1
Carex.	Carex teretiuscula, *Good.*	a b	1	3
	„ virgata, *Sol.*	a	3	2
	„ gaudichaudiana, *Kunth.*	a	3	3
Rautahi.	„ ternaria, *Forst.*	a	2	2
	„ testacea, *Sol.*	a	2	2
	„ lucida, *Boott.*	a	1	
	„ pumila, *Thunberg*	a	1	2
	„ forsteri, *Wahl.*	a	2	3
	„ cataractæ, *Br.*	a b	2	2
	„ trifida, *Cavan.*	a	2	2
	12. GRAMINEÆ.			
	(See under Grass land.)			
	CRYPTOGAMIA.			
	1. FILICES.			
	Gleichenia circinata, *Swartz*	a	2	
	„ *var. b.* hecistophylla, *A. Cunn.* ...	a b	2	
	„ cunninghamii, *Heward.*	a	2	2
Ponga. Tree Fern.	Cyathea dealbata, *Swartz*	a	3	1
Mamaku. Tree Fern.	„ medullaris, *Swartz*	a	1	3
Tree Fern.	„ smithii, *Hook. f.*	a	3	1
Weki. Tree Fern.	Dicksonia squarrosa, *Swartz*	a	3	3
Wekaponga. Tree Fern.	„ antarctica, *Br.*	a	3	2
Filmy leaf Family.	Hymenophyllum tunbridgense, *Smith* ...	a b	2	3
	„ unilaterale, *Willd.* ...	a b	1	1
	„ minimum, *A. Rich.* ...	a b	2	2
	„ bivalve, *Swartz*	a b	3	3
	„ multifidum, *Swartz* ...	a b	3	3
	„ rarum, *Br.*	a	3	3
	„ pulcherrimum, *Col.* ...	a b	3	3
	„ dilatatum, *Swartz* ...	a b	3	3
	„ crispatum, *Wallich.* ...	a b	2	3
	„ polyanthus, *Swartz* ...	a b	3	3
	„ demissum, *Swartz* ...	a b	3	3
	„ scabrum, *A. Rich.* ...	a b	1	2
	„ flabellatum, *Labill.* ...	a	1	1
	„ æruginosum, *Carmi.* ...	a	2	3
	„ lyallii, *Hook. f.*	a		2
	Trichomanes reniforme, *Forst.*	a		3
	„ strictum, *Menzies*	a		2
	„ colensoi, *Hook. f.*	a		
	„ venosum, *Br.*	a	3	2
	„ malingii, *Hook.*	a b	1	1

English and Maori Names.		Alt.	East Region.	West Region.
	1. FILICES—*continued.*			
	Cystopteris fragilis, *Bernhardi*	a	1	1
	Davalia novæ-zealandiæ, *Col.*	a	3	3
	Lindsæa trichomanoides, *Dryander*	a	2	2
Maidenhair	Adiantum affine, *Willd.*	a	2	2
Family.	„ cunninghamii, *Hook.*	a	3	3
	Hypolepis tenuifolia, *Bernh.*	a	2	2
	„ millefolium, *Hook.*	a	1	2
	„ distans, *Hook.*	a	3	3
	Cheilanthus tenuifolia, *Swartz*	a	2	2
	Pellæa rotundifolia, *Forst.*	a	2	1
Aruhe.	Pteris aquilina, *Linn.*, *var.* esculenta ...	a b	3	3
Brake Family.	„ scaberula, *A. Rich.*	a	2	2
	„ incisa, *Thunb.*	a	3	3
	Lomaria procera, *Spreng.*, *varieties*	a b	3	3
	„ fluviatilis, *Spreng.*	a	3	2
	„ membranacea, *Col.*	a	2	1
	„ pumila, *Raoul*	a	2	2
	„ vulcanica, *Blume*	a b		1
	„ elongata, *Blume*	a	1	1
	„ lanceolata, *Spreng.*	a	2	1
	„ discolor, *Willd.*	a	3	2
	„ alpina, *Spreng.*	a b	3	3
	„ banksii, *Hook. f.*	a	2	2
	„ nigra, *Col.*	a		1
Paretao.	Asplenium obtusatum, *Forst.*	a	1	1
Spleenwort	„ *var.* obliquum	a	3	3
Family.	„ lucidum, *Forst.*	a	2	2
	„ *var. b.* paucifolium	a	1	1
	„ *var. g.* lyallii	a	1	1
	„ trichomanes, *Linn.*	a		1
	„ flabellifolium, *Cavan.*	a	3	3
	„ falcatum, *Lamarck*	a	2	3
	„ hookerianum, *Col.*	a	2	2
	„ *var.* colensoi, *Moore*	a	2	2
	„ bulbiferum, *Forst.*	a	1	3
	„ richardi, *Hook. f.*	a	1	2
	„ flaccidum, *Forst.*, *varieties* ...	a	3	3
Shield Fern	Aspidium aculeatum, *Swartz*, *var.* vestitum	a	3	1
Family.	„ richardi, *Hook.*	a	2	2
	„ cystostegia, *Hook.*	a b		1
	„ aristatum, *Swartz*	a	2	2
	„ coriaceum, *Swartz*	a b	3	2
	Nephrodium decompositum, *Br.*	a	3	2
	„ hispidum, *Hook.*	a	3	2
Polypody	Polypodium australe, *Mettenius*	a b	3	2
Family.	„ grammitides, *Br.*	a b	3	3
	„ sylvaticum, *Col.*	a	1	2
	„ rugulosum, *Labill.*	a	2	2
Piupiu.	„ pennigerum, *Forst.*	a	1	3
	„ rupestre, *Br.*	a	3	3
	„ pustulatum, *Forst.*	a	1	2
	„ billardieri, *Br.*	a b	3	3
Heruheru.	Leptopteris hymenophylloides, *Presl.* ...	a	3	1
	„ superba, *Hook.*	a b	1	3
	Schizæa fistulosa, *Labill.*, *var. b*, australis ...	a		1
Adder's tongue.	Ophioglossum vulgatum, *Linn.*, *varieties* ...	a	3	2
Moon-wort.	Botrichium cicutarium, *Swartz*	a	3	1
	„ *var. b.* dissectum	a	2	1

English and Maori Names.		Alt.	East Region.	West Region.
	2. LYCOPODIACEÆ.			
Club Moss Family.	Lycopodium selago, *Linn.*	b c	3	3
	„ varium, *Br.*	b c	3	2
	„ billardieri, *Spreng.*	a	1	2
	„ clavatum, *Linn.*...	b c	2	2
	„ scariosum, *Forst.*	b c	2	3
	„ volubile, *Forst.*	a	3	2
Waewaekoukou.	Tmesipteris forsteri, *Endl.*	a	3	3
	3. MARSILEACEÆ.			
	Azolla rubra	a	3	2

ESSAY

ON THE

ORNITHOLOGY OF NEW ZEALAND.

By WALTER BULLER, F.L.S.

[*Written for the New Zealand Exhibition*, 1865.]

Scientific researches in all parts of the world have tended to confirm and establish the fact that, in every department of natural history, different parts of the earth's surface are endowed with peculiar types of organization,—that different regions are tenanted by totally distinct tribes of animals and plants, while their subordinate divisions are characterized by many exclusive genera and by numerous forms of species.

The primary causes which have led to this geographic dispersion of species, and the laws which at present control and regulate it, are and ever must be subjects of vague speculation; but it is a remarkable and suggestive fact, that the five great natural divisions of our globe are not only inhabited by different varieties of mankind, but differ so widely from each other in the character of their animal productions, that they may be regarded as so many separate zoological regions or provinces, each embracing many distinct faunas, but nevertheless characterized by strong distinguishing features.

Birds, from their very nature, might be supposed to be in some measure exempt from the operation of this geographic law. When we consider that they are extremely volatile beings, eminently endowed with the power of locomotion, and migratory in their nature—that the swallow speeds through the air at the rate of sixty miles an hour, and that many of the smaller birds perform every season a distance of several thousand miles—we might fairly conclude that birds, of all animals, are unconfined in their range, and will be found to spread into every region calculated to afford them congenial food and climate.

This, however, is far from being the order of nature. "The arrowy course of the swallow, the wanderings of the albatros, or the soaring of the eagle, are all directed to certain points and confined within limits, invisible, indeed, to the natural eye, yet as impassable and as exclusive as a wall of brass. 'Hither shalt thou come, but no further' with safety or comfort to thyself! This command, although not pronounced, is a part of the natural instinct of every animal in a state of nature."*

Some few birds are said to be cosmopolite, while many are common to several continents and extend their range over half the globe; but the vast majority of species are circumscribed in their range by narrow geographical limits, beyond which they seldom or never wander.

New Zealand affords a striking example of this fact; for, if we except the sea birds and some of the waders, our ornithology is strictly and exclusively local. Hardly a single species is common to any other country, while many of the genera are peculiar to our fauna. At the same time, the zoological peculiarities of the great natural division to which New Zealand belongs are strongly manifest. These distinguishing features of Australasian zoology are the total absence of large quadrupeds, the paucity of the smaller, and the vast preponderance of the class Aves; while the latter is characterized by the high development of the families *Meliphagidæ* and *Psittacidæ* and the entire absence of *Picidæ*, or true woodpeckers. In this respect the ornithology of this region presents a striking contrast to that of Europe, the fauna of which does not contain a single species of parrot, while the woodpeckers are comparatively numerous; and turning to the meliphagous genera, we find that the peculiar organization restricted in Africa, America, and India to the smallest birds in creation, is here developed to so high a degree that it comprises about one-sixth of the Australian perchers and includes many birds of appreciable size.

Any one at all acquainted with the zoology of New Zealand cannot have failed to remark these general characteristic features of the Australasian division, while it is equally apparent that New Zealand and the adjacent islands form together a distinct section, possessing an exclusive fauna, and marked by strong peculiarities.

The first published list of birds of this country was drawn up by G. R. Gray, Esq., of the British Museum, and appeared in 1843 in the Appendix to Dr. Dieffenbach's Travels. This list contained the names of eighty-four recorded species, but many of these were of doubtful authority, and were afterwards expunged.

Subsequently, in "The Voyage of H.M.SS. Erebus and Terror," the same naturalist produced a more complete list, embracing the birds of New Zealand and the neighbouring islands, accompanied by short specific

* Introduction to "Birds of Western Africa." *Nat. Lib.*

characters, and illustrated by twenty-nine coloured figures, many of them being life-size. But Mr. Gray's most valuable contribution to southern ornithology is the synopsis which appeared in "The Ibis" of July, 1862, in which his former list is reproduced with corrections, the newly recorded species added, and the list extended by the incorporation of the birds hitherto found on Norfolk, Phillip, Middleton's, Lord Howe's, Macaulay's and Nepean Islands. This enumeration contains 173 species, of which number 122 are noticed as occurring in New Zealand and the Chatham Islands.

The new species and stragglers since discovered* swell the number of our known birds to 133; and there is every reason to believe that, as the country becomes more thoroughly explored, the list will be considerably augmented.

When we reflect that New Zealand is cut off from the rest of the earth by a wide expanse of ocean, we can hardly be surprised that of the number stated, only sixty-nine species are, strictly speaking, land birds; yet if we take the aggregate number of our recorded birds, including a few that only appear at remote intervals as stragglers, we find that for the extent of country the list is a comparatively large one, being about one-fourth of the total number found in Europe.

But the ornithology of New Zealand, if not very important numerically, possesses many peculiar features of considerable interest to the general zoologist.

The former existence in these islands of a race of giant wingless birds not only constitutes a most important fact in natural history, but tends to enhance greatly the interest of the existing avifauna, which is found to contain diminutive types of some of the extinct colossal forms. Like the dodo of the Mauritius, the moa and its kindred have passed away almost within the memory of man, and till very recently it was generally believed that some of the smaller species still existed in the remote and unexplored parts of the country. Of their former existence in great numbers we have ample evidence in the traditions of the Maoris and in the abundance of their fossil remains. It appears that when the Maori ancestors first settled in these islands, about five hundred years ago, they found them tenanted by a

* The author has communicated to the Philosophical Institute of Canterbury notices of the following species, viz.:—*Strix haastii, Gerygone assimilis, Mimus carunculatus, Creadion cinereus, Nycticorax caledonicus, Rallus featherstonii, Nesonetta aucklandica,* and *Lestris antarcticus;* but as the Proceedings of the Society have not yet been published, to avoid confusion in treating of new species, descriptive notes will be added to this essay. In the large and valuable collection of New Zealand birds formed by Dr. Hector, and now deposited in the Provincial Museum at Dunedin, there is a fine specimen of this *Lestris,* beside many other rare and interesting birds, all of which have been collected in the Province of Otago. A list of the birds in this interesting collection has been prepared for the catalogue of the New Zealand Exhibition by the author of this essay.

race of struthious, brevi-pennate birds, embracing several distinct genera, and varying in size from that of a turkey to a stature far surpassing the tallest ostrich! These giant birds—the remnant, probably, of numerous tribes that originally roamed over a wide continent, now submerged—hemmed within the narrow limits of modern New Zealand, gradually diminished in numbers, till at length the race was finally annihilated, probably through human agency. Their skeletons, however, are still to be found embedded and preserved in the swamps and other alluvial deposits, or in the caves and sand-hills, of both North and South Islands; and the vast collections of these bones that have been transmitted to Europe have not only "excited the delight of the natural philosopher and the astonishment of the multitude," but have enabled Professor Owen to establish the characters of the principal genera and to determine many of the species.*

It would exceed the limits of the present sketch to attempt any comprehensive account of these extraordinary fossil birds, and we shall therefore only refer in the briefest way to the genera, as established by the learned professor, in order to trace the connection between the ancient and recent avifauna.

The most remarkable of these extinct forms, for their stupendous size and anomalous character, are comprehended in the genus *Dinornis*, and they belong to a type quite unknown either in a recent or fossil state in any other part of the world. The genus *Palapteryx*—the members of which attained a height of eight or ten feet, and in their osteological structure present some affinity to the *Dromaius*, or emu—is well typified by the existing species of *Apteryx*, while the *Brachypteryx*, or giant short-winged rail, finds its true type in the recent *Notornis mantelli*. The *Aptornis* (of which only one species has been determined) bears no relation whatever to any existing genus in New Zealand. It appears to have been a cursorial bird, presenting, in the structure of its feet, some resemblance to the celebrated dodo. On the other hand, a fossil parrot discovered by Mr. Mantell at Waingongoro (North Island), presents a close affinity to our living genus *Nestor*.

To pass on at once to the existing fauna, we may notice as peculiarities of New Zealand ornithology, the genus *Apteryx* (kiwi), a group of wingless birds, closely related to some of the extinct forms, and as anomalous in their

* Mr. Mantell was the first scientific explorer of the Waikouaiti and Waingongoro bone deposits. Possessed of great ability as a palæontologist, and exploring under favourable circumstances, he succeeded in forming a magnificent collection of these fossil remains, which he forwarded to England and ultimately deposited in the British Museum. It was chiefly from the results of Mr. Mantell's researches that Professor Owen was enabled to determine the following genera and species:—*Dinornis giganteus*, *D. robustus*, *D. crassus*, *D. elephantopus*, *D. struthioides*, *D. casuarinus*, *D. rheides*, *D. didiformis*, *D. curtus*, *D. gracilis*, *Palapteryx ingens*, *P. geranoides*, *Aptornis otidiformis*.

structure as they are singular in their habits and economy; the *Notornis*, a giant brevi-pennate rail, allied to *Porphyrio* in the form of its bill, and to *Tribonyx* in the structure of its feet; the *Strigops*, or ground parrot, known as the kakapo, and resembling in some respects an owl; the *Nestor*, another remarkable parrot genus, of which four species inhabit New Zealand, and a fifth, probably now extinct, recently existed on Phillip Island; and the beautiful huia (*Heteralocha gouldi*), confined to the mountains, and restricted in its range to narrow geographical limits—all of which will be more particularly noticed in their more natural order.

But, before proceeding further, it may be well to call the attention of naturalists to a hitherto unnoticed fact of considerable interest in connection with the geographical range or distribution of some of our birds. It consists in this, that between several of the species of the North and South Islands respectively there is a remarkable and very manifest *representation.* Thus, the saddle-back (*Creadion carunculatus*) of the North is represented in the South Island by *C. cinereus*, a closely allied species, but differing in the colour of its plumage; the weka (*Ocydromus earli*) is represented by a smaller species (*O. australis*) so closely resembling it in appearance and habits that they are called woodhens by the settlers of both islands, and by them as well as by the natives are generally regarded as identical; the popokatea (*Mohoua albicilla*) is represented by another species (*M. ochrocephala*), differing in colour, but so closely allied to it that the natives apply the same name to both; the toutouwai (*Petroica longipes*), to which precisely the same remark applies, is represented by *Petroica albifrons;* the *Callæas cinerea* by another species, distinguished by the colour of its wattles; and *Apteryx mantelli* by its smaller congener, *A. oweni.*

A similar fact is noticed by Mr. Darwin (Voyage of Beagle) as occurring in the Galapagos Archipelago, where three different islands were found to possess each a different species of *Mimus*, all closely related to one another, but exclusively restricted to their respective islands.

We shall now proceed to a closer but very rapid survey of our ornithology, noticing the families in the order of their natural arrangement, and briefly enumerating the species at present known. The birds of the Auckland Islands do not appear to belong properly to the New Zealand fauna, and will therefore be omitted.

Fam. FALCONIDÆ.—Probably among no section of birds has greater confusion or uncertainty prevailed than among the *Falconidæ.* The great difference in size between the male and female, the progressive variation of plumage to which they are subject before reaching maturity, and the difficulty of procuring an adequate number of specimens for examination and comparison, render it often very difficult to elucidate the species. Even in this country, possessing only few representatives of the family, the species have been very much confused by naturalists. Dr. Latham, in his "General Synopsis of Birds," figured the *Milvago leucurus* (an American bird) under the name of New Zealand falcon, and subsequent authors copied the mistake. Darwin, in his "Zoology of the Voyage of the Beagle," (1841,) on the authority of Mr. G. R. Gray, of the British Museum, rectified Latham's error, and Mr. Gray, in his "List of Birds," (1842,) appended to Dieffenbach's "New Zealand," classed together Gmelin's *Falco novæ-zealandiæ* and Forster's *Falco harpe* under the former title, considering this bird the kahu of the natives, while he referred karearea to the species characterized by Mr. Gould (Trans. Zool. Soc., 1837) under the name of *Falco brunnea.*

This naturalist afterwards, in his "Birds of New Zealand," (Voyage of Erebus and Terror,) reduced these names to synonyms, retaining as specific *Falco novæ-zealandiæ;* and again, more recently in his synopsis (Ibis, July, 1862), he has recognized two distinct species under the new generic term of *Hieracidea.*

Owing to a misapplication of the native names kahu and karearea, in Mr. Gray's first list, writers in this country have invariably fallen into the error of considering our large brown hawk the *Falco harpe,* and our sparrow-hawk the *Falco brunnea,* of that author.

There is reason to believe that, when we become better acquainted with the history of these hawks, it will be found necessary to expunge *H. brunnea* from our list of species, and to regard it merely as *H. novæ-zealandiæ* in an immature state of plumage. On the other hand, future exploration of the interior, and especially of the remote alpine regions of the South Island, will doubtless add some new forms to this portion of our ornithology; for whereas the neighbouring continent of Australia possesses nearly thirty members of the family, we can enumerate at present only three—*Hieracidea novæ-zealandiæ*, *H. brunnea*, and *Circus gouldi.*

The bird described as *Falco aurioculus*, or kahukorako, is the last-named species in the hoary plumage of extreme age. — Ellman, 1861.

Fam. Strigidæ.—Of the genus *Athene* we possess in this country at least two representatives, *Athene novæ-zealandiæ* and *Athene albifacies*, the latter being confined in its range to the most southern parts of the South Island.

There is evidence also of the existence of another owl, of much larger size, and an inhabitant of the sub-alpine parts of the Canterbury Province. It probably belongs to the restricted genus *Strix*, in which the ornithology of Australia is so peculiarly rich. It is described by Dr. Haast as being as large as the *Circus gouldi*, and "of dark brown plumage;" and in the notice of its discovery communicated to the Philosophical Institute of Canterbury, it has been provisionally named *Strix haasti* in honour of that enterprising naturalist.

The natives are acquainted with another owl, of very diminutive size and strictly arboreal in its habits. When our forests have been better explored we may know something more of this recluse species. At present it is impossible to determine to what genus it belongs.

In some species of birds, individuals from different localities present a slight but uniform variation of plumage, sufficiently apparent, although not amounting to a specific difference. This is particularly the case with our common owl. Specimens obtained in the Nelson Province are, on comparison with examples from the opposite side of Cook Strait, invariably found to be more largely marked with white around the eyes and on the feathers covering the base of the bill.

Fam. ALCEDINIDÆ.—The members of the restricted genus *Halcyon* range over the Indian Archipelago, Australia, and New Zealand. Two species appear on our list, viz., *Halcyon vagans* and *H. cinnamominus.* The former of these, our common kingfisher, has an extended range, frequenting alike the sea shore, the outskirts of the forest, dead timber, and the banks of fresh-water streams. It subsists chiefly on small ground lizards (*Tiliqua zealandica* and *T. ornata*), but feeds also on field mice, insects, and grubs.

The other species is of doubtful locality. It is quoted as a New Zealand bird on the authority of Mr. Swainson, who, in describing it (Zoological Illustrations, 1821), observes, "As far as I can ascertain, this beautifully coloured bird is quite new and hitherto undescribed. It is in the possession of Mr. Leadbeater, of Brewer Street, *by whom it was received from New Zealand,* and who gave me the opportunity of now publishing the accompanying figure and description."

Fam. UPUPIDÆ.—The form that constitutes the new genus *Heteralocha* is strictly a New Zealand one. Only one species is at present known, and this is becoming extremely scarce. It is the huia of the natives, and has been appropriately named by Mr. Gray, *Heteralocha gouldi.*

This rare and beautiful bird is confined within narrow geographical limits, its range being restricted to the Tararua and Ruahine mountain ranges, (North Island), with their divergent spurs and the intervening wooded valleys. It is occasionally found in the *Fagus* forests of the Wairarapa Valley, but never wanders far from its mountain home.

The sexes differ conspicuously in form and size of the bill; and the wattles, which in the adult are a bright orange colour, are flesh white in the young bird.

Fam. MELIPHAGIDÆ.—The honey-eating genera, as we have already observed, form an important section of Australian zoology. Even a large group of parrots (*Trichoglossus*) subsist entirely upon the nectar they extract from the flowers of the *Eucalypti*, and for this purpose nature has endowed them with a brush-tongue, in which respect they assimilate to the true *Meliphagidæ.*

Australia proper is the great seat or metropolis of this family. A few species are scattered over the Pacific Isles, and New Zealand possesses five, viz. *Prosthemadera novæ-zealandiæ*, *Anthornis melanura*, *A. melanocephala*, *A. auriocula*,* and *Pogonornis cincta.*

Of these, the two former (the tui and the korimako) are the commonest birds of the country, being more numerous and diffusive in their range than any of the other perchers.

Fam. CERTHIADÆ.—Three groups of this family are represented in New Zealand by the following species, viz. :—*Xenicus longipes*, *X. stokesii*, *Acanthisitta chloris*, *Mohoua ochrocephala*, and *M. albicilla.* A bird mentioned by the Rev. R. Taylor as having been seen by him in the Taranaki country, and described as " a diminutive wren with a mazarine blue crest," will probably be found to belong to the first-named group.

Fam. LUSCINIDÆ.—This comprehensive family embraces the following New Zealand species, viz. :—*Sphenœacus punctatus*, *S. fulvus*, *Gerygone igata*, *G. flaviventris*, *G. albofrontata*, *G. assimilis*,† *Certhiparus novæ-zealandiæ*, *C.*

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* *Anthornis auriocula*, Buller.—This species, which is a native of the Chatham Isles, resembles closely the common korimako (*A. melanura*), but is appreciably larger, and the tints of the plumage are lighter. The chief distinguishing feature is that in this bird the irides are bright yellow, while they are crimson in *Anthornis melanura.*

Mr. Gray, after describing the common species, ('Voy. Er. and Ter.' p. 4), observes, "Two others were also in the collection marked from the Auckland Islands. These differ in being somewhat larger in all their proportions." It is probable that these were specimens of *Anthornis auriocula.* This bird is plentiful on the Chatham Isles, where it is called by the natives "makomako." It appears to hold an intermediate station between *A. melanocephala* and *A. melanura*, the former of which is also a Chatham Island species.

† *Gerygone assimilis*, Buller.—In form and colour this bird is hardly distinguishable from *G. flaviventris*, although somewhat larger. It measures in length $4\frac{1}{2}$ inches; extent, 6; wing from flexure, $2\frac{1}{8}$; tail, 2; rictus, $\frac{1}{4}$; tarsus, $\frac{3}{4}$.

A comparison of the nests of these birds will remove any doubt as to their being specifically distinct. That of the smaller species is a compact little nest measuring about 6 inches by $3\frac{1}{2}$. It is "bottle-shaped"—full and rounded at the base and tapering upwards to a point, by which it is suspended. It is composed of a variety of soft materials—spiders' nests, dry moss, grass, vegetable fibres, &c. The spiders' nests consist of a soft, silky substance, by the aid of which the materials composing the nest are woven into a compact wall with a smooth and finished exterior. The entrance, which is situated on the side of the nest, is so small as to barely admit the finger, and it is protected from the weather by a very ingenious contrivance. It is surrounded by a protecting rim or ledge, composed of extremely fine roots, interlaced or loosely woven together, and firmly secured to the groundwork of the nest. This facing is arched at the top so as to form a vestibule or porch, while at the base it stands out boldly from the wall and is nearly an inch in depth, thus, furnishing a firm and secure threshold for the bird in its passage to and from the cell. The interior apartment or cavity is about two inches deep, and is thickly lined with soft *maculicaudus*, *Petroica macrocephala*, *P. dieffenbachii*, *P. toitoi*, *P. longipes*, *P. albifrons*, and *Anthus novæ-zealandiæ.* The specific difference between *Sphenœacus punctatus* and *S. fulvus*, as determined by Mr. Gray, is open to question, as the former species is subject to much variation.

Probably to the genus *Zosterops* of this family belongs a small migratory bird called by the natives kanohimowhiti. It is properly a South Island species, retiring to the southern parts of Otago during the summer months, and advancing northwards into the Nelson Province on the approach of winter.

The history of its appearance in the North Island is very remarkable. It crossed over, for the first time in the memory of the native inhabitants, in the winter of 1856. It appeared then in flocks numbering from twenty to fifty, and after a sojourn of nearly three months suddenly departed. After this it did not venture across the Straits for a period of [three] *two* years, but appeared in Wellington again, in greater numbers than before, in the winter of 1858, and repeated the visit regularly during the four years that followed. Since 1862 it has been a permanent resident in the Wellington Province, retiring in summer to the elevated lands of the interior, and returning to the coast districts on the approach of winter. This bird is invaluable to the orchards and gardens, where it subsists almost entirely on the destructive little *Aphis* known as American blight. The author has not yet had an opportunity of comparing this little migrant with the four species of *Zosterops* recorded from Norfolk and Lord Howe Islands, and therefore hesitates to pronounce it a new bird.

Fam. TURDIDÆ.—We have two representatives of this family belonging to different genera. One of them, *Mimus carunculatus*,* is found only in the extreme north, while the other, *Turnagra crassirostris*, has a southern range, being extremely rare to the north of Taranaki.

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feathers; and the nest forms altogether a well-proportioned and symmetrical structure, testifying alike to the skill and industry of the modest little builder.

The nest of the other species is of a somewhat similar size, but it is fuller in the middle than the one described, and is pear-shaped towards the apex instead of tapering. The materials composing it are of coarser texture, there is less execution or finish about it, and the ingenious porch, the peculiar feature of the one, is altogether wanting in the other. Moreover, the orifice is much larger, and the interior lining consists of soft grass capsules instead of birds' feathers. The eggs of *Gerygone assimilis* are generally three in number, of proportionate size, slightly pyriform in shape, and marked at the larger end with reddish spots on a white ground, while the eggs of the other species usually number four, are about one-third less in size, and of pure white.

* *Mimus carunculatus*, Buller.—Prevailing colour greyish-brown, darkest on the back; crown and surrounding parts dark brown; on the hind neck and back a touch of white down the centre of each feather; throat and a patch behind each wattle greyish-white; ear-coverts and below the eye silvery gray; sides of the neck and breast tinged with fulvous; on the abdomen a patch of canary yellow, diluted on the edges. Quills and tail-

Fam. Muscicapidæ.—Three species of the genus *Rhipidura* inhabit New Zealand. The fan-tailed flycatcher (*Rhipidura flabellifera*) is the commonest. It very closely resembles an Australian one, but is specifically distinct. The black flycatcher (*R. melanura*) belongs exclusively to the south. Only one instance is recorded of its occurrence, as a straggler, in the North Island. The other species—*Rhipidura tristis*—is quoted by Mr. Gray as an Otago bird.

Fam. Corvidæ.—Of the genus *Callæas* we have two species, closely allied to each other, and named respectively *Callæas cinerea* and *C. wilsoni.*

Fam. Sturnidæ.—Four species are enumerated in this family, viz., *Aplonis zealandicus*, *A. obscurus*, *Creadion carunculatus*, and *C. cinereus.** The two former have a very restricted range.

Fam. Psittacidæ.—The parrots of New Zealand form together an interesting study. Two of the genera, *Nestor* and *Strigops*, are peculiar to our fauna. Of the former, four species inhabit New Zealand,—the *Nestor meridionalis*, or kaka of the natives; the *Nestor notabilis*, a fine alpine species confined to the South Island; the *Nestor esslingii*, which assimilates to the Phillip Island parrot (*N. productus*) in the rich colouring of its plumage; and another, recently discovered, which the author proposes to name *Nestor superbus.*†

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feathers dark brown; on the outermost a terminal spot of white, which diminishes on the succeeding ones and disappears at the seventh quill and on the three medial tail-feathers. Outer web of tertiaries greyish-brown. Bill black, brown at the tip; legs umber brown. Extreme length, 13 inches; wing from flexure, 6; tail, $6\frac{3}{4}$; rictus, $\frac{7}{8}$; tarsus, $1\frac{1}{4}$; hind toe and claw, 1; middle toe and claw, $1\frac{1}{4}$; lateral toes, $\frac{3}{4}$. The wattles are situated immediately below the ear-coverts.

* *Creadion cinereus*, Buller.—This species is of the size and general form of *C. carunculatus*, to which it bears a close affinity, but the colouring of the plumage is altogether different. The common species (the saddle-back) is of a deep uniform black, relieved by a band of rufous brown which occupies the whole of the back, and forming a sharp outline across the shoulders, sweeps over the wing-coverts in a broad curve. In the present bird, however, the plumage is of a dark cinereous brown, paler on the under parts, and tinted with umber on the wings and scapularies; the upper and lower tail-coverts and a few spots on the smaller wing-coverts bright rufous. The wattles are of the same colour and shape as in *Creadion carunculatus*, but somewhat smaller. Extreme length, 10 inches; extent of wings, $12\frac{1}{2}$; wing from flexure, 4; tail, 4; rictus, $1\frac{1}{4}$; tarsus, $1\frac{5}{4}$; hind toe and claw, $1\frac{1}{8}$; middle toe and claw, $1\frac{1}{2}$.

† *Nestor superbus*, Buller.—Crown, hind-neck, breast, scapularies and upper wing-coverts, canary yellow of different shades and tinged with scarlet. Upper surface of wings whitish yellow, the primaries inclining to pale ash. Upper surface of tail when closed pale ashy-yellow, the sides being bright canary yellow with a scarlet tinge. Sides, abdomen, lower tail-coverts, axillaries, lining of wings, lower part of back, and upper tail-coverts bright scarlet, varied on the under parts and minutely edged on the upper tail-coverts with canary yellow. Cheeks, throat, ear-coverts, and a broad nuchal collar paler scarlet, largely mixed on the ear-coverts and collar with bright yellow. The under wing-coverts are beautifully marked with alternate bands of scarlet and yellow. The primaries on their under surface are ashy, marked on their inner vane with triangular spots of scarlet and

Very beautiful varieties of the kaka are sometimes met with. We have seen one with the whole of the plumage of brilliant scarlet shaded with brown, another of uniform pale yellow, and a third with green metallic reflections on all the upper parts. Pure albinos also are of occasional occurrence. These varieties are distinguished by the natives as kakakura kakakereru, and kakakorako, and are in high demand among them.

Like most parrots, it is a long-lived bird. One in the possession of the Upper Wanganui tribes has been chained to its pole for nearly twenty years, and presents the curious feature of its overgrown mandibles completely crossing each other! This is probably attributable to the fact of its having been constantly fed with soft food, thereby depriving the bill of its wear-and-tear incident to a state of nature.

The remarkable genus *Strigops*, or night parrot, is strictly a New Zealand one. Besides the well-known species *Strigops habroptilus* (kakapo), there probably exists another "characterized by the light blue colour on the sides and tip of each plume, in the place of yellowish green; also by the plumes being white instead of yellow, and by their being more numerously banded with black." Mr. Gray, from whose remarks we quote, proposes that, if hereafter proved to be distinct, the new species be named *Strigops greyi*, in honour of Sir George Grey, the Governor of this colony, who presented to the British Museum the specimen from which this description is taken.

A highly interesting paper on the structure and habits of the kakapo was read before the Philosophical Institute of Canterbury, in June, 1863, by Dr. Julius Haast, who, during his explorations on the West Coast of the South Island, where this bird is still comparatively plentiful, had ample opportunity for investigating the subject. The observations which he has so carefully and minutely recorded are a valuable contribution to science, for there can be little doubt that, as colonization spreads into the kakapo country, this species, like many others, will rapidly disappear. Birds possessing so feeble a development of wing as to be unable to fly, cannot, in the struggle for existence, long withstand the oppression of men and their domestic attendants, dogs and cats. The introduced rat (which has multiplied to a prodigious extent, and has almost exterminated the indigenous one) contributes also to the extinction of these races by preying on their eggs and young.

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yellow. Under surface of tail-feathers pale scarlet for two-thirds of their extent, and banded on their inner vane with brighter, ashy beyond, and yellowish towards the tip. Bill and legs dark bluish gray. Extreme length, 20 inches; wing from flexure, 11½; tail, 7½; rictus, 2½; tarsus, 1; longest toe and claw, 2⅜. This extremely rare and beautiful parrot is an inhabitant of the alpine heights of the South Island. Several specimens have been obtained, one of which has recently been deposited in the Canterbury Museum by Alfred Cox, Esq.

Like the *Nestor* of Phillip Island, the kakapo will ere long exist only in our museums, for, with many others of our rarer species, its numbers are already rapidly diminishing.

The other genus of this family that finds a place in New Zealand is the *Platycercus*—a large Australian group of parrakeets. We have two species, *Platycercus pacificus* and *P. auriceps*, the former of which is somewhat rare in the northern parts of the North Island. Towards Cook Strait, however, and throughout the South Island, both species are equally common. The smaller kind (*P. auriceps*) is subject to considerable variation of plumage, and specimens banded with red and yellow, or wholly red, are occasionally found. This fact will probably account for the introduction into our lists of two species (*P. cookii* and *P. unicolor*), which do not actually exist.

The Polynesian *Platycerci* afford a beautiful example of the law of representation. Our *P. pacificus* is represented on Norfolk Island by *P. rayneri*, on Macquarie Island by *P. erythrotis*, and on Auckland Island by *P. aucklandicus;* while several closely allied species are said to inhabit the Fiji and the other South Sea Islands.

Fam. CUCULIDÆ.—New Zealand possesses two cuckoos and both of them are migratory. Whence they come and whither they go has always been and is still a matter of conjecture. The long-tailed cuckoo (*Eudynamys taitensis*) arrives towards the end of October and leaves us in February; while the shining cuckoo (*Chrysococcyx lucidus*) makes its appearance early in October and departs towards the end of the year or beginning of January. They appear to arrive earlier at the extreme north, and to linger there when their notes are no longer heard in the south. This fact, coupled with the circumstance that the natives have from time immemorial called these migrants Birds of Hawaiki, would seem to indicate that they winter in some of the warm islands of the South Pacific.

Both species are parasitic in their nidification, and it is a very curious fact that both of them, notwithstanding their great difference in size, depend on the same little bird (*Gerygone flaviventris*) for the hatching and rearing of their young. Mr. Gould, in treating of the Australian genera, informs us that the genus *Eudynamys* is an exception to the rule in this respect. There can be no question, however, as to the New Zealand bird being parasitical, for the young have been seen attended by the little foster-parents long after the old birds had quitted the country.

During the quiet summer nights, the deep, rich notes of the koheperoa, or long-tailed cuckoo, may be heard at intervals till break of day. This bird is active during the cool hours of the morning, but reposes in the shade during the heat of noon. Its habits are more predatory than is usual with the members of this family. Lizards and large insects form its principal diet, but it also plunders the nests of small birds, devouring alike the eggs and young. The pipiwarauroa, or shining cuckoo, is of a milder disposition, and, like many of its congeners, subsists almost entirely on caterpillars. Its cry is plaintive but musical, and is always welcomed by the colonists as the harbinger of spring.

This bird has hitherto been confounded with an Australian species that closely resembles it. On comparison, however, it will be found that they are quite distinct. The Australian bird is somewhat larger, the metallic lustre of the plumage is not so bright, and the transverse bands of the under parts are narrower and less brilliant; besides which, there is a broad rufous band on the lateral tail-feathers which is altogether wanting in our bird.

Fam. COLUMBIDÆ.—There is an interesting group of fruit-eating pigeons (*Carpophaga*) dispersed over Australia, New Guinea, Malacca, the Celebes, and Polynesia. This genus is worthily represented in our lists by a fine wood-pigeon (*Carpophaga novæ-zealandiæ*), remarkable for its size and the brilliancy of its plumage. It subsists almost entirely on fruit or berries, but when these fail it feeds on the leaves of the kowai (*Edwardsia microphylla*) or on wild cabbage. It breeds in the remote parts of the country, and, notwithstanding the numbers that are annually destroyed, there is no sensible diminution on the recurrence of the shooting season.

Slight varieties occur, and albinos have been recorded, but there is no reason to believe that any other species exists in this country.

Fam. TETRAONIDÆ.—Of this family, also, we have only a single representative, and this is fast disappearing. Our handsome little quail (*Coturnix novæ-zealandiæ*) was formerly so abundant that in one locality in the neighbourhood of Nelson Dr. Monro and Major Richmond shot forty-three brace! This occurred in 1848. It is now almost, if not quite, extinct in the North Island, and is met with only in the unfrequented parts of the South. Its place, however, is adequately supplied by the introduced members of this family, the common pheasant and the Californian quail, both of which, under the protection of the Legislature, have rapidly increased, and are now probably more abundant in the North Island than the indigenous quail ever was.

Acclimatization Societies are now in operation in several of the provinces, and the introduction of useful birds is every day gaining a larger share of public attention; but the colony is greatly indebted to the efforts of private individuals, and especially to Sir George Grey, for many new and valuable additions to its fauna.

Fam. APTERYGIDÆ.—The members of this singular group of wingless birds are exclusively confined to New Zealand. Four species are recorded, viz.

Apteryx australis, *A. oweni*, *A. mantelli*, and *A. maxima;* and it is not improbable that on the West Coast of the South Island there exists another, closely resembling *A. oweni*, but distinguished by its smaller size, more slender legs, and straighter bill.

Only two examples of *Apteryx australis* are recorded*—the original bird figured by Dr. Shaw, in 1813, under that name, and deposited in the Earl of Derby's collection, and another specimen forwarded to Europe by Mr. Mantell—both of which were obtained from Dusky Bay, in the Otago Province. This species may therefore be regarded as belonging to the extreme south.

Apteryx oweni was first described by Mr. Gould, in 1847, from a specimen obtained by Mr. F. Strange. The range of this species appears to be restricted to the South Island. It is still comparatively plentiful in the wooded mountainous country of the Nelson Province.

Apteryx mantelli is the common kiwi of the North Island. It has long since disappeared from the inhabited country, but in the retired hilly districts it is still to be found; and it is an interesting fact in connection with the geographic distribution of species, that on a small wooded island in the Hauraki Gulf, known as the Little Barrier, and rising about 1,000 feet above the level of the sea, this bird is still comparatively numerous although it no longer exists on the neighbouring mainland.

Apteryx maxima is described by Mr. Rochfort, the Provincial Surveyor of Nelson, as "a kiwi, about the size of a turkey—very powerful, having spurs on his legs—which, when attacked by a dog, defends himself so well as frequently to come off victorious." The natives distinguish it as the roaroa.

But in addition to those we have enumerated, there is evidence of the existence of another large bird, probably of the struthious order, which may either belong to this family or may prove to be a living representative of one of the forms hitherto presumed to be extinct. The writer is indebted to Dr. Haast for the following information on the subject:—"I believe I have convincing proof that in those never before trodden alpine forests (Canterbury Province) there exists a large kiwi, the existence of which, till at present, was quite unknown. I have heard many times the roa, the large kiwi of the West Coast, but his call is like the cry of a child to the voice of a powerful man when compared to the call which we heard in the Alps, while

* Since the above was written, Dr. Hector (in whose collection are two specimens, male and female, of this bird) has favoured the writer with the following interesting note:—"*Apteryx australis* is the tokoeka of the Maoris. It is to be found to the north of Milford Sound, but is tolerably abundant in the woods west of Te Anau Lake, and as far south as Preservation Inlet. It is easily recognized by its cry, which is similar to the kiwi's (*Apteryx oweni*), but louder and less shrill."

encamped at the edge of an extensive forest. * * * * It was towards midnight, and though fast asleep, we were all awakened by this remarkably loud call!"

If the accounts of the natives may be relied on, the members of this family possess, in common with the *Megapodidæ* of the Australian continent, a very extraordinary habit of nidification—that of depositing their eggs in a mound of earth and leaves, and then leaving them to be hatched under heat produced by fermentation of the decaying vegetable matter. The natives agree further in the statement that in each of these vegetable mounds only one egg is deposited.

The egg of *Apteryx mantelli* is considerably larger than that of a goose, and is of a creamy white colour. The recent discovery of a nearly perfect moa's egg in an old Maori sepulchre in the South Island, has enabled us to complete the following comparative statement of measurements:—

	Greatest Length.	Greatest Breadth.
Egg of Moa	$9\frac{1}{2}$ inches	7 inches.
" Ostrich	6 "	5 "
" Emu	$5\frac{1}{12}$ "	$3\frac{7}{12}$ "
" Apteryx	5 "	3 "
" Megapodius	$3\frac{1}{4}$ "	$2\frac{1}{8}$ "

Fam. CHARADRIADÆ.—The birds of this family are widely dispersed over the globe. Of the seven species inhabiting New Zealand, two are common to Australia—*Charadrius bicincta* and *Hæmatopus longirostris*—while another, *C. xanthocheilus*, extends its range to Norfolk Island. In the new genus *Thinornis*, our beautiful *T. novæ-zealandiæ* is represented in the Auckland Islands by a closely allied one, *Thinornis rossii*. The others, all of which appear to be exclusively restricted to New Zealand, are *C. obscurus*, *C. frontalis* and *Hæmatopus unicolor*.

Fam. ARDEIDÆ.—The stately white crane (*Ardea flavirostris*) takes a prominent place in this section. New Zealand is its restricted habitat, and its range is limited to the southern districts of the South Island. Occasionally a straggler finds its way to the North Island, but this occurs only at distant intervals, and "rare as the kotuku" is a favourite Maori proverb.

A small slate-coloured heron (*Ardea matook*) inhabits our coasts, and the celebrated night heron of Australia (*Nycticora caledonicus*) is recorded as a straggler, a specimen having been killed some years ago in the neighbourhood of Wellington.

Almost every region of the globe is tenanted by one or more species of bittern. The one inhabiting New Zealand (*Botaurus poicilopterus*) possesses all the characteristics of the genus, and in its general appearance is not unlike the common bittern of Europe.

A spoon-bill is recorded by Mr. Ellman as having been seen at Castle Point (North Island). This was probably a straggler from Australia, being either *Platalea flavipes* or *P. regia.*

Fam. Scolopacidæ.—Of the genus *Himantopus*, New Zealand, like Australia, is inhabited by a single species, known as the stilt plover (*H. novæ-zealandiæ*). It is a handsome bird, and, notwithstanding the extreme length and apparent disproportion of its legs, all its movements are easy and graceful. The range of this plover does not extend further north than the Upper Waikato.

The bird described by Mr. Gray as the male of this species will probably prove to be distinct. The other recorded species are—*Limosa novæ-zealandiæ, Cœnocorypha aucklandica*, and *Recurvirostra* (?) *rubricollis.*

Fam. Rallidæ.—The rails of New Zealand constitute a prominent and peculiar feature in its ornithology. They embrace members of six different genera, each of which deserves separate notice.

Professor Owen had already determined the characters of the presumed extinct genus *Notornis*, when the discovery of a living example, by a party of sealers in Dusky Bay, while it established the soundness of his physiological inferences, furnished another proof of the comparatively recent existence of the moa and its kindred. Only two specimens of this bird have been obtained, both of which are now deposited in the British Museum. They were forwarded to Europe by Walter Mantell, Esq., of Wellington, in compliment to whom Professor Owen named the species *Notornis mantelli.* (Trans. Z.S. III., p. 337.)

Another genus of brevi-pennate rails (*Ocydromus*) is represented by three species, in all of which the anterior extremities are so feebly developed as to be utterly powerless for flight. The *Ocydromus australis* is excessively abundant in the South, and the *Ocydromus earli* is still common in the southern parts of the North Island; but the third species, *O. brachypterus*, is extremely rare, if not already extinct, in all the settled districts.

Our only member of the new genus *Hypotænidia* is the moeriki (*H. dieffenbachii*), an extremely beautiful rail, restricted in its range to the Chatham Islands. Mr. Gray has given an excellent figure of this bird in the Voyage of H.M.SS. "Erebus" and "Terror." This species is also fast disappearing from our fauna. It was sought for in vain during a visit to the Chathams nearly ten years ago, and the natives described it then as the rarest of their birds.

Our representative member of the restricted genus *Rallus* (*R. assimilis*) resembles closely an Australian species, but is distinguishable by the pectoral band and rufous colouring of the head and neck being less prominent. This is the land-rail of the colonists.

We have placed provisionally in this genus a rare and handsome rail, of which a description has been communicated to the Philosophical Institute of Canterbury, and of which only one example is known. It has been named *Rallus featherstoni* * in honour of the present Superintendent of the Wellington Province.

Two members of a smaller group inhabit our marshes and low river banks. Their swiftness of foot, retiring disposition, and semi-nocturnal habits render an acquaintance with their history difficult and necessarily imperfect. The slate-coloured rail (*Ortygometra tabuensis*) is very generally dispersed, and is said to exist in Norfolk Island. In the adult bird the eyes and legs are of a delicate crimson tint, and offer a lively contrast to the sombre plumage. The other species (*O. affinis*) is equally diffusive in its range and apparently more plentiful. It is represented in Australia by the *Porzana palustris.*

The next representative of the family to be noticed is our graceful pukeko (*Porphyrio melanotus*). This fine rail is one of our commonest birds. It runs swiftly and flies well, and consequently, unlike its more feeble congeners, it thrives and multiplies in the settled districts, frequenting the corn fields and potato grounds by night, and retiring to the swamps during the day. It is easily domesticated, and is considered excellent eating.

Fam. ANATIDÆ.—Our finest representative of this section is the paradise duck (*Casarca variegata*). To adopt the words of Macgillivray in treating of the *Casarca rutila* of Europe, " it is one of those birds which one might call a duck, and another with equal propriety a goose ;" but although the genus approaches to *Chenalopex* both in form and colouring, it may safely be placed in the group *Anatidæ*, assigning it there a station indicative of its approximation to the *Anserinæ.* It is very common in the South Island and in some parts of the Wellington Province, but is rarely met with further north.

The other species are *Anas superciliosa*, *Anas chlorotis*, *Spatula variegata*, *Fuligula novæ-zealandiæ*, *Nesonetta aucklandica*, and *Hymenolaimus mala-*

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* *Rallus featherstoni*, Buller.—Crown and surrounding parts brown, variegated with black; chin greyish-white; throat, breast, sides of head, and a band over each eye, ash grey; quills and smaller wing-coverts rufous brown; sides and flanks deep rufous brown, beautifully marked with transverse bars of white. Abdomen and inner side of thighs yellowish brown, obscurely barred. Scapularies and tail-feathers greyish brown, with a broad dash of black down the centre of each feather. Extreme length $11\frac{1}{2}$ inches; wing from flexure $5\frac{1}{2}$; tail $2\frac{1}{4}$; rictus $\frac{3}{4}$; tarsus $1\frac{5}{8}$; hind toe and claw $\frac{3}{8}$; middle toe and claw $1\frac{5}{8}$.

corhynchus. The last named is a genuine mountain duck, frequenting the river sources, and subsisting chiefly on a species of caddis-worm.

Fam. Colymbidæ.—A small dabchick (*Podiceps rufipectus*) is common in our fresh-water lagoons; and a large crested grebe, hitherto undescribed, inhabits the lakes of the south. Dr. Hector obtained several specimens of this fine bird during his exploration of the Otago Province, and they are now deposited in the Provincial Museum. The author proposes to name this species *Podiceps hectori*, in honour of the discoverer, who enjoys a high scientific reputation, not only in this colony, but also in Europe and America.* The first specimens of *P. rufipectus* were forwarded to Europe by the late Dr. Sinclair, R.N.

Fam. Alcidæ.—Four species of penguin have been found on our shores, viz. *Aptenodytes pennantii*, *Eudyptes pachyrhynchus*, *E. antipodes*, and *Spheniscus minor*, but the two former are of very rare occurrence, and have been detected only in the extreme south. The last-named species, which is also common to Australia, is found on all our coasts. It is comparatively plentiful in Cook Strait, and the island of Kapiti is resorted to annually as a breeding place.

Fam. Procellaridæ.—The Southern Seas are peculiarly rich in petrels, nearly 40 species having been recorded by Mr. Gould in the Birds of Australia. As all the members of this family have a strictly oceanic range, we have comparatively little knowledge of their habits and economy. The following 14 species belong to our list:—*Pelecanoides urinatrix*, *Puffinus assimilis*, *Procellaria gigantea*, *P. æquinoctialis*, *P. parkinsoni*, *P. glacialoides*, *P. capensis*, *P. cookii*, *P. gavia*, *P. ariel*, *P. cærulea*, *Prion vittatus*, *Diomedea exulans*, and *D. fuliginosa*.

Fam. Laridæ.—In this division the author has recorded the discovery, on the West Coast of the Wellington Province, of a fine specimen of the *Lestris antarcticus*, or plundering gull. It was unknown to the natives of that coast, and is therefore probably of very rare occurence.†

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* *Podiceps hectori*, Buller.—The distinguishing feature in this bird is an occipital crest nearly two inches in length, and an ample ruff of loose silky plumage which surrounds the upper part of the neck. Forehead, crown and crest-feathers glossy black; lores, intercrural space and cheeks, white shading into pale rufous; ruff, bright rufous, brown towards the throat, but glossy black in its outer portion. General upper surface, greyish-black, with rufous touches on the sides and wings. Under parts white, diluted with grey on the foreneck. Bill greyish-brown, paler towards the tip; feet olivaceous black. (In the female there is less white about the head and neck, and the general tints of the plumage are paler). Extreme length 24 inches; wing from flexure $7\frac{1}{2}$; rictus $2\frac{1}{4}$; tarsus $2\frac{1}{2}$; longest toe and claw, $3\frac{1}{4}$.

† Dr. Hector found another species of *Lestris* in Dusky Bay, on the south coast of the Otago Province. It is considerably larger than *L. antarcticus*, measuring 26 in. in length, and 17 in. from the flexure of the wing to the end of the first primary.

Besides our two common gulls, *Larus antipodum* and *L. scopulinus*, another species (*Larus schimperi*) is quoted by Mr. Gray as a New Zealand bird.

Among the birds enjoying an unlimited oceanic range are the terns, five species of which visit our shores. These are *Sterna strenua*, *S. frontalis*, *S. antarctica*, *Hydrochelidon albostriata*, and *Anous stolidus*.

Fam. PELECANIDÆ.—The great tribe of Cormorants finds no less than eight representatives in New Zealand, named respectively *Graculus carboides*, *G. cirrhatus*, *G. melanoleucus*, *G. varius*, *G. punctatus*, *G. brevirostris*, *G. chalconotus*, and *G. stictocephalus*.

A beautiful gannet (*Sula serrator*) frequents our bays and estuarie and great numbers of them breed on a small island near the Kawhia coast.

We shall conclude this short treatise on the birds of New Zealand by recording the capture of two fine specimens of the frigate bird (*Fregat aquila*), which is undoubtedly the noblest member of this family. One o them was killed in Whakapuaka Bay in the summer of 1855, and is now deposited in the Provincial Museum at Nelson; the other (measurin nearly seven feet in extent) was taken at Castle Point, on the East Coast o the Wellington Province, and came into the possession of George Moor Esq., who generously presented it to the writer of this essay.

ON THE

GEOGRAPHIC AND ECONOMIC BOTANY

OF THE

NORTH ISLAND OF NEW ZEALAND.

By WILLIAM COLENSO, F.L.S.

[*Written for the New Zealand Exhibition,* 1865.]

I. Preliminary.

1. It is very nearly a century since the botany of New Zealand first became known to science. On the north-west shore of Poverty Bay, in the evening of Sunday, the 8th of October, 1769, being early summer, Sir Joseph Banks and Dr. Solander (then first landing with Captain Cook) had the pleasure and privilege of beholding and gathering the first floral specimens of what they then believed to be the vegetation of the great *terra australis incognita.* That was truly a botanical æra; when the queen of natural science—through the efforts of the immortal Linnæus and his zealous disciples, aided by their royal patrons and promoters—vigorously flourished, and bore those pleasing and useful fruits which have come down with such good results to our own times. All those early naturalists in the New Zealand field, to whom her flora is so much indebted—Banks, Solander, Sparrman, and the two Forsters (father and son), were disciples and correspondents of Linnæus. When the writer, in January, 1838, first visited those forests at "Howahowa" (Uaua), Tolaga Bay (whence the earliest specimens of fine plants peculiar to New Zealand were first obtained by those botanists), a deep reverential indescribable feeling stole over him on treading the same ground which Banks and Solander and Cook had trod, and on viewing the remarkable cliffs and trees on which they had often gazed and visited and sketched—a feeling heightened doubtless through conversing with the few old New Zealanders still dwelling there, who have seen and recollected those patriarchs of British enterprise in New Zealand. This present year of grace, 1864, has been lately signalized by Great Britain and the civilized world as that of the tercentenary commemoration of the immortal British poet "of all nations and of all time;" and surely, five years hence, the colonists of New Zealand will suitably commemorate the centenary

landing of the adventurous and celebrated British navigator Cook,—*the great navigator of and for all nations,*—on these shores, with his illustrious band of devoted disciples of natural science! For although many a botanist has followed in their steps in New Zealand, yet none has equalled them, whether the obstacles which impeded, or the fruits of their labours, or their devotedness to their calling, or the correctness of their views, be duly considered.

2. But it is only during the nineteenth century that insular botany has begun to receive that attention which it demands. It could not advantageously have been studied much earlier; and even now it may justly be said to be in its infancy. Island floras, with their geology and climate, have to be more fully explored and made known; and species have to be more clearly defined, and the bounds of varieties ascertained; and the innate powers of a plant to evolve and change under favourable natural conditions have to be better understood, ere many important questions can be satisfactorily answered. Yet that day will come. Every natural fact collected and recorded by the true lover of science is a step towards it. The sphinx, Nature, is daily being evoked by her faithful sons; and her answers, always extorted and always correct, (though not always interpreted correctly), are being registered for future generations. To us it appears strange that a species should be found here, in New Zealand, and its like only at the antipodes; or perhaps at one of the two great southern capes of America, or Africa; or, which is far more probable, only at some small islet—a mere speck in the oceanic waste of waters—as Juan Fernandez or Easter Island, the Falkland Islands or Tristan d'Acunha, St. Paul's or Amsterdam, Kerguelen's Land or Norfolk Island. Is it the very same identical species, or is it only similar? If it is similar, has it become changed through climate, situation, and soil? and if so, how much more may it not change? If the same, was there more than one original germ of its kind? If only one, in which spot was it first? and how many ages rolled by ere it was first found in the other? and how many before it became common therein? Or were the present widely dissevered localities then one continent? and if so, how long a period did it require for the said one germ to reach its present outermost range—assuming such germ to have been originally placed in its centre? If not from one germ but many, were all, required for the various localities, created together? or some earlier, some later? and if so, which localities were the earlier, which the later supplied? Does every island, or island group, far from any mainland, contain genera and species peculiar to itself, (among many which are congeneric with others in the nearest, though far off, land), and thereby constitute a botanical centre or region? Were all existing species created at once? or are species still being created? or has such creation ceased? and if so, when? Are *all* the so-called generic or

specific distinctions really such? Has a species a power of evolution and metamorphosis *per se;* which, the factors, time, suitable soils, and climate being given, knows no bounds? Have there been in past æras any potent occult elemental causes at work, differing only in intensity, combination, and constancy from what now are, through which sub-varieties, varieties and species were the more readily evolved? May not a plant be outwardly distinct, yet chemically the same? May a plant be almost entirely outwardly the same with another, and yet chemically distinct? May not nature educe, under the most favourable circumstances, from two genera slightly differing, fertile plants forming new genera more divergent? and may not such (again crossed by nature) produce plants still more widely differing? Why, among several species of any given endemic genus (*e.g. Coprosma, Dracophyllum, Veronica*), should some species be of robust and vigorous growth and development, and common everywhere; other species of weakly growth and development, and comparatively scarce? Are some of these forms older than others? and if so, which are the seniors? Are not the more robust and vigorous ones, through their own progressive increase, likely to extirpate the weaker ones? . . . . . Such are some of the thoughts which must often arise in the intelligent botanist's mind, especially when contemplating new or old forms in far off insular situations.

II. GEOGRAPHIC.

3. But laying aside the ideal and theoretical, and coming to the practical and real, how does the vegetation of this Northern Island of New Zealand appear when seen for the first time? What is its peculiar aspect? The answer will mainly depend on two things: first, the place whence the newly-arrived beholder last came; and second, the place in New Zealand where he lands; not forgetting his expectations—as the eye ever sees what the mind brings. If he last left the shores of Great Britain, then the recollection of her verdant fields may cause the brown fern-clad hills and dark-green forests of New Zealand to appear the more gloomy and sad; if his last landscapes were either South African or Australian, then their glaucous sea-green hue and arid appearance will be agreeably contrasted with New Zealand forest vegetation; but if he should have come hither direct from the sunny skies and islands of the tropics, with their graceful perennial light ever-green dress, then the New Zealand hills and dells may appear very sombre, and will suffer from recollection and comparison. Again, if he should happen to anchor in one of the many rivers or harbours north of the Thames, while the ubiquitous brown fern (*Pteris esculenta*) is everywhere, he will be struck with the appearance of the white mangrove (*Avicennia officinalis*) growing within the range of the tide, and the romantic pohutukawa (*Metro-*

sideros tomentosa) pendant from the cliffs or perched on some rocky headland; and perhaps in some forest not far off the stately kauri pine (*Dammara australis*) uprearing its lofty head far above all its compeers; but these vegetable characteristics will not be found south of the East Cape.

4. The general appearance of New Zealand vegetation (North Island) is not on the whole of a pleasing character. Brown fern-clad plains, and low hills sometimes of tolerably regular outline, but oftener of all rugged shapes and sizes, and dark-green almost gloomy-looking forests—here extending for many miles, and there in belts or patches—yield not an agreeable prospect. But in summer—when the sombre fern is bedecked with the neat flowering mantle of its neighbour, the myriad blooming manuka (*Leptospermum scoparium*) diffusing also its aromatic smell with every breeze; and the smaller and much more variegated woods, found nestling in deep glens and fringing the watercourses, exhibit their "ever-changing ever-new" forms and summer colours in ever-varying lights and shades—then the New Zealand vegetation appears greatly to advantage.

5. Not many of our larger timber trees are either handsome or graceful in foliage and branching when full grown, although several are both while young:—*e.g.* the drooping branched rimu (*Dacrydium cupressinum*), the graceful fern-plumaged kawaka (*Thuja doniana**), the handsome celery-leaved tanekaha (*Phyllocladus trichomanoides*), the elegant poplar-like rewarewa (*Knightia excelsa*), the soft full-foliaged titoki (*Alectryon excelsum*), the ornate tawhai (*Fagus menziesii*), and in high alluvial soils the spreading tawhairaunui (*Fagus fusca*). Yet what may be absent of beauty and grace is more than supplied in size and utility. The huge bulk of some of the vegetable giants of the New Zealand forests, and the clean symmetrical trunks of others towering aloft in silent grandeur, can never fail to strike the beholder with astonishment and awe, a feeling sense of his own littleness and span-like existence, of admiration at "the (living) high embowered roof, with antique pillars massy proof,—casting a dim religious light,"—ending perchance in lofty thoughts tending towards immortality—is sure in such umbrageous retreats to steal over him.

6. Of our shrubs and smaller timber trees, several are of strikingly beautiful growth, or blossom, or foliage; and are often seen to advantage when standing on some clear glade, or on the outskirts of a forest:—*e.g.* the houhere (*Hoheria populnea*)† and its varieties, the horopito (*Drimys*

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* *Libocedrus doniana*, Hook, f.—Ed.

† *Hoheria populnea:* the botanist Allan Cunningham (who first visited this North Island of New Zealand in 1826, and who created this genus), was an accurate and enthusiastic observer of nature; he thus characteristically and truly notices the beauty of this tree, in drawing up its generic character (published in 1836),—"Arbuscula, spectabilis, sempervirens et maxime ornata in sylvis naturalibus iis."—*Ann. Nat. Hist.*, vol. iii. p. 319.

axillaris), the manukarauriki (*Leptospermum ericoides*), the kohuhu (*Pittosporum tenuifolium*), the kowhai, especially the small-leaved mountain variety (*Sophora tetraptera* var. *grandiflora*), the koromikotaranga (*Veronica*, several species), the mairehau (*Phebalium nudum*), the toro (*Persoonia toro*), the pukapuka (*Brachyglottis repanda*), the northern maire (*Santalum cunninghamii*), the tawari (*Ixerba brexioides*), the tipau (*Myrsine urvillei* and *M. salicina*), the tangeao (*Tetranthera calicaris*), the ramarama (*Myrtus bullata*), the ti (*Cordyline australis*), the kahikomaka (*Pennantia corymbosa*), the pate (*Schefflera digitata*), the horoeka (*Panax crassifolia*) ; and on the sea coast, the karaka (*Corynocarpus lævigata*), the karo (*Pittosporum crassifolium*), and the truly ever-green ngaio (*Myoporum lætum*) — fit symbol of vigorous health on its barren and desolate beaches !—while the tree-ferns are universally praised for elegance of form, and wherever seen, add an indescribable charm to the landscape, and draw willing homage from the delighted admirer.

7. The large virgin forests are generally composed of trees different in genera and sizes. The kauri pine is always associated with other trees, yet its loftiness, its colossal bulk, and peculiar growth—including a huge mound of 8 to 12 feet in height around its base, composed of its own fallen deciduous scales of outer bark—ever give the forest in which it grows a highly characteristic appearance, so that such is truly a kauri forest. A few only of our timber trees can be said to form large forests of a single species, such as (on the low grounds) kahikatea or white pine (*Podocarpus dacrydioides*) ; this alone of all the timber trees is chiefly found growing thickly together. The totara (*P. totara*), may also sometimes be found forming clumps or groves. The tawhai or black birch (*Fagus solandri*) is frequently, in the south parts of the island, the prevailing tree on the sides of clayey hills, where it forms continuous woods. The tawa (*Nesodaphne tawa*), on both dry hills and low alluvial grounds, is commonly found forming large forests. On high grounds in the interior, especially on the old sandstone (palæozoic), the tawhairaunui (*Fagus fusca*) often grows together in large forests ; and the peculiar glory of these woods is their openness and freeness from underwood, so that a traveller may run through them, to the great danger, however, of losing the track. And, at a much higher elevation —4,000 to 6,000 feet—on the top of the mountain ranges, grows an allied species, *F. cliffortioides ;* and with it many small tough thick-growing gnarled shrubs as underwood, which can only be passed by walking *on* (not among) ; and which, with the prostrate and concealed rotten trees and branches, sadly try the traveller's strength and patience, causing him to wish he was again in the low alluvial woods by the watercourses, among the supple-jacks, *Polygonums*, and brambles !

8. In order, however, that the botanical geography of this large island may be the better known, especially to those at a distance, it will be necessary to go a little into detail, and to show the same, as far as practicable, from its insular position, climate, and situation; as well as from a brief comparison of its botany with that of the nearest lands. In doing this, the phænogamous genera and species, including also ferns endemic to our island, will be particularly noticed; and those plants which are very local in their habitat will be pointed out. For although the general climate of the whole island is temperate and genial (extending as it does from 34° to 42° south, and with only two elevations above the line of perpetual snow), several of its vegetable productions are remarkably local. And, that this may be the more naturally and readily perceived, it is proposed to show the same in two ways:—(1) by areas corresponding more or less to its degrees of latitude; and (2) by zones increasing in altitude surrounding the island.*

Of phænogamic *genera* which as far as is at present known are peculiar to the North Island of New Zealand, the following may be mentioned, viz.:— *Entelea*, *Ackama*, *Ixerba*, *Alseuosmia* (several species), *Colensoa*, *Rabdothamnus*, *Nesodaphne* (2 sp.), *Dactylanthus*, and *Adenochilus*; and of ferns, *Loxsoma*. And of endemic *species* of genera hitherto unknown to the other New Zealand Islands, the following:—

PHÆNOGAMS.

Phebalium nudum†	Olea montana	Santalum cunninghamii
Pomaderris elliptica	Geniostoma ligustrifolium	Elatostemma rugosum
,, edgerleyi	Calceolaria sinclairii	Dammara australis
,, phylicifolia	,, repens	Sarcochilus adversus
Clianthus puniceus	Glossostigma elatinoides	Alepyrum pallidum

* I had also drawn a *third* division or classification of many of the plants of the North Island, according to its geognostic formation; but I have been obliged to abandon it, chiefly through want of space. No doubt, hereafter, it will be both interesting and useful to show the geognostic habitats of the various species,—whether on clay or alluvial soils,—on limestone, sandstone (*palæozoic*), or volcanic formations, &c. I feel assured that much more attention is absolutely needful to this branch of the science than has hitherto been given it, as a necessary step towards the solving of the great problem concerning the distribution of plants. I remember well (in 1845) being forcibly struck with seeing certain Bay of Islands plants (*e.g. Metrosideros scandens, Gaultheria antipoda, Cordyline stricta, Lindsæa linearis, Lycopodium volubile*, &c.) on the clayey hills near Wellington—plants which I had not before seen south of the Thames. I may also mention that, in 1844, Dr. Hooker published in the *London Journal of Botany*, Vol. III., the names, &c., of a collection of 123 plants made in the neighbourhood of Wellington by a visitor, of which number only two or perhaps three were not identical with the Bay of Islands plants. Hence arose a suspicion that the North Island of New Zealand possessed but few species, seeing that the same plants were collected in latitudes so far apart. But the fact is, that the same geologic features obtain on those hills as at the Bay of Islands, although but rarely intermediate. And many of these species (as far as I know) are not elsewhere found between 36° South and Cook Strait.

† Also found at Norfolk Island.

Eugenia maire
Meryta sinclairii
Sapota costata*
Olea cunninghamii
„ lanceolata
Vitex littoralis
Pisonia brunoniana*
Tetranthera calicaris
Knightia excelsa
Persoonia toro
Ehrharta colensoi
Microlæna avenacea
„ polynoda
Catabrosa antarctica

FERNS.

Doodia media
„ caudata
Arthropteris tenella
Nephrolepis tuberosa
Lygodium articulatum
Phylloglossum drummondii

10. Besides which there are very many species peculiar to the North Island, but of genera common to all New Zealand, of which species the more notable are the following:—

PHÆNOGAMS.

Ranunculus insignis
„ nivicola
Melicytus macrophyllus
„ lanceolatus
Pittosporum cornifolium
„ crassifolium
„ umbellatum
„ colensoi
„ pimeleoides
„ reflexum
Hoheria populnea (vera)
„ sinclairii
Aristotelia colensoi
Carmichælia pilosa
Quintinia elliptica
Metrosideros albiflora
„ diffusa
„ colensoi
„ robusta
„ tomentosa
Myrtus bullata
„ ralphii
Tetragonia trigyna
Panax sinclairii
Corokia buddleoides
Loranthus tenuiflorus
Coprosma spathulata
„ tenuicaulis
„ grandifolia
„ petiolata
„ propinqua
„ colensoi
„ depressa
„ repens
„ microcarpa
Nertera cunninghamii
„ setulosa
Olearia furfuracea
„ forsteri
„ albida
„ solandri
Lagenophora lanata
Cassinia retorta
Brachycome odorata
Senecio latifolius
„ colensoi
„ greyii
„ perdicioides
„ glastifolius
„ elæagnifolius
Forstera bidwillii
Pratia perpusilla
Gaultheria colensoi
„ fagifolia
„ oppositifolia
Epacris sinclairii
Dracophyllum latifolium
„ squarrosum
„ subulatum
„ recurvum
Myrsine salicina
„ montana
„ divaricata
Logania depressa
Exarrhena petiolata
Veronica pubescens
„ diosmæfolia
„ nivalis
„ spathulata
„ elongata
Utricularia novæ-zealandiæ
„ colensoi
„ protrusa
Plantago uniflora
Chenopodium pusillum
Pimelea buxifolia
„ arenaria
„ prostrata
Libocedrus doniana
Phyllocladus trichomanoides
Acianthus sinclairii
Prasophyllum tunicatum
„ pumilum
„ nudum
Thelymitra colensoi
„ imberbis
Pterostylis micromega
„ foliata
„ trullifolia
„ puberula
Cordyline pumilio
Astelia linearis
„ banksii
Arthropodium cirrhatum
Juncus capillaceus
Luzula colensoi
Chætospora tendo
„ brownii
„ concinnus
„ nitens
Gahnia xanthocarpa
Carex acicularis
„ dissita
„ lambertiana
„ vacillans
Uncinia rubra
„ cæspitosa
„ ferruginea
Agrostis setifolia
Danthonia bromoides
„ nuda

* Also found at Norfolk Island.

FERNS.

Cyathea cunninghamii	Trichomanes elongatum	Adiantum cunninghamii

11. In considering the vegetation of the North Island, in lateral areas nearly corresponding with its degrees of south latitude, the distribution of genera and species peculiar to each area (in a few instances overlapping) will be found very nearly thus:—

(1.) The northern area, from 34° to 35° south, contains:—

Drosera pygmæa	Hibiscus trionum	Ipomæa pendula
Colensoa physaloides	Cassinia retorta	Todea africana
Cassytha paniculata		

(2.) The Bay of Islands area, from 35° to 36° south, contains:—

Barbarea australis	Epacris pauciflora	Peperomia urvilleana
Melicytus macrophyllus	Dracophyllum latifolium	Libocedrus doniana
Pittosporum cornifolium	Sapota costata	Sparganium simplex
„ umbellatum	Geniostoma ligustrifolium	Prasophyllum pumilum
„ reflexum	Rhabdothamnus solandri	Thelymitra imberbis
„ pimeleoides	Gratiola pubescens	Pterostylis trullifolia
Hoheria populnea (vera)	Glossostigma elatinoides	Gleichenia semivestita
Phebalium nudum	Veronica diosmæfolia	„ flabellata
Pomaderris elliptica	„ elongata	Loxsoma cunninghamii
Eugenia maire	Pisonia brunoniana	Lomaria membranacea
Quintinia elliptica	Atriplex billardieri	„ fraseri
Ackama rosæfolia	Tetranthera calicaris	Doodia media
Corokia buddleoides	Nesodaphne tarairi	Schizæa dichotoma
Alseuosmia (several sp.)	Santalum cunninghamii	Marattia salicina
Lagenophora lanata	Elatostemma rugosum	Phylloglossum drummondii

(3.) The Thames area, from 36° to 37° 30′ south, contains:—

Cardamine divaricata	Dracophyllum squarrosum	Pterostylis squamata
Pomaderris edgerleyi	Coprosma crassifolia	Pellæa falcata
Panax anomala	Veronica pubescens	Pteris endlicheriana
Corokia cotoneaster	Spiranthes australis	Gymnogramma leptophylla
Epacris purpurascens	Pterostylis puberula	Psilotum triquetrum
„ sinclairii		

(4.) The East Cape area, from 37° 30′ to 39° south, contains:—

Clematis hexasepala	Euphrasia cuneata	Hymenophyllum æruginosum
Pittosporum rigidum	Myosotis forsteri	Trichomanes colensoi
Epilobium microphyllum	„ spathulata	Davallia novæ-zealandiæ
„ glabellum	Utricularia colensoi	Lomaria nigra
„ melanocaulon	„ protrusa	Dicksonia antarctica
Erechtites prenanthoides	Lemna gibba	„ lanata
Senecio odoratus	Adenochilus gracilis	Polypodium sylvaticum
„ perdicioides	Callixene parviflora	Nephrolepis tuberosa
Gaultheria fagifolia	Arthropodium candidum	Polystichum vestitum
Dracophyllum subulatum	Hymenophyllum pulcherrimum	Leptopteris superba
Calceolaria sinclairii		

(5.) The Hawke Bay and Taranaki area, from 39° to 40° south (excluding plants from above 4,000 feet altitude, which will be noticed separately hereafter), contains:—

Ranunculus geraniifolius
Melicytus lanceolatus
Drosera arcturi
„ spathulata *var.* pusilla
Pittosporum colensoi
„ fasciculatum
Stellaria parviflora
„ elatinoides
Colobanthus billardieri
Aristotelia fruticosa
Stackhousia minima
Carmichælia odorata
„ flagelliformis
„ juncea
Acæna microphylla
Panax simplex
„ colensoi
Ligusticum aromaticum
Angelica geniculata
Loranthus colensoi
„ flavidus
Coprosma fœtidissima
„ colensoi
„ parviflora
„ cuneata
„ linariifolia
„ depressa
„ repens
„ pumila
Asperula perpusilla
Olearia colensoi
„ ilicifolia
„ nitida
„ dentata
Celmisia coriacea
„ glandulosa
Lagenophora petiolata
„ pinnatifida
Leptinella squalida
Gnaphalium prostratum
Senecio elæagnifolius
Pratia perpusilla
Wahlenbergia saxicola
Gaultheria colensoi
„ oppositifolia
Cyathodes colensoi
Epacris alpina
Dracophyllum filifolium
Logania depressa
Gentiana montana
Calceolaria repens
Mazus pumilio
Veronica colensoi
„ lævis
„ buxifolia
„ lyallii
„ cataractæ
„ anagallis
Ourisia macrophylla
Myosotis antarctica
„ forsteri
Exarrhena petiolata
„ saxosa
Polygonum aviculare
„ dryandri
Muhlenbeckia ephedroides
Chenopodium pusillum
Atriplex patula
Pimelea buxifolia
„ lyallii
Zannichellia palustris
Cyrtostylis rotundifolia
„ macrophylla
Pterostylis foliata
Corysanthes rotundifolia
Hypoxis pusilla
Chrysobactron hookeri
Herpolirion novæ-zealandiæ
Astelia nervosa
Juncus novæ-zealandiæ
„ capillaceus
Calorophus minor
Isolepis cartilaginea
Schœnus pauciflorus
„ brownii
„ concinnus
„ nitens
Cladium articulatum
Carex inversa
„ colensoi
„ stellulata
„ teretiuscula
Uncinia distans
„ divaricata
„ rubra
„ cæspitosa
„ ferruginea
Microlæna stipoides
„ polynoda
Danthonia nuda
„ raoulii
Poa lævis
„ colensoi
Gymnostichum gracile
Gleichenia dicarpa *var.* alpina
Alsophila colensoi
Asplenium trichomanes
Riccia acuminata
„ natans

(6.) The southern, or Wellington area, from 40° to 41° 40′ south (Cook Strait), contains:—

Myosurus aristatus
Gypsophila tubulosa
Arenaria media
Carmichælia pilosa
Epilobium tenuipes
Gunnera prorepens
Myrtus obcordatus
„ ralphii
Tillæa purpurata
Tetragonia trigyna
Pozoa trifoliolata
Eryngium vesiculosum
Crantzia lineata
Aciphylla squarrosa
Aciphylla colensoi
Angelica gingidium
Coprosma petiolata
Nertera setulosa
Olearia virgata
„ forsteri
Leptinella pusilla
Senecio greyi
Calystegia marginata
Mimulus radicans
Utricularia novæ-zealandiæ
Plantago spathulata
Atriplex cinerea
Urtica australis
Urtica ferox
Ascarina lucida
Prasophyllum nudum
Apera arundinacea
Agrostis parviflora
Danthonia bromoides
Adiantum formosum
Aspidium oculatum
Gymnogramme rutæfolia
Grammitis rufus-villosa
Riccia fluitans
Parmelia perforata
„ chrysopthalma

12. In further endeavouring to show the distribution of the plants of the North Island by zones surrounding the same, the more noteworthy and stable genera and species alone will be noticed. These will be divided into eight zones, as follow :—

(1.) Maritime and Littoral.
(2.) Coast, mostly within a few yards above high-water mark.
(3.) Lowland,—from the Coast to an altitude of 500 feet.
(4.) Midland,—from 500 to 1,500 feet altitude.
(5.) Upland,—from 1,500 to 2,500 feet altitude.
(6.) Mountainous,—from 2,500 to 3,500 feet altitude.
(7.) Sub-alpine,—from 3,500 to 4,500 feet altitude.
(8.) Alpine,—from 4,500 to snow line.

(1.) The Maritime and Littoral zone contains :—

Myosurus aristatus	Apium filiforme	Plantago spathulata
Ranunculus acaulis	„ australe	Chenopodium (sp.)
Lepidium oleraceum	Coprosma retusa	Atriplex (sp.)
„ incisum	„ petiolata	Salicornia indica
Plagianthus divaricatus	Senecio lautus	Euphorbia glauca
Fuchsia procumbens	Goodenia repens	Desmoschœnus spiralis
Metrosideros tomentosa*	Calystegia soldanella	Leptocarpus simplex
Mesembryanthemum australe	Avicennia officinalis	Carex littorea
Tetragonia expansa	Myoporum lætum	Spinifex hirsutus
„ trigyna	Samolus littoralis	

(2.) The Coast zone contains :—

Hymenanthera crassifolia	Senecio greyi	Pisonia brunoniana
Pittosporum crassifolium	„ colensoi	Muhlenbeckia ephedroides
Hibiscus trionum	Colensoa physaloides	Suæda maritima
Entelea arborescens	Pratia perpusilla	Pimelea arenaria
Discaria toumatou	Sapota costata	Piper excelsum
Corynocarpus lævigata†	Dichondra repens	Peperomia urvilleana
Gunnera prorepens	Mimulus repens	Triglochin flaccidum
Sicyos angulatus	Veronica macroura	Arthropodium cirrhatum
Eryngium vesiculosum	„ speciosa	Bromus arenarius
Meryta sinclairii	„ parviflora	Triticum scabrum
Coprosma acerosa	„ diosmæfolia	Parmelia chrysopthalma
Cassinia retorta		

(3.) The Lowland zone, from the coast to an altitude of about 500 feet, contains :—

Clematis hexasepala	Weinmannia sylvicola	Hypoxis hygrometrica
Ranunculus plebeius	Angelica gingidium	Loxsoma cunninghamii

* The pohutukawa (*Metrosideros tomentosa*) is truly a littoral plant; and yet (in 1841) I detected it growing on the sandstone rocks of the high inland lake Waikare, about seventy miles from the sea; and I find from Dieffenbach (Vol. I. p. 384) that he too had observed it growing on the trachytic cliffs of the inland lake Tarawera (1,075 feet alt., *apud* Hochstetter), at about the same distance from the sea.

† The karaka (*Corynocarpus lævigata*) is naturally a coast plant; but it is sometimes found growing in the interior, in clumps or singly, particularly in the more northern parts, and on the shores of Lake Taupo, where it has been planted as a fruit-bearing tree by the New Zealanders.

Ranunculus hirtus
„ incisus
„ rivularis
Drosera pygmæa
„ auriculata
Pittosporum umbellatum
Plagianthus betulinus
Linum monogynum
Hoheria populnea
Aristotelia racemosa
Alectryon excelsum
Dodonæa viscosa
Dysoxylum spectabile
Melicope ternata
Clianthus puniceus
Carmichælia australis
„ juncea
Metrosideros florida
„ hypericifolia
„ scandens
Myrtus bullata
„ obcordata
„ ralphii
Carpodetus serratus
Quintinia serrata
Ackama rosæfolia
Angelica rosæfolia
Daucus brachiatus
Panax arborea
Aralia lessonii
Schefflera digitata
Corokia buddleoides
„ cotoneaster
Loranthus tetrapetalus
Tupeia antarctica
Coprosma lucida
„ tenuicaulis
„ rhamnoides
„ divaricata
„ propinqua
Calceolaria sinclairii
Tetranthera calicaris
Cassytha paniculata
Hedycarya dentata
Pimelea longifolia
„ virgata
„ prostrata
„ urvilleana
Elatostemma rugosum
Ascarina lucida
Podocarpus dacrydioides
Freycinetia banksii
Adiantum æthiopicum
„ fulvum
Lomaria lanceolata
„ banksii
„ fraseri
Asplenium flabellifolium
„ obtusatum
„ bulbiferum
Doodia caudata
Nephrodium decompositum
„ squamulosum
Polypodium sylvaticum
Gymnogramme rutæfolia
„ leptophylla
Schizæa bifida
„ dichotoma
Leptopteris hymenophylloides
Maratta salicina
Phylloglossum drummondii
Lycopodium billardieri
„ densum
„ laterale
„ volubile
Psilotum triquetrum

(4.) The Midland zone, embracing an altitude of from 500 to 1,500 feet, contains:—

Ranunculus multiscapus
„ macropus
Drosera spathulata
Pittosporum tenuifolium
„ eugenioides
Elæocarpus dentatus
„ hookerianus
Pennantia corymbosa
Carmichælia odorata
„ pilosa
Metrosideros colensoi
„ robusta
Myrtus pedunculata
Weinmannia racemosa
Ixerba brexioides
Panax anomala
Panax edgerleyi
Alseuosmia (sp.)
Coprosma grandifolia
„ robusta
Olea cunninghamii
„ lanceolata
Senecio lagopus
„ glastifolius
Leucopogon fasciculatus
Rhabdothamnus solandri
Ourisia macrophylla
Nesodaphne tarairi
Knightia excelsa
Persoonia toro
Santalum cunninghamii
Epicarpurus microphyllus
Fagus solandri
Libocedrus doniana
Hymenophyllum dilatatum
„ crispatum
„ flabellatum
„ æruginosum
Trichomanes colensoi
Davallia novæ-zealandiæ
Adiantum formosum
Pteris vespertilionis
Lomaria fluviatilis
„ vulcanica
„ elongata
„ nigra
Asplenium trichomanes
Polystichum coriaceum

(5.) The Upland zone, embracing an altitude of from 1,500 to 2,500 feet, contains:—

Ranunculus geraniifolius
Drimys axillaris
Viola filicaulis
Melicytus micranthus
Drosera arcturi
Pittosporum colensoi
Olearia colensoi
Celmisia coriacea
Gnaphalium prostratum
Gaultheria rupestris
„ oppositifolia
Epacris alpina
Uncinia distans
„ ferruginea
Poa lævis
Gymnostichum gracile
Gleichenia dicarpa *var.* alpina
Cyathea smithii

Aristotelia fruticosa
Geranium potentilloides
Carmichælia flagelliformis
Acæna microphylla
Epilobium glabellum
„ melanocaulon
Metrosideros lucida
Coprosma fœtidissima
„ pumila
Asperula perpusilla
Olea montana
Gentiana montana
Logania depressa
Calceolaria repens
Veronica lævis
„ buxifolia
Exarrhena saxosa
Anthericum hookeri
Herpolirion novæ-zealandiæ
Calorophus minor
Alsophila colensoi
Hymenophyllum bivalve
„ pulcherrimum
Lomaria alpina
„ imbricata
„ minor
Polystichum vestitum
Lycopodium varium
„ clavatum

(6.) The Mountainous zone, comprising an altitude of from 2,500 to 3,500 feet, contains :—

Pittosporum rigidum
Coriaria thymifolia
Geranium brevicaule
Carmichælia nana
Epilobium linnæoides
Ligusticum aromaticum
Panax simplex
„ colensoi
Oreomyrrhis colensoi
Coprosma microcarpa
„ cuneata
Olearia dentata
Celmisia incana
Wahlenbergia saxicola
Gaultheria colensoi
Cyathodes colensoi
Myrsine montana
Gentiana pleurogynoides
Veronica diffusa
Pimelea gnidia
Fagus menziesii
Pterostylis foliata
Callixene parviflora
Cordyline indivisa
Schœnus pauciflorus
„ concinnus
Uncinia divaricata
„ rubra
Hierochloe alpina
Danthonia cunninghamii
Hymenophyllum unilaterale
Leptopteris superba
Lycopodium scariosum
Andræa rupestris

(7.) The Sub-alpine zone, embracing an altitude of from 3,500 to 4,500 feet, contains :—

Caltha novæ-zealandiæ
Aciphylla colensoi
Celmisia spectabilis
Forstera bidwillii
Cyathodes empetrifolia
Pentachondra pumila
Myrsine nummularia
Veronica tetragona
Ourisia cæspitosa
„ colensoi
Euphrasia antarctica
„ revoluta
Plantago unifolia
„ carnosa
Fagus cliffortioides
Podocarpus nivalis
Dacrydium colensoi
„ laxifolium
Phyllocladus alpinus
Caladenia bifolia
Astelia linearis
Caltha alpina
Carex acicularis
Uncinia filiformis
Agrostis parviflora *var.* perpusilla
„ setifolia
Usnea melaxantha

(8.) The Alpine zone, or area, comprising an altitude of from 4,500 feet to the line of permanent snow, contains :—

Ranunculus insignis
„ nivicola
Geum parviflorum
Abrotanella pusilla
Raoulia grandiflora
Gnaphalium (Helichrysum) colensoi
Senecio rotundifolius
„ bidwillii
Helophyllum colensoi
Dracophyllum recurvum
Veronica nivalis
Drapetes dieffenbachii
Alepyrum pallidum
Oreobolus pectinatus
Carex pyrenaica
Uncinia scabra
Ehrharta colensoi
Catabrosa antarctica
Stereocaulon colensoi

13. After all, there are still several plants remaining unclassified, as to geographical distribution, habitat, or altitude, not a few of which are among the most noble and useful of all our vegetable productions. These have hitherto not been classed as to area or zone, from their being more or less

ubiquitous. The principal of them will therefore have now to be briefly considered in three separate divisions, viz., (1.) Plants common to the whole North Island; (2) Plants (unenumerated as to area or zone) not found in the south parts of the island; and (3) Plants (also unenumerated as to area or zone) not found in the north parts of the island.

(1.) *Plants common to the whole North Island.*

Among these the following may be noticed:—*Cardamine hirsuta*, in all soils and situations, to the altitude of 2,500 feet; *Elæocarpus dentatus; Aristotelia racemosa, Alectryon excelsum; Dodonæa viscosa; Pelargonium clandestinum*, from the sea coast to 2,000 feet; *Oxalis corniculata*, in all soils from the sea to 2,000 feet; *O. magellanica*, from 500 to 5,000 feet; *Edwardsia grandiflora*, in all soils from the sea to 2,500 feet; *Coriaria ruscifolia*, in all soils (but not *in* woods) from the sea to 3,000 feet; *Rubus australis*, in all soils from the sea to 2,500 feet; *Acæna sanguisorbæ*, in all soils from the sea to 3,000 feet; *Fuchsia excorticata*, from the coast to 2,000 feet; *Epilobium nummularifolium* and *E. rotundifolium*, ascending to 3,500 feet; *E. alsinoides, junceum*, and *pubens*, to 1,000 feet; *Leptospermum scoparium*, in all soils from the sea to 3,000 feet; *Coprosma lucida, grandifolia robusta*, and *tenuicaulis*; *Nertera depressa; Brachyglottis repanda; Sonchus oleraceus*, everywhere; *Wahlenbergia gracilis*, from the sea to 3000 feet; *Gaultheria antipoda* from the coast to 3,000 feet; *Myrsine salicina, australis*, and *divaricata; Olea cunninghamii; Parsonsia*, sp.; *Solanum aviculare* and *nigrum*, from the sea to 1,500 feet; *Veronica salicifolia*, from the sea to 2,500 feet; *Mentha cunninghamii*, ascending to 500 feet; *Nesodaphne tawa*, from 500 to 2,000 feet; *Atherosperma novæ-zealandiæ*, from near the coast to 1,500 feet; *Hedycarya dentata, Knightia excelsa, Pimelea prostrata*, and *P. urvilleana*, from the coast to 1,000 feet; *Podocarpus ferruginea* from near the coast to 3,000 feet; *P. spicata*, from 500 to 2,500 feet; *P. totara*, from the sea coast to 3,000 feet; *P. dacrydioides*, from the coast to nearly 1,000 feet; *Dacrydium cupressinum*, from 500 to 2,500 feet; *Phyllocladus trichomanoides*, ascending to 3,000 feet. The Orchideous genera, *Earina, Dendrobium, Bolbophyllum, Thelymitra, Microtis*, and *Acianthus*. *Phormium tenax*, and *P. colensoi* and their varieties, in all soils and situations, from the sea coast to 4,000 feet; *Cordyline australis*, in all soils and situations, from the coast to 3,000 feet; *Areca sapida*, from 200 to 1,500 feet; *Rhipogonum parviflorum*, in woods, from coast to 2,000 feet; *Arundo conspicua*, in all soils and situations, from the coast to 2,500 feet; *Cyathea medullaris* and *C. dealbata*, from 200 to 2,000 feet; *Dicksonia squarrosa*, from 500 to 1,500 feet; *Hymenophyllum multifidum, dilatatum, polyanthos*, and *demissum; Trichomanes reniforme*, and *T. venosum; Pteris esculenta*, in all soils not wholly wet, from the coast to

3,000 feet; *Lomaria procera,* and its varieties, in all soils and situations, from the coast to 4,000 feet; *Niphobolus rupestris; Botrychium virginicum,* in open lands, from the coast to 1,600 feet; and *Tmesipteris forsteri,* epiphytal, in forests from 300 to 2,500 feet.

(2.) *Northern plants occupying more than one area or zone, not found in the south parts of the island.*

Among these, *Drosera binata,* a Bay of Islands plant, has been very sparingly detected so far south as 39° 30′. *Dysoxylum spectabile,* not uncommon from the Bay of Islands to the Thames, has also been detected as far south as the River Mohaka in Hawke Bay; extreme altitude, 1,000 feet. *Metrosideros tomentosa,* a littoral plant, from the North Cape to Tolaga Bay,* *Alseuosmia,* sp., whose chief habitat is around the Bay of Islands, where, in shady dry woods, it is plentiful; *A. macrophylla* was found at Te Whau, Manukau Bay, in 1841; and, subsequently, a few plants of *A. banksii* in one spot in the dense forests between the River Manawatu and Wairarapa, but none intermediate, ascending to nearly 1,000 feet. *Geniostoma ligustrifolium,* abundant at the Bay of Islands and farther north, ascending to 1,200 feet; a straggling plant (having thicker leaves) has been seen as far south as the woods at Hawke Bay; the only plant, however, noticed south of the East Cape. *Vitex littoralis,* a tree very plentiful at the north, extending quite across the Island, and growing as diffusely on the immediate sea coast as on the high lands, ascending to 1,500 feet, is little known south of the East Cape; one tree, however, is said to be on the islet Mokoia in the large lake at Rotorua, and one is also at Table Cape (north side), its extreme southern limit. *Avicennia officinalis,* a maritime plant, very plentiful from the North Cape to about 37½° south; the mouth of the Waikato River on the west, and within Tauranga Harbour on the East Coast being its south limits. *Persoonia toro,* has not been met with south of Whangarei Bay. *Santalum cunninghamii,* and its varieties, plentiful at the north, has not been noticed south of 38°; yet, at the head of the Wairarapa Valley (just at the entrance of the long forest), in about 41° south, two trees were most unexpectedly found standing together; no more, however, were detected in a journey of three or four days through that forest, performed on several occasions. *Trophis opaca* (or *Epicarpurus microphyllus*) has its south limits at Tolaga Bay, or about 39° south. *Dammara australis,* which grows from the sea side to an altitude of 1,500 feet, in nearly all soils and situations, though its favourite soil is a stiff sterile clay, is very plentiful quite across the island from the North Cape to the Thames, but has its limits on the East Coast at 37½° south

* See footnote, p. 242.

and on the West Coast at Kauri River (Kawhia), 38° 4′ south, where are a few stunted trees. The writer well remembers seeing, in 1841, a straggling tree on the west bank of the River Waikato, a little below Ngaruawahia. *Libocedrus doniana* keeps always in the interior on high ground (500 to 2,000 feet), from 35° to the Thames seems to be its limit. It is, however, strongly suspected that there are *two* species of this genus in the North Island; the *Libocedrus* growing in dense thickets on the Ruahine Mountains, has never yet been found in fruit,* and appears in foliage different from the Bay of Islands plant, which is also of more robust growth. *Phyllocladus trichomanoides*, which is plentiful at the north, from about 35° south (where it has been observed growing from the sea-side to 1,200 feet altitude), has its southern limit at 39½° south, in the mountains inland west from Hawke Bay. *Arthropodium cirrhatum*, a common littoral northern plant, has its south limit at Cape Kidnappers, in 38° 50′ south. *Trichomanes elongatum* has not been met with south of the Thames. *Loxsoma cunninghamii*, for a long time only found at one spot (the noted Kerikeri waterfall in the Bay of Islands), has been also met with at Whangarei and in the Coromandel ranges. *Doodia caudata* (or *media*), so very common at the north, has not been seen south of the Thames, except in *one* locality near Napier; this plant, however, may prove to be a distinct species. *Gymnogramme leptophylla*, plentiful near the head of Manukau Bay, has only been again met with at Ahuriri and Cape Kidnappers. *Lygodium articulatum*, a northern plant, has not been noticed south of the East Cape; and *Schizæa dichotoma* appears to be wholly confined to the *Dammara* (kauri) forests.

(3.) *Plants found plentifully in the southern parts of the North Island, but rarely, if ever, extending north beyond the East Cape.*

Among these the following may be noticed:—*Elæocarpus hookerianus*, extending north to Tolaga Bay; *Hypericum gramineum*, from the coast to 600 feet altitude, has not been noticed north of Table Cape. *Coriaria thymifolia* (several varieties), from the sea coast (Hawke Bay) to 4,000 feet, has not been generally met with north of Poverty Bay; but the very small leaved species, *C. angustissima*, was found in 1838 on Mount Hikurangi, East Cape, and subsequently near the summits of the Ruahine range, at an altitude of 4,500 feet. *Discaria toumatou*, a coast plant, has not been detected north of Poverty Bay. *Potentilla anserina* and *Geum magellanicum* extend from Cook Strait to the East Cape. *Aciphylla squarrosa*, found from the sea coast to 3,500 feet altitude, has not been noticed north of 40° 30′ south. *Craspedia fimbriata*, several varieties, from the coast to 1,000 feet, extends north to the East Cape. *Microseris forsteri*, common near the

* Since made a new species by Dr. Hooker: *L. bidwillii.*

coast, has its north limit about Poverty Bay, where too it is very plentiful. *Taraxacum dens-leonis* growing sparingly with the former, but often rising to a much higher elevation of 3,000 feet, has not been detected north of Tolaga Bay. *Ourisia macrophylla*, found plentifully at from 1,500 to 3,000 feet, has not been seen north of Poverty Bay. *Calceolaria sinclairii* and *Euphrasia cuneata*, coast plants (rising, however, to 500 feet), have their north limits at the East Cape. *Myosotis* and *Exarrhena*, several species met with in both dry and damp spots, from the sea coast to an altitude of 2,000 feet, are unknown north of the East Cape. *Fagus fusca*, found in the interior at an altitude of from 500 to 2,500 feet, has not been seen north of Poverty Bay* while *F. solandri*, a species found much nearer the sea, and attaining to a higher elevation of 4,000 feet, reaches nearly to the East Cape. *Zannichellia palustris*, has not been noticed north of Table Cape; while its aquatic congener, *Lemna gibba*, reaches Poverty Bay. Of Ferns peculiar to the southern parts of the island may be noticed,—*Hymenophyllum bivalve*, *H. pulcherrimum*, and *H. æruginosum*, which extend throughout damp forests in the interior, at an elevation of 2,000 feet, to about 38° south, their north limit. *Davallia novæ-zealandiæ* has been found as far north as the Bay of Plenty. *Lomaria elongata* and *L. nigra*, at an elevation of 1,000 to 1,600 feet, extend plentifully north, from Wairarapa, near Wellington, to 38° south. Small specimens, however, of *Lomaria elongata* have lately been found near Wellington. *Polypodium sylvaticum* (a scarce fern), at a lower elevation, from Wellington to Tolaga Bay, 38° 30′ south; and *Leptopteris superba*, at an altitude of from 2,000 to 3,000 feet, extends north to about 38° south.

14. It has already been shown how widely spread and common many of the plants of this North Island are; nevertheless, there are some, both genera and species, which, as far as is known, are peculiarly local. This, it is believed, is a characteristic feature in the botany of New Zealand, and one which, if hereafter proved to be real, will be worthy of deep consideration,—as to the why such should be. A few of the more strikingly local plants, hitherto only found in *one* small spot, are here enumerated, with their known habitats :—*Clematis depauperata* (*n.*), near Hawke Bay. *Myosurus aristatus*, Palliser Bay. *Ranunculus geraniifolius* (*n.*), between Mount Tongariro and Ruahine mountain range. *Drosera pygmæa*, Cape Maria van Diemen; *Drosera arcturi*, at Taupo, near the base of Tongariro. *Stack-*

* "*Fagus fusca* has not been seen north of Poverty Bay." In 1839, however, I visited a small isolated wood of *Fagus* at the head of Whangarei Bay, but failed in getting any fruiting specimens. That plant, from its vernation, is believed by the writer to be a different species, or, at all events, a marked variety (*Vide London Journal of Botany*, Vol. III. p. 20.) The same tree grows also near Kaitaia Mission Station, north of 35° south. By the northern natives it is called *hutu*.

housia minima (*n.*), Hawke Bay, *Geum parviflorum*, summit of Ruahine Range, east side, 5,000 feet altitude. *Gunnera prorepens* (*n.*), Flat Point, South-east Coast. **Meryta sinclairii* (*n.*), Whangaruru Bay. **Angelica geniculata*, Hawke Bay. *Loranthus colensoi* (*n.*), Waikere Lake. *Coprosma repens* (*n.*), between Mount Tongariro and Ruahine Range; and *C. petiolata* (*n.*), between Castle Point and Pahawa. *Cotula perpusilla* (*n.*), Turakirae, Palliser Bay. *Abrotanella pusilla* (*n.*), near the top of Ruahine Range. *Gnaphalium* (*Helichrysum*) *colensoi* (*n.*), summit of Ruahine Range, east side. *Forstera bidwillii*, west side of Ruahine Range, 4,000 feet altitude. *Helophyllum colensoi* (*n.*), summit of Ruahine Range, 5,000 feet altitude. *Myrsine nummularia* (*n.*), west side of Ruahine Range, 4,500 feet altitude. **Logania depressa* (*n.*), between Taupo and Ruahine. *Calceolaria repens* (*n.*), west base of Ruahine. *Exarrhena saxosa* (*n.*), Hawke Bay. *Utricularia protrusa* (*n.*), Bay of Plenty. *Cassytha paniculata*, near Mount Camel. *Ascarina lucida* (*n.*), three trees growing together in a swamp, at Wairarapa. *Spiranthes australis*, Upper Waikato. *Adenochilus gracilis* (*n.*), near Lake Waikare. *Anthericum hookeri* (*n.*), between Mount Tongariro and the west base of Ruahine. *Hymenophyllum unilaterale* (according to Dr. Hooker, but a *sp. nov. mihi*), on one tree only, but plentiful upon it, in the dense forest, west side of Ruahine Range, 3,000 feet altitude. *Trichomanes colensoi* (*n.*), near Lake Waikare. *Adiantum formosum*, only in one spot in the dense forest between Wairarapa and Manawatu. *Hypolepis millefolium* (*n.*), near the top of Ruahine Range, east side. *Asplenium trichomanes*, Hawke Bay. *Gymnogramme rutæfolia*, near Cape Palliser. *Grammitis rufusvillosa* (*n.*), three specimens only, growing together in the dense forest, east base of Tararua Range. *Riccia natans*, in the little lake Rotoakiwa, Hawke Bay; and *Riccia fluitans*, at the head of the Wairarapa Valley.

15. The North Island of New Zealand also contains several well-known European plants, which were found here by her earlier scientific visitors (exclusive of the host of common plants which have come in with colonization); some of which, curiously enough, have not been found elsewhere in the Southern Hemisphere. Those European plants (several of which are cosmopolites) are of the following natural orders, viz.,—Cruciferæ, 3; Caryophylleæ, 2; Malvaceæ, 1; Geraniaceæ, 2; Oxalideæ, 1; Coriarieæ, 1; Rosaceæ, 2; Onagrarieæ, 1; Halorageæ, 1; Compositæ, 5; Solaneæ, 1; Chenopodiaceæ, 4; Naiadeæ, 3; Aroideæ, 4; Junceæ, 3; Cyperaceæ, 6; Gramineæ, 4; Filices, 7; and Lycopodiaceæ, 1;—total species, 57. It is worthy of remark that not a single species is hard-wooded, scarcely even a

* Of those marked with a star (*) before them, a single plant only has been seen; the letter *n.* after the name, denotes such to be a *new* species.

shrub, save *Coriaria ruscifolia*; and that many of them are sea-side and water plants, identical with those found in Great Britain.

16. Before, however, any comparison is attempted between the botany of New Zealand (North Island) and that of other lands, it will be advantageous further to consider such genera and species peculiar to the island—or to the New Zealand group—as are real and well developed, and which, united, form the characteristic New Zealand botany. Not but that a genus may be (and often is) quite as well developed by a single species as by a number—witness that unique New Zealand plant *Phylloglossum drummondii*, which single species, at present, not only constitutes a genus, but which, by eminent continental botanists, had very nearly been made the type of a new natural order! A genus, although not endemic, may properly enough be said to be "well-developed" in New Zealand, if better species are found, or if more abundantly met with, here than in other countries; if, in fact, New Zealand clearly seems to be its centre, its home. Several of our New Zealand genera were created by her first botanical visitors, Banks and Solander, and by Forster aided by Sparrman*; the younger Linnæus, De Candolle, and R. Brown also made a few. A. Cunningham increased the number considerably from the Bay of Islands plants; and more recently, Dr. Hooker has both confirmed

* Dr. Sparrman seems scarcely to have been done justice to; no New Zealand plant bears his name. G. Forster, however, in his *Voyage round the World* (Vol. I. p. 67, 4to. ed.), speaking of his father and himself, while collecting specimens at the Cape, on their voyage out with Captain Cook, says,—"Our abundant harvest gave us the greatest apprehensions that with all our efforts, we alone would be unequal to the task of collecting, describing, drawing, and preserving (all at the same time) such multitudes of species, in countries where every one we gathered would in all probability be a nondescript. It was therefore of the utmost importance, if we meant not to neglect any branch of natural knowledge, to endeavour to find an assistant well qualified to go hand in hand with us in our undertakings. We were fortunate enough to meet with a man of science, Dr. Sparrman, at this place, who, after studying under the father of botany, the great Sir Charles Linne, had made a voyage to China and another to the Cape in pursuit of knowledge. The idea of gathering the treasures of nature in countries hitherto unknown to Europe filled his mind so entirely, that he immediately engaged to accompany us on our circumnavigation, in the course of which, I am proud to say, we have found him an enthusiast in his science, well versed in medical knowledge, and endowed with a heart capable of the warmest feelings, and worthy of a philosopher." And the father, J. R. Forster, in the preface to his classic *Genera Plantarum* (among much laudatory language), also says,—"Sparrmannus plantas describebat, filius easdem delineabat.—Verum dum Sparrmannus plantas accuratius examinaret, filius et ego sæpe in consilium vocati in commune consulebamus," &c. It is hoped that future botanical describers and nomenclators of New Zealand plants will remember this. No man can read G. Forster's *Voyage*, or the *Observations* and botanical works published by his father, J. R. Forster, without perceiving how much they (we?) were indebted to Dr. Sparrman, who also did so much at the Cape for the advancement of natural science. His memory has been justly commemorated by Thunberg, in the South African genus *Sparrmannia*—a genus very closely allied to the New Zealand *Entelea*.

their genera, and added considerably thereto. Already (paragraphs 9 and 10) the phænogamic genera and species endemic to the North Island, as far as known, have been enumerated; and it now remains to show the well-developed New Zealand genera and peculiar species of the North Island, comprising those which mainly give that peculiar contour—*tout-ensemble*—to her vegetation, in order to the better contrasting of her botany with that of other lands.

17. The phænogamic genera which are truly and pre-eminently New Zealand, are:—**Melicytus*, *Hoheria*, *Entelea*, *Melicope*, *Corynocarpus*, *Carmichælia*, *Carpodetus*, *Ackama*, *Ixerba*, *Aciphylla*, *Griselinia*, *Corokia*, *Tupeia*, *Alseuosmia*, **Coprosma* (also found in Tasmania, but here it has upwards of twenty-five species), *Raoulia*, *Helophyllum*, *Colensoa*, *Geniostoma*, *Rhabdothamnus*, *Teucridium*, *Nesodaphne*, *Knightia*, *Elatostemma*, *Earina*, *Adenochilus*, *Nematocerus*, and **Phormium*;—yet, of these twenty-eight genera, scarcely half of the number are of that class which give the characteristic appearance or stamp to New Zealand botany. Of those which are more noticeable, several are either very local in area, or only occasionally met with. It is, then, to the distinct New Zealand species of genera which her botany has in common with other lands, that so much is due for characteristic vegetable appearance as well as for utility. At the same time, not a few of these will be found to be confined (so to speak) to the New Zealand botanical region. Among the more important and prominent of the species are the following:—

Drimys axillaris
Hymenanthera crassifolia
Pittosporum, upwards of 10 species
Plagianthus, 2 species
Elæocarpus, 2 species
Aristotelia, 3 or 4 species
Pennantia corymbosa
Alectryon excelsum
Dysoxylum spectabile
Pelargonium clandestinum
Coriaria, 3 or more species
Pomaderris, 3 species
Discaria toumatou
Clianthus puniceus
Edwardsia grandiflora
Acæna, 3 species
Fuchsia, 2 species
Epilobium, nearly 20 species and well-marked varieties
Haloragis, 4 species
Metrosideros, 10 species
Leptospermum, 2 or more species
Myrtus, 4 species
Celmisia, 24 species
Forstera, 2 species
Dracophyllum, 14 species
Myrsine, 5 species
Calceolaria, 2 species
Veronica, 40 species
Ourisia, 6 species
Vitex littoralis
Myoporum lætum
Laurelia novæ-zealandiæ
Trophis opaca (or Epicarpurus microphyllus
Pimelea, 10 species
Fagus, 5 species
Dammara australis
Libocedrus, 2 species
Podocarpus, 5 species
Dacrydium, 3 species
Phyllocladus, 2 species
Rhipogonum parviflorum
Anthericum hookeri
Cordyline, 5 or more species
Astelia, 5 species

* Also found in Norfolk Island.

Weinmannia, 2 species	Areca sapida
Ligusticum and Angelica, 16 species	Arundo conspicua
Panax, 10 species	Cyathea, 4 species
Olearia, 20 species	Dicksonia, 3 species

18. Those genera principally belong to the south temperate zone, where their habitat is mostly insular, and not unfrequently of the same meridionals with the New Zealand group. This is in strict accordance with what might have been expected—that from Norfolk Island in the north down to the Antarctic Islands in the south, including the Chatham Islands, the same genera would be found; and, in many instances, there are not only the same genera to be met with, but the same species. Moreover, it should not be forgotten that the majority of those genera are very small, some having only two species each (as *Alectryon*, *Dysoxylum*, *Knightia*, and *Rhipogonum*), others only three or four (as *Hymenanthera*, *Pennantia*, *Clianthus*, *Edwardsia*, *Atherosperma*, *Dammara*, and *Phyllocladus*), and these are only found as single species in their various habitats; and of others, containing from five to ten species each (as *Plagianthus*, *Aristotelia*, *Forstera*, *Ourisia*, *Cordyline*, *Astelia*, *Podocarpus*, and *Dacrydium*), the greater number of species of each genus are to be found in New Zealand; so that New Zealand (the North Island) may not inaptly be deemed their centre or home.

Further still—in the midst of much apparent dissimilarity, which, however, is daily lessening—there is a very great concord or botanical affinity between the vegetation of the various islands lying in or about the same parallels of south latitude. A belt around the globe, containing the Chatham Islands, Juan Fernandez, south Chili, the Fuegian and Falkland groups, Tristan d'Acunha, the Cape, Kerguelen's Land, St. Paul's Island, Tasmania, the south-east coast of Australia, Lord Howe's Island, the Middleton group, and Norfolk Island, all contain the same genera, and in not a few instances (particularly in the smaller islands) the very same species. And this will be much more evident when the *whole* of the botany (*i.e.*, including the numerous smaller Cryptogams,—*Musci*, *Hepaticæ*, *Algæ*, *Fungi*, and *Lichenes*) of those countries is collectively considered; particularly of those, however distant from each other, which partake of the same isothermal and humid climate. If, instead of writing on the botanical geography of the Northern Island *alone* of the New Zealand group, I were writing on that of the *whole* group, and at the same time possessed that necessary intimate botanico-geographical and geognostical knowledge of the interior of the Southern and Stewart Islands which I possess of the Northern Island, I should be in a far better position for comparing the botanical geography of New Zealand with that of other lands lying within or near the same parallels of south latitude than I now am; and, from what I already know, I believe that hereafter, and only in some such way, can the botanical geography of the New Zealand group be truly and efficiently shown and compared. Nevertheless, this cannot presently be done; for, to use the words of Dr. Hooker, "the subject is one that cannot be fully worked out without far more materials than have hitherto been collected............When the floras of the mountains of south Chili, New Zealand, South Tasmania, the Australian Alps, the Crozets, Prince Edward's Island, Amsterdam Island, St. Paul's Island, and Macquarrie Island" [and of all other islets lying south of 27° south], "shall have been properly explored" [together with their geology and climate], "the great problem of representation and distribution in the South Temperate and Antarctic Zone will be solved."*

19. Referring again to those genera which, though not endemic, possess characteristic New Zealand species, the following will be found to be their geographical distribution, including also a few species that are identical:—*Myosurus aristatus*, a plant of the Chilian Andes; *Drimys*, a small genus of only three species, one of which, the celebrated Winter's bark (*D. winteri*) is confined to Fuegia, and another has recently been found so far north as the alpine mountains of Borneo; but the New Zealand plant (*D. axillaris*) is very closely allied to a kindred plant much nearer home, one of another very small genus of two or three species, the *Tasmañia aromatica* of Tasmania. *Hymenanthera*, a genus of only four species, has a species in New Zealand, one in Norfolk Island, another in Tasmania, and another in Australia. *Pittosporum* has about a dozen species in Australia, and one in Tasmania, but "the maximum of this genus will probably be found in the Pacific Islands."† *Colobanthus billardieri* is also found in Tasmania and Campbell's Island. *Plagianthus* has a few species in New Holland and Tasmania. *Elæocarpus* has several species in tropical India and the Pacific Islands, and one species in New South Wales. *Aristotelia* has species in Chili, and one in Tasmania. *Pennantia*, a genus of only three species, one of which (*corymbosa*) is in New Zealand, one in Norfolk Island, and one on the coast of West Australia. *Alectryon excelsum* is said (by De Candolle, with some degree of doubt) to have a single allied species in New Holland. *Dysoxylum* (*Hartighsea*) has a species in Norfolk Island, and, perhaps, another on the east coast of New Holland. *Pelargonium clandestinum* is also found in Tasmania, Tristan d'Acunha, and the Cape; to which countries this extensive genus is almost wholly confined. *Oxalis magellanica* is also found in Tasmania and Fuegia. *Coriaria*—two at least of its species are common in south Chili. *Pomaderris* has several species in New Holland and Tasmania. *Discaria*, a small genus, is found in South America, Australia, Tasmania, and the Galapagos Islands. *Clianthus*, another small genus,

* Introductory Essay, "Flora Nov. Zel.," Vol. I., p. 33.

† Flora Tasmaniæ, Vol. I., p. 38.

is only again met with in Norfolk Island and New Holland. *Edwardsia* (*Sophora*) *grandiflora* is common in Chili, Chiloe, and Juan Fernandez; but, curiously enough, the genus is not found in Tasmania or Australia, where plants of the same natural order are so very common: this small genus only possesses some six or seven species, two of which, according to De Candolle, are confined to the Isle of Bourbon. *Acæna* has two species in Tasmania and Australia (one of them being the common New Zealand one), and several in South America, and in the Antarctic and Kerguelen's Islands. *Fuchsia*, a large genus; yet, out of New Zealand, is only found in South America, from Mexico to the Straits of Magellan. *Epilobium*, an extensive European genus, is also found in south-east and south-west Australia, in western South America, in the Antarctic Islands, and in Tasmania; but "is more abundant in New Zealand than in any other part of the globe;"* the six species found in Tasmania are all natives of New Zealand. *Haloragis* is found in south-east Australia, Tasmania, and Juan Fernandez. *Metrosideros*, in south Chili, the Cape, and Australia. *Leptospermum*, in south-east Australia and Tasmania. *Myrtus*, in Chili and at Cape Horn. *Montia fontana*, the only plant of this genus, is also abundant at Cape Horn, Kerguelen's Land, the Antarctic Islands, and Tasmania. *Weinmannia*, at the Cape, Madagascar, the Isle of Bourbon, Tahiti, and south Chili. *Ligusticum* and *Angelica*, several species in the Antarctic Islands. *Panax*,—our New Zealand species have close alliance with species in the Antarctic Islands and Chili; one small species alone of this genus is found in Tasmania, the only representative in that island of the natural order (*Araliaceæ*) to which it belongs; of which order, also, only eight or ten species are found in Australia. *Meryta*, a singular genus of only four or five species, two of which are found in Norfolk Island and one in Tahiti. The fine composite genera, *Olearia* and *Celmisia*, are also found in Australia and Tasmania; the latter genus, however, so well developed in New Zealand, is only feebly so by a single species in each of these two countries. Of the smaller Compositæ, *Lagenophora*, a small genus, is also found in Antarctic America, the Falkland Islands, Australia, and Tasmania. *Abrotanella* is confined to New Zealand, Tasmania, the Antarctic Islands, Fuegia, and Kerguelen's Land; and *Microseris*, a genus of only two species, is found in Tasmania and west Chili. *Olea* has a closely allied species in Norfolk Island, and others at the Cape, Mauritius, and Bourbon. *Sapota costata* is also found in Norfolk Island. *Forstera* is confined to New Zealand, Tasmania, and Fuegia. *Dracophyllum*, so well developed in New Zealand, extends south to the Antarctic Islands, east to

* Flora Tasmaniæ, Vol. I., p. 116.

the Chatham Islands, and north to New Caledonia; one species is also found in New South Wales. The large tropical genus *Myrsine*, containing above eighty species, of which fifty are Brazilian and Indian, and thirty insular,—from the West India Islands to the Sandwich Islands and Borneo, and southwards in Norfolk Island, New Zealand, and the Antarctic Islands,—is not found in Tasmania (where there are no plants of the whole natural order), and has only three species in Australia. *Geniostoma*, a small and wholly insular genus of only three species, one of which is found in the Isle of Tanna and another in the Isle of Bourbon. *Calceolaria* (another curious instance like that of *Fuchsia*) is only found besides in western South America, where it is common. *Veronica*, a large cosmopolite genus, is comparatively scarce in Tasmania and Australia; it abounds however throughout the New Zealand group and the Antarctic Islands, and is also found in the Falklands. *Ourisia* is found in Fuegia, and has one small species in Tasmania. *Myoporum*, in Tasmania and south-east Australia. *Atherosperma*, a very small genus containing only three other species, one of which is found in Tasmania and one in south Chili. *Pimelea* is well represented in Australia and Tasmania, while *Knightia* has only one other species, and that in New Caledonia. *Drapetes*, a small genus of only four species, one of which is found in Fuegia, and another as far north as the alpine mountains of Borneo. *Australina*, a curious small genus of only two species, one of which is in Tasmania. *Elatostemma*, another small genus, has a second species in the Society Islands. *Euphorbia glauca* is also found in Norfolk Island. *Piper excelsum* is also found in Norfolk Island, and has allied species in the Fiji and other South Sea Islands; so also has *Peperomia*. *Ascarina*, a small genus of only two species, one of which is in the Sandwich Islands. *Fagus*, a genus in the southern hemisphere, confined to south Chili, Fuegia, Tasmania, and New Zealand. *Dammara*, a small genus, one species of which is found so far north as La Perouse or Vanicolla Island, 11° 40′ S., 167° E., which, with another species said to be in the Fiji Islands, are all that are known in the southern hemisphere. *Libocedrus* (*Thuja*) *doniana* is closely allied to the "alerse," a highly useful species (*Thuja tetragona*), found in south Chili. *Podocarpus* is found in south Chili, and one small bushy species is found in Australia and Tasmania. *Dacrydium* has one noble species in Tasmania, the celebrated Huon pine, and several in the Polynesian Islands. *Phyllocladus*, a small genus of four species, one of which is in Tasmania, and one has lately been discovered so far north as the alpine mountains of Borneo. Most of the New Zealand orchideous genera, and some of the species, are found in Australia, Tasmania, and the Antarctic Islands. *Rhipogonum*, a genus of only two species, has one species in New Holland. *Callixene*, a genus of only three species, has two species in south Chili and in Fuegia. *Phormium* is only found besides in Norfolk Island.* *Cordyline* has a few species in Norfolk Island and one species in Australia. *Astelia* is found in Fuegia, Oahu, and Tasmania. *Areca sapida* is believed to be confined to New Zealand and to Norfolk Island, but the genus is found in some islands of the Malay Archipelago. The three genera of the New Zealand tree-ferns, *Cyathea*, *Alsophila*, and *Dicksonia*, are also found in Norfolk Island and in Tasmania; and of the New Zealand ferns, generally, it may be said, that their southern genera and species (excluding those few which are endemic) are also found in Norfolk Island, Tasmania, South America, and the Antarctic Islands; and more sparingly in Juan Fernandez, Chiloe, the Falkland group, Tristan d'Acunha, Kerguelen's Land, and the Cape.

20. Moreover, of the three great natural orders, Leguminosæ, Myrtaceæ, and Proteaceæ, so very common in Australia and tolerably so in Tasmania, but very few are found in New Zealand, and curiously enough these few do not belong to any of the great Australian genera, such as *Acacia*, *Eucalyptus*, *Melaleuca*, *Grevillea*, and *Hakea*. The Australian and Tasmanian species alone of the genus *Acacia* are upwards of 260 in number; and of *Eucalyptus*, *Melaleuca*, *Grevillea*, and *Hakea*, each genus numbers above 100 species. Not a single species, however, of those great genera has been found in New Zealand. Of Leguminosæ, of which order Australia has upwards of 900 known species, and Tasmania nearly seventy, New Zealand possesses some seven or eight species, belonging to three small genera; one of which, *Carmichælia*, having five of the eight species, is confined to New Zealand; and of another, *Edwardsia* (if separated from *Sophora*, a very small genus), the New Zealand species, *E. grandiflora* (as has been already shown, par. 19), is only found in Juan Fernandez and south Chili. Of Myrtaceæ (of which order Australia has upwards of 650 known species and Tasmania thirty-six), New Zealand has only fifteen species, belonging to four distinct genera, of which genera only one (*Leptospermum*) is found in Tasmania; and another of them (*Myrtus*), which has four species in New Zealand, is also not found in Australia. Of Proteaceæ (of which order Australia has also 650 known species and Tasmania only twenty-two), two species

* Since writing the above I have seen the following in an Auckland paper (*New-Zealander*, 2nd September, 1864).—" AUSTRALIAN PHORMIUM TENAX.—The *Pastoral Times* of the 13th inst. says,—'Large quantities of this plant have been found growing in the mallee scrub on the Lachlan plains. The flax is three or four feet high, and from one inch to two broad. It is stronger in its fibres than the New Zealand flax, and would seem to be exempt from the oily (*sic*) properties which render the New Zealand flax so difficult to convert into useful purposes. It is believed that by the aid of the small steamers running up our rivers, we shall be enabled to collect vast quantities of the article. Some specimens have already been forwarded to Melbourne for the purpose of being tested.'" I have great doubts, however, of its being *botanically* correct.

only are found in New Zealand. Of the whole twenty-four or twenty-five species of those three great natural families found in New Zealand, only *one* species, the common tea-tree (*Leptospermum scoparium*), is found in Tasmania and Australia, while those countries possess upwards of 2,200 known species.

21. Darwin indeed states, that "New Zealand in its endemic plants is much more closely related to Australia, the nearest main land, than to any other region."* Dr. Hooker, however, in his elaborate Introductory Essay to the *Flora Tasmaniæ*,† does not go so far as this, although he, too, says, "that 216 or one-fourth of the New Zealand phænogams are natives of Australia, and of these 115 species are confined to these two countries;" and, "that of the 115 specimens peculiar to Australia and New Zealand, only twenty-six belong to genera peculiar to those countries, and only six to the long list of Australian genera which contain upwards of twenty species each." Nevertheless it is believed that this comparison will be very materially altered when the *whole* of the flora of New Zealand and the many other Polynesian Islands shall be fully known. Already, since the publication of the *Flora Novæ-Zelandiæ*, have new species been discovered in New Zealand, particularly in the South Island; where, too, are several South American genera hitherto not detected in the North Island (as *Donatia*, *Rostkovia*, *Gaimardia*, &c.), and, consequently, not referred to in this essay. And of those twenty-six species belonging to genera at present only common to Australia and New Zealand, may it not reasonably be expected that some of these will be also found in the many unexplored sub-tropical islands? Again, seeing that the striking characteristic Australian genera, while found in Tasmania, are wholly wanting in New Zealand, and that the characteristic New Zealand genera are also (as such) wanting in Australia, is it not evident that it is not so much from what *is* (the positive), as from what is *not* (the negative), that the better comparison can in this case be drawn, and the truer botanical affinity deduced? Reviewing, then, what is already known of New Zealand and southern insular botany, and looking forward expectingly to future kindred revelations, it is not unreasonably believed that the botany of the New Zealand group will be found to be peculiar, and *not* so closely related with the nearest main-land (Australia) as with many other small islands, and therefore forming with them a southern botanical insular region, of which New Zealand is probably about the existing centre.

22. In bringing this necessarily imperfect outline of the botanical

* Origin of Species, chap. xii.

† Page 88. An admirable work, well worth the serious study of every student of New Zealand botany.

geography of the North Island to a close, many such thoughts as the following present themselves for consideration :—

Is there a natural law affecting the dissemination of plants?

Is a climate or geognostic difference of greater value than a mere geographical one?

Did cosmopolite genera or species proceed from a single germ or centre? and, if so, how did they reach the extreme outposts?

Did endemic genera and species proceed from a single germ or centre? and, if so, can that centre be found?

How is it that of some insular genera (*e.g. Coprosma*) there are many species and varieties; while of others (*e.g. Corynocarpus, Geniostoma, Carpodetus*) there is only one?

Were all such genera created simultaneously? and the large genus with all its species and varieties?

Are genera having many species older than those having only one, or *vice versâ?*

May not the several species and varieties of an insular or endemic genus be validly considered as having originally sprung from one species or plant?

Why are several species of the numerous-seeding and easily-distributed natural order Compositæ so comparatively scarce and very local? *e.g.*, several species of the genus *Celmisia;* the new Zealand daisies, *Brachycome sinclairi* and *B. odorata; Gnaphalium prostratum,* and *G. colensoi; Senecio greyii,* and *S. perdicioides;* and *Taraxacum dens-leonis? Senecio perdicioides* has not been found by any botanist since Cook's visit. *Senecio greyii,* although producing its fine flowers by hundreds, is very local, hitherto only met with in one rocky spot. And the small indigenous *Taraxacum dens-leonis* is comparatively very scarce; while the larger introduced plant is rapidly becoming a perfect pest, growing, together with the English daisy, by hundreds and thousands.

Does New Zealand (with the islets lying north and south) possess a peculiar botany of her own?

Is New Zealand the centre of this botanical region, at least as regards New Zealand species found north and south of her?

How is the isolation of certain species to one peculiar plant, spot, or locality (as stated in paragraph 14), to be accounted for? This last thought is never more strongly felt than when on the tops of a secluded mountain range, or in the depths of a deep untrodden glen, *one* or a *few* plants of any species are found, but no more; perhaps no more in the island! or, at all events, no more have been detected after several years of diligent research. How is this to be accounted for, if all present species were created as they now are, and at one time? There, in its habitat, everything has for years—or ages—combined to favour the growth and spread of that plant; but, although flourishing, it has not spread. Are we to infer from its scarcity that it is but a creation of yesterday? or the lingering relic of a past race? or a new form, or a sportive hybrid of nature?

Lastly, may future varieties in certain species be hereafter the more reasonably expected to take place in New Zealand, or *vice versâ*, through colonization, and through the introduction of congeneric plants of honey-making insects and of insectivorous birds?

* * * * * * *

III.—Œconomic.

23. In considering the œconomic botany of this island, the past should not be wholly omitted. It cannot, at least, be uninteresting to know something of those plants which, for a long period, were of the utmost importance to the race which preceded the colonist on these shores, and to which a large population was mainly indebted for food, for clothing, and for numerous articles of utility and of ornament. Such an inquiry, however brief, is become the more necessary from the fact that, owing to the great and growing disuse of many of those plants which were formerly prized and sought after, the knowledge of their qualities and uses is rapidly becoming forgotten. It is therefore proposed to show, with reference to the past—(i.) the plants used as food; and (ii.) those of utility and ornament to the New Zealander of former days.

(i.) The vegetable articles of food not introduced by Europeans, used by the natives of this island, were tolerably numerous, however inferior the qualities of many of them might be. Most, however, were only obtained through much labour, which, no doubt, contributed not a little towards the robust health of the consumers. Those food-yielding plants may be thus placed:—(1.) Main articles of food; and (2.) smaller fruits and vegetables commonly used, including those only resorted to in times of great scarcity.

(1.) The main or staple articles of vegetable food were but few in kind. They comprised those cultivated and those which were wild. The cultivated vegetables were only three in number; and which, curiously enough, and like the garden produce of many other countries, were not indigenous. These were—two roots, and one gourd-like fruit; the kumara, or sweet potato (*Convolvulus batatas*), the taro (*Caladium esculentum*), and the hue, a large kind of gourd, a species of *Cucurbita*. Of the first, the kumara, they had a large number of varieties, widely differing from each other in quality, appearance, and colour; which, of itself, is a highly puzzling problem, seeing the plant in this country never flowers. Of this root, most valuable to them, they must have raised immense quantities annually—an operation requiring unceasing care and toil on their part, as they generally fresh-gravelled their plantations every year; and which, combined with the great care required for the raising, keeping, and preservation of this root, could only have been effectually done through the beneficial influence of the *taboo* (tapu). Of the second, the taro, they had also several distinct varieties (exclusive of the inferior kind called by them tarohoia, which, with many other roots, was introduced by Europeans); they also ate the thick succulent stems of this plant, as well as its root, and sometimes its leaves. A large flourishing taro plantation is one of the most beautiful cultivations the writer has ever seen. These were planted in regular quincunx, the soil evenly laid, and strewed with white sand, and patted with their hands, giving such a relief to the elegant large shield-like dark-green versatile leaves of the taro, drooping gracefully from their thick clean red-brown stalks, and were scrupulously kept in perfect order. This plant very rarely flowers, and it has never been known to produce seed. The third, the hue, which is only propagated by its seeds, is very constant to its kind, although it varies much in size and shape, and has no varieties. The staple uncultivated articles of vegetable food were three fruits, the well-known fern-root, and the wild sow-thistle. Those three fruits are peculiar to the country, and comprised the hinau (*Elæocarpus dentatus*), the karaka (*Corynocarpus lævigata*), which was often planted about their villages, and the tawa (*Nesodaphne tawa*). Those berries (*drupæ*) were not however such as are generally known to civilized nations by the name of edible fruits, being scarcely so, especially those parts of them which were mainly used, save through long and necessitous habit. Although those fruits were yielded spontaneously and in abundance where the trees producing them grew, yet the gathering, preparing, and storing them, so as to be kept fit for food, was no light labour. The kernels of the karaka, after due preparation, would remain sound some time in a dry store, but not near so long as those of the tawa. Much labour, too, was required to procure and fit the aruhe or root of the common fern of New Zealand (*Pteris esculenta*) for food, while the spots producing fern-root of the best quality were by no means common. The puwha, or milk-thistle (*Sonchus oleraceus*), the large-leaved variety, was common, though not, it is reasonably suspected, too plentiful; and this was abandoned for the smaller-leaved European kind (after its introduction), as being less bitter and more palatable.

(2.) The smaller fruits and vegetables invariably used while in season comprised (*a*) those which were largely and commonly used, viz.,—The fruit of the tutu or tupakihi (*Coriaria ruscifolia*), the pleasant juice of which in the early summer was drunk with avidity in large quantities; the berry of the kohutuhutu or kotukutuku (*Fuchsia excorticata*); the kohoho or poroporo (*Solanum aviculare*), which, too, was sometimes planted; the fruits of the five following timber trees,—the miro (*Podocarpus ferruginea*), the mataii (*P. spicata*), the totara (*P. totara*), the kahikatea (*P. dacrydioides*), the fruit of which was called koroi, and the rimu (*Dacrydium cupressinum*); and also the fruit (ureure) and sugary bract-like spadices (tawhara) of the climbing plant kiekie (*Freycinetia banksii*). The watery honey from the perianths of the korari (*Phormium tenax* and *Ph. colensoi*) was also collected and eaten in large quantities; and so was a similar substance from the flowers of the pohutukawa (*Metrosideros tomentosa*). (*b.*) Those which were less often used: the curious red fruit (*arillus*) of the titoki or titongi (*Alectryon excelsum*); the fruit of the tutupapa (*Coriaria thymifolia*); of the New Zealand bramble, tataramoa (*Rubus australis*); of two of the New Zealand myrtles, the ramarama (*Myrtus bullata*), and the rohutu (*M. pedunculata*); of several species of *Coprosma*, particularly of the karamu (*C. lucida* and *C. robusta*), of the papaauma (*C. grandifolia*), and of the two littoral species taupata (*C. retusa*), and tataraheke (*C. acerosa*); of the koropuku (*Gaultheria depressa*); of the poroporo (*Solanum nigrum*); of the kawakawa (*Piper excelsum*); and of the karaeao or pirita (*Rhipogonum parviflorum*). The pollen also of the flowers of the large bulrush (*Typha angustifolia*) was extensively collected in its season by the southern tribes, and made into large gingerbread-like cakes, called pungapunga. Besides which the following roots and plants were often eaten, viz., the roots, cooked, of the panahi (*Calystegia sepium*); of the maikaika (*Arthropodium cirrhatum*); the tubers of several small orchideous genera, such as several species of *Thelymitra*, of *Microtus porrifolia*, of *Orthoceras strictum*, and of *Gastrodia cunninghamii*, containing "salep;" the roots of the little sugary tikoraha (*Cordyline stricta*), of the large ti or cabbage-tree (*C. australis*), and of the large fern, para (*Marattia salicina*). Also, the cooked leaves and herbaceous tops of the toi (*Barbarea australis*), and of the poroporo or raupeti (*Solanum nigrum*); and the baked inner stems and sago-like pith of the large black fern tree, korau or mamaku (*Cyathea medullaris*). The young succulent unexpanded shoots of several ferns, such as those of *Pteris esculenta*, *Asplenium lucidum*, *A. bulbiferum*, *and Botrychium virginicum*; several fungi, chief among which were the four following, which grow on trees,—the harori (*Agaricus adiposus*), the hakeke and the popoiahakeke (*Polyporus* sp.), and the pekepekekiore (*Hydnum clathroides*); also three terrestrial ones—the paruwhatitiri (*Ileodictyon cibarium*), the pukurau (*Lycoperdon fontanessii*), and the curious species *Aseröe rubra*. The young inner blanched leaves and heart of the ti or cabbage-tree (*Cordyline australis*), and of the nikau or New Zealand palm (*Areca sapida*), were eaten both raw and cooked. A few also of the sea-weeds were eaten, such as the karengo (a tidal species of *Laminaria* found plentifully from the East Cape to Cape Turnagain), the rehia, the rimurapa (*D'Urvillæa utilis*), and some others, including *Porphyra vulgaris;* some of which were also used exclusively to thicken the sweet juice of the tupakihi or tutu (*Coriaria ruscifolia*) ; while the small berries of the makomako (*Aristotelia racemosa*), of the heath-like totara (*Leucopogon fraseri*), and of two species of *Muhlenbeckia* (*M. adpressa* and *M. complexa*), of the ngaio (*Myoporum lætum*), of two species of *Pimelea* (*P. prostrata* and *P. arenaria*), and the large plum-like fruit of the taraire (*Nesodaphne taraire*), fine-looking but not very gustable, were eagerly sought after in their season by children; who also, with adults, thought highly of a sugary manna-like exudation (of doubtful vegetable origin) called pia-manuka, and found in the summer occasionally on the branches of the *Leptospermum scoparium.* The aromatic root and stem of the papaii (*Aciphylla squarrosa*), and the insipid watery koreirei, or roots of *Typha angustifolia*, were also eaten raw ; while in times of great scarcity the roots of the matuakumara (*Geranium dissectum*), and of the ririwaka (*Scirpus maritimus*), were also eaten.

(ii.) The plants of utility and ornament were very numerous—from the giant pine to the tiny moss. These may be conveniently classed thus:—(1.) Clothing, or fibre-yielding plants; (2.) timber trees, and other plants, whence they obtained their canoes, war and husbandry instruments and vessels; and (3.) plants and vegetable substances used as ornament.

(1.) Of the clothing, or fibre-yielding plants, one only was generally cultivated, and that, too, was not indigenous, viz., the aute, or paper-mulberry tree (*Broussonetia papyrifera*); this shrub, or small tree, was assiduously planted, but only for the purpose of obtaining white fillets for the hair of the chiefs. It has long been nearly, if not quite, extinct. The harakeke, or New Zealand flax (*Phormium tenax* and *Ph. colensoi*), of which there are many varieties, was sometimes planted, but not largely so; more to have it handy, or to secure a prized variety, than with a view to cultivation or to improve its fibre. The leaves of these valuable plants were universally used, both scraped and unscraped, and the fibre prepared in various ways—by scraping, soaking, beating, dyeing, and twisting—for clothing for both sexes. From it the chiefs' elegant and ornamented silky paipairoa, and the shaggy bee-butt looking pake and ngeri, with their many intermediate kinds of clothing mats, were alone manufactured. Common articles of clothing and war-mats of defence were also woven from the leaves of the kiekie (*Freycinetia banksii*) and from those of the ti (*Cordyline australis*) ; while from the fibres of the handsome large-leaved mountain ti (*Cordyline indivisa*), very strong and heavy mats for apparel, called toi, were made, which, dyed black, are still greatly prized. A few superior articles of apparel were also made by the northern tribes from the leaves of the neinei (*Dracophyllum latifolium*). Of the bright yellow leaves of the pingao (*Desmoschœnus spiralis*), strong and useful folding girdles were woven; and from the inner bark of the autetaranga (*Pimelea arenaria*), small white cloth-like strips were also obtained, for fastening up the hair or wearing as ornament in the ears.

(2.) The timber trees and other plants of various degrees of utility comprised the following:—For canoes, the natives from the Thames northwards generally used the kauri (*Dammara australis*), and the southern natives the totara (*Podocarpus totara*), which was preferred by all; the kahikatea (*P. dacrydioides*) was also often used for this purpose. Troughs, trays, and other large vessels were also made of totara and of mataii (*P. spicata*). The framing of the principal houses was of totara timber; while their roofs, and sometimes their sides, were often covered with its bark, obtained from the living tree and laid on in large slabs. The bark of the manuka (*Leptospermum scoparium*) was also used for covering the roof, but is greatly inferior. The carved work of the chiefs' houses was made out of both totara and mataii; but for the carved figure-heads of their canoes the pukatea (*Atherosperma novæ-zealandiæ*) was generally used; while the ornamental carved work of the sterns was made of mataii or totara. The titoki (*Alectryon excelsum*) furnished handles for light axes; and sometimes the kowhai (*Edwardsia grandiflora*) was used, particularly for the heavier ones. The ake (*Dodonæa viscosa*), and the maire* (*Santalum cunninghamii* at the north, and *Olea* sp. at the south), supplied hardwood for war implements and for carved walking-staves; and of another hardwood, manuka (*Leptospermum scoparium*), husbandry implements, canoe-paddles, and spears for war and taking fish were made. Long war-spears were also made of rimu (*Dacrydium cupressinum*); but the very long bird-spears (30–36 feet) were made of tawa (*Nesodaphne tawa*), the working of which out of a large tree with only their *stone* implements, obtaining as they did but two spears from a single tree, was indeed a most patient and admirable performance, often taking two years for its completion. The *hard-wooded* mairetawhake (*Eugenia maire*) was also prized, and used by the northern tribes, among whom alone it grew, for husbandry implements. The channelled stems of the neinei (*Dracophyllum latifolium*), and the red young saplings of toatoa, or tanekaha (*Phyllocladus trichomanoides*), made valued walking-sticks. The long straight young trees of manuka, and of tawa, were used for battens for the sides and roofs of their houses; stems of the kareao (*Rhipogonum parviflorum*), and also kakaho reeds (*Arundo conspicua*), and slips of totara timber,

* See par. 26 (8).

were often used for the same purpose. The creepers, aka (*Metrosideros scandens*), and kareao or pirita (*Rhipogonum parviflorum*), were extensively used for tying up fences, platforms, and the heavy frame-work of houses. Sometimes other creepers (*Passiflora tetrandra* and *Parsonsia* sp.) were used, but not commonly; and among the northern tribes the creeping fern mangemange (*Lygodium articulatum*) was generally used to bind the outward thatch securely on the roof of their houses. The raupo or large bulrush (*Typha angustifolia*) was universally used to cover the frame-work of their houses; the outer thatch being toetoe (*Cyperus ustulatus*), or rautahi (*Carex ternaria*), or ririwaka (*Scirpus maritimus*), or of two kinds of wiwi, or rushes (*Juncus maritimus* and *effusus*); sometimes, however, a hard-jointed rush (*Leptocarpus simplex*) was advantageously used; being by far the best of all the rushes or sedges for thatching, on account of its durability. The leaves of the ti or cabbage-tree (*Cordyline australis*), were also used for this purpose; but for the inner works of roofs, sides, partitions, &c., the large fronds of the nikau or New Zealand palm (*Areca sapida*), and the handsome reed kakaho (*Arundo conspicua*), were extensively used. The interior of the verandahs and sides of their chiefs' houses was often neatly ornamented with chequered work of various regular patterns and designs, caused by interlacing narrow strips of the leaves of the bright orange-coloured pingao (*Desmoschœnus spiralis*), with the greyish-green kiekie (*Freycinetia banksii*), and the olive-coloured harakeke (*Phormium tenax*), which, worked regularly, had a very pleasing effect. Sometimes, especially in the interior, the outside of their better houses was formed of hard fibrous slabs cut from the stout red-brown fern-tree, wekiponga (*Dicksonia australis*); and in other parts of the island, smaller pieces cut from the trunk of the black fern-tree, korau or mamaku (*Cyathea medullaris*), were closely placed like a plinth around the lower part of the house, especially if it was a sweet potato store, to keep out the rats. Their large and small fish-traps or creels were very strongly and skilfully made of the flexible stems of two species of *Muhlenbeckia* (*adpressa* and *ephedroides*), and also of the long fibrous roots of the New Zealand flax (*Phormium*); the stems of the twining-fern (*Lygodium articulatum*) were also extensively used for this purpose by the northern tribes. Their fishing nets, of all sizes of mesh (some of which nets were very long, and most skilfully made, the admiration of Cook and of all early voyagers), were made of the split but unscraped leaves of the New Zealand flax (*Phormium*); for floats, the light wood of the small tree whau, or hauama (*Entelea arborescens*), was used, and sometimes the leaves of the raupo, or large bulrush, rolled up; and for net-ropes, the tough stringy bark of the houhere, and also of the whauwhi or houi (*Hoheria populnea*, and its varieties), was plaited together; leaves of *Phormium* were also used for this purpose.

Excellent fishing-lines, of various lengths and sizes, were capitally spun by the hand from the dressed fibre of the New Zealand flax; and for hooks, the tough naturally curved stems of the climbing-fern (*Lygodium articulatum*), and the roots of the shrub tauhinu (*Pomaderris ericifolia*), hardened by fire, were sometimes used; human bone, however, being always preferred. Canoe sails were manufactured from the leaves of the raupo, laced across with the fibres of New Zealand flax; while the hune, or downy *pappus* of the seeds of the raupo, was used for caulking and plugging holes in their canoes. Useful floor and sleeping mats, of all sizes and of several patterns and kinds, were woven of leaves of New Zealand flax (*Phormium*), of kiekie (*Freycinetia banksii*), and sometimes of toetoe (*Arundo conspicua*). Baskets, large and small, plain and highly ornamented and dyed, for all manner of uses, were woven of the same materials; and sometimes the leaves of the ti (*Cordyline australis*), and of the nikau-palm (*Areca sapida*), were also used for the same purposes. Their sitting and sleeping places were strewed with the leaves of the toetoe, or of raupo; with the soft fragrant grass karetu (*Hierochloe redolens*), when in season, and sometimes with the leaves of the papaauma (*Coprosma grandifolia*); for visitors of rank, however, the fronds of the different tree-ferns were used, particularly of the ponga (*Cyathea dealbata*). The New Zealanders were often curiously particular as to what plants were used, tied around, or under and over their vegetable food, in their cooking ovens in the earth; for instance, the roots of the tikoraha (*Cordyline stricta*) were tied separately for baking in bundles of hangehange (*Geniostoma ligustrifolium*); for their kao, or prepared sweet potatoes, they used the leaves of the parataniwha (*Elatostemma rugosum*); generally, however, they used the fronds of the larger ferns, *Lomaria procera* and *Goniopteris pennigera*. Fire, by friction, was obtained from several woods; the kaikomako (*Pennantia corymbosa*), was however the one most prized, and also the pate (*Schefflera digitata*); and a trunk stem of the kohia (*Passiflora tetrandra*) was often sought to carry fire on a journey, as it had the quality of a slow-burning match. The green leaves and branches of the kawakawa (*Piper excelsum*) were gathered and laid in rows in their plantations of kumara or sweet potatoes, between the beds, and there slowly burnt, that the insects which injured the growing plant might be destroyed by the disagreeable bitter smoke. The hue, or gourd (a species of *Cucurbita*), gave useful calabashes, and vessels of several kinds and sizes, from a gill to three gallons, for many purposes. Sometimes, however, large sections of the great sea-weed, rimurapa (*D'Urvillæa utilis*), were inflated and used as calabashes, called powha, particularly for holding cooked animal food in its own fat, and for oil. The bark of the totara was also skilfully made up into neat vessels, for holding and carrying of water.

(3.) Of plants and vegetable substances used as ornament, &c., the following are the principal:—For dyes, the bark of the hinau and of the pokaka (*Elæocarpus dentatus* and *hookerianus*), and also of the makomako (*Aristotelia racemosa*), were used for black; and the bark of the tanekaha or toatoa (*Phyllocladus trichomanoides*) for red. Oil, for anointing, was expressed from the beaten seeds of the titoki or titongi (*Alectryon excelsum*), and also from the seeds of the kohia (*Passiflora tetrandra*). A gum-resin, used to perfume their oil, was obtained from the kohuhu and the tarata (*Pittosporum tenuifolium* and *P. eugenioides*), and also from the taramea (*Aciphylla colensoi*), which last was very highly prized. The strong smelling ferns, *Hymenophyllum villosum*, *Doodia media*, and *Polypodium pustulatum*, were also used for the same purpose of perfuming and for scenting oil; and so were a few fragrant mosses and *Hepaticæ*, called kopura—especially *Lophocolea novæ-zealandiæ* and *allodonta*. The aromatic leaves of the raukawa, a very scarce, small tree, sparsely growing in the high dense forests (*Panax edgerleyi*), were also sought for a similar purpose, particularly to rub their limbs and bodies. The daisy-like flowers of the roniu (*Brachycome odorata*), and the flowering tops of the sweet-scented grass karetu (*Hierochlöe redolens*), were worn round the neck, enclosed in fibrous leaves, as a scented necklace. Elegant female head-dresses were formed of flowering wreaths of various species of *Clematis* (particularly *hexasepala* and *colensoi*), and of the graceful waewaekoukou (*Lycopodium volubile*). Sometimes the snow-white downy fibres from the under side of the leaves of the kowharawhara, and the kahakaha (*Astelia cunninghamii* and *solandri*), and the thin transparent epidermis from the leaves of the mountain tikumu (*Celmisia coriacea*), were also used by females to ornament their hair and head. The fresh gum-resin from the kauri (*Dammara australis*) was commonly chewed as a masticatory,* so also was that obtained from the tawhiwhi or kohuhu (*Pittosporum tenuifolium*), mixed with the inspissated juice of the puwha or sow-thistle (*Sonchus oleraceus*), ingeniously collected. Combs were made of mapara and kapara, the hard dark woody tissue or heart-wood of rimu (*Dacrydium cupressinum*), which was assiduously sought for in the forest among old prostrate rotting rimu trees; they were also carved out

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* This chewing of the fresh gum resin of the kauri pine by the New Zealanders explains the error made by Forster (from Crozet, Voyage de M. Marion), who had named the mangrove (*Avicennia officinalis*) *A. resinifera*, believing that the gum chewed by the natives had been obtained from that tree! Forster says, "Gummi ex hac arbore exsudans forte idem est, quo barbari Novæ Zelandiæ homines vescuntur, ut patet e diaris navarchi gallici Crozet." This error has been since repeatedly printed; and, strange to say, more recently by Lindley (who even improves upon it) in his noble Vegetable Kingdom, where (p. 665), speaking of the mangrove, he says,—"It exudes a kind of green aromatic resin, which furnishes a miserable food to the barbarous natives of New Zealand." (!)

of mataii and manuka woods. The spines of the tumatakuru, or New Zealand thorn (*Discaria toumatou*), were sometimes used for tattooing, though instruments of bone were preferred; the black pigment for the same operation being obtained from the soot of old and hard kapia or kauri resin, dug out of the earth; and also from the ashes of the curious vegeto-caterpillar fungus, the hawhato (*Cordiceps robertsii*), which was sometimes mixed with the black juice of the mahoe berry (*Melicytus ramiflorus*). Flutes were made of the woody stems of the kohoho or poroporo (*Solanum aviculare*), and of the tupakihi or tutu (*Coriaria ruscifolia*). Ornamental boxes for holding feathers, &c., with their covers, were generally carved out of mataii wood; and flying-kites were very ingeniously made of the toetoe (*Cyperus ustulatus*). After the introduction of flint and steel the pith of the flowering stems of the New Zealand flax served for tinder, and so did the putawa, a fungus (*Boletus*) of enormously large growth, often found on the upper branches of the tawhairaunui (*Fagus ? fusca*). On the New Zealanders learning to write, they used the juice of the root of the New Zealand flax as ink; the crimson juice of the berry of the kokihi (a species of *Tetragonia—T. trigyna*), and the dark juice of the berries of *Schefflera digitata*, were also used for the same purpose. Sometimes they used a green leaf of New Zealand flax for writing on, etching on it with a nail or style of hard wood, thus unknowingly imitating their Asiatic neighbours. It is highly doubtful whether the New Zealanders ever used any vegetable as an internal medicine before their intercourse with Europeans; for severe burns, however, they applied outwardly the ashes and charcoal dust of burnt fern fronds (*Pteris esculenta*), and the fine reddish dust of the large decaying fungus pukurau (*Lycoperdon fontainesii*). The blanched bases of the leaves of the harakeke (*Phormium*), and the roots of the rengarenga or maikaika (*Arthropodium cirrhatum*), were sometimes roasted and beaten to a pulp and applied warm to unbroken tumours and abscesses. As a cataplasm for ulcers they used the leaves of the kohoho or poroporo (*Solanum aviculare*), and for wounds and old ulcerated sores they used the large leaves of the pukapuka or rangiora (*Brachyglottis repanda*), and also the hune, or *pappus* down of the large bulrush, but merely as a protection against dust, &c. Layers of dry totara bark, and the lower parts of stout green flax leaves, served admirably as splints in cases of broken bones, the New Zealanders being far better surgeons than physicians. And the leaves of several particular plants were in request for their rude steam or vapour baths for rheumatic and other stubborn and chronic complaints; but it is highly questionable whether the benefit derived from such baths did not arise entirely from the warm vapour. They sometimes rubbed the fresh juice of the ngaio (*Myoporum lætum*) over their skin, to keep off the persecuting namu (sandfly); and for several years they have used as purgative medicines the juice of the root of the New Zealand flax (*Phormium*), and the bark of the kowhai (*Edwardsia grandiflora*); as a tonic, the leaves of the kohekohe (*Dysoxylum spectabile*); as a demulcent, in colds, &c., the bark of the houhere (*Hoheria populnea*); as a diaphoretic, *Mentha cunninghamii;* and, as slightly alterative, a decoction of the bark and stems of the pikiarero (*Clematis hexasepala*), and the root of the tataraheke (*Coprosma acerosa*).

24. Touching the œconomic botany of the present time — or æra of New Zealand colonization—not a little has been already done by the early settlers to show the uses, qualities, and values of many of the timbers, and other vegetable substances of the North Island of New Zealand. Indeed, several of her botanical productions are better known in the old world than those of much older colonies. In now considering these, it is purposed to do so more with reference to their utility, &c., than to their botanical sequence or arrangement. Consequently the principal timber trees will be first noticed.

(1.) The chief timber-producing trees—*i.e.*, those which are usually sawn into boards for common purposes—are seven in number, all being botanically classed under the natural family *Coniferæ;* although really possessing among them only one true pine. This is the far-famed and justly celebrated kauri (*Dammara australis*), the largest and most useful of all the New Zealand timber trees. This stately tree grows commonly to the height of 140–150 feet; a few reach to 170 or even 200 feet. In general, it has a clean trunk 50 to 60 feet in height before reaching the branches (which are enormously large, and diverge around the stem from one spot), with a barrel of 8 or 9 feet, tapering gradually to 5 or 6 feet. The largest clean and perfect barrel *seen* by the writer was 12 feet in diameter; and the largest spar recorded was cut at the Hokianga River in 1839; it measured 106 feet in length, without a knot, and was 2 feet square at the smaller end. In a kauri forest the spar trees are in proportion as one to four or five to the tree fit for sawing. Of this timber there are three varieties known in the market,—the white, the red, and the mottled (the last being rather scarce), which are not botanically distinct. The light-coloured wood has the straightest grain, and is said to be less brittle when dry, and easier to work; the darker kind will admit of a good polish, and is a handsomer wood than the former, but it is only the mottled variety that can be considered a fancy wood; this kind sometimes resembles bird's-eye maple or knotted oak, and makes really handsome picture-frames and pannelling, and takes a good polish. The colour of the varieties of kauri wood varies from a light straw to a reddish light-brown; fancy pieces may often be met with delicately marked and variegated, with a wavy flowing appearance, which also takes a beautiful polish. Its detriment, however, as a wood is its great tendency to shrink and contract in length as well as in breadth, and this it does, however old or seasoned, when freshly planed. It is largely used by the shipwright, the house-builder, and the cabinetmaker; two-thirds of the houses in the North Island, and all the many vessels and boats, are mainly, if not entirely, built of this timber, and from a time long before the date of the colony, many cargoes of kauri spars were taken to England for the purposes of the Royal Navy. The demand for this timber is very great, and has ever been increasing. The quantity *exported* from Auckland and the northern ports of the Auckland Province in 1863 was—of spars and rickers, 270 tons, value £1,953; of sawn timber, 1,552,636 feet; and of squared wood 1,641 loads, the value of the two last items being £16,000. Although confined to the northern parts of the North Island—see par. 13, (2)—it grows in all soils, and at several altitudes from the sea-side to 1,500 feet, preferring, however, the dry and sterile clays of the hilly districts. It is still very plentiful, and is likely to meet all demands for fifty future years; although, as a matter of course, it is yearly getting less accessible. Many miles of valuable kauri forests have been from time to time thoughtlessly consumed by fire; which fires, it is sincerely hoped, will not hereafter be so frequent as they have been. There are few sights more impressive of grandeur than an untouched forest of this stately tree; few more impressive of misery and devastation than a worked-out and abandoned one!

(2.) The next valuable tree of this class, and scarcely less so than the kauri pine, is the totara (*Podocarpus totara*); which, while generally found throughout the North Island, abounds in the Provinces of Hawke Bay and Wellington, where it forms fine forests. It often attains the height of 120 feet and upwards, with a clean trunk of from 50 to 60, or even 70 feet, without a knot; having a diameter of 5 or even 6 feet, tapering gradually to 20 inches. It is not generally found near the sea (although it has been met with overhanging the tidal rocks), and flourishes most on rich alluvial levels. The wood of this tree is hard, and generally of a dark dull pink colour, resembling pencil cedar; it works freely, and when polished is handsome, and very suitable for massy ornamental interior work. In the southern parts of the North Island (particularly Wellington), the better and more durable houses, churches, &c., are generally built of it. It is the best New Zealand wood for bridges, wharfs, piles, &c., as it possesses the valuable property of resisting rot, more especially in wet situations. It splits well, and makes excellent shingles for roofs, and is very extensively used for posts in fencing. The heavier articles of furniture are sometimes made of it; and the portion of its wood which grows under a knot (or large warty excrescence, often seen on its trunk), is peculiarly veined, owing to its grain there being very tortuous, and when polished highly beautiful. Those knots are eagerly sought after for veneering purposes in England, but the supply hitherto has been very scanty. (*Vide* sec. 4.)

(3.) The kahikatea, or white or swamp pine (*Podocarpus dacrydioides*), is the next commonly used timber tree. It is the most generally diffused throughout the North Island of all the timber trees, often forming large forests, and is almost invariably found in wet spots and swampy situations, and often on the low banks of rivers, at a much lower elevation than its congeners. It often grows to the height of 100 feet, and as its trunk is generally clear from living branches it presents a tolerably clean barrel of from 50 to 70 feet. Its trunk, however, is frequently not so regularly formed as those of the other *Podocarpi* and the kauri, being sometimes largely ribbed or buttressed for some distance upwards from its base. This tree is anything but handsome when growing in the close forest; often, however, a single tree is met with standing alone and forming a very beautiful object. The timber of this tree has been and is pretty extensively used for all common purposes, apart from exposure or wet. It is the most easily obtained of all the New Zealand timbers; but, owing to its tendency to rot when exposed, and to its scarcely ever seasoning, continually contracting and expanding with the state of the weather, it is only used when others are not to be had. For in-door work, however, it is often advantageously used. It is strait-grained, and where free from knots works easily. It has been used for spars for small vessels, and is sometimes split for fence-rails and for roof-shingles. It is often found having fissures in the wood filled with a hard, dry, adhesive gum-resin, which is difficult to cut or remove. It is said that trees which have grown on a slope, or on gravelly land, possess closer-grained and more durable timber than those of the low wet lands. Choice parts of the wood of this tree, from its light yellow colour and rich changeable sparkling grain, are sometimes advantageously used as a contrast wood by the cabinetmaker to set off the darker coloured woods.

(4.) The rimu or red pine (*Dacrydium cupressinum*), another large size timber tree, is also common throughout the North Island, but is never met with forming forests, almost always scattered and single. In its young state, owing to its light green colour, graceful shape, fine foliage, and long drooping pendent branches, it is a truly elegant object, often rivetting for a few moments the entranced beholder, especially when seen standing out to advantage in bold relief on the slope of some secluded sunny dell in the virgin forests! forcibly reminding him of Xerxes and the beautiful plane-tree on the Mæander.* In the northern parts of the island this tree affects

* Herodotus, *Polymnia*, § 31.

much higher ground than the foregoing; it attains to the height of from 50 to 70 feet, with a diameter of from 4 to 5 feet, and is lower branched than its congeners. Its wood is tolerably close-grained and hard, and varies considerably in colour, from yellowish to a dull red interspersed with dark-brown streaks. It makes handsome furniture, takes a good polish, and is suitable for finished inside work, although it is often rather difficult to work, owing to its natural fissures (frequent in the best wood) filled with a hard resinous concretion much like some wood of the kahikatea or white pine, already mentioned. Its wood is in general use by the cabinetmaker and turner, and by the carpenter and house-builder, and is sometimes used by the joiner and millwright. At the north, where it is more plentiful than totara, it is often used for fence posts, being tolerably durable. From published official sources we learn that the quantity of sawn timber (*kind* not specified, but supposed to comprise the last three mentioned kinds—totara, and white and red pine) exported from the Port of Wellington in the year 1863, was 2,143,303 feet, value £19,705.

(5.) The mataii (*Podocarpus spicata*), another large-sized timber tree, is also common throughout the North Island, but, like the rimu, is generally found alone. It is sometimes found growing in forests with the rimu, but often it affects lower grounds, preferring rich alluvial soil. It grows to a height of 70 to 90 feet, and a diameter of 4 to 5 feet, with a straight clean trunk and few branches. The wood is variously coloured, sometimes reddish, and sometimes variegated ; it is easily worked, is hard and pretty durable, and is used for wheelwrights' and millwrights' work, and for cabinet-making and panelling.

(6.) The miro (*Podocarpus ferruginea*) is also a timber tree pretty general throughout the island, but not so common as the mataii. It grows to a height of from 40 to 60 feet, but is small in girth, rarely reaching 3 feet in diameter. The wood is smooth, close-grained, and dark, splits freely, and is very durable. It is used for spokes and for carpenter's work, and would no doubt be more extensively used if it were of larger dimensions and more easily obtained.

(7.) The tanekaha or toatoa (*Phyllocladus trichomanoides*) is also a timber tree of the same natural order as the last five trees, but very different from them in size and appearance. It is one of the celery-leaved pines, and being an ornamental tree of regular growth, often has a very handsome appearance. It is plentiful on dry hilly lands in the north parts of the island, but scarce in its more southern parts. Its average height is from 45 to 50 feet, and from 2 to 3 feet in diameter. It is used for all kinds of outside work, as posts, rails, and floors of verandahs, and is greatly preferred for decks of vessels. The wood is rather too heavy for spars, although it has been occasionally used for masts and booms. In colour it is a darker yellow than the kauri, has a closer grain, and a turpentine-like smell. It is a very valuable wood, but, from its small size and not being easily accessible, it has not been so largely used as it deserves.

25. Those other large timber trees which are commonly split for use, or chopped or sawn into short junks (rarely into boards or planks) for the market, are six in number, and comprise the following :—

(1.) The puriri, or New Zealand oak or teak (*Vitex littoralis*), is a large tree of irregular growth. It grows to the height of from 50 to 60 feet, with a clear trunk of 20 feet or more, and varies from 12 to 25 feet in circumference. Much larger trees, however, are occasionally met with. Several are often found growing near each other, forming a handsome dark green clump of wood. It is confined to the north parts of the island (see par. 13, § 2) where it prefers a rich soil, and is sometimes met with overhanging tidal rocks and beaches. From its earliest growth this tree is subject to the borings of a large larva-like insect, which makes long, clean-cut holes throughout the hardest part of the wood, large enough to admit a man's small finger. Of course this gives the wood a most unsightly appearance, yet it is but little injured thereby. The wood is heavy, of an olive or brownish colour, close in the grain, splits freely, and works well; it is extensively used for knees in ship-building, for piles in house-building, for gate and fencing posts, and for every purpose where solidity, strength, and exemption from rot is required. It is estimated as being about equal with English oak in stiffness, strength, and toughness.

(2.) The kahikatoa or manuka (*Leptospermum scoparium*) is a tree common throughout the North Island. It grows in the poorest as well as in the richest soil, but prefers steep and dry hill sides. It sometimes attains to a height of 40, or even 45 feet, and to a diameter of 2 feet. Often a large patch or small forest of this tree will be found growing closely together, without any other tree among them. The wood is very hard, and of a dark colour, varying from yellow to red and dark brown, and is admirably fitted for the cabinetmaker and turner. It makes good axe-handles, and is extensively used as rails for fencing, for which purpose it is one of our best New Zealand woods. It is also excellent fuel, and many thousands of tons of it as firewood are annually used in and exported from Auckland.

(3.) The tawhai and tawhairaunui, or black and red birches (*Fagus solandri* and *F. fusca*), often form large and sometimes handsome trees. Though plentiful in the south parts of the island, with one exception they are not found north of the East Cape; yet, where they flourish, especially in the higher mountainous grounds, they often form large forests. They run from 80 to 100 feet in height, and, according to the species and soil, from 3 to 7 feet in diameter. The wood unfortunately is not of great use or value as timber, yet is sometimes used for boat-knees and for cask staves. That of the black birch, however, is extensively used for fence rails in the Province of Wellington, and is said, when well dried, to make good firewood.

(4.) The pohutukawa (*Metrosideros tomentosa*) is another large hard-wooded tree, of diffuse irregular growth. Its habitat is the immediate sea shore of the north parts of the island; where, on rocky headlands and cliffs, sometimes pendent, it forms a striking and picturesque object. It is very robust, sometimes being 4 or even 5 feet in diameter, but the trunk and branches are invariably more or less crooked. Nevertheless it is a very valuable tree, especially for ship-building purposes, where its gnarled and crooked character make it highly serviceable for timbers, knees, breast-hooks, &c.; it is also used for making ship's blocks, and for building piles. This wood presents a very handsome grain, a rich rose colour, and a high polish when worked up by the cabinetmaker, and choice pieces are in great demand. The area, or zone, in which this valuable tree is found being very limited, its wood will soon be exhausted unless some means are speedily made use of to preserve or economize it.

(5.) The rata (*Metrosideros robusta*), a tree very closely allied generically to the pohutukawa, is one of the largest of the New Zealand forest trees, often attaining a height of 120 feet, of which from 60 to 80 feet form its trunk; which is sometimes very bulky, one having been measured which was 54 feet in girth. Unlike the preceding, however, it is mostly found inland, at a tolerably high elevation, and is pretty general throughout the island. Its growth is both regular and irregular, mainly arising from situation and soil. Its wood is heavy, red, close-grained, and durable, and is very valuable to the wheelwright and to the ship-builder, on account of its strength and toughness, owing to the peculiar twisting of its fibres; the roots and branches as well as the trunk affording excellent materials for naves, timbers, and knees. It is also a handsome wood for the purposes of the cabinet-maker, and will answer well for all uses where oak and beech are required.

(6.) The aka (*Metrosideros scandens*), although, in bulk, a small tree or climber, may also here be noticed, as it not only belongs to the same genus with the two preceding, and to the same sub-section, but is also very closely allied to them in its qualities and uses. This plant is generally common in all woods, and may be known as a large stout climber ascending to the tops of the highest trees, and often hanging like loose ropes from them. Like the others of the genus already noticed, it is heavy, close-grained, and tough, and is principally used for timbers for boats.

26. The trees which follow, though many are small and scarcely timber-trees, comprise some which are very useful to the manufacturer:—

(1.) The kowhai, or New Zealand acacia (*Sophora*, or *Edwardsia grandiflora*), is a small tree, sometimes reaching to the height of 30 or 35 feet. Its wood is hard, and of two or three colours or varieties, varying from a bright yellow in some specimens, to that of a light olive or a dull Indian pink in others. It is well fitted for the purposes of the cabinetmaker and the millwright.

(2.) The hinau (*Elæocarpus dentatus*), a tree generally common in the drier woods in the interior, attains to the height of from 50 to 60 feet, and 3 feet or upwards in diameter. The wood in general of this tree is inferior; but the crooked parts of the wood, with the knots and warty excrescences, have a very beautiful marbled grain, and are therefore valuable to the cabinetmaker.

(3.) The towai and tawhero (*Weinmannia sylvicola* and *W. racemosa*) are small trees which are found throughout the interior. Their average height is 40 feet, and about 2 feet in diameter. Their wood is said to be heavy, close-grained, and red, and to answer all purposes to which mahogany or New South Wales cedar is applied.

(4.) The titoki or titongi (*Alectryon excelsum*) is a tree general throughout the island. It is of lofty growth, sometimes reaching 60 or 70 feet, and 3 feet in diameter; it has a pleasing appearance, and is low-branched. Its wood is straight in the grain, and is very tough, and is much like that of the English ash. It is used by wheelwrights and shipwrights, and may be applied to like purposes with that of the ash.

(5.) The kohekohe (*Dysoxylum spectabile*) is a handsome tree which is only found plentifully in the north parts of the island. (See par. 13, § 2.) It reaches to the height of 50 or 60 feet, having its trunk clear of branches to the height of 30 or 40 feet, and of 3 feet diameter. Its wood is fine-grained, of a pale reddish colour, and is heavier than the New South Wales cedar. It is used in the making of furniture.

(6.) The tangeao or mangeao (*Tetranthera calicaris*) is a small tree, also confined to the northernmost parts of the island, where it is tolerably abundant. It reaches to the height of 45 feet, but its trunk is seldom above 18 inches in diameter. Its wood is of a dark reddish brown colour, and admits of a good polish; it is said to equal that of the elm in lightness, durability, and extraordinary toughness. It is used for agricultural implements, bullock-yokes, and oars, and, lately, for ships' blocks, for which last purpose it is likely to be very valuable. It would probably make good spokes and cogs.

(7.) The rewarewa (*Knightia excelsa*) is a handsome tree of peculiar fastigiate—or poplar-like—growth. It is much more plentiful in the north than it is in the south parts of the island. It is generally found in dry woods, and often attains to the height of 60 feet, although its diameter is rarely 3 feet. Its wood is beautifully variegated and mottled, reddish on a light-brown ground, and is used for picture frames and fancy work. It splits freely, and is therefore used for fence pales.

(8.) The maire.—Two or more very distinct genera, containing several trees (*Santalum cunninghamii* and *Olea* sp.), are confounded under this native name; although the natives themselves generally distinguish them pretty clearly, calling the *Olea* maireraunui. Both were by them called maire, from the fact of both being hard-wooded, and formerly used by them for the same purposes. One of the trees (*Santalum cunninghamii*) is confined to the north parts, while the various species of *Olea* are more general and much more plentiful in the south parts of the island. It is highly doubtful whether the true northern maire (*Santalum cunninghamii*) is yet much known in the arts and manufactures. It is a small tree, belonging to the sandalwood family, and the species is confined to a very limited area. (See par. 11, § 2.) The large maire tree, or maireraunui of the aborigines, comprises three known species of olive (*O. cunninghamii*, *lanceolata*, and *montana*), one species being found generally throughout the island. It commonly forms a large tree, 60 to 70, or even 100 feet high, and 4 feet or more in diameter. It is very closely allied to the European olive and to the ironwood of Norfolk Island, all being species of the same genus. There are two kinds known to the manufacturer—a dark variety fit for cabinet-making, and a white variety fit for sheaves and cogs, and for wheelwrights' work. The dark kind has a handsome grain, and polishes well; but its brittleness and great weight prevent its being more generally used.

(9.) The pukatea (*Atherosperma novæ-zealandiæ*) is among the largest trees of New Zealand, sometimes reaching the height of 150 feet, and a clear diameter of 5 to 7 feet, besides having immensely thick buttresses at the base. The wood, however, is soft, and will not split, and, at present, is little used save in boat-building; it is highly serviceable for the bottom boards of boats, as in case of striking a rock only the spot so struck is staved. A nail might be driven into the wood without splitting or boring.

(10.) The tawa (*Nesodaphne tawa*) is a fine tree, common throughout New Zealand, especially in the interior, often attaining to the height of 70 feet. Its wood is light and splits easily, and soon rots if exposed to wet; notwithstanding, from its freeness of splitting, it is used for fence rails and for shingles in places where it abounds.

(11.) The taraire (*Nesodaphne taraire*), another species of the same genus, but confined to the north parts of the island (See par. 11, § 2), is a handsomer and still larger tree; yet its wood, being similar in quality, is of little use.

(12.) The ake, or New Zealand lignum vitæ (*Dodonæa viscosa*), is a small tree or large shrub, seldom attaining a greater diameter than one foot. It is found generally on dry ground throughout the island, but is both more plentiful and larger at the north parts. Its wood is very hard and very heavy, being by far the heaviest of all the New Zealand woods, is of a reddish colour, and is often variegated with dark streaks, or mottled with a succession of knots, giving it a peculiarly beautiful appearance. It is used for sheaves, axe-handles, &c.

(13.) The tipau or mapau (*Myrsine australis*) is a small leafy tree, 15 to 20 feet high, found sparingly throughout the island, but more plentiful at the north. Its wood resembles beech, and is used for chairmaking, carpenters' tools, walking sticks, &c.

(14.) The wharangi or wharangipirau (*Melicope ternata*) is a small tree, 12 to 15 feet high, generally found throughout the island. Its wood resembles satinwood, and is used by the cabinetmaker for inlaying fancy work.

(15.) The kawaka (*Libocedrus doniana*) is a middle-sized hard-wooded tree of the pine family. It is sparingly found, and generally at much higher elevations than the larger timber trees, hence it is not much known. It is confined to the north parts of the island, where it attains to a height of from 30 to 40 feet or more, and from 2 to 3 feet in diameter. Its wood is dark coloured, beautifully grained, close, and heavy, well suited for picture frames. In the lower part of its trunk the wood is said to resemble the tulip-wood of New South Wales. This tree is very closely allied to the famed "alerse" (*Thuja tetragona*) of south Chili and the Straits of Magellan, and is believed to be a very valuable wood.

27. There still remain to be noticed a few more indigenous vegetable substances known in commerce, foremost among which as valuable exports are two of world-wide fame, though peculiar to the island, viz. the New Zealand flax and the kauri gum:—

(1.) The New Zealand flax, or fibre of the *Phormium tenax* and of *Ph. colensoi*, and of their varieties (muka of the natives, the dressed fibre of the harakeke or flax plant), has long been too well known to require any lengthened remarks here. The plants are common in every situation and soil throughout the island or the New Zealand group (including also Norfolk Island), where alone the *Phormium* is found indigenous. (See footnote, p. 256.) Some swamps or low grounds possess it as almost the only plant growing continuously for miles. Formerly it was hand-dressed in large quantities by the aborigines, both for home consumption among themselves and for sale, and was exported very largely. As an article of export it has greatly diminished, but this is entirely owing to the natives having generally given up the dressing the plant for sale, to the dearth of hand-labour, and to the difficulty in properly preparing its fibre for use by machinery, which difficulty, however, will without doubt be eventually overcome. From official statistical papers it is gathered that the export of hand-dressed flax, during the ten years ending 1852, from the port of Wellington alone, amounted to 523 tons 15 cwt., value £7,200; of which nearly one-fourth, or 128 tons 10 cwt. 85 lbs., was exported in one year, 1850. Of late years the export of this article has been very small compared with what it once was and with what it is firmly believed it will yet be.

(2.) The kapia or kauri gum is, as its colonial name shows, a gum, or rather a resin, from the kauri pine (*Dammara australis*); it is not, however, obtained in the present living kauri pine forests, but only in the north parts of the Province of Auckland, where, it is believed, such trees formerly grew; yet of such ancient forests no other trace generally remains than the resin itself, slightly buried in the soil. Large tracts of the country north of Auckland, particularly of the more barren spots, are of this description, and much of it has been already dug over, carelessly perhaps, and the resin collected. It is now about twenty years since the kauri gum was first noticed as an article of export; and it has been mainly, if not entirely, gathered by the aborigines from the Thames to the North Cape. The quantity exported from Auckland in 1863 was 1,400½ tons, worth £27,026; and the total quantity exported from that province during the ten years ending 1862, amounted to 13,575 tons 18 cwt. 84 lbs., worth £174,148. The largest quantity exported in any one year (1857) was 2,464 tons 10 cwt., worth £34,550.

(3.) Another peculiar article of export, which has also been extensively used in the colony for tanning, is the bark of the towai (*Weinmannia racemosa*). This tree, or a closely allied species, is more or less common throughout the island, but it is much more abundant in the northern parts, where, too, its bark has been more particularly gathered for use, and exported for tanning purposes.

(4.) Other indigenous vegetable substances which have been both successfully used and brought to market are, the kareao or supplejack creeper (*Rhipogonum parviflorum*), as coarse basket and wicker work; brooms, for ship and domestic purposes, made of the twiggy manuka (*Leptospermum scoparium*); the woody stems of the white mangrove (*Avicennia officinalis*), for soapmaking; the downy *pappus* hune, from the fruiting heads of the large bulrush (*Typha angustifolia*), for beds, bolsters, and pillows; and honey, since the introduction of bees and their becoming wild. Of this last article a large quantity increasing every year, particularly at the North, finds its way into the market.

28. It is reasonably believed that there are yet several indigenous plants and vegetable substances which may prove to be valuable both for use and export, some of which are all but quite unknown to arts and manufactures: a few of them will be here mentioned:—

(1.) Of Timbers:—(a. *Known hard woods.*) The mairetawhake (*Eugenia maire*); the rohutu (*Myrtus pedunculata*), especially the larger southern tree; the maire (*Santalum cunninghamii*), a small tree with dark bark, of the sandalwood genus, scarcely averaging 30 feet in height, only known as growing in the dry forests northward of 36° S.; the manoao (*Dacrydium colensoi*), a small hard-wooded pine, incorruptible, according to the natives, found sparingly in high and dry forests on the East Coast, north of Whangarei, and also in the mountainous country near Taupo; and the long-leaved *Myrsine* (*M. salicina*), being the next species to the well-known and valued beech-like tipau or mapau (*M. australis*), and also a much larger tree.

(b. *Trees supposed to be hard-wooded.*) The tawari (*Ixerba brexioides*), the toro (*Persoonia toro*), the kohuhu, and the tarata (*Pittosporum tenuifolium* and *P. eugenioides*), and the porokaiwhiri (*Hedycarya dentata*); besides which there are the white-wooded horoeka (*Aralia crassifolia*), the kaikomako (*Pennantia corymbosa*), the large species of *Plagianthus* (*P. betulinus*), and the *Epicarpurus microphyllus* (or *Trophis opaca*); all these, from their known affinities, are well worthy of a trial.

(2.) Of Barks: a. *for dyeing;* the hinau and the pokaka (*Elæocarpus dentatus* and *E. hookerianus*), for dyeing black; and the makomako (*Aristotelia racemosa*) for a blue-black.—b. *for tanning*; the toatoa, or tanekaha (*Phyllocladus trichomanoides*), the makamaka (*Ackama rosæfolia*), so closely allied to the towai; and the maanawa, or white mangrove (*Avicennia tomentosa*), the bark of which is said to be extensively used for tanning at Rio Janeiro.

(3.) Sundries: The living bark, branches, stumps and roots, and even leaves, of the kauri pine would yield a large amount of kauri resin under proper management. The fibrous leaves of the keikei (*Freycinetia banksii*) are an excellent article for men's hats, far better than the largely imported common cabbage-tree hat, and but little inferior to a coarse Leghorn or Manilla one, as the writer knows from experience. A serviceable oil* could be largely extracted from the seeds of the titoki (*Alectryon excelsum*); and from the aromatic leaves and bark of the pukatea (*Atherosperma novæ-zealandiæ*) a valuable essential oil might also be extracted, seeing that from a closely allied Tasmanian plant (*A. moschata*) an essential oil, called "sassafras oil," has been obtained; and Dr. F. Mueller has recently

* In 1849 the writer sent two bottles of this oil to the Kew Museum of Economic Botany; one was cold-drawn, and the other expressed by heat.

strongly recommended the bark of that tree as "deserving extensive adoption into medicine." Several dye-lichens are abundant in the island, viz. *Usnea*, *Ramalina*, and *Parmelia* (*P. conspersa, saxatilis, parietina,* and *perlata*). The pure semi-liquid gum found in such large quantities at the bases of the leaves of the New Zealand flax may yet be collected and form a matter of export; and *Zostera*—useful for stuffing mattresses—(the recently proposed substitute in England for manufacturing paper), is very plentiful in many of our tidal waters.

(29.) Having thus briefly noticed the *utile*, the *dulce* must not be overlooked; rather, in the words of Goethe, "Let us look closely after the beautiful, the useful will take care of itself." Not a few of the plants and ferns of New Zealand have long been cultivated in England, from the time of her first British visitors, and the number of those plants is annually increasing. Still, several highly ornamental and striking plants, chiefly confined to forests in the interior, or to sub-alpine solitudes, are believed to be unknown both to European and to colonial gardens. The most prominent and worthy of them will be now mentioned:—(1.) Large Shrubs and Small Trees: *Pittosporum*, several species; *Hoheria populnea*, and *H. lyallii*, with their several strongly marked ornamental varieties; *Melicope simplex; Phebalium nudum; Leptospermum ericoides; Myrtus*, two or three species; *Ixerba brexioides; Senecio*, several sp.; *Leucopogon fasciculatus*, and its varieties; *Dracophyllum latifolium; Libocedrus doniana*, and *Dacrydium colensoi*. (2.) Small Shrubs: *Carmichælia odorata* and *C. flagelliformis; Fuchsia procumbens; Alseuosmia*, several sp. and vars.; *Coprosma*, several sp.; *Olearia*, several sp.; *Senecio greyii; Gaultheria*, several sp.; *Cyathodes colensoi; Dracophyllum*, several sp.; *Veronica*, several sp.; *Pimelea* several sp.; and *Cordyline*, two or three species. (3.) Herbaceous Plants: *Ranunculus insignis* and *R. nivicola*, among the largest species of the genus; *Drosera binata; Aciphylla colensoi; Celmisia*, several sp.; *Colensoa physaloides; Wahlenbergia saxicola; Gentiana montana* and *G. pleurogynoides; Calceolaria sinclairii; Ourisia*, several sp.; *Callixene parviflora; Forstera bidwillii; Helophyllum colensoi;* and several of the peculiar orchideous plants, both terrestrial and epiphytical.

30. Lastly, of indigenous medicinal plants and vegetable substances, a few will be here mentioned—a future time may prove their value.

(1.) *Those which have already been usefully tried*:—The root of the harakeke (*Phormium tenax*) as an anthelmintic and cathartic; the leaves and bark of the kohekohe (*Dysoxylum spectabile*) as a tonic; the roots of the kareao (*Rhipogonum parviflorum*) as an alterative,—this plant is very closely allied to the sarsaparilla plant (*Smilax sarsaparilla*), and its roots have been beneficially used in New Zealand instead of that medicine, which is so commonly adulterated;* the bark of the houhere (*Hoheria populnea*) as a demulcent; the fragrant herb *Mentha cunninghamii* as a diaphoretic; the aromatic leaves of *Angelica rosæfolia* as a diuretic and remedial in syphilitic cases; and the roots of *Taraxacum dens-leonis* as an alterative.

(2.) *Those which, from their known natural affinities, are believed to be valuable;* from such the following are selected:—The spicy bark of the horopito (*Drimys axillaris*), a species ranking next to the well-known *D. winteri* of Cape Horn, which produces the valuable Winter's bark; the intensely bitter bark of the kowhai (*Sophora* or *Edwardsia grandiflora*)—it is worthy of notice that both African and East Indian *kino* is produced by plants of an allied genus of the same sub-order; the leaves of the wharangi-pirou (*Melicope ternata*)—as allied naturally to the genus *Diosma*, species of which genus produce the well-known *buchu* leaves, which the New Zealand *Melicope* also resembles in taste and smell; the kawakawa (*Piper excelsum*)—many closely allied species of this genus (and of the next genus *Cubeba*) are extensively used as medicines in various parts of the world; the aromatic succulent stems and roots of various species of *Panax*, and of *Aralia* —of which genera several species are used in medicine—and the roots of *P. quinquefolium* (a plant closely allied to some of our *Panaxes*), are sold by the Americans to the Chinese for real ginseng root (*P. ginseng*); the astringent bark and diuretic seeds of *Sapota costata;* the roots of the two mountain gentians, which are just as purely bitter as those of the officinal *Gentiana lutea;* the aromatic bark of the tawa (*Nesodaphne tawa*), a plant belonging to the same natural order with those producing the cinnamon, cassia, sassafras, benzoin, and camphor of commerce; and lastly, the wai-watua (*Euphorbia glauca*) may also prove useful as a medicine, seeing so very many species of the same genus have long been medicinally employed.

31. Although the fitness and suitability of many parts of the North Island for producing all cereals and edible roots and vegetables, and most European fruits, have long been well known, and its great fruitfulness proved

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* Such is the demand for sarsaparilla, and the limited area where it grows, that (as is well known) it is greatly adulterated. The true sarsaparilla is obtained from *Smilax sarsaparilla*, but several distinct species are used, known in commerce as producing the Peruvian, Brazilian, Lisbon, and Jamaica sarsaparillas, and perhaps really but little inferior. Another kind, *Smilax glycyphylla*, has also of late years been introduced into medical use from New Holland; while the roots of three sedges (*Carex arenaria, hirta*, and *intermedia*) are collected to make German sarsaparilla. The New Zealand plant (*Rhipogonum parviflorum*) is not only very nearly allied to the genus *Smilax*, but was by its first discoverers, Banks and Solander, and subsequently by Forster, classed under that genus, from which it only slightly differs. From its having been successfully (privately) used in New Zealand, and from its natural affinity, it is confidently hoped it will prove a useful and valuable article of export; at all events, a far better substitute for the true sarsaparilla than the three German *Carices*.

by its former large exports of the same after providing a sufficiency for its own people, still it would scarcely be proper to close this essay without some reference to such productions. It is greatly to be lamented that, with the exception of potatoes, there has been no export of agricultural produce for the last three years; owing in part to the war, and to the very great increase of consumers with less producers. For several years, however, before the present war commenced, the export of Cerealia from this island had been steadily decreasing annually; as the following statement, compiled from official papers, will show:—

VALUE in Money of GRAIN (WHEAT, BARLEY, OATS, MAIZE, and FLOUR) and of POTATOES exported annually from the Provinces of the North Island of New Zealand, for the ten years ending 1862.

YEAR.	AUCKLAND.		TARANAKI.		WELLINGTON AND HAWKE BAY.	
	Grain, &c.	Potatoes.	Grain, &c.	Potatoes.	Grain, &c.	Potatoes.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1853	12,495 0 0	18,489 15 0	2,456 10 0	3,078 0 0	1,175 1 9	3,667 0 6
1854	27,589 3 8	35,255 10 0	5,181 16 6	5,076 10 0	6,607 11 6	16,137 13 0
1855	61,194 2 6	44,496 10 0	3,007 0 0	15,168 19 0	5,706 17 0	17,686 9 0
1856	12,934 6 0	11,133 0 0	...	1,200 0 0	5,889 0 0	1,349 0 0
1857	17,884 19 0	8,136 0 0	274 0 0	1,582 0 0	2,575 10 0	6,552 0 0
1858	5,859 14 0	13,043 0 0	552 2 6	4,350 0 0	623 0 0	4,393 0 0
1859	5,087 0 0	6,568 0 0	525 0 0	2,819 0 0	2,643 0 0	240 0 0
1860	1,013 0 0	7,562 0 0	61 0 0	278 0 0	1,228 0 0	2,720 0 0
1861	174 0 0	1,760 0 0	...	...	68 0 0	150 0 0
1862	60 0 0	7,445 0 0	...	...	...	1,942 0 0
TOTALS...	141,291 5 2	153,888 15 0	12,057 9 0	33,552 9 0	26,516 0 3	54,837 2

The quantity of potatoes exported from Auckland in 1863 was 508 tons, value £3,233.* It is believed that this falling off is mainly owing (apart from war) to much too little attention being given to tillage; which noble and necessary occupation is neither followed nor encouraged as it should be. At present this island is greatly too dependent on foreign countries for grain, which is now being brought not only from Australia and Chili, but even from California and England. It is hoped that this growing evil may be clearly and timely discerned and put a stop to, or the consequences resulting therefrom may some day be unexpectedly and highly disastrous to the whole island.

32. It is also believed that a future generation will derive great advan-

* No potatoes were exported in 1863 from the other provinces of the North Island.—ED.

tages from the extensive cultivation of certain plants which cannot be successfully cultivated in the open air in Great Britain, some of which have been already naturalized in this island, such as the vine, the mulberry, the castor-oil plant (*Ricinus communis*), the olive (*Olea europæa*), the cochineal cactus (*Opuntia* sp.), the tobacco, and the maize, the last both for the sake of its spathes and leaves for paper-making (*for which it seems admirably adapted*), as well as for its grain. The northern parts of this island, especially the warm climate and rich volcanic soils north of the Thames, will doubtless produce wine and oil in abundance, and perhaps silk, as the climate is well known to be suited to the mulberry, and the European olive might be advantageously grafted upon the several indigenous olives of the island. Further, it is not improbable that cochineal, cinchona, and coffee may also be successfully cultivated in the warm climate of the northern districts, seeing these two last-mentioned plants have very near botanical relations in the many species of the genus *Coprosma*, everywhere common and flourishing amongst us. Those parts of the island possessing limestone soils, and, at the same time, not below the necessary isotherm, seem admirably adapted for raising tobacco, a plant which, like clover and lucerne, requires a deal of lime in the soil to bring it to perfection, its ashes containing more than 20 per cent. of lime and magnesia salts; while the more equable and temperate climate and rich alluvial soils of the southern parts of the island will also continue to produce and export, as heretofore, all British grain and fruits and edible roots very abundantly:—

> "Hic segetes, illic veniunt felicius uvæ;
> Arborei fetus alibi, atque injussa virescunt
> Gramina."— —VIRG. *Georg.* l. i.

A COMPARATIVE TABLE OF WEIGHT AND SPECIFIC GRAVITY.

Name of Wood.	Weight per cubic foot. lb.	oz.	Specific Gravity.	Remarks.
English Oak	40	14	·654	Epping.
Do.	39	0	·625	Sussex.
Do.	40	10	·714	Wandsworth.
American Oak	42	9	·681	
English Beech	41	2	·658	From Oxfordshire.
Do.	27	6	·438	From Epping.
Riga Fir	37	10	·602	
Malabar Teak	37	14	·606	
Ceylon Teak	47	3	·755	

A TABLE showing the relative Strength, Weight, &c., of some of the most useful Woods indigenous to the North Island of New Zealand.*

Name of Plant, or Wood.		Stiffness.	Strength.	Toughness.	Weight per cubic foot.	Specific Gravity.
Botanical Name.	Maori Name.				lbs. oz.	
Dammara australis	Kauri	90	99	102	25 3	·403
„ (best specimen)	... ...	...	...	...	26 13	·429
Podocarpus totara	Totara	49	61	57	39 5	·629
Podocarpus dacrydioides ...	Kahikatea ...	54	68	85	31 1	·497
Dacrydium cupressinum ...	Rimu	90	81	95	34 6	·560
Podocarpus spicata	Mataii	73	67	61	...	...
Podocarpus ferruginea ...	Miro	...	...	...	48 4	·772
Phyllocladus trichomanoides ...	Tanekaha ...	98	103	134	36 7	·583
Vitex littoralis	Puriri	100	100	100	52 5	·837
Leptospermum scoparium ...	Manuka ...	...	...	...	57 9	·921
Metrosideros tomentosa ...	Pohutukawa ...	126	109	94	52 2	·834
Metrosideros robusta	Rata	89	103	138	...	...
Edwardsia grandiflora	Kowhai	...	...	...	43 13	·701
Weinmannia racemosa ...	Towai	...	...	...	43 6	·674
Weinmannia sylvicola	Tawhero ...	93	96	99	...	...
Dysoxylum spectabile	Kohekohe ...	81	72	60	...	...
Tetranthera calicaris	Tangeao ...	89	119	160	...	...
Knightia excelsa	Rewarewa ...	54	60	85	53 15	·683
Olea cunninghamii	Maireraunui ...	...	...	...	34 5	·549
Nesodaphne tawa	Tawa	...	...	...	35 4	·564
Nesodaphne taraire	Taraire	...	...	...	35 12	·572
Dodonæa viscosa	Ake	...	...	...	63 3	1·011
Myrsine australis	Tipau	78	92	103	...	...

NOTE.—The first three columns of figures are from the Church Almanac for 1847 in which *Vitex littoralis* was made the standard of comparison.—The last two columns are from W. W. Saunders's Catalogue, in 'Report of Juries,' Exhibition, 1851.

* See, 'The Results of a Series of Experiments on the Strength of New Zealand and other Colonial Woods;' by James M. Balfour, C.E.; Appendix C., Jurors' Reports of the New Zealand Exhibition, 1865.

P.S.—The writer of this Essay wishes to return his best thanks to those few gentlemen who so kindly and promptly responded to his appeal to them. He would most particularly thank His Honor the Superintendent of Auckland (Robert Graham, Esq.) and the Chief Provincial Surveyor of that province (C. Heaphy, Esq.); also the gentlemen composing the Chamber of Commerce at Wellington. To Mr. Heaphy he is largely indebted for much useful information in colonial œconomic botany, as well as for that portion of the first table containing the weight and specific gravity of woods, and the whole of the last table herein given.

ESSAY

ON THE

CULTIVATION AND ACCLIMATIZATION OF TREES AND PLANTS.

BY A. LUDLAM.

[*Written for the New Zealand Exhibition,* 1865.]

In contributing the following paper on the cultivation and acclimatization of trees and plants in New Zealand from different parts of the world, I wish to guard myself from its being supposed that I do so otherwise than as an amateur, with the object of imparting to my fellow-settlers who are interested in gardening such information as I have gained from several years spent in the introduction and cultivation of trees and plants of the more rare and beautiful kinds, and with the hope that many who now look upon the culture of plants of this character as difficult, if not impossible, in this climate, may be induced, after reading this paper, and learning what plants are actually growing in one garden, to make an effort in the same direction. It will be a great point gained in a new country like this, where so many of its inhabitants have a taste for gardening, if they can be induced to substitute for the present growth of blue gums, poplars, and willows, plants of a more ornamental, and, I may say, durable character, such as are to be found among the coniferous family. It must not be supposed that I despise for one moment the usefulness of such trees as I have mentioned. For forming outside plantations, as a shelter to young trees, they are easily and quickly grown, which is a matter of some moment, particularly in an open country, where, perhaps, without such a shelter for a time, it would be difficult to get the more ornamental, and, in some instances, tender varieties to thrive. Such shelters may be made to serve two purposes: 1st, to protect the young trees until they are grown sufficiently strong to bear exposure to the wind; 2nd, when done with they would be found very useful for firewood; but care must be exercised in cutting away such shelter by degrees, so that the plants that have been sheltered by them are only exposed to the wind from time to time—too great an exposure at one time would likely be very detrimental to their future growth. In forming my garden, I planted the places I intended for groups of trees and shrubberies thickly with native shrubs, which in two years afforded ample shelter for the protection of young plants. As I obtained different varieties of plants I cut away the insides of these plantations, and planted them in the place of the native shrubs, but not removing more than was sufficient to allow of sun and air to the young plants. Every year I cut away more as the plants grew, until at last, in many places, none of the original shrubs are left. The great point to be attended to in this mode of forming a garden is, that the young trees have sufficient room to grow without being drawn up. The result of this plan has been that I have succeeded in growing many really tender plants, which, without such shelter, would have perished when young. In planting outside shelter, I would much prefer native shrubs to the gum, willow, or poplar, and for this reason—the former do not throw out straggling roots, and certainly tend to enrich the land, so that, in planting tender growing plants near them, they are not robbed by the roots of the native shrubs impoverishing the soil; the latter, which are rank growers, take out of the land a great amount of its strength, in consequence of their roots running to a great distance, much to the detriment of other plants near them. I am aware that it would in many places be very difficult, if not impossible, to procure a sufficient number of native shrubs to form shelters, and that recourse must be had to gums, &c.; in such cases, I should say, lay out a garden in such a way that the necessary shelters are planted by themselves, and may be entirely removed when they are no longer required. The planting of coniferous trees among such a growth as this would in most cases fail; they would struggle on for a time and then die, much to the disappointment of the planter.

I propose dividing my remarks under three headings—1st, Coniferous plants; 2nd, trees and shrubs; 3rd, ornamental plants. I will name those I have in my garden which are worthy of cultivation, the country to which they are indigenous, their degree of hardiness, and any information as to their cultivation. Before doing so I will refer to what is most necessary to be done in the formation of a garden to insure success to its future well-doing. Preparatory to planting, the piece of ground should be well drained to the depth, if possible, of 4 feet 6 inches, and the drain covered in with timber, so as to secure its lasting for many years. This first step is a most important one, by which you will secure ample drainage of the overplus water from the roots of your trees and plants. From the want of such drainage, many have been disappointed in the sickly growth of their plants. The stagnation of water about the roots causes the bark of the roots to rot, hence the sickly growth. The next season, having drained the land, it will require, if the soil is light and friable in its character, to be well dug over a foot deep; but retentive soil should be trenched. These two preliminary steps, which are so necessary, will involve some expense, but in the end it will be found the cheapest plan; for if the cheaper mode of planting is adopted, and holes dug in a piece of ground in which trees are planted, they often perish, and generally grow very sickly, in consequence of the water from the land around them draining into these holes, so that in the end the expense must be incurred to insure their growth. I have found even in this alluvial soil, where the natural drainage is very good, that I have lost plants from the want of drainage. To those interested in the planting of coniferous trees I would recommend a little book called "Practical Hints on planting Ornamental Trees," by Standish and Noble, price five shillings, published by Bradbury and Evans, London. It contains much valuable information to an amateur gardener.

CONIFERÆ.

Araucaria excelsa	Norfolk Island	tender.
„ *cunninghamii*	Moreton Bay	„
„ *bidwillii*	Wide Bay	„
„ *cookii*	New Caledonia	„
„ *imbricata*	Chili	hardy.
„ *braziliensis*	Brazil	„

The above are all very handsome trees, and well adapted for specimen plants. I have marked the first four as tender, which they are when young, being liable to have their leaders nipped by frost, but with care they may be grown out of doors in many places, particularly if they are covered during winter and spring with a slight covering overhead, until such time as the plants get established. I have tried many plans for protecting plants from frost without rendering them too delicate; at last I hit on a plan, which I will describe hereafter. To have these trees in great beauty when they get large, they must have plenty of growing room.

Biota meldensis	Japan	hardy.

Handsome when young, but liable to become dingy as it grows up.

Cedrus deodara	Himalaya Mountains	hardy.

This well-known handsome cedar is well suited to this climate; to have it in its beauty it requires plenty of room; as a specimen plant on a lawn it is very beautiful; seedlings appear to form a better tree than those grown from cuttings or layers.

Cryptomeria japonica	China	hardy.
„ *lobbii*	„	„

Both very handsome as specimen plants by themselves when young, grow very quickly, but unfortunately become very straggling and dingy as they attain any size. They produce plenty of seed, so that young plants are easily procured.

Cunninghamia sinensis	South China	hardy.

This plant is closely allied to the *Araucarias*, but hardier and well worth growing; when young its foliage turns brown in winter, and the plant appears sickly, but as it grows this is not perceptible. It is very graceful in its growth.

Cephalotaxus fortuni (male)	North China	hardy.
„ „ (female)	„	„

This variety of *Taxus* grows very well here; the male plant, however, is too straggling in its growth; the female promises to form a compact, handsome tree.

Cupressus lawsoniana	California	hardy.
„ *macrocarpa*	„	„
„ *majestica*	„	„
„ *macnabiana*	„	„
„ *udheana*	Mexico	„
„ *thurifera*	„	„
„ *torulosa*	Nepal	„
„ *lusitanica*	East Indies	„
„ *corneyana*	China	„
„ *funebris* or *pendula*	„	„
„ *thyoides variegata*	North America	„
„ *horizontalis*	South Europe	„
„ *sempervirens*	Greece	„

These are some of the best varieties of the cypress family, and grow remarkably fast and well, so much so that they will sooner than any coniferous plant I know form shelter. They are very handsome in their growth where they are allowed plenty of room to grow as specimen plants; to crowd them up in shrubberies is to lose their graceful growth. The fastest growing of those named are *macrocarpa* and *torulosa*, both of which form large trees; the foliage of the former is a very beautiful green; *thurifera*, *macnabiana*, and *udheana* are dwarfer in their growth; *pendula* is a beautiful variety, but does not assume its pendulous character until attaining a good size. Altogether, few plants are more deserving of culture than the cypress tribe.

Dammara australis	New Zealand	hardy.
„ *bidwillii*	Wide Bay	tender.
„ *moori*	New Caledonia	„
„ *browni*	Swan River	hardy.

This class of plants is more curious than beautiful, and therefore hardly worthy of general culture.

Juniperus bermudiana	Bermuda	hardy.
„ *sinensis*	China	„
„ „ *pendula*	„	„
„ *cracovia*	Poland	„
„ *hibernica*	Ireland	„
„ *oxycedrus*	South of Europe	„
„ *sabina*	„	„
„ *prostrata*	„	„

Juniperus virginiana	South of Europe	hardy
,, *stricta*	Ireland	,,
,, *rufescens*		

The junipers have many beautiful varieties among them, and are well adapted for planting in front of shrubberies, care being taken that they are not too much crowded. The best, so far as I can judge from mine, are *sabina*, *cracovia*, and *hibernica*, being close-growing shrubs ; *bermudiana* and *virginiana*, if they flourish, may be useful as timber trees.

Libocedrus chilensis	Chili	hardy.

This is a very beautiful plant, in growth very much like a cypress, but closer, with slightly variegated foliage.

PINE TRIBE.

Abies alba	Canada	hardy.
,, *douglasii*	California	,,
,, *excelsa*	Norway	,,
,, *smithiana*	Himalaya Mountains	,,
,, *cephalonica*	Cephalonia	,,
,, *nordmanniana*	Crimea	,,
,, *pinsapo*	Spain	,,
,, *picea*	Pyrenees	,,
,, *webbiana*	Himalaya Mountains	,,
,, *larix* (larch)	Tyrol	,,

This section of the pine tribe containing the firs, among which are some of the silver firs, appears to thrive well in this country ; judging from the growth of those I have, they are well worth the trouble of growing, and in spite of their slowness of growth for the first few years, they will, if proper room is allowed them, amply repay the trouble. In spring, their young luxuriant growth is very striking, particularly the Himalaya Mountain varieties, which at home are liable to be cut back by spring frosts ; here they have proved quite hardy. The larch, perhaps the most interesting and useful of the class, does not appear to me to thrive so well as one hoped for. I have a few doing pretty well, but I observe, as they increase in size, they lose their leaders and die back. I much fear the warm autumns of this country will be against them, inducing as it does a second growth, thus robbing the tree of its rest. I think the alluvial soil is perhaps too rich ; maybe it will thrive better in more exposed positions.

Pinus austriaca	Austria	hardy.
,, *pinaster*	Europe	,,
,, *halepensis*	Syria	,,
,, *pinea*	Mediterranean	,,
,, *sylvestris*	Scotland	,,
,, *benthamiana*	California	,,
,, *insignis*	,,	,,
,, *sabiniana*	,,	,,
,, *hartwegii*	Mexico	,,
,, *llaveana*	,,	,,

Pinus longifolia	Nepal	hardy
,, *canariensis*	Canaries	,,
,, *ponderosa*	North America	,,
,, *excelsa*	Nepal	,,
,, *rigida*	Virginia	,,
,, *radiata*	California	,,
,, *jeffreyi*	North America	,,
,, *strobus* (Weymouth)	,,	,,

The pine is perhaps the most valuable section of the coniferous family for planting in New Zealand; and, judging from the growth of them here, I should say the climate was peculiarly adapted for them, taking into consideration all the varieties. The first five I have named are well known, and require no comment, except to point them out as invaluable for shelter, and well adapted for firewood, some of them for timber. The next eight varieties are long-leaved pines, quite hardy here; they, however, are more ornamental, and require to be grown either singly as specimen plants, or in groups where they have plenty of room for their branches to sweep to the ground; in any other position they are lost. The *Pinus insignis*, called the remarkable pine, is a most beautiful and desirable tree; its foliage of vivid green is very striking to the eye; it grows very quickly. This section requires more care in growing when young, for until well rooted their long leaves offer greater resistance to the wind. The last five are not so difficult to grow, but require room. There are many other varieties both of the firs and pines which would be a great addition to a collection, both for ornament and timber. I have made a great many attempts to import them, but have failed. My experience leads me to believe that coniferous plants are very difficult of carriage in closed cases on a long voyage. I have also tried importing seeds, but with little or no better success, particularly in the seeds of the varieties of *Picea* or silver fir; I fear the turpentine contained in the seed destroys germination on a voyage.

Rentinospora obtusa	Japan	hardy.
,, *pisifera*	,,	,,

These are lately introduced plants, and as yet small; they promise to be handsome.

Taxodium sempervirens	California	hardy.
,, *distichum*	Florida	,,

The former is a shrubby growing tree, requiring plenty of room; when young it has a ragged appearance, but grows into a bold tree, though at all times very straggling. The latter is very inferior, and not worth growing, never seeming to throw up a leader.

Taxus adpressa	Japan	hardy.

Very much in character like the varieties of *Cephalotaxus*.

Thuja craigiana	Japan	hardy.
,, *gigantea*	California	,,

Thuja falcata	Japan	hardy
„ *aurea*	California	„
„ *occidentalis*	Canada	„

These are well worth growing, and, like the cypress, form beautiful trees; *Thuja craigiana* has very bold foliage; *Thuja aurea* is a close-growing plant, and assumes a very pretty appearance in spring, when the plant is tipped with the young growth, of a golden colour.

Thujopsis borealis	Behring Straits	hardy.
„ *dolabrata*	Japan	„

The former is a very graceful growing plant, and well suited to stand singly; the latter a new introduction, with peculiar foliage, like scale armour; it has stood out two winters, and promises well.

Wellingtonia gigantea	California	hardy.

This tree, well known to every one by name, will no doubt prove a valuable addition to our gardens, from its hardiness and rapidity of growth. Mine are only small seedling plants, but, judging from larger plants I have seen, it struck me that it was not so graceful in its growth as many of the cypress, *Thuja*, and other coniferous plants.

Widdringtonia cupressoides	Cape of Good Hope	hardy.

A dwarf-growing plant, somewhat like the *Wellingtonia* in its foliage, but no particular acquisition to a collection of conifers.

Having enumerated the different varieties of conifers growing here, I would make a few remarks as to their cultivation. In selecting plants I would recommend the purchaser to obtain those which have been transplanted from the seedbed the first year in preference to those that have gained considerable height without being transplanted; for I think it will be found that the latter, from having their tap roots destroyed in removing, are very liable to die off after a time, while those which have been transplanted, although smaller in size, have made fresh roots, and are pretty sure to succeed. In planting, care should be taken to spread each root separately, putting some in all directions, and, when so spread, they should be fixed in their places with pulverized earth before the hole is filled in. Many persons use stakes to tie the young plants to prevent their being blown aside. This plan I do not think a good one, but prefer going round, and if I find any blown on one side, I put some fresh earth on and tread the plant upright. I found that planting on hillocks, as adopted at home, does not answer well in this country: the soil becomes dried through, and the roots of the plants suffer. I prefer raising them only a little above the surrounding ground. Manure should not be used in planting any of the coniferous tribe. I have done so in ignorance; it appears very poisonous to the roots. As to the future management of the plants little requires to be said, for if the land has been properly prepared they will soon take care of themselves. The only suggestion I can make is, that the ground should be hoed to keep it clear of weeds in preference to digging, by which means no interruption will be offered to the free growth of the roots, whereas digging must destroy those anywhere near the surface. I have found it a good plan to put the mowings of the lawn over the surface of the ground in summer, which serves to keep in the moisture, and acts as a slight dressing of vegetable manure. Pines should not be pruned, unless it is necessary to get rid of a limb.

Trees and Shrubs.

Arbutus unedo	Ireland	hardy.
„ *andrachne*	Levant	„
„ *procera*	North America	„

These are very desirable for planting either singly or in the shrubbery, and when in flower are very showy.

Aucuba japonica	Japan	hardy.

This shrubby plant, although slow in its growth, is an addition to the garden, from its variegated leaves.

Aloysia citriodora	Chili	hardy.

This plant appears hardy enough to grow anywhere in New Zealand, in sheltered positions; it keeps its lemon-scented leaves nearly all the year.

Berberis aquifolia		hardy.
„ *atropurpurea*		„
„ *fortunii*	China	„
„ *fascicularis*	California	„
„ *buxifolia*	Straits of Magellan	„
„ *darwinii*	Chiloe	„
„ *japonica*	Japan	„
„ *bealii*	„	„

The whole of these, with the exception of *fortunii*, are very handsome shrubs, both in foliage and bloom, particularly *darwinii*. The two latter are new introductions from Japan, having much larger foliage than the others; the leaves become variegated as the plants grow up; few dwarf shrubs are more worthy of cultivation.

Banksia, varieties	New South Wales	hardy.

Several varieties of this tree do well here, and afford good shelter; they grow slower than in their own country, but, in consequence, more compact.

Acacia dealbata	New South Wales	hardy.
„ *alata*	„	„
„ *lophantes*	„	„
„ *cultriformis*	„	„
„ *armata*	„	„

Of these, *dealbata* is the most beautiful and useful for shelter, also for planting along the banks of rivers to protect them. Its roots become so matted together that they will offer greater resistance to water than the roots of the willow. They have an inclination to grow bare, if left to themselves this can be obviated by heading the trees well back so soon as they have done blooming. As yet, this variety has seeded very little, but throws up a large number of suckers from the roots. In transplanting them, they should not be headed back. *Alata* is a stronger growing tree, and flowers about the same time as *dealbata; cultriformis* and *armata* are shrubs, both very beautiful when in bloom.

Bambusa arundinacea	China	doubtful.
„ *metake*	Japan	hardy.
„ *nigra*	Himalaya Mountains	„

The bamboo, if it can be grown in this country, would prove very useful for many purposes. The large one, I much fear, would be too tender. I have tried plants at different times, and now have one which has been twelve months in the ground without making any growth; it is still alive, and I have some hopes it may shoot up this season. In New South Wales, in a district visited by harder frosts than any I have seen here, it grows to a fair height, with strong canes. The black bamboo from the Himalaya Mountains is a much hardier variety, but much smaller. I have had it growing for several years very well; the canes grow to the height of about fourteen feet in a season. It will prove very valuable for ornamental shelter if planted in a soil suited to it. With me it grows in the ordinary soil, and will no doubt thrive anywhere except on very dry ground. It is increased by taking the canes off with a portion of the roots of the main plant. The Japan variety has white canes; I have only lately obtained it. In summer the bamboos, when in full growth, have a singular and pretty appearance, and are well worth a trial.

Cerasus lusitanica	Portugal	hardy.
„ *lauro-cerasus*	Levant	

The former of these, the Portugal laurel, grows particularly well in this country, being covered in spring with bloom. As a plant for shelter in a group of laurels and viburnums, I know of no better; it must, however, have plenty of room to form a handsome plant. The common laurel does not appear to me to thrive as well as one would have expected—it, however, blooms very freely.

Deutzia scabrata	Japan	hardy.
„ *gracilis*		„

Both very pretty flowering shrubs; the latter dwarf in its growth, and a very free bloomer.

Daphne odorata	China	tender.
„ „ *variegata*	„	„
„ *fortunii*	„	„
„ *hybrida*	„	hardy.

These are very pretty and highly-scented flowering plants, and very desirable for a garden; they are, unfortunately, very uncertain in their growth, and I fear a little too tender for our climate.

Daubentonia longifolia	Spain	hardy.

This is a species of acacia; its flower is pea-shaped, and very handsome. The growth of the plant is very straggling.

Eugenia or *Myrtus ugni*	South America	hardy.

This is a variety of myrtle, bearing a small fruit used in South America for dessert. It forms a pretty shrub.

Escallonia floribunda	Grenada	hardy.
,, *organensis*	Oregon Mountains.	,,
,, *grandiflora*		,,
,, *montevidensis*	Monte Video	,,
,, *macrantha*	South Chili	,,

Handsome flowering shrubs, particularly the last, which was introduced into the colony by Mr. Mantell. Its close habit of growth, dark glossy green leaves, and bright crimson flowers, render it a great addition to our gardens. It grows very quickly.

Ficus elastica	East Indies	tender.
,, *macrophylla*	Moreton Bay	hardy.

Both large trees, with very large and handsome leaves; the former appears too tender to stand the frost, for, even when covered, the young shoots are cut back. The latter is likely to do well, if it is covered over during the winter for two or three years; when growing well, it is a noble tree.

Forsythia viridissima	China	hardy.
,, *suspensa*	Japan	,,

Are worthy of cultivation from their blooming early in spring: they grow very straggling, and require to be staked.

Gardenia flore-pleno	China	tender
,, *beaumiana*		,,
,, *thunbergiana*	Cape of Good Hope	,,
,, *fortunii*	China	,,
,, *sinensis*	,,	,,

These, like the *Daphnes*, have highly-scented flowers, and are equally difficult to grow in the open air.

Habrothamnus elegans	Mexico	hardy.
,, *fascicularis*	,,	,,
,, *lutea*	,,	,,

Very showy flowering shrubs, and early bloomers; grow very freely, and require to be pruned back a good deal, otherwise they become shabby.

Ilex aquifolium	Britain	hardy
,, *cornuta*	China	,,
,, Variegated varieties		,,

This climate is well suited to the growth of the hollies, judging from the profusion of berries produced on the trees of *aquifolium.*

Illicium anisatum	Japan	hardy.

The aniseed tree. I have only a young plant, which grows well and stood this last winter.

Iochroma tubulosa	Yangana	tender.

A very beautiful flowering shrub, but rather tender, the frost cutting it back every winter. It grows very freely during the summer, and in autumn is covered with bunches of deep blue tubular flowers. A very showy plant.

Laurus nobilis	South Europe	hardy
,, *borbonia*		
,, *camphora*	Japan	tender

The first, the sweet bay, is well known; the last, the camphor laurel, is slow of growth, and is hardly hardy enough for our winters. When growing well, it is a graceful shrubby tree.

Lagerstrœmia indica	East Indies	hardy.
,, *alba*	,,	,,

Being deciduous, they are hardy; their foliage is small, but pretty. Mine have not bloomed yet.

Magnolia grandiflora	Carolina	hardy.
,, *anonifolia*	China	,,
,, *fuscata*	,,	,,
,, *conspicua*	,,	,,
,, *purpurea*	Japan	,,
,, *gracilis*	,,	,,
,, *glauca*	North America	,,
,, *soulangeana*	Hybrid	,,

The whole of these are very beautiful flowering plants, some growing into trees, but mostly shrubs. *Grandiflora* thrives well here, after it once becomes established in the ground, and when of any size is covered with its beautiful fragrant blooms. The Chinese varieties are very free growers, with fragrant but smaller flowers than *grandiflora*. *Glauca*, called in America the swamp laurel, has numerous cupped flowers, very fragrant; any labour bestowed on the cultivation of them will be amply repaid by their beauty when in bloom; they like to grow in rich soil.

Quercus ilex	
,, *luccombiana*	
,, *lanata*	Japan
,, *spicata*	
,, *coccinea,* and others	

The three first are evergreen oaks, and grow well here; they are valuable for planting in windy situations, forming handsome trees. The timber oaks do not thrive well on this alluvial soil; it appears to me they prefer more clayey ground.

Raphiolepis indica	China	hardy.

A very pretty free flowering dwarf shrub.

Liriodendron tulipifera	North America	hardy.

The tulip tree thrives well in this soil, but has not produced any bloom yet.

Nerium splendens		hardy.

Grows very freely, but from some cause the flowers do not open well.

Olea americana	N. America	hardy.
„ *ilicifolia*	Japan	„
„ *fragrans*	China	„

The two last varieties are very ornamental.

Paulownia imperialis	China	hardy.

A very handsome deciduous shrubby tree, growing very quickly; in spring it produces on the terminals of the last season's growth bunches of light blue flowers, in shape much resembling a *Gloxinia.* The leaves of this tree, when growing well, are very large, of a bright green colour. Judging from one I have, I should say it was a very free bloomer. This season it is covered with buds. Owing to the leaves being thin, it requires to be planted in a very sheltered situation, otherwise the wind would destroy the leaves, causing the tree to look unsightly.

Pœonia moutan	China	hardy.
„ *papaveracea*	„	„

Two very beautiful varieties of the tree pœony, and well worthy of cultivation. *Moutan* produces in spring a large number of immense-sized flowers, very double; the other is semi-double and more marked. They require to be grown in rich soil. Care should be taken to plant them in a sheltered position.

Photinia serrulata	China	hardy.

A tall shrub, having a flower somewhat like the *Laurustinus,* but larger. In spring its young growth is very attractive.

Protea mellifera	Cape of Good Hope	hardy.
„ *nigra*	„	„

Very pretty flowering shrubs in winter. They are, however, rather difficult to cultivate—why, I can hardly say, but at times young thriving plants will die off without any apparent cause.

Platanus orientalis	Levant	hardy.

The true plane tree, and one which, I think, will prove of great value in New Zealand for planting as shelter, both from wind and the heat of the sun in summer. It grows very rapidly, and if attended to when young will form a very handsome tree. It may not be generally known that it will grow freely from cuttings planted in the spring.

Viburnum arboreum		hardy.
„ *japonicum*	Japan	„
„ *sinense*	China	„
„ *opulus*	America	„
„ *plicatum*	China	„

Viburnum rugosum	Canary Islands	hardy.
,, *tinus*	South Europe	,,
,, *cassinioides*	North America	,,
,, *suspensum*		,,
,, *macrocephalum*	China	,,

The above are all good varieties for planting in shrubberies, having very distinct foliage from each other, so that they group well together. Another advantage they possess is, that nearly all of them bloom in winter and early spring. No class of plants are better adapted for ornamental shelter; they can be cut back without any injury to their future growth.

Weigelea rosea	China	hardy.
,, *amabilis*	,,	,,

Very ornamental, free-flowering shrubs. In spring, so soon as the leaves show, the carmine and pink flowers appear, giving the plant a very gay appearance.

I have not referred to forest trees, as they are well known by all interested in planting, nor have I mentioned the names of many trees and shrubs I have growing, because they have not proved desirable additions to a garden.

PALMS.

I have tried, for the sake of experiment, whether some of the palm tribe would not thrive in this country. I have several varieties of the more hardy kinds; and if I find they will grow, I propose trying some of the more tropical species. What I have, have stood out for two winters, with a slight protection overhead, and seem to be doing pretty well; they are, however, very slow of growth.

Areca sapida	New Zealand	hardy.
Bactris minor	South America	,,
Corypha australis	New South Wales	,,
Chamærops palmetto	Carolina	,,
,, *humilis*	South Europe	,,
Phœnix dactylifera, date palm	Levant	,,
Seaforthia elegans	New South Wales	,,

CREEPERS.

Bignonia capensis	Cape of Good Hope	hardy.
,, *grandiflora*	Caraccas	,,
,, *picta*	South America	,,
,, *venusta*	,,	tender.
,, *cherere*	Guiana	,,

All very beautiful flowering plants, and thrive well except the two latter, which only exist in the open air.

Mandevillea suaveolens	Buenos Ayres	hardy.

A creeper with large pure white scented flowers; in good positions a very free grower. A beautiful creeper.

Passiflora comlea	Brazil	hardy.
,, *edulis*	West Indies	,,
,, *floribunda*	Hybrid	,,

All very beautiful when in bloom. *Edulis* will produce fruit in the open air in a very sheltered situation. There are several other varieties far exceeding in beauty those I have named, but they are too tender to stand out.

Solanum jasminoides		hardy.

A very pretty creeper, with delicate white blossoms.

Tecoma jasminoides	Moreton Bay.	hardy.
,, *alba*	,,	,,

Two very handsome flowering creepers, particularly the first-named. At first they are a little tender and require protection for the winter; I have had the first-named in beautiful bloom the last two seasons.

Tropæolum pentaphyllum	Monte Video	hardy.

A very delicate creeper, well adapted for covering an old stump: when in bloom it is very pretty.

Wisteria or *Glycine sinensis*	China	hardy.
,, *bidwillii*	Wide Bay	,,

The Chinese variety is a beautiful plant, and in early spring, when covered with bunches of lilac-coloured pea-shaped flowers, is very showy. A sheltered sunny situation is necessary to its thriving. For some time the growth of young plants is slow, but once established it grows with great vigour. Is fond of a supply of old manure.

Ornamental Plants.

Azalea indica	China	hardy.

About twenty-five varieties.

Azalea calendulacea	North America	hardy.
,, *pontica*		

Several varieties.

A very beautiful and showy class of plants, particularly the Indian varieties. When planted in masses, judging from the profusion of bloom with which they are covered in spring, sometimes quite dazzling to the eye to look at. There can be no doubt this climate is well suited to their growth, there being frost enough to stop their too vigorous growth and throw them into bloom; they are easy of culture if planted in soil suited to them, reference to which I will make in noticing the growth of the *Rhododendron*. The deciduous varieties are pretty, but very inferior to the others. I will give the names of some of the best I have growing. *A. indica-phœnicea, indica-alba, triumphans, refulgens, coronata, optima, georgiana, purpurea-superba, splendens, verchaffelli.*

Abutilon striatum	Brazil	hardy.
,, *venosum*	,,	,,

Two very pretty flowering free-growing plants, particularly the last.

Camellia japonica	China	hardy.

About fifty varieties.

This plant, so highly esteemed for its beautiful flowers and foliage, is one about which there seems a great difference of opinion, as to whether it is possible to grow it generally in the open air in this country to any state of perfection. For some time I was of opinion, after trying a plant for two years, that our climate was too cold either to grow it or mature their flower buds, even supposing it remained alive; but while on a visit to New South Wales I saw it growing as large shrubs in a district visited by severe frosts in winter, which determined me on making another trial, the result of which has been, that I have now two beds containing about fifty varieties growing and blooming luxuriantly every season; they commence blooming in April and last till November, making the garden during the winter months quite gay. I will describe the mode in which I formed the beds and cultivate them, should any reader of this like to try the experiment. In the first place I dug a drain under the beds four feet deep, and slabbed it in; I then raised my beds with soil about ten inches above the ordinary level with sandy loam,—the ground was dug over very deep and allowed to remain until it settled; second, I made holes in which I put prepared soil, formed by mixing half alluvial loam, quarter old peat earth, quarter old cow dung, which had been mixed for some time and left in a heap, being turned over from time to time; the prepared soil should be trodden well in, and the *Camellias* planted, taking care that the roots of the plant are extended in all directions. For the first season they made very little progress; the third year they grew very rapidly and commenced blooming, and have continued to do so ever since; in fact this last season, to prevent their being injured from over-blooming, I picked off between two and three thousand buds. The success of this experiment I attribute to the fact of the plants having free drainage, and from being in beds by themselves having plenty of root room. I find some old manure laid on the surface of the bed every season after the bloom is over of great service to them. Below I give the names of some of the best I have.

White.

Camellia alba plena
„ *leila*
„ *imbricata alba*
„ *fimbriata alba*
„ *calliope*

Variegated.

Camellia presii
„ *rosa mundi*
„ *variegata plena.*
„ *lysanthe*
„ *donklerii.*

Red.

Camellia coccinea.
„ *clio.*
„ *marina.*
„ *splendens.*
„ *ianthe.*

Pink.

Camellia wellbankii.
„ *picta.*

I have had all these in bloom.

Erythrina crista-galli	Brazil	hardy.
„ *bidwillii*	Hybrid	„

Are two varieties of the coral plant well worthy of a place in the garden; they die back every season after blooming, and should not be pruned until they show their young growth in the spring. For a time they grow slowly; they are free bloomers, and in autumn, when covered with spikes of deep crimson flowers, are very beautiful. They require rich soil, and some stable manure put round the plants in winter will be found of advantage. I have tried the tree varieties, but found them too tender for this climate.

Plumbago capensis	Cape of Good Hope	hardy.
„ *larpenta*	China	„

The first is a pretty shrubby plant with lavender flowers. The plants, when young, should be protected in winter. The latter an herbaceous plant, well adapted for massing in beds; it has a very dark blue flower, and from its richness and profusion contrasts well with the leaves.

Bouvardia triphylla	Mexico	hardy.

A very pretty dwarf plant, quite deciduous; in summer it has bunches of scented tubular flowers.

Rhododendron arboreum	Nepal	hardy.
„ *roseum*	„	„
„ *paxtonii*	Khoseea	„
„ *altaclarense*	Hybrid	„
„ *catawbiense*	North America	„
„ *delicatum*	Hybrid	„
„ *cunninghamii*	„	„
„ *nigrum maculatum*	„	„
„ *ponticum album*	„	„
„ *ponticum*	Gibraltar	„

And many other varieties.

These, like the *Azalea indica*, seem quite at home in the climate of New Zealand, and in spring, when covered with their beautiful and gay blooms, have a very striking appearance in the garden. The three varieties of the *arboreum* are growing well, but have not yet bloomed. There is very little trouble in their culture after they have obtained sufficient size to be planted out; the raising them from seed is however a tedious and difficult matter; when so very young they are easily lost from damping off. Care must be taken with these and the *Azaleas*, in preparing the ground properly for them before planting; they, like the *Camellia*, require free drainage to their roots and a prepared soil, which should be composed of one-half alluvial loam, quarter peat earth, and quarter white sand (no manure), well mixed together. I am now trying to grow these plants in alluvial soil, only in a position well drained they grow very luxuriantly, and will, I think, flower well. I mention this because I am of opinion that a good sandy loam may answer as well for them, in which case it will save a good deal of trouble. It must not be supposed from my saying that good drainage is required that the plants would grow on soil liable at any time to become very dry; there is just a fair medium required to insure success in their growth; care must be taken in digging the bed not to disturb the roots of the plants. Every season I put some fresh earth round mine, and tread it in; a dressing of ashes from burnt weeds is a first-rate manure for them.

ROSES.

These general favourites, so well known, and so universally cultivated, I should not say anything about, but that I tried a plan of growing them which I have found to succeed well, and I hope to induce others to try it. My great objection to the ordinary culture is to the digging about their roots every season. I prepared my beds, which are of deep alluvial soil (well suited to the rose), by first putting on an ample allowance of old manure, and digging it well down for some time before I want to plant the roses. Having planted, I merely keep the beds hoed to destroy the weeds, and every winter I give a top dressing of old manure. By this means the plants are fed sufficiently to support a strong growth, and bloom without their roots being hacked about. The varieties I treat in this manner are the perpetuals, mosses, Chinas, &c. I have about ninety distinct varieties, which, for months in the summer, are one mass of flowers, many of them of a very large size. I prune them well back in winter, so soon as they are quite dormant. To have plants like *Camellias*, *Azaleas*, *Rhododendrons* and roses in perfection, I should say make beds for each variety; for many reasons—firstly, they appear to greater advantage in masses, particularly if attention is paid to have a proper distribution of colours; secondly, they thrive much better than when planted in the borders with other plants and trees, where they have to contend with ranker growing shrubs, &c.; thirdly, they are much easier attended to if a large collection is wished for.

One of the greatest troubles I find in the cultivation of the rose arises from the ravages of the aphis or green fly; unless attention is paid to destroy them, there is little chance of obtaining a good bloom. I have tried many plans, such as smoking them with tobacco, washing them with the same and wood ashes, but have found the effects only temporary. I now watch the plants very closely as they begin to grow in spring, and, with a tooth brush, destroy the insects so soon as they appear. Looking at them every other day will be enough to keep them down. It appears, at first, as though it involved great trouble, but such is not the case, as, if constantly attended to, an hour will be time enough to go over a good number of plants; but the great point is to begin destroying so soon as they make their appearance.

Gynerium argenteum	Pampas	hardy.

A grass in growth and bloom very much like the New Zealand toe-toe. It blooms in winter, and the flower has a bright silver hue, very graceful in appearance.

Hedychium gardenianum	East Indies	hardy.
„ *coronarium*	„	„

Varieties of the garland flower. Though coming from a tropical climate, they have grown and bloomed here for several years. The latter has a most powerfully scented flower, and blooms very freely. They are nearly herbaceous in winter; the stem that blooms is thrown up fresh every year.

Phlox herbacea, varieties		all hardy.

These are very beautiful flowering plants, and well worthy of cultivation, about which there is little difficulty. They are fond of rich soil.

Yucca gloriosa	North America	hardy.
„ *crenulata*	Missouri	„
„ *aloifolia*		„
„ *filamentosa*		„

Adam's needle—very ornamental in garden when grown as single plants. *Yucca gloriosa* is the only one that has as yet bloomed with me. I have now another variety—*aloifolia*—just going to bloom.

Flowering Bulbs.

Amaryllis johnsonii	Hybrid	hardy.
„ *virgata*	„	„
„ *vittata*	Cape of Good Hope	„
„ *formosissima*	North America	„
„ *fulgida*	Brazil	„
„ *magnifica*	Hybrid	„
„ *vallota purpurea*	Cape of Good Hope	„
„ *blanda*	Hybrid	„
„ *belladonna*	„	„
„ *nerine sinensis*	Japan	„
„ *aulioa*	Brazil	„
„ *spittisana*	„	„

and other varieties.

These are all very handsome flowering bulbs, and thrive well in this country, not requiring to be taken up every year for protection against frost. I find the best mode of cultivating them to be, to plant them in front of *Camellia* beds, and only move them once in four years, to divide them: a little old manure put over them, when they have died down in winter, will keep the soil rich enough; their brilliant flowers will amply repay any trouble bestowed on them.

Crinum scabrum	Azores	hardy.
„ *augusta*	Hybrid	„
„ *pedunculatum*	New South Wales	„

Crinum macleayii	Hybrid	hardy.
„ *niobe*	„	„
„ *helen*	„	„
„ *capense*	Cape of Good Hope	„

These are nearly allied to the *Amaryllis,* and require the same cultivation; the flowers are mostly white with a delicate tinge of pink, some of them highly scented.

Convallaria majalis	Britain	hardy.

The beautiful lily of the valley. It thrives well here; once it becomes well established it is a free bloomer. I give the bed, every season, a light dressing of old manure, and judging from the luxuriance of their growth and bloom, they appear grateful for it. I do not think they will thrive so well if planted under the shelter of trees.

Dielytra spectabilis	China	hardy.

A very beautiful flowering tuberous rooted plant; requires good soil, and to be kept propagated at intervals of about three years. This is easily done by dividing the tubers in the same way as the *Dahlia.*

Lilies—about forty varieties, including the handsome varieties from Nepal and Japan, which are quite hardy, and will stand the winter if left in the ground. The whole of them are very ornamental when in bloom. They should be grouped together in a bed, very easy of cultivation. I grow them in deep soil, well manured, and do not take them up more than once every four years, when they should be divided and replanted. I find that by removing the earth from their crowns every winter, taking out the flower stems so as to leave the crowns quite exposed, and putting on a dressing of old manure or ashes obtained from burnt weeds, they succeed very well.

Polyanthus tuberosa	East Indies	hardy.

The *tuberosa* has thriven with me for some years in the open air, producing its most fragrant blooms every season. I plant it in the ordinary soil. Care must be taken not to remove it too often, for so long as it is constantly divided it does not bloom.

Pœonia, sixteen herbaceous varieties.

Thrive very well in rich ground. They require a top dressing of manure every season to insure a good bloom.

I have a great many other varieties of very beautiful flowering bulbs, but those I have mentioned are the best for general culture, and most suited for growing in beds by themselves. I recommend this mode of growing because in my own garden I have found it to answer so much better than planting them in the borders, where they have to contend against the roots of stronger plants; consequently they become starved and produce miserable flowers, and very often get destroyed when the borders are dug. Where only a few bulbs of each variety are desired, it is very easy to have one general bulb bed, I have selected from the plants I have growing the names of such as are deserving a place in the garden; I have many other varieties that would hardly repay the trouble of growing. I have also omitted any mention of plants such as the *Fuchsias*, *Geraniums*, and herbaceous plants, because they are well known, and a description of them would take too much room.

I send a sketch of the shelter I have adopted for protecting tender plants in winter from frost. In form it is like the top of a basket, and is supported at a height to allow of sufficient air and light to the plant by three or four stakes driven into the ground. A little frost will find its way through the wickerwork to the plant, which I think an advantage, as tending to harden the plants by degrees. I have mine made of split supplejacks, but willows will do as well, care being taken that it is not too open. I have never found plants damp off with this covering.

I have a few words to say as to the destruction of that pest of all pests, sorrel,—one which appears to flourish all the better for the attention it receives in digging it up and carefully collecting its roots. During the last few years I have tried many of the recipes to get rid of this enemy to the garden, but to no purpose; at last I thought I would try constant hoeing during the summer, which I have done for two seasons, and found it answer well. I simply hoe the ground very shallow on a dry day so soon as the weed makes its appearance—a few hours' hot sun dries it up. This plan I have found the most effective one I have tried, for many beds are quite free from it, and in every place it was so treated it is fast disappearing.

In concluding this paper, I may be allowed to hope that the information contained in it will lead to a more general cultivation of the coniferous trees in this country. I am quite aware that many of the rarer varieties are not so easily obtained in this colony. To those wishing to procure them, I would say, you can procure most of them from the nurseries in Australia. It has always been a matter of deep regret to me that the Government of the colony, in former years, did not establish a botanical garden for the collection and propagation of trees and plants from different countries. Had such been done, New Zealand might now possess one of the finest public gardens, which would be a credit and pleasure to its inhabitants, and a source of utility in providing them with plants of a beautiful character. Perhaps, when peace is once more restored to the Northern Island, we may hope to see some advance made in that direction.

In conclusion, I will say to those who may peruse this paper, Be merciful to any faults that are in it. It has no pretension to be written by a botanist, but simply by a lover of plants. Many, no doubt, are in the same position as myself; and if they will give the result of their experience as amateur gardeners to the public, they will be doing good service.

ESSAY

ON THE

GEOLOGY OF THE NORTH ISLAND

OF

NEW ZEALAND.

By the Hon. J. COUTTS CRAWFORD, F.G.S.

[*Written for the New Zealand Exhibition,* 1865.]

Up to the time when the first systematic colonization of New Zealand commenced, but little appears to have been known of the geology of the country. The prevailing idea concerning the North Island was, that it was a region of volcanic rocks only; and the greenstone weapons of the aborigines, the material for the manufacture of which was said to be procured from some mysterious lake in the South Island, proved that rocks of nephrite were found there.

In the year 1839, however, the directors of the New Zealand Company, with intelligent foresight, selected a talented and experienced naturalist to proceed to the colony with their first expedition in the ship "Tory," and to the person so appointed to report on the natural history and geology of the colony, Dr. Ernest Dieffenbach, we owe our first systematic information as to the geology of the North Island. About the same time the late Mr. John Bidwill, a man of excellent scientific attainments, and known to fame from the *Araucaria* which he discovered at Moreton Bay, and which bears his name, performed a journey through the North Island; and, having succeeded in effecting the ascent of Tongariro, or more probably of its lateral cone called Ngauruhoe, gave interesting information concerning the volcanic system of the interior, and other geological matters. I am glad to have this opportunity of bearing testimony to the merits of an old and valued friend. The communications of Mr. Walter Mantell to the Geological Society also threw much light on the palæontology of New Zealand; and his observations on the deposits of moa bones, and subsequent deductions as to the existence, at the same period, of man and the moa, are extremely curious and interesting.

Contributions towards the knowledge of the rocks of the colony continued to be made from time to time by Mr. Charles Heaphy and Mr. Theophilus Heale, of Auckland.

In 1845, Darwin's Voyage of a Naturalist was published, with some account of the geology of the Bay of Islands.

In the year 1855, Dr. C. Forbes, R.N., of H.M.S. "Pandora," contributed a valuable paper to the Geological Society on the geology of New Zealand.

In 1856, the Rev. R. Taylor, of Wanganui, published his work on New Zealand and its inhabitants, which contains the results of his long geological experience.

In 1859, Dr. Thomson's Story of New Zealand was published, in which he refers instructively to the geology of the colony, and describes some points of great interest. In the same year Dr. Hochstetter arrived in New Zealand, in the I. and R. Austrian frigate "Novara," and commenced that investigation of the Provinces of Auckland and Nelson which has resulted in the valuable contributions to science now before the public. In this investigation he was assisted by the present government geologist of Canterbury, Dr. Julius Haast.

In the Province of Wellington, Mr. William Lyon has done much during a long series of years to advance the cause of geology, and Mr. Thomas Dawson Triphook has investigated the rocks of the Province of Hawke Bay. From him, in the year 1860, I obtained a valuable "tabular view" of the rocks of that province.

Having now brought down these observations on our previous knowledge of the North Island rocks, I will state that for the purpose of this essay I shall principally make use of the results of Hochstetter's investigations in the Province of Auckland, and my own observations in the southern part of the island, while engaged as government geologist of the Province of Wellington, from the year 1861 to 1864. In this investigation I received valuable assistance from the Rev. W. B. Clarke, of Sydney, whose zeal for the advancement of geological knowledge is so well known.

As a considerable portion of the North Island of New Zealand has never been subjected to a systematic geological investigation, many parts of it still require to be scientifically examined; and as indeed too short a period has been devoted to the study of any one part of the island, I can do no more than collate all the evidence that is already before the world on the subject —which is, at all events, considerable, and amply sufficient to give a good general idea of the age and character of the rocks, and of the changes which have taken place in them.

In the North Island there appears to be an absence of the older crystalline and plutonic rocks, and the various formations appear to be principally composed of a flooring of palæozoic age, overlaid in general by sedimentary tertiary rocks, which cover an extensive area (comprising about half the island) to the northward and eastward of a line struck from the southern slopes of Mount Egmont and Ruapehu, and are broken through by volcanic rocks, which, to a considerable extent, overspread their surface.

The secondary or mesozoic rocks as yet discovered or positively known occupy an area of moderate extent, and the greater part of the surface of the island is covered by the above strata of tertiary age, both sedimentary and volcanic.

Before entering upon a description of the palæozoic rocks, it is however necessary to state that there is reason to suspect that a considerable proportion of the rocks now classed as palæozoic may have hereafter to be transferred to the mesozoic list. Dr. Hector thinks that the sandstones and slates associated with the plant beds near Wellington have a strong resemblance to mesozoic rocks elsewhere in New Zealand, and that they will probably be found to lie unconformably upon the older diorite rocks of the neighbourhood; while I have a decided impression that the rocks of the ranges at Cape Palliser will prove to be of later date than those of the Rimutaka Range on the eastern side of the Wairarapa. With the above understanding, it will be as well, for present purposes of description, to consider all the apparently old and highly inclined rocks of the great leading ranges of mountains as of palæozoic age.

PRIMARY OR PALÆOZOIC ROCKS.

There is reason to suppose that the palæozoic rocks, which are almost invariably found highly inclined, decrease in geological age from west to east. They appear to have been subjected during the lapse of ages to extreme lateral pressure, which has thrown them, particularly towards the eastern or main ranges, into abrupt mountain ridges, extending in a N.N.E. and S.S.W. direction, and enclosing only very narrow valleys. Except where these mountain ridges rise from out of the tertiary covering, the indication of their existence can often only be proved at remote spots, where the violent torrents near the sources of the great rivers have scooped out deep gullies in the soft tertiaries, and left a flooring of old slates or sandstones exposed in their beds.

Although the volcanic chain of Ruapehu and Tongariro may be said to be the leading feature of the North Island, rising as it does from a very elevated plateau, one of its cones, Ruapehu, being the highest mountain in the island, yet we cannot consider this isolated chain as the leading range, but must award a higher structural importance to the palæozoic ranges further to the eastward. These ranges, though broken, pass completely through the island from the coast near Wellington in a N.N.E. direction. They have an extreme width of about twenty-three miles, and a minimum width of about four miles, and form a succession of gigantic "hog-backs," rising from Cook Strait to an extreme elevation of over 5,000 feet nearly opposite the Horowhenua river and lake. At this latter place they attain the greatest width, and afterwards sink to an altitude of 1,300 or 1,400 feet, and at the gorge of the Manawatu their breadth is decreased to four or five miles. Here the striking feature is observed of a river (the Manawatu) rising on the eastern side of the main range, passing through a narrow gorge, and falling into the sea on the western side of the island. This phenomenon also occurs in the opposite direction, viz. from west to east, with various Hawke Bay rivers. The mountains which may be regarded as the southernmost group of the main range, pass under the general names of Tararua and Rimutaka, but have various spurs and offshoots bearing subordinate denominations.

From the northern side of the Manawatu Gorge, the main range, which is composed of rocks of a similar geological character, continues its course to the N.N.E., under the name of Ruahine, attaining an elevation of 5,000 or 6,000 feet, and, like the above described more southern group, drops again to the northward, to be succeeded by the Kaweka range, and that again by other ranges continuing the line to Hicks Bay, westward of the East Cape. These ranges in the latter part of their course have never been surveyed nor even examined, but their general character has been roughly determined by observation in passing along the coast.

Parallel ranges of palæozoic rocks are found both east and west of this line, but none of them, like the above described mountains, traverse the island from end to end.

The rocks of these ranges consist of sandstones of different kinds, varying from a soft decomposing texture and yellow colour, to a hard compact blue and grey semi-crystalline rock, plant beds, tentaculite beds, slates, (some being pyritous), diorite schist, jasperoid rocks, and a little serpentine.

More modern eruptive rocks also appear to penetrate the ranges, as seen at Mukamuka and elsewhere, consisting of amygdaloidal trap and basalt.

The line of strike of these eruptive rocks will probably be found to be shown by the jasperoid rocks, supposing these to have been metamorphosed into their present state by the effect of the intrusive dykes.

The fossils that have been found in the palæozoic ranges are few and indistinct, and, as far as we know, are confined to those discovered by myself in the neighbourhood of Wellington. One from Belmont Hill, above the western entrance of the Hutt Valley, is supposed to be either *Theca* or *Dentalium;* and some vermiform casts, probably *Tentaculites*, have been found at the same place.

The most frequent remains of organic life, however, are to be found as markings, or seams of carbonaceous substances. Organisms are found at Porirua and at Oriental Bay, near Wellington, where they seem to indicate a mesozoic age; but they are in both cases too obscure to found a theory upon, and we must await the discovery of more distinct specimens before drawing decided conclusions.

Thin seams of an impure graphite are found at a great variety of places —on the Pitone Road near Wellington, at the Mungaroa Hill, at various points on the Rimutaka Mountains, in the mountain part of the valleys of the Waiohine, the Waingawa, and the Ruamahunga, in the Waikanae, the Akatarewa, and particularly in the upper part of the Otaki valleys.

The inclination of these old rocks is very great, from 45° to vertical (on an average perhaps 70°). They must have been folded by great lateral pressure; and at various points on the south coast, particularly between Wellington Harbour and the Wairarapa Valley, there are excellent examples of contorted strata.

These rocks are freely jointed, and consequently break readily into angular fragments. They are therefore, in general, unfit for building purposes.

To the eastward of the main chain, a parallel range of palæozoic rocks rises from Cape Palliser to an elevation of about 3,000 feet above the sea; but at or about the latitude of the Pahaoa River its palæozoic rocks pass beneath the tertiaries, with the exception of a few insignificant ridges, which may be seen further to the northward. To all appearance no palæozoic rocks are found *along the same line* further north than the Kaiwhata River, on the eastern side of the Wellington Province, nor in those parts of the Provinces of Auckland and Hawke Bay which lie to the eastward of the main palæozoie range. The continuation in the South Island of similar rocks to those of the main range is said by Dr. Haast to lie between the Wairau and the Awatere.

To the westward, the first great upward undulation of the palæozoic rocks is found in the Kaimanawa range—the "heart-eater." This range commences its rise from beneath marine tertiaries and volcanic deposits to the eastward, and about ten miles from the base of Ruapehu, assumes an elevation of 5,000 feet opposite Lake Taupo, and passes in a N.N.E. direction towards the Bay of Plenty, under the subsequent names of Te Whaiti or Whakatane range. In the maps, Ruahine is generally made to curve to the westward, to meet the Kaimanawa range. This is incorrect, and gives a false view of the topography of the country. Kaimanawa is parallel to Ruahine or its successors, not continuous with them; nor do they curve to the westward towards it.

Passing further to the eastward, the palæozoic ranges are found at

Coromandel Harbour and at Cape Colville, and there form the boundaries of both sides of the Frith of the Thames. For a description of these rocks we must refer to Hochstetter, who writes as follows*:—

"The oldest rock I have met with in the Province of Auckland belongs to the primary formation. It is of very variable character, sometimes being more argillaceous, of a dark blue colour (when decomposed, yellowish brown, the colour generally presented on the surface), and more or less distinctly stratified like *clay slate*—(at Maraetai, on the Waitemata). At other times the siliceous element preponderates, and, from the admixture of oxide of iron, the rock has a red jasper-like appearance (at Waiheke, Manganese Point). In other localities it is more distinctly arenaceous, resembling the old sandstones of the Silurian and Devonian systems, called grauwacke (at Taupo, on the Hauraki Gulf). As no fossils have yet been found in this formation in New Zealand, it is impossible to state the exact age. I am, however, of opinion that these argillaceous siliceous rocks will be found to correspond to the oldest Silurian strata of Europe. In these rocks occur the *copper pyrites*, which has been worked for some years at the Kawau and Great Barrier, the manganese (psilomelane) at Waiheke, and the gold-bearing quartz at Coromandel.

"The *gold* which is washed out from the beds of quartz gravel in the rivers and creeks flowing down from both sides of Coromandel range is derived from quartz veins, of crystalline character and considerable thickness, running in a general direction from north to south, through the old primary rocks, which form the foundation of the Coromandel range. In some places these veins stand up like a wall on the summit of the range to the height of eight or ten feet. The clay slate rock itself is exposed only at the bottom of deep gorges which form the channels of the principal streams. In almost all places it is covered by large masses of trachytic tuff and breccia, of which the hills surrounding the Harbour of Coromandel are composed. The magnetic iron sand which, in washing, is found with the gold, is derived from the same source as all the magnetic iron sand of New Zealand,† namely, from the decomposition of trachytic rocks. Small veins of quartz of amorphous character—that is, not crystalline, but in the shape of chalcedony, carnelian, agate, and jasper—are found in numerous places on the shores of Coromandel. These veins, occurring in trachytic rocks, are quite different from the auriferous quartz veins in the primary formation."

"The primary formation occurs, to a more considerable extent, to the eastward of Auckland, in ranges on both sides of the Wairoa River, attaining an altitude of 1,500 feet above the level of the sea—and striking from thence

* Fischer's Translation, p. 14.

† Magnetite occurs in the chloritic schists of Otago.—Ed.

northward, over Waiheke and Kawau to the Bay of Islands. In a southerly direction they extend, through Hakarimata and Hauturu range, parallel with the West Coast, to the Mokau district, where, at Wairere, the Makau River falls in a magnificent cascade over a lofty precipice of that rock."

"The same formation occurs again in the Rangitoto Mountain, in the upper Waipa, and west of Taupo Lake, in the Tuhua mountains."

To the southward of the country described by Hochstetter, palæozoic slates and sandstones are found cropping out in the bed of the Waipare, a tributary of the upper Whanganui, and from Maori report old slates will probably be found in a similar manner in the bed of the Whakapapa and other tributaries of the Whanganui, and perhaps also at some point of the upper part of the main stream itself.

At the Waipare, tertiary sandstones and volcanic tuffs have been cut through by the action of the stream down to the palæozoic base. The latter rock, at this point, is a slate traversed by threads of quartz.

To the eastward of the Hauraki Gulf the palæozoic rocks retain somewhat, but in a lesser degree, the bold angular form of the main ranges to the eastward of the island; but on the western side of the gulf, as at Kawau, they frequently sink to comparatively a few feet above the sea level, and are often covered by a thin coating of newer tertiaries, by which their characteristic outline is destroyed.

Secondary, or Mesozoic Formations.

It is quite possible that secondary rocks may exist to a considerable extent in the North Island; but, if so, they must be in great part either covered up and hidden by rocks of a later era, or be represented by some of the rocks now classed as palæozoic. To Hochstetter belongs the merit of discovering the only decided secondary rocks which have yet been found, and the following is his description of them* :—

"A very wide interval occurs between the primary rocks of the North Island and the next sedimentary strata that I met with. Not only the upper members of the primary series are absent, but also nearly the whole of the secondary formations. The only instance of secondary strata that I have met with consists of very regular and highly inclined beds of marl, alternating with micaceous sandstone, extending to a thickness of more than 1,000 feet, which I first saw on the South Head of the Waikato, and afterwards met with on the western shore of Kawhia Harbour.

"These rocks possess great interest, from the fact that they contain remarkable specimens of marine fossils, which belong exclusively to the secondary period; especially Cephalopods of the genera *Ammonites* and

* Fischer's Translation, p. 17.

Belemnites, there being several species of Belemnite, but all belonging to the family of *Canaliculati.* These are the first specimens of these genera which have been discovered in the regions of Australasia."

"Secondary rocks may probably be found in some other parts of the West Coast, and occur, as I have been kindly informed by the Rev. A. G. Purchas, in the harbour of Hokianga, but everywhere of limited superficial extent."

To this short description of the secondary rocks, I can only add the *possible* secondary character of sundry limestones and sandstones on the east coast of the Wellington Province, but in which no distinctive fossils have as yet been found. The southern limit of these is at the White Rock, Barton's Station, and they extend, at all events, as far as the northern boundary of the Province of Wellington, occupying, with some decided tertiaries, which rest upon them, a breadth of about seven miles from the coast.

Tertiary, or Kainozoic Formations.

By far the greater part of the North Island of New Zealand is covered by rocks of tertiary age.

The oldest of the tertiary rocks would appear to be beds of brown coal, with accompanying shales. It is necessary to observe that there are beds of lignite found in the newer tertiary sandstones, which may be defined as lignites, not brown coal.

These brown coal and shale strata are succeeded, in the Wellington Province, by strata of blue clay and limestone, with *Cucullæa singularis,* of which beds this fossil is most characteristic. The blue clay is again covered by a succession of strata of sandstones and arenaceous limestones, both being fossiliferous, and attaining in some parts a great thickness. Above these, again, a drift gravel is often found. In the Whanganui, Rangitikei, and other West Coast rivers, some of these tertiary strata are marked in a remarkable manner with numerous horizontal bands or lines of boulders, or concretions surrounding boulders or some other substances, such as fossil shells. These boulders are generally either of igneous or palæozoic rocks. In the southern part of the island these tertiary formations, or some of them at least, are found on both sides of the main range, lying generally horizontal or slightly inclined, and abutting on the Tararua and Ruahine ranges on both sides. They then stretch northward on the west side of the range until they reach, and become mixed with, the volcanic products of the interior, continue to the N.W. probably all through the Province of Taranaki (fringing Mount Egmont), into the Province of Auckland—the tertiaries of which will be hereafter described. From the western shores of Cook Strait these tertiaries have a gentle slope upwards until they reach to within half a mile of Tararua and Ruahine, where the inclination becomes greater and the beds appear somewhat disturbed, as if the range had been thrust through them, or pressed against them from the eastward; and in support of this view there is a line of fault along the western or Wairarapa side of the ranges, in which the gravels of the plain resting against the ranges are fissured, and that side of the fissure next the ranges is raised some four feet above the other.

In a similar way the nearly horizontal tertiaries at the Whanganui part of the basin are tilted at an angle of perhaps 20° on approaching the volcanic chain.

We may therefore describe the whole of the North Island, except the palæozoic ranges, or, at all events, all that part of the country to the westward of the main ranges, as the great tertiary *field* of New Zealand; and the country sloping from the flanks of Tararua and Ruahine, from the Patea country and the end of Kaimanawa, and from the great volcanic chain, and also the slopes of Mount Egmont, into, perhaps across, Cook Strait, in fact all the slopes towards Cook Strait, as the great tertiary *basin* of the country. On the eastern side of the main range the usual tertiaries are found, except the brown coal series, which has not yet been discovered, unless perhaps in small quantity; but *Cucullæa singularis* is found on a tributary of the Pahaoa, and the usual tertiary fossils abound in many places. The eastern rocks generally dip slightly to the westward, but, at about seven miles from the east coast, they are thrown up at a very high angle, where the edges of the upturned strata form a most striking series of peaks called *Taipo*, and supposed by the aborigines to be the haunts of *taniwha*, or other mysterious and mythical animals; and certain sandstones and limestones of undetermined age succeed them, which, as before stated, are probably of mesozoic age.

The tertiary rocks pass northward from the eastern side of the Province of Wellington, through that of Hawke Bay, and *appear* to extend throughout along the east coast to the East Cape, at which point they lie horizontal, and extend from that cape to the nearest palæozoic rocks in Hicks Bay, a distance of perhaps eight to ten miles.

It will be seen from the above that the tertiaries occupy a great breadth of country on the east coast, having an average width of about thirty miles; and as Hochstetter gives perhaps somewhat undue prominence to the mountain chain extending N.N.E. from Cape Palliser, and inferentially to the older rocks along the east coast,* I propose to amend his description of the main ranges, as follows, viz., *which stretch along parallel to the east coast, and at an average distance of about thirty miles inland, from Cook Strait to*

* Fischer's Translation, p. 45.

Hicks Bay, near the Bay of Plenty. This description will leave room for the tertiaries and probable secondaries, which, although forming ridges of an average height of perhaps 1,000 feet, or rather more, can barely be called mountainous, nor can they be considered as the continuation of the Southern Alps.

In the Southern part of the island the general character of the tertiaries is as follows:—

On the eastern side the upper beds are calcareous, the middle beds are arenaceous and argillaceous.

On the western side the upper Whanganui beds are arenaceous, the middle calcareous and argillaceous, and the lower argillaceous.

With regard to the Auckland tertiaries, Hochstetter writes as follows:— "The various tertiary strata are found for the most part in a horizontal position. A remarkable fact, from which we may conclude that even the numerous volcanic eruptions which took place during and after the period of their deposition had not power enough to dislocate the whole system, but merely to produce local disturbances.

"The tertiary period must be divided into two distinct formations, which may perhaps correspond to the European eocene and miocene. There is an older formation which is found principally on the west coast and in the interior on both sides of the primary ranges, and a newer one which may be called the *Auckland tertiary formation.*" After a description of the brown coal of the Auckland Province, the same writer goes on to state: "I now come to another series of the older tertiary strata, examples of which are found occurring in great regularity on the west coast from Waikato to Kawhia. The lowest are argillaceous, the middle calcareous, and the upper arenaceous. The characteristics of the first clayey strata are a light grey colour, very few fossils, small crystals of iron pyrites, and *glauconitic* grains, which give these clay marls a similarity to the gault and greensands of the cretaceous formation in Europe. They are found on the eastern branches of Whaingaroa, Aotea, and Kawhia Harbours.

"Of greater interest and importance are the calcareous strata, consisting of tabular limestone, sometimes of conglomerate nature, sometimes more crystalline, the whole mass of which is formed of fragments of shells, corals, and foraminiferæ, interspersed with perfect specimens of terebratulæ, oysters, pectens, and other shells. The limestone when burnt makes excellent lime, and may be wrought and polished for architectural purposes." Beds of limestone in the Wairoa district, as well as rich fossiliferous strata from the Waikato Heads towards Kawhia Harbour, also columnar blocks of the same adorning the entrance to Whaingaroa Harbour, and the fine caves of the Rakaunui branch of Kawhia Harbour, are then described.

"The limestone attains its greatest thickness (from 400 to 500 feet) in the Upper Waipa and Mokau District, between the Rangitoto range and the west coast.

"The third and uppermost stratum of the older tertiary strata consists of beds of fine fossiliferous sandstone, in which quarries of good building stone may be found. There are whole ranges parallel to the primary mountains which seem to consist of this sandstone. I will mention only the Tapuiwahine range, about 2,000 feet above the level of the sea, in which is the pass from Mokau to the Whanganui country.

"The horizontal beds of limestone and marl, which form the cliffs of the Waitemata, and extend in a northerly direction towards Kawau, belong to a newer tertiary formation, and, instead of coal, have only thin layers of lignite. A characteristic feature of this *Auckland tertiary formation* is the existence of beds of volcanic ashes, which are here and there interstratified with the ordinary tertiary layers.

"Sandstone and brown coal have been found in places to the north of Auckland, in the districts from Cape Rodney to the North Cape."

I have now, with Hochstetter's assistance, taken a glance at the tertiary rocks which occupy so much of the surface of the island, but as yet little has been said of the brown coal which is found in large quantities, and which, for inland navigation and other economical purposes, promises to prove of great value.

A description of the brown coals of the Auckland Province, with several analyses, will be found in Hochstetter's work.*

Besides the localities in the Waikato Valley in which the brown coal is found, it has also been discovered in the direction of the Bay of Islands. In the Wellington Province these coal measures are found cropping out in the upper part of the Whanganui River, and some of its tributaries, particularly in the Tangarakau, which takes its rise towards the head waters of the Waitara.

As the Tangarakau seams are found in or near the boundary of Taranaki, it is probable that that province also may contain much brown coal.

To the eastward of the main range, a seam about 9 inches thick has been observed in the Hawke Bay Province, and it is not unlikely that good seams of brown coal may yet be discovered on that side of the island.

We may perhaps now consider the circumstances under which these tertiaries have been deposited.

We find a flooring of palæozoic rocks generally, perhaps invariably, inclined at high angles, and on this flooring we find the brown coal, with

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Fischer's Translation, commencing at page 18.

accompanying shales, deposited unconformably. At the period of deposition of the coal we must have had dry land for the growth of coal plants. After the deposition of the coal, the island must have undergone depression; and, as it sunk, the various tertiaries must have been deposited above the coal. Not yet, perhaps, did the volcanic eruptions commence; but as the country gradually sunk, and reached its point of greatest depression, the crust of the earth was broken, and streams of basalt flowed over the surface, the depression probably reaching a depth of 1,800 or 2,000 feet. Nature having completed her work so far, the island commenced to rise again slowly and steadily, but slightly disarranging the tertiary rocks on either side of the island, the volcanic eruptions doubtless still continuing. The island appears to have rested in its rise at various points, at from 1,000 feet to 1,200, at 400, 150 to 200, at 15, and at 9 and 4 feet. Various comparatively slight oscillations of level appear to have taken place in recent times, for we find strata of trees, not yet converted into lignite, covered by marine deposits—as between Whanganui and Taranaki, on the Rangitikei River, in Palliser Bay, and in places in the Auckland Province.*

Thus, after a depression of 1,800 or 2,000 feet, and the deposition of successive beds of tertiary strata, the island rose again, and assumed somewhat of its present form, although probably at the time of emergence it was joined to the South Island.

I must not omit a most striking feature of the tertiaries in the southern part of the island, in the very broken character which they assume over large areas, notwithstanding their general horizontality. The great tertiary basin in the interior of the West Coast country appears to have formed a series of terraces, gradually rising to the volcanic plateau and chain, and to the palæozoic ridges; but, whether from contraction, or from the shaking of earthquakes, or from unequal rising of the land, or simply from the wearing away of soft rocks by the action of rain and rivers, each, several, or all of these causes have cut up the terraces into deep ravines of a very remarkable character.

General View in passing round the Coast.

To give a general idea of the character of the New Zealand landscape, as chiefly affected by its geological formations, it will be desirable to travel round the coasts of the North Island.

On approaching New Zealand from the westward, it is possible that the

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* *Terebratulæ* are found in gravel at Cape Palliser 200 feet above the sea level, and a long rest of the sea level at a lower elevation may be inferred from the growth of pohutukawa trees in certain inland districts of the Auckland Province, a tree which only grows naturally on the sea shore.—*Thomson*, pp. 1, 10, and 12.

eye of the traveller will first light upon the magnificent cone of Mount Egmont, forming, with its bold outlying spur, the grand buttress of igneous rocks which protects the great tertiary basin of the North Island from the encroachments of the waves driven upon the shore by the westerly gales. Mount Egmont forms a regular cone of surpassing beauty, and may be regarded as the Vesuvius of New Zealand. Although hardly possessing the grand features of the great volcanic group of the centre of the island, Ruapehu and Tongariro, it has nevertheless a more graceful outline, and its beauty may perhaps be described as of a softer character, the more so when we consider that the great central chain rises from a plateau of some 2,000 feet above the sea, which is swept by cold blasts and covered by the snows of winter, while the cone of Mount Egmont sweeps gracefully down to the sea level, into fertile plains and low plateaux, which enjoy a genial climate and are clad in luxuriant vegetation.

The cone of Mount Egmont reaches an elevation of 8,270 feet. Its rocks are composed of dolerites and trachytes. Its eruptions have probably ceased since the early tertiary period; at all events, it does not appear that it has shown any activity since New Zealand has been inhabited.

There is a fanciful tale of the Maoris that Taranaki quarrelled with Tongariro, descended the Whanganui River, and established itself in its present position, but the most fertile imagination can hardly suppose this might refer to the rise of the cone of Mount Egmont during the "recent" period.

In the neighbourhood of Taranaki are volcanic tuffs, forming cliffs of moderate elevation, and at their base on the sea beach is found the well-known ironsand of Taranaki, released by degradation from some of the trachytes of the mountain, or its outlying flows, or other volcanic rocks along the coast, for the titaniferous ironsand appears to extend, more or less, as far north as Kaipara Heads, and as far south as Whanganui. Indeed small quantities are found still further south, at the Rangitikei and even at the Manawatu Rivers, and there are few parts of the island where its presence may not be detected; this, with siliceous sand, forms dunes on parts of this coast. The tertiaries in the neighbourhood of Taranaki are probably very recent. Coasting along to the northward, the Waitara River is passed, and the country becomes higher and of a more broken character, the tertiaries being much fractured and worn into narrow gullies, with an upper surface sometimes flat and sometimes forming sharp ridges. On a clear morning the central volcanic chain may be observed at this point from a short distance in the offing. Passing onwards towards Mokau, a large area appears to be covered by a tabular limestone of a middle tertiary age, composed of fragments of shells, corals, and *Foraminiferæ,* interspersed with perfect specimens of *Terebratulæ, oysters, Pectens,* and other shells.*

The aspect of the west coast from Taranaki, we may say as far as the Kaipara Heads, or even to Cape Maria van Diemen, is hilly and broken. The rocks principally consist of marine tertiaries, viz. sandstones and limestones alternating with doleritic and trachytic lavas, conglomerates and breccias of the same, an occasional volcanic cone (as at Karioi to the southward of Whaingaroa Harbour), considerable formations of drift sand forming dunes which reach a height of 500 feet above the sea, and patches of secondary rocks at the heads of the Kawhia and Whaingaroa harbours.

The coast ranges are hardly high enough to be called mountainous, but almost too high to be described as hilly.

The sand dunes appear to a great extent between the Waikato and Manukau Heads, and also at some points to the northward of the latter, but the country north of Auckland has never, to my knowledge, been systematically described.

It appears, however, that this district shows in places a flooring of palæozoic rocks, and a large proportion of marine tertiaries. Secondary rocks are said to occur in the harbour of Hokianga to a limited extent. Limestones and calcareous sandstones are found profusely distributed in the Kaipara Harbour, of which the age is undetermined, but they are probably tertiary. Coal, of which the beds appear to be of considerable thickness, is found to the northward, and at the Bay of Islands appears to be of good quality, whatever its geological age may be.

The northern peninsula is dotted over with numerous volcanic cones, and other remains of igneous action. The range which runs from Cape Rodney to the Kaipara Harbour, on the ridge of which the escaped Waikato prisoners have built their "pa," seems to be mostly composed of tufaceous materials, frequently arranged in spheroidal concretions. Similar rocks are found at Matakana and near Mahurangi, not far from which (at Waiwera) are hot springs.

At Wangarei North Head are the remains of a magnificent crater, which formerly may have included the "Hen and Chickens" group of islands, either as one gigantic crater or as a series of cones forming a volcanic chain. Almost all of the old crater wall is now broken down and has disappeared, but part of it, I think, may still be made out from inland of the heads. Many first and second-class harbours indent the northern peninsula. The palæozoic rocks of the "Barrier," on the left, contrast with the more tame outline of the tertiary landscape on the right.

* See Hochstetter, Fischer's Translation, p. 25.

Certainly the approach to the Waitemata Harbour is very beautiful. The Hauraki Gulf is dotted over with islands of all sizes; and being of various geological formations, they are, in consequence, of varied and picturesque outline. Those of tertiary formation, or of older rocks capped by tertiaries, are of a low, horizontal character. Those composed of palæozoic rocks are bold and angular in outline, while the regular cone of Rangitoto guards with its hard volcanic rocks the entrance to the Auckland port.

There we find a great extent of the later tertiaries forming low cliffs along the coast, while the Isthmus of Auckland is found to be a crowded group of small volcanic cones. The decomposing rocks of this volcanic series form the richest soils of the north, and the slopes of these volcanoes are covered by fertile fields.

Passing round the Frith of the Thames we find palæozoic rocks on both sides, with low lands of alluvium and swamp in the interval. Thence passing between the mountainous country at Cape Colville and the Great Barrier Island, is found a tract of country of palæozoic, flanked by basaltic rocks; and turning to the southward we pass along by the high Coromandel ranges, which attain a maximum elevation of 2,700 feet, until we find ourselves trending to the eastward along the low shores of the Bay of Plenty, a large part of which presents to the sea a low swampy shore,* with basaltic or trachytic rocks at various points, as at Okura and Matata. Approaching Whakatane, the long and lofty ridges of the palæozoic rocks of the main ranges may be perceived coming up from the S.S.W., possibly invaded by some eruptive rocks, and amongst them, as Hicks Bay is approached, the high peaks of Mount Hikurangi, 5,533 feet above the sea, show well out in the interior, and indicate an apparent volcanic or, to say the least, a trappean appearance for that mountain. About eight miles from the East Cape, at a place called Kawakawa, rocks, evidently of tertiary age and with cliffs much resembling those of the Whanganui River, appear abutting on the palæozoic rocks. Their highest elevation is about 400 feet. Passing the East Cape, we find apparently the same tertiaries, with possible secondaries, all the way to Table Cape and Portland Island; but this country has never been geologically examined. The interior, as seen from the sea, is much broken, and the long ridges of the palæozoic ranges may generally be seen some twenty or thirty miles inland. Between the Terakaka Peninsula and Napier, besides the *marine* tertiaries, there is also said to be a good deal of drift pumice in places. Arriving at Napier, we find a peninsula of new tertiary limestone rising to a height of several hundred feet, and forming a

* Hochstetter's Map.

centre to long boulder banks on both sides. That on the northern side forms a protection to the inner harbour.

From the southern boulder bank the Ahuriri Plains sweep into the interior to join the plains of the Ruataniwha, which are continued by the terraces of the Forty-Mile Bush to the Wairarapa Plain and to Palliser Bay.

Passing round the shores of Hawke Bay we find the tertiary limestones, sandstones, mudstones, and clays forming the cliffs towards Cape Kidnappers. They dip slightly to the westward, and therefore it may be supposed that certain lines of trappean dykes which are found further south, near Flat Point and elsewhere, here pass out diagonally seaward, and that their intrusion has caused the tilting action which will account for the westerly dip. At Cape Kidnappers there is some reason to suppose that the hydraulic limestones, of probably mesozoic age, may be found lying unconformably below the tertiaries. From Cape Kidnappers on a clear day Ruapehu may be seen, but Tongariro and Ngauruhoe are hidden by the intervening ranges. Hence the Ruahine range shows out strongly and sharply, covered by snow for many months in the year. Passing to the southward from Cape Kidnappers we skirt a range of calcareous and sandstone rocks, the probable secondaries, rising to an average elevation of about 1,000 feet, and preserving a monotonous sameness of character and outline. They hide the higher and more picturesque ranges in the background. At Castle Point a small harbour is formed by a reef and peninsula of tertiary limestone, with *Pecten burnettii*, and here also certain sandstones and mudstones are found containing undefined impressions of plants and small seams of coal. Along this coast, and more particularly between Flat Point and Pahaoa, the hydraulic limestone series is met with, which may possibly be of mesozoic age. At Waikekino, six miles south of Flat Point, reefs of *Amphibolite* are found on the shore and in the sea, penetrating the above-named calcareous rocks, and boulders of various trappean rocks are common in the Kaiwhata and other rivers. Passing to the south of the Pahaoa River, palæozoic sandstones and slates appear, with jasperoid rocks, and these continue round the bold buttress-like headland of Cape Palliser.

Proceeding round the abrupt and rugged country which lies behind Cape Palliser, we reach the level plain of the Wairarapa Valley. An inland plain of about ten miles broad, which passes up between the Rimutaka and Tararua ranges on the left, and the lower slope of the tertiary ranges on the right, continues with a similar width through the Forty-Mile Bush to the *eastern* Manawatu, thence to the Ruataniwha Plains, and then turns seaward to Napier. An old fjord, or possibly two separate arms of the sea which formed gravel terraces, now offers an admirable line of communication between Wellington and Napier. In Palliser Bay the cliffs are from 50 to 150 feet high, composed of "drift" gravel on the western side, of gravel over blue clay on the eastern. Passing across Palliser Bay we arrive at the highly inclined rocks of the main range, cut off and scarped along this south coast, and at the Mukamuka are found trappean rocks, altering the slates into jasperoid rocks. At this point also was the greatest rise of land caused by the earthquake of 1855 (viz. 9 feet), and here the coast road, which was before that time almost impassable except at low tide, has now a broad stretch of rocky beach between it and the sea.

Proceeding to the westward along the south end of the island, we continue to pass the vertical scarp of the rocks caused by the great depression of Cook Strait; the strata being highly inclined, and the mountains forming remarkably sharp ridges, rising to a height of from 2,000 to 3,000 feet, and running in a N.N.E. direction. Looking up the noble harbour of Port Nicholson, the alluvial valley of the Hutt may be perceived, forming the only great longitudinal valley of the mountain ranges. Proceeding onwards we may find the same evidence of the intrusion of igneous rocks as at the Mukamuka, and may also perceive small patches of drift gravel lying at various elevations from 400 feet downwards. From the position of these terraces we may, I think, conclude that they were formed previous to the depression which formed Cook Strait. At Terawiti, instead of passing along the great scarp at right angles to the strike of the rocks, we now proceed to the northward in their line of direction, and as we look into the harbour of Porirua we may think of the "plant beds" there, a further investigation of which may perhaps lead to a clear history of the age of these rocks. On the left we leave the flat-topped island of Mana (palæozoic), and pass on to the junction of the tertiary and palæozoic rocks near Paikakariki, and here the great tertiary basin commences. From this point the ranges of the old rocks pass away inland towards the N.N.E., while the tertiaries, commencing the great western curve towards Cape Egmont, are as yet only represented by dunes of sand. Eight miles further on we reach Waikanae, opposite to which is the high palæozoic island of Kapiti, which forms a shelter from the prevailing westerly winds. In consequence of this protection the Waikanae River throws out a long point seaward. At Otaki, in addition to the sandy dunes, there is a considerable breadth of "drift" gravel formation, and also here and along this coast there is much alluvium and swamp. At the Manawatu River, the sandhills, which sometimes reach a height of from 40 to 50 feet, attain their greatest breadth, of about ten miles, and are intermixed with some rich tracts of swamp and alluvium. Inland of this the "drift" gravel forms terraces, and what appears to be the blue clay shows itself a few feet above the river level, the mountains having receded to a distance of 25 or

30 miles from the coast. The coast now trends rapidly to the westward, fringed by sandhills, behind which may be seen the fertile country composed of upper tertiaries. Passing the low ground at Rangitikei the coast rises into cliffs towards Whanganui, of from 100 to 200 feet high. The bold outline of Ruapehu may now be seen overlooking the great tertiary basin, and covered with snow, to the north of Whanganui. The ridges of Ruahine stretching to the N.N.E. are far in the distance, while to the westward the graceful cone of Mount Egmont also comes into the general view. Between Whanganui and Kai-iwi an "old forest" is found in the cliffs, and numerous remains of the moa in the sandhills above. Between this and Taranaki the grand curve of the coast shows tertiary cliffs to the sea, the upper beds of which appear to be very recent. This part of the coast has not yet been examined, and it is more than probable that the basalts or other igneous rocks may be exposed at different points on the coast and to the inland of the mountain. With this exception, the interior country here appears to be entirely composed of sedimentary tertiaries, with the grand cone of Mount Egmont rising like an island from their midst.

Volcanic.

The volcanic system of the North Island is comprised within certain limits, as follows:—If we draw a line from the southern base of Mount Egmont and continue it past the southern base of Ruapehu until it approaches the Kaimanawa range—then, by striking a line nearly at right angles from this point to the mouth of the Whakatane River, in the Bay of Plenty, we shall find the whole country to the north and north-west, as far as the North Cape, more or less dotted over with volcanic cones. Certain trappean dykes are found in districts to the southward and eastward of these lines, but no true volcanic craters, unless possibly Mount Hikurangi, previously mentioned, may prove to be one.

With regard to the volcanic part of the island, Hochstetter states as follows:—"Lofty trachytic peaks covered with perpetual snow, a vast number of smaller volcanic cones, presenting all the varied characteristics of volcanic systems, and a long line of boiling springs, fumaroles and solfataras, present an almost unbounded field of interest, and at the same time a succession of magnificent scenery.

"The first volcanic eruptions were submarine, consisting of vast quantities of trachytic lava, breccia, tuff, obsidian and pumice stone, which, flowing over the bottom of the sea, formed an extensive submarine volcanic plateau. The volcanic action continuing, the whole mass was upheaved above the level of the sea, and new phenomena were developed. The eruptions going on in the air instead of under the sea, lofty cones of trachytic and phonolitic lava, ashes and cinders were gradually formed. These eruptions breaking through the original submarine layers of trachytic lava, breccia and tuff, raised them and left them, as we now find them, forming a more or less regular belt round the central cones, and having a slight inclination from the centre outwards. These belts I shall have occasion to refer to under the name of 'tuff craters,' or 'cones of tuffs,' or 'craters of elevation.' In the course of time the volcanic action decreased, and we must now imagine that tremendous earthquakes occurred, that parts of the newly-formed crust gave way and fell in, forming vast chasms and fissures, which are now occupied by the lakes, hot springs, and solfataras.

"Thus we now find in the central part of the Northern Island an extensive volcanic plateau of an elevation of 2,000 feet, from which rise two gigantic mountains—Tongariro and Ruapehu. They are surrounded by many smaller ones, as Pihanga, Kakaramea, Kaharua, Rangitukua, Puke Onaki, Hauhanga. The natives have well-named these latter—'the wives and children of the two giants Tongariro and Ruapehu'—and they have a legend to the effect that a third giant, named Taranaki, formerly stood near these two, but quarrelling with his companions about their wives, was worsted in combat and forced to fly to the West Coast, where he now stands in solitary grandeur, the magnificent snow-capped beacon of Mount Egmont (8,270 feet). These are the three principal trachytic cones of the Northern Island.

"By far the grandest and loftiest of the three is Ruapehu, whose truncated cone, standing on a basis of about twenty-five miles in diameter, attains a height of 9,000 to 10,000 feet above the level of the sea, about 3,000 feet of which is covered with glaciers and perpetual snow. Ruapehu, like Taranaki, is extinct; Tongariro can alone be said to be active. I was enabled to distinguish five craters on Tongariro, three of which are, to a certain extent, active. Steam is always issuing from them, and the natives state that from the principal crater, called Ngauruhoe, on the top of the highest cone of eruption (6,500 feet), occasional eruptions of black ashes and dust took place, accompanied by loud subterranean noises."

To this description I will add that Tongariro appeared to me to be a truncated cone, of which the main crater had fallen in, and had probably at one time exceeded Ruapehu in height. Ngauruhoe rises from its flank as a lateral cone.

The plateau under the eastern side of Ruapehu is called *Onetapu*, or sacred ground. The wild appearance of this tract is well described by Dieffenbach. Here the trees, principally birch and totara, are dwarfed from the elevation, and the ground is scarred by the washing of torrents or from the effects of winter frosts.

From the eastern base of Ruapehu the River Wangaehu rises as a stream of water, said to be charged with sulphurous acid as well as other mineral compounds. All along the base of the volcanic chain similar springs may be found, until on arriving at Tokanu, on the southern shores of Lake Taupo, the delta of the Tongariro River is found honeycombed by hot springs, and long lines of the same may be seen extending up the side of the hill overlooking the smothered village of Terapa, where the venerable Te Heuheu and many of his tribe met their death by the slipping of the side of the mountain in the year 1847.

It would occupy too much space in an essay of this kind to enter into a description of the grand system of hot springs, warm lakes, mud springs, and other volcanic phenomena which are found in this country, extending from Lake Taupo to the Bay of Plenty, and thence to White Island. For a description of these the reader must be referred to Hochstetter and other authors.*

We may now proceed to consider the igneous rocks in the south-western or trappean part of the island, as previously indicated.

These rocks are only to be perceived at a few points, apparently forming dykes in, or nearly in, the line of direction of the ranges. Thus amygdaloidal trap may be perceived traversing palæozoic rocks at Mukamuka, and *amphibolite* traversing calcareous rocks of a newer age at Waikekino, on the east coast of the Wellington Province.

Terraces and Raised Beaches.

These form a characteristic feature of New Zealand geology. Pumice-stone terraces are found fringing the volcanic chain at an elevation of about 2,000 feet, and also occupying large areas in the Province of Auckland at a lower elevation.

Terraces at the south part of the island are found, as previously stated, at about 1,000 feet, 400, 250 to 300, and decided raised beaches at about 15, and 4 to 9 feet. That these extend throughout the island at similar levels is probable, but more information is wanted to establish this fact.

Between these principal terraces are many smaller ones. Although fossils are in general absent, it is likely that the terraces mark successive rests of the land during its rise. To account for them as lake terraces would require the supposed erection, or rather demolition, of a vast number of barriers.

At a height of about fifteen feet above the present sea level a very well-defined sea beach is found all along the southern coast, worn into cavities and bored by the shells of *Pholadæ*. The latest raised beach is that which

* Fischer's Translation, pp. 35 and 67. Thomson, Vol. I.

marks the rise of the land during the great earthquake of 1855. This upheaval appears to have been greatest at the Mukamuka rocks—nearly nine feet—and is supposed to have sloped off to nothing at the Manawatu; but, although the coast may not have risen at the latter point, there is no evidence that the interior ranges were not lifted, and they certainly show signs of having been thrust through, and having partially lifted the tertiaries either at that time or at some former period, or to have oscillated upwards on the eastern side with a pressure at the same time against the west coast tertiaries. In the southern part of the island the chief gravel formations extend from Palliser Bay up through the Wairarapa and Forty-Mile Bush towards Napier; next on the west coast from the Waikanae River to the Rangitikei and Whanganui Rivers, capping the tertiary sandstones of the interior where undenuded. At the south-west corner of the Wairarapa Valley the higher drift is found to rest unconformably upon an older formation of gravel and lignite.

GOLD.

Gold has been found at various points in the North Island, and it may almost be said that all the palæozoic rocks show its presence. It has only been worked, however, to any extent at Coromandel.* From Coromandel and from the palæozoic rocks on the western side of the Frith of the Thames, it is possible that gold may be found to extend up the Valley of the Thames, wherever the old clay slates may be exposed, but whether in the shape of quartz reefs or of alluvial gold remains to be proved.

Specimens of auriferous quartz have been procured from the Hangawera range, which separates the Valley of the Thames and the Waikato, and this indicates the line along which the precious metal may be sought for. The Kaimanawa range has never been examined. Some specimens of galena and other metallic ores, brought in by the natives to Hochstetter's party, are said to have come from it; and there is a strong probability of its rocks having an auriferous character, lying, as it does, in the continuation of a probable line of strike from the gold-bearing rocks of the Pelorus district.

The great mass of tertiaries which covers the interior renders the search for gold difficult and uncertain. A small quantity has been procured from some of the gullies in the neighbourhood of Terawiti, near Wellington, and it seems probable that the *pyritous* slates or veins of the ranges there may be more or less auriferous.

EARTHQUAKES.

Any remarks on the geology of New Zealand would be deficient if they

* Total exported to 31st December, 1864, 9,584 oz., value £22,875.—ED.

did not refer to the numerous earthquakes by which this group of islands has been visited.

It may be decidedly assumed that there are certain long lines, or segments of circles, along which, either from the weakness of the earth's crust or from other causes, volcanic eruptions are most prevalent, and the action of subterranean forces is prominently shown by earthquake shocks.

The New Zealand group is situated on one of these lines, the southern known limit of which is the land where Mounts Erebus and Terror raise their lofty volcanic peaks amidst Antarctic snow and ice. From these mountains the trend of the curve may be said to pass through New Zealand and other oceanic isles to New Guinea (appearing to conform to the shape of the eastern coast of Australia), and thence through a long chain of eastern islands to the Straits of Sumatra. The experience of twenty-four years is insufficient to form very decided opinions on the character or locality of the earthquakes of New Zealand. Nor indeed is there sufficient knowledge of the causes at work to be able to predict where or when an earthquake may break out. Reasoning on the subject is useless, from want of sufficient data. Along the analogous volcanic line of South America earthquakes are of constant occurrence. One day they will break out at Concepcion, the next shock will be felt at Lima, then at Valparaiso, at Islay, at Guayaquil; and two years ago the action appears to have shifted to the city of Mendoza, on the eastern side of the Andes, where earthquakes had been hitherto unknown. The changes going on from time to time in the great area of depression of the Pacific may be reasonably supposed to act with notable force on the eastern and western edges of the basin, whether in America or in New Zealand and its continuing curves.

The severest shocks of earthquakes that have been felt in New Zealand since the arrival of the settlers took place in 1843, in October 1848, in January 1855, and in February 1863. These three latter shocks appear to have been felt more or less over at all events a large part, if not the whole, of the islands; but no systematic attempts have hitherto been made to record earthquake shocks throughout the colony. The three former ones were most severe in Cook Strait, the last at Napier. The greatest force of the earthquakes of 1848 and 1855 appears to have been exerted near the Kaikoura mountains, in the South Island. Wellington suffered severely from the earthquake of 1848, and that of 1855 raised the land in its vicinity to a height of from nine to four feet above its former level. Nelson felt both shocks perhaps less severely than Wellington. The impression is that during the earthquake of 1855, while the land at Wellington rose, that on the south side of the Strait was depressed, and of this there appears to be good evidence. The earthquake of 1863 was felt severely in some parts of the Hawke Bay Province, and considerable local changes of level there appear to have taken place. A description of several of these earthquakes may be found in Taylor's work, page 226 *et seq.*

The natives have traditions of many earthquakes having happened before the arrival of the settlers.

Earthquakes are generally looked upon as the manifestation of a destructive force, whereas, if rightly considered, they indicate a great conservative power, which balances the relation of land and water on the surface of the globe, and it may not be out of place to remark, that in many countries subject to their effects we find the ancient seats of civilization. In the East we find these in China and Japan, in India and Mesopotamia, all earthquake countries. In Europe and Africa, the old haunts of arts, science, and philosophy—Egypt, Greece, and Italy—are earthquake countries. In America the highest civilization to which the old race attained was reached by the Aztecs of Mexico and the subjects of the Incas of Peru, both races inhabiting earthquake countries "par excellence" of the American continent.

The most fertile lands of the Southern Hemisphere are those which are and have been subjected to great igneous and earthquake action; and the varied outline, and in consequence the well-watered and fertile lands of New Zealand, might be disadvantageously exchanged for the broader and more level, less earthquake shaken, but arid expanse of the Australian plains.

The present information as to earthquakes in New Zealand may be summarized as follows:—

Mr. Edward Weller felt shocks of very great force in Stewart Island in the year 1833, and it is probable that there may have been many shocks since that time.

Mr. Mantell collected information from the Maoris, that very severe shocks had formerly been felt in Otago.

The earthquake of 1855 was marked in this latter province by a great sea wave, and since then various slight shocks have been felt at different times by the settlers.

In Canterbury the information with regard to earthquakes is imperfect, but many minor shocks have been felt, and the earthquake of 1855 was felt severely.

In Cook Strait earthquake shocks have been more numerous than elsewhere since the settlers arrived. The severest shocks, as before stated, were in the years 1848 and 1855. At Taranaki shocks have been very numerous, and some of them tolerably severe. At Napier the shocks latterly have been more severe than elsewhere; and at Auckland many minor shocks have been felt, with a few of rather decided character.

Comparisons with the South Island.

It is a point worthy of note that the vertical oscillations of the two great islands of New Zealand seem to have differed very much, both in time of occurrence and in degree. In the North Island the depression in tertiary times would appear to have been much greater than that of the South Island. At all events, if not greater in amount, it must have affected the character of the island to a greater degree, from its much smaller elevation and consequent greater submergence.

In the North Island the greatest depression seems to have been on the western side, while in the South Island the reverse was probably the case.

In the North Island the tertiaries occupy a far greater area than in the South Island, which alone would tend to show a *longer* and greater depression. Glacial action must have had much less effect in the North than in the South Island, irrespective of difference of latitude; for two peaks only in the former island now carry perpetual snow, viz. Ruapehu and Mount Egmont, and at no tertiary time could the mountain masses have equalled those of the latter island.

Aerolites.

Aerolites have been frequently seen in New Zealand. It is believed, however, that the only one which has been found on the surface of the country is that which will be now described. It was found in the year 1863, in front of Mr. Donald's house, at Manaia, near the left bank of the Waingawa River, in the Wairarapa, Province of Wellington. The plain is here composed of coarse gravel. The aerolite was found on or near the surface, and measures 9 in. by 6 in. by 7 in.

A portion of this interesting specimen was forwarded for examination to the Laboratory of the Otago Geological Survey, at Dunedin, and the following notes respecting its composition have been furnished by Dr. Hector:—

"The fragment submitted for analysis was externally of a rust colour with an exudation of chloride of iron. The freshly fractured surface was of a dull grey colour. Its hardness was between 5 and 6, and its specific gravity 3·254. It is affected by the magnet, but does not exhibit polarity. It consists principally of earthy silicates and sulphide of iron, but also contains nickel and native iron, and possesses the general character of a meteoric stone."

Dune Formation.

The direction of the prevailing winds is well shown in the North Island by the fact of sandhills being almost entirely confined to the west coast, and wherever the shores are sufficiently low the sand on that coast travels inland and forms dunes. Where the coast trends north and south, with the above conditions, the sand travels far into the interior. Where the coast line runs east and west the sand blows along it, and does not reach far inland.

A SHORT SKETCH OF

THE MAORI RACES,

By EDWARD SHORTLAND.

[*Written for the New Zealand Exhibition*, 1865.]

The traditions of the New Zealanders date back to times long anterior to the first arrival of their ancestors in these islands.

According to these traditions, Po, or Darkness, was the origin of all things; and in the course of successive generations, through different orders of Po, Kore, or Nothingness, was arrived at. Then, through different orders of Kore, came at last Ao, or Light. After successive generations of Ao came Rangi, the Sky. From Rangi and his wife Papa, the Earth, are descended man, beasts, birds, trees, and all things here on earth. There is a very circumstantial tradition preserved by a few of the initiated of the Ngatiraukawa tribe, which relates how the first female of the human form was formed out of the earth at a place named Onekura (red earth). How the female so formed gave birth, first, to an egg from which came all sorts of birds; how, secondly, a female was born from the same parents, from which female and her own father was produced a daughter, who became the mother of the human race, Tiki being the father, which gave rise to the proverb, "Aitanga-a-Tiki," used to signify a person well born. Then we meet with a variety of traditions respecting certain heroes or demigods, who lived in very remote ages, long before the migration to New Zealand, which, however, give evidence that the people to whom they relate were then islanders, for whenever any expedition is about to set out, it is always related first how the canoes were repaired and equipped for sea.

The great fact observable from a consideration of the traditions to which I am now referring is, that the people had no idea of a Supreme Being, the Creator of all things in heaven and in earth. The idea pervading all their narratives is, that all things have been produced by a process of generation, commencing with darkness and nothingness. They believed, however, that when the body dies, the spirit which animated it still exists, but retires to another place, situated under the earth, from whence he can return, on fitting occasions, to visit his living descendants on earth; his business there being to advise or punish those who break the laws prescribed to regulate their social state. These laws were wonderfully minute and complex, and must have been a grievous burden, from which, by adopting Christianity, they might be relieved. Hence it is not to be wondered at that Christianity spread rapidly at first among the younger men. All gods being spirits of their ancestors who had died, there was no idea involved in the teaching of the missionaries repugnant to their sentiments; and their priests, when consulted as to the God of the white men, replied, as I have been often told by them, "that Christ was a true God, and more powerful than theirs."

Traditions which speak of the first colonization of New Zealand by the Maori, are to be found among all the tribes, more or less perfect and circumstantial.

The northern tribes called Ngapuhi have a tradition of one Kupe, who made a voyage from an island called Wawauatea to New Zealand, who, having circumnavigated the North Island, and given names to different places there, returned to his own countrymen, who, in a succeeding generation, fitted out an expedition to seek for the land of Kupe, and found their way to the North Island, where they remained. These first made the land at Muriwhenua, the North Cape, and finally settled at Hokianga, where their descendants are now to be found, and are able to deduce pedigree in unbroken succession from those first settlers. The present northern tribes, however, are also descended from other ancestors, whose canoe first made the coast near the East Cape at Waiapu, some of whom migrated to the north, and intermarried with those there located.

Hawaiki is the name of the island most generally referred to by the New Zealanders as the place from which their ancestors came. The causes which led to the abandonment of Hawaiki are variously related; but the most probable tale is that, a civil war having broken out among their ancestors, the weaker party determined to seek a new country, and embarked in several canoes, some of which, after a long voyage, reached the coast of New Zealand.

The two most celebrated of these canoes were named Tainui (full tide) and Arawa (shark). The latter of them made the land a short distance north of Waitemata, the harbour on which Auckland is situated; and a sperm whale (paraoa) being discovered stranded on the beach, the place obtained the name of Wangaparaoa, or whale port, from that circumstance.

Tainui first made the land near the East Cape, which was also named Wangaparaoa, owing to a similar circumstance; hence we may infer that in those early times, when man had not hunted them in these seas, the sperm whale frequented the northern coast of New Zealand.

It will be curious to trace what became of Tainui and its crew after reaching New Zealand, as it will throw some light on the notions of this people on the subject of colonization and the acquirement of territory. They very quickly left a settlement a little to the westward of their first landing place, where their descendants, a tribe called Ngatitai, still dwell. Thence they sailed to Tauranga, entered that harbour, and, navigating its waters, left another settlement at Katikati; a rock named Te punga o Tainui, the anchor of Tainui, is pointed out, and an extensive shoal, Te ranga a Taikehu, was named after Taikehu, one of the chiefs on board the canoe. It is affirmed that Taikehu, having dropped a greenstone hatchet overboard, according to custom had recourse to a charm, which was so potent that the land rose and the water dried up, so that he picked up the lost hatchet without difficulty; that the shoal now exists is the evidence of the fact, and who may doubt it? Leaving Katikati, the next place Tainui touched at was Mercury Bay; thence it sailed on towards Waitemata, and some of them settled near there, at Tamaki; their descendants are also called Ngatitai, who have the title Manawapowatu (stony heart), to distinguish them from their kindred Ngatitai, who were left on the shore of the Bay of Plenty, and who were called in distinction Manawaiti (little heart). Arriving at the head of the arm of the sea called Tamaki—the spot is still called Te apunga o Tainui, the landing place of Tainui—the canoe was dragged across to the waters of Manukau, and passing out through the entrance of that harbour, thence sailed along the coast to the southward, till it arrived off the River Waikato. On seeing that river flowing into the sea, the priest exclaimed "Waikato, Waikato kau." This jest of his gave the name to that river. As they coasted along the beach now called Te akau, he exclaimed, "Ko te akau kau"—it's nothing but beach; and when they arrived off Kawhia, he called it "Kawhia kau." At that place they landed, and the canoe was finally dragged ashore. Kawhia has ever since remained in possession of the descendants of its crew, who form a tribe called after it Tainui. This as well as all the tribes, more than twenty-five in number, which together are comprehended under the general name of Waikato, have sprung from a Tainui source.

Of the voyage of the canoe Te Arawa, and of the history of its crew and their descendants, there exists the most circumstantial narrative I have met with; it preserves so many circumstances looking like truth. It is, however, too lengthy to give here. I may mention that from it we ascertain the season of the year when these voyagers reached New Zealand; the rata tree was then in flower, for one of them, named Taininihi, threw away his kura, which was a head-dress made of red feathers, described by Cook as worn by the South Sea Islanders, thinking to get a new and better one from the rata flowers. This kura drifted ashore, and was afterwards picked up by a person named Mahina, who refused to restore it when asked. Hence the proverb still commonly in use, "Kura pae a Mahina," signifying a waif or godsend. Thus, if a person find anything which has been lost by another by the way-side or in the bush, and the loser afterwards hearing who found it, were to go and ask him to restore it, his answer would probably be, "I will not restore it; it is a kura pae a Mahina; if you wish to have it you must pay for it."

The Arawa sailed southward to the Bay of Plenty, and when they got to Katikati they found the Tainui settlers we have spoken of in possession; so they went on, and, leaving a small settlement at Maunganui, on the east entrance of the harbour of Tauranga, sailed to Maketu, about sixteen miles further to the east, and there settled. Before they reached the shore two of the chiefs stood up in the canoe and laid claim to all the land they could see. This with them could be done by a very simple process. It was only necessary to say, "This land is the bed of my child," which would give his family so sacred a title that no one else of the colonists would dare to claim it. Hence we perceive that the New Zealanders brought with them their greed for territorial possessions; and if it is reflected that they came from islands of limited extent, where the increase of population tended to curtail the lands of each, we may thus perhaps account for their grasping at large landed possessions on their reaching New Zealand. Certain it is that two chiefs, Hei and Tia, claimed all the lands for miles north and south of Maketu for their sons Waitaha and Tapuika, whose descendants still claim them.

Such a system of colonization tended to disperse these settlers over very extensive limits, and we consequently find that other chiefs started inland, each little family taking possession of a separate locality at a wide interval from any neighbour. The different territories thus acquired became the lands of their descendants, who came to be distinguished as a sub-tribe of the Arawa, the name by which all sub-tribes were known when spoken of as a body.

The territory of a sub-tribe belonged to the whole body, excepting such parts thereof as had been specially appropriated to families or individuals as cultivation grounds, fisheries, or otherwise; and their rights passed to their descendants. Other members of the sub-tribe had no right to meddle in any way with lands so appropriated; at the same time, lands never appropriated specially belonged to the whole tribe.

It is true that chiefs of influence often sought to seize lands which did not rightfully belong to them; but such acts could only be carried through by might and not by right, and were always pertinaciously resisted; and there is a favourite proverb, that the best death for man is to die for his land, and that his blood be shed thereon.

It has been stated by many that a native title to land is so complicated that it is impossible to unravel it; indeed, latterly the favourite theory has prevailed that the only remedy is to cut the knot. No doubt it is a troublesome matter thoroughly to investigate a native title; but such has been done in some cases, and could in every case have been done with the application of patience by a person who understood his work and had sufficient intelligence. How much of talent, education, and experience is brought into play to investigate the title to an estate in England when a purchase is contemplated! In New Zealand it has too often been the case to intrust the investigation of title to native lands and their purchase to men possessing no qualification fitting them for the office. It is much to be regretted that political influence should be suffered to intervene in such affairs.

To return to the history of the descendants of the crew of the Arawa: they spread themselves from Maketu to Rotorua and the adjacent lakes, thence to Taupo, and some of them as far as Wanganui, near Cook Strait, peopling the shores of the numerous lakes of the interior; but they did not extend themselves along the coast very far in either direction. They now form one of the most important natural divisions of the New Zealanders, their numbers amounting, on a rough estimate, to about one-sixth of the entire population, or perhaps to rather more. They have also some general peculiarities of dialect which distinguish them from the Waikato tribes and from the rest of their countrymen. The majority of this tribe have taken no part in favour of the Maori King, but have taken up arms to oppose the passage of the East Coast tribes through their territory on their way to join Waikato. They have had several sharp encounters with their own countrymen on this ground of dispute, in which they have been finally victorious. Winiata Tohi Te Ururangi, one of their bravest chiefs and our firm ally, lost his life very recently in one of these engagements at Te Matata.

Eastward of the Arawa, in the Bay of Plenty, dwell the tribe Ngatiawa, whose ancestors are said to have come also from Hawaiki in a canoe named Te Mataatua. Their canoe came to land at Wakatane. The descendants of its crew have spread eastward and westward, touching the Ngatitai and the Arawa tribes, and, inland, the Urewera tribe have the same origin.

Bordering on the eastern limit of the Ngatitai come the tribe Ngatiporou, who extend all along the east coast as far as Wairarapa. The southern division, however, have for many generations taken the name of Ngatikahuhunu, from their ancestor Kahuhunu, who came from the North Cape in search of a celebrated beauty whom he married, and settled in the country of his adopted tribe.

The Ngatikahuhunu were formerly much more powerful than at the present time, and extended along the north shores of Cook Strait as far as

Rangitikei, and over a great part of the Southern and Stewart Islands, where they still remain, and are there called Kaitahu.

The tribes now residing south of Kawhia, known as Te Atiawa, are also said to have come from Hawaiki, in their canoe Tokomaru. This canoe made the coast of New Zealand at night, and the land was first discovered in a singular manner, by the barking of a dog on board, which scented the carcass of a whale stranded on the beach. This, from the similarity of the circumstances mentioned, seems to have been the same place as that spoken of in the traditions of the Arawa as their landing place. The story goes, that a dispute having arisen between them and the crew of another canoe as to the proprietorship of the whale and of the land, Manaia, the chief of Tokomaru, resolved to go elsewhere. He and his party therefore sailed northward till they arrived at the extremity of the land, and then coasted along the western shore till they made Taranaki, where they finally settled.

Subsequently to the discovery of New Zealand by Cook, the Atiawa were driven southward by Waikato, in the absence of a large portion of them who had joined Te Rauparaha in his wars against Kahuhunu, of Cook Strait, and the natives of the South Island. When Colonel Wakefield reached New Zealand he found this division settled at Waikanae and Port Nicholson, from which places they had expelled the Ngatikahuhunu.

In their raid on the tribes dwelling on the southern shores of the North Island, they were not able to conquer the tribes dwelling about the River Wanganui, as these fled up the river and found refuge in the protection of its rapids and in its precipitous and wooded banks.

As to the Wanganui tribe, the tradition is that their ancestors came to New Zealand in a canoe named Aotea, and gave its name to the small harbour on the west coast, where they first landed. At that place the canoe was abandoned, and the crew, with their chief Turi, proceeding on foot along the shore to the southward, at last settled down on the River Patea. From Turi and his wife Rongorongo sprang the tribes Wanganui and Ngatimamoe. As they found no inhabitants as they came along the coast, this migration, if we credit the tale, must have been anterior to that of Te Atiawa.

It is related by the other tribes that attempts have several times been made to return to Hawaiki; and within the last twenty-five years an instance occurred at Tauranga, where a family fitted out and provisioned a canoe for a long voyage, and then put to sea with the design of returning to that island, having no better guide than the stars and the tradition of its position. The fate of these intrepid voyagers was of course never known in New Zealand; but that such an undertaking should ever have been deliberately planned and entered on is hardly credible, and we should look in vain for a more remarkable instance of the bold and adventurous spirit of this people. //

From the genealogies of chiefs which we have noted down, it would appear that only about eighteen generations have passed away since New Zealand was first colonized; that is to say, a space of time probably not much exceeding five hundred years. To test the probability of this conclusion, the genealogies of chiefs of different tribes were carefully collected and compared, and it was found that they all nearly agreed in reckoning the same number of generations from the time when their forefathers first landed in New Zealand. The remarkable uniformity, being undesigned, is the best proof we can have of their correctness.

The idea that these islands were not peopled at a very remote date is supported by the scantiness of the population very generally when first discovered by Cook, the more particularly so of the South and Stewart Islands, which, according to the accounts given by the New Zealanders, were colonized from the North Island.

About ten generations ago all that part of the South Island which extends from Waipapa, a point about twenty miles south of Cape Campbell, to Rakiura or Stewart Island, including Foveaux Strait, and a great part of the West Coast as far as the Buller (Kawatiri), appears to have been in possession of one tribe, who were called Ngatimamoe, and are said to have come from Wanganui or its neighbourhood. Bordering on them to the north was a tribe called Te Huataki, whose ancestors also came from the North Island and settled at Wairau. To the westward of them the country about Totaranui and Arapaoa, Queen Charlotte Sound, was in possession of the tribe Ngaitara, whose ancestors also came from the North Island, under a chief named Te Pahirere. The fame of the pounamu stone, which was found on several streams or rivers on the west coast and in the interior of the South Island, stimulated large bodies of the Ngatikahuhunu, the powerful East Coast tribe we have before spoken of, to make war on Ngatimamoe, and after many years, by dint of a constant supply of fresh forces, they completely subdued and took possession of all their territory. At present there are only a few broken hapus remaining, who were allowed to live on a small portion of the land once their own.

Subsequently Te Rauparaha, with an army composed of Ngatitoa and several other septs of northern tribes, overran the southern shores of Cook Strait, and having nearly exterminated the natives he found there, attacked Ngatikahuhunu, and carried the war south to Banks Peninsula. The rapid spread of Christianity put a stop to his wars, so that the tribe Kaitahu retained still the greater part of the lands they had conquered from Ngatimamoe. But the south shores of Cook Strait are now chiefly inhabited by natives who formed part of Te Rauparaha's army of filibusters, or their relatives.

From the accounts given by the New Zealanders of their origin, and from what we know of the present relationship of the various tribes into which they are divided, it appears that the whole native population may be classed under six primary divisions, distinguished more or less one from the other by peculiarities of dialect, of physiognomy, and of disposition. These primary divisions have been traced to the crews of different canoes which found their way to the shores of New Zealand. Whether all the canoes which may have thus reached these shores proceeded from several different islands of Polynesia, or only from the two or three the names of which are recorded, we will not pretend to say with anything like certainty. The traditions respecting the origin of their ancestors pervading all the tribes in New Zealand are very similar; and although many peculiarities of dialect are observed to prevail very generally throughout the members of the primary divisions of which we have been speaking, yet the actual differences in dialect between the inhabitants of the most distant parts of the country are inconsiderable, and, in fact, no more than may be accounted for by lapse of time, added to the want of union, and, consequently, of familiar communication between each other.

It is an inquiry of some interest where Hawaiki, the island generally given by the New Zealanders as that from which they came, is situated. The reply we give is, that it seems most probable that the island referred to is either the principal one of the Sandwich Islands group, pronounced Hawaii by its present native inhabitants, or one of the Navigators, written Savaii by the missionaries who are best acquainted with the language; both of which forms are dialectic variations of the New Zealander's pronunciation written Hawaiki.

That so long a voyage as that from the Sandwich Islands could be safely made in open canoes may appear to some almost incredible; but it is certain that, when skilfully managed, the canoe of the Polynesians can brave very rough seas. Besides, the nearest spot from which the first inhabitants of the country could possibly have come is more than one thousand miles distant; and we may fairly presume that a canoe able to make a voyage of that length could, under favourable circumstances, have made a voyage three times as long. We know from the traditions of the people that when they landed the rata was in bloom, which determines the time of the year to have been February, a season most favourable for making a voyage in those seas.

In the Navigator and Society Islands, as well as in the islands of Polynesia lying further eastward, are found the same race of men as in New Zealand and the Sandwich Islands, speaking languages so much alike to each other that they may almost be looked on as dialects of the same language; and, as far as is known, the superstitions, customs, and manners of their inhabitants have a general similarity.

At the Friendly Islands, however, the Polynesian race is found to be partially blended with a totally distinct race called Papuans, having a different language and different habits; while in New Caledonia, in the New Hebrides, and in other islands lying more to the west, as well as in the chain of islands connecting them with New Guinea, the inhabitants are all Papuans, New Guinea being the stronghold of that race.

It is a rational conjecture that the primitive inhabitants of the whole Indian Archipelago were also Papuans. This may be inferred from the fact that traces of the race are still discovered in many of the islands now occupied by the brown race, as well as in the Malay Peninsula, and even, according to some accounts, in Cochin-China, while the natives of the Andaman Islands, in the Bay of Bengal, have all the characteristics of the Papuan family.

A migration from the continent of Asia of a brown race of Indians appears to have taken place at a subsequent era, and to have established itself by force in the Malay Peninsula, in Sumatra, Java, Borneo, the Celebes, and several of the adjacent islands, as well as in the Philippine group, exterminating to a great measure or absorbing the Papuan races in the conquered districts.

From the Philippines detached portions of the population of the brown race must have migrated eastward in search of new lands, and thus peopled the Caroline and Ladrone Islands, whence they found their way to the Sandwich Islands and to the Navigators and Society Islands, and the islands comprising Polynesia proper, all of which, we have every reason to believe, were before then uninhabited.

The most convincing proof that the primitive stock from which the brown race of the Indian Archipelago and the Polynesians have sprung was the same, is derived from comparisons made between their languages. It is observed that the languages of both are constructed on the same grammatical principles, and present many striking points of agreement in other respects.

I was much struck by finding the identity of a root of the pronoun of the first person singular in the Maori of New Zealand with the root of the same pronoun in Malayan, and in the T'hay or Siamese, an allied continental language. In the Maori this pronoun has two roots, *au* and *ku*, just as in the English the same pronoun has two roots *I* and *me*. In the Malayan, *I* is represented by one of these roots, *ku*, which becomes *aku* by the addition of the personal prefix *a*. In the Siamese language, the same pronoun is represented by the simple root *ku*.

The present native inhabitants of New Zealand are evidently, to a certain extent, a mixed race containing two elements, one of which may be called the pure Indian, the other being the Papuan. The marked characteristics of the former are a brown or copper-coloured skin, black hair, sometimes sandy (called by them hurukehu), straight, wavy, or curling, and a tolerably well-formed nose, sometimes even aquiline; while those in whom the Papuan element is most marked have the skin much darker, the hair black and crisp (but not growing in separate tufts like that of the true blooded Papuans), the nose flat and broad at the nostrils, and the lips more full and prominent. Between these extremes, every intermediate variety of feature may be met with among the New Zealanders; but their prevailing type of feature is the Indian.

To account for this mixture some persons have suggested that a Papuan race was found in possession of the country by the ancestors of the New Zealanders when they first arrived, and that the mixed breed had sprung from alliances between the two races. It has even been stated that the Papuan element belongs more especially to slaves, who are supposed to have sprung principally from the subdued and degraded race. Such statements, however, have no trustworthy foundation; for the crisp hair prevails equally among the rangatira, or gentleman class, and among slaves. Besides, the traditions of the New Zealanders speak of the country as being uninhabited on the arrival of their canoes from Hawaiki; and in the other islands of Polynesia there exist similar indications of a mixed race.

These traces of a mixed race are easily accounted for by supposing, as indeed appears certain, that the Indian Archipelago and the Malay Peninsula were primitively inhabited by Papuans, and that the brown or copper-coloured race, whom we have called Indian, invaded their country and took possession of parts of it; for a long time must have elapsed between their first invasion of the Malay Peninsula and their conquest of the Philippine Islands, from which points we suppose the ancestors of the Polynesians to have migrated. And during the interval, in which the two races remained so nearly in contact, while the one was being supplanted or absorbed by the other, alliances must have taken place between individuals of opposite sexes, giving rise to the appearance of a mixed race now observable.

ON THE

MAORI RACES OF NEW ZEALAND.

By WILLIAM COLENSO, F.L.S.

[*Written for the New Zealand Exhibition,* 1865.]

ANALYSIS.

I. Physiological.

1. *Individual.*

1. Colour.
2. Height; shape.
3. Physiognomy; head.
4. Hair.
5. Health; constitution; teeth.
6. Sensorial faculties.
7. Puberty; natural selection; number of children.
8. Malformations; albinos.
9. Diseases.

2. *Social.*

10. Ordinary habits; of men; of women.
11. Modes of obtaining subsistence; food plentiful.
    (1.) Fishing.
    (2.) Bird-snaring, &c.
    (3.) Cultivations.
    (4.) Wild fruits and vegetable substances.
12. Division of labour.
13. Architecture.
14. Canoe building.
15. Manufactures—
    (1.) Textile.
    (2.) Implements of agriculture and of war; tools and various vessels.
    (3.) Stone implements and mechanical appliances.
16. Ornaments; musical instruments; carvings.
17. Barter, &c.
18. Ordinary events—
    (1.) Birth, &c.
    (2.) Betrothal.
    (3.) "Naming."
    (4.) Tattooing, &c.
    (5.) Marriage.
    (6.) Polygamy and divorce.
    (7.) Death; lamentations; burial.
    (8.) Exhumation; cleaning of bones; desecration.
19. Distinctions of rank.
    (1.) Free.
    (2.) Slave.
20. Property.
    (1.) Private right.
        (i.) Definite.
        (ii.) Indefinite.
        (iii.) Inheritance.
        (iv.) Succession.
        (v.) Usufructuary.
        (vi.) Peculiar.
    (2.) Common.
21. Treatment of diseases; surgery; poisoning.
22. Acquired habits.
23. Drinks.
24. Masticatories.
25. Fondness for children and pets.
26. Games and diversions.

II. Psychological.

27. Intellectual and moral faculties.
    (1.) Intellectual.
    (2.) Moral.
28. Natural propensities.
    (1.) Good.
    (2.) Bad.
29. Vices.
30. Æsthetics.
31. Acquirements.
32. Germs of the principles of mechanics.
33. Colours.
34. Courtesy and etiquette.
35. Sentiments and feelings.
    (1.) Sentiments.
    (2.) Feelings.
36. The taboo (*tapu*).
37. Credulity; dreams; omens; ghosts; sorcery, &c.
38. Religion.
39. Death; the *Reinga* (*Hades*).

III. Philological.

40. The New Zealand a dialect of the Polynesian language.
41. Its grammar.
42. Beauties.
43. Arbitrary change of words.
44. Proverbs and sayings; fables.
45. Poetry.
46. Traditions; legends; myths.
47. Oratory.
48. Of Europeans speaking it.
49. Its extent and connections.

IV. Palæontological.

50. Origin of the New Zealanders.
    - (1.) Are the present New Zealanders autochthones?
    - (2.) Were there autochthones?
    - (3.) Did the immigrants come from nearest land?
    - (4.) Whence came they?
        - (i.) Probable.
        - (ii.) Mythical (Sandwich Islands) considered.
        - (iii.) Ditto (Samoan Islands) considered.
        - (iv.) If either, still unsatisfactory.
        - (v.) Hawaiki probably allegorical.
51. Antiquity of New Zealanders in New Zealand, proved—
    - (1.) By tradition.
    - (2.) By archæology.
    - (3.) By history.
    - (4.) By habits, customs, manufactures, &c.
    - (5.) By language.
    - (6.) By religion.
    - (7.) And possibly by the moa (*Dinornis*).
    - (8.) Conclusion.
52. Of the first mythical immigrants and their doings.
53. The question repeated:—Whence came they?
    - (1 to 27.) Thoughts and Excogitations.

V. Modern.

54. Comprising a century; changes caused by the introduction of four animals.

1. *Foreign or External.*

55. From A.D. 1769 to 1794 (Cook to Governor King).
56. From A.D. 1794 to 1814 (Governor King to first settlers).
57. From A.D. 1814 to 1840 (first settlers to Treaty of Waitangi).
58. From A.D. 1840 to 1865 (Treaty of Waitangi to present year).

2. *Domestic or Internal.*

59. From 1769 to 1800.
60. From 1800 to 1840.
61. From 1840 to 1865.
62. Their numbers; past; present.
63. Their decrease and its causes.
64. Decline of power and influence; reflections.

VI. Future.

65. Fears and hopes.
    - (1.) Needful and preparatory.
    - (2.) Real and active measures.
66. Conclusion.

Table of native population, North Island of New Zealand, with names of tribes and boundaries.

Much has been said of late about the New Zealanders; from the palace to the cottage, from the senate of Great Britain to the village ale-house, themselves, their doings, and their country, have been greatly talked of. Not many, however, of those who have talked or written the most concerning them, have really understood them; and it is not wholly without hopes of making them to be a little better known, that the following brief essay has been undertaken by the writer.

I. PHYSIOLOGICAL.

1. *Individual.*

1. In colour the New Zealanders varied more than those of any other of the Polynesian islanders. Various hues of olive, of yellow-brown, and of an approach to the copper-colour were common. A few were of fair complexion; while others were very dusky, particularly of the more northern tribes. Such colours, however, were not invariably perpetuated by descent; seeming rather to follow the abnormal law of all domesticated animals.

2. In height they were generally above the middle stature, especially the chiefs; owing, no doubt, to more food and better nurture, as well as to blood. The women generally were smaller than the men. In figure both sexes were well proportioned, muscular, and fleshy, with good-sized calves. The men had often finely formed fingers and nails; and many of the women had beautifully small, delicate hands. Their knee joints were large, and their feet flat and broad, but not long.

3. Their physiognomy varied much. Generally the open countenance, nose large and broad at the base but not very prominent, thickish lips, and dark eyes prevailed. Sometimes the nose was aquiline, but more often flat; sometimes the whole face was a handsome oval, sometimes round; mostly wearing an expression of cheerfulness and good humour. Rarely were the eyes light, never blue. The eyebrows much as in Europeans, but narrower, and seldom meeting over the nose; and the teeth beautifully regular and white, except in the case of the inland Rotorua and Taupo tribes, with whom the four front incisors were always discoloured. The head was generally well shaped, oval, with a fine forehead and well-developed cerebral regions. Sometimes the forehead assumed the Turanian type, giving almost a pyramidal appearance; and a few rare instances have been noticed of an approach to the peculiar Mongolian eye and eyebrows. Very rarely has any indication of the prognathous jaw been observed, while the orthognathous type is far from uncommon.

4. As their complexions varied, so did their hair. Generally it was profuse, black, and waving, or slightly inclined to curl. Sometimes it was red, of which colour there were also many shades; and sometimes it was of a very peculiar shade for human hair, being of two colours—a dark reddish brown, having an inch or two of the tips somewhat flaxen, as if bleached. Sometimes it was lank, and sometimes it was excessively curled; and not unfrequently it was to be met with having a wiry appearance, as if every single hair was separately curled, and always in such cases rising high in a pyramidal form. With many, the beard, whiskers, moustache, &c., grew as profusely as with Europeans, and of much the same quality and colour; while a few only possessed a harsh, rigid moustache, and some (particularly

of the northern tribes) were wholly without hair on the face; no doubt mainly owing to their continual and early attempts to eradicate it. In age the hair became grey, yet not commonly thin, and sometimes, though rarely, quite white. Hair on the thorax or shoulders, as in some Europeans, was wholly unknown.

5. Their frame being strongly built, and constitution good, they were naturally long lived, and generally retained their hair, and their teeth sound and white to the last; baldness being very rare among them. The old natives have always and everywhere affirmed that formerly they lived to a very advanced age, and commonly only died gradually through old age. The writer is quite inclined to believe this, from the numbers of wiry, lithe, and active aged men and women he has seen among them; as well as from the testimony of Captain Cook.

6. Their sensorial faculties were particularly good—far more so than those of Europeans—no doubt quickened both through their absolute need and constant use. The senses of seeing, hearing, and feeling were pre-eminently vigorous and acute, insomuch that the writer has been often astonished at the quiet displays he has witnessed. To define an object plainly a long way off among the fern or shrubs; to distinguish clearly a far-off and indistinct sound among many others; to know certainly, by the feel of the foot, that the dense moss in the trackless mountain forests had been before trodden by man (an accomplishment which took the writer many years to learn), were common things to them; though the last, in its perfection, was confined to the natives inhabiting the mountains. Their senses also of smell and of taste were peculiar, as well as keen, and, though blunt and rude, were plain and unsophisticated.

7. They early arrived at the age of puberty, from twelve or even eleven years upwards; they did not, however, cease growing until eighteen or nineteen years. A few females have been mothers at the age of thirteen, but such cases were rare. Large families were by no means uncommon; very many women have each borne more than ten or even twelve children, though they seldom reared them all. Of course the strongest lived; which was a very good kind of natural selection, no doubt highly beneficial to the race. The act of giving birth, with them, was easy, and mostly a very common matter; sometimes women delivered themselves alone, and having done what was necessary for themselves and infant, returned to their usual occupations. They commonly suckled their children until they were two years old, and sometimes much older. Instances are known of married women having given birth to children when nearly forty years of age, and often after several years of cessation. Twins were not uncommon, though three at a birth was rare. Formerly it was almost unknown for mothers to

lose their milk at an early period, but of late years it has become common. If the mother's milk failed while the infant was still very young, small birds were snared, and their flesh chewed as food for it.

8. Children born blind, or idiots, or deaf and dumb, were all but unheard of; tongue-tied or lisping children were also extremely rare; so were stammerers, though these have certainly increased with civilization. A hare-lipped child was unknown; children, however, with six fingers and six toes were not unfrequent; so were some without any fingers on one hand, yet generally having a thumb, and with very small rudimentary nails on the fingerless stump, at the end of the metacarpal bones. Left-handed persons were not uncommon. Hunchbacks were not unfrequently met with, caused (it is believed by the writer) by their having been injured in passing through their low doors while being borne on the parent's back; although the natives would never allow it. The fairer children would often be strongly marked with *nævus maternus* or mole; such *nævi*, however, were almost always pigmentary, rarely hairy, and never vascular. Albinos, too, though rare, were sometimes born; in their weak reddish-pink eyes and light flaxen hair much resembling the albinos of other nations.

9. Their diseases were but few; and among them only one which could properly be styled mortal, and at the same time general. That, however, was a fatal species of consumption, which alone carried off half of those who died from natural causes. A fever, of a typhoid character, was also prevalent in marshy districts in the summer, which also annually took away several victims, more, however, owing to want of proper food and aid when beginning to rally than to the disease itself. Scrofula, of a very serious nature, often attacked some of the fairest and finest children, particularly at the northern parts of New Zealand; if, however, they survived till years of puberty, they generally recovered. Sometimes it (or a kindred disease, perhaps a severe species of leprosy, not unlike elephantiasis, and confined to the north) attacked the miserable patient in the hands or feet, causing the fingers and toes, and even the hands and feet, to drop off at the joints. Fortunately for the poor sufferer, this disease gave little or no pain. Rheumatism, especially in the back, was very common; so also was ophthalmia, increased sometimes to cataract and to utter blindness through the smoke of their close huts, the dust, and the glare of the sun. Amaurosis was occasionally met with. Dropsy was known, but rare; so was hydrocele. Their principal skin diseases were—a virulent species of itch (*Psora*); boils of two kinds, and often of large size (*Furuncle* and *Anthrax*); shingles, which, however, was not common; an obstinate kind of scald-head (*Tinea granulata?*); and ringworm (*Herpes circinatus*); the two last-mentioned were confined to children. Worms, especially *Ascarides*, were not unfrequent. Fits, of an

epileptic nature afflicted some, both men and women; while a few have lost their lives through sunstroke. Sudden deaths were rare. Insanity, mostly aberrant, of a mild melancholy type, was occasionally to be found. And a new epidemic disease, of some violent plague-like character, called by them *rewharewha*, and which appeared about forty-five or fifty years ago, destroyed nearly three-fifths of the people of the more southern parts of the Northern Island; in some villages and sub-tribes leaving only one or two individuals. This name has since been given by the Maoris to the influenza—a disease of much more recent date.

2. *Social.*

10. In their ordinary habits of life they were industrious, regular, temperate, and cleanly. They loved society, and dwelt together in or near large fenced villages (*pa*); which *pa*, or forts, before the introduction of fire-arms, were always advantageously situated on some eminence, and only made with a vast amount of labour. Always early risers, they naturally enjoyed their siesta at noon. They had two principal meals a day, at morning and evening, which were cooked and eaten hot, and always in the open air, the men apart from the women. Fire they obtained by friction; an easy though sometimes a troublesome process, often dependent on the material, its state, and the skill of the operator. No common (cooking) fire could be ever used to kindle one for warming a house, or for sitting by; nor, long after the introduction of tobacco, for lighting a pipe. Each fine day brought its daily labour to, at least, all the adults:—

(1.) The *men* to their cultivations; or to sea-fishing; or to catching birds, eels, or rats; or to digging of fern-root; or to climbing the highest forest trees for their small fruits; or to the building or repairing of houses, canoes, fences, earthworks, and eel weirs; or to the felling and bringing out of trees and split timber from the forest; or to the making of troughs, paddles, spades, axes and their handles, spears of various kinds, and other offensive implements of stone, bone, and hardwood (some of which required years to perfect a single article); or to the manufacture of fishing lines, canoe ropes, and small cord; or of nets, of eel traps, of canoe sails, and of their prized dog-skin or kiwi-feather clothing mats; or to the making of combs and flutes; or to the making and ornamenting of greenstone, ivory, and bone ear-rings and breast ornaments; or of fish-hooks, circlets for tame parrots' legs, various tattooing instruments, and of tags, pins, skewers, and needles for their own dress mats, for most of which purposes human bone was preferred; or to the seeking for and preparing the various coloured mineral pigments, feathers, vegetable and animal oils, and vegetable dyes used as ornament; or to tattooing, or to the drying and preserving of human heads; or to the carving of figures (some larger than life) on posts of fences or slabs (pilasters) of chiefs' houses; or of carving boxes for feathers, or of balers for canoes, or their large and highly ornamented stern-posts, taffrails, and figure-heads.

(2.) The *women* attended to their peculiar work—to the diurnal preparing of food, and the coarse weaving of small baskets (*paro*) of green flax as dishes for their food, no cooked food basket being used twice; to the gathering of shell-fish; to the cleaning of sea-fish; to fetching of firewood; to preparing of flax, and to plaiting and weaving it into clothing and baskets of very many different kinds; and to their work in the cultivations, such as weeding, &c.; and above all, to the very heavy task of carrying on their backs fresh gravel thither every year for their sweet-potato beds. In the summer season, too, they sought and gathered in large quantities the juicy fruits of the *tutu* (*Coriaria ruscifolia*), and expressed its juice as a refreshing drink. They also gathered in the swampy forests the sugary fruits and fleshy edible flower-bracts of the *kiekie* plant (*Freycinetia banksii*).

11. Their means of obtaining subsistence were as varied as the things themselves. They were not (as many have rashly supposed) deficient in food; although (having but one domestic animal, and that a small dog) what they had and used was not to be obtained without a large amount of daily labour. At the same time, there must have been a great difference in the food of the natives of the Northern and of the Southern and Stewart Islands; as Cook states, "the southern natives have not yams, *taro* or *kumara*" (iii. p. 56). They were very great consumers of fish; those on the coast being true ichthyophagi. The seas around their coasts swarmed with excellent fish and crayfish; the rocky and sandy shores abounded with good shell-fish; the cliffs and islets yielded plenty of mutton-birds, and fat young shags and other sea-fowl, and their eggs, all choice eating. The rivers and lakes (in their season) contained plenty of ducks and other wild fowl, and plenty of small fish and fine mussels, and small crayfish; the marshes and swamps were full of large rich eels; the open plains had plenty of quail, rail, and other birds, and edible rats; the fern lands abounded in the *kiwi* and ground parrot; and the forests yielded fine pigeons and parrots, and plump parson-birds (*tui*), together with many other birds which are now very rare; while many a rich meal was also made from the large larvæ so commonly found in rotten wood. In seeking all these, they knew the proper seasons when, as well as the best manner how, to take them:—

(1.) Sometimes they would go in large canoes to the deep-sea fishing, to some well-known shoal or rock, five to ten miles from the shore, and return with a quantity of large cod, snapper, and other prime fish; sometimes they would use very large drag nets, and enclose great numbers of grey mullet, dog-fish, mackerel, and other fish which swim in shoals, of which (especially of dog-fish and of mackerel) they dried immense quantities for winter use. They would also fish from rocks with hook and line, and scoop-nets; or, singly, in the summer, in small canoes manned by one man and kept constantly paddling, with a hook baited with mother-of-pearl shell, take plenty of *kahawai;* or with a chip of *tawhai* wood attached to a hook, as a bait, they took the barracouta in large quantities. Very fine crayfish were taken in great numbers by diving, and sometimes by sinking baited wicker traps. Heaps of this fish, with mussels, cockles, and other bivalves, were collected in the summer, and prepared and dried; and of eels also, and of several delicate fresh-water fishes, large quantities were taken in the summer, and dried for future use.

(2.) Birds, such as quail, rail, and ground parrot, also the pigeon and parson-bird, and various species of wild duck, they ingeniously snared; although they often speared the pigeon. The large brown parrot was first decoyed to a stand fixed on the top of a high tree by the cry of a tame one, and then suddenly trapped and killed by the concealed native. The *kiwi* was caught by night, through successfully imitating its cry; and the fat frugivorous and harmless indigenous rat was both trapped and dug out of its burrow in several ways.

(3.) A large portion of their time and attention was necessarily given to their cultivations, especially as the few plants they cultivated—two edible roots, the *kumara* (*Batatas edulis*) and *taro* (*Caladium esculentum*), and a gourd-like fruit called *hue*, and the cloth plant, or paper mulberry tree, *aute* (*Broussonetia papyrifera*)—each required a different soil to bring it to perfection; added to which they always wisely preferred cultivating in patches far apart, so as perchance to save one or more in case of a sudden inroad from a *taua* (a legal or illegal honouring, stripping, or fighting party), which visit was perfectly sure to take place at least two or three times a year. The *kumara*, or sweet potato, was planted with much ceremony and regularity in little hillocks in sheltered dry ground facing the sun, carefully prepared, and heavily gravelled with fresh gravel obtained from some gravel pit, or from the bed of a neighbouring stream; this annual gravelling of their *kumara* grounds was alone a heavy service. Among some tribes (as at Rotorua), the *kumara* root was not planted until the sprout had gained some length, which caused additional care and labour. It had to be constantly watched when in leaf, or it would be destroyed by a large caterpillar which fed on the plant, and which was continually being gathered and destroyed in great quantities. It was also carefully weeded, and the ground around its roots loosened. When about two-thirds ripe, a few of its largest roots were carefully taken away by an experienced hand; these were scraped and dried in the sun, and called *kao*, and were reserved to be used as a kind of sweetmeat, or delicacy at feasts, boiled and mashed up in hot water. And when the *kumara* was fully ripe, the labour in taking it up, sorting and packing it into its own peculiar baskets for store—including the weaving of those baskets, and the half-digging, half-building of the stores supposed to be absolutely needful for effectually keeping it (and which were often the best-built houses in the village, and often renewed)—was very great. The *taro* (of which the leaves and stems were also eaten) required a moist, and the *hue* and *aute*, a rich soil, with much less care, however, in raising them; but the manufacture of the bark of the *aute* into cloth-like fillets for the hair of the chiefs (it never was made into clothing in New Zealand) was also a tedious work.

(4.) Of wild edible vegetable substances they made great use; particularly of the fruits of three trees,—the *karaka* (*Corynocarpus lævigata*), the *tawa* (*Nesodaphne tawa*), and the *hinau* (*Elæocarpus dentatus*). The kernels of the first two they annually collected in large quantities, and prepared, by baking, steeping, and drying, for future provision, and which (if kept dry) continued good a long time. The flesh of the *karaka* was also largely eaten when ripe. The fruit of the *hinau* was also collected and placed in water to steep, to separate the dry flesh from the nuts; which powder or flour was subsequently strained, made into coarse cakes, and eaten. The common fern-root *aruhe* (*Pteris esculenta*) was also generally used; and the spots in which it grew to perfection (mostly a deep light soil, especially on a hill side or slope) were prized, and sometimes fought for. It is a great mistake, and one often made by foreigners, to suppose that, because the fern is common, the root which was eaten was also common. The writer has known the natives to dig and carry it a distance of upwards of twenty miles to their homes. Much labour was also expended in procuring and preparing it; on being dug up, it was sorted and loosely stacked, that the wind might pass through and dry it; after which it was put up into bundles or baskets, and stored for use. When used, it was soaked, roasted, and repeatedly beaten with a small club, on a large smooth stone, until it was supple; a process always tiresome, both to eater and to beater, to master and to slave. It was seldom, however, eaten alone, mostly with fish; and in the summer, soaked in the juice of *tupakihi* or *tutu*. The large sugary roots of the great cabbage-tree, or *ti* (*Cordyline australis*), and also the small ones of the little *ti-koraha* (*Cordyline pumilio*), were also baked and eaten, or rather the pulpy substance which is among its fibres. The sago-like pith of the stem of the large black tree-fern, *korau*, or *mamaku* (*Cyathea medullaris*), was also baked in their earth ovens and used; it is very good and nourishing eating. The heart and blanched stems of leaves of the New Zealand palm, *nikau* (*Areca sapida*), and also of the *ti* (*Cordyline australis*), were eaten both raw and cooked. The watery farinaceous roots of *raupo* (*Typha angustifolia*) were also eaten raw; and its pollen was made into cakes like gingerbread and baked. The fleshy blanched sugary bracts of the flowers of the *kiekie* plant (*Freycinetia banksii*), called by the natives *tawhara*, and the fruit of the same (*ureure*), when quite ripe, were eagerly sought after in their season. The common sow-thistle, *puwha* (*Sonchus oleraceus*), of which there were two varieties, and the little *poroporo* (*Solanum nigrum*), and the *toi* (*Barbarea australis*), were also cooked and eaten as vegetables. So were several *fungi* found growing in open fern lands, and in woods on trees; also a few of the sea-weed class, particularly the *karengo*, a low growing thin fronded species, found extensively on clayey tidal rocks from the East Cape southwards. This kind was gathered and dried for use, and sometimes carried a long way into the interior to friends as a great delicacy. Many small fruits were also eaten when ripe; such as the fruits of the large timber trees, *kahikatea*, *totara*, *mataii*, and *rimu*, (*Podocarpus dacrydioides*, *P. totara*, *P. spicata*, and *Dacrydium cupressinum*); of the *kohoho* (*Solanum aviculare*), of the *poroporo* (*S. nigrum*), of the *kotukutuku* (*Fuchsia excorticata*,) of the *karamu* (*Coprosma lucida*), of the *ngaio* (*Myoporum lætum*), of the *korapuka* (*Gaultheria antipoda*), of two species of myrtle, the *ramarama* and *rohutu* (*Myrtus bullata* and *pedunculata*), and of the little heath *totara* (*Leucopogon fraseri*).

12. Labour was by them divided into four great classes, viz.—(1) Male; (2) Female; (3) Sacred, and (4) Common. Of *fruges consumere nati* there were none. The chiefs worked equally with the slaves, especially in the cultivations, and often better and more energetically. There were no really *adstricti glebæ*. From their youth the chiefs were taught to be foremost and to excel; and as they gloried in getting a great name, they strove to do so. The *men* caught fish and eels, and snared birds and rats; they dug and planted their cultivations; they climbed the highest trees for their fruits; they dug up the fern-root; they felled the timber, and built the houses, and canoes, and made the fences, and all wooden, stone, and bone implements and ornaments; they made their fishing nets and lines, and eel traps and hooks; they performed all the tattooing; and very frequently carried their infants for hours on their backs, even while at work. The *women* prepared the daily food; cleaned the fish for drying; collected shellfish, edible sea-weeds, and herbs, and firewood; weeded the plantations, and gathered up the crop when dug; cut and dressed the flax leaves for clothing and floor mats and baskets, and plaited and wove them. Their *quasi* "sacred" or taboo (*tapu*) duties (of which much might be written) could only be properly performed by a "sacred" person; for although in some

few cases, a person not "sacred" might act, yet he sometimes most inconveniently became "sacred" by his doing so! As a rule, a "sacred" person never touched common work or things. Their common matters, however, were open to all, with this only reservation,—that men's work was not done by women, and *vice versâ*.

13. Their better architecture and building,—bearing in mind the non-durability of the materials used,—though peculiar, was of first order, and well fitted for the people and the climate. Their houses, particularly those of the principal chiefs, were strongly and neatly built, snug, and often highly ornamented. They were cool in summer and warm in winter. The faults of all their houses were, their being too low, with excessively low doors, with earthern floors, and without chimney or sufficient ventilation. In shape they were generally a parallelogram, with their walls always slightly inclined inwards, with the angle of the roof low, and invariably with the one door and one window at the sunny end, within a pretty large veranda. In size they were from one which would contain with ease a hundred men, to one which would only contain six. The floors were rarely ever raised above, oftener sunk into, the ground. The window shutter and door, each fixed in a substantial and often highly carved wooden frame, slid to and fro, and when closed all was dark within. The house having its framework wholly of *totara* wood (of which the pilasters were often each two feet wide, and smoothed by repeated chipping with a stone adze), was built of several coats of bulrushes, securely fixed with flax, having a handsome ornamental lining of reeds to the roof and between the wide pilasters, covered outside with one or more coats of strong thatch firmly fixed, and often with the bark of the *totara* pine laid on in large slabs. On the large and wide barge-boards, posts, ridgepole, and ends of the veranda, much grotesque carving and ornamental work was often displayed; these were mostly coloured red. Their sweet-potato stores were also often elaborately finished. Sometimes their stores were neatly set on high posts, which were not unfrequently carved, and were climbed up into by means of a notched pole as a ladder. Their common houses though plain were often very strongly made; sometimes, however, their walls were not more than two feet high, with a prodigious roof. No observable order was followed in placing their houses in a village; throughout which there were ways of communication in all directions, but no proper streets; each sub-tribe or family generally enclosed with an inner fence, having around their own houses apertures for ingress and egress. The outer fence of the village, often composed of whole timber trees set in the ground, without their bark or branches, and from fifteen to twenty or even to thirty feet in height, and strongly secured with transverse timbers cross-lashed to

the uprights with durable supplejacks and vines from the forest, looked very formidable and was very strong. All its posts were surmounted with human figures as large as life, *in puris naturalibus*, elaborately though roughly carved out of solid wood, with faces in every conceivable or inconceivable state of distortion. Inside this was generally a second wooden fence, made like the outer one, but of lighter materials; within this were excavated earthworks. Sometimes the wooden fences, or some portions of them, were raised on earthworks; and sometimes they were made to overhang a cliff or side of a hill, as a *chevaux de frise*, presenting a low angle with the horizon.

14. If there was much to admire in their house architecture and fortification building, there was still more in their naval architecture; bearing in mind (as before) that they did all without the aid of iron or any metal; their solid and strong double canoes (*wakaunua*), long since extinct, and scarcely known even by name to the present generation; their handsome, well-arranged war canoes, of which there are not many, and perhaps not a single first-class one left; their fishing and voyaging canoes, also with raised sides; * and their common canoes of several kinds and sizes, formed out of a single tree, and often of great length. A first-class war canoe, with all its many fittings—its hundred paddles, its handsome elaborately carved stem and stern, and all its many ornaments and decorations of feathers, rouge, and mother-of-pearl, was always the work of many hands throughout many years. Fully to complete one was indeed a triumph, in which many hearts would heartily join: so true it is,—

"A thing of beauty is a joy for ever!"

Their largest canoes were rigged with two masts, and carried a large light triangular-shaped sail to each. Their smaller canoes had only one similarly shaped sail. Besides their canoes, they sometimes made use of rafts for crossing streams and inlets when the water was deep; such, however, were only made for the occasion, of dry bulrushes, or the dry flowering stems of the flax plant, tied together in bundles with green flax. In some places (as about the East Cape, where there are no harbours), the natives made use of an open frame-like raft of light wood, on which they went out to sea for some distance; and of late years have not unfrequently visited ships on such, carrying with them two or three baskets of potatoes.

15. They also excelled in some few manufactures, more particularly in their textiles, in this respect far surpassing all the other Polynesians; nature having bountifully given to them that most useful plant the New Zealand flax, or *Phormium*, which was very nearly to them what the cocoa-nut palm is to the Indian.

* Commonly called "war canoes" by the colonists.

(1.) From this plant they wove a very great variety of dress mats; from the large, elegant, and silky bordered *kaitaka* of the chiefs, to the common *pakè*, or rough bee-butt-like cape for the shoulders, against the rain and cold. Much time was necessarily occupied in weaving a first quality dress-mat: the seeking the variety of flax requisite, and the scraping, preparing, and selecting of its fibre; the tewing it to make it soft and silky; the slow weaving; the further seeking of the different barks and earths required for dyeing the flax in three colours for its lozenge border, to which they always gave the utmost attention. Under the most favourable circumstances one of those best mats could scarcely be finished in two years. Some of those mats were made very soft by repeated tew-tawing. All were more or less ornamented; some with a wide border woven differently from the body of the mat, and dyed with enduring colours; others having a profusion of fine glossy black tasselled strings, about five or six inches long, regularly depending at equal distances from them; others with a rich border of black, or black and white, fringe; and others (*korirangi*) were thickly adorned with chequered black and yellow strings, which being also hard in spots or joints through the leaving on of the skin, &c., of the flax, rattled pleasingly with every movement of the wearer. Their more common and daily rough and shaggy dress mats, though anything but ornamental, were exceedingly useful, and excellently adapted for preserving their health. Being water-proof, this mat kept them dry and warm in the severest weather; being loosely worn, it allowed of free ventilation; and being rough, it kept up that healthy, slight irritation of the skin which to them was indispensable. They also used other fibrous plants for clothing mats, although the flax (*Phormium*) grew everywhere. The strong, durable, and wholly black-dyed mat called *toii*, was made of the fibres of the handsome large-leaved mountain *Cordyline* (*C. indivisa*). The long leaves of the climbing *kiekie* (*Freycinetia banksii*), and of the *neinei*, or large-leaved *Dracophyllum latifolium*, were also used by them; while the bright yellow leaves of the *pingao* (*Desmoschœnus spiralis*) were woven into useful purse-like girdles. The natives in the more southern parts of the group also wove very useful flax sandals for wearing on the snow. The floor mats, of various sizes, patterns, and fineness, were also neatly woven of flax or *kiekie* leaves, separated by the thumb-nail into narrow slips; or of the leaves of the large cutting-grass *toetoe* (*Arundo conspicua*), denuded of its edges; or of those of the *nikau* palm (*Areca sapida*); of all which materials they also made their numerous baskets, of many patterns, kinds, and sizes. Some of their fancy baskets, woven in elegant patterns with dyed leaves, were highly ornamental. They also made strong and serviceable dress mats of the hairy skins of their dogs, and also of the feathers of the *kiwi* (*Apteryx*), for which they wove a strong lining of flax.

Their dogskins they always separated into narrow shreds, which they firmly sewed together, so as to variegate the colours according to the fancy of the maker and owner; or sewed in stripes upon a stout woven lining of flax—not unlike sackcloth. The flax plant also furnished them with excellent material for their many and various threads, twines, cords, lines, and ropes. These they commonly made of 2, 3, or 4 twist, which operation was always performed with the hand on the naked thigh! They also made their several kinds of drag and hand nets, of various sized mesh, of its undressed leaves; of which, and of the leaves of the *ti* or cabbage-tree (*Cordyline australis*), they plaited flat, round, and square ropes, for their canoes, nets, &c. Their canoe sails were curiously constructed of bulrush leaves (*Typha*) laid flat edge to edge, and laced across with flax.

(2.) Their implements of agriculture were made of hardwood, and were few in number. The principal one was a *ko*, a rude kind of narrow and pointed spade with a very long handle, to which, at about eighteen inches or more from the point, they fitted a small crooked bit of carved wood, as a rest for the foot. Much smaller implements of a similar shape were used for digging around the plants and for breaking the clods; these last they used in a sitting or squatting posture. Their canoe paddles and fish spears were also made of hardwood, *manuka* (*Leptospermum scoparium*); but their bird spears being very long, some upwards of thirty feet, were made of the light wood *tawa* (*Nesodaphne tawa*). Their war implements of wood were made both of *manuka* and *rimu;* the curious halbert-shaped *wahaika*, the broad *meremere* (or hand club), for close quarters, and their short spears, were made of the former, and the long spears of the latter, wood. They also made darts with heads of light combustible materials; these they used in attacking a *pa* or village. Their saw-knives, used for cutting up the flesh of whales, &c., were also made of hardwood; some were edged with sharks' teeth. Their fish-hooks had the shaft made of the fossil bone of the *moa* (*Dinornis*), and the barb of human bone, with a small tuft of metallic blue feathers of the little penguin attached; some were also made of the tough crooked roots of shrubs, hardened by fire; to some of which a glittering piece of mother-of-pearl shell was attached as a lure. Their sinkers, for deep-sea fishing, were made of stone, which they cut and notched to suit; sometimes using a large fossil bivalve, and sometimes a piece of rock which had been perforated by a *Pholas*.

(3.) Their stone axes of various sizes, used for felling trees, shaping canoes, and many other purposes, were made of three or more different kinds of stone;—the green jade, or axe stone; a close-grained dark basalt; and a hard grey stone. A piece of broken shell was commonly used for cutting, scraping, carving, &c.; but for cutting their own bodies (in lamenting for the dead, &c.), as well as for cutting their hair, and sometimes for carving, they used a thin piece of obsidian. One of their most ingenious instruments was a kind of wimble, or drill, composed of a small cylindrical piece of wood, produced to a point at one end, to which was fixed a small angular quartz stone; two strings were also fastened at the opposite end, these being repeatedly pulled by both hands in a contrary direction (the stone to be bored, &c., being firmly held by the feet), a hole was in time perforated. They used the wedge (*matakahi*) in splitting trees; and another simple machine, composed of a short lever with short straps, on the plan of a tourniquet, was also used by them in expressing oil from the seeds of the *titongi* (*Alectryon excelsum*), &c., &c. For water vessels they commonly used the hard and fully ripened rind of the cultivated gourd, *hue*, which sometimes attained to a large size, hardened by baking, sun and fire. The larger calabashes were selected for potting fat birds, and similar delicacies, in their own fat. Oil was often kept in the smaller calabashes; also in dilated joints of kelp, and in the stout double air-bladder of the curious sea-porcupine fish (*Tetraodon* sp.)

16. They cultivated the ornamental as well as the practical. This has been already shown (in part) in the manufacture of their clothing mats, in their canoe decoration, in their carving, &c. Their greenstone ear and neck ornaments belong to this class; which, from their shape, polish, and tenuity, as well as from the well-known hardness of the stone, must have taken an enormous time to finish. The *mako*, or teeth of the long-snouted porpoise (a species of mammal rarely indeed to be met with,—driven on shore, at least), was also greatly prized for ear ornaments. The black and white tail feathers of the bird *huia* (*Neomorpha gouldii*), and the snowy plumes of the *kotuku* (*Ardea flavirostris*), were greatly prized, to adorn the heads of their chiefs; the former were snared in their proper forests, by skilled natives imitating their call; the latter was (in the Northern Island) rarely seen, and yet they sometimes managed to capture it alive, and to keep it so in a cage for a considerable time for the sake of its feathers, which they regularly plucked. The white down of the albatros and of the gannet was also worn by the chiefs both in their hair and ears, as ornaments; while the women often wore suspended to their necks the mottled feathers of the paradise duck and of the little blue teal of the mountain rivers. They also ornamented themselves by wearing in their ears the beak and feathered skin of the *huia*, deprived of its tail-feathers; and also of the *tui* or parson bird, and of the elegant little glossy cuckoo, or *pipiwharauroa* (*Chrysococcyx lucidus*), while the long tail-feathers of the larger cuckoo, or *koheperoa* (*Eudynamis taitensis*), they also wore in their hair. Flowers were also sometimes used for this purpose; especially the elegant climbing *puawananga* (*Clematis* sp.), and neat *waewaekoukou* (*Lyco-*

podium volubile), of both which the women often made graceful wreaths and garlands. They carved handsome staves (*hani* and *taiaha*) out of the hard variegated wood of the *ake* (*Dodonæa viscosa*); which weapon was used both as insignia of rank and for defence; this they further ornamented with mother-of-pearl eyes set into the wood, and with small red feathers, obtained from under the wings of the brown parrot, firmly fastened around it, and with the prized long white hair of their dogs' tails, neatly quilled up into little queues and pendant from it. Then their musical instruments (rude though they were and possessing only a few notes) were several; perhaps they would have improved these had they possessed proper material for making them. Their three or four flutes of different sizes were made of human bone, or the hollow stems of the *tutu* (*Coriaria ruscifolia*), or of the *koholo* (*Solanum aviculare*), or of two pieces of hard wood, cleverly constructed and fitted together, having the joining in the centre, where, too, it was much larger. Their trumpet was made of a large conch shell (*Triton variegatum*), and sometimes of a piece of wood. All their musical instruments were also more or less carved and ornamented. Their larger war-gongs were made of *mataii* wood, and were suspended in their forts. Their combs for their hair were also both neatly made and carved; these, however, were not used as combs commonly are by us, but by the chiefs to keep up their hair, much as English ladies use their high back-combs. The cloth-like inner bark of the *aute*, or paper mulberry, was manufactured only for head ornaments, for which sole purpose too the exotic was carefully and annually cultivated. They very elaborately carved their boxes for holding their *huia* and *kotuku* feathers; and so they afterwards often did their tinder-boxes. They also carved the deep circlet necks, or collars, of hardwood, which they neatly fixed on to their large provision calabashes for potted birds; to which they also fitted tripod-like stands. The *poukaakaa*, or parrot perch, was also generally carved and ornamented. And they assiduously sought, and only obtained with much trouble and preparation, their favourite colours of red and blue mineral pigments, with which to ornament their bodies, as well as their chiefs' houses, canoes, storehouses, tombs, and boundary posts.

17. Buying and selling for a price, as practised by us, was unknown to them. Such was not wanted where every man or household had nearly alike, and made their own commodities. They had, however, a kind of barter or exchange; or, more properly, a giving to be afterwards repaid by a gift. Dried sea-fish, or dried edible sea-weed, or shark oil, or *karaka* berries, would be given by natives living on the sea-coast to friendly natives dwelling inland; who would afterwards repay with potted birds, or eels, or *hinau* cakes, or mats, or rouge, or birds' feathers and skins. So, a chief would give to one of his own, or of a friendly tribe, some article as an

acknowledgment or equivalent for building a canoe, carving, &c., but always without any kind of stipulation or fixed price. Or he would make a present (always to be repaid) of a canoe, or a dress mat, or a stone war weapon, or a dog, to some other chief, generally to one of higher, or equal, rank than himself; but all without anything like price stated. And when the return gift was made, it was always stated to be such, for if not so stated it would not be so considered—want of knowing this has occasioned much misunderstanding between them and whites. A return gift was always expected to be a larger one than the one which occasioned it. Sometimes they sought to exchange one thing for another, especially with strangers visiting, but this was very rare.

18. The four great yet ordinary events to a New Zealander, were birth, marriage, death, and exhumation; to which may be added, the ceremony of naming, the arranging of betrothal, and tattooing. On all these occasions there was great feasting; particularly in the case of death and exhumation; when, too, there was grievous lamentation, much of which was very often real. Time, however, will not permit of anything more at present than a passing mention of those matters.

(1.) At the birth of a child, especially of the first-born of a couple of high rank, there was quite as much rejoicing as in more civilized countries. The maternal aunt or maternal grandmother of the infant was generally present and ruled on such occasions; if not, then the paternal grandmother took her place. Sometimes the birth of a daughter was preferred to that of a son, for political reasons. Of course, the spot where the child was born (if in fine weather in the open air), everything touched or used, and all who had anything to do at the birth, were strictly tabooed (*tapu*)—under customary restraint, or "legally unclean"—set apart for the time from every ordinary matter. The umbilical cord was tied with scraped flax, which sometimes slipping caused a protuberant navel, and not unfrequently hernia; which latter, however, disappeared at adult age. The natives have been charged with compressing the infant's nose, to flatten it; and while this has been commonly denied, it is evident that the nose salutations (*hongi*, nose-rubbing) it was continually receiving from its mother and relatives, must have had a great tendency that way: besides, flat noses were always admired. Soon after its birth they commenced rubbing down its knee joints, in order to reduce the inner part of the joint, and so make them "handsome." For this purpose the infant was placed face downwards by its grandmother, or by one of the elder women, on her closed legs, and its little legs and knees rubbed downwards with pretty much squeezing of the inner knee; this operation was daily, or oftener, performed during several weeks. Female infants had the first joint of their thumbs half-disjointed, or bent considerably outwards, to enable the woman the better to hold, scrape, weave, and plait flax. At an early period, the little ears of the infant were bored with a sharp fragment of stone, or bit of obsidian; an operation generally performed by its mother.

(2.) Betrothal often took place at, or shortly after, birth (if not indeed, mentally, and conditionally, before). This was almost certain to ensue in the case of simultaneous births of opposite sexes among friends of equal rank, or distant relatives. If not then arranged by the parents or uncles, it was generally done during the early childhood of the children. While, no doubt, all such affiances arose from both good and political motives, nothing the New Zealanders ever did caused them more misery, and yet they could never be brought to see it.

(3.) "Naming" of the child also followed soon after its birth. This ceremony was always performed by a "priest" (cunning wright, or skilled man, who managed all such secret and mysterious matters, of exorcism, objurgation, or incantation); it has been called by Europeans, the "naming" of the child, but it does not mean that; it has also been called "baptism," and compared with Christian baptism, and the term *iriiri* adopted, rather unwisely, to express that ordinance. No doubt it was a high ceremony in the eyes of a New Zealander; but it was nothing else than a removal of the *tapu* (restraint, or prohibition) under which the child and mother lay—more a rite of purification than anything else. If the child was a boy, the "priest" expressed his wish that he should be brave and manly; if a girl, that she should be efficient in all those peculiar duties pertaining to her sex.

(4.) About the age of puberty the tattooing operation was begun on both sexes, as, in the case of the man, it took several years to complete, and in that of the woman it was necessary, at least, that her lips should be finished ere she could have a husband; *red* lips in women being abhorred, and *black* ones being considered the perfection of beautiful feminine lips. Regular tattooing in the *male* was confined to the whole face and to the breech, and sometimes to the thighs: certainly some were very handsomely done. In the *female* it was confined to the lips, chin, between the eyes, and a little up the forehead, and on the back part of the leg, from the heel to the calf; the three last-mentioned being always indicative of rank. The women, also, often got themselves irregularly marked on the hands, arms, breast, and face, with small crosses, short lines, and dots. A very few women the writer has seen with tattooed faces just as a man; these belong to southern tribes; some of whom formerly had a very different style of tattooing (such as is shown in Cook's Voyages, plate 13, 4to edition). The chiefs wore their hair long, and dressed up into a knot on the top of their heads; the women wore it cut short.

(5.) At the marriage, or coming together as man and wife of the young couple, there was really no ceremony; indeed they had no proper name for it in their own language. It was known as *noho tahi*, or *moe tahi*, or *whakamoe*—*i.e.*, dwelling together, or sleeping together, or causing to do so. If they had been betrothed by their parents, it was merely a matter of time,—always supposing no rupture, or anything serious having occurred, which, however, was rarely the case. The mats being woven, and the provisions ready for the feast, and the parents, brothers, uncles, and tribe being of opinion that the long looked-for dwelling together should take place, (which they were often too ready to do), and the young couple also willing, the betrothed bride was brought, generally by her brothers and uncles, to the house of the bridegroom's parents, clothed in new mats, where she was received with acclamation, and given over to her husband; by whom and by his people gifts were always made to the parents of the girl. If, however, there had been no betrothal, a marriage between young people was always a very difficult thing to effect, and one which took some time, as every one, of both the tribes, had something to say, and must be satisfied ere it could take place; particularly the uncles and aunts, the sisters, and female cousins of the young man, and the brothers and male cousins of the girl. Hence, the young couple, disgusted, often ran away to the woods, and there remained some time together in solitude, pretty sure of being soon sought after, and their living together acquiesced in. Contrary to what obtains (openly at least) among us, with them the unbetrothed young woman commenced the courtship; not unfrequently, however, even after all the relations had agreed, other suitors appeared at the last moment, and a passionate and severe struggle took place, sometimes ending in the forcible abduction of the girl (especially if the newly-arrived suitor was a person of high rank), after being nearly killed through the pulling and hauling she received.

(6.) Polygamy being encouraged, and divorce allowed, all chiefs had several wives; which increased their power and influence considerably. Polygamy was not the cause of disagreement or jealousy among the wives, who lived together in great harmony. Nor did it cause a disproportion of marriageable women, as many males were being continually killed in their frequent battles. The *sudden* bringing home of a new wife, which sometimes happened (perhaps a slave, or from a distance), as a matter of course made quite a sensation among the old wives, but it was only temporary. Often the old wives themselves encouraged their husband to take another, and aided efficiently in his doing so. Their injudicious early betrothals, (marriages of policy, not love), which *must* take place; their great desire of offspring; their belief that barrenness always proceeded from the female; and their rule of a brother always taking the widow of his deceased brother; were among the main causes of polygamy. Politically speaking, had polygamy and divorce not been too early and rudely ecclesiastically interfered with and prohibited, the New Zealanders as a nation would, in all probability, have now been very much more numerous and better off.

(7.) Death was always gloomy to a New Zealander, and yet they often met the "king of terrors" bravely. Whether they slowly died from disease, or from barbarous cruelties practised by their enemies;—whether suddenly from unlooked-for casualty, or the excited anger of a superior, or in the battle-field, they all, young and old, of either sex, died bravely, though not willingly. This is the more striking, from the fact of their belief, that, whether they died at home from disease, or at sea from a canoe upsetting, or from a fall from a lofty tree, or through a house taking fire, or in the battle-field, or as a captive,—such was invariably owing to the anger of the *atua* (or man-destroying demon). Often did they, when sinking, calmly give their last words (alas! too frequently of deadly revenge) to their weeping relatives; which burning words the hearers treasured up never to be forgotten. They rarely ever died in a good house; mostly in the open air, or under some wretched shed; this was done because the house in which any one died would have to be forsaken as *tapu*. At death there was much loud lamentation, accompanied with gashing themselves on their arms, chests, and foreheads, through which the blood flowed profusely. They also further disfigured themselves by cutting their hair close on one side; sometimes a few locks of long hair were left untouched, and these were seldom afterwards trimmed, but allowed to grow and mat together as a constant and ever present memento of the departed. The whole place was very sad; several of the principal resident mourners have been known to die from sheer exhaustion. Such miserable wailing continued for a long time; as fresh parties of mourners kept continually arriving. Some came before the body was removed; some not till long after; but this made no difference. All sang and wailed with much gesticulation and lacerating of themselves, with their faces towards the deceased, or his tomb, or the place where he had breathed his last; the burden of their lament invariably being, "Go, go, depart, depart; go before us to thy people: we follow." The body was sometimes tied up in a sitting posture, and clothed, and placed with its greenstone *mere*,* &c., in a small house, or mausoleum, prepared for it. Sometimes, though not frequently, it was boxed up in the corner of the veranda of the house in which it had lived; oftener it was placed on a small canoe or bier, and taken to a gloomy forest, anciently set

* Short cutting club.

apart for the purpose, and there put up in the broad forked branches of some dark tree; in all such cases to remain until the flesh should have decayed.

(8.) The exhumation, or *hahunga—i.e.*, cleaning of the bones—sometimes took place within a year after death. For this work great preparations were made in the way of preparing provisions, and not unfrequently the ceremony was put off until a sufficiency should have been provided. Of course all engaged in cleaning the bones were very *tapu*, and rightly so. Not one of the smallest was ever left behind; they were cleaned, anointed, and decorated, the head especially, with feathers and ornaments. After being exhibited, seen, wept, and wailed over, they were carried by a single man and near relative to their last resting place; the exact spot of deposit, for wise political reasons, being only known to a select few. Sometimes the bones were thrown into some old volcanic rent or chasm; sometimes thrown into very deep water-holes; and sometimes neatly and regularly placed in a deep, dark cave; always, if possible, wherever those of his ancestors happened to be; their principal object being to prevent their falling into the hands of their enemies, who would dreadfully desecrate and ill-use them, with many bitter jeers and curses. The skull might be made to serve as a dish for food, or be placed on a stake to be daily mocked, or even taken out to sea on fishing excursions, to be taunted and derided afresh there with new indignities. The bones of the body would also be used for fish-hooks, flutes, needles, skewers, dining-forks, &c. All such ill-usage was always dreaded and detested. Some tribes, especially the Ngatiporou (East Cape), extracted the teeth, and, having strung them, wore them as a necklace.

19. Of rank and class, the New Zealanders had keen and clear, if not subtle, distinctions. First, there were the great ones of bond and free:—

(1.) Of the *free*, there were—(*a.*) The *ariki*, or head of the tribe, being the first born (male or female) by the eldest branch; the lineal heir or heiress. (*b.*) The principal man (*tino tangata*) or head of the sub-tribe. (*c.*) His brothers and sisters, and half-brothers and sisters by other mothers. (*d.*) His uncles and aunts, cousins, &c. The tribe or sub-tribe having sprung from one progenitor, the greatness of any one of it depended partly on his nearness to that progenitor, and partly on the rank, power, and influence of his own immediate parent or ancestor (male or female), who had married into the tribe. Thus, paradoxical as it may appear, the children were often of higher rank than either of their parents; this often caused what would be by us termed gross insubordination. The children of a principal chief by wives of unequal rank would not all be of one rank; as their rank always depended on that of their mothers as well as on that of their fathers. The first-born of the eldest of the tribe, whether male or female, was called *ariki* (*i.e.* first-born, heir, high chief, or ruler), and besides his high rank had great privileges. Of him or her, great care was taken. To him from his birth, being of much higher rank than his father or mother, it was as if the world around was made for him. In every case the eldest child ruled all the younger children; and they generally promptly obeyed him. Sometimes, in consequence of the will of the father, or owing to a quiet or retiring disposition, to bodily deformity or ailment, to want of capacity or of signalizing himself, on the part of the elder child, or to the scheming daring character of the younger, the younger superseded the elder, and governed the tribe in all ordinary matters; but not in the greater tribal matters. A chief generally lost his influence among his own tribe, if not his rank, by not asserting his position and rights. Here, as in other countries, *might* very soon became to be considered as *right*. Hence the constant exertion and struggle, and the difficulties continually arising in the daily jostle of New Zealand life. Chiefs of rank were also known by their tattooing, dress, insignia, and ornaments. The black and white tail-feather of the *huia* bird, and the white plume of the crane (*kotuku*), were worn by them alone in the hair; the prized tooth (*mako*) in their ears; the quaintly carved greenstone *heitiki* suspended on their breasts; and the greenstone *mere* and ornamented *hani* in their hands; these, with their best mats, of flax, dogskin, and birds' feathers, were all for patrician ornament and use. (*e.*) Poor men and low plebeians, though free, were the children of remote lateral descendants of a tribe, especially if their mothers or fathers had been slaves. (*f.*) Successful "priests" and skilled artificers, both male and female, whether belonging to the tribe or not, always gained both renown and influence, whatever their proper rank might be; so did the brave warrior and fortunate fisher and bird snarer. The "priest," however, lost his influence the moment he ceased to be successful, or to be believed, on which his success depended; hence all manner of lying props and stratagems were used.

(2.) With the *slave*, too, it was much the same; if skilled, or if active and industrious, and willing to serve his new masters, he was sure to rise and have some influence; which, however great his rank might have been in his own tribe, he would never again have there, even if he could return. This was a strange and cruel trait in their character, but it is easily understood when it is considered that his own tribe attributed his being enslaved to the anger of the *atua* (evil demon), and that by his becoming so he had lost his *tapu;* and if they were to compassionate and restore, they too would incur the anger of the *atua*, which they dreaded above all things. Slaves have been known to rise to very important positions among their new masters; and, even when having opportunities to escape, or set at liberty, to choose to remain and live and die with them. The writer has known several instances, especially among the Ngapuhi (Bay of Islands) tribes, in which the slave, although without original rank, has become the principal man or leader in the sub-tribe in which he was a slave. A New Zealand slave had full liberty, even of speech, before his masters, and plenty to eat, and was generally as cheerful as the free. True, he could not wear the clothing or ornaments of patrician rank, nor would he be greatly bewailed at death, nor have his bones ceremonially scraped; but these things *now* did not move him. Those about him knew, and he too knew, that his lot of to-day might be theirs to-morrow. Bad, irritating language was sometimes used towards a slave by tyrannical, passionate masters; but such was the exception, not the rule, and was secretly disapproved of among themselves. All things considered, ordinary slavery among the New Zealanders was not so bad as the word imports, and as some Europeans, from want of due knowledge, have made it to appear.

20. Their views of *property* were, in the main, both simple and just; and, in some respects (even including those most abnormal), wonderfully accorded with what once obtained in England. Among the New Zealanders property may be said to have been divided into two great classes—immovable and movable;—or, ordinary and extraordinary;—or, peculiar and common. Perhaps the latter definition may be most advantageous for consideration.

(1.) *Of peculiar or private rights.*—With them every man had a right to his own, as against every one else, but then this right was often overcome by might. A man of middle or low rank caught, perhaps, some fine fish, or was very lucky in snaring birds; such were undoubtedly his own, but, if his superior or elder chief wished or asked for some, he dared not refuse, even if he would. At the same time such a gift, if gift it might be termed, was (according to custom) sure to be repaid with interest, hence it was readily yielded. The whole of a man's movable property was his own, which included his house and fences, as well as all his smaller goods. All that a freeman made, or caught, or obtained, or raised by agriculture, was his own, private and peculiar; his house erected by himself was his own, but if not on his own land (rarely the case) he could not hold it against the owner of that spot, unless such use had been openly allowed to him by the owner before all (*i te aroaro o te tokomaha*). So a plantation planted by himself, if not on his own land (also a rare thing), he would have to leave after taking his crops, on being ordered to do so; but not so if he had originally and with permission felled the forest, or reclaimed that land from the wild; in which case he would retain it for life, or as long as he pleased, and very likely his descendants after him. To land, a man acquired a peculiar right in many ways.

(i.) *Definite.*—(*a.*) By having been born on it, or, in their expressive language, "where his navel-string was cut," as his first blood (ever sacred in their eyes) had been shed there. (*b.*) By having had his secundines buried there (this, however, was much more partial). (*c.*) By a public invitation from the owner to dwell on it. (*d.*) By having first cultivated it with permission. (*e.*) By having had his blood shed upon it. (*f.*) By having had the body or bones of his deceased father or mother or uterine brother or sister, deposited or resting on it. (*g.*) By having had a near relative killed or roasted on it, or a portion of his body stuck up or thrown away upon it. (*h.*) By having been bitterly cursed in connection with that piece of land—*i.e.* this oven is for thy body, or head; on that tree thy liver shall be fixed to rot; thy skull shall hold the cooked birds, or berries of this wood, &c. (*i.*) Or by the people of the district using for any purpose a shed which had been temporarily put up there and used by a chief in travelling.

(ii.) *Indefinite.*—(*a.*) By having been invited to come there by the chief with a party to dwell (*lit.* having had their canoe in passing called to shore). *b.* Through his wife by marriage, but such would only be a *quasi* life-interest to him—*i.e.* during her life and infancy of the children; as, in case of children, they would take all their mother's right. (*c.*) By having assisted in conquering it. (*d.*) By having aided with food, a canoe, a spear, &c., an armed party who subsequently became conquerors of it. All these equally applied, though he should belong to a different tribe or sub-tribe.

(iii.) Beyond all these, however, was the right *by gift* or *transfer*, and *by inheritance*, which not unfrequently was peculiar and private. This (which has of late years been much contested, and too often, it is feared, by ignorant and interested men, or by those who have too readily believed what the talkative *younger* New Zealanders *now* say) may clearly be proved beyond all doubt—(*a.*) By the acts of their several ancestors (great-grandfathers) to their children, from whom the present sub-tribes derive their sub-tribal names, and claim their boundaries; such ancestors divided and gave those lands simply to each individual of their family, which division and alienation, however unfairly made, has never been contested. (*b.*) By their ancient transfers (gifts or sales) of land made by individuals of one tribe to individuals of another, as related by themselves; and from which gift, or alienation, in many instances, they deduce their present claims. (*c.*) By their earliest (*untampered*) sales and transfers of land to missionaries and to others, which were not unfrequently done by *one* native (as was notably the case in the *first* alienation of land by deed, to Mr. Marsden at the Bay of Islands, in 1815); although the foreign transferees, not knowing the native custom, often wished others, being co-proprietors, to sign the document of transfer—and this, by-and-by, came to be looked upon as the New Zealand custom—whence came the modern belief that *all* must unite in a sale; and thence it followed that one could not sell his own land! But such is not of New Zealand origin.

(iv.) Their *order of succession of inheritance*, as clearly shown in their genealogical recitals, &c., was from father to son; but on the demise of the eldest, the next brother succeeded to the inheritance, *pro tempore*, and so on; eventually, however, reverting to the children of the senior brother, and mainly to the eldest of them. Hence a New Zealander, in speaking of his right to land, even after the decease of his parent through whom he derived his title, preferred to mention his grandfather's name, and himself as deriving from him. It must not be forgotten that the living brother invariably took to wife the widow of his deceased brother, unless she destroyed herself, or he was willing to forego his right; this, also, often entangled the succession still more, especially to a European.

(v.) *Usufructuary.*—Of which two classes may be here noticed. (*a.*) *Permanent:* As the right of a man to a hidden rock, or shoal, at sea for cod-fishing; to a tidal bank for shell-fish; or to a certain wood, or tract of land, for taking certain birds; or to a defined portion of a plain for quail and rats; or to a forest, for *hinau*, *tawa*, or *karaka* berries; or to a defined portion of a flax swamp for cutting flax; or to a spot for an eel-weir; or to a hill, &c., for digging fern-root. Sometimes there would be a double right to the usufruct of the same estate—*i.e.* one man or family would have the right to the eels, another to the ducks; one to the fern-root, another to the rats, quails, &c. Those permanent usufruct rights often originated in transfers or gifts, and generally continued in the first line of descent. They were mostly easily managed by the New Zealanders before the incoming of the European, or rather before the younger natives became infiltrated with novel European notions. (*b.*) *Temporary:* Often only for a year or season—such as, to the fruit (juice) of the *tutu* shrub, or to the watery honey of the flax (*Phormium*) flowers, growing within certain bounds; to the young shags of a certain cliff; to the *inanga* (whitebait), or other annual fish, of a certain part of a stream. In all such cases the right was generally made known by a pole being stuck up with fragments of wearing apparel, or a bunch of flax, grass, or such like, tied around it; and this was usually respected.

(vi.) There were also other *peculiar rights* to property, such as that of the *ariki*, or head chief, to a whale, porpoise, or dolphin ("royal fish") cast anywhere on shore within his territories, to a white crane, if in any of his streams; these, on being seen, should not be touched, but information given directly to him, the supreme lord. Also, to any wreck driven on a desolate shore; but a wreck of any kind, or even a canoe and property of friends and relatives upsetting off a village, and drifting on shore where a village was, became the property of the people of that village, although it might be that the people in the canoe had all got safely to land, or were coming by special invitation to visit that very village, perhaps to lament over their dead. Strangest of all, the (unfortunate ?) people in the upset canoe would be the very first to resent—even to fighting—any kind alleviation of this strange law ! so that such conduct, while appearing to us (as Blackstone says) to be "consonant neither 'to reason nor humanity,' was not to them the 'adding of sorrow to sorrow.'" So also, goods floating at sea (a canoe, &c.), or found on the high-road, or anywhere dropped, not hidden, became the property of the finder. Recently hidden property, if discovered, was restored to its owner, on its being clearly identified; but anciently hidden property (mostly stone axes and stone ornaments) became the property of the lord of the manor, who sometimes gave it (*ex proprio motu*) to the descendants of the person, when known, to whom it had belonged.

(2.) *Of common rights.*—Such everywhere existed, both to—(i.) movable and to (ii.) immovable property: (i.) As where several joined together to build a village, to build a large house, to make a large net, to fell a forest, and to plant the ground, to fish with a seine net, or to snare birds in company, to make a large eel-weir, &c., &c. (ii.) To land, including what it spontaneously produced (which latter was often of the greater moment to them); such was common and unrestricted for every purpose to all the tribe, and to their relatives by marriage of other tribes, and to their friends; always excepting any such isolated peculiar claims and rights as those already mentioned. Hence, any one of the tribe or sub-tribe would clear a portion of the forest for planting, or set fire to the fern or swamp, or select and mark for himself a tree in the wood, to be hereafter felled by him and made into a canoe, &c.

21. Their treatment of internal diseases, excepting, perhaps, rheumatism, was altogether bad, yet ignorantly so, as they wholly relied on the efficacy of the objurgations or exorcisms of the "priest," or skilled man. In rheumatic affections, however, among other remedies, they often resorted to a rude hot vapour bath; and both in rheumatism, and in some obstinate cutaneous diseases, the tribes living near to hot springs and hot sulphurous mud wells used them advantageously. But, while bad physicians, they were tolerably good surgeons, especially in reducing dislocations and setting broken bones, as they knew well the economy of the human frame, from their too often cannibal feasts, as well as from their practice of cleaning the bones of the dead. They set broken bones admirably, using splints of *totara* bark, or of the broad green bases of the large flax leaves. They also managed to cut off crushed fingers and toes, and even badly maimed hands, feet, and fore-arms, in a creditable manner, although wholly ignorant of the arterial system. Spearheads broken off within and perceived, they managed to cut out; but, if

not apparent, they repeatedly exorcised, to the double misery and expense of the sufferer. Recent wounds were generally left to themselves, and, like their fractures, they mostly healed quickly and well; owing, no doubt, to their non-stimulating diet, temperate living, and low pulse. Old obstinate ulcers (often arising from scrofula, or from some fragment of bone or foreign substance remaining in the flesh, or from fungoid flesh) they sometimes adroitly managed, by weaving a little wicker boss, or shield, which they strapped on to protect the sore. They were also clever at boils, in courageously bearing the extraction of the core by pressure, only they did it too early. Painful excoriations of the hands by poling or paddling, they eased by the actual cautery, burning the same with live embers. In midwifery cases they were also very expert, in severe cases extracting the fœtus piecemeal, when the husband was generally the operator. They were always extraordinarily solicitous about the retention of the afterbirth. In cases of children being poisoned by eating the seeds of the *tupakihi* or *tutu* (*Coriaria ruscifolia*), they generally smoked them over a heap of green bushes, having a little fire underneath, shaking them about at the same time ; sometimes they also ducked them roughly in the sea or river. In cases of poisoning through eating the unprepared kernels of the *karaka* (*Corynocarpus lævigata*), they dug a deep pit as fast as possible, in which they placed the unhappy sufferer standing, with his arms lashed to his sides, his legs tied together, and a gag in his mouth, filling in the earth or sand to his neck. If this treatment was well and expeditiously performed, the patient not only recovered, but had again the proper use of his limbs. The convulsions and rigidities during the action of the poison were dreadfully severe.

22. They had several acquired habits, some of which were notably good, others peculiar. Their great industry has been already mentioned. They usually carried their heavy loads strapped on their backs, where they also carried their children. They were fond of sitting squatting on their haunches, both on land and in their canoes. They often used their toes to pick up any small article with. They endured their smoky houses without inconvenience, and always ate their food out of doors in all weathers. They saluted each other on meeting by placing their noses in contact, rubbing and pressing them ; in this way chiefs saluted chiefs and slaves slaves. They often signified their assent to anything by a slight elevation of the head or of the eyebrows. Silence was the understood sign of dissent. They measured length, especially cordage, &c., with expanded arms, or by stretching themselves on the ground or surface to be measured. Lice of two kinds (*Pediculus hum. capitis*, and *P. hum. corporis*), with which their heads and clothing formerly abounded, they uniformly caught and cracked with their teeth. They had a peculiar gait, turning in their toes, and planting the sole flat on

the ground, one foot closely before the other; hence they walked in very narrow pathways, yet they trod firmly, and stood strong on their legs.

23. Of drinks, save water, no people had fewer; of really artificial ones none. In summer they everywhere drank the sweet and pleasant juice of the *tutu*, sometimes mixed with gelatinous seaweeds or a little prepared fern root to give it consistency. Sometimes they mixed the fresh gathered watery honey of the flax flowers, *korari* (*Phormium*), with water; and sometimes the large roots of the cabbage-tree, *ti* (*Cordyline australis*), were slowly baked and bruised up in water, and yielded a sweetish drink.

24. Their masticatories were few and scanty, yet most of what they had they prized. The resin of the *tarata* (*Pittosporum eugenioides*) they gathered and mixed into a ball with the gum of the sow-thistle, which they chewed. A kind of bitumen which was sometimes found thrown up on their coasts, though rarely, and called by them "*kauritawhiti*," and "*mimiha*," they also chewed; as they did the fresh resin of the *kauri* tree (*Dammara australis*). In using them, they passed them freely from one to another without hesitation.

25. Fond of children, pets, and playthings, they endeavoured to domesticate a few animals. Foremost among them was their dog, which, for many reasons, must have been one of their great treasures; this animal they prized for his long tail-hair, his skin, and his flesh. In some places they dexterously managed to flay the outer skin of his living tail in narrow strips, so as to obtain the much coveted long white hair; which in time grew again! They also had a very ingenious mode of castrating them. This variety of dog has long become wholly extinct in New Zealand. Next to their dog, as being like him wholly at liberty, were the two large sea-gulls, the *karoro* and the *ngoiro* (*Larus* sp.); these, however, were of no real service; they would go to the sea and return again to the village. The large brown parrot, *kaakaa* (*Nestor meridionalis*), and the parson-bird, *tui*, or *koko* (*Prosthemadera novæ-zealandiæ*), they also tamed, the former as a useful decoy-bird for catching his fellow-parrots, the latter merely for his song, talking, and antics. They kept the *tui* in a kind of rude cage, and taught him to repeat tolerably well a long song; while the poor parrot was always kept fast confined, tied by his leg to a cord with a running noose on a light perch or spear. They also sometimes kept the white crane, *kotuku* (*Ardea flavirostris*), in a miserable cage of basket work, much smaller than the bird required to stand upright in, where they scantily fed him with small fresh-water fish; this was done for the sake of its prized feathers, which were regularly plucked every four or six months.

26. Of games and diversions the New Zealanders had several; some of them were remarkably innocent. For children they had the whipping top,

which, curiously enough, closely resembled the common English one; also a game called *whai*, played with a string, much like the "cat's-cradle" of English children; and another called *poi*, played with a large light ornamented ball attached to a short string. Young men often strove for the mastery in short spear exercises, and in projecting long dry fern stalks over a piece of level ground or sandy beach; and in wrestling, running, leaping, hopping with or without a pole, climbing, swinging, paddling a small canoe, swimming, and diving; in the three last-mentioned the girls also took part. They had also, for the young of both sexes, games of guessing, in one of which a pebble was hidden among a company; of repeating long involved sentences without stay or hesitation; of singing; and of regular gesticulation by a company all sitting. They had various dances, some of which were mostly performed in their villages by the young women; while the rougher dances, accompanied with grimaces, and defiance, and brandishing of weapons, culminating in the hideous war-dance, were generally executed by the adult men. In dancing, however, with the sole exception of the war-dance, and also in swimming and other aquatic exercises, they were very much inferior to the other Polynesians. Old men often amused themselves with looking on and encouraging the younger ones, and especially with kite-flying, and in playing with the *poi*-ball. Their kites (*pakaukau*) were wholly different from European ones, and more resembling those of the Chinese. They were very ingeniously and neatly made with round and flat rushes, and hovered very prettily in the air. They usually sang or chaunted a song to the kite while flying it.

II. Psychological.

27. Their intellectual and moral faculties, as a race, were of a high order; however stunted, warped, or debased they may have been through custom, habit, or their strong and unrestrained animal propensities.

(1.) They often showed acuteness of understanding and of comprehension, with great quickness of apprehension; consequently they were very apt to learn. Their subtlety was great, notwithstanding their openness and want of secrecy; so also was their ready power of mimicry and imitation, and of low wit. Their memory was very good; and their ingenuity ever ready to follow closely any pattern, though certainly barren of originality and invention. They often exhibited great skill in finding out how best to do or get anything (with their very limited means), as well as ingenuity in performing or obtaining it; this they exemplified in many ways:—as in making their various axes, weapons, and ornaments of stone; in not only taking, preserving, and curing fish and birds for food, but in making the highly poisonous vegetable substances, *karaka* and *tawa* kernels, subserve the same ends; in procuring fire by friction, and in making it to blaze, and in finding out the best tinder; in making their ingenious snares for hawks, ducks, rats, &c., and their various cleverly made fish-hooks, some artificially baited with mother-of-pearl shell for the *kahawai*, and others with a chip of *tawhai* (*Fagus*) wood for the barracouta; in making their quartz-pointed wimble, and their "Spanish tourniquet," and their delicate tattooing instruments. They were passionately fond of music, but it was peculiarly their own: and of poetry, or of its chief ingredients, sentiment and rhythm, although they had not rhyme. They greatly excelled in order and regularity, which they carried into almost everything they did, as shown in their parallel carving, regular in its wildness, and in tattooing the right and left faces and posteriors with circles and scrolls almost mathematically exact; in their building and ornamenting of canoes and houses; in the laying out of their plantations, and particularly in the planting of their crops; in their measured paddling to "time and stroke;" and, above all, in their war-dance; hence their practised eye always detected want of regularity in the stroke of the best-manned man-o'-war's boat, as well as in the most precise military drill. They paid great attention to nature, and profited largely and deservedly by the observance. They calculated their years by moons, and their moons by days, or rather by nights—as, indeed, they reckoned all their time—each having a distinct and appropriate name. The names of their moons were particularly appropriate, naturally reminding one of the French nomenclature of the months introduced at the institution of the Empire. They divided the year into two great annual seasons of summer and winter, which they subdivided into four great agricultural times, of preparation, planting, cessation, and harvest. Their year commenced with spring; to which, and to the proper planting season, they were guided by the rising of certain constellations, particularly of Pleiades and of Orion; by the flowering of certain trees, especially a red-flowered creeper (*Metrosideros* sp.); by the sprouting of ferns, principally of the *rauaruhe* (*Pteris esculenta*); by the mating, moulting and change of note of birds; by the singing of insects; and by the arrival of the migratory *pipiwharauroa*, or little glossy cuckoo. In planting their precious *kumara*, they carefully turned its young sprout to the sun; which position they also chose for the entrance of their *kumara* stores, so as to avoid the cold south. They attended to the appearance of the clouds, and the redness of the heavens at sunrise and sunset; to the flight and noise of birds and of insects; to the opening of flowers; to the apparent nearness of far-off hills; and the distinctness of distant sounds by night, for indications of coming wind and weather. They knew in what weather fish would bite, and what baits to use, and when certain fish were in season, and when crayfish were spawning and in their prime. If at sea, out of sight of land, or in a strange trackless country or forest, they shaped their course by the stars and by the sun. The diurnal ebbing and flowing of the tide they well knew, although they attributed it to the constant inhalation and exhalation of a certain monstrous being living in the sea in deep water, named Te Parata. They noticed the natural affinities of plants; hence the two *Solanums* (*S. aviculare* and *S. nigrum*), though widely differing in appearance, were both named *poroporo;* the two large pea-flowered plants (one a hard-wooded tree, the yellow *Edwardsia grandiflora*, and the other an herbaceous shrub, the red *Clianthus puniceus*), were respectively called *kowhai* and *kowhai-ngutu-kaakaa* (*kowhai* and parrot's-bill kowhai); the black and the red birches (*Fagus fusca* and *F. solandri*), though greatly unlike in leafing, bark, &c., they appropriately knew as *tawhairauiti* and *tawhairaunui* (large-leaved and small-leaved tawhai); as also with the two species of olive (*Olea cunninghamii* and *O. montana*), with the two species of flax (*Phormium*), and with several others. They not only well knew the difference between their common fern-trees, giving them proper distinctive names; but another and scarce one, *Dicksonia antarctica*, they distinguished by the name of *wekiponga*, because it possesses characters in common with two of the commoner ones, severally called by them *weki* and *ponga*. It is also evident, from their proper names and descriptive remarks, that long before Linnæus's age they knew something of the sexes of the plants; they had noticed, if there was little or no pollen discharged in the summer from the male catkins (*amentæ*) of the taxaceous trees (and which the writer has sometimes seen escape in clouds) there would be no fruit that year for them, and their favourite pigeons would not be fat; and they were well acquainted with certain curious natural facts, such as the cuckoo (*Chrysococcyx lucidus*) laying her eggs in the nest of the little *riroriro* (*Miro toitoi*); the eel having two holes to its lurking place in the mud; the sea migration of the lamprey; and the various metamorphoses of insects.

(2.) That powerful moral faculty, conscience, often showed itself strongly; so did its close attendant shame—"that lurks behind;" although, from custom, the New Zealanders often exhibited much more shame at little failings and mistakes than at great sins. They had a large share of fidelity and attachment; hence the slaves and lower classes were attached to their masters and lords; and hence, too, they frequently left their homes and tribes to live with and work for strangers, to whom they had become attached; and their women generally made good and faithful wives to the early European settlers and whalers. Their filial attachment, however, was very slight. They were often very patient, and could exercise well and for a long time the virtues of endurance, especially if they had any object in view.

They sometimes eminently showed their endurance in trying situations, by completely controlling their temper. They possessed a large amount of physical courage, as is abundantly shown in their desperate hand-to-hand encounters and many hair-breadth adventures; but in moral courage they were very deficient, *e.g.* their fearing to speak to their superiors on unpleasant or unwelcome matters; their being afraid to go anywhere in the dark; and their moral superstitious dread of harmless and pretty lizards.

28. Their natural propensities, both good and bad, were strong, and generally freely indulged. Unfortunately, their good ones, though striking, were but few in number, and were consequently often overcome by their more numerous bad ones.

(1.) Of their *good* ones, hospitality to visitors and travellers must ever stand foremost. The New Zealand host not only willingly shared what he had with his guests, but often freely gave them all, while he, his family, and his people looked on, quite pleased at seeing them eating. As it was with the coming, so it was with the going guest; he was often loaded with food, &c., so that it was a difficult matter to carry it away, and a heinous offence to refuse or to leave it. They were also very open and free in giving one to another, and things were generally given without the least hesitation or appearance of regret. A constant cheerfulness of disposition and countenance, often amounting to gladsomeness or hilarity, was also very prevalent, more especially among all the younger ones; hence, perhaps, their peculiar habit of surnames, commonly calling any unfortunate sufferer by his infirmity or deformity, as blind, lame, deaf, one-handed, hunchbacked, &c., &c., without giving or taking offence. Their love and attachment to children was very great; and that not merely to their own immediate offspring. They very commonly adopted children; indeed, no man having a large family was ever allowed to bring them all up himself; uncles, aunts, and cousins claimed and took them, often whether the parents were willing or not. They certainly took every physical care of them; and, as they are rarely chastised (for many reasons), of course petted and spoiled them; sowing the seed of which they invariably reaped the bitter crop of disobedience. The father or uncle often carried or nursed his infant on his back for hours at a time, and might often be seen quietly at work with the little one there snugly ensconced. Perhaps in no race has the love of offspring been more fully developed, which by them was also often carried out to excess towards the young of brutes—especially of their dogs, and, afterwards, of cats and pigs introduced. Hence it was by no means an unusual sight to see a woman carrying her child at her back, and a pet dog or pig in her bosom. Another praiseworthy feature was, their being ever ready to help, and desirous of assisting to the utmost, whenever the *taboo* did not hinder them, any one they could, whether visitor or neighbour, friend or relative; always, however, excepting their enemies. They were certainly not quarrelsome; nor were they thievish among themselves; excepting the slaves, who often stole from each other. They would, however, steal freely from strangers; at the same time, things left in their charge by strangers were almost invariably safe. They were childishly inquisitive; but this they were with so much artfulness and good grace, and from a real desire for information, that it must be classed among their good qualities. Lastly, their being able to command sleep at any time —by day or by night, in health or in sickness—must not be omitted, for by being able to do so they doubtless escaped much misery, mental and physical.

(2.) Of their *bad* propensities, the following were among the more prominent:—Revenge, never weakening, never dying; ever assiduously cherished in their tenacious memories; sucked in with their mother's milk, and brooded over incessantly, with large accruements of interest and compound interest, and handed down as a precious legacy from father to son. Their combativeness, or love of fighting (especially after their fashion), was no doubt largely developed; it seems as if it and its preparations must have taken up fully half of their time; for, once fairly roused, a New Zealander shuts his eyes to consequences. Akin to this was their cruelty and barbarity, and their love of teasing and tormenting—whether the poor and afflicted, the unfortunate recent captive, or the innocent dumb animal. Some of the barbarities sometimes practised by way of revenge on their newly taken prisoners of war were horrifying, and quite equal those of the North American Indians, or the worse Christian (!) savages of "The Holy Inquisition." They were also hasty, passionate, and envious, and treacherous, especially to strangers, and in making war. But their constant suspicion of almost all others exceeded everything; no strange canoe could appear in sight, nor travelling party, however small, be descried at a distance, but their worst suspicions were aroused, and immediately, and by every one, evil was surmised. So it was of any track or sign of any one unknown having lately travelled that way. Their instability and fickleness were also very great, and likely to occur at any time—often enough at an awkward time; allied to which was their superserviceableness, or over-officiousness; their incessantly taking on themselves to do something new, or of little use, or not wanted; a trait best known by their own emphatic and peculiarly appropriate term, *pokanoa* (an undesired, causeless, or worthless doing or thing). Their disagreeable ever-asking for some *utu*—return, payment, recompense, or equivalent—for the least assistance or thing (*quid pro quo*), is more a matter of growth during the last twenty-five years—at all events, if latent, it has wonderfully developed during that period; so also has their begging faculty, which, however, was well known to and encouraged by their first visitors. From their childhood they were incessantly prone to practise all manner of deceit (*maminga, hangareka, hianga*), from fun and joke, to imposition and fraud, at which they were great adepts, ever glorying in beguiling and terrifying. To this list must be added their superstition, or better, perhaps, credulity—ever ready to believe anything strange, new, or wonderful; and their excessive ostentation and desire of being talked of, which, though bad in the abstract, was, it is reasonably believed, the main cause why several apparently good actions were done by them. Perhaps not a little of their old industry, and of their hospitality to strangers, is rightly to be attributed to this characteristic trait, as well, in some instances at least, of their more recent adopting the Christian religion, building chapels, &c.

29. Their common and biggest vices, which have gained them such sad notoriety, were the luxuriant unpruned growths or fruits of their natural evil propensities. Their implacability and unmercifulness was but another phase of their never-dying revenge; from these came their cold-blooded murders, and cruel retaliating on the innocent, which was closely followed by cannibalism in all its horrors. Nothing more clearly shows the truth of the old adage, "The best corrupted is the very worst," than that a party of New Zealanders should be so carried away by the diabolical frenzy of the moment, as wholly to forget their strongly and highly characteristic natural feelings, and kill, roast, and eat little children. In considering, however, their savage cannibalism, two things should never be forgotten—(1) that they, in practising it, broke no known law, and as they did not think it wrong, they never once thought of concealing it; and (2) that as they (their tribe) were doing to-day, they (their tribe) had been done by yesterday, and might be again to-morrow. Neither should it be altogether lost sight of, that commonly a bloody engagement—often the storming of a hill *pa*, or fort—could only take place when both sides were well nigh doubly desperate with starvation, and that after the fight was over there was really nothing to eat. There can be little doubt but that at *such* times large bodies of men were often in a nearly similar situation, as to want of food, to distressed ship-wrecked mariners at sea; with this important addition, of having their worst passions dreadfully excited from the smarting of their own wounds, and the sight of their dead and dying friends and relatives around them. So much may, perhaps, be allowed for their cannibal feasts under such circumstances on the battle-field; but those which often took place afterwards, although on a much smaller scale, cannot be so palliated. At the same time it should be remembered, that a race who ever thought so little of human life as commonly to commit suicide at the death of a husband or favourite child, could not estimate highly the life of a slave. At home they rarely killed a

slave, as they were too valuable, and they wished them to become attached to them, knowing, too, their dependence upon them; and if they did, it was almost sure to be one who was incorrigibly bad, and had been already often warned and sentenced; who himself, perhaps, cared little for life, and who, in being killed, would be *mercifully* instantly despatched (the greatest mercy the New Zealander ever knew). But their most cruel, murderous, and cannibal atrocities were invariably perpetrated on the immediate return of the victors (mostly by water in their war canoes) to their homes. Then, on hearing from the heralds of their loss, the infuriated women who had remained at home—widows, sisters, and daughters—would frenziedly fly upon the trembling captives, demand them to be given up to them as *utu* (payment or satisfaction), and cruelly murder them in cold blood; and to add to their horrors, perhaps some of these—wives or daughters of the vanquished—might have been taken to wife by some of the victor chiefs during their long return voyage, and who themselves were now utterly unable to save them. Disobedience of children to parents, a common fault of their bringing up, with all its many kindred vices, was also very prominent; this mostly ended in a total filial disregard. It seems strange that children generally, after puberty, should scarcely ever think of their parents who had always been so kind to them, although the parents still continued to show their great solicitude for their children. Lying too, of all kinds, was another highly characteristic vice; common every day, lying was never by them considered to be a sin. But the chiefs were too sadly given to calumniate one another with all kinds of fictions. No one ever believed all that any one should say. It has often seemed to the writer as if a New Zealander could not possibly relate any matter truly. Their most public and solemn promises and asseverations, even to the making of peace or a truce, after imposing and gaining their own terms, could always without any shame, and without any pretext, be wholly scattered to the winds at pleasure. Their heartless and cold neglect of sick, infirm, and aged parents, relatives, and friends, is another sad charge which is too true. Many a poor creature has slowly yet early died through sheer neglect. Fish, and birds, and pork, and fruit, and other good things, have often been in profusion in the village for the whole and hearty, of which the sick and infirm, though desirous, never tasted and, knowing their own people too well, never once solicited. Sometimes, no doubt, such gross neglect was owing to superstition; and the miseries of the sufferers were perhaps lessened through knowing that such had ever been their custom. Of their common immorality much has been said; and very much has been laid to their charge, far more, it is reasonably believed, than is their just due. At all events the point of view must not be that of high artificial civilization, where everything natural is studiously concealed, and common matters, which may not be openly mentioned, are freely talked of secretly, the more copiously, perhaps, in accordance with the well-known law of our nature, from the fact of restraint being laid upon them. With the New Zealander all was open and unconcealed from his birth; so that a host of common things of every day occurrence, any one of which to a highly civilized European might be a cause of distress and unpleasantness, or to another of evil thoughts and desires, was not so to him. Many such sights, sayings, and doings were to the New Zealander as if they were not; simply from being always used to them. It was just that kind of difference which exists between the aged grave-digger in the old church-yard, the old professor in the dissecting room, the phrenological philosopher in his study,—and the highly civilized but uninitiated gentleman. New Zealand men often went naked, without any breach of modesty or decorum, but a New Zealand woman never did so. Keeping in mind the "well-known law" above alluded to, and remembering that the New Zealander kept no secrets—with him everything was known—there is good reason for believing that their immorality was really less through the promiscuous dwelling and sleeping together of the sexes in one house, than if they had been made to dwell and sleep separately. Adult brothers and sisters slept together, as they had always done from their birth, not only without sin, but without thought of it. Incest and other high crimes were scarcely known, even by name; nor was it likely to be by a race among whom the marriage of first-cousins has always and justly been viewed with great disgust, as "weakening the shoot." Whatever the New Zealand girl might be before marriage, after marriage she was faithful; and even before marriage, the betrothal, when made, supported by the *tapu*, in the majority of cases, kept her from going astray. Adultery on the part of the wives, generally punished with death, was by no means common among the same sub-tribe or village. In fact, such could not be among the suspicious, revengeful New Zealanders. A chief going anywhere confidingly left his wife or wives behind in his brothers' or relatives' charge; generally speaking, such a thought as their faithlessness during his absence never entered his head. Of course, the writer, in thus giving his firm belief as to the immorality of the New Zealanders, wishes to be understood as speaking of it as practised by a race among themselves. The grosser and more frequent immoralities, which have been caused by the arrival of the "superior" man among them, is no more to be charged as a vice to their account as a race, than is that of their selling an estate for a musket or a jew's harp, or a large pig for a stick of tobacco. There is still one more glaring vice of theirs to be noticed, namely, ingratitude. This, it must be confessed, did everywhere exist, and that to an extent almost unheard of elsewhere. To a New Zealander gratitude was wholly unknown. They have no word for it in their language; no way of expressing such a feeling, which never existed in their breast. To a deeply reflecting mind, this sad fact may appear to be a far worse one than their cannibalism. There can be little doubt but that their total want of this high feeling of the soul arose from their own peculiar natural condition; particularly from the fact that no New Zealander ever did any kindness or gave anything to another without mainly having an eye to himself in the transaction; and this was known and reciprocated. Of all their characteristic vices, this of ingratitude appears to be one of the worst. Our immortal bard might well truthfully and feelingly say,—

> "Freeze, freeze, thou bitter sky;
> Thou dost not bite so nigh
> As benefits forgot;
> Though thou the waters warp,
> The sting is not so sharp
> As friends remember'd not."

30. From what is gloomy and repulsive in their character, let us now turn to what is pleasing, and what perhaps, by some, has been hastily set down as wanting—their love of *æsthetics* or the beautiful. This, it is believed, will be clearly seen, if we keep hold of the fine clue, and pursue it steadily through all its entanglements and ramifications to the end. They generally sought a clear open site for their villages, so as to command a good view; a fine open prospect from a village being loudly praised by strangers, while a cramped or bad one was denounced. They did all they could to keep their villages both clean and tidy. Each village had its common privy, generally in some secluded spot. Their houses were often neatly kept, all their little articles hung up or stowed away in baskets in their proper places. Their fishing residences, and huts near their cultivations, and forest huts where they sometimes dwelt (for a chief had generally five or six residences), were usually beautifully placed and snugly ensconced under shady trees, and by the side of a murmuring brook; they rarely ever wantonly cut down evergreen shrubs or old shady trees growing near them for the sake of their wood for timber or firing, choosing rather to fetch the same from a long distance. They liked to hear the birds warbling, and they often planted the red parrot's-bill acacia (*kowhai-ngutukaakaa*) and the ornamental variety of striped-leaved flax about their houses, on account of their beauty. They sought largely after the beautiful in their making of clothing mats, as is seen in their handsome coloured borders, in their many ornamental strings and tassels of various dyes, in their cutting up their dogskins into narrow strips and then sewing them together, so as to have the greater effect from shade and colour, and in

the peculiar bias seams skilfully introduced in their weaving, in order to make the mat fall in graceful folds over the shoulders. Even their back-straps for carrying their common loads they sometimes plaited of scraped flax fibre, dyed of two or three colours. It was the love of the beautiful, also, which led them to seek after and use other fibrous substances only obtained with much more labour, flax being everywhere so plentiful. Hence, too, their love of neat, pretty, elegant, contrast ornaments, of graceful drooping feathers, as of the white crane, or bunches of snowy down from the gannet and albatros, of the small feathered skins of the *huia*, the *tui*, and the little glossy cuckoo, of their female head-dresses made of the snowy down-like epidermis from the leaves of the *Astelia* and *Celmisia* plants, the graceful small-leaved *Clematis*, and the elegant climbing *Lycopodium*, and of the white fillets from the paper-mulberry tree for the dark raven locks of the men. Hence, too, their scented necklaces of the odorous grass *karetu*, of the *roniu* flowers, and of the *piripiri* moss, enclosed within the neat spotted feathers of the paradise duck. Hence their prizing the scented gums of the *tarata* and of the *taramea* plants as perfumes; the latter, an alpine plant, only collected with much labour and danger. It was owing to their love of the beautiful that they so tastefully decorated their canoes with plumes of feathers, and with elegant long flowing pennants of feathery tufts, which so loudly elicited the praises of Cook and the early navigators. Through this love of the beautiful they were led to chequer and make regular dark spirals on their yellow reeds for lining their chiefs' houses, which was done by winding slips of green flax at regular distances around them and passing them through the fire. It was owing to this that they carved so much and so regularly, even down to their canoe-balers and paddles, and the wooden necks of their large calabashes. Hence, too, in all their good carvings, however quaint, "the true line of beauty, the curve," is found, which they skilfully managed to produce without drawn plans, copy, or pair of compasses.

31. The educated New Zealander possessed many acquirements. In him, sound and practical knowledge of the *utile* and *dulce*—the useful and the ornamental—were very often to be found combined. It was not with them as with us—one man knowing one trade or occupation, and another another; with them, generally, one clever man knew all things, while every one, at least, knew several useful and practical ones. Invariably, in whatever they sought to learn, they strove to excel; hence they generally succeeded. They uniformly counted very well and without difficulty up to a hundred, and some among them could go further; their term *mano*, however, now used for a thousand, scarcely definitely meant that number. Besides their common counting by units, they had another mode of counting by pairs, which principally obtained for baskets of sweet potatoes and fish, and a few other

articles. The many and varied acquirements of the different parts and kinds of house building; of making their many different canoes; and of all kinds of wooden and stone implements for use and defence; of cultivating successfully the soil; of making several kinds of very ingenious traps for catching animals; of bird and rat snaring; and of sea, river, and swamp fishing in all its various branches; of carving, tattooing, weaving, spinning, and plaiting; and of making sails and nets of many kinds; of skill in paddling, steering, and navigating a canoe; of swimming, climbing, and parrying spear thrusts; of music, singing, and dancing; of surgery and oratory; of genealogies and relationships; of old feuds, and their causes, and their unsettled scores; of boundaries, and of roads and tracks to distant places, not to mention all the needful acquirements respecting the *tapu*, traditions, songs, chaunts, exorcisms, and very many customs. In bygone years the writer has not unfrequently looked with quiet admiration at such an individual diligently and unassumingly working at his many varied occupations, often, when tired at one, dropping it and taking up another; and in doing so he has thought,—what an example such an one was of the successful pursuit of knowledge under difficulties! How truly *he* deserved to be called a "*tohunga*" (a living cyclopædia or skilled man)! At such times the exquisite and not inapplicable lines of Hurdis (learnt in childhood) would rush into the mind, and may not be wholly out of place here:—

> "But most of all it wins my admiration,
> To view the structure of this little work.—
> ————Mark it well, within, without,
> No tool had he that wrought, no knife to cut,
> No nail to fix, no bodkin to insert,
> No glue to join; [his hand alone] was all
> And yet how neatly finished!——
> ————Fondly then
> We boast of excellence, whose noblest skill
> Instinctive genius foils."

32. It is evident they possessed the germs of knowledge of the first principles of mechanics; but it appeared more like a decaying remnant of ancient wisdom, or a growth nipped in its bud, than a new or recent development. They seem scarcely ever to have improved the one original idea. The powers of the inclined plane they knew and used in the wedge, and in moving heavy weights up a prepared slope. In using the lever they well knew the difference between a high or low, near or far-off fulcrum. The wheel and axle, rude as it was, they had in their quartz-pointed drill or wimble; the screw, in the "Spanish tourniquet," for expressing of oil, &c.; and the pulley in rollers for their canoes and for hoisting up heavy weights to their high stages for great feasts, which rollers they often smoothed and wetted, or covered with wet sea-weed, to make the body to be moved the better to glide.

33. It is said that the New Zealander's perception of colours was defective and weak, because he had proper names for only three colours, and none for blue, green, brown, violet, &c. This, however, is, in the opinion of the writer, a mistake. Their colours, it is true, were mainly divided into three distinctive classes—*ma*, *panga*, and *whero* (white, black, and red, or light, dark, and reddish)—but they were never at a loss with these three words clearly to express all colours. They used them much as an English mariner uses the four names of the principal winds and points of the compass, repeated and involved to make 32, only much more expressively; as they also used with them several adjectives, increasing or lessening their meaning; also the words themselves reduplicated as diminutives. Besides which, if a New Zealander wished to convey to another a very exact idea of any colour intended, he would mention that of some natural object which was of the same shade of colour; for greens, the *karaka* leaf, or the blue-green of the sea, or the light-green of the young grass, or the yellow glancing green of the plumage of the little paroquet; for blues, the differing blues of the day and of the night sky, or of the *pukepoto* mineral, or of the neck of the red-billed swamp-bird *pukura* (*Porphyrio melanotus*), &c., &c.

34. Their courtesy and etiquette deserve notice; particularly from the sad fact of such having become nearly extinct, and that mainly through their intercourse with foreigners. In visiting, the visitors when near the village sounded their conch shell or wooden trumpet (in later times fired a musket), or sent on some one known to the people to inform them of their approach, lest they should be taken unawares—a thing very much disliked by all New Zealanders. If they were loudly invited, they went straight on, without speaking, into the village, unless the company were straggling, when they waited for those behind. If they were not so invited, through the people of the village being absent in their neighbouring cultivations, they quietly waited in a body outside until they were. On entering, they were led to some large house or spot, strewed with clean mats, or fresh fern, or leafy branches. There they quietly sat until food was prepared and brought them. After having eaten they were welcomed by the chief or chiefs in speeches and songs, and individually saluted when conversation began. No inquiries were ever made as to the purport of their visit till after they had been refreshed. Great respect was shown to known rank; to such, the best seat in the canoe and in the house (which was always on the window side) was constantly given. A proper respectful mode of address was always used to chiefs. Bad and unexpected startling tidings were generally couched in other words, or delicately alluded to in a song or saying of well-known meaning. In conversation, euphonious words and euphemisms were often chosen, and care was taken to make no allusions to past disagreeable

matters. They took great heed not wantonly to hurt anyone's feelings; and if any such was attempted, it was immediately repressed. Such a person was spoken of as having had no parents, or as having been born (laid) by a bird (a term repeatedly used by the New Zealanders concerning many English "gentlemen," owing to their rude behaviour). Things which might remind the visitors of past sorrows and troubles were also carefully put out of sight. The people of the place were mindful not to use any bad or intemperate language towards, or in the hearing of, their visitors. No foolish tricks were offered in jest. They were very careful not to step over, or to hand food over, any of them. If they wished to pass through or by them, and there was little or no room, they did not shove, but civilly said, "*Tukua a hau,*"—Allow me to pass. They brought their visitors fire, food, and water, always of the best they had; and if they were of high rank, such was in part carried to them by the chiefs of the place; and often, if they had any reserved prized delicacy, they also brought it. Sometimes, when their visitors were very few, and arrived just as the evening meal was cooked, they sent them the best of it, the chief sometimes culling with his own hands. In laying down anything before their visitors, they always retired nimbly, lest they should hear their own praises, or be supposed to be desirous of hearing them. They avoided openly staring or laughing at the newly arrived, or making impertinent remarks upon their appearance, manner, clothing, &c.; and quickly removed all offensive things dropped near by animals, and carefully covered up all sores or deformities of their own. The chief of the village often gave up his own house to his visitors, and sat outside the door in the sun, rain, and wind, conversing with them until they had repeatedly invited him in. If the party was small, and house accommodation scanty, the chief of the village and his people occupied the inferior side of the house, leaving all the other and best side to the visitors. They were careful not to ask any one his name, particularly a stranger. They were always exceedingly circumspect not to cause offence by a look, word, or gesture. They rarely inquired after anyone's health by name, and took good care not to inquire specially after any female. They also abstained from finding fault with any of the words or doings of their visitors, even when they might justly have done so. From courtesy alone they generally assented to what was said by a visitor, and always to anything said by a person of rank; at the same time quietly holding to their own opinions. (This *trait* in their character has been the means of deceiving many Europeans, and not a few of those in high authority.) While their visitors slept by day, they were attentive not to disturb them. If anyone happened to be among the party who was an enemy, or had done wrong to anyone of the village, and had not yet made reparation, they quietly overlooked it for the sake of the head of the party; at the same time they abstained from giving him individually anything, or welcoming him particularly. They always saluted on meeting in the way, and if the one party was carrying anything edible, they dropped their loads, unlaced their baskets, and freely gave the other a portion; if both were, they gave to each other. They sometimes sat down to receive and to give messages, and to receive salutations, as a sign of inferiority. On their visitors leaving, they were loaded with food, and freely supplied with all little accommodations of baskets, straps, &c., with many attentions; the chief usually went with them a short distance to point out the way, and sometimes accompanied them to the next village. If he did so, although related to the people of the village, he entered and remained with the visitors, and was treated as one of them. In war, women who were related to both sides, the besiegers and besieged, were allowed to pass and repass continually, and often were the cause of much mischief. Sometimes, when a besieging party knew of their enemies wanting food, or stones, or spears, they sent them a supply, laying them down in heaps near their defences, and then retiring, but such chivalrous (?) conduct was rare.

35. Like some of the nations of the old world, they believed the seat of their sentiments and feelings to be in the stomach and bowels (*ngakau*).

(1.) Many of their sentiments respecting plain practical matters of every-day life were eminently sagacious and just, yet here there was a great difference in those concerning things with which they were conversant and those which were new; also between objective and subjective matters. Again, other of their sentiments, including most of those concerning sickness, death, the cause of common natural phenomena, and of everything pertaining to the *tapu*, sorcery, and the state hereafter, were excessively puerile. They loudly expressed their approbation and disapprobation, and were often not a little biassed in giving judgment by considerations of relationship and of tribe. Having espoused a cause or party they generally pertinaciously adhered, and though shown their error would rarely allow themselves to be in the wrong. They judged of others by their looks, especially by their eyes and cheeks and by their manner and tone of voice; and if they thought them to be angry, &c., they often very plainly told them of it, or politely asked them if they were not so.

(2.) Their feelings were very strong, often easily excited, and rarely ever concealed. In showing them the New Zealander was very changeable—now in a towering passion or bitterly weeping at a single slight word or a look; anon quite stoical, and not to be stirred. At times their feelings were soon controlled, and at others with extreme difficulty suppressed. Consequently with them it was ever an easy matter "to rejoice with those who rejoice, and to weep with those who weep." Their keen uncontrolled feelings often led them to beat, kick, and strike inanimate objects, sometimes to their own greater hurt, and commonly to gnaw and bite, on extraction, a splinter or thorn which had pierced them, and which was often carefully preserved to be burnt in fire. An object of pity and suffering often excited feelings of disgust. Hate and desire of revenge were fearfully exhibited at seeing or hearing anything of their enemies. Superstitious dread was universally shown at going anywhere in the dark, or at approaching where any one had died or was buried, and most particularly at all kinds of lizards, living or dead, although harmless, as such ever reminded them of a malignant demon or *atua*. Their sense of loneliness or desertion was often expressed in mournful songs, while that of wounded pride was borne with extreme difficulty. Ridicule, invariably freely given, was most keenly felt; so was shame, while the salutary conviction of having wronged or injured any one, even when done under a mistake, was generally followed with ample restitution. Sometimes their feelings have been so intense at being rebuked before others, though perhaps very slightly (as by a husband for negligence in cooking, or for want of care towards a child at that one time, or for breaking a calabash or a pipe, or some other small thing), that they have run away into the woods or attempted suicide. But it was mainly at the death of the loved one—husband, child, or brother—that the feelings of anguish of the bereaved were utterly uncontrollable, and not seldom ending in self-murder, while others have gone down pining and lamenting to the grave. Some fathers cut off their hair close on one side of the head for the death of a child, and never allowed the hair on the other side to be cut or touched; hence it grew very long, and became completely matted together, while over it they would often sigh and weep. A chief often changed his name at the death of a beloved son or daughter, relative or friend, and took for a new name that of something last said or even eaten by the departed, or something strongly reminding of the sad event. Sometimes, too, tribes and sub-tribes altered their names, generally in order to bear some loss or insult in mind. Most New Zealanders would destroy or remove every article which had pertained to or had been touched by the departed loved one, sometimes burying them with him; a few, however, would keep some little thing, but always away out of sight, to be now and then produced and wept over. A chief's greenstone battle-axe and breast and ear ornaments, though frequently buried with him, were always recovered for future use. Many forsook the place where the loved departed had died, while others left their homes and wandered about unsettled for a long time, seeking to forget their grief.

36. Their mysterious and intricate institution of the *tapu* (taboo), with all its many forms, rites, observances, and customs, was, on the whole, beneficial to the New Zealanders. However irregular, capricious, and burdensome it

may now appear to us to have been, it was certainly the source of order to them, and was of great use to conserve them as a race, and to sharpen their intellectual and moral faculties. Having no written language, it is not at all unlikely but that the observances of the *tapu* institution were much more simple and charitable at the first; seeing, too, that its observances and modes of working varied in different districts and under oral directions. Very likely the more the tribes, sub-tribes, and "priests" increased, the more varied became the taboo. How greatly would the Mosaic code of laws have been changed or added to had they not been written! As it was, two thousand years ago the Jews were charged with having "made the word of God of no effect through their traditions;" and how much have some of the early Christian churches departed from what was written through non-attention to that writing, and that continual inseparable desire of the human breast to be always adding something new. A good-sized book might be written about all the numerous requirements of the *tapu* system. They commenced with the birth of the New Zealander, continued with him throughout life in all its varied scenes, and did not leave him until long after he was in the grave. The *tapu* regulated, or pretended to regulate, all his movements. It certainly enabled him to accomplish many heavy and useful works, which without it he could not have done. Through it their large cultivations, their fisheries, their fine villages and hill forts, their fine canoes, their good houses, their large seine nets, their bold carvings, and a hundred other things were accomplished without their possessing either iron or metal. Through it their fowl and fish and forests were preserved. Through it the crimes of murder, theft, sorcery, and adultery were less common, and when committed sure not to go long unpunished, and through it fornication and other errors were lessened, and the headstrong passions of the New Zealander were in a great measure controlled. It had great influence over them: the stoutest and fiercest of the New Zealand chiefs bowed like an infant before it, and dared not disobey its behests. In all their changes, they held it to the last, and only relinquished it by slow degrees;—(have they done so yet?) Notwithstanding, they certainly never liked it. No man, or body of men, has ever yet liked a coercive law, however beneficial. If through it (or rather, perhaps, owing to its being broken or neglected) much blood was shed, many lives were also through it saved. Several of its requirements were certainly very peculiar and abnormal, and bear the appearance, at least, of being very cruel; —*e.g.*, at the death of a chief, a *taua*, or stripping party, came and stripped the family of all eatables and other movables, digging up root crops, and seizing and spearing tame pigs, and devouring and carrying them off; and if by any chance the family were not so stripped, they would be sure deeply to resent the neglect, as much on account of their being lowered (*i.e.* not taken notice of) as for the violation of the *tapu*, in failing to carry it out. Again, in case of any infringement of the *tapu*, or of any error or wrong, real or supposed, the *taua* would be sure to pay its visit; such *taua* was not unfrequently a friendly one!—one quickly made up of the nearest relatives and neighbours to the offender; for, as he must be stripped and mulcted, they might as well do it as others, and so keep his goods from wholly going to strangers. If a road was tabooed, and any one was foolish or hardy enough to go over it, the *taua* would be sure to inflict a very heavy penalty. On the completion of a large seine net, it was brought on a set day to some beach "to be first wetted," when not only that beach, but the neighbouring ones, and also the whole sea in front, would be rigidly tabooed; on such an occasion, should any unfortunate canoe, however unwittingly, trespass on the prohibited waters, it, and all its contents, would be immediately confiscated, and loss of life might very probably take place in the *mêlée*. Their strange custom, also, which obtained in the upsetting of friendly canoes, or their drifting on to their shores, has been already mentioned (par. 20, sec. vi.); also that respecting a chief who had been made captive (par. 19, sec. 2). Several others, equally unreasonable, might also be adduced. As there was not a family or individual among them who were exempt from the influence and operation of the *tapu*, and as there was no such thing known as a standing or selected party to act as a *taua*, so those who suffered through it to-day were enabled to retaliate, with true New Zealand zest, upon those who might be sufferers to-morrow, especially if they had been engaged in paying them a visit yesterday; and this, no doubt, always had a tendency both to equalize the inflictions and temper the operations of the *taua*.

37. Their credulity was very great, and sometimes accompanied with a large amount of superstitious dread, which cannot well be defined. They believed in the truth of dreams, of which they had many kinds, both good and bad. To dream of a nice house was indicative of great good; of wounds, or of death, or of eating bad food, indicated great evil, perhaps death. All were alike firmly believed to be remembrances of what they had seen in the *reinga*, or unseen world, or place of the departed, whither the spirit (*wairua*) was supposed to have been during the sleep of the body. They also put great faith in convulsive startings in sleep, especially of their chiefs—whether such were directed to the right or to the left, from or to; a start forward or outward was a prognostic of good; in the contrary direction, of evil. Their omens were many; among them were the catching or tripping of the toe or foot on beginning a journey, which would sometimes cause them to return. An ember bouncing from the fire towards any one, a singing noise or gaseous flame issuing from firewood burning,

sneezing, various persons or peculiar things first met on leaving the house, &c., &c., were all ominous. An *aitua*, or evil prognostic, casually arising by some chance thing or accident done by or to another, was also believed in. Ghosts, too, were commonly believed, and greatly dreaded; but this haunting spirit or phantom (*kehua*) which haunted its former place of residence when in the body, and also the repositories of the dead, differed widely from the sensible intellectual spirit (*wairua*) which had departed to the *reinga*, and which was not feared. The former were as *lemures* and *larvæ*, the latter as *manes* or *spiritus*. There were also nocturnal visitations (*taepo*); voices from the dead; demon spectres speaking in the whistling winds, especially in an old hut; and, above all, the *last* words (*poroaki*) of the dying, to which they paid great attention, and when spoken at random, in great weakness, wandering, or delirium, were often productive of much mischief. They had also their soothsayers and augurs, who gave predictions of lucky and unlucky days for fighting, voyaging, &c., and which they often ascertained by a kind of *sortes*, or lot. Many of the "priests" were great physiognomists, and read the features closely, that they might know what such a slave would become; they also believed in something akin to the "evil eye" of the East. Some tribes disliked the owl and the lonely little swamp bird *maata* (*Sphenœacus punctatus*), and yet they both persecuted and killed them. All lizards were more or less dreaded by every New Zealander: this is a curious feature, and worthy of deep investigation. It was their only living representation for the *Atua* (or malignant demon), which, according to their belief, was gnawing their vitals in sickness, and especially in consumption; while, however, stout men and warriors would often fly from a lizard, they would also return and kill it. Shooting stars, meteors, and phosphorescent fires in woods and marshes, they considered portentous; but thunder, lightning, severe storms, volcanic eruptions, and earthquakes, they laughed at. The nearness of the moon to a star or planet was also considered very ominous. They had many trivial ceremonies in travelling and voyaging; as in crossing the culminating peak of a range, or by certain solitary stones (named), or by any famed cliff or cavern, or upon entering on dreary plains, or on crossing a spot termed by them the backbone of the North Island; at such places they all singly perform a slight simple ceremony in passing; gathering a small branch, they cast it on or towards the object, using a few words by way of salutation, or custom, or charm, which words varied in different parts and by different tribes. So at sea, on being about to pass over a bar, or to enter a narrow tidal passage, or to pass round a cape or headland; there they would halt a moment, and the "priest," or chief, would mutter a few words of chaunt or charm, and then proceed. To the writer it has ever been most animating at such a time, with danger rioting around, to see the old grey-haired man arise in his puny little vessel, and in a few simple words command the heavy breakers and the demon-guardian of the pass to listen to his powerful charms. All such, in his opinion, is a picture of man struggling for his true position in nature, as lord and master of her powers and gifts; although, alas, as yet he has them not. The brief ceremony over, the inspired crew paddle away heartily, nothing doubting. Their credulity as to sorcery and necromancy, in all their branches, causing sickness and death, was universal and very great. Hence hair, saliva, &c., of chiefs were carefully buried, lest such should get into the sorcerer's hands. The heads of the chiefs were always tabooed (*tapu*); hence they could not pass or sit under food hung up, or carry food, as others, on their backs; neither would they eat a meal in a house, nor touch a calabash of water in drinking. No one could touch their head, nor, indeed, commonly speak of it or allude to it; to do so offensively was one of their heaviest curses and grossest insults, only to be wiped out with blood. All fruits, vegetables, &c., which grew at a prohibited spot (*wahi tapu*) were not to be eaten or gathered. A tabooed child was not on any account to be washed; and common cooking fire was not to be used for warming a house, or a company in the open air, nor lighting a pipe, lest the taboo should be broken, and penalties, sickness, and death ensue.

38. Religion, according to both the true and popular meaning of the word, they had none. Whatever religion be defined to be—virtue, as founded upon the reverence of God, and expectation of future rewards and punishments, or any system of divine faith and worship—they knew nothing of the kind. They had neither doctrine nor dogma, neither *cultus* nor system of worship. They knew not of any Being who could properly be called God. They had no idols. They reverenced not the sun, or moon, or glittering heavenly host, or any natural phenomena; rather, when they chose, they derided them. The three principal beings, or rather personifications—*Tu*, *Whiro*, and *Tawhirimatea* (all alike malignant, and ever hated by the New Zealander as the sole cause to them of pain, misery, and death, in war, in peace, and in voyaging)—were certainly never loved, or reverenced, or worshipped. The New Zealander knew better than to worship them. Sometimes in some of their *karakia* (recitals) the name of one or other of these imaginary beings would be mentioned, but it was done more by way of exorcism—to order him off, to bind him down, or to abuse him. They never once thought of getting any aid or good from them; they rather hoped (through their "priests") to overcome them, or their malignancy, by the power of their muttered *karakia* (recitations) acting like charms. Moreover, in their own traditions and legends, they are sometimes represented as being ancestors of, or related to, their own (mythical) progenitors.

With the New Zealanders the observances of the *tapu* were in place of religion. Hence it was that the *tapu* was so rigidly upheld and enforced. Nothing could set it aside or alleviate it; all were equally obnoxious to it. Hence, too, we may see why they increased the misery of the miserable, and made the wretched sufferer still more wretched. If a man died at home in peace, it was owing to the anger of the demon *Whiro* (and very likely, as stated by the "priests," in seven cases out of ten, to have been inflicted on account of some infringement of the *tapu*); consequently the family were to be also pillaged and peeled, to end, if possible, the visitation, by still further

——"placating the dread Atargatis."

If a canoe was upset, such of course could only be caused by the anger of the watery ruler, the New Zealand Neptune, *Tawhirimatea* (perhaps, too, for some secret infringement of the *tapu*); when the result must be the same, on the part of those on shore—siding, for the time, with the stern Nemesis. So in the case of death, or captivity in war, the malignant demon, *Tu*, who there presided, had definitively sentenced, as seen (doubtless for some violation of the *tapu*), and it only remained for the living—the captive and his relations—to ratify by silently acquiescing. Even their savage cannibalism at such times may owe much of its origin to their belief in this. Again, in the case of the new seine (par. 36), which is rigidly tabooed until the first fish taken are tabooed and set free, their legends of Maui and his fishing up the North Island of New Zealand state that the present broken and abrupt face of the country is entirely owing to the brothers of Maui rushing to cut up the huge fish he had caught without having made the tabooed offerings of the first fish. Consequently it came to pass that under the *tapu* they were secularists, never once thinking or caring about an hereafter. Not that they disbelieved in an after state for man; but (1) that it was not a state to be desired; and (2) that it would follow as a matter of course, not being dependent or contingent on anything done on earth—unless it were, on the one hand, in being a strenuous supporter of the "priests" and of the *tapu;* and, on the other, of dying a slave.

39. Death with the New Zealander was the passage to the *Reinga* (*Hades*), the unseen world containing his departed people. No one, however, unless some suicides in a fit of insanity, ever willingly went there. Even the disembodied went on unwillingly, casting lingering, longing looks behind. Occasionally (according to the natives) a few of such returned from the very verge to the bodies and the world they had left; such truly recovered from the gates of death. In the *Reinga*, the departed live without labour and trouble. They feed on *kumara* (sweet potatoes). Messages were often given to the dying person to take to deceased relatives there. All funeral

wails and chaunts over the recent dead ended with—"Go, go, away to thy people." It is a curious fact, that by the Fijians, Tahitians, Tongans, and Samoans, as well as by the New Zealanders, the place of departure of the spirits to the unseen world is uniformly fixed at the western extremity of the island.

III.—PHILOLOGICAL.

40. The New Zealand tongue is a distinct dialect of the great Polynesian language, spoken more or less throughout most of the numerous isles in the Pacific Ocean lying east of the longitude of New Zealand. It consists of fifteen letters—five vowels and ten consonants; of the latter, two may be called double, though having each but one sound. No two consonants can possibly come together, and every syllable and every word ends with a vowel. The New Zealand dialect has ten principal subdivisions, which cannot, however, with propriety be termed sub-dialects, viz.,—(1) Rarawa, or Northern; (2) Ngapuhi, or Bay of Islands; (3) Waikato; (4) Rotorua and Taupo; (5) Bay of Plenty; (6) East Cape and Poverty Bay; (7) Hawke Bay to the Straits; (8) Ngatiawa, or Wellington to Taranaki; (9) the South Island; and (10) Chatham Islands. In all these sub-divisions the grammatical structure is the same, with very slight variations; the principal differences being found in words and idioms. There are, however, three exceptions as to the change or dropping of a consonant:—(1.) The Bay of Plenty, where *n* is used for *ng*. (2.) The Ngatiawa tribes, from Wellington to Taranaki, who alone, of the New Zealanders, have a very peculiar mode of expressing the *h* by a kind of guttural click, or half-expressed hiatus, or semi-stop; and (3.) The Ngaitahu in the South Island, who use *k* for *ng*. It is highly worthy of notice, that all these differences are also found in the dialects of the various island groups, though not as in New Zealand—all in the one dialect of one island or group.

41. Its grammar is peculiar, as compared with those of western languages, having neither declension of nouns by inflection, nor conjugation of verbs as there obtains; all such being clearly done by simple particles affixed or suffixed. Its singular is changed into the plural number by prefixing a syllable. There is no auxiliary verb "to be," but the particle *ano* often supplies its place. Every verb has a causative, as well as active and passive meanings. Intensitives, superlatives, and diminutives abound. It has double dual pronouns, and also a double plural; both of which may be termed inclusive and exclusive, allowing of great grammatical precision in speaking. It has several articles, singular and plural, and is rich in prepositions, adverbs, conjunctions and particles; each bearing delicately different shades of meaning. The New Zealanders all speak grammatically from their

infancy, and never make any mistake in pronunciation. The same may also be said of the writing of the most untaught among them; with the exception of their elision of terminal and initial vowels, and their division of words. These, however, arise from their close adherence to their quick pronunciation.

42. The language is remarkable for its euphony, simplicity, brevity, clearness, and copiousness. For its euphony, it is not only indebted to its not having two or more consonants coming together, and no word ever ending with a consonant, but to the copious use of the vowel *i* (pronounced *ee*), to the sound of its semi-liquid *r* (approaching *l*), and to several vowels often closely following, together with a quick flowing elision of others. Its simplicity arises from one word or root being noun, verbal noun, adjective, or verb, requiring merely the addition of a simple short particle, and from the peculiarity of its idiom. It knows of no circumlocution. All long, involved, parenthetical sentences are utterly foreign to it. Its brevity is often quite laconic; and while exceedingly terse, contains great beauty and power of expression. It is very clear and exact, as shown by its many singular and plural articles, and double dual and double plural pronouns; its various modes of address, according to age, sex, and rank; and its many intensitive and diminutive particles; while its copiousness may be readily inferred, from its having proper names for every natural thing however small—different names for a tree and its fruit, and for every part of a vegetable whether above or below ground, and for young and adult fish of the same species; for everything made by them, and for each of all its various parts; for every kind of tattooing, and each line and marking of the same; and upwards of fifty names for a sweet potato, and forty for a common one. Nevertheless, in words for abstract ideas, unknown to the New Zealanders, such as hope, gratitude, mercy, charity, &c., it is deficient; as also for many new things. It does not, however, follow, that an intelligent New Zealandeı, wishing to speak of any such, would not easily find suitable expressions wherewith to make himself quickly and clearly understood, and convey a very correct idea to the minds of the hearers. The writer has never known an old New Zealander, or a young one who knew his own language, to be at a loss accurately and minutely to describe whatever he wished of any new thing or transaction to his countrymen; at the same time it is believed by him that the New Zealand language is but a remnant of what it once was, and is fast going to decay.

43. There is one peculiarity of their language, or rather of their manner of dealing with it, that requires notice. If a principal chief should bear the name of anything, or be named with any word in common use, that thing would thenceforth, by his own tribe and friends, be called by some other

name, and the word be changed for another. After his death, or after he began to be forgotten, such new names and words might drop, and the old words be again commonly used; but if such a chief had lived long, had great influence, and was either severe or greatly loved, so as to make him to be respected and the disuse of the said words more general and certain, it is easy to see that the old terms would not always be restored; which in time must tend to make a great alteration in the language. No doubt to this source not a few of its strange aberrant words are to be rightly attributed.

44. They have many proverbs and sayings, and not a few fables, most of which are very amusing, even to a European. Their proverbs are mostly derived from observation and experience; many of them express much wisdom, and serve to prove how very highly industry and skill were prized by their ancestors. One or two may be here quoted, although, like all others, they lose much by translation:—

"For the winter seek fuel, but food for the year."

"Plenty of food, plenty of vigour."

"Stand (to work) and thrive; squat and want food."

"Hasty to eat, lazy to dig."

"The seeker finds."

"Lazy hand, gluttonous throat."

"A wooden spear can be parried, not so a mouth one" (an accusation).

"Will the escaped wood-hen return to the snare?"

"Dark skin and red skin united will do it" (that is, the cultivation by chiefs and slaves together; formerly the chiefs always anointed themselves with a red pigment).

"With the brave in war is great uncertainty; with the brave in cultivation is sure reward."

"A lazy and sleepy man will never be rich."

"Labour's gains are carried off by do-nothing."

Their sayings were mostly laconical expressions of men of other days, indicative of their feelings at having lost or gained; and (as their stories were well-known) were used as cautions and warnings. Their fables were very natural and correct, and mostly conversational between animals or natural objects; such as between the large rock lizard and the red gurnard, the cod-fish and the fresh-water eel, the common shark and the large lizard, the rat and the green parroquet, the sweet potato and the edible fern root, and the paper-mulberry tree and the New Zealand cork tree. Had they more and larger animals, they might have had a volume of fables rivalling those of Æsop or Pilpay.

45. Their poetry was plentiful and various, and suited to all times and conditions—peace or war, work and ease, love and death, constancy and despair. Being naturally of a cheerful disposition, they were often humming a stanza or verse; and frequently beguiled the monotonous drudgery of some of their heavier work, performed together in company, with suitabl inspiriting chaunts and songs, in which all joined in chorus, and which always

had a surprising effect. In many of their old songs, as in their proverbs, industry is highly praised. Such heavy work comprised paddling of war canoes, or dragging them out, when new, from the forests (which they sometimes did up and down hill and ravines for many a mile), or over necks of land (peninsulas) on their voyages, or when digging together in their cultivations or fern lands with their wooden spades. The funereal wails and dirges were only used on occasions of death; to attempt to use them at any other time was considered highly improper. Their war songs and defiances contained horrible curses, and were truly ferocious, and must especially have so sounded in the ears of a New Zealander. Several of their love songs possess tender and affecting passages; a selection from them would bear comparison with the most celebrated ones of Britain. Their sentimental songs, expressive of abandonment, loneliness, and despair, contain much pathos, and simply sung in their peculiar low notes and melancholy cadence are very affecting. They had also baby songs, which they chaunted to their infants. The whole of their poetry, while often possessing pleasing natural images and strong gushing sentimental utterances, was equally destitute of rhyme and metre, which deficiency they managed to get over in the using, by lengthening and shortening vowels and words, much after the manner of a chaunt; proving here, as at the antipodes, that the popular mind always conceives of something in poetry far higher than mere versification. From a close examination, however, of their poetry, it is apparent that the New Zealand poet had taken some pains towards rhythm, a first step as it were towards shapeliness; the blocks and logs had been rough-hewn and riven, though neither file nor chisel had ever approached them. This is seen in the frequent omission of grammatical particles, in the abbreviation of proper names, in the ellipsis of portions of words and sentences, in the curious divisions of words at the end of a line (half being in one line and half in another), in the unusual lengthening of vowels, and in the peculiar reduplication of syllables. It is this which makes it so difficult to understand or translate. Much of their poetry is very old; none worthy of notice has been produced by the present generation. All the various poetical effusions—praises and laments—which from time to time during the last twenty years have appeared respecting Her Majesty the Queen, the late Prince Consort, our several Governors, &c., &c., are old, and merely hashed up again (perhaps for the hundredth time) and dexterously *improvised* for the occasion—a characteristic of the New Zealanders, and one in which they greatly excel. Many of the so-called "translations" of New Zealand poetry, which have been from time to time printed, are not really such (not even allowing the utmost latitude to the translator); they are mostly wild paraphrases, not unfrequently lacking the ideas of the original.

46. Like other rude martial unlettered nations, the New Zealanders had many traditions, legends, and myths. These were on all subjects, from the gravest and most sublime to the most puerile and ridiculous, not unfrequently the same myth containing both. Some of them are, no doubt, of very ancient date; others, while still old, are more modern, and have modern interpolations. The language in all is modern, much more so than in several of their songs. With most if not all nations their early religion and early history is blended with fable; but there is this difference with the New Zealander, that the large proportion of his traditions and myths are neither religious nor historical, and were not believed to be such by the intelligent among them. Their common myths vary a little; a few considerably in the various districts, especially those relating to the arrival in New Zealand of their immigrant ancestors; but not more than might be reasonably expected from such a people. They all show their common New Zealand source; and, as far as is known, vary very much indeed from anything similar among the Polynesian race. To understand them, they should be read and studied in their original New Zealand language, in their roughness and originality; not in either the meagre or the polished semi-classical dress which some of them have been made to assume in translations. The celebrated myths of dry land and sky; of Maui fishing up the North Island of New Zealand; of his obtaining fire for man; of his seizing and beating the sun, to have longer daylight; and of the untimely death of the hero through the laughing of the little New Zealand flycatcher; of the ascent to heaven of Rupe and Tawhake; of the arrival of the first New Zealanders in this country, and many others,* are all so many indications of the mind of man groping after truth in ages long past. In the writer's opinion many of those myths will be found to be allegorical.

> "The intelligible is food to that which understands.
> ——For the paternal intellect, which understands
> Intelligibles, and adorns things ineffable, has sowed
> Symbols through the world."
>
> —ZOROASTER.

47. A few words must be said about their oratory, or rather oratorical language. Some of the New Zealanders were truly natural orators, and consequently possessed in their large assemblies great power and influence. This was mainly owing, next to their tenacious memories, to their proper selection from their copious expressive language, skilfully choosing the very word, sentence, theme, or natural image best fitted to make an impression on the lively impulsive minds of their countrymen. Possessing a tenacious memory, the orator's knowledge of their traditions and myths, songs,

* Posterity will be greatly indebted to Sir George Grey for the exertions made by him to obtain and record many of these myths, the recollection of which is fast dying out.

proverbs, and fables, was ever to him an exhaustless mine of wealth; for the New Zealander, both speaker and hearer, never tired of frequent repetition, if pregnant and pointed. All the people well knew the power of persuasion, particularly of that done in the open air, before the multitude. Hence, before anything of importance was undertaken, there were repeated large open-air meetings, free to all, where the tribe, or confederates, were brought into one way of thinking and acting by the sole power of the orator. Their auditories applauded and encouraged with their voice, in an orderly manner, as with us. Not unfrequently has the writer sat for hours (some twenty or thirty years ago) listening with admiration to skilled New Zealand speakers arousing or repressing the passions of their countrymen; scarcely deciding which to admire the most—their suitable fluent diction, their choice of natural images, their impassioned appeals, or their graceful action. No young New Zealander of the present generation knows anything practically of natural Maori eloquence; arising not so much from colonization and its many new things and ideas, as from a real deficiency in his knowledge of the past, and of the New Zealand language.

48. Several Europeans now speak the New Zealand language: few, however, correctly; still fewer idiomatically; and scarcely any in such a way as to be wholly grateful (*reka*) to a native's ear. The reason is, their ideas, language, and gesture, if any, are altogether foreign. They have never thought, or cared to think, in *Maori;* hence, while many of them are ready to speak of the meagreness of the New Zealand tongue, the leanness is entirely on their own side. There are not a few Europeans who have grown grey in service in New Zealand, and who have been speaking, in their way, the language every day of their lives, who neither speak it correctly nor clearly understand it. Some Europeans have even ventured to write "learnedly" upon it, using, without acknowledgment, the material obtained by others, and racking and distorting by turns Hebrew, Sanscrit, Arabic, Greek, Coptic, Spanish, and many others; never once suspecting their own ignorance of that of New Zealand. It is surprising how few words, and those of the common everyday sort, suffice to talk daily with natives (or ourselves), especially when that intercourse is mainly of one kind. It is also remarkable how very soon natives get to know the true mental calibre of a white man; to gauge, as it were, his knowledge of their language and of themselves, and to say and act accordingly; setting wholly aside for the time, with him, their own true grammar, pronunciation, and idiom, to suit and accommodate him, while he does not perceive or suspect it. Not a few of our old missionaries, officials, and settlers, are thus continually being politely treated by them, from the old native woman down to her little toddling grandchild. It is also to be regretted, that not unfrequently the

translations made for the Government of English documents into the New Zealand language are more or less faulty; partly, no doubt, owing to the translator's contracted knowledge of the English language, and partly to the faulty correction of such printed documents; as in the New Zealand tongue the typographical error of a single letter is sure to alter the meaning of that word, and not unfrequently the whole sentence.

49. It is an astonishing fact, and one worthy of close attention from future philologists, that the Polynesian language, of which the New Zealand is a branch dialect, is commonly spoken by people scattered over one-tenth of the whole globe. Throughout an island area, containing eighty degrees of latitude and seventy degrees of longitude, from Stewart Island in the New Zealand group, in 47° S. lat., to the North Island in the Sandwich group, in 22° N. lat., and from the west coast of New Zealand, in long. 167° E., to Easter Island in 109° W., is this great Polynesian language spoken. It has also been detected* in names of places and in sentences used in the Island of Madagascar, in the Indian Ocean; although, from its not having been adopted by the missionaries there in their translations, it is considered (viewed from this distance) as probably belonging to an older form of the present Malagasi, or to a distinct and more ancient language. The Polynesian is therefore peculiarly an island language, being nowhere found on the mainland in either the east or west continents, or in any of the larger semi-continental islands of the world. Another interesting fact is, that while there are many known dialects in use, some of which differ greatly among the various islands and groups within the above-mentioned area, the extreme outlying ones, viz. the Sandwich Islands on the north, New Zealand on the south and west, and Easter Island on the east, are those possessing the dialects nearest to each other, in several instances the words and sentences being identically the same.† Williams, of the London Mission, who spent many years among the islands, considered the principal dialects as being eight in number, viz. the Sandwich, the Tahitian and Society, the Marquesan, the Austral, the Hervey, the Samoan, the Tongan, and the New Zealand. The number of letters required to form an alphabet in each of these dialects is about the same; although while one, as the New Zealand, retains the *h*, the Hervey dismisses it; for the New Zealand *wh*, the Tahitian, Samoan, and Tongan have *f;* for the New Zealand *w*, the Austral and Marquesan have *v*. The nasal New Zealand sound *ng* is also used in the Hervey, Samoan, and Tongan, but it is rejected from the Tahitian, Sandwich, Marquesan, and Austral. The New Zealand *k* is also rejected by the Samoan,

* By the writer, in 1835.

† The dialect of Rarotonga, one of the Hervey group, in 160° W. long., may also be here included.

Austral, and Tahitian, while it is used by the Marquesan and Hervey Islanders, and serves for *t* in the Sandwich group. There can, however, be but little doubt, that had those dialects been reduced to writing by one man, or one party of men, the few differences which appear would be even less than they now are. At present it is almost difficult to say which of those eight should be considered as the standard or leading dialect; but while the writer has always inclined to the New Zealand, partly from internal philological considerations observed in comparing it with the cognate dialects, and partly from the fact of its having, as already stated, remarkable affinity with those the more distant, *e.g.* Sandwich group and Easter Island, he is now strengthened in his opinion, in finding that Mr. Williams (L.M.) was also nearly of the same opinion, although he knew very little indeed of that of New Zealand. He says, "I shall select the Tahitian as the standard, and compare the others with it. I do this, however, not because I think it the original, *for the Hervey Islands dialect appears to possess superior claims to that title, as it is so much more extensively spoken, and bears a closer affinity to the other dialects than the Tahitian,* but because the latter was first reduced to system." Now, as the Hervey Islands (Rarotonga) and the New Zealand dialects are very near each other, it will not perhaps be too much to assume that the New Zealand dialect, spoken as it is by the largest number of natives, and over the greatest area, is the standard or leading dialect; but this will be still more clear when its philological claims come to be considered.

IV.—Palæontological.

50. The question has very often been asked, *Whence came the people who were found inhabiting the islands of New Zealand?* and this question has not yet been satisfactorily answered. It is therefore purposed to take up the consideration of this subject, and possibly to place some matters connected with it in a new or clearer light.

(1.) *Are the present New Zealanders autochthones?* The commonly received statement that the whole globe was peopled from one pair, which pair primarily resided in Western Asia; the traditions of the people themselves; and (chiefly) their cultivated plants being exotics, and their only domestic animal not indigenous; and their language radically agreeing with that of other island groups,—are the present reasons for disallowing this.

(2.) *Were there autochthones?* Possibly, or rather very likely. (*a.*) From the fact that no large island like New Zealand, however distant from the nearest land, is uninhabited. (*b.*) From the fact that nearly all the numerous islands in the Pacific, though vastly smaller in size, teem with population. (*c.*) From the fact of a remnant, at present existing in the Chatham Islands (the nearest land to New Zealand), of a race which is allowed by the present New Zealanders to be truly aboriginal, and before them in occupation. (*d.*) From their traditions, and fear of "wild men" in the interior. (*e.*) From the allusions, and even direct statements, in their traditionary myths, of their having found inhabitants on their arrival in the country, both at Waitara, on the west coast of the North Island, and at Rotorua, in the interior. But if there were, which appears very probable, they have been destroyed, or become amalgamated with the present race.

(3.) *Did the immigrants come from the nearest land?*—Australia, &c. No: proved by their being a wholly distinct race, in appearance, civilization, manners, customs, habits, and language.

(4.) *Whence, then, came they?* Before entering on this question, it should be carefully noted that could the island be clearly shown whence they came, such would not really answer the question; it would only remove it a step further off. In reply to this :—

(i.) Very little can be gathered from their own traditions worthy of any credit; save that (*a*) some arrived hither in canoes; and (*b*) that those arrivals were successive. Even these two postulates could scarcely be allowed, were it not for two facts—first, that their only cultivated vegetables were exotics; and, second, that the principal different tribal or district varieties among the New Zealanders—as seen in physiology, language, and traditions—partly coincide with what at present obtains in some of the Island groups. The use of the nasal sound *ng* by two-thirds of the New Zealanders agrees with the usage in the Tonga, Samoan, and Hervey Islands; the omission of the *h*, and the substituting instead of a peculiar click (as done by the Cook Strait and West Coast New Zealanders), agree with those of Austral Island and Rarotonga; and the dropping of the nasal sound *ng* by the natives of the Bay of Plenty, and using *n* instead, agree with those of Marquesan, Society, and Sandwich Islands; while the New Zealand use of the *k* agrees with that of the Hervey and the Friendly Islands.

(ii.) In their traditionary myths, the New Zealanders also say that they came hither from "Hawaiki." The writer was formerly of opinion (in 1835–6, which has subsequently been taken up as valid by several others), that this Hawaiki was identical with the Sandwich Islands, or Hawaii, the *k* being dropped according to the rules of their dialect; but he has long given that up as untenable: (1) from the utter impossibility of their having come that distance (65° of latitude) against the prevailing winds in their frail open canoes; and (2) from the irreconcilable differences which exist in their habits, customs, manufactures, traditions, and religion. By way of illustration, the following may be here briefly mentioned, bearing in mind, that the New Zealanders, like most other uncivilized people, most pertinaciously adhere to the plans, patterns, and sort of things made by their ancestors:—(*a*) all the various kinds of New Zealand canoes are very differently made; (*b*) they have no outrigger; (*c*) the New Zealanders never used the *kawa* root, notwithstanding a very closely allied species of *Piper* grows throughout New Zealand; (*d*) nor the bow and arrows; (*e*) the New Zealanders invariably carry their burthens on their backs, the Sandwich Islanders on a balance pole over the shoulders; (*f*) the New Zealander has no words for swearing, oath, or vow; (*g*) the New Zealander never practised circumcision;* (*h*) nor had any temples for religious worship; (*i*) nor idols; (*j*) nor king; (*k*) they knew not the names of the numerous chief gods of the Sandwich Islands; (*l*) their old customs respecting their chiefs, &c., do not agree; (*m*) their tattooing is different; (*n*) they had no "refuge cities" (a most remarkable custom, only found at the Sandwich Islands): and (3) from there being no vestige of any of their several emigrations from Hawaiki, and of the wars, &c., which occasioned such (as related by the New Zealander), to be found in the ancient history of the people of the Sandwich Islands, whose traditions are much more ancient and clear than those of the New Zealanders.

(iii.) Others have supposed the largest island of the Samoan, or Navigator, group, called by the same name, *Sawaii* (the sibilant being used for the aspirate—Sawaii, Hawaii, Hawaiki), to be the Hawaiki of the New Zealanders. This opinion has been warmly supported by several later writers,† but, with the sole exception of the Samoan group being only half the distance from New Zealand that the Sandwich Islands are, certainly with much less reason than the former. For, in addition to the objections adduced against the Sandwich Islands being the New Zealand home, or Hawaiki, here, at the Samoan group, they never tattoo their heads and upper part of their bodies, but only from the waist downwards, and that in a wholly different style; the women also are never tattooed; the men, including chiefs of the highest rank, do all the cooking;|| their dialect, on the whole, has much less affinity with that of New Zealand; their traditions about the creation of the earth, &c., are widely different; and the *kumara*, or sweet potato (common at the Sandwich Isles), they have not among them.

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* *Vide* Cook's Voyages, 4to ed., vol. iii. p. 50.

† Erskine's "Journal of a Cruise in the Western Pacific," p. 103, ed. 1853: *et al.* It may be noticed, by the way, that Dr. Thomson, in his elaborate compilation, "Story of New Zealand," London, 1859, speaks of this view as being *peculiarly his own.*

|| Turner says, "The duties of cooking devolve on the men; and all, even chiefs of the highest rank, consider it no disgrace to assist in the cooking-house."—*Nineteen Years in Polynesia,* p. 196.

(iv.) But even if it were conceded or proved that the New Zealanders really came from the Hawaiki of either the Samoan or the Sandwich group, the next question would be, Whence came their ancestors? *(Vide infra,* par. 53.)

(v.) There is yet another view to be taken of this word Hawaiki, or Hawaii, which at least is not wholly unworthy of notice, viz. to consider the New Zealand tradition of their emigration thence to New Zealand more as a figurative or allegorical myth than anything really historical. Such is wholly in keeping with all their other traditionary myths, and with the genius of the race; and also with the common legends of all nations. Viewing it thus, Hawaiki or Hawaii will no longer mean any particular (if any) island, and may prove to be a portion of a still more ancient myth than that of the fishing-up of the Northern Island of New Zealand by Maui. Williams (L.M.) says that "one of the Polynesian traditions concerning the creation of the world and of the first peopling of it, was, that after the island of Hawaii was produced by the bursting of an egg, which an immense bird laid upon the sea, a man and a woman, with a hog, a dog, and a pair of fowls, arrived in a canoe from the Society Islands, and became the progenitors of the present inhabitants." And another account, given by Turner,* represents Tangaroa, the great Polynesian Jupiter, as rolling down from heaven two great stones, one of which became the first land, or island of Savaii (or Hawaii) in the Samoan group. Very likely it may yet more clearly be seen that this mythical or allegorical Hawaii or Sawaii of those two groups, is also the mythical Hawaiki of the New Zealanders—the whole being fragmentary portions of the legend of a flood which are found underlying the myths of all ancient races; by whom, however, the universal greatness of the event (as found in the Biblical record) is generally lessened or lost sight of; while the legend itself is contracted into a matter of insular, national, and special interest, serving to carry back the forms of every-day life into antediluvian ages; common proofs of the inventive mind of man ever seeking to understand the why and the wherefore of things around him.

51. Leaving, however, for a while the further consideration of the *place* whence the immigrant ancestors of the New Zealanders may have come, let the endeavour now be made to ascertain the *time* when they arrived in New Zealand. Here again, little really valuable of a positive nature can be gathered from their traditions. The writer very well knows how cleverly the different tribes of New Zealanders contrive to deduce their descent from some one of those early (mythical) emigrants; although in so doing they diametrically oppose each other in their early genealogies; while others, finding no means of tacking themselves on to a "parent stem," cut the matter

* "Nineteen Years in Polynesia," p. 245, ed. 1861.

short by saying their ancestors came from Hawaiki on the water by enchantment in a few hours; or under water by diving; or on the back of an albatros, &c., &c. And the writer also knows how many late writers and lecturers on this subject have repeatedly stated their full belief in the historical truth of such traditions; and not only so, but by proceeding to calculate the generations of the New Zealanders (believing, of course, *all* their genealogical statements), have come to the conclusion, that "their dwelling in New Zealand has not been more than 500 years;" scarcely four centuries before Cook and not three before Tasman discovered them (A.D. 1642). In reasonably prosecuting this inquiry, a few old truthful witnesses will have to be carefully examined; and although their evidence, from the nature of the case, will scarcely be any other than purely negative, yet, combined, the reasonable proof they will yield of great antiquity may be sufficient to establish its claim for favourable consideration to the intelligent and scientific mind.

(1.) *Tradition* uniformly speaks of the Northern Island of New Zealand having been fished up by Maui. How did this peculiar myth arise concerning this one island? Did the first inhabitants see recent signs of upheaval, which, geologically speaking, are patent to us, especially on the East Coast, and in the Hawke Bay province? Further, tradition speaks of the vehement struggles of the said huge earth-fish after having been brought to the surface (owing to the impiety of the brothers of Maui, who, in his absence, had proceeded to cut up his fish), which caused the very broken and abrupt appearance of the country;—may this be also considered as indicative of subsequent violent volcanic action, known to the first inhabitants? What necessity was there for such an addition to the Polynesian myth of Maui, seeing either of the countries they had left (Hawaii or Sawaii), were *more* broken? Again, the hook, with which Maui had fished up the land, was said to be at Cape Kidnappers, in Hawke Bay; no doubt from the curved extension of the land at that cape in ancient times, when the present two islets lying off it were joined to the land; but those two islets existed, as now, in Cook's time. And long before that period, owing to the very gradual irruption of the sea there at that clayey cape, the ancestors of the present natives, seeing the "hook" was gone, had removed its locality to Cape Turnagain, which cape also had a similar though smaller curvature; this, too, has long ago been washed away. May not this be considered as another item in favour of antiquity? Tradition also speaks of many local portions of the North Island having been upheaved, fallen-in, submerged, and deluged; of the old channels of the present rivers having been far off from, and flowing over much higher ground than where they now are; of chasms having opened, and of the escape of the imprisoned monsters (*Taniwha* or *Ngarara*) to the sea, and, in some few cases, of their having been killed by some renowned hero of former days. Now in most of these instances alluded to (some of which places the writer has seen and examined), a thousand years would scarcely suffice for their subsequent forests and depth of vegetable *humus.* Again, the *stone* canoes in which those mythical emigrants arrived, scattered on both the East and West Coast, one being on the crest of a high range, twenty miles from the sea; the footmarks of Rongokako, one of those emigrants, also left in stone at various parts of the East Coast; the several men metamorphosed into large perpendicular stones at Manaia, in Whangarei Harbour, &c., &c., all indicate a long time back in the old night preceding all history, or such conspicuous stones would not have been handed down and narrated by such a shrewd inquisitive race as the New Zealanders. Lastly, the tradition which the writer received in 1837, from an intelligent aged "priest" in the Bay of Plenty, respecting Tuhua, or Mayor Island, there, viz. that anciently the northern natives obtained their prized greenstone from that island; but that the guardian god being vexed, covered it with excrementitious substances, and swam away with the fish which produced it to the South Island, whence subsequently all the greenstone was with difficulty obtained. Now, as the island is an eruptive volcanic mass, this tradition, in more ways than one, points to a time long since past. Often what is not scientifically correct has in it a deep and pregnant truth of feeling.

(2.) *Archæology.*—In repeated travelling in the North Island, from Cook Strait to Cape Maria van Diemen, during more than a quarter of a century, and that by by-paths long disused, through forests and over mountain and hilly ranges, the writer has been often astonished at the signs frequently met with of a very numerous ancient population, who once dwelt in places long since desolate and uninhabited: such as the number and extent of their hill forts, cut, levelled, escarped, moated, and fenced only with immense labour, considering they had no iron tools and the number and extent of their ancient cultivations, all long since overgrown; and the enormous mounds of river, lake, and sea-shells, sometimes clearly revealing the slow accretions through years or centuries, by their accumulations having been made *stratum super stratum* with intervening layers of vegetable mould and *humus*, each stratum of shell possessing small fragments of obsidian, which mineral (used by them for cutting their hair and themselves in lamentation, and also for scraping their finer woodwork), being only found in one or two districts, had been brought from a great distance. He also noticed, and that in more than one or two places, that some of the ancient New Zealanders buried their dead in the earth or sand; skulls having been met with and skeletons which had been buried, and from which the winds had removed the soil. On inquiry it was found that none of the present generation knew aught of the people to whom such bones had belonged; they also expressed no astonishment at them, and always disowned their ever having belonged to their tribe, and which, indeed, their conduct showed. Moreover, the very great number of their jade (greenstone) war implements and ornaments (found by Cook and others, even at the Bay of Islands and the North Cape) seem to indicate their antiquity as a race in New Zealand. The great number appears the more remarkable when it is considered that they always endeavoured to hide them securely in time of war, through which great numbers have been lost. Now that stone is *only found at one spot in the South Island*,* difficult of access both by sea and land. It was only obtained thence with great difficulty, increased through the superstitious belief that it was produced by a "fish" under the guardianship of a "god," to propitiate whom many ceremonies were observed. Further, there is also the known antiquity of many of those prized stone weapons and ornaments which have descended as heirlooms through several generations, and the great length of time necessarily taken in the making of one of them. Again, there is the silent evidence of the *mako*, or tooth of the long-snouted porpoise, the prized ear ornament of the New Zealanders, many of which are also heirlooms of great antiquity. How did their ancestors obtain these teeth, seeing the animal which produces them inhabits the open ocean? The natives say, by occasionally finding the animal driven on shore after a gale. But during the writer's long residence of more than thirty years, always on the sea coast, and his frequent travelling over all the beaches, he has only heard of *one* of those animals having been found, and that was too small for its teeth to be of any value. What amount of years, then, may it not reasonably have required to obtain all those teeth now left among the natives, exclusive of the large number sold and lost.

(3.) *History*.—From Tasman and Cook we learn that the natives were very numerous. Tasman, who came suddenly upon them from the south, coasting up the western side of the South Island, and who only remained at anchor for a few hours in one of its bays, was visited by eight canoes filled with men, who attacked him, and having killed his quartermaster and four others, they retreated, bearing off one of the bodies. Tasman "immediately left the scene of this bloody transaction, when twenty-two more *boats* put off from the shore and advanced towards them." From a drawing given by Tasman, we find the "boats" he speaks of to be the ancient double canoe, long since out of date. This occurred in 1643, some 280 years, according to our calculators, after the arrival of the first few emigrants in this country. Here let it be observed that according to the natives' own legends those so-

* Found from Dun Mountain to Martin Bay, wherever the serpentine rocks occur.—Ed.

called emigrants were not many in number; that they soon fell out among themselves, went to war with each other, and slew several where they had landed in the Bay of Plenty; and that of the remainder many went inland, and farther north in the North Island, and settled. Yet Tasman found the inhospitable and colder latitudes of the South Island, near Cape Farewell, so thickly peopled as to send thirty boats and canoes from one beach, well manned, to the attack. Cook, who had long and repeated interviews with them during his different voyages, and who was associated with scientific and observing men, although, both from the nature of the country and character of the people, he could only have seen those tribes who lived on the sea coast and *near* to his anchorages, which anchorages were not many in the vastly more populous Northern Island—Cook was of opinion that they were very numerous; so also were the two French navigators, D'Urville and Crozet, who arrived in New Zealand shortly after Cook. But what has ever been of great weight with the writer, as being highly corroborative of the correctness of the opinion formed by the early navigators, is the statements they give, especially Cook, of the innumerable number of canoes, of the number of large seine nets which they everywhere found in houses erected purposely for them, of the extent of the *kumara* or sweet potato cultivations, and of the very many places on the immediate East Coast, particularly between Capes Palliser and Kidnappers, and Capes Rodney and Brett, and Cape Pococke and the North Cape, which then abounded with pas (forts and villages), and swarmed with people, but which are now, and have been for many years, wholly uninhabited. All which, it is believed, silently indicate the ancient settlement of the race, especially when their warlike character and habit are also considered.

(4.) *Habits, customs, manufactures, ornaments, and tattooing.*—Very many of the habits and customs of the New Zealanders, indeed nearly all, are widely different from those of other Polynesian islanders, though belonging to the same race. So also their manufactures, whether the more useful and durable, as canoes, houses, implements of wood, &c., or the many varied textile ones, for clothing and daily use; all differed, and that greatly. And when their immense variety, with their woven and dyed ornamental patterns, and their skill in manufacturing, is also considered, how long a time would it not require for them to *lose* all the *old* knowledge (which they had brought with them) and to gain the *new*, and also to use it successfully upon entirely new materials? For not only is the New Zealand flax plant (*Phormium*) not found in the other islands, but also no like fibrous substitute. And that by a people so prone to copy, and so exceedingly tenacious of innovation;—by a people, too, who, according to their own traditions and legends, and the sad experience of the early navigators, were so prone to war and murder.

Again, tediously to fashion their war implements of whalebone and of jade (green or axe-stone), instead of hardwood, was wholly a new thing to them; and these substances were only occasionally to be obtained, and that slowly and with great trouble and labour. Could such a change, such an entire revolution—one, too, almost needless—have taken place save in a very long lapse of time? Moreover, the peculiar carving of all their greenstone breast ornaments (*heitiki*), which possess great sameness, and which might be correctly styled national, differs from any other Polynesian carving, particularly in the invariably reclined, not erect, head, and in only having three fingers to each hand, which striking peculiarities also invariably obtain in all their old carving: could such a great change in the national taste have taken place in a few generations? Lastly, the tattooing of their chiefs, which entirely differs from all other Polynesian islanders, and which has certainly not varied in the least during the last 150 years: could such an universal revolution in their old tastes possibly have taken place in the short period which preceded, of 350 years?

(5.) *Language.*—The negative evidence to be obtained from this source is very important. Language adheres to the soil, when the lips which spoke it are resolved into dust. "Mountains repeat, and rivers murmur, the voices of nations denationalized or extirpated in their own land." It has already been briefly shown in what respects the New Zealand dialect differs from other dialects of the great Polynesian language, as far as relates to the change or substitution of letters; but there are still greater differences observable in the dialects of the two groups, Sandwich and Samoan—from one of which it has been said the New Zealanders emigrated hither—and the dialect of New Zealand; of which the great difference in the causative verb in the Sandwich Islands, and of "the distinct and permanent vocabulary of words" used in addressing chiefs, can only be here mentioned. It is also noticeable that the names of "gods" whom the mythical emigrants are said to have consulted before leaving, are not known as such in those islands; and all the names of the emigrants themselves are pure New Zealand words, which do not exist in the dialects of those islands. Their traditions and songs, however ancient, are all very distinct; for although some of the New Zealand myths do possess a few of the names of the numerous Polynesian "gods" or deified heroes, they are all assigned a very different and inferior position and work by the New Zealanders. Could all this have been brought about in less than a very large number of years? So with the sub-dialects observed in New Zealand, which agree in their outline characters with others in the Pacific, as has been already stated, and which were much more strongly defined formerly than they are now (mainly owing to the introduction of a written language within the last thirty years, which has caused the chosen one or two of the sub-dialects to become both commonly used and dominant); could those tribes also severally set aside their own many peculiar words, and adopt words which were strange and new (N.Z.), in such a short period? or, rather, did they not gradually do so, through the long lapse of ages, and of little intercourse, while they still retained their characteristic tribal pronunciation and manner of speaking?

(6.) *Religion.*—It is well known that the Sandwich islanders (Hawaii or Hawaiki) had an old and costly idolatrous worship, possessing ancient temples and many ceremonies. It almost seems too ridiculous momentarily to entertain such a notion as that such a ceremonial worship had only originated 400 years before Cook visited them; or, in other words, that it sprang up (*de novo*) after our emigrants to New Zealand had left. Yet both these positions the believers in the New Zealand immigration myth, from that Hawaiki, must be prepared to support. For certainly, had those emigrants known of it, they could not so easily and entirely have cast it off. So, again, at Savaii (or Hawaiki) of the Samoan group; their religion was, if possible, still farther from anything that either has, or reasonably might have, obtained in New Zealand. For there, "every village had its god, and its small temple consecrated to the deity of the place." A woman would say, on the birth of her child, "I have got a child for so-and-so," and name the village god.* In their village temples, too, were objects for veneration. They also daily offered meat-offerings and drink-offerings to their god, and this at home in every house. And their many taboos (*tapu*)—the sea-pike taboo, the white shark taboo, the cross-stick taboo, the ulcer, the tic-doloreux, and the death taboo, the rat, and the thunder taboo, &c.—were all differing widely from anything which has ever obtained in New Zealand.

(7.) The Moa, *Dinornis.*—Its valuable evidence is purposely omitted, as the writer still holds to his original opinion, published twenty-three years ago,† and drawn both from geological deductions as well as from history, in reference to its *never* having been seen alive by the present race of New Zealanders. For if it had been seen by them, and by them had been gradually killed and extirpated, as some Europeans have *laboured* to show, then no surer evidence could be desired as to the great antiquity of the present race in New Zealand.

(8.) After examining and weighing all this evidence gathered from various sources, the mind is irresistibly driven to accept the only logical conclusion, that the *time* of the early or first peopling of New Zealand is one of high antiquity.

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* Turner's "Nineteen Years in Polynesia," pp. 239, 240.

† In "Tasmanian Journal of Natural Science," Vol. II.

52. Further, it is believed that it will also be satisfactory briefly to consider the first emigrants mentioned in the New Zealand traditionary myths;—the persons and their doings. The names of several canoes are given, also of their crews or leaders; their marvellous adventures by the way; the numerous things they brought to New Zealand; and the height of the men, "9 and 11 feet." Also, that some of them had previously discovered New Zealand, in a voyage of exploration purposely made hither, and having coasted and visited different parts of it, had returned to the mother country and had been the means of others coming to New Zealand to settle; and that many of the canoes, on reaching the land of New Zealand, immediately set about circumnavigating the Northern Island, &c., &c. In all this mythical rhapsody there is scarcely a grain of truth; and yet some educated Europeans have wholly believed it. The New Zealanders themselves, however, never did so. The names of the canoes and of the leaders are nearly all figurative names suitably coined in the New Zealand tongue, and given after the event; several of the latter being also the names of ideal beings in their mythology. They are all said to have come from *one* place; but it has been shown, and any one may yet see, that they evidently came from several, as their sub-dialects, still partly extant, clearly show. They are also said to have come by several consecutive migrations; this alone would require a very long time. Their adventures on the way, their enchantments, battles, and charms, excelling those of Munchausen or Gulliver, are suited, perhaps, for the region of romance, but ought to have no place in any reasonable inquiry. Among the numerous things said to have been brought by them to New Zealand, were several of the *wild* New Zealand birds, such as the swamp *pukeko*, the green parroquet, the woodhen, and many others; also the New Zealand rat! and, with the exotic plants, the *karaka* tree, which last they everywhere planted; but, unfortunately for them, the tree is not found anywhere else; the canoes which brought them are spoken of as being only ordinary canoes, and some even small, yet to contain 140 men! And, while several kinds of food (*used by New Zealanders*) are spoken of, no mention whatever is made of any of the peculiar edible productions of the islands; or of *water*, none of the Polynesian islanders having any large water-holding vessels. Some of their leaders are described as leaving in great haste and flying for their lives, others as being of monstrous size, and able to accomplish anything—even to run to the top of the mountain Tongariro, or to dive under the island and emerge on the other side, or to tame whales—nevertheless to be subject to all the common infirmities of smaller and ordinary men.

53. To return—the question put (par. 50, sec. 4) has not yet been answered,—*Whence came the Maori—the Polynesian race?* It is not, how-

ever, the present intention of the writer to go deeply into the subject. Only a few thoughts and excogitations will be here set down.

(1.) That the race is *one* throughout the numerous islands in the Pacific Ocean where the language is spoken. (*Vide* par. 49.)

(2.) That from its original wide separation into groups, sufficient time must be allowed for the perfect grammatical construction and full development of its leading dialects; the growth of its many and varied habits, customs, and manufactures; and the slow change and product of its various mythologies and traditions.

(3.) That notwithstanding their long and sanguinary wars among themselves from time immemorial, prior to their discovery by Europeans, the respective islands were teeming with population.

(4.) That while some have supposed the race to have sprung from the Malays, from a very slight physical resemblance, and from the likeness of a *few* words of their language, there is quite as much, if not a greater, physical resemblance between the race and the people of Madagascar, on the opposite side of the globe, whose language also contains a few words and sentences which are identical.

(5.) That, with the exception of the Islands of New Zealand, which are the farthest south, the race is almost exclusively found in the easternmost isles and groups of the Pacific, and not in the numerous isles nearest to the Malays.

(6.) That it would have been impossible for any regular migration to have ever taken place from the Malays to the Polynesian islands, owing to the frailness of their shipping, and to the prevailing trade winds and equatorial currents being contrary.

(7.) That the Malays were found by Cook and the earlier navigators to know the use of iron and other metals, and invariably to chew betel, drink palm wine (*toddy*), smoke, cook in earthen pots, live in partitioned houses, and to be strict monogamists; none of which national habits and customs, nor the knowledge of any metal, has been detected among the Polynesians.

(8.) That the near resemblance or even identity of a few (*quasi*) Malayan words prove really little, when it is considered (*a*) that those words only obtain among the sea-coast natives of Malaya; and (*b*) that the *same* words are found more or less in use in the sea coasts of Java, Sumbawa, and the Philippine and other isles, including even Madagascar. May it not therefore be reasonably inquired, whether those few words might not rather have reached those several Northern Asiatic isles from Polynesia, than *vice versâ?*

(9.) That the language spoken by the Polynesian race has no affinity with the Malayan, being in its whole formation and construction of a far more primitive and ancient cast. The structure of the Malayan language is wholly different.

(10.) That if the origin of the people on some few of the islands (in the lapse of ages) might have arisen from a drift canoe (which seems next to impossible), exotic edible roots were not at all likely to have been by such means imported; nor the peculiar and ancient Asiatic drink of palm wine (*toddy*) to be to them, where the cocoa-nut is everywhere indigenous, wholly unknown.

(11.) That the *kumara*, or sweet potato, so generally cultivated in the islands by the Polynesian race, is believed on good grounds to be only indigenous to South America.

(12.) That a large migration has ever been traditionally spoken of as having anciently taken place from Mexico and Central America (on the breaking up of the Toltec Empire); and that it is an easy and short voyage, and one not impossible to large canoes, from Central America to several of the nearest Polynesian islands.

(13.) That of all the various dialects to be found among the largely scattered Polynesian race, the New Zealand dialect agrees most with that of the little isolated islet called Easter Island, and next with that of the Sandwich group; which islands are also the nearest of all the inhabited isles to the shores of America.

(14.) That the carving of the Polynesian race, and particularly of the New Zealanders, agrees most, as far as is at present known, with that of the ancient inhabitants of Central America, as shown by the late discoveries at Uxmel and Palenque.

(15.) That, like the ancient inhabitants of Central America, the New Zealanders obtained fire by friction; and steeped poisonous kernels of the *karaka*, &c., to obtain a food, much as those also did the poisonous roots of the mandioc or cassava plant.

(16.) That there is incontestable geognostic evidence of a chain or series of active volcanoes surrounding the Pacific Ocean.

(17.) That there are good reasons for believing that very great changes have taken place in the Pacific through volcanic agency.

(18.) That there are also good reasons for believing, geologically and analogically, from what we see in Europe, and also here in New Zealand, that anciently the volcanic *focus* (or *foci*) in the Pacific was nearer its centre than it is now.

(19.) That there are also reasons for believing that through such agency a continent, or large continental island or islands, have been wholly or partially rent, and submerged in the Pacific Ocean.

(20.) That it is a highly interesting fact, and one that is increasing in importance every day, that the large majority of animals and plants of the whole island region inhabited by this great race, while more or less allied in themselves, are peculiar to this region.

(21.) That in New Zealand, and in several other islands of the Pacific, there are species of European, African, and American plants identical with the plants of those countries, but which have not been taken to the Pacific islands by the agency of man.

(22.) That there are living remnants of an apparently earlier creation, both animal and vegetable, in the Pacific isles and seas.

(23.) That the Polynesian race of man may be a fixed variety of the genus *homo*.

(24.) That there seems to be just the same kind of difficulty attending this question as attends that of the geographical distribution of animals and plants among the Polynesian islands.

(25.) That the Polynesian variety (*stirps*) of the genus *homo* may be an earlier one than the Caucasian or European; and from its creation peculiar to its own (now) insular region.

(26.) That it is believed, that while the fair Polynesian race everywhere exhibits signs of great antiquity, it also bears unequivocal symptoms of great and rapid decadence, or universal deterioration and decline.

(27.) That the origin of the Polynesian race is a problem that has yet to be solved; and it is believed (having firm faith in the vocation of man, and his power to fulfil it) that IT WILL BE SOLVED.

V.—MODERN.

54. This period, comprising nearly a century, from the discovery of New Zealand by Cook to the present, is a most eventful one in the history of the New Zealanders. A large and instructive volume might be written of the principal acts and actors, men and things, of this period. Time, however, will only allow of a very brief mention in this essay of the most prominent of them. It was during this century that four European quadrupeds were introduced into New Zealand—the pig, the dog, the cat, and the rat. These have each done its share in the work of effecting a great change in the country. Had foreigners ceased to visit New Zealand after the introduction of those animals, the country would no longer have been the same it once was to its Maori inhabitants. And it is a question difficult to answer, whether their introduction alone, followed by such a circumstance, would have been a benefit or an injury. These four animals, especially the two smaller ones, destroyed the choice and numerous ones of the Maori—the edible rat, the kiwi, the quail, and the ground parrot, and the birds gene-

rally; while the foreign dog was also the cause of the entire loss of their own peculiar little dog, to them a most useful animal; and the pig caused them an enormous amount of extra work in everywhere fencing their many cultivations, as well as became the cause of much dissension, strife, and fighting. It is highly instructive to trace and to see the great and important changes, affecting even the destiny of peoples and nations, which are sometimes brought about by apparently unimportant and trivial circumstances.

1. *Foreign or External.*

55. *From their discovery by Cook in* 1769, *to the visit of Governor King in* 1794.—This first quarter of the past century seems to be a very proper division, beginning and ending with their two greatest known foreign benefactors during that period. Cook found the New Zealanders numerous, healthy, strong, industrious, abounding in children, contented, and happy. As is well known, he visited New Zealand five times during the years 1769–1777, on two of which visits he was also accompanied by Captain Furneaux. From Cook the New Zealanders received many valuable things, more especially the pig and potato, which have proved an incalculable blessing to the people. Unfortunately, Cook was obliged to show them his superiority, by using his firearms no less than twelve times during his first visit, and to shed blood on each occasion, through which several natives lost their lives. That more serious collisions did not take place was, without doubt, owing both to his able manner of dealing with them, and to his having with him the Tahitian islander Tupaea, whose services as interpreter must have been invaluable; and yet not always appreciated by the New Zealanders, as the lamentable affray at Cape Kidnappers, when they kidnapped and carried off his son Taieto, fully shows. It is remarkable that while Cook was on the coast, during his first visit in 1769, the French navigator D'Urville also visited New Zealand, and spent some time at anchor at Doubtless Bay, near the North Cape, during which he surveyed it, naming it Lauriston Bay.* Unfortunately, D'Urville, after receiving great kindness from the natives, came also into collision with them, burnt down their village, and carried off their principal chief, Kinui, prisoner. This chief died of a broken heart on board of D'Urville's ship three months after, when off the island of Juan Fernandez. In 1771, only a few weeks after Cook's return to England, the celebrated Dr. Franklin projected a scheme for the civilization of the New Zealanders. His proposals were printed and circulated; but, owing to the sad massacre of M. Marion and his crew, which took place early in the following year, or some other cause, they were never carried out. In 1772,

* Published by the Hydrographic Office, London.

before Cook's second visit, another French navigator, M. Marion du Fresne, visited New Zealand in two ships, the "Muscarin" and the "Marquis de Castries." These ships anchored in the Bay of Islands, and remained there two months; and at first, and for some time, there appears to have been great kindness and cordiality on both sides. Unfortunately again a collision took place, in which Marion and twenty-eight of his crew lost their lives. Shortly after a very large number of natives were slain by the exasperated French. Cook paid his second visit in the following year, 1773, in two ships, Captain Furneaux commanding the consort. On leaving New Zealand to prosecute their voyage, they were separated by a heavy gale, and Captain Furneaux putting back to refit to the same harbour they had so recently left, unfortunately got into collision with the natives, who killed the whole of his boat's crew of ten men, ate them, and broke up the boat. Soon after this unhappy affair, Cook again visited them, and again in his third voyage in 1777, each time adding to his former benefactions. In 1791 they were also visited by the benevolent Vancouver, who spent a short time at Dusky Bay, from whom the natives also received several gifts. In 1793 another French navigator, D'Entrecasteaux, commanding two frigates ("Recherche" and "Esperance") in search for La Perouse, and having the naturalist Labillardière on board, communicated briefly with the natives living near the North Cape, who received from him several presents. In the same year the English settlement at Norfolk Island having been lately founded, Lieutenant Hanson, in the "Dædalus," was sent to New Zealand by Governor King to obtain some New Zealanders to teach the new settlers at Norfolk Island how to manufacture the flax (*Phormium*), which was also indigenous there. Two chiefs were therefore carried thither, who, however, proved to be of little service for the specific purpose they were obtained for, as the working of the flax in New Zealand was peculiar to women. They remained, however, with Governor King until the next year, 1794, when he honourably returned them to New Zealand, accompanying them himself, and giving them many useful things, among others a fresh supply of pigs, potatoes, and maize. There can be no doubt but that their stay with Governor King, and his humane and kind treatment of them, were productive of great good.

56. *From Governor King's visit* (1794) *to that of the Rev. S. Marsden, and the introduction of the first British settlers* (1814), a period of twenty years. From about the time of Governor King's visit, ships engaged in the South Sea whale fishery occasionally called at New Zealand for refreshments. From time to time several New Zealanders entered as sailors in those ships, few of whom ever returned to their native country. Other ships too arrived in New Zealand for spars, and their number increased every year. From this date also the New Zealanders began to acquire firearms and ammunition, for

which (and often of the most wretched kind) they paid almost fabulous prices. These fatal exchanges and gifts came to them from all quarters, and were, and long continued to be, of immensely greater value in their eyes than anything else. In 1805 Mr. Savage, an English surgeon, visited them, and remained a short time at the Bay of Islands, taking with him to London, in 1806, the chief Moehanga, who was the first known New Zealander who visited England. In 1809 the sad tragedy of the murder of the captain and crew of the "Boyd," nearly seventy in number, and the pillage and burning of the ship, occurred at Whangaroa, to which harbour the ship, on her return voyage from New South Wales to England, had put in for *kauri* spars. For this savage murder the New Zealanders, as a people, again paid severely, many hundreds of all ages and both sexes being soon after slaughtered by the enraged united crews of several whalers; but their retribution, unfortunately, fell wholly (*a la Nouvelle Zelande!*) on a wrong tribe. Nearly the whole of this period was one of great loss and suffering to the New Zealanders, from the cupidity and lust of their European visitors; and to such a length did their maltreatment of them proceed, that at last the New South Wales Government was obliged to interfere by severe proclamations. In 1814 a few missionary settlers (who had come out for that purpose some time before to New South Wales, under the auspices of the Church Missionary Society) arrived in New Zealand, and they settled at Rangihoua, in the Bay of Islands. They brought with them several New Zealanders from Port Jackson, among whom was the notorious Hongi. Some time after the Rev. S. Marsden paid his *first* visit to New Zealand, accompanied by his friend, the classical New Zealand historian, Mr. Nicholas, and remained in New Zealand nearly three months. From Mr. Marsden the natives received several useful things.

57. *From the introduction of the first British settlers and Christianity* (1814) *to the Treaty of Waitangi* (1840). This period of another quarter of a century was also a very important one for New Zealand. It is highly probable that in no like period did the New Zealanders lose such a number of their population. From without, as before, the natives received much good, although not unfrequently dashed with some evil, often the fruits of their own sad doings. During this period the crews of several small trading vessels were treacherously murdered; among others were those of the "Agnes" at Tokomaru, of a whaler at Whanganui, and of the "Sydney Cove" farther south. For a long time the first settlers, although daily benefiting the natives, only held their ground with extreme difficulty, more thon once being on the point of leaving. During this period the Wesleyan Society also commenced a mission in New Zealand. Such, however, was the dreadful state of things, that their first station at Whangaroa was obliged to be

abandoned; shortly, however, to be re-formed and re-strengthened at Hokianga. Still it was not until 1824, or ten years after the commencement of the mission, that the first New Zealand convert was baptized. In the year 1819 the Church Mission took up a new station at Kerikeri, also in the Bay of Islands, then the headquarters of the chief Hongi. In 1823 the Paihia station was formed; and here, soon after, the first schooner (of 52 feet keel) was built. In 1830 the Waimate station was formed; and in 1834 the Kaitaia, or northernmost one. In 1834–5, mission stations were also formed at Matamata and at Mangapouri in Waikato, at Tauranga in the Bay of Plenty, and at Rotorua. Soon after mission stations were also formed in the Thames and at Manukau; Entry Island, Otaki, and Whanganui, in Cook Strait, and Poverty Bay, Uawa ("Tolaga"), and the East Cape, were all occupied in the years 1839–40. From all these spots, and some others, as so many centres, the natives around, for many miles, were regularly visited, and more or less brought under Christian instruction; receiving largely at the same time the manifold blessings of trade, commerce, and civilization. The printing press was introduced in 1834, and early in 1835 portions of the Holy Scriptures were first printed in New Zealand. In 1837 the first edition of the complete New Testament was printed at Paihia, in 8vo., of which edition 5,000 copies were printed, and soon entirely disposed of. During the five years ending 1840, many thousands of other books were printed in the New Zealand language and distributed. Within this quarter of a century several whalers and sealers had located themselves in different parts of New Zealand, especially in and near Cook Strait, at Dusky Bay, and at Stewart Island. But at the Bay of Islands was by far the largest number of settlers and white residents. If the first half of this period of twenty-five years was to the New Zealander the most deadly, the last quarter was certainly the most beneficial, whether in spiritual, intellectual, or outward wealth.

58. The period *from the year* 1840 *to the present year* (1865), another quarter of a century, might be very advantageously divided into two portions—(1) to the end of the year 1852, up to which time the natives were generally progressing; and (2) from that to the present, during which they have been generally falling back,—but time will not permit of this. During the whole of this period very much has been done for the New Zealander. New mission stations have been formed in many places; the British Bible Society, and other societies, have given them immense donations of holy and religious books; the Colonial Government has done much for them in aiding them with water-mills, ploughs, harrows, horses, seed, vessels, boats, clothing, &c., and with annual grants of money for schools. Many laws also have been made exclusively for their benefit. They have also received directly

from the Government, for lands sold, some tens of thousands of pounds in gold; while the greatly increased value of their own reserves within and near such alienated blocks, and the enormous consequent value of the large tracts still in their hands, is almost beyond computation. The industrial stimulus they have received through the steady influx of settlers, the formation of towns for all their supplies, and the largely increasing demands for pigs, grain, potatoes, kauri-resin, and tanning barks, are also very great. A New Zealander of low rank, or even a slave, of the present day, is possessed of far more real wealth and comforts than a chief was twenty years ago, or than a whole tribe possessed thirty years back; and all *exotic*—through their increased intercourse with Europeans. Unfortunately, however, this period, like all the others, is marked by the shedding of their blood by their European friends, the present unfinished war being the third within the last twenty years, and in each case brought on and begun by themselves.

2. *Domestic or Internal.*

59. *From the time of their discovery by Cook* (1769) *to the end of that century.*—It is evident that Cook found them much as Tasman left them,—ready to shed blood, and delighting in doing it. Tasman, their discoverer, lost a boat's crew of six men through their sudden murderous attack. Cook on several occasions was attacked by them,—sometimes, too, at sea, by their throwing stones at his ship! and smashing his cabin windows, which we can now well afford to laugh at; and Furneaux (Cook's consort on his third voyage) lost, as we have seen, a whole boat's crew of "ten of the best men of the ship," by the natives of Queen Charlotte Sound, who, besides killing, ate them. These were the same tribe, or their neighbours, as those who had killed Tasman's crew. Their treacherous attack the year before on Marion and his crew in the Bay of Islands, in which they killed the commander and twenty-eight of his men, showed clearly their character towards Europeans, who were their benefactors, while the full information obtained from Cook as clearly showed their character towards each other. The first few natives whom he took on board his ship by force at Poverty Bay (after killing four of their companions) begged hard *not* to be landed by him at a place in the Bay only a few miles from whence their canoe had come, lest they should be killed by their own neighbours! Speaking of them generally, he also says, "If I had followed the advice of all our pretended friends, I might have extirpated the whole race; for the people of each hamlet or village, by turns, applied to me to destroy the other." Such being their known fierce character, discovery and other ships generally avoided them, and they were left to their old practice of destroying one another; until towards the end of the eighteenth century, when, owing to the colonization of New South Wales, they

were again visited by Europeans and brought a little into notice. During the last ten years of the century vessels occasionally visited the coast, and in 1794 the two natives who had been taken to Norfolk Island were returned, with pigs, potatoes, maize, and other useful seeds, which they assiduously cultivated.

60. *From the year* 1800 *to the year* 1840.—The beginning of this century first found the New Zealanders visiting the European colonies. Te Pahi and his five sons visited New South Wales, to which place the father again returned in 1808. In 1806 Moehanga visited London, whither also Matara, one of Te Pahi's sons (who had been to New South Wales) went in 1807, and Tuatara in 1809. Matara, while in England, was introduced to the Royal Family; and all returned to their native country laden with presents. In 1815 a chief named Maui visited England, followed, in 1818, by two others, Tui and Titore. During these years the New Zealanders, having had the worst propensities of their native character inflamed, were active in seizing ships and murdering their crews, among which the "Boyd" at Whangaroa, the "Agnes" at Tokomaru, a whaler at Whanganui, and the "Sydney Cove" at South-east Cape, may be noticed. Every ship approaching the coast had boarding-nets for protection. Love of murder and greed for plunder stirred up the coast natives generally to be on the watch for prey, while the Europeans sometimes retaliated by shooting or encouraging the shooting of "a race of treacherous cannibals." In 1820 the two Ngapuhi chiefs, Hongi and Waikato, also visited England, returning to New Zealand the following year. Hongi brought back with him a large amount of arms and ammunition, which enabled him and his allies to commit much wholesale slaughter. The Ngapuhi (or Bay of Islands) tribes, being well armed with muskets, revelled in destruction, slaying thousands at Kaipara, Manukau, Tamaki, the Thames, the interior of Waikato on to Rotorua, and even to Taranaki; and they also came in their canoes so far south as Ahuriri, in Hawke Bay, remorselessly destroying everywhere as they went. Not content with this, they subsequently turned their arms against themselves and the tribes in their neighbourhood, where eventually Hongi himself received the wound which caused his death. The tribes further north were also fighting against each other; only ending in the Rarawa destroying the Aopouri, who were very numerous about the North Cape. Te Wherowhero, at the head of his people, was slaughtering for many years on the West Coast, from Taranaki to Whanganui and Entry Island; Te Waharoa and other chiefs, in the interior and overland to Hawke Bay; the Rotorua tribes in the Bay of Plenty; and Te Rauparaha exterminating in the neighbourhood of Cook Strait and along the east coast of the South Island. From 1822 to 1837 was truly a fearful period in New Zealand. Blood flowed like water.

There can be little doubt that the numbers killed by the New Zealanders, in their many sanguinary battles and surprises during this period of forty years throughout all the New Zealand Islands, together with those who also perished in consequence thereof, far exceed 60,000 persons. Nothing is more erroneous than to suppose that the introduction of firearms made their wars less sanguinary. Such a view is a very partial and mistaken one, and only made by those who have not had the opportunities of knowing the truth. During the last three years, however, of this period there was very much less fighting than in any three previous years of the same; and missionaries and instruction, commerce and trade, became daily more valuable in their eyes. Several New Zealanders early became very good sawyers and carpenters. In 1836 a few made excellent window-sashes, dove-tailed boxes, and even cedar writing desks, while at least one, whom the writer knew, was in 1835 the mate of a whaler, and was very much liked as an officer.

61. *From* A.D. 1840 *to the present time,* 1865.—During this quarter of a century the natives as a race have become nominally Christian. From 1840 to 1852 they eagerly sought for Christian and other instruction, often submitting to great privations and hardships in seeking after it. They also cultivated wheat, &c., very largely, increasing in quantity every year, although in 1845, and again in 1846, small portions of them were fighting against the Government. Hitherto, however, they have been written of as they *were:* now they will have to be considered as they *are.* They have sought for and obtained everything the European could bring; but while they became rich in foreign they became poor in domestic wealth,—yearly more and more idle and discontented, and careless in Christian observances, in schools and in morals. In 1854 they formed an anti-land-selling league, and soon after set up one of themselves as "King!" Their houses are now wretched huts; their canoes are almost entirely gone; their far-famed and useful nets they have ceased to make; and their cultivations, even of their own esteemed roots, are not of one-eighth the extent they formerly were. Their few children (baptized) are growing up in idleness, without being taught to read and write, though mostly clothed and sometimes gaudily dressed in European costume. Their drunkenness, idleness, and greediness are painfully increasing, and many bad habits, formerly unknown, have been acquired, and, like the introduced weeds, grow luxuriantly. It cannot be denied that in many places the savage has been spoiled, and the civilized man is not yet formed. And how to do this is a very difficult task, seeing that from the very beginning the New Zealanders have ever had the fatal quality or fatality of turning honey into gall—of drawing ill from every good thing. Many of them are now engaged in a murderous war against their best friends, the colonists; in which war, begun in 1860, upwards of 1,000 have already

perished; while, to crown the whole, or to accelerate "the evil day" for their race, they have largely consented to abandon Christianity, and again to take up with a disgusting heathenish fanaticism in its stead!

62. It has been stated in this essay that the natives were formerly in great numbers. This is true, but it may need explanation. They were formerly in great numbers, (1) considering the area which they inhabited; and (2) comparing their former with their present sparse population. Whether they were numerically more when Tasman discovered them (1642) than they were when Cook first saw them (1769), is perhaps beyond our research. The writer, however, is inclined to believe they were many more in number at the time of Tasman's visit than they were at the time of Cook's, at least in the South Island. This, he thinks, may reasonably be inferred from the two following facts:—(1.) The natives coming off to attack Tasman's ships "in eight canoes," and immediately after, on seeing him under sail, to follow him "with twenty-two more boats put off from the shore;" these latter were double canoes. And (2) the men in them, Tasman says, "wore their hair tied up on the crown of the head, like the Japanese, *each having a large white feather stuck upright in it*," a sure sign they were chiefs or free men. Although Cook was subsequently several times at anchor in that very neighbourhood, he never saw there anything like such a number of natives, canoes, or "boats," nor could he obtain any traditionary information respecting Tasman's visit, a highly pregnant fact. Dr. Forster, who accompanied Cook on his second voyage, supposed the population to be 100,000, *although he never saw any of the populous parts of the North Island*; since when, down to 1840, it has been variously estimated at from 150,000 (by Nicholas in 1814) to 80,000. Forster's estimate is believed, by the writer, to have been too low, because Cook himself, in all his voyages, only saw the natives who were inhabiting a portion of the sea-coast, and in particular those spots where he anchored. He saw *none* on the *whole* west coast of the North Island, which he therefore believed to be uninhabited, and, of course, none of the numerous tribes inhabiting the interior. In 1834 the missionaries had very good data for believing that from the Bay of Islands northwards there were 7,000 fighting men;—are there more than one-seventh of that number to be found there now belonging to those tribes? In 1847–8 the writer of this essay collected, with much pains and care, an exact census of the natives living between Wairarapa and Ahuriri (Hawke Bay) inclusive; going to every village, and seeing every individual native himself (and this two or three times); their number then amounted to 3,704 persons, divided among forty-five *ascertained* tribes and sub-tribes. At present (leaving out the immigrant natives since arrived from Manawatu, Waikato, Taupo, and

the Bay of Islands, and also strangers) the population of the same district is under 2,000, or less than two-thirds of what they were seventeen years ago. Children are every year becoming fewer. Marriages are rarely fruitful. The seven principal chiefs of Ahuriri (including Te Moananui, lately deceased) are all without children, with the exception of Te Hapuku; and of four of his sons married, three are still childless. Mr. Fenton, from an accurate census* of a portion of certain tribes in the Waikato district, has clearly shown that the decrease among them in fourteen years (1844–1858) was at the rate of nineteen per cent. Another table,* also compiled by Mr. Fenton, showing the numbers of the natives of the Colony of New Zealand in 1858, gives the following :—

	Males.	Females.	Total.
North Island	29,984	22,993	52,977
South Island	1,326	957	2,283
Stewart Island and Ruapuke	110	90	200†
Chatham Islands	247	263	510
	31,667	24,303	55,970

Unfortunately at the present time there is no means of accurately showing the difference on the whole of New Zealand; still this may be done for certain isolated districts :—

	Males.	Females.	Total.
The Province of Nelson (including Marlborough) had in 1855	692	428	1,120
The same in 1864	—	—	980
Decrease	—	—	140
The Provinces of Otago and Southland (including Ruapuke and Stewart Island) had in 1852	382	327	709
Ditto in 1864	217	179	396
Decrease	—	—	313
The Chatham Islands in 1859	247	263	510
Ditto in 1861	—	—	413‡
Decrease	—	—	97
"Middle Whanganui," 1859	—	—	2,210
"Central Whanganui," 1864	—	—	1,417§
Decrease	—	—	793
Rotorua, the Lakes, and Maketu, 1859	1,210	1,050	2,260
Ditto, 1864	1,023	742	1,765§
Decrease	—	—	495

* *Blue Book, N.Z.,* 1859.

† Estimated.

‡ *Government Gazette,* January 14, 1862. Mr. W. Seed also gives, "Maoris, 413, of whom 24 are children; Morioris, 160; half-castes, 17."

§ Kindly furnished by Hon. Mr. Mantell, Native Minister. The Rotorua return officially said to be "incomplete."

With the exception of the return for Otago and Southland, and also that for the Chatham Islands, the foregoing can scarcely be depended on, owing to the vagueness of the Whanganui return, the "incompleteness" of the Rotorua one, and the recent numbers in the Nelson one, being only estimated by Mr. Mackay. The return for Otago and Southland (which appears to have been each time very accurately and satisfactorily taken—in 1852 by Mr. Mantell, and in 1864 by Mr. Clarke) shows the greatest decrease! but here it should be noticed, that the last return (1864) also shows 125 half-castes, *i.e.* 72 males and 53 females; of whom some probably had not been included by Mr. Mantell in 1852. Mr. Seed accompanies his Chatham Islands return with the following remarks:—"From this return it will be seen the natives must be rapidly on the decline. At Kaingaroa and the adjacent villages, 34, nearly all adults, have died since 1856, and only 17 have been born in the same period. Several years ago the Bishop of New Zealand took a list similar to the one I obtained, and then the natives, I am told, numbered over a thousand." It may reasonably be doubted whether the whole Maori population at present number 50,000. Appended is a table, copied by the writer from recent official documents in the House of Representatives, showing the numbers of the natives, the principal tribes, tribal boundaries, and geographical position in the North Island; it can scarcely, however, be wholly relied on for perfect accuracy, yet in all its main features is correct.

63. The causes of their very rapid decrease might here be properly shown, but such can only be done very briefly. The writer believes that *many* separate causes have all combined to bring about this sad state of things; not a few of which are nearly or wholly unknown to or overlooked by those who have hitherto written on Maori statistics.—(1.) Their own prevailing strong propensities, implacability and revenge; hence their love of war, murder, and pillage; in their exterminating wars mercy was never shown—the helpless and (to the victors) valueless were struck down and slain in heaps. Besides the actual slaughter, they were always wearing themselves out in preparing arms and building forts on high hills; or, more lately, in working day and night to obtain flax, &c., wherewith to purchase firearms, and in building new forts on low lands. In this half-harassed state many children and weak persons perished through want of proper rest, care, and food. (2.) The increasing number of small tribes also increased their feuds. (3.) Their immorality with foreigners, especially shipping. (4.) Consequent infanticide (before birth, fœticide) and sterility, to an extent which no writer has yet correctly conceived. (5.) Sorcery. (6.) New diseases, especially epidemics, including the *rewharewha* of forty-five years back, the measles, hooping-cough, influenza, &c. (7.) The unlimited

use of tobacco, and its many substitutes, *and its many attendant evils,* especially by the young and females. (8.) Carelessness as to regular food and wet *thin* clothing, bringing on early disease and death. (9.) Their exposing themselves in serving and working hard for others, whether in whale ships at sea, whalers on shore, missionaries, settlers, &c. (10.) Their labouring beyond their strength in their greed after European goods, to the continual neglect of themselves; in scraping flax and in raising potatoes, wheat, &c., for sale to Europeans, and their bringing the same, with much labour, difficulty, and exposure, to market. (11.) Their selling all their best, including all their tame pigs, and keeping only the refuse food for themselves, being stimulated thereto by the price given. (12.) The introduction and rapid increase of the horse, strange as it may appear, has certainly been very injurious to the native, through their abuse of that noble animal; it proving a great means of calling them constantly away from their homes and cultivations, especially the young and strong (thereby leaving the work to be done by the old and weak), tending to habits of idleness, wandering, and dissipation, and of consequent exposure to hunger and wet in travelling about, and of want, &c., at home. (13.) Many minor causes attendant upon their transition state and the incoming of the settler, such as the abandoning of their own rough and dry flax garments for the thin European ones, frequent exposure to bad weather, sleeping in wet garments, and often in cold damp houses, going in crowds to a distance to large gatherings (whether of their own or of the Europeans—mission or government), to see new arrivals, or things, &c., &c., and there badly provided for, and always much suffering in and after returning to their homes. The writer has long been convinced that the amount of mortality arising from the causes mentioned under heads seven to thirteen has been truly frightful—stealthy, unnoticed, and slow, but ever sure.

64. Apart from their numerical decrease, is the great decline of their power and influence, whether we consider the race or a tribe, a family or a single chief; and that not only among Europeans, but also among themselves. This has, in a measure, been caused by their decrease in numbers, but not wholly or mainly so. The sudden termination of polygamy, slavery, and the taboo (*tapu*) system, without anything to replace the last two, has been the chief cause of their decline *as a people* in *status* and influence. Had some comprehensive mind early arrived in New Zealand, to point out to the *first* missionaries the sure consequence of the utter and sudden removal of what then upheld the tribes and nation, unless renewed with something equally strong and equally suitable, more cautious and better adapted means for preserving them might have been used. However distasteful these three things might be to an European and Christian, they

were the life of the New Zealander. They were perhaps the three rotten hoops round the old cask, but they kept the cask together. Slavery (though an ugly word) might have been ameliorated in New Zealand, where its form was mild compared with what it was in ancient Rome, even as it was both there and in Asia Minor by Paul. Polygamy might have been far better dealt with, for the time, according to the lenient dealings of God with the Jewish fathers, and with New Testament teaching, than according to ecclesiastical dogmas. And much of the taboo might have been softened and altered, and borne with too for a time, until a better and not altogether distinct scheme, suited to uphold and expand the moral character of the neophyte Maori Christian, had been got ready. An Eastern sage has said, "In time the mulberry leaf becomes satin." The writer of this essay has seen a chief,—a lineal descendant of ancient kings,—whose nod yesterday was life or death, who had several wives, many fine children, and a number of slaves; whose home was full of merry laughing faces, food, and hospitality; he has seen him afterwards a baptized man, without servants or helpers, with little food and less clothing, ashamed and vexed at not having the means to be hospitable; with one weak wife (soon brought to be so through extra daily labour) and three children, for whom he himself had daily to work very hard, and yet could *not* procure for them the fish and birds and pork of former days; while any one of his late slaves was far better off than he. The writer has seen with secret grief that man (and several such) more than once, and he has asked Christianity, "Was there really a necessity for all this?" Very likely, had those notable Maori kings been only gradually altered, and not so suddenly and rudely abolished, and had fitting *short* Christian services obtained instead of wearisome long ones, the principal chiefs, heads of tribes, would have kept their *status*, order would have prevailed, the rising generation would have both known and kept their proper place, the decrease in their numbers would have been considerably less, they would have confidence in the Government, missionaries, and settlers, instead of suspicion; in all probability there would have been now no war with the Government, and the degrading fanaticism which now obtains would never have found support. *Fuit Ilium!* Cook found the New Zealanders healthy, happy, and contented in the midst of all their wars and poverty;—*are they so now?*

VI.—THE FUTURE.

65. Seeing but very little of a cheering nature in the late past and present of the New Zealanders, the mind, ever hopeful, naturally looks forward to the future. But where is the seer who can truly decipher the mysterious signs of the times; much less predict the state and position of the Maori race at the end of another period of twenty years? But why say twenty

years? Less than five years more will complete the century of years since Cook first saw them; how will the last year of that century close upon them? This is difficult to answer, not merely because of the present sad state of the native mind, and of the dismal fatality hitherto attending them; but because of the crotchetty individuals among the colonists themselves;—men, doubtless, who are well-wishers to the Maori, but who (through their own cloistered, high-flying, or crotchetty views, and want of really understanding the native, and *what is good and suitable for him*) have done them more injury (unwittingly) than their bitterest foes. This is the really great obstacle in the way of truly benefiting the Maori; and, judging from the past, it appears to be all but hopelessly insurmountable. The following, however (or something very like it), is believed by the writer to be really needful, in order to a better state of things, and to the conservation of the Maori race:—

I. *Preparatory.*

1. The present war must be ended, and ended *well;* the sooner the better.

2. "Ended well" is to have done so leaving a real salutary impression on the native; that come what will, he will never go to war again with the Government.

3. Their work done, the military must be all withdrawn from New Zealand.

4. The suspicions of the native must be removed; this will be a work of time.

5. The Colonial Government must have the government of the Maori wholly in their own hands.

6. Individuals, especially those in authority, must, for the common good, at once and for ever cease their fruitlessly teasing the native with their fine-spun theories, and their secretly writing to powers and parties at home against the New Zealand Government and the colonists; or, if not, the Government of the day *must* gird up their loins to the task, and put such persons down with a strong hand, and, if necessary, make a public example of them. Above all, pensionaries on the public purse must be taught a useful lesson.

7. All bishops and other ecclesiastics should cheerfully and zealously, openly and privately, support the Government, remembering Paul's teaching, "*The powers that be are ordained of God.*"

8. The Governor, the Government, and the various ecclesiastical bodies and settlers generally, must unite, and be as one in these matters. *The Maori should be able to see this.*

II. *Real: Active.*

9. The present mischievous and costly system of "Civil Commissioners" must be immediately abandoned. The Maori well know it to be an office of *espionage.*

10. The present objectionable system of bribing Maoris (derided among themselves) with gifts and with salaries for work never performed, must be wholly thrown aside. It is directly opposed to the genius of the people, as it is to their advancement, and is the cause of much bad feeling and jealousy. Until this is done, their suspicions and distrust will never be really less.

11. One strict, equal, but lenient law for them as for Europeans, in the *one* Court in all European districts.

12. Good, useful, zealous, loving men, to be stationed as Resident Magistrates in purely native districts—men whom the natives could love, obey, respect, and work with. Such to be obtained from England, if not to be found in the colony.

13. Such magistrates to *itinerate* throughout their districts, say, four times a year, to hold their simple Courts at the principal villages of the sub-tribes; to act in co-operation with the head or heads of the tribe (not, as now, with assuming inferior chiefs and pert loquacious youngsters); and to get reparation for almost all Maori offences, by fines judiciously inflicted. Such a mode of proceeding falls in with the genius of the people, is just and Christian, and is not costly. Their errors among themselves should be dealt gently with; a spirit of love and forgiveness (alas! foreign to our laws) should be inculcated. Insult not their prejudices.

14. The authority of the oldest head chief of a tribe or sub-tribe should be firmly but steadily supported.

15. Maori views—modes of reparation, fines, forfeitures, semi-banishment from the village and tribe, &c.—should be supported and acted on where proper and just, and not our unsuited Draconian laws. A celebrated author says, "Humanity is one of the best fruits of refinement. It is only with increasing civilization that the legislator studies to economize human suffering, even for the guilty; to devise penalties, not so much by way of punishment for the past, as of reformation for the future."*

16. Young persons, of both sexes, should on no account be allowed to be enticed away from their tribe by Europeans; on their being so enticed away, and complaint made, the authorities should interfere, and cause them to be restored, and the abductors severely punished.

* Prescott, "Conquest of Mexico," Vol. I., p. 144.

17. Good, useful, plain, married schoolmasters should be stationed in the various Maori districts; such to be had also from home, through the various Christian and philanthropic societies.

18. Zealous, loving, self-denying European ministers to be placed among them; men contented to serve their great Master in humility. Also to be had from home through the various Christian societies. No hireling, no mere observer of rites and ceremonies. The Maori have had enough of muttered charms and incantations. The young New Zealand Samson is not to be surely bound with green withes.

19. In populous, wholly Maori districts, a religious physician or surgeon should be stationed; to be also obtained from home.

20. Anglo-Maori books should be written and printed for their use; and a really useful Anglo-Maori weekly paper should be established and circulated.

21. Once a year the Governor should meet the assembled chiefs at some principal Maori place to be fixed by them; and once in two years they should be assembled at the seat of government to see the Governor.

22. The sons of the head chiefs, and of others, who may show an aptness to learn, should be sent to England, to be educated at Government expense; but they should not be foolishly and flatteringly educated there as "gentlemen:" rather in a plain, sound Christian way; they should also be taught *useful* arts and trades. Remember Peter the Great.

23. Occasionally one or more of the chiefs of the highest rank and most deserving should be taken to England, to see the sons of the chiefs there being educated, and to be presented to Her Majesty.

24. European gentlemen visiting Maori districts and villages should be careful to demean themselves as such. They should act there as they would in a village at home, or on the Continent.

25. Spirituous liquors should be kept out of all purely Maori districts and villages.

Cook found the Maori happy;—are they happy now? LET US ENDEAVOUR TO MAKE THEM SO.

CONCLUSION.

66. The writer of this essay has no hesitation in expressing his settled conviction that, apart from any spiritual Christian benefit—a subject he has generally throughout this essay carefully avoided—taking all things into consideration, and viewing the matter from a philanthropic as well as a New Zealand point of view, it would have been far better for the New Zealanders *as a people* if they had never seen an European.

———" De duro est ultima ferro.—
—Fugêre pudor, verumque, fidesque;
In quorum subiêre locum fraudesque dolique,
Insidiæque, et vis, et amor sceleratus habendi."
—OVID.

POSTSCRIPT.—At the suggestion of some of his friends, the writer of this essay has deemed it advisable to add that he was first applied to by the Commissioners of the New Zealand Exhibition to write this essay when at Auckland, in December, 1863; and that, as they wished it to be ready in four or five weeks, he began it on his return to Napier in January, and sent it to Otago in February, 1864. This, he thinks, will sufficiently account for the rough and fragmentary appearance of many of its passages.

Napier, 1864.

Native Population, North Island of New Zealand, with Names of Tribes and Boundaries.—(*Corrected to* 1863.)

Name of Tribe.	No.	Area in Acres.	Tribal Boundaries, Geographical Position, &c., &c.
1. Rarawa and Aopouri ...	1858	587,680	North of Hokianga, W. C., and of Mount Camel, E. C.
2. Ngapuhi	5693	2,195,765	North of 36°, W. C., and of Cape Rodney, E. C.
3. Ngatiwhatua and Uriohau	550	1,276,978	North of Manukau, W. C., and of Auckland to Cape Rodney.
4. Ngatitai	77	134,951	South of Auckland, and North of Frith of the Thames.
5. Ngatipaoa	2060	1,266,977	Head of the Thames, across to Katikati, E. C., thence north to Cape Colville.
6. Ngaiterangi	957	396,498	From Katikati to Maketu, E. C., and extending forty miles inland.
7. Ngatiwhakaaue	2367	473,240	Maketu to Waitahanui River, E. C., and inland to the Lakes.
8. Ngatiraukawa	490	2,411,357	Nearly central; at Arowhena, nearly where 38° S. lat. bisects 176° long., and for twenty miles round.
9. Waikato & Ngatimaniapoto	9971		North of Mokau to Manukau, W. C., and about half across the island at 38° S.
10. Ngatiawa, E. C.	1864	1,456,077	Waitahanui River to Ohiwa, E. C., and inland to Mount Edgcombe.
11. Ngatiawa, W. C.	1300	591,425	From 38° 50′ S., W. C., to the Sugar Loaves, and inland about forty miles, including Mount Egmont.
12. Ngatiawa, Waikanae ...	385		A few miles around Waikanae, W. C., and extending inland to the mountain ranges.
13. Ngatiawa, Wellington ...	115	194,908	Near Wellington, extending E. to Rimutaka range and Palliser Bay.
14. Te Whakatohea	1730	361,870	S. of Ohiwa, Bay of Plenty, for thirty miles, and extending inland about fifty miles.
15. Ngatipouri	4365	1,571,760	Cape Runaway, E. C., to Table Cape, and extending inland about fifty miles.
16. Ngatituwharetoa... ...	1850	2,784,000	Centre of island, including Taupo lakes and mountains, from 38° to 39° 30′ S.
17. Ngatitama	90	917,947	Between Mokau, W. C., and 39° S., extending inland about fifty miles.
18. Taranaki	690	276,969	Near Taranaki, W. C., from Sugar Loaves to about 39° 30′ S.
19. Ngatiruanui	1330	1,224,491	From about 39° 30′ S., W. C., to near Waitotara, and extending inland sixty miles.
20. Ngarauru	243	183,249	From Waitotara to near Whanganui, W. C., and extending inland about forty miles.
21. Ngatihau	3360	724,699	From a few miles N. of Whanganui River to Whanganui River, W. C., extending inland about sixty miles.
22. Ngatiraukawa	1203	2,069,161	From Whanganui River to a few miles S. of Otaki, and extending to mountain ranges.
23. Ngatiapa	505		
24. Muaupoko	125		
25. Rangitane	345		
26. Ngatitoa	168		Included in No. 13.
27. Taranaki, Wellington ...	205	201,161	East of Wellington to Palliser Bay and Wairarapa.
28. Ngatikahungunu ...	4839	5,572,989	From Table Cape to Palliser Bay, extending fifty miles inland, generally to the mountains.
29. Te Urewera	400*		Interior: a radius of about forty miles around 38° 20′ S. and 177° longitude.
30. Whanauapanui			From Cape Runaway, Bay of Plenty, E. C., to forty miles N., coast line, and extending inland about forty miles.

* Estimate in 1858.

Note.—W. C. means West Coast, and E. C. East Coast.

PROCEEDINGS.

WELLINGTON PHILOSOPHICAL SOCIETY.

Preliminary Meeting (held in the Legislative Council Chamber).
13th November, 1867.

His Excellency Sir George Grey, K.C.B., President, in the chair.

Mr. R. Pharazyn stated that the object of the meeting was to adopt the resolutions come to by the trustees of the old Society, and to elect officers; also that seventy-four persons had paid subscriptions and become original members of the Society.

The following resolutions were adopted:—

1. That an effort should be made to reconstitute the New Zealand Society on the basis of the old New Zealand Society.

2. That the Society so reconstituted should be incorporated under "The New Zealand Institute Act, 1867."

3. That the rules of the New Zealand Society be adopted, subject to amendment.

4. That all members of the New Zealand Society, all members of the General Assembly, and all other persons who, on or before the 15th of October, shall have signified their desire to become members, shall be entitled, on payment of the annual subscription of one guinea on or before the 31st of October, to be placed on the list of original members of the reconstituted Society.

5. That His Excellency Sir George Grey be requested to act as President of the New Zealand Society.

6. That His Honor the Superintendent of Wellington and His Lordship the Bishop of Wellington be Vice-Presidents of the Society.

7. That the following gentlemen be the Council of the Society:—Messrs. R. Hart, A. Sheath, W. T. L. Travers, J. C. Crawford, R. Pharazyn.

8. That Mr. R. Pharazyn be appointed Honorary Secretary and Treasurer of the New Zealand Society.

9. That the Council be authorized to revise and prepare rules to be adopted at a general meeting of the Society, to be held on Wednesday, the 4th of December, 1867.

SPECIAL MEETING. 30*th November*, 1867.

The Bishop of Wellington, Vice-President, in the chair.

Dr. Featherston, Vice-President, stated that the meeting was called for the purpose of electing a Governor of the New Zealand Institute, under the Act.

On the motion of Dr. Featherston it was resolved, "That Mr. J. C. Crawford be elected a member of the Board of Governors, under "The New Zealand Institute Act, 1867."

On the motion of Mr. Crawford it was resolved, "That with a view to settle any doubts on the subject, it is now declared that the President and Vice-Presidents are *ex officio* members of the Council of the Society."

On the motion of Mr. C. J. Pharazyn it was resolved, "That all persons paying the annual subscription before the 31st of December, 1867, be included in the list of original members of the reconstituted New Zealand Society."

On the motion of Mr. R. Pharazyn it was resolved, "That the resolution for meeting on the 4th of December be rescinded."

The rules, as amended by the Council, were then read seriatim, and passed with amendments.

FIRST ANNUAL MEETING. 31*st January*, 1868.

The Bishop of Wellington, Vice-President, in the chair.

Minutes of last meeting were read and confirmed.

The Secretary read his report, stating that ninety-five persons having paid their subscriptions before the end of last year, appear on the list as original members, and that several other persons had expressed their intention of joining the Society.

The following printed papers were laid on the table by the Secretary:—

Rules of the New Zealand Society, reconstituted 1st November, 1867.

Presented by Dr. Hector:—

Colonial Museum Report, 1866-67.

Geological Report on the Lower Waikato District, 3rd June, 1867, by Captain Hutton.

Geological Report on the Thames Gold Fields, by Captain Hutton, 23rd September, 1867.

First General Report on the Coal Deposits of New Zealand, by Dr. Hector, October, 1866.

Abstract Report on the Progress of the Geological Survey of New Zealand during 1866–67, by Dr. Hector.

On a new Form of Mudfish from New Zealand, by Dr. Albert Günther, F.R.S. Extracted from the Annals and Magazine of Natural History, for November, 1867.

Notes on the Moa Remains in the New Zealand Exhibition, 1865, by Dr. Hector. Extract from the Proceedings of the Zoological Society of London.

Presented by W. Buller, Esq. :—

Notes on New Zealand Insects, by W. Buller, F.L.S. Extract from the Zoologist, August, 1867.

1. "On Building Materials for New Zealand," by J. C. Crawford, F.G.S.

Abstract.

The author commenced by pointing out the causes which have led to the general use of wood for building purposes in the towns of New Zealand, and the disadvantages of this material. In the City of Wellington, corrugated iron is now used extensively for stores; but although as a partial safeguard against fire this material has an advantage over timber, in other respects it is subject to similar and other disadvantages, among which the effects of temperature are greatest. In considering what is the best permanent material for building in Wellington and other towns similarly situated, the following points must be kept in mind :—1st, The risk from earthquakes; 2nd, the prevalence of high winds. To guard against the first danger the building ought to be, if possible, monolithic. To lessen the wear and tear caused by the action of high winds, the building and its roof should be as low as is consistent with the required accommodation. A wooden building may be considered an approach to a monolith, except that its chimneys are detached, and consequently dangerous; but the narrow walls and high pitched roofs in vogue give great power of leverage to high winds. It will be found impossible to make a monolithic building of stone or brick, and the best material to meet our requirements seems to be concrete. This material has lately come into extensive use in Europe, and more particularly in France, where it is stated to have been found much stronger than stone, and much cheaper than either stone or brick. It was first applied to the construction of bridges and sewage drains, then to church architecture, and finally to dwelling-houses. There are many reasons for the adoption of concrete as the chief building material in Wellington. (1.) There is a deficiency in the supply of the ordinary materials, with the exception of timber. (2.) The power of making a building monolithic would be an immense protection from the risk of damage by earthquakes, and its additional weight and

strength would obviate shaking by wind. (3.) If the flat roof be introduced, the leverage power exercised by the wind would be reduced to a minimum. (4.) The supply of sand and gravel is ample in and near the city. The required materials for the cement can be readily procured in unlimited quantities from the east coasts of this and of the Southern Island. Mr. Crawford cited the reports of the Commissioners on the Paris Exhibition, and articles in the *Building News*, in support of his statements, and also quoted from an article in the November number of the *Fortnightly Review*, entitled "The Future of London Architecture." The writer of this article states the concrete to be formed of gravel combined with hydraulic mortar and sand. According to experiments made in France, concrete formed with a proportion of five parts of cement to two of lime and thirty-six of sand, has an ultimate strength of four tons to the inch, being twice that of Portland stone, eight times that of Bath stone, and sixteen times that of brickwork, as determined by the experiments undertaken by the Institute of British Architects in 1863; and the cost of such concrete walling is only half that of brickwork.

The Secretary asked Mr. Crawford if he referred to the chemical or simply the mechanical process of making artificial stone? because he understood there was a chemical mode by which artificial stone was made, somewhat in the way in which natural stone is formed.

Mr. Crawford imagined that in the formation of any concrete for building purposes, the means used would be both mechanical and chemical. The concrete, however, the use of which he advocated, was not a chemical compound like Ransome's cement, but one of a much cheaper character, being composed of ordinary building materials, such as lime, sand, and gravel.

Mr. Sheath thought the principal question that would have to be considered was, whether buildings of concrete could be erected as cheaply as those of timber. The answer to this question would probably determine whether concrete would be brought into general use in this colony or not.

The Chairman asked whether the concrete had been tried in countries subject to earthquakes.

Mr. Crawford said he believed it had been principally used in France and England.

The Secretary read the following papers by Mr. Skey, Analyst to the Geological Survey of New Zealand, detailing some of the most interesting results of the work performed in the Colonial Laboratory during the last few weeks.

2. "On the Amount of Silver in Gold from Makara," by W. Skey.

An analysis showed it to contain 13·60 per cent. of silver, a rather large proportion, making it approximate in this respect to the least argentiferous gold from Coromandel, but having an excess of silver over the Whakamarina gold.

3. "Results of an Analysis of the fixed Constituents of Rain Water collected from a Galvanized Iron Roof," by W. Skey.

The analysis was undertaken more especially with the view to determine the quantity of zinc and arsenic present.

One gallon of the water yielded 1·16 grain of matter, fixed at a dull heat, which analysis divided as follows:—

Silica	·656
Sesquioxide of iron	·224
Alumina	·112
Lime	·048
Magnesia	Traces
Alkalies	"
Oxide of zinc	·120
Carbonic acid	Traces
Hydrochloric acid...	"
	1·160

4. "On supposed Coal from the Auckland Islands," by W. Skey.

This proved to be crystalline hornblende.

5. "On Extract of Towai Bark," by W. Skey.

The bark was furnished by Mr. Grayling, of Taranaki.

ANALYSIS.

Water	21·5
Catechuic acid	42·5
Tannic acid...	31·1
Lignin	1·8
Gum and undetermined matter	3·1
	100·

These results show that the substance is chemically allied to the gum kino of commerce. The towai is the *Weinmannia sylvicola*, and is closely allied to the tree that affords that gum, so that their value is about equal.

6. "On the Water from the Whangaehu River, Onetapu, Auckland," by W. Skey.

The Whangaehu River rises from within a few yards of the source of the Waikato, on the eastern slopes of Ruapehu Mountain, in the interior of the North Island, and flows into the sea south of the Wanganui River. Its waters are intensely bitter, and of a milky colour for many miles from the source; the bitter taste of the mineral substance which the water holds in solution is quite appreciable at the mouth of the river after a course of about seventy miles.

It was down this river that the wonderful avalanche of ice and mud forced its way from Ruapehu to the sea in 1863, scouring out the bed of the river, destroying a bridge, and doing great damage to the native cultivations. The cause of the avalanche may no doubt be attributed to a sudden escape of vapours from the same volcanic source that gives origin to the mineral waters.

A specimen of the water from near the source of the river, forwarded by Mr. Gilbert Mair, R.M., has been analyzed, with the following results:—

Water persistently turbid, from the presence of clayey matter; taste, very sour. Contains the constituents of potash alum, with the addition of a little chloride of magnesium and protochloride of iron. The total of fixed matters obtained from 2 oz. of the water was ·370 gramme, or at the rate of 456 grammes per gallon.

7. "On Phosphate of Lime for Manure," by W. Skey.

The analysis showed this to be a really valuable manure, admirably adapted from its richness in phosphates, and especially in soluble phosphates, to supply growing crops with the one thing which is most useful, viz. phosphoric acid.

This manure was sold by Messrs. W. and T. Hurst, of Auckland, and was forwarded by Mr. Ryburn, of Auckland, for analysis.

8. "On Coal from Preservation Inlet," by W. Skey.

The specimen was forwarded for examination by Mr. Eccles, of Dunedin.

It appears that this coal belongs to the series of hydrous or brown coals, and, as is usual with such, its proportion of sulphur is very large. As a fuel, therefore, it ranks in value with the Clutha and Saddle Hill coals of the South Island. The following is an analysis:—

Water	16·20
Fixed carbon	41·23
Hydro-carbon	29·43
Sulphur	5·40
Ash	7·74
	100·

Percentage of water upon carbonaceous matter, 21·29.

9. "Remarks on some of the Coleopterous Insects which injure Trees in the Neighbourhood of Wellington, by R. H. Huntley.

Abstract.

After explaining upon what trees the various insects feed, the author pointed out that it is almost impossible to get at the eggs or larvæ to destroy them; although in the latter state the insects are most mischievous, because their presence is not noticed until the withering of the leaves shows that they have done their work. Numbers of small birds, to destroy the perfect insects before they have time to lay their eggs, seem to be the only remedy. A small brown beetle, which makes its appearance in the apple trees when the apples are about the size of cherries, is a great pest; it eats the skin, particularly near the stalk, and the apple falls. Mr. Huntley first noticed it four or five years ago, and since that time its numbers have enormously increased. In his orchard, this spring, the dropping of these insects was like the rattle of a shower of rain on the leaves of the trees. They were in millions, and did great damage. He has tried dusting with lime, and, on particular trees, tobacco water, soapsuds, and sulphur, but without effect. The beetle, however, does not confine its ravages to apple trees, but attacks gooseberries, strawberries, cherries, and, to a small extent, peaches. It eats the leaves of all these, and of most forest trees, and the petals of most flowers, particularly roses and geraniums. Mr. Huntley has not been able to find the larvæ of this insect, which comes and departs with equal suddenness; but suggests that if the larvæ be on the ground, they might be destroyed by the use of ammonia water from gasworks.

The author laid before the meeting specimens of the insects referred to in the paper.

Mr. Travers directed attention to the necessity of the mould imported with plants being either calcined or destroyed immediately upon its arrival, as it often contains the larvæ of destructive foreign insects.

The Secretary read the following papers:—

10. "On a proposed Improvement in the mechanical Separation of Liquids from each other in certain Analyses for Alkaloids," by W. Skey.

Abstract.

In certain analytical operations, more especially where alkaloids are sought for in cases of suspected poisoning, it is necessary to remove liquids floating upon others. At present this object is effected, or rather partially effected, by manual dexterity. As a substitute for this method, Mr. Skey proposes to expel the ether by means of mercury, in some such way as this: The stopper is removed from the bottle containing the two fluids, and a damp cork hollowed out at its narrow end substituted, inserted into which are two tubes, of small bore, one a straight tube, long enough to reach deep into the bottle, and to project a few inches above. The other—the delivery tube—is U-shaped, and just caps the hollow of the cork with one of its legs. The long tube is tightly connected with a tap, communicating with a reservoir of mercury above. The mercury then being turned on, the whole, or practically

the whole, of the ether solution is passed through the U-shaped tube, uncontaminated with any of the heavier saline fluid beneath. By regulating or cutting off the supply of mercury, it is easy to take determinate quantities of ether, measured if desired by drops, as discharged from the delivery tube. The object of having the mercury tube narrow is, that the ether may be forced along with the rest, on the principle of the mercurial air pump.

The author illustrated this paper by experiments.

11. "On the Solubility of the Alkaloids generally in certain Hydrocarbons, and the proposed Substitution of Benzol for Ether in the Separation of certain of the Alkaloids," by W. Skey.

ABSTRACT.

When strychnia or veratria is warmed for a short time with benzol, kerosine, or turpentine, it dissolves to a large extent, but only a small deposit of the alkaloid takes place when the solution is cooled. When an aqueous solution of strychnia and chloride of calcium, or hydrate of potash, is agitated with benzol or kerosine, it seems entirely to attach itself to the oil. To obtain these results it appears necessary to employ heat in the one case, and powerful affinities of some foreign substance in the other—affinities which, of course, must not extend to the alkaloid itself. Nicotina is also extracted from an aqueous alkaline solution by benzol or benzine, and, analogically, it may reasonably be assumed that the greater part of the remaining alkaloids are also soluble therein, under certain conditions. The alkaloids mentioned can be completely removed from the several solvents by re-agitation with hydrochloric or sulphuric acids, &c. The solubility of these alkaloids in benzol, Mr. Skey proposes to turn to account, by substituting the latter for ether in those methods of analysis where ether or ethereal solutions are in use as mediums for their separation from organic matter. The great advantage to be gained by the substitution would be derived from the fact that water has no chemical affinities for benzol, while for ether it has sufficient affinity to interfere with its use.

12. "Notes on the proposed Substitution of Cyanide of Potassium for Sodium, in certain amalgamating Processes for the Extraction of Gold from metallic Sulphides, &c.," by W. Skey.

ABSTRACT.

The results of some experiments (not, however, fully completed), made by Mr. Skey, for the purpose of ascertaining the value of cyanide of potassium as a preventive of the flouring of mercury used for the extraction of gold, shows that cyanide of potassium does certainly prevent the sickening and flouring of mercury, or its tarnishing and granulation; but as cyanogen appears capable of dissolving metallic mercury, and is certain to be liberated from cyanide of potassium by carbonic acid, always present, it is question-

able if cyanide of potassium could ever be profitably substituted for sodium as a preventive to the flouring of mercury. Even if there did not seem to exist this affinity of cyanogen for metallic mercury, there is this also to be considered—that the sodium puts the mercury in an electro-positive state, thus increasing its affinity for gold; while the effects of cyanide of potassium appear to be entirely confined to its property of keeping the surface of mercury bright.

Copies of the following papers, which had been forwarded by Mr. Skey for publication in the *London Chemical News*, were laid on the table:—

On the Solubility of Amorphous Silica in Ammonia.

On the Production of a fragrant volatile Substance from Resins by Oxydation, &c.

On the Absorption of Arsenic, Arsenious and Tungstic Acids, from Solution, by Charcoal.

On the Coagulation and Precipitation of Clay from Water by neutral Salts generally.

On the Formation of a Series of double Sulphocyanides of certain of the Alkaloids with the Metals Tin, Zinc, Mercury, Molybdenum, Iron, Platinum, and Gold.

Mr. Crawford read the following papers, which had been transmitted by Dr. Hector:—

Report on the Geology of the Country between the Lower Clutha and Mataura Rivers, by John Buchanan, of the Geological Survey Department. (See Geological Survey Reports, 1868.)

Report on the Geology of the Great Barrier Island, by Captain F. W. Hutton. (See Geological Survey Reports, 1868.)

SECOND MEETING. *7th April*, 1868.

The Bishop of Wellington, Vice-President, in the chair.

The Chairman explained the course that would have to be adopted to obtain the incorporation of the Society, under the rules adopted by the Governors of the New Zealand Institute; and read the by-law passed by the Council.

Resolved, "That the name of the Society be changed, and that it be called henceforth 'The Wellington Philosophical Society.'"

Resolved, "That the Society be incorporated with the New Zealand Institute."

Resolved, "That the Chairman of this meeting and the Secretary of the Society be authorized to sign and forward to the Governors of the Institute the certificate required under Rules Nos. 1 and 2."

Resolved, "That one-sixth part of the annual income of the Society be contributed towards the extension and maintenance of the Museum and Library of 'The New Zealand Institute.'"

Resolved, "That every member of the Society be entitled to admit, by personal introduction, two friends to the ordinary meetings of the Society."

The business of a special character being concluded at half-past eight o'clock, the proceedings of the ordinary quarterly meeting commenced.

The Secretary read his report.

1. "Notes on the Earthquake felt in Wellington on the 1st of February, 1868," by the Bishop of Wellington.

ABSTRACT.

The author commenced by stating that he thought it might be interesting to keep some record of the earthquakes felt in this locality and neighbourhood.

The earthquake referred to was a smart shock felt in Wellington, at 8 a.m. on February 1st, 1868. It appeared to come from the north-east, and threw down a picture leaning against the north-east wall of his house. Another shock occurred thirteen seconds after, which was the sharper of the two. Mr. Ludlam, at the Hutt, observed the pines in his garden bow down from south-west towards north-east. The shock was not felt much by persons inside his house. A rumbling noise was heard at the time.

Residents at Paikakariki (west coast), Otaki, Wanganui, and Taranaki, felt the shock, but only one at the same hour as it was felt at Wellington, and all agreed that it came from the seaward.

In Marlborough an earthquake shock was felt, preceded by a rumbling noise. It seemed to come from a south-west direction, and the earth during its progress could be plainly seen to move. The oscillations of the houses were visible to those outside, but little actual damage was done. The earthquake was the severest that had been felt for some years, and lasted a few seconds.

At Lyttelton the shock was reported to have been felt at about ten minutes to eight o'clock; it appeared to run from west to east, and lasted about three seconds.

At Nelson, a rather smart shock was felt at about seven minutes before eight. It was preceded by a slighter motion. The movement, the apparent direction of which was from north-east to south-west, was felt more on low-lying grounds than on higher lands.

2. "On Boulders and travelled Blocks in the Wellington Province," by J. C. Crawford, F.G.S. (*Transactions*, p. 19.)

3. "On New Zealand Agricultural Implements," by R. Pharazyn, F.R.G.S.

This paper was principally in reference to a newly-invented Fern-cutting Machine, a model of which was exhibited.

4. "On a new *Chiton* from Wellington Harbour, by W. T. L. Travers, F.L.S.

5. "On a Fluke from the intestinal Canal of a Snapper," by W. T. L. Travers, F.L.S.

Specimens of both were exhibited.

6. "On Suggestions and Experiments on the Smelting of Taranaki Ironsand," by R. Pharazyn, F.R.G.S.

Abstract.

The author had frequently heard it stated that one of the most serious difficulties in producing iron or steel from the well-known titaniferous ironsand of Taranaki, was owing to its mechanical condition, which made it exceedingly troublesome to smelt, the whole mass of iron in a furnace falling to the bottom like a fluid, thus preventing the blast from acting properly upon it.

It appeared to him that a remedy might be found by making, as it were, an *artificial* iron ore of the sand, and thus smelting it in the ordinary manner. He had tried some simple blow-pipe experiments, and found that although he could not obtain a temperature sufficiently high to melt the ironsand, yet it was easy to produce an ore compact and hard enough to stand considerable pressure. By mixing one-third in bulk of ordinary impure sandy clay with two-thirds in bulk of ironsand, at a full red heat, a hard ironstone was produced. This mixture of binding materials with the ironsand would in no way interfere with the subsequent process of manufacture, but might indeed be of assistance, since it is well known that about half as much limestone as iron, by weight, is used as a flux to promote the fusion of ordinary iron ores.

Mr. Pharazyn quoted from Percy's "Metallurgy" on the composition and qualities of slags and fluxes, and the way they aid in the extraction of particular metals. One of these consists of nearly the same combination of materials usually found in poor clays, with lime added, namely,—

Silica	38·
Lime	50·
Alumina	6·

and a small percentage of magnesia and manganese. In Muspratt's translation of Plattner's work on the blow-pipe, a tabular view is given of the action of the different fluxes employed in what may be called *smelting works on a small scale*, from which it would be easy to arrive at some conclusion as to what might best be used in extensive operations. In the "Jurors' Reports of the New Zealand Exhibition, 1865," p. 452, a tabular statement of the analyses of nine of the N.Z. black sands is given, from which it appears that the Taranaki ironsand contains no less than 56 per cent. of metallic iron.

ANALYSIS.

Magnetic iron (oxides)	71·00
Titanic iron	8·00
Siliceous matter	21·00
	100·

A very large proportion; whilst the percentage of titanium is very appreciable, being about 1·5 per cent. Whether this quantity is sufficient to produce all the wonderful effects attributed to it is doubtful. It is certain that remarkably good steel is produced from the ironsand alone, and the only question is, whether it can be economically produced in this country, which will depend chiefly on the supply of fuel obtainable near those places where the sand is found.

It cannot be doubted that the freight saved would yield a very handsome profit to the manufacturer, and enable him to compete with the European ironmaster here, even if he should not be able to undersell him in his own country.

Third Meeting. *28th July*, 1868.

J. C. Crawford, F.G.S., in the chair.

The Chairman explained that, during the session, a series of addresses on subjects of interest would be delivered, under the auspices of the Governors of the New Zealand Institute; and that a course of four lectures on the geology of New Zealand would be delivered by Dr. Hector.

The Chairman also informed the members that since their last meeting steps had been taken to incorporate their Society with the New Zealand Institute, and that a favourable reply had been received. He then explained the privileges they would enjoy as members of the Institute, and the rules to which they became subject. He urged the members to enter into an honourable rivalry with the other local institutions in the colony, and to show that they were not to be surpassed in the excellence of their papers and lectures on matters of scientific interest. It was especially desirable that all classes should be enlisted in the interests of science, because a careful observance of facts in different quarters would, if properly reported to the Society, be of great value. Several gentlemen in other provinces had subscribed to their Society, but as they now possessed local institutions of a similar character, it was considered unfair to call upon them to contribute, and it had therefore been proposed to refund their subscriptions.

The Secretary, Mr. R. Pharazyn, read a special report respecting the arrangements that had been made since joining the New Zealand Institute, and a list of the books which had been added to the library since last meeting.

Dr. Hector read a report by Captain Hutton, F.G.S., "On the Gold-bearing District near Rangiriri," and pointed out that it appeared to indicate gold under conditions more nearly resembling the gold fields in the South than those of the Thames district; also, an abstract of a letter from T. R. Hackett, Esq., containing notes on the Queensland Gold Fields. He also laid upon the table a report by the Government Geologist for South Queensland, "On the Geological and Mining Features of the Gympie Gold Field;" and, in adverting to the progress of gold discoveries, gave the following account of the amount of gold found between the years 1492 and 1867 throughout the world:—

Yield of Gold throughout the World,

From the Discovery of America, in the Year 1492, to the present Time.

The following information respecting the yield of gold throughout the world, from the earliest time of which we have any record, namely, the discovery of America in 1492, up to the present time, has been collected from various sources, in order to show the relative importance of the Californian, Australian, and New Zealand gold fields.

Excepting perhaps in very early times, prior to that date gold seems to have been obtained principally by trade with the inhabitants of various districts in Europe and Asia, so that the yield, though small, was uniform.

From the time of the discovery of America, however, the amount of gold obtained annually has on the average steadily increased.

The progress of the gold discoveries since the above date may be divided into the following periods:—

During the 16th century the principal supply was from Central America and Peru. In the 17th century the Mexican and Brazilian mines attracted most attention. In the 18th century, in addition to the large yield which continued from America, gold-mining enterprise was directed to Siberia, and a large quantity was obtained by trade from Africa.

In the first half of the present century the yield from the Siberian mines became permanent, though it never equalled that from America.

The year 1850 may be taken as the starting point of the modern gold fields, and 1860 for that in which this colony is most interested.

Dividing the history of gold discoveries according to their period, the following table will show at a glance their relative importance:—

		oz.
From the discovery of America (1492) to 1600—108 years...		41,000,000
From 1600 to 1700 ...		80,000,000
From 1700 to 1800	America	100,000,000
	Africa, Russia	27,000,000
		248,000,000
From 1801 to 1850	America	60,000,000
	Russia	30,000,000
	50 years	90,000,000
From 1851 to 1860	America, excluding California, say...	7,000,000
	California	23,000,000
	Australia	25,000,000
	Russia	7,000,000
	10 years	62,000,000
From 1861 to 1867	California and British Columbia ...	11,200,000
	Australia	13,300,000
	Rest of America and Russia, say ...	8,400,000
	New Zealand	3,500,000
		36,400,000

Total Amount, ~~1492~~ 1,800 to 1867.

Russian Dominions	33,734,000
Europe (Austria)	3,271,000
Southern Asia (East Indies)	11,300,000
Africa	2,436,000 59
South America	26,136,900
United States	52,400,000
British Columbia	1,440,000
Australia	39,183,000
New Zealand, to July, 1868	3,906,500*
	173,806,500

Thus the Average Annual Yield of Gold has been for the—

	oz.
17th century	800,000
18th ,, ...	1,270,000
1801 to 1850	1,800,000
1851 to 1860	6,200,000
1861 to 1867 (including New Zealand to date)	5,002,000

In reporting some of the most interesting results of the labours of the Geological Department since last meeting, Dr. Hector said that there had been upwards of five hundred analyses made in the laboratory, and the results of each had been entered in a book, which was open for inspection by members. The principal analyses recently made were of samples from the large deposits of brown coal which had been found in Southland. This coal occurred in seams of great thickness, being in some places over thirty-five feet thick; and though it was inferior in quality to the coal on the West Coast, it would no doubt prove of great local value, and perhaps be extensively

* The total yield of gold in New Zealand from 30th April, 1857, to 31st December, 1874, was 7,599,973 ounces, valued at £29,577,016.—Ed.

used for steam coasting purposes. There were also thin seams of a true black coal, associated with sandstone, abounding in mesozoic fossils. The mineral waters from the geysers in the Bay of Plenty had also been analyzed. Dr. Hector stated that there was now sufficient evidence to prove that the hot springs at Rotorua were produced by the contact of fresh water with hot rocks; while the springs at White Island were entirely different, owing to their being dependent upon the access of salt water. Dr. Hector also explained that the source of heat at these different localities, some sixty miles apart, might be in some way connected, and that the character of the salts contained in thermal waters depends on local circumstances. These chemical investigations had been made in continuation of a paper communicated to the Auckland Society. A few metallic ores had been added to those previously known. Further, that Mr. Skey in the course of some recent investigations had discovered a new process for desilvering argentiferous gold, such as that found at the Thames Gold Fields. The processes at present in use for separating the silver from the gold are costly and tedious, but Mr. Skey had found that an addition of bichromate of potass (in the proportion of five parts to every three of silver contained in the argentiferous gold) to the ordinary melting pot will remove the silver, along with all traces of iron and copper contained in the gold. The process is being tried on a larger scale on the Thames, by the assayers to the Banks; and Mr. Henry Severn, the chief assayer to the Union Bank, who is at present inspecting the Thames Gold Field, has undertaken to report as to the practical utility of the process, the great advantages of which will be obvious to all metallurgists. The pressure of business for the evening prevented the reading of Mr. Skey's paper on the subject.

1. "On the Measurement of *Dinornis* Bones," by Dr. J. Haast, F.R.S. (*Transactions*, p. 21.)

In the absence of Dr. Haast, the principal portions of the paper were read by Dr. Hector, matters of detail being omitted.

Mr. Mantell wished to know how it was possible to determine, otherwise than by means of the *crania*, whether the number of bones taken out of a confused heap belonged to *Dinornis* or *Palapteryx*.

Dr. Hector said that Dr. Haast must have had great difficulty in determining the different varieties from the data at his command. It was hard to see how Professor Owen himself could assign a single bone to a different variety or even to a different genus. Dr. Haast appeared to have been guided almost entirely by proportional dimensions, and in that respect he had followed the example of Professor Owen. Disregarding mere difference of size, without accompanying differences in proportion, there appeared to be five different kinds; but the specimens of bones on the table would show

how many gradations there are, if measurement be taken as the sole criterion.

Mr. Travers said that where the bones were found mature, Dr. Haast seemed to have determined their species by their relative proportions. Supposing it should be ascertained that the test was not a good one, Dr. Haast must be absolved from all blame, seeing that he had followed Professor Owen.

Mr. Mantell had not considered it necessary to state that he merely wished to remark that Dr. Haast showed great courage in endeavouring to determine species upon no other data than (what he took the liberty of considering) the very unsatisfactory test adopted by Professor Owen.

2. "On Indications of Changes in the Level of the Coast Line of the Southern Part of the North Island, as deduced from the Occurrence of drift Pumice," by J. C. Crawford, F.G.S.

Abstract.

Mr. Crawford remarked that pumice, having a small specific gravity, floats in water, and in the rivers flowing from the volcanic plateau in the interior of this island it may be seen descending in great quantities and at all hours towards the sea; when there, it is of course liable to be washed up at any point of the shore, and if there is no cause again to carry it away, it necessarily remains stranded.

Pumice is found on the flats in the Peninsula, near this city, at a height of about eight or ten feet above the present high watermark. He had not observed it on any of the coast terraces, consequently it is probable that the land had attained within ten to twenty feet of its present level before the volcanic chain sent pumice to the sea; and this will give an age to the present coast line, or to one from ten to twenty feet lower (supposing a steady rise of the land), enough to satisfy a very ardent lover of antiquity.

He concluded by saying, "It may therefore be held that the probabilities are against any great oscillation of the present sea level in this part of New Zealand since the commencement of the vast period which must have elapsed since the central volcanic group of Tongariro and Ruapehu (and Mount Egmont inclusive) began to send down pumice to the coast."

Dr. Hector said that pumice was a mechanical variety of obsidian, the most perfectly fused product of volcanic eruption, and did not indicate any particular era in a volcanic eruption, or elevation of a chain of mountains, as Mr. Crawford seemed to require for his theory. The whole of the eastern shore of Lake Taupo had been formed by wind-blown pumice. Along some of the rivers that had cut through the slate rocks on their way to the sea at Hawke Bay, there were terraces with pumice clinging to the sides of the valleys 400 feet above the water, showing clearly that the pumice was of great age, as it must have been deposited by the rivers when they ran at a much greater height than at present. Mr. Crawford did not prove by his paper that the sea had not been relatively lower, or, in other words, that the land had not been undergoing submergence. The sea could never have been at a much higher level, or the pumice would have been drifted up, but there is every reason to believe that the country was much higher formerly, and, in the interior, contained larger lakes by which the pumice would be drifted up at great heights above the sea.

Mr. Hart thought that indications of sea level, by deposits of pumice, could not be relied upon as a measure of time, and instanced cases of sudden elevations or depressions in this province.

Mr. Travers said there were other indications of an alteration in the elevation of the coast line; for instance, the raised sea beach on the Hutt road.

On the motion of Mr. Mantell, the discussion of Mr. Crawford's paper was deferred until the first meeting after it should have been printed.

3. "On Hybridization with reference to Variation in Plants," by W. T. L. Travers, F.L.S. (*Transactions*, p. 31.)

Dr. Hector remarked that it was highly satisfactory that a gentleman who was a member of that Society had, by close observation of nature in this colony, arrived at conclusions on this subject, which were almost identical with some of the views now advocated by Darwin, and he understood from Mr. Travers that the substance of his paper was communicated to Dr. Hooker, in a letter, some years ago.

4. A paper by Mr. Buchanan, botanist and draughtsman to the Museum, on "Variation in the New Zealand Flora" (reserved), was read by Dr. Hector; but as it was thought desirable to consider these two papers together, the discussion was postponed until next meeting.

Mr. Mantell suggested that the discussion would be rendered more interesting and intelligible if specimens of the plants referred to by the essayists were laid on the table.

Resolved, "That the ordinary meetings of the Society should, in future, be held at half-past seven for business, and that the reading of papers should commence at eight o'clock."

Fourth Meeting. *25th August*, 1868.

W. T. L. Travers, F.L.S., in the chair.

1. Mr. Crawford read the following notes by Mr. E. Baker, "On the Appearance of a Meteor which had been recently observed by several persons in the Neighbourhood of Wellington."

"At about a quarter after seven o'clock, on the evening of the 5th of August, and while at work in the bush, observed a light very much brighter than the moon, which had just risen and was only two days past the full, shining brightly in a clear sky. The light appeared to be a large round ball of fire, about the size of the moon, travelling from an easterly direction towards the west. The ball of fire burst, and a portion of it apparently struck the ground at about 50 to 100 yards from my house at Karori. The meteor produced a very strange feeling upon me, but which I cannot describe.

"There was a rumbling noise at the time of the descent of the meteor."

The Chairman, Mr. Braithwaite, and Mr. Steward, remarked that they had also seen the meteor referred to.

Dr. Hector hoped that such unusual phenomena would be closely observed in future. In Europe, the whole of the circumstances would be recorded with the greatest accuracy, and he suggested that all who had made observations should reduce them to writing, and send them to the Secretary.

2. "On the Orthography of the Maori Language," by J. C. Crawford, F.G.S.

ABSTRACT.

It was a subject of congratulation to the inhabitants of New Zealand, that in the reduction of the Maori tongue to a written language, a system of orthography has been adopted similar to that of the languages of Southern Europe, inasmuch as the letters are pronounced as they are spelt.

The Maori tongue has been thereby relieved from the grotesque aspect which many aboriginal and Eastern languages have assumed, under the attempt to reduce them to intelligible sounds, by the use of the undefined and variable English alphabet. It would not be out of place to offer a few remarks on the peculiarity of the English orthography, of the application of the same system to the pronunciation of the classical languages, and of the effects thereby produced on the inhabitants of the British Isles, and of other countries, with whom they have become associated.

The great peculiarity of the English tongue, as distinguished from the languages of the European continent, is the number of medial sounds which it contains.

These sounds are represented by the usual Roman alphabet, each vowel having, in consequence, to do duty for a great variety of sounds, which makes it so difficult for the foreigner, accustomed to well-defined sounds in his own language, to acquire the correct pronunciation of the English tongue.

From this cause, the defect of what may be called vowel-deafness has

been inflicted on a large portion of the human race, including not only the population of the British Isles, but the swarming multitudes which have thence spread over the world, to conquer nations and to found colonies.

Mr. Crawford then gave a list of words in various languages in proof of what he had said; and concluded by remarking that it was therefore very commendable in those who first reduced the Maori tongue to a written language, that a system had been adopted by them of definite vowel sounds, which thus gave to the language a much more civilized aspect than it would have presented under the usual painful attempts which are vainly made to reduce aboriginal sounds to the rule, or no rule, of English orthography.

3. Tareha, Native Member in the House of Representatives for the Eastern District, then gave a description of the Maori house in which the meeting was assembled. His Honor the Superintendent of Hawke Bay acted as interpreter. Tareha spoke as follows:—

"In accordance with the request made to me, I shall now give the meeting an account of this house, its history and origin.

"Such a building as this is only erected by men holding a high position among the tribes; it is a sign of chieftainship, and the proprietor becomes a noted man. The whole tribe assist in building it when called together by the chief for that purpose.

"This house was built at Tauranga, in Poverty Bay, by Rahurahi (or Lazarus) in 1845, during Governor Fitzroy's administration. When finished, all the tribes that had an interest in it were called together to discuss their affairs. It was about the time when you Europeans introduced Christianity amongst us, consequently many important subjects were talked over. The name of the house is 'Tehaukituranga.' All these carved posts represent certain individuals, ancestors of mine; the lower and larger figures represent the fathers, the upper ones their sons. Most of them have their names attached, as you may observe, but the oldest names have become obliterated.

"This is considered an important and valuable property among the Maori; but misfortunes visited the land, troubles were cast upon us, the tribes were scattered, and the result is that the house now stands here. When the King movement commenced, dissension and jealousy arose amongst the natives; it was found to be wrong, and you all know how the evil has been atoned for. Then other natives created a new god, and called him 'Hauhau;' this movement commenced on the east side of the country and crossed over to the west, and led to the death of Mr. Volkner. In consequence of all this, and through other troubles and dissensions, the house has become your property."

Kiekie, one of the ex-prisoners from the Chatham Islands, and a relative of Tareha, on being requested by the meeting, gave some further particulars.

He stated that the three distinguishing marks of a New Zealand chief were a mere poanamu, a dog-skin mat, and a house like this. It was only chiefs, men who were well skilled in the art of carving, who owned such buildings. On great occasions, the chiefs only were admitted.

In reply to some questions put to him, Tareha said that it took the tribe about five years to prepare the carved posts. Each figure had something distinctive about it, but he would have to examine closely before he could say who was represented by each. The tools formerly used in the construction of such buildings were made of bone, and were of very ancient origin, having been brought from the land originally inhabited by the Maori; in later times hard stone was used instead. All those who came first in the *Tanetewa* canoe were well skilled in carving; this was one of the great works of their descendants. The name of the man who invented painting was Tuaneko. The ancient god of carving was Taukaruo.

A general vote of thanks was awarded to Tareha by the meeting at the conclusion of his address, in acknowledging which, Tareha said he did not think he could undertake to give a history of all the persons represented by the figures, on which much dependence could be placed. He doubted much whether he was sufficiently well acquainted with the subject to do so.

4. "A preliminary Notice on the recently experienced Earthquakes and Tidal Phenomena," by J. Hector, M.D., F.R.S. (*Transactions*, p. 35.)

In answer to Mr. Pharazyn, Dr. Hector said it was not merely the height of the wave that led him to believe the centre of disturbance to have been at a distance. The intervals between the waves were equally long in the case of the earthquake at Japan, in 1853, which he had cited in the course of his remarks, but yet their effect was only detected by the use of instruments of great delicacy; whereas the recent waves on this coast had been obvious to the most casual observer. The only remaining conclusion, if they did not originate at a distance, was, that they originated in a series of shocks at close intervals; but this did not explain the other phenomena.

Dr. Hector then drew the attention of the meeting to some very inexpensive instruments for showing the vibration of the earth, both lateral and perpendicular, which were on the table.

5. A Process for desilvering Gold, like that obtained at the Thames diggings, was next described in a paper by Mr. Skey. (*Transactions*, p. 47.)

After some remarks from Mr. Crawford, Dr. Hector observed that the importance of this new method was very great, when it was remembered that there was a proportion of about 35 per cent. of silver in the gold found in that district; a matter of great importance with bankers and other exporters of gold, particularly as the process described was simple and inexpensive.

6. The last paper brought before the meeting was one by W. L. Buller, F.L.S., containing remarks upon a review of the author's Essay on the Ornithology of New Zealand, which appeared in a German periodical, from the pen of Dr. Otto Finsch, of Bremen. (*Transactions*, p. 49.)

Dr. Hector stated that, in order to understand fully this paper of Mr. Buller's, it would be necessary to read also Dr. Finsch's critique, and also a part of the original essay; this would take a considerable time, and he would therefore move that the paper be considered as read, and that it be printed, so that members could then examine the interesting details of the ornithology of New Zealand at their leisure; this was the more advisable, since the paper contained descriptions of ten new species of birds, and many valuable notes and abstracts, which will be treated in detail in Mr. Buller's large work on the ornithology of New Zealand, about to be published. The motion was agreed to.

FIFTH MEETING. 15*th September*, 1868.

The Hon. W. B. D. Mantell, F.G.S., in the chair.

Minutes of previous meeting were read and confirmed, and other routine business disposed of.

1. "On the Celtic Origin of the English Vowel Sounds," by the Right Reverend C. J. Abraham, Bishop of Wellington. (*Transactions*, p. 73.)

This treatise was discussed at considerable length by several of the members, including Mr. Crawford, Mr. W. Pharazyn, Dr. Hector, and Mr. Mantell.

2. Dr. Hector read a notice of a Swordfish, which had lately been presented by Dr. F. J. Knox to the Museum. The specimen, admirably prepared by Dr. Knox, was exhibited.

ABSTRACT.

The fish had been stranded on the West Coast, in June, 1867. Dr. Hector explained that the specimen belonged to the genus *Histiophorus*, and not, as was supposed, to the *Xiphias*, the swordfish of the northern hemisphere, which is characterized by the absence of ventral fins.

Mr. Travers gave a very interesting account of several rare species of fish which have been found on our coasts, such as Banks' *Oar fish*, of the genus *Gymnetrus*. One of these, the fourth of the kind ever described, was cast ashore in Nelson, and fragments saved by him are now in the British Museum: it was of an extraordinary form; fifteen feet in length, and about twice the width of the blade of an oar, and almost as thin. He exhibited a specimen of *Gallus*, from Saltwater Creek, Canterbury, the second specimen ever found; and described some of the remarkable features of the *Black fish*, which is known to occasion great sickness or vertigo to those who slaughter them when stranded. Some years ago, two men were actually drowned while cutting the throats of several of these fishes in Massacre Bay, having fallen on their faces in a few inches of water; Mr. Mackay, one of the party, saved his life and that of one of his companions only by extraordinary exertions.

3. "On the Geographical Botany of New Zealand," by James Hector, M.D., F.R.S. (*Transactions*, p. 157.)

This was explanatory of a series of essays on the above subject, written by Sir D. Monro, and Messrs. Travers and Buchanan, for the New Zealand Exhibition, 1865, but which had not been printed for want of funds. They were now laid on the table to appear among the Transactions of the Society.

Dr. Hector, in communicating these essays, explained the chief physical peculiarities which regulate the distribution of the vegetation of the South Island, illustrating the same by maps and diagrams. The greatest altitude in such a section of the island was about 10,000 feet, but the mean elevation of the ridges that connect the summits of the higher mountains was only 5,000 feet; while there occur breaks or "passes" in the mountain chain, which, by permitting the passage of the western winds, give rise to local modifications of the flora at the points where they led out on to the eastern slope. These breaks have all about the same altitude of less than 2,000 feet above the sea level, being sufficiently low to allow of the transfusion of many species of plants. After alluding to the marked difference in the character of the flora, caused by the climate, on the moist western slopes of the island, and the comparatively arid district in the interior and parts of the east coast where forests are rare, Dr. Hector described the division of the flora into zones, according to position and altitude.

Considerable discussion ensued, in which Messrs. Travers, Hart, Hamilton, and Pharazyn took part.

4. "On the Mineralogy of Gold in New Zealand," by J. Hector, M.D., F.R.S.

Abstract.

The author explained that the manner of distribution of alluvial gold is a separate question from the distribution of gold in the rock matrix. On the former subject he had already explained his views, and the object of the present communication was, to explain the conditions under which gold occurs in the rock matrix of New Zealand, and the minerals and rocks associated with it. The introductory portion of this paper involved a large amount of theoretical geology, which the author illustrated by maps and longitudinal sections of the island. The second part of this paper had to be deferred.

Sixth Meeting. 12*th October*, 1868. (Adjourned from 6th October.)

The Hon. W. B. D. Mantell, F.G.S., in the chair.

His Excellency the Governor, Sir G. F. Bowen, G.C.M.G., was present.

Letter read from His Lordship the Bishop of Wellington, resigning the office of Vice-President, on account of his being about to leave the colony.

Before proceeding to the papers for the evening, Dr. Hector exhibited some geological specimens, including two from "The Golden Claim," Thames District. First, vein rock, highly pyritous, which had been analyzed in the laboratory, and showed the following results:—First sample, pulverized very finely and roasted, yielded on extraction, with mercury, at the rate of 683 oz. 16 dwts. per ton. A second sample of the same rock, more pyritous than the first, yielded to mercury, when finely pulverized, but *not* roasted, proportionally as follows to the several amalgamations:—

			oz.	dwts.	grs.	
1st amalgamation	...	...	1,213	4	8	
2nd "	...	...	89	3	14	
3rd "	...	...	33	4	0	
4th "	...	...	Traces.			
Total	=		1,335	11	22	per ton.

When at last only traces of gold could be extracted by mercury, the whole of the residue from these amalgamations was dried and well roasted, and the amalgamating process again repeated, when a very white alloy was obtained, consisting mostly of silver, in the proportion of 4 oz. 11 dwts. 9 grs. to the ton.

These results show plainly that all the gold is in a free state, and also that a portion of the silver present is in combination, and most probably with sulphur, the effect of roasting being to decompose, and so render the silver amenable to the affinities of mercury.

The second specimen was a felstone, a portion of the bed rock in which the above vein stone was found. It has not been hitherto valued by the miners, but analysis showed it to contain at the rate of 53 oz. 16 dwts. 6 grs. per ton. The proportion of silver in gold, on first amalgamation, was 29·60 per cent.

Several other geological specimens were laid on the table, including samples of siliceous deposit from the Waiotapu Springs, pyritous quartz, and part of the gold obtained by Mr. Groves when prospecting in this province.

1. "A further Notice of the Earthquake Wave," by James Hector, M.D., F.R.S. (*Transactions*, p. 42.)

The author recapitulated some of the facts already explained at previous meetings, and added some interesting particulars received lately from other localities, his object being to place on record all the particulars obtainable of this remarkable phenomenon. All parts of Australia appear to have been visited by the wave except Port Phillip, as, for instance, Sydney, Brisbane, Adelaide, and King George Sound. In South Australia several slight earthquake shocks were felt, the two events, the shocks and the waves, being quite distinct. In Peru the first great shock was felt at 5 p.m. on the 13th of August, which time corresponds in Wellington with 9.30 a.m. on the morning of Friday, the 14th. This shock is described to have come from the south-west, and there is no doubt that it was the result of a great submarine eruption at a considerable distance from the coast, for it appears that there was sufficient time for the people to escape from the towns along the shore to the hills before the great wave arrived. The same wave reached New Zealand seventeen hours after, and its velocity having been calculated from the time it reached Chatham Islands, Australia, &c., was found to agree with previous results. The earthquake shock, if felt here, must have travelled over six thousand miles; the wave, having a slower velocity, or at the rate of about six miles per minute, reached us much later. Dr. Hector then, by means of maps and diagrams, explained the course such a wave would travel, forming a curve on maps laid down on Mercator's projection principle. He stated that in the deep sea the wave would only be felt by a slight tremor, and would be scarcely perceptible until it reached shallow water. The author concluded by saying that we have no historic record of so stupendous a wave, and that the outburst which caused it must have been of a very unusual and perhaps unprecedented character.

Captain Vine Hall, on being asked by the Chairman, stated that the wave had been felt at Rapa, where it washed away a portion of the jetty. It arrived there apparently from the south-east, but he could not yet inform them of the exact time of its occurrence.

Mr. Hart explained that, in his opinion, Port Phillip had not experienced any of the effects of the wave, from its narrow entrance, as well as the protection afforded by Tasmania. He indorsed Dr. Hector's opinion, that the outburst must have been *oceanic*.

Dr. Hector wished to state, that it appeared from recent intelligence, that the south-east portion of the Chathams had felt the wave most; but, not being so thickly populated as the western or northern portion, the damage done had not been so great.

Mr. Travers alluded to the New Zealand earthquake of 1855 as having caused an immense wave, over thirty feet in height, which did much damage along the east coast of this province, and expressed a wish that any one who knew the particulars of that event would communicate them to the Society.

Mr. Mantell and Mr. R. Pharazyn both remembered the occurrence, and spoke of the wave being about the height represented, and as having done much injury along the east coast.

2. "On the Island of Rapa," by Captain Vine Hall. (*Transactions*, p. 75.)

3. "On New Zealand Mean Time," by James Hector, M.D., F.R.S.

The author explained that it had been decided by the Legislature to establish by statute a mean time for the whole colony. This resolution had so many advantages that it was needless to discuss them; the only question to be decided was, what time should be used. The time for the colony at large may be calculated from any of the following meridians:—

Firstly, New Zealand, including the small islands which form its dependencies, lies between the meridians

178° 36′ 5″ east of Greenwich,
166° 26′ 30″ " "

The average meridian is therefore

172° 31′ 17·5″ east.

Secondly, the meridian which has an equal area of land lying to the east and west of it, within New Zealand, is

172° 48′ 57″ east.

Thirdly, the following is the approximate longitude of the various ports in the colony to which telegraphic communication exists or is in contemplation, and which at the same time form centres of districts, throughout which uniform time might be enforced without practical inconvenience.

It is preferable that the ports should be taken instead of the inland towns, when they do not happen to be in the same longitude, as in the case of Lyttelton and Christchurch, as minute accuracy of time is only of practical importance to mariners; and as, moreover, we have in New Zealand only chronometric differences of longitude as yet determined, and these only for the seaports.

Auckland	174° 49′ 10″
Napier	176° 55′ 10″
New Plymouth	174° 4′ 58″
Wellington	174° 47′ 53″
Nelson	173° 16′ 58″
Picton	174° 17′ 30″
Westport	171° 45′ 00″
Lyttelton	172° 44′ 17″
Port Chalmers	170° 39′ 10″
Bluff	168° 21′ 55″

The average meridian of these places is

173° 14′ 12·5″.

The difference from Greenwich mean time of each of the above average meridians, is—

	hours.	min.	sec.
1. Mean longitude	11	30	5·2
2. Longitude of mean area ...	11	30	34·7
3. Average longitude of ports ...	11	32	56·9

The object being to establish one time for the whole colony, the adoption of which will cause the least inconvenience, the author recommended that the meridian of 172° 30′ east be taken, for the following reasons :—

1st. It is a close approximation to the average longitude for the colony.

2nd. The absolute longitude of any place in the colony has not yet been determined; and it is therefore better for a statute to adopt a meridian as basis, than an approximate longitude for a place which might hereafter require rectification.

3rd. Longitude 172° 30′ east is 11h. 30m. east of Greenwich; and being an even number, will be most suitable for the purpose of enabling mariners to compare the errors of their chronometers on mean Greenwich time; while the adoption of the mean time of place for any town or port in the colony will have no practical advantages.

The following table shows the correction required to reduce the time for meridian 172° 30′ to the mean time at the various ports; and the correction for any other place can at once be found by adding or subtracting four seconds for every minute of longitude the place lies east or west of 172° 30′.

Corrections to be applied to New Zealand Telegraph or Mean Time to find Local Mean Time at the following places :*—

		min.	sec.
Auckland	add	9	16·7
Napier	„	17	40·7
New Plymouth	„	6	19·9
Wellington	„	9	11·5
Nelson	„	3	7·9
Picton	„	7	10·0
Lyttelton	„	0	57·1
Westport	subtract	3	0·0
Port Chalmers	„	7	23·3
Bluff	„	16	32·3

The time could, as at present, be determined at Wellington by the meridian transit, as it will be most convenient that the time-balls at the different ports should be dropped at 1 p.m. of the adopted statute time, which for Wellington would be at 1 h. 9 m. 11·5 sec. mean time of place. By providing the telegraph office clocks with two minute hands, indicating

* This Table is substituted for that given in the First Edition, in which several copyist's errors occur.

the instant required for the difference between the longitude of the place east or west of 172° 30′ with the true time, telegraph time can be shown if desired.

4. "On the Merits of Patent Slips," by J. R. George, C.E.; read by Mr. Travers, in the absence of the author.

ABSTRACT.

The author commenced by observing that as much apprehension appears to exist in reference to the safety of patent slips, for the purpose of raising vessels of large tonnage out of the water, he had been induced to offer a few observations on the mode of working such slips, in order to show that it is premature to assert the absolute superiority of graving or floating docks. There appeared to be great difficulty in dealing with the subject, from the fact that very scanty data exist, and there is no work of reference as yet published on the subject.

The terms "slip" and "wet dock" were formerly synonymous, and implied a narrow inlet of the same form as an ordinary graving dock, but with an inclined bottom, and having no flood gates; this form of slip was, consequently, only in use in situations having a large rise and fall of tide.

The Americans appear to have first invented slips, and worked them under the name of "Patent Submarine Railways." The first patent granted by the British Government for slips was in 1832, to Mr. Morton. In the report of the Committee appointed to consider the renewal of that patent, they remarked that by means of a slip a vessel could be placed in a situation to be repaired at a cost of £3, which previously amounted to £170; this is the first strong authority as to their capacity and usefulness for raising vessels.

It appears, from competent authority,* that a durable and substantial slip may be constructed, under favourable circumstances, at about one-tenth of the expense of a dry dock; and be laid down in situations where it is almost impossible, from the nature of the ground, or the want of a rise and fall of tide, to have a dock built. Some of the other advantages deserving of mention are: the air has a free circulation all around the ship, and there is better and longer light than within the walls of a dry dock; there is a considerable saving of expense in the carriage of the necessary materials; the vessel is exposed to no strain whatever; and she may be hauled up, repaired, and launched, within a few hours, no interruption taking place, as in docks, from the necessity of emptying and filling the dock with water.

Messrs. Morton add further, that ships of 2,000 tons register have frequently been drawn out of the water by means of their slip; and they estimate the relative cost of slips and docks as one to ten.

* Messrs. Morton, in their circular.

Mr. George next gave some quotations from the "Encyclopædia Britannica," speaking in strong terms of the many advantages which slips possess over dry docks, particularly as to cost, which they quote as one to twenty; he explained the method of using and working the slip, and quoted some examples as to the favour with which slips are now being looked upon. For instance, a slip for raising vessels of 3,000 tons register was supplied by Messrs. Morton to the Egyptian Government; and Messrs. Inglis, of Glasgow, in 1867, erected a slip 800 feet in length for raising vessels of 3,000 tons, dead weight.

There did not appear to be on record any instance in which a ship has sustained permanent injury, when being placed on a slip, or in being launched. In the case of the first vessel placed on the Melbourne slip, she was satisfactorily raised out of the water, but, from the subsidence of the ways, would not run off again; the vessel was not permanently injured. The same difficulty as in Melbourne occurred in launching the "Great Eastern," in 1857, and with the iron-clad "Northumberland," of 6,650 tons register, and weighing 8,000 tons, at the Millwall Ironworks. The subsidence of the ways in the two last examples is not much to be surprised at, when we remember that the foundation of the ways consisted of Thames mud.

On the other hand, graving docks also are not free from liability to accident. At Marseilles, the "Imperatrice," a steam ship of upwards of 2,000 tons register, fell bodily a height of three feet, from the giving way of the struts, after the water had been pumped out of the dock, and everything moveable in the vessel was broken.

The principal objection urged against slips is, that in launching a vessel she would be liable, as the phrase goes, to "break her back," from the fact of her after part being afloat, and lifted by the action of the water, while her fore part was fixed in the carriage. This the author endeavoured to dispel by entering into a consideration of the force of waves during storms, and argued that a ship that could be so strained in being launched from a slip as to be at all damaged, would not be in a fit state to resist the action of the sea during a storm, and therefore would be much better in port.

Mr. George concluded by remarking, that extremes are dangerous in all things, and that he was not then prepared to assert the superiority of slips over docks, or docks over slips, but to show that those who are prepared to do so ought also to be prepared to support their assertions, either by citing some high authority, or by adducing facts in support of their assertions. Theory, practice, and science must all naturally be brought to bear on such a subject; docks have been subject to all three. Theory and science have been applied to the question of the value of slips, but more practice is required before any assertion can be supported as to the superior convenience of a dock.

An abstract of a paper, by James Balfour, C.E., Marine Engineer, "On the Merits of Graving Docks," was then read, and both papers were discussed, the following gentlemen speaking on the subject:—Dr. Hector, Captain Vine Hall, Mr. Travers Mr. Crawford and Mr. R. Pharazyn.

AUCKLAND INSTITUTE.

First Meeting (held in the Provincial Museum). *4th May*, 1868.

F. Whitaker, President, in the chair.

The following contributions were laid upon the table:—A series of photographs of the Atlantic cable machinery—Mr. J. T. Mackelvie. A number of South Sea Island shells—Mr. Vilcocq, of Russell. Part of a porpoise's head—Mr. Mackenzie, of Mongonui. Maori stone axes—Mr. Bell, of Whangaroa; also, by the same gentleman, a piece of the copper of the ship 'Boyd," the crew of which were massacred and eaten there; a piece of manganese ore from Tikiora, Bay of Islands; quartz rock from near Spirits Bay. There was also a specimen of clay which had been burned by a gentleman at the Tamaki, and which was believed to be a near approach to china clay.

Mr. Gillies, the Honorary Secretary, read a note that had been left at the Museum, stating that a number of miners from the Thames had visited the collection, and had been much interested and gratified at examining the minerals there. Mr. Gillies stated that the Council of the Association, immediately upon being formed, wrote to England for various scientific publications, and had received the first of them by last mail. They were then on the table, and would be lent out to be read by members at the close of the meeting. Any not taken out would lie at his office. He had also to mention that they had received a number of New Zealand birds from the south, which illustrated the advantage of being connected with the New Zealand Institute.

The President then read the following

INAUGURAL ADDRESS.

Gentlemen,—We are met this evening, for the first time, as the members of an Institute, having for its object the promotion of art, science, and literature. We have laid the foundation of a society embracing a very wide field of operations, but as yet we have performed only a small portion of what we have undertaken, and the foundation will be useless if we fail successfully to prosecute the work.

It is obvious that we have taken upon ourselves no light task, if we discharge efficiently but one-half even of the duties which devolve upon us.

For myself, it would be much more agreeable to me to occupy a position of less prominence than that in which it has pleased the members of this Institute to place me, for I cannot but feel that much more will reasonably be expected from the President than I can hope to fulfil. I should, therefore, have declined the proffered honour, but, well knowing the difficulties that promoters of such an institution have to encounter in its establishment, and unwilling to refuse assistance in any capacity in which my colleagues considered that I could be serviceable, I, adversely to my own opinions and wishes, reluctantly consented to become the first President. I can only promise that I will endeavour to compensate in zeal for what I may lack in attainments and ability.

The New Zealand Legislature, in its last session, passed a statute for the establishment of an "Institute for the Advancement of Science and Art in New Zealand," and conferred on it, together with the societies to be incorporated with it, the privileges of a body corporate. The Act, in the first place, provides for the appointment of a "fit and proper person to superintend and carry out the geological survey of the colony, and also to superintend the formation, establishment, and management of a public museum and laboratory." This refers to the parent society (if I may so call it), domiciled at Wellington; but the services of this gentleman (the Act does not give him an official name) are also to be available "to superintend the formation and establishment of any museum and laboratory intended to be established by any society incorporated with the parent institution."

For the management of this Institute there is a Board of Governors, in the first instance nominated, but afterwards partly to be nominated and partly to be elected. Their powers are defined, provision made for their meetings, and for the enactment of rules, by the Governor in Council, for the management and regulation of the Institute. Such is the general character of the provisions of the New Zealand Institute Act. How far it will satisfactorily answer the purposes for which it is intended remains yet to be seen. Experience is necessary to settle that question; but I must say that I very much fear that some of the provisions will be found cumbersome, and difficult to work satisfactorily. We cannot but be struck with the similarity of the scheme for the government of science to that for the political government of the colony. The General and Provincial Governments appear to have afforded models for, and to be reproduced in, the New Zealand Institute and those institutions, when established in the provinces, to be incorporated with it. The Auckland Institute has been successfully formed, and now numbers nearly eighty members. It has not yet been associated with the New Zealand Institute. It is competent for us now to effect this association or not, as may be thought desirable. We have complied with all the preliminary conditions that have been prescribed. If we prefer a separate and independent existence, there is nothing to prevent our taking that course, but for my part I think there are sufficient advantages to be derived from association to lead us in that direction.

We are all aware how difficult it is in a new country, such as this, to find men competent in knowledge, and enjoying sufficient leisure, to devote their time to superintending the formation and establishment of a museum and a laboratory. The Act provides that the services of such a person shall be available for institutions associated with the parent Institute. The Act also provides that a yearly sum of £500, at the least, shall be placed on the colonial estimates, to be applied in the payment of the general current expenses of the parent establishment and of the several societies or associations incorporated with it. There are other advantages, but it appears to me that I have said enough to lead to the conclusion that the Auckland Institute should be incorporated with the New Zealand Institute.

Thus, we see that the New Zealand Legislature, impressed, no doubt, with the importance of promoting the general study and cultivation of art, science, and literature, has endeavoured to do its share of the work by giving a legal constitution to an institution formed for the advancement of those objects, by providing competent assistance, and by contributing towards the necessary expenses to be incurred. But it is not in the power of any Legislature alone to create a permanent and flourishing institution of this character; it can only be done by the energy and co-operation of those fitted to undertake the task, and that not by one spasmodic effort, but by patient and unflagging perseverance. No doubt, in order to induce a sufficient number of persons to give their time and attention to the support of such an institution, it is necessary that they should be convinced that they will derive therefrom an adequate amount of amusement and profit.

Now, it is admitted that the first and principal duty of every man is to provide for the daily wants of himself and those dependent on him; and, moreover, it is a duty that he owes to his country. No man can neglect this without entailing suffering and disgrace to himself. All other employments must yield to this; and if the pursuit of science and literature necessarily involved a neglect of this first duty, it would be a crime to urge men to devote their attention to it. But there are hours of leisure and recreation, and it is those that can be properly and profitably employed in such pursuits. It is, I think, fortunate that there are occasions on which men of all parties, whatever may be their creeds or political views, can meet on common ground. It is, I say, fortunate that occasions occur on which people of all shades of opinion, political or otherwise, can meet and unite for a common object.

Nothing tends more to soften the asperities that necessarily arise than friendly meetings for the entertainment and instruction of each other. In a community like ours something of the kind is essential. In the race of life we jostle each other hardly; and in politics every subject is discussed with such freedom, that every man says and writes almost without restriction whatever he feels inclined. In such a state of things it is but natural that differences should arise, and angry passions be sometimes excited. Everything, therefore, that tends to calm or mollify such passions, and render us more considerate and tolerant the one to the other, has—indeed, must have —a salutary effect. And what is better fitted to produce such an effect than meeting for the friendly discussion of topics connected with arts, science, and literature?

In a social point of view, therefore, the advantages which will result from a flourishing institution, such as this Institute may become under vigorous and careful management, should not be overlooked or depreciated. However devoted we may be to the necessary occupation of our lives—however anxious to push ourselves forward in the worldly career we are pursuing—it is essential that some time should be set apart for, and devoted to, recreation and amusement. It is indispensable for re-invigorating the faculties, and preparing them for renewed exertion in our vocations. But much time is unfortunately spent—harmlessly perhaps, but unprofitably. This is the more to be regretted, because at least equal employment, combined with profit, might be as readily obtained. Pleasure, no doubt, is to be derived simply from the acquisition of knowledge—knowing that which we knew not before—although it may be of a useless or trivial character; but how much more satisfactory to a thinking man is the reflection that he has added an important truth to his stock of knowledge, and how much is that satisfaction enhanced by having clearly fixed in his mind the proofs by which that truth is established. But of how far more importance than mere amusement are the advantages which ensue from the steady pursuit of scientific knowledge. There is not an occupation in life which cannot be assisted by science; and in a newly-settled country like New Zealand there are especially some sciences the knowledge of which would have pointed out the way to fortunes, or saved from ruin many who have passed away or are still amongst us.

Of what service, for instance, may I ask, would not a competent knowledge of geology, mineralogy, and chemistry have been to many of us? It is not long since that some mineral specimens were brought to Auckland by men who were impressed with the belief that they had made a great discovery. They were persuaded that they had found quartz and gold, and, led on by delusive expectations, had expended time and money in explorations. They had thus squandered the means at their disposal, and they sought assistance to prosecute their investigations. Now, the most superficial acquaintance with mineralogy or chemistry, by themselves or their neighbours, would have saved these men from grievous disappointment and serious loss. A tyro in mineralogy could have told them that the supposed quartz was carbonate of lime, and the supposed highly valuable gold nothing more valuable than delusive iron pyrites. A slight knowledge of the use of some of the most readily obtained chemicals would, without difficulty, have enabled them to obtain the same information.

Again, how many experiments have been tried during the last twenty-five years on the *Phormium tenax*. How many men have wasted their time and their money on a process which a very slight acquaintance with science would have warned them to eschew. These are but two of the many instances that are occurring in which science would have liberally repaid attentions bestowed on her.

It may be affirmed, as a proposition universally true, that science is of great practical value; how peculiarly important is it that in this colony it should be generally cultivated. Here we are in a land abounding in raw materials of every description, of the greatest value and importance. Treasures of all kinds are spread with an unsparing hand around us in every direction, inviting us to accept the wealth, which, if properly used, they will bestow. Why do we not avail ourselves of the opportunity? Science and the arts are required to lend their aid, and we neglect to avail ourselves of their use. In a colony like this, men no doubt have serious disadvantages to contend with. They cannot, as in a highly civilized community, obtain that advice and assistance of which they often stand in need, and they are compelled to rely on their own resources.

Take, for an instance, what is daily advancing towards becoming one of the most important and prosperous industries in this part of the colony—I mean gold-producing. How little do we know about it; how much have we to learn! There are peculiarities about the Thames Gold Field which render experience gained elsewhere in some measure inapplicable, and it may, I am certain, be safely affirmed that at least one-third to one-half in value is daily lost in the inartistic and inefficient manner in which the gold is attempted to be extracted from the mine, and afterwards separated from the worthless material with which it is mixed.

By what means can this loss be obviated, or, at all events, mitigated? Of the members of this Institute—and at present there are but few—there are several, I feel assured, who know, at all events, some little that would be useful to the gold miner; and if all these "littles" were brought together, well sifted by discussion, and that which is valuable made readily available, an essential service might be rendered with great advantage to the community, also to a large body of men engaged in a laborious and hazardous pursuit. Much may, I am sure, be done by union. Co-operation in the present day is the great engine of progress. We see it made subservient to every variety of purpose. Man standing alone is but weak, but union gives a power which may almost be said to be irresistible. Co-operation not only concentrates means which are all but useless when dispersed ; it does more, it becomes creative, and gives life and development to new powers. The mere conflict of thought and opinion produces results not previously contemplated.

I regard it as one of the most important advantages to arise from this Institute, that it may be made the means of bringing men together, not alone for their own amusement, but to work for the common good ; and, proceeding a step further, that it may be the means also of interchanging opinions and information between the most distant parts of the colony. In our constitution and rules we have undertaken, as the object of this Institute, the promotion of art, science, and literature, and we have at the same time provided ample means by which that object is to be attained. We purpose the establishment of a museum and a library, and, I trust, if the institution is sufficiently supported, that we shall be able to add a laboratory. Lectures, periodical meetings, the reading of original papers, and conversations and discussions, are all designed to the same end.

I need not point out how useful in days gone by would have been a library such as that now contemplated, and of what essential service would have been a museum well stored with specimens. I feel a conviction that one of the greatest benefits that could be conferred on a newly established settlement, in a country but little known, would be to provide for it a library well supplied with books on the arts and sciences, and a well and judiciously filled museum.

It may be regretted that what we are now doing has not been done before, and it is a reasonable matter for regret; but this affords an additional argument why no further delay should take place. We have now made a commencement under more than ordinarily favourable circumstances, and if failure should ensue, it will be from want of energy and well-directed efforts on our parts. On the one hand we must not be too sanguine or confident, and on the other not too readily depressed by difficulties or discouraged by slowness of progress. We should bear in mind that some years ago, at Wellington, an institution of a similar character to that now established enjoyed but a short and, apparently, not very successful life. The failure, no doubt, resulted from want of activity and energy in the management, and adequate support from the people. That institution was reconstituted in November last, and is intended to co-operate and work harmoniously with this Institute and similar societies to be established in the colony. Let us hope that its future career may be more prosperous than its past, and that we may run a friendly race with it and other similar institutions that may enter on the same course, in our endeavours to render the most important services to the cause we have undertaken to promote.

But, on the other hand, we may well take courage when we look back to the beginning of the most eminent and flourishing institutions of the present day. With hardly an exception, I believe, it may be affirmed that the beginnings have been small—of some, small even in comparison with our own. The splendid results have, it is said, been achieved, "not by the favour of the many, but by the wisdom and energy of the few." The Royal Society of England owes its origin to a small club, and its title to an accidental circumstance. The first meetings in London were held in a tavern, subsequently at a private house, and afterwards in the parlour of Gresham College. It received its name soon after the Restoration, when everybody went mad with loyalty—a name not appropriate to its objects, but complimentary to His Majesty King Charles II. The French Academy was equally humble in its origin. A few literate residents in Paris arranged to meet once a week for the friendly interchange of ideas. For many years the Academy continued to be but an insignificant private society: it shines forth now as one of the most illustrious institutions of the age. But notwithstanding these encouraging examples, I am impressed rather with wavering hope than with belief. I cannot forget that though the beginnings of the splendid institutions to which I have referred were indeed but small, yet the assistance of men of genius, capable of giving life, strength, and repute to the early efforts of the founders, was earnestly given. Where are we to look for such men in the youthful colony of New Zealand?

That this colony will grow rapidly in wealth and strength, and will eventually become a great nation, I do most firmly believe—it possesses all the elements for such a destiny. That the New Zealand Institute, with its incorporated societies, may keep pace, and in future ages become to New Zealand what the Royal Society is to England and the French Academy is to France, is the very utmost that we can ever hope for; and if such should ever be, the most sanguine expectations that may now be reasonably entertained would be fully realized. Many, very many generations must pass away before this can come to pass; but it may, and let us trust that it will.

For the present our duty is plain: we have ventured to lay foundations, let us add so much of the superstructure as may be within our power. It may be but little, but let that little be done. We may be wanting in the qualifications necessary to complete such a work, but it only requires that which is in our power—energetic and judicious efforts—to complete the small portion of the task that falls to the share of the present generation. The rest must be left to time and posterity.

1. "On the Botany of the Northern Part of the North Island," by T. Kirk. (*Transactions*, p. 84.)

Dr. Hector spoke in commendation of the paper. He hoped that such excursions as that of the cutter "Glance," during which the observations were made, would more frequently be undertaken than hitherto. He himself had had a six months' excursion in the same quarter. Novelties could now hardly be looked for in New Zealand, for the plants were pretty equally distributed, and a number of excellent observers had devoted themselves to exploration in it. Passing from botany, Dr. Hector made some remarks upon the geology of the district to the north of Auckland. Although the geology of New Zealand was very complex, still the great features were now fairly ascertained. Dr. Hochstetter's researches had surpassed the others in published results, but he must have derived a great deal of information from Major Heaphy and other local geologists. Dr. Hector then gave a most interesting account, first, of the geology of the New Zealand Islands as a whole; and next, more particularly of the geology of the northern part of Auckland, pointing out especially the areas occupied by palæozoic rocks that might prove auriferous, and also the area and extent of the great northern coal field. The lecture was illustrated by a geological map of the Northern District, which was published by Dr. Hector in 1866, and also by unpublished maps and sections of the coal fields.

Captain Hutton followed with some remarks on the same subject, saying that he believed Dr. Hector's account was the first that had been given of the general geology of New Zealand, and more especially of that part which had been more minutely described.

The Rev. Dr. Purchas expressed his gratification at the remarks that had been made by Dr. Hector and Captain Hutton. He said he had visited the Thames Gold Fields, and had been surprised at the quantity of gold lost there owing to the presence of sulphurets and the fine nature of the gold. That loss, he thought, might be obviated. He moved that the thanks of the meeting be given to Dr. Hector for his interesting statement.

Dr. Fischer seconded the motion, which was agreed to.

Thanks were also given to Mr. Kirk.

2. The Secretary then read a paper "On the Crater of White Island," by Dr. Rolston and Lieut. Edwin, of H.M.S. "Falcon."

Abstract.

The depth of Lake Hope, in the interior of White Island, at about fifty yards from the south shore, was found to be about two fathoms, and the soundings appeared to be uniform. The temperature of the lake was 110° F.; colour, light green. There was very much more water in the lake than when last visited in November, 1866, which precluded the possibility of reaching the largest steam jets, at the extreme north-west corner of the crater, but it was observed that these steam jets were not nearly so active as in 1866. There was only one mud geyser observable, which was on the south-east margin of the lake, on a slightly elevated bank, the mouth of which was about twelve feet in diameter. The mud was in a very liquid state, quite black looking; the depth obtained was about four feet; the temperature, 200° F.

The highest point at which steam was seen was on the outside of the crater, at the western side of the island, within one hundred yards of the top, or highest peak, of the island.

The height of the lake, above sea level, appeared to be about fifteen feet.

There seemed to be no rocks of original formation anywhere.

The vegetation seen (which could not be got at) was a dense, scrubby, green bush, growing all over the western end of the island. A grass was also observed on an inaccessible rock on the south bank, short, and very green.

The paper was illustrated by drawings (Plate VIII.), diagrams, and specimens.

List of specimens obtained:—

(1.) Sand, found on the sea beach between large boulders of conglomerate.

(2.) Mud, brought up by hand-lead, from the depth of four feet, while the geyser was in an active state of ebullition. This is the mud geyser before described. A bottle of the liquid mud, sealed up on the spot, also accompanied this.

(3.) Mud, from a steam jet (temp. 215° F.) at the south-west side of the lake, about 200 yards distant from it.

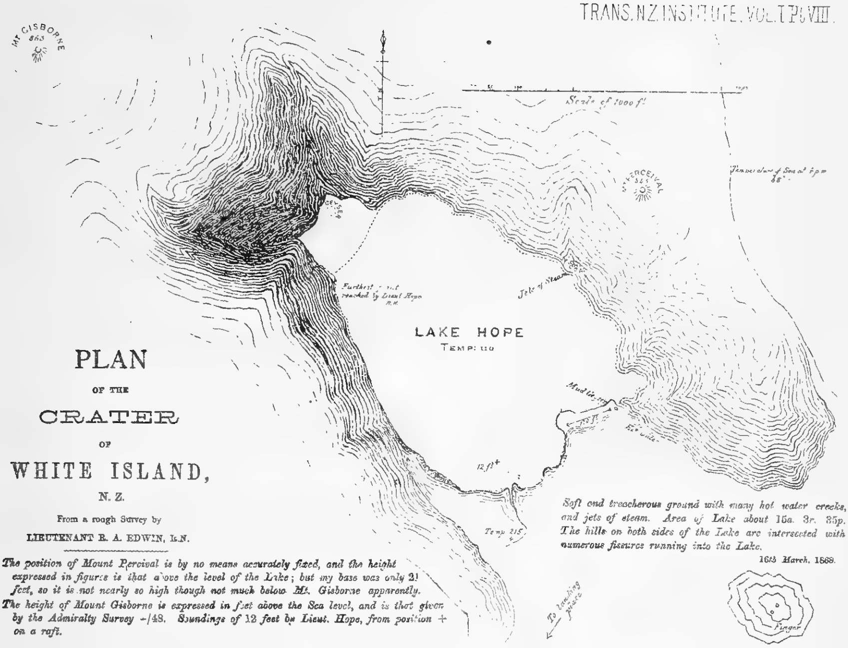
(4.) Dried surface mud, between the south beach and the lake.

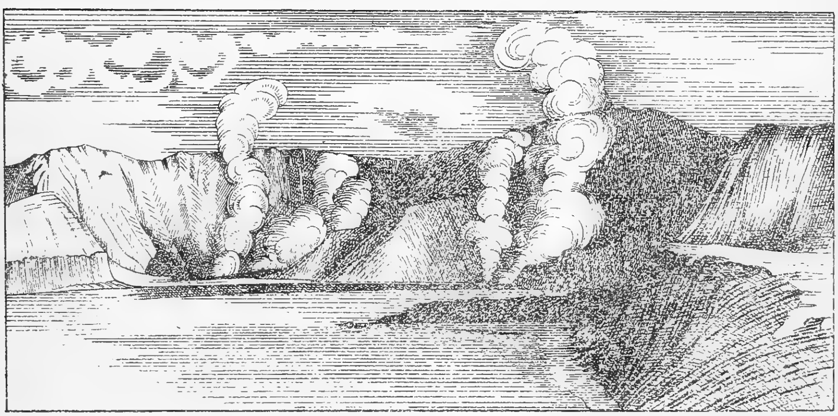
(5.) Crust of feathery crystals, taken from the dry bed of a water-course, where at one time water had run from geysers to the lake itself, in a north-west direction, and appeared to be of rather recent formation.

(6.) Bottle of lake water, taken at a temperature of 110° F.

With several other specimens of no great value.

Dr. Hector explained that the paper had been furnished by Dr. Rolston and Lieut. Edwin, in answer to a request made by him when he heard that





LAKE HOPE WHITE ISLAND

FROM A SKETCH BY J. C. RICHMOND.

tive degrees of inertia of a body, proved that in all cases the bird would reach the water in a curved line, at a certain distance behind its first position; and concluded that the common notion, that a certain position of the bird's wings and feathers enabled it to sail against the wind, was erroneous, and opposed to the known laws of physical science. He also combated the theory that an albatros could fly almost against the wind in the same manner that a ship beats to windward, pointing out that in the one case the pressure of the wind was resolved in forces, having other directions, by the resistance it received from the water; whereas the albatros was placed in only one medium, having a uniform direction, affording no opportunity, as in the case of the ship, of resolving its direction into that most advantageous to itself, viz. forwards.

The author then propounded his own theory, that the albatros receives motion by means of the momentum it has previously acquired by strokes of its wings in the air, or of its feet in the water, or both combined. He then went on to illustrate that duration of sailing might be supposed to depend upon the relative momentum and resistance. He showed, by algebraic formulæ, that a velocity, at starting, of 116 feet a second, sailing at an angle of five degrees to the horizon, would enable the bird—by gradually increasing the angle at which he was flying to ten degrees—to maintain a uniform height until its velocity was reduced to 58 feet a second. He then went on to show, by means of comparing the resistance offered to a round shot, the amount of resistance required to allow an albatros to sail for half an hour without employing his wings, and only reducing his velocity from 115 to 58 feet per second. He allowed 0·16 square feet as the effective area of resistance to the forward progress of the bird; and, by ably arranged and accurately defined formulæ, arrived at the conclusion that the resistance would be much less than one-fortieth of that calculated for round shot. He also showed that the greater the weight of the bird, and the smaller the velocity at which it was compelled to fly in order to maintain its position in the air, and the less the front area, the greater would be the period during which the bird could sail without using its wings. Thus, it might be said that the sailing power of a bird depended upon its weight, resistance to the downward force of gravity being great, while the resistance to its forward movement was small. He then took a Cape pigeon as an illustration; and calculating its terminal velocity at 10 feet a second, and the rate of flying at an angle of five and ten degrees to the horizon, at fifty-eight and twenty-nine respectively, showed that it would be able to sail only about eight minutes, or one-fourth as long as the albatros, the resistance of the air being in a similar ratio in both cases. However, the pigeon could not sail so long as eight minutes without being carried away by the wind, as the bird would have to use its wings some time before it had reached its least possible velocity. Bearing this in mind, it was shown that a diminution in velocity of 11·6 feet a second could be compensated for by an increase of one degree in the angle at which the bird happened to be flying; and that, therefore, it was extremely probable that the albatros used its air cells to enable it to slightly shift its centre of gravity with respect to the position of its wings, and so, with little muscular exertion, to alter the angle at which it was flying. The essayist concluded his able and instructive paper by stating that he did not pretend to have solved the problem connected with the flight of the albatros, but merely to have suggested a method of solving it. Experiments required to be made respecting the resistance offered by the front and under surface of the bird to different velocities of wind before any satisfactory conclusion could be arrived at.

A vote of thanks was tendered to Captain Hutton for the care and ability he had shown in the preparation of this paper.

2. "Notes on Land and Fresh-water Shells collected in the Northern Part of the Province of Auckland, during the Month of April, 1868," by T. B. Gillies.

Abstract.

After a few introductory remarks, the author observed that, at the native settlement of [Waitatiora] *Whitiora*, he had found a fine specimen of the *Bulimus* crawling across the path, which appeared to be the *Bulimus antipodarum*, but differing from some hundreds of specimens that he had seen, in having two strongly developed bars or projections on the inner side of the outer lip. The presence of half-burnt shells, on peat, at Whangaruru, from which the fern had been previously burnt off, afforded ample evidence that it had once been a favourite habitat of the *Bulimus antipodarum*. A smaller shell, which he was inclined to set down as the young of the *Bulimus antipodarum*, or an *Achatina*, had been obtained from the natives. None of the larger *Bulimus antipodarum* had been found at Bream Head, though abundance of the smaller kind were met with. However, he had some doubt of the identity of the Whangaruru with the Bream Head species. On Mania Hill, near Whangarei, he had found what at first sight appeared to be three varieties of a whorled shell, like a *Turritella*, but which he supposed to be a *Cyclostoma*. The larger variety had six whorls, about half an inch long by one-eighth of an inch in width, and of a brownish colour, indistinctly striped; the mouth being nearly circular and much contorted to the right, with a sort of double lip all round. The smaller variety, five whorls, a quarter of an inch to three-eighths of an inch long, had not the contorted mouth nor the double lip. The smaller variety was only ten-twelfths of an inch in length, by ·7 in. wide. He had also obtained a large number of

Helices, amongst which he could distinguish the *Helix busbyi* and the *Helix dunniæ.* Mr. Gillies went on to exhibit and to describe shells which he had obtained at the Waitangi Falls and in the northern streams.

Captain Hutton said Mr. Gillies deserved the thanks of the members of the Institute for the valuable services he had rendered to the geology of New Zealand.

3. A paper "On Thames Auriferous Quartz," by Mr. George Ford, Gold-mining Chemist, of Australia, was read by the Secretary.

The paper contained much valuable information as to the character of Thames gold, modes of its extraction, indications for judging of its presence, value, &c. It had been written by Mr. Ford for the owners of the "Bobbie Burns" claim at the Thames, who had submitted for examination a portion of outside casing, not taken from a leader. A request was made to the meeting that the contents of this paper should not be made public for the present, the shareholders themselves having been at considerable expense in obtaining it.

Captain Hutton warned the miners against the use of cyanide of potassium, as the result of it would be to dissolve the gold. He, however, approved of the use of Mr. Crook's sodium amalgam as a corrective.

Captain Goldsmith drew attention to the fact that the separation of the gold was often impeded, and loss occasioned, by clay getting into the stamper box and mixing with the mercury.

Third Meeting. *6th July,* 1868.

Frederick Whitaker, President, in the chair.

The following contributions were laid upon the table:—

Golden pheasant, from the Auckland Acclimatization Society. Fossil *Pecten,* from Te Pahi, Kaipara—Mr. Kirk. Work on the anatomy of *Hatteria punctata,* by Albert Günther—from the author. Auriferous quartz, from the "Bobbie Burns" claim—Mr. W. Aitkin. Copy of the *Auckland Times,* 12th September, 1842, found at an old native burial-place at the Thames—Mr. H. M. Jervis. One rare *Murex,* one rare *Venus*—Mr. Traill. Specimen of king penguin, captured at the Bay of Islands—Captain Hutton. One skin of huia, one of *Apteryx oweni,* from Mr. Buller, Wanganui, in exchange for skins from museum collection; and one skull of fish (unknown), collected at Hokitika, by Mr. Murdoch.

Moved and carried, that the thanks of the meeting be given to the donors.

1. "On some Experiments in Hydraulic Mortar," by James Stewart, Assoc. Inst. C.E. (*Transactions,* p. 101.)

A discussion ensued, in which several members took part; during which astonishment was expressed that stones of different sorts, especially fire-bricks, should still be imported into the colony at a heavy cost, when they could be obtained much cheaper in the province itself.

2. "Notes on the Birds of the Great Barrier Island," by Captain F. W. Hutton, F.G.S. (*Transactions*, p. 104.)

3. "Notes on the Birds of the Little Barrier Island," by Captain F. W. Hutton, F.G.S. (*Transactions*, p. 106.)

Several specimens were produced as the result of Captain Hutton's explorations on these islands. Mr. Kirk, who accompanied Captain Hutton in his visit to the Little Barrier, added a few interesting remarks to the papers read.

In answer to a question put by the Rev. Mr. Purchas, Captain Hutton replied that the crater at the Little Barrier appeared to be about the same age as that at the North Head of the Manukau, and was, with slight exceptions, similar to that of Tongariro.

4. "On the Hot Spring of Te Tarata, Rotomahana," by Captain F. W. Hutton, F.G.S. (*Transactions*, p. 106.)

A vote of thanks to Captain Hutton and Mr. Stewart closed the proceedings.

FOURTH MEETING. *3rd August*, 1868.

The Rev. James Buller in the chair.

The following contributions were announced:—

Specimen of copper from Whangapurapura, Great Barrier Island—Mr. F. Whitaker. Two living specimens of *Hatteria punctata*, from Karewa Island, near Tauranga—Mr. H. T. Clarke. Gold from Kapanga, gold from South Island, gold from South America, and arsenic from Kapanga—Mr. F. Whitaker. Gold from Paparata. Collection of moa bones—Dr. Haast, Christchurch, per Captain Hutton. Fossil wood from the Portland beds, England—Dr. Purchas. Johnston's "Lectures on Agricultural Chemistry and Geology"—Mr. J. H. Crawford. Specimen of cement with gold (about four ounces to the ton), from Charleston, Nelson; specimen of quartz with gold, from Westport, Nelson—Mr. D. Murdoch. Trachytic rocks from Tokatoka, Kaipara—Captain Hutton. Specimen of wood (probably *Leptospermum*), taken from a depth of forty feet below the scoria, near Mount Eden—Mr. John Probert. Crystallized quartz and rock casing from the York and Devon claims; quartz and bed rock from the Bendigo claim; quartz from the Pretty Jane claim—Mr. Cartwright. Collection of thirty-nine coins and medals, chiefly silver—Mr. J. H. Crawford.

1. "Description of Arid Island," by Captain Hutton and T. Kirk. (*Transactions*, p. 108.)

At the conclusion of the paper, which was read by the honorary secretary, Mr. Gillies, some discussion took place respecting what had been stated as to the subsidence of the island. Dr. Purchas, Mr. Gillies, Mr. Boardman, and Captain Hutton spoke on the subject.

2. "On Agricultural Chemistry," by J. Lowe, C.E.

ABSTRACT.

The author commenced by observing that the fertility of a soil, as relates to the production of particular crops, may depend upon the presence or absence of very minute or almost imperceptible portions of inorganic substances—alkalies for instance—and salts of metals. The necessity, for example, of sulphate of lime to clover, silica to grapes, phosphorus to wheat, &c., was formerly quite disregarded, and it is only of late years that these matters have been more looked into; and we see, with satisfaction, the result of the joint labour of the farmer and the chemist. Soils are made up of organic and inorganic constituents; he would confine himself to the latter, and class them as those which constitute the bulk of the soil, on the mechanical texture of which the growing crops depend, such as clay, sand, and lime; also those involving the fitness of soil for particular crops, such as sulphate and phosphate of lime, soda, ammonia, magnesia, &c. The author described various mineral and chemical compounds suitable for the different kinds of soils and crops; also the method for making and applying such. He described at some length the different kinds of clays and earths, and the properties peculiar to them, and recommended farmers to have their lands chemically tested or analyzed, so as to enable them, by applying the necessary compounds, to make the soil suitable for particular crops.

Captain Hutton said that in anticipation of the paper, he had prepared a map showing where limestone existed in the province. It would be seen that it occurred all over the north, in small patches, but the only great mass was in that part from Raglan Harbour to Aotea, Kawhia, and Mokau. As to the value of limestone as a manure, he should like to ask Mr. Wark what was done with the refuse lime from the gasworks, which was a most valuable manure.

Mr. Wark said that when the gasworks were first started, lime was used to purify the gas; but it had been found expensive, and he (Mr. Wark) now used oxide of iron, which cost three farthings, while the lime had cost sixpence. While the lime was being used, it was readily bought by the farmers at two shillings and sixpence per load. A good deal of ammonia had been given to farmers gratuitously, but he had not heard of the result.

Perhaps Mr. Gillies, who had got some, would inform them as to his experience.

Mr. Gillies said he was convinced that the ammonia was one of the most valuable manures for grass; it would increase the crop at least one-third, and was excellent as a destroyer of grubs, wire-worms, and slugs. He was sorry to see that the farmers pooh-poohed so much the idea of agricultural chemistry being of any benefit. He had conversed with many of them, and was sorry to hear their opinions on the subject. He observed that Dr. Hector had done something to create an interest in the subject, by advertising that any person who sent a bag of soil to Wellington would get an analysis free. It seemed to him (Mr. Gillies) that every farmer ought to send down a specimen of the soil of his farm and have it analyzed. He was surprised, however, to hear from Dr. Hector, when he was last in Auckland, that he had not got half a dozen specimens of soils from the whole province. The society might get specimens analyzed from every district in the province, and make out a map of soils, showing what their products might be. By this they would see that in one district wheat might advantageously be grown, in another clover, in another barley, and so on. Two years ago he thought of growing vines at Mount Eden, which he thought would be admirably adapted for their growth. He found, however, that they produced too much wood, and did not succeed.

Dr. Fischer said that the soil upon which he had experimented, with reference to vines, was trachytic scoria, while Mount Eden was basaltic scoria. He (Dr. Fischer) had not yet succeeded very well with his vines. He believed that the Mount Eden soil would be too dry for the vines. Dr. Fischer remarked that to have a map applied to such a purpose as that spoken of by Mr. Gillies, they would require to have the particulars of the climates of the different districts also.

Resolved, "That the Secretary be instructed to apply to Dr. Hector for forms respecting the analysis of soils."

Fifth Meeting. *7th September*, 1868.

F. Whitaker, President, and subsequently T. B. Gillies, in the chair.

The Chairman read the following list of donations which had been made to the society since the last meeting:—

Specimens of a *Mactra*, from the alluvium of Kauwaeranga Creek, Thames—Captain Hutton. Model of a river steamer, model of a line-of-battle ship, and leaf impressions from Waikato—T. Russell, Esq. Four copper coins—John Kirby, Esq. Coal from Mount Rochfort, Nelson—H. Wrigg, Esq., C.E. Crystallized quartz, from the York and Devon claims—Mr. Cartwright.

1. "On Sinking Funds,"* by Captain F. W. Hutton, F.G.S., illustrated by a series of calculations applicable to the different methods adopted to pay off debts.

2. Mr. Gillies read a paper consisting of a letter to Captain Hutton from Mr. Mair, Resident Magistrate at Opotiki, descriptive of the tidal phenomenon at that place.

Dr. Purchas said that he might mention a very curious circumstance with reference to the rise that had occurred in the land about Auckland. He thought it afforded positive proof that the land about Auckland was rising sufficiently to be quite measurable. Messrs. Thornton and Co. got a supply of water from the harbour. They had a pipe fixed at some distance down the wharf, with a rose at the bottom. They have had to alter that rose three times, at intervals of three years. Mr. Firth had told him of the circumstance, and he believed that special pains had been taken with the fixing of the pipe the last time in order to test the matter. He had been assured by a settler that the harbour of Mahurangi was two feet less in depth than it was two years ago. If the bottom of the harbour was rising, it was a matter of vital importance to people in the neighbourhood of the city. He had no doubt about the accuracy of the information, as was shown by the fact that the rose had had to be altered three times in order to get a supply of water at low tide. He could not think that the wharf had risen, and would suppose the traffic would rather tend to put it down.

A discussion ensued, in which Mr. Weymouth, Captain Hutton, Mr. Wark, Mr. Buckland, and Mr. Stewart took part. Most of the speakers seemed to be of opinion that there was not sufficient proof to show that the land was absolutely rising.

Captain Hutton said he should be happy to investigate the subject, and report upon it to next meeting.

Mr. Gillies said it seemed to him that two things had been brought before them—first, the silting up, and second, the average high water or low water. The water would maintain its level whatever silting up occurred. The level was not affected in the slightest degree by the silting up of the harbour. He was sure they were much obliged to Dr. Purchas for having mentioned the matter, and to Captain Hutton for having volunteered to investigate it. In such a case the facts must be carefully noted to be of any use at all.

3. "On the Preparation of Native Flax," by the Rev. A. G. Purchas, M.R.C.S.

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* This paper has also to be reserved, as it was found impossible to procure the type for printing the algebraic formulæ which it contains in Wellington.—Ed. (See "Transactions," Vol. II. p. 236.)

Abstract.

Dr. Purchas described several different kinds of vegetable fibre, showing specimens derived from the ti tree, and what he termed the most beautiful fibre he knew of, a fibre from the leaf of the pine-apple. He then spoke of the *Phormium tenax*, and the capabilities of the fibre derived from it. He thought the refuse in manufacturing might be converted into useful brown paper. If used from the green leaf, he thought the paper would not require any size. The author then pointed out what he considered to be the necessary processes to produce the fibre. It was simply a mistake to talk about getting rid of the gum; it was the cellular tissue that they wanted to get rid of—the gum was easily got out. Dr. Purchas said it was some years since he had made the discovery, that merely striking the leaf with a hammer on a piece of hard wood released the fibre. He then spoke of the native mode, which, he said, was ingenious and effective, but in which there was a great waste. It also very easily fermented. When they wanted to make kaitaka mats, the natives steeped the fibre, and beat it until it was freely divided. He also spoke of the boiling process, and showed a specimen prepared in that way. There was one person who prepared flax by boiling, and then subjecting it to a mechanical process, which he kept secret. In speaking of the process of fermentation, Dr. Purchas said that it was averred that that process spoiled the fibre, which he thought likely. Dr. Purchas then exhibited a piece of rope made from the common flax produced at Waitangi. He would like to see a rope manufactory established here as well as at Canterbury.

Mr. Buckland said he was sure they were all much obliged to Dr. Purchas for bringing before them a matter second in importance not even to the digging of gold. He was afraid they never could make flax well adapted to rope making, unless they could succeed in preventing rotting. Dr. Purchas had told them that, before the war, the miners in Victoria had preferred the flax ropes, but they had found by experience that they could not stand exposure to wet, and they had ceased to use them. The fault found in the rope was that it would not take tar well, and that it rotted. The system of cleaning the flax by beating was not new, as he had seen it in Wellington in 1840, where flax was manufactured by beating it between two pieces of hard wood. This plan was given up, and they afterwards took to boiling. If the people of New Zealand ever made up their minds to cultivate flax, they must take the tihore, and there were several distinct kinds of tihore. The best flax he knew of was to be found at Maungatautari, where the natives could earn seven shillings a day, at a price of £20 per ton. That was done by using only the best description of flax. He trusted the time was not far distant when they would be able to export a large quantity of flax.

Captain Hutton said flax could not be made useful for sail-cloth.

Dr. Purchas said his own opinion was, that it was not good for sails, or for anything that had to be much exposed to the weather, as it was destroyed by constant wetting and drying. With regard to ropes, there was a mode of preparation that would make it take tar. The ti-tree fibre had enormous power in resisting the weather, but they could only apply the flax to its proper purpose. If they took the New Zealand flax, they might make a rope from it stronger almost than any other; but if they wanted it to retain its strength, they must coat it with material to keep it from the weather. Therefore, he freely acknowledged that New Zealand flax was not a good material for rope making, where it was to be exposed to constant changes in the weather without any protecting material. Whether, when tarred, it would last as long as a rope made from European flax, he did not know; he should say not. Probably one great reason was, that the tar penetrated more thoroughly into the inner fibres of the European rope. If they subdivided the fibre of the *Phormium tenax*, they gained the strength on the knot, but lost strength in the direct line of the fibre.

Mr. Wrigley said there was one point spoken of by Dr. Purchas he should like some further explanation about—namely, as to mixing the flax with other materials.

Mr. Stewart said his impression was, that the flax would take tar much better than Manilla, although not so well as hemp.

Dr. Purchas said that in one place in Yorkshire ten thousand pounds worth of machinery had been put up to work the New Zealand flax, but they could not get a supply, and the machinery had to be taken down. That was what they were constantly told in England: "There is no use sending samples; send us the material by ship-loads, and we will take it, and give a good price."

The Chairman said that he might make some remarks on the subject, having been one of the Committee of the House of Representatives, in 1860, when Dr. Purchas' patent was passed. He confessed that he was utterly against patents, and thought them wrong in principle. He, however, happened to be on the Committee on Dr. Purchas' application, and he was very much pleased when Dr. Purchas showed him the principle upon which he was manufacturing the flax. He was surprised as well as pleased at the simplicity and yet effectiveness of it; and when he went South he tried all he could to interest some of the people there in the matter, and get them to take up the patent and work it. He did all he could to push it there, because he believed it to be a right principle. He had seen it, and it seemed to him to be a right principle mechanically; and upon these grounds it seemed to him that the principle was adapted not only to flax but to other materials like flax. He remembered being surprised, in the Committee, to see the fibre produced by that method from an aloe leaf. By the percussion process they got rid of the epidermis and cellular tissue of the flax, and then there was left the fibre intact; but that fibre consisted of a multitude of fibres glued together, as they might see, by some matter which had been called a gum—an insoluble gum, and by other names. If they got rid of that gum, they reduced it from a fibre—a very strong fibre—into tow. If they got rid of the gum by chemicals, boiling, or in any other way, just in proportion as they got rid of it they also got rid of the tenacity of the fibre, and rendered it useful for other purposes, such as for paper making. The grand question was, where was the exact limit—where it would pay best—whether to get it in its greatest strength longitudinally, or to reduce it more or less into tow, when it might be useful for mixing with woollen, cotton, or other substances.

Dr. Purchas said he had omitted to mention one thing in connection with the preparation of the flax, namely, that the refuse made most excellent food for cattle.

Sixth Meeting. *5th October*, 1868.

F. Whitaker, President, in the chair.

The President observed that he was sorry he had not been present at the meeting on the previous Saturday. Had he been so, he would have drawn up a closing address, and delivered it on this the closing night of the session. Had he known that such an address was expected from him, he would have been prepared to have drawn it up; but he had quite forgotten that that was the last night of the session. He made this explanation so that the members might not think he was careless in the matter. He would always be most glad to devote his time to advancing the interests of the Institute. Looking at the past session, he thought they had on the whole been as successful as they could have expected; and if the members would devote a little extra time, gathering up information in the recess for the next sessional meetings, there was no doubt it would be a very great success.

The following contributions were announced:—

One copper coin—Mr. Charles Hime. Two Australian birds—Captain Holt, from Sir George Grey. One frog—Mr. Isaac Hunt, Tapu. One specimen from the Kyber Pass claim—Mr. R. M. Heighton. Thirty-three rock specimens from the Thames—Mr. O'Keeffe. *Ianthina exigua*, and two other shells; specimens of fossil wood—Mrs. W. Young. Skin of an undescribed petrel—donor's name unknown, left at the museum. Sundry rock specimens—Colonel De Quincey. Minerals from the caves at the Three Kings—Captain Hutton. Specimen of spider, supposed to be the katipo.

1. "Analyses of Waters, lately forwarded to Dr. Hector, at Wellington."

EXTRACTS.

"Class IV. Results of analysis of specimen No. 156-L. Water, six bottles; forwarded by T. B. Gillies; locality, Hot Springs, near Mahurangi, Auckland; received, 24th January, 1868; reported on, 25th February, 1868; 4 oz. of water from cold spring (A) yielded 1·85 grain, or per gallon 74· grains; ditto hot (B), 3·51 grains, or per gallon 140·4 grains; ditto hottest (C), 3·54 grains, or per gallon 141·6 grains. The analysis of the solid residue from A could not be completed for want of material.

ANALYSIS (A).

	gr.		gr.
Sulphuric acid	·22	or per gal.	8·80
Chlorine	·56	or per gal.	22·40
Lime	·13	or per gal.	5·20
Magnesia	·23	or per gal.	9·20
Silica	·08	or per gal.	3·20
Potash	·12	or per gal.	4·80
Balance left, probably carbonic acid and soda ...	·51	or per gal.	20·40
	1·85		74·00

ANALYSIS OF THE SOLID RESIDUE FROM B.

	gr.		gr.
Chloride of magnesium	·55	or per gal.	22·00
Chloride of calcium	·42	or per gal.	16·80
Chloride of sodium	2·13	or per gal.	85·20
Silica	·09	or per gal.	3·60
Potash	Traces		Traces
Carbonic and sulphurous acids	Traces		Traces
Constitutional water and loss...	·32	or per gal.	12·80
	3·51		140·40

"(C.) The composition of C appearing the same as B to a qualitative examination, it was not quantitatively analyzed.

"Results of analysis of specimen No. 252-L, forwarded by T. B. Gillies, from a hot spring near a lake on the west side of the Waikato River, received 23rd September, 1868:—

"Water: Character, clear; reaction is decidedly alkaline; contains 47·04 grains of fixed matter per gallon, consisting principally of alkaline chlorides, the remainder being chiefly silicates of lime and alkaline carbonates.

"The carbonaceous matters are very small in quantity.

"Note.—The quantity of water furnished was far too small to admit of a complete quantitative analysis.—W. SKEY.

"Forwarded for Mr. Gillies' information.

"JAMES HECTOR.

"New Zealand Geological Survey Laboratory,
"24th September, 1868."

HOT SPRINGS.

Mr. Gillies, referring to the water taken from the neighbourhood of Wangape, said the spring was so hot that eggs could be boiled in it.

Captain Hutton gave a description of the spring in question. It was about four miles from Lake Wangape, in the Waikato. There were several hot springs close together, but this was the largest of them, being about fifteen yards long by five yards broad, and it was very deep. The water was so hot that it was impossible to bear the hand in it for more than a second; and on one occasion when he was in company with others in the neighbourhood of this spring, having caught a pig for dinner, they fastened it with flax and threw it into the spring, and on taking it out it was perfectly scalded, and they had no difficulty in scraping the hair off. The temperature of the spring was from 160° to 200° at the very least. The water itself was almost tasteless; he had drunk it himself. He thought it was the chloride of sodium which gave it the reaction referred to. What its effects would be as a mineral spring he could not say; but it was easy of access, was very prettily situated, and was not above fifty miles from Auckland, and he trusted that some day it would be called into use.

Mr. Gillies said, with regard to the hot springs at Waiwera, when he was there last year he took samples of water from the three springs and forwarded them for analysis. The coolest of the springs ranged from 110° upwards. He believed that many of our Auckland residents had derived much good from bathing in these springs for the purpose of curing rheumatism.

REMARKABLE CIRCUMSTANCE CONNECTED WITH THE SAVING OF GOLD.

Mr. Whitaker said that a most remarkable circumstance had come to his notice, which he thought, now that the subject of water was under discussion, was well worthy of being mentioned. Close to the Kurunui there was another claim called the "Long Drive," from which came a small stream of water, which was used by the Kurunui Company to work their machine. To this machine there were two batteries, one of which was worked by the water he had mentioned, and the other by water which came from the hill above, by the Kurunui Creek. It was found that the battery worked by the water coming from the creek always produced more gold than the one worked by water from the Long Drive, although both batteries were treated in precisely the same manner. Alterations were made, but the yield was still the same, when the waters were crossed, and the right-hand battery worked by the water which had previously been used for the left-hand one. The consequence was that the right-hand battery then produced more than the left-hand one. Experiments were again made, and the effect was always the same: whenever the water from the Long Drive was used from one-third to half the gold was lost. This was stated to him by the manager of the claim, who put down the whole result to the water coming from the Long Drive. If they stopped the water from the creek, and used that coming from the Long Drive only, the result was still the same: they lost from a third to half the gold. In consequence of this statement of the manager, he (the speaker) had brought up two bottles of water from the Long Drive for the purpose of having it analyzed. It was a matter of the greatest importance that it should be ascertained what the contents consisted of. The other water, by which the battery produced the most gold, came from the Moanataiari hill, which was the richest hill as yet found on the gold field. The people who had given him the information on this subject might possibly be mistaken, but he was quite sure they were not deceiving him. The water which he had brought up he intended to forward to Dr. Hector for analysis.

It was a most important question, involving immense monetary considerations. If the statement made to him were correct, and he had no reason to doubt it, that this water from the Long Drive lost, say, even a third of the gold, which could only be obtained by using the other water, then the loss must have been already very large.

Dr. Purchas asked if the water used from the hill referred to, as saving the most gold, was clean.

Mr. Whitaker replied that it was pretty clean; it was used at one machine before coming down to the Kurunui, but it was filtered, and tolerably pure when used by that Company.

Captain Hutton said that, taking the general question of water, there are more hot springs in Auckland, in proportion to its size, than in any other part of the world. A great many had already been discovered, and there were, doubtless, many more lying undiscovered away in the far north—probably a vast number. No doubt some day these springs would prove as attractive as those of Switzerland and Germany did in the present day. He had drunk the water from the springs at Whangarei, and it was quite equal to any Seltzer water he had ever tasted in his life.

With regard to the question of analysis, he thought it useless to send less than six gallons of water if a thorough analysis were required, as a large quantity had to be evaporated to leave an appreciable residue. Respecting the question brought by Mr. Whitaker before the notice of the members of the Institute, it was certainly very remarkable, but he was not at all disposed to doubt it; but, taking it for granted that one water saved more gold than the other, it could only arise from one of two causes—the one chemical and the other mechanical. The two waters mentioned might be of different specific gravities. This might be a possible explanation, but he did not think it was sufficient to account for it. The water spoken of by Mr. Whitaker probably contained silica in solution. What action the silica might have upon the gold was very obscure; but still there was the fact as stated by Mr. Whitaker, and there might be some unknown action between silica, which was an acid, and gold, which might have some effect on the gold, and make it less susceptible of amalgamating with the mercury than if the water was quite clear. He only threw out these suggestions on the spur of the moment, the question having come up during the last half-hour.

2. "On the Geology of the Island of Pakihi," by Captain F. W. Hutton, F.G.S. (*Transactions*, p. 113.)

Captain Hutton said there were two or three things in connection with the Island of Pakihi which gave it a particular interest, one of which was, that it contained large quantities of manganese, by which they might ultimately be able to extract gold from iron pyrites, without having to roast it.

BEST METHOD OF SAVING GOLD AT THE THAMES.

Dr. Purchas said he was aware that on that occasion he had promised to give a *vivâ voce* description of the various processes employed in saving gold. He had, however, no time to get up his subject as he should have wished, but would, as there was so little business on the paper, say a few words on the subject. The speaker then went on to describe the manner in which gold was treated in South America, saying that far poorer ores than those at the Thames were crushed and made payable. Speaking of the space required for the working of some of the machinery in South America, he said that on many claims a space as large as six men's ground at the Thames was required for amalgamating ground. He then briefly explained the process by which the amalgamation took place. The ore, speaking more particularly of silver ore, was laid upon the ground mixed with salt, and horses were kept going round, treading upon it, and so breaking it fine. It was also dressed three or four times with quicksilver, and, in some seasons of the year, small quantities of lime were added. It was a remarkable circumstance that in the winter the temperature was made higher and in the summer was made lower by the process. If the ore was poor in sulphur, then another ore having sulphur was mixed with it, and trodden down in it to make it work, and left on the ground, in summer sixteen days, and in winter twenty-five days. The way in which the thorough amalgamation and separation were afterwards carried on, by means of certain machinery, was fully explained by the speaker. Then there was another process, by which ores were roasted, and mixed with salt, and placed in barrels having certain machinery, for separation and amalgamation. So perfect was this system that a very minute portion of metal was left in the ore. The heat, dews, wet, and the magnetic state of the atmosphere, all played a part towards the extraction of the metal from the ore. They might say this process was very rough, but if it saved the gold, what mattered it? At present, at the Thames, a great part—he might say the greater part—of the gold was lost, even with the best machinery. One reason of which, he believed, was because the process was gone through far too quickly; and another thing that militated against the thorough saving of gold was the immense quantity of undecomposed sulphurets that pass through the mills. Speaking of the amount of gold that might be extracted from these iron pyrites, Dr. Purchas said that in Australia as much as forty ounces to the ton had been obtained.

Captain Hutton said ninety in some places.

Dr. Purchas said that, if that were the case, there must be an enormous quantity of gold lost at the Thames. He was much struck, in reading over a book on the subject of gold separating and amalgamating, to find that in one mine in California a shaft had been sunk 1,300 feet, and yet, notwithstanding the immense depth, the shareholders said that it paid better than ever it had done before. Even then it was only yielding an ounce to the ton; and if this could be done in California, surely it could be done here where there was a yield of three or four ounces. Another thing he wished to say about the Thames, and that was, that a great deal of the soil that was thrown away, in fact, in the majority of cases, contained a large percentage of gold.

Captain Hutton asked whether the earth was meant, or the casing of the veins.

Dr. Purchas said it would be the casing he was referring to. With regard to the processes he had mentioned of getting the gold from the stone, many people would grumble at the time taken, but everything of this sort required to be done by companies. He thought it was a mistake to attempt to mine at the Thames as diggers were doing at the present time; the right way to do it was to mine with companies, and with large areas of ground and proper machinery. He believed an immense amount of labour was wasted; certainly a large amount of gold was.

Mr. Gillies said he would not discuss the question of gold saving, but there was one thing which he would ask the Society and the people at large not to admit, and that was, that large public companies were always the best.

While he admitted the advantages which the companies had for working the ground by means of capital, he did not believe in their finding out anything new in the mode of saving gold. If anything new was to be found, it would be done by individual miners.

Dr. Fischer thought the only sure way of saving the whole of the gold was by the hot-blast process, as it was termed. The speaker then explained, by means of diagrams, the whole process from beginning to end.

Captain Hutton thought the idea of the last speaker, with regard to the zinc plates, was a fallacious one, saying they would stop the very stuff intended to be thrown off the tables. It would be, in his opinion, far better to have what was known as a *broken table*, with movable copper plates, so that as soon as they were fully charged with amalgam they could be removed and others substituted, which would in many instances effect a large saving of the precious metal. With regard to what had been said, and what was always being said, about new inventions for saving gold, he believed, for his own part, that those machines which had been used in Australia and California were thoroughly good; and it was a mistake to get any on new principles till they had tested the good old ones. Many ingenious inventions had been put forward for saving gold—more inventions than for anything else; but all he could say about most of them was, that they were very much advertised and very little used. With regard to what had been said by Dr. Purchas, the processes he had described were applicable mainly to the saving of silver from ores containing gold, which was very different from the requirements of the Thames. In Victoria, at the starting of the gold fields, the same high charges ruled for crushing as were now paid at the Thames; and the consequence was that only a few claims really paid, whereas, now that the prices were low, 2,000 reefs were worked. In his opinion, to have the thing properly worked, every claim must have its own machine, going night and day, and crush everything before it. Another great drawback was the want of security; and until claims were held on the same kind of leases as other property, no man of sense would put much money in them. But, given these two things—security and machinery—for every claim, and he was convinced that the Thames, for its area, would turn out more gold than any other field yet known; and continue to do so, perhaps, for centuries to come. Speaking of the gold contained in the iron pyrites at the Thames, Captain Hutton said that it would yield from three ounces to thirty ounces to the ton (of pyrites, of course); but that would not pay under the present system. He hoped he would see the day when the whole face of the rock would be taken down, and everything treated properly, either by the roasting system or chlorine, so as to make it all pay; though, no doubt, it would be some time before that would come to pass.

Captain Hutton proposed that Dr. Ferdinand Hochstetter should be elected the first honorary member of the Auckland Institute.

Mr. Gillies seconded the proposition, and, in doing so, said it was doing honour to themselves more than to the doctor.—Carried unanimously.

The Chairman then declared the present session of the Institute closed for the season, but stated that the Council meetings would take place as usual.

APPENDIX.

THE CLIMATE OF NEW ZEALAND.

METEOROLOGICAL STATISTICS.

The following TABLES, which form the most reliable data for judging of the Climate of New Zealand, are extracted from the Reports of the Inspector of Meteorological Stations, for 1867, and are appended for the information of those to whom the above Report was not accessible.

TABLE I.—MEAN TEMPERATURE of the AIR in shade, recorded at the Chief Towns in the NORTH and SOUTH ISLANDS of NEW ZEALAND, from the earliest Observations, to the end of 1867.

Place.	Mean Annual Temp.	Mean Temp. for (SPRING) Sept., Oct., Nov.	Mean Temp. for (SUMMER) Dec., Jan., Feb.	Mean Temp. for (AUTUMN) Mar., April, May.	Mean Temp. for (WINTER) June, July, Aug.	Period of Observations.
NORTH ISLAND.	Degrees.	Degrees.	Degrees.	Degrees.	Degrees.	
Auckland	60·3	58·8	68·6	62·3	53·3	15 years
Taranaki	56·8	55·9	64·2	57·4	49·5	12 „
Wellington	55·7	54·6	63·6	56·7	47·9	10 „
Means for North Island	57·6	56·4	65·4	58·8	50·2	
SOUTH ISLAND.						
Nelson	55·0	53·3	62·5	56·4	46·7	16 years
Christchurch ...	55·1	55·5	61·4	55·9	44·5	11 „
Dunedin	50·7	50·0	57·4	51·6	47·0	15 „
Means for South Island	53·6	52·9	60·4	54·6	46·0	
	57·6	56·4	65·4	58·8	50·2	
	53·6	52·9	60·4	54·6	46·0	
Means for North & South Islands	55·6	54·6	62·9	56·7	48·1	

From the above table it will be observed that in the North Island the mean annual temperature for Auckland is the highest (60·3 degs.), and that for Taranaki (56·8 degs.) the next, while Wellington is the lowest (55·7 degs.)

In the South Island, Christchurch and Nelson show the highest annual mean temperature (55·1 and 55·0 degs.), and Dunedin is very much lower, viz. 50·7 degs.

January and February, corresponding to July and August in England, are the two warmest months in New Zealand; and July and August, the two coldest (excepting in Nelson and Wellington, at which places the mean readings are lowest for June and July).

The climate of London is 7·2 degrees colder than that of the North Island, and 3·8 degrees colder than the South Island of New Zealand; and the difference between the mean annual temperature of the whole of New Zealand and that of London is 5·7 degs., the former being 55·7 degs., and the latter 50 degs.

The following are the means for the two warmest and two coldest months in the year in the several localities, with their differences:—

Auckland.	Taranaki.	Wellington.	Nelson.	Christchurch.	Dunedin.
69·6	64·7	64·6	63·6	65·2	58·0
53·1	49·3	47·8	45·9	44·3	43·2
16·5	15·4	16·8	17·7	20·9	14·8

From which we find that the average difference between the mean temperature of the warmest and coldest months of the year in New Zealand is 17 degs.; at Rome it is 27 degs., at Montpellier 33 degs., at Milan 38 degs., and at Jersey 22 degs.

The observations from these six stations have been selected to form the above table, as they extend over a tolerably long period, and give a fair comparison of the climate of the North and South Islands.

TABLE II.—Showing the Influence of the Southern Alps on the Climate of the East and West Coasts of the South Island, from Averages for the years 1866 and 1867.

Locality.	Mean Annual Temperature.	Maximum Solar Radiation recorded.	Minimum Terrestrial Radiation recorded.	Mean Elastic Force of Vapour.	Mean Degree of Moisture.	Mean Annual Rainfall.	Average Number of Days on which Rain fell.	Average Velocity of Wind, in miles per day.
	Degs.	Degs.	Degs.	Inches.	Sat.=100	Inches.	Days.	Miles.
Christchurch (East Coast)	53·3	137· Feb.	18· July.	·347	76	24·70	91	165
Hokitika (West Coast)	52·3	103· Jan.	22· Aug.	·393	89	119·00	202	133

TABLE III.—Showing the RAINFALL in the NORTH and SOUTH ISLANDS of NEW ZEALAND, compiled from the earliest Observations to the present date, 1867.

Place.	Mean Annual Rainfall.	Averages of Rainfall for the different Seasons of the Year, with the Mean Number of Days of Rain.								Mean Number of Days on which Rain falls annually.	Period of Observations.
		SPRING. (Sept., Oct., Nov.)		SUMMER. (Dec., Jan., Feb.)		AUTUMN. (Mar., April, May.)		WINTER. (June, July, Aug.)			
	Inches.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Days.	
NORTH ISLAND.											
Auckland	44·682	11·031	45	8·378	27	11·009	37	14·265	56	177	15 years.
Taranaki	58·584	17·088	42	10·974	27	14·133	30	17·199	47	146	12 ,,
Wellington	50·091	12·148	35	9·685	27	12·666	33	16·021	46	146	10 ,,
Means for North Island	51·119	13·422	40	9·679	27	12·602	33	15·828	49	156	
SOUTH ISLAND.											
Nelson	54·721	16·746	28	13·211	17	8·795	19	14·551	23	92	16 years.
Christchurch*	31·636	5·145	24	7·266	23	8·022	26	13·193	35	113	11 ,,
Dunedin	32·886	8·129	44	9·428	41	7·943	38	7·253	36	178	15 ,,
Means for South Island	39·747	10·006	32	9·968	27	8·253	27	11·665	31	127	
	51·119	13·422	40	9·679	27	12·602	33	15·828	49	156	
	39·747	10·006	32	9·968	27	8·253	27	11·665	31	127	
Means for both Islands	45·433	11·714	36	9·823	27	10·427	30	13·746	35	141	

* The monthly averages for the amount of rain and the number of days of rainfall are only for eight years, while the mean annual fall and number of days are for the eleven years.

NOTE.—From the above it will be observed that Taranaki has the highest average annual rainfall (58·584), and Nelson is the next (54·721), while the average means for Christchurch (31·636) and Dunedin (32·886) are the lowest; but while Dunedin has a much smaller annual fall of rain than the others, yet there are a greater number of days of rain yearly at that place than at any of the other stations; and although the mean fall for Nelson is one of the highest averages, still the mean number of days of rain in that locality is the least of all. Taking these six stations, the annual rainfall and number of days of rain is greater in the North than in the South Island.

MEMBERS
OF THE
NEW ZEALAND INSTITUTE,
1868.

WELLINGTON PHILOSOPHICAL SOCIETY.

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Bannatyne, W., Wellington
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Blakiston, A. F. N.
Bowen, Rev. C.
Bowen, C. C.
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Packe, W.
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Powell, L.
Purnell, C. W.
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Wilson, W.
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WESTLAND NATURALISTS' AND ACCLIMATIZATION SOCIETY.

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Allen, C.
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Beswick, S., M.R.C.S.L.
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Schaw, C. C.
South, S. M.
Sprott, M.
Traill, D.
Williams, J.
Winter, G.

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NEW ZEALAND INSTITUTE.

ESTABLISHED UNDER AN ACT OF THE GENERAL ASSEMBLY OF NEW ZEALAND, ENTITLED "THE NEW ZEALAND INSTITUTE ACT, 1867."

BOARD OF GOVERNORS.

(EX OFFICIO.)

His Excellency the Governor. | The Hon. the Colonial Secretary.
His Honor the Superintendent of Wellington.

(NOMINATED.)

James Edward Fitzgerald; Hon. Colonel Haultain, Treasurer (and Secretary, 1868); Alfred Ludlam; Hon. W. B. D. Mantell, F.G.S., Secretary (retired 1868); Hon. Sir David Monro; W. T. L. Travers, F.L.S.

(MANAGER.)

James Hector, M.D., F.R.S. (nominated Governor, 1868).

ABSTRACTS OF RULES AND STATUTES,

GAZETTED IN "THE NEW ZEALAND GAZETTE," 9TH MARCH, 1868.

SECTION 1.

Incorporation of Societies.

1. No Society shall be incorporated with the Institute under the provisions of "The New Zealand Institute Act, 1867," unless such Society shall consist of not less than twenty-five members, subscribing in the aggregate a sum of not less than fifty pounds sterling annually, for the promotion of art, science, or such other branch of knowledge for which it is associated, to be from time to time certified to the satisfaction of the Board of Governors of the Institute by the Chairman for the time being of the Society.

2. Any Society incorporated as aforesaid shall cease to be incorporated with the Institute in case the number of the Members of the said Society shall at any time become less than twenty-five, or the amount of money annually subscribed by such Members shall at any time be less than £50.

3. The by-laws of every Society to be incorporated as aforesaid shall provide for the expenditure of not less than one-third of its annual revenue in or towards the formation or support of some local public Museum or Library; or otherwise shall provide for the contribution of not less than one-sixth of its said revenue towards the extension and maintenance of the Museum and Library of the New Zealand Institute.

4. Any Society incorporated as aforesaid which shall in any one year fail to expend the proportion of revenue affixed in manner provided by Rule 3 aforesaid, shall from thenceforth cease to be incorporated with the Institute.

5. All papers read before any Society for the time being incorporated with the Institute shall be deemed to be communications to the Institute, and may then be

published as proceedings or transactions of the Institute, subject to the following regulations of the Board of the Institute regarding publications:—

Regulations regarding Publications.

(*a*.) The publications of the Institute shall consist of a current abstract of the proceedings of the Societies for the time being incorporated with the Institute, to be intituled "Proceedings of the New Zealand Institute," and of transactions comprising papers read before the Incorporated Societies (subject, however, to selection as hereinafter mentioned), to be intituled "Transactions of the New Zealand Institute."

(*b*.) The Institute shall have power to reject any papers read before any of the Incorporated Societies.

(*c*.) Papers so rejected will be returned to the Society before which they were read.

(*d*.) A proportional contribution may be required from each Society towards the cost of publishing the proceedings and transactions of the Institute.

(*e*.) Each Incorporated Society will be entitled to receive a proportional number of copies of the proceedings and transactions of the Institute, to be from time to time fixed by the Board of Governors.

(*f*.) Extra copies will be issued to any of the Members of Incorporated Societies at the cost price of publication.

6. All property accumulated by or with funds derived from Incorporated Societies and placed in the charge of the Institute shall be vested in the Institute, and be used and applied at the discretion of the Board of Governors for public advantage, in like manner with any other of the property of the Institute.

7. Subject to "The New Zealand Institute Act, 1867," and to the foregoing rules, all Societies incorporated with the Institute shall be entitled to retain or alter their own form of constitution and the by-laws for their own management, and shall conduct their own affairs.

8. Upon application signed by the Chairman and countersigned by the Secretary of any Society, accompanied by the certificate required under Rule No. 1, a certificate of incorporation will be granted under the Seal of the Institute, and will remain in force as long as the foregoing rules of the Institute are complied with by the Society.

Section II.

For the Management of the Property of the Institute.

9. All donations by Societies, Public Departments, or private individuals to the Museum of the Institute shall be acknowledged by a printed form of receipt, and shall be duly entered in the books of the Institute provided for that purpose, and shall then be dealt with as the Board of Governors may direct.

10. Deposits of articles for the Museum may be accepted by the Institute, subject to a fortnight's notice of removal, to be given either by the owner of the articles or by the Manager of the Institute; and such deposits shall be duly entered in a separate catalogue.

11. Books relating to Natural Science may be deposited in the Library of the Institute, subject to the following conditions:—

(*a*.) Such books are not to be withdrawn by the owner under six months' notice, if such notice shall be required by the Board of Governors.

(*b*.) Any funds specially expended on binding and preserving such deposited books, at the request of the depositor, shall be charged against the books, and must be refunded to the Institute before their withdrawal, always subject to special arrangements made with the Board of Governors at the time of deposit.

(*c*.) No books deposited in the Library of the Institute shall be removed for temporary use except on the written authority or receipt of the owner, and then only for a period not exceeding seven days at any one time.

12. All books in the Library of the Institute shall be duly entered in a catalogue, which shall be accessible to the public.

13. The public shall be admitted to the use of the Museum and Library, subject to by-laws to be framed by the Board.

Section III.

14. The Laboratory shall, for the time being, be and remain under the exclusive management of the Manager of the Institute.

LIST OF INCORPORATED SOCIETIES.

Name of Society.	Date of Incorporation.
Wellington Philosophical Society	June 10, 1868.
Auckland Institute	June 10, 1868.
Philosophical Institute of Canterbury	Oct. 22, 1868.
Westland Naturalists' and Acclimatization Society	Oct. 22, 1868.

WELLINGTON PHILOSOPHICAL SOCIETY.

Office-Bearers.—*President*—Sir George Grey, K.C.B., D.C.L.; *Vice-Presidents*—Right Reverend C. J. Abraham, Bishop of Wellington; His Honor I. E. Featherston, M.D., Superintendent of Wellington; *Council*—W. T. L. Travers, F.L.S., R. Hart, R. Pharazyn, F.R.G.S., J. Hector, M.D., F.R.S.; *Honorary Secretary and Treasurer*—R. Pharazyn.

Extract from the Rules of the Wellington Philosophical Society.

1. Candidates may be admitted Members of the Society on the recommendation of a Member of Council and two ordinary Members of the Society, and on the payment of the annual subscription.

5. Every Member shall contribute annually to the funds of the Society the sum of one guinea.

6. The annual contribution shall be paid in advance, on or before the 1st day of January in each year.

7. The sum of £10 may be paid at any time as a composition of the ordinary annual payment for life.

12. The honorary Members of the Society shall be persons who have been eminent benefactors to this or some other of the Australian Colonies, or distinguished patrons and promoters of the objects of the Society.

17. General meetings for business of Members of the Society shall be held in the evening of one day or more of each quarter (the time and place of the meeting to be fixed by the Council, and duly announced by the Secretary), to receive the Secretary's report, and to carry out the general objects and business of the Society.

Meetings will be held during the Session of the General Assembly on the following evenings, commencing with the ordinary quarterly meeting of July 28th, 1868:—

July 28th, Tuesday (ordinary). September 15th, Tuesday.
August 25th, Tuesday. October 6th, Tuesday.

The meetings will be held in the Colonial Museum, Wellington.

AUCKLAND INSTITUTE.

Office-Bearers.—*President*—F. Whitaker; *Council*—A. G. Purchas, M.D., G. B. Owen, Captain F. W. Hutton, F.G.S., J. Peacock, J. M. Wayland; *Honorary Secretary*—T. B. Gillies; *Honorary Treasurer*—J. H. Crawford; *Secretary*—Thomas Kirk.

Extract from the Rules of the Auckland Institute.

3. Candidates may be admitted Members of the Society on being proposed in writing at a meeting of the Society by two Members who are personally acquainted with him, and who shall be responsible for payment of his entrance fee and first annual subscription.

4. New Members on election to pay one guinea entrance fee, in addition to the annual subscription of one guinea, for residents within ten miles of Auckland, and ten shillings and sixpence for residents beyond that distance; the annual subscriptions being payable in advance on the first day of April for the then current year.

5. Members may at any time become life Members by one payment of ten pounds ten shillings for residents, and five pounds five shillings for non-resident Members, in lieu of future annual subscriptions.

8. Honorary Members may be elected by the unanimous vote of the Society, in acknowledgment of their contributions to art, science, or literature in general, or to this Society in particular, such Members to have all the privileges of Members without payment of any fees.

9. Members of Societies incorporated with the New Zealand Institute, when in the Province of Auckland, shall be entitled to all the privileges of Members of this Society.

10. Annual general meeting of the Society on the third Monday of February in each year. Ordinary business meetings are called by the Council from time to time.

PHILOSOPHICAL INSTITUTE OF CANTERBURY.

Office-Bearers.—*President*—Julius Haast, Ph.D., F.R.S.; *Vice-Presidents*—J. S. Turnbull, M.D., E. Dobson, C.E.; *Council*—Rev. James Wilson, Ed. Jollie, H. J. Tancred, C. Davie, T. Nottidge, G. Packe; *Honorary Treasurer*—J. W. S. Coward; *Honorary Secretary*—Rev. Charles Fraser, M.A., F.G.S.

Extract from the Rules of the Philosophical Institute of Canterbury.

2. The Philosophical Institute of Canterbury is founded for the advancement of science, literature, and art, as well as the development of the resources of the Province.

7. The ordinary meetings of the Institute shall be held every first week during the months from March to November inclusive.

10. The President, Vice-Presidents, the Treasurer, the Secretary, and three senior ordinary Members of Council, shall retire from office annually at the anniversary meeting.

22. Every candidate for membership shall be proposed and seconded by Members of the Institute.

24. Gentlemen not resident in the Province, who are distinguished for their attainments in science, literature, or art, may be proposed for election as honorary Members on the recommendation of an absolute majority of the Council. The election shall be conducted in the same manner as that of ordinary Members, but nine-tenths of the votes must be in favour of the candidate.

25. Members of the Institute shall pay two guineas annually as a subscription to the funds of the Institute.

27. Members may compound for all annual subscriptions of the current and future years by paying thirty guineas.

34. Members shall have the privilege of reading before the Institute papers containing accounts of experiments, observations, and researches, conducted by themselves, on subjects within the scope of the Institute.

47. Every book, pamphlet, model, plan, drawing, specimen, preparation, or collection, presented to or purchased by the Institute, shall be placed in the Museum of the Institute.

66. That from and after the 1st of July, 1868, the Institute shall devote one-third of its annual revenue in or towards the formation of some local public museum or library.

WESTLAND NATURALISTS' AND ACCLIMATIZATION SOCIETY.

OFFICE-BEARERS.—*President*—The Hon. J. A. Bonar; *Vice-President*—The Venerable Archdeacon Harper; *Committee*—R. Abbott, J. Aylmer, S. Beswick, B. Clapcott, G. G. Fitzgerald, J. Frew, G. W. Harvey, J. Heawood, G. Mueller, J. Rochfort, G. S. Sale, S. M. South; *Treasurer and Secretary*—Malcolm Fraser.

Extract from the Rules of the Westland Naturalists' and Acclimatization Society.

2. The objects of the Society shall be to promote the cultivation of natural history, especially with reference to this portion of New Zealand; to form a museum for the collection and preservation of botanical, zoological, and geological specimens; to acclimatize plants and animals; and to communicate with, and exchange with, other kindred societies.

3. The Society shall consist—First, of life members, *i.e.* persons who have at any one time made a donation to the Society of £5 or upwards, or persons who, in reward of special services rendered to the Society, have been unanimously elected as such by the Committee, or at the general half-yearly meeting. Second, of members who pay two guineas the first year and one guinea each subsequent year. Third, of members paying smaller sums, not less than ten shillings.

4. The Society shall be managed by a Committee elected from the Society, and consisting of a President, a Vice-President, a Treasurer and Secretary, and twelve members, to be chosen out of Classes 1 and 2.

13. The Committee shall have power to consider and determine all matters directly or indirectly affecting its interest, and to make such by-laws as may in their opinion be necessary for the management of the Society, provided such by-laws are not repugnant to these rules.

14. One-third of the annual revenue of the Society shall be applied in procuring books, objects of natural history or of scientific interest, for the permanent benefit of the Society and of the community.

BY AUTHORITY: GEORGE DIDSBURY, GOVERNMENT PRINTER.