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PALÆONTOLOGY OF NEW ZEALAND

PART IV

Corals and Bryozoa

OF THE

NEOZOIC PERIOD IN NEW ZEALAND

BY

THE REV. J. E. TENISON WOODS, F.G.S., F.L.S.;
HON. MEM. NEW ZEALAND INSTITUTE; ROY. SOC. N.S.W.; ROY. SOC. TASM.;
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NEWTOWN, SYDNEY.

FLABELLUM CIRCULARE

TENISON-WOODS.

OTOTARA LIMESTONE.

Colonial Museum and Geological Survey Department.

JAMES HECTOR, M.D., C.M.G., F.R.S.,
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President of the Linnean Society of New
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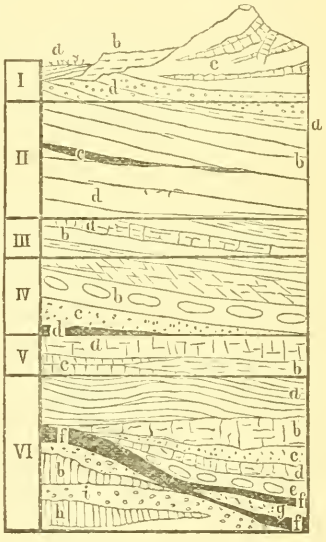
CONTENTS.

	Page
Frontispiece.	
Preface	v
Characters of Families, etc.	ix
Table showing the Stratigraphical Distribution of the Species ...	xiii
Addenda	xiv
General Index	xv
Introduction	1
Corals	7
Bryozoa	22
List of Illustrations	33
Plates.	

PREFACE.

An acknowledgment is due to the author of this work for the great service he has rendered to the Geological Survey of New Zealand by so cordially undertaking its preparation. His minute acquaintance with the marine invertebrata of the tropical and temperate parts of Australia, both fossil and recent, as testified by his numerous publications during the past twenty years, peculiarly qualifies him for the task; so that his important inferences regarding the physical conditions which prevailed in Tertiary times will be received by geologists with confidence.



A few remarks are necessary as supplementary to the author's references to the strata from which the collections submitted to him were obtained.

The accompanying vertical section indicates the relative positions which the strata occupy, and refers to the columns of the table of the stratigraphical distribution of the species.

The formations represented in the collection are the following:—

Upper Miocene.

IIIa. *Wanganui Series.*—A group of sandy and argillaceous strata, the distribution and mineral character of which indicate

that they were deposited near the shore-line. The mollusca in this formation comprise 120 recent and 25 extinct forms. It is probably the equivalent in time to the *shell limestone* which skirts the South Australian Bight.

Lower Miocene.

IVc. *Pareora Series.*—This is also a littoral formation, at the base of the Lower Miocene, and separated from the previously mentioned formation by 1,500 feet of sandy clays. About 55 existing and 110 extinct species of shells are known from this horizon, which corresponds with that of the Portland beds of Western Victoria.

Upper Eocene.

Vb. *Oamaru or Hutchison's Quarry Beds.*—Calcareous strata, sometimes pure limestone, composed of shell fragments, corals, and bryozoa, and evidently a shallow-water and littoral deposit, associated with basaltic and tufaceous rocks, indicating a period of volcanic activity. As I have previously pointed out, these strata are probably the equivalents of the Table Cape beds of Tasmania.

Lower Eocene.

VIb. *Ototara Stone.*—A calcareous sandstone, passing downwards into true chalk with flints, and overlaid conformably by the "Grey marl," which is a sandy and marly formation, passing at its base into the Fucoidal greensand and Amuri limestone, with Cretaceous fossils. The strata thus grouped represent the Lower Eocene and Upper Cretaceous periods, and have a thickness of about 2,000 feet.

Upper Greensand.

VIe. *Island Sandstone.*—Ferruginous sandstone, that forms the cover of the most important coal-bearing formation in New Zealand.

The slab figured in the frontispiece by photography was collected by Mr. Alex. McKay, in 1877, from the *Phorus* beds

at Maraewhenua, in Otago. This is a local deposit, resting conformably on the Ototara limestone, and probably represents in the district the "grey marls" of the above section.

It is right to state that the author is not responsible for the systematic characters of the families, or the index, which have been prepared by my assistant, Mr. T. W. Kirk.

JAMES HECTOR,

Director.

Geological Survey Office, Wellington,
18*th November*, 1880.

CHARACTERS OF FAMILIES, ETC.

SUB-KINGDOM—ZOOPHYTA. SECTION—RADIATA.

Class—Polypi.

Animal fixed, having no locomotive organs. Provided with a circle of retractile tentaculæ around the mouth, and a central gastric cavity, not communicating with an anus, and containing the reproductive organs when these exist.

Sub-class—Corallaria.

Polypi possessing distinct internal reproductive organs.

Order—Alcyonaria.

Polypi with eight tentacles, which are fringed on their sides with lateral pinnæ.

Family—Gorgonidæ.

Polypi provided with a thick, suberous cœnenchyma, surrounding a central stem that is adherent to an extraneous body by its basis, and is formed of epidermic sclerenchyma.

Sub-family—Isinæ.

Common axis articulated, or composed of segments, the structure of which differs alternately.

Sub-order—Zoantharia sclerodermata.

Polypi with conical, tubular, simple or arborescent tentacula.

Section—Madreporaria aporosa.

Corallum composed essentially of lamellar dermic sclerenchyma, with the septal apparatus highly developed, completely lamellar, and primitively composed of six elements; no tabulæ.

Family—Turbinolidæ.

Corallum usually simple, not fissiparous. Interseptal loculi extending from the top to the bottom of the visceral chamber,

and containing neither dissepiments nor synapticulæ. Walls thin, lamellar, imperforate. Septa highly developed, simple, compact. Costæ usually well marked and straight.

Sub-family—Caryophyllinæ.

Calicule presenting one or more rows of pali, placed between the columella and the septa.

Group—Trochocyathaceæ.

Pali of divers orders, forming two or more coronets.

Sub-family—Turbinolinæ.

Corallum destitute of pali. The septa extending to the columella, or meeting in the centre of the visceral chamber.

Family—Oculinidæ.

Corallum composite, produced by gemmation, and presenting in general an abundant, compact cœnenchyma or common tissue, the surface of which is smooth, delicately striate near the calices, or slightly granular, but never echinulate. Walls of the corallites complete, not distinct from the cœnenchyma, and increasing by their internal surface, so as to invade progressively the inferior part of the visceral cavity, and to fill it up more or less in old age. Loculi imperfectly divided by a few dissepiments; no synapticulæ. Septa entire, or having their upper edge slightly divided.

Family—Astræidæ.

Corallum composite or simple, circumscribed by imperforate walls, and often increasing by fissiparity. Corallites becoming tall by the progress of their growth; each individual or series of individuals well defined, and separated from the others by perfect walls. Cœnenchyma none, or formed either by the development of the costæ and their dissepiments, or by the epithecal tissue alone. The visceral cavity never obliterated inferiorly by the growth of the walls, but subdivided and more or less completely closed up by the interseptal dissepiments, which are generally very abundant.

Group—Cladocoraceæ.

Corallum increasing by lateral gemmation. The corallites segregate, and having an arborescent or fasciculate arrangement. Septa regularly and delicately serrated; those of the principal cycla bearing pali.

Group—Astrangiaceæ.

Corallum increasing by the development of buds on stolons, or on membraniform basal expansions. The corallites not united by their sides, excepting accidentally by means of their walls, and remaining short. Septa feebly denticulated. Dissepiments almost rudimentary.

Section—Madreporaria perforata.

Corallum composed essentially of porous sclerenchyma; with the septal apparatus well characterized, and consisting of six primitive elements, but being sometimes represented only by series of trabiculæ. Dissepiments rudimentary; no tabulæ.

Family—Madreporidæ.

Corallum composite, increasing by gemmation. Cœnenchyma abundant, spongy and reticulate. Walls very spongy, and not distinct from the cœnenchyma. Septa lamellose, and well developed; loculi free.

Family—Stylasteridæ.

Skeleton branched, calcareous, studded at intervals with cup-like depressions, each of which exhibits a central chamber, occupied axially by a styliform rod, and surrounded by a series of secondary chambers, separated from one another by short septa.

SUB-KINGDOM—MOLLUSCA.

Class—Bryozoa.

Alimentary canal suspended in a double-walled sac, capable of being partially protruded. Mouth surrounded by a circle of hollow, ciliated tentacles. Animals always composite.

Order—Gymnolæmata.

Lophophore orbicular, or nearly so; no epistome.

Sub-order—Cyclostomata.

Cells tubular. Mouth of the same diameter as the cell, without any movable lip.

Family—Sparsidæ.

Polyzoarium erect, simple or branched; branches cylindrical, or sub-compressed; free or anastomosing.

Family—Selenariadæ.

Polyzoarium free (?); orbicular or irregular, conical or depressed, convex on one side and plane or concave on the other; composed of a single layer of cells, usually of two kinds, which open on the convex surface only.

Family—Theonidæ.

Polyzoarium massive, subglobose, or irregular. Cells contiguous, crowded.

TABLE

SHOWING THE

STRATIGRAPHICAL DISTRIBUTION OF SPECIES.

—	Formations.				
	IIIa.	IVc.	Vb.	VIb.	VIe.
CORALS.					
Isis dactyla	...	...	*	...	...
Trochocyathus mantelli	...	*	...	...	...
„ hexagonalis	...	...	...	*	...
„ quinarius	...	...	...	*	...
Notocyathus pedicellatus	...	*	...	...	...
Sphenotrochus huttonianus	...	...	...	...	*
„ coronatus	...	...	*	...	...
Flabellum circulare	*	...	...	*	...
„ rugulosum	*	...	...	...	...
„ simplex	...	...	*	...	...
„ corbicula	...	...	*	...	...
„ laticostatum	...	...	*	...	...
„ sphenodeum	...	...	*	...	...
„ radians	...	...	*	...	...
„ mariæ	*	...	...	...	...
„ attenuatum	...	*	...	...	...
Platyhelia distans	...	*	...	...	...
Amphihelia intricata	...	...	*	...	...
„ ramosa	...	...	*	...	...
„ granulata	...	*	...	...	...
Cladocora dubia	...	*	...	...	...
Scolangia parvisepta	...	...	...	*	...
Balanophyllia alta	...	...	...	*	...
„ hectori	...	...	...	...	*
Heteropora ovalis	*	...	...	...	...
„ calcifera	*	...	...	...	...
Cylindropora areolata	*	...	...	...	...
„ spongiosa	*	...	...	...	...
Sporadopora marginata	...	...	*	...	...
BRYOZOA.					
Entalophora zealandica	...	*	...	...	...
„ nodosa	...	*	...	...	...
Spiroporina vertebralis	...	*	...	*	...
„ immersa	...	*	...	...	...
Fungella lobata	...	*	...	...	...
Idmonea alternata	...	...	*	...	...
Eschara monilifera	...	...	*	...	...
„ ampla	...	...	...	*	...
Porina dieffenbachiana	...	...	...	*	...
Celleporaria gambierensis	*	...	...	...	*
„ papillosa	...	...	...	*	*
„ nummularia	...	...	...	*	...
Salicornaria immersa	...	...	...	...	*
Vincularia maorica	...	...	...	*	...
Cellaria punctata	...	...	*	...	...
Selenaria squamosa	*	...	...	...	...
Fasciculipora intermedia	...	...	...	*	...
„ ramosa	...	...	...	*	...

ADDENDA.

Since the following pages were in type I have seen the Rev. Mr. Hinckes' work on British Polyzoa. It was too late for me to make use of it, though the reasons alleged by him hardly convince me about the use of the term Polyzoa. While expressing my warm admiration for the labours of the author, which place him in the front rank of all writers on the subject, I may be allowed to express my regret that in his essay on the classification all reference to certain foreign genera has been omitted. I am quite inclined to adopt his views as to the suppression of the genus *Eschara*, and the use of *Cellepora* for *Celleporaria*. I still think that *Salicornaria* should be separated from *Cellaria*.

In describing *Fasciculipora* there is some confusion in what I say about the *three* previously known species. There were two known in Europe, and one in New Zealand. I add that "at one time I was of opinion that we had an existing species in the Australian seas, but this was certainly an error." The error was in referring the specimen figured at p. 187 of my Geological Observations in South Australia to the genus.

Mr. J. R. G. Goldstein, Secretary to the Microscopical Society of Victoria, informs me that there is one, if not two, species in the South Australian seas, in addition to *F. ramosa* of Busk. With reference to the latter name, I regret to find that I have overlooked the species described by Busk in the third part of his British Museum Catalogue of Marine Polyzoa. He has used D'Orbigny's genus as a synonym of Hagenow's *Fungella*. I cannot think that this is correct, but the matter does not admit of any examination previous to sending this essay to press. If Professor Busk is right, my *Fasciculipora* should be *Fascicularia;* but for the present I adhere to the nomenclature adopted, for the reasons given already.

J. E. T.-W.

23*rd October*, 1880.

GENERAL INDEX.

	PAGE
Akitco River	17
alatus (Notocyathus)	10
Alcyonaria	7
aldingensis (Deltocyathus)	10
alta (Balanophyllia)	18
alternata (Idmonea)	24
Amphihelia	1, 2, 16
ampla (Eschara)	25
angustiloba (Melicerita)	5
areolata (Cylindropora)	21
Astræidæ	2
Astreidæ	17
Astrangiæ	16
Astrangiaceæ	1, 2, 18
attenuatum (Flabellum)	15
aurantium (Fasciculipora)	29
Awamoa beds	16
Aohanga Falls	17
Baton River	17
Balanophyllia	1, 2, 3, 18
Bistylia	2
Brighton	26
Broken River	14
Bryozoa	5
Buller Valley	11
buskii (Eschara)	25
calycifera (Heteropora)	20
Canterbury	12, 14, 19
Cape Kidnappers	26
Caryophyllinæ	7
Caryophyllia	2, 3, 9
Cellaria	5, 27, xiv
Cellepora	25, xiv
Celleporaria	25, xiv
Chatham Islands	17, 22
circulare (Flabellum)	12, 14
Cladocora	2, 17
Cladocoraceæ	17
Conocyathus	3, 9
Conosmilia	2, 10
Conotrochus	2
contortilis (Cladocora)	18
Conway River	18, 19, 27
corbicula (Flabellum)	13
coronatus (Sphenotrochus)	11
Cyathosmilia	2
Cyclostomata	22
Cylindropora	4, 21
dactyla (Isis)	7
Deltocyathus	2, 3, 9
Dendrophyllia	2
dieffenbachii (Porina)	5, 25
distans (Platyhelia)	16
Dorset's	21
dubia (Cladocora)	17
elongatus (Placotrochus)	14
Eupsammineæ	18
Entalophora	5, 22
Eschara	21, 24, xiv
excisus (Sphenotrochus)	10
Fascicularia	31, xiv
Fasciculipora	4, 21, 29, 31, xiv
Fasciculiporæ	31
Flabellum	2, 3, 11
Forty-Mile Bush	21
Fungella	23, xiv
gambierense (Flabellum)	12
gambierensis (Celleporaria)	26
Glauconome	27
Gorgonidæ	7
granulata (Amphihelia)	17
Gymnolæmata	22
Hawke's Bay	11
haastiana (Retehornera)	28
,, (Entalophora)	23
hectori (Balanophyllia)	19
Heteropora	20
hexagonalis (Trochocyathus)	8
hirsuta (Onchopora)	28
Hutchison's Quarry	4, 7, 23, 25, 26
huttonianus (Sphenotrochus)	10
Hydro-corallinæ	20
Idmonea	24
immersa (Spiroporina)	23
,, (Salicornaria)	27
Inangahua River	11
intermedia (Fasciculipora)	31
intricata (Amphihelia)	16
Isidinæ	7
Isis	2, 7
italicus (Deltocyathus)	3
Kokohu River	19
laticostatum (Flabellum)	14
Lepralia	26
Limekiln Gully	13
lobata (Fungella)	23
Madreporaria aporosa	7
,, perforata	18
Madreporidæ	18
mantelli (Trochocyathus)	8
maorica (Vincularia)	5, 27
Margaretta	28

	PAGE
marginata (Sporadopora)	22
mariæ (Flabellum)	15
Mariwhenua River	12
Melicerta	5
melitensis (Isis)	7
Membranipora	28
Millepora	4, 20, 21
Milleporidæ	4, 20
Mokihinui River	18, 24, 25
monilifera (Eschara)	25
Montlivaltia	2
Mount Caverhill	14
Mount Gambier	4, 13, 25
Mount Vernon	20, 21, 31
Muddy Creek, Victoria	23
Napier	13, 20, 21, 26, 31
Nelson	13, 17, 18, 19, 24, 25, 27
Ngaruroro River	13
nodosa (Entalophora)	22
Notocyathus	3, 9, 10
nummularia (Celleporaria)	26
Oamaru	10, 13, 14, 15, 16, 23, 25, 26, 27, 28
Oculina	3, 16
Oculinaceæ	15
Oculinidæ	15
Onchopora	5, 28
Otago	12, 16
Ototara	21
ovalis (Heteropora)	20
Palæoseris	2
papillosa (Celleporaria)	26
Paracyathi	9
Pareora beds	8, 13
parvisepta (Scolangia)	18
pedicellatus (Notocyathus)	9
Placotrochus	2, 10
Platythelia	3, 15
Plesiastræa	1, 2
Pustulipora	5, 22
punctata (Cellaria)	28
Polyzoa	5
Porina	5, 25
Port Hills	13
quinarius (Trochocyathus)	8
radians (Flabellum)	14
ramosa (Amphihelia)	17
,, (Fasciculipora)	31
Retepora	24
Retehornera	28
Rotomahana Plains	26
rubrum (Flabellum)	12
rugulosum (Flabellum)	12
Salicornaria	26, 27, xiv
Scolangia	18
Selenaria	29
Selenariadæ	28
Shakespeare Cliff	9, 12, 15, 22, 23, 24, 26, 29
simplex (Flabellum)	13
sinuosa (Salicornaria)	27
Solenastræa	2
Sparsidæ	22
sphenodeum (Flabellum)	14
Sphenotrochus	2, 3, 10, 11
Spiroporina	5, 23
spongiosa (Cylindropora)	21
Sporadopora	4, 22
squamosa (Selenaria)	29
St. Kilda	26
Stylasteridæ	4, 20, 22
Stylina	31
Sutherland's	17
Table Cape beds	23, 26
tateanus (Notocyathus)	10
Thamnastræa	2
Theonidæ	29
Thomas River	14
tigelles	5
Trematrochus	3
Trochocyathaceæ	7
Trochocyathus	2, 3, 7
Trochosmiliaceæ	11
tuberculatus (Trochocyathus)	8
tubipora (Fasciculipora)	29
Tubucellaria	28
Turbinolia	3, 9
Turbinolidæ	9
Turbinoliæ	10
undulosa (Millipora)	4, 20, 21
ungulata (Pustulipora)	23
vertebralis (Spiroporina)	5, 23
victoriæ (Flabellum)	12
Vincularia	5, 27, 28
viola (Caryophyllia)	9, 10
vitilia	5
Waikato	8
Waipukurau	20, 21, 31
Waitaki	12
Wanganui	9, 12, 15, 22, 23, 24, 26, 29
Weka Pass	12, 32
Wellington	17, 21
Whangape Lake	8
White Rock Point	18, 24
zealandica (Entalophora)	22
Zoantharia sclerodermata	7

INTRODUCTION.

In compliance with a request from Dr. Hector, the eminent Director of the Geological Survey of New Zealand, I have examined the collection of Tertiary corals and Bryozoa exhibited in the New Zealand Court of the Sydney International Exhibition. This collection does not comprise the whole of the fossil corals exhibited or in the Museum of the Survey at Wellington, New Zealand, but only the obviously distinct species, so that, as the fine points of distinction which separate not only species but genera would not be detected except by experts, it may be concluded that other species may still remain in the Museum.

A few words on the subject of the extratropical corals of the Southern Hemisphere, both living and fossil, may not be out of place as an introduction to what I shall have to say with reference to the general features of this collection. Of the living corals comparatively little is known either in Australia or New Zealand. Before a complete study can be made, dredging must be carried on extensively, and a real knowledge obtained of what are the organisms of our seas at moderate distances from the shore. Outside the tropical or the reef-building area, which sometimes extends considerably beyond the tropics, we find but few true corals. These are never of the reef-building kind. They are either simple corals, which are free, or, as single individuals, are rooted on the bottom of the deep; or they are compound organisms consisting of corallites, forming a spreading or branching mass. The latter are not large. In Australia they are confined, as far as we know, to two or three species of *Plesiastræa*, one or two species of *Amphihelia*, with some encrusting members of the family *Astrangiaceæ*. The simple corals are more numerous. In Australia they are of a peculiar kind, the genus *Balanophyllia*, with porous walls and intricate interlocked septa, predominating. The living coral

fauna of New Zealand is of the poorest kind as far as we know it. One species of *Flabellum* and one or two *Astrangiaceæ* are all that are known.

With the fossil corals in Australia the case is different. In what are called the Muddy Creek beds of Hamilton, in Western Victoria, there is a deposit which is peculiarly rich in fossil corals. They are all of a simple kind, and, as a rule, well preserved. About sixteen years ago I sent a small collection to Professor P. Martin Duncan, F.R.S., who made the first report upon the fossil corals of Australia. They proved to be new and interesting, giving quite exceptional and new features. The result of his examination was that seven or eight new species were added to science. All possessed features of singular interest, with an unusual array of Australian abnormalities. The relations were mostly with tropical forms, and the living species amongst them were Australian, but tropical. Professor Duncan subsequently published an elaborate essay on the Australian fossil corals in the Journal of the Geological Society of London for 1870. In this he described two new genera, *Conosmilia* and *Palæoseris*, besides species of *Trochocyathus, Deltocyathus, Flabellum, Placotrochus, Sphenotrochus, Conotrochus, Caryophyllia, Amphihelia,* and *Balanophyllia*. The same learned professor described some other species of the same genera from Table Cape in the Quar. Jour. Geol. Soc. for 1876, together with new species of *Dendrophyllia, Thamnastræa, Solenastræa,* and *Isis*. In 1877 I published, in the Proceedings of the Royal Society, New South Wales, a further description of new genera and species, including *Sphenotrochus, Conotrochus, Placotrochus, Deltocyathus,* and *Conosmilia*. In 1878 I published in the same journal (September meeting) descriptions of other new and remarkable species, including a beautiful and extraordinary genus (*Trematatrochus*), and a new species of the almost mesozoic *Montlivaltia*. In the same year (September, 1878) I published, in the Proceedings of the Adelaide Philosophical Society, a description of several fossil corals from Aldinga, near Adelaide, South Australia. This description included two new genera of *Astræidæ, Cyathosmilia* and *Bistylia;* besides new species of *Deltocyathus, Cladocora, Trochocyathus, Conosmilia, Amphihelia,* and *Plesiastræa*.

The result of all these examinations has been to prove that the fossil corals of Australia possess local peculiarities which

distinguish them from every other fauna, whether recent or fossil. They have not much connection with those corals living in our present seas, and scarcely any with Tertiary formations elsewhere. The first striking feature is the abundance of species of *Balanophyllia*. Second in importance is, perhaps, *Flabellum*. Next to this comes a type of coral about which a few words must be said in explanation. One of the first species sent to England by me was what I then regarded as a *Turbinolia*, but which Professor Duncan determined to be a *Caryophyllia*. Subsequent examination induced me to remove the species to the genus *Deltocyathus*. After seeing the New Zealand specimens, where the same type exists, I think that a new genus must be erected for these corals, which are intermediate in character between *Deltocyathus*, *Conocyathus*, and *Trochocyathus*. I have named it *Notocyathus*. It may safely be said to be the most peculiarly characteristic coral of the Southern Hemisphere, and it is equally represented in Australian and New Zealand formations, though by different species. Two, or perhaps three, of the Australian corals have been identified with European Miocene or Pliocene forms, and two with living species, one of which, *Deltocyathus italicus*, seems to be found all over the world.

After an examination of the New Zealand fossil corals, I have found no certain specific identity with the Australian tertiaries. Instead of any predominance of the forms or genera common in Australia, I find that *Balanophyllia* was absent from the tertiaries corresponding with those of Australia, and occupies quite an insignificant position in older beds. There are only two species. One of these is a large and interesting form. The genus *Flabellum* rises into extraordinary importance. Ten species are here described, all of great beauty and interest. It is very possible that some of these species may be varieties, which only can be decided by examining larger collections of specimens. *Amphihelia* is also well represented, the species being new and beautiful, and there are two very beautiful corals belonging to the genera *Trochocyathus* and *Sphenotrochus*. The European resemblances of any of the species are small, but where they exist they are to Miocene forms. There is a complete absence, so far, of any of the *Astræidæ*. One of the most remarkable features is an encrusting member of the *Oculina* family, with *pali*, for which I have erected the new genus *Platyhelia*.

The New Zealand formations can boast of one very interest-

ing speciality which is essentially its own. This is the possession of fossil Hydroids of great beauty and variety. Amongst them is a second species of *Sporadopora*, a genus hitherto only known from a single specimen dredged up by the "Challenger," 300 miles off the Rio de la Plata, from a depth of 600 fathoms. These Hydroids—or, at least, certain peculiar genera of the families *Milleporidæ* and *Stylasteridæ* — are restricted to the southern seas. There is one common form living on the New Zealand coast to which I formerly gave the name of *Millepora undulosa*. This I have removed to a new genus, of which there are two representatives among the fossils, which I distinguish as *Cylindropora*. There is also a true species of *Millepora*, which is very like certain tropical forms, showing that in Tertiary times the genus was not so restricted as it is now.

The whole evidence of the fossil corals shows a climate and an isolation in the New Zealand fauna not very different from the conditions which exist now. The large *Flabella* are only now found in warmer seas, accompanying quite a different series of corals from that which we find fossil in these beds. The fauna generally, as far as I have seen it, is not that of a warm sea, nor like what we should find on the warmer extratropical portions of the Australian coast.

I turn now to the Bryozoa, where we find a much larger correspondence with Australian fossils: in fact, the greater portion are the same in the two places. I have no doubt that, from the fossil corals, the formation at Oamaru (Hutchison's Quarry beds) and that of Mount Gambier were contemporaneous. The Oamaru strata are regarded as Upper Eocene by Dr. Hector; which is very nearly the age assigned to the Mount Gambier formation by Professor Tate, the best authority on the ages of the Australian strata, his strata being perhaps a stage younger. In the newer formations it is very remarkable to find two, and perhaps three, species of *Fasciculipora*, a genus thought to be peculiarly characteristic of the European upper tertiaries.

The extraordinary correspondence of the strata at Oamaru and those of Mount Gambier points to a prevalence of a peculiar kind of life on the earth over very large areas at the same period. At Mount Gambier there are immense masses of limestone, all composed of fossil Bryozoa with very few shells, and the corals always occur as casts. Precisely the same features are visible in

such fragments of the Hutchison's Quarry stone as I have seen. In the upper formations the corals are well preserved, and are seldom in the form of casts. *Melicerita angustiloba* (Busk) has already been described by Stolickza; as also *Porina dieffenbachii, Spiroporina vertebralis,* and *Vincularia maorica.* All these are in the collection, with some other new species.

In conclusion, I wish to make a few remarks on the terminology employed. I have used a new technical term for the word *tigelles,* so commonly used by French naturalists to express the lamina of the columella of corals. The Latin word *vitilia,* or *twig,* will, I think, be found useful, and thus restrict the term "lamina" to the septa.

It will be observed also that I use the term "Bryozoa" instead of "Polyzoa." I think it quite useless for English and a few American naturalists to withstand the universal use of Ehrenberg's term. After seeing all that Mr. Waters has written on the subject, I think that he has made out his case, and disposed of the claim of priority put forward for the word Polyzoa; and when such writers as D'Orbigny, Hagenow, Bronn, Van Beneden, Reichert, Reuss, Nitsche, Kirchenpaur, Smitt, Römer, Clarepede, Manzoni, Ehlers, Barrois, Joliet, Stolickza, Zittel, and many others, persist in using the term Bryozoa, it seems to me only to propagate confusion to contend for "Polyzoa." It will be observed also that I adopt the terms *Entalophora* for *Pustulipora,* and *Cellaria* for *Onchopora,* used by Busk in his "Crag Polyzoa." I do not think that work is always reliable when the literature of the subject is in question. The labours of Lamouroux and D'Orbigny are sometimes inadvertently forgotten or passed over. The work of Stolickza, in the geological portion of the "Reise d. 'Novara,'" shows immense care in working up the difficult subject of nomenclature, and should be studied by those who wish to know the exact generic definitions of the Bryozoa.

In the following list, certain figures occurring after the locality are meant to express the geological horizon according to the classification adopted by the Director of the New Zealand Geological Survey* :—

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* *See* "Handbook to New Zealand, Sydney International Exhibition, 1879," art. "Geology," p. 17. *Also,* "Appendix to Official Catalogue of the New Zealand Court," pp. 33–42, Collection exhibited by New Zealand Geological Survey Department. Fossils Nos. 1421–1515.

I. Post-Tertiary. Recent.
II. Pliocene.
III. Upper Miocene.
IV. Lower Miocene.
V. Upper Eocene.
VI. Cretaceo-Tertiary.

According to the terms used in Australia, as I understand them, the Miocene formation is divided into Upper, Middle, and Lower, the Middle and Lower being Formations IV. and V. of New Zealand geologists.

NEW ZEALAND FOSSIL CORALS.

(Principally from Tertiary formations.)

Order — Alcyonaria. Family — Gorgonidæ. Sub-family— Isidinæ. Genus—Isis. Linné.

Corallum composed of calcareous articulations, united by discs of elastic corneous tissue. This genus has only living representatives in tropical seas, India, the Pacific, and America. The fossil species are very few—Tertiary and Secondary for Europe; but there are at least two from the Australian Tertiary formations, one from the Mount Gambier bryozoan beds being very common. See Quart. Jour. Geol. Soc. 31, p. 673, pl. 38.

Isis dactyla, n. s. Two calcareous articulations of this coral show it to differ to some extent from any described species. They are long and compressed, so as to give an oblong transverse section. The ends are dilated into an acute projecting edge. The condyles are convex or sub-conical, concentrically striate. The sides are finely and rather faintly grooved in parallel lines. Long. 35, lat. 10, lat. of condyle 12 millim. Hutchison's Quarry, Oamaru; Formation V. Appendix Official Cat., No. 1, p. 35. This fossil, judging from the figures, is very near the *Isis melitensis* of Goldfuss. Petrefac. Germaniæ, pl. 7, fig. 17; also Pictet, 2nd edit., pl. 108, fig. 12. The resemblance is very close, as the form for *Isis* is exceptional. The European fossil is found in the Pliocene of Sicily, at Lipari, and in Piedmont. Fig. 1.

Other articulations of a smaller kind of coral are found in the collection (No. 11, Appendix Off. Cat.) from the same quarry. The specimens are smaller and the grooves larger. They may, however, belong to some other genus of *Gorgonidæ*.

Sub-order—Zoantharia sclerodermata. Section—Madreporaria aporosa. Family—Turbinolidæ. Sub-family—Caryophyllinæ. Second group—Trochocyathaceæ. Genus—Trochocyathus. M.-Ed. and Haime.

Corallum simple, pedicellate, or free with traces of adherence. Pali before all the cycles except the last. Columella well developed. Epitheca, if present, only rudimentary.

The most of the numerous species of *Trochocyathus* are fossil, only a few having lately been discovered in a living state by deep-sea dredging. The fossil species are mostly Miocene or Eocene, one or two extending into the Upper or Middle Secondary formations. Three species are found in New Zealand, and all of decidedly Miocene affinities.

Trochocyathus mantelli. M.-Ed., Hist. Nat. des Corall., Vol. 2, p. 47. See also Mantell, Quart. Jour. Geol. Soc., Vol. 6 (1850), p. 331, pl. 28, fig. 18 (as *Turbinolia*). A fragment of two systems, with the pali and columella, is all that is preserved of this fossil. That is sufficient to determine that it is a *Trochocyathus*, and may be the same as the one figured by Mantell. The corallum is circular, pedicellate, shallow, with a flat base, and the remains of six long tubercular processes proceeding from the sides opposite the primaries. Costa manifested by nearly equal grooved lines above the tubercles. Septa in six systems of five cycles, granulate, and slightly exsert at the margin. Primaries and secondaries large, equal, slightly more exsert, forming a coronate edge. Fossa wide and open. Pali forming a double circle of large laminæ. Alt. 15, probable diam. 30 millim. The form is very beautiful, the crown of pali especially so. If different from Mantell's coral, I should propose the name of *T. tuberculatus*. Locality doubtful, whether from the Pareora beds IV. or from the marly greensands of VI. Fig. 2, fragment of calice; fig. 3, base, showing tubercles. App. Off. Cat., No. 60 *bis*, p. 39.

Trochocyathus hexagonalis. M.-Ed., *loc. cit.*, Vol. 2, p. 46. See also Mantell, *loc. cit.*, pl. 28, fig. 19. Specimen No. 81 of the Appendix to the Official Catalogue is a cast of what seems to be like the base of Milne-Edwards species as above. It is remarkable for the hexagonal form of the calice, and the prominence of the primary costa, which probably correspond to the septa. If so, there are four cycles in six systems. The columella is a mass of twisted vitilia, with which the pali are confounded. I do not affirm positively that the species are the same, or that this is undoubtedly a *Trochocyathus*. I had only one specimen for examination, and that a cast; though it appears there are many more found in the Leda marls at Whangape Lake, Waikato, and elsewhere; VI.

Trochocyathus quinarius, n. s. Corallum tall, elegantly cup-shaped, on a round, cylindrical pedicel. Epitheca rather

thick, letting the costa appear on the edge of the calice only where they correspond with the septa, and are not granular. Calice very slightly oval, of medium depth. Septa but little exsert, in five systems of four regular cycles, all complete, the various orders being easily distinguished by their relative sizes. Largely granulated in curved lines. Pali before all the orders except the fourth and fifth. Columella confined to a few vitilia. Alt. 14, major axis 8, minor 9 millim. App. Off. Cat., p. 37, No. 37 *bis*. Shakespeare Cliff, Wanganui; III.

This peculiar form differs from every fossil coral in the Australian tertiaries. In shape it recalls some of the mesozoic *Paracyathi*. It has no known living representative in the southern seas, and it remains to be seen whether the abortion of one system is constant.

New Genus—Notocyathus.

Corallum free, rarely pedicellate, no columella, younger orders of septa uniting in front of secondaries and tertiaries, from whence spring pali. Secondary and primary septa uniting in the centre. No epitheca. Costa prominent, moniliform.

A few remarks on this genus may be necessary here. In 1865 Professor Duncan figured and described a fossil coral from the Australian tertiaries, which he named *Caryophyllia viola*. The specimens from which his figures and descriptions were taken had been sent to him by me. In 1876 I obtained a large number of much better specimens, from which I found that the fossil was certainly not a *Caryophyllia*, and that its relations were rather to *Conocyathus* or *Deltocyathus*—to *Conocyathus* by the union of the septa in the centre, and to *Deltocyathus* by the peculiar chevron-like forms in which the septa unite, and from which the pali spring. This peculiarity it also shares with some of the genus *Turbinolia* and *Conocyathus*. But *Deltocyathus* and *Conocyathus* are both peculiar and characteristic genera, from which all the Australian fossil corals with the features I have named differ in important particulars. Under these circumstances a new genus with the diagnosis as above becomes necessary, and it will be the more useful in arranging the corals of our Tertiary formations, as the species are confined apparently to them. It will involve some changes, as I will note in the proper place.

Notocyathus pedicellatus. Corallum short, pedicellate,

irregularly cup-shaped. Costa distinct, covered with small spiniform granules, and corresponding with the septa. Systems six, with four cycles irregular and incomplete. Fourth and fifth orders uniting to the tertiaries in front of its palus, about two-thirds of the distance to the columella. Pali in front of every cycle but the last. But these and other details are not certain, as the only specimen is much damaged and obscured by matrix. Alt. 12, major axis 15, minor 13 millim. This specimen was fastened to a card with a *Flabellum*, and numbered in the Appendix Off. Cat. 40, p. 38. It is from Oamaru, horizon unknown. Fig. 5.

The following species will now be included in the new genus :—

N. viola=*Turbinolia viola* (mihi) and MS.=*Caryophyllia viola* (Duncan), *loc. cit.*=*Deltocyathus viola* (mihi), Proc. Roy. Soc. N. S. Wales, 1877, p. 191.

N. excisus=*Sphenotrochus excisus* (Duncan), Quart. Jour. Geol. Soc., 1870, p. 298=*Deltocyathus excisus* (mihi), Proc. Roy. Soc. N. S. Wales, 1877, p. 192.

N. aldingensis (mihi)=*Deltocyathus aldingensis*, Trans. and Proc. Philos. Soc. Adelaide, 1877, p. 107.

N. tateanus=*Deltocyathus tateanus* (mihi), Proc. Adelaide Phil. Soc., *loc. cit.*

N. alatus=*Deltocyathus alatus* (mihi), *loc. cit.*, p. 108.

Sub-family—Turbinolinæ. Genus—Sphenotrochus. M.-Ed. and Haime.

Simple free corals, without epitheca, and with a lamelliform columella.

This genus is only distinguished from *Placotrochus* by the absence of epitheca, which is a feature certainly not of generic value. It will be for future palæontologists to decide which of the genera we should retain. The fossils classified thus are all Eocene or Miocene, with very few existing forms—two or three at most. We have one in Australia; and the fossil representatives in the Tertiary formations of Australia are two, one of which is existing. The *Sphenotrochus excisus* of Duncan is a worn *Notocyathus*.

Sphenotrochus huttonianus, n. s. Corallum small, cup-shaped, terminating in a fine point. There is no scar, and the coral was free. Epitheca (?). A white calcareous encrustation

between the costa, which are broad, rounded, bifurcating, with a groove in the centre, near the summit, into which groove the septa seem to be inserted. There are six systems, with four cycles of very thin structure, and apparently not composed of two laminæ. Columella a thin septum. Some of the septa are thickened towards the centre of the fossa. Calice perfectly circular; edge worn away. Alt. 7, lat. 10 millim. The general appearance of this fossil recalls the genus *Conosmilia* of Duncan, and it is more like one of the mesozoic *Trochosmiliaceæ* than a *Sphenotrochus;* but I found no endotheca in the only specimen I examined. I should have liked other examples to render the determination quite satisfactory. App. Off. Cat., No. 15, p. 36; VI.; Christie's, Inangahua River, Buller Valley. Fig. 9, coral, twice natural size.

Sphenotrochus coronatus, n. s. Corallum narrowly pedicellate; cuneiform, spreading into a broad basket-like oval calice. Costa distinct and projecting, not corresponding with the septa, except in the case of the fourth and fifth orders, where they project as tall spines or laminæ. Calice broad and shallow, the septa projecting very little into the fossa. Columella consisting of one long, undulating septum at the bottom of the calice. Six systems and four cycles. First to third orders equal in height, the primaries slightly thicker, and all distinctly composed of two laminæ, not granular, but with close circular corrugations. Alt. to summit of exsert septa 18, major axis 41, minor 19 millim.

This singular and beautiful form of *Sphenotrochus* was represented by two broken fragments of calices which could not be examined satisfactorily. It is unlike anything living or fossil known to me. App. Off. Cat., No. 26, p. 37. Grey marls, Hawke's Bay; V. Fig. 6, ideal restoration from fragments.

Genus—Flabellum. Lesson, 1831.

Corallum simple, more or less fan-shaped and compressed. No columella. Epitheca abundant, often with lateral spines. Septa very numerous, and the older orders so nearly equal that they present the appearance of many systems.

This large genus numbers now over sixty species, rather more than half of which are fossil, and all belonging to the Eocene and Miocene formations. The living species are generally tropical, but we have two or three in the temperate waters of Austra-

lia and one in New Zealand. Recent deep-sea dredgings have also revealed many species in cold and deep seas; and the fossils of the Australian Tertiary formations manifest that some species, which are now tropical, were formerly found in deep seas, in latitudes as far south as 40°. Five or six species are found in the Australian tertiaries, some of which, such as *Flabellum victoriæ* and *F. gambierense*, are peculiar and exceptional forms. From the fossils here enumerated it will be seen that the New Zealand seas, in Tertiary times, were rich in species of this genus, but not of an exceptional type. Some of those I here enumerate as distinct may prove to be varieties of one species. As a rule the evidence is unsatisfactory, as most of those described were found as casts only. It may be stated generally that the species are inhabitants of deep seas.

Flabellum circulare, n. s. Corallum spreading from a narrow pedicel into almost a complete circle. Calice compressed, narrowly oval, or flat on one side and curved on the other. Epitheca fine, and only slightly corrugate with lines of growth. Septa close and long, apparently in six systems, with six cycles. Though this appears to be one of the very commonest of the New Zealand Tertiary corals, I have not as yet seen a specimen in which a view of the calice could be obtained. In only one case have I seen the fossa, and that was at the base of a cast. The coral structure is always removed, and, though what remains often looks like septa, in reality it is only casts of the loculi between. The fossil is a very remarkable form, and we have nothing at all like it in the Australian tertiaries. There is a specimen in the collection which is a stone all covered with impressions of one side of this *Flabellum*, showing how gregarious it must have been in its mode of growth. App. Off. Cat. No. 34: Shakespeare Cliff, Wanganui; III. No. 86: Weka Pass, Canterbury; VI. No. 91: North bank of Maruwhenua River, Waitaki, Otago, from the Phorus beds overlying the Ototara limestone; VI. Fig. 7, coral, natural size. Also Frontispiece.

Flabellum rugulosum, n. s. Corallum tall, pedicellate, broadly cuneiform, and tapering to a very narrow pedicel. Outline rugged and irregular. Epitheca thin, not concealing the costa or the lines of growth, which are deeply marked. Calice broad, rounded at the ends of the major axis, which are depressed. Systems six; cycles five. Septa granular, first three orders equal,

not thickened at the margin. No false columella. Costa not corresponding with the septa, which spring from between them. Alt. 30, major axis 32, minor 12 millim.

This coral has some points of resemblance to *F. rubrum* (Quoy and Guimard), at present living in the New Zealand seas. It is, however, larger, and the costa are different, besides its general form. There are some also like it in the Australian tertiaries; but in none is the resemblance close. Nearer to *F. woodi* (M.-Ed.), of the Iken Miocene. App. Off. Cat., p. 40, No. 74. Ngaruroro River, Napier; II. Fig. 8, A, B, two specimens, natural size.

Flabellum (?) simplex, n. s. Corallum seen in casts only. Rather tall, cuneiform. As I have never seen the perfect coral, I can only add that the systems appear to be six, with only four cycles, that the calice is broadly oval, and that one fragment shows radiciform appendages. It is very like *F. victoriæ* of the Australian tertiaries, though I hesitate to refer it to that species, or even with certainty to the genus, as in one cast there seemed to be faint evidence of granular costa. I record the fossil, however, as I have seen it also as a cast in the Mount Gambier limestones. Alt. 20, major axis 15, minor 10 millim. App. Off. Cat., p. 40, No. 70. Limekiln Gully, Oamaru; V.

Flabellum corbicula, n. s. Corallum short, compressed, slightly deltoid, with a very large basilar scar giving rise to a moderately-rounded crest at each side; and from thence to the summit the sides are undulating in correspondence to the lines of growth, which are well marked. Epitheca very thin. Costa not raised or projecting, but distinct, bifurcating, and corresponding to the septa, with which they are continuous, and conspicuously marked across the basilar scar. Systems six, with four complete cycles and the rudiments of a fifth; not granular, but regularly ridged in curves, which slope inwards and downwards. A false columella formed by the interlocking of thickened projections on the edges of the septa. The wall appears very thick from the partial filling-up of the loculi in the lower portions. Alt. 16; major axis 18, minor 8; length of basilar scar 12, width 7 millim. App. Off. Cat., p. 40, No. 69. Port Hills, Nelson, Pareora beds; V.

This fossil has some resemblance to Australian Miocene forms. The scanty epitheca and the partial filling-up of the loculi are very peculiar. Fig. 10—A, coral, natural size; B, portion of septa enlarged, to show partial filling-up of loculi.

Flabellum, sp. A fragment of what is clearly a species of *Flabellum* is contained, with other fragments of fossils, in specimen No. 67, from Oamaru. It may be the same as No. 42, which now follows.

Flabellum laticostatum, n. s. Corallum large, finely pedicellate, almost circular in lateral outline, compressed acutely, but expanding into a rather broad calice, the whole form of which is beautifully curved and regular. Epitheca thin; not corrugated. Costa broad and flat, regularly bifurcating, and all equal. The calice is destroyed by matrix, so that the septa are not seen, but apparently forming only five cycles, as far as the costa can indicate. The fewness of the cycles and the costa distinguish this species from *F. circulare;* but better specimens are wanting to determine other details. It is, however, much of the character of all the New Zealand species, and like a good many described forms. Alt. 52, major axis 80, minor 21 millim. App. Off. Cat., p. 38, No. 42. Broken River, Canterbury; V. Between Mount Brown and Weka Pass limestones. Fig. 11, coral, natural size.

Flabellum sphenodeum, n. s. Corallum tall, compressed, cuneate, often with two aliform processes at the base, below which there is in some specimens a semicircular basilar attachment much compressed. Epitheca a fine pellicular covering, easily worn off. Costa slender, prominent, corresponding with the septa. Calice deep, open, oval. Septa in six systems of four cycles, but difficult to distinguish, as the first three orders are nearly equal; edges much thickened and uniting below. Alt. 20 *circiter*, major axis 15, minor 8 millim. Fig. 12, *a, b, c,* three corals, natural size.

This coral is a good deal like the Australian Tertiary *Placotrochus elongatus,* and inasmuch as it approaches the Australian type it differs from all the other species of *Flabellum* in the New Zealand beds. App. Off. Cat., p. 38. No. 44: Thomas River, Canterbury; V. No. 46: Mount Caverhill, Nelson; V.

Flabellum radians, n. s. This fossil is the external cast of what is probably a *Flabellum,* and closely allied to *F. circulare.* As none of the septa are seen, I give it a name provisionally. The costa bifurcate, and are beautifully radiate. The coral is narrowly pedicellate, and the ends of the major axis of the calice are nearly horizontal. App. Off. Cat., p. 38, No. 48. Oamaru limestone; V. Fig. 13, natural size.

Flabellum mariæ, n. s. Corallum narrowly pedicellate, rising for a short distance from the pedicel, and then the ends of the major axis suddenly spread out horizontally, while the sides form a semicircle. The calice is rather wide, as well as deep. Septa in six systems of six cycles; but this is not certain, as all the calices are full of the matrix, and so brittle and thin that no attempt could be made to free them. The sides of the septa are sparingly granular in radiating lines. Epitheca thick, not wrinkled, but incremental lines well marked. Costa broad, flat, separated by faint grooves. Interstices marked with fine "herring-bone" ornamentation, which is seen on some of the Australian Tertiary corals. Alt. 32, lat. 40 millim. Fig. 14, coral, natural size. App. Off. Cat., p. 37, No. 31. Shakespeare Cliff (lower part), Wanganui; III.

Flabellum attenuatum, n. s. Corallum tall, thin, spreading at an angle of about 40° from a short cylindrical pedicel, covered with a thin shining epitheca, through which the costa and concentric lines of growth are plainly visible; ends of major axis depressed. Calice not visible. Costa moderately rounded, rather broad and bifurcating. Alt. 25, lat. 19 millim. Only one side of this fossil is visible, the rest being imbedded in a soft matrix, which could not be safely cleared away without destroying the coral. There is, however, quite sufficient to show its distinctness from any of the species hitherto described. Its peculiar characters are the attenuate form and the shining epitheca. App. Off. Cat., p. 38, No. 40. Oamaru, IV. This specimen was fastened to a card with another quite different coral *(Notocyathus)*, and therefore the No. 40 appears twice. Fig. 15, coral in matrix, natural size.

Family—Oculinidæ. New genus—Platyhelia.

Spreading and encrusting oculinæ with pali. I erect this genus for corals with the usual compact dermic tissue of *Oculinaceæ* and with pali-like oculina; but spreading and encrusting instead of growing in a ramose tuft. No such coral has hitherto been found in any seas or formation, and none of the existing genera provide for its reception. Professor Duncan has described an encrusting Amphihelia from the Mount Gambier limestones; but altogether of a different type from this.

In the classification of the *Oculinaceæ* proposed by Professor Verrill, Oculinidæ is a family made to include encrusting or

branched forms with compact cœnenchyma, smooth or slightly costate near the cells, which are of moderate size, more or less filled up below. Septa 12 to 48 or more, in several unequal cycles, the edge of the principal ones entire. The learned Professor has shown also that the species of *Oculina*, when young, are encrusting and bud like *Astrangiæ*, some of them always remaining nearly in this condition. It will be understood, however, that this is a very different state from the permanently-spreading form of the genus now erected, in which all the cells are of equal height, and forming with the cœnenchyma a perfectly level surface.

Platyhelia distans, n. s. Corallum with a very compact tissue. Calices quite immersed, with faint radiating costa, corresponding to all the septa, either extending a short distance or as far as a faint hexagonal margin which bounds some of the corallites. Septa thick, granular, in six systems of four cycles, the fourth incomplete in some systems. Pali round, tubercular, before the two first cycles only. Columella a single tubercle rather larger than the pali. No endotheca. Dermic tissue very dense, hard, white, compact, like ivory. Calices about four millim. in diameter, and the depth of the encrusting mass about the same. The appearance of this coral is a good deal like some of our existing *Plesiastræa*. App. Off. Cat., p. 38, No. 45. Awamoa beds, Oamaru, Otago; IV. Fig. 16.

Genus—Amphihelia. M.-Edwards and Haime, 1849.

Branched corals without pali; corallites with entire septa, alternate and separated by an abundant compact cœnenchyma.

This was until lately a genus with only two known species, one of which was Australian, and one belonged to the Mediterranean. Deep-sea dredging has revealed a good many more, and three fossil forms have been found in the Australian tertiaries. It appears to have been well represented in the New Zealand Tertiary seas.

Amphihelia intricata, n. s. This is a worn specimen, in which the cylindrical stems send off branches at right angles, to unite with parallel stems, forming an intricate tuft. There are no costa, but the whole surface is granular, hispid, or verrucose. No perfect calice visible. In a few of the broken ones the septa are represented by mere grooves. The species may be distinguished by its hispid, granular surface. App.

Off. Cat., p. 36, No. 16. Chatham Islands; V. Fig. 17, coral, natural size.

Amphihelia ramosa, n. s. Corallum very hard and compact, in slender cylindrical branches striated with longitudinal grooves. There are no perfect calices in the few broken fragments examined by me; but one peculiarity which seems to distinguish it is their abundance and their not being alternate. They are distributed irregularly and closely all over the branches, and in most cases they penetrate to the centre. App. Off. Cat., p. 36, No. 17. Sutherland's, Akiteo River, Wellington; V.

Amphihelia granulata, n. s. Branched with nearly alternate calices, which are deep, curved, with about twenty-four nearly equal septa. The external surface is covered with rounded depressed granulations. Costa well marked, and covering the whole external surface of the calice. In this species there is a distinct and rather abundant endotheca, which is rather a rare feature in the genus, with from one to three partitions in each of the loculi. The divisions of different loculi sometimes correspond. The fossil is represented by abundant fragments in two specimens (Nos. 65 and 66 of Off. Cat. App., pp. 39 and 40), but they are all a good deal broken. What is seen is, however, quite sufficient to prove its distinctness from any described form. Aohanga Falls, Akiteo River, Wellington, IV.; and marly greensands above coal, Baton River, Nelson; VI.

Family—Astreidæ. Group—Cladocoraceæ. Genus—Cladocora. Ehrenberg and Hemprich, 1834.

Astræan corals, with long corallites, hard and compact, irregularly united, but free for the greatest part of their extent. Calices shallow, with papillary columella and pali.

The greater portion of the species are living, and belong to temperate seas. The fossils extend to the Cretaceous formations, and one has been described by me in the Transactions of the Philosophical Society, Adelaide, 1877–78.*

Cladocora dubia, n. s. This coral is an irregularly-branched fragment of what appears to be a species of *Cladocora*. No

* In the plate of the work referred to a mistake is made: Fig. 4, instead of Fig. 6, is *Cladocora contortilis*; and all the references are to be similarly changed.

calices are visible. In the peculiar mode of branching it resembles *C. contortilis* (mihi). I only name the specimen provisionally. App. Off. Cat., p. 41, No. 90. White Rock Point, north of Mokihinui River, West Coast, Nelson; IV. or V. The specimen is described as a Lower Tertiary form of net-coral; so there must be a mistake in the label, and probably in the locality.

Group—Astrangiaceæ. New genus—Scolangia.

Astrangiaceæ united by a calcareous *stolon*, which covers the calices with concentric layers. Corallites inclined. No spiniform processes on the septa, and no columella.

Scolangia parvisepta, n. s. Corallum much inclined, nearly cylindrical, thick and solid. Walls in very thick concentric layers. Calice open and deep; slightly narrower at the base. Septa in six systems of four cycles, which differ very little in size; not exsert, and projecting only a short distance from the wall, leaving a wide and deep fossa, very undulating at the base, where the higher orders are more prominent. Height, about 15 millim.; width of calice, 12 millim., but no complete calice in the specimen.

There are no members of the group Astrangiaceæ known in the Australian tertiaries; but the genus *Cylicia* is widely spread both in Australia and New Zealand, and has probably many species. The entire septa, their equality and inconspicuous character, are all peculiar features in this fossil, as the family is remarkable for the prominence of the higher orders of septa. App. Off. Cat., p. 36, No. 24. Conway River, Nelson, from Leda marls; VI. Fig. 18, portion of calice, natural size.

Section—Madreporaria perforata. Family—Madreporidæ.
Sub-family — Eupsammin.æ. Genus — Balanophyllia. Searles-Wood, 1844.

Simple pedicellate corals, very porous, with a well-developed fourth cycle and columella. In all the known species the septa unite according to the various orders, forming an intricate network right up to the columella.

This genus was not a large one until very lately. It was known only by a few European Tertiary fossils, and two or three living species from temperate seas, with one tropical exception. I am not aware to what extent this has been altered by the "Challenger" dredgings, but the discoveries in the Australian tertiaries

have largely extended the genus. From this fact, and about five living species which are known to me in Australian seas, we may look upon the genus as characteristic of Australia. It is therefore a matter of surprise to find it so poorly represented in the New Zealand tertiaries. Only two species are found, and only one of these has anything peculiar or characteristic about it.

Balanophyllia alta, n. s. Corallum fixed by a rather stout pedicel, tall, cylindrical or enlarging very slowly. Costa broad and flat, much hidden by the vermicular markings. Calice shallow, almost filled by the columella, which ascends as an almost compact cylindrical mass of twisted vitilia united to the edges of the septa. Edge of calice not seen in any of the specimens. Septa perforate, apparently in six systems of four cycles. The tertiaries united to the secondaries in front of them and close to the columella, forming a compact mass. Sides of septa covered with a regular series of curved ridges, which descend to the columella, across which the perforations make radiating lines in a contrary direction. Alt. 61, lat. 16, base 7 millim.

All the specimens are so filled with siliceous matrix that the details of the orders cannot be well seen. The side view of the peculiar columella reminds one of the corallites of many of the *Astræidæ*. It is a most peculiar form, and quite distinct from any yet described. App. Off. Cat., p. 36, No. 23. Conway River, Nelson; Leda marls; VI. Fig. 19—A, corallum, natural size; B, section of another, natural size.

Balanophyllia hectori, n. s. Corallum pedicellate, cuneiform, tapering, short and curved. No epitheca. Calice broadly elliptical, filled with matrix in all the specimens, so that the details cannot be well made out. The septa are thin; exsert (?). Four cycles in six systems; primaries free, fourth and fifth orders united with tertiaries near the wall, and these again with the secondaries near the columella, which is composed of a few twisted vitilia. There seem to be the rudiments of a fifth cycle; but all these details are uncertain, owing to the state of the specimens. Costa well marked, vermicular, and bifurcating. Alt. 17, diam. cal. 13, lat. cal. 10 millim. I have dedicated this specimen to Dr. Hector, F.R.S., the distinguished Director of the Geological Survey. The fossil has characters which ally it to a good many of the Australian *Balanophylliæ*, both living and fossil. App. Off. Cat., p. 39, No. 64. Kokohu River coral

beds, Canterbury; VI. Four specimens are noted; but one has been transferred, as it is a *Flabellum corbicula*, nobis. Fig. 20—A, coral, natural size; B, one system of septa enlarged.

Sub-order—Hydro-corallinæ.

Hydroids forming a corallum with two kinds of zooids—viz., Gastrozooids and Dactylozooids. Family—*Milleporidæ*. Dactylozooids, with numerous tentacles. Ampullæ absent.

Heteropora. De Blainville, 1833.

Corallum irregular, arborescent or encrusting. Pores of two kinds, devoid of styles, and scattered irregularly without tabulæ.

Heteropora ovalis, n. s. Corallum small, oval, free (?). Surface covered with small gasteropores and minute dactylopores, the latter more numerous, and both disposed irregularly. Tubes long, gradually contracting, and curved inwards.

There is only a small fragment of this coral, not more than 25 millim. in length. No one would question its being very like *Millepora*, a genus which is essentially tropical. It has no tabulæ; and this, with the curved tubes, connects it with the other fossil genera to be described, as well as with a living species which I have already named *M. undulosa*. It is a transitional group between the *Stylasteridæ* and *Milleporidæ*, and this species forms a connecting link. App. Off. Cat., p. 40, No. 78. Te Aute limestone, Mount Vernon, Waipukurau, Napier; III.*

Heteropora calycifera, n. s. Corallum massive, calcareous, with short branches, terminating in cup-shaped depressions, forming a cup with thickened margins, full of radiating curved tubes. Gasteropores with an irregular quincuncial arrangement, a circular aperture, and a raised margin. About two small dactylopores to one gasteropore, the latter prolonged inwards and downwards. The peculiarity of this fossil is the curious cup-like branches, which have the appearance of calices. The aspect is like *Amphihelia*, and one would almost expect to

* This form seems to come very near to Busk's *Heteropora neozelandica* (see Jour. Linn. Soc., vol. 14, p. 724), if not identical with it. Professor A. Nicholson figures, in his recent work on "Tabulate Corals" (p. 257), a fragment of an undescribed living species of *Heteropora* from New Zealand which must be closely allied to the present fossil. But as *Heteropora* is classed amongst the Bryozoa, I prefer to name and place the species as above, especially as there are no signs of the "hymen-like lids" in the interstitial tubes, forming pseudo-tabulæ.

find septa in the terminal cups. App. Off. Cat., p. 41, No. 80. Te Aute limestone, Mount Vernon, Waipukurau, Napier; III. Fig. 22—A, coral, natural size.

New genus—CYLINDROPORA.

Hydroid corals, in which the pores are all equal, and disposed on radiating descending tubes round the solid axis of a branched corallum.

These very interesting corals might easily be mistaken for Bryozoa. They belong to a type of which there is a living example in the New Zealand seas, which I described in the eleventh volume of the Transactions of the New Zealand Institute, p. 345, under the name of *Millepora undulosa*. I believe it has representatives in the Tertiary formations of Australia, but in any case it is a form very characteristic of the New Zealand fossil fauna.

CYLINDROPORA AREOLATA, n. s. Corallum solid, much branched, branches more or less cylindrical. Cells or gastero-pores deeply immersed, sloping from an acute raised hexagonal margin to a deep, pyriform, nearly central pore, from which the cell curves deeply inwards and downwards to the centre of the axis, making the central tissue spongy in appearance, but hard and compact.

I should be inclined to refer this fossil to Mantell's *Ceriopora ototara* (See Jour. Geol. Soc., Vol. 6, 1850, p. 329), but the figure is smaller, and the section is that of *Eschara*. From the fact that Mantell refers the genus to *Ceriopora*, which Goldfuss defines as not having the pores prolonged into tubes, we may infer that the species are not the same. App. Off. Cat., p. 40. No. 79: Te Aute limestone, Mount Vernon, Waipukurau, Napier; III. Also No. 73: Dorset's, Forty-Mile Bush, Wellington; III. Fig. 21—A, branch, slightly enlarged; B, cells, much enlarged; C, transverse section of branch, much enlarged; D, longitudinal section, ditto.

CYLINDROPORA SPONGIOSA, n. s. This is a mass of hydroid coral, about two inches in diameter. The upper crust is composed of cerebriform ridges, very like *Fasciculipora;* but, instead of the mass being made up of fasciculi, with smooth external sheaths, the sides, as well as the crests, are a mass of round pores. In section the tubes are small, long, curved, and tapering to a point. It is evident that this coral belongs to the hydroids

described above, and is closely allied to the species just described. The greater part of the specimen is massive, but there are some loose, spreading branches. App. Off. Cat., p. 40, No. 76. Te Aute limestone, Mount Vernon, Waipukurau; III.

Family—Stylasteridæ. Genus—Sporadopora. Mosely, 1878.

Pores of both kinds simple. Gasterozooids with four tentacles.

Sporadopora marginata, n. s. I give this name to two pieces of a hydroid coral from the Chatham Islands. They are both much worn, but there is quite sufficient to show that they belong to Mr. Mosely's genus, as above. The species is new, as the pores have a raised margin, and the style is different, and quite visible at the mouth of the gasteropores. There is no regularity in the arrangement, but the pores are close, and the reticular tissue between is as if it were punctured. One of the branches is almost hollow, but irregularly so, as if perforated by an annelid tube.

This genus was unknown until described by Mr. Mosely (Proceed. Roy. Soc., Vol. 173, p. 94) from a single species, obtained on one occasion only by the "Challenger," off the mouth of the Rio de la Plata, at 600 fathoms. The fossil therefore possesses unusual interest, and no doubt more will be found. App. Off. Cat., p. 38, No. 41. Chatham Islands; V.

Class—BRYOZOA.

Order—Gymnolæmata. Sub-order—Cyclostomata. Family—Sparsidæ. Genus—Entalophora (Lamouroux, 1821); Pustulopora (Goldfuss, 1830; Blainville; *et auctorum*).

Zooarium calcareous, branched; attached branches cylindrical; cells terminating irregularly on the surface; orifices more or less prominent, tubular, rounded.

Entalophora zealandica, Mantell (as *Pustulopora*). See Jour. Geol. Soc., Vol. 6, p. 342, pl. 28, figs. 20, 21. Wanganui. This species occurs also in South Australian Miocene beds. App. Off. Cat., p. 37, No. 29. Shakespeare Cliff (lower part), Wanganui; III.

Entalophora nodosa, n. s. Zooarium erect, ramose; grow-

ing in regular clavate internodes, each of which sends off a small branch. Lines of tubes distinctly marked. Whole surface closely punctate.

There is sufficient definiteness of character in this form to warrant its separation as a species. *E. haastiana* (Stol.) is very distinct from this, the orifices being quincuncial. App. Off. Cat., p. 37, No. 37. Shakespeare Cliff (lower part), Wanganui; III. Fig. 23, branch magnified.

Genus—SPIROPORINA. Stolickza (Reise d. "Novara," Geol. Theil., 1ste Band, p. 103).

Zooarium calcareous, branched; branches cylindrical; cells tubular; orifices disposed in rings at intervals, encircled by a raised ring; surface porous; centre of the branches spongy, with cells and minute tubes.

SPIROPORINA VERTEBRALIS. (Stol., *loc. cit.*, p. 106, and plate, figs. 6, 7.) This species is well represented in New Zealand, as there are a great many specimens in the collection. It is equally common in the Mount Gambier, South Australian, limestones; in the Table Cape beds, Tasmania; Muddy Creek, Victoria; and Cape Otway beds. It was described by me, under the name of *Pustulipora ungulata*, in the Proc. Roy. Soc. N.S.W., 1876, p. 150. App. Off. Cat., p. 36. No. 3: Hutchison's Quarry, Oamaru; V. No. 35: Shakespeare Cliff (lower part), Wanganui; III. No. 54: coralline limestone, Raglan; V.

SPIROPORINA IMMERSA, n. s. Zooarium with bifurcating cylindrical branches. Cells in somewhat inclined circles. Mouth with a raised pyriform margin, which is notched in front; an inner margin surrounding an oval orifice.

One specimen from Wanganui is the only one I have seen. It is very much like one of the mesozoic species. The genus may be regarded as mesozoic in its affinities, and another instance of the mesozoic character of all our Australian Tertiary fossils. App. Off. Cat., p. 37, No. 35. Shakespeare Cliff (lower part), Wanganui; III. Fig. 24—A, branch, slightly magnified; B, cells, much magnified.

Genus—FUNGELLA. Hagenow.

Zooarium pedunculate, capitate, simple or divided into lobes, the contiguous tubes opening on the upper surface.

FUNGELLA LOBATA, n. s. Zooarium broadly pedunculate,

rising into a flabellate mass, round which there are lobes formed by fascicles of tubes. The pores of the lobes larger and more inclined than those of the central mass. Alt. 5 millim. App. Off. Cat., p. 37, No. 38. Shakespeare Cliff (lower part), Wanganui; III. Fig. 25, zooarium, much enlarged.

Genus—Idmonea. Lamouroux, 1821.

Zooarium calcareous, ramose, erect; branches laterally compressed, angular in front, convex or flat behind; orifices of the cells in oblique alternate lines on each side of the central keel; surface smooth, cells often margined and punctate.

Idmonea alternata, n. s. Distinguished by the cells being in a single alternate series. Central keel very prominent. Better specimens wanted for a complete diagnosis. App. Off. Cat., p. 40, No. 90. Enclosed in a mass of Bryozoan limestone from White Rock Point, north of Mokihinui River, West Coast, Nelson; IV. or V.

Genus—Retepora.

Of this genus there are many specimens in the collection, but none sufficiently perfect for identification. The reason of this is that the cells are disposed in a loose, friable incrustation on one side only of the zooarium. They are so easily broken away that very seldom is a specimen found which has the cells preserved. One small fossil in which the fenestræ are exceptionally close is the only one I have attempted to identify, and this I have named provisionally *R. contigua*. One is named by Stolickza in the geology of the cruise of the "Novara." I have little doubt that a good many of the species are identical with those of the Australian Tertiary formations, where *Retepora* is a common fossil. What is wanted is a monograph of the genus, so that the whole may be reviewed and compared together.

Genus—Eschara. Ray.*

Zooarium calcareous, erect, ramose; with flattened branches and urceolate decumbent cells, disposed quincuncially on both

* This is the statement of Stolickza, who gives no authority, but adds the date 1724. There must be an error somewhere, as Ray died in 1704. Nearly all authors since Ellis give Ray as the founder of the genus *Eschara*, taken, I suppose, from the Syn. Stirpium Brit., Lond. 1690. It is evident, however, that Ray refers to Flustra. The proper authority is Lamouroux, 1821.

sides, and separated by a lamina; cells with variously-shaped orifices and accessory pores.

Eschara monilifera. (M.-Ed., Ann. Sciences Nat. II., Ser. VI., p. 7, pl. XI., fig. 1. Busk, Polyz. of the Crag, p. 68, pl. XI., figs. 1–3.) I found one loose specimen of this Bryozoon, without any indication of the locality. I believe it became detached from some fragment from Mokihinui River, West Coast, Nelson; IV. or V. This fossil also occurs at Mount Gambier, South Australia.

Eschara ampla, n. s. Zooarium very foliaceous and expanding. Cells open for nearly their whole extent; the upper part fringed by six or eight calcareous points, the lower forming an oval opening. There are irregular pores or vibracular sockets, but all the specimens are worn. App. Off. Cat., p. 35, No. 8. Hutchison's Quarry, Oamaru; V. Apparently very common in the formation. Fig. 26, one cell, much magnified.

Eschara Buskii *(mihi)*. See Proc. Roy. Soc. N.S.W., p. 159. This species was described by me from Mount Gambier, South Australia, where it is very common. It appears to be equally abundant at Oamaru. App. Off. Cat., p. 35, Nos. 9 and 10. Hutchison's Quarry; V. After comparing it with specimens from New Zealand, and with Stolickza's figures, I am convinced that it should be referred to D'Orbigny's genus *Porina*, from the European Tertiary; and the species is the same as Stolickza's, as noted below. *Porina* is Cretaceous, with several Eocene and Miocene species as well.

Genus—Porina. D'Orbigny, 1852.

Zooarium calcareous, erect, ramose, with rather compressed branches; cells quincuncially disposed on both sides, separated by a central lamina; inflated, submarginate, with a rounded raised central or nearly central orifice, and accessory pores various or none.

Porina dieffenbachiana. Stolickza, Reise d. "Novara," Geol. Theil., 1ste Bd., p. 135, pl. XIX., fig. 20. Proc. Roy. Soc. N.S.W., 1876, p. 149, pl. 7, figs. 16, 17, as *Eschara Buskii*.

Genus—Celleporaria (Lamouroux, 1821), Cellepora and Celleporaria (D'Orbigny, 1852), Cellepora (Busk, 1857).

Zooarium calcareous, spongiose, encrusting, globose or ramose, composed of cells heaped or conjoined.

This genus has been more commonly known amongst Australian naturalists as *Cellepora;* but that name more properly belongs to what we term *Lepralia,* and so it is regarded by foreign palæontologists, in which nomenclature they are justified by the laws of priority. As the change is a very slight one, I am induced to adopt it; more especially as *Lepralia,* as at present understood, must be divided eventually into several genera.

Celleporaria gambierensis. (Busk, Quart. Jour. Geol. Soc., Vol. 16, p. 260; *mihi,* Geol. Obs. in S. Austral., pp. 74–85 —figured in many places as *Cellepora;* Stoliekza, *loc. cit.,* p. 141, pl. 20, fig. 7.) This is a very common fossil in the South Australian tertiaries, especially at Mount Gambier. It appears to be equally common in the New Zealand formations, for I find it in specimens Nos. 6, Oamaru; 28, Shakespeare Cliff, Wanganui; 63, coralline limestone, Reefton, VI.; 75, Te Aute limestone, Johnston's, Rotomahana Plains, Napier, III.: but the specimens are all imperfect.

Celleporaria papillosa, n. s. I have given this name to an encrusting species, which is very common in the River Murray beds. It is generally spread over convex surfaces, and is thickly studded with thick, rounded, mammillary eminences about a quarter of an inch high, and the same in diameter. Any attempt to make out the details of the cells was unsuccessful; but the papillary character of the fossil is so very constant that I have not hesitated to give it a name. App. Off. Cat., p. 40. No. 71: Cape Kidnappers, Napier; V. No. 83: St. Kilda, Brighton, West Coast; VI.

Celleporaria nummularia. (Busk, Quart. Jour. Geol. Soc., 1860, Vol. 16., p. 261; *mihi,* Geol. Obs. S. Austral., 1862, pl. 1, fig. 1; Trans. R. Soc. Victoria, Vol. 6, p. 4, pl. 1, fig. 5.) This fossil was named only by Busk, and subsequently figured and described by me. It was figured first by Sturt in his "Narrative of Two Expeditions," &c.; and the fossil was brought from the Murray beds. It occurs at Mount Gambier, S.A.; and at Table Cape, Tasmania. It appears to be very common in the rocks at Oamaru. App. Off. Cat., p. 40, No. 84. Hutchison's Quarry.

Genus—Salicornaria. Cuvier.

Zooarium branched; articulated cells disposed round the

cylindrical axis, opening to a surface of nearly regular hexagonal facets; avicularia immersed, irregular.

Salicornaria immersa, n. s. Internodes long, slender, cylindrical; margins of cells very prominent, and lamellar; cells deeply immersed; mouth crescentic, with a simple semicircular crescentic lip, an oval or a round pore above, and another at the base of the cells. The mouth of the species distinguishes it from any of those described, besides the immersed cells and the raised margin. There is only one specimen in the collection, and this is in remarkable contrast to the Australian tertiaries. Other species of *Salicornaria* are very plentiful. One of these is *S. sinuosa* (Hassal), a living species abundant also in the Pliocene crag of Suffolk. App. Off. Cat., p. 37, No. 27. Conway River, Nelson, from Leda marls; VI. Fig. 27, one cell, much magnified.

Genus—Vincularia. Defrance, 1829.

Like *Salicornaria;* but the branches rigid, not articulate.

Vincularia maorica. (Stolickza, *loc. cit.*, p. 153, pl. 20, fig. 8.) I believe this fossil is also found in the Mount Gambier tertiaries. App. Off. Cat., p. 36, No. 13. Hutchison's Quarry, Oamaru; V.

Genus—Cellaria. Ellis and Solander, 1787.

Zooarium erect, calcareous, ramose, articulate; articulations fibrous, flexible; branches cylindrical; cells urceolate, decumbent; orifices subtubular or roundly marginate, with or without accessory pores.

This genus has been so variously described by different authors that it is worth while to quote the synonymy according to Stolickza, who has given a very exhaustive essay on the much-confused and difficult subject of Bryozoan nomenclature*:—

Cellaria. Ellis and Solander; Lamarck, 1801, 1816, Anim. sans Vertèbres, Vol. 2, p. 132; Lamouroux, Exposition Methodique, 1821.

Salicornaria. Cuvier, Regne Animal, Vol. 4, p. 75.

Glauconome. Münster, 1827; Goldfuss, Petrefactæ Germaniæ.

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* "Die oben citirte Synonomie wird zeigen dass eine grosse Confusion existirt at."

Vincularia. Defrance, 1829, Dict. Science Nat., Vol. 58, p. 214.

Margaretta. Gray, 1843, in Dieffenbach's New Zealand, Vol. 2, p. 293.

Tubucellaria. D'Orbigny, 1852, Pal. Française Cret., Vol. 5, p. 335.

Onchopora. Busk, Quart. Jour. Microscop. Soc., No. 12, p. 320.

Cellaria punctata, n. s. Zooarium not much contracted at the internodes; branches nearly cylindrical; surface finely punctate; cells circular, disposed distantly, quincuncially; orifice round, raised.

This fossil is, I think, represented in the South Australian tertiaries, Muddy Creek, and is closely allied to an existing species in the Australian seas, the *Onchopora hirsuta* of Busk. App. Off. Cat., p. 60 *(bis?)*. Locality, Oamaru, but doubtful whether from IV. or VI. Fig. 28, single internode, much magnified.

Genus—Membranipora.

There are a number of specimens in the collection with fossils of the genus *Membranipora,* but not in a state of preservation sufficiently good for determination.

Genus—Retehornera. Kirchenpaur.

Retepores, with quadrate fenestræ. One imperfect specimen of this genus is in the collection (No. 51, p. 38). The fossil is imbedded in stone, face downwards, and the cells are not visible. The fenestræ are about 2 millimetres in length, and half that in diameter, and the calcareous portions are scarcely more than half a millimetre in diameter. I have named it provisionally *R. Haastiana.* The genus has one living species in New Zealand waters.

Family—Selenariadæ.

Zooarium free; orbicular or irregular; conical or depressed; convex above, flat or concave below. Zooœcia of two kinds, disposed quincuncially. This family is well represented in Australia in both living and fossil state. It may indeed be said to be Australian, though some European fossil members are known. I have written a monograph of the whole family in the Trans. and Proceed. of the Adelaide Phil. Society, Sept. 2, 1879.

Genus—Selenaria. Busk, 1852.

Only a certain number of cells, with vibracular pores, which are irregularly distributed over the convex, discoid zooarium.

Selenaria squamosa, n. s. Zooarium orbicular, roundly convex, depressed, somewhat thick; under surface smooth, enamelled. Zooœcia irregularly disposed; sometimes with lines of avicularian cells, and sometimes without; concave, overlapping each other like scales; orifice at the base projecting, and of horse-shoe shape. Avicularian pores, pyriform, with calcareous spiculæ on the margin. Under surface with irregular rounded costa without margins or pores.

The form of the cells is like some of the Australian Miocene species. App. Off. Cat., p. 37, No. 37 *(bis)*. Shakespeare Cliff (lower part), Wanganui; III. Fig. 29—A, zooarium, magnified 8 diameters; B, cell, with vibracular pore magnified 24 diameters.

Family—Theonidæ. Genus—Fasciculipora.

This genus was hitherto supposed to be confined to the Older Pliocene formations of England and France. It has been known to authors since the Exposition Methodique of Lamouroux was published, and it received some examination at the hands of M. de Blainville in his Manuel d'Actinologie, p. 408. But, though named, the genus does not appear to have been fully described until Professor Busk gave a full diagnosis in his Monograph of the Crag Polyzoa, published in 1857 by the Palæontographical Society. The learned professor included it amongst his Polyzoa, in the family *Theonidæ* massive globose or irregular zooaria, with contiguous crowded tubular cells. In *Fasciculipora,* the peculiarity of the structure consists in its being made up of radiating bundles of tubes. The bundles are cylindrical, and of uniform or irregular dimensions. In the only two species hitherto known there are striking differences in the relations of the cylindrical fasciculi or bundles. In one, *F. tubipora,* they are united at regular distances by tabular concentric divisions. In the other species, *F. aurantium,* the fasciculi anastomose irregularly, and there are no concentric tabulæ. The external surface where the tubes terminate is also different. In *F. tubipora* it has rounded eminences. In *F. aurantium* the surface presents undulating anastomosing ridges. It is a singular and interesting fact that we have two

species of this fossil in New Zealand, and that one of them varies much in habit, so as in some specimens to present the features of *F. tubipora*, and in others those of *F. aurantium*. There are concentric septa; but yet these appear to be obliterated, and the fasciculi anastomose. There are no cerebriform crests at the surface, but the fasciculi project in rounded prominences, of all sizes and shapes. The fasciculi have a distinct including sheath, which has occasionally a trumpet-like dilatation at the summit. The whole character of these organisms is peculiar, and we may question the propriety of including them amongst the Bryozoa. The long minute character of the tubes is utterly different from the ordinary cells or zoœcia of the Bryozoan. They differ, too, in a remarkable way from the Hydroids, though there seems to be much more affinity to these than to any other order. Perhaps the living organisms obtained by the "Challenger" may include some whose tissues, when examined, may throw a light on the matter. In the meantime it should be a matter of great interest to naturalists carefully to study the difference between the so-called Bryozoa with tubes instead of cells. The distinction is very great, and has not met the attention it deserves.

There is a species of *Fasciculipora* from New Zealand, noticed by Zittel in the Geological volume of the Reise d. "Novara," p. 61. Beyond a description of the species I cannot find that he made any observations on its character. His diagnosis is: "Fasciculi of cells ramose, numerous, narrow, cylindrical, smooth. Branchlets rising from the centre, divergent, connected by transverse septa placed at irregular distances. Surface of the zooaria globular or mammillate. Fasciculi free or confluent." From this description it would not be easy to say whether the species is distinct from the ones seen by me or not. The figure, however (pl. 11, fig. 8, *a*, *b*, *c*, *d*), seems to me to decide the question. The branches and septa are quite distinct. They are smaller, branched in a different way, and the septa are different.

It is somewhat remarkable that Professor Zittel made no observation on the discovery of the fossil he described. The genus has long been looked upon as characteristic of the British Pliocene crag; and when, in 1859, Professor Busk examined a collection of fossils sent to England from Mount Gambier by me, he remarked on the absence of any such fossils. The

Bryozoa on that occasion inclined him to believe that the formation was Pliocene. It is not known to be older. Professor Zittel's specimen was from the Lower Miocene or Upper Eocene beds of the mouth of the Waikato River. Those now to be described are from the Te Aute limestone, Mount Vernon, Waipukurau, Napier; Formation No. III., Upper Miocene of New Zealand geologists. This would be in keeping with the position of the organisms in Europe; and it is a fact of no ordinary interest in natural science that two such peculiar closely-allied organisms should flourish in the same epoch in such remote seas as Britain and New Zealand. At one time I was of opinion that we had an existing species in the Australian seas, but this was certainly an error.

I have adopted D'Orbigny's name, *Fasciculiporæ* (1839), for the genus, instead of M.-Edwards's *Fascicularia*, which was not published (being only MS.), as the same name had been used by Lamarck to describe a genus of corals allied to *Stylina*, and now included with them. *Fascicularia* is, in any case, so close to *Fasciolaria* that its use would lead to confusion.

Fasciculipora.

Zooarium composed of bundles of tubes formed of radiating fasciculi, united either by tabulæ or to each other. Pores simple.

Fasciculipora intermedia, n. s. Zooarium irregularly hemispherical, with distant or close radiating fasciculi, with a distinct, rather thick epitheca, on which the marks of the tubes appear plainly. Tabulæ irregular. Pores of one kind only, but occasionally small, hexagonal, with what appear like interstices.

There are three specimens in the collection. Two are regularly tabulate, and the third has scarcely any of these septal divisions. They are sometimes 2 millimetres in thickness, or dwindle down to mere laminæ. In one specimen the tabulæ are in regular semicircular divisions. In another, they break off irregularly. The casts of a little colony of Balani in one of the specimens shows that it began its structure as a parasite. Fig. 30—A, section of portion of zooarium, slightly enlarged; B, mouths of tubes, much enlarged; C, section of fascicle, enlarged. Fig. 31, another specimen, natural size.

Fasciculipora ramosa. Zooarium composed of fine, slender fasciculi, which ramify in all directions, anastomosing or sending off little short branches, which terminate in clusters of pores;

no tabulæ; diameter of fasciculi, 1 to 2 millimetres, dilated at the summit.

In referring this fossil to the genus *Fasciculipora*, it may be mentioned that it is of much more open texture, and is only massive from the matrix which surrounds it. App. Off. Cat., p. 38, No. 47, Mount Brown beds, Weka Pass; V. Fig. 32, natural size.

LIST OF ILLUSTRATIONS.

Frontispiece. Autotype of block showing *Flabellum circulare*, $\frac{2}{3}$ nat. size.

Fig. 1. *Isis dactyla*, nat. size.

Fig. 2. *Trochocyathus mantelli (?)*. M.-Ed. Fragment of calice.

Fig. 3. ,, ,, ,, Base, showing tubercle.

Fig. 4. ,, *quinarius*, nat. size.

Fig. 5. *Notocyathus pedicellatus*. Calice, nat. size.

Fig. 6. *Sphenotrochus coronatus*. Ideal restoration from fragments.

Fig. 7. *Flabellum circulare*, nat. size.

Fig. 8. ,, *rugulosum*, nat. size.

Fig. 9. ,, *huttonianum*, twice nat. size.

Fig. 10. ,, *corbicula*. A, coral, nat. size; B, portion of septa, to show partial filling-up of loculi.

Fig. 11. *Flabellum laticostatum*, nat. size.

Fig. 12. ,, *sphenodeum*, nat. size.

Fig. 13. ,, *radians*, nat. size.

Fig. 14. ,, *mariæ*, nat. size.

Fig. 15. ,, *attenuatum*, nat. size.

Fig. 16. *Platyhelia distans*, nat. size.

Fig. 17. *Amphihelia intricata*, nat. size.

Fig. 18. *Scolangia parvisepta*, nat. size.

Fig. 19. *Balanophyllia alta*. A, coral, nat. size; B, section.

Fig. 20. ,, *hectori*. A, coral, nat. size; B, one system of septa, much enlarged.

Fig. 21. *Cylindropora areolata*. A, branch, slightly enlarged; B, cells, much enlarged; C, transverse section of branch, much enlarged; D, longitudinal section, much enlarged.

Fig. 22. *Cylindropora calycifera*, nat. size.

Fig. 23. *Entalophora nodosa*. Branch, much enlarged.

Fig. 24. *Spiroporina immersa*. A, branch, slightly enlarged; B, cells, much enlarged.

Fig. 25. *Fungella lobata*, much enlarged.

Fig. 26. *Eschara ampla*. One cell, much enlarged.

Fig. 27. *Salicornaria immersa.* One cell, much enlarged.

Fig. 28. *Cellaria punctata.* One internode, much enlarged.

Fig. 29. *Selenaria squamosa.* A, zooarium, enlarged 8 diameters; B, single cell, with vibracular pore magnified 24 diameters.

Fig. 30. *Fasciculipora intermedia.* A, section of portion of zooarium, slightly enlarged; B, mouths of tubes, much enlarged; C, section of fasciculus, much enlarged.

Fig. 31. *Fasciculipora intermedia,* nat. size. Specimen showing concentric tabulæ.

Fig. 32. *Fasciculipora ramosa,* nat. size.

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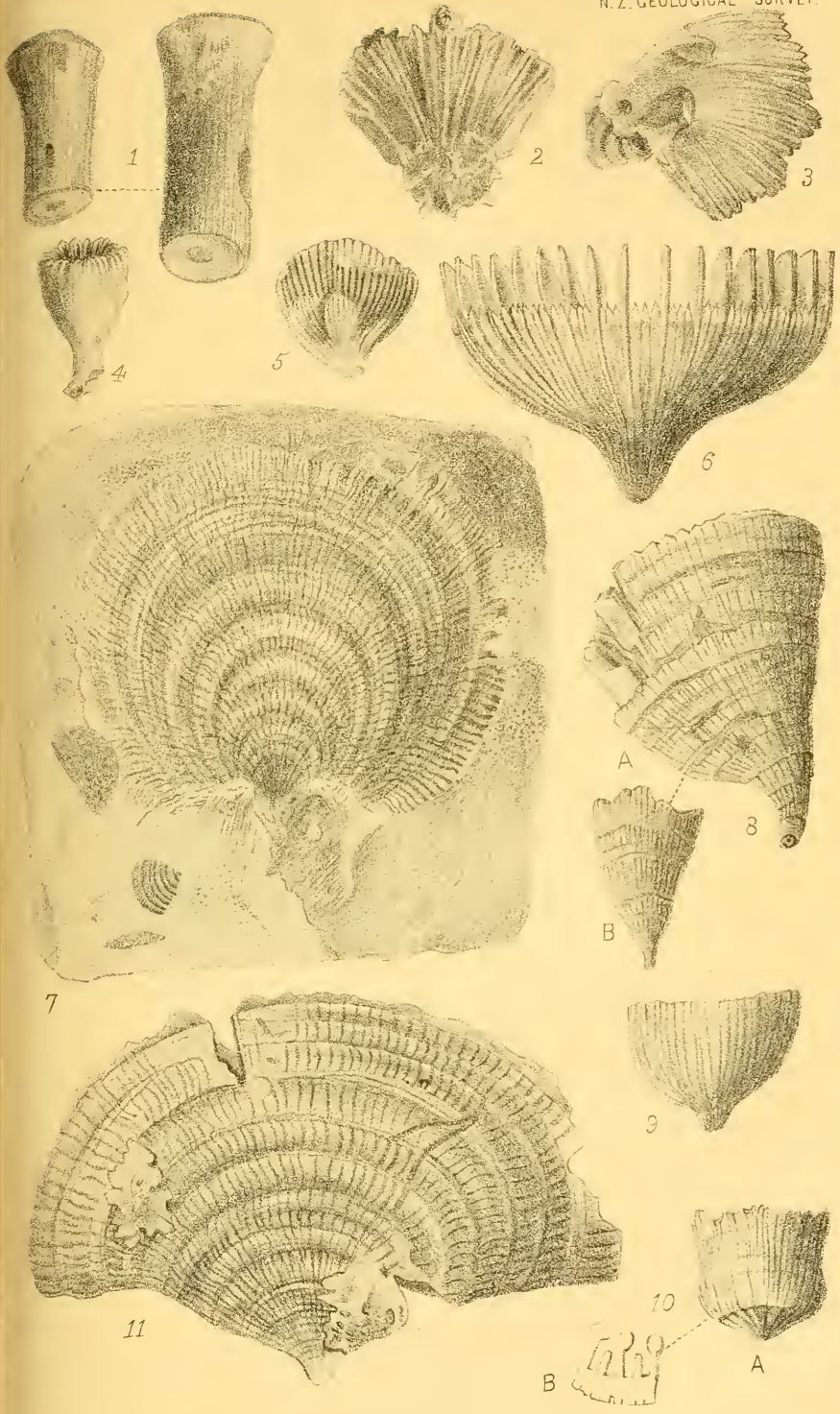

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