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NEW ZEALAND.

Department



of Mines.

GEOLOGICAL SURVEY BRANCH.

(P. G. MORGAN, Director.)

PALÆONTOLOGICAL BULLETIN No. 8.

# LISTS OF NEW ZEALAND TERTIARY MOLLUSCA

FROM VARIOUS LOCALITIES EXAMINED AND NAMED FROM 1913 TO  
THE END OF 1917.

(A FEW EMENDED LISTS, PREVIOUSLY PUBLISHED ELSEWHERE, ARE ADDED.)

BY

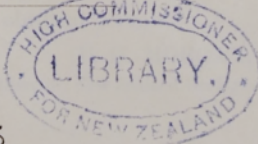
HENRY SUTER.

WITH NOTES AND A REVIEW OF RESULTS, ETC.,

BY

P. G. MORGAN.

ISSUED UNDER THE AUTHORITY OF THE HON. G. J. ANDERSON, MINISTER OF MINES.

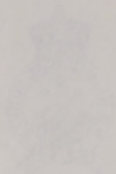


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NEW ZEALAND



Geological Survey of New Zealand

Geological Survey of New Zealand

Palaeontological Bulletin No. 8

LISTS OF NEW ZEALAND TERTIARY MOLLUSCA

FROM EXPOSURE LOCALITIES, EASTERN AND NORTH ISLANDS

BY G. H. R. DALL

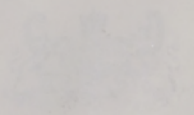
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Geological Survey of New Zealand

## LETTER OF TRANSMITTAL.

GEOLOGICAL SURVEY OFFICE,

Wellington, 3rd May, 1921.

SIR,—

I have the honour to transmit herewith Palæontological Bulletin No. 8, entitled "Lists of New Zealand Tertiary Mollusca . . . with Notes and a Review of Results, &c." These lists were compiled by the late Mr. Henry Suter, Consulting Palæontologist to the Geological Survey, and were transmitted by him to the Geological Survey shortly before his death in 1918. I have added various notes and have written the final chapter. Mr. J. Marwick, Assistant Geologist, has helped in reading the proofs.

The Bulletin contains 107 pages of letterpress, and two maps showing fossil localities, &c., in the North and South Islands respectively. Although the information given is necessarily of such a nature as not to appeal to the general public, its circulation among scientific workers is desirable in order to advance our knowledge of the geology of New Zealand. It is perhaps not necessary to point out that the science of geology is as yet only in its infancy, and that every addition to the sum of his knowledge will aid the economic geologist in the solution of those problems connected with mineral deposits which are by universal consent assigned to him. Among these problems may here be mentioned the discovery of new coalfields and, possibly, of oilfields. Both these objects are of the highest importance, and both will be greatly assisted by a full knowledge of our Tertiary fossils.

I have the honour to be,

Sir,

Your obedient servant,

P. G. MORGAN,

Director, New Zealand Geological Survey.

The Hon. G. J. Anderson,  
Minister of Mines, Wellington.





## P R E F A C E.

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THE great collections of fossils from all parts of New Zealand made during the earlier years of the New Zealand Geological Survey attest the importance attached by Sir James Hector, the first Director, to palaeontological research. Unfortunately, he was prevented from carrying to completion his plans for preparing and publishing a number of palaeontological reports. Had this been done not only would our general knowledge of the geology of this country have been much advanced, but those economic researches towards which the attention of the Geological Survey has been rightly, but too exclusively, directed would have been greatly benefited. Prior to 1911, however, except for the early labours of the late Captain F. W. Hutton, very little had been done towards the classification and description of the fossil collections, notwithstanding the urgent need for this work, as was emphatically pointed out in 1904 by the Australasian Association for the Advancement of Science, and by the late Mr. Augustus Hamilton, at that time Director of the Dominion Museum.\*

In 1911, with the appointment of Dr. J. A. Thomson (now Director of the Dominion Museum) as Palaeontologist to the Geological Survey, a period of progress began, and the present bulletin is the eighth of a series dealing with the fossil collections. In 1913 the late Mr. Henry Suter, the author of that monumental work the *Manual of the New Zealand Mollusca*, was engaged as Consulting Palaeontologist, and during the next five years, except for two periods of six months each, was employed wholly on work connected with Tertiary Mollusca. Having examined Hutton's types (so far as these were available) and revised his descriptions (*Palaeontological Bulletins Nos. 2 and 3*), Mr. Suter took in hand the identification of the Tertiary Mollusca in the Geological Survey collections. For this work, on account of his unrivalled knowledge of the Recent New Zealand Mollusca, he was well equipped; and as the result of his labours many thousand determinations were made, and a large number of new species distinguished. Not quite two-thirds of the latter are described in *Palaeontological Bulletin No. 5*. The present bulletin contains lists of most of the identifications made prior to the end of 1917, but those made during 1918 will be published elsewhere.

One cannot too strongly emphasize the value of the spade-work done by Mr. Suter in the almost uncultivated field assigned to him. Even where some work had been done in that field it had, one might say, almost reverted to its original state; so that in most respects Mr. Suter's work was that of a pioneer, preparing the ground for his successors, and some of the refinements of modern palaeontology had necessarily to be dispensed with. Thus an inspection of the suites of specimens determined by him shows that wide limits were given to most of the species, many of which therefore correspond to the "aggregate species" of the botanist. Mr. Suter's familiar acquaintance with the Recent Mollusca no doubt led to many fossils which closely resemble living species being identified with those species, but in a number of cases close examination of well-preserved suites will certainly show that varietal and even specific differences exist. Thus, until the aggregate species are split up and the finest possible distinctions made, close zoning of the New Zealand Tertiary strata cannot be expected; but, as stated on page 98, broad divisions can now be made with

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\* See *Trans. N.Z. Inst.*, vol. 42, 1910, pp. 52-54. It should be observed that, as stated by Mr. Hamilton, the late Mr. Alexander McKay spent some years from 1904 onwards in re-sorting, relabelling, and cataloguing the mineral and fossil collections of the Geological Survey, a work which has greatly facilitated their description.

a considerable degree of confidence, very largely as the result of Mr. Suter's work. No doubt, too, the percentages of Recent species in the lists now published will be reduced by future workers. This statement applies especially to the pre-Awamoan faunas.

Although the contention of most latter-day biologists that a species ought to be defined as narrowly as possible is a sound one, yet in the early stages of palæontological research one may best proceed on a somewhat different principle. The geological survey of a new country requires a rapid, if imperfect, clearing of the palæontological ground, so that the field-geologist, wherever he goes, may not have to depend for his correlations wholly on stratigraphical and lithological considerations. As geological survey advances, the need for refinement in palæontological methods becomes ever and ever greater. Largely on account of Mr. Suter's work the time has arrived when narrow definitions and exact identifications of fossil species are necessary. Of even greater importance is the collection of large fossil suites from well-defined stratigraphical horizons, a work in which the field-geologist may well be expected to take the greater part. There is room, however, for many workers other than the officers of the official Geological Survey. The present publication, it is believed, will be of material assistance to all these in indicating numerous places where fossils may be found, and the fauna that may be expected to occur. So far as can be foreseen, it will not be necessary in the near future to publish such extensive fossil lists as those given in this bulletin. It is intended, however, whenever important fossil collections have been examined and the determinations cannot conveniently be published in one of the ordinary geological bulletins of the Geological Survey, to make copies of the lists, which will be communicated, on request, to those who are actively engaged in research connected with the geology of New Zealand.

P. G. MORGAN.

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L I S T S

OF

NEW ZEALAND TERTIARY MOLLUSCA.

INTRODUCTORY NOTE.

DURING the past few years many thousand specimens of Tertiary Mollusca have been identified by the late Mr. Suter, and the need for publishing the results in a form convenient for reference has become increasingly apparent. Accordingly Mr. Suter, in 1918, shortly before his death, prepared the following lists, with the names arranged alphabetically, and the localities in approximate order from north to south. An asterisk prefixed to the name of the species indicates that it is also found Recent. The writer of this note, except in the case of the Oamaru fossils collected by Professor Park and Mr. G. H. Uttley, and of some of Dr. J. A. Thomson's collections, has added the supposed age of the fossils, and as a rule the horizon or formation from which they were collected. In many cases additional remarks, some of them from the late Mr. Alex. McKay's manuscript lists of localities, of which two are in existence, together with references to the literature, are also given. Some of the lists have been previously published, but in a few instances with slight alterations or additions not made by Mr. Suter. The various lists are now all brought together, and published in the same form as supplied by Mr. Suter in July, 1918, except that some of the headings are modified so as to define the localities more exactly, or to bring them into accordance with McKay's manuscript lists. In one case (Loc. No. 637)† a brachiopod named by Dr. Thomson has been added by the writer to the list. There are also two lists in which Mr. Suter has named a brachiopod.‡ Any other alterations or additions are of a trifling nature. Mr. Suter's carefully compiled lists are almost free from slips of the pen, and hardly a letter had to be changed.

In many cases only one or two isolated specimens from a large or fairly large collection have been identified by Mr. Suter. Most of these came either from the Dominion Museum show-cases, or from the collection of pectens sent to Professor Ralph Tate, of Adelaide, many years ago, and

† See p. 34.

‡ Pohokura tunnel collection, p. 24; Oaro Creek, p. 33.

returned only within the last few years through the good offices of the Rev. W. Howchin, F.G.S. Again, some fairly large collections have been dispersed, and others consist mainly of poor material.

The fossils identified by Mr. Suter during the first half of 1918 were mostly comprised in recent collections from the North Taranaki and South-west Auckland districts. Lists of these will be published in forthcoming bulletins dealing with the geology of the areas in which the collections were made.

Most of the fossils identified by Mr. Suter have either been packed away again or at the time of writing had not been unpacked, and hence have not been seen by the writer or other members of the Geological Survey staff. For this reason, and for others that need not be mentioned, the writer has not always been able to give as much additional information concerning the collections as is desirable.

During the period of Mr. Suter's engagement with the Geological Survey, collections were submitted to him for identification by Dr. J. A. Thomson, Dr. P. Marshall, Messrs. M. C. Gudex, A. Purchas, and J. A. Bartrum, the understanding being that lists of identifications and topotypes of new species (when possible) were to be supplied to the Geological Survey. Some of these lists, as indicated above, have been previously published, but were included by Mr. Suter in his manuscript, and for the sake of convenient reference are now reprinted. The various changes in nomenclature that will be observed were, of course, made by Mr. Suter, and represent his final views.

P. G. MORGAN.

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## CHAPTER I

## NORTH ISLAND.

Hokianga South Head : Orbitolite Limestone. Geol. Surv. Loc. 733. McKay; 1888.

<i>Ancilla (Alocospira) papillata</i> (Tate).	<i>Leda semiteres</i> Hutt.
<i>Architectonica</i> n. sp.	<i>Lima</i> aff. <i>huttoni</i> Sut. ( <i>non</i> Woods).†
* <i>Argobuccinum australasia</i> (Perry). New as a fossil.	* <i>Murex octogonus espinosus</i> Hutt.
<i>Cardium</i> aff. <i>spatiosum</i> Hutt.	<i>Pecten (Pallium) polymorphoides</i> Zitt.
<i>Corbula kaiparaensis</i> Sut.	* <i>Placunanomia zelandica</i> (Gray).
* <i>Crepidula monoxyla</i> (Less.).	<i>Polinices (Neverita) huttoni</i> Iher.
	<i>Turritella (Torcula) semiconcava</i> Sut.

Thirteen species, of which four also Recent = 31 per cent.

*Age*: Miocene (McKay). McKay in MS. assigned this collection, which originally contained 67 specimens, to the Awatere Series. He states that "the peculiar fossil of this locality" (the "*Orbitoides*" = *Miogypsina* probably) "is found also at Kawakawa immediately above the shell-bed forming in places the roof of the coal. The Hokianga beds, however, must be of a different age." See *Rep. of Geol. Explor. during 1887-88*, No. 19, 1888, p. 50, and *Rep. of Geol. Explor. during 1885*, No. 17, 1886, p. 166. See also references quoted under next list.

Pakaurangi Point, Kaipara Harbour : Grey Mudstone. Dr. P. Marshall, up to 1917 (Mr. J. A. Bartrum assisted Dr. Marshall in making collections in 1912 and in 1916).

* <i>Acteon craticulatus</i> Murd. & Sut. New as a fossil.	<i>Conus armoricus</i> Sut.
" <i>ovalis</i> (Hutt.).	" n. sp.
<i>Alectrion socialis</i> (Hutt.).	" n. sp.
<i>Ampullina (Megatylotus) suturalis</i> (Hutt.).	" n. sp.
* <i>Ancilla (Baryspira) australis</i> (Sow.).	<i>Coptocheilus</i> n. sp. Genus new to fauna.
" ( <i>Alocospira</i> ) <i>papillata</i> (Tate).	<i>Corbula canaliculata</i> Hutt.
" n. sp.	" <i>kaiparaensis</i> Sut.
" n. sp.	* " <i>macilenta</i> Hutt.
<i>Anomia</i> n. sp.	" n. sp.
* <i>Arca novae-zealandiae</i> E. A. Smith.	<i>Crenilabium</i> n. sp. Genus new to fauna.
" <i>subvelata</i> Sut.	<i>Crepidula gregaria</i> Sow.
<i>Architectonica</i> n. sp.	* <i>Crossea labiata</i> T.-Woods. New as a fossil.
<i>Astraea subfimbriata</i> Sut.	<i>Cucullaea australis</i> (Hutt.).
<i>Bathytoma haasti</i> (Hutt.).	<i>Cylichnella enysi</i> (Hutt.).
" <i>sulcata excavata</i> Sut.	<i>Cymatium minimum</i> (Hutt.).
<i>Borsonia (Cordieria)</i> n. sp.	<i>Cytherea chariessa</i> Sut.
* <i>Cadulus delicatulus</i> Sut. New as a fossil.	* <i>Dentalium ecostatum</i> T. W. Kirk.
<i>Calliostoma</i> n. sp.	" <i>pareorensis</i> Pils. & Sharp.
* <i>Cardita calyculata</i> (L.).	" <i>solidum</i> Hutt.‡
" ( <i>Glans</i> ) n. sp.	<i>Dentilucina</i> n. sp. Genus new to fauna.
<i>Cerithiella fiducula</i> Sut.	<i>Dolicholatirus</i> n. sp. Genus new to fauna.
<i>Chama huttoni</i> Hect.	* <i>Dosinia greyi</i> Zitt.
<i>Chione meridionalis</i> (Sow.).	" n. sp.
<i>Cominella carinata</i> (Hutt.).	<i>Drillia avamoensis</i> (Hutt.).
	" <i>imperfecta</i> Sut.

† Under date of 18th June, 1918, Mr. Henry Suter wrote: "The name *Lima huttoni* H. Woods, *N.Z. Geol. Surv. Pal. Bull. No. 4*, 1917, p. 27, is preoccupied by *Lima huttoni* Suter, *N.Z. Geol. Surv. Pal. Bull. No. 2*, 1914, p. 45, and I now propose the name of *Lima (Limatula) woodsii* for the former species."

‡ There is also a *Dentalium solidum* Verrill, but at the time of writing it is not known whether Hutton's or Verrill's name has priority. Hutton's name dates from 1873.



- Drillia* n. sp.  
 \**Emarginula striatula* Q. & G  
*Fusinus kaiparaensis* Sut.  
 " *morgani* Sut.  
 " n. sp.  
*Galeodea muricata* (Hect.).  
 " *senex* (Hutt.).  
 " *sulcata* (Hutt.).  
*Glycymeris subglobosa* Sut.  
*Helicacis* n. sp.  
 \**Leda fastidiosa* A. Ad.  
 " *semiteres* Hutt.  
*Leucosyrinx alta transenna* (Sut.).  
*Lima colorata* Hutt.  
*Macrocallista assimilis* (?) (Hutt.).  
 " *pareoensis* Sut.  
 \**Mangilia dictyota* (Hutt.).  
 " n. sp.  
*Marginella (Eratoides) conica* Harris.  
 " " *harrisi* Cossm.  
*Miomelon corrugata* (Hutt.).  
 " n. sp.  
 " n. sp.  
 " n. sp.  
 " n. sp.  
*Mitrella* n. sp.  
 \**Murex angasi* (Crosse).  
 " *zelandicus* Q. & G.  
 " " *komiticus* Sut.  
*Mytilus* n. sp.  
 \**Natica zelandica* Q. & G.  
*Ostrea* (s. str.) *wuellerstorfi* Zitt.  
 \**Panope zelandica* Q. & G.  
*Paphia curta* (Hutt.).  
*Pecten (Chlamys) aldingensis* Tate.

- Pecten (Pallium) burnetti* Zitt.  
 " (*Chlamys*) *chathamensis* Hutt.  
 " n. sp.  
 " n. sp.  
 " n. sp.  
 " n. sp.  
*Polinices gibbosus* (Hutt.).  
 \**Protocardia (Nemocardium) pulchella* (Gray).  
*Ptychotractus pukeuriensis* Sut.  
 " *tenuilatus* (?) Sut.  
 \**Sarepta obolella* (Tate).  
*Siphonalia* n. sp.  
*Solaricella stoliczkaei* (Zitt.).  
*Spondylus* n. sp. Genus new to fauna.  
*Struthiolaria cincta* Hutt.  
*Surcula climacota* Sut.  
 " *fusiformis* (Hutt.).  
 " n. sp.  
 " n. sp.  
 " n. sp.  
 " n. sp.  
 \**Tellina eugonia* Sut.  
 \* " *glabrella* Desh.  
 " (*Arcopagia*) n. sp.  
*Terebra orycta* Sut.  
 \**Thyasira flexuosa* (Mont.).  
 \**Trivia avellanoides* (McCoy).  
*Turbo* aff. *etheridgei* T.-Woods.  
*Turris* n. sp.  
 " n. sp.  
*Turritella (Torcula) semiconcava* Sut.  
*Vaginella* n. sp.  
*Venericardia subintermedia* Sut.

One hundred and sixteen species, of which twenty-two also Recent = 19 per cent.

*Age*: Miocene. *Horizon*: Probably above supposed unconformity.

*References*: P. Marshall, *Trans. N.Z. Inst.*, vol. 49, 1917, pp. 433-50 (see pp. 446-48), and vol. 50, 1918, pp. 263-78 (many of above-mentioned new species described and figured).

The name "Komiti Bluff" applied in old Geological Survey reports to the locality where Dr. Marshall made this collection is somewhat in error, Komiti Bluff being several miles to the westward. (See P. Marshall, *Trans. N.Z. Inst.*, vol. 49, 1917, pp. 435-37.) According to Cox, Hector made a collection here in 1874. Cox himself collected a considerable number of fossils in January, 1880, and a further collection was made by Park in March, 1885. These collections have not been examined in detail, but Cox (*Rep. of Geol. Explor. during 1879-80*, No. 13, 1881, p. 33), and Park (*Rep. of Geol. Explor. during 1885*, No. 17, 1886, p. 167) give imperfect lists, and seven species collected by Park from the lower beds are listed below.

#### South-west Side of Pakaurangi Point, near Batley, Kaipara. J. A. Bartrum; 1916.

- Ampullina (Megatylotus) suturalis* (Hutt.).  
 \**Anomia* aff. *trigonopsis* Hutt. Young shells.  
*Cardita (Glans) n. sp.*  
*Chama huttoni* Hector.  
*Chione* aff. *meridionalis* (Sow.). Young shells.  
*Glycymeris* aff. *subglobosa* Sut. Young shell.  
*Mesalia striolata* (Hutt.).  
 \**Siphonalia* aff. *mandarina* (Dulcos). Young shell.  
 \**Spisula ordinaria* (E. A. Smith).  
*Surcula climacota* Sut.  
 " *fusiformis* (Hutt.).  
*Turris* n. sp.  
 " n. sp.

Thirteen species, of which three most likely also Recent = 23 per cent.

*Age*: Miocene. The above fossils were collected from sandy beds south-west of the spot where a possible unconformity (not admitted by Mr. Bartrum) is visible, and, so far as was determined, at a higher horizon than the supposed unconformity.

**Pakaurangi Point, Kaipara**: Lower "Komiti Point" Beds. Geol. Surv. Loc. 542. J. Park; 1885.

<i>Bathytoma sulcata excavata</i> Sut.	<i>Pecten (Pseudamusium) huttoni</i> (Park).
<i>Corbula kaiparaensis</i> Sut.	<i>Siphonalia costata</i> (Hutt.).
<i>Fusinus morgani</i> Sut.	<i>Struthiolaria cingulata</i> (?) Zitt.
<i>Pecten (Pallium) burnetti</i> Zitt.	

*Age*: Miocene (?). *Horizon*: Below supposed unconformity. The collection originally contained 194 specimens, and apparently only a part has been examined by Mr. Suter.

*Reference*: Park, *Rep. of Geol. Explor. during 1885*, No. 17, 1886, pp. 165-67; *Rep. of Geol. Explor. during 1886-87*, No. 18, 1887, pp. 220-21.

**Pahi Township, Kaipara**: Pahi Greensands. Geol. Surv. Loc. 732. McKay; 1887.

<i>Atrina distans</i> (Hutt.).	* <i>Panope zelandica</i> Q. & G.
<i>Cardium gracile</i> (?) Hect. (MS.).	* <i>Siphonalia aff. nodosa</i> (Mart.).
* <i>Mytilus canaliculus</i> Mart.	

*Age*: Probably Miocene.

*Reference*: McKay, *Rep. of Geol. Explor. during 1887-88*, No. 19, 1888, pp. 53-54.

**Coast near Takapuna, Auckland**: Volcanic Breccia. Geol. Surv. Loc. 539. J. Park; 1885.

*Pecten (Pallium) burnetti* Zitt.

*Age*: Miocene. *Horizon*: Waitematan. The specimen identified is an isolated example from a large collection of 280 to 290 specimens.

*Reference*: Park, *loc. cit.*, 1886, p. 154.

**Waikato**: Mercer Marls. Geol. Surv. Loc. 101. McKay; 1875.

* <i>Murex octogonus espinosus</i> Hutt.
<i>Pecten (Chlamys) aldingensis</i> Tate.
,, ( <i>Patinopecten</i> ) <i>hutchinsoni</i> Hutt.

*Age*: Miocene. *Horizon*: Below Raglan limestone and above coal-measures proper. McKay states in MS. that the beds are the same as at Whangape Lake, Whaingaroa or Raglan Harbour, and Miranda.

*Reference*: S. H. Cox, *Rep. of Geol. Explor. during 1874-76*, No. 9, 1877, pp. 11, 13. (See also *Rep. of Geol. Explor. during 1874-76*, No. 10, 1877, p. 22, &c.).

**Kupakupa, Waikato**: Aotea Sandstone (Calcareous) between Raglan and Kupakupa.

Geol. Surv. Loc. 268. Cox; 1876.

* <i>Epitonium (Cirsotrema) zelebori</i> (Dkr.).
<i>Mytilus</i> sp.
<i>Pecten (Pseudamusium) huttoni</i> (Park).

*Age*: Miocene (Oamaruan). Kupakupa is on the west bank of the Waikato, near Huntly. The fossils were apparently collected near the Huntly-Raglan Road, at a spot six miles or more west of the Waikato River, and probably not very far from Pukemiro.

*Reference*: S. H. Cox, *loc. cit.*, 1877, pp. 10, 13.

Coast Four or Five Miles North of Raglan: Limestone. Geol. Surv. Loc. 97. Cox and McKay; 1875.

*Pecten (Patinopecten) marshalli* Sut.

Age: Miocene. Horizon: Ototaran (?). The specimen identified is an isolated example from a collection of eighty specimens.

Reference: S. H. Cox, *loc. cit.*, 1877, pp. 10, 14; and also *Rep. of Geol. Explor. during 1876-77*, No. 10, 1877, p. 25.

Raglan: Coralline Limestone. Geol. Surv. Loc. 112. Cox and McKay; 1875.

*Cardium (Fragum) maorinum* Sut.

Age: Miocene. Horizon: Ototaran (?). The specimen identified is from a collection of sixty specimens.

Reference: S. H. Cox, *Rep. of Geol. Explor. during 1876-77*, No. 10, 1877, pp. 15, 23.

Raukokore River, Bay of Plenty: Shelly Limestone. Geol. Surv. Loc. 682. McKay; 1887.

*Corbula canaliculata* Hutt.

\**Modiolus australis* (Gray).

*Ostrea wuellerstorfi* (?) Zitt. Fragment.

According to McKay's MS. the age of the material is Pliocene. The fossiliferous beds occur on the north bank of the river, several miles inland.

Reference: McKay, *Rep. of Geol. Explor. during 1886-87*, No. 18, 1887, pp. 184, 209.

Hicks Bay, East Cape District. Geol. Surv. Loc. 263. Hector; 1874.

*Pecten (Patinopecten) sectus* Hutt.

According to McKay's MS. the age is Miocene (Pareora Series). He adds that the collection contains twenty-four specimens, in addition to Hutton's type of *Ostrea corrugata* and Echinodermata. The type of *O. corrugata*, however, seems to have come from Shakespeare Cliff, Wanganui (Hutton, *Cat. Tert. Moll. and Echin. of N.Z.*, 1873, p. 35). It is now in the Dominion Museum.

Reference: Hector, *Rep. of Geol. Explor. during 1873-74*, No. 8, 1877, p. xvii.

"Duncan's," between Tolaga and Tokomaru Bays: Sands with Bands of Cementstone and Greensands. Geol. Surv. Loc. 249. McKay; 1874.

- |   |   |
|---|---|
| <i>Ampullina (Megatylotus) suturalis</i> (?) (Hutt.). | * <i>Corbula macilenta</i> Hutt.              |
| * <i>Anomia huttoni</i> (?) Sut.                      | <i>Crassatellites amplus</i> (Zitt.).         |
| " " <i>trigonopsis</i> Hutt.                          | " " <i>attenuatus</i> (Hutt.).                |
| <i>Atrina distans</i> (Hutt.). Plentiful; all juv.    | " " <i>obesus</i> (A. Ad.).                   |
| " " <i>zelandica</i> (Gray). Several young shells.    | * <i>Crepidula costata</i> (Sow.).            |
| <i>Calliostoma hodgci</i> (?) (Hutt.).                | " " <i>monoxyla</i> (?) (Hanley).             |
| <i>Calyptrea (Sigapatella) maccoyi</i> (?) Sut.       | <i>Cucullaea alta</i> Sow.                    |
| " " " <i>maculata</i> (Q. & G.).                      | " " var. B Hutt.                              |
| " " (s. str.) <i>tenuis</i> (Gray).                   | " " <i>australis</i> (Hutt.).                 |
| <i>Cardium brachytonum</i> Sut.                       | <i>Cylichnella evysi</i> (Hutt.).             |
| " aff. <i>huttoni</i> Ther.                           | * <i>Cytherea oblonga</i> (?) (Hanley).       |
| " ( <i>Fragum</i> ) <i>maorinum</i> Sut.              | <i>Dentalium mantelli</i> Zitt.               |
| " aff. <i>patulum</i> Hutt.                           | " " <i>nanum</i> Hutt. Common.                |
| " aff. <i>subcordatum</i> Sut.                        | " " <i>solidum</i> Hutt. Common.              |
| * <i>Chione meridionalis</i> (Sow.). Cast.            | * <i>Diplodonta zelandica</i> (Gray).         |
| " " <i>spissa</i> (?) (Desh.). Cast.                  | * <i>Divaricella cumingi</i> (Ad. & Ang.).    |
| " " ( <i>Salacia</i> ) <i>yatei</i> (?) (Gray).       | * <i>Dosinia greyi</i> Zitt.                  |
| * <i>Cochlodesma angasi</i> (C. & F.).                | " " <i>lambata</i> (Gould).                   |
| <i>Cominella carinata</i> (?) (Hutt.).                | * <i>Euthria</i> aff. <i>striata</i> (Hutt.). |
| <i>Corbula canaliculata</i> Hutt. Plentiful.          | * <i>Fulgoraria arabica</i> (Mart.).          |
| " " <i>humerosa</i> Hutt.                             | " " <i>gracilis</i> (Swains.).                |

- Glycymeris cordata* (Hutt.).  
 " *globosa* (Hutt.).  
 \* " *laticostata* (Q. & G.). Plentiful.  
*Hemiconus ornatus* (Hutt.). Fragment.  
*Hinnites trailli* (?) Hutt.  
 \* *Leda bellula* A. Ad. Plentiful.  
 " *semiteres* Hutt. Plentiful.  
 \* *Lima angulata* Sow.  
 \* *Macrocassina multistriata* (Sow.).  
 \* *Mactra discors* Gray.  
 \* " *ovata* (Gray).  
 \* " " *rudis* Hutt.  
 \* " " *scalpellum* Reeve.  
 \* *Mesodesma australe* (Gmel.).  
*Miomelon corrugata* (Hutt.).  
*Modiolus dolichus* Sut.  
 \* *Myllita stoevei* (Hutt.). New as a fossil.  
 \* *Myodora antipodum* Smith.  
 \* " *pandoriformis* (Stutchb.). Plentiful  
*Olivella neozelanica* (Hutt.). Many juv.  
 \* *Ostrea* (*Anodontostrea*) *angasi* (?) Sow.  
 \* " (s. str.) *corrugata* (?) Hutt.  
 " *aff. incurva* Hutt.  
 " *aff. manubriata* Tate.  
 " (s. str.) *subdentata* Hutt.  
*Panope orbita* Hutt.  
 " *worthingtoni* Hutt.  
*Paphia curta* (Hutt.) var.  
 \* *Pecten* (*Pallium*) *convexus* Q. & G. Juv.  
 " (*Patinopecten*) *crayfordi* Hutt. Plentiful.  
 " (*Pallium*) *polymorphoides* Zitt.  
 " (*Chlamys*) *williamsoni* Zitt.  
 \* " " *zelandica* (?) Gray.  
 \* *Polinices amphialus* (Wats.).
- Polinices gibbosus* (Hutt.). Plentiful.  
 " (*Neverita*) *ovatus* (Hutt.).  
 \* *Protocardia* (*Nemocardium*) *pulchella* (Gray).  
 Very abundant.  
 \* *Psammobia lineolata* Gray.  
 \* " *zelandica* Desh.  
 \* *Saxicava arctica* (L.).  
 \* *Siphonalia dilatata* (Q. & G.).  
 " *subnodosa* (Hutt.).  
 " *turrita* Sut. Plentiful.  
*Solaria stoliczkai* (?) (Zitt.).  
 " *sulcatina* (?) Sut.  
 \* *Spisula ordinaria* (E. A. Smith).  
*Struthiolaria canaliculata* Zitt.  
 " *cincta* Hutt.  
 " *frazeri* Hutt.  
 \* " *papulosa* (Mart.). Impression.  
 " *spinosa* Hect. Fragment.  
 \* " *vermis tricarinata* Less. Fragments.  
 \* *Tellina deltoidealis* Lamk.  
 \* " *eugonia* Sut.  
 \* " *glabrella* Desh.  
*Terebra orycta* Sut. Impression.  
*Teredo hepaphyi* Zitt.  
 \* *Thracia vitrea* (Hutt.).  
*Trochus* sp. indet.  
 \* *Turritella* (*Peyrotia*) *carlotta* Wats.  
 " (*Torcula*) *concava* (?) Hutt.  
 " (*Archimediella*) *huttoni* Cossm.  
 \* " (*Peyrotia*) *rosea* Q. & G.  
 \* " (s. str.) *symmetrica* Hutt. Plentiful.  
 \* *Venericardia difficilis* (Desh.). Juv.  
 " *lutea* (Hutt.).  
 \* *Zenatia acinaces* (Q. & G.).

One hundred and nine species and varieties, of which fifty-six also Recent = 51 per cent.

This locality seems to be a former "shelly beach," washed-up shells accumulating and being buried in sand and mud. There are comparatively few Gastropods, the majority of specimens consisting of single valves of Pelecypods.

Age: Probably late Miocene and Lower Pliocene horizons are represented. In MS. McKay places the beds at Duncan's in the Awatere Series, a correlation that seems to be correct.

Reference: McKay in *Rep. of Geol. Explor. during 1873-74*, No. 8, 1877, pp. 149, 150, 151, &c.†

Spring near Track above Komomona-te-wai Stream, near North Boundary of Uawa Survey District, Tolaga Bay District. Geol. Surv. Loc. 868. M. Ongley; December, 1915.

- \* *Barnea similis* (Gray).  
*Dentalium solidum* Hutt.  
*Polinices gibbosus* (Hutt.). Plentiful.  
 \* *Protocardia* (*Nemocardium*) *pulchella* (Gray).
- Siphonalia subnodosa* (?) (Hutt.).  
 " sp.  
 \* *Spisula ordinaria* (E. A. Smith). Plentiful.

Age: Upper Miocene. Tawhiti Series. Matrix of fossils: Calcareous argillaceous sandstone.

Road-cutting beside Mangatokerau Stream, below Fitzgerald's, Tolaga Bay District. Geol. Surv. Loc. 866. M. Ongley; December, 1915.

- Ancilla* aff. *waikopiroensis* Sut.  
*Clio* (*Styliola*) *rangiana* (Tate).  
*Crepidula gregaria* Sow.  
 \* " *monozyla* (Less.).  
*Dentalium* sp.?  
 \* *Fulguraria arabica* (Mart.).
- Glycymeris subglobosa* Sut.  
*Polinices gibbosus* (Hutt.).  
 \* *Siphonalia dilatata* (Q. & G.).  
 " *aff. turrita* Sut.  
*Struthiolaria tuberculata* (?) Hutt.

Age: Upper Miocene. Tawhiti Series. Matrix: Calcareous argillaceous sandstone.

† See also N.Z.G.S. Bull. No. 21, 1920, pp. 46-47, &c., which contains also various succeeding lists.

Track from Hikurangi Trig. to Fitzgerald's, Tolaga Bay District. Geol. Surv. Loc. 869.  
M. Ongley; December, 1915.

- Miomelon corrugata* (Hutt.) (*Lapparia* of Handlist). *Siphonalia* aff. *costata* (Hutt.).  
\**Protocardia* (*Nemocardium*) *pulchella* (Gray) var. *Solariella sulcatina* Sut.  
Also Loc. 864. \**Venericardia difficilis* (?) (Desh.).

Age: Upper Miocene. Tawhiti Series. Matrix: Calcareous argillaceous sandstone.

Boland's Corner, Hikuwai Stream, Tolaga Bay District. Geol. Surv. Loc. 864. L. Teychenné  
December, 1915.

- Anomia* sp. *Lima* aff. *colorata* Hutt.  
*Astræa* sp. *Mitra* sp.  
*Atrina distans* (Hutt.). Fragments. \**Modiolus australis* (?) (Gray).  
\**Calyptrea* (s. str.) *tenuis* (Gray). \**Mytilus* (*Aulacomya*) *magellanicus* Lamk.  
*Cardium facetum* Sut. *Olivella neozelanica* (Hutt.).  
*Chione meridionalis* (Sow.). *Polinices* sp.  
*Conus* aff. *fusellinus* Sut. Cast. \**Protocardia* (*Nemocardium*) *pulchella* (Gray) var.  
*Corbula* n. sp.? *Rapana* aff. *waihaeensis* Sut. Cast.  
*Crepidula gregaria* Sow. *Sinum* sp.?  
\* " *monozyla* (Less.). Plentiful. *Siphonalia* sp.  
" *striata* (Hutt.). *Struthiolaria cincta* Hutt.  
*Cucullæa* sp. " *tuberculata* Hutt.  
*Cymatium minimum* (?) (Hutt.). *Teredo heaphyi* Zitt.  
*Dentalium solidum* Hutt. *Turritella* sp.  
*Glycymeris subglobosa* (?) Sut.

Twenty-nine species, of which five also Recent = 17 per cent.

Age: Upper Miocene. Tawhiti Series. Matrix: Calcareous argillaceous sandstone.

Marau Point, Eight Miles North of Tolaga Bay. Geol. Surv. Loc. 865. M. Ongley; December, 1915.

- \**Aleira varians* (?) (Hutt.). *Limopsis zitteli* Iher.  
*Cardium brachytonum* (?) Sut. *Polinices gibbosus* (?) (Hutt.).  
" *waiakiense* Sut. var. *Rapana* aff. *waihaeensis* Sut. Cast.  
" n. sp.? \**Siphonalia dilatata* (Q. & G.). Fragments.  
\**Cominella zealandica* (Reeve). " *turrita* (?) Sut.  
\**Crepidula monozyla* (Less.). *Surcula fusiformis* (?) (Hutt.).  
*Dentalium solidum* Hutt. Fragment. *Turris* aff. *complicatus* Sut.  
*Fusinus* sp.

Fifteen species, of which four also Recent = 27 per cent.

Age: Upper Miocene. Tawhiti Series. Matrix: Calcareous argillaceous sandstone.

Hikuwai, Tolaga Bay District: Road-quarry. Geol. Surv. Loc. 867. M. Ongley; January, 1916.

- \**Anomia undata* Hutt. \**Panope zealandica* Q. & G.  
\**Calyptrea* (*Sigapatella*) *maculata* (Q. & G.). *Paphia curta* (?) (Hutt.) var. The same occurs  
*Cardium brachytonum* Sut. at Loc. 871 (Ormond).  
*Corbula canaliculata* Hutt. *Pecten* (*Patinopecten*) *crawfordi* (?) Hutt.  
*Cucullæa alta* Sow. *Polinices*, operculum of ?  
" *attenuata* Hutt. \**Protocardia* (*Nemocardium*) *pulchella* (Gray).  
*Dentalium solidum* Hutt. \**Siphonalia dilatata* (Q. & G.).  
*Dosinia* sp.? " sp. Fragment.  
*Lima colorata* (?) Hutt. Juv. *Struthiolaria* aff. *cingulata* Zitt. Juv.  
*Ostrea* (*Anodontostrea*) *incurva* (?) Hutt. *Turritella* (*Torcula*) *semiconcava* Sut.  
" (s. str.) *subdentata* Hutt.

Twenty species, of which five also Recent = 25 per cent.

Age: Upper Miocene. Tawhiti Series. Matrix: Calcareous argillaceous sandstone.

Cook's Cove, Tolaga Bay. Geo. Surv. Loc. 328. McKay; 1874.

*Cucullaea alta* Sow.

*Cucullaea attenuata* Hutt.

„ „ var. B Hutt.

„ *worthingtoni* Hutt.

Age: Upper Miocene. Pareora Series (McKay) = Tawhiti Series.

The following determinations, marked "A" to "H," represent various small collections made during the recent survey of the Gisborne district by Dr. J. Henderson and Mr. M. Ongley.

A. Conglomerate composed of Pebbles of Igneous Rocks, Waipaoa River, 20 Chains below Waipaoa Station, Mangatu Survey District, Gisborne District. M. Ongley; April, 1916.

*Panope worthingtoni* Hutt.

*Teredo hepaphyi* Zitt. Two tubes.

*Turritella (Archimediella) huttoni* Cossm.

Age: Upper Miocene. Tawhiti Series.

B. Sandstone near Spring on Waikura Valley Road, Six Miles West of Waerengaokuri, Patutahi Survey District. J. Henderson; March, 1915.

\**Bathytoma nodilirata* (Murd. & Sut.).

Age: Miocene. Te Arai Series.

C. Argillaceous Sandstone, Wharekopae River, Three Miles South-west of Gardiner's Homestead, Waikohu Survey District.

*Bathytoma haasti* (Hutt.).

*Siphonalia turrata* (?) Sut. Fragment.

Age: Miocene. Te Arai Series.

D. Marshall's Road, near Head of Mangaehu Stream, Waimata Survey District. J. Henderson; February, 1916.

*Ancilla (Alocospira) papillata* (Tate).

*Polinices gibbosus* (Hutt.).

Age: Upper Miocene. Tawhiti Series.

E. Sandy Mudstone at Mouth of Urukokomoko Stream, Mangatu Survey District. J. Henderson; April, 1916.

*Astræa* n. sp.

*Dentalium solidum* Hutt.

*Mytilus huttoni* Cossm.

Age: Upper Miocene. Tawhiti Series.

F. Mangatu Road, near Wairere, Mangatu Survey District. J. Henderson; April, 1916.

*Cominella* sp.

*Conus* n. sp. Cast.

*Cymatium minimum* (Hutt.).

Age: Upper Miocene. Tawhiti Series. Matrix: Argillaceous sandstone.

G. Mudstone at Road-cutting near Junction of Waimata and Te Arai Streams, Patutahi Survey District. J. Henderson; April, 1915.

\**Polinices* aff. *amphialus* (Wats.). Broken specimen.

Age: Miocene. Te Arai Series.

H. Quarry near Road, Two Miles and a Half West of Waerengaokuri, Patutahi Survey District.  
J. Henderson; March, 1915.

*Pecten (Pallium) burnetti* Zitt.

Age: Pliocene. Ormond Series. Matrix: Shell limestone. Mr. Suter adds: "There is also a large subfossil shell of the Recent snail-slug *Schizoglossa novoseelandica* (Pfr.). This has also been found in caves together with moa-bones. (See *Man. N.Z. Moll.* 1913, p. 787.)"

Cuff's, Oil-spring District, Whatatutu, Poverty Bay: Grey Marls. Geol. Surv. Loc. 307.  
McKay; 1874.

*Lima jeffreysiana* Tate.  
*Pecten (Chlamys) williamsoni* (?) Zitt.  
\**Placunanomia zelandica* (Gray).

Also the hydroid *Cylindropora areolata* T.-Woods, and brachiopods.

Age: Upper Miocene. Tawhiti Series. McKay states in MS. that the locality is some miles to the north-east of the oil-springs.

Waimata River, near Head, Quarter of a Mile below Thomas's Whare. Geol. Surv. Loc. 862.  
M. Ongley; February, 1916.

<i>Ampullina (Megatytiotus) suturalis</i> (Hutt.).	<i>Miomelon corrugata</i> var. B (Hutt.).
<i>Ancilla (Alocospira) papillata</i> (Tate).	* <i>Ostrea</i> (s. str.) <i>corrugata</i> Hutt.
* <i>Anomia trigonopsis</i> Hutt.	" " <i>subdentata</i> Hutt.
<i>Atrina distans</i> (Hutt.).	<i>Pecten (Pallium) burnetti</i> Zitt. Juv.
<i>Chione meridionalis</i> (Sow.).	<i>Polinices gibbosus</i> (Hutt.).
* <i>Crepidula costata</i> (Sow.).	* <i>Protocardia (Nemocardium) pulchella</i> (Gray).
* <i>Cytherea oblonga</i> (Hanley).	Plentiful.
<i>Dentalium mantelli</i> Zitt.	* <i>Siphonalia dilatata</i> (Q. & G.).
" <i>solidum</i> Hutt.	" <i>subnolosa</i> (Hutt.).
* <i>Diplodonta zelandica</i> (Gray).	" <i>turrita</i> (?) Sut. Juv.
<i>Glycymeris subglobosa</i> Sut.	<i>Struthiolaria tuberculata</i> Hutt.
<i>Hemifusus goniodes</i> Sut.	<i>Turritella (Torcula) semiconcava</i> Sut. Fragment.

Twenty-three species, of which seven also Recent = 30 per cent.

Age: Miocene (Upper). Tawhiti Series. Matrix: Argillaceous sandstone.

Gisborne-Opotiki Road, Twelve Miles North of Ormond: Limestone. Geol. Surv. Loc. 710  
McKay; 1887.

\**Leda bellula* A. Ad.  
\**Lima lima* (L.).  
\**Trochus tiaratus* (?) Q. & G.

Age: Pliocene. Ormond Series.

Gisborne-Opotiki Road, Two Miles West of the Waipaoa River: Pumice Sands.  
Geol. Surv. Loc. 711. McKay; 1887.

\**Pecten (Pallium) convexus* Q. & G.  
\**Poroleda lanceolata* (Hutt.).  
\**Protocardia (Nemocardium) pulchella* (Gray).

Age: Pleistocene.

## Waihora River, Two Miles from Te Karaka, Poverty Bay : Sandstone above Unconformity.

Geol. Surv. Loc. 870. M. Ongley; December, 1914.

- Ampullina (Megatylotus) suturalis* (Hutt.).  
 \* *Anomia undata* Hutt.  
*Atrina distans* (Hutt.).  
*Cardium spatiosum* Hutt. Fragment.  
 \* *Cochloidesma angasi* (C. & F.).  
 \* *Crepidula monoxylla* (Less.).  
*Dentalium solidum* Hutt.  
 \* *Dosinia greyi* Zitt.  
*Drillia equistriata* Hutt.  
*Galeodea sulcata* (?) (Hutt.).  
 \* *Leptomya lineata* (Hutt.).  
 \* *Macrocallista multistriata* (Sow.).  
 \* *Mactra scalpellum* Reeve.  
*Miomelon corrugata* (Hutt.).  
 \* *Ostrea (Anodontostrea) angasi* Sow.  
 \* " (s. str.) *corrugata* Hutt.  
 " " *subdentata* Hutt.  
*Pecten (Chlamys) chathamensis* Hutt. Impression.
- \* *Pecten (Pallium) convexus* Q. & G. Fragments.  
 " (*Patinopecten*) *triphooki* Zitt. Juv.  
 \* " (*Chlamys*) *zelandica* Gray.  
*Polinices (Neverita) huttoni* Iher.  
 \* *Protocardia (Nemocardium) pulchella* (Gray).  
 \* *Psammobia lineolata* Gray.  
*Sinem* n. sp.  
 \* *Siphonalia dilatata* (Q. & G.). Fragments.  
*Struthiolaria canaliculata* Zitt. Juv.  
 \* *Tellina eugonia* Sut.  
*Teredo heaphyi* Zitt.  
*Trochus conicus* (Hutt.).  
*Turritella (Archimediella) ambulacrum* Sow.  
 " " *huttoni* Cossm.  
 " (*Torcula*) *semiconcava* Sut.  
 \* " (s. str.) *symmetrica* Hutt.  
 \* *Venericardia lutea* (Hutt.).

Thirty-five species, of which seventeen also Recent = 48.6 per cent.

Age: Pliocene. Ormond Series. Matrix: Soft rather coarse sandstone.

## Ormond, Poverty Bay : Calcareous Glauconitic Sandstone, overlying Clays with Concretions.

Geol. Surv. Loc. 212. McKay; 1874.

- \* *Anomia trigonopsis* Hutt.  
*Cardium greyi* Hutt.  
 " *brachytonum* Sut.  
 " *patulum* (?) Hutt.  
 " *spatiosum* Hutt.  
 \* *Glycymeris laticostata* (Q. & G.).
- \* *Modiolus australis* (Gray).  
 \* *Ostrea (Anodontostrea) angasi* Sow.  
*Paphia curta* (Hutt.).  
*Pecten (Patinopecten) triphooki* Zitt.  
 \* *Venericardia purpurata* (Desh.).

Eleven species, of which five also Recent = 45 per cent.

Age: Pliocene. McKay in MS. describes the matrix as sandy glauconitic limestone.

## Waihire Stream, Waimata Survey District, Gisborne Subdivision : Ormond Limestone.

Geol. Surv. Loc. 871. M. Ongley; January, 1915.

- \* *Anomia undata* Hutt.  
 \* " *trigonopsis* Hutt.  
 \* *Atrina zelandica* (Gray).  
*Cardium brachytonum* Sut.  
 \* *Glycymeris laticostata* (Q. & G.).  
 \* *Modiolus australis* (Gray).  
*Ostrea (Anodontostrea) arenicola* Tate.
- Paphia curta* (?) (Hutt.) var. (Occurs also at Loc. 867, p. 8.)  
*Pecten (Patinopecten) crawfordi* Hutt.  
 " " *triphooki* Zitt.  
 " aff. *williamsoni* Zitt. or *aldingensis* Tate.  
 \* *Protocardia (Nemocardium) pulchella* (Gray).

Age: Pliocene. Ormond Series. Matrix: Somewhat sandy limestone.

## Near Trig. B, North-east Part of Patutahi Survey District, Gisborne Subdivision.

\* *Glycymeris laticostata* (Q. & G.).*Modiolus dolichus* Sut.\* *Protocardia (Nemocardium) pulchella* (Gray). Plentiful.

Age: Pliocene. Ormond Series. Matrix: Calcareous sandstone or allied rock.



Trig. 122a, North-west Part of Patutahi Survey District. Geol. Surv. Loc. 863. J. Henderson ;  
April, 1915.

\**Anomia trigonopsis* Hutt.

*Cardium factum* Sut.

\**Crepidula monoxyla* (?) (Less.).

*Cucullæa attenuata* Hutt.

\**Glycymeris laticostata* (Q. & G.).

*Ostrea* aff. *nelsoniana* Zitt.

*Pecten* (*Patinopecten*) *crayfordi* (?) Hutt.

" (*Pallium*) *polymorphoides* Zitt.

\**Siphonalia dilatata* (Q. & G.).

\**Tellina eugonia* Sut.

Ten species, of which five also Recent = 50 per cent

Age: Pliocene. Ormond Series. Matrix: Impure shelly limestone.

Trig. 101, North-east Part of Patutahi Survey District. Geol. Surv. Loc. 872. J. Henderson ;  
April, 1915.

\**Anomia undata* Hutt.

Age: Pliocene. Ormond Series. Matrix: Impure shelly limestone.

McDonald's Section, North-east Shore of Poverty Bay, towards the Headland. Geol. Surv. Loc. 90.  
McKay; 1874.

*Acmaea* sp. Nearest to the Recent *A. parviconoidea* Sut.

*Leda semiteres* Hutt.

*Limopsis* aff. *zitteli* Iher.

Age: Tertiary (?). One of McKay's MS. lists states that "the southern end of the section shows what are undoubtedly Cretaceous beds. The northern end towards the mouth of the Turanganui River may be Tertiary." In another MS. list and in his report of 1877 (*Rep. of Geol. Explor. during 1873-74*, No. 8, 1877, pp. 162-64) McKay mentions the presence of *Inoceramus* in the section.

Poverty Bay: Hill East of the Mouth of the Turanganui River. Geol. Surv. Loc. 203.  
McKay; 1874.

*Acteon sulcatus* (Hutt.).

\**Arca nova-zealandica* E. A. Smith.

*Bathytona gemnea* (Murd.).

\**Calyptrea* (s. str.) *tenuis* Gray.

\**Cerithiæa bicarinata* (Gray).

\**Chione stutchburyi* (Gray).

\**Cominella lurida* Phil.

\* " *virgata* A. Ad.

\**Cytherea oblonga* (Hanley).

\**Dosinia subrosea* (Gray).

*Drillia buechanani* (Hutt.).

\* " *lewis* (Hutt.).

" *wanganuiensis* (Hutt.).

\**Emarginula striatula* Q. & G.

\**Epitonium (Cirsotrema) zelebori* (Dkr.).

\**Euthria striata* (Hutt.).

\**Kellia suborbicularis* (Montagu).

\**Macrocallysta multistriata* (Sow.).

\**Mesodesma australe* (Gmel.).

\* " *ventricosum* (?) Gray.

\**Myodora striata* (Q. & G.).

\**Natica zelandica* Q. & G.

\**Phalium achatinum pyrum* (Lamk.).

\**Psammobia stangeri* Gray.

\**Serpulorbis siphon* (Lamk.).

\**Tellina deltoidealis* (Lamk.).

\* " *glabrella* Desh.

\**Tugalia intermedia* (Reeve).

\**Turritella (Peyrotia) carlotte* Wats.

Twenty-nine species, of which twenty-five also Recent = 86 per cent.

Age: Pleistocene (?). In MS. McKay states that the collection was made from raised beaches and estuarine deposits, which he regarded as of Pleistocene and Recent age.

Bryant's Farm, near Gisborne. Geol. Surv. Loc. 65. McKay; 1874.

*Amusium zitteli* (Hutt.).

\**Crassatellites obesus* (?) (A. Ad.).

Age: Miocene (probably).

Reference: McKay in *Rep. of Geol. Explor. during 1874-76*, No. 8, 1877, pp. 119-20, 156-57.

*Siliquaria* sp. ?

\**Trochus tiaratus* (?) Q. & G. Impression.

Poverty Bay: Shells collected prior to 1874. Geol. Surv. Loc. 60. (Mostly casts only).

- |  |  |
|--|--|
| <i>Cardium</i> sp.   | * <i>Polinices amphialus</i> (Wats.).                          |
| <i>Chione meridionalis</i> (Sow.).                             | "    aff. <i>huttoni</i> Iher.                                 |
| "    sp.   | "    sp.   |
| <i>Conus</i> n. sp.  | * <i>Psammodia lineolata</i> Gray.                             |
| <i>Corbula humerosa</i> (?) Hutt.                              | * <i>Sinum</i> ( <i>Eunaticina</i> ) <i>undulatum</i> (Hutt.). |
| * <i>Crassatellites obesus</i> (?) (A. Ad.) Juv.               | <i>Siphonalia</i> sp.  |
| * <i>Cytherea oblonga</i> (?) (Hanley).                        | * <i>Spisula aciculateralis</i> (?) (Desh.) Juv.               |
| * <i>Diplodonta zelandica</i> (?) (Gray).                      | <i>Struthiolaria cincta</i> Hutt.                              |
| * <i>Dosinia greyi</i> Zitt.                                   | * <i>Tellina eugonia</i> Sut.                                  |
| <i>Epitonium</i> ( <i>Cirsotrema</i> ) <i>lyratum</i> (Zitt.). | *    " <i>glabella</i> Desh.                                   |
| "    n. sp. ?  | *    " <i>spenceri</i> Sut. New as a fossil.                   |
| * <i>Mactra discors</i> (?) Gray. Fragment.                    | <i>Teredo heaphyi</i> (?) Zitt.                                |
| * <i>Modiolus australis</i> (Gray).                            | <i>Turris duplex</i> Sut.                                      |
| <i>Pecten</i> aff. <i>chathamensis</i> Hutt.                   | <i>Turritella</i> ( <i>Torcula</i> ) <i>semiconcava</i> Sut.   |

Twenty-eight species, of which thirteen also Recent = 46 per cent.

McKay states in his MS.: "This is a general collection contributed to the Colonial Museum prior to 1873, of which the localities are uncertain. The immediate vicinity of Poverty Bay exhibits formations of different ages, so that no particular age can be assigned to this collection, which contains 182 specimens."

Gisborne District: Whatatutu Series. P. Marshall, *N.Z. Geol. Surv. Bull. No. 9 (n.s.)*, 1911, p. 22.

(Revised list of names.)

- |  |  |
|--|--|
| * <i>Anomia huttoni</i> Sut.   | <i>Lima paleata</i> Hutt.                                    |
| <i>Astræa</i> sp. Cast.  | * <i>Limopsis aurita</i> (Brocchi).                          |
| * <i>Calyptrea</i> ( <i>Sigapatella</i> ) <i>maculata</i> (Q. & G.). | " <i>zitteli</i> (?) Iher. (not <i>L. insolita</i> ).        |
| <i>Conus</i> sp. ind.  | * <i>Lithophaga truncata</i> (Gray).                         |
| * <i>Crassatellites obesus</i> (A. Ad.).                             | * <i>Mactra ovata</i> (Gray).                                |
| <i>Crepidula gregaria</i> Sow.                                       | <i>Maculopeplum attenuatum</i> (Hutt.).                      |
| * <i>Cymatium spengleri</i> (?) (Chemn.). [? not <i>Septa</i>        | * <i>Modiolus australis</i> (Gray).                          |
| <i>costata</i> (Born) = <i>Lotorium olearium</i> (L.).]              | <i>Olivella neozelandica</i> (Hutt.).                        |
| <i>Dentalium pareorense</i> Pils. & Sharp.                           | <i>Panope orbita</i> Hutt. (There is no <i>P. sulcata</i> .) |
| " <i>solidum</i> Hutt.   | <i>Pecten</i> ( <i>Pseudamysium</i> ) <i>huttoni</i> (Park). |
| * <i>Dosinia subrosea</i> (Gray).                                    | "    ( <i>Pallium</i> ) <i>polymorphoides</i> Zitt.          |
| * <i>Ethalia zelandica</i> (H. & J.).                                | <i>Plejona huttoni</i> (Sut.).                               |
| * <i>Fulgoraria arabica elongata</i> (Swains.).                      | <i>Polinices callosus</i> (Hutt.).                           |
| " <i>gracilis</i> (Swains.).   | " <i>gibbosus</i> (Hutt.).                                   |
| * <i>Fusinus spiralis</i> (A. Ad.).                                  | " <i>ovatus</i> (Hutt.).                                     |
| <i>Galeodea senex</i> (Hutt.).                                       | <i>Siphonalia conoidea</i> (Zitt.).                          |
| " <i>sulcata</i> (Hutt.).  | <i>Struthiolaria calcar</i> Hutt.                            |
| <i>Genota robusta</i> (Hutt.).                                       | * <i>Tellina eugonia</i> Sut.                                |
| <i>Glycymeris globosa</i> (Hutt.).                                   | * <i>Trophon plebejus</i> (Hutt.).                           |
| " <i>traversi</i> (Hutt.).   | * <i>Turritella</i> ( <i>Peyrotia</i> ) <i>rosea</i> Q. & G. |
| <i>Latirus</i> ( <i>Leucozonia</i> ) <i>brevirostris</i> (Hutt.).    | * <i>Venericardia purpurata</i> (Desh.).                     |

Thirty-nine identified species, of which seventeen also Recent = 43 per cent.

This list gives the revised names of the fossils from the Whatatutu Subdivision identified by Dr. P. Marshall. The collection was a general one, but probably every specimen came from Miocene strata. The usual matrix was argillaceous calcareous sandstone with shelly bands. The collection was carefully packed away in 1911, but is not now in existence. Its fate is indicated on page 5 of *11th Ann. Rep. of Geol. Surv.*, Parl. Paper C-2B, 1917.

Raised Beach, North Shore of Mahia Peninsula. Geol. Surv. Loc. 689. McKay; 1887.

\**Hipponix hexagonus* Sut.

Age: Recent. This is an isolated specimen from a large collection, said by McKay to contain over one hundred species of Mollusca, in addition to Foraminifera. (See *Rep. of Geol. Explor. during 1886-87*, No. 18, 1887, pp. 198-99.)

Te Purutu Creek, near Mohaka Crossing, Napier-Taupo Road, Hawke's Bay. Geol. Surv. Loc. 680.  
McKay; 1887.

*Crepidula gregaria* Sow.

*Age*: Pliocene (?). This is an isolated specimen from a large collection.

*Reference*: McKay, *Rep. of Geol. Explor. during 1886-87*, No. 18, 1887, pp. 183, 207, 208, 209.

Kiwi Range, North Side of Mohaka River, Napier-Taupo Road, Hawke's Bay. Geol. Surv. Loc. 573.  
McKay; 1885.

*Crepidula gregaria* Sow.

*Age*: Miocene (McKay). A collection of 160 specimens was made from the northern slope of the range in a creek where the strata are vertical.

Te Waka Range, North-west of Pohui, Twenty-six Miles North-west of Napier. Geol. Surv. Loc. 703. McKay; 1887.

- |  |  |
|--|--|
| * <i>Atrina zelandica</i> (Gray).                                    | * <i>Ostrea</i> (s. str.) <i>corrugata</i> Hutt.                     |
| * <i>Calyptrea</i> ( <i>Sigapatella</i> ) <i>maculata</i> (Q. & G.). | * " ( <i>Anodontostrea</i> ) <i>tatei</i> Sut.                       |
| * " " " <i>inflata</i> (Hutt.).                                      | * <i>Panope zelandica</i> Q. & G.                                    |
| <i>Cardium greyi</i> Hutt.   | * <i>Pecten</i> ( <i>Pallium</i> ) <i>convexus</i> Q. & G.           |
| " " <i>spatiosum</i> Hutt.   | " " ( <i>Patinopecten</i> ) <i>crayfordi</i> Hutt.                   |
| * <i>Diplodonta zelandica</i> (Gray).                                | * " ( <i>Chlamys</i> ) <i>radiatus</i> Hutt.                         |
| * <i>Glycymeris laticostata</i> (Q. & G.).                           | " " ( <i>Patinopecten</i> ) <i>triphooki</i> Zitt.                   |
| * <i>Lima bullata</i> (Born).  | * " ( <i>Chlamys</i> ) <i>zelandica</i> Gray.                        |
| * <i>Macrocallista multistriata</i> (Sow.).                          | <i>Polinices laevis</i> (?) (Hutt.).                                 |
| * <i>Modiolus australis</i> (Gray).                                  | * <i>Protocardia</i> ( <i>Nemocardium</i> ) <i>pulchella</i> (Gray). |
| * <i>Myodora boltoni</i> E. A. Smith.                                | * <i>Serpulorbis siphon</i> (Lamk.).                                 |
| * <i>Mytilus canaliculus</i> Mart.                                   | * <i>Struthiolaria vermis tricarinata</i> Less.                      |
| * <i>Ostrea</i> ( <i>Anodontostrea</i> ) <i>angasi</i> Sow.          |  |

Twenty-five species, of which twenty also Recent = 80 per cent.

*Age*: Pliocene. Correlated by McKay in MS. with Te Aute, Scinde Island, and Waitotara limestones. (See also McKay, *Rep. of Geol. Explor. during 1886-87*, No. 18, 1887, p. 206, &c.)

*Reference*: McKay, *loc. cit.*, 1887, pp. 183, 209, &c. On p. 209 McKay states that the collection made by him contained thirty-five species, of which eight were extinct.

Petane: Upper Band of Limestone, Lower Esk River to Petane Hotel. Geol. Surv. Loc. 720.  
McKay; 1886.

- |   |  |
|---|--|
| * <i>Alcira varians</i> (Hutt.).  | * <i>Chiton pellisserpentis</i> Q. & G.    |
| * <i>Ancilla</i> ( <i>Baryspira</i> ) <i>australis pyramidalis</i> (Reeve). | * <i>Cominella adspersa</i> (Brug.).       |
| * " " <i>depressa</i> (Sow.).   | * " <i>virgata</i> A. Ad.                  |
| * " ( <i>Amalda</i> ) <i>novæ-zelandiæ</i> (Sow.).                          | * <i>Crepidula costata</i> (Sow.).         |
| * <i>Anomia huttoni</i> Sut.  | * " <i>monoxyla</i> (Less.).               |
| <i>Bezanconia</i> ( <i>Ataocerithium</i> ) n. sp.                           | " " <i>striata</i> (Hutt.).                |
| * <i>Calyptrea</i> ( <i>Sigapatella</i> ) <i>maculata</i> (Q. & G.).        | * <i>Dentalium nanum</i> Hutt.             |
| " (s. str.) <i>tenuis</i> (Gray).   | " " <i>solidum</i> Hutt.                   |
| * <i>Cerithidea bicarinata</i> (Gray).                                      | * <i>Divaricella cumingi</i> (Ad. & Ang.). |
| * <i>Chione mesodesma</i> (Q. & G.).  | <i>Drillia</i> n. sp.                      |

- Drillia wanganuiensis* (Hutt).  
 \**Epitonium (Cirsotrema) zelebori* (Dkr.).  
 \**Ethalia zelandica* (H. & J.).  
*Euthria drewi* (Hutt).  
 \* " *striata* (Hutt.).  
 \**Fulgoraria arabica* (Mart.).  
 \**Fusinus spiralis* (A. Ad.).  
 \**Glycymeris laticostata* (Q. & G.).  
 \* " *modesta* Ang.  
 \**Loripes concinna* Hutt.  
 " *laminata* Hutt.  
 \**Mangilia sinclairi* (E. A. Smith).  
 \**Marginella pygmaea* Sow.  
 \**Mesodesma australe* (Gmel.).  
 \**Mitrella choava* (Reeve).  
 \**Murex octogonus espinosus* Hutt.  
 \**Natica australis* (Hutt.).  
 \* " *zelandica* Q. & G.  
 \**Ostrea (Anodontostrea) angasi* Sow.  
 " " *arenicola* Tate.  
 " (s. str.) *subdentata* Hutt.
- \**Pecten (Pallium) convexus* Q. & G.  
 \* " *(Chlamys) zelandica* Gray.  
 \**Seila chathamensis* Sut.  
 \**Siphonalia mandarina* (Duclos).  
*Struthiolaria cingulata* Zitt.  
 \**Terebra tristis* Desh.  
*Tritonidea* n. sp.  
 \**Trochus tiaratus* Q. & G.  
 \**Trophon ambiguus* (Phil.).  
 \* " *rugosus* (Q. & G.).  
 \**Tugalia bascauda* Hedley.  
 \**Turbonilla zelandica* (Hutt.).  
 \**Turritella (Peyrotia) carlotta* Wats.  
 \* " *(Archimediella) fulminata* Hutt.  
 \* " *(Peyrotia) rosca* Q. & G.  
 \* " (s. str.) *symmetrica* Hutt.  
 " " *waikopiroensis* Sut.  
 \**Venericardia corbis* (Phil.).  
 \* " *difficilis* (Desh.).  
 \* " *lutea* (Hutt.).

Sixty-one species, of which forty-nine also Recent = 80 per cent.

Age: Pliocene.

Reference: McKay, loc. cit., 1887, p. 201, &c.

Petane, Hawke's Bay: Sandy Clays below Limestone. Geol. Surv. Loc. 221. Cox; 1876.

- Anachis pisanioopsis* (Hutt).  
 \**Ancilla (Baryspira) mucronata* (Sow.).  
 \**Bathytoma albulu* (Hutt.).  
 \* " *nodilirata* (Murd. & Sut.).  
 \**Calyptrea (Sigapatella) maculata* (Q. & G.).  
 \* " " *inflata* (Hutt.).  
*Chione meridionalis* (Sow.). Very abundant.  
 \* " *mesodesma* (Q. & G.).  
 \**Cochloesma angasi* (C. & F.).  
*Cominella acuminata* Hutt.  
 \* " *zelandica* (Reeve).  
 \**Crepidula monoryla* (Less.).  
 \**Cuspidaria trailli* (Hutt.). New as a fossil.  
 \**Dentalium nanum* Hutt.  
 \**Dosinia lambata* (?) (Gould).  
*Drillia acquistriata* Hutt.  
 " *buchanani* (Hutt.).  
 " *wanganuiensis* (Hutt.).  
 \**Epitonium (Cirsotrema) zelebori* (Dkr.).  
*Eulima obliqua* (?) (Hutt.). Juv.  
 \**Fulgoraria gracilis* (Swains.).  
 \**Leda bellula* A. Ad.  
 \**Leptomya lineata* (Hutt.).  
*Leucosyrinx alta* (Harris).  
 \**Mactra scalpellum* Reeve. Abundant.  
 \**Malletia australis* (Q. & G.). Fragment.
- \**Mangilia sinclairi* (E. A. Smith).  
 \**Megalatractus maximus* (Tryon). Juv.  
 \**Mesodesma australe* (Gmel.). Abundant.  
 \**Modiolus australis* (Gray).  
 \**Murex zelandicus* Q. & G.  
 \**Myodora striata* (Q. & G.).  
 \**Natica australis* (Hutt.).  
 \**Pecten (Chlamys) radiatus* Hutt.  
 \* " " *zelandica* Gray.  
 \* " " *gemmulatus* Reeve.  
 Fragments.  
 \**Poroleda lanceolata* (Hutt.). Fragment.  
 \**Protocardia (Nemocardium) pulchella* (Gray).  
 Abundant.  
 \**Psammobia stangeri* Gray.  
 \**Siphonalia mandarina* (Duclos). Juv.  
 \* " *nodosa* (Mart.). Juv.  
 \**Spisula ordinaria* (E. A. Smith).  
 \**Tellina glabella* Desh.  
 \**Trochus tiaratus* Q. & G.  
*Trophon expansus* Hutt.  
 \* " *plebejus* (Hutt.).  
 \**Tugalia intermedia* (Reeve).  
 \**Turritella* (s. str.) *symmetrica* Hutt.  
 \**Zenatia acinaces* (Q. & G.).

Forty-nine species, of which forty also Recent = 82 per cent.

Age: Pliocene.

Reference: Cox in Rep. of Geol. Explor. during 1874-76, No. 9, 1877, pp. 97, 101-2.

Petane, Seven Miles North-west of Napier : Clays under Limestone. Geol. Surv. Loc. 690.  
McKay; 1887.

- Admete lacunosa* (Hutt.).  
*Anachis cancellaria* (Hutt.).  
 \* *Ancilla* (*Baryspira*) *australis* (Sow.).  
 \* " " *depressa* (Sow.).  
 \* " " *mucronata* (Sow.).  
 \* " " (*Amalda*) *novae-zelandiae* (Sow.).  
 \* *Anomia huttoni* Sut.  
 \* *Bathytoma cheesemani* (Hutt.).  
 \* " " *nodilirata* (Murd. & Sut.).  
 \* *Calyptrea* (*Sigapatella*) *maculata* (Q. & G.).  
 \* " " (s. str.) *tenuis* (Gray).  
 \* *Cardita calyculata* (L.).  
 \* *Cominella adspersa* (Brug.).  
 \* " " *zealandica* (Reeve).  
 \* *Corbula macilenta* Hutt.  
 \* " " *zealandica* Q. & G.  
 \* *Crepidula gregaria* Sow.  
 \* " " *monoxyla* (Less.).  
 \* *Dentalium nanum* Hutt.  
 \* *Drillia buchanani* (Hutt.).  
 \* " " *wanganuiensis* (Hutt.).  
 \* *Epitonium* (*Cirsotrema*) *zelebori* (Dkr.).  
 \* *Fulgoraria* sp. Pullus.  
 \* *Fusinus spiralis* (A. Ad.).  
 \* *Mangilia protensa* (Hutt.).

- \* *Mesodesma australe* (Gmel.).  
 \* *Murex zealandicus* Q. & G.  
 \* *Natica australis* (Hutt.).  
 \* " " *zealandica* Q. & G.  
 \* *Ostrea* (*Anodontostrea*) *angasi* Sow.  
 \* *Pecten* (*Patinopecten*) *triphooki* Zitt.  
 \* *Protocardia* (*Nemocardium*) *pulchella* (Gray).  
 \* *Serpulorbis siph* (Lamk.).  
 \* *Siphonalia caudata* (Q. & G.).  
 \* " " *dilatata* (Q. & G.).  
 \* " " *mandarina* (Duclos).  
 \* " " *nodosa* (Mart.).  
 \* *Struthiolaria vermis tricarinata* Less.  
 \* *Trichotropis clathrata* Sow.  
 \* *Trochus tiaratus* Q. & G.  
 \* *Trophon ambiguus* (Phil.).  
 \* " " *bonneti* Cossm.  
 \* *Tugalia bascauda* Hedley.  
 \* *Turritella* (*Peyrotia*) *carlotte* Wats.  
 \* " " (*Archimediella*) *fulminata* Hutt.  
 \* " " (*Peyrotia*) *rosea* Q. & G.  
 \* " " (s. str.) *symmetrica* Hutt.  
 \* *Venericardia bollonsi* Sut.  
 \* " " *difficilis* (Desh.).

Forty-nine species, of which forty-three also Recent = 88 per cent.

*Age* : Pliocene. From McKay's MS. it appears that this collection includes material from the same locality collected at other dates than 1887. He places the beds from which the collection was made in the "Putiki and Petane series."

*Reference* : McKay, *loc. cit.*, 1887, p. 201, &c. It may apparently be assumed that the collection was made from sandy clays, &c., under the upper limestone. The term "Putiki series" (Wanganui) is used by Hutton in *Trans. N.Z. Inst.*, vol. 18, 1886, p. 339.

Petane, Seven Miles North-west of Napier : Limestone. Geol. Surv. Loc. 691. McKay; 1887.

- \* *Ancilla* (*Baryspira*) *australis* (Sow.).  
 \* " " " *pyramidalis* (Reeve).  
 \* " " " *depressa* (Sow.).  
 \* *Anomia huttoni* Sut.  
 \* *Calyptrea* (*Sigapatella*) *maculata* (Q. & G.).  
 \* " " (s. str.) *tenuis* (Gray).  
 \* *Cantharidus tenebrosus* A. Ad.  
 \* " " " *huttoni* (E. A. Smith).  
 \* *Cardita calyculata* (?) (L.).  
 \* *Cerithidea bicarinata* (Gray).  
 \* *Chione mesodesma* (Q. & G.).  
 \* *Cominella huttoni* Kobelt.  
 \* *Crepidula monoxyla* (Less.).  
 \* *Dentalium nanum* Hutt.  
 \* *Epitonium* (*Cirsotrema*) *zelebori* (Dkr.).  
 \* *Ethalia zealandica* (H. & J.).  
 \* *Euthria drewi* (Hutt.).  
 \* " " *littorinoides costulata* (?) Sut.  
 \* " " *martensiana* (?) Hutt.  
 \* *Fulgoraria arabica* (Mart.).
- \* *Fulgoraria gracilis* (Swains.).  
 \* *Glycymeris laticostata* (Q. & G.).  
 \* *Mangilia dictyota* (Hutt.).  
 \* *Marginea* (s. str.) *hectori* (?) T. W. Kirk.  
 \* *Mesodesma australe* (Gmel.).  
 \* *Natica australis* (Hutt.).  
 \* *Ostrea* (*Anodontostrea*) *angasi* Sow.  
 \* *Pecten* (*Chlamys*) *radiatus* Hutt. Fragments.  
 \* *Siphonalia caudata* (Q. & G.).  
 \* " " *mandarina* (Duclos).  
 \* " " *nodosa* (Mart.). Juv.  
 \* *Terebra costata* (?) Hutt. Much worn.  
 \* *Trochus tiaratus* Q. & G.  
 \* *Trophon ambiguus* (Phil.). Juv.  
 \* " " *gouldi* Cossm.  
 \* " " *plebejus* (Hutt.). Juv.  
 \* *Turritella* (*Peyrotia*) *carlotte* Wats.  
 \* " " (*Archimediella*) *fulminata* Hutt.  
 \* " " (s. str.) *symmetrica* Hutt.  
 \* *Venericardia difficilis* (Desh.).

Forty species, of which thirty-six also Recent = 90 per cent.

*Age* : Pliocene.

*Reference* : McKay, *loc. cit.*, 1887, p. 201, &c.

## Petane and Scinde Island. Geol. Surv. Loc. 736. A. Hamilton; 1884.

- Anachis pisaniopsis* (Hutt.).  
 \**Ancilla* (*Baryspira*) *mucronata* (Sow.).  
 \**Bathytoma nodulifera* (Murd. & Sut.).  
*Calliostoma hodgei* (Hutt.).  
 \**Calyptrea* (s. str.) *alta* (Hutt.).  
 \* " (*Sigapatella maculata inflata*) (Hutt.).  
*Chione meridionalis* (Sow.).  
 \* " *mesodesma* (Q. & G.).  
 \**Cominella huttoni* Kobelt.  
 \* " *virgata* A. Ad.  
 \* " *zealandica* (Reeve).  
 \**Crepidula costata* (Sow.).  
 \* " *monoxyla* (Less.).  
 \**Cylichnella striata* (Hutt.).  
 \**Dentalium nanum* Hutt.  
 " *solidum* Hutt.  
*Drillia buchanaui* (Hutt.).  
 \* " *chordata* Sut.  
 \* " *lævis* (Hutt.).  
 \* " *scanganuiensis* (Hutt.).  
 \**Epitonium* (*Cirsotrema*) *zelebori* (Dkr.).  
 \**Eithalia zealandica* (H. & J.).  
 \**Fulgoraria arabica elongata* (Swains.).  
 \* " *gracilis* (Swains.).  
 \**Glycymeris laticostata* (Q. & G.).  
 \**Leptomya lintea* (Hutt.).  
*Lutraria solida* Hutt.  
*Mangilia abnormis* (Hutt.).  
 \**Mesodesma australe* (Gmel.).  
 \* " *ventricosum* Gray.
- Miomelon corrugata* (Hutt.).  
 \**Modiolaria impacta* (Hermann).  
 \**Modiolus australis* (Gray).  
 \**Nucula tranzei* A. Ad.  
 \**Ostrea* (s. str.) *corrugata* Hutt.  
 \* " (*Anodostrea*) *tatei* Sut.  
 \**Panope zealandica* Q. & G.  
 \**Pecten* (*Pallium*) *convexus* Q. & G.  
 \* " (*Chlamys*) *zealandica* Gray.  
 \**Protocardia* (*Nemocardium*) *pulchella* (Gray).  
 \**Psammobia lineolata* Gray.  
*Rissoa* (*Alvania*) *rugosa* Hutt.  
*Siphonalia elegans* (?) Sut.  
*Struthiolaria cingulata* Zitt.  
 " *parca* Sut.  
*Surcula* n. sp.  
 \**Therasia decidua* (Pfr.).  
 \**Trichotropis clathrata* Sow.  
*Trigonia neozelandica* (?) Sut.  
*Trochus conicus* (Hutt.).  
 \* " *tiaratus* Q. & G.  
*Trophon gouldi* Cossm.  
 \**Tugalia bascauda* Hedley.  
*Turris duplex* Sut. New for the Pliocene.  
 \**Turritella* (*Peyrotia*) *carlotte* Wats.  
 \* " (s. str.) *symmetrica* Hutt.  
 \**Venericardia difficilis* (Desh.).  
 \* " *lutea* Hutt.  
 \**Zenatia acinaces* (Q. & G.).

Fifty-nine species, of which forty-one also Recent = 69 per cent.

Age: Pliocene. Mr. Hamilton collected from more than one locality, and apparently at lower horizons than Cox and McKay. (See *Rep. of Geol. Explor. during 1886-87*, No. 18, 1887, p. 202, where McKay states that Hamilton collected from the Petane clays, &c., below the limestones.) Yet the fossil collections by Cox (Loc. 221) and by McKay (Loc. 690) from the clays under the limestone contain 82 and 88 per cent. respectively of Recent species.

## Scinde Island (Bluff Hill), Napier: Lower Limestone. Geol. Surv. Loc. 194. McKay; 1877.

- \**Anomia* sp.  
 \**Atrina zealandica* (Gray).  
 \**Calyptrea* (s. str.) *alta* (Hutt.).  
 \* " (*Sigapatella maculata*) (Q. & G.).  
 \* " " *inflata* (Hutt.).  
 " " " *inflata* (Hutt.).  
 \* " (s. str.) *tenuis* (Gray).  
*Chione meridionalis* (Sow.).  
 \* " *spissa* (Desh.).  
 \* " *stutchburyi* (Gray).  
 \**Crepidula monoxyla* (Less.). Common.  
 \**Cytherea oblonga* (Hanley).  
 \**Dipladonta zealandica* (Gray).  
 \**Dosinia subrosea* (?) (Gray).  
 \**Epitonium* (*Cirsotrema*) *zelebori* (Dkr.).  
 \**Fulgoraria gracilis* (?) (Swains.).  
 \**Glycymeris laticostata* (Q. & G.).  
 \**Leptomya lintea* (?) (Hutt.).  
 \**Lima bullata* (Born).  
 \* " *lima* (L.).  
*Lutraria solida* Hutt.  
 \**Mactra elongata* Q. & G.  
 \* " *ovata* (Gray). Common.  
 \* " *scalpellum* Reeve.  
 \**Mesodesma australe* (Gmel.).  
 \* " *subtriangulatum* (Gray).  
 \**Modiolus australis* (Gray).  
 \**Mytilus canaliculus* Mart.  
 \* " *edulis* L.  
 \* " *magellanicus* Lamk.  
 \**Ostrea* (*Anodostrea*) *angasi* Sow.  
 \* " " *tatei* Sut.  
 \**Paphia intermedia* (Q. & G.).  
 \**Pecten* (*Pallium*) *convexus* Q. & G.

- \**Pecten (Euvola) melius* (Lamk.).  
 \* " (*Chlamys*) *radiatus* Hutt.  
 " " *semiplicatus* Hutt.  
 " (*Patinopecten*) *triphooki* Zitt.  
 \* " (*Chlamys*) *zelandica* Gray.  
 \**Protocardia (Nemocardium) pulchella* (Gray).  
 \**Psammodia lineolata* Gray.  
 \**Siphalonia mandarina* (Duclos).  
 \**Tellina eugonia* Sut.  
 \**Tugalia intermedia* (Reeve).  
 \**Turbo smaragdus* (Mart.). Cast.  
 \**Zenatia acinaces* (Q. & G.).

Forty-five species, of which forty-one also Recent = 91 per cent.

*Age*: Upper Pliocene. With few exceptions the specimens are casts only, the identification therefore is difficult, and in many cases somewhat doubtful.

McKay states in MS. that the collection was made from the lower limestone on the seaward side of Scinde Island (which is not an island, but an isolated hill, now commonly known as Bluff Hill). Cox appears to have made a considerable collection at Scinde Island in 1876. (See *Rep. of Geol. Explor. during 1874-76*, No. 9, 1877, pp. 100-1.)

*Reference*: McKay, *Rep. of Geol. Explor. during 1876-77*, No. 10, 1877, p. 68, &c. (no specific reference of any consequence bearing on the collection).

Scinde Island, Napier: Lower Limestone. Geol. Surv. Loc. 702. McKay; 1887.

- \**Anomia huttoni* (?) Sut.  
 \**Atrina zelandica* (Gray). Fragments.  
 \**Calyptrea (Sigapatella) maculata* (Q. & G.).  
 " " (*s. str.*) *tenuis* (Gray).  
 \**Cardium spatiosum* Hutt. Casts.  
 \**Crepidula monoxyla* (Less.).  
 \**Cytherea oblonga* (Hanley). Casts.  
 \* " *subsulcata* (?) (Sut.).  
 \**Divaricella cumingi* (Ad. & Ang.).  
 \**Fulguraria arabica elongata* (Swains.). Fragment.  
 \**Glycymeris laticostata* (Q. & G.).  
 \**Lima lima* (?) (L.). Impression.  
 \**Maetra elongata* (Q. & G.).  
 \**Mesodesma australe* (?) (Gmel.). Casts.  
 \**Mytilus canaliculus* Mart.  
 \* " *magellanicus* Lamk.  
 \**Ostrea (Anodontostrea) angasi* Sow.  
 \**Panope zelandica* Q. & G. Fragments.  
 \**Pecten (Chlamys) semiplicatus* Hutt. Fragment.  
 " (*Patinopecten*) *triphooki* Zitt.  
 \* " (*Chlamys*) *zelandica* Gray.  
 \**Protocardia (Nemocardium) pulchella* (Gray). Casts.  
 \**Siphalonia mandarina* (Duclos). Fragments.  
 \**Struthiolaria* sp. Fragments.  
 \**Trochus* sp. Casts.

Twenty-five species, of which twenty-two also Recent = 88 per cent.

*Age*: Pliocene.

*Reference*: McKay, *loc. cit.*, 1887, p. 193, &c.

The list given above, and preceding lists, prove McKay's contention that all the beds at Scinde Island are of Pliocene age. Hutton (*Trans. N.Z. Inst.*, vol. 18, 1886, pp. 329-30) found 61 per cent. of Recent species in the lower limestone at Scinde Island, but considered it to be of Pareora age. He evidently thought that further collecting would reduce the percentage of Recent species, rather than increase it.

Watchman's Island, Napier Harbour. Geol. Surv. Loc. 222. Williams (probably Archdeacon Williams); 1878.

- Acteon sulcatus* (Hutt.).  
 \**Ancilla (Baryspira) mucronata* (Sow.).  
 \**Calliostoma selectum* (Chemn.).  
 \**Cardita calyculata* (L.).  
 \**Corbula zelandica* Q. & G.  
 \**Crepidula costata* (Sow.).  
 \**Daphnella striata* (Hutt.).  
 \**Dosinia lambata* (Gould).  
 \**Epitonium (Cirsotrema) zelebori* (Dkr.).  
 \**Lima bullata* (Born).  
 \**Lithophaga striata* (Hutt.).  
 \**Modiolus australis* (Gray).  
 \**Placunanomia zelandica* (Gray).  
 \**Venericardia difficilis* (Desh.).  
 \**Zenatia acinaces* (Q. & G.).

Fifteen species, of which thirteen also Recent = 87 per cent.

*Age*: Pliocene.

*Reference*: Watchman's Island is mentioned by McKay in *Rep. of Geol. Explor. during 1876-77*, No. 10, 1877, pp. 84, 88, and a further reference to islands in Napier Harbour is made by him in *Rep. of Geol. Explor. during 1886-87*, No. 18, 1887, p. 203.

Napier. Geol. Surv. Collection.

*Pecten (Patinopecten) sectus* Hutt.

Apparently an isolated unnumbered specimen, either from the Museum show-cases or from the collections sent to Professor Ralph Tate (Adelaide) in 1885 and 1890. During the past few years, owing to the good offices of the Rev. W. Howchin, F.G.S., most of the latter specimens have been returned.

Shrimpton's, Ngaruroro River, Hawke's Bay: Upper Shelly Beds. Geol. Surv. Loc. 191. McKay; 1877.

- \**Anomia huttoni* Sut. Common.  
 \* " *undata* Hutt.  
 \**Atrina zelandica* (Gray).  
*Bezanconia (Atazocerithium) huttoni* (Cossm.).  
 \**Calyptrea (Sigapatella) maculata* (Q. & G.).  
 \* " (s. str.) *tenuis* (Gray).  
 \**Cerithidea bicarinata* (Gray).  
*Chione meridionalis* (Sow.). Common.  
 \* " *mesodesma* (Q. & G.). Abundant.  
 \**Cominella adpersa* (Brug.).  
 \* " *huttoni* Kobelt.  
 \* " *lurida* (Phil.).  
 \* " *nassoides* (Reeve).  
 \* " *zelandica* (Reeve).  
 \**Crepidula monozyla* (Less.).  
 \* " *striata* (Hutt.).  
 \**Cytherea oblonga* (Hanley).  
 \* " *subsulcata* Sut. Abundant.  
 \**Dentalium nanum* Hutt.  
 \**Diplodonta globularis* (Lamk.).  
 \* " *zelandica* (Gray).  
 \**Dosinia anus* (Phil.).  
 \* " *greyi* Zitt.  
 \* " *lambata* (Gould).  
 \* " *subrosea* (Gray).  
*Drillia angustriata* Hutt.  
 " *buchanani* (Hutt.).  
 \**Ethalia zelandica* (H. & J.).  
 \**Euthria striata* (Hutt.).  
 \**Fissuridea monilifera* (Hutt.).  
 \**Fulgoraria arabica* (Mart.).  
 \* " *elongata* (Swains.).  
 \* " *hedleyi* Murd. & Sut. var. New as a fossil.  
 \**Glycymeris laticostata* (Q. & G.).  
 \* " *modesta* (Ang.). Common.  
 \* " *striatularis* (Lamk.). New to fauna.  
 \**Leptomys lintea* (Hutt.).  
 \**Lima bullata* (?) (Born). Cast.  
 \* " *lima* (L.).  
 \**Loripes concinna* Hutt.  
*Lutaria solida* Hutt.
- \**Malletia australis* (Q. & G.).  
*Melina zelandica* Sut. Fragment.  
 \**Mesodesma australe* (Gmel.). Common.  
 \**Modiolaria impacta* (Hermann).  
 \**Modiolus australis* (Gray).  
 \**Monodonta nigerrima* (Gmel.). New as a fossil.  
 \**Myodora striata* (Q. & G.).  
 \**Mytilus canaliculus* Mart.  
 \**Nucula hartvigiana* Pfr. New as a fossil.  
 \* " *nitidula* A. Ad.  
 \**Ostrea (Anodontostrea) angasi* Sow.  
 \* " " *hyotis* L.  
 \**Panope zelandica* Q. & G.  
 \**Paphia intermedia* (?) (Q. & G.).  
 \**Pecten (Chlamys) radiatus* Hutt.  
 \* " " *zelandica* Gray. Common.  
 \**Poroleta lanceolata* (Hutt.).  
 \**Protocardia (Nemocardium) pulchella* (Gray).  
 \**Sinum (Eunaticina) undulatum* (?) (Hutt.).  
 \**Siphonalia caulata* (Q. & G.).  
 \* " aff. *conoidea* Zitt.  
 \* " *costata* Hutt.  
 \* " *dilatata* (Q. & G.).  
 \* " *nodosa* (Mart.).  
 \* " *mandarina* (Duclos).  
 \**Solariella egea* (Gould).  
 \**Spisula ordinaria* (E. A. Smith).  
*Struthiolaria frazeri* Hutt.  
 \* " *vermis* (Mart.).  
 \**Thais striata* (Mart.).  
 \**Trophon ambiguus* (Phil.).  
 \* " *hanleyi* (Ang.). New as a fossil.  
 \* " *plebejus* (Hutt.).  
 \**Tugalia bascauda* Hedley.  
 \**Turritella (Peyrotia) carlotta* Wats.  
 \* " *(Archimediella) fulminata* Hutt.  
 \* " *(Peyrotia) rosea* Q. & G.  
 \* " (s. str.) *symmetrica* Hutt.  
 \**Venericardia difficilis* (Desh.).  
 \* " *lutea* (Hutt.).  
 \* " *purpurata* (Desh.). Common.  
 \**Zenatia acinaces* (Q. & G.).

Eighty-three species, of which seventy-three also Recent = 88 per cent.

*Age*: Pliocene. According to McKay's MS. the fossiliferous beds are formed of calcareous sands and shells but little consolidated, and consequently the fossils can be extracted in an excellent state of preservation.

*Reference*: McKay in *Rep. of Geol. Explor. during 1876-77*, No. 10, 1877, pp. 68, 84, 93 (Kikowhero Creek), &c. The collection was probably made near the junction of Kikowhero Creek with the Ngaruroro River.



Cape Kidnappers, South End of Hawke Bay: Scinde Island Limestone. Geol. Surv. Loc. 78. McKay; 1875.

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|--|--|
| * <i>Chione stutchburyi</i> (Gray).                        | <i>Ostrea</i> (s. str.) <i>wuellerstorfi</i> Zitt.         |
| * <i>Crepidula monoxyla</i> (Less.).                       | * <i>Pecten</i> ( <i>Pallium</i> ) <i>convexus</i> Q. & G. |
| * <i>Cytherea oblonga</i> (Hanley).                        | " ( <i>Chlamys</i> ) <i>hilli</i> Hutt.                    |
| * <i>Glycymeris laticostata</i> (Q. & G.).                 | *  " ( <i>Euvola</i> ) <i>medius</i> Lamk. Fragment.       |
| * <i>Lima bullata</i> (Born).                              | " ( <i>Patinopecten</i> ) <i>triphooiki</i> Zitt.          |
| * <i>Mytilus edulis</i> L.                                 | *  " ( <i>Chlamys</i> ) <i>zelandica</i> Gray.             |
| <i>Ostrea</i> ( <i>Anodontostrea</i> ) <i>ingens</i> Zitt. | * <i>Placunanomia zelandica</i> (?) (Gray).                |
| "  "  " <i>nelsoniana</i> Zitt.                            |  |

Fifteen species, of which ten also Recent = 67 per cent.

Age: Pliocene. The correlation with the Scinde Island limestone seems doubtful.

Reference: McKay in *Rep. of Geol. Explor. during 1874-76*, No. 9, 1877, pp. 49-50.

Kereru, Forty-one Miles South-west of Napier: Lower Beds. Geol. Surv. Loc. 190. McKay; 1877

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|---|--|
| * <i>Ancilla</i> ( <i>Baryspira</i> ) <i>australis pyramidalis</i> (Reeve). | <i>Melina zelandica</i> Sut. Fragment.                               |
| * <i>Anomia huttoni</i> Sut.  | * <i>Modiolaria impacta</i> (Hermann).                               |
| * <i>Atrina zelandica</i> (Gray).   | * <i>Modiolus australis</i> (Gray).                                  |
| * <i>Calliostoma selectum</i> (Chemn.).                                     | * <i>Mytilus canaliculus</i> Mart.                                   |
| * <i>Calyptrea</i> ( <i>Sigapatella</i> ) <i>maculata</i> (Q. & G.).        | * <i>Ostrea</i> ( <i>Anodontostrea</i> ) <i>angasi</i> Sow.          |
| <i>Chione meridionalis</i> (Sow.).  | * <i>Panope zelandica</i> Q. & G.                                    |
| * <i>Corbula zelandica</i> Q. & G.  | * <i>Paphia intermedia</i> (Q. & G.).                                |
| * <i>Crepidula monoxyla</i> (Less.).  | * <i>Pecten</i> ( <i>Chlamys</i> ) <i>zelandica</i> Gray.            |
| " <i>striata</i> Hutt.  | * <i>Protocardia</i> ( <i>Nemocardium</i> ) <i>pulchella</i> (Gray). |
| * <i>Diplodonta zelandica</i> (Gray).                                       | Common.  |
| * <i>Dosinia lambata</i> (Gould).   | * <i>Siphonalia dilatata</i> (Q. & G.).                              |
| *  " <i>subrosea</i> (Gray).  | *  " <i>mandarina</i> (Duclos).                                      |
| * <i>Ethalia zelandica</i> (H. & J.).                                       | * <i>Struthiolaria vermis</i> (Mart.).                               |
| * <i>Fulgoraria gracilis</i> Swains.  | * <i>Trochophora hanleyi</i> (Ang.).                                 |
| * <i>Leptomys lineata</i> (Hutt.).  | * <i>Tuqalia intermedia</i> (Reeve).                                 |
| * <i>Lima bullata</i> (Born).   | * <i>Venericardia purpurata</i> (Desh.).                             |
| <i>Lutraria solida</i> Hutt.  |  |

Thirty-two species, of which twenty-eight also Recent = 88 per cent.

Age: Pliocene.

Reference: McKay in *Rep. of Geol. Explor. during 1876-77*, No. 10, 1877, pp. 68, 81, 82, 93.

Waitomo Valley, One to Three Miles West of Waitomo Caves Hostel, along Hauturu Road: Argillaceous Sandstone overlying Limestone. Geol. Surv. Loc. 882. J. Henderson; April, 1917.

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|---|--|
| <i>Alectrion</i> ( <i>Hima</i> ) <i>socialis</i> (Hutt.).         | * <i>Dosinia lambata</i> (?) (Gould).                        |
| <i>Ampullina</i> ( <i>Megatylotus</i> ) <i>suturalis</i> (Hutt.). | <i>Polinices gibbosus</i> (Hutt.).                           |
| <i>Cardium</i> ( <i>Trachycardium</i> ) <i>greyi</i> (?) Hutt.    | * <i>Spisula aquilateralis</i> (Desh.). Juvenile casts.      |
| <i>Crassatellites amplus</i> (?) (Zitt.). Juv.                    | <i>Turritella</i> ( <i>Torcula</i> ) <i>semiconcava</i> Sut. |

Age: Miocene (Oamaruan).

Four Mile West of Hangatiki, on Waihohonu Road: Weathered Mudstone overlying Limestone. Geol. Surv. Loc. 880. J. Henderson; March, 1917.

*Pholadomya neozelanica* (?) Hutt. Juv.

Age: Miocene,

Four Miles West of Otorohanga, on Honikiwi Road, near Junction with Te Raumauku Road :  
Arenaceous Limestone, in places passing into Fine Conglomerate. Geol. Surv. Loc. 881.  
J. Henderson ; March, 1917.

*Cucullaea attenuata* Hutt.

*Pecten (Pseudamusium) hochstetteri* Zitt.

*Lima* n. sp. ?

" " *huttoni* (Park).

*Miomelon corrugata* (Hutt.). (*Lapparia* of Hand-  
list).

*Siphonalia* aff. *costata* (Hutt.).

*Panopea worthingtoni* Hutt.

*Stomatella* n. sp. Genus new to fauna.

*Venericardia psutes* Sut.

Age : Miocene. Horizon : Ototaran (?).

One Mile West of Te Kuiti, along Road to Awakino : Calcareous Argillaceous Sandstone. Geol.  
Surv. Loc. 877. J. Henderson ; February, 1917.

*Astraea* sp. (perhaps n. sp.). Juv.

*Pecten (Pseudamusium) huttoni* (Park). Juv.

\**Mactra scalpellum* (?) Reeve.

*Siphonalia* sp.

Age : Miocene. The beds collected from overlie the Te Kuiti limestone, perhaps uncon-  
formably.

Half a Mile East of Te Kuiti, between Mangarino and Rangitoto Roads : Pumiceous Slightly  
Calcareous Sandstone. (Same series as Loc. 877.) Geol. Surv. Loc. 878. J. Henderson ;  
March, 1917.

*Amusium titeli* (Hutt.).

*Capulus* sp. ?

Age : Miocene.

Railway-ballast Quarries, One Mile and a Half South-south-east of Te Kuiti : Lower Arenaceous  
Limestone. Geol. Surv. Loc. 883. J. Henderson ; February, 1917.

\**Anomia huttoni* (?) Sut.

*Pecten (Pseudamusium) huttoni* (Park).

*Pecten (Pseudamusium) hochstetteri* Zitt.

*Teredo heaphyi* Zitt.

Age : Miocene.

Five Miles East of Te Kuiti, on Road joining Puketawai and Otewa Roads : Calcareous Sand-  
stone. Geol. Surv. Loc. 884. J. Henderson ; February, 1917.

*Pecten (Pseudamusium) huttoni* (Park).

*Teredo heaphyi* Zitt.

Age : Miocene. Horizon nearly the same as that of Loc. 883.

One Mile South of Oparure, along Road to Mairoa : Argillaceous Sandstone. (Same series as  
Loc. 877.) Geol. Surv. Loc. 879. J. Henderson ; March, 1917.

*Chione chiloensis truncata* (?) Sut. Juv.

*Siphonalia* sp. ?

*Pecten (Chlamys) williamsoni* Zitt.

*Surcula* aff. *huttoni* Sut.

Age : Miocene.

Mangaotaki Gorge, Six Miles South-west of Piopio, on Road to Mahoenui : Calcareous Sand-  
stone at Base of Limestone. Geol. Surv. Loc. 886. J. Henderson ; February, 1917.

*Pecten (Pseudamusium) huttoni* (Park).

Age : Miocene.

Four Miles East of Awakino, along the Road to Te Kuiti, One Mile from the River-flats :  
Argillaceous Sandstone. Geol. Surv. Loc. 885. J. Henderson; February, 1917.

*Lima colorata* Hutt.

*Limopsis zitteli* Iher.

\**Tellina glabrella* (?) Desh.

\**Xenophora corrugata* (Reeve).

Fry of *Phalium* ?

Age: Miocene. The beds collected from overlie the limestone horizon.

Top of Taumatamaire Hill, Awakino-Mahoenui Road, Awakino County. J. Henderson; 1917.

*Polinices gibbosus* (Hutt.).

Age: Miocene. Horizon: Above limestone (?). See also E. de C. Clarke in *N.Z. Geol. Surv. Bull. No. 14*, 1912, p. 19.

Patokatoka Creek, Mokau River: Greensands underlying Limestone. J. Park, *Rep. of Geol. Explor. during 1886-87*, No. 18, 1887, p. 44. (Revised list of names.)

\**Ancilla (Baryspira) australis* (?) (Sow.).

„ (s. str.) *hebra* (Hutt.).

*Bathytoma sulcata* (Hutt.).

*Chione acuminata* Hutt.

*Glycymeris globosa* (Hutt.).

*Lima colorata* Hutt.

*Ostrea* sp. ind.

*Pecten (Pseudamusium) huttoni* (Park).

Age: Miocene.

This list consists of the revised names of the species listed by Park. The collection made by him at Patokatoka Creek is presumably that from Loc. No. 584, and has not yet been re-examined, so that the correctness of the above list depends on the accuracy of the identifications made in 1887.

White Cliffs, Taranaki. J. Park, *loc. cit.*, p. 43. (Revised list of names.)

\**Bathytoma nodilirata* (Murd. & Sut.).

*Dentalium solidum* Hutt.

*Galeodea sulcata* (Hutt.).

\**Malletia australis* (Q. & G.).

\**Nucula nitidula* A. Ad.

\**Protocardia (Nemocardium) pulchella* (Gray).

*Siphonalia nodosa robinsoni* (Zitt.).

Age: Upper Miocene or Lower Pliocene.

White Cliffs, North of Urenui, Taranaki. Geol. Surv. Loc. 52. J. Hector; 1874.

\**Anomia huttoni* (?) Sut. Juv.

*Bathytoma haasti* (Hutt.).

*Clio (Creseis) uenuiensis* Sut.

\**Leptomya lineata* (?) (Hutt.). Impression.

*Mionelon corrugata* (Hutt.).

„ var. B (Hutt.).

Age: Upper Miocene or Lower Pliocene.

Urenui, Taranaki: Blue Clay. Geol. Surv. Loc. 582. J. Park; 1886.

*Bathytoma haasti* (Hutt.).

*Drillia buehanani* (Hutt.).

*Euthria media* (?) (Hutt.).

\**Fulgoraria arabica* (?) (Mart.). Fragment.

\**Leptomya lineata* (Hutt.).

\**Malletia australis* (Q. & G.).

\**Nucula hartveigiana* Pfr.

\**Protocardia (Nemocardium) pulchella* (Gray).

*Siphonalia costata* (Hutt.).

„ *subnodosa* (Hutt.).

Age: Lower Pliocene (probably). Onairo Series of E. de C. Clarke (*N.Z. Geol. Surv. Bull. No. 14*, 1912).

Onairo, near Waitara, Taranaki: Pareora Beds.† Geol. Surv. Loc. 583. J. Park; 1886.

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|--|--|
| * <i>Ancilla (Baryspira) mucronata</i> (Sow.). | <i>Miomelon corrugata</i> (Hutt.).                   |
| * <i>Chione mesodesma</i> (Q. & G.).           | <i>Polinices (Neverita) huttoni</i> Iher.            |
| * <i>Cominella zealandica</i> (Reeve).         | * <i>Protocardia (Nemocardium) pulchella</i> (Gray). |
| <i>Crassatellites</i> sp. ?                    | * <i>Siphonalia caudata</i> (Q. & G.).               |
| <i>Crepidula gregaria</i> Sow.                 | * " " <i>nodosa</i> (Mart.).                         |
| <i>Cytherea sulcata</i> (Hutt.).               | <i>Struthiolaria cincta</i> Hutt.                    |
| <i>Dentalium solidum</i> Hutt.                 | * " " <i>papulosa</i> (?) (Mart.).                   |
| * <i>Divaricella cumingi</i> (Ad. & Ang.).     | * " " <i>vermis tricarinata</i> Less.                |
| <i>Dosinia</i> sp.                             | <i>Turritella (Torcula) semiconcava</i> Sut.         |
| <i>Glycymeris globosa</i> (Hutt.). Common.     | * <i>Zenatia acinaces</i> (Q. & G.).                 |

Eighteen identified species, of which ten also Recent = 55.6 per cent.

Age: Lower Pliocene (probably). Onairo Series of E. de C. Clarke.

Onairo, Taranaki. J. Park, *Rep. of Geol. Explor. during 1886-87*, No. 18, 1887, p. 43. (Revised list of names.)

- |  |  |
|--|--|
| * <i>Ancilla (Baryspira) australis</i> (Sow.). | <i>Galeodea sulcata</i> (Hutt.).                           |
| * <i>Cardita calyculata</i> (L.).              | * <i>Glycymeris laticostata</i> (Q. & G.).                 |
| * <i>Chione mesodesma</i> (Q. & G.).           | * <i>Malletia australis</i> (Q. & G.).                     |
| * " " <i>stutchburyi</i> (Gray).               | <i>Ostrea</i> sp. ind.                                     |
| * <i>Cominella adspersa</i> (Brug.).           | * <i>Polinices amphialus</i> (Wats.).                      |
| <i>Crepidula gregaria</i> Sow.                 | <i>Siphonalia nodosa robinsoni</i> (Zitt.).                |
| * <i>Dentalium ecostatum</i> T. W. Kirk.       | * <i>Spisula <math>\alpha</math>-quilateralis</i> (Desh.). |
| * " " <i>nanum</i> Hutt.                       | <i>Struthiolaria tuberculata</i> Hutt.                     |
| * " " <i>solidum</i> Hutt.                     | * <i>Tellina deltoidalis</i> Lamk.                         |
| * <i>Divaricella cumingi</i> (Ad. & Ang.).     | * <i>Turritella (Peyrota) rosea</i> Q. & G.                |
| * <i>Dosinia greyi</i> Zitt.                   | * " " (s. str.) <i>symmetrica</i> Hutt                     |
| * " " <i>subrosea</i> (Gray).                  | * <i>Zenatia acinaces</i> (Q. & G.).                       |

Twenty-three identified species, of which eighteen Recent = 78 per cent.

Age: Lower Pliocene (probably). Onairo Series of Clarke. The matrix of the fossils is argillaceous pebbly conglomerate (more or less calcareous).

New Plymouth Subdivision. E. de C. Clarke, *N.Z. Geol. Surv. Bull. No. 14 (n.s.)*, 1912, p. 20. (Revised list.)

- |  |  |
|--|--|
| * <i>Ancilla (Baryspira) australis</i> (Sow.). | <i>Limopsis zitteli</i> (?) Iher.                          |
| * <i>Bathytoma nodilirata</i> (Murd. & Sut.).  | * <i>Malletia australis</i> (Q. & G.).                     |
| * <i>Cardita calyculata</i> (L.).              | * <i>Nucula nitidula</i> A. Ad.                            |
| <i>Chione acuminata</i> Hutt.                  | <i>Pecten fischeri</i> Zitt.                               |
| * " " <i>mesodesma</i> (Q. & G.).              | " " ( <i>Pseudamysium hochsteteri</i> (?) Zitt.            |
| * " " <i>stutchburyi</i> (Gray).               | [Perhaps <i>P. huttoni</i> (Park).]                        |
| * <i>Cominella adspersa</i> (Brug.).           | * <i>Polinices amphialus</i> (Wats.).                      |
| <i>Crepidula gregaria</i> Sow.                 | " " <i>ovatus</i> (Hutt.).                                 |
| <i>Cucullaea alta</i> Sow.                     | * <i>Protocardia (Nemocardium) pulchella</i> (Gray).       |
| * <i>Dentalium ecostatum</i> T. W. Kirk.       | * <i>Siphonalia nodosa</i> (Mart.).                        |
| * " " <i>nanum</i> Hutt.                       | " " <i>robinsoni</i> (Zitt.).                              |
| * " " <i>solidum</i> Hutt.                     | * <i>Spisula <math>\alpha</math>-quilateralis</i> (Desh.). |
| * <i>Divaricella cumingi</i> (Ad. & Ang.).     | <i>Struthiolaria tuberculata</i> Hutt.                     |
| * <i>Dosinia greyi</i> Zitt.                   | * <i>Tellina deltoidalis</i> Lamk.                         |
| * " " <i>subrosea</i> (Gray).                  | <i>Teredo hepaphyi</i> Zitt.                               |
| <i>Galeodea sulcata</i> (Hutt.).               | * <i>Turritella</i> (s. str.) <i>symmetrica</i> Hutt.      |
| <i>Glycymeris globosa</i> (Hutt.).             | * <i>Zenatia acinaces</i> (Q. & G.).                       |
| * " " <i>laticostata</i> (Q. & G.).            |  |

Thirty-four species, of which twenty-one also Recent = 62 per cent.

This list embodies a revision of Mr. Clarke's nomenclature. His list was partly compiled, and the fossil localities are not specifically mentioned. Various horizons (Pliocene and Miocene) are represented.

† So entitled in McKay's manuscript list of fossiliferous localities.

Pohokura Tunnel, Stratford-Whangamomona Railway. P. G. Morgan and W. Gibson; October, 1914.

\**Anomia huttoni* Sut.

\**Ancilla bicolor* (?) (Gray).

\**Cerithidea bicarinata* (?) (Gray).

\**Chione mesodesma* (Q. & G.).

\**Crepidula monozylla* (Less.).

*Diplodonta ampla* (Hutt.).

\**Dosinia anus* (Phil.).

\**Glycymeris laticostata* (Q. & G.).

\* " *modesta* (Ang.).

\**Magellania lenticularis* (Desh.).

\**Ostrea tatei* Sut.

*Pecten triphooki* Zitt.

*Age*: Pliocene. The collection was made from calcareous sandy claystones on the dumps at the south-western end of the tunnel.

Nolan's Quarry, on Hilltop near Te Wera, Ngatimaru Survey District. W. Gibson; 1914.

\**Cytherea oblonga* (?) (Hanley).

\**Glycymeris laticostata* (Q. & G.).

\**Struthiolaria vermis* (?) (Mart.).

*Age*: Pliocene. The matrix is a calcareous sandstone.

Shell-bed, Railway-cutting, One Mile and a Half South-west of Huiroa Railway-station. W. Gibson; 1914 (or early in 1915).

*Anomia* sp. Juv. Very likely *A. huttoni* Sut.

*Ostrea angasi* Sow. Juv.

*Age*: Pliocene.

Beach, North-east of Tapuae Stream, South-west of New Plymouth, Taranaki. P. G. Morgan; 1916.

*Mastra chrydæa* Sut.

This specimen is from an immense block of fine calcareous sandstone embedded in volcanic agglomerate. This block is mentioned by Clarke (*N.Z. Geol. Surv. Bull. No. 14*, p. 15), who speaks of it as limestone. He collected a number of fossil specimens, but unfortunately these were lost, and the writer of this paragraph could find nothing identifiable except casts of the fossil mentioned above. The interest attaching to the block of sandstone containing the fossils lies not only in its size and mode of occurrence, but also in the fact that it belongs to a lower horizon than any sedimentary rock known to exist *in situ* near the surface in the New Plymouth Subdivision. (See, however, the following list.)

West of Salisbury Road, and Two Miles and a Half East of Tariki, Taranaki: Fossiliferous Tuff. W. Gibson; 1915.

*Chione meridionalis* (?) (Sow.). Cast.

*Mastra chrydæa* Sut.

*Pecten (Patinopecten) triphooki* Zitt.

*Pecten* n. sp.

*Typhis maccoyi* (?) T.-Woods. Impression.

*Age*: Probably Lower Pliocene, though the list as it stands suggests a Miocene age. The determination of the exact horizon is a matter of great importance from an oil-boring point of view.

Oil-bore, at Depth of 4,550 ft. to 4,760 ft., Huiroa, Taranaki. J. Henchman; 1916.

*Siphonalia* n. sp. Nearest to *S. orbita* Hutt.

*Struthiolaria* n. sp. With short, broadly angled spire.

*Turritella (Torcula) semiconcava* Sut.

These specimens were forwarded to the Geological Survey in November, 1916, by Mr. J. Henchman, manager at the Huiroa oil-bore (fifteen miles north-east of Stratford). It is fairly certain that their horizon is well down in the Miocene. The exact determination of that horizon is obviously important.

Mania Beach, at Foot of Rainie Road : Sandy Mudstone (Papa) which forms the Lower Part of the Sea-cliff of South Taranaki, and is overlain by Volcanic Material. Geol. Surv. Loc. 875. M. Ongley ; March, 1917.

- |   |   |
|---|---|
| * <i>Anomia trigonopsis</i> Hutt.                 | <i>Miomelon corrugata</i> var. B (Hutt.).                               |
| * <i>Calyptrea</i> (s. str.) <i>alta</i> (Hutt.). | * <i>Ostrea</i> ( <i>Anodontostrea</i> ) <i>hyotis</i> (L.).            |
| <i>Cardium spatiosum</i> Hutt. Fragment.          | <i>Pecten</i> ( <i>Patinopecten</i> ) <i>crawfordi</i> Hutt.            |
| <i>Crepidula gregaria</i> Sow.                    | * " ( <i>Chlamys</i> ) <i>zelandica</i> Gray.                           |
| " <i>striata</i> (Hutt.).                         | <i>Polinices</i> ( <i>Neverita</i> ) <i>sagenus</i> Sut.                |
| * <i>Cytherea oblonga</i> (Hanley).               | * <i>Protocardia</i> ( <i>Nemocardium</i> ) <i>pulchella</i> (Gray).    |
| <i>Dentalium mantelli</i> Zitt.                   | <i>Siphonalia</i> sp. (Near <i>S. plicatilis</i> , but twice its size.) |
| * <i>Dosinia greyi</i> Zitt.                      | <i>Struthiolaria cingulata</i> Zitt.                                    |
| * <i>Glycymeris laticostata</i> (Q. & G.).        | <i>Turbo</i> n. sp. Fragments.  |
| <i>Loripes</i> n. sp. (The same Loc. 876.)        |   |
| <i>Miomelon corrugata</i> (Hutt.).                |   |

Twenty species, eight of which also Recent = 40 per cent.

Age : Uppermost Miocene (probably).

Hawera Beach, at Mouth of Waihi Stream : Sandy Mudstone (Papa) which forms the Lower Part of the Sea-cliff of South Taranaki, overlain by Volcanic Material. Geol. Surv. Loc. 876. M. Ongley ; March, 1917.

- |  |  |
|--|--|
| * <i>Ancilla</i> ( <i>Baryspira</i> ) <i>mucronata</i> (Sow.).       | <i>Loripes</i> n. sp. (The same Loc. 875.)                             |
| * <i>Chione mesodesma</i> (Q. & G.).                                 | * <i>Ostrea</i> ( <i>Anodontostrea</i> ) <i>hyotis</i> (L.).           |
| * <i>Crepidula monozygia</i> (Less.).                                | <i>Pecten</i> ( <i>Patinopecten</i> ) <i>triphooki</i> Zitt. Fragment. |
| * <i>Cytherea oblonga</i> (Hanley). Fragments.                       | <i>Polinices</i> ( <i>Neverita</i> ) <i>ovatus</i> (Hutt.).            |
| <i>Dentalium mantelli</i> Zitt.                                      | " " <i>sagenus</i> Sut.  |
| * <i>Divaricella cumingi</i> (Ad. & Ang.).                           | <i>Struthiolaria canaliculata</i> Zitt.                                |
| * <i>Dosinia</i> ( <i>Dosinidia</i> ) <i>greyi</i> Zitt.             | * <i>Turritella</i> ( <i>Peyrotia</i> ) <i>carlottæ</i> Wats.          |
| <i>Epitonium</i> aff. ( <i>Confusiscala</i> ) <i>nympha</i> (Hutt.). |  |

Fifteen species, eight of which also Recent = 53 per cent.

Age : Lower Pliocene or uppermost Miocene.

Waitotara, Puketapu, North-west Wellington. Geol. Surv. Loc. 588. Hector ; 1866.

\**Ostrea* (*Anodontostrea*) *tatei* Sut.

Age : Pliocene. Horizon : Waitotaran. An isolated specimen from a small collection of sixteen specimens. There is some doubt about the locality.

Wanganui : Shakespeare Cliff (Upper Part). Geol. Surv. Loc. 206. T. W. Kirk ; 1875.

- |  |  |
|--|--|
| * <i>Ancilla</i> ( <i>Baryspira</i> ) <i>australis</i> (Sow.).       | * <i>Fusinus spiralis</i> (A. Ad.).                                  |
| * " " " <i>pyramidalis</i> (Reeve).                                  | * <i>Glycymeris laticostata</i> (Q. & G.). Common.                   |
| * " " " <i>depressa</i> (Sow.).                                      | * " " <i>modesta</i> (Ang.).   |
| * <i>Astraea heliotropium</i> (Mart.).                               | * <i>Maetra elongata</i> Q. & G.                                     |
| * <i>Calyptrea</i> ( <i>Sigapatella</i> ) <i>maculata</i> (Q. & G.). | * " <i>scalpellum</i> Reeve.   |
| * " " " <i>inflata</i> (Hutt.).                                      | * <i>Mesodesma australe</i> (Gmel.).                                 |
| * " " (s. str.) <i>tenuis</i> (Gray).                                | * " " <i>subtriangulatum</i> (Gray).                                 |
| * <i>Cardita calyculata</i> (L.).                                    | * <i>Mesodesma ventricosum</i> Gray.                                 |
| * <i>Chione mesodesma</i> (Q. & G.). Common.                         | * <i>Murex zelandicus</i> Q. & G.                                    |
| * " <i>spissa</i> (Desh.).   | * <i>Myodora striata</i> (Q. & G.). Common.                          |
| * <i>Cominella lurida</i> (Phil.).                                   | * <i>Nucula nitidula</i> A. Ad.                                      |
| * <i>Corbula zelandica</i> Q. & G.                                   | * <i>Ostrea</i> ( <i>Anodontostrea</i> ) <i>angasi</i> Sow. Common.  |
| <i>Crepidula gregaria</i> Sow.                                       | * " " <i>arenicola</i> Tate. New to fauna.                           |
| * " <i>monozygia</i> (Less.).  | * " (s. str.) <i>corrugata</i> Hutt.                                 |
| * <i>Diplodonta zelandica</i> (Gray).                                | * " ( <i>Anodontostrea</i> ) <i>hyotis</i> (L.). Common.             |
| * <i>Divaricella cumingi</i> (Ad. & Ang.).                           | * <i>Pecten</i> ( <i>Euvola</i> ) <i>medius</i> Lamk.                |
| * <i>Dosinia greyi</i> Zitt.   | * " ( <i>Chlamys</i> ) <i>radiatus</i> Hutt.                         |
| * " <i>subrosea</i> (Gray).  | * <i>Polinices amphialus</i> (Wats.).                                |
| * <i>Ethalia zelandica</i> (H. & J.).                                | * <i>Protocardia</i> ( <i>Nemocardium</i> ) <i>pulchella</i> (Gray). |
| * <i>Euthria</i> sp.   |  |

- \**Psammobia lineolata* Gray.  
 \**Siphonalia mandarina* (Duclos).  
 \* " " *nodosa* (Mart.).  
 \**Solariella eyena* (Gould).  
 \**Struthiolaria papulosa* (?) (Mart.). Casts.  
 \* " " *vermis* (Mart.).  
*Trochus conicus* (Hutt.).

Fifty-three species, of which fifty are also Recent = 94 per cent.

Age: Highest Pliocene or Early Pleistocene. Horizon: Castlecliffian (?).

The collection may contain some of the material collected by John Buchanan in 1866 (Loc. 92).

Wanganui Fossils: Shakespeare Cliff and Elsewhere.

- \**Ancilla (Baryspira) australis* (Sow.).  
 \* " " " *pyramidalis* (Reeve).  
 \* " " " *depressa* (Sow.).  
 \* " " " *micronata* (Sow.).  
 \**Arca nova-zealandia* E. A. Smith.  
 \**Astraea heliotropium* (Mart.).  
 \**Atrina zelandica* (Gray).  
 \**Barnea similis* (Gray).  
 \**Bathytoma nodulivirata* (Murd. & Sut.).  
 \**Calliostoma punctulatum* (Mart.).  
 \**Calyptraea (Sigapatella) maculata* (Q. & G.).  
 \* " " (s. str.) *tenuis* (Gray).  
 \**Cardita calyculata* (L.).  
 \**Chione mesodesma* (Q. & G.).  
 \* " " *spissa* (Desh.).  
 \* " " *stutchburgi* (Gray).  
 \* " " *yatei* (Gray).  
 \**Cominella costata* (Q. & G.).  
 \* " " *lurida* (Phil.).  
 \* " " *virgata* A. Ad.  
 \**Corbula zelandica* (Q. & G.).  
 \**Crepidula costata* (Sow.).  
 \* " " *gregaria* Sow.  
 \* " " *monoxyla* (Less.).  
 \**Cymatium spengleri* (Chemn.).  
 \**Cytherea oblonga* (Hanley).  
 \**Dentalium nanum* Hutt.  
 \**Diplodonta zelandica* (Gray).  
 \**Divaricella cumingi* (Ad. & Ang.).  
 \**Dosinia greyi* Zitt.  
 \* " " *subrosea* (Gray).  
 \**Drillia equistriata* Hutt.  
 \* " " *buchanani* (Hutt.).  
 \* " " *wanganuiensis* (Hutt.).  
 \**Emarginula striatula* Q. & G.  
 \**Epitonium (Cirsotrema) zelebori* (Dkr.).  
 \**Ethalia zelandica* (H. & J.).  
 \**Fulgoraria arabica elongata* (Swains.).  
 \* " " *gracilis* (Swains.).  
 \**Fusinus spiralis* (A. Ad.).  
 \**Glycymeris laticostata* (Q. & G.).  
 \* " " *modesta* (Ang.).  
 \**Leda bellula* A. Ad.  
 \**Lima angulata* Sow.  
 \* " " *bullata* (Born).  
 \**Lithophaga striata* (Hutt.).  
 \**Macrocallista assimilis* (Hutt.).
- \**Maetra ovata rufis* Hutt.  
 \* " " *scalpellum* (Reeve).  
 \**Megalatractus maximus* (Tryon).  
 \**Mesodesma australe* (Gmel.).  
 \* " " *subtriangulatum* (Gray).  
 \* " " *ventricosum* Gray.  
 \**Modiolaria impacta* (Hermann).  
 \**Modiolus australis* (Gray).  
 \**Murex octogonus umbilicatus* (T.-Woods).  
 \* " " *zelandicus* Q. & G.  
 \**Myodora striata* (Q. & G.).  
 \**Natica zelandica* Q. & G.  
 \**Nucula nitidula* A. Ad.  
 \**Ostrea (Anodontostrea) angasi* Sow.  
 \* " " " *arenicola* Tate.  
 \* " " (s. str.) *corrugata* Hutt.  
 \* " " (*Anodontostrea*) *hyotis* (L.).  
 \**Paphia intermedia* (Q. & G.).  
 \**Pecten (Pallium) convexus* Q. & G.  
 \* " " (*Euvola*) *medius* Lamk.  
 \* " " (*Chlamys*) *radiatus* Hutt.  
 \**Phalium achatinum pyrum* (Lamk.).  
 \**Polinices amphialus* (Wats.).  
 \**Protocardia (Nemocardium) pulchella* (Gray).  
 \**Psammobia lineolata* Gray.  
 \* " " *stangeri* Gray.  
 \* " " *zelandica* Desh.  
 \**Siphonalia mandarina* (Duclos).  
 \* " " *nodosa* (Mart.).  
 \* " " *subnodosa* (Hutt.).  
 \**Solariella eyena* (Gould).  
 \**Spisula ordinaria* (E. A. Smith).  
 \**Struthiolaria papulosa* (Mart.).  
 \* " " *vermis* (Mart.).  
 \**Tellina deltoidalis* Lamk.  
 \**Thracia neozelandica* Sut.  
 \**Trochus conicus* (Hutt.).  
 \* " " *tiaratus* Q. & G.  
 \**Trophon ambiguus* (Phil.).  
 \* " " *gouldi* Cossm.  
 \* " " *plebejus* (Hutt.).  
 \**Tugalia intermedia* (Reeve).  
 \**Turritella (Peyrotia) carlotta* Wats.  
 \* " " " *rosea* Q. & G.  
 \* " " (s. str.) *symmetrica* Hutt.  
 \**Venericardia difficilis* (Desh.).  
 \**Zenatia acinaces* (Q. & G.).

Ninety-four species, of which eighty-three also Recent = 88 per cent.

This list appears to represent a somewhat miscellaneous collection of Wanganui fossils sent to Mr. Suter several years ago. Portions of the collections made by John Buchanan in 1866 (Locs. 91 and 92) are probably included in the material.

Manawatu Gorge (East End): Limestone. J. Henderson, 1915.

\**Ostrea tatei* Suter (= *O. hippopus* Tate, non Lamarck).

Age: Pliocene.

Mauriceville, Wellington: Limestone. J. Henderson; 1915.

\**Astraa sulcata* (Mart.). Casts. New as a fossil.

\**Mytilus canaliculus* Mart.

\**Calliostoma pellucidum* (Val.).

\**Panope zelandica* Q. & G.

\* " " *selectum* (Chemn.).

\**Siphonalia mandarina* (?) (Duclos).

\**Lithophaga truncata* (Gray). New as a fossil.

Age: Pliocene (Upper).

Mangapakeha Valley, East of Masterton, Wairarapa District. Geol. Surv. Loc. 117. Hector; 1866.

*Struthiolaria tuberculata* Hutt.

Age: McKay remarks in MS. that *S. tuberculata* indicates a Miocene age. This statement is confirmed to some extent by McKay's brief list of shells from beds underlying the shell limestone, Taueru (*Rep. of Geol. Explor. during 1874-76*, No. 9, 1877, p. 53), and Morgan's list of species from shelly conglomerate and limestone published in "Petroleum and other Minerals in Eastern Wairarapa District," *Parl. Paper C.-16*, 1910, p. 2. The proofs of this paper were not submitted to the writer, and consequently it contains many typographical errors. The list of fossils, corrected according to Suter's nomenclature, is as follows:—

*Dentalium solidum* Hutt.

*Glycymeris* sp.

*Turritella cavershamensis* Harris.

*Cucullaea alta* var. B Hutt.

" " 2 spp.

" sp.

\**Struthiolaria papulosa* (Mart.).

Taipos, Masterton County (near Tenui). Geol. Surv. Loc. 93. Hector; 1866.

*Pecten (Chlamys) semiplicatus* Hutt.

This is an isolated example from a collection of sixty-one specimens, besides types described by Hutton (McKay, MS.). The fossils themselves indicate a Miocene age, as will be seen by reference to McKay's lists (*loc. cit.*, p. 53). The rugged hills known as the Taipos, however, are formed mainly of a thick-bedded, hard sandstone, apparently non-fossiliferous, and probably of pre-Tertiary (certainly pre-Miocene) age. (See Morgan in *Parl. Paper C.-16*, 1910, p. 2, and also Thomson in *8th Ann. Rep. of N.Z. Geol. Surv.*, part of *Parl. Paper C.-2*, 1914, p. 164.)

Castle Point, East Coast of Wellington. Geol. Surv. Loc. 81. McKay; 1875.

*Pecten (Chlamys) semiplicatus* Hutt.

Age: Pliocene (McKay). This is an isolated example from a large collection.

Cliffs at Mouth of Ruamahanga River, Palliser Bay. Geol. Surv. Loc. 749. McKay; 1882.

\**Terebra tristis* Desh.

Age: Pliocene (McKay). This is an isolated specimen from a collection which originally contained ninety-two specimens, or by a later count seventy-five.



## CHAPTER II.

## SOUTH ISLAND.

Cave Hill, East of Bainham, Aorere Valley : Limestone. Geol. Surv. Loc. 746. J. Park; 1888.

- |  |   |
|--|---|
| <i>Anomia</i> sp.  | * <i>Mactra elongata</i> Q. & G.                            |
| * <i>Calyptrea</i> ( <i>Sigapatella</i> ) <i>maculata</i> (Q. & G.). | * <i>Mesodesma australe</i> (?) (Gmel.).                    |
| <i>Cardium patulum</i> (?) Hutt.                                     | * <i>Mytilus edulis</i> L.                                  |
| <i>Crassatellites amplus</i> (?) (Zitt.).                            | <i>Ostrea</i> sp.   |
| <i>Dentalium</i> sp. ?   | <i>Paphia curta</i> (?) (Hutt.).                            |
| <i>Glycymeris</i> sp. ?  | <i>Pecten</i> ( <i>Patinopecten</i> ) <i>palmipes</i> Tate. |
| <i>Lima</i> aff. <i>colorata</i> Hutt.                               | * <i>Placunanomia zelandica</i> (?) (Gray).                 |
| „ sp. ?  |   |

All specimens in a bad condition for identification. The collection contains fifteen species, of which five are Recent = 33 per cent.

Age : Miocene (Oamaruan). Horizon : Ototaran (?).

The locality from which Park collected is near Doctor's Creek, a small tributary of the Aorere. See *Rep. of Geol. Explor. during 1888-89*, No. 20, pp. 213, 239. For a brief description of the caves see *N.Z. Geol. Surv. Bull. No. 3, 1907*, p. 31, para. 7.

Coast between Anatori and Big Rivers, Collingwood County : Greensands. Geol. Surv. Loc. 739. J. Park; 1887.

*Pecten* (*Patinopecten*) *hutchinsoni* Hutt.

Age : Miocene (Oamaruan).

Tata Island, Takaka County : Limestone. Geol. Surv. Loc. 662. Hector; 1887.

*Pecten* (*Patinopecten*) *hutchinsoni* Hutt.

Age : Miocene. Horizon : Ototaran (probably).

Port Hills, near Town of Nelson. Geol. Surv. Loc. 319. McKay; 1874.

*Cardium* (*Fragum*) *maorinum* Sut.

*Lithophaga nelsoniana* Sut.

Age : Upper Miocene. Kanieri Series (McKay) = Pareoran.

These are fossils from a considerable collection, containing specimens collected prior to 1874 (McKay in MS.).

Awatere Valley. Shells collected by J. von Haast (for F. von Hochstetter), F. W. Hutton, and J. Park. (Revised lists.)

	Recorded by
<i>Ampullina suturalis</i> (Hutt.) .. .. .	Hutton.
* <i>Ancilla</i> ( <i>Baryspira</i> ) <i>australis</i> (Sow.) .. .. .	Park.
* <i>Anomia trigonopsis</i> Hutt. .. .. .	Park.
* <i>Atrina zelandica</i> (Gray) .. .. .	Hutton, Park.
* <i>Calliostoma selectum</i> (Chemn.) .. .. .	Park.
* <i>Calyptrea maculata</i> (Q. & G.) .. .. .	Hochstetter.

	Recorded by
* <i>Cantharidus purpuratus</i> (Mart.)	Park.
* " <i>tenebrosus</i> A. Ad.	Hutton.
<i>Cardium spatiosum</i> Hutt.	Park.
* <i>Chione stutchburyi</i> (Gray)	Park.
<i>Crepidula gregaria</i> Sow.	Hutton.
" <i>striata</i> Hutt. "Novara," pl. xv, fig. 10	Hochstetter, Hutton.
* <i>Cylichnella striata</i> (Hutt.)	Park.
* <i>Cytherea oblonga</i> (Hanley)	Park.
<i>Dentalium mantelli</i> Zitt.	Hutton.
" <i>solidum</i> Hutt.	Park.
* <i>Diplodonta zelandica</i> (Gray)	Park.
* <i>Dosinia greyi</i> Zitt.	Hochstetter, Park.
" <i>magna</i> Hutt.	Park.
* <i>Epitonium zelebori</i> (Dkr.)	Park.
* <i>Fulgoraria arabica</i> (Mart.)	Hochstetter, Park.
* " <i>gracilis</i> (Swains.)	Hutton.
* <i>Fusinus spiralis</i> (A. Ad.)	Hutton.
* <i>Glycymeris laticostata</i> (Q. & G.)	Hochstetter, Park.
<i>Hipponix radiatus</i> (Hutt.)	Hutton.
<i>Leda semiteres</i> Hutt. "Novara," pl. xv, fig. 12	Hochstetter.
<i>Ludraria sulcata</i> Hutt.	Hutton.
<i>Maetra chrydæa</i> Sut.	Park, Hutton.
* " <i>elongata</i> Q. & G.	Hutton.
<i>Miomelon corrugata</i> (Hutt.)	Park, Hutton.
* <i>Mytilus magellanicus</i> Lamk. (? <i>striatus</i> Hutt.)	Park.
* <i>Natica zelandica</i> Q. & G.	Park.
* <i>Ostrea angasi</i> Sow.	Park.
" <i>nelsoniana</i> Zitt.	Hutton.
<i>Panope orbita</i> Hutt.	Park.
* <i>Paphia intermedia</i> (Q. & G.)	Hutton.
" n. sp.	Park.
* <i>Pecten convexus</i> Q. & G.	Park.
" <i>triphooki</i> Zitt.	Park.
<i>Polinices huttoni</i> Iher. "Novara," pl. xv, fig. 6	Hochstetter.
* <i>Protocardia pulchella</i> (Gray)	Park.
* <i>Siphonalia caudata</i> (Q. & G.)	Park.
" <i>comoides</i> (Zitt.)	Hochstetter.
* " <i>dilatata</i> (Q. & G.)	Park.
" <i>subnodosa</i> (Hutt.)	Park.
* <i>Solariella egena</i> (Gould)	Park.
" <i>stoliczkai</i> (Zitt.)	Hochstetter.
* <i>Soletellina siliqua</i> Reeve	Hutton.
<i>Struthiolaria canaliculata</i> Zitt.	Hochstetter.
" <i>cincta</i> Hutt.	Hutton, Park.
" <i>cinpulata</i> Zitt.	Hochstetter.
* " <i>papulosa</i> (Mart.)	Park.
* " <i>vermis</i> (Mart.)	Hutton, Park.
" sp. "Novara," pl. xv, fig. 3	Hochstetter.
<i>Trochus circinatus</i> Hutt.	Hutton.
<i>Turritella ambulacrum</i> Sow. (? <i>huttoni</i> Cossm.)	Hutton.
* " <i>rosea</i> Q. & G.	Park, Hutton.
* " <i>symmetrica</i> Hutt.	Park, Hutton.
* <i>Zenatia acinaces</i> (Q. & G.)	Park.

Fifty-nine species, of which thirty-three also Recent = 56 per cent.

Age: Miocene to Pliocene. Awatere Series.

For the original lists or records see—Hochstetter, F. von, and others, "Paläontologie von Neuseeland," *Reise der österr. Fregatte Novara*, Geol. Theil., 1 Bd., 2 Abt., 1864; Hutton, F. W., *Catalogue of the Tertiary Mollusca and Echinodermata of New Zealand*, 1873; Park, J., "On the Marine Tertiaries of Otago and Canterbury," *Trans. N.Z. Inst.*, vol. 37, 1905, pp. 547-48.

## Lower Awatere River. Geol. Surv. Loc. 126. Buchanan; 1867.

T = also collected by J. A. Thomson (see following lists).

- Ampullina (Megatylotus) suturalis* (Hutt.).  
 \**Ancilla (Baryspira) depressa* (Sow.). T.  
 \**Calyptrea* (s. str.) *alta* (Hutt.).  
*Chione meridionalis* (?) (Sow.). T.  
 \* " *mesodesma* (Q. & G.). T.  
*Crepidula gregaria* Sow. T.  
 \* " *monoxyla* (Less.). T.  
 " *striata* (Hutt.). T.  
*Cucullæa alta* Sow.  
 \**Dosinia greyi* Zitt.  
 \**Ethalia zelandica* (H. & J.). T.  
 \**Glycymeris laticostata* (Q. & G.). T.  
*Helicacis imperfectus* Sut.
- Lutraria sulcata* (?) Hutt. T.  
 \**Macrocallista multistriata* (?) (Sow.).  
 \**Maetra ovata* (Grey).  
*Maculopeplum elegantissimum* (Sut.). T.  
*Miomelon corrugata* (Hutt.). T.  
 \**Natica zelandica* Q. & G.  
 \**Ostrea (Anodontostrea) angasi* Sow. T.  
 " " *nelsoniana* Zitt.  
*Polinices (Neverita) huttoni* Iher. T.  
 " " *ovatus* (?) (Hutt.).  
 \**Solaria egena* (Gould).  
*Struthiolaria cincta* Hutt. T.  
 " *cingulata monilifera* Sut.

Twenty-six species, of which twelve also Recent = 46 per cent. Fourteen of these have also been collected by J. A. Thomson.

Age: Upper Miocene and Lower Pliocene (?). Awatere Series.

The exact locality or localities from which Buchanan collected cannot now be identified, but it is probable that his material came from a considerable thickness of strata, and from more than one locality.

## Mudstone Cliffs, Awatere River, Left Bank, above Seddon Railway-bridge. J. A. Thomson; 1914.

B in this and following lists = also collected by Buchanan (loc. No. 126).

- \**Ancilla (Baryspira) depressa* (Sow.). B.  
 \* " *(Amalda) nova-zelandica* (Sow.).  
 " *(Alocospira) papillata* (Tate).  
*Awaterea streptophora* Sut. 22 specimens.  
 " " *evanida* Sut. 4 specimens.  
 \**Bathytoma nodilirata* (Murd. & Sut.).  
 \**Drillia chordata* Sut.
- Lutraria sulcata* (?) Hutt. B.  
 \**Murex zelandicus* Q. & G.  
 \**Protocardium (Nemocardium) pulchella* (Gray).  
*Siphonalia conoidea* (Zitt.).  
 \* " *mandarina* (Duclos).  
 \**Turritella (Peyrotia) carlotta* Wats.

Thirteen species, of which eight also Recent = 61.5 per cent.

Age: Lower Pliocene (?). Awatere Series.

## Awatere Valley, Starborough Creek, above Waterfall. J. A. Thomson; 1914

- \**Anomia trigonopsis* Hutt.  
 \**Chione yatei* (Gray).  
 \**Corbula zelandica* (?) Q. & G.  
*Crepidula gregaria* Sow. B.  
 " *striata* (Hutt.). B.  
 \**Dentalium nanum* Hutt.  
 " *solidum* Hutt.  
 \**Dosinia lambata* (Gould).  
 \**Nucula nitidula* A. Ad.
- Polinices (Neverita) huttoni* Iher. B.  
*Siphonalia conoidea* (Zitt.).  
 " *turrita* Sut.  
 \**Soletellina siliqua* Reeve.  
 \**Spisula ordinaria* (E. A. Smith).  
*Struthiolaria canaliculata* Zitt.  
 \**Tellina glabrella* Desh.  
*Trophon pulcherrimus* Sut.  
 \**Turritella (Peyrotia) carlotta* Wats.

Eighteen species, of which ten also Recent = 56 per cent.

Age: Lower Pliocene or Uppermost Miocene. Awatere Series.

## Awatere Valley, Lower End of Starborough Creek. J. A. Thomson; 1914.

- Ampullina (Megatylotus) suturalis* (Hutt.).  
 \**Ancilla (Baryspira) depressa* (Sow.). B.  
 \**Anomia trigonopsis* Hutt.  
*Bathytoma sulcata excaevata* Sut.  
*Cardium spatiosum* Hutt.  
 \**Chione mesodesma* (Q. & G.). B.  
 \**Crepidula monocryla* (Less.). B.  
*Dentalium solidum* Hutt.  
 \**Dosinia lambata* (Gould).  
 " *magna* Hutt.  
 \**Drillia chordata* Sut.  
 \**Epitonium (Cirsotrema) zelebori* (Dkr.).  
 \**Ethalia zelandica* (H. & J.). B.  
 \**Glycymeris laticostata* (Q. & G.). B.  
*Maetra chrydæa* Sut.  
*Miomelon corrugata* (Hutt.). B.  
*Olivella neozelandica* (Hutt.).  
 \**Ostrea (Anodontostrea) hyotis* (L.).
- \**Ostrea (Anodontostrea) tatei* Sut.  
*Panope orbita* Hutt.  
*Pecten (Patinopecten) crawfordi* Hutt.  
 " " *triphooki* Zitt.  
*Polinices (Neverita) huttoni* Iher. B.  
*Siphonalia conoidea* (Zitt).  
 \* " *mandarina* (Duclos).  
 " *turrita* Sut.  
*Solariella stoliczkai* (Zitt). Common.  
 \**Soletellina siliqua* Reeve.  
*Struthiolaria canaliculata* Zitt.  
 " *cingulata* Zitt.  
 \* " *papulosa* (Mart).  
 \* " *vermis tricarinata* Less.  
*Turritella (Archimediella) huttoni* Cossm.  
 \* " (*Peyrotia*) *rosea* Q. & G.  
 \**Zenatia acinaces* (Q. & G.).

Thirty-five species, of which seventeen also Recent = 49 per cent. Seven were also collected by Buchanan in 1867.

Age: Uppermost Miocene or Lowest Pliocene. Awatere Series.

Starborough Creek is a small stream which flows through Seddon and enters the Awatere below the railway-bridge.

## Railway-cutting South-east of Seddon. J. A. Thomson; 1912.

- Alectrion socialis* (Hutt.).  
*Cominella* sp.?  
 \**Cuspidaria fairchildi* Sut. New as a fossil.  
*Dentalium mantelli* Zitt.  
 \**Malletia australis* (Q. & G.).
- Marginella (Eratoidea) harrisi* (?) Cossm.  
*Miomelon corrugata* (Hutt.). B.  
*Mitra* sp.?  
 \**Nucula strangei* A. Ad.  
 \**Verticipronus mytilus* Hedley. New as a fossil.
- Age: Miocene (Upper) or Pliocene (Lower). Awatere Series.

## East Shore of Lake Grassmere, Half a Mile from Bar: Awatere Beds. J. A. Thomson; 1914.

- Avateria streptophora* Sut.  
 \**Bathytoma nodulirata* (Murd. & Sut.).  
 " *sulcata excaevata* Sut.
- Drillia wanganuiensis* (Hutt.) var.  
*Miomelon corrugata* (Hutt.) B.  
*Surcula fusiformis* (Hutt.)
- Age: Miocene (Upper) or Pliocene (Lower). Awatere Series.

## Tatchell's† Creek Tributary of Flaxbourne River), West of Ward. J. A. Thomson; 1914.

- \**Ancilla (Baryspira) australis* (Sow.).  
*Cardium maorinum* (?) Sut.  
 " *spatiosum* Hutt.  
*Chione meridionalis* (?) (Sow.). B.  
 \**Cominella lurida* (Phil.).  
*Dentalium solidum* Hutt.  
*Leda semiteres* Hutt.  
 \**Limopsis aurita* (Brocchi).  
 " *catenata* Sut.
- Maculopeplum elegantissimum* (Sut.). B.  
*Miomelon corrugata* (Hutt.). B.  
 \**Ostrea (Anodontostrea) angasi* Sow. B.  
*Panope orbita* Hutt.  
*Pecten (Pseudamusium) huttoni* (Park).  
 \**Siphonalia dilatata* (?) (Q. & G.).  
*Struthiolaria cincta* Hutt. B.  
 " *tuberculata* Hutt.  
 \**Turritella* (s. str.) *symmetrica* (?) Hutt.

Eighteen species, of which six also Recent = 33 per cent.

Age: Miocene. Awatere Series (presumably).

† Spelt "Tachall" on Lands and Survey Department's map of Marlborough County.

Waipapa Point and Clarence Valley, Marlborough : Grey Marls. J. A. Thomson ; 1912.

(1.) Grey Marls, Waipapa Point.

\**Emarginula striatula* Q. & G.  
\**Malletia australis* (Q. & G.).  
*Turritella (Torcula) semiconcava* Sut.

(2.) Upper Grey Marls, South Cliff, North Branch Dee.

*Cytherea chariessa* Sut. *Siphonalia subnodosa* (Hutt.).  
*Dentalium mantelli* Zitt. *Struthiolaria tuberculata* Hutt. Juv.  
*Glycymeris globosa* (Hutt.). *Turritella (Torcula) semiconcava* Sut.  
*Polinices gibbosus* (Hutt.).

(3.) Upper Grey Marls, North Branch Dee.

*Acmæa* n. sp.

(4.) Supposed Lower Grey Marls, South Side, North Branch Dee.

*Turritella (Torcula) semiconcava* Sut. Many specimens.

(5.) Upper Grey Marls, Mead Gorge, 20 ft. below Conglomerate.

*Ancilla* (s. str.) *hebera* (Hutt.). \**Limopsis aurita* (Brocchi).  
*Clio (Styliola) rangiana* (Tate). New to fauna *Turritella (Torcula) semiconcava* Sut.  
(i.e., in 1912).

(6.) Grey Marls, Mead Gorge, 25 ft. below Conglomerate.

*Ancilla* (s. str.) *hebera* (Hutt.). Fragment. *Polinices* sp.?  
*Dosinia magna* Hutt. *Turritella (Torcula) semiconcava* Sut.  
*Glycymeris globosa* (Hutt.). \**Zenatia acinaces* (Q. & G.).  
*Paphia curta* (Hutt.).

(7.) Upper Grey Marls, Mead Gorge, 30 ft. below Conglomerate.

*Ancilla* (s. str.) *hebera* (Hutt.). Fragment. *Polinices gibbosus* (Hutt.).  
*Chione meridionalis* (?) (Sow.). *Siphonalia conoidea* (?) (Zitt).  
\**Malletia australis* (Q. & G.). " n. sp.  
*Miomelon corrugata* (?) (Hutt.). Juv. *Turritella (Torcula) semiconcava* Sut.  
*Paphia curta* (?) (Hutt.).

(8.) Upper Grey Marls, Mead Gorge, 100 ft. below Conglomerate.

*Dentalium mantelli* Zitt.  
\**Fulgoraria arabica* (?) (Mart.). Juv.  
*Paphia curta* (Hutt.).

(9.) Upper Grey Marls, Mead Gorge, 130 ft. below Conglomerate.

*Cardium patulum* (?) Hutt. Fragment.

(10.) Upper Grey Marls, Mead Gorge : Derived Boulder in situ.

*Ancilla* (s. str.) *hebera* (Hutt.). \**Mactra scalpellum* Reeve.  
\**Anomia trigonopsis* (?) Hutt. *Paphia curta* (Hutt.).  
\**Calyptrea (Sigapatella) maculata* (Q. & G.). *Polinices* sp. ?  
*Glycymeris globosa* (Hutt.).

(11.) Upper Grey Marls, Mead Gorge : Derived Boulder from Slip.

\**Anomia trigonopsis* (?) Hutt. (*A. walteri* Hect. *Glycymeris globosa* (Hutt.).  
is a synonym.) \**Mactra scalpellum* Reeve.  
\**Calyptrea (Sigapatella) maculata* (Q. & G.). *Paphia curta* (Hutt.).  
*Cucullæa alta* Sow. *Turritella (Torcula) emiconcava* Sut.  
*Dentalium mantelli* Zitt.

## (12.) Slip, Upper Grey Marls, Mead Gorge.

*Ancilla* (s. str.) *hebra* (Hutt.). Fragment.  
 „ (*Alocospira*) *papillata* (Tate). Fragment.

\**Limopsis aurita* (Brocchi).

*Paphia curta* (Hutt.).  
*Polinices gibbosus* (Hutt.).  
*Struthiolaria cincta* (?) Hutt.  
*Turritella (Torcula) semiconcava* Sut.

*Age*: Tertiary. The Grey Marls of Weka Pass, Amuri Bluff, Clarence Valley, &c., were supposed by Hector and McKay to form the closing member of the Cretaceo-Tertiary Formation. It is now certain that they are purely Tertiary in age, but from time to time calcareous mudstones in many localities, and without doubt from varying horizons, have been assigned to the Grey Marl. Some of these rocks are Miocene, others probably pre-Miocene. Thus the term "Grey Marl" is practically without age significance. See J. A. Thomson in *6th Ann. Rep. N.Z. Geol. Surv.*, Parl. Paper C.-9, 1912, p. 9; *7th Ann. Rep. N.Z. Geol. Surv.*, part of Parl. Paper C.-2, 1913, p. 123, &c.; and *Trans. N.Z. Inst.*, vol. 48, 1916, p. 50.

## Deadman's Creek Beds, Marlborough. J. A. Thomson; 1912.

\**Dosinia greyi* (?) Zitt.

\**Fulgoraria arabica* (Mart.).

\* " *depressa* Sut. New as a fossil.

*Glycymeris globosa* (Hutt.).

*Polinices gibbosus* (Hutt.).

*Protocardia sera* Hutt.

*Siphonalia subnodosa* (Hutt.).

*Struthiolaria tuberculata* Hutt.

*Turritella (Torcula) concava* Hutt.

" " *semiconcava* Sut. Many specimens.

*Age*: Miocene.

*Reference*: J. A. Thomson, *7th Ann. Rep. N.Z. Geol. Surv.*, part of Parl. Paper C.-2, 1913, p. 123.

## Oaro Creek, North of Amuri Bluff (900 ft. above Sea-level): Sandy Beds. C. A. Cotton and J. A. Thomson; 1912.

\**Chione mesodesma* (Q. & G.)

\**Cominella virgata* A. Ad.

\* " *zelandica* (Reeve).

\**Dentalium nanum* Hutt.

*Drillia æquistriata* Hutt.

\* " *chorlata* Sut.

\**Glycymeris laticostata* (Q. & G.).

\**Glycymeris modesta* (Ang.).

*Pecten triphooki* Zitt.

*Siphonalia elegans* Sut.

\**Terebratella sanguinea* Leach.

\**Turritella symmetrica* Hutt.

\**Venericardia difficilis* (Desh.).

\* " *lutea* (Hutt.).

*Age*: Upper Pliocene (probably).

The above list was not among those forwarded by Mr. Suter. The determinations were made in 1912. See *6th Ann. Rep. N.Z. Geol. Surv.*, Parl. Paper C.-9, 1912, p. 8.

## Amuri Bluff: Amuri Limestone. Geol. Surv. Loc. 12. McKay, 1873, 1876; J. A. Thomson, 1913.

(M = McKay; T = Thomson.)

*Amusium* n. sp. ? M, T.

*Pecten (Patinopecten) delicatulus* (?) Hutt. M, T.

\* " (*Chlamys*) *zelandica* Gray. M.

" n. sp., near *P. chathamensis*, but distinct. M, T.

*Age*: Upper Cretaceous (Danian) (?). *Horizon*: Uppermost Waiparan.

J. A. Thomson has collected *Amusium zitteli* in the same locality. See *Trans. N.Z. Inst.*, vol. 48, 1916, p. 50.

Amuri Bluff : Raised Beach (450 ft.). Geol. Surv. Loc. 158. McKay; 1876.

\**Cantharidus tenebrosus huttoni* (E. A. Smith).

\**Trochus chathamensis* (Hutt.).

Age: Pleistocene.

McKay made a large collection from a bed of fine beach gravel overlain by 8 ft. to 10 ft. or more of fine loam (MS.).

Amuri Bluff Hill : Raised Beach, 450 ft. above Sea-level. Geol. Surv. Loc. 767. McKay; 1876.

*Cominella monilifera* Hutt.

\**Euthria linea traversi* (?) (Hutt.).

Age: Pleistocene.

Loc. 767 is the same as Loc. 158 (McKay, MS.).

Reference: McKay in *Rep. of Geol. Explor. during 1874-76*, No. 9, 1876, p. 173.

Cheviot Hills Estate, Cheviot County : Upper Pareora Beds. Geol. Surv. Loc. 505. McKay; 1882.

*Pecten (Patinopecten) triphooki* Zitt.

Age: Upper Miocene (possibly Pliocene). Awatere Series, or Upper Pareora beds (McKay in MS. lists written at different times).

Between West Wanganui and Mokihinui, West Coast of Nelson. Geol. Surv. Loc. 637. Hector; 1866.

\**Glycymeris laticostata* (?) (Q. & G.).

*Ostrea* (s. str.) *wuellerstorfi* Zitt.

*Ostrea (Anodontostrea) nelsoniana* Zitt.

*Polinices (Neverita) huttoni* Her.

Also *Terebratula magna* (Hamilton) (determined by J. A. Thomson).

Age: Tertiary (Miocene).

References: Hector in *Abstract Rep. on Progress of Geol. Surv. of N.Z. during 1866-67* (= *Rep. of Geol. Explor.* No. 4), 1868, pp. 14, 15; *N.Z. Geol. Surv. Bull. No. 17*, 1915, p. 92. So far as can be ascertained, Hector's collection (which originally contained over thirty specimens) was made from at least two distinct localities, one north of Kahaurangi Point and the other near the mouth of the Mokihinui River.

White Rock (Gentle Annie) Point, North of Mokihinui. Geol. Surv. Loc. 55. McKay; 1874.

*Ostrea* (s. str.) *wuellerstorfi* Zitt.

Age: Middle Miocene (probably). Horizon: Ototaran (?).

Inland of White Rock Point, Four Miles (or less) North of Mokihinui River. Geol. Surv. Loc. 34. McKay; 1874.

*Amusium zitteli* (Hutt.).

Age: Eocene. Horizon: Kaiatan.

The description given in McKay's MS. list states that the beds he collected from consist of dark marly mudstone similar to the roof of the coal in Coal or Parenga Creek. *Amusium zitteli* was also collected north of the Mokihinui River by P. G. Morgan in 1911 (*N.Z. Geol. Surv. Bull. No. 17*, 1915, p. 81).

Brewery Creek, Mokihinui River, West Coast of Nelson: Conus Beds. Geol. Surv. Loc. 44.  
McKay; 1874.

- |   |  |
|---|--|
| <i>Ampullina (Megatylotus) suturalis</i> (Hutt.). | <i>Maetra</i> aff. <i>chrydæa</i> Sut.               |
| * <i>Atrina zelandica</i> (Gray).                 | <i>Polinices gibbosus</i> (Hutt.).                   |
| <i>Bathytoma haasti</i> (?) (Hutt.).              | "    ( <i>Neverita</i> ) <i>huttoni</i> Iher.        |
| <i>Chione meridionalis</i> (Sow.).                | * <i>Protocardia (Nemocardium) pulchella</i> (Gray). |
| <i>Conus deperditus</i> Sut.                      | * <i>Psammobia zelandica</i> Desh.                   |
| " <i>fusellinus</i> Sut.                          | <i>Sinum (Eunaticina) cinctum</i> (Hutt.).           |
| <i>Corbula canaliculata</i> Hutt.                 | <i>Siphonalia</i> aff. <i>costata</i> (Hutt.).       |
| " <i>humerosa</i> Hutt.                           | <i>Strutholaria cincta</i> Hutt.                     |
| <i>Cytherea sulcata</i> (Hutt.). Fairly common.   | * <i>Tellina eugonia</i> Sut.                        |
| <i>Dentalium solidum</i> Hutt.                    | <i>Turbo</i> n. sp.                                  |
| * <i>Dosinia greyi</i> Zitt. Fairly common.       | <i>Turritella (Torcula) semiconcava</i> Sut.         |
| <i>Epitonium</i> sp. ?                            | * <i>Zenatia acinaces</i> (Q. & G.).                 |
| <i>Galeodea senex</i> (?) (Hutt.).                |  |

Twenty-five species, of which six also Recent = 24 per cent.

The collection consists chiefly of fragments and casts.

*Age*: Upper Miocene. *Horizon*: Pareoran.

*Matrix*: Fine-grained calcareous sandstone or sandy mudstone.

*References*: McKay in *Rep. of Geol. Explor. during 1873-74*, No. 8, 1877, p. 113; Morgan and Bartrum in *N.Z. Geol. Surv. Bull. No. 17*, 1915, pp. 89 *et seq.*; G. F. Harris in *Cat. of Tert. Moll. in Dept. of Geology, Brit. Mus.*—Part I, The Australian Tertiary Mollusca, 1897, p. 36, &c.

Between Ngakawau and Mokihinui Rivers. Geol. Surv. Loc. 281. Hector; 1871.

*Ostrea* (s. str.) *wuellerstorfi* Zitt.

One specimen is a very large accumulation of left valves.

*Age*: Eocene or Miocene—probably the former.

Cape Foulwind, Westport. Geol. Surv. Loc. 823.

*Miomelon corrugata* (Hutt.).

*Age*: Miocene. *Horizon*: Pareoran (probably).

McKay in one of his MS. lists assigns this locality to the Pareora Series, and mentions that the collection (three specimens) contains a very large tooth described by Davis (*Carcharodon megalodon*).

Buller-Mokihinui Subdivision, Westport Division. P. G. Morgan, J. A. Bartrum, and others; 1911-1913. *N.Z. Geol. Surv. Bull. No. 17*, 1915.

Mr. Suter's lists are rearranged according to localities.

Karamea Road, near Corbyvale and Fall Creek.

*Glycymeris* sp. Casts of young, not Recent, shells.

*Age*: Miocene. *Horizon*: Ototaran. *Matrix*: Argillaceous limestone.

Coast-line near Kongahu Point: Coarse Calcareous Grit.

*Ostrea* (s. str.) *wuellerstorfi* Zitt.

*Age*: Miocene. *Horizon*: Ototaran(?).



Mouth of Six-mile Creek, South of Kongahu Point.

*Pecten (Pseudamysium) huttoni* (Park).

Age: Miocene. Horizon: Ototaran.

Near Gentle Annie Point, North of Mokihinui River.

*Hinnites trailli* (?) Hutt. Neanic part of valve missing.

Age: Miocene. Horizon: Ototaran.

Karamea Road, North of Seddonville: Limestone.

*Anomia* sp.  
*Lima* sp.

Age: Miocene. Horizon: Ototaran.

Karamea Road, near Tobin Creek: Kaiata Beds.

*Amysium zitteli* (Hutt.).  
\**Lima bullata* (Born).

Age: Eocene. Horizon: Kaiatan.

Foraminifera from the calcareous Kaiatan mudstone of this locality have been examined by Mr. F. Chapman. His determinations are—

*Cristellaria subalata* Reuss.  
" *cultrata* (Montfort).  
*Haplophragmium incisum* Stache.

Yellow Silver-pine Exploration Company's Tramway, South of Mokihinui Mine. P. G. Morgan; 1911.

*Melina zealandica* Sut. Fragment.  
*Ostrea (Anodontostrea) nelsoniana* Zitt.  
,, (s. str.) *wuellerstorfi* Zitt.

*Trigonia* sp. Fragment.  
*Turritella (Torcula) concava* Hutt. Young shells.

Age: Eocene. Horizon: Islandian (below Kaiatan). Matrix: Dark sandstone and grit, not far above coal horizon.

Road to Denniston, East of Waimangaroa Junction. P. G. Morgan and J. A. Bartrum; 1912.

*Chione meridionalis* (Sow.).  
\* ,, *stutchburyi* (Gray).  
,, sp.  
*Crepidula gregaria* Sow.  
*Dentalium solidum* Hutt.

\**Fulgoraria gracilis* (?) Swains.  
*Glycymeris cordata* (Hutt.).  
*Olivella neozelanica* (Hutt.).  
*Polinices gibbosus* (Hutt.).

Age: Upper Miocene. Horizon: Pareoran. Matrix: Calcareous sandy claystone.

East of Denniston, on Road between Burnett's Face and Kiwi Compressor. P. G. Morgan; 1912.

*Cardium brunneri* Hect.  
*Pecten hochstetteri* Zitt.

Age: Eocene. Horizon: Lowest Kaiatan or Islandian. Matrix: Dark sandy shelly mudstone just above coal-grits and sandstones.

Upper Mackley River, 35 chains South-east of Trig. J. P. G. Morgan; 1912.

*Amusium zitteli* (Hutt.).

*Chione* sp.

*Mastra* sp. Juv.

*Ostrea* aff. *wuellerstorfi* Zitt.

*Pecten* (*Chlamys*) *williamsoni* (?) Zitt.

*Pholadomya neozelanica* Hutt.

*Turritella* aff. *ambulacrum* Sow.

Age: Eocene. Horizon: Lowest Kaiatan or Islandian. Matrix: Dark micaceous argillaceous sandstone.

Cape Foulwind, West of Westport. P. G. Morgan; 1912-13.

*Dentalium mantelli* Zitt. Below limestone.

„ *solidum* Hutt.

*Limopsis morgani* Sut. Generic position not beyond doubt, as the hinge is unknown. Horizon about 150 ft. above limestone.

*Pecten* (*Pseudamusium*) *huttoni* (Park). Above limestone.

Age: Miocene. Horizon: Ototaran to Pareoran.

Omanu (or Back) Creek, South-south-east of Westport. J. A. Bartrum; 1912 or 1913.

*Cytherea* sp. ? Cast.

*Mastra chrydæa* Sut.

*Trochus* sp. Cast of a small species.

Age: Upper Miocene. Horizon: Pareoran. Matrix: Calcareous sandy claystone.

Totara River, between Addison's Flat and Charleston. J. A. Bartrum; 1913.

*Cucullæa ponderosa* var. B Hutt.

\**Dosinia greyi* Zitt.

Age, &c.: As for Omanu Creek.

One Mile below Lyell, Buller River, West Coast of Nelson. Geol. Surv. Loc. 274. McKay; 1874.

*Cardium patulum* (?) Hutt. Juv.

*Chione meridionalis* (Sow.).

*Crepidula gregaria* Sow.

*Cytherea sulcata* (?) (Hutt.). Juv.

*Panope worthingtoni* Hutt.

*Pholadomya neozelanica* Hutt. Cast.

Age: Miocene. Horizon: Ototaran (probably).

This collection was made near the present bridge over the Buller on the main road, but whether from the limestone that there outcrops or underlying calcareous claystone is not known. An examination of the matrix of the fossils (which have not been seen by the writer of this note) would clear up the point.

McKay seems to have made the collection in the latter part of 1874. See *Rep. of Geol. Explor. during 1874-76*, No. 9, 1877, pp. 36 *et seq.* Lyell mentioned on p. 40.

The localities listed below, from Three-channel Flat to Rainy Creek, are in the Reefton Subdivision. See *N.Z. Geol. Surv. Bull. No. 18*, 1917.

Three-channel Flat, North of Inangahua Junction. V. Dellavedova.

*Cucullæa alta* Sow. Collected from Miocene rocks.

Christie's, Westport-Reefton Road, near Inangahua Junction. Geol. Surv. Loc. 50. McKay; 1874.

*Crepidula* sp.?  
*Dentalium solidum* Hutt.

Age: Miocene. Horizon: Below Inangahua limestone.

According to McKay in MSS., the beds collected from are dark marly clays with concretions underlying the limestone at the junction of the Inangahua and Buller rivers. In one list he states that the beds overlie the limestone, but this is believed to be a slip of the pen.

Reference: McKay, *Rep. of Geol. Explor. during 1873-74*, No. 8, 1877, pp. 101-2.

Junction of Inangahua and Buller Rivers, West Nelson. Geol. Surv. Loc. 48. McKay; 1874.

* <i>Anomia undata</i> Hutt. Juv.	<i>Ostrea</i> (s. str.) <i>wuellerstorfi</i> Zitt.
<i>Atrina distans</i> (?) (Hutt.).	<i>Pecten</i> ( <i>Chlamys</i> ) <i>williamsoni</i> (?) Zitt.
<i>Chama huttoni</i> Hect.	* <i>Protocardia</i> ( <i>Nemocardium</i> ) <i>pulchella</i> (Gray).
<i>Fusinus</i> sp.?	<i>Turbo</i> sp.
* <i>Lima angulata</i> Sow.	<i>Turritella</i> sp.
* „ <i>suteri</i> Dall. New as a fossil.	* <i>Xenophora corrugata</i> (Reeve).
<i>Modiolus</i> sp.?	

Very few fossils could be determined; fragments of oyster-shells are numerous in this rock.

Age: Miocene. Horizon: Below Inangahua limestone.

Reference: McKay, *Rep. of Geol. Explor. during 1873-74*, No. 8, 1877, pp. 101-2.

Ferry, Inangahua River, Westport-Reefton Road: Limestone Horizon. Geol. Surv. Loc. 49. McKay; 1874.

* <i>Anomia huttoni</i> Sut.	<i>Pecten</i> ( <i>Pseudamysium</i> ) <i>huttoni</i> (Park).
<i>Cytherea sulcata</i> (?) (Hutt.).	<i>Pholadomya neozelanica</i> Hutt.

Age: Miocene. Horizon: Upper Ototaran (?).

Reference: McKay, *loc. cit.*, p. 101 (Inangahua Crossing). There is some reason for believing that the Inangahua limestone is, on the whole, at a somewhat higher horizon than the Cobden limestone, which may very fairly be assigned to the Ototaran, and thus correlated with the Oamaru or Ototara limestone.

St. Kilda, North of Brighton, West Coast of Nelson. Geol. Surv. Loc. 45. McKay; 1874.

<i>Cardium priscum</i> Sut.	<i>Pecten</i> ( <i>Pseudamysium</i> ) <i>hochstetteri</i> Zitt. Common.
„ <i>waitakiense</i> (?) Sut.	„ ( <i>Chlamys</i> ) <i>scandula</i> Hutt.
<i>Cucullæa alta</i> Sow.	<i>Pinna</i> (?) <i>lata</i> Hutt.
* <i>Dosinia greyi</i> (?) Zitt.	<i>Teredo heaphyi</i> Zitt.
* <i>Lima angulata</i> Sow.	<i>Turritella</i> ( <i>Peyrotia</i> ) <i>patagonica</i> Sow.
* „ <i>suteri</i> Dall.	„ ( <i>Torcula</i> ) <i>semiconcava</i> (?) Sut.
* <i>Ostrea</i> (s. str.) <i>corrugata</i> (?) Hutt. Juv.	* „ (s. str.) <i>symmetrica</i> (?) Hutt.
* <i>Panope zelandica</i> Q. & G.	

Fifteen species, of which six are Recent = 40 per cent.

Age: Miocene. Horizon: Ototaran (?).

Reference: McKay, *loc. cit.*, p. 108. The collection made by McKay contains numerous Foraminifera embedded in highly calcareous marl or soft limestone which passes upward into the Charleston and Fox River limestone (McKay in MS.).

Welshman's Terrace, Fox River, Brighton, West Coast of Nelson : Roof of Coal. Geol. Surv.  
Loc. 28. McKay ; 1873-74.

\**Arca novæ-zealandiæ* E. A. Smith.  
*Cardium* sp. ?  
*Chione chiloensis truncata* (?) Sut.  
" *meridionalis* (?) (Sow.).  
*Cucullæa* n. sp. ?  
*Daphnella* aff. *neozelanica* Sut.  
*Dosinia* sp. ?

*Leda semiteres* Hutt.  
*Olivella neozelanica* (Hutt.). Juv.  
*Panope orbita* (?) Hutt. Juv.  
*Paphia curta* (Hutt.).  
*Pecten (Chlamys) scandula* Hutt.  
*Polinices* sp.  
*Surcula* n. sp. ?

Age : Miocene. Horizon : Waiarekan (?).

Woodpecker Bay, near Brighton, West Coast of Nelson : Island Sandstone. Geol. Surv. Loc. 31.  
McKay ; 1874.

*Lima colorata* Hutt.  
*Ostrea wuellerstorfi* Zitt.  
*Pecten (Pseudamantium) hochstetteri* Zitt. Com-  
mon.  
" (*Patinopecten*) *hutchinsoni* Hutt. Juv.

*Pecten (Patinopecten) marshalli* (?) Sut.  
" *sectus* Hutt.  
*Teredo heaphyi* Zitt.  
\**Turritella* (s. str.) *symmetrica* Hutt.

Age : Miocene. Horizon : Ototaran (?) or Waiarekan (?).

Reference : McKay, loc. cit., pp. 108, 111. "Island sandstone" is undoubtedly a misnomer.  
Correlation must be made with the lower part of the Greymouth Series, not with the Mawheranui Series.

Woodpecker Bay, near Brighton, West Coast of Nelson : Above Sandstone. Geol. Surv. Loc. 33.  
McKay ; 1874.

*Atrina distans* (Hutt.).  
*Chione* aff. *elegans* (Hutt.).  
\**Dosinia greyi* Zitt. Fragment.  
*Pinna lata* (?) Hutt. Fragment.

*Teredo heaphyi* Zitt.  
*Trochus* sp. ?  
*Turris* sp.

Age : Miocene. Horizon : Ototaran (?).

Reference : McKay, loc. cit., pp. 108, 111.

Seal Rock, Woodpecker Bay, near Brighton, West Coast of Nelson. Geol. Surv. Loc. 46.  
McKay ; 1874.

*Lima (Plagiostoma) regia* Sut. (holotype).

Age : Miocene. Horizon : Ototaran (?).

The above-named fossil is figured in *N.Z. Geol. Surv. Pal. Bull. No. 5*, 1917, pl. ix, fig. 1, and is described on pp. 70-71. The collection made by McKay contained at least twenty-six specimens. A specimen of the penguin *Palæudyptes antarcticus* Huxley and the type of the crab *Harpactocarcinus tumidus* Woodward have also been collected on Seal (or Penguin) Island.

References : McKay, loc. cit., p. 111 ; *N.Z. Geol. Surv. Bull. No. 18*, 1917, pp. 93, 94.

Fox River, above Dilemma Creek, Brighton, West Coast of Nelson : Blue Bottom. Geol. Surv.  
Loc. 38 (red number). J. Henderson ; 1913.

*Dentalium solidum* Hutt.  
\**Dosinia greyi* Zitt.  
*Lima paucisulcata* Hutt.  
*Panope orbita* Hutt.  
*Paphia curta* (?) (Hutt.).

*Pleurotomaria tertiaria* McCoy.  
*Polinices gibbosus* (Hutt.).  
\**Psammobia lineolata* Gray.  
*Semele* n. sp. ?

Age : Upper Miocene. Horizon : Pareoran.

Fox River, Brighton, West Coast of Nelson. Geol. Surv. Loc. 125. McKay; 1874.

*Macrocallista pareoraensis* (?) Sut.

\**Madiolus australis* (Gray).

*Sinum (Eunaticina) cinctum* (Hutt.).

Age: Upper Miocene. Horizon: Pareoran.

Reference: McKay, loc. cit. pp. 109-10.

Fox River, West Coast of Nelson: Blue Bottom. P. G. Morgan; March, 1911.

\**Dosinia greyi* Zitt.

*Olivella neozelanica* (Hutt.).

Age: Upper Miocene. Horizon: Pareoran. Matrix: Calcareous sandy claystone.

The last three localities are one and the same.

South of Brighton, on the Coast. P. G. Morgan; March, 1911.

*Pecten (Pseudamusium) hochstetteri* Zitt.

Age: Miocene. Horizon: Ototaran (probably).

Two Miles and a Half South of Brighton, West Coast of Nelson. Geol. Surv. Loc. 37 (red number). J. Henderson; 1913.

*Pecten (Pseudamusium) hochstetteri* Zitt.

Age: Miocene. Horizon: Ototaran (probably).

Hunt Creek, Reefton: Blue Bottom. Geol. Surv. Loc. 39 (red number). J. Henderson; 1913.

*Crepidula gregaria* Sow.

*Ostrea (Anodontostrea) incurva* Hutt.

Age: Upper Miocene. Horizon: Pareoran.

Moonlight Creek, Waiwhero Survey District: Blue Bottom. Geol. Surv. Loc. 41 (red number). J. Henderson; 1912.

\**Ancilla (Baryspira) australis* (Sow.).

*Miomelon corrugata* (?) (Hutt.).

\* " " *mucronata* (Sow.).

\**Natica zelandica* (?) Q. & G.

\**Architectonica (Philippia) lutea* (Lamk.).

*Polinices (Neverita) huttoni* Iher.

*Euthria* aff. *media* (Hutt.).

*Siphonalia conoidea* (Zitt.).

\**Glycymeris laticostata* (Q. & G.).

Age: Upper Miocene. Horizon: Pareoran.

Rainy Creek, Inangahua Valley, above Reefton: Beds overlying Coal. Geol. Surv. Loc. 38. McKay; 1874.

*Cardium* sp.

\**Psammobia lineolata* Gray.

\**Dosinia greyi* (?) Zitt.

*Semele* n. sp. ?

*Panope orbita* Hutt.

Age: Miocene. Horizon: Ototaran (?).

McKay in MS. list states that the locality is near the Inkerman Mine.

Ten-mile Creek, on Coast North of Grey River, Greymouth : Roof of Coal-seam. Geol. Surv.  
Loc. 27. McKay; 1873-74.

*Ancilla* sp. *Struthiolaria tuberculata concinna* Sut.  
*Cardium* aff. *brunneri* Hector. *Tellina* sp.  
*Cominella* sp. *Venericardia* sp.

All the fossils are in a very unsatisfactory condition for determination.

Age: Eocene. Horizon: Islandian.

References: McKay, *loc. cit.*, p. 81; *N.Z. Geol. Surv. Bull. No. 13*, 1911, pp. 61, 62, &c.

Nine-mile Bluff, North of Greymouth. Geol. Surv. Loc. 32. McKay; 1873 (also Hector; 1866).

*Cardium brunneri* (?) Hect. *Pecten (Pseudamusium) hochstetteri* Zitt.  
\**Crassatellites obesus* (?) (A. Ad.). *huttoni* (Park).  
*Epitonium (Cirsotrema) lyratum* (Zitt.). *Teredo heaphyi* Zitt.  
*Galeodea senex* (?) (Hutt.). \**Turritella* (s. str.) *symmetrica* Hutt.

Age: Eocene. Horizon: Islandian.

Reference: McKay, *loc. cit.*, pp. 80, 81, 82, 83. The large oyster mentioned by McKay does not appear to have been in the collection submitted to Mr. Suter.

Bluff, South of Nine-mile Creek (Nine-mile Bluff), Cobden Survey District, Greymouth : Island Sandstone. P. G. Morgan; 1910.

*Pecten (Pseudamusium) hochstetteri* (?) Zitt.  
*Teredo heaphyi* (?) Zitt.

Same locality as last.

Reference: *N.Z. Geol. Surv. Bull. No. 13*, 1911, pp. 61, 62, &c.

Point Elizabeth, Greymouth. Geol. Surv. Loc. 58. McKay; 1873 (also Hector).

*Ostrea* sp.  
*Venericardia* sp.

Age: Miocene (Oamaruan). Horizon: Ototaran.

McKay's manuscript description of the locality implies that he collected from the limestone only.

Reference: McKay, *loc. cit.*, pp. 79-80, 83.

Greymouth : Cobden Limestone. Geol. Surv. Loc. 35. McKay; 1873.

*Amusium zitteli* (Hutt.). \**Lima angulata* Sow.  
*Aturia australis* McCoy. Fragment. *Ostrea* (s. str.) *subdentata* (?) Hutt.  
*Gryphæa tarda* (?) Hutt. *Siphonalia* sp. ?

Age: Miocene (Oamaruan). Horizon: Ototaran.

This was originally a large collection.

Reference: McKay, *loc. cit.*, p. 74.

Greymouth : Cobden Limestone-quarries. Geol. Surv. Loc. 757. 1891 (contributed, but name of donor not recorded).

*Cardium (Fragum) dolichum* Sut.

Same locality as last. The collection originally contained 126 specimens.

Brunner Mine, Grey Valley, Greymouth. Geol. Surv. Loc. 29. Hector, 1870; McKay, 1873.

*Cardium brunneri* Hect.

Age: Eocene (Mawheranuian). Horizon: Islandian.

Callaghan's Hill, Westland. Geol. Surv. Loc. 225. Hector; 1869.

*Galeodea sulcata* (Hutt).

*Pecten (Patinopecten) burnetti* Zitt.

Age: Miocene (Oamaruan). Horizon: Pareoran or Hutchinsonian.

According to McKay's MS. list, the beds collected from consist of dark greensands (lower beds) and blue clays. The collection at one time contained twenty-nine specimens.

Reference: See also N.Z. Geol. Surv. Bull. No. 13, 1911, p. 71, &c.

Kanieri River, Westland. Geol. Surv. Loc. 154. McKay; 1875.

*Pecten (Patinopecten) sectus* Hutt. Juv.

Age: Upper Miocene. Horizon: Pareoran.

Two specimens from a fairly large collection of 162 or 163 specimens.

Waikari Valley, North Canterbury, near the Greta Railway-station, right on the Bank of the Stream. A. Purchas; 1913.

\**Calyptrea (Sigapatella) maculata* (Q. & G.).

*Cominella purchasi* Sut.

\**Crepidula monoxylla* (Less.).

\**Glycymeris laticostata* (Q. & G.).

*Modiolus huttoni* Sut.

\**Mytilus canaliculus* (?) Mart.

*Polinices gibbosus* (Hutt.).

\**Siphonalia dilatata* (Q. & G.).

\* " *nodosa* (Mart.).

" *turrata* Sut.

*Surcula fusiformis* (Hutt.).

\**Turritella (Peyrotia) carlotta* Wats.

" *(Torcula) concaea* Hutt.

" " *semiconcaea* Sut.

Fourteen species, of which seven also Recent = 50 per cent.

Age: Miocene (?).

Weka Pass, North Canterbury: Grey Marls. Geol. Surv. Loc. 71. Hector; 1867.

*Sinum (Eunaticina) miocenicum* (Sut.).

Age: Eocene or Oligocene.

Reference: Hector, Rep. of Geol. Explor. during 1868-69, No. 5, 1869, pp. ix-xii.

Weka Creek, above Weka Pass: Grey Marls. Probably collected by J. A. Thomson; 1913.

*Amusium zitteli* (Hutt.).

\**Limopsis aurita* (?) (Brocchi). Young shells.

Mount Donald, Weka Pass, North Canterbury: Mount Brown Beds. J. A. Thomson; 1913.

\**Glycymeris laticostata* (Q. & G.).

*Lima jeffreysiana* Tate. (Mount Brown, fallen boulder).

*Limopsis* sp. ? Cast with *Flabellum*.

\**Ostrea* (s. str.) *corrugata* Hutt.

*Pecten (Patinopecten) bechami* Hutt.

" " " var. B Hutt. (Sands under Mount Brown limestone.)

*Pecten (Pseudamusium) huttoni* (Park).

" *(Patinopecten) triphooki* Zitt.

Age: Miocene. Horizon: Various.

## Weka Pass, above Mount Brown Beds. A. Purchas; 1913.

- \**Ancilla (Baryspira) australis* (Sow.).  
 \* " " *mucronata* (Sow.).  
 \**Calyptrea* (s. str.) *alta* (Hutt.).  
*Cerithiella* n. sp. ?  
 \**Chione stutchburyi* (Gray).  
 \**Cominella huttoni* Kobelt.  
 \**Dosinia greyi* (?) Zitt.  
 \**Euthria striata* (?) (Hutt.).  
 \**Glycymeris laticostata* (Q. & G.).  
 \**Maetra discors* Gray.  
 \**Mesodesma subtriangulatum* (Gray).
- Miomelon corrugata* (Hutt.).  
 \**Mytilus canaliculus* Mart.  
 \**Natica australis* (Hutt.).  
 \**Ostrea (Anodontostrea) angasi* Sow.  
*Phos cingulatus* (Hutt.).  
*Polinices gibbosus* (Hutt.).  
 " (*Neverita*) *ovatus* (Hutt.).  
 \**Siphonalia mandarina* (Duclos).  
*Struthiolaria* sp.  
 \**Terebra tristis* Desh.  
*Trochus conicus* Hutt.

Twenty-two species, of which fifteen also Recent = 68 per cent.

Age: Pliocene. Horizon: Motunau beds.

## Weka Pass, between Waipara and Waikari, North Canterbury. J. A. Thomson; 1913.

I. UPPER MOUNT BROWN LIMESTONE (ZONE OF *Pachymagas parki*). A, M.

A = Main Mount Brown limestone (railway-cutting, 43½ miles)—a series of limestones separated by sands: A<sub>1</sub> = lowest, A<sub>7</sub> = highest bed.

M = Upper part of main body of Mount Brown limestone (valley behind cuesta, lower end of Weka Pass).

- Ancilla (Alocospira) papillata* (Tate). A<sub>1</sub>, A<sub>4</sub>.  
 \**Anomia trigonopsis* Hutt. A<sub>1</sub>, A<sub>2</sub>, A<sub>5</sub>.  
*Lima paucisulcata* Hutt. M.
- \**Mytilus magellanicus* (?) Lamk. A<sub>2</sub>.  
 \**Ostrea (Anodontostrea) angasi* Sow. M.  
*Pecten (Patinopecten) beethami* Hutt. M.

II. UPPERMOST MOUNT BROWN BEDS (ZONE OF *Neothyris sufflata* Tate). B<sub>1</sub>, D to L, O, Z.

K, H, E, D = Sands between main Mount Brown limestone and uppermost Mount Brown limestone.

K = Weka Pass Stream above suspension bridge and below H, E, D, in horizon.

H = Weka Pass Stream above suspension bridge: shell-bed.

E = Same shell-bed below suspension bridge.

D = Same shell-bed in Weka Creek, above bridge.

B<sub>1</sub>, F, L = *Hinnites* shell-bed at base of uppermost Mount Brown limestone, slightly higher than shell-beds K, H, E, D.

B<sub>1</sub> = In railway-cutting (43 m. 2-3 ch.). (See also IV, B<sub>3</sub>.)

F = In Weka Pass Stream.

L = In tributary of Weka Pass Stream crossing railway between the two cuttings.

O, Z = Uppermost Mount Brown limestone.

O = Cuesta above railway-line, behind Weka Pass ridge.

Z = In Weka Pass Creek.

- Ampullina (Megatylotus) suturalis* (Hutt.). K.  
 \**Ancilla (Amalda) nova-zelandiae* (Sow.). D.  
 " (*Alocospira*) *papillata* (Tate). H, K, Z.  
 \**Anomia trigonopsis* Hutt. Z.  
 \**Calyptrea (Sigapatella) maculata* (Q. & G.). D.  
 \**Cochlodesma angasi* (Crosse and Fischer). F.  
*Crassatellites attenuatus* (Hutt.). Fragment. H.  
*Crepidula gregaria* Sow. D, E, Z.  
 \* " *monoxyla* (Less.). H.  
 " *striata* (Hutt.). E.  
 †*Cucullaea alta* Sow. var. B Hutt. K.  
 †*Cytherea sulcata* (Hutt.). E, F, H, Z.  
*Dentalium solidum* Hutt. D, F.  
 \**Dosinia greyi* Zitt. K.  
 \**Fulgoraria arabica* (Mart.). D, H.
- Galeodea senex* (?) (Hutt.). Z.  
 " *sulcata* (Hutt.). E.  
*Hinnites trillii* Hutt. F.  
*Latirus (Leucozonia) brevisrostris* (Hutt.). D.  
*Lima colorata* Hutt. K.  
 " *paleata* Hutt. Z.  
 " *paucisulcata* Hutt. F.  
*Limopsis zitteli* Iher. D, H, K.  
*Maculopeplum elegantissimum* (Sut.). E.  
 \**Natica australis* (Hutt.). K.  
 \**Ostrea (Anodontostrea) angasi* Sow. F.  
*Pecten (Patinopecten) beethami* Hutt. O, Z.  
 " (*Pallium*) *burnetti* Zitt. B<sub>1</sub>, D, H, O.  
 " (*Patinopecten*) *cravfordi* Hutt. Fragments. B<sub>1</sub>, E, L, O.



- Pecten (Pseudamysium) hochstetteri* Zitt. Z.      *Protocardia alata* Sut. Fragment. D.  
 " " *huttoni* (Park). F.      *Siphonalia costata* (Hutt.). D, K.  
 " (*Patinopecten*) *triphooki* (?) Zitt. Frag- \* " *dilatata* (Q. & G.). E.  
 ment. Z.      *Surcula fusiformis* (Hutt.). K.  
 " (*Chlamys*) *williamsoni* Zitt. K.      \**Tellina eugonia* Sut. K.  
 " n. sp. Fragment. B<sub>1</sub>.      *Thracia* n. sp. D.  
*Placunanomia incisura* Hutt. H.      *Turritella (Torcula) concava* Hutt. K.  
*Polinices gibbosus* (Hutt.). D, E.      \**Venericardia purpurata* (Desh.). H.

Forty-four species, of which twelve also Recent = 27 per cent.

### III. LOWER BAND OF MOUNT BROWN LIMESTONE IN MOUNT DONALD. W, X.

W = Col to south-west of Mount Donald (exact horizon uncertain).

X = Between W and Mount Donald.

- \**Anomia trigonopsis* Hutt. X.      *Pecten (Pallium) burnetti* Zitt. W.  
*Astarte* n. sp. Fragment. W.      *Turritella (Torcula) concava* Hutt. W.  
 \**Chione stutchburji* (Gray). X.      \**Venericardia purpurata* (Desh.). W.  
 \**Diplodonta zelandica* (Gray). W.

### IV. MOTUNAU BEDS, WEKA PASS. B<sub>3</sub>, S, T.

B<sub>3</sub> = In railway-cutting (43 m. 2-3 ch.).

S, T = In Weka Creek, below bridge, right bank; mudstones with *Chione*.

S = Oyster-beds above T; T = Shell-beds above.

- \**Ancilla (Amalita) nova-zelandica* (Sow.). B<sub>3</sub>, T.      \**Mytilus canaliculus* Mart. T.  
 \**Anomia huttoni* Sut. B<sub>3</sub>, T.      \**Ostrea (Anodontostrea) angasi* Sow. B<sub>3</sub>.  
*Barnea* n. sp. Part of a valve. T.      " " *arenicola* Tate. S.  
 \**Calyptrea (Sigapatella) maculata* (Q. & G.). B<sub>3</sub>, T.      " " *manubriata* Tate. B<sub>3</sub>.  
 \* " (s. str.) *tenuis* (Gray). T.      " " New to fauna.  
*Chione chiloensis* (Phil.). B<sub>3</sub>.      \* " " *tatei* Sut. B<sub>3</sub>, T.  
*Crepidula gregaria* Sow. B<sub>3</sub>.      \**Polinices (Neverita) ovatus* (Hutt.). B<sub>3</sub>.  
*Dentalium solidum* Hutt. B<sub>3</sub>.      \**Psammobia lineolata* Gray. T.  
 \**Dosinia subrosea* (Gray). B<sub>3</sub>.      \**Siphonalia dilatata* (Q. & G.). T.  
 \**Glycymeris laticostata* (Q. & G.). B<sub>3</sub>.      \**Spisula equilateralis* (Desh.). B<sub>3</sub>, T.  
*Mactra chrydæa* Sut. T.      *Trochus conicus* (Hutt.). T.  
 \**Mesodesma australe* (Gmel.). B<sub>3</sub>.

Twenty-two species, of which thirteen also Recent = 59 per cent.

### V. SPECIMENS WITHOUT SPECIAL LETTERING.

- \**Anomia trigonopsis* Hutt. Cuesta between North Dean and Waipara River.  
 \**Epitonium (Cirsotrema) zelebori* (Dkr.). Between Weka Pass stone and lower calcareous beds, Waipara River.  
 \**Limopsis aurita* (?) (Brocchi). Grey Marls, Weka Pass.  
 \**Ostrea (Anodontostrea) angasi* Sow. Sands below Mount Brown zone, between Mount Brown and Waipara River.  
*Pecten (Patinopecten) beethami* Hutt. North Dean cuesta.  
 " (*Pallium*) *burnetti* Zitt. North Dean cuesta.  
*Struthiolaria tuberculata* Hutt. Lower Mount Brown beds, Weka Pass.

COLLECTIONS MADE BY J. A. THOMSON, 1913.

(1.) Main Mount Brown Limestone, Foot of the Dip-slope of the Cuesta which faces the Weka Pass.

\**Ostrea (Anodontostrea) angasi* Sow.

(2.) Barnacle Conglomerate, Lower Mount Brown Beds, Weka Pass Stream, South of 44-mile Peg.

\**Anomia trigonopsis* Hutt.

## (3.) Motunau Beds, Weka Pass, First Railway-cutting South of 43-mile Peg.

- Ancilla* (s. str.) *hebra* (Hutt.). \**Dosinia greyi* Zitt.  
 \* " " (*Baryspira*) *mucronata* (Sow.). *Glycymeris globosa* (?) (Hutt.).  
*Cerithiella* n. sp. \* " " *laticostata* (Q. & G.).

## (4.) Upper Calcareous Band, Mount Brown Beds, Dean Range Cuesta, and Sandy Beds immediately below it, overlooking Waipara River.

\**Anomia trigonopsis* Hutt.

## (5.) Lower Calcareous Band, Mount Brown Beds, South-west of Mount Brown.

\**Anomia trigonopsis* Hutt.  
*Ostrea* n. sp. ?

## (6.) Sandy Beds, Lower Mount Brown Beds, Boby Creek, below Bridge.

*Nucula sagittata* Sut.

Mount Brown, Middle Waipara : Upper Calcareous Band. J. A. Thomson ; 1913.

*Siphonalia* n. sp. One cast with three nodulous keels on body-whorl ; nearest to *S. nodosa*, but larger and distinct.

This is the same locality as Geol. Surv. Loc. 723.

Lower Gorge of the Waipara. Geol. Surv. Loc. 228. Hector ; 1867.

*Pecten (Pseudamusium) huttoni* (Park).

The beds at the Lower Waipara Gorge itself correspond to the Motunau beds, of Pliocene age. It is not likely that the specimen named above came from the Motunauan horizon. It is probably from one of the older horizons in the immediate neighbourhood.

Lower Waipara : Motunau Beds. J. A. Thomson ; 1913.

A to H = Motunau beds on left side of the river from the bridge, towards the sea. A is the lowest bed, and the others follow in upward order to H. A = shell conglomerate on the road-cutting.

- |   |  |
|---|--|
| * <i>Ancilla (Baryspira) australis</i> (Sow.). H.   | * <i>Maetra ovata</i> (Gray). F <sub>1</sub> .                                       |
| * " " <i>depressa</i> (Sow.). H.                    | * <i>Myodora striata</i> (Q. & G.). H.   |
| * " " <i>mucronata</i> (Sow.). D.                   | * <i>Ostrea (Anodontostrea) angasi</i> Sow. A, B, E, F.                              |
| * <i>Anomia huttoni</i> Sut. A.                     | * " (s. str.) <i>corrugata</i> Hutt. B.  |
| * <i>Atrina zelandica</i> (Gray). A.                | * " ( <i>Anodontostrea</i> ) <i>hyotis</i> (L.). A, E.                               |
| * <i>Calliostoma waiparaense</i> Sut. C.            | * " " <i>nelsoniana</i> (?) Zitt. D.   |
| * <i>Cerithiidea bicarinata</i> (Gray). H.          | * " " <i>tatei</i> Sut. A.   |
| * " <i>tricarinata</i> Hutt. H. New as a fossil.    | * <i>Paphia curta</i> (?) (Hutt.). C. Sands between Grey Marls and Mount Brown beds. |
| * <i>Chione stutchburyi</i> (Gray). F, H.           | * <i>Pecten (Pallium) convexus</i> Q. & G. A.  |
| * <i>Crepidula gregaria</i> Sow. B, D.              | " ( <i>Patinopecten</i> ) <i>crayfordi</i> Hutt. A.                                  |
| * " <i>monozyla</i> (Less.). H.                     | " " <i>triphooki</i> Zitt. A.  |
| * <i>Cytherea subsulcata</i> (Sut.). H.             | * <i>Tellina disculus</i> Desh. H.   |
| * <i>Glycymeris laticostata</i> (Q. & G.). B, C, D. | * <i>Turritella</i> (s. str.) <i>symmetrica</i> Hutt. H.                             |
| * <i>Lutraria solida</i> Hutt. D.                   |  |

Twenty-seven species, of which twenty also Recent = 74 per cent.

Age : Pliocene.

Lower Waipara : Grey Marls. J. A. Thomson ; 1913.

- |                                    |  |
|------------------------------------|--|
| <i>Chione meridionalis</i> (Sow.). | * <i>Modiolus australis</i> (Gray).            |
| <i>Dentalium solidum</i> Hutt.     | * <i>Turritella (Peyrotia) carlottae</i> Wats. |
| <i>Limopsis zitteli</i> Iher.      |  |

## Kowhai River.† J. A. Thomson; 1913.

A, B, and C are localities in the Motunau beds in the lower end of the basin, seaward side Mount Brown cuesta, B and C being oyster-beds. Probably C is the lowest and A the highest bed.

\**Anomia huttoni* Sut. C.

\**Ostrea (Anodontostrea) angasi* Sow. A, C.

\**Architectonica (Philippia) lutea* (Lamk.). C.  
New as a fossil.

\* " (s. str.) *corrugata* Hutt. A.

\* " (*Anodontostrea*) *hyotis* L. A, B, C.

\**Chione stutchburji* (Gray). A.

\**Psammobia lineolata* Gray. C.

Age: Pliocene.

## Middle Waipara. J. A. Thomson; 1913.

F = Grey Marl in a tributary of Boby Creek, above Onepunga Homestead.

H = Grey Marl between the Waipara River and North Dean.

B = Sands below the Mount Brown limestone in Boby Creek; 1 to 5 are various distances down creek between the bridge and the Waipara River, but the succession is not continuous and the collections may be lumped under B.

D = Lower Mount Brown limestone forming the watershed between Onepunga and Mount Grey.

K, L = Adjacent pockets in the main Mount Brown limestone, between Mount Brown and the Waipara River.

*Ancilla (Alocospira) papillata* (Tate). D.

\**Malletia australis* (Q. & G.). F.

\**Anomia trigonopsis* Hutt. B<sub>1</sub>, L.

*Nucula sagittata* Sut. B<sub>3</sub>, B<sub>5</sub>.

*Corbula canaliculata* Hutt. H.

*Pecten (Patinopecten) beethami* Hutt. B<sub>1</sub>.

\**Diplodonta zelandica* (?) (Gray). F.

" (*Pseudamysium*) *huttoni* (Park). B<sub>1</sub>, D.

*Glycymeris cordata* (Hutt.) D.

" (*Chlamys*) *williamsoni* (?) Zitt. K.

\* " *laticostata* (Q. & G.). D.

\* " *zelandica* Gray. K.

*Lima colorata* Hutt. K.

*Polinices gibbosus* (Hutt.). D.

\**Limopsis aurita* (Brocchi). F.

*Siphonalia costata* (Hutt.). F.

" *zitteli* Iher. D.

\**Turritella (Peyrotia) carlotta* Wats. H.

*Maculopeplum elegantissimum* (Sut.). D.

Nineteen species, of which seven also Recent = 37 per cent.

Age and horizon: Various.

## Middle Waipara: Motunau Beds. J. A. Thomson; 1913.

O = Lowest cuesta of Motunau beds exposed alongside Mount Brown Road.

P = First exposure of Motunau beds, left side, Waipara River, quarter-mile below end of Mount Brown cuesta.

S = First exposure of Motunau beds, Waipara River, right side, opposite end of Mount Brown cuesta. T = 4 ft. below S.

U = 15-20 ft. below T.

\**Ancilla (Baryspira) australis* (Sow.). S.

*Crepidula striata* Hutt. S.

\* " " " *pyramidalis* (Reeve).  
S.

*Cymbiola (Miomelon) corrugata* (?) (Hutt.). S.

\* " " " *mucronata* (Sow.). T, and  
top shell-bed above S.

\**Cytherea oblonga* (?) (Hanley). O.

*Dentalium solidum* Hutt. O.

\**Anomia huttoni* Sut. U, and top shell-bed  
above S.

\**Diplodonta zelandica* (Gray). Juv. S.

\**Dosinia greyi* Zitt. P, S.

\* " *subrosea* (Gray). O, P.

\**Barnea similis* (Gray). S.

\**Fulgoraria (Alcithoë) arabica* (Mart.). S.

\**Calyptrea (Sigapatella) maculata* (Q. & G.). P, S.

\**Glycymeris laticostata* (Q. & G.). O.

\**Cerithidea bicarinata* (Gray). P, T, U,

\**Macla discors* (?) Gray. T. Cast.

*Chione chilensis* (Phil.). P, S.

\**Mangilia sinclairi* (E. A. Smith). S.

\* " *yatei* (Gray). S, T.

\**Modiolaria impacta* (Hermann). S. A much-  
elongated form, but not *M. elongata* (Hutt.).

\**Chiton quoyi* Desh. S. New as a fossil.

\**Modiolus australis* (Gray). P, S.

\**Cominella adspersa* (Brug.). S, T.

\**Mytilus magellanicus* Lamk. Loc. ?

\* " *huttoni* Kobelt. S, T.

\**Ostrea (Anodontostrea) angasi* Sow. S, T, U.

\**Crepidula costata* (Sow.). S.

" *nelsoniana* Zitt. O, U.

\* " *gregaria* Sow. O, T.

*Plejona huttoni pseudorarispina* (?) Sut. S.

\* " *monoxyla* (Less.). O, P, S.

† According to the geographical order adopted (see p. 2) this list should follow all the Waipara River lists.

- Rissoina vana* (Hutt.). S.  
 \**Seila chathamensis* Sut. var. S. More cylindrical than Recent specimens. New as a fossil.  
 \**Siphonalia dilatata* (Q. & G.). S, U.  
 \* " *mandarina* (?) (Duclos). O, S.  
 " *subreflexa* (Sow.). S.  
 \**Spisula aequilateralis* (Desh.). O.  
 \**Struthiolaria papulosa* (Mart.). T.

- \**Tellina deltoidalis* Lamk. P, T, U,  
 \* " *disculus* Desh. P.  
 \**Terebra tristis* Desh. S.  
 \**Trochus tiaratus* Q. & G. S.  
 \**Trophon corticatus* (Hutt.). S.  
 \**Venericardia difficilis* (Desh.). U.  
 \* " *purpurata* (Desh.). S.

Forty-six species, of which thirty-seven also Recent = 80 per cent.

Age: Pliocene.

Middle Waipara: Weka Pass Stone, behind Onepunga Homestead. J. A. Thomson; 1913.

- Dentalium solidum* Hutt.  
*Dentalucina* (Here) n. sp. Casts.  
*Epitonium (Cirsotrema) lyratum* (Zitt.).  
*Euthria media* (?) (Hutt.).  
*Leucosyrinx alta* (Harris).  
 †*Lima (Acesta?) imitata* Sut.

- \**Limopsis aurita* (Brocchi).  
*Maculopeplum elegantissimum* (Sut.).  
*Pecten (Pseudamusium) huttoni* (Park).  
*Struthiolaria spinosa* Hect.  
*Teredo heaphyi* Zitt.

Age: Eocene (?).

This is perhaps the best collection yet made from the Weka Pass stone. For general lists of fossils from this rock see von Haast, *Rep. of Geol. Explor. during 1870-71*, No. 6, p. 13 (most of the fossils are probably from the Curiosity Shop, however), and Hutton, *Q.J.G.S.*, vol. 41, 1885, pp. 554-56 (see also pp. 266-78).

Waipara: Upper Horizon, Motunau Series. A. Purchas; 1913. (Exact locality not stated.)

- \**Ancilla (Baryspira) australis* (Sow.).  
 " (s. str.) *hebra* (Hutt.).  
 \* " (*Amalda*) *novae-zelandiae* (Sow.).  
 " (*Alocospira*) *papillata* (Tate).  
 \**Arca novae-zelandiae* E. A. Smith.  
*Bathytoma haasti* (Hutt.).  
*Chione chilensis* (Phil.).  
 " *meridionalis* (Sow.).  
 " *speighti* Sut.  
 \**Cochlodesma angasi* (C. & F.).  
 \**Cominella huttoni* Kobelt.  
 \**Crassatellites obesus* (A. Ad.).  
*Crepidula gregaria* Sow.  
*Cucullæa alta* Sow.  
*Dentalium mantelli* Zitt.  
 " *solidum* Hutt.  
 \**Dosinia greyi* Zitt.  
 " *magna* Hutt.  
 \**Ethalia zelandica* (H. & J.).  
*Euthria media* (Hutt.).  
 \**Fulgoraria (Alcihoë) arabica* (Mart.).  
 \* " *gracilis* (Swains.).  
 \**Glycymeris striatularis* (Lamk.).

- Miomelon corrugata* (Hutt.).  
*Olivella neozelandica* (Hutt.).  
*Paphia curta* (Hutt.).  
*Phos cingulatus* (Hutt.).  
*Plejona huttoni pseudorarispina* Sut.  
 \**Polinices amphialus* (Wats.).  
 " *gibbosus* (Hutt.).  
 \**Psammobia lineolata* Gray.  
*Sinum (Eumaticina) elegans* Sut.  
*Siphonalia costata* (Hutt.).  
 \* " *dilatata* (Q. & G.).  
 \* " *mandarina* (Duclos).  
 \* " *nodosa* (Mart.).  
 " *orbata* Hutt.  
 " *subnodosa* (Hutt.).  
 " n. sp.  
*Struthiolaria cincta* Hutt.  
 " *cingulata* Zitt.  
*Surcula* n. sp.  
*Trophon* n. sp.  
 \**Turritella (Peyrotia) carlotta* Wats.  
 " (*Torcula*) *semiconcava* Sut.  
 \* " (s. str.) *symmetrica* Hutt.

Forty-six species, of which eighteen also Recent = 39 per cent.

This collection is probably not from the Motunau beds, but from a Pareoran horizon. Compare with Dr. Thomson's collection (last list but one), with which it has only nine species in common.

† This specimen came from the Weka Pass stone on the cuesta running from the Waipara River towards the Deans. See *N.Z. Geol. Surv. Pal. Bull. No. 5*, p. 70. I do not remember another specimen.—J. A. T.

Broken River, Trellissick Basin : Based upon Hutton's Catalogue of the Tertiary Mollusca of New Zealand, 1873. (Revised names.)

## 1. UPPER HORIZON.

- |   |  |
|---|--|
| * <i>Anomia huttoni</i> Sut.                    | <i>Glycymeris globosa</i> (Hutt.).             |
| * <i>Bathytoma sulcata</i> (Hutt.). Type.       | * " <i>laticostata</i> (Q. & G.).              |
| * <i>Calyptrea maculata</i> (Q. & G.).          | * <i>Modiolus australis</i> (Gray).            |
| <i>Cardium spatiosum</i> Hutt.                  | <i>Paphia curta</i> (Hutt.). Type.             |
| <i>Cerithium hectori</i> Harris. Type.          | <i>Plejona (Athleta) huttoni</i> (Sut.). Type. |
| <i>Cominella carinata</i> (Hutt.). Type.        | <i>Polinices huttoni</i> Iher. Type.           |
| <i>Crassatellites amplus</i> (Zitt.).           | " <i>ovatus</i> (Hutt.).                       |
| * <i>Crepidula monozyla</i> (Less.).            | * <i>Serpulorbis siphio</i> (Lamk.).           |
| <i>Cytherea enysi</i> Hutt.                     | <i>Struthiolaria tuberculata</i> Hutt. Type.   |
| <i>Dosinia magna</i> Hutt. Type.                | <i>Turbo superbus</i> Zitt.                    |
| * " <i>subrosea</i> (Gray).                     | <i>Turritella cavershamensis</i> Harris.       |
| * <i>Fulgoraria (Aleithoë) arabica</i> (Mart.). | * " <i>rosea</i> Q. & G.                       |

Twenty-four species, of which nine also Recent = 37 per cent.

## 2. MIDDLE HORIZON.

*Ancilla* (s. str.) *hebra* (Hutt.).

## 3. LOWER HORIZON.

- |  |  |
|--|--|
| * <i>Calyptrea maculata</i> (Q. & G.).               | <i>Marginella dubia</i> Hutt. Type.                  |
| * <i>Cantharidus tenebrosus huttoni</i> E. A. Smith. | <i>Modiolaria elongata</i> (Hutt.). Type.            |
| <i>Cardium patulum</i> Hutt.                         | <i>Ostrea subdentata</i> Hutt. Type.                 |
| <i>Crassatellites attenuatus</i> (Hutt.). Type.      | <i>Panope orbita</i> Hutt.                           |
| <i>Crepidula striata</i> (Hutt.).                    | " <i>worthingtoni</i> Hutt.                          |
| <i>Cylichnella enysi</i> (Hutt.). Type.              | <i>Pecten athleta</i> Zitt.                          |
| <i>Cymatium minimum</i> (Hutt.).                     | " <i>chathamensis</i> Hutt. Type.                    |
| <i>Cypræa oculatella</i> Tate.                       | " <i>huttoni</i> (Park) or <i>hochstetteri</i> Zitt. |
| * <i>Divaricella cumingi</i> (Ad. & Ang.).           | " <i>yahliensis</i> T.-Woods.                        |
| * <i>Lima bullata</i> (Born).                        | <i>Polinices ovatus</i> (Hutt.).                     |
| <i>Maetra attenuata</i> Hutt. Type.                  | <i>Protocardia sera</i> Hutt. Type.                  |
| <i>Maculopeplum attenuatum</i> (Hutt.). Type.        | <i>Vexillum enysi</i> (Hutt.). Type.                 |

Twenty-four species, of which four also Recent = 17 per cent.

Porter and Thomas Rivers, Trellissick Basin : Fan-coral Bed. Geol. Surv. Loc. 239. McKay : 1879.

- |  |   |
|--|---|
| * <i>Ancilla (Amalda) nova-zelandica</i> (Sow.). | <i>Modiolus dolichus</i> Sut.               |
| * <i>Capulus australis</i> (Lamk.).              | * <i>Myodora subrostrata</i> E. A. Smith.   |
| * <i>Corbula zelandica</i> Q. & G.               | <i>Panope worthingtoni</i> Hutt.            |
| <i>Cylichnella enysi</i> (Hutt.).                | <i>Paphia curta</i> (Hutt.).                |
| <i>Dentalium solidum</i> Hutt.                   | <i>Pecten (Patinopecten) beethami</i> Hutt. |
| * <i>Diplodonta zelandica</i> (?) (Gray).        | * " (Pallium) <i>convexus</i> Q. & G.       |
| * <i>Divaricella cumingi</i> (Ad. & Ang.).       | " (Patinopecten) <i>triphooki</i> Zitt.     |
| * <i>Dosinia carulea</i> (?) Reeve.              | * <i>Pholadidea tridens</i> (Gray).         |
| <i>Glycymeris globosa</i> (Hutt.).               | <i>Polinices gibbosus</i> (Hutt.).          |
| * <i>Lima angulata</i> Sow.                      | <i>Protocardia sera</i> Hutt.               |
| * " <i>lima</i> (L.).                            | * <i>Siphonium planatum</i> Sut.            |
| * <i>Loripes concinna</i> Hutt.                  | <i>Solariella pratextilis</i> Sut.          |
| * <i>Maetra elongata</i> Q. & G.                 | " <i>sulcatina</i> Sut.                     |
| * <i>Modiolus australis</i> (Gray).              | <i>Turritella (Torcula) concava</i> Hutt.   |

Twenty-eight species, of which fifteen also Recent = 53.6 per cent.

Age : Miocene (Oamaruan). Horizon : Doubtful. McKay correlated the fan-coral bed with the Hutchinson Quarry beds (= Hutchinsonian).

Notwithstanding the high percentage of Recent species in the above list, a correlation with the Upper Oamaruan (Awamoan) seems to be justified according to our present knowledge. In MS. McKay remarks, "The brachiopods are identical [with] or very similar to those of the Ototara limestone at Kakanui Mouth, Otago." It is noteworthy that *Pecten beethami* and *Pecten triphooki* have not been recorded in other collections from the Trellissick Basin. Both, however, occur in the Oamaruan of the Oamaru district.

Trellissick Basin : Fan-coral Bed. Geol. Surv. Loc. 243. Enys ; 1866-79.

- |  |  |
|--|--|
| * <i>Ancilla (Baryspira) australis</i> (Sow.).       | * <i>Limopsis aurita</i> (Brocchi).                  |
| " ( <i>Alocospira</i> ) <i>papillata</i> (Tate).     | " <i>zitteli</i> Iher.                               |
| <i>Calliostoma filiferum</i> Sut. Fragments.         | * <i>Maetra elongata</i> Q. & G.                     |
| " <i>oryctum</i> Sut. Fragment.                      | <i>Modiolaria elongata</i> (Hutt.).                  |
| * " <i>punctulatum</i> (?) (Mart.). Fragment.        | * <i>Natica zelandica</i> Q. & G.                    |
| * <i>Calyptrea (Sigapatella) maculata</i> (Q. & G.). | <i>Pecten (Patinopecten) delicatulus</i> Hutt.       |
| <i>Chione subroborata</i> Tate. Juv. New to fauna.   | " " <i>palmipes</i> Tate. Juv.                       |
| * <i>Corbula zelandica</i> Q. & G.                   | " ( <i>Chlamys</i> ) <i>williamsoni</i> Zitt.        |
| <i>Crepidula gregaria</i> Sow.                       | <i>Polinices (Neverita) oyalus</i> (Hutt.).          |
| <i>Cylichnella enysi</i> (Hutt.).                    | * <i>Protocardia (Nemocardium) pulchella</i> (Gray). |
| <i>Cypraea ovulata</i> Tate.                         | * <i>Psammbobia lineolata</i> Gray.                  |
| <i>Daphnella (Raphitoma) neozelandica</i> Sut.       | <i>Siphonalia nodosa acuticostata</i> Sut.           |
| * <i>Diplodonta striata</i> Hutt. New as a fossil.   | <i>Trochus avarus</i> Sut.                           |
| * <i>Emarginella cumingi</i> (Ad. & Ang.).           | " <i>circinatus</i> (?) Hutt.                        |
| <i>Emarginula wannonensis</i> Harris.                | " <i>nodosus</i> Hutt. Fragment.                     |
| <i>Epitonium (Clathroscala) cylindrellum</i> Sut.    | <i>Turbo etheridgei</i> T.-Woods. New to fauna.      |
| Fragment.  | <i>Turritella (Archimediella) huttoni</i> Cossm.     |
| * <i>Euthria striata</i> (Hutt.).                    | " ( <i>Torula</i> ) <i>semiconcava</i> Sut.          |
| * <i>Fulguraria arabica elongata</i> (Swains.).      | <i>Venericardia difficilis benhami</i> Thomson.      |
| * <i>Lima lima</i> (L.).                             |  |

Thirty-eight species, of which fourteen also Recent = 37 per cent.

It is remarkable that only five of these species are included in the preceding list. The percentage of Recent species approaches what one would expect in the Awamoan.

Trellissick Basin : Weka Pass Stone. Geol. Surv. Loc. 242. Enys ; 1866-79.

- Lima paucisulcata* Hutt. Juv.  
*Miomelon corrugata* (Hutt.).

Apparently this collection, a small one, was made from the limestone elsewhere called by McKay the Ototara limestone.

Trellissick Basin : Lower Beds. Geol. Surv. Loc. 449. Enys ; 1880.

- Glycymeris convexa* (Tate). New to fauna.  
 " *globosa* (Hutt.).  
*Venericardia pseutes* Sut.

Age and horizon : Various—possibly pre-Oamaruan.

Whitewater Creek, Trellissick Basin : Tufaceous Greensands. Geol. Surv. Loc. 241. McKay ; 1879.

- |  |   |
|--|---|
| * <i>Ancilla (Baryspira) australis</i> (Sow.).       | <i>Cypraea ovulata</i> Tate.                                |
| * <i>Calyptrea (Sigapatella) maculata</i> (Q. & G.). | " <i>trellissickensis</i> Sut.                              |
| * <i>Cantharidus tenebrosus</i> A. Ad.               | <i>Cytherea chariessa</i> Sut.                              |
| * <i>Capulus australis</i> (Lamk.).                  | <i>Emarginula wannonensis</i> Harris.                       |
| <i>Cardium huttoni</i> Iher. Juv.                    | <i>Epitonium (Clathroscala) cylindrellum</i> Sut. Fragment. |
| * <i>Cochlodesma angasi</i> (?) (C. & F.).           | <i>Fissuridea</i> (?) <i>annulata</i> Sut.                  |
| <i>Cymatium minimum</i> (Hutt.). Fragment.           |   |

- \**Lima bullata* (Born).  
 ,, *colorata* Hutt. Juv.  
 \**Limopsis aurita* (Brocchi).  
 \**Mactra elongata* Q. & G.  
*Marginella dubia* Hutt.  
*Miomelon corrugata* (Hutt.). Juv.  
*Pecten (Patinopecten) palmipes* Tate. Juv. New  
 to fauna.  
*Polinices (Neverita) huttoni* Iher.
- Protocardia sera* Hutt.  
*Siphonalia nodosa acuticosata* Sut.  
 \**Siphonium planatum* Sut.  
*Surcula antegyssata* (?) Sut.  
*Teredo heaphyi* Zitt.  
*Trivia zelandica* T. W. Kirk.  
*Trochus nodosus* Hutt. Fragments.  
*Turritella (Archimediella) huttoni* Cossm.

Twenty-nine species, of which nine also Recent = 31 per cent.

Age: Miocene (Oamaruan).

Trelissick Basin: Upper Part of Mount Brown Limestone. Geol. Surv. Loc. 237. McKay; 1879.

The list includes fossils collected by J. A. Thomson and R. Speight in 1914 from the shell-bed at the base of the Pareora beds, junction of Porter and Thomas rivers (labelled "Trelissick 'B'").

- Ancilla (Alocoispira) papillata* (Tate).  
 \**Anomia trigonopsis* Hutt.  
 \**Arca nove-zelandica* E. A. Smith.  
*Astraea bicarinata* Sut. Fragment.  
 ,, *transenna* Sut. Fragment.  
*Cardium huttoni* Iher.  
 ,, *subcordatum* Sut.  
 \**Crassatellites obesus* (A. Ad.).  
*Crepidula striata* (Hutt.).  
 \**Fulguraria (Alcihoë) arabica* (Mart.).  
*Glycymeris globosa* (Hutt.).  
*Hinnites trailli* Hutt. Juv.  
 \**Lima bullata* (Born).
- Lima colorata* Hutt.  
*Modiolaria elongata* (Hutt.).  
 \**Mytilus canaliculus* Mart.  
 ,, *huttoni* Cossm.  
*Paphia curta* (Hutt.).  
*Polinices gibbosus* (Hutt.).  
 \**Serpularis siph* (Lamk.).  
 \**Siphonalia dilatata* (Q. & G.).  
 ,, *turrata* Sut.  
 \**Stephonomma nucleogranosum* Verco.  
*Turbo superbus* Zitt. Fragments.  
*Turritella (Turcula) concava* Hutt.  
 ,, (*Peyrotia*) *patagonica* Sow.

Twenty-six species, of which nine also Recent = 35 per cent.

Age: Miocene (Oamaruan).

Trelissick Basin A: Lower Tuffs (so called by McKay)—i.e., Tuffs above Chalk Marl (= Amuri Limestone) and below Lower Limestone—Broken River, above Junction with Porter River. J. A. Thomson and R. Speight; 1914.

- Ampullina (Megatylotus) suturalis* (Hutt.).  
 \**Calliostoma aucklandicum* E. A. Smith.  
 \**Calyptraea (Sigapatella) maculata* (Q. & G.).  
*Clio (Styliola) tatei* Sut.  
*Crassatellites cordiformis* Sut.  
 \**Crepidula monozylla* (Less.).  
*Cypraea ovalatella* Tate. Juv.  
 \**Diplodonta zelandica* (?) (Gray).  
*Emerginula wannonensis* Harris. Cast.  
*Lima huttoni* Sut. Juv.
- Martesia concentrica* Sut.  
 \**Natica zelandica* Q. & G.  
*Panope orbita* Hutt.  
*Pecten (Chlamys) williamsoni* Zitt.  
 \**Psammobia lineolata* Gray.  
 \**Siphonalia mandarina* (Duclos).  
 \**Siphonium planatum* Sut.  
 \**Tellina eugonia* Sut.  
*Trochus nodosus* Hutt.

Nineteen species, of which nine also Recent = 47 per cent.

Broken River, Trelissick Basin: Coal-beds.

- Crassatellites cordiformis* Sut.  
*Martesia concentrica* Sut.

These may be specimens from the preceding collection, erroneously labelled.

Trelissick Basin C : Whitewater Creek, where the Marls are followed by Tuffs. J. A. Thomson and R. Speight; 1914.

"The tuffs are followed by the upper limestone. The fossils were collected from the top of these tuffs. It is not certain whether they represent the lower or upper tuffs, this depending on whether the absence of the lower limestone is due to removal by denudation, as Hutton thought, or to non-deposition owing to volcanic conditions, as I think possible."—J. A. THOMSON.

- |   |  |
|---|--|
| * <i>Ancilla (Baryspira) depressa</i> (Sow.).                   | <i>Emarginula wannonensis</i> Harris.            |
| * <i>Calliostoma aucklandicum</i> E. A. Smith. New as a fossil. | * <i>Fulgoraria arabica</i> (Mart.). Protoconch. |
| * <i>Calyptræa (Sigapatella) maccoyi</i> Sut.                   | * <i>Lima bullata</i> (Born).                    |
| * " " " " <i>maculata</i> (Q. & G.).                            | * <i>Natica australis</i> (?) (Hutt.).           |
| * <i>Cantharidus tenebrosus</i> A. Ad.                          | * " " <i>zelandica</i> (?) Q. & G.               |
| <i>Cardium facetum</i> Sut.                                     | <i>Polinices (Neverita) huttoni</i> Iher.        |
| <i>Cymatium minimum</i> (Hutt.).                                | <i>Siphonalia orbita</i> (?) Hutt.               |
|   | <i>Turritella (Archimediella) huttoni</i> Cossm. |

Fifteen species, of which eight also Recent = 53 per cent.

Trelissick Basin D : Coleridge Creek : Tuffs interbedded with Chalk Marls (= Amuri Limestone). Tuff band 25 ft. thick and 10 ft. from the top. J. A. Thomson.

- |   |  |
|---|--|
| * <i>Admete trailli</i> (Hutt.).                  | <i>Limopsis catenata</i> Sut.                  |
| <i>Ampullina (Megatylotus) suturalis</i> (Hutt.). | <i>Marginella (Glabella) harrisi</i> Cossm.    |
| <i>Ancilla (Alocospira) papillata</i> (Tate).     | <i>Polinices (Neverita) huttoni</i> Iher. Juv. |
| " " " " <i>(Baryspira) subgradata</i> (?) (Tate). | " " " " <i>ovatus</i> (Hutt.).                 |
| * <i>Calliostoma aucklandicum</i> E. A. Smith.    | <i>Seiâ huttoni</i> Sut.                       |
| <i>Chione chilensis truncata</i> (?) Sut. Cast.   | <i>Sinum (Eunaticina) miocenicum</i> (Sut.).   |
| <i>Cominella intermedia</i> (?) Sut.              | <i>Siphonalia turrita</i> (?) Sut. Small form. |
| <i>Epitonium (Cirsotrema) lyratum</i> (Zitt.).    | * <i>Siphonium planatum</i> Sut.               |
| " " " " <i>zelebori</i> (Dkr.) var.               | <i>Surcula seminuda</i> Sut.                   |
| <i>Fusinus bicarinatus</i> Sut.                   | <i>Terebra costata</i> Hutt.                   |
| <i>Hemifusus (Mayeria) goniodes</i> Sut.          |  |

Twenty-one species, of which three also Recent = 14 per cent.

To the above list add *Euthria (Dennantia)* sp.

The term "Amuri limestone" has been used by all visitors to the Trelissick Basin, but the correlation appears to be made largely on lithological grounds, and at present cannot be accepted as proved by palæontological data. For the stratigraphical evidence, &c., in its favour see R. Speight, *Trans. N.Z. Inst.*, vol. 49, 1917, p. 326, &c.

Trelissick Basin E : Lower Tuffs, below Lower Limestone, Right Side of Porter River, above the Upper Gorge. J. A. Thomson and R. Speight; 1914.

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|--|--|
| * <i>Calliostoma aucklandicum</i> E. A. Smith. | <i>Pecten (Pseudamysium) yahiensis</i> T.-Woods. |
| <i>Pecten (Patinopecten) hutchinsoni</i> Hutt. | * <i>Siphonium planatum</i> Sut.                 |

Trelissick Basin F : Junction of Porter and Thomas River : Tuffs between Upper and Lower Limestone (i.e., Upper Tuffs of Hutton, Fan-coral Beds of McKay). J. A. Thomson and R. Speight; 1914.

- |  |                                       |
|--|---------------------------------------|
| * <i>Ancilla (Baryspira) mucronata</i> (?) (Sow).          | <i>Cardium waitakiense</i> Sut.       |
| <i>Calliostoma filiferum</i> Sut. Fragments.               | * <i>Chione yatei</i> (Gray). Juv.    |
| " " " " <i>oryctum</i> Sut. Fragment.                      | * <i>Corbula zelandica</i> Q. & G.    |
| * <i>Calyptræa (Sigapatella) maculata inflata</i> (Hutt.). | <i>Cypræa ovulata</i> Tate.           |
| * " " " " (s. str.) <i>tenuis</i> (Gray).                  | * <i>Diplodonta zelandica</i> (Gray). |



- Lima colorata* Hutt. Juv.  
*Limopsis catenata* Sut. Fragment.  
 \**Macrocallista multistriata* (?) (Sow.).  
*Moliolaria elongata* (Hutt.).  
 \**Modiolus australis* (Gray).  
*Panope orbita* (?) Hutt. Fragments.
- \**Panope zelandica* Q. & G.  
*Pecten (Chlamys) chathamensis* Hutt.  
*Teredo heaphyi* Zitt.  
*Turritella (Torcula) semiconcava* Sut. Fragment.  
 \**Venericardia difficilis* (Desh.). Fragments.

Twenty-one species, of which ten also Recent = 48 per cent.

See also pages 48-49, and R. Speight in *Trans. N.Z. Inst.*, vol. 49, 1917, pp. 352-55 (col. 4).

Trelissick Basin: Coleridge Creek: Base of Pareora Beds. Presumably J. A. Thomson and R. Speight; 1914.

- \**Glycymeris laticostata* (Q. & G.).  
*Polinices callosus* (Hutt.).
- Polinices gibbosus* (Hutt.).  
 ,, (*Neverita*) *ovatus* (Hutt.).

Trelissick Basin: Whitewater Creek: Amuri Limestone. Presumably J. A. Thomson and R. Speight; 1914.

- Pecten (Pseudamysium) aucklandicus* Zitt.  
 ,, (*Chlamys*?) *fischeri* (?) Zitt.

Many of the previous lists were used by Speight in connection with his paper "The Stratigraphy of the Tertiary Beds of the Trelissick or Castle Hill Basin," *Trans. N.Z. Inst.*, vol. 49, 1917, pp. 321-56. (See especially pp. 352-55.)

Curiosity Shop, Rakaia River, Canterbury. Geol. Surv. Loes. 311, 549. McKay; 1879.

- Ampullina (Megatylotus) suturalis* (Hutt.).  
 \**Anomia huttoni* Sut.  
 \**Astraea sulcata* (?) (Mart.). Cast.  
*Atrina distans* (?) (Hutt.). Fragment.  
*Chione chiloensis truncata* (?).  
 \* ,, *spissa* (Desh.).  
 \**Caminella adspersa* (?) (Brug.).  
*Caminella* sp.?  
*Cucullæa alta* Sow.  
 ,, ,, var. B Hutt. Casts.  
 ,, *attenuata* Hutt. Casts.  
*Cytherea sulcata* Hutt. Casts.  
*Glycymeris* sp. Casts.  
 \**Helcioniscus ornatus* (Dillw.). New as a fossil.  
*Lima huttoni* Sut.  
 ,, *paleata* Hutt.  
*Macrocallista* sp.? Cast.  
*Olivella neozelanica* (Hutt.).  
*Panope orbita* Hutt.
- Pecten (Chlamys) aldingensis* Tate.  
 ,, ,, *chathamensis* Hutt.  
 ,, (*Patinopecten*) *delicatulus* Hutt.  
 ,, (*Pseudamysium*) *huttoni* (Park).  
 ,, ,, *yahliensis* T.-Woods.  
 \* ,, (*Chlamys*) *zelandica* Gray.  
 \**Placumanomia zelandica* (Gray).  
*Protoecardia sera* (?) Hutt. Casts.  
*Siphonalia* sp.?  
 \**Siphonium planatum* Sut.  
*Solarrella* sp.? Casts.  
 \**Struthiolaria papulosa* (Mart.). Cast.  
 ,, sp.  
 \**Tellina glabrella* Desh. Casts.  
*Teredo heaphyi* Zitt. Plentiful.  
 \**Thracia vitrea* (Hutt.). Cast.  
*Trochus nodosus* (?) Hutt.  
 \**Venericardia purpurata* (?) (Desh.). Casts.

Mostly casts, the Pectens excepted. Thirty-seven species and varieties, of which twelve also Recent = 32 per cent.

Age: Miocene (Oamaruan). Matrix: Sandy and calcareous beds.

Reference: McKay, *Rep. of Geol. Explor. during 1879-80*, No. 13, 1881, pp. 75-82. On pp. 81-82 McKay gives a list of species and genera identified by him. Several of these were evidently not in the material examined by Mr. Suter. For another fossil-list see F. W. Hutton in *Q.J.G.S.*, vol. 41, 1885, pp. 547-64 (list on pp. 549-54).

Kakahu River, South Canterbury: Weka Pass Stone. Geol. Surv. Loc. 162. McKay; 1876.

*Atrina distans* (?) (Hutt.).  
*Dentalium mantelli* Zitt.  
*Pecten* (*Pseudamysium*) *huttoni* (Park).

Age: Miocene (Oamaruan). Horizon: Ototaran (?). The correlation with the Weka Pass stone is probably to be rejected.

Reference: McKay in *Rep. of Geol. Explor. during 1876-77*, No. 10, 1877, pp. 46, 53, 59-60, &c.

Kakahu River: Greensands overlying Coal-beds. Geol. Surv. Loc. 163. McKay; 1876.

*Atrina distans* (Hutt.).  
*Cardium waitakiense* Sut.  
*Cucullæa australis* (Hutt.).  
*Ostrea* (s. str.) *subdentata* Hutt.

*Teredo heaphyi* Zitt.  
 \**Venericardia purpurata* (Desh.).  
 „ *pseutes* Sut.

Age: Miocene (Oamaruan). Horizon: Waiarekan (?).

Reference: McKay, *loc. cit.*, pp. 47, 62, &c.

Kakahu River: Coal-beds underlying Waitaki Limestone and Greensands. Geol. Surv. Loc. 164.

McKay; 1876.

*Ampullina* (*Megalyotus*) *suturalis* (Hutt.).  
 \**Ancilla* (*Amalda*) *novæ-zelandiæ* (Sow.).  
*Astarte australis* (?) Hutt.  
*Atrina distans* (Hutt.).  
 \**Calyptrea* (s. str.) *alta* (Hutt.).  
*Cardium brunneri* (?) Hect.  
 „ *huttoni* (?) Iher. Juv.  
 „ *patulum* (?) Hutt. Juv.  
 „ *waitakiense* Sut.  
 \**Chione mesodesma* (?) (Q. & G.).  
 \**Caminella zealandica* (Reeve).  
*Corbula pumila* Hutt.  
*Crassatellites amplus* (Zitt.).  
 \* „ *obesus* (A. Ad.).  
*Cucullæa alta* Sow.  
 „ „ var. B Hutt.  
*Cuspidaria kirki* (Hutt.). Impression.  
*Cytherea chariessa* Sut.  
 \**Dentalium ecostatum* T. W. Kirk.  
 „ *pareorensis* Pils. & Sharp.  
 \**Dosinia greyi* (?) Zitt.  
*Euthria* (*Dennantia*) *mystica* Sut.  
 \**Fulgoraria arabica* (Mart.).  
*Fusinus solidus* Sut.  
*Galeodes* (*Pugilina*) *angusta* Sut.  
 „ *biconica* Sut.  
 „ (*Pugilina*) *livæcostata* Sut.  
 „ *maoriana* Sut.

*Galeodes modesta* Sut.  
 \**Glycymeris laticostata* (Q. & G.).  
 „ *subglobosa* Sut.  
*Harpa* (*Eocithara*) *neozelandica* (?) Sut.  
*Lapparia hebes* (Hutt.). (Also Loc. 480, Waihao.)  
 \**Mesodesma australe* (Gmel.).  
*Ostrea* (s. str.) *gudexi* Sut. (M. C. Gudex leg.)  
 „ „ *subdentata* Hutt.  
 „ „ *wuellerstorfi* Zitt.  
 \**Panope zealandica* Q. & G.  
*Pecten* (*Pseudamysium*) *huttoni* (Park).  
*Plejona necopinata* Sut.  
*Polinices* (*Neverita*) *huttoni* Iher.  
 „ „ *ovatus* (Hutt.).  
*Ringicula* n. sp.  
*Siphonalia* sp.  
*Struthiolaria cincta* Hutt.  
 \**Tellina eugonia* (?) Sut.  
*Tudicula neozelandica* Sut.  
*Turritella* (*Archimediella*) *ambulacrum* Sow.  
 Common.  
 \* „ (*Peyrotia*) *carlotta* Wats.  
 „ *cavershamensis* Harris.  
 \**Venericardia difficilis* (?) (Desh.).  
 \* „ *lutea* (Hutt.) var.  
 „ *pseutes* Sut.  
 „ aff. *purpurata* (Desh.).

Fifty-four species, of which fifteen also Recent = 28 per cent.

Age: Miocene (Oamaruan). Horizon: Waiarekan (?).

The possible presence of *Cardium brunneri* is noteworthy. The term "coal-beds" used in describing the horizon seems somewhat misleading. Apparently the collection is from the lowest part of the greensands, &c., overlying the coal-measures proper. McKay (*loc. cit.*, p. 47) mentions the occurrence in the Kakahu greensands of *Cardium brunneri* Hect. and *Ostrea carbonacea* Hect. MS. (in this case, no doubt, *O. wuellerstorfi*).

## Kakahu River : Pareora Beds. Geol. Surv. Loc. 577. J. Park; 1885.

- Ancilla (Alocospira) papillata* (Tate).  
*Bathytoma haasti* (Hutt.).  
 \**Calyptrea* (s. str.) *alta* (Hutt.).  
 \**Chione mesodesma* (Q. & G.).  
*Cucullæa alta* Sow.  
 " " var. *B. Hutt.*  
 " " *australis* (Hutt.).  
*Cylichnella enysi* (Hutt.).  
*Dentalium mantelli* Zitt.  
 \**Dosinia carulea* (Reeve).  
 \* " " *lambata* (Gould).  
 \* " " *subrosea* (Gray).  
*Lima colorata* Hutt.  
 \**Limopsis aurita* (Brocchi). Plentiful.  
 " " *catenata* Sut.
- \**Macrocallista multistriata* (Sow.).  
*Modiolus dolichus* Sut.  
 \**Nucula strangei* A. Ad.  
*Pecten (Chlamys) chathamensis* (?) Hutt. Juv.  
 " " (*Pseudamysium huttoni* (Park)).  
 \**Placunanomia zelandica* (?) (Gray).  
*Polinices (Neverita) ovatus* (Hutt.).  
 \**Psammobia lineolata* Gray.  
 \**Siphonalia nodosa* (Mart.).  
*Struthiolaria cincta* Hutt.  
 \**Tellina eugonia* Sut.  
*Turritella (Torcula) semiconcava* Sut.  
 \**Venericardia purpurata* (Desh.).  
 " " *pseutes* Sut.  
 \**Zenatia acinaces* (?) (Q. & G.).

Thirty species, of which fourteen also Recent = 47 per cent.

Age : Miocene. Horizon : Pareoran (probably) = Awamoan.

Mr. Suter's heading to this list originally contained the following words, placed in brackets: "Greensands under Waitaki stone, *vide* Park, 1905." Reference to *Trans. N.Z. Inst.*, vol. 37, 1905, pp. 532-33, shows that the statement attributed to Park is not explicitly made, though it may be held to follow from his remarks. On the other hand, Park's section of 1886 (*Rep. of Geol. Explor. during 1885*, No. 17, 1886, p. 174) shows Pareora beds east of, and necessarily above, the "Waitaki stone," as well as to the west, where possibly they may not be downfaulted, as supposed by von Haast in 1879 (*Geology of Canterbury and Westland*, p. 310), McKay in 1877 (*Rep. of Geol. Explor. during 1876-77*, No. 10, p. 53, and section, "North Bank of Kakahu River," opposite p. 50), and by Park himself in 1885. At present there is no record known to the writer indicating that the collection from Loc. 577 was not made from indubitable Pareoran beds. The list of species identified by Mr. Suter strongly confirms the Pareoran horizon, thus suggesting also that Park's section of 1886 is more correct than his 1905 section. It may profitably be compared with the following list of species from an horizon known to be below the limestone:—

## Kakahu River : Greensands under Weka Pass Stone. Geol. Surv. Loc. 578. J. Park; 1885.

- \**Anomia trigonopsis* Hutt.  
*Astarte australis* Hutt.  
 \**Astræa heliotropium* (Mart.).  
*Cæcum* n. sp.  
*Cardium brunneri* Hect.  
 " " *waitakiense* Sut.  
 " " n. sp.  
*Chione meridionalis* (Sow.). Adult and several young shells.  
*Cucullæa alta* Sow. Cast of young shell.  
 \**Dosinia carulea* (Reeve).  
 \* " " *greyi* Zitt.  
 \**Fulgoraria arabica* (Mart.).  
*Glycymeris* aff. *subglobosa* Sut.  
 \**Mesodesma subtriangulatum* (?) (Gray). Juv.
- \**Myodora pandoriformis* (?) (Stutchb.). Fragment.  
*Pecten (Pseudamysium) huttoni* (Park).  
*Sinum fornicatum* Sut.  
 \**Tellina glabella* (?) (Desh. Juv.  
 " " n. sp.  
*Terebra pareoraensis* Sut.  
*Turritella (Archimediella) ambulacrum* Sow.  
 Plentiful.  
 \* " " (*Peyrotia carlotte* Wats.  
 " " (*Archimediella) huttoni* Cossm.  
 " " (*Peyrotia) patagonica* Sow.  
 " " (*Torcula) semiconcava* Sut.  
 \**Venericardia lutea* Hutt. Common.  
 " " *pseutes* Sut.

Twenty-seven species, of which ten also Recent = 37 per cent.

All the shells are embedded in a hard calcareous matrix, and many could not be identified with any approach to correctness. If all could be named, the percentage of Recent shells would no doubt be lower.

Age : Miocene (Oamaruan). Horizon : Waiarekan (?).

Only five of the twenty-seven species appear in the preceding list.

Reference : Park, loc. cit., 1886, pp. 173 et seq. See also McKay, *Rep. of Geol. Explor.* during 1886-87, No. 18, 1887, pp. 92 et seq.

Kakahu River, Canterbury : Coal-beds. J. A. Thomson ; 1917.

- |   |  |
|---|--|
| <i>Dentalium (Fustiaria) pareorensis</i> Pils. & Sharp. | <i>Ostrea gulexi</i> Sut. Common                         |
| <i>Cucullaea alta</i> var. B Hutt.                      | <i>Mitra (Cancilla) armorica</i> (?) Sut. Fragment.      |
| * <i>Dosinia greyi</i> Zitt.                            | <i>Plejona necopinata</i> (Sut.).                        |
| <i>Galeodes biconica</i> Sut.                           | <i>Polinices ovalis</i> (Hutt.).                         |
| * <i>Glycymeris laticostata</i> (Q. & G.).              | <i>Turritella (Archimediella) huttoni</i> Cossm. Common. |
| " <i>subglobosa</i> Sut.                                |  |
| <i>Lapparia hebes</i> (Hutt.).                          |  |

Presumably this is the same locality and horizon as Geol. Surv. Loc. No. 164. (See p. 53.)

Kakahu River : Sands under Limestone. J. A. Thomson ; 1917.

- |   |  |
|---|--|
| <i>Ancilla (Alocospira) papillata</i> (Tate). | <i>Polinices gibbosus</i> (Hutt.).           |
| <i>Corbula canaliculata</i> Hutt.             | * <i>Psammobia lineolata</i> Gray.           |
| <i>Cytherea chariessa</i> Sut.                | * <i>Siphonalia nodosa</i> (?) (Mart.).      |
| <i>Dentalium mantelli</i> Zitt.               | " <i>subreflexa</i> (Sow.).                  |
| <i>Galeodea senex</i> (Hutt.).                | <i>Turritella (Torcula) semiconcava</i> Sut. |
| * <i>Limopsis aurita</i> (Brocchi).           | <i>Venericardia pseutes</i> Sut.             |
| " <i>catenata</i> Sut.                        |  |
| Age : Miocene (Oamaruan).                     |  |

Kakahu Bush : Soft Sandstones (Greensands) with Calcareous Bands and Masses, resting upon the Coal-beds and underlying the Waitaki Limestone. Copied and amended from Professor J. Park's list in *Trans. N.Z. Inst.*, vol. 37, 1905, p. 533. A few species from the same locality which are in the Canterbury Museum are added.

- |   |   |
|---|---|
| <i>Ancilla</i> (s. str.) <i>hebra</i> (Hutt.).                              | <i>Miomelon corrugata</i> (Hutt.). ( <i>Scaphella</i> .)                |
| * <i>Anomia huttoni</i> Sut. ( <i>A. alectus</i> .)                         | * <i>Ostrea (Anodontostrea) angasi</i> Sow. (Cant. Mus.)                |
| <i>Astarte australis</i> Hutt. ( <i>Crassatellites australis</i> .)         | "    (s. str.) <i>wuellerstorfi</i> Zitt.                               |
| * <i>Atrina zelandica</i> (Gray). (Cant. Mus.)                              | <i>Panope orbita</i> Hutt. ( <i>Panopæa</i> .)                          |
| <i>Aturia australis</i> McCoy.  | <i>Pecten (Pseudamysium) huttoni</i> (Park.) ( <i>Pseudamysium</i> .)   |
| * <i>Chione spissa</i> (Desh.). ( <i>C. crassa</i> of Hand-list also.)      | "    ( <i>Chlamys</i> ) <i>williamsoni</i> Zitt.                        |
| " <i>meridionalis</i> (Sow.). ( <i>C. vellicata</i> .)                      | <i>Plejona huttoni</i> (Sut.). (Cant. Mus.)                             |
| <i>Corbula canaliculata</i> Hutt.   | <i>Polinices (Nevirita) huttoni</i> Iher. ( <i>Natica darwini</i> .)    |
| <i>Crassatellites amplus</i> (Hutt.).                                       | * <i>Siphonalia latilata</i> (Q. & G.).                                 |
| * <i>Crepidula monozylla</i> (Less.). ( <i>Calyptrea monozylla</i> Martyn.) | " <i>costata</i> (?) (Hutt.). ( <i>S. regularis</i> Sow.)               |
| <i>Cucullaea alta</i> Sow.  | * <i>Struthiolaria papulosa</i> (Mart.).                                |
| " <i>australis</i> (Hutt.). ( <i>Cucularia</i> .)                           | "    " <i>spinosa</i> Hect. (Cant. Mus.)                                |
| <i>Dentalium mantelli</i> Zitt.   | * <i>Terebra tristes</i> Desh. (Perhaps <i>T. pareorensis</i> Sut.)     |
| " <i>pareorensis</i> Pils. & Sharp. ( <i>D. lewis</i> .)                    | <i>Teredo heaphyi</i> Zitt.   |
| <i>Dosinia magna</i> Hutt.  | <i>Turritella (Peyrotia) cavershamensis</i> Harris.                     |
| <i>Galeodea senex</i> (Hutt.). ( <i>Cassidaria</i> .)                       | *    "    " <i>rosea</i> Q. & G.  |
| <i>Glycymeris globosa</i> (Hutt.).  | *    "    (s. str.) <i>symmetrica</i> Hutt. ( <i>T. kanieriensis</i> .) |
| <i>Lima semiteres</i> Hutt. ( <i>L. fastidiosa</i> .)                       |   |
| <i>Lima paleata</i> Hutt.   |   |

As amended by Mr. Suter the above list contains thirty-six species, of which ten are Recent = 28 per cent.

Age : Miocene (Oamaruan). Horizon : Lower Waiarekan (?).

## Red Rocks, Opuha Gorge, South Canterbury. J. A. Thomson; 1917.

- Cardium* cf. *huttoni* Iher.  
*Corbula pumila* Hutt.  
*Cytherea* sp. Juv.  
*Dosinia* sp.  
 \**Ostrea corrugata* Hutt.
- Pecten (Pseudamysium) huttoni* (Park).  
 \**Tellina eugonia* Sut.  
*Teredo heaphyi* Zitt.  
 \**Venericardia lutea* (?) (Hutt.).

Conglomerate containing mostly casts.

Age: Miocene (Oamaruan).

## Sutherland's, Tengawai River, Seventeen Miles North-west from Timaru, Canterbury: Upper Pareorā Beds. M. C. Gudex; 1913.

- Ancilla* (s. str.) *hebra* (Hutt.).  
 " (*Allocospora*) *papillata* (Late).  
 \**Anomia trigonopsis* Hutt.  
*Bathytoma sulcata excavata* Sut.  
*Cardium greyi* Hutt.  
*Cominella carinata* (Hutt.).  
*Crepidula gregaria* Sow.  
 \* " *monoxyla* (Less.).  
 " *striata* (Hutt.).  
*Cucullaea attenuata* Hutt.  
 \**Dentalium nanum* Hutt.  
 " *solidum* Hutt.  
 \**Dosinia*, aff. *anus* (Phil.).  
*Epitonium (Cirsotrema) lyratum* (Zitt.).  
 \**Fulgoraria arabica* (Mart.).  
 \* " " *elongata* (Swains.).
- \**Glycymeris laticostata* (Q. & G.).  
*Latirus (Leucozonia) brevisrostris* (Hutt.).  
*Limopsis zitteli* Iher.  
 \**Mactra scalpellum* Reeve.  
*Polinices gibbosus* (Hutt.).  
*Siphonalia costata* (Hutt.).  
 \* " *dilatata* (Q. & G.).  
 " *subnodosa* (Hutt.).  
*Struthiolaria tuberculata* Hutt.  
*Surcula fusiformis* (Hutt.).  
*Terebra orycta* Sut.  
 " *pareoraensis* Sut.  
 \**Turritella (Peyrotia) carlottæ* Wats.  
 " " *cavershamensis* Harris.  
 " (*Torcula*) *concava* Hutt.  
*Venericardia pseutes* Sut.

Thirty-two species, of which ten also Recent = 31 per cent.

Age: Upper Miocene. Horizon: Pareoran = Awamoan.

Reference: M. C. Gudex in *Trans. N.Z. Inst.*, vol. 50, 1918, pp. 244-62.

## Raincliff Red Rocks, near Pleasant Point, South Canterbury. J. A. Thomson; 1917

- \**Anomia huttoni* Sut.  
*Cardium huttoni* Iher.  
*Crepidula gregaria* (?) Sow. Cast.  
*Epitonium (Cirsotrema) lyratum* (Zitt.).  
 \**Ostrea (Anodontostrea) hyotis* (L.).  
 " aff. *nelsoniana* Zitt.
- Ostrea* aff. *wuellerstorfi* Zitt.  
*Struthiolaria minor* Marshall.  
*Teredo heaphyi* Zitt.  
 \**Venericardia lutea* (Hutt.).  
 " sp.

Eleven species, of which three also Recent = 27 per cent.

Age: Miocene (Oamaruan).

## Current-bedded Shell-bed at Base of Raincliff. J. A. Thomson; 1917.

- Corbula canaliculata* Hutt.  
 " *pumila* Hutt.  
*Cytherea* sp.? Juv.  
 \**Ostrea corrugata* Hutt.
- \**Ostrea (Anodontostrea) hyotis* (?) (L.) Juv  
*Teredo heaphyi* Zitt.  
 \**Venericardia purpurata* (Desh.) Juv

Age: Miocene (Oamaruan).

## Lower Gorge of Pareora River : Clays. Geol. Surv. Loc. 166. McKay; 1876.

- Aecon ovalis* (?) (Hutt.).  
*Ampullina* (*Megatylotus*) *suturalis* (Hutt.).  
*Ancilla* (s. str.) *hebera* (Hutt.).  
*Anomia* sp.  
*Bathytoma haasti* (Hutt.).  
\**Calyptraea* (*Sigapatella*) *maculata* (Q. & G.).  
*Corbula canaliculata* (?) Hutt.  
" *humerosa* Hutt.  
\**Crassatellites obesus* (A. Ad.).  
*Cucullæa alta* Sow.  
*Cuspidaria kirki* (?) (Hutt.).  
\**Cylichnella striata* (Hutt.).  
\**Cytherea oblonga* (Hanley).  
*Dentalium solidum* Hutt.  
\**Dosinia greyi* Zitt.  
\**Fissuridea monilifera* (Hutt.).  
\**Fulgoraria arabica* (Mart.).  
*Glycymeris subglobosa* Sut.  
*Leucosyrinx alta* (Harris).  
*Lima colorata* Hutt.
- \**Limopsis aurita* (Brocchi).  
*Mesalia striolata* (Hutt.).  
*Miomelon corrugata* (Hutt.).  
" " var. B Hutt.  
\**Panope zelandica* (?) Q. & G.  
*Pecten* (*Pseudamusium*) *huttoni* (Park). Frag-  
ment.  
\**Psammobia lineolata* Gray.  
*Sinum* (*Evanaticina*) *cinctum* (Hutt.).  
*Siphonalia costata* (Hutt.).  
*Surcula fusiformis* (Hutt.).  
\**Tellina eugonia* Sut.  
*Teredo heaphyi* Zitt.  
\**Turbonilla zelandica* (Hutt.).  
\**Turritella* (*Peyrotia*) *carlotta* Wats.  
" (*Torcula*) *concava* Hutt.  
" (*Peyrotia*) *patagonica* Sow.  
\**Venericardia lutea* (Hutt.) var.  
\**Zenatia acinaces* (Q. & G.).

Thirty-eight species, of which fifteen also Recent = 39 per cent.

Age: Upper Miocene. Horizon: Pareoran.

McKay in MS. and his report of 1877 states that the collection was made from blue sandy clays on the left bank of the Pareora River, near the lower east slope of Mount Horrible and from some distance down the river (on the south side: see reference below).

Reference: McKay, *Rep. of Geol. Explor. during 1876-77*, No. 10, 1877, pp. 47, 55, &c.

## Lower Gorge of Pareora River : Coal-beds. Geol. Surv. Loc. 167. McKay, 1876; Enys, 1879.

- \**Crassatellites obesus* (A. Ad.).  
*Cucullæa attenuata* Hutt.  
\**Mytilus* (*Chloromya*) *canaliculus* (?) Mart. Juv.
- Turritella* (*Archinediella*) *ambulacrum* Sow.  
\**Venericardia difficilis* (Desh.) var.  
" *psutes* Sut.

Age: Miocene (Oamaruan). Horizon: Waiarekan.

Reference: McKay, *loc. cit.*, 1877, pp. 47, 64. "The rocks are grey quartzose sands, with occasional beds of small pebbles, composed of quartz, and often contain sharks' teeth. A shell-bed occurs in contact with these sands, but, as it presented some appearance of unconformity, this may belong to a younger series."

## Lower Part of Pareora River. Geol. Surv. Loc. 458. Enys; 1879.

- Alectrion* (*Hima*) *socialis* (Hutt.).  
*Ancilla* (s. str.) *hebera* (Hutt.).  
\**Anomia trigonopsis* Hutt.  
*Bathytoma haasti* (Hutt.).  
\**Calyptraea* (*Sigapatella*) *maculata inflata* (Hutt.).  
" (s. str.) *tenuis* (Gray).  
*Cardium patulum* Hutt.  
\**Chione stutchburys* (Gray).  
*Corbula pumila* Hutt.  
\**Crassatellites obesus* (A. Ad.).  
*Crepidula striata* (Hutt.).  
*Cucullæa alta* Sow.  
*Cylichnella enys* (Hutt.).  
\**Dentalium ecostatum* T. W. Kirk.  
" *mantelli* Zitt.  
" *solidum* Hutt.  
\**Diplodonta zelandica* (Gray).  
\**Dosinia lambata* (Gould).
- \**Dosinia subrosea* (Gray).  
\**Fasciolaria johnstoni* (T.-Woods). New to our fauna.  
*Galcodes senex* (?) (Hutt.).  
*Genota robusta* (Hutt.).  
*Glycymeris globosa* (Hutt.).  
" *laticostata* (Q. & G.).  
*Latirus* (*Leucozonia*) *brevirostris* (Hutt.).  
\**Limopsis aurita* (Brocchi).  
*Loripes laminata* Hutt.  
\**Macrocallista multistriata* (Sow.).  
" *pareoraensis* Sut.  
\**Maetra discors* (?) Gray.  
" *scalpellum* Reeve.  
\**Natica zelandica* Q. & G.  
\**Nucula strangei* A. Ad.  
\**Ostrea* (s. str.) *corrugata* Hutt.  
*Panope orbita* Hutt.

- Paphia curta* (Hutt.).  
*Placunanomia incisura* (?) Hutt.  
 \* " *zelandica* (Gray).  
 \* *Polinices amphialus* (Wats.).  
 " *gibbosus* (Hutt.).  
 \* *Psammobia lineolata* Gray.  
 \* " *zelandica* Desh. New as a fossil.  
*Sinum (Eunaticina) cinctum* (Hutt.).  
*Siphonalia costata* (Hutt.).  
 \* " *dilatata* (Q. & G.).  
 \* *Spisula ordinaria* (E. A. Smith).  
 \* *Struthiolaria papulosa* (Mart.).
- Struthiolaria spinosa* Hect.  
*Surcula fusiformis* (Hutt.).  
 \* *Tellina glabella* Desh.  
*Terebra orycta* Sut.  
 \* " *tristis* Desh.  
 \* *Trophon hanleyi* (Angas). New as a fossil.  
*Turritella (Pegrotia) cavershamensis* Harris.  
 " *(Torcula) semiconcava* Sut.  
 " *(Pegrotia) patagonica* Sow.  
*Typhis (Typhina) maccoyi* T.-Woods.  
 \* *Venericardia purpurata* (Desh.).  
 \* *Zenatia acinaces* (Q. & G.). Fragment.

Fifty-nine species, of which twenty-nine also Recent = 49 per cent.

Age: Upper Miocene. Horizon: Pareoran.

Right Bank of Pareora River, opposite Mount Horrible: Coal Rocks. Geol. Surv. Loc. 784. McKay; date of collection unknown.

*Venericardia lutea* (Hutt.) var.

Larger than Recent shells, the radial ribs more numerous, 18 to 20, the interstices narrower; maximum height 19 mm. The specimens are hardly good enough for description.

Age: Miocene (Oamaruan).

Pareora River, South Canterbury. J. A. Thomson; 1917.

- Alectrion socialis* (Hutt.).  
*Ampullina (Megatylotus) suturalis* (Hutt.).  
*Ancilla* (s. str.) *hebera* (Hutt.).  
 " *(Alcospira) papillata* (Tate). Juv.  
*Borsonia (Cordieria) n. sp.*  
*Corbula canaliculata* Hutt.  
 \* *Crassatellites obesus* (A. Ad.). Fragment.  
*Cucullaea australis* (Hutt.).  
*Cylichnella soror* Sut.  
*Diplodonta ampla* (Hutt.).  
*Drillia n. sp.* The same from Blue Cliffs.  
*Epitonium (Cirsotrema) lyratum* (Zitt.).  
*Fusinus n. sp.?*  
*Galeodea senex* (Hutt.).  
*Leda semiteres* Hutt. Juv.  
*Lima colorata* Hutt.  
 \* *Limopsis aurita* (Brocchi).  
*Miomelon corrugata* (Hutt.).  
*Mitra (Cancilla) armorica* Sut.  
*Modiolus dolichus* Sut.  
 \* *Murex zelandicus* Q. & G. Juv.
- \* *Natica australis* (Hutt.).  
 \* " *zelandica* Q. & G.  
*Pecten (Pseudamusium) huttoni* (Park). Fragments.  
 \* *Placunanomia zelandica* (Gray).  
*Polinices gibbosus* (Hutt.).  
 \* *Psammobia lineolata* Gray.  
*Ptychactractus nodosoliratus* Sut.  
*Sinum (Eunaticina) cinctum* (Hutt.).  
*Siphonalia costata* (Hutt.).  
 \* " *dilatata* (Q. & G.). Juv.  
*Struthiolaria cincta* Hutt. n. var.  
*Surcula climacota* Sut.  
 " *fusiformis* (Hutt.). Juv.  
 " n. sp.  
*Trophon lepidus* Sut.  
 \* *Turbonilla zelandica* (Hutt.).  
*Turritella (Torcula) concava* Hutt. Fragments.  
*Typhis maccoyi* T.-Woods.  
 \* *Venericardia purpurata* (Desh.). Juv.  
*Vezillum apicale* (Hutt.).

Pareora River: Blue Clay below Mount Horrible. J. A. Thomson; 1917.

- Clavagella n. sp.*  
*Corbula canaliculata* Hutt.  
 \* *Crepidula costata* (Sow.).  
*Dentalium mantelli* Zitt.  
 " *(Fustiaria) pareorensis* Pils. & Sharp.  
 " *solidum* Hutt.  
*Diplodonta ampla* (Hutt.).  
*Leda semiteres* Hutt.  
 \* *Murex octogonus espinosus* (?) Hutt. Juv.
- Pecten (Pseudamusium) huttoni* (Park).  
*Pinna lata* (?) Hutt. Juv.  
*Placunanomia incisura* Hutt.  
 \* *Psammobia lineolata* Gray.  
 \* *Tellina glabella* Desh.  
*Teredo heaphyi* Zitt.  
*Venericardia psutes* Sut.  
 \* *Zenatia acinaces* (Q. & G.).

This and the preceding list taken together contain fifty-two species, of which fourteen are also Recent = 27 per cent.

Age: Upper Miocene. Horizon: Pareoran.

White Rock River, Upper Pareora Valley. Geol. Surv. Loc. 165. McKay; 1876.

- Acteon ovalis* (Hutt.).  
*Alectrion (Hima) socialis* (Hutt.). Common.  
 \**Ancilla (Baryspira) australis pyramidalis* (Reeve).  
 \**Anomia huttoni* Sut.  
 \**Bathytoma albula* (Hutt.).  
 " *perlata* Sut.  
 " *sulcata excavata* Sut.  
*Bela (Buchozia) infelix* Sut.  
*Borsonia (Cordieria) cineta* (Hutt.).  
 \**Calyptraea* (s. str.) *alta* (Hutt.). Many young shells.  
 \* " *(Sigapatella) maculata* (Q. & G.).  
*Cardium greyi* (?) Hutt. Fragments.  
*Corbula pumila* Hutt.  
 \**Crepidula monoxyla* (Less.).  
 " *gregaria* Sow.  
 " *striata* (Hutt.).  
*Cucullaea ponderosa* var. B Hutt.  
*Cylichnella soror* Sut.  
*Cytherea* sp.  
*Dentalium mantelli* Zitt. Fairly common.  
 " *solidum* Hutt. Fairly common.  
 \**Dosinia greyi* Zitt. Fragment.  
 " *subrosea* (Gray). Fragment.  
 \**Drillia avamoensis* (Hutt.).  
 " *buchanani* (Hutt.).  
 " *chordata* Sut.  
 " *wanganuiensis* (Hutt.).  
 \**Epitonium (Cirsotrema) zelebori* (Dkr.).  
*Fusinus congestus* Sut.  
 " *spiralis dentatus* (Hutt.).  
 " *tegens* (Hutt.).  
*Genota robusta* (Hutt.).  
*Glycymeris corlata* (Hutt.).  
 " *globosa* (Hutt.).  
 \* " *laticostata* (Q. & G.).  
*Hemiconus ornatus* (Hutt.).  
*Latirus (Leucozonia) brevisrostris* (Hutt.).
- Limopsis catenata* Sut. Common.  
*Loripes laminata* Hutt. Fairly common.  
 \**Maetra scalpellum* Reeve.  
*Mangilia gracilentia* Sut.  
 " *leptosoma* (Hutt.). Fairly common.  
*Mesalia striolata* (Hutt.). Plentiful.  
*Miomelon corrugata* (Hutt.). Fragments.  
 \**Natica australis* (Hutt.).  
 \* " *zelandica* Q. & G. Many young shells.  
 \**Nucula nitidula* A. Ad.  
 \**Ostrea (Anodontostrea) tatei* Sut.  
*Paphia curta* (Hutt.).  
*Pecten (Pseudamysium) huttoni* (Park). Fragment.  
*Polinices gibbosus* (Hutt.).  
 " *(Neverita) huttoni* Iher.  
 " " *onatus* (Hutt.).  
 " " *sagenus* Sut.  
 \**Psammobia lineolata* Gray. Fragments.  
 \**Siphonalia dilatata* (Q. & G.). Very massive shells.  
 \* " *nodosa* (Mart.).  
 " *subnodosa* (Hutt.).  
 " *turrita* Sut.  
 \**Spisula ordinaria* (E. A. Smith).  
*Surcula obliquecostata* Sut.  
 " *pareoraensis* (Sut.).  
*Terebra pareoraensis* Sut. Plentiful.  
*Trophon minutissimus* Sut.  
 \**Turbonilla zelandica* (Hutt.).  
*Turris utleyi* (?) Sut. Fragment.  
*Turritella (Torcula) concava* Hutt. Many specimens, both adult and juvenile.  
 " " *semiconcava* Sut.  
 \**Venericardia lutea* (Hutt.).  
*Vexillum rutidolomum* Sut.  
 \**Zenatia acinaces* (Q. & G.). Fragments.

Seventy-one species, of which twenty-three also Recent = 32 per cent.

Age: Upper Miocene. Horizon: Pareoran. Matrix: Mainly loose sands or shelly conglomerate.

Reference: McKay, loc. cit., 1877, pp. 47, 54, &c.

White Rock River, Upper Pareora Valley. J. A. Thomson; 1917.

- \**Anomia trigonopsis* Hutt.  
*Bathytoma antecostata* Sut.  
 " *haasti* (Hutt.).  
*Cardium waitakiense* Sut.  
*Chione speighti* Sut.  
*Circulus helicoides* (Hutt.).  
*Cominella ordinatis* Hutt.  
 " n. sp.  
*Corbula humerosa* Hutt.  
 " *pumila* Hutt.  
*Epitonium (Cirsotrema) lyratum* (Zitt.).  
*Eulima* sp.  
*Fusinus congestus* Sut.  
*Macrocallocista pareoraensis* Sut. var.  
 \**Mangilia dictyota* (Hutt.).  
 \**Protocardia (Nemocardium) pulchella* (Gray).  
*Solaria* n. sp.  
*Strepsidura* n. sp. Genus new to fauna.  
 " n. sp.  
 " n. sp.  
 " n. sp.  
*Surcula fusiformis* (Hutt.).  
 " *obliquecostata* Sut.  
*Trophon minutissimus* Sut.  
*Turbonilla (Chemnitzia) n. sp.*  
*Turritella (Torcula) concava* Hutt.

Age: Oamaruan.



The number of Recent species in this list is no indication of the fossil horizon, for the specimens sent to Mr. Suter were selected from a larger collection, and species previously recorded from the upper Pareora district, if noticed, were excluded. Thus this list has only four species in common with the preceding.

Pareora River, South Canterbury. M. C. Gudex; 1913.

(1.) PAREORA RIVER (exact locality not stated).

<i>Alectrion socialis</i> (Hutt.).	<i>Lima colorata</i> Hutt.
<i>Ampullina</i> ( <i>Megatylotus</i> ) <i>suturalis</i> (Hutt.).	* <i>Limopsis aurita</i> (Brocchi).
<i>Ancilla</i> ( <i>Amalda</i> ) <i>waikopiroensis</i> Sut.	* <i>Natica zelandica</i> Q. & G.
<i>Bathytoma sulcata excavata</i> Sut.	<i>Sinum</i> ( <i>Evanaticina</i> ) <i>miocenicum</i> (Sut.).
<i>Borsonia</i> ( <i>Cordieria</i> ) <i>cincta</i> (Hutt.).	* <i>Siphonalia nodosa</i> (Mart.).
<i>Corbula humerosa</i> Hutt.	<i>Surcula fusiformis</i> (Hutt.).
* <i>Crassatellites obesus</i> (A. Ad.).	<i>Turritella</i> ( <i>Torcula</i> ) <i>semiconcava</i> Sut.
* <i>Dentalium ecostatum</i> T. W. Kirk.	<i>Typhiss maccoyi</i> T.-Woods.
" <i>mantelli</i> Zitt.	<i>Vexillum apicale</i> (Hutt.).
<i>Exilia dalli</i> Sut.	"    ( <i>Costellaria</i> ) <i>rutidolomum</i> Sut.

(2.) BLUE SANDS ABOVE THE LIMESTONE.

<i>Amusium zitteli</i> (Hutt.).	* <i>Malletia australis</i> (Q. & G.).
<i>Chione meridionalis</i> (?) (Sow.).	<i>Polinices</i> sp.
<i>Corbula canaliculata</i> Hutt.	<i>Surcula fusiformis</i> (?) (Hutt.).
<i>Crepidula gregaria</i> Sow.	

(3.) OTAIO COAL SERIES.

<i>Ampullina</i> ( <i>Megatylotus</i> ) <i>suturalis</i> (Hutt.).	* <i>Pupa alba</i> (?) (Hutt.).
<i>Astarte australis</i> (?) Hutt.	<i>Siphonalia costata</i> (?) (Hutt.).
<i>Chione meridionalis</i> (Sow.).	<i>Struthiolaria cincta</i> Hutt.
<i>Corbula canaliculata</i> Hutt.	* <i>Tellina glabrella</i> (?) Desh.
* <i>Dosinia greyi</i> Zitt.	<i>Teredo heaphyi</i> (?) Zitt.
<i>Mesalia striolata</i> (Hutt.).	<i>Turritella</i> ( <i>Pegrotia</i> ) <i>patagonica</i> Sow.
* <i>Psammobia</i> aff. <i>stangeri</i> Gray.	

(4.) LIMESTONE AT SQUIRE'S.

*Pecten* (*Chlamys*) *chathamensis* Hutt.

(5.) CLAY BANK AT SQUIRE'S.

<i>Corbula canaliculata</i> Hutt.	<i>Ostrea</i> sp.
* <i>Dentalium ecostatum</i> T. W. Kirk.	<i>Vexillum</i> n. sp.
<i>Marginella</i> ( <i>Eratoidea</i> ) <i>conica</i> Harris.	

(6.) RED SANDS OVERLYING BLUE CLAYS AT SQUIRE'S.

<i>Ancilla</i> (s. str.) <i>hebera</i> (Hutt.).	<i>Siphonalia costata</i> (Hutt.).
<i>Nucula sagittata</i> Sut.	<i>Surcula fusiformis</i> (Hutt.).
<i>Pecten</i> ( <i>Pseudamusium</i> ) <i>huttoni</i> (?) (Park). Frag-	<i>Turritella</i> ( <i>Torcula</i> ) <i>semiconcava</i> Sut.
ment.	<i>Venericardia pseutes</i> Sut.
<i>Polinices gibbosus</i> (Hutt.).	

(7.) HIGGINBOTHAM.

<i>Cardium waitakiense</i> Sut.	<i>Venericardia acanthodes</i> Sut.
<i>Cucullæa attenuata</i> Hutt.	*    " <i>lutea</i> (Hutt.).
<i>Ostrea</i> (s. str.) <i>subdentata</i> Hutt.	" <i>pseutes</i> Sut.

## (8.) CRAB-BEDS CAVE.

*Dentalium* aff. *mantelli* Zitt.  
*Pecten* (*Patinopecten*) *delicatulus* Hutt.  
*Turritella* aff. *patagonica* Sow.

## (9.) RED SAND BELOW CRAB-BEDS.

*Ostrea* (s. str.) *subdentata* Hutt.

The different localities taken together give forty species, of which twelve are also Recent = 30 per cent.

Age: Miocene (Oamaruan). Horizon: Various.

Reference: M. C. Gudex, loc. cit.

Holme Station, Pareora River: Shelly Sandstone immediately above the Limestone.  
 M. C. Gudex; 1913.

- |   |  |
|---|--|
| * <i>Ancilla</i> ( <i>Amalda</i> ) <i>novæ-zelandiæ</i> (Sow.). | <i>Epitonium</i> ( <i>Cirsotrema</i> ) <i>lyratum</i> (Zitt.). |
| " ( <i>Alocospira</i> ) <i>papillata</i> (Tate).                | * <i>Limopsis aurita</i> (Brocchi).                            |
| <i>Bathytoma haasti</i> (Hutt.).                                | <i>Marginella</i> ( <i>Eratoides</i> ) <i>conica</i> Harris.   |
| " <i>sulcata excavata</i> Sut.                                  | <i>Miomelon corrugata</i> (Hutt.).                             |
| <i>Corbula canaliculata</i> Hutt.                               | <i>Polinices gibbosus</i> (Hutt.).                             |
| " <i>humerosa</i> Hutt.   | <i>Siphonalia costata</i> (Hutt.).                             |
| * <i>Crassatellites obesus</i> (A. Ad.).                        | <i>Surcula fusiformis</i> (Hutt.).                             |
| <i>Dentalium mantelli</i> Zitt.                                 | <i>Turritella</i> ( <i>Torcula</i> ) <i>concava</i> Hutt.      |
| " <i>solidum</i> Hutt.  | " ( <i>Peyrotia</i> ) <i>patagonica</i> Sow.                   |
| <i>Drillia avamoensis</i> (Hutt.).                              | <i>Vexillum</i> ( <i>Costellaria</i> ) <i>rutidolomum</i> Sut. |

Twenty species, of which three also Recent = 15 per cent.

Age: Miocene (Oamaruan). Horizon: Pareoran.

Holme Station, Pareora River: Uppermost Stratum. M. C. Gudex; 1913.

- |   |  |
|---|--|
| <i>Alectrion socialis</i> (Hutt.).                                | <i>Limopsis catenata</i> Sut.                                      |
| <i>Ampullina</i> ( <i>Megatylotus</i> ) <i>suturalis</i> (Hutt.). | * <i>Maetra discors</i> Gray.                                      |
| <i>Ancilla</i> (s. str.) <i>hebera</i> (Hutt.).                   | <i>Modiolus dolichus</i> Sut.                                      |
| " ( <i>Alocospira</i> ) <i>papillata</i> (Tate).                  | <i>Panope worthingtoni</i> Hutt.                                   |
| * <i>Anomia huttoni</i> Sut.                                      | <i>Paphia curta</i> (?) (Hutt.). Casts.                            |
| *   " <i>trigonopsis</i> Hutt.                                    | <i>Pecten</i> ( <i>Pseudamysium</i> ) <i>huttoni</i> (Park).       |
| *   " <i>undata</i> Hutt.   | * <i>Placunanomia zelandica</i> (Gray).                            |
| <i>Bathytoma haasti</i> (Hutt.).                                  | <i>Polinices gibbosus</i> (Hutt.).                                 |
| " <i>sulcata</i> (Hutt.).   | " ( <i>Neverita</i> ) <i>huttoni</i> Iher.                         |
| * <i>Calyptrea</i> (s. str.) <i>alta</i> (Hutt.).                 | * <i>Psammobia lineolata</i> Gray.                                 |
| <i>Chione meridionalis</i> (?) (Sow.).                            | *   " <i>zelandica</i> Desh.                                       |
| " <i>speighti</i> Sut.  | * <i>Pupa alba</i> (Hutt.).  |
| * <i>Crassatellites obesus</i> (?) (A. Ad.).                      | <i>Siphonalia costata</i> (Hutt.).                                 |
| <i>Crepidula striata</i> (Hutt.).                                 | *   " <i>nodosa</i> (Mart.).                                       |
| <i>Cucullæa alta</i> Sow.   | <i>Struthiolaria cincta</i> Hutt.                                  |
| " <i>attenuata</i> Hutt.  | *   " <i>papulosa</i> (Mart.).                                     |
| <i>Cyllichnella enysi</i> (Hutt.).                                | <i>Surcula fusiformis</i> (Hutt.).                                 |
| <i>Dentalium solidum</i> Hutt.                                    | <i>Terebra orycta</i> Sut.   |
| * <i>Dosinia greyi</i> Zitt.                                      | " <i>pareoraensis</i> Sut.   |
| *   " <i>lambata</i> (Gould).                                     | <i>Turritella</i> ( <i>Peyrotia</i> ) <i>cavershamensis</i> Harris |
| <i>Glycymeris cordata</i> (Hutt.).                                | " ( <i>Torcula</i> ) <i>semiconcava</i> Sut.                       |
| *   " <i>laticostata</i> (Q. & G.).                               | <i>Venericardia psutes</i> Sut.                                    |
| <i>Latirus</i> ( <i>Leucozonia</i> ) <i>brevirostris</i> (Hutt.). | <i>Vexillum</i> ( <i>Costellaria</i> ) <i>rutidolomum</i> Sut.     |
| * <i>Limopsis aurita</i> (Brocchi).                               | * <i>Zenatia acinaces</i> (Q. & G.).                               |

Forty-eight species, of which seventeen also Recent = 35 per cent.

Age: Miocene (Upper). Horizon: Pareoran.

Near Bluecliffs Station, Upper Otaio Valley, Canterbury: Bluish Clays above the Oamaru Limestone. M. C. Gudex; 1913.

A list of fossils from this locality has been published by Mr. Gudex in *Trans. N.Z. Inst.*, vol. 46, 1914, p. 278, containing a few species which are not on my own list.

- Alectrion socialis* (Hutt.).  
*Ampullina (Megatylotus) suturalis* (Hutt.).  
*Ancilla* (s. str.) *hebera* (Hutt.).  
 \* " (*Amalda*) *nova-zelandica* (Sow.).  
 \* " (*Alcocospira*) *papillata* (Tate).  
*Bathytoma haasti* (Hutt.).  
 " *sulcata excavata* Sut.  
 \* *Calyptræa (Sigapatella) maculata* (Q. & G.).  
 \* " " *inflata* (Hutt.).  
*Chione chiloensis truncata* (Sut.).  
 " *meridionalis* (Sow.).  
*Cominella pulchra* Sut.  
*Corbula canaliculata* Hutt.  
 \* *Crassatellites obesus* (A. Ad.).  
*Cucullæa australis* (Hutt.).  
 \* *Dentalium ecostatum* T. W. Kirk.  
 " *mantelli* Zitt.  
 " *solidum* Hutt.  
 \* *Dosinia greyi* Zitt.  
*Drillia avamoensis* (Hutt.).  
 " *callimorpha* Sut.  
*Epitonium (Clathroscala) elatum* Sut.  
 " (*Cirsotrema*) *lyratum* (Zitt.).  
*Exilia dalli* Sut.  
*Fulgoraria arabica turrita* Sut.  
 \* *Fusinus spiralis* (A. Ad.).  
*Lima colorata* Hutt.  
 \* *Limopsis aurita* (Brocchi).  
 \* *Malletia australis* (Q. & G.).  
*Miomelon corrugata* (Hutt.).
- Mitra (Cancilla) armorica* Sut.  
 " n. sp.  
 \* *Natica australis* (Hutt.).  
 \* " *zelandica* Q. & G.  
*Pecten (Pseudamysium) huttoni* (Park).  
 \* *Placunanomia zelandica* (Gray).  
*Polinices gibbosus* (Hutt.).  
 " (*Necerita*) *ovatus* (Hutt.).  
 \* " (*Euspira*) *planispirus* Sut.  
*Ptychotractus nodosoliratus* Sut.  
*Simum (Eunaticina) cinctum* (Hutt.).  
 \* " " *undulatum* (Hutt.).  
*Siphonalia conoidea* (Zitt.).  
 " *costata* (Hutt.).  
 \* " *dilatata* (Q. & G.).  
*Surcula fusiformis* (Hutt.).  
*Terebra orycta* Sut.  
 " *pareoraensis* Sut.  
*Teredo heaphyi* Zitt.  
*Turbonilla (Mormula) prisca* Sut.  
 \* *Turritella (Peyrotia) carlottæ* Wats.  
 " " *cavershamensis* Harris.  
 " (*Torcula*) *concava* Hutt.  
 " (*Peyrotia*) *palagonica* Sow.  
 " (*Torcula*) *semiconcava* Sut.  
*Typhis maccoyi* T.-Woods.  
 \* *Venericardia difficilis* (Desh.).  
 \* " " *purpurata* (Desh.).  
*Vexillum linctum* (Hutt.).  
 " (*Costellaria*) *rutidolum* Sut.

Sixty species, of which seventeen also Recent = 28 per cent.

Age: Upper Miocene (probably). Horizon: Pareoran (probably).

Blue Cliffs, Otaio River, South Canterbury. J. A. Thomson; 1917.

- Alectrion socialis* (Hutt.).  
*Ampullina (Megatylotus) suturalis* (Hutt.).  
 \* *Ancilla (Amalda) nova-zelandica* (Sow.).  
 " (*Alcocospira*) *papillata* (Tate).  
 \* *Bathytoma albula* (Hutt.).  
 " *sulcata excavata* Sut.  
*Borsonia (Cordieria)* n. sp.  
 " " n. sp.  
 " (*Mitromorpha*) n. sp.  
*Chione chiloensis truncata* Sut. Cast.  
*Corbula canaliculata* Hutt.  
 " *pumila* Hutt.  
 \* *Crepidula monoxyla* (Less.).  
*Cucullæa alta* (?) Sow. Fragment.  
*Cylichnella enysi* (Hutt.). Juv.  
*Dentalium mantelli* Zitt.  
 " (*Fustiaria*) *pareorensis* Pils. & Sharp.  
 " *solidum* Hutt.  
*Dosinia greyi* Zitt.
- Drillia avamoensis* (Hutt.).  
 " n. sp.?  
 " n. sp. Near *D. lyallensis* Murdoch.  
 \* *Emarginula striatula* Q. & G. Fragment.  
*Epitonium (Clathroscala) elatum* Sut.  
 " (*Cirsotrema*) *lyratum* (Zitt.).  
*Exilia dalli* Sut.  
*Fasciolaria johnstoni* (T.-Woods).  
*Leda semiteres* Hutt. Juv.  
*Lima colorata* Hutt.  
*Marginella conica* Harris.  
*Mesalia striolata* (Hutt.).  
*Miomelon corrugata* (Hutt.).  
 \* *Natica australis* (Hutt.).  
 \* " *zelandica* Q. & G.  
*Pecten (Pseudamysium) hochstetteri* (?) Zitt. Fragment.  
 " " *huttoni* (Park). Fragment.

*Ptychotractus nodosoliratus* Sut.  
 " *pukeuriensis* Sut.  
*Rozaxia* n. sp.  
*Sinum* (*Eunaticina*) *cinctum* (Hutt.).  
*Siphonalia costata* (Hutt.).  
 " *dilatata* (Q. & G.). Juv.  
 \* " *nodosa* (Mart.). Juv.  
*Surcula climacota* Sut.

*Surcula fusiformis* (Hutt.).  
*Terebra orycta* Sut.  
*Teredo heaphyi* Zitt.  
*Trophon lepidus* Sut.  
*Turritella* (*Torcula*) *conca* Hutt. Juv.  
 \* *Venericardia purpurata* (Desh.). Juv.  
*Vexillum apicale* (Hutt.).

Fifty-one species, of which ten also Recent = 20 per cent.

Age: Upper Miocene (probably). Horizon: Pareoran (probably).

The percentage of Recent species is smaller than is usual in beds of undoubted Pareora age.

Near Waihao River: Grey Marls. Geol. Surv. Loc. 485. McKay; 1880.

*Amusium zittelli* (Hutt.). Many specimens.  
 \* *Anomia trigonopsis* Hutt.  
*Astræa* sp.? Fragment.  
 \* *Calyptrea* (*Sigapatella*) *maculata inflata* (Hutt.).  
*Cantharidus fenestratus* Sut.  
*Cardium* aff. *huttoni* Iher. Juv.  
*Chione chilensis truncata* Sut.  
 \* " *mesodesma* (Q. & G.).  
*Corbula canaliculata* Hutt.  
 " *kaiparaensis* Sut.  
 \* *Crassatellites obesus* (A. Ad.).  
 " n. sp.  
*Cylichnella enysi* (Hutt.).  
*Dentalium mantelli* Zitt.  
 " *pareorense* Pils. & Sharp.  
*Exilia waihaoensis* (?) Sut.  
*Galeodea senex* (Hutt.).  
 \* *Leda bellula* A. Ad.  
*Leucosyrinx alta* (Harris).

\* *Lima suteri* Dall.  
 \* *Limopsis aurita* (Brocchi).  
 " *zittelli* Iher.  
*Modiolaria elongata* (?) (Hutt.).  
*Nucula sagittata* Sut.  
*Pecten* (*Pseudamusium*) *huttoni* (Park).  
 " (*Pallium*) *polymorphoides* Zitt.  
*Pholadomya neozelanica* Hutt.  
 \* *Protocardia* (*Nemocardium*) *pulchella* (Gray).  
*Sinum* (*Eunaticina*) *cinctum* (Hutt.).  
*Surcula fusiformis* (Hutt.).  
 \* *Tellina eugonia* Sut.  
*Terebra orycta* Sut.  
*Teredo heaphyi* Zitt.  
*Turritella* (*Peyrotia*) *patagonica* Sow.  
 \* " (*s. str.*) *symmetrica* Hutt.  
 \* *Venericardia lutea* (?) (Hutt.). Juv.  
 \* *Zenatia acinaces* (Q. & G.).

Thirty-seven species, of which twelve also Recent = 32 per cent.

Age: Miocene (Oamaruan). Horizon: Upper Waiarekan (?).

In MS. McKay states that the collection was made from beds appearing on the right bank of the Waihao River and in a small creek leading up to the higher part of Mount Harris.

Reference: McKay, *Rep. of Geol. Explor. during 1881*, No. 14, 1882, pp. 56, 69, &c. (no special mention). The so-called "Grey Marls" of the South Canterbury and Oamaru districts cannot be correlated with the Grey Marl above the Weka Pass stone. In making the correlation McKay relied on their conformity to the underlying limestone and palaeontological evidence (not stated). In 1887, however, he found that the supposed Grey Marls underlay the Waihao limestone. See *Rep. of Geol. Explor. during 1886-87*, No. 18, 1887, pp. 98, 99, &c.

Waihao Bridge, One Mile and a Half below Waihao Forks. Geol. Surv. Loc. 462. McKay; 1880.

*Ampullina* (*Megatylotus*) *suturalis* (Hutt.).  
 " *waihaoensis* Sut.  
 \* *Ancilla* (*Baryspira*) *micronata* (Sow.).  
 " (*Amalda*) *waikopiroensis* Sut.  
 \* *Dentalium ecostatum* T. W. Kirk.  
 " *mantelli* Zitt.  
 " *pareorense* Pils. & Sharp.  
 " *solidum* Hutt.

*Exilia waihaoensis* Sut.  
*Hemiconus ornatus* (Hutt.).  
 \* *Mangilia sinclairi* (E. A. Smith).  
*Mitra inconspicua* Hutt.  
*Sinum* (*Eunaticina*) *elegans* Sut.  
*Siphonalia conoidea* (?) (Zitt.).  
 " *costata* (?) (Hutt). Fragment.  
 " *turrita* Sut. Juv.

*Surcula serotina* Sut.  
*Terebra costata* Hutt.  
*Turris complicatus* Sut.  
*Turritella (Haustoria) aldingæ* Tate.

*Turritella (Archimediella) ambulacrum* Sow.  
 " (*Torcula*) *conca* Hutt. Juv.  
 \**Venericardia difficilis* (Desh.).

Twenty-three species, of which four also Recent = 17 per cent. Only three of these twenty-three species appear on the preceding list, namely, *Dentalium mantelli*, *Dentalium pareorense* and *Exilia waihaeensis*.

Age: Miocene (Oamaruan). Horizon: Waiarekan (?).

Reference: McKay loc. cit., 1882, pp. 56, 72, &c. (no special mention). See also McKay, loc. cit., 1887, p. 98, where he says a collection was made from grey sandy beds two miles below Waihao Forks. These beds were found to rest on the greensands of Waihao Forks.

Mount Harris, Waihao River. Geol. Surv. Loc. 475. McKay, 1880; J. A. Thomson, 1913.

\**Ancilla (Amalda) novæ-zelandiæ* (Sow.).  
 " (*Alocospira*) *papillata* (Tate).  
*Bathytoma haasti* (Hutt.).  
 \**Calyptrea (Sigapatella) maculata* (Q. & G.).  
*Chione meridionalis* (Sow.).  
*Cominella exculpta* Sut.  
*Corbula canaliculata* Hutt.  
 " *humerosa* Hutt.  
 " *kaiparaensis* Sut.  
 \**Crassatellites obesus* (A. Ad.).  
*Cucullæa attenuata* Hutt.  
 \**Cytherea oblonga* (Hanley).  
*Dentalium mantelli* Zitt.  
 \**Dosinia greyi* Zitt. Fragment.  
*Drillia avamoensis* (Hutt.).  
 \**Fulgoraria arabica* (Mart.).  
 \* " *elongata* (Swains.). Juv.  
 " *biconica* Sut.  
 \* " *gracilis* (Swains.).  
 \**Fusinus spiralis* (A. Ad.).  
*Leucosyrinx alta* Harris.  
 " *transnana* Sut.  
*Lima paucisulcata* Hutt.  
 \**Limopsis aurita* (Brocchi).

\**Malleia australis* (Q. & G.).  
*Marginella (Eratoides) conica* Harris.  
*Miomelon corrugata* (Hutt.).  
*Panope orbita* Hutt.  
*Pecten (Pseudamusium) huttoni* (Park).  
 " " *waihaeensis* Sut. (P. Marshall leg.)  
 \**Placunanomia zelandica* (Gray).  
 \**Polinices amphialus* (Wats.).  
 " *gibbosus* (Hutt.).  
 " (*Neverita*) *ovatus* (Hutt.).  
*Sinum (Evanaticina) miocenicum* Sut.  
*Siphonalia costata* (?) (Hutt.). Spire only.  
 \* " *dilatata* (Q. & G.).  
 " *subreflexa* (Sow.).  
*Struthiolaria tuberculata* Hutt.  
*Surcula fusiformis* (Hutt.).  
*Tritonidea compacta* Sut. Juv.  
 \**Turritella (Peyrotia) carlotæ* Wats.  
 " *cavershamensis* Harris.  
 " (*Torcula*) *conca* Hutt.  
 " (*Peyrotia*) *patagonica* Sow.  
*Typhis (Typhina) maceoiji* T.-Woods.  
*Venericardia pseutes* Sut.

Forty-seven species, of which fifteen also Recent = 32 per cent.

Age: Upper Miocene. Horizon: Pareoran.

Reference: McKay, loc. cit., 1880, pp. 56, 64; also 1887, p. 98.

Waihao River: Marly Greensands. Geol. Surv. Loc. 479. McKay, 1880; J. A. Thomson, 1913.

*Ampullina (Megatylotus) suturalis* (Hutt.).  
*Ancilla (Alocospira) papillata* (Tate).  
*Aturia australis* McCoy.  
*Borsonia (Cordieria) cincta* (Hutt.).  
 " *rudis* (Hutt.).  
*Clavatula mackayi* Sut.  
*Clio (Crescis) sp.*  
*Cucullæa attenuata* Hutt.  
*Cymatium n. sp.?*  
 \**Dentalium ecostatum* T. W. Kirk.  
 " *mantelli* Zitt.  
 " *solidum* Hutt.  
*Fulgoraria arabica turrita* Sut.  
*Galeodea senex* (Hutt.).

*Hemifusus goniodes* Sut.  
*Leda semiteres* Hutt.  
 \**Limopsis aurita* (Brocchi).  
*Miomelon corrugata* (Hutt.).  
*Mitra inconspicua* Hutt.  
 \**Nucula nitidula* A. Ad.  
 \**Ostrea* (s. str.) *corrugata* Hutt.  
*Panope orbita* Hutt.  
*Pecten (Æquipecten) devinctus* Sut.  
 " (*Pseudamusium*) *huttoni* (Park).  
 " *waihaeensis* Sut.  
*Plejona (?) gracilicostata* (Zitt.).  
 " *neocopinata* (Sut.).  
 \**Polinices amphialus* (Wats.).

- Polinices gibbosus* (Hutt.).  
*Rapana neozelanica* Sut.  
 \**Sinum* (*Eunaticina*) *undulatum* (Hutt.). Juv.  
*Streptocheilus* n. sp.  
*Struthiolaria cincta* Hutt.  
     " *minor* Marshall.  
*Surcula mordax* Sut.

- \**Terebra tristis* Desh.  
*Turris duplex* Sut.  
     " *utleyi* Sut.  
*Turritella* (*Archimediella*) *ambulacrum* Sow.  
 \* " (*Peyrotia*) *carlottae* Wats.  
 \**Venericardia difficilis* (Desh.) var.  
*Vexillum apicicostatum* Sut.

Forty-two species, of which nine also Recent = 21 per cent.

Age: Miocene (Oamaruan). Horizon: Waiarekan (?).

Reference: McKay, loc. cit., 1880, pp. 71-72, &c.

**Waihao River: Waihao Limestone.** Geol. Surv. Loc. 482. McKay; 1880.

- Epitonium* (*Cirsotrema*) *lyratum* (Zitt.).  
*Pecten* (*Pseudamysium*) *huttoni* (Park). Fragment.  
 ment.

- \**Pecten* (*Chlamys*) *zelandiae* Gray. Fragment.  
*Struthiolaria* sp. (?).

Age: Miocene (Oamaruan). Horizon: Ototaran (?).

Reference: McKay, loc. cit., 1880, p. 70. See also McKay, loc. cit., 1887, pp. 91 et seq.

**Waihao River: Lower Part of Greensands.** Geol. Surv. Loc. 480. McKay, 1880; J. A. Thomson, 1913.

- Acteon ovalis* (?) (Hutt.).  
*Ampullina* (*Megatylotus*) *suturalis* (Hutt.).  
*Ancilla* (*Alcocospira*) *papillata* (Tate). Juv.  
 \**Calyptrea* (*Sigapatella*) *maculata inflata* (Hutt.).  
*Cardium waitakiense* Sut. Plentiful.  
*Chione meridionalis* (Sow.). Juv.  
*Clavatula mackayi* Sut.  
*Conus* sp. Spire.  
*Corbula canaliculata* Hutt.  
     " *kaiparaensis* Sut.  
 \**Crassatellites obesus* (A. Ad.) Juv.  
*Cucullæa attenuata* Hutt. Plentiful; many  
 young.  
*Cylichnella enysi* Hutt.  
*Dentalium solidum* Hutt.  
 \**Dosinia greyi* Zitt.  
*Drillia awamoensis* (Hutt.).  
     " sp.  
*Epitonium* (*Acrilla*) *gracillimum* Sut. Frag-  
 ments.  
*Euthria* sp.  
*Euthriofusus spinosus* Sut.  
*Fulgoraria* (*Alcihoë*) *biconica* Sut.  
*Fusinus* sp.  
*Galeodea senex* (Hutt.).  
*Glycymeris* sp.  
*Harpa* (*Eocithara*) *neozelanica* Sut.  
*Heliacus* n. sp. (?).  
*Lapparia hebes* (Hutt.).  
*Leda semiteres* Hutt.  
 \**Limopsis aurita* (Brocchi).  
 \**Natica australis* (Hutt.).  
 \* " *zelandica* Q. & G.

- \**Nucula strangei* A. Ad.  
*Plejona necopinata* Sut.  
 \**Polinices amphialus* (Wats.).  
     " (*Neverita*) *huttoni* (?) Iher.  
     " *ovatus* (Hutt.) Juv.  
 \**Protocardia* (*Nemocardium*) *pulchella* (Gray).  
     " *sera* (?) Hutt. Valve; sculpture lost  
 \**Psammobia lineolata* Gray.  
*Rapana waihaoensis* Sut. Cast.  
*Ringicula* n. sp. Apertures filled with matrix.  
*Sinum fornicatum* Sut. Juv.  
*Siphonalia nodosa acuticostata* Sut.  
*Solariella* n. sp.  
*Streptocheilus* n. sp.  
*Struthiolaria cincta* Hutt.  
     " *minor* Marshall.  
     " *tuberculata* Hutt. Juv.  
     " *concinna* Sut  
*Surcula antegypsata* Sut.  
     " *fusiformis* (?) (Hutt.).  
     " *laciniata* Sut.  
     " *serotina* Sut.  
     " *sertula* Sut.  
     " sp.  
 \**Tellina eugonia* Sut.  
*Terebra costata* (?) Hutt.  
*Teredo heaphyi* (?) Zitt.  
*Triphora* sp. Cast.  
*Trophon* n. sp.  
*Turris* sp.  
*Venericardia acanthodes* Sut.  
 \* " *difficilis* (Desh.).  
     " *pseutes* Sut.

Sixty-four species, of which twelve also Recent = 19 per cent.

Age: Lower Miocene or Oligocene (Oamaruan). Horizon: Waiarekan (?).

References: As for preceding list.

Mount Harris, Waihao River, South Canterbury. J. A. Thomson; 1917.

- |   |   |
|---|---|
| <i>Alectrion socialis</i> (Hutt.).            | <i>Leda semiteres</i> Hutt.                         |
| <i>Ancilla (Alocospira) papillata</i> (Tate). | <i>Limopsis catenata</i> Sut. Juv.                  |
| <i>Bathytoma sulcata excavata</i> Sut.        | <i>Marginella fraudulenta</i> Sut.                  |
| <i>Borsonia (Cordieria) n. sp.</i>            | * <i>Polinices amphialus</i> (Wats.).               |
| <i>Corbula humerosa</i> Hutt.                 | <i>Surcula fusiformis</i> (Hutt.). Juv.             |
| * <i>Crepidula monozyla</i> (Less.).          | <i>Trophon lepidus</i> Sut.                         |
| <i>Cymatium minimum</i> (Hutt.).              | <i>Turritella (Peyrotia) covershamensis</i> Harris. |
| <i>Drillia awamoensis</i> (Hutt.).            | Fragment.   |
| <i>Heliacis sp.</i> Juv.                      | * <i>Venericardia purpurata</i> (Desh.). Juv.       |

Seventeen species, of which three also Recent = 18 per cent.

Near McCulloch's Bridge: Waihao Greensands. J. A. Thomson; 1917.

- |   |   |
|---|---|
| <i>Ampullina (Megatylotus) suturalis</i> (Hutt.). Juv.        | * <i>Limopsis aurita</i> (Brocchi). Juv.          |
| " <i>waihaoensis</i> Sut.                                     | <i>Merica</i> n. sp.                              |
| <i>Ancilla (Alocospira) papillata</i> (Tate).                 | <i>Miomelon corrugata</i> (Hutt.).                |
| <i>Ancistrosyrinx n. sp.</i> Genus new to fauna.              | <i>Mitra inconspicua</i> Hutt.                    |
| <i>Borsonia (Cordieria) cincta</i> (Hutt.).                   | * <i>Natica australis</i> (Hutt.).                |
| "    " <i>rudis</i> (Hutt.).                                  | <i>Pecten (Pseudamysium) waihaoensis</i> Sut.     |
| <i>Corbula canaliculata</i> Hutt.                             | <i>Polinices gibbosus</i> (Hutt.). Juv.           |
| *    " <i>macilentia</i> Hutt.                                | <i>Sinum (Eunaticina) elegans</i> Sut.            |
| <i>Corbula pumila</i> Hutt.                                   | * <i>Siphonalia dilatata</i> (Q. & G.). Juv.      |
| <i>Dentalium mantelli</i> Zitt.                               | *    " <i>mandarina</i> (Duclos). Juv.            |
| "    ( <i>Fustiaria</i> ) <i>pareorensis</i> Pils. & Sharp.   | *    " <i>nodosa</i> (Mart.). Juv.                |
| " <i>solidum</i> Hutt.  | <i>Surcula serotina</i> Sut.                      |
| <i>Epitonium (Clathroscala) elatum</i> Sut.                   | <i>Turris bimarginatus</i> Sut.                   |
| "    ( <i>Cirsotrema</i> ) <i>lyratum</i> (Zitt.). Juv.       | " <i>complicatus</i> Sut.                         |
| <i>Gilbertia</i> aff. <i>paucistriata</i> (Marshall). Broken. | <i>Turritella (Archimediella) ambulacrum</i> Sow. |
| * <i>Leda bellula</i> A. Ad.                                  | <i>Vexillum apicicostatum</i> Sut.                |
| " <i>semiteres</i> Hutt.                                      | "    n. sp.                                       |

Thirty-four species, of which seven also Recent = 21 per cent.

Age: Lower Miocene or Oligocene. Horizon: Waiarekan.

Right Bank of the Waihao River, Three Miles below the Waihao Forks, in a Bed of Greensands which lies conformably below the Arenaceous Limestone. G. H. Uttley; 1912. (See also *Trans. N.Z. Inst.*, vol. 47, 1915, p. 385.)

- |   |   |
|---|---|
| <i>Alectrion socialis</i> (Hutt.).                | * <i>Limopsis aurita</i> (Brocchi).             |
| <i>Ampullina (Megatylotus) suturalis</i> (Hutt.). | <i>Miomelon corrugata</i> (Hutt.).              |
| <i>Ancilla (Alocospira) papillata</i> (Tate).     | * <i>Struthiolaria papulosa</i> (Mart.).        |
| <i>Bathytoma haasti</i> (Hutt.).                  | " <i>tuberculata</i> Hutt.                      |
| <i>Corbula canaliculata</i> Hutt.                 | <i>Surcula fusiformis</i> (Hutt.).              |
| * <i>Crasatellites obesus</i> (A. Ad.)            | "    n. sp.                                     |
| <i>Dentalium mantelli</i> Zitt.                   | * <i>Turritella (Peyrotia) carlotta</i> Wats.   |
| <i>Galeodea senex</i> (Hutt.).                    | "    ( <i>Torcula</i> ) <i>conca</i> Hutt.      |
| <i>Hemiconus ornatus</i> (Hutt.).                 | "    ( <i>Peyrotia</i> ) <i>patagonica</i> Sow. |
| <i>Leucosyrinx alta</i> (Harris).                 | "    ( <i>Torcula</i> ) <i>semiconca</i> Sut.   |
| <i>Lima colorata</i> Hutt.                        |   |

Twenty-one species, of which four also Recent = 19 per cent.

Age: Lower Miocene or Oligocene (Oamaruan). Horizon: Waiarekan.

Waihao Forks, 300 Yards from Hotel, on Rise. G. H. Uttley; 1912.

*Ampullina (Megatylotus) suturalis* (Hutt.).  
*Cardium* sp.

*Lima paleata* Hutt.  
\**Limopsis aurita* (Brocchi).

Age: Oamaruan. Horizon: Waiarekan.

Right Bank of the Waihao River, at McCullogh's Bridge: Greensands lying conformably beneath the Arenaceous Limestone. G. H. Uttley; 1912. (See also *Trans. N.Z. Inst.*, vol. 47, 1915, p. 385.)

*Ampullina (Megatylotus) suturalis* (Hutt.).

*Siphonalia turrata* Sut.

\**Ancilla (Amalda) novæ-zelandiæ* (Sow.).

*Surcula pareoraensis* (Sut.).

*Borsonia (Cordieria) rudis* (Hutt.).

*Turris duplex* Sut.

*Corbula canaliculata* Hutt.

„ *regius* Sut.

*Dentalium solidum* Hutt.

*Turritella (Haustator) aldingæ* Tate.

*Mitra inconspicua* Hutt.

„ (*Archimediella ambulacrum* Sow.

\**Natica zelandica* Q. & G.

Thirteen species, of which two also Recent = 15 per cent.

Age: Lower Miocene or Oligocene. Horizon: Waiarekan.

Near Mount Harris, on the Slope towards the Waitaki Valley—the First Outcrop on the Road leading from the Waitaki to the Waihao Valley; overlying the Limestone. G. H. Uttley; 1912. (See also *Trans. N.Z. Inst.*, vol. 47, 1915, p. 385.)

\**Ancilla (Amalda) novæ-zelandiæ* (Sow.).

\**Malletia australis* (Q. & G.).

*Corbula canaliculata* Hutt.

*Nucula sagittata* Sut.

„ *humerosa* Hutt.

*Polinices gibbosus* (Hutt.).

„ *kaiparaensis* Sut.

\**Psammobia lineolata* Gray.

\**Crassatellites obesus* (A. Ad.).

*Surcula fusiformis* (Hutt.).

*Cytherea oblonga* (Hanley) var.

*Turritella (Peyrotia) cavershamensis* Harris.

*Dentalium mantelli* Zitt.

„ (*Torcula*) *concava* Hutt.

*Drillia* n. sp.

„ *semiconcava* Sut.

*Epitonium (Cirsotrema) lyratum* (Zitt.).

\**Venericardia difficilis* (Desh.).

*Galeodea senex* (?) (Hutt.). Juv.

\**Zenatia acinaces* (Q. & G.).

\**Limopsis aurita* (Brocchi).

Twenty-one species, of which eight also Recent = 38 per cent.

Age: Upper Miocene. Horizon: Pareoran.

Top of the Hill from Waihao Forks to Elephant Hill: The Rocks are Brown Sands similar to those of the Last Locality, overlying the Limestone. G. H. Uttley; 1912. (See also *Trans. N.Z. Inst.*, vol. 47, 1915, p. 386.)

*Alectrion socialis* (Hutt.).

*Marginella (Eratoidea) harrisi* Cossm.

*Ampullina (Megatylotus) suturalis* (Hutt.).

\**Natica zelandica* Q. & G.

\**Ancilla (Amalda) novæ-zelandiæ* (Sow.).

*Polinices (Neverita) huttoni* Iher.

*Bathytoma sulcata exzevata* Sut.

*Siphonalia conoidea* (Zitt.).

*Corbula canaliculata* Hutt.

*Streptosiphon reticulatum* Sut.

\**Crassatellites obesus* (A. Ad.).

*Surcula fusiformis* (Hutt.).

*Cylichnella enysi* (Hutt.).

„ *huttoni* Sut.

\**Dentalium ecostatum* T. W. Kirk.

*Terebra costata* Hutt.

\* „ *nanum* Hutt.

\**Thalassohelix igniflua* (Reeve). New as a fossil.

\**Fulgoraria arabica* (Mart.).

\**Turritella (Peyrotia) carlotta* Wats.

*Leucosyrinx alta* (Harris).

„ *cavershamensis* Harris.

*Mangilia* n. sp. (?).

\**Venericardia difficilis* (Desh.).

Twenty-four species, of which nine also Recent = 37.5 per cent.

Age and horizon: As for last locality.



## Wharekuri, Waitaki River. Geol. Surv. Loc. 251. C. Traill; 1874.

<i>Bathytoma sulcata</i> (?) (Hutt.). Fragment.	<i>Pecten</i> ( <i>Pseudamysium</i> ) <i>huttoni</i> (Park). Fragment.
<i>Cardium huttoni</i> Iher.	
<i>Cucullæa attenuata</i> Hutt.	<i>Polinices gibbosus</i> (Hutt.).
<i>Dentalium solidum</i> Hutt.	( <i>Neverita</i> ) <i>huttoni</i> Iher.
<i>Epitonium</i> ( <i>Cirsotrema</i> ) <i>lyratum</i> (Zitt.).	<i>Teredo heaphyi</i> Zitt.
* <i>Limopsis aurita</i> (Brocchi).	<i>Turris utleyi</i> Sut.
" <i>zitteli</i> Iher.	<i>Turritella</i> ( <i>Peyrotia</i> ) <i>cavershamensis</i> Harris.
<i>Miomelon corrugata</i> (Hutt.).	* <i>Xenophora corrugata</i> (Reeve). Fragment.

Fifteen species, of which two also Recent = 13 per cent.

Age: Miocene or Oligocene (Oamaruan).

## Wharekuri, Waitaki River: Otekaieke Limestone. Geol. Surv. Loc. 478. McKay; 1880.

<i>Crepidula gregaria</i> Sow.	<i>Nucula sagittata</i> Sut.
<i>Dentalium mantelli</i> Zitt.	<i>Panope orbita</i> Hutt.
" <i>solidum</i> Hutt.	<i>Polinices</i> ( <i>Neverita</i> ) <i>ovatus</i> (Hutt.).
<i>Ficus transennus</i> (?) Sut.	<i>Teredo heaphyi</i> Zitt.

Age: Miocene (Oamaruan). Horizon: Ototaran (or, according to J. Park in *N.Z. Geol. Surv. Bull. No. 20*, 1918, Hutchinsonian). McKay's view is roughly the same as Park's—namely, that the Otekaieke limestone is younger than the Ototara stone, but he considered the latter rock to be of Cretaceo-Tertiary age, not middle Tertiary, as now commonly believed.

## Wharekuri, Waitaki River: Hutchinson Quarry Beds. Geol. Surv. Loc. 483. McKay; 1880.

<i>Ampullina</i> ( <i>Megatylotus</i> ) <i>suturalis</i> (Hutt.).	<i>Limopsis zitteli</i> Iher.
<i>Ancilla</i> ( <i>Alocospira</i> ) <i>papillata</i> (Tate).	<i>Polinices gibbosus</i> (Hutt.).
<i>Chione meridionalis</i> (Sow.).	"    ( <i>Neverita</i> ) <i>huttoni</i> Iher.
* <i>Crassatellites obesus</i> (A. Ad.).	" <i>ovatus</i> (Hutt.).
<i>Dentalium solidum</i> Hutt.	<i>Turris utleyi</i> Sut.
* <i>Glycymeris laticostata</i> (Q. & G.)	* <i>Venericardia purpurata</i> (?) (Desb.).
"    "    var.	" <i>pseutes</i> Sut.

Fourteen species, of which three also Recent = 21 per cent.

Age: Miocene. Horizon: Hutchinsonian. According to McKay's MS., the beds collected from the higher part of the ridge south of the coal-mine at Wharekuri.

Reference: McKay, *Rep. of Geol. Explor. during 1881*, No. 14, 1882, p. 65, &c. The fossiliferous beds "consist of loose dirty greensand, full of shells, followed by grey sands."

## Wharekuri, Waitaki River: Greensand. Geol. Surv. Loc. 486. McKay; 1880.

<i>Ampullina</i> ( <i>Megatylotus</i> ) <i>suturalis</i> (?) (Hutt.).	<i>Pecten</i> ( <i>Pseudamysium</i> ) <i>hochstetteri</i> Zitt.
<i>Astarte australis</i> Hutt.	"    " <i>huttoni</i> (Park). Juv.
<i>Chione chilensis truncata</i> (?) Sut.	"    " <i>yahliensis</i> T.-Woods.
<i>Crassatellites attenuatus</i> (?) Hutt. Juv.	<i>Pholadomya neozelanica</i> (?) Hutt. Cast.
*    " <i>obesus</i> (A. Ad.).	<i>Pleurotomaria tertiaria</i> McCoy.
<i>Cucullæa attenuata</i> Hutt.	<i>Polinices</i> ( <i>Neverita</i> ) <i>huttoni</i> Iher.
* <i>Cytherea oblonga</i> (Hanley).	<i>Siphonalia conoidea</i> (?) (Zitt.).
<i>Dentalium mantelli</i> Zitt.	<i>Teredo heaphyi</i> Zitt.
<i>Leda semiteres</i> (?) Hutt.	<i>Turbo</i> ( <i>Marmorostoma</i> ) <i>approximatus</i> Sut.
<i>Panope orbita</i> Hutt.	* <i>Turritella</i> ( <i>Peyrotia</i> ) <i>carlottæ</i> Wats.
" <i>worthingtoni</i> Hutt.	* <i>Venericardia difficilis</i> (?) (Desh.).
<i>Pecten</i> ( <i>Chlamys</i> ) <i>aldingensis</i> Tate.	* <i>Xenophora corrugata</i> (Reeve).

Twenty-four species, of which five also Recent = 21 per cent.

Age: Miocene or Oligocene (Oamaruan). Horizon: Waiarekan.

Reference: McKay, *loc. cit.*, 1882, pp. 73-74. See also F. W. Hutton in *Q.J.G.S.*, vol. 41, 1885, p. 559, &c.

Left Bank of Waitaki River, about a Mile below Wharekuri: Marly Greensands below the Limestone. G. H. Uttley; 1912. (See also *Trans. N.Z. Inst.*, vol. 47, 1915, p. 382.)

- Ampullina (Megatylotus) suturalis* (Hutt.).  
*Ancilla (Alocospira) papillata* (Tate).  
 \**Anomia trigonospira* Hutt.  
*Bathytoma sulcata excavata* Sut.  
*Borsonia (Cordieria) rudis* (Hutt.).  
 \**Calyptrea (Sigapatella) maculata* (Q. & G.).  
*Chione meridionalis* (Sow.).  
*Corbula humerosa* Hutt.  
 \**Crassatellites obesus* (A. Ad.).  
*Cucullæa attenuata* Hutt.  
*Dentalium mantelli* Zitt.  
 " *solidum* Hutt.  
 \**Dosinia greyi* Zitt.  
*Epitonium (Cirsotrema) lyratum* (Zitt.).  
*Glycymeris cordata* (?) (Hutt.).  
 \**Limopsis aurita* (Brocchi).  
*Limopsis zitteli* Iher.  
 \**Macrocallista multistriata* (Sow.).  
 \**Malletia australis* (Q. & G.).  
*Miomelon corrugata* (Hutt.).  
 \**Ostrea (Anodontostrea) tatei* Sut.  
*Polinices gibbosus* (Hutt.).  
 " (Neverita) *huttoni* Iher.  
 \**Psammobia lineolata* Gray.  
*Sinum (Eunaticina) cinctum* (Hutt.).  
*Teredo heaphyi* Zitt.  
*Turritella (Archimediella) ambulacrum* Sow.  
 \* " (*Peyrotia*) *carlotta* Wats.  
 " (*Torcula*) *conca* Hutt.  
 \* " (s. str.) *symmetrica* Hutt.  
*Venericardia pscutes* Sut.

Thirty-one species, of which eleven also Recent = 35.5 per cent.

Age: Miocene (Oamaruan). Horizon: Waiarekan (?).

Otiakē, Waitaki County, North Otago. J. A. Thomson; 1917.

- Ampullina (Megatylotus) suturalis* (Hutt.).  
*Ancilla (Alocospira) papillata* (Tate).  
 \**Anomia trigonospira* Hutt.  
*Bathytoma sulcata excavata* Sut.  
 \**Calyptrea alta* (Hutt.).  
 \* " *maculata* (Q. & G.). Juv.  
*Corbula canaliculata* Hutt.  
 \**Cytherea oblonga* (Hanley). Fragment.  
*Dentalium (Fustiaria) pareorensis* Pils. & Sharp.  
 \**Divaricella cumingi* (Ad. & Ang.). Fragment.  
 \**Dosinia greyi* Zitt.  
*Ficus parvus* Sut.  
 \**Fulgoraria gracilis* (Swains.).  
*Lima colorata* Hutt.  
 \**Limopsis aurita* (Brocchi).  
 \**Macrocallista multistriata* (Sow.).  
*Miomelon corrugata* (Hutt.). Fragment.  
*Mitra (Cancilla) armorica* Sut.  
 \**Murex zelandicus* Q. & G.  
 \**Natica zelandica* Q. & G. Juv.  
 \**Ostrea (Anodontostrea) tatei* Sut.  
*Pecten (Patinopecten) beethami* Hutt.  
 " (*Chlamys*) *chathamensis* Hutt. Fragments.  
*Polinices gibbosus* (Hutt.).  
 " *huttoni* Iher.  
 \**Siphonalia nodosa* (Mart.).  
 " *turrita* Sut.  
*Surcula* cf. *huttoni* Sut. Fragment.  
 \**Tellina glabella* Desh. Fragment.  
*Teredo heaphyi* Zitt.  
 \**Thyasira flexuosa* (?) (Montagu). Fragment.  
 \**Turbonilla zelandica* (Hutt.).  
*Turris uttleyi* Sut.  
*Turritella (Archimediella) ambulacrum* Sow.  
 " (*Peyrotia*) *cavershamensis* Harris.  
 " (*Torcula*) *semiconcava* Sut.  
*Venericardia pscutes* Sut.  
 \* " *purpurata* (Desh.). Juv.  
*Verillum* n. sp. Near *V. waitei* Sut.  
 \**Zenatia acinaces* (Q. & G.).

Forty species, of which eighteen also Recent = 45 per cent.

Age: Upper Miocene. Horizon: Pareoran (Awamoan).

Otiakē River, Trig. Z, Maerewhenua District, Half a Mile distant from the Railway-line between Oamaru and Kurow, just below the Bridge over the Otiakē Stream: Arenaceous Limestone. G. H. Uttley; 1912. (See also *Trans. N.Z. Inst.*, vol. 47, 1915, p. 383.)

- Ampullina (Megatylotus) suturalis* (Hutt.).  
 \**Ancilla (Baryspira) mucronata* (Sow.).  
 " (*Alocospira*) *papillata* (Tate).  
*Bathytoma sulcata excavata* Sut.  
*Borsonia (Cordieria) rudis* (Hutt.).  
 \**Calyptrea (Sigapatella) maculata* (Q. & G.).  
*Corbula canaliculata* Hutt.  
 " *humerosa* Hutt.  
 " *kaiparaensis* Sut.  
 \**Crassatellites obesus* (A. Ad.).  
*Crepidula striata* Hutt.  
*Cucullæa attenuata* Hutt.

*Cymatium minimum* (Hutt.).  
*Cytherea chariessa* Sut.  
 \* " *oblonga* (Hanley).  
*Dentalium mantelli* Zitt.  
 " *solidum* Hutt.  
 \* *Divaricella cumingi* (Ad. & Ang.).  
 \* *Dosinia greyi* Zitt.  
*Leucosyrinx alta* (Harris).  
 \* *Limopsis aurita* (Brocchi).  
*Macrocallista assimilis* (Hutt.).  
 " *multistriata* (Sow.).  
*Mangilia blandiata* Sut.  
*Marginella (Eratoidea) harrisi* Cossm.  
*Miomelon corrugata* (Hutt.).  
*Mitra (Cancilla) armorica* Sut.

*Modiolaria elongata* (Hutt.).  
 \* *Murex zelandicus* Q. & G.  
 \* *Natica zelandica* Q. & G.  
*Polinices gibbosus* (Hutt.).  
 " (*Neverita*) *huttoni* Iher.  
*Ptychotractus tenuiliratus* Sut.  
*Siphonalia turrita* Sut.  
*Surcula* n. sp.  
 " n. sp.  
*Teredo heaphyi* Zitt.  
*Turris utleyi* Sut.  
*Turritella (Peyrotia) cavershamensis* Harris.  
*Typhis maccoyi* T.-Woods.  
*Venericardia pseutes* Sut.

Forty-one species, of which ten also Recent = 24 per cent.

Age: Miocene. Horizon: Ototaran (or, according to Park, Hutchinsonian).

Station Peak, North Side of Waitaki Valley: Otekaieke Limestone. Geol. Surv. Loc. 477. McKay; 1880.

*Ancilla (Alocospira) papillata* (Tate).  
 " (*Baryspira*) *subgradata* (Tate).  
 \* *Anomia trigonopsis* Hutt.  
*Astræa (Guildfordia)* n. sp.  
*Bathytoma sulcata* (Hutt.).  
 \* *Calyptrea (Sigapatella) maculata* (Q. & G.).  
 " " *inflata* (Hutt.).  
 \* *Corbula canaliculata* Hutt.  
 \* *Crassatellites obesus* (A. Ad.).  
 \* *Crepidula monoxyla* (Less.).  
*Cucullæa attenuata* Hutt.  
*Cytherea chariessa* Sut.  
*Dentalium mantelli* Zitt. Fragments.  
 " *solidum* Hutt.  
 \* *Divaricella cumingi* (Ad. & Ang.).  
 \* *Fulgoraria* sp. Egg-capsule.  
*Leucosyrinx alta* (Harris).  
 \* *Lima lima* (L.).  
 " *paleata* Hutt.

\* *Limopsis aurita* (Brocchi).  
 \* *Macra scalpellum* Reeve.  
*Marginella (Eratoidea) harrisi* Cossm.  
*Mitra* n. sp.  
 \* *Natica zelandica* Q. & G.  
*Nucula sagittata* Sut. Fragment.  
 \* *Ostrea (s. str.) corrugata* Hutt.  
*Panope worthingtoni* Hutt.  
*Pecten (Pseudamusium) huttoni* (Park). Fragment.  
*Phos* n. sp. Imperfect.  
*Ptychotractus tenuiliratus* Sut.  
*Siphonalia* aff. *subnodosa* (Hutt.).  
 \* *Terebra tristis* Desh.  
*Teredo heaphyi* Zitt.  
*Turritella (Peyrotia) cavershamensis* Harris.  
 " (*Torcula*) *concaea* Hutt.  
 \* *Zenatia acinaces* (Q. & G.). Fragments.

Thirty-six species, of which fourteen also Recent = 39 per cent.

Age: Miocene (Oamaruan). Horizon: Ototaran (?). The locality is on the north side of the Waitaki River, nearly opposite the Otekaieke Junction (*Rep. of Geol. Explor. during 1881*, No. 14, 1882, p. 66).

Otekaieke, Waitaki River: Otekaieke Limestone. Geol. Surv. Loc. 481. McKay; 1880

\* *Crassatellites obesus* (A. Ad.).  
*Cucullæa worthingtoni* Hutt.  
*Dentalium solidum* Hutt.  
 \* *Divaricella cumingi* (Ad. & Ang.).  
 \* *Dosinia greyi* Zitt. Fragment.

\* *Limopsis aurita* (Brocchi).  
 \* *Ostrea* (s. str.) *corrugata* Hutt.  
 \* *Pecten (Chlamys) zelandica* Gray. Fragment.  
*Polinices (Neverita) huttoni* Iher.  
*Venericardia pseutes* Sut.

Age: Miocene (Oamaruan). Horizon: Ototaran (?).

Reference: McKay, *loc. cit.*, 1882, pp. 65-67, &c.

Otekaieke, Waitaki Valley. Geol. Surv. Loc. 252. C. Traill; 1874.

- |   |  |
|---|--|
| * <i>Crassatellites obesus</i> (A. Ad.) | <i>Pecten</i> ( <i>Pseudamysium</i> ) <i>huttoni</i> (Park). |
| <i>Crepidula gregaria</i> Sow.          | <i>Teredo heaphyi</i> Zitt.                                  |
| <i>Dentalium solidum</i> Hutt.          | <i>Turritella</i> ( <i>Torcula</i> ) <i>concava</i> Hutt.    |

\**Limopsis aurita* (Brocchi). Plentiful.

Age: Miocene (Oamaruan). Horizon: Ototaran (?).

According to McKay's MS., these fossils were presumably collected from the Otekaieke limestone (which he regarded as equivalent to the Wharekuri limestone, and younger than the Ototara limestone).

Waitaki River: Maerewhenua Limestone. Geol. Surv. Loc. 179. McKay; 1876.

- |  |  |
|--|--|
| <i>Astræa</i> sp. Cast.  | <i>Lima paleata</i> Hutt.                                    |
| <i>Epitonium</i> ( <i>Cirsotrema</i> ) <i>lyratum</i> Zitt. Fragments. | <i>Pecten</i> ( <i>Pseudamysium</i> ) <i>huttoni</i> (Park). |
|  | <i>Teredo heaphyi</i> Zitt.                                  |
| * <i>Fulgoraria</i> sp. Cast.  | * <i>Zenatia acinaeae</i> (Q. & G.).                         |
| <i>Lima</i> ( <i>Plagiostoma</i> ) <i>laevigata</i> Hutt.              |  |

Age: Miocene (Oamaruan). Horizon: Ototaran. McKay writes in MS.: "This limestone resembles and without doubt is the equivalent of the Ototara limestone near Oamaru."

References: McKay, *Rep. of Geol. Explor. during 1876-77*, No. 10, 1877, pp. 48, 60, 61, and *Rep. of Geol. Explor. during 1881*, No. 14, 1882, pp. 69-70, &c.

Pigeon Rock, Waitaki Valley: Maerewhenua Limestone. Geol. Surv. Loc. 484. McKay; 1880.

- |  |  |
|--|--|
| <i>Anomia</i> sp. Fragment.                                    | <i>Lima colorata</i> Hutt.                                 |
| <i>Dentalium mantelli</i> Zitt.                                | <i>Limopsis catenata</i> Sut.                              |
| " <i>solidum</i> Hutt.   | * <i>Odostomia</i> (s. str.) <i>pubica</i> Sut. Fragments. |
| <i>Epitonium</i> ( <i>Cirsotrema</i> ) <i>lyratum</i> (Zitt.). |  |

Age and horizon: As for last locality.

Waitaki River: "Kekenodon" Beds. Geol. Surv. Loc. 476. McKay; 1880.

- |   |  |
|---|--|
| * <i>Ancilla</i> ( <i>Baryspira</i> ) <i>australis</i> (Sow.). Mostly the spire only. | <i>Miomelon corrugata</i> (Hutt.). Fragments.                            |
| * <i>Anomia trigonopsis</i> Hutt.   | <i>Ostrea</i> aff. <i>arenicola</i> Tate. Fragment.                      |
| <i>Cardium waitakiense</i> Sut.   | <i>Pecten</i> ( <i>Chlamys</i> ) <i>chathamensis</i> Hutt.               |
| * <i>Crassatellites obesus</i> (A. Ad.)   | " ( <i>Pseudamysium</i> ) <i>huttoni</i> (Park).                         |
| <i>Cucullæa attenuata</i> Hutt.   | * <i>Placunanomia zelandica</i> (Gray).                                  |
| <i>Dentalium mantelli</i> Zitt.   | <i>Polinices gibbosus</i> (Hutt.).                                       |
| " <i>solidum</i> Hutt. Plentiful.   | " ( <i>Neverita</i> ) <i>huttoni</i> Iher.                               |
| <i>Epitonium</i> ( <i>Cirsotrema</i> ) <i>lyratum</i> (Zitt.).                        | <i>Teredo heaphyi</i> Zitt.  |
| <i>Limopsis zitteli</i> Iher. Plentiful.  | <i>Turritella</i> ( <i>Peyrotia</i> ) <i>cavershamensis</i> Harris. Juv. |
| * <i>Malletia australis</i> (Q. & G.).  | " ( <i>Torcula</i> ) <i>semiconcava</i> Sut.                             |
|   | <i>Venericardia psetes</i> Sut.  |

Twenty-one species, of which five also Recent = 24 per cent.

Age: Miocene (Oamaruan). Horizon: Waiarekan. According to McKay, the "Kekenodon" beds consist of slightly calcareous greensand, passing downwards into grey sands and rusty quartzose pebble-beds. They occupy an area about four miles by three, near Wharekuri.

References: McKay, *loc. cit.*, 1882, pp. 67-68, 73, &c.; Hector in *Trans. and Proc. N.Z. Inst.*, vol. 13, 1881, pp. 434-36 and pl. 17 (*Kekenodon onamata*).

Black Point, Waitaki River. Geol. Surv. Loc. 176. McKay; 1876.

- |  |   |
|--|---|
| <i>Ancilla</i> ( <i>Alocospira</i> ) <i>papillata</i> (Tate). Juv. | <i>Clio</i> ( <i>Styliola</i> ) <i>rangiana</i> (Tate). |
| * <i>Anomia huttoni</i> Sut.                                       | * <i>Cochlodesma angasi</i> (C. & F.).                  |
| <i>Cardium</i> aff. <i>facetum</i> Sut.                            | <i>Corbula canaliculata</i> Hutt.                       |
| " <i>waitakiense</i> Sut.  | " <i>humerosa</i> Hutt.                                 |
| <i>Chione meridionalis</i> (Sow.).                                 | <i>Crassatellites amplus</i> (Zitt.).                   |

- Cucullæa alta* Sow.  
 „ *attenuata* Hutt.  
 „ *australis* (Hutt.). Juv.  
*Cylichnella enysi* (Hutt.).  
 „ *soror* Sut.  
*Cytherea chariessa* Sut. Juv.  
 \**Dentalium ecostatum* T. W. Kirk.  
 „ *mantelli* Zitt.  
 „ n. sp.  
 \**Dosinia greyi* Zitt.  
 „ *magna* Hutt. Juv  
*Euthriofusus spinosus* Sut.  
*Ficus parvus* Sut.  
*Fusinus morgani* Sut.  
*Galeodea senex* (Hutt.).  
*Galeodes liræcostata* (?) Sut. Juv.  
 „ n. sp.  
 „ n. sp.  
*Glycymeris globosa* (Hutt.).  
 „ *subglobosa* Sut.  
*Helicæus imperfectus* Sut. Juv.  
*Lapparia hebes* (Hutt.).  
*Leda semiteres* Hutt.  
*Limopsis catenata* Sut.  
*Lithophaga nelsoniana* Sut.  
 \**Myodora pandoriformis* (Stutchb.).  
 \**Natica zelandica* Q. & G. Juv.  
*Panope worthingtoni* Hutt.  
*Parvisipho* n. sp. Genus new to fauna.
- Sixty-six species, of which fifteen also Recent = 23 per cent.

Age: Miocene or Oligocene. Horizon: Lower Waiarekan.

There are many species in this list not mentioned in that printed on page 34 of N.Z. Geol. Surv. Bull. No. 20, 1918.

Reference: McKay, loc. cit., 1877, pp. 49, 64, and 1882, p. 75, &c. The matrix of the fossils is presumably the yellow and green sands mentioned by McKay.

Black Point, Waitaki Valley, in Sandstone immediately overlying the Coal. J. Park; 1916.

(“ A lower horizon than any other in the district from which I have collected.”—J. PARK.)

- Cardium waitakiense* Sut.  
*Chione chiloensis truncata* Sut. Juv.  
 „ *meridionalis* (Sow.).  
*Crassatellites amplus* (Zitt.). Fragment.  
*Cucullæa alta* Sow.  
 \**Dosinia greyi* Zitt.  
*Euthriofusus spinosus* Sut. Fragments.  
*Fulgoraria arabica turrata* (?) Sut.  
*Lyria* n. sp. Cast. Genus new to fauna.  
*Melina zealandica* Sut. Juv.  
 \**Ostrea* (s. str.) *corrugata* Hutt.
- Panope worthingtoni* Hutt.  
*Pecten* (*Pseudamysium*) *hochstetteri* Zitt.  
*Plejona necopinata* Sut.  
*Sinum* (*Eunaticina*) *elegans* Sut.  
*Streptochetus* n. sp. Genus new to fauna.  
*Struthiolaria tuberculata concinna* Sut.  
*Surcula serotina* Sut.  
*Teredo heaphyi* Zitt.  
*Turritella* (*Archimediella*) *ambulacrum* Sow.  
 \* „ (*Peyrotia*) *carlottæ* Wats.  
 \**Venericardia difficilis* (Desh.). Juv.

Twenty-two species, of which four also Recent = 18 per cent.

Mostly casts or imperfect specimens.

Age and horizon: As for last locality.

Reference: N.Z. Geol. Surv. Bull. No. 20, 1918, p. 34. As a rule, no remarks will be made on the lists of fossils collected by Professor Park, Dr. J. A. Thomson, and Mr. G. H. Uttley in 1912-17 that now follow. Reference may be made to N.Z. Geol. Surv. Bull. No. 20 for further information.

Oamaru Borough Water-race, Half a Mile below Papakaio Church. J. Park; 1916.

- \**Calyptrea* (s. str.) *alta* (Hutt.).  
*Cardium huttoni* (?) Iher. 1 juv. and impression of fragment.  
*Chione meridionalis* (Sow.).  
*Corbula canaliculata* Hutt.  
*Crassatellites* sp. Fragment.  
*Crepidula gregaria* (?) Sow.  
*Cucullaea alta* (?) Sow. Fragment.  
*Cytherea sulcata* (Hutt.).  
 \* „; *subsulcata* (Sut.).  
*Epitonium* sp. ? Cast of juv.  
*Lima colorata* Hutt.  
 \**Limopsis aurita* (Brocchi).
- Panope worthingtoni* Hutt. Fragments.  
*Pecten (Pseudamysium) huttoni* (Park).  
*Polinices gibbosus* (Hutt.).  
 \**Psammodia lineolata* (?) Gray.  
*Siphonalia subnodosa* (?) (Hutt.). Fragment.  
*Surcula fusiformis* (Hutt.). Fragment.  
*Teredo heaphyi* Zitt.  
*Turritella (Peyroliia) cavershamensis* Harris.  
 Plentiful.  
 „ (*Torcula*) *semiconcava* Sut.  
 \**Zenatia acinaces* (Q. & G.). One shell very large, 125 mm. × 60 mm.

Twenty-two species, of which five also Recent = 23 per cent.

Many determinations based on fragments only.

Reference: N.Z. Geol. Surv. Bull. No. 20, p. 35.

Near Windmill Creek, Peebles, Waitaki Valley: Below Oamaru Stone. J. Park; 1916. (Lowest horizon in locality.)

- Cardium spatiosum* (?) Hutt. Fragment.  
*Chione chiloensis truncata* (?) Sut. Fragment.  
 „ *meridionalis* (Sow.).  
*Crassatellites amplus* (?) (Zitt.). Fragment.  
*Cucullaea alta* (?) Sow. Fragment.  
 \**Dosinia greyi* Zitt. Fragment.  
 „ *magna* (?) Hutt. Juv.
- Melina zealandica* (?) Sut. Fragment.  
 \**Nucula strangei* A. Ad.  
 \**Panope zealandica* Q. & G.  
 \**Psammodia lineolata* Gray.  
*Turritella (Torcula) concava* Hutt. Fragment.  
 \**Zenatia acinaces* (Q. & G.). Fragments.

Reference: N.Z. Geol. Surv. Bull. No. 20, p. 35.

Maerewhenua Gold-workings, Waitaki River. Geol. Surv. Loc. 177. McKay; 1876.

- Cardium waitakiense* Sut. Fragment.  
 \**Chione mesodesma* (Q. & G.). Juv.  
 \**Dentalium ecostatum* T. W. Kirk.  
 \**Dosinia greyi* Zitt.  
 \**Leptomya lineata* (?) (Hutt.).  
 \**Maetra scalpellum* Reeve. Juv.
- \**Ostrea* (s. str.) *corrugata* Hutt. Juv.  
*Turritella (Archimediella) ambulacrum* Sow.  
 Mostly juv.  
 \* „ (*Peyroliia*) *carlotta* Wats.  
 \**Venericardia* aff. *purpurata* (Desh.). Plentiful.

Material in very poor condition and difficult to identify.

Age: Miocene or Oligocene. Horizon: Waiarekan. It is probable either that some of the above identifications are incorrect, or that most of the unidentifiable specimens belong to extinct species. In MS. McKay states that the collection came from a shell-bed overlying the auriferous sands and gravels of Golden Gully, near the township of Livingstone.

Reference: McKay, loc. cit., 1877, pp. 62-63.

Maerewhenua, Waitaki Valley: "Phorus" Beds. Geol. Surv. Loc. 178. McKay; 1876.

- \**Atrina zealandica* (Gray).  
 \**Calyptrea (Sigapatella) maculata* (Q. & G.).  
*Cardium patulum* (?) Hutt.  
*Chione meridionalis* (?) (Sow.). Cast.  
*Corbula canaliculata* Hutt.
- Crepidula gregaria* Sow.  
*Cucullaea attenuata* Hutt.  
*Cytherea chariessa* (?) Sut. Casts.  
 \* „ *oblonga* (?) (Hanley). Casts.  
*Dosinia magna* Hutt. Cast.

- \**Fulgoraria arabica elongata* (Swains.). Cast.  
*Galeodea senex* (Hutt.). Fragment.  
*Glycymeris* sp.  
 \**Leda bellula* A. Ad.  
*Lima colorata* Hutt.  
 " *paleata* Hutt.  
*Modiolus huttoni* (?) Sut.  
*Panope orbita* Hutt.  
 \* " *zelandica* Q. & G.  
*Pecten (Chlamys) aldingensis* Tate.  
 " (*Pseudamusium*) *huttoni* (Park).

- \**Psammobia lineolata* (?) Gray.  
*Sinum (Eunaticina) miocanicum* (?) Sut.  
*Siphonalia turruta* Sut.  
 \**Struthiolaria vermis tricarinata* (?) Less.  
*Surcula oamarutica* Sut. Cast.  
*Tugalia elata* (Sut.).  
*Turritella (Peyrotia) cavershamensis* Harris.  
 \* " " *rosea* Q. & G.  
 \**Xenophora corrugata* (Reeve).  
 \**Zenatia acinaces* (Q. & G.).

Thirty-one species, of which eleven also Recent = 35.5 per cent.

*Age*: Miocene (Oamaruan). *Horizon*: Hutchinsonian, or possibly Awamoan. McKay states in MS. that the collection is from calcareous sands that succeed or form the higher part of the Maerewhenua limestone. These beds are developed on the north side of the Maerewhenua River on and over the area denominated "The Earthquakes," within which vast blocks of limestone are shattered and displaced owing to the removal of underlying softer beds.

*Reference*: McKay, *loc. cit.*, 1877, pp. 48, 57.

Twenty-four Miles North-west of Oamaru: Maerewhenua Greensands, lying above Oamaru Limestone. J. Park; 1916.

- \**Crassatellites obesus* (A. Ad.). Juv.  
*Cypræa ovulata* (?) Tate. Cast.  
*Epitonium (Cirsotrema) lyratum* (Zitt.). Frag-  
 ments.  
*Pecten (Pseudamusium) huttoni* (Park).  
 " (*Chlamys*) *zelandica* Gray.

- Protocardia sera* Hutt. Casts.  
*Siphonalia* sp.  
*Teredo heaphyi* Zitt.  
*Turritella (Torcula) semiconcava* (?) Sut. Frag-  
 ment.

Maerewhenua River, Right Bank, Ten Miles from the Point where it joins the Waitaki River: Limestone. G. H. Uttley; 1912. (See also *Trans. N.Z. Inst.*, vol. 47, 1915, p. 385.)

- \**Ancilla (Amalda) nova-zelandica* (Sow.).  
 \**Capulus australis* (Lamk.).  
*Cardium huttoni* Iher.  
 " n. sp.  
*Corbula humerosa* Hutt.  
*Cylichnella enysi* (Hutt.).  
*Mangilia* n. sp.

- Nucula strangei* A. Ad.  
 \**Polinices amphialus* (Wats.).  
*Sinum fornicatum* Sut.  
*Surcula* n. sp.  
 \**Turritella (Peyrotia) carlotta* Wats.  
 \**Venericardia difficilis* (Desh.).

Thirteen species, of which five also Recent = 38 per cent.

Buick Creek, Ten Miles from Oamaru: Glauconitic Sandstone, older than Awamoan. J. Park; 1916.

- Chione chiloensis truncata* (?) Sut. Casts.  
 " *meridionalis* (?) (Sow.). Casts.  
*Corbula humerosa* Hutt.  
 \**Crassatellites obesus* (?) (A. Ad.).  
*Dentalium solidum* Hutt.  
*Lima colorata* (?) Hutt. Fragments.

- Lima huttoni* (?) Sut. Fragment.  
 \**Macrocallista multistriata* (?) (Sow.). Juv.  
 \**Malletia australis* (Q. & G.).  
*Paphia curta* (?) (Hutt.). Casts.  
*Pecten (Pseudamusium) huttoni* (Park).  
 \**Zenatia acinaces* (Q. & G.).

This list is not quoted in *N.Z. Geol. Surv. Bull. No. 20.*

## Pukeuri, Six Miles North of Oamaru, Otago. J. A. Thomson; 1917.

- Aleira* n. sp.  
 " n. sp. The same from Rifle Butts.  
*Ampullina* (*Megatylotus*) *suturalis* (Hutt.). Juv.  
*Bela* (*Buchozia*) *canaliculata* Sut.  
 \**Calyptrea* *alta* (Hutt.). Juv.  
*Cerithiella* *fidicula* Sut.  
*Corbula* *canaliculata* Hutt.  
 " *pumila* Hutt.  
*Cylichnella* *enysi* (Hutt.).  
*Cymatium* *minimum* (Hutt.).  
*Dentalium* (*Fustiaria*) *pareorense* Pils. & Sharp.  
*Drillia* *awamoensis* (Hutt.).
- Drillia* *costifer* Sut.  
 " n. sp.  
*Leucosyrinx* *alta* *transenna* (Sut.).  
 \**Limopsis* *aurita* (Brocchi).  
*Lissarca* n. sp. Nearest to *L. aucklandica*.  
*Merica* n. sp.  
 \**Natica* *zelandica* Q. & G. Juv.  
 \**Nucula* *hartvigiana* Pfeiffer. Juv.  
*Pecten* cf. *williamsoni* Zitt. Juv.  
 \**Pleurodon* *maorianus* Hedley. New as a fossil.  
*Turritella* (*Torcula*) *semiconcava* Sut.

Twenty-three species, of which five also Recent = 22 per cent.

## Pukeuri Beds, North of Oamaru: Above Oamaru Stone; probably Awamoan. J. Park; 1916.

- Aleira* n. sp.  
*Alectrion* (*Hima*) *socialis* (Hutt.).  
*Ampullina* (*Megatylotus*) *suturalis* (Hutt.).  
 \**Ancilla* (*Amalda*) *nova-zelandiae* (Sow.).  
 " (*Alocospira*) *papillata* (Tate).  
*Bela* (*Buchozia*) *canaliculata* Sut.  
 \**Calyptrea* (*Sigapatella*) *maculata* (Q. & G.).  
 " " *inflata* (Hutt.).  
 \**Cominella* *pulchra* Sut. var.  
*Corbula* *pumila* Hutt.  
 \**Crassatellites* *obesus* (A. Ad.).  
*Crepidula* *gregaria* Sow.  
*Cucullæa* *alta* Sow.  
*Cylichnella* *enysi* Hutt.  
*Cymatium* *minimum* (Hutt.).  
*Dentalium* *mantelli* Zitt.  
 \* " *nanum* Hutt.  
 " *pareorense* Pils. & Sharp.  
*Drillia* *awamoensis* (Hutt.).  
 \**Fulgoraria* *arabica* (Mart.).  
*Fusinus* *spiralis* *dentatus* (Hutt.).  
*Galeodea* *senex* (Hutt.).  
*Hemiconus* *ornatus* (Hutt.).  
*Leucosyrinx* *alta* (Harris).  
*Lima* *colorata* Hutt.  
 \**Limopsis* *aurita* (Brocchi).  
 \**Molletia* *australis* (Q. & G.).
- Marginella* (*Eratoidea*) *conica* Harris.  
 " (*Glabella*) *fraudulenta* Sut.  
 " (*Eratoidea*) *harrisi* Cossm.  
*Miomelon* *corrugata* (Hutt.).  
 \**Myodora* *crassa* (Stutchb.). New as a fossil.  
 \* " *pandoriformis* (Stutchb.). New as a fossil.  
 \**Natica* *zelandica* Q. & G.  
*Pecten* (*Patinopecten*) *beethami* Hutt.  
 " (*Pseudamysium*) *hochstetteri* Zitt.  
 \**Placunanomia* *zelandica* (Gray).  
*Polinices* *gibbosus* (Hutt.).  
 \**Protocardia* (*Nemocardium*) *pulchella* (Gray).  
*Siphonalia* *excelsa* Sut.  
 " *turrita* Sut.  
*Struthiolaria* *tuberculata* Hutt.  
*Surcula* *fusiformis* (Hutt.).  
 " *pareoraensis* (Sut.).  
*Turritella* (*Torcula*) *conca* Hutt.  
 " *semiconcava* Sut.  
 \**Venericardia* *difficilis* (Desh.).  
 " *pseutes* Sut.  
*Vexillum* *apicale* (Hutt.).  
 " *fenestratum* Sut.  
 " *linctum* (Hutt.).  
 \**Zenatia* *acinaces* (Q. & G.).

Fifty-two species, of which fifteen also Recent = 29 per cent.

Reference: N.Z. Geol. Surv. Bull. No. 20, pp. 92-93. *Lima huttoni* is omitted from the present list, and *Pecten beethami* added.

## Pukeuri, Six Miles North of Oamaru. Geol. Surv. Loc. 253. C. Traill; 1874.

- Alectrion* (*Hima*) *socialis* (Hutt.).  
*Gryphaea* *tarda* (?) Hutt.  
*Leucosyrinx* *alta* (Harris). Fragments.
- \**Limopsis* *aurita* (Brocchi).  
*Marginella* (*Glabella*) *fraudulenta* Sut.  
*Venericardia* *pseutes* Sut. Plentiful.

Age: Miocene (Oamaruan). The exact locality, and therefore the horizon, are unknown.



Tabletop Hill, Head of Oamaru Creek: Tuffs, intercalated in Upper Portion of Oamaru Stone.  
J. Park; 1916.

- Chione meridionalis* (?) (Sow.). Juv. cast.      *Pecten (Patinopecten) delicatulus* Hutt. Frag-  
\**Lima angulata* Sow. Juv.      ment.  
\* " *bullata* (Born). Juv.      *Placunanomia incisura* Hutt.  
*Limopsis zitteli* Iher. Numerous young shells.      \**Venericardia difficilis* (Desh.). Juv.  
*Pecten (Chlamys) aldingensis* Tate. Juv.

Reference: N.Z. Geol. Surv. Bull. No. 20, p. 65. In the above list *Limopsis zitteli* replaces *L. catenata* of the bulletin list.

Brockman's Hill, South of Tabletop Hill: Calcareous Tuffs below Oamaru Stone. J. Park; 1916.

- Ostrea (Anodontostrea) incurva* Hutt. With borings of *Pholadidea*.  
*Panope* sp. Fragments.  
*Teredo heaphyi* (?) Zitt.

Reference: N.Z. Geol. Surv. Bull. No. 20, p. 64.

North-west Branch of Landon Creek, near Pukeuri: Glauconitic Sandstone, above Greensands.  
J. Park; 1916.

- Ostrea (Anodontostrea) nelsoniana* Zitt.

Reference: N.Z. Geol. Surv. Bull. No. 20, pp. 46-47, 79 (references to locality and matrix only).

North-west Branch of Landon Creek: Greensands. J. Park; 1916.

- Chione meridionalis* (?) (Sow.). Juv. cast.      *Pecten (Patinopecten) hutchinsoni* Hutt. Frag-  
\**Crassatellites obesus* (?) (A. Ad.). Cest.      ments.  
\**Epitonium (Cirsotrema) zelevori* (Dkr.).      " (*Pseudamusium*) *huttoni* (Park).  
*Pecten (Patinopecten) beethami* Hutt.      " (*Chlamys*) *semiplicatus* Hutt. Fragments.  
" (*Pallium*) *burnetti* Zitt. Fragment.

There are also Corals, Echinoderms, Bryozoa, and Brachiopods.

Reference: N.Z. Geol. Surv. Bull. No. 20, pp. 46-47, 64.

Devil's Bridge, Oamaru: Glauconitic Sandstone overlying Oamaru Stone. J. Park; 1916.

(Species marked with T are listed by Park in *Trans. N.Z. Inst.*, vol. 37, 1905, p. 518.)

- Astarte australis* Hutt.      \**Limopsis aurita* (Brocchi). T.  
\**Calyptrea (Sigapatella) maculata* (Q. & G.).      \**Ostrea (Anodontostrea) angasi* Sow. T.  
\**Chione spissa* (Desh.). T.      *Pecten (Pseudamusium) huttoni* (Park).  
" *meridionalis* (Sow.). Plentiful.      " (*Chlamys*) *williamsoni* Zitt. T.  
" *acuminata* Hutt. T.      " (*Pseudamusium*) *yahliensis* T.-Woods.  
\**Crassatellites obesus* (A. Ad.).      \**Sinum (Eunaticina) undulatum* (?) (Hutt.).  
*Cucullæa alta* (?) Sow. Fragment.      *Teredo heaphyi* Zitt.  
*Dentalium mantelli* Zitt. T.      *Turritella (Torcula) concava* Hutt. Fragments.  
\**Dosinia greyi* Zitt. T.      " *semiconcava* Sut.  
*Emarginula wannonensis* Harris.      \**Venericardia purpurata* (Desh.).  
*Lima paleata* Hutt.      " *pseutes* Sut.  
" *colorata* Hutt.

Twenty-three species, of which eight are also Recent = 35 per cent.

Devil's Bridge: Magellanian Bed overlying Oamaru Stone.

- Pecten (Patinopecten) beethami* Hutt.  
" (*Pseudamusium*) *huttoni* (Park).

Twenty-four species in the two lists, of which eight also Recent = 33 per cent.

Reference: N.Z. Geol. Surv. Bull. No. 20, pp. 62, 79, 82.



- Dentalium mantelli* Zitt.  
 \* " *nanum* Hutt. Plentiful.  
*Dosinia magna* Hutt.  
*Drillia avamoensis* (Hutt.).  
 " *callimorpha* Sut.  
 " n. sp.  
*Epitonium (Cirsotrema) lyratum* (Zitt.).  
 \* *Fulguraria arabica* (Mart.). Cast and fragment.  
*Fusinus climacotus* Sut. Fragment.  
*Hemiconus ornatus* (Hutt.).  
 \* *Leda bellula* A. Ad.  
*Lima colorata* Hutt.  
 \* *Limopsis aurita* (Brocchi).  
 " *catenata* Sut. Juv.  
*Loripes laminata* Hutt.  
 \* *Malletia australis* (Hutt.).  
*Marginella (Eratoidea) conica* Harris.  
 " " *harrisi* Cossm.  
*Mericia (Aphera) n. sp.*  
*Miomelon corrugata* (Hutt.). Juv.  
 \* *Natica zelandica* Q. & G. Juv. Numerous.  
 \* *Nucula sagittata* Sut.  
*Panope worthingtoni* Hutt.  
*Paphia curta* (Hutt.). Fragment.
- Pecten (Pseudamusium) huttoni* (Park).  
 \* *Phalium achatinum pyrum* (Lamk.). Juv.  
*Placunanomia incisura* Hutt.  
 \* *Polinices amphialis* (Wats.).  
 " " *gibbosus* (Hutt.).  
 \* *Psammobia strangei* Gray.  
 \* *Serpulorbis siphon* (Lamk.).  
 \* *Siphonium planatum* Sut.  
*Struthiolaria cincta* (Hutt.). Juv.  
*Surcula fusiformis* (Hutt.).  
 " *huttoni* (?) Sut.  
 " *oamarutica* Sut.  
*Teredo heaphyi* Zitt.  
*Trophon lepidus* Sut.  
*Turritella (Pyrotria) covershamensis* Harris.  
 Plentiful.  
 " (*Torcula semiconcava* Sut. Plentiful.  
 \* *Venericardia difficilis* (Desh.). Juv.  
 \* " *lutea* (Hutt.). Juv. Plentiful.  
 " *pseutes* Sut.  
*Vexillum rutidolomum* Sut.  
 \* *Volvulella reflexa* (Hutt.).  
 \* *Zenatia acinaces* (Q. & G.).

Sixty-nine species, of which twenty-two also Recent = 32 per cent.

Reference: N.Z. Geol. Surv. Bull. No. 20, pp. 81, 90. See also P. Marshall and G. H. Uttley in *Trans. N.Z. Inst.*, vol. 45, 1913, pp. 302-3. A sketch-map on p. 299 shows exact position of fossil locality.

Near Oamaru Creek, South of Devil's Bridge: Sandstone at Base of Ardgowan Shell-bed, above the Limestone. J. Park; 1916.

- \* *Calyptrea* (s. str.) *alta* (Hutt.). Juv.  
 \* *Crassatellites obesus* (A. Ad.). Juv.  
*Cytherea chariessa* Sut.  
 \* *Lima suteri* Dall.  
*Limopsis catenata* Sut. Juv.  
 \* *Malletia australis* (Q. & G.).
- \* *Modiolus australis* (Gray). Cast.  
*Pecten (Pseudamusium) huttoni* (Park). Juv.  
*Turritella (Torcula) semiconcava* Sut.  
 \* *Venericardia lutea* (Hutt.). Juv.  
 " *pseutes* Sut.  
 \* *Zenatia acinaces* (Q. & G.). Fragment.

Reference: N.Z. Geol. Surv. Bull. No. 20, p. 81.

Ardgowan Road, near Creamery: Basaltic Conglomerate overlying Oamaru Stone. J. Park; 1916.

- Ampullina (Megatylotus) suturalis* (?) (Hutt.).  
 \* *Anomia trigonopsis* (?) Hutt.  
 \* *Capulus australis* (?) (Lamk.).  
*Clio* sp.  
*Cypraea (Eocypraea) trelissickensis* (?) Sut.  
*Galeodea senex* (Hutt.).  
*Lima colorata* (?) Hutt. Juv.
- Lima huttoni* (?) Sut.  
*Melina zelandica* (?) Sut. Juv.  
*Nucula sagittata* Sut. Cast.  
*Ostrea (Anodontostrea) nelsoniana* Zitt.  
*Panope worthingtoni* Hutt. Fragment.  
*Pecten (Patinopecten) delicatulus* Hutt.  
*Protocardia sera* Hutt. Cast.

Nearly all specimens difficult to determine.

Reference: N.Z. Geol. Surv. Bull. No. 20, p. 77. In the above list *Anomia trigonopsis* Hutt takes the place of *A. walteri* Hect., regarded as a synonym.

Grant's Creek, Oamaru : Greensands above Basaltic Conglomerate, overlying the Limestone at Lower End. J. Park ; 1916.

*Ampullina (Megatylotus) suturalis* (?) (Hutt.).  
*Chione chilensis truncata* (?) Sut. Cast.  
*Pecten (Patinopecten) delicatulus* (?) Hutt. Fragment.

Many Brachiopods.

Reference : N.Z. Geol. Surv. Bull. No. 20, p. 45 (list not quoted in bulletin).

Teaneraki (Enfield), Oamaru District. Geol. Surv. Loc. 630. Thomas Esdaile ; circa 1886.

- |   |  |
|---|--|
| <p>*<i>Ancilla (Amalda) nova-zelandica</i> (Sow.).<br/>         " " <i>waikopiroensis</i> Sut.<br/> <i>Aturia australis</i> McCoy. Fragment.<br/> <i>Corbula canaliculata</i> Hutt.<br/> <i>Cymatium</i> n. sp. Not good enough for description.<br/> <i>Daphnella (Raphitoma) neozelandica</i> Sut.<br/> <i>Dentalium solidum</i> Hutt.<br/>         *<i>Dosinia greyi</i> Zitt.<br/> <i>Exilia crassicosata</i> Sut.<br/> <i>Fusinus climacotus</i> Sut.<br/>         " <i>solidus</i> Sut.<br/>         *<i>Leda bellula</i> A. Ad. New for the Miocene.<br/>         " <i>semiteres</i> Hutt.</p> | <p>*<i>Limopsis aurita</i> (Brocchi). Juv.<br/> <i>Maculopeplum elegantissimum</i> (Sut.).<br/> <i>Miomelon corrugata</i> (Hutt.).<br/> <i>Pecten (Pseudamusium) huttoni</i> (Park).<br/> <i>Polinices (Neverita) ovatus</i> (Hutt.).<br/> <i>Sinum (Eunaticina) elegans</i> Sut.<br/>         *<i>Siphonalia nodosa</i> (Mart.).<br/> <i>Struthiolaria frazeri</i> Hutt.<br/> <i>Surcula huttoni</i> Sut.<br/> <i>Terebra costata</i> Hutt.<br/> <i>Turris bimarginatus</i> Sut.<br/>         " <i>neglectus</i> Sut.<br/> <i>Turritella (Archimediella) ambulacrum</i> Sow.<br/> <i>Venericardia difficilis benhami</i> (Thomson).</p> |
|---|--|

Twenty-seven species, of which five also Recent = 19 per cent.

Age : Miocene (Oamaruanian). Horizon : Waiarekan.

References : J. Park, *Rep. of Geol. Explor. during 1886-87*, No. 18, 1887, p. 139 ; J. Hector, same vol., pp. xlv-xlv.

Teaneraki (Enfield), Waiareka Valley : Waiareka Tufas. Geol. Surv. Loc. 675. J. Park ; 1886.

*Siphonalia costata* (Hutt.).

Age : Miocene. Horizon : Waiarekan.

The next collection listed (Esdaile, Loc. 831) is from the same locality.

Reference : J. Park, *loc. cit.*, 1887, pp. 138-39, &c.

Cave Valley and Upper Waiareka Valley : Chalk Ooze and Tufaceous Greensands. Geol. Surv. Loc. 831. Thomas Esdaile ; circa 1886.

- |   |  |
|---|--|
| <p><i>Cantharidus fenestratus</i> Sut.<br/>         *<i>Capulus australis</i> (Lamk.).<br/> <i>Cardium patulum</i> (?) Hutt.<br/>         " sp.<br/> <i>Corbula canaliculata</i> Hutt.<br/>         " sp.<br/>         *<i>Crassatellites obesus</i> (A. Ad.). Juv.<br/> <i>Cucullæa attenuata</i> Hutt.<br/> <i>Cylichnella enysi</i> (Hutt.).<br/> <i>Cymatium minimum</i> (Hutt.).<br/> <i>Cytherea</i> sp. ?<br/> <i>Daphnella</i> sp.<br/> <i>Fusinus solidus</i> Sut.<br/> <i>Glycymeris globosa</i> (Hutt.).</p> | <p><i>Hemiconus ornatus</i> (Hutt.).<br/> <i>Leda semiteres</i> Hutt.<br/> <i>Lima paleata</i> Hutt.<br/> <i>Mitra inconspicua</i> Hutt.<br/> <i>Mytilus huttoni</i> Cossm.<br/> <i>Ostrea</i> (s. str.) <i>subdentata</i> Hutt.<br/> <i>Panope orbata</i> Hutt.<br/> <i>Pleurotomaria tertiaria</i> McCoy.<br/>         *<i>Protocardia (Nemocardium) pulchella</i> (Gray).<br/>         " <i>sera</i> Hutt.<br/>         *<i>Psammobia lineolata</i> Gray.<br/>         *<i>Serpulorbis siphon</i> (Lamk.).<br/> <i>Siphonalia conoidea</i> (Zitt.). Juv.<br/> <i>Struthiolaria cincta</i> Hutt.</p> |
|---|--|

*Struthiolaria minor* Marshall.  
 " *tuberculata concinna* Sut.  
 \**Tellina eugonia* (?) Sut.  
 \**Turritella (Peroytia) carlotta* Wats.

*Turritella (Torcula) concava* Hutt.  
*Venericardia difficilis benhami* (Thomson).  
 " sp.

Thirty-five species, of which seven also Recent = 20 per cent.

Age : Miocene (Oamaruan). Horizon : Waiarekan.

References : As for Loc. 630 (see p. 79).

Parson's Creek, Oamaru : Basaltic Conglomerate under Deborah Limestone. J. Park ; 1916.

*Dentalium mantelli* Zitt.  
*Ostrea* (s. str.) *mackayi* Sut.

*Ostrea (Anodontostrea) nelsoniana* (?) Zitt.  
 " (s. str.) *wuellerstorfi* Zitt. Juv.

Reference : N.Z. Geol. Surv. Bull. No. 20, p. 74.

Parson's Creek, West of Oamaru : Bluish-green Sandy Clays. J. Park ; 1915-16.

\**Ancilla nova-zelandiae* (Sow.).  
 " *papillata* (Tate). \*  
*Bathytoma sulcata excavata* Sut.  
 \**Calyptraea maculata* (Q. & G.).  
 \* " *inflata* (Hutt.).  
 \* " *tenuis* Gray.  
 \**Crassatellites obesus* (A. Ad.).  
 \**Dentalium eostatum* T. W. Kirk.  
 " *mantelli* Zitt.  
 " *solidum* Hutt.  
 \**Diplodonta globularis* (Lamk.).  
*Epitonium lyratum* (Zitt.).  
*Galeodea senex* (Hutt.).  
*Lima colorata* Hutt.  
 \**Limopsis aurita* (Brocchi).  
 " *catenata* Sut.  
*Leucosyrinx alta* (Harris).

\**Macrocallista multistriata* (Sow.).  
 \**Malletia australis* (Q. & G.).  
*Marginella harrisi* Cossm.  
*Miomelon corrugata* (Hutt.).  
 \**Natica zelandica* Q. & G.  
*Nucula sagittata* Sut.  
*Pecten huttoni* (Park).  
 \**Sarepta obolella* (Tate).  
*Sinum (Eunaticina) cinctum* (Hutt.).  
 \**Siphonalia nodosa* (Mart.).  
*Surcula fusiformis* (Hutt.).  
*Teredo heaphyi* Zitt.  
*Turritella semiconcava* Sut.  
 \**Venericardia difficilis* (Desh.).  
 " *pseutes* Sut.  
 \**Zenatia acinaces* (Q. & G.).

Thirty-three species, of which fifteen are also Recent = 45 per cent.

Reference : N.Z. Geol. Surv. Bull. No. 20, p. 91.

The above list was not in the MS. forwarded by Mr. Suter. It is a copy of a list supplied by him in 1916.

Oamaru Creek, interbedded with Volcanic Rocks. Geol. Surv. Loc. 310. McKay ; 1876.

*Pecten (Chlamys) chathamensis* Hutt.  
*Struthiolaria cingulata* (?) Zitt. Casts.

Age : Miocene (Oamaruan). Horizon : Hutchinsonian (McKay in MS.).

Reference : McKay, loc. cit., 1877, pp. 48, 57, &c. (no specific reference).

Limekiln Gully (= Target Gully), Oamaru. Geol. Surv. Loc. 173. McKay ; 1876.

*Crassatellites attenuatus* (?) (Hutt.).  
*Cucullæa alta* var. B Hutt.  
*Glycymeris* sp. ?  
*Lima colorata* Hutt.  
*Limopsis züteli* Ther.  
 \**Placunanomia zelandica* (Gray).

*Teredo heaphyi* Zitt.  
*Turritella (Peyrotia) cavershamensis* Harris.  
*Venericardia acanthodes* Sut.  
 \* " *difficilis* (?) (Desh.).  
 " *pseutes* Sut.

Age : Miocene (Oamaruan). Horizon : Hutchinsonian. The locality collected from was probably Hutchinson's Quarry and the immediate neighbourhood.

Reference : McKay, loc. cit., 1877, pp. 48, 57, &c.

Oamaru. Geol. Surv. Loc. 308. Hector; 1876? (and earlier).

\**Fulgoraria arabica elongata* (Swains.).

*Miomelon corrugata* (?) (Hutt.). Cast.

Age: Miocene (Oamaruan). Horizon: Various.

This was originally a fairly large collection, including old specimens of the Otago Provincial Geological Survey, partly from greensands and partly from limestone (McKay in MS.).

Target Gully, Oamaru: Shell-bed above the Hutchinson Quarry Beds, which rest on Oamaru Limestone. P. Marshall and J. Park; 1915-16. (Separate collections.)

- Acteon præcursorius* Sut.  
 " n. sp.  
*Alectrion (Hima) socialis* (Hutt.).  
*Ampullina (Megalyotus) suturalis* (Hutt.).  
*Anachis pisaniopsis* (Hutt.). New for the Miocene.  
 \**Ancilla (Baryspira) australis* (Sow.).  
 " (s. str.) *hebra* (Hutt.).  
 \* " (*Amalda*) *novæ-zelandiæ* (Sow.).  
 " (*Alocospira*) *papillata* (Tate).  
 \**Anomia huttoni* Sut.  
 \**Arca novæ-zelandiæ* E. A. Smith.  
 " (s. str.) *subrelata* Sut.  
*Barnea* n. sp.  
*Basilissa* n. sp.  
 \**Bathytoma albula* (Hutt.).  
 " *antecostata* Sut.  
 " *perlata* Sut.  
 " *sulcata* (Hutt.).  
*Bela (Buchozia) canaliculata* Sut.  
 " " *infelix* Sut.  
*Bezanconia (Atazocerithium)* n. sp.  
 " n. sp.  
*Borsonia (Cordieria) rudis* (Hutt.).  
*Calliostoma* n. sp.  
*Calyptrea (Sigapatella) maccoyi* Sut.  
 \* " " *maculata* (Q. & G.).  
 \* " " " *inflata* (Hutt.).  
 " " " n. var.  
 \**Cantharidus tenebrosus* A. Ad.  
*Cardium patulum* Hutt.  
*Cerithiella fiduciala* Sut.  
*Cerithiopsis æquicincta* Sut.  
*Chama huttoni* Hect.  
 \**Chamostrea albida* (Lamk.).  
*Chione meridionalis* (Sow.).  
 \* " *mesodesma* (Q. & G.).  
 \* " (*Salacia*) *yatei* (Gray).  
*Circulus helicoides* (Hutt.).  
 " *politus* Sut.  
*Cominella intermedia* Sut.  
 " *ordinatis* Hutt.  
 " *pulchra* Sut.  
*Corbula canaliculata* Hutt.  
 " *humerosa* Hutt.  
 " *kaiparaensis* Sut.  
 " *pumila* Hutt.  
*Crassatellites amplus* (Zitt.).  
 " *attenuatus* (Hutt.).  
 \* " *obesus* (A. Ad.).  
 \**Crepidula costata* (Sow.).
- Crepidula densistria* Sut.  
 " " *gregaria* Sow.  
 \* " " *monoryla* (Less.).  
 " " *striata* (Hutt.).  
*Cucullæra alta* Sow.  
 " *australis* (Hutt.).  
*Cuna* n. sp.  
*Cyclostrema* n. sp.  
*Cylichnella enysi* (Hutt.).  
 " *soror* Sut.  
*Cymatium minimum* (Hutt.).  
 \**Cytherea oblonga* (Hanley).  
 \* " *subsulcata* (Sut.).  
 " *sulcata* (Hutt.).  
 " n. sp.  
 \**Dentalium ecostatum* T. W. Kirk.  
 " *mantelli* Zitt.  
 \* " *nanum* Hutt.  
 " *solidum* Hutt.  
 \**Diplodonta globularis* (Lamk.).  
 \**Divaricella cumingi* (Ad. & Ang.).  
 \**Dosinia (Dosinidea) greyi* Zitt.  
 " (*Austrodosinia*) *magna* Hutt.  
*Drillia avamoensis* (Hutt.).  
 " *callimorpha* Sut.  
 " (*Crassispira*) *costifer* Sut.  
 " *imperfecta* Sut.  
 " n. sp.  
 " n. sp.  
 " n. sp.  
*Eghisia* n. sp.  
 \**Emarginula striatula* Q. & G.  
*Epitonium (Cirsotrema) lyratum* (Zitt.).  
 \* " " *zebori* (Dkr.).  
*Erato neozelanica* Sut.  
*Eulima obliqua* (Hutt.). New for the Miocene.  
 " n. sp.  
*Euthria strophora* Sut.  
 \**Fulgoraria arabica* (Mart.).  
 \* " " *elongata* (Swains.).  
 \* " " *gracilis* (Swains.).  
*Fusinus climacotus* Sut.  
 \* " *spiralis* (A. Ad.).  
 " n. sp.  
*Glycymeris subglobosa* Sut.  
 \**Helicacis variegatus* (Gmel.). New as a fossil.  
 " *imperfectus* Sut.  
*Hemiconus ornatus* (Hutt.).  
*Hinnites trailli* Hutt.  
*Latirus (Leucozonia) brevirostris* (Hutt.).  
*Leda semiteres* Hutt.  
 \**Leptothyra fluctuata* (Hutt.).

- Leucosyrinx alta* (Harris).  
 " " *transenna* (Sut.).  
 \**Lima* *bullata* (Born).  
 " *colorata* Hutt.  
*Limopsis catenata* Sut.  
 " *zitteli* Iher.  
*Lissospira exigua* Sut.  
 \**Loripes concinna* Hutt.  
 " *laminata* Hutt.  
 \**Macrocallista multistriata* (Sow.)  
 \**Malletia australis* (Q. & G.).  
 \**Mangilia dictyota* (Hutt.) New for the Miocene.  
 " *gracilentia* Sut.  
 " *leptosoma* (Hutt.).  
 " *præcophinodes* Sut.  
*Marginella* (*Eratoidea*) *conica* Harris.  
 " (*Glabella*) *fraudulenta* Sut.  
 " (*Eratoidea*) *harrisi* Cossm.  
 " n. sp.  
 \**Megalatractus maximus* (Tryon).  
*Merica* n. sp.  
 " n. sp.  
 " n. sp.  
 " (*Aphera*) n. sp.  
*Mesalia striolata* (Hutt.).  
*Miomelon corrugata* (Hutt.).  
*Mitra armorica* Sut.  
 \**Modiolus australis* (Gray).  
 \**Monodonta coracina* (Troschel). New as a fossil.  
 \**Murex angasi* (Crosse).  
 " *octogonus* Q. & G.  
 \**Myodora subrostrata* Smith.  
*Mytilus huttoni* Cossm.  
 \**Natica australis* (Hutt.).  
 " *zelandica* Q. & G.  
 \**Nucula nitidula* A. Ad.  
 " *sagittata* Sut.  
 \**Odosstomia* (s. str.) *pudica* Sut. New for the Miocene.  
 " (*Pyrgulina*) *rugata* Hutt.  
 " n. sp.  
 " n. sp.  
 \**Ostrea* (*Anodontostrea*) *angasi* Sow.  
 " *nelsoniana* Zitt.  
*Paphia curta* (Hutt.).  
*Pecten* (*Pallium*) *burnetti* Zitt.  
 " (*Pseudamysium*) *huttoni* (Park).  
 " (*Chlamys*) *radiatus* Hutt.  
 \**Placunanomia incisura* Hutt.  
 " *zelandica* Gray.  
 \**Polinices gibbosus* (Hutt.).  
*Protocardia sera* Hutt.  
 \**Psammobia lineolata* Gray.  
*Ptychotractus pukeuriensis* Sut.  
 " *tenuiliratus* Sut.  
*Ringicula uniplicata* Hutt.  
 \**Rissoina* (*Zebina*) *emarginata* (Hutt.). New for the Miocene.  
*Rissoina* n. sp.  
 \**Schismope atkinsoni* (T. Woods).  
 \**Seila bulbosa* Sut. New as a fossil.  
 \**Serpularbis-sipho* (Lamk.).  
 \**Siliquaria widdii* T. Woods. New as a fossil.  
*Sinum* (*Eunaticina*) *cinctum* (Hutt.).  
 " *carinatum* (Hutt.).  
 \**Siphonalia caudata* (Q. & G.).  
 " *conoidea* (Zitt.).  
 " *costata* (Hutt.).  
 \* " *dilatata* (Q. & G.).  
 " *excelsa* Sut.  
 " *nodosa zitteli* Sut.  
 " *subreflexa* (Sow.).  
 \**Siphonium planatum* Sut.  
*Streptochetus* n. sp.  
*Struthiolaria cincta* Hutt.  
 " *tuberculata* Hutt.  
*Surcula fusiformis* (Hutt.).  
 " *parcoraensis* (?) Sut.  
*Sweltia* n. sp.  
 \**Tellina glabrella* Desh.  
*Terebra costata* Hutt.  
 " *orycta* Sut.  
*Teredo hepheyi* Zitt.  
*Tornatina* n. sp.  
 \**Triphora lutea* Sut. New as a fossil.  
*Tritonidea acuticingulata* Sut.  
 " *compacta* Sut.  
 " *elatior* Sut.  
 " n. sp.  
 \**Trivia acellanoides* (McCoy). New to our fauna.  
 \**Trochus* (*Calotrochus*) *chathamensis* (Hutt.).  
 " *tiaratus* Q. & G.  
 \**Trophon hanleyi* (Angas).  
 " *lepidus* Sut.  
 " *minutissimus* Sut.  
 \**Tugalia intermedia* (Reeve).  
*Turbonilla* (*Pyrgiscus*) *oamaruica* Sut.  
 " (*Mormula*) *prisca* Sut.  
 \* " *zelandica* (Hutt.).  
*Turris regius* (?) Sut.  
 \**Turritella* (*Peyrotia*) *carlotta* Wats.  
 " (*Torcula*) *concaua* Hutt.  
 " (*Peyrotia*) *patagonica* Sow.  
 \* " *rosea* Q. & G.  
 " (*Torcula*) *semiconcaua* Sut.  
*Typhis* (*Typhina*) *maccoyi* T. Woods.  
 \**Venericardia difficilis* (Desh.).  
 " *lutea* (Hutt.).  
 " *pseudes* Sut.  
 " *subintermedia* Sut. n. var.  
*Vermicularia* n. sp.  
*Vexillum fenestratum* Sut.  
 \* " *marginatum* (Hutt.).  
 " *rutidolomum* Sut.  
 \**Volucella reflexa* (Hutt.).  
 \**Zenatia acinaces* (Q. & G.).

Two hundred and fifteen species and varieties, of which seventy-two also Recent = 33 per cent.

References: N.Z. Geol. Surv. Bull. No. 20, pp. 94-96, &c.; P. Marshall and G. H. Uttley, Trans., N.Z. Inst., vol. 45, 1913, pp. 297-307 (see pp. 301-2), and vol. 46, 1914, pp. 279-80; P. Marshall, Trans. N.Z. Inst., vol. 47, 1915, pp. 377-87 (see pp. 378-80).

## Target Gully, Oamaru : Greensands below Shell-bed. J. Park ; 1916.

- Acteon præcursorius* Sut.  
*Alectrion (Hima) socialis* (Hutt.).  
*Ancilla (Alocospira) papillata* (Tate).  
 \* *Anomia huttoni* Sut.  
 \* *Arca novæ-zealandiæ* E. A. Smith.  
   " (s. str.) *subelata* Sut.  
*Bela (Buchozia) canaliculata* Sut.  
 \* *Calliostoma pellicudum* (Val.).  
*Calyptraea (Sigapatella) maccoyi* Sut.  
 \* " " *maculata* (Q. & G.).  
 \* *Cantharidus tenebrosus* A. Ad.  
*Chione meridionalis* (Sow.).  
*Corbula humerosa* Hutt.  
   " *pumila* Hutt.  
 \* *Crassatellites obesus* (A. Ad.).  
 \* *Crepidula monoxyla* (Less.).  
   " *gregaria* Sow.  
*Cucullæa alta* Sow.  
*Cylichnella soror* Sut.  
*Dentalium mantelli* Zitt.  
   " *solidum* Hutt.  
 \* *Diplodonta globularis* (Lamk.).  
 \* " *zelandica* (Gray).  
*Drillia callimorpha* Sut.  
*Lima colorata* Hutt.  
 \* *Limopsis aurita* (Brocchi).  
   " *zitteli* Iher.  
 \* *Loripes concinna* Hutt.  
   " *laminata* Hutt.  
*Macrocallista assimilis* (Hutt.).  
 \* " *multistriata* (Sow.).  
 \* *Malletia australis* (Q. & G.).  
*Marginella (Eratoides) harrisi* Cossm.  
*Miomelon corrugata* (Hutt.).  
 \* *Modiolus australis* (Gray).  
 \* *Monodonta coracina* (Troschel).
- Mytilus huttoni* Cossm.  
 \* *Natica zelandica* Q. & G.  
*Nucula sagittata* Sut.  
 \* *Ostrea* (s. str.) *corrugata* Hutt.  
*Panope orbita* Hutt.  
*Pecten (Patinopecten) hutchinsoni* Hutt.  
   " " *(Pseudamusium) huttoni* (Park).  
 \* " *(Chlamys) radiatus* Hutt.  
   " " *semiplicatus* Hutt.  
   " " *williamsoni* Zitt.  
   " *(Pseudamusium) yahliensis* T.-Woods.  
*Placunanomia incisura* Hutt.  
 \* " *zelandica* (Gray).  
*Polinices* (s. str.) *gibbosus* Hutt.  
 \* *Psammobia lineolata* Gray.  
*Ptychotractus tenuiliratus* (?) Sut.  
 \* *Siliquaria weldii* T.-Woods.  
 \* *Siphonalia caudata* (?) (Q. & G.).  
   " *nodosa zitteli* Sut.  
   " *subnodosa* (?) (Hutt.).  
 \* *Siphonium planatum* Sut.  
*Struthiolaria cincta* Hutt.  
*Surcula fusiformis* (Hutt.).  
 \* *Tellina glabrella* Desh.  
*Terebra orycta* Sut.  
*Teredo heaphyi* Zitt.  
*Tritonidea acuticingulata* Sut.  
*Tugalia elata* Sut.  
 \* *Turbonilla zelandica* (Hutt.).  
*Turritella (Torcula) concava* Hutt.  
   " " *semiconcava* Sut.  
 \* *Venericardia difficilis* (Desh.).  
 \* " *lutea* (Hutt.).  
   " *pseutes* Sut.  
 \* " *purpurata* (Desh.).

Seventy-one species, of which twenty-eight also Recent = 39 per cent.

Reference : N.Z. Geol. Surv. Bull. No. 20, pp. 80-81. The present list differs from that in the bulletin by the omission of *Lima bullata*. Several generic names have also been changed.

Hutchinson Quarry, Oamaru : Greensands above the Limestone. Geol. Surv. Loc. 172.  
 A. McKay, 1876 ; J. Park, 1916.

(Mc = McKay ; P = Park.)

- Cucullæa alta* Sow. Cast. P.  
 \* *Diplodonta globularis* (Lamk.). Cast. P.  
*Dosinia* sp. Cast. P.  
*Epitonium (Cirsotrema) lyratum* (Zitt.). P.  
*Lima colorata* Hutt. Mc, P.  
 \* " *lima* (L.). Mc.  
   " *paleata* Hutt. Mc, P.  
*Ostrea* (s. str.) *wuellerstorfi* (?) Zitt. Fragments.  
 Mc, P.  
*Panope orbita* Hutt. Casts. P.  
*Paphia curta* (Hutt.). Cast. P.  
*Pecten (Patinopecten) beathami* Hutt. Frag-  
   ment. P.
- Pecten (Pallium) burnetti* Zitt. Mc.  
   " *(Patinopecten) hutchinsoni* Hutt. P.  
   " *(Pseudamusium) huttoni* (Park). P.  
 \* " *(Chlamys) radiatus* Hutt. P.  
   " " *semiplicatus* Hutt. P.  
   " *(Pseudamusium) yahliensis* T.-Woods.  
   Fragment. P. (May be left valve of  
   *P. beathami*.)  
 \* *Protocardia (Nemocardium) pulchella* (Gray).  
   Cast. P.  
   " *sera* Hutt. Mc, P.  
 \* *Siphonium planatum* Sut. P.  
 \* *Venericardia purpurata* (Desh.). Cast. P.

Twenty-one species, of which six also Recent = 28.6 per cent.

References : McKay, loc. cit., 1877, pp. 48, 57, &c. ; N.Z. Geol. Surv. Bull. No. 20, p. 78.  
 The list in the bulletin does not contain *Lima lima* or *Pecten burnetti*.



South-west Side of Cape Hills, Oamaru : Oamaru Formation. Geol. Surv. Loc. 312. McKay ; 1876.

*Dentalium mantelli* Zitt.  
 ,, *solidum* Hutt.

*Lima paucisulcata* Hutt.  
*Turritella (Peyrotia) cavershamensis* Harris.

Age : Miocene (Oamaruan). Horizon : Ototaran and Hutchinsonian (McKay in MS.).

Reference : McKay, *loc. cit.*, 1877, p. 58, &c. See also McKay, *Rep. of Geol. Explor. during 1883-84*, No. 16, 1884, p. 62 (beds under Ototara limestone collected from).

Boatman's Harbour, Oamaru : Bed No. 5, overlying Oamaru Stone. J. Park ; 1916.

*Cardium huttoni* (?) Iher. Juv. casts.  
*Glycymeris* sp. Fragment.  
*Polinices* sp.

Many Brachiopods.

Reference : N.Z. Geol. Surv. Bull. No. 20, pp. 38, 39, &c. Bed collected from at base of bed h, fig. 4, p. 38.

Oamaru Cape (Cape Wanbrow). G. H. Uttley ; 1912.

(1.) INTERSTICES OF PILLOW-LAVA.

*Cardium* sp.  
 \* *Lima bullata* (Born).  
 \* ,, *lima* (L.).

*Polinices (Neverita) huttoni* (?) Iher.  
*Trochus* sp.  
*Turritella* sp.

(2.) TUFFS, FIRST OUTCROP ON BEACH.

\* *Dosinia cœrulea* (Reeve). New as a fossil.

(3.) LIMESTONE BAND BELOW PILLOW-LAVA.

*Emarginula wannonensis* Harris.  
*Pecten (Patinopecten) hutchinsoni* Hutt.

(4.) LIMESTONE BAND, BOATMAN'S HARBOUR.

*Pecten (Chlamys) aldingensis* Tate.  
 ,, (*Patinopecten*) *hutchinsoni* Hutt.

(5.) GREEN TUFFS BELOW TRACHYTE BRECCIA.

*Lima jeffreysiana* Tate.  
 \* *Limopsis aurita* (Brocchi).

*Venericardia lutea* (Hutt).  
 \* ,, *purpurata* (Desh.).

References : N.Z. Geol. Surv. Bull. No. 20, pp. 37, 39 ; G. H. Uttley in *Trans. N.Z. Inst.*, vol. 50, 1918, pp. 106-17 (see p. 109).

Cape Wanbrow, Oamaru : 12 ft.† Raised Beach. J. Park ; 1915.

\* *Anomia huttoni* Sut.  
 \* *Argobuccinum tumidum* (Dkr.) (= *A. argus* of Manual).  
 \* *Calliostoma punctulatum* (Mart.).  
 \* *Calyptrea maculata* (Q. & G.).  
 \* *Cantharidus tenebrosus* A. Ad.  
 \* *Chione mesodesma* (Q. & G.).  
 \* *Cytherea oblonga* (?) (Hanley).  
 \* *Dosinia anus* (Phil.).

\* *Emarginula striatula* Q. & G.  
 \* *Euthria striata* (Hutt.).  
 \* *Fulgoraria arabica elongata* (Swains.).  
 \* *Glycymeris modesta* (Angas).  
 \* *Helcioniscus ornatus* (Dillw.).  
 \* ,, ,, *inconspicuus* (Gray).  
 \* ,, ,, *radians* (Gmel.).  
 \* ,, ,, *affinis* (Geml.).  
 \* ,, ,, *flavus* (Hutt.).

† As received this list was headed "40 ft. Raised Beach," but this is an error, as will be seen by reference to N.Z. Geol. Surv. Bull. No. 20.

- \**Leptomya lineata* (Hutt.).  
 \**Mactra discors* Gray.  
 \**Mesodesma subtriangulatum* (Gray).  
 \**Monodonta athiops* (Gmel.).  
 \* " *coracina* (Troschel).  
 \**Mytilus canaliculus* (?) Mart. Fragment.  
 \* " *edulis* L.  
 \* " *magellanicus* Lamk.  
 \**Ostrea angasi* Sow.  
 \* " *reniformis* (?) Sow.  
 \* " *tatei* Sut.
- \**Siphonaria obliquata* Sow.  
 \**Spisula aquilateralis* (Desh.).  
 \**Tellina alba* Q. & G.  
 \**Trichotropis clathrata* Sow.  
 \**Trochus tiaratus* Q. & G.  
 \**Trophon corticatus* (Hutt.).  
 \* " *plebejus* (Hutt.).  
 \**Turbo smaragdus* (Mart.).  
 \**Venericardia difficilis* (Desh.).  
 \* " *purpurata* (Desh.).

Thirty-eight species, all Recent.

Reference: N.Z. Geol. Surv. Bull. No. 20, pp. 112-13.

South of Cape Wanbrow, Oamaru: Fossiliferous Tuff, immediately below Oamaru Stone.  
 J. Park; 1916.

- Ancilla* (s. str.) *hebra* (Hutt.).  
 \**Astraa heliotropium* (Mart.). New for the Miocene.  
*Calliostoma* n. sp.  
 \**Calyptrea* (*Sigapatella*) *maculata* (Q. & G.).  
 \**Cardita calyculata* (L.). New for the Miocene.  
*Crassatellites amplus* (Hutt.). Juv.  
 \* " *obesus* (A. Ad.). Juv.  
*Cytherea sulcata* (?) (Hutt.). Fragment.  
 \**Diplodonta zelandica* (Gray).  
*Lima colorata* Hutt.  
*Mactra attenuata* Hutt.
- \**Mytilus* (*Aulacomya*) *magellanicus* Lamk.  
*Ostrea* (s. str.) *wuellerstorfi* Zitt.  
*Panope orbita* Hutt.  
*Pecten* (*Patinopecten*) *hutchinsoni* Hutt. Fragment.  
 " n. sp.  
 \**Psammobia lineolata* (?) Gray. Fragment.  
*Teredo heaphyi* Zitt.  
*Trochus* n. sp.  
 \**Venericardia purpurata* (Desh.).  
 " *pseudes* Sut.

Twenty-one species, of which eight also Recent = 38 per cent.

Many Brachiopods and a few Serpulæ.

Reference: N.Z. Geol. Surv. Bull. No. 20, p. 40.

South of Cape Wanbrow, near Rifle Butts, Oamaru: Bed K, Tuffs about 30 ft. below Oamaru Stone. J. Park; 1916.

- \**Astraa heliotropium* (Mart.).  
*Calliostoma acutangulum* Sut.  
 \**Dosinia greyi* (?) Zitt.  
*Epitonium* (*Cirsotrema*) *lyratum* (Zitt.).  
*Ficus parvus* Sut.  
 \**Glycymeris laticostata* (Q. & G.). Juv.
- \**Mytilus* (*Chloromya*) *canaliculus* (?) (Mart.). Fragment.  
*Polinices* (*Neverita*) *ovatus* (Hutt.).  
*Struthiolaria tuberculata* (?) Hutt. Juv.  
*Teredo heaphyi* Zitt.  
 \**Venericardia purpurata* (Desh.) var.

Eleven species, of which five also Recent = 45 per cent.

See also N.Z. Geol. Surv. Bull. No. 20, p. 40, where the fossiliferous bed is named "L."

Rifle Butts, Oamaru: Bed A, overlying Oamaru Stone. J. Park; 1916.

(Incorporated are also collections made in the locality by Dr. P. Marshall and Mr. G. H. Uttley. M = Marshall; P = Park; U = Uttley.)

- Alicia* n. sp. P.  
*Alectrion* (*Hima*) *socialis* (Hutt.). Plentiful.  
 P, U.  
*Ampullina* (*Megatylotus*) *suturalis* (Hutt.). U.  
 \**Ancilla* (*Amalda*) *nova-zelandica* (Sow.). U.  
*Atrina distans* (Hutt.). Fragment. P.  
 \**Bathytoma albula* (Hutt.). U.
- Borsonia* (*Cordieria*) *rudis* (Hutt.). U.  
 \**Calyptrea* (*Sigapatella*) *maculata* (Q. & G.). P.  
*Chione meridionalis* (Sow.). P.  
 \* " *mesodesma* (Q. & G.). P.  
*Corbula canaliculata* Hutt. U.  
*Crassatellites attenuatus* (?) (Hutt.). P.  
*Crepidula gregaria* Sow. U.

- Cucullæa alta* Sow. P.  
 " *attenuata* Hutt. U.  
 " *australis* (Hutt.). P.  
*Cylichnella enysi* (Hutt.). P. U.  
 \**Cytherea oblonga* (Hanley). U.  
*Dentalium solidum* Hutt. P. U.  
 \**Dosinia greyi* Zitt. P.  
*Drillia avamoensis* (Hutt.). P. U.  
 " *costifer* Sut. P.  
*Erycina* n. sp. P.  
 \**Fulgoraria arabica* (Mart.). Fragments. P.  
*Leucosyrinx alta* (Harris). P.  
 \**Lima angulata* Sow. U.  
 \* " *bullata* (Born). U.  
 " *colorata* Hutt. P. U.  
*Limopsis züteli* Iher. U.  
*Loripes laminata* Hutt. P. U.  
*Macrocallista pareoraensis* Sut. P.  
 \**Malletia australis* (Q. & G.). P.  
 \**Mangilia leptosoma* (Hutt.). U.  
 " *præcophinodes* Sut. U.  
*Marginella (Eratoidea) conica* Harris. P. U.  
*Marginella (Eratoidea) harrisi* Cossm. Many  
 juvenile specimens and 3 adult. P. U.  
 \**Mesodesma australe* (Gmel.). U.  
 \**Natica zelandica* Q. & G. Juv. P. U.  
 \**Ostrea (Anodontostrea) angasi* (?) Sow. P.  
*Pecten (Patinopecten) delicatulus* (?) Hutt. U.  
 " " *hutchinsoni* Hutt. P. U.
- Sixty-six species, of which twenty-one also Recent = 32 per cent.

References: N.Z. Geol. Surv. Bull. No. 20, p. 89, and Trans. N.Z. Inst., vol. 47, 1915, p. 384 (P. Marshall).

#### Rifle Butts, South of Cape Wanbrow, Oamaru.

##### (1.) CALCAREOUS TUFF ABOVE THE LIMESTONE. G. H. Uttley; 1912.

- \**Lima angulata* Sow.  
 \* " *bullata* (Born).  
 " *colorata* Hutt.  
*Limopsis züteli* Iher.  
 \**Mesodesma australe* (Gmel.).  
*Pecten (Chlamys) aldingensis* Tate.
- Pecten (Patinopecten) hutchinsoni* Hutt.  
 \**Siphonalia caudata* (Q. & G.).  
 " *conoidea* (Zitt.).  
 " *excelsa* Sut.  
*Turritella (Torcula) semiconcava* Sut.  
 \**Venericardia purpurata* (Desh.).

##### (2.) CALCAREOUS BAND IN BLUE CLAY ABOVE OAMARU STONE. G. H. Uttley; 1912.

- Alectrion socialis* (Hutt.).  
*Ampullina (Megatylotus) suturalis* (Hutt.).  
 \**Ancilla (Amalda) novæ-zelandiæ* (Sow.).  
 \**Bathytoma alba* (Hutt.).  
*Borsonia (Cordieria) rudis* (Hutt.).  
*Corbula canaliculata* Hutt.  
*Crepidula gregaria* Sow.  
*Cucullæa attenuata* Hutt.  
*Cylichnella enysi* (Hutt.).  
 \**Cytherea oblonga* (Hanley).  
*Dentalium solidum* Hutt.  
*Drillia avamoensis* (Hutt.).  
*Leucosyrinx alta* (Harris).  
*Loripes laminata* Hutt.  
*Mangilia leptosoma* (Hutt.).  
 " *præcophinodes* Sut.
- Marginella (Eratoidea) conica* Harris.  
 " *harrisi* Cossm.  
 \**Natica zelandica* Q. & G.  
*Pecten (Chlamys) scandula* (?) Hutt. Fragment.  
 \**Placunanomia zelandica* (Gray).  
 \**Polinices amphialus* (Wats.).  
 " *gibbosus* (Hutt.).  
*Surcula fusiformis* (Hutt.).  
 \**Tellina glabrella* Desh.  
*Turritella (Torcula) concava* Hutt.  
 " *(Peyrota) patagonica* Sow.  
 " *(Torcula) semiconcava* Sut.  
 \**Venericardia difficilis* (Desh.).  
*Vexillum apicale* (Hutt.).  
 " *linctum* (Hutt.).  
 \**Zenatia acinaces* (Q. & G.).

Thirty-two species, of which nine also Recent = 28 per cent.

(3.) TOP OF LIMESTONE, RIFLE BUTTS. G. H. Uttley; 1912.

*Pecten (Patinopecten) hutchinsoni* Hutt.

(4.) CALCAREOUS BAND IN BLUE TUFFS BELOW THE LIMESTONE. G. H. Uttley; 1912.

*Ficus parvus* Sut.  
\**Lima lima* (?) (L.). Juv.  
*Pecten* sp. Juv.

References to Rifle Butts: See preceding list.

Railway-cutting North of Deborah, near Oamaru, overlying Deborah Limestone: Greensands.  
J. Park; 1916.

<i>Cardium patulum</i> (?) Hutt. Cast of young shell.	<i>Pecten (Patinopecten) beethami</i> Hutt. Fragment.
„ <i>spatiosum</i> (?) Hutt. Casts and young shells.	„ „ <i>hutchinsoni</i> Hutt.
<i>Dentalium solidum</i> Hutt.	„ ( <i>Pseudamysium</i> ) <i>huttoni</i> (Park). Fragments.
<i>Epitonium (Pliciscula)</i> n. sp. Fragment.	„ ( <i>Chlamys</i> ) <i>semiplicatus</i> Hutt.
<i>Fusinus solidus</i> (?) Sut. Cast.	<i>Protocardia sera</i> Hutt.
<i>Lima colorata</i> Hutt.	* <i>Siphonalia dilatata</i> (Q. & G.). Fragment.
„ <i>paleata</i> Hutt.	<i>Struthiolaria tuberculata</i> (?) Hutt. Juv.
<i>Mactra attenuata</i> Hutt.	<i>Teredo heaphyi</i> Zitt.
<i>Miomelon corrugata</i> (Hutt.).	<i>Turritella (Torcula) concava</i> (?) Hutt. Cast.
<i>Panope worthingtoni</i> Hutt.	* <i>Xenophora corrugata</i> (Reeve).

Twenty species, of which two also Recent = 10 per cent.

Reference: N.Z. Geol. Surv. Bull. No. 20, pp. 59, 78.

It will be observed that the above list does not correspond very closely with that representing the molluscan fauna in the Hutchinson Quarry greensands. (See p. 83.)

Deborah (or Kakanui) Limestone. J. Park; 1916.

<i>Cardium spatiosum</i> (?) Hutt. Casts of young shells.	<i>Lima huttoni</i> (?) Sut.
<i>Cypræa ficoides</i> (?) (Hutt.). Casts.	<i>Surcula oamarutica</i> (?) Sut. Cast.
<i>Lima colorata</i> Hutt. Juv.	<i>Venericardia purpurata</i> (?) (Desh.). Juv.

Mostly casts; determinations therefore somewhat doubtful.

Deborah, Three Miles South of Oamaru. G. H. Uttley; 1912.

(1.) TUFFS WITH PILLOW-LAVA.

<i>Cardium</i> sp.	<i>Panope orbita</i> Hutt.
* <i>Mesodesma australe</i> (?) (Gmel.).	<i>Pecten (Patinopecten) hutchinsoni</i> Hutt.

(2.) NODULAR BAND ABOVE THE LIMESTONE.

<i>Chione meridionalis</i> (?) (Sow.).	<i>Panope orbita</i> Hutt.
<i>Euthria media</i> (Hutt.).	<i>Polinices</i> sp.
* <i>Ostrea</i> (s. str.) <i>corrugata</i> Hutt.	

Old Quarry, Awamoa Creek, near Deborah, Oamaru District: Tuffs below Oamaru Stone.  
J. Park; 1916.

* <i>Crassatellites obesus</i> (A. Ad.). Juv. and casts.	<i>Pecten (Pallium) burnetti</i> Zitt.
<i>Lima colorata</i> (?) Hutt. Fragment.	<i>Protocardia sera</i> Hutt. Casts.
<i>Ostrea</i> (s. str.) <i>wuellerstorfi</i> Zitt.	<i>Turbo</i> aff. <i>superbus</i> Zitt. Fragments of casts, juv.
<i>Panope worthingtoni</i> Hutt.	

Reference: N.Z. Geol. Surv. Bull. No. 20, p. 41. The locality is the same as that of the next list.

Old Quarry, Awamoa Creek, near Deborah : Calcareous Tuffs below Oamaru Stone. J. Park ; 1916.

- |  |   |
|--|---|
| <i>Chione meridionalis</i> (?) (Sow.).     | * <i>Ostrea</i> ( <i>Anodontostrea</i> ) <i>angasi</i> (?) Sow.         |
| * <i>Crassatellites obesus</i> (A. Ad.).   | <i>Panope orbita</i> Hutt.  |
| <i>Cucullæa attenuata</i> (?) Hutt.        | <i>Pecten</i> ( <i>Chlamys</i> ) <i>aldingensis</i> Tate.               |
| * <i>Glycymeris laticostata</i> (Q. & G.). | " ( <i>Patinopecten</i> ) <i>marshalli</i> (?) Sut.                     |
| * <i>Lima angulata</i> Sow.                | * <i>Placunanomia zelandica</i> (Gray).                                 |
| " <i>colorata</i> Hutt.                    | * <i>Siphonium planatum</i> Sut.  |
| " <i>paleata</i> (?) Hutt.                 | <i>Teredo heaphyi</i> Zitt.   |
| <i>Melina zelandica</i> Sut.               | <i>Turritella</i> ( <i>Peyrotia</i> ) <i>cavershamensis</i> (?) Harris. |
| * <i>Mesodesma australe</i> (Gmel.).       | * <i>Venericardia difficilis</i> (?) (Desh.).                           |
| * <i>Modiolus australis</i> (?) (Gray).    |   |

Nineteen species, of which nine also Recent = 47 per cent.

A number of specimens, no doubt representing extinct species, could not be identified, and therefore the percentage of Recent forms can safely be taken at a lower figure.

Reference : N.Z. Geol. Surv. Bull. No. 20, pp. 40-41.

Trig. M., South of Alma : Tuff Beds below or on Horizon of the Ototara Limestone.

This locality was discovered by Mr. G. H. Uttley, and the rock is a calcareous tuff. Collections of fossils were made by Dr. J. A. Thomson and Mr. G. H. Uttley in 1914, and by Professor Park in 1916. (T & U = Thomson and Uttley ; P = Park.)

- |   |  |
|---|--|
| * <i>Arca nova-zealandia</i> E. A. Smith. T & U.                      | <i>Pecten</i> ( <i>Chlamys</i> ) <i>aldingensis</i> Tate. T & U, P.  |
| * <i>Calyptrea</i> ( <i>Sigapatella</i> ) <i>maculata</i> (Q. & G.).  | " ( <i>Patinopecten</i> ) <i>delicatulus</i> Hutt. P.                |
| " " " <i>inflata</i> (Hutt.). T & U.                                  | " " <i>hutchinsoni</i> Hutt. P.                                      |
| * " " " <i>inflata</i> (Hutt.). T & U.                                | " " <i>venosus</i> Hutt. T & U, P.                                   |
| * <i>Capulus australis</i> (Lamk.). T & U.                            | * <i>Polinices amphialus</i> (Wats.). T & U.                         |
| <i>Cardium</i> sp. T & U.   | " <i>gibbosus</i> (Hutt.). T & U.                                    |
| * <i>Chione spissa</i> (Desh.). T & U.                                | " ( <i>Neverita</i> ) <i>huttoni</i> Iher. T & U.                    |
| " <i>meridionalis</i> (Sow.). P.                                      | * <i>Protocardia</i> ( <i>Nemocardium</i> ) <i>pulchella</i> (Gray). |
| <i>Dentalium solidum</i> Hutt. T & U.                                 | T & U.   |
| <i>Emarginula wannonensis</i> Harris. T & U.                          | * <i>Serpulorbis siph</i> (?) (Lamk.). T & U.                        |
| <i>Ficus transeinus</i> (?) Sut. T & U.                               | * <i>Siphonium planatum</i> Sut. T & U.                              |
| * <i>Gadinea conica</i> Angas. T & U. New as fossil.                  | <i>Trochus</i> n. sp. T & U.   |
| * <i>Lima angulata</i> Sow. T & U, P.                                 | <i>Turbo</i> sp., operculum of. P.                                   |
| * " <i>bullata</i> (Born). T & U, P.                                  | <i>Turritella</i> ( <i>Archimediella</i> ) <i>ambulacrum</i> Sow.    |
| " <i>huttoni</i> (?) Sut. P.  | T & U.   |
| <i>Pecten</i> ( <i>Patinopecten</i> ) <i>accrementus</i> Hutt. T & U. | * " (s. str.) <i>symmetrica</i> Hutt. T & U.                         |

Twenty-nine species, of which thirteen also Recent = 45 per cent.

Reference : N.Z. Geol. Surv. Bull. No. 20, p. 74.

Near Totara, South of Oamaru : Waiareka Tuffs. J. Park ; 1916.

- Pecten* (*Patinopecten*) *delicatulus* Hutt. Fragment.  
*Venericardia acanthodes* Sut.

Reference : N.Z. Geol. Surv. Bull. No. 20, p. 43.

Old Quarry at Totara : Tuff Bed between Upper and Lower Beds of Oamaru Stone. J. Park ; 1916.

- |   |   |
|---|---|
| * <i>Anomia huttoni</i> (?) Sut. Fragment.                                | <i>Pecten</i> ( <i>Pseudamusium</i> ) <i>yahliensis</i> T.-Woods. |
| <i>Pecten</i> ( <i>Patinopecten</i> ) <i>delicatulus</i> Hutt. Fragments. | Fragment.   |
|   | * <i>Siphonium planatum</i> Sut.                                  |

Reference : N.Z. Geol. Surv. Bull. No. 20, p. 73.

Awamoa Beach and Creek. Geol. Surv. Loc. 170. McKay; 1876.

- Alectrion (Hima) socialis* (Hutt.) Very plentiful.  
*Ampullina (Megatylotus) suturalis* (Hutt.).  
 \**Ancilla (Amalda) novae-zelandiae* (Sow.).  
 \**Anomia huttoni* Sut.  
 \* " *trigonopsis* Hutt.  
 \**Arca novae-zealandiae* E. A. Smith:  
 " (s. str.) *subvelata* Sut.  
*Bela (Buchozia) canaliculata* Sut. var.  
 \**Calyptraea* (s. str.) *alta* (Hutt.).  
 " (*Sigapatella*) *maccoyi* Sut.  
 \* " " *maculata* (Q. & G.).  
*Chione chilensis truncata* Sut.  
 " *meridionalis* (Sow.).  
 " (*Salacia*) *speighti* Sut.  
 \**Cominella huttoni* Kobelt.  
 " n. sp.  
*Corbula humerosa* (?) Hutt.  
*Crepidula densistriata* Sut.  
 " *gregaria* Sow.  
 " *striata* (Hutt.).  
*Cylichnella enysi* (Hutt.) Juv.  
*Cymatium minimum* (Hutt.).  
 \**Dosinia greyi* Zitt.  
*Drillia buchanani* (Hutt.).  
 " n. sp.  
 \**Fulgoraria arabica* (Mart.).  
 \**Fusinus spiralis* (A. Ad.).  
*Hemiconus ornatus* (Hutt.) Plentiful.  
*Leucosyrinx alta* (Harris).  
 \**Macrocallista multistriata* (Sow.) Juv.  
*Mactra chrydæa* Sut.  
*Mangilia* n. sp.  
*Marginella (Eratoidea) conica* Harris.  
 " (*Glabella*) *fraudulenta* Sut.  
 " (*Eratoidea*) *harrisi* Cossm.  
*Miomelon corrugata* (Hutt.).  
 \**Modiolus australis* (Gray).  
*Mytilus huttoni* Cossm.  
 \**Natica zelandica* Q. & G.  
 \**Panope zelandica* Q. & G.  
 \**Placunanomia zelandica* (Gray).  
*Polinices gibbosus* (Hutt.).  
 " (*Neverita*) *ovatus* (Hutt.).  
 \**Psammobia lineolata* Gray.  
 \**Serpulorbis siphon* (Lamk.).  
*Sinum (Eunaticina) miocenicum* (Sut.).  
 \**Siphonalia mandarina* (Duclos).  
*Solariella stoliczkae* (?) (Zitt.).  
*Surcula fusiformis* (Hutt.).  
 \**Tellina alba* (?) Q. & G. Juv.  
 \**Turritella (Peyrotia) carlottæ* Wats.  
 " " *cavershamensis* Harris.  
 " (*Torcula*) *concava* Hutt.  
 " " *semiconcava* Sut. Plentiful.  
 \* " (s. str.) *symmetrica* Hutt.  
*Venericardia psetes* Sut.  
*Vexillum apicale* (Hutt.).  
 \**Zenatia acinaces* (Q. & G.).

Fifty-eight species, of which twenty-two also Recent = 38 per cent.

Age: Upper Miocene. Horizon: Pareoran (Awamoan). McKay in MS. says, "The collection is mainly from boulders between high- and low-water marks."

References: McKay, *loc. cit.*, 1877, pp. 48, 58, &c.; N.Z. Geol. Surv. Bull. No. 20, p. 88.

The greater part of the Awamoa collection was not handled by Mr. Suter, and therefore it is probable that many species could be added to the above list.

Awamoa. Geol. Surv. Loc. 254. C. Traill; 1874.

- \**Crepidula monozylla* (Less.).  
*Dentalium solidum* Hutt.  
 \**Dosinia subrosea* (Gray).

Age: Upper Miocene. Horizon: Pareoran (Awamoan).

References: C. Traill, *Trans. N.Z. Inst.*, vol. 2, 1870, pp. 166-69; McKay, *loc. cit.*, 1877, p. 58.

Teschemaker's Old Quarry, South of Oamaru: Tuffs in Oamaru Stone. J. Park; 1916.

- Clavagella* sp. Genus new to fauna.  
*Pecten (Chlamys) aldingensis* Tate.  
 " (*Patinopecten*) *delicatulus* Hutt. Left valves.  
*Pecten (Patinopecten) venosus* Hutt.  
 \**Siphonium planatum* Sut.  
*Teredo heaphyi* Zitt.  
*Turritella* sp. Cast.

Reference: N.Z. Geol. Surv. Bull. No. 20, p. 72.

Maheno, South of Oamaru, near Flour-mill : Tufts below Oamaru Stone. J. Park ; 1916.

*Amusium zitteli* (Hutt.).

*Cardium* n. sp.

„ n. sp.

*Clio (Styliola) annulata* (Tate). Fragment. New to fauna.

*Crepidula densistria* Sut. Juv.

*Cuspidaria* n. sp.

*Cylichnella enysi* (Hutt.).

*Dentalium (Episiphon)* n. sp.

\**Divaricella cumingi* (Ad. & Ang.). Fragment.

\**Protocardia (Nemocardium) pulchella* (Gray).

Many young examples.

\**Pupa alba* (Hutt.). Fragment.

*Teredo heaphyi* Zitt. Fragment of tube.

Also one crab.

Reference : *N.Z. Geol. Surv. Bull. No. 20*, pp. 43-44.

Left Bank Kakanui River, opposite Maheno : Chalk Marls. Geol. Surv. Loc. 498. McKay ; 1882

*Amusium zitteli* (Hutt.).

Age : Miocene (Oamaruan). Horizon : Waiarekan (probably).

A single specimen from a very large collection probably consisting mainly of Foraminifera.

Reference : McKay, *Rep. of Geol. Explor. during 1883-84*, No. 16, 1884, p. 62, &c.

Left Bank Kakanui River, a little below Maheno : Maheno Marls. Geol. Surv. Loc. 606. McKay ; 1886.

*Amusium zitteli* (Hutt.).

Age and horizon : As for Loc. 498.

This is a single species (twenty-six specimens) from a large collection containing numerous Foraminifera (McKay in MS.).

Reference : McKay, *Rep. of Geol. Explor. during 1886-87*, No. 18, 1887, p. 237.

Kakanui : Tufts below Limestone. J. A. Thomson.

\**Murex zelandicus* Q. & G.

*Pecten (Pseudamusium) huttoni* (Park).

*Pecten (Pallium) polymorphoides* Zitt.

*Solariella sulcatina* Sut.

“Isolated Hill,” North Side of Mouth of Kakanui River : Ototara Limestone. Geol. Surv. Loc. 489. McKay ; 1882.

*Pecten (Chlamys) dendyi* Hutt.

Age : Miocene (Oamaruan). Horizon : Ototaran.

McKay in MS. states that the collection (142 specimens) “has been referred to the Ototara limestone rather than to the Hutchinson Quarry beds, largely owing to the different character of the Brachiopods contained in the beds.”

Reference : McKay, *Rep. of Geol. Explor. during 1883-84*, No. 16, 1884, p. 63.

“Isolated Hill” is a manuscript name of McKay’s.

Isolated Hill, Kakanui, Otago : Volcanic Breccia or Tuff, underlying Ototara Limestone. Geol. Surv. Loc. 490. McKay ; 1882.

*Cardium waitakiense* Sut.

*Cythera* sp.? Casts.

*Pecten (Chlamys) aldingensis* Tate.

Age : Miocene (Oamaruan). Horizon : Ototaran (McKay in MS.).

Isolated Hill, Limekiln Hill, Kakanui, Otago: Ototara Limestone. Geol. Surv. Loc. 627.  
McKay; 1886.

*Pecten (Chlamys) aldingensis* Tate.  
,, (*Pallium*) *polymorphoides* Zitt.

Age and horizon: As for Locs. 489 and 490.

Three Roads, between Kakanui and Awamoa Creek: Waiareka Tuff on Beach. J. Park; 1916.

\**Diplodonta zelandica* (Gray)

*Panope worthingtoni* Hutt.

\**Dosinia cœrulea* (Reeve).

*Siphonalia turrita* Sut. Juv.

Reference: N.Z. Geol. Surv. Bull. No. 20, p. 71.

Road-cutting, Deborah Road, Half a Mile East of Rocky Peak, North of Kakanui: Tuffs intercalated in Upper Portion of Oamaru Stone. J. Park; 1916.

\**Astræa heliotropium* (?) (Mart.): Cast.

*Pecten (Chlamys) aldingensis* Tate.

*Cardium* sp.

,, *chathamensis* (?) Hutt.

\**Crepidula monozylla* (Less.): Cast.

,, (*Pseudamusium*) *huttoni* (Park).

*Dentalium mantelli* (?) Zitt. Cast.

,, ,, *yalhensis* T. - Woods.

\**Diplodonta zelandica* (?) (Gray).

Fragment.

*Glycymeris* sp.

*Protocardia sera* (?) Hutt. Cast.

*Mytilus huttoni* Cossm. Fragments.

\**Siphonium planatum* Sut.

*Ostrea* (s. str.) *uellerstorfi* Zitt.

*Venericardia* sp.

Fifteen species, of which four also Recent = 27 per cent.

Very poor material.

Reference: N.Z. Geol. Surv. Bull. No. 20, p. 71.

#### Kakanui, Otago: Greensands on North Shore.

*Dentalium mantelli* Zitt.

*Pecten (Patinopecten) hutchinsoni* Hutt.

*Pecten (Patinopecten) delicatulus* Hutt.

*Teredo heaphyi* Zitt.

#### Kakanui, Otago: Cliffs on North Shore.

*Dentalium mantelli* Zitt.

*Siphonalia turrita* (?) Sut.

*Pecten (Chlamys) aldingensis* Tate.

*Solariella sulcatina* Sut.

,, (*Pallium*) *burnetti* Zitt.

Kakanui Beach: Calcareous Volcanic Breccia, lying below Kakanui Limestone. J. Park; 1916.

*Ampullina (Megatylotus) suturalis* (Hutt.)

*Fusinus* n. sp. (aff. *bicarinatus*).

\**Astræa heliotropium* (Mart.) Fragment.

\**Glycymeris laticostata* (Q. & G.).

\**Capulus australis* (Lamk.): Cast.

*Maculopeplum elegantissimum* (Sut.).

*Cardium patulum* (?) Hutt. Cast of juv.

*Mytilus huttoni* Cossm. Cast.

,, *spatiosum* (?) Hutt. Impressions.

*Pecten (Chlamys) aldingensis* Tate.

,, *waitakiense* Sut. 1 juv., 1 impression

,, (*Pallium*) *polymorphoides* Zitt.

,, n. sp. 9 specimens.

*Pholadomya neozelandica* Hutt. Cast.

*Colubraria* sp. Impression. (Same from Geol.

*Protocardia sera* Hutt. Cast.

Surv. Loc. 642, Waihao Bridge.)

*Siphonalia turrita* Sut.

*Cytherea chariessa* Sut. Cast.

\**Siphonium planatum* Sut.

*Dentalium mantelli* Zitt.

*Solariella sulcatina* Sut.

*Emarginula wannonensis* Harris.

*Surcula fusiformis* (Hutt.). Impressions.

*Epitonium (Cirsotrema) lyratum* (Zitt.).

*Teredo heaphyi* Zitt.

,, (*Confusiscula*) *nympha* (Hutt.). New

*Turritella (Torcula) semiconcava* Sut.

for the Miocene.

*Venericardia acanthodes* Sut. Impression.

*Exilia* sp. (?). Cast.

,, *difficilis benhami* (Thomson).

*Ficus transemus* Sut. Impression.

Thirty-one species, of which four also Recent = 13 per cent.

Reference: N.Z. Geol. Surv. Bull. No. 20, p. 68.



Beach near Three Roads, North of Kakanui : Awamoan Beds. J. Park ; 1916.

- |   |  |
|---|--|
| <i>Ampullina (Megatylotus) suturalis</i> (Hutt.). Cast. | <i>Modiolaria elongata</i> (Hutt.).                              |
| <i>Arca</i> (s. str.) <i>subvelata</i> Sut.             | <i>Mytilus huttoni</i> Cossin.                                   |
| <i>Cardium spatiosum</i> (?) Hutt. Juv.                 | <i>Ostrea</i> (s. str.) <i>wuellerstorfi</i> (?) Zitt. Fragment. |
| <i>Chione meridionalis</i> (Sow.).                      | <i>Paphia curta</i> (Hutt.).                                     |
| * <i>Crassatellites obesus</i> (A. Ad.).                | <i>Surcula fusiformis</i> (Hutt.). Cast.                         |
| " <i>attenuatus</i> (?) (Hutt.). Fragment.              | * <i>Tellina glabrella</i> Desh.                                 |
| <i>Cucullæa alta</i> Sow.                               | <i>Turritella (Torcula) semiconcava</i> Sut. Frag-               |
| * <i>Limopsis aurita</i> (Brocchi).                     | ments.   |
| " <i>catenata</i> Sut.                                  | * <i>Zenatia acinaces</i> (Q. & G.).                             |
| * <i>Malletia australis</i> (Q. & G.).                  |  |

Eighteen species, of which five also Recent = 28 per cent.

Reference : N.Z. Geol. Surv. Bull. No. 20, p. 87.

Kakanui : Kakanui Limestone. J. Park ; 1916.

*Pecten (Chlamys) aldingensis* Tate.

Lady Jane Creek, Middle Kakanui : Glauconitic Sandstone. J. Park ; 1916.

*Pholadomya neozelanica* (?) Hutt. Cast.  
*Surcula fusiformis* (?) (Hutt.).

Reference : N.Z. Geol. Surv. Bull. No. 20, p. 35.

Two Roads, Kakanui : Calcareous Breccia below Kakanui Limestone. J. Park ; 1916.

- |  |  |
|--|--|
| <i>Anomia</i> sp.                            | * <i>Psammobia lineolata</i> Gray. Impression. |
| <i>Chione meridionalis</i> (?) (Sow.). Cast. | <i>Teredo heaphyi</i> Zitt.                    |
| <i>Cymatium minimum</i> (?) (Hutt.). Casts.  |  |

Reference : N.Z. Geol. Surv. Bull. No. 20, p. 71.

Kakanui and Neighbourhood. G. H. Uttley ; 1912. (See also *Trans. N.Z. Inst.*, vol. 48, 1916, pp. 19-27.)

(1.) CALCAREOUS TUFFS BENEATH QUARRY LIMESTONE, KAKANUI, OTAGO.

- |   |   |
|---|---|
| <i>Chione meridionalis</i> (Sow.).        | <i>Pecten (Pallium) polymorphoides</i> Zitt.        |
| <i>Dentalium solidum</i> Hutt.            | "    ( <i>Patinopecten</i> ) <i>triphooki</i> Zitt. |
| <i>Pecten (Chlamys) aldingensis</i> Tate. |   |

(2.) NODULAR LAYER ON TOP OF LIMESTONE, KAKANUI BEACH.

- |   |   |
|---|---|
| * <i>Arca novæ-zealandiæ</i> (?) E. A. Smith. | <i>Lima lima</i> (L.).                            |
| * <i>Astræa heliotropium</i> (Mart.). Cast.   | <i>Miomelon corrugata</i> (Hutt.).                |
| <i>Cardium</i> aff. <i>brachytonum</i> Sut.   | <i>Olivella neozelanica</i> (Hutt.). Cast.        |
| <i>Cypræa</i> aff. <i>ovulata</i> Tate. Cast. | <i>Pecten (Pallium) polymorphoides</i> Zitt.      |
| * <i>Lima angulata</i> Sow.                   | <i>Trochus</i> aff. <i>conicus</i> (Hutt.). Cast. |
| " <i>jeffreysiana</i> Tate.                   |   |

(3.) KAKANUI GLAUCONITIC FORAMINIFERAL GREENSAND, ABOVE THE LIMESTONE.

- |   |   |
|---|---|
| * <i>Lima angulata</i> Sow.               | <i>Pecten (Pallium) polymorphoides</i> Zitt.        |
| *    " <i>bullata</i> (Born).             | "    ( <i>Patinopecten</i> ) <i>triphooki</i> Zitt. |
| <i>Pecten (Chlamys) aldingensis</i> Tate. | * <i>Siphonalia nodosa</i> (?) (Mart.). Cast.       |

## (4.) AWAMOEA BEDS—BLUE CLAYS OVERLYING THE LIMESTONE, ALL DAY BAY.

<i>Ancilla (Alocospira) papillata</i> (Tate).	<i>Miomelon corrugata</i> (Hutt.).
<i>Borsonia (Cordieria) rudis</i> (Hutt.).	<i>Mitra</i> aff. <i>hectori</i> Hutt. Fragment.
<i>Cymatium</i> n. sp.	* <i>Phalium achatinum pyrum</i> (Lamk.).
<i>Cypræa trelissickensis</i> Sut.	* <i>Placunanomia zelandica</i> (Gray).
<i>Ficus transennus</i> Sut.	<i>Polinices gibbosus</i> (Hutt.).
<i>Macrocallista assimilis</i> (Hutt.).	<i>Turbonilla (Mormula) prisca</i> Sut.
<i>Marginella (Eratoidea) conica</i> Harris.	<i>Vexillum apicale</i> (Hutt.).
"                    " <i>harrisi</i> Cossm.	

Fifteen species, of which two also Recent = 15 per cent.

## (5.) NODULAR BED, TOP OF LIMESTONE, ALL DAY BAY, ONE MILE SOUTH OF KAKANUI.

<i>Cypræa ovulatella</i> (?) Tate. Casts.	<i>Siphonalia</i> n. sp. ?
<i>Euthria media</i> (?) (Hutt.).	<i>Struthiolaria</i> sp. ?
<i>Miomelon corrugata</i> (?) (Hutt.).	<i>Turbo</i> sp.
<i>Polinices (Neverita) ovatus</i> (?) (Hutt.).	

All Day Bay, One Mile South of Kakanui : Hutchinson Quarry Beds. Geol. Surv. Loc. 624.  
McKay ; 1886.

*Pecten (Chlamys) semiplicatus* Hutt. Fragment.  
    " (*Patinopecten*) *hutchinsoni* Hutt.

Age : Miocene (Oamaruan). Horizon : Hutchinsonian.  
Two examples from a collection of forty-one specimens (McKay).  
Reference : McKay, *loc. cit.*, 1887, pp. 235-36, &c.

North End of All Day Bay : Greensands. J. Park : 1916.

*Pecten (Chlamys) williamsoni* Zitt.  
\**Siphonium planatum* Sut.  
*Teredo heaphyi* Zitt.

Reference : N.Z. Geol. Surv. Bull. No. 20, p. 56.

Puketapu, near Palmerston South, Shag Valley, Eastern Otago : Calcareous Sandstone (or Impure Limestone). Geol. Surv. Loc. 620. McKay ; 1886.

*Ficus* sp. ?  
*Dentalium solidum* Hutt.  
\**Mactra elongata* (?) Q. & G.

Age : Miocene (Oamaruan). Horizon : Ototaran (?).  
Reference : McKay, *loc. cit.*, 1887, p. 8.

Upper Kyeburn, Maniototo County, Central Otago : Pareora Beds. Geol. Surv. Loc. 493.  
McKay ; 1883.

*Bathytoma eximia* Sut.  
*Corbula canaliculata* Hutt.

Age : Miocene. Horizon : Pareoran (McKay) (?).

This collection originally contained eighty-five specimens. McKay says in MS. that the matrix is greensands, a somewhat uncommon rock in the Pareora formation. The greensands,

however, may be of "the age of the limonitic sandstone (decomposed greensands) at the Government Dam, Naseby."

Reference: McKay, *loc. cit.*, 1884, p. 64, and "Older Auriferous Drifts of Central Otago," Parl. Paper C.-4, 1894, pp. 29, 40 (see also 2nd ed., 1897, pp. 74, 100).

Welshman's Gully, Switzers, Southland County. Geol. Surv. Loc. 752. McKay; 1890.

*Ancilla (Alocospira) papillata* (Tate).

\**Arca nova-zealandia* E. A. Smith.

*Astarte australis* (?) Hutt.

*Bathytoma* aff. *sulcata* (Hutt.).

*Dentalium mantelli* Zitt.

*Miomelon corrugata* (Hutt.).

*Ostrea* (s. str.) *wuellerstorffi* Zitt. Fragments.

*Polinices gibbosus* (Hutt.).

\**Struthiolaria papulosa* (Mart.).

\* " aff. *vermis tricarinata* Less.

*Turritella (Torcula) concava* Hutt.

" (*Archimediella*) *huttoni* Cossm.

*Vermicularia* n. sp. ?

Thirteen species, of which three also Recent = 23 per cent.

Age: Miocene (Oamaruan). Horizon: Waiarekan (?).

References: (1) McKay, *Rep. of Geol. Explor. during 1890-91*, No. 21, 1892, pp. 63-64. Reference, however, is made only to Muddy Creek† fossils, and not to fossils at Switzers, which is a locality two or three miles north-east of Waikaia. The rail-head at Waikaia is erroneously named Switzers, and, curiously enough, McKay in the report cited writes "Waikaka" instead of "Waikaia." (2) McKay, *loc. cit.*, 1894, pp. 32, 40; 1897, pp. 81, 99.

Castle Rock, Oreti Valley, Southland. Geol. Surv. Loc. 245. McKay; 1878.

*Placunanomia incisura* Hutt.

Age: Miocene. Horizon: Ototaran (?).

References: McKay, *Rep. of Geol. Explor. during 1877-78*, No. 11, 1878, p. 77. See also F. W. Hutton, *Rep. of Geol. Explor. during 1871-72*, 1872, p. 109.

Ohai (Nightcaps), Forty-four Miles North-west from Invercargill, Southland, nearly a Mile West of Smith's House. Collected as loose specimens from the banks of the Ohai Stream, which had washed them out of slipped mudstone. Geol. Surv. Loc. 888. M. Ongley; May, 1917.

*Diplodon* n. sp.

Age: Miocene or older.

The specimens collected are almost certainly *Diplodon inflatus* (Hutt.), the type of which has been mislaid or lost, and therefore is not at present available for comparison.

References: *11th Ann. Rep. N.Z. Geol. Surv.*, Parl. Paper C.-2b, 1917, p. 9; F. W. Hutton, *loc. cit.*, 1872, p. 108; J. Hector, *Rep. of Geol. Explor. during 1868-69*, No. 5, 1869, pp. v et seq.

Limehills, Twenty-five Miles North from Invercargill, Southland: J. G. Ward Company's Quarry. M. Ongley; 1917.

*Voluta* n. sp.

A large *Volute* resembling somewhat the Patagonian *Adelomelon pilsbryi* (Iher.), but unfortunately too imperfect to determine the genus.

Age: Miocene (Oamaruan). Horizon: Ototaran (?).

Reference to Locality: S. H. Cox, *Rep. of Geol. Explor. during 1877-78*, No. 11, 1878, p. 48.

† Muddy Creek is the stream in the valley west of Waikaia.

Chatton, Eight Miles North of Gore, Southland : "In Sands" on the West Bank of the Okapua Creek, about a Mile and a Half North of the Small Village of Chatton. Collected by Mr. R. A. Sutherland, and in the collection of Dr. P. Marshall, Wanganui.

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|--|---|
| <i>Ateon</i> n. sp.                                    | * <i>Natica zelandica</i> Q. & G.                   |
| <i>Ancilla (Alocospira) papillata</i> (Tate).          | <i>Nerinea</i> n. sp. New to fauna.                 |
| <i>Batillaria pomahakensis</i> Harris.                 | * <i>Nucula hartvigiana</i> Pfeiffer.               |
| * <i>Calyptrea tenuis</i> (Gray).                      | " n. sp.  |
| <i>Cardium</i> sp.                                     | * <i>Odotomia</i> (s. str.) <i>bembix</i> Sut.      |
| <i>Circulus</i> n. sp.                                 | " ( <i>Jordaniella</i> ) <i>sherriffi</i> Hutt.     |
| <i>Cominella</i> n. sp.                                | <i>Pecten (Patinopecten) hutchinsoni</i> Hutt.      |
| <i>Corbula pumila</i> Hutt.                            | <i>Psammobia</i> n. sp.                             |
| * " <i>zelandica</i> Q. & G.                           | <i>Ringicula uniplicata</i> Hutt.                   |
| * <i>Crassatellites obesus</i> (A. Ad.).               | <i>Sinum fornicatum</i> Sut.                        |
| * <i>Crepidula costata</i> (Sow.).                     | * <i>Siphonalia nodosa</i> (Mart.).                 |
| " <i>gregaria</i> Sow. subsp. nov.                     | * " <i>valedicta</i> (Wats.).                       |
| <i>Cuna</i> sp.  | <i>Solariella</i> n. sp.                            |
| <i>Cyamiomactra</i> sp.   Provisional identifications. | <i>Terebra</i> n. sp.                               |
| <i>Dentalium solidum</i> Hutt.                         | <i>Trophon</i> sp. 2                                |
| <i>Epitonium (Cirsotrema) lyratum</i> (Zitt.).         | <i>Turbonilla (Mormula) prisca</i> Sut.             |
| <i>Erycina</i> sp. ?                                   | * " <i>zelandica</i> Hutt.                          |
| <i>Glycymeris subglobosa</i> Sut.                      | <i>Turritella (Peyrotia) covershamensis</i> Harris. |
| * <i>Macrocallista multistriata</i> (Sow.).            | " ( <i>Torcula</i> ) <i>concava</i> Hutt.           |
| <i>Marginella (Eratoidea) conica</i> Harris.           | * <i>Venericardia difficilis</i> (Desh.).           |
| <i>Mesalia striolata</i> (Hutt.).                      | " <i>ponderosa</i> Sut.                             |
| <i>Mitra</i> n. sp.                                    | " <i>pseutes</i> Sut.                               |
| * <i>Modiolus australis</i> (Gray).                    |   |

Forty-five species, of which thirteen also Recent = 29 per cent.

*Age*: Miocene (Oamaruan). Dr. Marshall considers that the Chatton beds are probably of Oligocene age. See *Trans. N.Z. Inst.*, vol. 49, 1917, p. 465. On p. 460, however, there is a somewhat contradictory statement, which seems to assign the Chatton sandstone to the Cretaceous.

Castle Hill Shaft, Kaitangata Coalfield, Otago. Geol. Surv. Loc. 759. Hector; 1891.

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| <i>Ateon subovalis</i> Marshall.               | <i>Malletia elongata</i> Marshall. Fragment.   |
| <i>Architectonica inornata</i> Marshall.       | <i>Nerinella</i> sp. ?                         |
| <i>Astarte australis</i> (?) Hutt. Casts.      | <i>Panope worthingtoni</i> Hutt.               |
| <i>Cardium</i> aff. <i>waitakiense</i> Sut.    | <i>Phos ordinarius</i> Marshall.               |
| <i>Crassatellites cordiformis</i> (?) Sut.     | * <i>Placunanomia zelandica</i> (Gray).        |
| <i>Crepidula monoxyla</i> var. nov.            | <i>Plejona necopinata</i> (Sut.).              |
| <i>Cucullaea alta</i> Sow.                     | <i>Polinices</i> aff. <i>gibbosus</i> (Hutt.). |
| " " var. B. Hutt.                              | " sp.  |
| <i>Cylichnella enysi</i> (Hutt.).              | * <i>Protocardia pulchella</i> (Gray).         |
| <i>Dentalium pareoreense</i> Pils. & Sharp.    | * <i>Psammobia zelandica</i> (?) Desh.         |
| * <i>Dosinia greyi</i> (?) Zitt.               | <i>Struthiolaria minor</i> Marshall.           |
| <i>Fusinus</i> n. sp.                          | " <i>spinosa</i> (?) Hect. Cast.               |
| " n. sp.                                       | " <i>tuberculata</i> Hutt.                     |
| " n. sp.                                       | <i>Turris striatus</i> Marshall.               |
| <i>Gilbertia paucistriata</i> (Marshall). Juv. | <i>Turritella concava</i> (?) Hutt.            |
| <i>Glycymeris subglobosa</i> Sut.              | " <i>semiconcava</i> Sut.                      |
| <i>Lapparia hebes</i> (?) (Hutt.).             | * <i>Venericardia difficilis</i> (Desh.).      |
| <i>Macrocallista assimilis</i> (?) (Hutt.).    | * " <i>lutea</i> (Hutt.).                      |

Also shark-teeth.

Thirty-six species, of which six also Recent = 17 per cent.

*Age*: Eocene or Upper Cretaceous (Kaitangatan). *Horizon*: Wangaloan. *Matrix*: Calcareous shelly sandstone.

*Reference*: Hector, *Rep. of Geol. Explor. during 1890-91*, No. 21, 1892, pp. lviii-lix. See also references to following locality.

McKay remarks in one of his MS. lists: "The species individually and collectively have a Tertiary facies, but on stratigraphical considerations the beds have been considered Cretaceous-Tertiary." If the beds are really Upper Cretaceous, then some of the shells named above have been wrongly identified.

**Measly Beach, Wangaloa, Kaitangata Coalfield, Otago.** Geol. Surv. Loc. 760. Hector; 1891.

<i>Acteon semispiralis</i> Marshall.	<i>Nucula sagittata</i> (?) Sut.
" n. sp.	<i>Panope worthingtoni</i> Hutt.
" n. sp.	<i>Phos ordinarius</i> Marshall.
<i>Cardium</i> sp. Juv.	<i>Polinices gibbosus</i> (?) (Hutt.).
* <i>Crassatellites</i> aff. <i>obesus</i> (A. Ad.) Juv.	" n. sp.
<i>Dentalium pareoreense</i> Pils. & Sharp. Plentiful.	* <i>Protocardia pulchella</i> (Gray).
* <i>Dosinia greyi</i> Zitt. Plentiful.	<i>Rozania</i> n. sp.
<i>Fusinus</i> ? n. sp.	<i>Solariella comica</i> (Marshall). ( <i>Heliacus</i> .)
<i>Glycymeris</i> sp. Cast.	<i>Struthiolaria minor</i> Marshall.
<i>Leda semiteres</i> Hutt. Plentiful.	" <i>tuberculata</i> (?) Hutt. Juv.
<i>Macrocallista assimilis</i> (Hutt.). Plentiful.	<i>Tornatina</i> n. sp.
<i>Malletia elongata</i> Marshall.	<i>Turris multicinctus</i> Marshall.
<i>Melina zealandica</i> Sut. Juv.	<i>Turritella semiconcava</i> Sut.
<i>Modiolaria elongata</i> (?) (Hutt.).	* " <i>symmetrica</i> Hutt.

Twenty-eight species, of which four also Recent = 14 per cent.

*Age*: Eocene or Upper Cretaceous (Kaitangatan). *Horizon*: Wangaloan.

*References*: Hector, *loc. cit.*, 1892, p. lviii; Hector, *Rep. of Geol. Explor. during 1871-72*, No. 7, 1872, p. 168; F. W. Hutton, *Geology of Otago*, 1875, p. 57; P. Marshall, *Trans. N.Z. Inst.*, vol. 48, 1916, pp. 114-15, and vol. 49, 1917, pp. 450-60; *11th Ann. Rep. N.Z. Geol. Surv.*, Parl. Paper C.-2B, 1917, p. 10. McKay in MS. makes much the same remarks concerning the collection from Loc. 760 as those quoted above concerning Loc. 759.

**Mitchell's Point, Wangaloa, Half a Mile North of Coal Point, near Kaitangata: Shelly Calcareous Sandstone.** Geol. Surv. Loc. 887. J. Park; 1912.

<i>Cardium</i> aff. <i>waitakiense</i> Sut.	<i>Leda semiteres</i> Hutt.
<i>Crassatellites cordiformis</i> Sut.	<i>Macrocallista assimilis</i> (?) (Hutt.). Cast.
<i>Cucullæa alta</i> Sow.	<i>Phos</i> n. sp.
* <i>Cytherea oblonga</i> (Hanley).	<i>Polinices gibbosus</i> (Hutt.).
<i>Dentalium pareoreense</i> Pils. & Sharp.	<i>Pugnellus australis</i> Marshall. Fragments and casts.
* <i>Dosinia greyi</i> Zitt. Juv.	<i>Rozania</i> n. sp.
<i>Epitonium parvicostatum</i> (Marshall). ( <i>Scala</i> .)	<i>Struthiolaria minor</i> Marshall.
" n. sp.	<i>Surcula</i> n. sp.
<i>Eudolium</i> ? n. sp. Juv.	<i>Turris multicinctus</i> Marshall.
<i>Perissolax</i> n. sp.	<i>Turritella semiconcava</i> Sut.
<i>Gilbertia</i> n. sp.	<i>Venericardia ponderosa</i> Sut. var.
<i>Glycymeris concava</i> Marshall.	* " <i>purpurata</i> (Desh.).
" <i>subglobosa</i> Sut.	
<i>Heteroterma zealandica</i> Marshall.	

Twenty-six species, of which three also Recent = 12 per cent.

*Age*: Eocene or Upper Cretaceous (Kaitangatan). *Horizon*: Wangaloan.

This is the same locality as that of the last list.

**Mitchell's Point, Wangaloa, near Kaitangata, Otago: Shelly Calcareous Sandstone.** Geol. Surv. Loc. 887A. M. Ongley; 1917.

<i>Cardium greyi</i> (?) Hutt.	* <i>Dosinia greyi</i> (?) Zitt. Juv.
<i>Crassatellites amplus</i> (?) (Zitt.). Fragment.	* " <i>lambata</i> (Gould).
<i>Crepidula</i> sp. Casts.	<i>Hinnites trailli</i> (?) Hutt.
<i>Dentalium pareoreense</i> Pils. & Sharp.	<i>Limopsis</i> aff. <i>zitteli</i> Iher. Juv.

- Macrocallista* sp. ? Cast.  
*Malletia elongata* Marshall. Cast.  
 \**Polinices amphialus* (Wats.).  
     *gibbosus* (Hutt.).  
 \**Pupa affinis* (A. Ad.). Juv.
- Siphonalia* sp. ? Fragment.  
*Struthiolaria minor* Marshall.  
     " sp. ? Juv.  
*Turritella semiconcava* Sut.  
 \**Venericardia* aff. *purpurata* (Desh.).

Eighteen species, of which five also Recent = 28 per cent.

*Age*: Eocene or Upper Cretaceous (Kaitangatan). *Horizon*: Wangaloan.

*Reference*: 11th Ann. Rep. N.Z. Geol. Surv., Parl. Paper C.-2B, 1917, p. 10.

Taken as a whole, the Castle Hill shaft and Wangaloa beds, according to the preceding lists, contain a fauna of seventy-seven species, of which thirteen, or 16.9 per cent., are also Recent. How far Mr Suter's identifications are correct is at present a matter of opinion. Many of the specimens are imperfect and embedded in a hard matrix. On close examination some were found to differ slightly, but perceptibly, from the Oamaruan and Recent species with which they have been identified.

In a report on the Upper Cretaceous Gasteropods of New Zealand (not yet published) Dr. Otto Wilckens advances the opinion that the various species of *Pugnellus* described by Marshall and Trechmann are identical with or merely varieties of *Conchothyra parasitica*. This, if correct, supports the view that the Wangaloa beds are of Cretaceous age. On the other hand, Wilckens thinks that *Conchothyra* may have survived into Tertiary times.

Recent examination of the molluscan faunas in the marine strata underlying the Shag Point and Green Island coal-measures has led to the conclusion that they are of Cretaceous age. This has generally been admitted to be true of Shag Point, but the age of the Green Island coal-measures has been disputed. As in all probability the Kaitangata beds are contemporaneous with those of Green Island and Shag Point, the writer is constrained to believe, at least tentatively, that the former are of Upper Cretaceous age, and therefore practically to come into line with Park, Marshall, Trechmann, and Thomson. Such a belief involves the discarding of Recent species from Mr. Suter's Wangaloa and Castle Hill shaft lists. If, however, the presence of Recent species in the Kaitangata fauna is accepted as a fact, one would more reasonably assign it to the Eocene than to any earlier or later period.

It may be mentioned that the Wangaloa and Castle Hill shaft collections of the Geological Survey have been sent to Mr. R. B. Newton, F.G.S., lately of the British Museum, who has kindly consented to examine and report upon them.

Chatham Islands. Geol. Surv. Loc. 792. H. H. Travers; circa 1863?

*Pecten (Pseudamusium) yalliensis* T.-Woods.

*Age*: Miocene (Oamaruan). *Horizon*: Hutchinsonian (McKay).

This fossil is from a collection of 134 specimens. According to McKay's MS., the "fossiliferous rocks are volcanic tuffs and altered limestones (lithographic), in this agreeing with the Hutchinson Quarry beds at Oamaru. The fossils also indicate a like age."

*References*: H. H. Travers, *Trans. N.Z. Inst.*, vol. 1, 1869, pp. 173 *et seq.* (2nd ed., 1875, pp. 119-27); Julius von Haast, same vol., pp. 180 *et seq.* (2nd ed., pp. 127-29).

In conversation Mr. Travers has stated that fossils occur mainly at Red Bluff, four miles north of Waitangi, and on the western side of Pitt Island (the rock in the latter locality being, according to von Haast, a tufaceous whitish limestone).

## CHAPTER III.

## REVIEW OF RESULTS; CLASSIFICATION OF SEDIMENTARY FORMATIONS.

(By P. G. MORGAN.)

IMPORTANT results, the full effect of which cannot yet be foreseen, follow from the palaeontological work done on New Zealand Cretaceous and Tertiary fossils during the past few years. The principal workers in New Zealand have been Mr. Henry Suter, Dr. J. A. Thomson, and Dr. P. Marshall; whilst abroad Mr. Henry Woods, of Cambridge University, and Mr. Frederick Chapman, of Melbourne, have made valuable additions to our knowledge.† Many others have contributed to the progress that has undoubtedly been made. In this connection those who have collected fossils in their own time and at their own expense deserve special mention.

The revision of Hutton's types of Tertiary Mollusca, the description of a large number of new species, and the thousands of specific determinations made by Mr. Suter probably constitute the most important and most directly profitable of all the contributions to New Zealand palaeontology as yet made. In giving a summary of the results that have followed or are likely to follow from Mr. Suter's work, the writer would like to make it clear that others have assisted in bringing about these results, but he hopes to be pardoned for not making direct references to their work in the following paragraphs.

Mr. Suter's determinations enable broad divisions of the Tertiary to be made with considerable confidence. These are:—

Pliocene (Castlecliffian, Petanian, Waitotaran).

Late Miocene (Pareoran or Awamoan).

Middle Miocene (Ototaran, including Hutchinsonian).

Early Miocene (Waiarekan).

In addition an Eocene horizon may be distinguished on the west coast of the South Island (Westport, Greymouth, &c.), and possibly at Weka Pass (North Canterbury).

The chief criteria for these divisions are (1) the assemblage of fossils, and (2) the percentages of Recent species. As yet no strict line between any two adjacent divisions can be drawn by means of palaeontology alone. Thus in the Awatere district and in some other localities the Late Miocene strata pass, or appear to pass, into the Pliocene without a break, either palaeontological or stratigraphical. Again, there is no decided palaeontological break between the Eocene and the Miocene, and according to some New Zealand geologists there is no stratigraphical break either in this part of the geological succession or anywhere between the Middle Cretaceous (Clarentian) and the Pliocene. Broadly it may be said that the Tertiary faunas are continuous,‡ but this statement need not, and with the writer does not, imply that there are no unconformities of any kind. On the contrary, there are certainly local unconformities in the stratigraphic columns, and one or more of these may be tolerably widespread.

The determinations of Mr. Suter, taken as a whole, enable one to say that in no known locality is there any mingling of Cretaceous and Tertiary faunas. All his lists indicate a purely Tertiary facies,§ and the only localities for which this statement will be disputed are Wangaloa and the neighbouring Castle Hill shaft, Kaitangata. In the former locality Marshall believes that he has recognized a fauna with distinct Cretaceous (Maestrichtian or Danian) affinities. The fauna at the Castle Hill shaft in beds overlying the Kaitangata coal-measures is evidently the same as that at Wangaloa. The lists given on former pages, and the papers

† The late Dr. E. A. Newell Arber's work on New Zealand Mesozoic floras does not come within the scope of this review.

‡ See also preface to *N.Z. Geol. Surv. Pal. Bull. No. 5*, 1917, and P. Marshall in *Trans. N.Z. Inst.*, vol. 50, 1918, p. 277.

§ Since this was written the writer has changed his opinion regarding the age of the Kaitangata fauna (see last page), and therefore the Wangaloa and Castle Hill shaft lists are admitted to be exceptions to the statement made.

by Marshall and Trechmann which are cited, will enable the reader to form his own opinion. New Zealand geologists at least agree to this extent: that the Wangaloa beds are pre-Oamaruan in age. There is also substantial agreement with the view that no part of the Oamaru Formation contains Cretaceous fossils, or need be placed in a Cretaceous-Tertiary series, as was done by Hector and McKay. Marshall, as one of the upholders of a continuous conformable succession from Cretaceous to Pliocene, may possibly dissent to some extent. His view still seems to be that Cretaceous and Tertiary faunas flourished at the same time, the former in deep water, the latter in the shallow waters close to the Early Tertiary coast-line. Apparently he thinks, however, that at Wangaloa mingling of these faunas took place—a view that is not now held by any one else of prominence, and, as formerly advanced by Hector and McKay, has, rightly or wrongly, been scouted by several European writers.

Thomson claims that certain species of Oamaruan Brachiopoda are probably confined to a comparatively narrow vertical range, and therefore that fairly close zoning can be done by means of their aid; but he has not yet published all his evidence, and in the meantime it may be said, as was implied in a previous paragraph, that only broad zoning can be done by means of palaeontological data. At present it would hardly be safe to name a single molluscan species that is confined to any one stage of the Tertiary succession. In the case of the Oamaru Formation, at any rate, the stages cannot be distinguished with certainty by the molluscs alone, unless a considerable collection can be made.

The utility of using percentages of Recent species in determining horizons has often been questioned, but the fact that Lyell's method has been found satisfactory in Europe and North America indicates that its use in New Zealand is justifiable. It is true, however, that the percentage alone is not a safe guide, and possibly there has been a tendency in New Zealand to exaggerate its value, and more especially to neglect some or all of the following additional criteria, which ought to be considered when correlations are to be made:—

- (1) The number of species certainly identified must be considerable.
- (2) The beds to be correlated ought to be lithologically similar, and laid down under similar conditions of depth of water, &c.
- (3) Stratigraphical evidence must be favourable, or at least not opposed.
- (4) It is desirable that the localities should not be widely separated, as, for example, are North Auckland and Otago.
- (5) The personal equations of the palaeontologists making the identifications have to be taken into account.

Among other factors affecting the percentage of Recent species found in a collection are the following:—

- (a) Imperfect collecting. In particular, the larger shells are sure to be collected, whilst many of the small shells may be overlooked.
- (b) It seems to be a fact, as observed by Hutton in 1886, that Recent species are generally more plentiful and more widely distributed than the extinct forms. This presumably is because those species which have survived were better adapted to the conditions and had more vigorous constitutions than those that have died out.
- (c) Some shells are less liable to decay than others, especially in certain matrices. Where solution of calcium carbonate is going on, large thick shells may survive, whilst small thin shells disappear.
- (d) Some collections are made for special purposes and are not wholly representative. For example, the collector may select only those species which he believes have not previously been recorded, or a beginner may select only the best-preserved shells.

If, owing to the paucity of fossils, only a small collection of, say, twenty or thirty species can be made in a given bed, an application of the theory of probability shows that the percentage of Recent species is likely roughly to conform to the true percentage in the contemporaneous fauna; and this statement becomes almost exact if the percentage of Recent



species approaches fifty. In the case of Oamaru faunas, with from 20 to 40 per cent. of Recent species, the probable error of an assumption on the basis indicated will not be so great as to prevent a distinction being made between Upper Oamaru (Pareora) beds and Lower Oamaru (Ototaran and Waiarekan) beds. Even where a considerable collection could be but has not been made, a small collection, if selected with impartiality, is likely to conform to the law of averages.

The fact that all the molluscan determinations given in this bulletin have been made by the one paleontologist enables the personal equation to be eliminated when comparisons are made between the lists: it has to be considered only when the percentage of Recent species is in question, or comparison is made with the determinations of other workers.

Hutton† many years ago showed that when proper precautions are observed the percentage of Recent species in a Tertiary fauna has a real value. A moment's consideration will show that essentially the same principle is generally followed when comparisons are made between two or more wholly extinct faunas. If numerous species, some of which are known or believed to have a restricted time-range, are common to all the faunas, they are considered to be of the same, or nearly the same, age. It is true that wonderful work has been done by Buckman and others in establishing zones by means of the intensive study of a single group of organisms, such as the Ammonites; but it is doubtful if the highly specialized zoning methods have, or can have, such an extensive application to the problems of geology as the broader method of comparing faunas as a whole. Marshall,‡ though at times inclined to deprecate the method of correlation by means of percentages, has also stated the conditions under which it may, in his opinion, be safely used, and in one of his latest papers§ appears to be a fairly strong supporter of it.

Mr. Suter's work has helped to establish, or at least points to the probability of, the following conclusions:—

- (1.) The Tertiary age of the bituminous coal-measures of the west coast of the South Island. These strata, it is now admitted, have nothing in common with the Upper Cretaceous (Senonian) beds of Amuri Bluff, &c.
- (2.) The pre-Oamaruan age of the Kaitangata coal-measures.
- (3.) The Tertiary age of the Weka Pass stone.
- (4.) As already stated, the total absence of Cretaceous forms from the Oamaru Formation.
- (5.) The Miocene age of the Oamaru Formation, with the proviso that the lowest beds may be Oligocene.
- (6.) The correctness or otherwise of many correlations made in past years between Tertiary strata in widely separated localities.

Besides helping to bring about a more general agreement as to correlation among New Zealand geologists, Mr. Suter's work has important economic bearings, especially in connection with the coal deposits of New Zealand. The known coal resources of this Dominion are not great, and the time is approaching when extensive exploration for hidden coalfields by means of boring will have to be made. Until correct correlations between the known coal-seams are made, and until surface strata can be correctly identified, work of this kind cannot be intelligently or efficiently directed. During the past few years considerable advance in establishing a firm foundation for the scientific prospecting of our hidden coalfields has been made. It is imperative, however, that there should be no falling-off in detailed geological survey, or in the collection and precise identification of Tertiary fossils.

The following tentative classification of New Zealand Cretaceous and Tertiary sedimentary strata nearly expresses the present views of the New Zealand Geological Survey. For the sake of completeness it is followed by a tentative classification of pre-Cretaceous strata.

† HUTTON, F. W., The Wanganui System, *Trans. N.Z. Inst.*, vol. 18, 1886, pp. 336-67 (see pp. 344-45).

‡ MARSHALL, P., The Tertiary Molluscan Fauna of Pakaurangi Point, Kaipara Harbour, *Trans. N.Z. Inst.*, vol. 50, 1918, pp. 263-78 (see pp. 275-76). See also *Trans. N.Z. Inst.*, vol. 46, 1914, p. 280; vol. 47, 1915, pp. 379-80, &c.

§ MARSHALL, P., Fauna of the Hampden Beds and Classification of the Oamaru System, *Trans. N.Z. Inst.*, vol. 51, 1919, pp. 226-50 (see pp. 243 *et seq.*).

TABLE 1.—CLASSIFICATION OF CRETACEOUS AND TERTIARY STRATA.

Approximate Age.	Series or System.	Stage and Group Names (Adjectival Form).	Northern Auckland.	South-west Auckland, Taranaki, and Wanganui.	East Coast of North Island.	Marlborough and North Canterbury.	South Canterbury and Otago.	Nelson and Westland.
Pliocene.	Wanganui Series or System (Wanganuian).	Castelliffian or Petanian. Waitotaran.		Castelliff beds; Kaawa Creek beds. Waitotara beds. Onairo and Tongaporutu Series, &c.	Petone and Scinde (Island beds) (Stupier Series). Te Aute Series. Ormond limestone.	? Great Marlborough conglomerate; Awatere beds (part); Gretna and Motunau beds.		Dolomite beds of Inangahua-Grey valley.
Miocene and Oligocene.	Oamaru System (Oamaruan).	Paroran (Awaroran). Hutchinsonian. Ototaran. Wairekan. Ngaparan.	Waitemata and Orakei Bay beds. Whangarei limestone. Whangarei coal-measures.	Mohakaiti, Mokai, and Maloe-nui beds. Raglan and Te Kaiti limestone, &c. ? Leda Marls, &c. Waikato (Huntly) coal-measures, &c.	Tawhiti Series. Te Arai Series (8,000 ft. thick).	Part of Awatere beds. Mount Brown beds, &c.	Parora and Awamoa beds. Hutchinson Quarry beds. Ototara limestone. Waireka beds. Ngapara beds.	Blue Bottom and Upper Kōngahu beds. Cobden limestone and Lower Kōngahu beds. Port Eliza beds and Imotomoto beds ? Reefton coal-measures.
Eocene.	Mawheranui or Waimangaroa Series (Mawheranuian).	Kaistan.	? Part of Kaeo Series; ? Tiger Hill sandstone.		? Whero Series.	Grey Marl of Weka Pass; Weka Pass stone.	Hampton (Onekaka) beds.	Kaiaia beds.
Upper Cretaceous (Albian or Cenomanian).	Waipara Series or System (Waiparan).	"Atituan." Piripapan (Thomson, 1917).	Part of Kaeo Series; Hydraulic limestone. Part of Kaeo Series; Ammotite beds, Hatley (Marshall, 1917).		Mangatu Series.			Island sandstone. Brunner beds. Paparua beds. Hawks Creek breccia.
Middle Cretaceous (Albian or Cenomanian).	Coverham, Waiautoa, or Charence River Series. Port Waikato plant beds	Clarence or Waiautoan.		Port Waikato plant beds.		Saurian beds, Belemnite beds, &c.	? Wanganui beds and Katangata coal-measures. ? Shag Point beds = Makarewa (Hutton, 1888) or Pukeitahi beds.	
Lower Cretaceous (Neocomian).	? Awanui beds.	Awanuian.			? Awanui beds.			

TABLE II.—CLASSIFICATION OF PRE-CRETACEOUS STRATA.

Approximate Age.	Series or System.	Group or Alternative Names.	Chief Localities, &c.
Jura-Trias.	Hokanui System.	Mataura Series (Jurassic); Putataka Series; Catlin's River Series; Flag Hill Series; Bastion Series; Otapiriri Series; Oreti Series; Wairoa Series (Triassic); Kaihiku Series; Mount St. Mary Series; Aorangi Series; Manaia Hill Series (Jurassic); Mochau Series; Tokatea Series; Waipapa Series, &c.	Waikawa (Middle Jurassic); Mokoia Farm and Mataura Falls (Lower Jurassic); Malvern Hills (? Lower Jurassic); Owaka (? Rhætic); Hokanui Hills (Rhætic and younger); Kaihiku; Clent Hills and Mount Potts (Rhætic); Nugget Point; Mount St. Mary; Wairoa Valley (Nelson); Wellington district; Coromandel district; Whangaroa district; &c.
Permian or Permo-Carboniferous.	Maitai Series.	? Part of Arahura Series.	Dun Mountain district; ? Taylor's Pass (Marlborough).
Late Palæozoic.	Te Anau Series.	Hauptiri Series; Pelorus Series; Kakanui Series.	Western Central Otago; Collingwood district; Pelorus Valley; North-east Otago (Kakanui Series).
Silurian (Wenlock).	Wangapeka Series.	Baton River Series; Reefton beds or Series.	Baton River; Reefton (so-called "Devonian" beds).
Ordovician.	Aorere Series or System.	Greenland Series; Wanaka System of Hutton; Part of Manapouri System of Park; ? Part of Arahura Series.	Collingwood district; Reefton; Paparoa Mountains; Ross; Preservation Inlet; ? Otago schists, &c.
Pre-Ordovician.	Manapouri Series.	Manapouri System of Marshall; ? Part of Aorere Series; Part of Manapouri System of Park.	North-west Nelson and Western Otago (gneisses, &c.).

## REMARKS ON CLASSIFICATION TABLES.

If these tables are compared with any of Hector's classifications—for example, that on pages 39–40 of the *Outline of New Zealand Geology*, 1886—it will be seen that the most important differences arise from the abandonment of the Cretaceo-Tertiary hypothesis. The Waitemata and Ototara Series, together with the bituminous coal-measures of the west coast of the South Island and the overlying marine strata, are transferred from the Cretaceo-Tertiary to Miocene and Eocene formations. The Te Aute Series is regarded as Pliocene, the Awatere Series as partly Pliocene, and the Mount Brown Series, &c., as Miocene (and perhaps in part Oligocene). Many names of local application used by Hector, McKay, and others could not conveniently be included in the table. The term "Buller Series" is not likely ever to be used again, and the term "Amuri Series" at present does not appear to have any useful application.†

The classification adopted bears a strong resemblance in its main outlines to that set out by Hutton‡ in 1900. The essential differences lie in the exclusion of the glacier period from the Pliocene, and the introduction of an Eocene system. The Wanganui Series or System, also, is recognized as including the Older as well as the Younger Pliocene.

If compared with Park's§ classification of 1910 the present classification will be found to differ very little in essential principles. The differences in detail are obvious, and therefore it is not necessary specifically to mention them.

Marshall's|| classification of 1912 is a very simple one, which superficially differs from that now advanced mainly by placing the oldest rocks of New Zealand definitely in the Archæan, and the Maitai Series or System in the Trias-Jura. There are, however, very

† See also THOMSON, J. A., *Trans. N.Z. Inst.*, vol. 49, 1917, p. 408.

‡ HUTTON, F. W., *The Geological History of New Zealand*, *Trans. N.Z. Inst.*, vol. 32, 1900, pp. 159–83.

§ PARK, J., *The Geology of New Zealand*, 1910, p. 25.

|| MARSHALL, P., *Geology of New Zealand*, 1912, pp. 208–9. See also pp. 6–7 of *New Zealand and Adjacent Islands*, 1912 (reprinted from *Handbuch der Regionalen Geologie*, Heidelberg, 1912).

marked differences in the application of the classification. The Otago schists are considered to be of Triassic age, and the Waipara Series is regarded as a subdivision of the Oamaru System.

In 1917 Thomson† proposed the term "Notocene" as an age-name for the "covering strata" or "younger rock-series" of New Zealand. This term is intended to include the Upper Cretaceous and Tertiary strata of this country, and if, as some believe, there is no stratigraphic break between the Cretaceous and the Tertiary it will probably be accepted by most geologists.‡ It will also be useful if any break that exists is of a minor character. The writer cannot adopt the former view, but has an open mind regarding the extent of the stratigraphic and palaeontological hiatus that he believes does exist between Mesozoic and Tertiary. Thomson§ has also proposed adjectival names applicable to the divisions of the Notocene. These terms are quoted in the classification, and most of them are likely to be generally adopted, notwithstanding the objection that may well be raised by purists in language to the combination of an English (or Latin) suffix and a Maori name. Hybrid terms have previously been used by Park, and it appears useless to oppose a practice which is convenient, and against which only sentimental objections can be urged. One of the proposed Oamaruan stage-names, the Hutchinsonian, is not likely to be of much use. Outside the Oamaru district the corresponding beds are recognizable, if at all, with difficulty, and no harm would be done by merging the Hutchinsonian with the Middle Oamaru or Ototaran stage. Thomson almost fails to recognize the stages present in the older Tertiary rocks of the west coast of the South Island, an area that has been geologically surveyed in detail, and stratigraphically placed on a sure basis. That the whole of the Mawheranui Series belongs to lower horizons than any part of the Oamaru System as developed near Oamaru might well be regarded as proved. It is true that the beds of the Kaiatan and Islandian stages are somewhat poor in recognizable marine organisms, whilst the Brunner and Paparoa beds (the latter recognized by Thomson as forming a stage) have only plant fossils, but nowhere else in New Zealand has so much careful field-work been done as in the districts where these beds occur.

Several new names have been introduced in the classification. The terms "Te Arai," "Wheao," and "Mangatu" Series will be found in Geological Bulletin No. 21, dealing with the Gisborne district. The adjective "Atiuan," from Atiu Point, Kaikoura Peninsula, is intended to cover the Amuri limestone, for which a stage or alternative name, notwithstanding its poverty in fossils, seems desirable. Possibly a better term may hereafter be found, and in the meantime no claim for priority is advanced. Waiautoa is the Maori name for the Clarence River, and the adjectival form "Waiautoan" is a mere synonym of "Clarentian." If Maori names are to be employed as much as possible in New Zealand geological nomenclature, then Waiautoan may be used, but on other grounds preference ought to be given to Clarentian. No brief for the Maori term is held, but it may as well be suggested now as later.

One other matter requires discussion here—the use of European time-names in the classification. Objection to the European terms has been taken on the ground that there is not sufficient evidence to show that the New Zealand formations correspond exactly to the European formations with which they are intended to be correlated. It may be admitted at once that exact correlation cannot be made; but there are some good reasons for using the European time-names. In the first place, it is abundantly clear that the latter are by no means as precisely defined as is inferred by the argument

† THOMSON, J. A., Diastrophic and other Considerations in Classification and Correlation, and the Existence of Minor Diastrophic Districts in the Notocene, *Trans. N.Z. Inst.*, vol. 49, 1917, pp. 397-413.

‡ Marshall has lately stated objections to the use of the word "Notocene," and suggests that some other expression is desirable in order to convey the intended meaning. At the same time he prefers to use the term "Oamaru System" in the same sense.—"Fauna of the Hampden Beds and Classification of the Oamaru System," *Trans. N.Z. Inst.*, vol. 51, 1919, pp. 226-50 (see p. 240).

§ *Loc. cit.*, pp. 408-11.

mentioned above. In practice a certain amount of latitude is taken and allowed. There is really, in the present state of our knowledge, no reason why the time-names "Cretaceous," "Eocene," "Miocene," &c., should not be considered somewhat elastic terms. No one has ever supposed that the New Zealand Miocene corresponds exactly to the Miocene of England or to the Miocene of any other country. To be sure, the New Zealand Miocene (Oamaruan) might be called the "Noto-Miocene," the New Zealand Eocene the "Noto-Eocene," and so on; but nothing can be gained by this terminology, and it might well cause inconvenience when comparing, say, New Zealand and South American formations. One advantage of using a measure of European nomenclature is that thereby the world-wide scope of geology is emphasized. An important practical advantage is that it enables European geologists who have not visited this country more easily to grasp the broad outlines of our geology, and assists New Zealand students, especially beginners, in making use of foreign text-books and other literature. Geologists in outside countries show a very evident preference for the European time-names when they touch on New Zealand geology: hence it is clear that the retention of the chief European names tends to co-operation. The writer, however, must deprecate the use of the minor subdivisions of the European time-scale, for this implies an exactness in correlation which is wanting. It is somewhat strange that those writers on New Zealand geology who are most inclined to discard the Tertiary time-names used in Europe have adopted the terms "Cenomanian," "Senonian," "Maestrichtian," and "Danian" without apparent hesitation. The introduction of several of these terms in the classification table is not to be regarded as giving an unqualified approval to their use. Moreover, it is in all cases desirable to give prominence to the series or system name approximately corresponding to the European time-name.

It is to be hoped that no one will suppose that the writer in advocating the use of the chief European time-names wishes to infer that diastrophic movements throughout the world have always been contemporaneous. This must be left an open question; but there is reason to believe, at least tentatively, that the major diastrophic movements were world-wide, and that minor movements in one area have generally been reflected by similar movements somewhere else. It is possible, for example, that each minor deformation in New Zealand can be correlated with a similar event in some other part of the Pacific region.

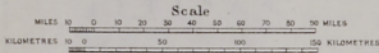


168° 169° 170° 171° 172° 173° 174°



# SOUTH ISLAND OF NEW ZEALAND

SHOWING FOSSIL LOCALITIES &c.



Reference  
Railways, opened .....  
under construction. - - - -  
proposed - - - - -



SOUTH  
PACIFIC  
OCEAN

167° 168° 169° 170° 171° 172° 173° 174°

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