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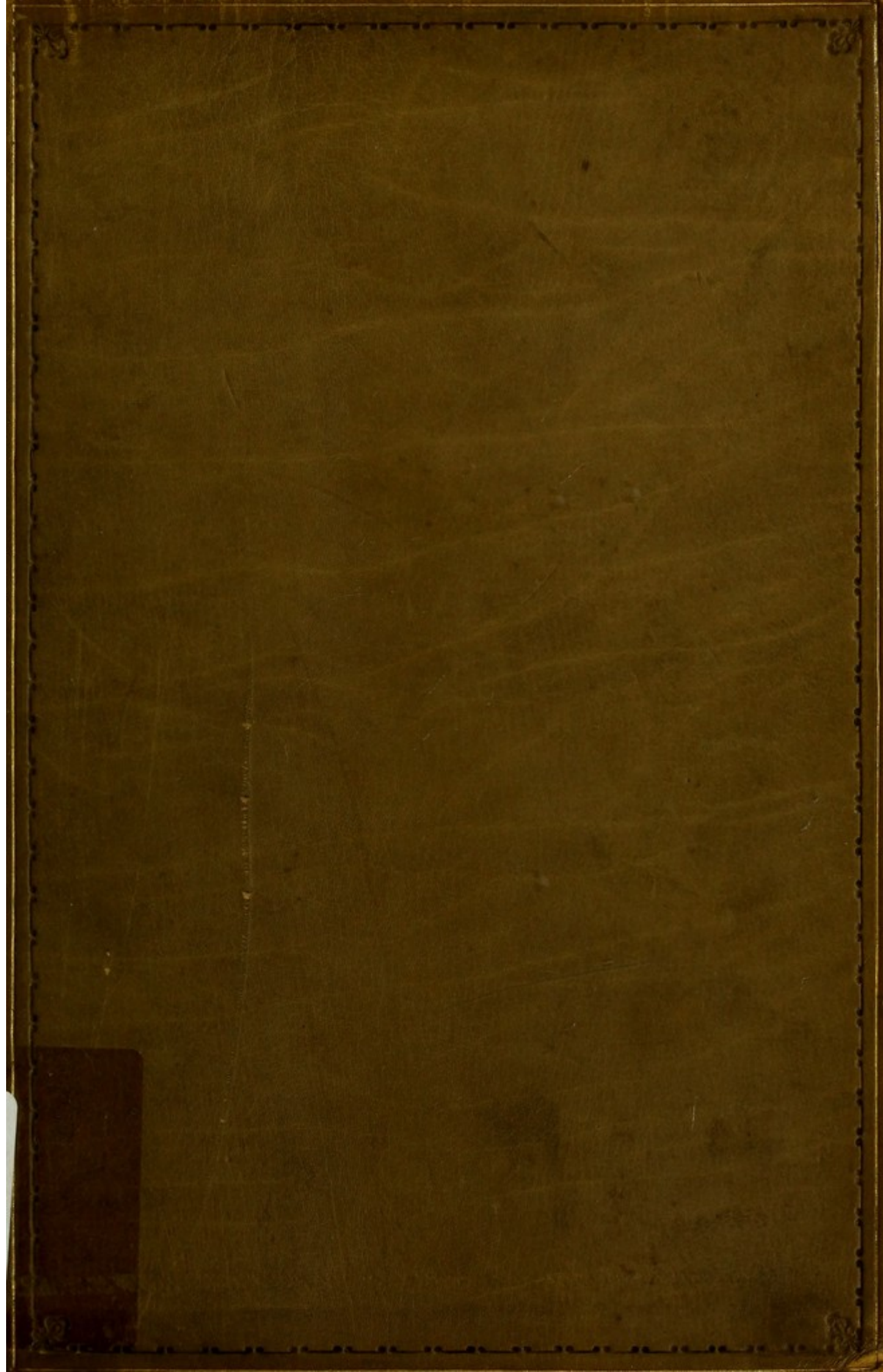
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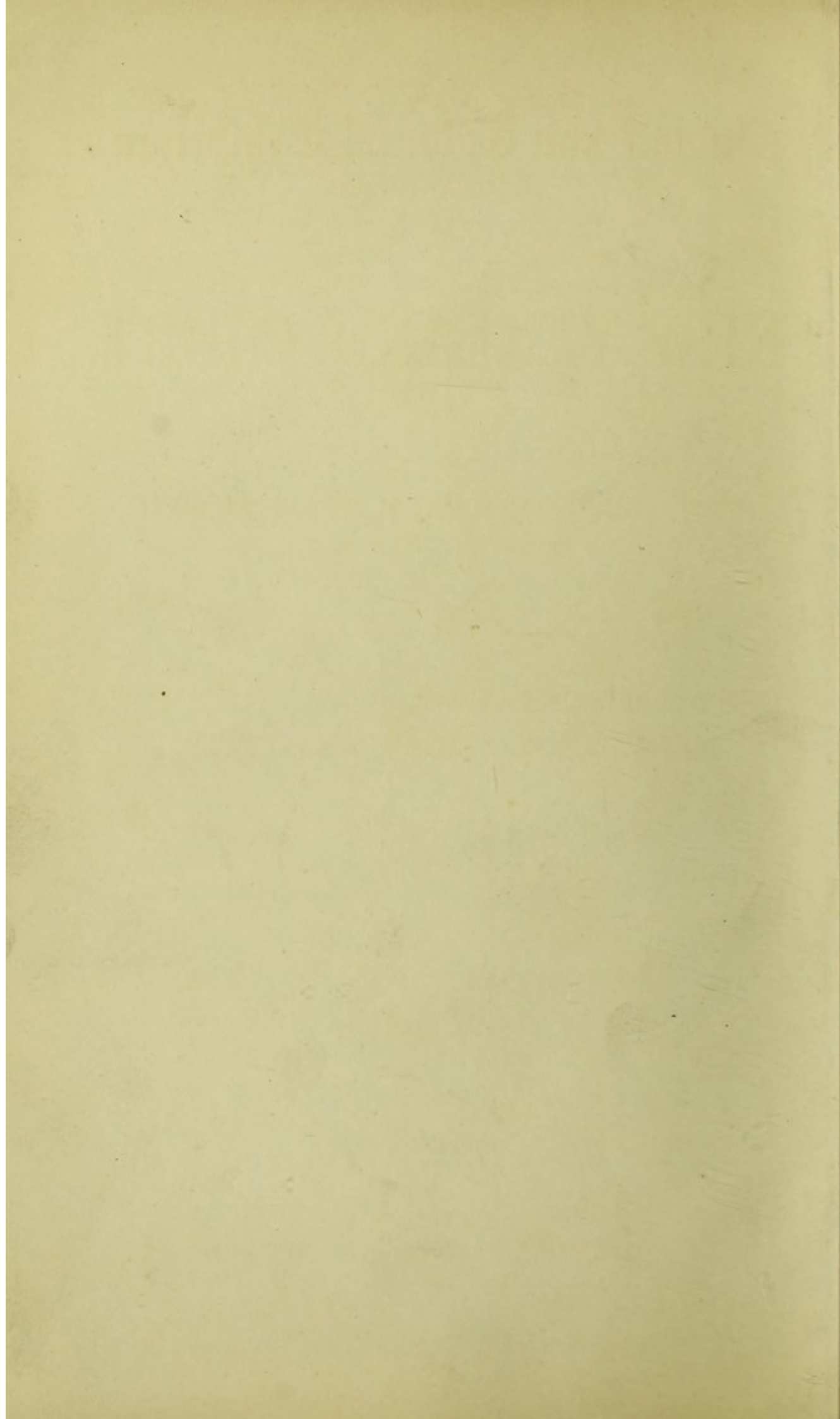
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Indian and Colonial Exhibition,
LONDON, 1886.

NEW ZEALAND COURT.

NEW ZEALAND GEOLOGICAL SURVEY DEPARTMENT.

JAMES HECTOR, M.D.,
DIRECTOR.

DETAILED CATALOGUE AND GUIDE TO
THE GEOLOGICAL EXHIBITS.



WELLINGTON.

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I. GEOLOGICAL MAP and SECTIONS of the COLONY of NEW ZEALAND, showing the distribution of the formations, and the localities where mineral ores have been found.

Scale : 12 miles to the inch.

General Table of Reference to the Sedimentary Rocks of New Zealand, as coloured on the Geological Map and represented by the Collections of Fossils exhibited.

Age.	System.	Colour on Map.	Formation.	Mono-gram.	Series.
Cainozoic.	Post-tertiary ..	Chrome green..	I. Recent	Q	<i>a, b, c, d, e.</i>
	Tertiary ..	Orange ..	II. Pliocene ..	P	<i>a, b, c, d, e.</i>
			III. Upper Miocene ..	O	<i>a, b, c, d, e, f.</i>
			IV. Lower Miocene ..	N	<i>a, b, c.</i>
			V. Upper Eocene ..	M	<i>a, b, c.</i>
Mesozoic.	Cretaceous ..	Green ..	VI. Cretaceo-tertiary	K	<i>a, b, c, d, e, f, g, h.</i>
			VII. Lower Cretaceous	H	<i>a, b, c.</i>
	Jurassic ..	Blue ..	VIII. Oolitic	G	<i>a, b, c.</i>
			IX. Lias	F	<i>a, b.</i>
	Triassic ..	Indian red ..	X. Trias	E	<i>a, b, c.</i>
Palæozoic.	Permian ..	Sepia ..	XI. Permian	D	<i>a.</i>
	Carboniferous..	Neutral tint ..	XII. Carboniferous ..	C	<i>a, b, c, d.</i>
	Devonian ..	Stone ochre ..	XIII. Devonian ..	B	<i>a, b.</i>
	Silurian ..	Pink ..	XIV. Silurian	A	<i>a, b.</i>

II. RELIEF MODEL of NEW ZEALAND in 15 slabs, geologically coloured to distinguish the following formations :—

Upper Tertiary, *Yellow.*

Lower Tertiary, *Pale pink.*

Upper Secondary, *Green.*

Lower Secondary, *Blue.*

Palæozoic, *Dark brown.*

Foliated Schists, *Dark pink.*

Crystalline Schists, *Light red.*

Igneous, *Scarlet.*

Scale : 1 inch = 4 miles horizontal and 4,000 feet vertical.

III. RELIEF MODEL of the CENTRAL VOLCANIC REGION of the NORTH ISLAND, to illustrate the structure of New Zealand mountains which have been formed by the accumulation of volcanic materials combined with upheaval of the land.

IV. RELIEF MODEL of MILFORD SOUND, intended to illustrate the formation of mountains in New Zealand by excessive atmospheric denudation and glacier sculpturing, followed by subsidence of the land.

[For detailed description of the map and models, see appended notes on the geology of New Zealand.]

V. COLLECTIONS.

TERTIARY FOSSILS.

No.	Name:	Locality and Remarks.	Age or Formation.	No. of Specimens.
GASTEROPODA.				
1	<i>Voluta pacifica</i> ..	Shrimpton's, Napier (Recent to Lower Miocene)	II.	2
2	" <i>elongata</i> ..	Shrimpton's, Napier ..	"	1
3	" ..	Wanganui; Petane, Napier ..	"	2
4	" <i>gracilis</i> ..	Wanganui; Petane, Napier (Recent to Lower Miocene)	II.-IV.	3
5	" ..	Shrimpton's, Napier ..	II.	2
6	<i>Murex zealandicus</i> ..	Shakespeare Cliff, Wanganui (not known lower)	"	2
7	" <i>octogonus</i> ..	Wanganui, upper beds (not known lower)	"	1
8	" (?) ..	Komiti, Kaipara, Auckland (not known from other beds)	V.	1
9	<i>Turbinella brevicostatus</i> ..	Pareora, South Canterbury (not known from other beds)	IV.	2
10	<i>Buccinum zealandicum</i> ..	Amuri Bluff Hill, Marlborough ..	I.	3
11	<i>Purpura textiliosa</i> ..	Amuri Bluff Hill, Marlborough (Recent to Lower Miocene)	"	4
12	<i>Ranella leucostoma</i> ..	Amuri Bluff Hill, Marlborough ..	"	1
13	<i>Cominella subnodosa</i> ..	Pareora, South Canterbury ..	IV.	3
14	<i>Buccinum maculatum</i> ..	Shrimpton's, Napier (not found in older rocks)	..	1
15	" <i>costatum</i> ..	Shrimpton's, Napier ..	II.	2
16	<i>Fusus australis</i> ..	Wanganui, Upper (not found in older rocks)	"	1
17	" <i>zealandicus</i> ..	Wanganui, Upper ..	"	1
18	" <i>dilatatus</i> ..	Pareora, South Canterbury ..	IV.	2
19	" <i>pensum</i> ..	Komiti, Kaipara, Auckland ..	V.	2
20	" <i>nodosus</i> ..	Wanganui ..	II.	4
21	" .. var. B ..	Shrimpton's, Napier ..	"	2
22	" <i>sp. (?)</i> ..	Amuri Bluff Hill, Marlborough (not known lower)	I.	1
23	" <i>corticatus</i> ..	Petane, Napier (not known lower)	II.	1
24	<i>Murex lyratus</i> ..	Wanganui ..	"	1
25	<i>Trophon</i> ..	Shrimpton's, Napier (not known lower)	"	1
26	" (?) ..	Shrimpton's, Napier (not known lower)	"	1
27	<i>Fusus variabilis</i> ..	Komiti, Kaipara, Auckland ..	V.	2
28	" .. var. A ..	Pareora, South Canterbury ..	IV.	1
29	" <i>ahuririensis</i> ..	Shrimpton's, Napier (not known lower)	II.	1
30	" .. var. A ..	Shrimpton's, Napier (not known lower)	"	1
31	"	Shakespeare Cliff, Wanganui (not found in lower beds)	"	1
32	<i>Struthiolaria nodosa</i> , var. C	Shakespeare Cliff, Wanganui (not found in lower beds)	"	2
33	" .. " C(?)	Awatere, Marlborough ..	IV.	1
34	" <i>vermis</i> ..	Shrimpton's, Napier (not found in lower beds)	II.	3
35	" .. var. A	Petane, Napier ..	"	1
36	"	Shrimpton's, Napier (not found in lower beds)	"	2
37	" <i>tuberculata</i> ..	Pareora, South Canterbury ..	IV.	2

TERTIARY FOSSILS—continued.

No.	Name.	Locality and Remarks.	Age or Formation.	No. of Specimens.
GASTEROPODA—continued.				
38	<i>Struthiolaria spinosa</i>	.. Pareora, South Canterbury ..	IV.	2
39	<i>Cerithium bicarinatum</i>	.. Shrimpton's, Napier ..	II.	1
40	" <i>kirki</i> (?)	.. Palliser Bay, Wellington ..	"	3
41	" <i>nodulosum</i>	.. Trelissick Basin, Canterbury ..	IV.	2
42	" <i>bicarinatum</i>	.. Kereru, Napier ..	II.	3
43	<i>Dentalium</i>	.. Petane, Napier ..	"	2
44	" <i>giganteum</i>	.. Waitaki Valley, Otago..	V.	3
45	" <i>solidum</i>	.. Pareora, South Canterbury ..	IV.	3
46	" <i>irregulare</i>	.. Kanieri River, Westland ..	"	1
47	" <i>mantelli</i>	.. One mile south of Devil's Bridge, Oamaru Creek, Oamaru, Otago	"	1
48	" ..	.. Komiti, Kaipara, Auckland ..	V.	1
49	<i>Ancillaria australis</i>	.. Shrimpton's, Napier (reaches down to Formation IV.)	II.	2
50	" <i>pomahaka</i>	.. Pomahaka, Otago ..	IV.	1
51	" <i>lata</i>	.. Kakahu River, South Canterbury	"	1
52	" <i>hebera</i>	.. Pareora River, South Canterbury	"	1
53	<i>Natica solida</i>	.. Pareora River, South Canterbury	"	1
54	" <i>ovata</i>	.. Pareora River, South Canterbury	"	4
55	" <i>zealandica</i>	.. Wanganui ..	II.	3
56	" <i>vitrea</i>	.. Awamoa, Otago ..	IV.	12
57	" <i>sp. (?)</i>	.. Komiti, Kaipara, Auckland ..	V.	1
58	<i>Acus nitida</i>	.. Pareora River, South Canterbury	IV.	1
59	<i>Cassis muricata</i>	.. Komiti, Kaipara, Auckland ..	V.	1
60	<i>Conus trailli</i>	.. Pareora River, South Canterbury	IV.	1
61	<i>Conus ornatus</i>	.. Awamoa, Otago ..	"	24
62	<i>Crypta costata</i>	.. Awamoa, Otago; Station Peak, Waitaki Valley, Otago	IV., V.	2
63	" <i>striata</i> , var. A	.. Awamoa, Otago ..	IV.	1
64	" <i>profunda</i>	.. (1) Awatere, Marlborough; Awamoa, Otago	IV., II.	4
"	" ..	.. (2) Wanganui, Petane, Napier (range Recent to IV.)	..	
65	" <i>contorta</i>	.. Pareora River, Canterbury; Kye-burn, Otago	IV.	2
66	" <i>costata</i>	.. Shrimpton's, Napier; Awamoa, Otago	II., IV.	3
67	<i>Calyptraea maculata</i>	.. Kereru, Napier; Awamoa, Otago	"	2
68	" <i>mackayii</i>	.. Awamoa, Otago ..	IV.	1
69	<i>Cylichna striata</i>	.. Trelissick Basin, Canterbury; Komiti, Kaipara, Auckland	V.	3
70	<i>Rotella zealandica</i>	.. Shrimpton's and Petane, Napier	II.	6
71	<i>Scalaria zealebori</i>	.. Petane, Napier ..	"	1
72	<i>Trochus</i>	.. Komiti, Kaipara, Auckland ..	V.	1
73	<i>Turritella</i>	.. Waikawau Creek, Waikato, Auckland	"	2
74	" <i>pagado</i>	.. Pareora River, South Canterbury	IV.	5
75	" <i>gigantea</i>	.. One mile south of Devil's Bridge, Oamaru Creek, Oamaru, Otago	"	4
76	" ..	.. Awamoa, Otago ..	"	1
77	" ..	.. Waitaki Valley, Otago..	"	1
78	" <i>vittata</i>	.. (1) Wanganui; (2) Awamoa (respectively)	II.-IV.	5
79	" <i>tricincta</i>	.. Wanganui; Petane, Napier ..	II.	5
80	" <i>rosea</i>	.. Shrimpton's, Napier; Castlepoint, Wellington	II., IV.	5
81	" <i>concava</i>	.. Pareora River, South Canterbury	IV.	4

TERTIARY FOSSILS—continued.

No.	Name.	Locality and Remarks.	Age or Formation.	No. of Specimens.
GASTEROPODA—continued.				
82	Typhis	Awamoa, Otago	IV.	1
83	Trophon	Petane, Napier	II.	2
84	Mitra spicalis	Awamoa, Otago	IV.	2
85	Ancillaria	Awamoa, Otago	"	1
86	Buccinum	Awamoa, Otago	"	2
87	Pleurotoma trailli	Awamoa, Otago	"	4
88	" novæ-zealandiæ	Petane, Napier	II.	1
89	" wanganuiensis	Petane, Napier	"	4
90	"	Petane, Napier	"	1
91	"	Awamoa, Otago	IV.	1
92	" tuberculata	Petane, Napier	II.	1
93	"	Petane, Napier	"	1
94	"	Petane, Napier	"	2
95	" (?)	Petane, Napier	"	2
96	" (?)	Petane, Napier	"	1
97	" (?)	Petane, Napier	"	1
98	" sulcata	Komiti, Kaipara, Auckland	V.	1
99	Buccinum carinatum	Trelissick Basin, Canterbury	IV.	1
100	Mitra	One mile south of Devil's Bridge, Oamaru Creek, Oamaru, Otago	"	1
101	Emarginula striata	Petane, Napier	II.	1
102	Various small bivalves	Pareora River, South Canterbury	IV.	200

Total of Gasteropoda, &c., 428.

LAMELLI-BRANCHIATA.

103	Pecten secta	(2) Kanieri River, Westland	IV.	3
104	" semiplicata	Duncan's, Poverty Bay, Auckland	V. (?)	1
105	"	Culverden, Nelson	V.	1
106	" vellicatus	Castlepoint, Wellington	IV.	1
107	" hutchinson	(1) Hutchinson's Quarry, Oamaru, Otago	V.	2
	"	(2) Curiosity Shop, Canterbury .. ..	..
108	" triphooki	Napier	II., IV.	1
109	" delicatula	Castlepoint, Wellington	IV.	1
110	" radiatus	Petane, Napier	II.	1
111	" hochstetteri	Curiosity Shop, Canterbury	V.	1
112	" laticostatus	Wanganui	II.	1
113	" chathamensis	Wharekuri, Waitaki Valley, Otago	V.	4
114	"	Komiti, Kaipara, Auckland	"	3
115	" (hectori ?)	Trelissick Basin, Canterbury	"	1
116	" zittelli	Komiti, Kaipara, Auckland	"	2
117	"	Curiosity Shop, Canterbury	"	1
118	Modiola albicosta	Kereru, Napier	II.	1
119	Mytilus magallanicus	Awamoa, Otago	V.	3
120	Solenella australis	Wharekuri, Waitaki Valley, Otago	"	2
121	Pectunculus laticostatus	Wanganui, Upper	II.	3
122	" cordatus	Wairoa Gorge, Nelson	IV.	2
123	" globosus	(1) Shrimpton's, Napier (found down to IV.)	II., IV.	3
	"	(2) Pareora River, S. Canterbury .. ..	..
124	" traversi	Wharekuri, Waitaki Valley, Otago	V.	1
125	Limopsis zealandica	Pareora River, South Canterbury; Waitaki Valley, Otago	IV., V.	3
126	Crassatella trailli	One mile south of Devil's Bridge, Oamaru Creek, Oamaru	"	2
127	"	Wharekuri, Waitaki Valley, Otago	V.	1

TERTIARY FOSSILS—continued.

No.	Name.	Locality and Remarks.	Age or Formation.	No. of Specimens.
LAMELLI-BRANCHIATA—continued.				
128	<i>Crassatella attenuata</i> ..	Trelissick Basin, Canterbury ..	V.	1
129	" <i>ampla</i> ..	Sherwood, Amuri, Nelson (Lottery Creek Section)	IV., at base	1
130	<i>Venericardia australis</i> ..	Wanganui, Upper; Manawatu Gorge, upper end; Chatham Islands	II.-IV.	3
131	" <i>intermedia</i> ..	Awamoa, Otago; Waitaki Valley, Otago	IV., V.	2
132	" " var. A	Hutchinson's Quarry beds, Wharekuri, Waitaki Valley, Otago	V.	1
133	" " ..	Petane, Napier ..	II.	5
134	<i>Cardita</i> ..	Kyeburn, Central Otago ..	V.	1
135	<i>Venericardia intermedia</i> , large variety	Kekenodon beds, Wharekuri, Waitaki Valley, Otago	"	1
136	<i>Mactra attenuata</i> ..	Trelissick Basin, Canterbury ..	"	2
137	<i>Tapes curta</i> ..	Trelissick Basin, Canterbury ..	"	2
138	" <i>intermedia</i> ..	Amuri Bluff Hill, Marlborough; Motunau, Canterbury	I.-IV.	2
139	<i>Cucullæa alta</i> (?) ..	Otaikaika limestone, Waitaki Valley, Otago	V.	2
140	" " (?) ..	Otaikaika limestone, Waitaki Valley, Otago	"	1
141	" <i>worthingtoni</i> ..	Otaikaika limestone, Waitaki Valley, Otago	"	1
142	" " (?) ..	Hicks Bay, Auckland ..	IV.	1
143	" <i>attenuata</i> ..	Hicks Bay, Auckland ..	"	1
144	" " ..	Lake Wakatipu ..	(?) IV. or VI.	1
145	<i>Lima bullata</i> ..	Kereru, Napier ..	II.	3
146	" <i>lingulata</i> , var. B	Wanganui ..	"	1
147	" " ..	Komiti, Kaipara, Auckland ..	V.	1
148	" " ..	Highfield Ridge, Waiau, Amuri, Nelson	IV.	1
149	" <i>multiradiata</i> ..	Curiosity Shop, Canterbury ..	"	1
150	" <i>colorata</i> ..	Kakahu River, South Canterbury (Pareora beds)	V.	1
151	" <i>paleata</i> ..	Maerewhenua, Waitaki Valley, Otago	"	1
152	<i>Panopæa zealandica</i> ..	Awamoa, Otago; Taueru, Wellington	III., IV.	2
153	" <i>plicata</i> ..	Maerewhenua, Waitaki Valley, Otago	V.	2
154	" " ..	Trelissick Basin, Canterbury ..	"	1
155	<i>Cyprina</i> ..	Awatere Valley, Marlborough ..	IV.	1
156	<i>Dosinia subrosea</i> ..	Shrimpton's, Ngaruroro River, Napier; Palliser Bay, Wellington	II.	4
157	" <i>anus</i> ..	Shrimpton's, Ngaruroro River, Napier	"	1
158	" <i>greyi</i> ..	Awatere Valley, Marlborough ..	IV.	1
159	" " ..	Awamoa, Otago ..	"	3
160	" <i>magna</i> ..	Trelissick Basin, Canterbury ..	V.	1
161	" " ..	Kawau Island, Auckland ..	IV.-VI.	1
162	<i>Cytherea</i> (?) ..	Awatere Valley, Marlborough ..	IV.	1
163	<i>Ostrea ingens</i> ..	Waitotara, Wellington ..	III.	1
164	" <i>discoidea</i> ..	Shakespeare Cliff, Wellington ..	II.	2
165	" <i>lutaria</i> ..	Shrimpton's, Ngaruroro River, Napier; Awatere Valley, Marlborough	"	2

TERTIARY FOSSILS—*continued.*

No.	Name.	Locality and Remarks.	Age or Formation.	No. of Specimens.
<i>LAMELLI-BRANCHIATA—continued.</i>				
166	<i>Ostrea mordax</i> ..	Amuri Bluff Hill, Marlborough ..	I.	1
167	" <i>corrugata</i> ..	Hicks Bay, East Coast, Auckland	IV.	1
168	" <i>glomerata</i> ..	Wanganui ..	II.	3
169	" (?) ..	Pareora beds, Upper Pareora River, Canterbury	IV.	2
170	<i>Placunanomia</i> ..	One mile south of Devil's Bridge, Oamaru Creek, Oamaru, Otago	"	1
171	" ..	Awamoa, Otago ..	"	1
172	" ..	Ashburton River, near Mount Somers, Canterbury	V.	1
173	<i>Anomia stowei</i> ..	Kereru, Napier ..	II.	1
174	<i>Lutaria solida</i> ..	Kereru, Napier ..	III.	1
175	<i>Lucina divaricata</i> ..	(1) Trelissick Basin, Canterbury	V.	2
"	" ..	(2) Upper part Shakespeare Cliff, Wanganui	II.	
176	<i>Mysia globularis</i> ..	Shrimpton's, Ngaruroro River, Napier; Wanganui	"	3
177	<i>Cyclina dispar</i> ..	Kereru, Napier ..	III.	1
178	<i>Venus zealandica</i> ..	(1) Lower Gorge, Pareora River, South Canterbury; (2) Awamoa, Otago	IV.	1
179	<i>Chione crebra</i> ..	Castlepoint, Wellington ..	III.	1
180	" <i>vellicata</i> ..	Kereru, Napier ..	II.	3
181	" <i>assimilis</i> ..	Wanganui (upper beds) ..	"	2
182	" <i>mesodesma</i> ..	Shrimpton's, Ngaruroro River, Napier	"	3
183	" <i>stuehburyi</i> ..	Kereru, Napier ..	"	3
184	" <i>yatei</i> ..	Awamoa, Otago; Trelissick Basin, Canterbury	IV.	3
185	<i>Zenatia acinaces</i> ..	Awamoa, Otago ..	"	1
186	<i>Corbula macilenta</i> ..	Lower part Shakespeare Cliff, Wanganui; Komiti Point, Kaipara, Auckland	II., IV.	1
187	" <i>sulcata</i> ..	Komiti Point, Kaipara, Auckland; Kyebrun, Otago	IV., V.	2
188	" <i>dubia</i> ..	Awamoa, Otago ..	IV.	2
189	<i>Crassatella</i> ..	Komiti, Kaipara, Auckland ..	V.	1
190	<i>Psammobia stangeri</i> ..	(1) Pareora beds, Kakahu River, South Canterbury	IV.	3
"	" ..	(2) Awamoa, Otago ..	"	
191	<i>Tellina alba</i> ..	Wanganui (upper beds) ..	II.	1
192	" <i>deltoidalis</i> ..	Wanganui (upper beds) ..	"	1
193	<i>Arca</i> ..	Awamoa, Otago ..	IV.	1
194	<i>Barbatia sinuata</i> ..	(1) Trelissick Basin, Canterbury	V.	3
"	" ..	(2) Wanganui (lower beds) ..	II.	
195	<i>Myodora striata</i> ..	Kereru, Napier ..	"	2
196	<i>Perna quadrata</i> ..	Shrimpton's, Napier ..	"	1
197	<i>Standella inflata</i> ..	Wanganui ..	"	1
198	<i>Mytilicardia excavata</i> ..	Wanganui ..	"	1
199	<i>Mesodesma novæ-zealandiæ</i> ..	Wanganui ..	"	1
200	" ..	Wanganui (upper beds) ..	"	1
201	" <i>chemnitzia</i> ..	Shrimpton's, Napier ..	"	3
202	" (?) ..	Taueru River, Wellington ..	III.	2
203	<i>Lithodomus striatus</i> ..	Wanganui ..	II.	2
204	<i>Cardium spatiosum</i> ..	Trelissick Basin, Canterbury ..	V.	1
205	" <i>striatulum</i> ..	Taueru, Wellington ..	III.	2
206	<i>Crenella impacta</i> ..	Wanganui ..	II.	1

TERTIARY FOSSILS—*continued.*

No.	Name.	Locality and Remarks.	Age or Formation.	No. of Specimens.
LAMELLI-BRANCHIATA— <i>continued.</i>				
207	<i>Crenella discors</i>	Kereru, Napier	III.	1
208	<i>Chama</i>	Castlepoint, Wellington ..	"	1
209	<i>Mytilus hectori</i> , sp. nov. ..	Te Kara Point, Raglan ..	V.	1
210	<i>Cyprina</i> (?)	Ashburton, Canterbury; Maerewhenua, Otago	"	2

Total of Lamelli-branchiata, 180.

BRACHIOPODA.				
211	<i>Waldheimia</i> —No. 40	Kereru lower beds, Napier ..	III.	1
212	" No. 20B	Curiosity Shop, South Canterbury	V.	1
213	" No. 30	Phorus beds, Maerewhenua, Waitaki, Otago	"	1
214	" No. 31	Curiosity Shop, South Canterbury	"	2
215	" No. 36	Curiosity Shop, South Canterbury	"	1
216	" No. 25B	Hutchinson's Quarry, Oamaru ..	"	1
217	" No. 26	Curiosity Shop, South Canterbury	"	1
218	" No. 20	Curiosity Shop, South Canterbury	"	1
219	" No. 22	Caversham, Dunedin	"	1
220	" No. 28	Curiosity Shop, South Canterbury	"	1
221	" No. 16B	Curiosity Shop, South Canterbury	"	1
222	" No. 16A	Curiosity Shop, South Canterbury	"	1
223	" No. 15	Curiosity Shop, South Canterbury	"	1
224	" No. 16	Curiosity Shop, South Canterbury	"	1
225	" No. 38	Curiosity Shop, South Canterbury	"	1
226	" No. 37	Curiosity Shop, South Canterbury	"	3
227	" No. 17	Curiosity Shop, South Canterbury	"	1
228	" <i>lenticularis</i> (?), No. 12	Fan-coral bed, Broken River, Canterbury	"	1
229	" "	Kereru, Napier	II.	2
230	" <i>patagonica</i>	Kereru and Petane, Napier ..	II. (?)	2
231	" No. 2	Whitewater Creek, Trelissick Basin, Canterbury	V.	1
232	" <i>triangulare</i>	Kyeburn Diggings, Central Otago	"	1
233	" No. 14	South-west side Cape Wanbrow, Oamaru	"	1
234	" No. 25A	Hutchinson's Quarry, Oamaru ..	"	1
235	" No. 25	Hutchinson's Quarry, Oamaru ..	"	1
236	" No. 13	South-west side Cape Wanbrow, Oamaru	"	1
237	"	South-west side Cape Hills, Oamaru	"	1
238	"	Hutchinson's Quarry, Oamaru ..	"	1
239	"	Hutchinson's Quarry, Oamaru ..	"	1
240	"	Maerewhenua, Waitaki, Otago ..	"	1
241	"	Waiholo Gorge, Otago	"	1
242	<i>Rhynchonella nigricans</i> , var.	Curiosity Shop, South Canterbury	"	1
243	" No. 56	Curiosity Shop, South Canterbury	"	1
244	" No. 55	Cape Rodney, Auckland	"	1
245	<i>Magas evansii</i>	Amuri Bluff Hill, Marlborough ..	II.	2
246	<i>Terebratella dorsata</i>	Cape Rodney, Auckland	V.	1
247	" No. 46	Shrimpton's, Napier (lower bed)	III.	1
248	" <i>rubicunda</i>	Petane and Porangahau Creek, Napier; Wanganui	II.	3
249	" <i>suessii</i> (<i>Terebratulina</i>)	Curiosity Shop, South Canterbury	V.	1
250	" <i>cruenta</i>	Wanganui; Petane, Napier ..	II.	5

Total of Brachiopoda, 52.

CRETACEO-TERTIARY FOSSILS.

No.	Name.	Locality and Remarks.	Age or Formation.	No. of Specimens.
GASTEROPODA.				
251	<i>Turritella</i> ..	.. Kakahu River, South Canterbury	VI.e-g	5
251A	" ..	.. Black Point, Waitaki Valley, Otago	"	1
252	" <i>vittata</i> ..	.. Pahi, Kaipara, Auckland ..	VI.e	1
253	<i>Turbo</i> ..	.. Waihao River, South Canterbury	VI.a	2
254	<i>Trochus</i> ..	.. Wharekuri, Waitaki, Otago ..	VI.e	1
255	" ..	.. Trelissick Basin, Canterbury ..	"	2
256	<i>Crypta</i> ..	.. Baton River, Nelson ..	"	1
257	<i>Calyptrea</i> ..	.. Trelissick Basin, Canterbury ..	"	3
258	<i>Marginella ventricosa</i>	.. Trelissick Basin, Canterbury ..	"	2
259	" <i>dubia</i> ..	.. Trelissick Basin, Canterbury ..	"	3
260	<i>Buccinum</i> (?) ..	.. Kakahu River, South Canterbury	VI.e-g	2
261	<i>Voluta</i> ..	.. Kakahu River, South Canterbury; Black Point, Waitaki, Otago	"	3
262	" (?) ..	.. Kakahu River, South Canterbury	"	1
263	" ..	.. Kakahu River, South Canterbury	"	6
264	<i>Gibbula nitida</i> (?)	.. Trelissick Basin, Canterbury ..	VI.e	2
265	<i>Turbo</i> ..	.. Okoko, Waipa-Kawhia Road, Auckland	VI.a	2
266	<i>Natica</i> ..	.. Kakahu River, South Canterbury	VI.e-g	1
267	" ..	.. Kakahu River, South Canterbury	"	4
268	" ..	.. Okoko, Waipa-Kawhia Road, Auckland	VI.a	1
269	<i>Fusus</i> (?) ..	.. Kakahu River, South Canterbury	VI.e-g	1
270	<i>Triton minimus</i> ..	.. Trelissick Basin, Canterbury ..	VI.e	1
271	" <i>nodosus</i> (?)	.. Baton River, Nelson ..	"	1
272	<i>Scalaria rotunda</i> ..	.. Whangarei, Auckland ..	"	2
273	<i>Cassidaria</i> ..	.. Waihao River, South Canterbury	VI.f	1
274	<i>Trophon</i> (?) ..	.. Kakahu River, South Canterbury	VI.e-g	1
275	<i>Pyrula</i> ..	.. Kakahu River, South Canterbury	"	2
276	<i>Struthiolaria carbonacea</i>	.. Kakahu River, South Canterbury	"	1
277	" <i>senex</i> ..	.. Okoko, Waipa-Kawhia Road, Auckland	VI.a	2
278	" ..	.. Okoko, Waipa-Kawhia Road, Auckland	"	2
279	<i>Ancillaria</i> ..	.. Trelissick Basin, Canterbury ..	VI.e	2
280	" ..	.. Raglan, Auckland ..	"	1
281	<i>Cylichna striata</i> ..	.. Kyebrun, Otago ..	"	1
282	<i>Patella</i> ..	.. Pahi, Kaipara, Auckland ..	"	1
283	<i>Dentalium tenuis</i>	.. Okoko, Waipa-Kawhia Road, Auckland	VI.a	2
284	" <i>magas</i> ..	.. Black Point, Waitaki Valley, Otago	VI.f	2
285	" (?) ..	.. Kakahu Valley, South Canterbury	VI.e	1
Total of Gasteropoda, 67.				
LAMELLI-BRANCHIATA.				
286	<i>Ostrea nelsoniana</i> (?)	.. Island sandstone, Brighton, Nel- son	VI.f	1
287	" <i>wullerstorffii</i>	.. Raglan, Auckland ..	VI.d, e	1
288	" <i>carbonacea</i>	.. Nine-mile Bluff, Greymouth, Nel- son	VI.f	1
289	" ..	.. Trelissick Basin, Canterbury ..	VI.f or g	1
290	" <i>waiparaensis</i>	.. Trelissick Basin, Canterbury ..	"	1
291	" <i>corrugata</i> ..	.. Kawakawa, Auckland ..	VI.f	1
292	" <i>subdentata</i>	.. Trelissick Basin, Canterbury ..	VI.d	1
"	" ..	.. Cobden limestone, Greymouth ..	VI.c	3
"	" (?)	.. Point Elizabeth, Cobden, Nelson	VI.b, c	2

CRETACEO-TERTIARY FOSSILS—*continued.*

No.	Name.	Locality and Remarks.	Age or Formation.	No. of Specimens.
<i>LAMELLI-BRANCHIATA—continued.</i>				
293	<i>Ostrea</i> (?)	Raglan, Auckland; St. Kilda, Brighton, Nelson	VI.e, f	3
294	<i>Pecten hochstetteri</i>	Maerewhenua, Waitaki, Otago; Raglan, Auckland	VI.b, c	2
295	" " var. A	Okoko, Waipa-Kawhia Road, Auckland	VI.a	1
296	" <i>hectori</i>	Lower beds, Trelissick Basin, Canterbury	VI.e	2
297	" " var. A	St. Kilda, Brighton, Nelson; Island sandstone, Brighton, Nelson	VI.f	2
298	"	St. Kilda, Brighton, Nelson ..	VI.e or f	2
299	"	Wharekuri, Waitaki Valley, Otago	VI.e	2
300	"	Kaeo River, Whangaroa, North Auckland	"	2
301	"	Seymour River, Clarence Valley, Marlborough	(?)	2
302	" <i>zittelli</i>	Weka Pass, Canterbury ..	VI.b	1
303	" " (?)	Waihao River, South Canterbury	VI.a	4
304	" " (?)	Seymour River, Clarence Valley, Marlborough	VI.b	2
305	"	Seymour River, Clarence Valley, Marlborough	"	1
306	" <i>fischeri</i>	Okoko, Waipa-Kawhia Road, Auckland; Raglan, Auckland	VI.a-e	2
307	" <i>aucklandicus</i>	St. Kilda, Brighton, Nelson	VI.f	1
308	<i>Cardita</i>	Lower Gorge, Pareora River, Canterbury	"	2
309	"	Black Point, Waitaki Valley, Otago	VI.e	1
310	"	Waihao River, South Canterbury	VI.f	2
311	"	Wharekuri and Black Point, Waitaki Valley, Otago	VI.e, f	2
312	"	Grey Marls, Waihao, South Canterbury	VI.a	1
313	<i>Cardium</i>	Kakahu River, South Canterbury; Black Point, Waitaki Valley, Otago	VI.f	2
314	"	Kakahu River, South Canterbury	"	1
315	"	Lake Wakatipu, Otago ..	VI.e	1
316	" <i>brunneri</i>	Brunner Mine, Grey, Nelson; Okoko, Waipa-Kawhia Road, Auckland	VI.f	2
317	"	Kaeo River, Whangaroa, North Auckland	VI.e	1
318	<i>Cucullæa alta</i>	Kakahu River, South Canterbury	VI.f	1
319	" " (?)	Kakahu River, South Canterbury	"	1
320	" <i>attenuata</i>	Lake Wakatipu, Otago ..	VI.e	1
321	"	Lake Wakatipu, Otago ..	"	1
322	"	Ten miles north of Cobden, Nelson	VI.f	1
323	"	Okoko, Waipa-Kawhia Road, Auckland	VI.e	1
324	"	Inangahua Ferry, Buller, Nelson	"	1
325	<i>Pectunculus globosus</i>	Kakahu River, South Canterbury	VI.e-g	2
326	<i>Dosinia</i>	Pahi, Kaipara, Auckland ..	VI.e	1
327	" (?)	Okoko, Waipa-Kawhia Road, Auckland	VI.a	1
328	<i>Perna</i>	Broken River, Canterbury ..	VI.	1

CRETACEO-TERTIARY FOSSILS—*continued.*

No.	Name.	Locality and Remarks.	Age or Formation.	No. of Specimens.
LAMELLI-BRANCHIATA— <i>continued.</i>				
329	<i>Panopæa plicata</i>	Okoko, Waipa-Kawhia Road, Auckland; Tiger Hill, Whangarei, Auckland	VI.a	3
330	<i>Tellina</i>	Ten miles north of Cobden, Nelson; Trelissick Basin, Canterb.	VI.e-g	2
331	"	Kyeburn River, Otago	VI.e	1
332	"	Black Point, Waitaki Valley, Otago	VI.e-f	1
333	<i>Nucula</i>	Jenkins's Hill, Nelson; Conway River, Marlborough; Waihao River, South Canterbury	VI.	3
334	<i>Limopsis insolita</i> ..	Okoko, Waipa-Kawhia Road, Auckland	"	
335	"	Waihao River, South Canterbury	VI.a	1
336	<i>Leda</i>	Wangape Lake, Auckland ..	VI.d-e	1
337	"	Pahi, Kaipara, Auckland ..	VI.e	2
338	<i>Astarte australis</i> ..	Waihao River, South Canterbury	VI.f	1
339	<i>Crassatella</i>	Waihao River, South Canterbury	VI.a	1
340	<i>Venus</i> (?)	Ten miles north of Cobden, Nelson; Whangaroa, North Auckland	VI.e, f	2
341	" (?)	Okoko, Waipa-Kawhia Road, Auckland	VI.a	3
342	<i>Lima</i>	Cobden limestone, Greymouth, Nelson	VI.	2
343	" <i>paleata</i>	Maerewhenua, Waitaki Valley, Otago	"	1
344	" <i>bullata</i>	St. Kilda, Brighton, Nelson ..	VI.f	1
345	<i>Cardita</i>	Pahi, Kaipara, Auckland ..	VI.e-g	5
346	<i>Lutraria</i> (?)	Okoko, Waipa-Kawhia Road, Auckland	VI.a	1
347	<i>Crassatella</i>	Kakahu River, South Canterbury; Black Point, Waitaki Valley, Otago	VI.e	1
348	<i>Anatina</i>	Kakahu River, South Canterbury; Black Point, Waitaki Valley, Otago	"	1
349	<i>Lucina divaricata</i> ..	Pahi, Kaipara, Auckland ..		1
350	" <i>americanus</i>	Kakahu River, South Canterbury; Black Point, Waitaki Valley, Otago	VI.e-g	3
351	<i>Astarte</i>	Kakahu River, South Canterbury; Black Point, Waitaki Valley, Otago	VI.e-g	1
352	<i>Solenella australis</i> ..	Conway River, Marlborough ..	VI.	1
Total of Lamelli-branchiata, 108.				
BRACHIOPODA.				
353	<i>Terebratula</i>	Kakanui Mouth, Oamaru ..	VI.	1
354	"	Kakanui Mouth, Oamaru ..	"	1
355	"	Kakanui Mouth, Oamaru ..	"	1
356	"	Kakanui Mouth, Oamaru ..	"	1
357	" No. 4	Broken River, Canterbury ..	"	1
358	"	Kakanui Mouth, Oamaru ..	"	1
359	"	Kakanui Mouth, Oamaru ..	"	1
360	"	Kakanui Mouth, Oamaru ..	"	1
361	" No. 7	Trelissick Basin, Canterbury ..	"	1

CRETACEO-TERTIARY FOSSILS—*continued.*

No.	Name.	Locality and Remarks.	Age or Formation.	No. of Specimens.
<i>BRACHIOPODA—continued.</i>				
362	<i>Terebratula</i> No. 10	.. Trelissick Basin, Canterbury ..	VI.	1
363	" ..	.. Kakanui Mouth, Oamaru ..	"	1
364	" ..	.. Kakanui Mouth, Oamaru ..	"	3
365	<i>Terebratella</i> No. 19	.. Maerewhenua, Waitaki Valley, Otago	"	1
366	" No. 19A	.. Maerewhenua, Waitaki Valley, Otago	"	1
367	" No. 19B	.. Maerewhenua, Waitaki Valley, Otago	"	1
368	<i>Waldheimia sinuata</i>	.. Maerewhenua, Waitaki Valley, Otago	"	3

Total of Brachiopoda, 20.

<i>ECHINODERMATA, ETC.</i>				
369	<i>Meoma crawfordi</i>	.. Maerewhenua, Waitaki Valley, Otago	VI.	1
370	<i>Macropneustes australis</i>	.. Greymouth, Nelson ..	"	1
371	" <i>cordatus</i>	.. Greymouth, Nelson ..	"	1
372	" " (?)	.. Point Elizabeth, Cobden, Nelson	"	1
373	<i>Echinus</i> ..	.. Waihao River, South Canterbury	"	1
374	<i>Echinoderm</i> ..	.. Greymouth, Nelson ..	"	1
375	" ..	.. Maerewhenua, Waitaki Valley, Otago	"	3
376	<i>Echinus</i> spines ..	.. Maerewhenua, Waitaki Valley, Otago	"	5
377	Crab ..	.. Wharekuri, Waitaki Valley, Otago	VI.e	1
378	<i>Cristallaria haasti</i>	.. Weka Pass, Canterbury ..	VI.	2

SECONDARY FOSSILS.

<i>CEPHALOPODA.</i>				
379	<i>Ammonite</i> ..	.. Hokanui Range, Southland ..	X.	1
380	<i>Belemnite</i> ..	.. Amuri Bluff, Marlborough ..	VII.	3

Total of Cephalopoda, 4.

<i>GASTEROPODA.</i>				
381	<i>Aporrhais</i> ..	.. Amuri Bluff, Marlborough ..	VII.	3
382	" (?) ..	.. Amuri Bluff, Marlborough ..	"	1
383	" (?) ..	.. Amuri Bluff, Marlborough ..	"	1
384	" (?) ..	.. Mouth of Maungakuri River, Napier	VI.	1
385	<i>Terebra</i> (?) ..	.. Whangaroa, North Auckland ..	VII.	1
386	<i>Calyptraea</i> ..	.. Waipara, Canterbury ..	"	1
387	<i>Murchisonia</i> ..	.. Nugget Point ..	X.	1
388	<i>Conchothyra parasitica</i>	.. Waipara and Malvern Hills, Canterbury	VI.	2
389	<i>Dentalium</i> ..	.. Amuri Bluff, Marlborough ..	VII.	3
390	" ..	.. Amuri Bluff, Marlborough ..	"	1

Total of Gasteropoda, 15.

SECONDARY FOSSILS—continued.

No.	Name.	Locality and Remarks.	Age or Formation.	No. of Specimens.
LAMELLI-BRANCHIATA.				
391	<i>Ostrea carbonacea</i>	.. Bobbies' Creek, Waipara, Canterbury	VI.	1
392	" ..	.. Malvern Hills, Canterbury	"	1
393	" No. 6 ..	.. Amuri Bluff, Marlborough	"	1
394	" ..	.. Amuri Bluff, Marlborough	"	3
395	" ..	.. Amuri Bluff, Marlborough	VII.	2
396	" ..	.. Amuri Bluff, Marlborough	"	1
397	" ..	.. Amuri Bluff, Marlborough	VI.	3
398	" ..	.. Flag Hill, Southland	VIII.	1
399	" ..	.. Hokanui Range, Southland	IX.	1
400	" ..	.. Catlin's River, Otago	"	2
401	<i>Pecten</i> ..	.. Amuri Bluff, Marlborough	VII.	2
402	" ..	.. Amuri Bluff, Marlborough	VI.	2
403	" obovatus ..	.. Amuri Bluff, Marlborough	VII.	3
404	" ..	.. Amuri Bluff, Marlborough	"	2
405	" ..	.. Amuri Bluff, Marlborough	"	4
406	" ..	.. Tableland, Otapiri Gorge, Southland	VIII.	3
407	" ..	.. Hokanui Range, Southland	IX.	3
408	" ..	.. Hokanui Range, Southland	"	2
409	" ..	.. Otapiri Creek, Southland	"	2
410	<i>Cardium</i> ..	.. Flag Hill, Southland	VIII.	2
411	" ..	.. Otapiri Creek, Southland	IX.	1
412	" ..	.. Nugget Point, Otago	X.	2
413	" ..	.. Amuri Bluff, Marlborough	VII.	4
414	" ..	.. Malvern Hills, Canterbury	"	2
415	" ..	.. Wairoa Gorge, Nelson	X.	1
416	<i>Nucula</i> ..	.. Amuri Bluff, Marlborough	VII.	3
417	" ..	.. Hokanui Range, Southland	IX.	2
418	" (?) ..	.. Amuri Bluff, Marlborough	VI.	2
419	<i>Solen</i> ..	.. Amuri Bluff, Marlborough	VII.	2
420	<i>Cytherea</i> ..	.. Amuri Bluff, Marlborough	"	1
421	<i>Cyprina</i> ..	.. Amuri Bluff, Marlborough	"	2
422	<i>Venus</i> (?) ..	.. Amuri Bluff, Marlborough	VI.	2
423	<i>Mytilus</i> ..	.. Flag Hill, Southland	VIII.	1
424	" problematicus ..	.. Amuri Bluff, Marlborough	VII.	1
425	" ..	.. Amuri Bluff, Marlborough	"	1
426	<i>Teredo</i> ..	.. Amuri Bluff, Marlborough	VI.	1
427	<i>Avicula</i> ..	.. Amuri Bluff, Marlborough	"	2
428	" costata ..	.. Hokanui Range, Southland	VIII.	1
429	" ..	.. Flag Hill, Southland	"	6
430	" ..	.. Otapiri Creek, Southland	IX.	2
431	" ..	.. Otapiri Creek, Southland	"	2
432	<i>Trigonia amuriensis</i> ..	.. Amuri Bluff, Marlborough	VII.	2
433	" sulcata ..	.. Amuri Bluff, Marlborough	"	3
434	" costata ..	.. Flag Hill, Southland	VIII.	1
435	" ..	.. Wairoa Gorge, Nelson	X.	2
436	<i>Schizodus</i> ..	.. South slopes, Benmore Range, Southland	"	1
437	" ..	.. Otapiri Creek, Southland	IX.	3
438	" ..	.. Wairoa Gorge, Nelson	X.	2
439	" ..	.. Wairoa Gorge, Nelson	"	2
440	<i>Lucina americanus</i> ..	.. Amuri Bluff, Marlborough	VII.	6
441	<i>Cucullæa alta</i> ..	.. Amuri Bluff, Marlborough	"	2
442	<i>Gryphæa</i> ..	.. Amuri Bluff, Marlborough	"	1
443	" ..	.. Amuri Bluff, Marlborough; Cobden, Nelson	VI.	1

SECONDARY FOSSILS—*continued.*

No.	Name.	Locality and Remarks.	Age or Formation.	No. of Specimens.
LAMELLI-BRANCHIATA— <i>continued.</i>				
444	Lima	Amuri Bluff, Marlborough ..	VI.	4
445	Inoceramus	Awanui and Whangaroa, Auckland	VII.	2
446	"	Amuri Bluff, Marlborough ..	"	3
447	" multiplicatus ..	Amuri Bluff, Marlborough ..	"	5
448	(3) " haasti ..	Amuri Bluff, Kawhia; Caro Creek, Amuri	VII., VIII.	4
449	Tancredia	Otapiri Gorge, Southland ..	VIII.	2
450	"	Flag Hill, Southland ..	"	3
451	Pinna	Awanui, Auckland ..	VII.	1
452	Perna	Catlin's River, Otago ..	IX.	1
453	Plicatula	Hokanui Range, Southland ..	"	3
454	Myacites	Amuri Bluff, Marlborough ..	VII.	4
455	" (?)	Amuri Bluff, Marlborough ..	"	3
456	" (?)	Kahururu, Waingaroa, Auckland	VIII.	4
457	Arca (?)	Flag Hill, Southland ..	"	5
458	"	Kahururu, Waingaroa, Auckland	"	1
459	Aucella (?)	Hokanui Range, Southland ..	X.	1
460	"	Waikato Heads, Auckland ..	VII.	2
461	" (?)	Nugget Point, Otago ..	X.	3
462	" (?)	Wairoa Gorge, Nelson ..	"	1
463	Astarte elegans ..	Flag Hill, Southland ..	VIII.	4
464	"	Tautuku, Otago ..	VII.	1
465	Monotis salinaria ..	Eighty-eight Valley, Nelson ..	X.	1
466	" speluncularia ..	Hokanui Range, Southland ..	IX.	3
467	Pholadomya	Upper end, Otapiri Gorge, Southland	VIII.	2
468	"	Lower end, Otapiri Gorge, Southland	"	3
469	"	Top of Flag Hill, Southland ..	"	3
470	Pleurophorus costatus ..	Nugget Point, Otago ..	X.	1
471	Plagiostoma	North face, Flag Hill, Otapiri Gorge, Southland; Nugget Point, Otago	IX.	1
472	Isocardia	North face, Flag Hill, Otapiri Gorge, Southland; Nugget Point, Otago	"	2
473	Myoconcha	Wairoa Gorge, Nelson ..	X.	1
474	"	North face, Flag Hill, Southland	IX.	3
475	Panopæa	Malvern Hills, Canterbury ..	VI.	2
Total of Lamelli-branchiata, 187.				
BRACHIOPODA.				
476	Rhynchonella	Flag Hill, Southland ..	VIII.	5
477	"	Conical Hill, Otapiri, Southland	IX.	4
478	"	Conical Hill, Otapiri, Southland	"	5
479	"	Otapiri Gorge, Southland ..	"	1
480	"	Wairoa Gorge, Nelson ..	X.	2
481	"	Kahururu, Waingaroa, Auckland	VIII.	2
482	" squamosa	Amuri Bluff, Marlborough ..	VII.	1
483	Epithyris, No. 74 ..	Mount Heslington, Nelson ..	X.	2
484	" No. 77	Taylor's Creek, Southland ..	"	1
485	" No. 65	Eighty-eight Valley, Nelson ..	"	1
486	"	Eighty-eight Valley, Nelson ..	"	1
487	"	Kahururu, Waingaroa, Auckland	VIII.	3
488	Athyris, No. 149 ..	Mount Heslington, Nelson ..	X.	1
489	" No. 163	Sellen's, Eighty-eight Valley, Nelson	"	3

SECONDARY FOSSILS—*continued.*

No.	Name.	Locality and Remarks.	Age or Formation.	No. of Specimens.
BRACHIOPODA— <i>continued.</i>				
490	Athyris, No. 155 ..	.. Nugget Point, Otago ..	X.	2
491	" No. 158 ..	.. Mount Heslington, Nelson ..	"	2
492	" No. 148 ..	.. Oreti beds, Hokanui Range, Southland	"	2
493	" No. 152 ..	.. Mount Heslington, Nelson ..	"	2
494	" No. 162 ..	.. Sellen's, Eighty-eight Valley, Nelson	"	2
495	" No. 7 ..	.. Mount Heslington, Nelson ..	"	1
496	" No. 157 ..	.. Mount Heslington, Nelson ..	"	1
497	Clavigera ..	.. Taylor's Creek, Southland ..	VIII.	3
498	" No. 9 ..	.. Taylor's Creek, Southland ..	"	1
499	" No. 14 ..	.. Nugget Point, Otago ..	X.	1
500	" No. 18 ..	.. Nugget Point, Otago ..	"	1
501	" No. 5 ..	.. Benmore Railway cutting, Southland	"	1
502	" ..	.. Wairoa Gorge, Nelson ..	"	4
503	Rastelligera ..	.. Taylor's Creek and Oreti Railway cutting, Southland	"	3
504	" ..	.. Eighty-eight Valley, Nelson; Nugget Point, Otago	"	5
505	Spiriferina ..	.. Tree Bluff and Otapiri Gorge, Southland	VIII.	2
506	" ..	.. Otapiri Gorge, Southland ..	"	2
507	" ..	.. Conical Hill and Tableland, Otapiri, Southland	"	6
508	" No. 12 ..	.. Taylor's Creek, Southland ..	X.	2
509	" No. 23 ..	.. Taylor's Creek, Southland ..	"	2
510	Psioidea ..	.. Nugget Point, Otago ..	"	1
511	" No. 4 ..	.. Eighty-eight Valley and Wairoa Gorge, Nelson	"	2
512	Terebratula, No. 71 ..	.. Wairoa Gorge, Nelson ..	"	4
513	" ..	.. Conical Hill, Otapiri, Southland	"	2
514	" ..	.. Otapiri Gorge, Southland ..	IX.	2

Total of Brachiopoda, 88.

CORALS, ETC.

515	Pentacrinus ..	.. Amuri Bluff, Marlborough ..	VI.	1
516	" ..	.. Nugget Point, Otago ..	X.	1
517	Vermites ..	.. Amuri Bluff, Marlborough ..	VI.	6

PALÆOZOIC FOSSILS.

GASTEROPODA.

518	Patella ..	.. Eighty-eight Valley, Nelson ..	XI.	3
519	" ..	.. Eighty-eight Valley, Nelson ..	"	1
520	Murchisonia uniangulata ..	.. Baton River, Nelson ..	"	1
521	Streptorhyncus ..	.. Mount Potts, Canterbury ..	XIV.	2
522	Lima ..	.. Tableland, Otapiri, Southland ..	XI.	1
523	Avicula ..	.. Baton River, Nelson ..	XIV.	2
524	" cancellata ..	.. Baton River, Nelson ..	"	2
525	" anisota ..	.. Baton River, Nelson ..	"	2
526	Pterinea ..	.. Baton River, Nelson ..	"	4
527	Nucula ..	.. Mount Potts, Canterbury ..	XI.	1
528	Leda ..	.. Mount Potts, Canterbury ..	"	1
529	Modiolopsis modiolaris ..	.. Baton River, Nelson ..	XIV.	1

PALÆOZOIC FOSSILS—*continued.*

No.	Name.	Locality and Remarks.	Age or Formation.	No. of Specimens.
GASTEROPODA— <i>continued.</i>				
530	Modiolopsis (?) ..	.. Mount Potts, Canterbury ..	XI.	1
531	" ..	.. Lankey's Gully, Reefton ..	XIII.	1
Total of Gasteropoda, 23.				
TRILOBITES.				
532	Homalonotus harrisoni ..	.. Baton River, Nelson ..	XIV.	2
533	" ..	.. Baton River, Nelson ..	"	1
534	" knightii ..	.. Baton River, Nelson ..	"	2
535	" expansus ..	.. Lankey's Gully, Reefton ..	XIII.	1
536	" ..	.. Baton River, Nelson ..	XIV.	1
537	" ..	.. Baton River, Nelson ..	"	2
BRACHIOPODA.				
537A	Psioidea, No. 1 ..	.. Baton River, Nelson ..	XIV.	2
538	" No. 2 ..	.. Baton River, Nelson ..	"	2
539	Spiriferina, No. 57 ..	.. Wiltshire Beach, Molyneux Bay, Otago	XI.	1
540	" No. 10 ..	.. Eighty-eight Valley, Nelson ..	"	1
541	" No. 41 ..	.. North Peak, Hokanui Hills, Southland	"	1
542	" No. 43 ..	.. Cowan's Railway-station, Oreti, Southland	"	3
543	" No. 46 ..	.. Cowan's Railway-station, Oreti, Southland	"	2
544	" No. 35 ..	.. North Peak, Hokanui Hills, Southland	"	1
545	" No. 20 ..	.. Eighty-eight Valley, Nelson ..	"	2
546	" No. 38 ..	.. Cowan's Railway-station, Oreti, Southland	"	1
547	" No. 42 ..	.. Mount Potts, Canterbury ..	"	2
548	" No. 40 ..	.. North Peak, Hokanui Hills, Southland	"	1
549	" No. 44 ..	.. Cowan's Railway-station, Oreti, Southland	"	1
550	" No. 34 ..	.. North Peak, Hokanui Hills, Southland	"	1
551	" ..	.. Eighty-eight Valley, Nelson; Mount Potts, Canterbury; Cowan's Railway-station, Oreti, Southland	"	3
552	Trigonetreta ..	.. Eighty-eight Valley, Nelson ..	"	3
553	" ..	.. Eighty-eight Valley, Nelson ..	"	2
554	Spirifera, No. 5 ..	.. Lankey's Gully, Reefton ..	XIII.	1
555	" No. 3 ..	.. Rainy Creek, Reefton ..	"	1
556	" speciosa ..	.. Lankey's Gully, Reefton ..	"	3
557	" radiata ..	.. Baton River, Nelson ..	XIV.	5
558	" ..	.. Baton River, Nelson ..	"	3
559	" No. 2 ..	.. Baton River, Nelson ..	"	2
560	" No. 4 ..	.. Lankey's Gully, Reefton ..	XIII.	1
561	Rhynchonella ..	.. Lankey's Gully, Reefton ..	"	5
562	" ..	.. North Peak, Hokanui Hills, Southland	XI.	2
563	" ..	.. Cowan's Railway-station, Oreti, Southland	"	3
564	" ..	.. Baton River, Nelson ..	XIV.	5
565	" ..	.. Lankey's Gully, Reefton ..	XIII.	1

PALEOZOIC FOSSILS—*continued.*

No.	Name.	Locality and Remarks.	Age or Formation.	No. of Specimens.
BRACHIOPODA— <i>continued.</i>				
566	Rhynchonella ..	.. Cowan's Railway-station, Oreti, Southland	XI.	6
567	" wilsoni ..	.. Baton River, Nelson ..	XIV.	3
568	Athyris, No. 6 ..	.. Eighty-eight Valley, Nelson ..	XI.	1
569	" No. 17 ..	.. Mount Potts, Canterbury ..	"	2
570	" No. 19 ..	.. North Peak, Hokanui Hills, Southland	"	3
571	" No. 153 ..	.. Lower Kaihiku Gorge, Southland	"	1
572	" No. 18 ..	.. North Peak, Hokanui Hills, Southland	"	1
573	" No. 151 ..	.. Eighty-eight Valley, Nelson ..	"	2
574	" (Spirigera) ..	.. Lankey's Gully, Reefton ..	XIII.	3
575	Leptaena bipartita ..	.. Lankey's Gully, Reefton ..	"	1
576	Spirigera ..	.. Lankey's Gully, Reefton ..	"	1
577	Epithyris, No. 63 ..	.. Cowan's Railway-station, Oreti, Southland; North Peak, Hokanui Hills, Southland	XI.	2
578	" elongata ..	.. Hokanui Range, Southland ..	"	1
579	Orthis unguis ..	.. Baton River, Nelson ..	XIV.	2
580	" basilis ..	.. Baton River, Nelson ..	"	5
581	" paterna ..	.. Baton River, Nelson ..	"	2
582	" .. ..	.. Baton River, Nelson ..	"	2
583	" fissicostata, var. A ..	.. Baton River, Nelson ..	"	1
584	" reversa ..	.. Baton River, Nelson ..	"	1
585	" No. 8 ..	.. Baton River, Nelson ..	"	2
586	" circulus ..	.. Baton River, Nelson ..	"	7
587	" crassa ..	.. Baton River, Nelson ..	"	5
588	" fissicostata ..	.. Baton River, Nelson ..	"	6
589	" No. 3 ..	.. Baton River, Nelson ..	"	1
590	Pentamerus ..	.. Baton River, Nelson ..	"	3
591	Discina ..	.. Baton River, Nelson ..	"	1
592	" .. ..	.. Lankey's Gully, Reefton ..	XIII.	1
593	Stricklandia ..	.. Lankey's Gully, Reefton ..	"	1
594	" lyrata ..	.. Baton River, Nelson ..	XIV.	3
595	Strophomena corrugatella, var. A	.. Baton River, Nelson ..	"	1
596	Strophomena orbignyi ..	.. Baton River, Nelson ..	"	1
597	" No. 2 ..	.. Lankey's Gully, Reefton ..	XIII.	1
598	" corrugata ..	.. Baton River, Nelson ..	XIV.	1
599	" corrugatella ..	.. Baton River, Nelson ..	"	2
600	" orbignyi ..	.. Baton River, Nelson ..	"	4
601	" profunda ..	.. Baton River, Nelson ..	"	1
Total of Brachiopoda, 142.				
CORALS, ETC.				
602	Crinoid fragments ..	.. Baton River, Nelson ..	XIV.	1
603	" .. ..	.. Baton River, Nelson ..	"	2
604	" .. ..	.. Wangapeka River, Nelson ..	"	2
605	" .. ..	.. Baton River, Nelson ..	"	2
606	" .. ..	.. Baton River, Nelson ..	"	3
607	" stalks ..	.. Baton River, Nelson ..	"	2
608	" .. ..	.. Baton River, Nelson ..	"	2
609	" .. ..	.. Baton River, Nelson ..	"	1
610	" .. ..	.. Baton River, Nelson ..	"	2
611	" .. ..	.. Baton River, Nelson ..	"	2
612	Crinoidea ..	.. Baton River, Nelson ..	"	1
613	Crinoid fragments ..	.. Baton River, Nelson ..	"	2

PALÆOZOIC FOSSILS—*continued.*

No.	Name.	Locality and Remarks.	Age or Formation.	No. of Specimens.
CORALS, ETC.— <i>continued.</i>				
614	Encrinite stalks ..	Hokanui Range, Southland ..	XI.	2
615	" " ..	Graham River, Nelson ..	XIV.	1
616	" " ..	Lankey's Gully, Reefton ..	XIII.	3
617	" " ..	Eighty-eight Valley, Nelson ..	XI.	3
618	" " ..	Hokanui Range, Southland ..	"	4
619	" " ..	Mount Potts, Canterbury ..	"	1
620	Pentacrinite ..	Hokanui Range, Southland ..	"	2
621	Polyzoa ..	Baton River, Nelson ..	XIV.	1
622	" ..	Baton River, Nelson ..	"	1
623	" ..	Baton River, Nelson ..	"	2
624	Streptoclasma ..	Baton River, Nelson ..	"	4
625	Receptaculitis ..	Baton River, Nelson ..	"	1
626	Calamopora ..	Eighty-eight Valley, Nelson ..	XI.	3
627	Callopora ..	Baton River, Nelson ..	XIV.	2
628	Fenestella ..	Baton River, Nelson ..	"	2
629	Coral ..	Baton River, Nelson ..	"	1
630	Coral (Favosites?) ..	Lankey's Gully, Reefton ..	XIII.	1
631	Coral ..	Baton River, Nelson ..	XIV.	1
632	Fucoid-like concretions ..	Baton River, Nelson ..	"	1
633	Annelid borings ..	Baton River, Nelson ..	"	1
634	Plant-remains ..	Baton River, Nelson ..	"	1
635	" ..	Baton River, Nelson ..	"	1
636	" (?) ..	Baton River, Nelson ..	"	1

Total of Corals, &c., 62.

MIOCENE-CRETACEOUS FOSSILS.

CORALS.

637	Trochocyathus hexagonalis	Wangapeka Lake, Auckland ..	VI.	1
638	Sphenotrochus huttoniana	Inangahua River, Nelson ..	"	2
639	" ..	Brighton, Nelson ..	"	2
640	Coral (branching) ..	Petane ..	II.	3
641	Celeporina nummularia ..	Curiosity Shop, Canterbury ..	V.	1
642	Retepora ..	Cape Rodney, Auckland ..	"	1
643	Flabellum circularis ..	Point Elizabeth, Nelson ..	"	1
644	" marie ..	Komiti, Kaipara ..	"	1
645	" radians ..	Kakanui Mouth, Oamaru ..	"	1
646	" irregulosum ..	Shrimpton's, Napier ..	II.	2
647	" ..	Weka Range, Mohaka, Hawke's Bay ..	IV.	2
648	Trochocyathus tuberculatus	Wharekuri, Waitaki ..	V.	1
649	Balanophyllia alta ..	Waikawau Creek, Auckland ..	VI.	1
650	" hectori ..	Kakahu River, South Canterbury ..	"	3

TERTIARY ECHINODERMATA.

651	Meoma crawfordi ..	Curiosity Shop, Canterbury ..	V.	1
652	Hemiaster posita ..	Curiosity Shop, Canterbury ..	"	2
653	Schizaster ..	Petane, Napier ..	II.	1
654	Fibularia gretata ..	Curiosity Shop, Canterbury ..	V.	2
655	Echinus ..	Curiosity Shop, Canterbury ..	"	1
656	Echinoderm spines(?) ..	Curiosity Shop, Canterbury ..	"	10
657	" plates ..	Curiosity Shop, Canterbury ..	"	10

SAURIANS.

658	Plesiosaurus crassicostratus	Amuri Bluff ..	VI.	1
659	" australis ..	Amuri Bluff ..	"	1
660	" (sp.?) ..	Amuri Bluff ..	"	1
661	Mauisaurus haasti ..	Amuri Bluff ..	"	1
662	Ichthyosaurus (sp.?) ..	Amuri Bluff ..	"	1

ROCKS.

No.	Description.	Locality.
SEDIMENTARY: TERTIARY AND UPPER SECONDARY.		
1	Calcareous sandstone	Oamaru.
2	Ferruginous "	Otepopo.
3	Limonite "	Shag Point, Otago.
4	Greensand	Trotter's Creek, Otago.
5	Sandy shale	Shag Valley, Otago.
6	Silicious sandstone	Longwood Range, Southland.
7	Sandstone	Palmerston, Otago.
8	Freestone	Palmerston, Otago.
9	Sandy clay	Moeraki, Otago.
10	Fossilized wood	Longwood Range, Southland.
11	Clay-marl	Trotter's Creek, Otago.
12	Coarse sandstone	Trotter's Creek, Otago.
13	Coal "	Shag Point, Otago.
14	Shale	Shag Point, Otago.
15	"	Shag Point, Otago.
16	Plant-sandstone	Shag Point, Otago.
17	Grit	Shag Point, Otago.
18	Ferruginous conglomerate	Horse Range, Otago.
19	Quartz "	Shag Point, Otago.
20	Grit	Green Island, Dunedin.
21	Auriferous cement	Hamilton's, Otago.
22	Ferruginous "	Palmerston, Otago.
23	Quartz "	Palmerston, Otago.
24	Conglomerate	Shag Valley, Otago.
25	Chert	Waiholo Lake, Otago.
26	Black grit	Conway, Marlborough.
27	Lithographic limestone	Oamaru.
28	Cone-in-cone "	Moeraki, Otago.
29	Chalk*	Cave Valley, Oamaru.
30	Sandstone concretion	Amuri Bluff, Marlborough.
31	Kaolin clay	Waihao River, Canterbury.
32	Calcareous sandstone	Mount Somers, Canterbury.
33	Flint from chalk-marls	Kaipara, Auckland.
34	Quartz-grit	Mount Rochfort.
35	"	Brunner Coal-mine.
36	Fireclay	Miranda, Auckland.
37	Chalk-marl	Mahurangi, Auckland.
38	Chertose veins in chalk-marl	Mahurangi, Auckland.
SEDIMENTARY: LOWER SECONDARY AND PALEOZOIC.		
39	Chert, with coating of serpentine	Wilson's Hill, Canterbury.
40	Slate-breccia	Greenstone River, Lake Wakatipu.
41	Jasperoid breccia	Greenstone River, Lake Wakatipu.
42	Blue slate	Greenstone River, Lake Wakatipu.
43	Aphanite sandstone	Greenstone River, Lake Wakatipu.
44	" breccia	Greenstone River, Lake Wakatipu.
45	" sandstone	Weatherstone, Tuapeka.
46	Silicious "	Greenstone River, Lake Wakatipu.
47	Carbon-slate	Routeburn, Lake Wakatipu.
48	Pyritous sandstone	Routeburn, Lake Wakatipu.
49	Grey sandstone	Routeburn, Lake Wakatipu.
50	Red slate	Routeburn, Lake Wakatipu.
51	Pyritous slate	Lake Wakatipu.
52	Arenaceous slate	Von River, Lake Wakatipu.
53	Jasperoid "	Mount Kyeburn, Otago.
54	Laminated "	Head, Lake Wakatipu.
55	Brecciated sandstone	Von River, Lake Wakatipu.
56	Green cherty slate	Kurow, Otago.

ROCKS—*continued.*

No.	Description.	Locality.
SEDIMENTARY: LOWER SECONDARY AND PALÆOZOIC— <i>continued,</i>		
57	Schistose breccia	Mount Burster, Otago.
58	Talcose	Longwood Range, Southland.
59	Jasperoid slate	Mount Cook.
60	"	Waihao River, Canterbury.
61	Slate	Kakahu River, Canterbury.
62	Blue limestone	Riwaka Range, Nelson.
63	White	Riwaka Range, Nelson.
64	"	Kakahu River, Canterbury.
65	Blue	Kakahu River, Canterbury.
66	Serpentinous slate	Mount Cook.
67	Sandy	Mount Cook.
68	Indurated sandstone	Mount Cook.
69	Altered slate, with calcite	Mount Cook.
70	Brecciated slate	Mount Cook.
71	Slate-breccia	Mount Cook.
72	Ferruginous chert	Ashburton, Canterbury.
73	Coarse sandstone	Mount Cook.
74	Slate	Mount Cook.
75	Limestone	Mount Cook.
76	Slate-breccia	Waihao River, Canterbury.
77	Calcareous sandstone	Mount Cook.
78	Altered	Rakaia River, Canterbury.
79	Jasperoid breccia	Ward's Hill, Nelson.
80	Quartz conglomerate	Collingwood, Nelson.
81	Carbon-slate	Graham River, Nelson.
82	Silurian slate	Graham River, Nelson.
83	Breccia (Te Anau series)	Graham River, Nelson.
84	Banded slate	Okarita, Westland.
85	Slate, with pyrites	Waiohine, Wellington.
86	Silicious slate-breccia	Pitone, Wellington.
87	Black slate	Little Omaha, Auckland.
88	Calcareous slate	Hutt, Wellington.
89	Sandstone	Ngauranga, Wellington.
90	Limestone	Petone, Wellington.
91	Graphite and pyrites in quartzite	Petone, Wellington.
CRYSTALLINE.		
92	Granite	Riwaka, Nelson.
93	"	Buller River, Nelson.
94	"	Inangahua River, Nelson.
95	"	Inangahua River, Nelson.
96	"	Dusky Sound, Otago.
97	Red granite	Inangahua River, Nelson.
98	Granulite	Dusky Sound, Otago.
99	Granite	Kanieri, Westland.
100	Granite-porphry	Big River, Nelson.
101	Syenite rock	Routeburn, Lake Wakatipu.
102	Syenitic gneiss	Milford Sound, Otago.
103	Syenite	Inangahua River, Nelson.
104	Protogene gneiss	Collingwood, Nelson.
105	Gneiss	Collingwood, Nelson.
106	Syenitic porphyry	Milford Sound, Otago.
107	Anthophyllite rock	Big Ben, Nelson.
108	Chlorite schist	Mount Alta, Wanaka, Otago.
109	Mica-schist	Tuapeka, Otago.
110	Foliated schist	Saddle Hill, Dunedin.
111	Steatite	Routeburn, Lake Wakatipu.
112	Marble, with slate	Anita Bay, Milford Sound.

No.	Description.	Locality.
CRYSTALLINE—continued.		
113	Gritty chlorite schist	Moke Creek, Otago.
114	Quartzite	Wilson's Hill, Canterbury.
115	Chlorite schist, with magnetite..	Kaiwarau, Otago.
116	Cupreous "	Moke Creek, Otago.
117	Quartzose "	Kingston, Otago.
118	Hornblende "	Dusky Sound, Otago.
119	Maitai limestone	Lake Harris Range, Otago.
120	Blue crystalline limestone ..	Blue Mountains, Shag Valley.
121	" " " " " " ..	Blue Mountains, Shag Valley.
122	Contorted schist, with quartz ..	Chalky Inlet, Otago.
123	Fine-grained hornblende schist ..	Preservation Inlet, Otago.
124	Quartzite	Weatherstone, Tuapeka.
125	" with pyrrhotine	Dusky Sound, Otago.
126	Crystalline limestone	Shag Valley, Otago.
127	Marble	Caswell Sound, Otago.
128	Crystalline limestone, with graphite	Crooked Arm, Otago.
129	Ferruginous schist, with specular iron	Routeburn, Otago.
130	Chloritic schist	Routeburn, Otago.
131	Talcose "	Routeburn, Otago.
132	Fine-grained hornblende schist..	Dusky Sound, Otago.
133	Schistose slate	Buckler Burn, Otago.
134	Micaceous quartzite	Rees River, Otago.
135	Hornblendic mica-schist	Lake Wakatipu.
136	Red schist	Routeburn, Otago.
137	Calcareous schist	Routeburn, Otago.
138	Carbon-schist	Routeburn, Otago.
139	Serpentinous schist	Routeburn, Otago.
140	Micaceous quartzite	Rees River, Otago.
141	Talcose schist	Wataroa River, Westland.
142	Mica-schist	Rees River, Otago.
143	Granular quartzite	Dead Horse Gully, Lake Wakatipu.
144	Talc-schist	Dead Horse Gully, Lake Wakatipu.
145	Granular quartzose schist	Dead Horse Gully, Lake Wakatipu.
146	Grey schist	Lake Harris, Otago.
147	" " " " " "	Moke Creek, Otago.
148	Fissile slate	Kingston, Lake Wakatipu.
149	Mica-schist	Moke Creek, Otago.
150	Chloritic schist, with magnetite and hauerite	Lake Wakatipu.
151	Arenaceous schist	Von River, Lake Lake Wakatipu.
152	Brecciated schist, with quartz ..	Buckler Burn, Lake Wakatipu.
153	Quartzite	Shag Valley, Otago.
154	Arenaceous schist	Buckler Burn, Lake Wakatipu.
155	Chlorite schist, with specular iron	Buckler Burn, Lake Wakatipu.
156	Quartzose "	Dead Horse Gully, Lake Wakatipu.
157	Chlorite "	Dead Horse Gully, Lake Wakatipu.
158	Micaceous quartzite	Moonlight Creek, Lake Wakatipu.
159	" " " " " "	Buckler Burn, Lake Wakatipu.
160	Schistose slate	Head of Lake Wakatipu.
161	" serpentine	Mount Kyeburn, Lake Wakatipu.
162	Contorted schist, with garnets ..	Waikukupa River, Westland.
163	Fine-grained hornblende schist..	Grey River, Nelson.
164	Chlorite schist	Buckler Burn, Lake Wakatipu.
165	Gritty "	Buckler Burn, Lake Wakatipu.
166	Quartzite	Wataroa River, Westland.
167	Red schistose slate	Kurow, Otepopo, Otago.
168	Tremolite schist, with asbestos ..	Dusky Sound, Otago.

ROCKS—continued.

No.	Description.	Locality.
CRYSTALLINE—continued.		
169	Micaceous slate	Kanieri River, Westland.
170	Talcose schist	Wataroa River, Westland.
171	Granular chlorite schist	Buckler Burn, Otago.
172	Gneiss	Dusky Sound, Otago.
173	" with iron pyrites	Shotover, Otago.
174	Quartzose mica-schist	Dunstan, Otago.
175	Fine-grained hornblendic gneiss	Dusky Sound, Otago.
176	Quartzose schist	Okarita, Westland.
177	Fine-grained mica-schist	Buckler Burn, Otago.
178	Mica-schist	Shotover, Otago.
179	Porphyritic gneiss	Milford Sound, Otago.
180	Micaceous quartzite	Rees River, Otago.
181	Magnetite schist	Dunstan, Otago.
182	Banded chert	Dunstan, Otago.
183	Mica-schist	Kanieri, Westland.
184	Fine-grained gneiss	Dusky Sound, Otago.
185	Red quartzite	Kurow, Otepopo, Otago.
186	Quartz laminae in schist	Naseby, Otago.
187	Chert in schist	Maniototo, Otago.
188	Schistose sandstone	Kaimanawa River, Wellington.
189	" slate	Sinclair Head, Wellington.
190	Micaceous "	Kanieri, Westland.
191	Mica-schist	Paringa River, Westland.
192	Marble	Baton River, Nelson.
193	Quartzite	Riwaka Range, Nelson.
194	"	Mount Cook, Canterbury.
195	Silicious schist	Kakahu River, Canterbury.
196	Quartzite	Kakahu River, Canterbury.
197	Red schistose slate	Mount Cook, Canterbury.
198	Talcose schist	Collingwood, Nelson.
199	Elvanite	Dun Mountain, Nelson.
200	Dunite	Dun Mountain, Nelson.
201	"	Anita Bay, Otago.

PLUTONIC.

202	Hypersthene	Aniseed Valley, Nelson.
203	Diorite	Mokomoko, Bluff, Southland.
204	Propylite-porphry (decomposed)	Tararu Creek, Thames.
205	Serpentine	Wairoa Gorge, Nelson.
206	Diabase, fine-grained	Dun Mountain, Nelson.
207	Diorite	Kaitaki, Taranaki.
208	Porphyry tufa	Clent Hills, Canterbury.
209	Quartziferous porphyry	Rockwood Ranges, Canterbury.
210	" " dyke	Rockwood Ranges, Canterbury.
211	" " partly de- composed	Rockwood Ranges, Canterbury.
212	Diabase tufa	Cheviot Hills, Nelson.
213	Calcareous diabase tufa	Cheviot Hills, Nelson.
214	Felsite, with pyrites	Coromandel.
215	Hornblende rock	Buller, Nelson.
216	Amphibolite	Baton River, Nelson.
217	Melaphyre	Ashburton, Canterbury.
218	" wacké	Rakaia, Canterbury.
219	" "	Rakaia, Canterbury.
220	" fine-grained	Rakaia, Canterbury.
221	Porphyritic tufa	Coromandel.
222	Quartziferous porphyry	Rockwood Ranges, Canterbury.
223	Serpentine	D'Urville Island, Nelson.

ROCKS—*continued.*

No.	Description.	Locality.
PLUTONIC— <i>continued.</i>		
224	Melaphyre boulder	Mount Somers, Canterbury
225	" in dykes	Snowy Peaks, Canterbury.
226	" decomposing	Gawlor Downs, Canterbury.
227	" tufa	High Peak Range, Canterbury.
BASIC VOLCANIC.		
228	Vesicular basic lava	Mount Eden, Auckland.
229	Basaltic lava	Mount Eden, Auckland.
230	Dolerite	Coromandel, Auckland.
231	" with labradonite	Rakaia River, Canterbury.
232	"	Rakaia River, Canterbury.
233	"	North Peak, Canterbury.
234	"	Lyndon, Canterbury.
235	"	Hart's Coal-mine, Canterbury.
236	Basaltic tufa, with lapilli	Ashburton, Canterbury.
237	" breccia	Hind's, Canterbury.
238	Scoriaceous basalt	Manuherikia, Otago.
239	Basalt, with olivine	Mahemo, Otago.
240	"	Naseby, Otago.
241	Lapilli in basaltic tufa	Ashburton, Canterbury.
242	Amygdaloid	Snowy Peak, Canterbury.
243	"	Ashburton, Canterbury.
244	Vesicular basic lava, with porcel- lanites	Mount Eden, Auckland.
245	Amygdaloidal tufa	Cheviot Hills, Nelson.
246	Basaltic tufa	Ashburton, Canterbury.
247	Anamesite	Mount Somers, Canterbury.
248	Amygdaloidal anamesite	Oamaru, Otago.
249	Amygdaloid	Snowy Peak, Canterbury.
ACIDIC VOLCANIC.		
250	Vesicular lava	Oamaru Creek, Otago.
251	Pitchstone	Oamaru, Otago.
252	"	Clent Hills, Canterbury.
253	"	Rakaia River, Canterbury.
254	Calcareous pitchstone breccia	Oamaru, Otago.
255	"	Oamaru, Otago.
256	Rhyolite porphyry	White Island, Auckland.
257	Obsidian	Mayor Island, Auckland.
258	Trachyte sandstone	Governor's Bay, Canterbury.
259	Trachyte	Mandamus, Canterbury.
260	Compact trachyte	Hyde, Otago.
261	Trachyte breccia	Port Chalmers.
262	" tufa	Blueskin Railway, Otago.
263	" breccia	Blueskin Railway, Otago.
264	" decomposed	Blueskin Railway, Otago.
265	" agglomerate	Blueskin Railway, Otago.
266	" dyke	Rockwood, Canterbury.
267	"	Mayor Island, Auckland.
268	" tufa	Lyndon, Canterbury.
269	Pumiceous trachyte, with obsidian	Mayor Island, Auckland.
270	Trachy-dolerite	Taranaki.
271	"	Sugarloaves, Taranaki.
272	"	Coromandel.
273	" with zeolite	Bell Hill, Dunedin.
274	"	Bell Hill, Dunedin.
275	Palla	Gawlor Downs, Canterbury.

MINERALS.

No.	Description.	Locality.
METALLIC MINERALS.		
1	Scheelite	Maori Point, Otago.
2	Chromite	Whangamoa, Nelson.
3	"	Dun Mountain, Nelson.
4	Native copper	Dun Mountain, Nelson.
5	"	Champion Mine, Nelson.
6	"	D'Urville Island, Nelson.
7	" .. in granular serpentine	Aniseed Valley, Nelson.
8	Silicate of copper	D'Urville Island, Nelson.
9	"	Nelson.
10	Cuprite	D'Urville Island, Nelson.
11	Copper-glance	D'Urville Island, Nelson.
12	Cuprite and copper-glance	Aniseed Valley, Nelson.
13	Cupriferous schist	Moke Creek, Otago.
14	Copper-pyrites	Moke Creek, Otago.
15	"	Golden Crown, Thames.
16	" .. and pyrrhotine	Dusky Sound, Otago.
17	Copper brick from richmondite	Collingwood.
18	Native arsenic	Kapanga, Auckland.
19	" .. with calc-spar	Kapanga, Auckland.
20	Braunite	Malvern Hills, Canterbury.
21	Psilomelane	Bay of Islands.
22	Pyrolusite	Bay of Islands.
23	Manganite	Kawau Island.
24	Rhodonite	Dunstan, Otago.
25	Richmondite (1,792oz. silver per ton)	Richmond Hill, Collingwood.
26	Richmondite	Richmond Hill, Collingwood.
27	"	Richmond Hill, Collingwood.
28	"	Richmond Hill, Collingwood.
29	Zinc-blende	Tararu Creek, Thames.
30	"	Perseverance Mine, Collingwood.
31	"	Perseverance Mine, Collingwood.
32	" .. and galena	Te Aroha, Auckland.
33	Stibnite	Tararu Creek, Thames.
34	"	Waitahuna, Otago.
35	"	Endeavour Inlet, Marlborough.
36	"	Langdon's, Greymouth.
37	"	Endeavour Inlet, Marlborough.
38	Galena	Wangapeka, Nelson.
39	"	Perseverance Mine, Collingwood.
40	" .. with zinc-blende	Perseverance Mine, Collingwood.
41	Dufrenoy'site	Mine Bay, Great Barrier Island.
42	Pyrrhotine	Dusky Sound, Otago.
43	Copper-pyrites and pyrrhotine	Dusky Sound, Otago.
44	Magnetite	Fox Glacier, Canterbury.
45	Pig-iron, made from Taranaki ironsand	Taranaki.
46	Silicious hæmatite	Richwood.
47	Brown hæmatite	Parapara, Nelson.
48	"	Parapara, Nelson.
49	"	Kawau Island.
50	Ironstone altered by basaltic dyke	Miranda.
51	Red hæmatite	Mongonui, Auckland.
52	Spathic iron ore	Collingwood Coal-mine.
53	Iron-pyrites	Collingwood.
54	"	Parapara, Collingwood.
55	Bar of steel made from Taranaki ironsand	Taranaki.
56	Vivianite	Pohangina River, Manawatu.

MINERALS—*continued.*

No.	Description.	Locality.
NON-METALLIC MINERALS.		
1	Asbestos	Dun Mountain, Nelson.
2	Chalcedonic quartz	Mount Somers, Canterbury.
3	Amethyst quartz	Rakaia Gorge, Canterbury.
4	Chabasite with natrolite	Town Belt, Dunedin.
5	Lydian stone	Whangarei, Auckland.
6	Calcite	Dun Mountain, Nelson.
7	Jasper	Coromandel, Auckland.
8	Chalcedonic quartz	Mount Somers, Canterbury.
9	Almandine in granulite	Dusky Sound, Otago.
10	Opaline quartz	Portobello, Otago.
11	Hornblende	Baton River, Nelson.
12	Dunite	Dun Mountain, Nelson.
13	Aragonite	Quartz Hills, Collingwood.
14	Graphite	Pakawau, Collingwood.
15	Calcite	Thames.
16	Barytes	Waikouaiti, Otago.
17	" with quartz	Opotiki, Auckland.
18	Sulphur	White Island, Auckland.
19	Crystallized quartz	Gawlor Downs, Canterbury.
20	Quartz crystals	Milford Sound, Otago.
21	Sulphur	White Island, Auckland.
22	Natrolite in calcite	Dunedin.
23	Massive scapolite	Nelson.
24	Chalcedonic agate	Clent Hills, Canterbury.
25	Quartz geode	Mount Somers, Canterbury.
26	Nephrite	Milford Sound, Otago.
27	Chrome glimmer	Dead Horse Gully, Wakatipu.
28	Fuchite (chrome mica)	Dusky Sound, Otago.
29	Wollastonite	Nelson.
30	Iron garnet in schist	Collingwood.
31	Actinolite	Parapara, Collingwood.
32	Green quartz	Gawlor Downs, Canterbury.
33	Selenite	Waihao, Canterbury.
34	Calcite with pyrites	Thames.
35	Tridimite in trachyte lava	Lyttelton, Christchurch.
36	Chert with agate	Tapu Creek, Thames.
37	Quartz geode	Clent Hills, Canterbury.
38	Marble	Milford Sound, Otago.
39	"	Milford Sound, Otago.
40	Aragonite	Thames.

MINERALS IN LARGE BLOCKS.

1	Lithographic limestone	Twelve-Mile Creek, Wakatipu.
2	" " " "	Amuri Bluff.
3	Talc-schist	Moonlight Creek, Wakatipu.
4	Auriferous quartz	Reefton.
5	" " " "	Moanataiari, Thames.
6	Chromite in dunite	Dun Mountain, Nelson.
7	Dunite	Dun Mountain, Nelson.
8	Serpentine	Wooded Peak, Nelson.
9	Nephrite	Anita Bay, Milford Sound.
10	Obsidian	Mayor Island, Auckland.
11	Cement boulder	Amuri Bluff.
12	Antimony boulder	Queen Charlotte Sound.
13	Manganese boulder	Bay of Islands.
14	Richmondite (596 oz. silver per ton)	Collingwood.
15	Chromite boulder	Aniseed Valley, Nelson.

MINERALS—*continued.*

No.	Description.	Locality.
MINERALS IN LARGE BLOCKS— <i>continued.</i>		
16	Copper pyrites	Champion Mine, Nelson.
17	Native copper in granular serpentine	Aniseed Valley, Nelson.
18	Pyrrhotine	Dusky Sound, Otago.
19	Clay-band ironstone	Miranda Redoubt.
20	"	Miranda Redoubt.
21	Ironsand brick	Taranaki.
22	Wollastonite	Dun Mountain, Nelson.
23	Steatite	Collingwood, Nelson.
24	Amethyst	Rakaia Gorge, Canterbury.
25	Natrolite	Dunedin.
26	Aragonite	Quartz Hills, Collingwood.
27	"	Quartz Hills, Collingwood.
28	Selenite with sulphur	White Island, Auckland.
29	Sulphur	White Island, Auckland.
30	"	White Island, Auckland.
31	Gypsum, with disseminated sulphur	White Island, Auckland.
32	Selenite	White Island, Auckland.
33	Smoky calcite	Cape Rodney, Auckland.
34	Volcanic bomb	Mount Eden, Auckland.
35	Te Anau breccia boulder	Tuapeka Gold Drift.
36	Auriferous quartz	Macetown, Otago.
37	Sinter	Lake Rotomahana.
38	"	Lake Rotomahana.
39	"	Lake Rotomahana.
40	"	Lake Rotomahana.
41	"	Lake Rotomahana.
42	"	Lake Rotomahana.
43	"	Lake Rotomahana.
44	"	Lake Rotomahana.
45	"	Lake Rotomahana.
46	Chalk	Oxford, Canterbury.

COALS OF NEW ZEALAND.

No.	DESCRIPTION	LOCALITY.	FORMATION.	ANALYSIS.					LABORATORY No.
				Fixed Carbon.	Hydro-Carbon.	Water.	Ash.	Evaporative Power.	
1	Pitch coal ..	Black Creek, Grey River	Cretaceous-tertiary ..	60.20	29.97	8.01	1.82	7.82	3886
2	" ..	Kawakawa ..	" ..	50.15	42.63	4.18	3.04	6.50	1372 (?)
3	Bituminous coal	Preservation Inlet ..	" ..	60.88	20.69	4.33	6.19	7.91	234
4	Brown coal ..	Kaitangata, Otago ..	" ..	39.41	37.25	19.61	3.73	5.12	1145
5	" ..	Westport ..	" ..	56.01	37.17	2.60	4.22	7.28	3910
6	" ..	Rakaia Gorge, Canterbury	" ..	50.12	21.61	24.09	4.18	6.50	4088 (2)
7	Bituminous coal	Otamataura Creek ..	" ..	52.89	36.63	2.19	8.29	7.90	1370a
8	" ..	Mokihinui ..	" ..	57.92	34.94	3.96	3.18	7.50	4064
9	" ..	South of Ross, Westland	" ..	42.53	31.43	6.58	19.46	4.10	1234
10	Glance coal	Rakaia Gorge, Canterbury	" ..	64.51	21.27	6.76	7.46	8.30	(?)
11	Pitch coal ..	Grey River, Westland	" ..	34.80	55.40	6.20	2.60	4.50	1220
12	Altered brown coal	Malvern Hills, Canterbury	" ..	68.54	19.89	4.15	7.42	8.87	3314
13	Bituminous coal	Near Cape Farewell ..	" ..	48.59	43.17	2.18	6.06	6.63	3928
14	Brown coal ..	Honebush Colliery, Malvern	" ..	47.70	30.90	19.20	2.20	6.20	(?)
15	Pitch coal ..	Walton's Mine, Whangarei	" ..	38.80	41.20	7.20	12.80	4.96	(?)
16	Bituminous coal	Mokihinui, Westport	" ..	55.59	38.86	3.16	2.39	7.20	4049
17	" ..	Mokihinui, Westport	" ..	59.75	32.14	3.97	4.14	7.76	4031
18	Brown coal ..	Shag Point, Otago ..	" ..	45.30	30.10	19.20	5.40	5.66	(?)
19	" ..	Kaitangata, Otago ..	" ..	44.11	38.32	15.44	2.13	5.74	(?)
20	" ..	Waikato, Auckland ..	" ..	50.01	29.97	19.82	2.20	6.50	(?)
21	Bituminous coal	Grey River, Westland	" ..	62.37	29.44	1.99	6.20	8.01	(?)
22	Brown coal ..	Springfield Colliery ..	" ..	38.00	31.50	18.60	11.90	4.90	(?)
23	Bituminous coal	Brunner Mine ..	" ..	56.62	35.68	1.59	6.11	7.36	(?)
24	Glance coal	Whangarei, Auckland	" ..	50.11	38.68	8.01	3.20	6.50	2682
25	Altered brown coal	Malvern Hills, Canterbury	" ..	53.29	32.04	12.65	2.02	6.92	3314
26	Pitch coal ..	Kamo Mine, Whangarei	" ..	50.01	37.69	9.61	2.69	6.50	(?)
27	Brown coal ..	Malvern, Canterbury	" ..	49.99	35.42	11.79	2.80	6.49	3314
28	Anthracite ..	Acheron, Canterbury	" ..	84.12	2.06	1.80	12.12	10.93	3884
29	Brown coal ..	Okoko, Waipa, Auckland	" ..	39.83	33.74	22.21	4.22	5.17	3982

FOSSIL PLANTS.

No.	Name.	Locality.
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XI. KAIHIKU SERIES.

1	Plants	Lower Kaihiku Gorge, Otago.
2	"	" " Otago.
3	Glossopteris haasti	Mount Potts.
4	" "	Mount Potts.

X. OTAPIRI SERIES.

5	Tæniopteris	Wairoa Gorge, Nelson.
6	"	Eighty-eight Valley, Nelson.
7	Asplenites	Eighty-eight Valley, Nelson.
8	Lomarites	Eighty-eight Valley, Nelson.
9	Glossopteris	Eighty-eight Valley, Nelson.
10	Gleichenia waitia	Eighty-eight Valley, Nelson.
11	Noeggerathia valida	Eighty-eight Valley, Nelson.

VIII. MATAURA SERIES.

12	Asplenites cuneata	Clent Hills.
13	" rhomboides	Catlin's River.
14	" "	Clent Hills.
15	" "	Mataura.
16	Tæniopteris huttoni	Waikawa.
17	" "	Waikato Heads.
18	" stipulata	Waikawa.
19	" "	Waikawa.
20	" graminea	Waikato Heads.
21	" matauriensis	Mataura.
22	" tetrapervis	Waikato Heads.
23	" obtusatus	Mataura.
24	" "	Clent Hills.
25	" "	Clent Hills.
26	" "	Waikato Heads.
27	Macrotaeniopteris	Mataura.
28	Taxites manaou	Mataura.
29	" kahikatea	Mataura.
30	" miro	Clent Hills.
31	" totaranui	Waikato Heads.
32	" totara	Waikato Heads.
33	Pecopteris linearis	Waikawa.
34	" ovata	Trelissick Basin, Canterbury.
35	" "	Mataura.
36	" "	Waikato Heads.
37	" haastii	Clent Hills.
38	" "	Mataura.
39	" grandis	Waikawa.
40	" "	Waikawa.
41	" "	Waikato Heads.
42	" "	Mataura.
43	" obliqua	Waikato Heads.
44	" hochstetteri	Waikawa.
45	" "	Waikawa.
46	" "	Waikawa.
47	" "	Mataura.
48	" "	Waikato Heads.
49	Camptopteris incisa	Mataura.
50	" "	Clent Hills.

FOSSIL PLANTS—*continued.*

No.	Name.	Locality.
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VIII. MATAURA SERIES—*continued.*

51	<i>Lomarites pectinata</i> Mataura.
52	" " Mataura.
53	" "	.. .. Clent Hills.
54	" "	.. .. Waikato Heads.
55	<i>Pterophyllum grandis</i>	.. .. Clent Hills.
56	" "	.. .. Clent Hills.
57	<i>Sphenopteris asplenoides</i>	.. .. Waikawa.
58	<i>Palæozamia matauriensis</i>	.. .. Mataura.
59	" "	.. .. Mataura.
60	" "	.. .. Mataura.
61	" "	.. .. Mataura.
62	<i>Asplenium palæopteris</i>	.. .. Waikato Heads.
63	<i>Asterophyllites clentii</i>	.. .. Clent Hills.
64	<i>Tympanophora paradoxus</i>	.. .. Waikato Heads.

VI. WAIPARA FORMATION.

65	<i>Phyllites purchasi</i>	.. .. Collingwood, and Waikato Lower Basin.
65A	" "	.. .. Quail Flat, Clarence Valley.
66	" "	.. .. Pakawau, Nelson.
67	" "	.. .. Malvern Hills.
68	<i>Panax elongata</i>	.. .. Wangapeka.
69	" <i>subserata</i>	.. .. Wangapeka.
70	<i>Fagus grandifolia</i>	.. .. Wangapeka.
70A	" "	.. .. Quail Flat, Clarence.
71	" <i>neinnisiana</i>	.. .. Wangapeka.
72	" "	.. .. Waikato Lower Basin.
73	<i>Damarites lanceolata</i>	.. .. Shag Point.
74	" <i>carinata</i>	.. .. Shag Point.
75	" "	.. .. Waipara.
76	<i>Coprosma elongata</i>	.. .. Wangapeka.
77	<i>Santalum maire</i>	.. .. Wangapeka.
78	<i>Menispermities pentanervis</i>	.. .. Wangapeka.
79	<i>Metrosideros longifolia</i>	.. .. Wangapeka.
80	" "	.. .. Wangapeka.
81	<i>Taxites rimu</i>	.. .. Pakawau.
82	<i>Tæniopteris obtusatus</i>	.. .. Pakawau.
82A	" "	.. .. Quail Flat, Clarence.
83	<i>Auricularites buechanani</i>	.. .. Shag Point.
84	<i>Cyperites</i>	.. .. Grey River, Westland.
85	<i>Pecopteris hochstetteri</i>	.. .. Quail Flat, Clarence.

CASTS.

No.	Name.	Where described.	Particulars of Specimen.	Formation.	Locality.	Original in
1	Taniwhasaurus oweni	Hector: Trans. N.Z. Inst., Vol. VI., p. 534	Skull, mandibles, and teeth (slab 18in. x 20in.)	Waipara, VI. <i>h</i>	Amuri Bluff..	Col. Museum.
2	"	"	Paddle-bones (slab 28in. x 18in.)	"	"	"
3	"	"	Vertebrae and ribs (slab 32in. x 19in.)	"	"	"
4	Leiodon haumuriensis	" p. 351	Mandibles of right side (slab 42in. x 18in.)	"	"	"
5	"	"	Portion of left jaw and teeth	"	"	"
5A	"	"	Vertebrae	"	"	"
6	Mauisaurus haastii	" p. 346	Paddle and 19 phalanges..	Waipara, VI. <i>f</i>	Jed River	"
6A	"	"	Tooth	"	"	"
7	"	"	Vertebrae	"	"	"
8	"	"	Coracoid	"	"	"
9	Plesiosaurus crassirostratus	Owen: Geol. Magazine, 1870, p. 52	Vertebrae and ribs (slab 44in. x 26in.)	"	Waipara	"
10	"	"	Vertebrae	Waipara, VI. <i>h</i>	"	"
11	"	"	Vertebrae and paddle	"	"	"
12	"	"	Coracoid	"	"	"
13	"	"	Single vertebra	"	"	"
14	" australis	Owen: Brit. Assoc. Rep., 1861, p. 122	Vertebra	Waipara, VI. <i>f</i>	"	"
14A	"	"	Thorax	"	"	"
15	Polycotylus tenuis	Hector: Trans. N.Z. Inst., Vol. VI., p. 395	Vertebrae	Waipara, VI. <i>k</i>	Amuri Bluff	"
16	"	"	Humerus	"	"	"
17	"	"	Head of large humerus	"	"	"
18	Plesiosaurus hoodii	Hector: Trans. N.Z. Inst., Vol. VI., p. 395	Vertebra	Waipara, VI. <i>f</i>	Waipara	"
19	Crocodylus novae-zealandiae	Hector: MSS.	"	Waipara, VI. <i>h</i>	Waipara	"
20	Kekenodon onamata	Hector: Trans. N.Z. Inst., Vol. XIII., p. 435	Slab with teeth (22in. x 8in.)	Waitaki series, V. <i>c</i>	Waitaki River	"
21	"	"	Molar teeth	"	"	"
22	"	"	Incisor tooth	"	"	"
23	"	"	"	"	"	"
24	"	"	Sternum	"	"	"

CASTS—continued.

No.	Name.	Where described.	Particulars of Specimen.	Formation.	Locality.	Original in
25	Kekenodon onamata ..	Hector: Trans. N.Z. Inst., Vol. XIII. p. 435.	Ear-bone ..	Waitaki series, V.c	Waitaki River	Col. Museum.
26	" ..	" ..	Section of jaw ..	" ..	" ..	" ..
26A	" ..	" ..	Portion of jaw of young specimen ..	" ..	" ..	" ..
27	(?) ..	" ..	Tooth of cetacean ..	Putataka series, VIII.b	Waitaki ..	" ..
28	Ammonitis sisyphi, n.s., and fossil wood ..	MSS. ..	" ..	Amuri series, VII.a	Kawhia ..	" ..
29	Scaphitis grandis, n.s. ..	" ..	" ..	Amuri series, VII.a	Amuri Bluff	" ..
30	Ancyloceras monstrosa, n.s. ..	" ..	Natural cast of exterior ..	Waipara, VI.e	" ..	" ..
31	Ammonitis (sp.?) ..	" ..	" ..	Otapiri series, X.a	Shaw's Bay..	" ..
32	Ichthyosaurus pottsi ..	Hector ..	Rib-fragments ..	Mount Potts beds, XI.	Mount Potts	" ..
33	Plagiostoma expansum, n.s. ..	" ..	" ..	Waipara, VI.f	Brighton ..	" ..
34	Fucoid ..	" ..	" ..	Waipara, VI.a	Cobden ..	" ..
35	Inoceramus (sp.?) ..	" ..	" ..	Amuri series, VII.a	Akito ..	" ..

36. Terebratula from Ototara stone.

37.

38, 39. Models of Milford Sound and Mount Tongariro (see ante, p. 5).

40. Cast of METEORITE found at Manaia, near Masterton, in 1862, by Mr. W. H. Donald, who gave it to Mr. Richard Collins, of Te Oreore: Mr. Collins presented it to the Hon. W. B. D. Mantell, M.L.C., F.G.S., F.R.G.S., &c., who deposited it in the Colonial Museum, Wellington, New Zealand, in 1867.

GUIDE
TO THE
GEOLOGICAL EXHIBITS.

GUIDE

TO THE

GEOLOGICAL EXHIBITS

OUTLINE OF THE GEOLOGY OF NEW ZEALAND.

THE geological reports, maps, and sections which are issued by the Geological Department of New Zealand (see appended list) indicate in detail our present knowledge of the structure of the Islands and the distribution of the chief groups of rock formations; and the leading features have been drawn on the index-map which accompanies this pamphlet.

The terms used in classifying the stratified rocks are the following :—

AGE.
SYSTEM.
Formation.
Series.
Beds.

The term "group," which by some is used to signify two or more formations, is reserved for the classification of igneous and metamorphic rocks, in dealing with which a collective term is frequently necessary.

EXPLANATION OF TERMS OF PROPOSED CLASSIFICATION.

AGE.—This is a collective term of general adoption, and is applied to the larger divisions of the stratified rocks that are accepted as indicating great periods in the history of life on the globe, distinguished in all countries by palæontological evidence, such as Palæozoic, Mesozoic, and Cainozoic ages, which are chiefly of use in dealing with the larger questions of physical geology and geography, there being no really well-pronounced natural divisions or periods in the history of the earth as a whole which correspond with them.

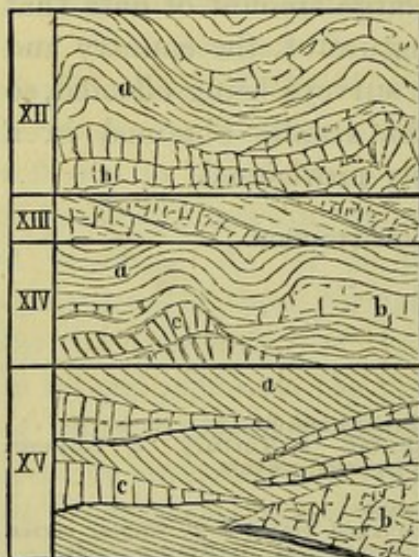
SYSTEM.—This term is applied to the subdivisions which are subordinate to the "ages," each representing a lengthened period of time, the strata deposited during which had in all parts of the earth a number of mineral and fossil characters in common, and may be therefore regarded as each representing one great physical epoch in the evolution of the stratified portions of the earth's crust.

Each system is distinguished in all maps and sections by the definite colour or tint allotted to it in the schedule.

Formations.—These are the large systematic divisions actually in use in describing the geology of New Zealand, being a natural classification of the stratified rocks, founded on observation. Each formation is distinguished in the map, plan, or section, and when referred to in reports, by Roman numerals or capital letters, and by a distinctive marking impressed on the colour of the system to which it belongs. As far as possible the names usually applied to the equivalents of these formations in other countries have been employed, for the convenience of those to whom local names are unfamiliar; but in several instances the natural subdivisions of the strata which admit of being mapped overlap the conventional subdivisions. In such cases, local or composite terms have been used, as, for instance, "Waipara" or "Cretaceo-tertiary formation," which includes the Lower Eocene and Upper Cretaceous of ordinary classifications, for the reason that no division-line that can be used for the purpose of practical geology can be interposed. The term "formation" is therefore to be read as the local development in the New Zealand area of any system or part of a system the boundaries of which can be distinctly traced in mapping the country.

Series.—The terms "series" and "beds" are of use chiefly in descriptive geology, and can rarely be employed as distinguishing features in general maps; but in local geological plans, and in illustrative sections, they are frequently introduced. Each series is part of and subordinate to a formation, and bears the name of the locality where the most typical, or, in some cases, the first-discovered, section of the particular series of beds was found. Each series is indicated by an Arabic numeral following the number, letter, or name of the formation in which it occurs. The division of any formation into series is dictated entirely by practical utility. As far as possible, the different series adopted in the classification are arranged so as to be consecutive in superposition and age, but in some cases the term has necessarily been used in a descriptive sense.

The "beds" (layers or strata), in the particular application of the word, are the things to be classified under the foregoing phrases, and this term is therefore of very varied application. As a rule the term is employed to indicate an imperfect and local development of a series, or a portion of a series, that has well-marked distinctive characters, founded on its mineral composition or fossil contents.

Coloured on
Index-Map.

- Sepia. {
- XII. Carboniferous—
a. Maitai series. b. Limestones.
 - XIII. Devonian—
a. Te Anau series. b. Kakanui series.
 - XIV. Upper Silurian—
a. Baton River series. b. Limestones.
c. Serpentine.
 - XV. Lower Silurian—
a. Aorere series. b. Marbles. c. Horn-
blende rock.

Metamorphic Rocks.

- Purple. XVI. Foliated schists.
- Crimson { XVII. Crystalline rocks.
Lake. { XVIII. Granite.

Igneous Rocks.

- Carminc. { XIX. Plutonic and dyke rocks.
{ XX. Basic volcanic rocks.
- Pink. XXI. Acidic volcanic rocks.

New Zealand presents a peculiar feature on the surface of the globe, as, notwithstanding its isolated position, its structure is highly complicated, in which respect it differs from that of most of the oceanic islands. It is, in fact, the remnant of a large continent, which, formerly extending far to the eastward, has been reduced in area by the erosive action of the sea. There is reason to believe, from consideration of the existing and extinct fauna and flora, that the continent of which it formed part may have been connected in the temperate zone with South America. On the other hand, there is no clear evidence of its having been connected during Tertiary times with Australia, lying to the westward.

On the whole, the geological record, so far as yet known, is more complete in the New Zealand than in the Australian area. The Tertiary strata are perhaps equally well developed, and the distinguishing facies of each existing fauna is discernible as early as the Eocene formations. The upper Mesozoic formations are very imperfectly

represented in Australia, but have enormous development in New Zealand, in which country, as in America, the Tertiary facies of the fauna and flora springs from a shore-line and land-surface of pre-Cretaceous age. This is the period of the chief coal deposits in New Zealand.

The surface configuration of New Zealand is that of a mountainous country having a leading range chiefly composed of upper Palæozoic rocks. This mountain-range commences on the south-east of Otago, sweeps round the West Coast, where it culminates in Mount Cook, and reaches to Cook Strait. Thence it is continued through the North Island in a north-easterly direction to the East Cape. The rock-formations of this backbone range have, on the whole, a synclinal arrangement, and, where highest, have an easterly dip, thus presenting a scarp to the westward, along the base of which, in the South Island, have been laid bare areas of metamorphic rock supporting synclinal masses of fossiliferous Lower Palæozoic strata, and in the North Island extensive volcanic outbursts, associated with vast Tertiary formations. The investigations of the "Challenger" expedition have also shown that, unlike other oceanic islands, New Zealand is surrounded by a submarine plateau or shelf, which extends a varying distance from the coast. On the south-west the edge of this plateau almost coincides with the coast-line, which here presents a massive buttress of granitoid rocks to the prevailing erosive action of the ocean from that quarter. To the eastward the extent of the plateau is unknown, except that it probably reaches as far as the Chatham Islands. The depth of water on the plateau is about 300 to 600 fathoms, the surrounding water of the ocean having a depth of from 2,000 to 2,600 fathoms. Along the base of the mountains in the South Island are extensive plains of Tertiary fluviatile formation, with occasional protruding ridges of upper Mesozoic rocks, forming low mountain-ranges subordinate to the main axis. In the North Island there are similar outcrops of the Mesozoic rocks through the marine Tertiary and volcanic formations which occupy the greater portion of the surface. In many cases the evidence is very marked that in New Zealand the newer and unconsolidated formations have only survived and escaped denudation through the protecting influence of the harder masses of metamorphic and igneous rocks. This is illustrated by reference to the relation of the volcanic system of Banks Peninsula to the Canterbury Plains, and of that of Mount Egmont to the great Tertiary plain of the North Island.

The inspection of the large geological model facilitates the comprehension of the structure of the Islands. The best point of view to

commence the examination is at the East Cape. The great leading range of Upper Palæozoic rocks (dark sepia) is seen to stretch through both Islands as a narrow range, dislocated at Cook Strait, and spreading out into two branches in the far south to enclose the extensive schistose area of the interior of Otago. Schistose and other metamorphic rocks (purple and vermillion) are seen to crop out along the western base of the mountains of the South Island, and are found nowhere else, with the exception of small areas on the south side of Cook Strait, where they appear to have been faulted up. On the eastern side of the mountains we have evidence of a succession of a synclinal or trough-like arrangement of all the formations up to the close of the Waipara or Cretaceo-tertiary formation (green) ; while the Tertiary formations (Upper, chiefly of fluvatile and lacustrine origin—yellow ; and Lower, chiefly of marine origin—pale pink) occupy the bays and indentations of the higher lands, and, although ascending to a considerable altitude, have their distribution always in obvious relation to the existing orographical features.

In the North Island the Tertiary formations occupy a much greater extent of surface, and have a more continuous distribution. Those of a marine origin form a semicircle, extending from Mokau on the west to the East Cape on the east, and rise from the sea-level on the coast to 3,700ft. altitude on the south slope of the Kaimanawa Mountains (Palæozoic slates), the centre of the dome being formed by the great volcanic mountains of Ruapehu and Tongariro, the latter of which is still active. On the other hand, in the north-west part of the North Island the Tertiary rocks are, with a few insignificant exceptions, of fluvatile or lacustrine origin, resting unconformably on formations of greater age than the marine Tertiaries, and smothered by extensive igneous accumulations, the products of long-continued volcanic eruptions. The formation of the west coast of both Islands is worthy of attention, taking the scarp of palæozoic rocks that forms the main range as the division between east and west. This commences on the east coast, at Shag Point, in Otago, and sweeps north-west through Mount Cook, across the narrowest part of Cook Strait, and through the North Island, along its eastern border, to the East Cape. Lying to the west of the longitudinal division thus defined are three large areas which require special attention, as they are occupied by exposures of those deep-seated formations which yield metallic ores. The first of these is the Otago area, which is the crown of a flat anticlinal dome, the denudation of which has exposed metamorphic schists over an area of 8,000 square miles, the rocks within this area having been changed from the original sediments into

foliated mica schists. Schistose rock of this kind is quite unable to resist even the feeblest denuding agency, as it is easily broken up into fine micaceous matter that almost floats away, leaving a residue of quartz-fragments that rapidly wear into rounded gravel, in which form it is also easily moved by water. This is proved by the manner in which the surface of the schistose area has been worn into ridges and furrows by the action of the smallest streams, while the larger rivers act like gigantic sluice-boxes, through which an enormous amount of detrital matter is carried, leaving behind in a concentrated "wash" the gold and other metallic particles which are disseminated through the mineralized rock.

On the weather side, or the south-west, of the foliated schists lies a great area of crystalline schists, in which the original sediments have been thoroughly crystallized into the toughest and most obdurate forms of rock. This area (light vermilion) has acted as a protecting buttress, without which the soft schistose area would have been long since removed; and its hard, resisting surface is seamed by the scars of denuding agencies, the action of which has been continued throughout many geological ages. It is in this manner that the grand scenery characterizing the fiords and sounds of south-west Otago has been produced.

From Jackson's Bay northwards the west side of the main range presents an abrupt scarp, but having on each Island a triangular projection stretching to the north-west, remnants, as it were, of extensions of land in that direction which have resisted and survived the denuding influence that has elsewhere eaten back into the very core of the mountain-range. The projecting area from the South Island terminates at Cape Farewell, and has its base from Greymouth to Nelson. The corresponding area from the North Island is much more extensive, and terminates in the North Cape, having its base along the western side of the main range, from the Manawatu to Opotiki. Both of these areas present one remarkable feature in common, in which they differ from the prevailing character of the rest of New Zealand—and that is, in the extensive and complicated development of igneous rocks which they exhibit, the only difference being that in the South Island these igneous rocks are irruptive or plutonic, while in the North Island they are eruptive or volcanic.

In the north-west area of Nelson, where we have the most ancient fossiliferous formations associated and interbedded with plutonic rocks, intense local mineralization has occurred, attended by the formation of veins that contain a great variety of valuable metallic ores. The remnant of the great western land extension in the North Island

has been so heavily enveloped in the volcanic products of recent geological periods that the underlying mineralized and metalliferous formations are only rarely accessible, although there is conclusive evidence of their existence. The hydro-thermal agencies that mark the expiring activity of volcanic outbursts has led to the infiltration of siliceous veins, carrying gold, silver, and other metals, into rocks of comparatively modern date. Where the deep-seated portions of such infiltrated areas have been exposed by erosive denudation, as, for instance, in the exposed peninsula of Cape Colville, the metalliferous veins are brought within the reach of the miner as the result of marine denudation; and there are probably infiltrated areas in the interior where the hot springs have become dormant, and in which the cores have been laid bare by the intense atmospheric denudation that affects elevated alpine areas, in the same manner as the mineral veins have been laid bare in the Sierra Nevada and other alpine mining districts in America.

DETAILED DESCRIPTION OF FORMATIONS.

I. RECENT AND POST-TERTIARY.

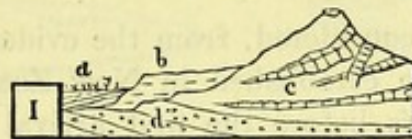


Fig. 1.

a. Alluvial. b. Turbary. c. Volcanic. d. Dispersed gravels.

DEPOSITS of this description have accumulated with great rapidity in New Zealand, as the mountainous character of the country gives to the rivers, even when of large size, the character of torrents, which are liable to occasional floods of extreme violence. To some extent, also, the remarkable indications of change which are everywhere manifest must be attributed to alterations of relative level which have affected the surface, some of which have occurred during the present century. Such changes are more easily detected on the sea-coast, where they effect sudden alterations of the shore-line; but there is no doubt that they have been equally potent in inland districts, and have caused, for instance, marked alterations in the courses of some of the rivers. The rapidity with which the coastal drifts accumulate and are again dispersed by such changes is well exemplified on the west coast of the South Island by the following section, exposed by the gold-miners in their search for the gold-dust brought down by the rivers and again cast back on the ocean-beach by the action of the waves:—

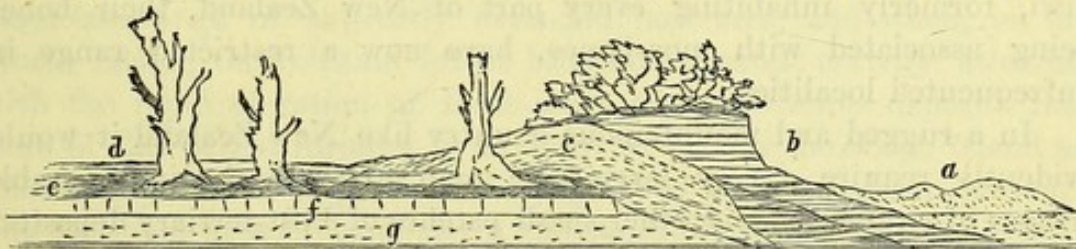


Fig. 2.

North of Buller River, Coastal Drifts. a. Modern shingle-beach. b. Ancient river-silt. c. Ancient shingle-beach. d. Modern lagoon-silt. e. Soil and forest. f. Blue clay. g. Black sand (auriferous).

The earthquake-rents, which are observed in many parts of the country, afford further evidence of recent change; but they seem to

have opened along lines which have been affected in the same manner from very remote periods. The cumulative tendency in one direction of such disturbances has produced the most astonishing results, considering the limited geological period from which they date. Recent surveys have shown that some of these earthquake-rents are vertical to and coincide in direction with great displacements of strata by faulting, amounting, in the case of the Great Clarence Fault, to several thousand feet, the earlier movements being probably of Pliocene date.

The Maori race is considered, from the evidence afforded by their traditions, to have been established in New Zealand for little more than five hundred years before the first arrival of Europeans; but during that period, while the islands were being explored in all parts by this intelligent and adventurous native race, the spread of fires, causing the destruction of the primeval forests and rank vegetation, was the means of setting free vast accumulations of loose soil and disintegrated rock that were formerly retained on the mountain-slopes. The material thus displaced has accumulated in the river-courses, causing them to raise their beds above the adjacent lands, so that they have broken away from their channels in many places.

The race of gigantic moa birds (*Dinornis*) had its maximum development in the New Zealand area, and only became extinct during the recent period; but their extermination must have commenced at an earlier date than the first human occupation, as their bones are found in vast numbers deeply imbedded in the gravels and swamps, while the evidences of human occupation are confined to the surface-soil, shelter-caves, and sand-dunes.

Other genera of flightless birds besides *Dinornis* have disappeared from the New Zealand area within recent times—namely, *Harpagornis*, *Cnemidornis*, and *Aptornis*—whilst the *Notornis*, the kakapo, and the kiwi, formerly inhabiting every part of New Zealand, their bones being associated with moa-bones, have now a restricted range in unfrequented localities.

In a rugged and mountainous country like New Zealand it would evidently require a very large-scale map to show the innumerable fringes of river-beds, and other small patches of Post-tertiary deposits; and accordingly these have been neglected in the geological map, and indications of the recent deposits have been limited to those places where the structural rock of the country is not exposed. These deposits, however, cover a considerable area of country in the Canterbury Plains, the Mackenzie country, around the mouth of the Waitaki River, and in the Maitara, Waimea, and Five Rivers plains,

in the South Island; and in the Manawatu, Waikato, Thames, and Kaipara districts, and the isthmus between Awanui and North Cape, in the North Island.

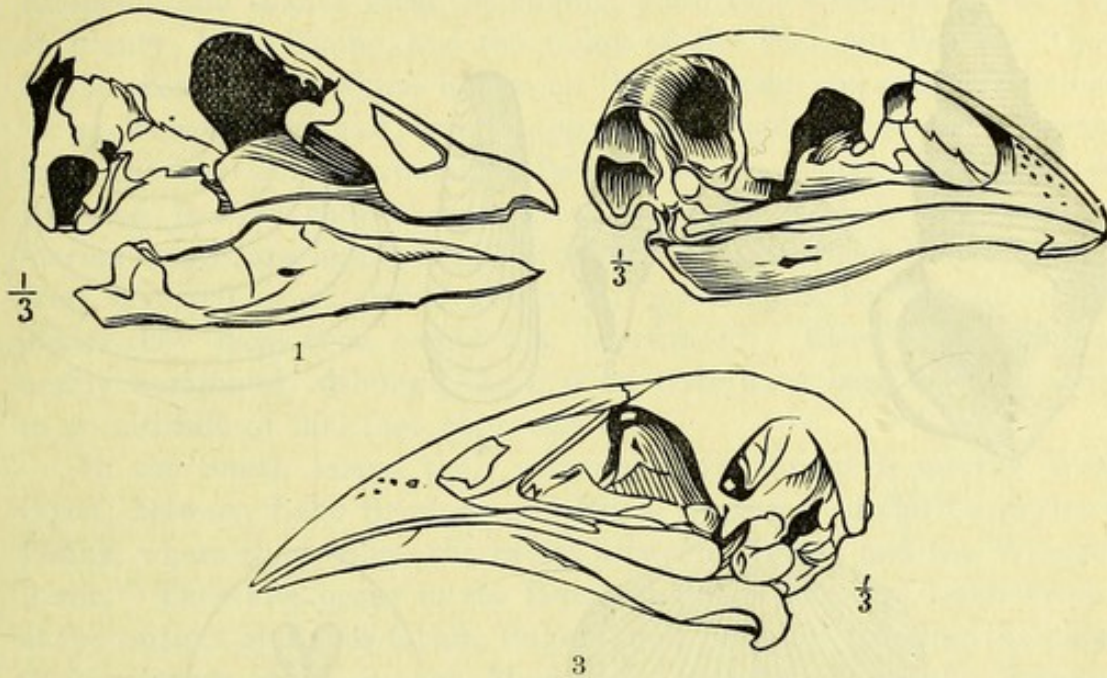


Fig. 3.

1. Cnemiornis. 2. Dinornis. 3. Aptornis.

II. PLIOCENE.



Fig. 4.

a. Dispersed gravels. b. Napier series. c. Lignite series. d. Kereru series.

This formation belongs to a period when New Zealand was the mountain-range of a greatly extended land-area, and when, in the North Island, the volcanic forces had their greatest activity, attended with the rapid elevation of local areas of fossiliferous deposits that were at this period forming in adjacent seas. In the South Island no marine deposits of importance belonging to this period are present; but the great area of land above the shore-line intensified the erosive action of the glaciers radiating from the mountain centres, and gave rise to enormous deposits of gravel, such, for instance, as compose the greater part of the Canterbury Plains, and the Moutere Hills in Nelson.

The marine beds of Pliocene age are characterized by the great abundance of the existing shell, *Rotella zealandica*, and among extinct

species, *Struthiolaria fraseri*, *Pleurotoma tuberculata*, *Pileopsis uncinatus*, and *Lutraria solida*.

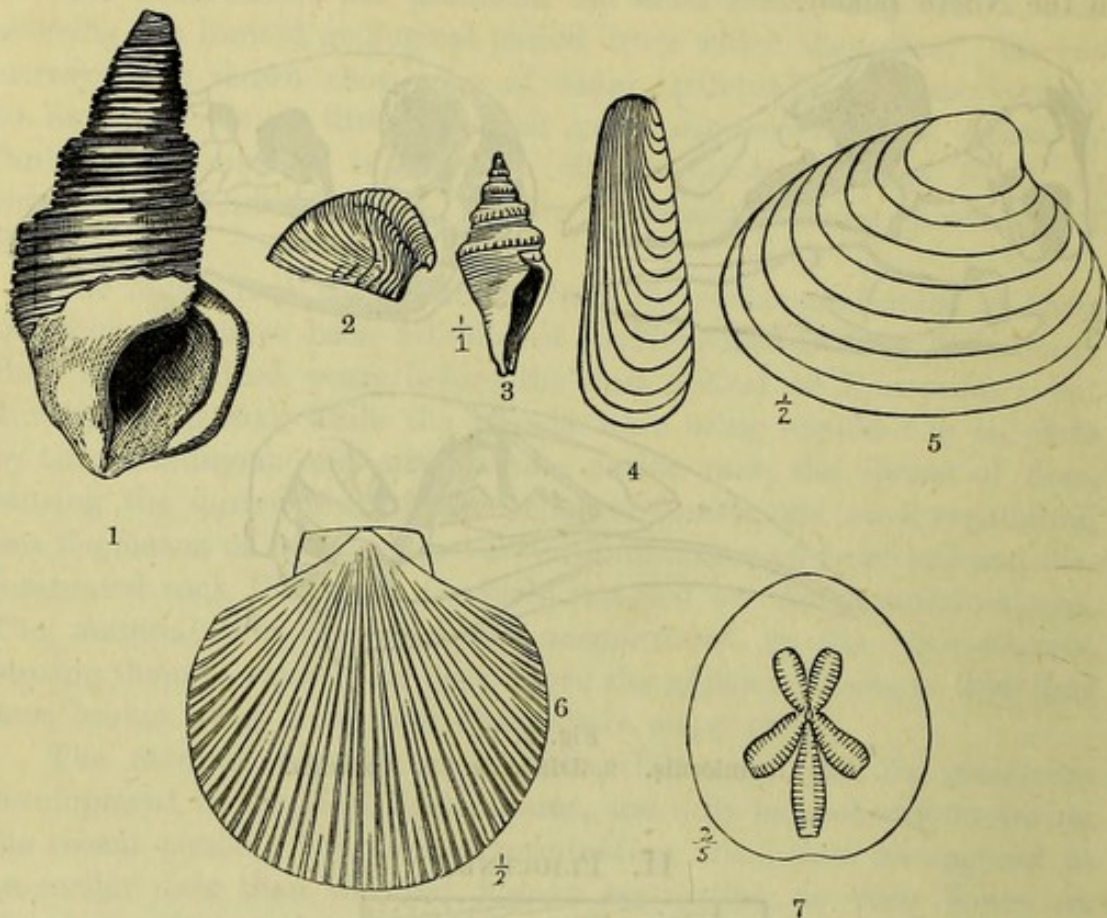


Fig. 5.

1. *Struthiolaria fraseri*. 2. *Pileopsis uncinatus*. 3. *Pleurotoma tuberculata*.
4. *Lithodomus striatus*. 5. *Hemimactra notata*. 6. *Pecten accrementa*.
7. *Amphidotus* (sp.), Scinde Island.

The economic importance of some formations of this age is very considerable, from their containing the richest deposits of alluvial gold that support the mining population. In the elevated schistose area of Otago the ancient drainage-channels of this period, with the earliest-formed auriferous gravels, have been intersected by the modern watercourses, and now occupy elevated positions, where their presence is often unsuspected until revealed by accident.

In the north they are represented by marine beds on various parts of the coast and around Manukau Harbour, and, as fluviatile beds, cover a considerable area of country in the districts between Alexandra and the Upper Thames, and stretch from Lake Taupo towards Opotiki, fringing the coast between that point and Katikati.

They also occur as a marine deposit at Wanganui, where they are highly fossiliferous; and, as superficial drifts, stretch back from there

towards the Rangitikei and Pohangina Rivers. As pumice-sands they cover the elevated country round the base of Tongariro and Ruapehu, and thence form the sloping plain that stretches to the Bay of Plenty, Lake Taupo, and the valley of the Waikato River. They further flank the Ruahine Range on the east side, and extend north as far as Moeangiangi, and, besides appearing as isolated patches between, form the low hills surrounding Poverty Bay. Where they flank the Ruahine Ranges they have a great thickness, and, being there of marine origin, are highly fossiliferous. In that district they have also been involved in extensive structural movements, so that in many places they have been completely overturned. Elsewhere they are nearly horizontal, although the marine beds have been locally raised to an altitude of 300 feet above sea-level.

In the South Island their principal development is on the West Coast, between Lake Brunner and Bruce Bay, and in the Canterbury Plains, where they fringe the range between Timaru and the Waipara River. They also occur in the Hurunui Plains; around Lake Tripp; at the outlets of Lakes Ohau, Pukaki, and Tekapo; fringing the older Carboniferous rocks in the Mackenzie country; from the Wanaka and Hawea Lakes as far south as Wakefield; the upper lacustrine gravels of the Manuherikia and Maniototo Plains; also between Lake Te Anau and the Mararoa River; and in the Southland Plains, a part of which is composed of these beds.

III. UPPER MIOCENE.

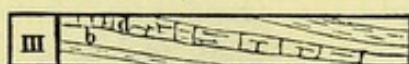


Fig. 6.

a. Te Aute series. b. Taueru series.

The marine beds of this age are limited in their extent to the southern and eastern districts of the North Island, where, on the south slope of the Kaimanawa Range, they have a full development up to 3,700 feet above the sea-level from the coast-line at Wanganui.

In the South Island they occur as patches, inland from Timaru, between Peel Forest and the Waitaki River; at the mouth of the Waipara; at Ross; to the south of Greymouth; and in Nelson, from Lake Rotoiti to the sea; but here, as at many other places, these beds are often represented by gravel conglomerates that, from the absence of fossils, have not been distinguished from the preceding formation.

Their mineral character is a series of sandy, calcareous, and

argillaceous strata, the distribution of which, and, as a rule, also the mineral character, indicate that they were related to a closely-adjacent shore-line, as they often pass almost suddenly from coarse conglomerates into narrow strips of fine mud and clay, such as are deposited in the centres of deep channels and inlets.

The New Zealand seas have yielded about 450 species of existing shells, of which 120 have been found in this formation, together with 25 forms which are now extinct.

They are specially characterized by the occurrence of *Ostrea ingens*, *Murex octagonus*, *Fusus triton*, *Struthiolaria cingulata*, *Chione assimilis*, *Chama huttoni*, and *Pecten gemmulatus*.

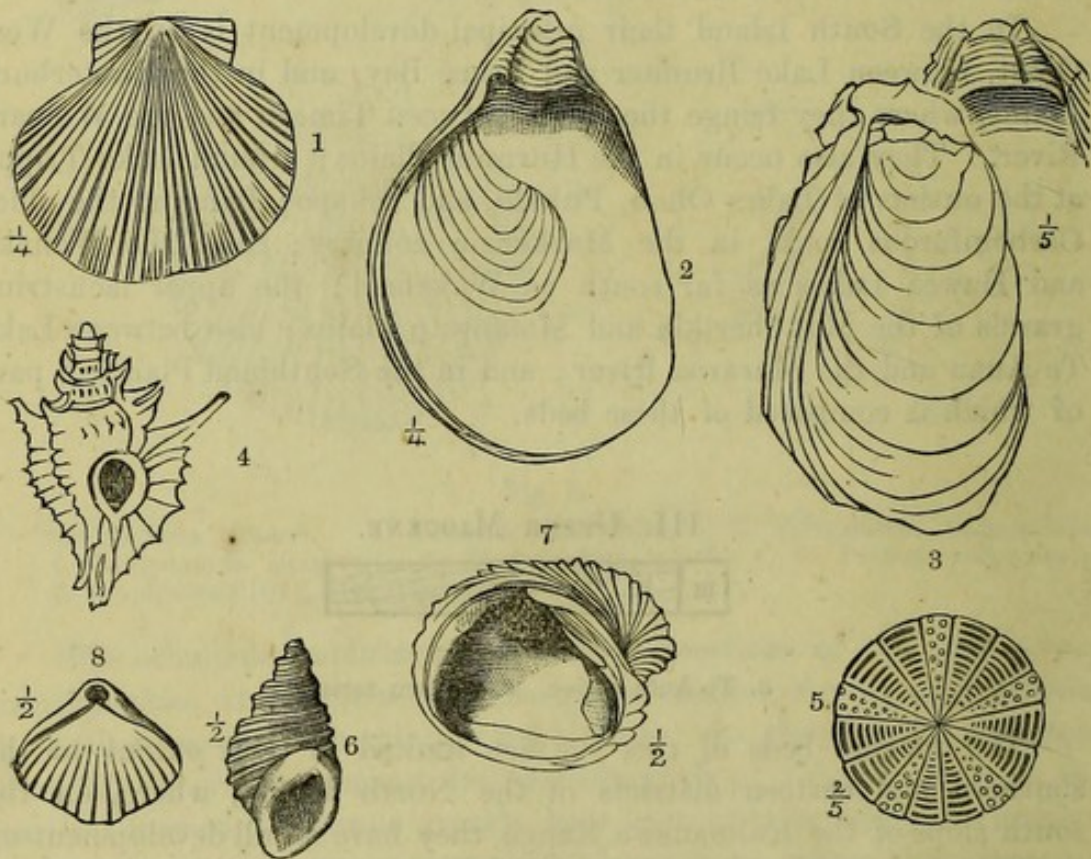


Fig. 7.

1. *Pecten vellicatus*. 2, 3. *Ostrea ingens* (Te Aute). 4. *Murex zealandica*. 5. *Arachnoides zelandiae*. 6. *Struthiolaria sulcata*. 7. *Chama huttoni*. 8. *Terebratella cruenta*.

In Otago the beds are partly marine, partly lacustrine, with lignite deposits at their base. The marine beds are exemplified at Mataura Falls and in the vicinity of Landslip Hill, Pomahaka Valley; the lacustrine beds by deposits containing fossil fish at Bannockburn and St. Bathans, Central Otago.

IV. LOWER MIOCENE.



Fig. 8.

a. Awatere series. b. Pareora series. c. Awamoa series. d. Lignite.

This formation, which is distinguished from the foregoing chiefly

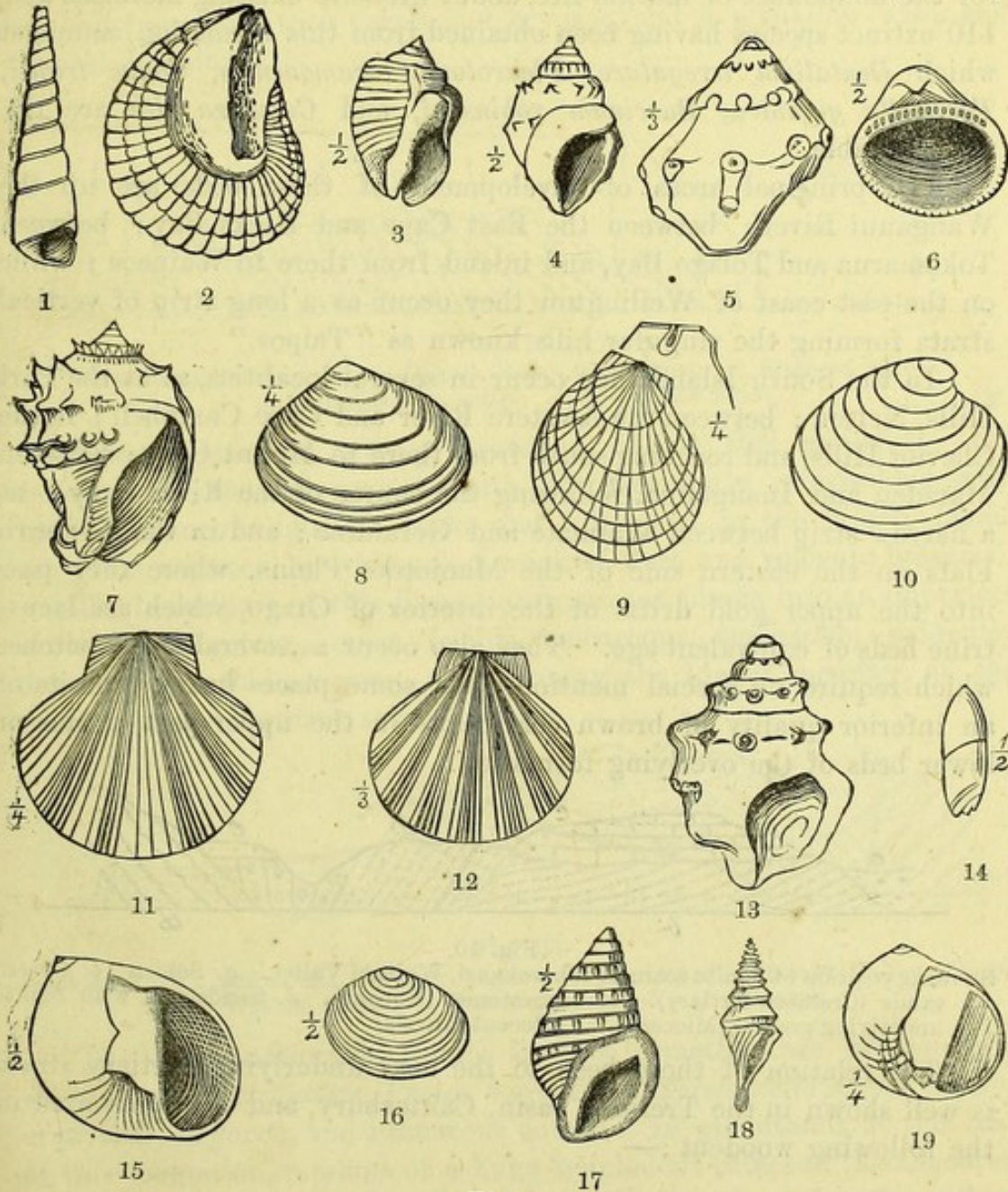


Fig. 9.

1. *Turritella gigantea*. 2. *Ostrea corrugata*. 3. *Buccinum carinatum*. 4. *Struthiolaria tuberculata*. 5. *Fusus crawfordi*. 6. *Pectunculus cordatus*. 7. *Cassis muricata*. 8. *Crassatella ampla*. 9. *Hinnites trailli*. 10. *Cytherea enysi*. 11. *Pecten crawfordi*. 12. *Pecten secta*. 13. *Struthiolaria spinosa*. 14. *Ancillaria hebera*. 15. *Natica ovata*. 16. *Callista elegans*. 17. *Struthiolaria cingulata*. 18. *Pleurotoma pagoda*. 19. *Natica solida*.

by its fossils, is a calcareous and argillaceous formation, widely spread over the east and central part of the North Island and both sides of the South Island, and, when not removed by denudation, can be traced to an altitude of 2,500 feet above the sea. It represents a period of great depression, and the deposits are remarkable for the absence of evidence of volcanic activity in any part of the region and for the abundance of marine life, about fifty-five existing mollusca and 110 extinct species having been obtained from this formation, amongst which *Dentalium irregulare*, *Pleurotoma awamoaensis*, *Conus trailli*, *Turritella gigantea*, *Buccinum robinsoni*, and *Cucullæa alta* are the most notable.

The principal areas of development of these beds are up the Wanganui River; between the East Cape and Hicks Bay; between Tokomarua and Tolago Bay, and inland from there to Waipaoa; while on the east coast of Wellington they occur as a long strip of vertical strata forming the singular hills known as "Taipos."

In the South Island they occur in several localities, as at the Port Hills, Nelson; between the Awatere River and Cape Campbell; in the Cheviot Hills, and reaching south from there to Mount Grey; between Marsden and Inangahua, following the course of the River Grey; as a narrow strip between Waimate and Geraldine; and in the Kyeburn Flats on the eastern side of the Maniototo Plains, where they pass into the upper gold drifts of the interior of Otago, which are lacustrine beds of equivalent age. They also occur as several small patches which require no special mention. In some places heavy deposits of an inferior quality of brown coal occur in the upper part of this or lower beds of the overlying formation.

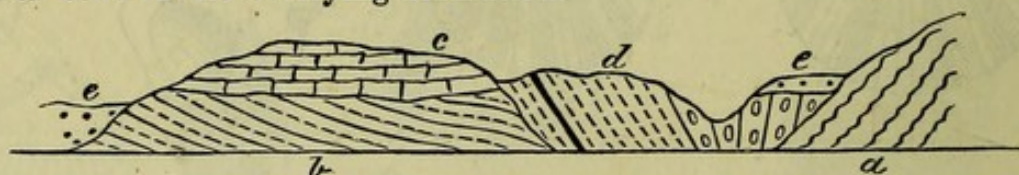


Fig. 10.

Showing position of lignite seam at Wharekauri, Waitaki Valley. a. Schist. b. Green-sands (Cretaceo-tertiary). c. Limestones (Eocene). d. Sandstone, with lignite underlying gravels (Miocene). e. Recent gravels.

The relation of these beds to the next underlying Tertiary strata is well shown in the Trelissic basin, Canterbury, and is represented in the following woodcut:—

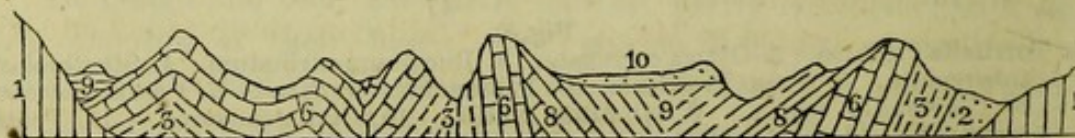


Fig. 11.

Section from Hog Back (Trelissic basin) along north bank of Broken River. 6. Weka Pass stone. 8. Mount Brown limestone. 9. Pareora beds. 10. Recent.

V. UPPER EOCENE.

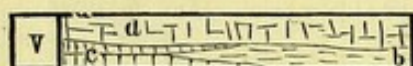


Fig. 12.

a. Mount Brown series. b. Oamaru series. c. Waitaki series.

This is a very marked formation of calcareous sandstone, composed of shell-fragments with corals and bryozoa, and is a shallow-water and littoral deposit.

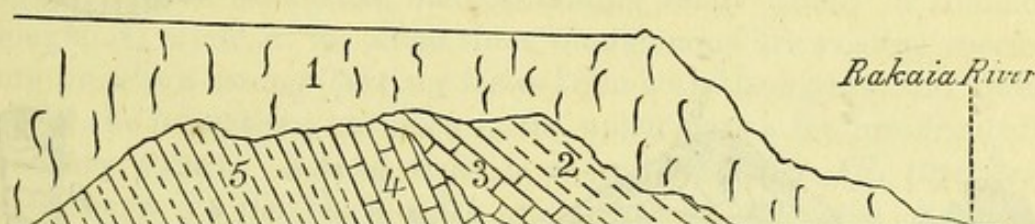


Fig. 13.

Section at Curiosity Shop, Rakaia River, Canterbury. 2. Pareora series. 3. Mount Brown series. 4, 5. Ototara series.

Intense volcanic activity prevailed during this period in both Islands, and the calcareous strata are frequently interbedded with contemporaneous igneous rocks and tufas, and in the North Island are often replaced by widespread trachyte floes and volcanic breccias.

The lower part of this formation passes at places into an imperfect orbitolite limestone, or a friable calcareous sandstone, evidently deposited in shallow seas, and forming the lowest member of the proper marine Tertiary series.

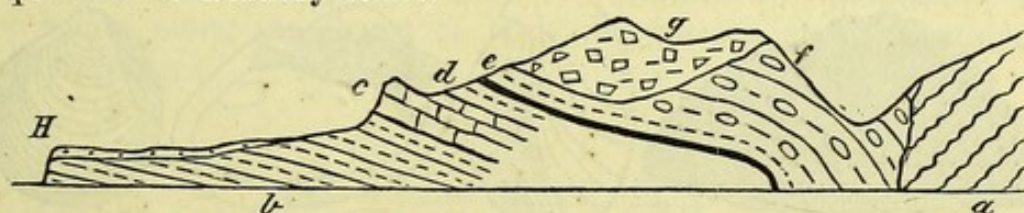


Fig. 14.

Section, E.-W., across the Tertiary basin at Wharekauri, Waitaki Valley, Otago. b. Waitaki series. c. Oamaru series. d, e, f. Miocene.

The more noticeable fossils in this formation are *Struthiolaria senex*, *Pecten hutchinsoni*, *Pecten hochstetteri*, *Terebratella suessi*, *Meoma crawfordi*, *Bryozoa*, and numerous corals. In greensands at the base of this formation, remains of a huge zeuglodont cetacean (*Kekenodon*) have been discovered by Mr. A. McKay, allied to those found in strata of equivalent age in Europe and America.

The distribution of these beds is limited in area, the principal

development being about the Waiau River, in Southland, and on the eastern side of Te Anau Lake, with a few patches up the east coast of

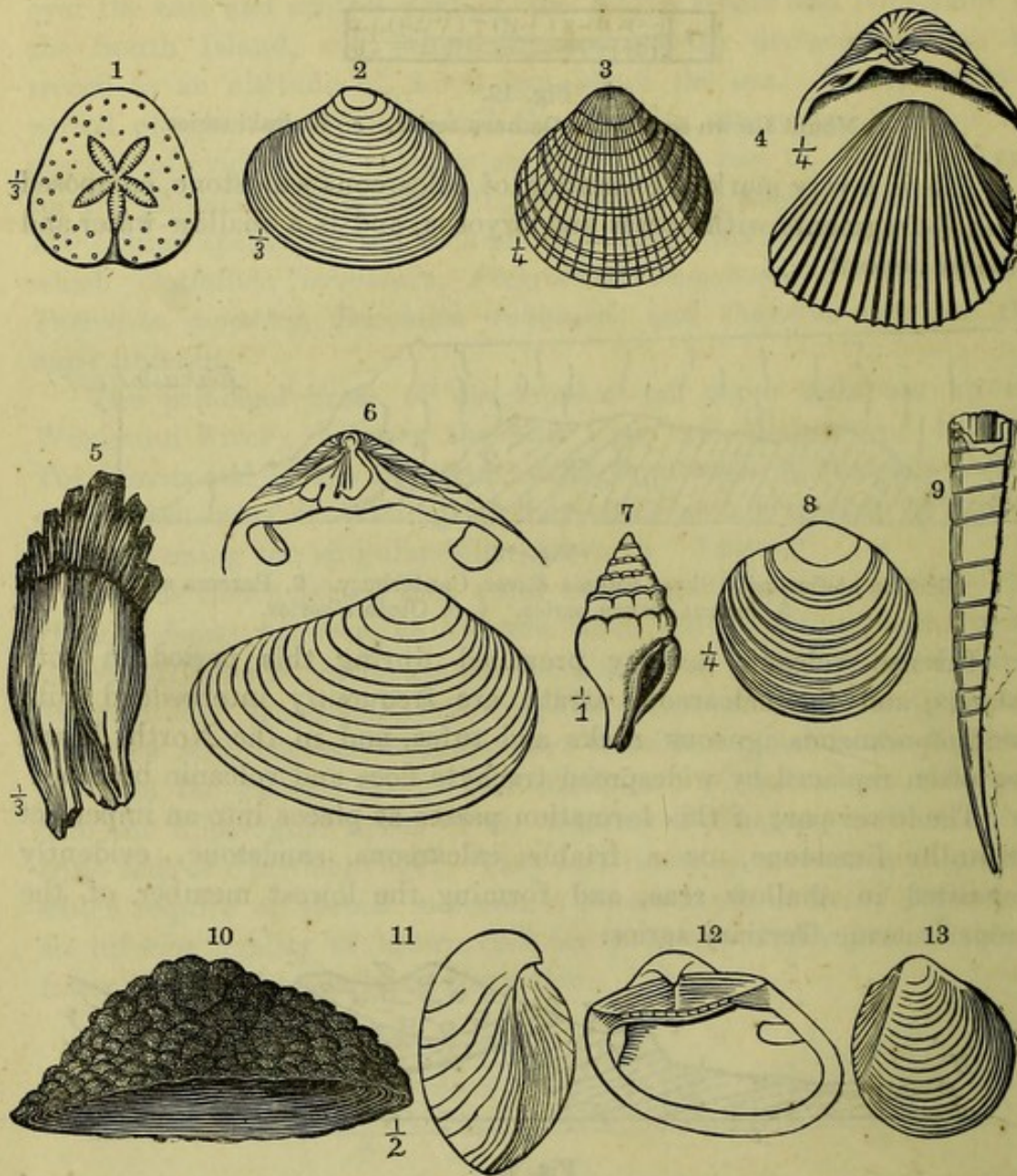


Fig. 15.

1. *Hemiaster posita*. 2. *Tapis curta*. 3. *Cardium patulum*. 4. *Cardium spatiosum*.
 5. *Kekenodon onomata* (tooth). 6. *Crassatella attenuata*. 7. *Pleurotoma latescens*.
 8. *Dosinia magna*. 9. *Dentalium giganteum*. 10. *Celeporina papalosa*. 11. *Terebratulina angulare*. 12. *Cucullæa attenuata*. 13. *Protocardium serum*.

the South Island at Oamaru, Geraldine, Mount Somers, and Mount Grey; while in the North Island they are principally developed from Cape Kidnappers south and inland up the Tukituki River. A small patch of the same beds also occurs at Mokau and Kaipara.

VI. CRETACEO-TERTIARY FORMATION.

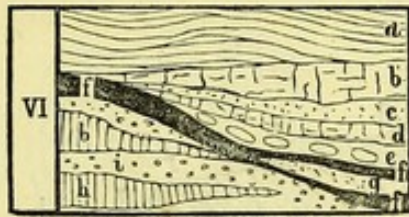


Fig. 16.

a. Grey marls. b. Ototara series. c. Mawhera series. d. Chalk series. e. Waireka series. f. Coal series. g. Black grit series. h. Propylite breccia series. i. Great conglomerate series.

These strata constitute the Cretaceo-tertiary formation, being stratigraphically associated, and containing many fossils in common throughout; while, at the same time, though none are existing species, many present a strong Tertiary facies from both the highest and lowest parts of the formation, but even in the upper part a few are decidedly Secondary forms. Among these is a true belemnite (*B. superstes*), which occurs in the black marls, immediately under the chalk and flints, in the Coverham or Middle Clarence Valley section.

The distribution of this formation shows that it was not, like the foregoing formations of latter date, deposited in relation to a form of the land like that at present obtaining in the New Zealand area, except in the vicinity of some of the oldest and most lofty land-masses in the south, which appear to have remained above the water-line since the Lower Cretaceous period.

In the northern part of the South Island the thickness of the strata thus included under the term Cretaceo-tertiary is very considerable, and the beds reach an elevation exceeding 5,000 feet above sea-level, and are deeply involved in complicated movements of older strata along the slopes of both the eastern and the western mountain-ranges.

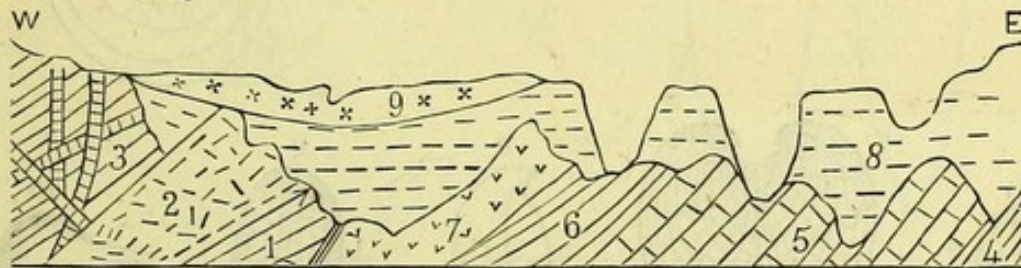


Fig. 17.

Section along north-east bank of Dart River, Clarence Valley, 2,500 feet above sea-level, showing the higher Cretaceo-tertiary beds (5 and 6), together with (7) Post-miocene conglomerates, passing under beds 1, 2, and 3, of old Secondary or Palæozoic age. Valley gravels (Post-pliocene), 8 and 9.

The upper part of this formation is a deep-sea deposit, but the lower subdivisions indicate the close vicinity of land, and are replaced in some areas by true estuarine and fluvial beds containing coal.

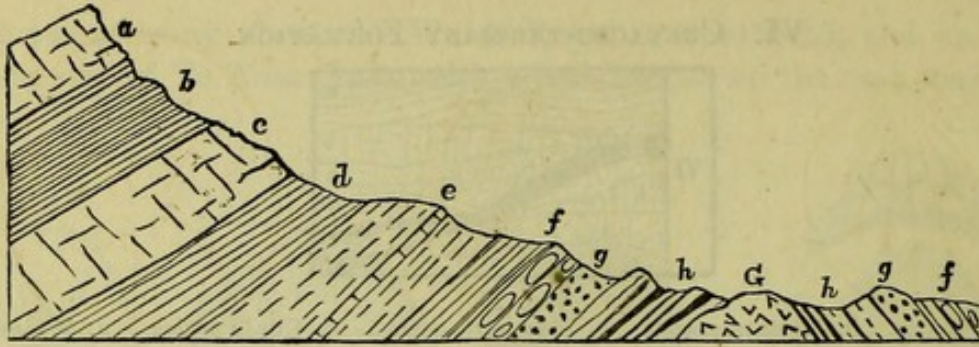


Fig. 18.

Section at source of Karamea River. *a.* Grey concretionary limestone. *b.* Grey marls, with *Pecten pleuronectes*. *c.* White, splintery limestone. *d.* Fucoidal greensand. *e.* Chalk-marls, with bands of chert. *f.* Dark greensand and concretionary sandstone. *g.* Brown grit and sandstone, with *Cardium brunneri*. *h.* Brown sandstone, with fossil plants and coal-seams. *G.* Granite.

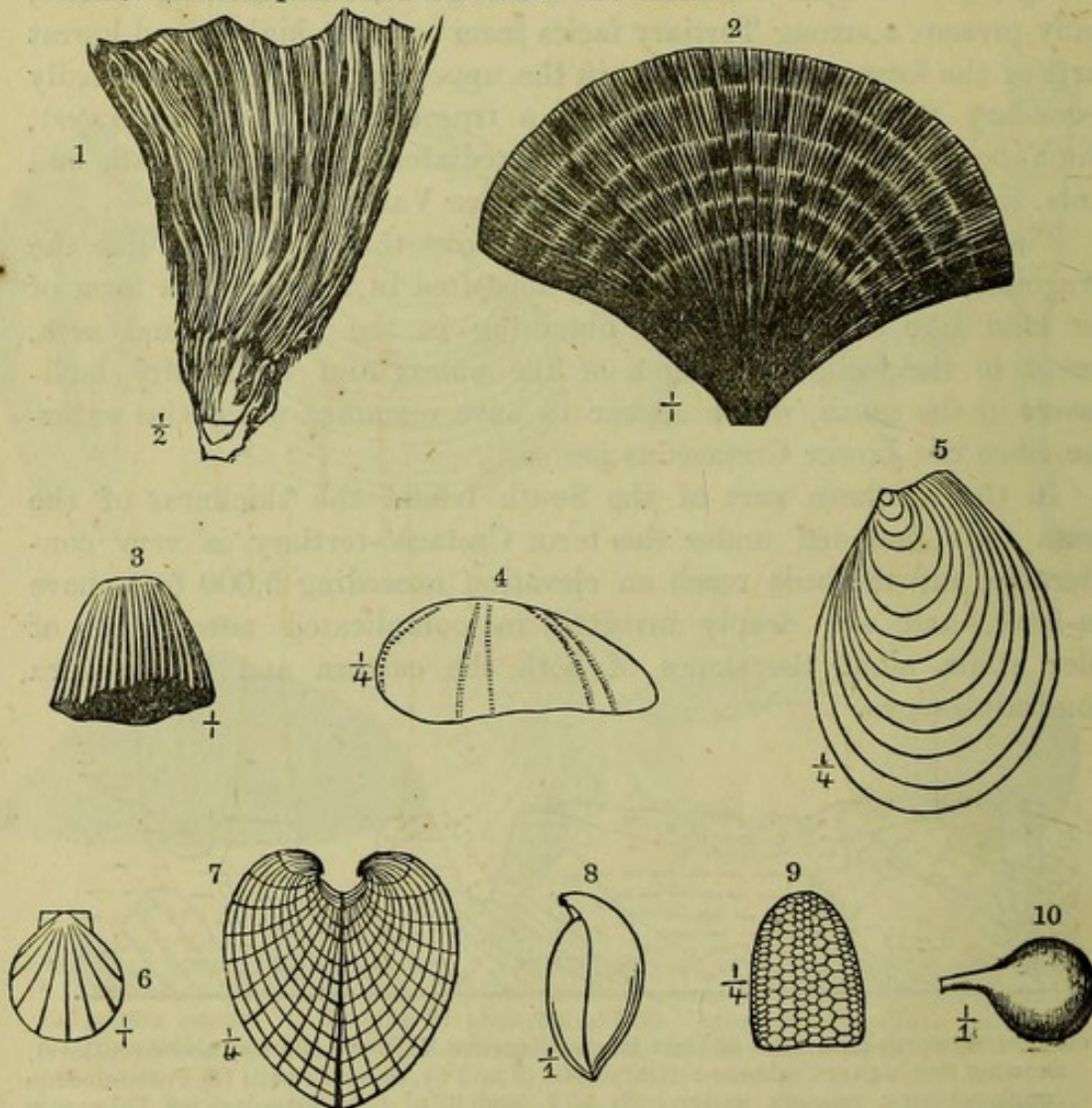


Fig. 19.

1. *Flabellum irregulare*, Motunau. 2. *Flabellum radians* (Kakanui North). 3. *Flabellum huttonianum*. 4. *Macropneustes* (Cobden). 5. *Lima laevigata*. 6. *Pecten zittelli* (Jenkins' Hill, Nelson). 7. *Hemicardium cordatum* (Mahemo, Oamaru). 8. *Waldheimia* (Cobden). 9. *Galerites cobdenensis*. 10. *Neera kirki* (Whangape Lake).

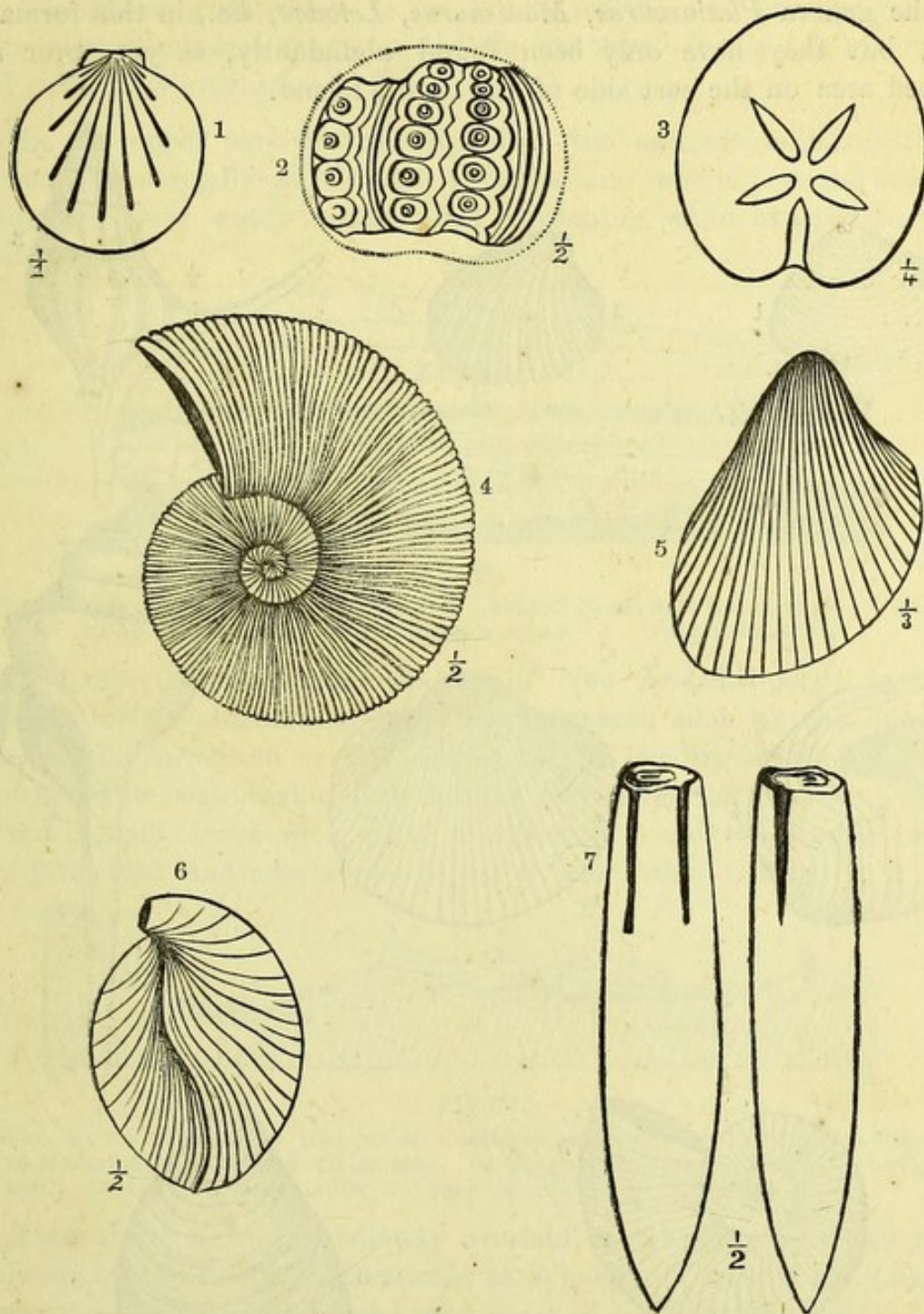


Fig. 19A.

1. *Pecten zittelli* (Whangape Lake). 2. *Cidaris* (Waihoa, South Canterbury).
 3. *Meoma crawfordii*. 4. *Ammonites McKayi* (Waipawa Gorge, Hawke's Bay).
 5. *Cardium coxii* (Castles, Collingwood). 6. *Terebratula* (Kakanui Mouth).
 7. *Belemnites superstes* (Upper Marls, Coverham).

The marine fossils include, besides well-marked Greensand forms, such as *Ancyloceras*, *Belemnites*, and *Rostellaria*, a number that have still a marked affinity to the Tertiary fauna. Saurian bones occur,

of the genera *Plesiosaurus*, *Mauisaurus*, *Leiodon*, &c., in this formation, but they have only been found abundantly, as yet, over a limited area on the east side of the South Island.

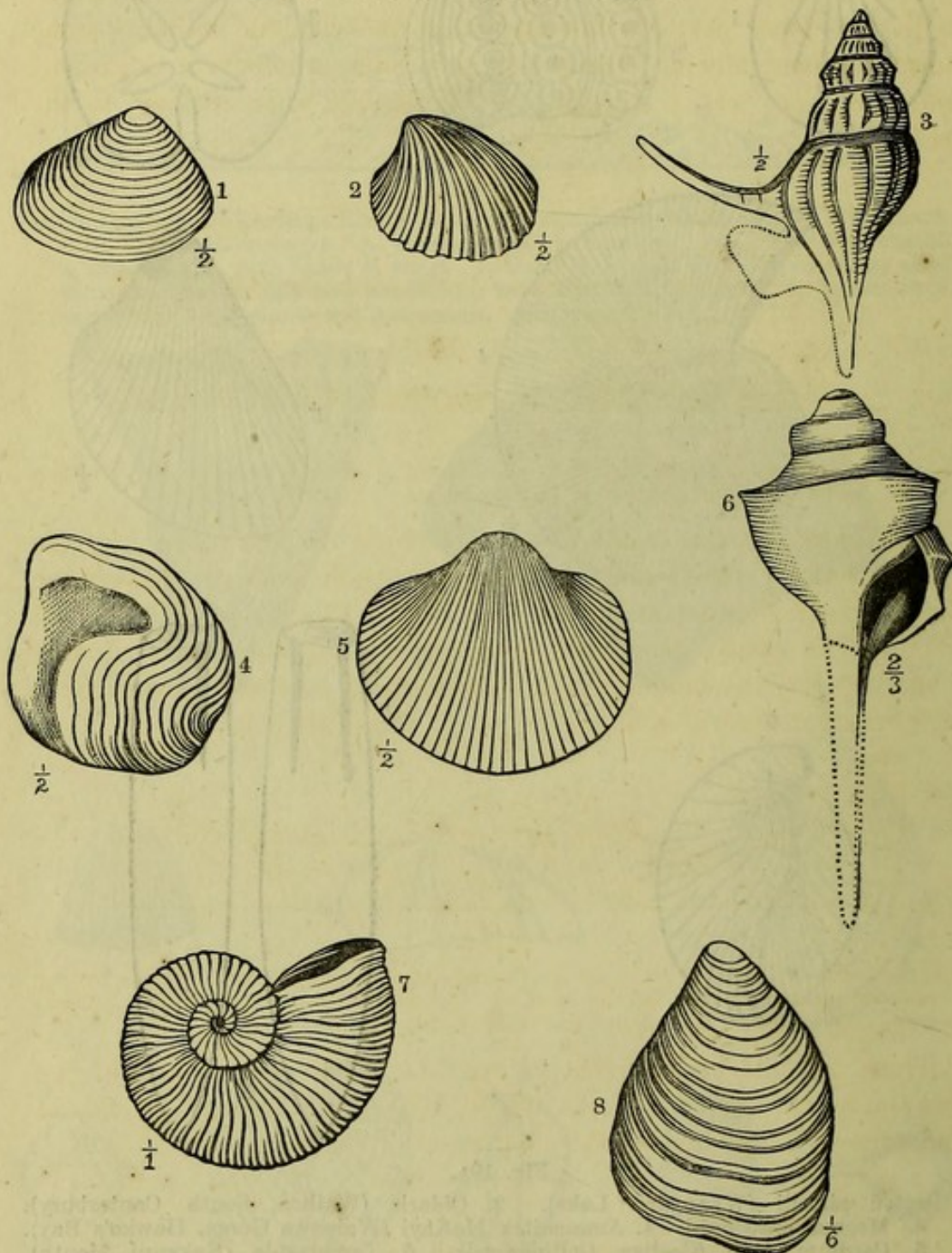


Fig. 20.

1. *Astarte australis* (Kakahu). 2. *Hemicardium* (Blackpoint, Waitaki). 3. *Rostellaria waiparensis* (Saurian beds, Waipara and Amuri Bluff). 4. *Conchothyra parsisitica* (McCoy). 5. *Cardium brunneri* (Brunnerton). 6. *Tudiela biangulata*. 7. *Ammonites haumuriensis* (Coverham and Amuri group, Amuri Bluff). 8. *Inoceramus* (Coverham and Wellington).

The black grit, which is the lowest marine bed of this group, resembles, in mineral character and the contained fossils, the carstone and calcareous greensand of England.

In the upper part of this formation the valuable building-stone known commercially as Oamaru stone occurs, which is a calcareous sandstone, very easily worked, but hardening when exposed to the weather.

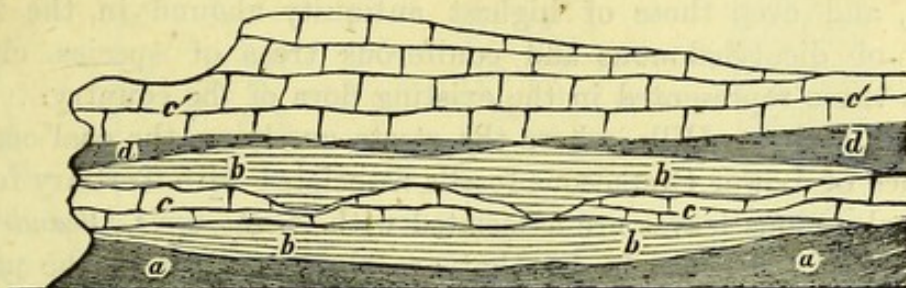


Fig. 21.

Section showing Oamaru stone, east bank of Kakanui River, near Oamaru. *a*. Waireka tufas. *b*. Chalk-marls. *c*. Ototara series. *c'*. Weka Pass stone.

The most valuable coal deposits of New Zealand occur in the Cretaceo-tertiary formation, but always beneath such of the marine beds of the formation as are present in the locality where the coal occurs. The coal-bearing beds always rest upon the basement rock of the district, marking a great unconformity and the closing of a long-persistent land area at the period to which they belong.

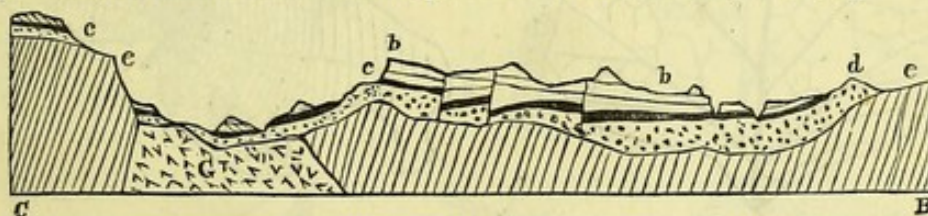


Fig. 22.

Section, Mount William to plateau at Coalbrookdale, showing coal series resting unconformably on the underlying rock. *b*. Quartz-grit overlying the coal. *c*. Coal-seam. *d*. Conglomerates under the coal. *e*. Slates. *g*. Granite.

Thus the coal is immediately overlaid by the grey marls in the Waikato, by the fucoidal greensands at Whangarei, and by the Island Sandstone in Otago and on the west coast of the South Island.



Fig. 23.

Section, Greymouth to Brunner, showing Island Sandstone immediately overlying coal-seam. *a-d*. Higher beds of the Cretaceo-tertiary group. *f*. Upper coal. *g*. Lower coal. *h*. Great conglomerate. *sl*. Slate.

The coals immediately beneath the marine beds are everywhere hydrous brown coals; but on the West Coast these rest upon an immense formation of micaceous sandstones, grits, and conglomerates, in which are seams of valuable bituminous coal, and this lower part of the formation is possibly the equivalent in time of the Lower Greensand group.

The same fossil plants are found associated with all these coal-deposits, and even those of highest antiquity abound in the fossil remains of dicotyledonous and coniferous trees of species closely allied to those represented in the existing flora of the country.

In the Malvern Hills, where the strata overlying the coal contain abundance of Lower Cretaceous fossils associated with Tertiary forms, the dicotyledonous leaves are associated with *Alethopteris*, *Oleandridum* (*Teniopteris*), and other forms that are also prevalent in the underlying Jurassic beds.

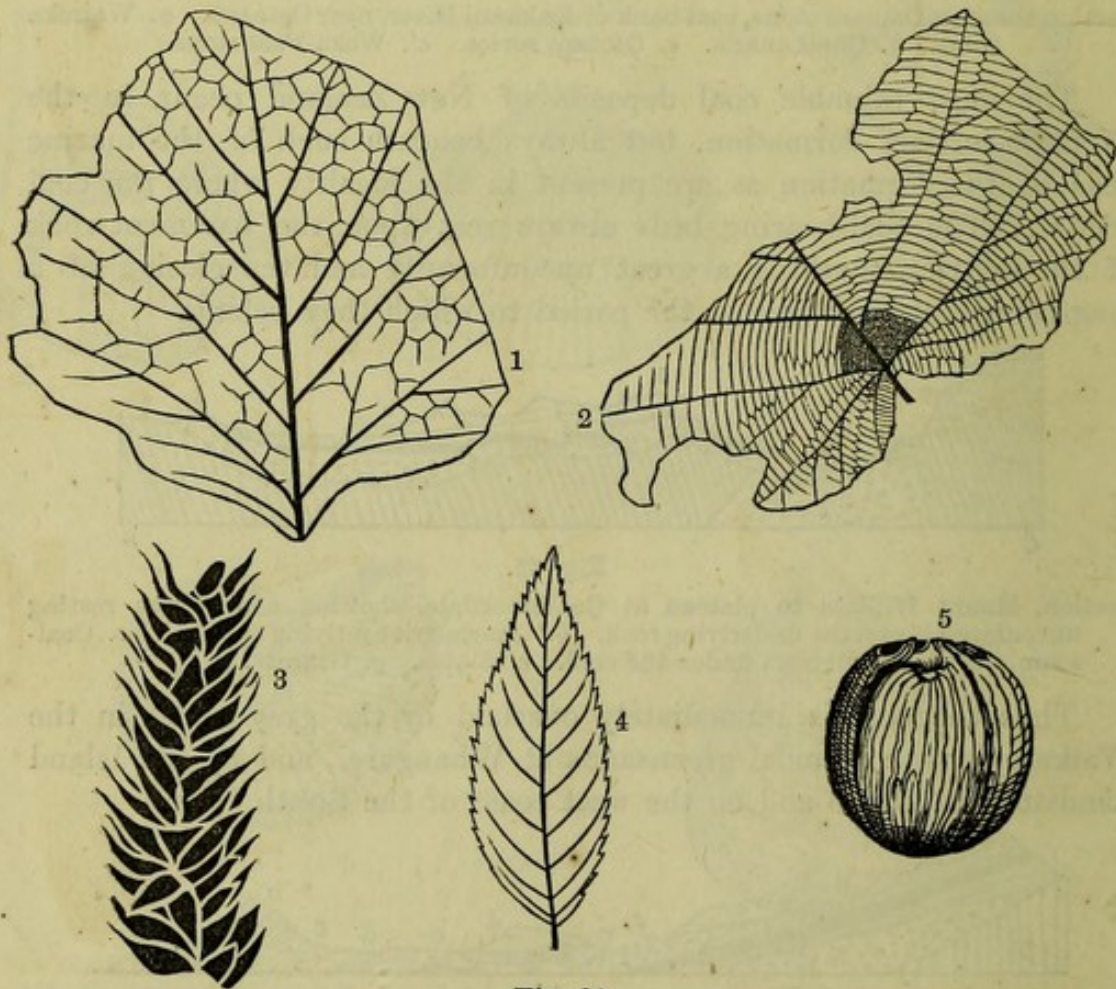


Fig. 24.

Fossil plants of New Zealand coal formation (see p. 61). 1. *Phylites whaurangi* (Shag Point). 2. *Protophyllum* (Pakawau). 3. *Auricaurites buehanani* (Shag Point). 4. *Phylites rubiformis*. 5. Palm-nut (Cooper Beach, Mongonui; also Livingstone Tunnel, Oamaru).



Fig. 24A.

Fossil plants of New Zealand coal formation (see p. 60). 1. *Patete scheffleri* (Pakawau). 2. *Phylites karamu* (Wangapeka). 3. *Teniopteris stipulata* (Pakawau). 4. *Damarites lanceolata*. 5. *Phylites geumoides* (Pakawau). 6. *Taxites tanekaha* (Wangapeka). 7. *Aciphylla pungens* (Wangapeka). 8. *Taxites toa-toa* (Wangapeka). 9. *Potomageton ovatum* (Trelissic basin, coal-shales). 10. *Cycaditus* (Malvern Hills). 11. *Auricaurites buehanani* (Waipara). 12. *Taxites maitai* (Shag Point). 13. *Auricaurites carinaria* (Shag Point).

At Amuri Bluff, where *Belemnites*, *Trigonia*, and *Inoceramus* abound, and *Ammonites*, *Ancyloceras*, and *Baculites* also occur, the remains of the same species of dicotyledonous plants are found in the lowest beds of the Amuri series, and also abundantly in the Middle Clarence Valley. In the latter place they are associated with a variety of plant-remains that in India appear to characterize a much more ancient formation. The same association takes place in the sandstones overlying the coal on the West Coast, the same flora appearing throughout the Waipara and Lower Greensand formations wherever circumstances have favoured its deposit and preservation.

It thus appears from the foregoing that the land-surface preceding the great depression during Cretaceo-tertiary times survived to a later date in the north than in the south of New Zealand, the beds overlying the coal in the north being generally of younger Cretaceous age.

This formation has a large distribution from north to south; but coal is only found at its base in a limited number of localities.

At Kawakawa, and between that point and Whangarei, coal has been found; and again in the Waikato, at Kawhia, and Mokau. On the east side of the North Island coal-seams are yet unknown associated with these beds, but strong escapes of petroleum and gaseous hydro-carbons are found in many places.

On the western slope of the main axis of the South Island all but the lower series of beds included in this formation occur in disconnected areas from Collingwood to Jackson Bay, being in every case associated with coal; and at the Buller and Grey the well-established coal-mines are in seams that belong to this period.

At Preservation Inlet some divisions of the formation are found, as also at the Nightcaps; on the Maitara; at Kaitangata and Green Island—in every case associated with coal; while from Shag Point up to the Waitaki River they have a further development.

Several other patches occur going northward along the East Coast, and, as a rule, coal-seams occur at their base until reaching the Malvern Hills; but north of this point, as at the Amuri Bluff, they pass down conformably into the next-described formation.

The Island Sandstone, with its characteristic fossils, underlies and is associated with the older gold-drifts that occupy the interior plains of Otago, proving that these great valleys were excavated prior to the Cainozoic period.

VII. LOWER GREENSAND.

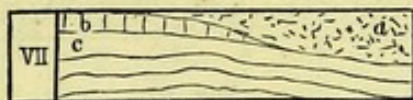


Fig. 25.

a. Buller series. b. Porphyry breccia series. c. Amuri series.

The Buller series has already been mentioned as consisting of heavy conglomerates and sandstones, with coal-seams. The porphyry breccia series consists of local developments of the igneous rocks, acidic and basic, belonging to this period.

The Amuri series consists of green and grey incoherent sandstones, with hard concretions, and large masses of silicified wood.

This formation, which is confined to a few localities of limited extent, is very rich in fossils of the genera *Belemnites* and *Trigonia*, with a few saurian bones and teeth of large chimæroid fishes. Its typical development is at the Waipara and Amuri Bluff, but equivalent beds are also found on the east coast of the North Island in several localities, and they have a considerable development in the neighbourhood of East Cape, extending inland as far as Hikurangi.

The Lower Greensand is almost everywhere succeeded by a development of the Waipara formation, and the two may be considered as having their maximum development in the lower part of the Middle Clarence Valley, where in the Coverham section there is not less than 12,000 feet of sedimentary beds.

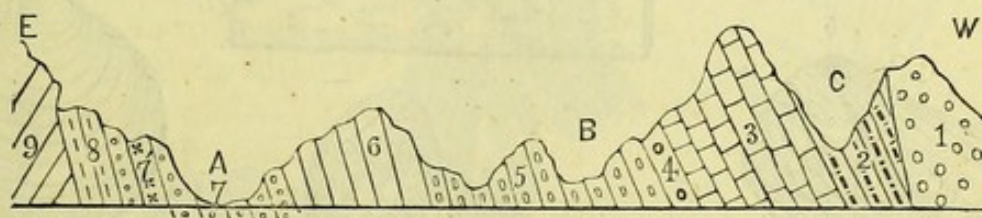


Fig. 26.

From the slopes of the Sawtooth Range north-west across the Coverham Chalk Range.

1. Post-miocene conglomerate. 2-5. Waipara formation. 6-8. Lower Greensand formation.

Higher up the Clarence Valley thick beds of tufa and solid floes of volcanic rocks interbed with the coal-bearing strata and partly with the marine rocks belonging to the Amuri group.

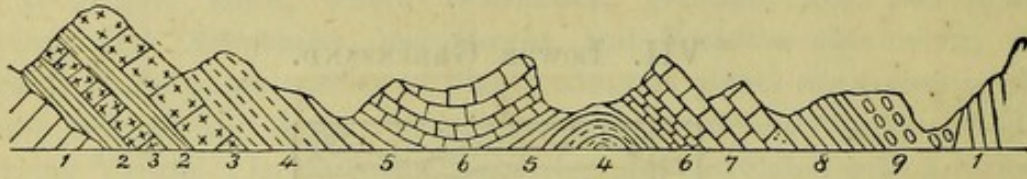


Fig. 27.

Section of left bank of Seymour River (Heron Creek), Middle Clarence Valley.
4-8. Waipara formation. 2. Coal beds, Lower Greensand. 3. Volcanic, Lower Greensand.

From this formation fossils have been most abundantly collected at the Amuri Bluff; but the same beds are fossiliferous on the coast-line farther north, and yield abundance of characteristic fossils where they are found in the Clarence Valley.

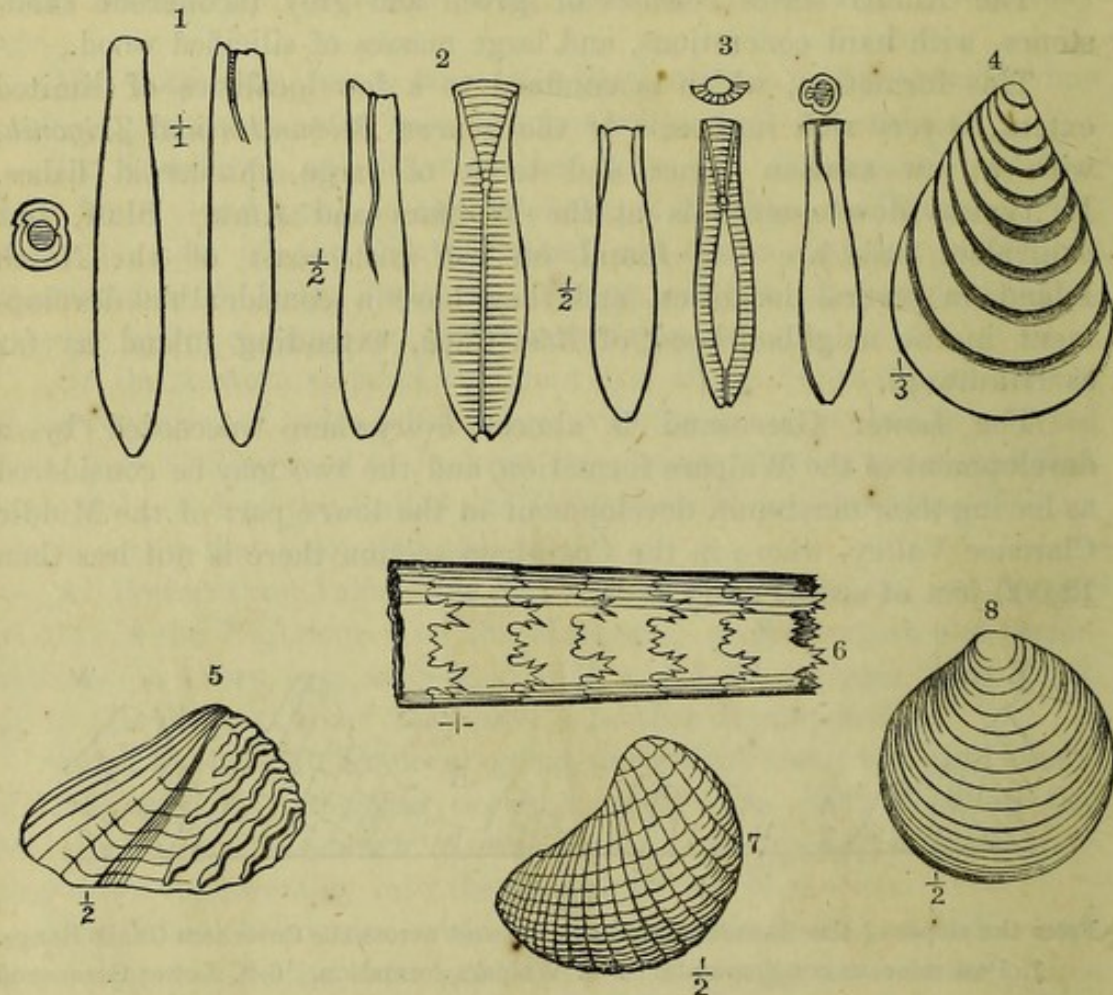


Fig. 28.

1. *Belemnites australis*, var. *a*. 2. *Belemnites australis*, var. *b*. 3. *Belemnites australis*, var. *d*. 4. *Inoceramus haastii*. 5. *Trigonia sulcata*. 6. *Baculites anceps*. 7. *Trigonia pseudo-cundata*. 8. *Lucina americana*.

VIII. JURASSIC.

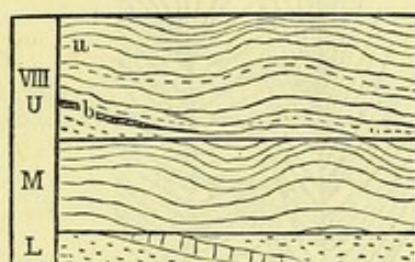


Fig. 29.

a. Mataura series. b. Putataka series. c. Flag Hill series.

These beds, which are the youngest of the Lower Secondary formation in New Zealand, require mention under their several subdivisions, although on the general map no distinction has been made between them.

The Mataura series consists largely of estuarine beds, marine fossils being absent or rare. It consists of dark-coloured marls and fine-grained sandstones, and contains the fossil remains of a number of plants, of which eight species have been recognized. Amongst these are *Camptopteris*, *Cycadites*, and *Echinostrobus*, which connect these with the plant-beds of the next lower formation. Those found at Waikawa and Mataura falls are especially interesting from at least one species, *Macrotæniopteris lata*, being identical with a plant found in the Rajmahal beds of India, which are considered to be of Liassic age.

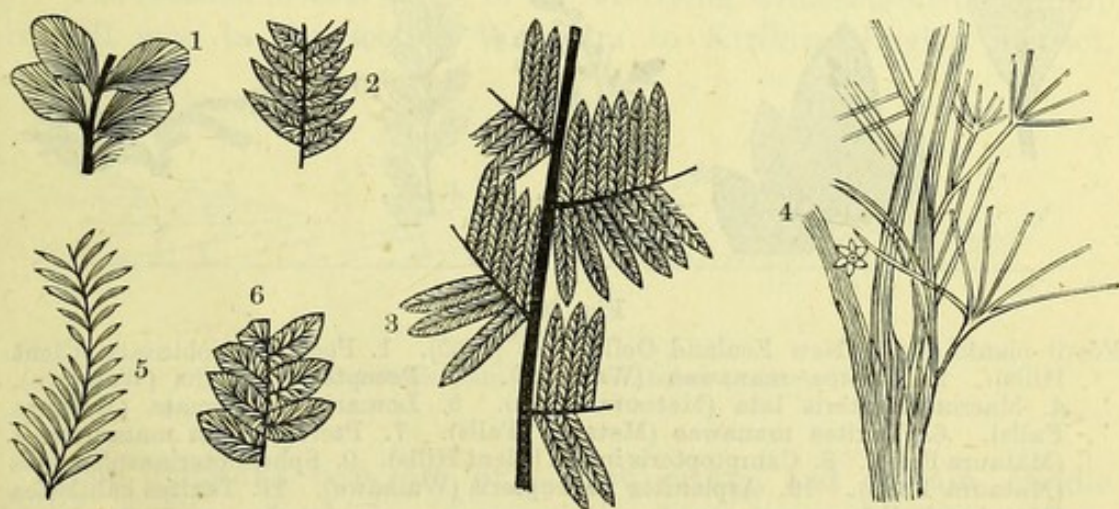


Fig. 30.

Fossil plants of the New Zealand Oolite (see p. 66). 1. *Asplenites rhomboides* (Clent Hills). 2. *Pecopteris acuta* (Clent Hills). 3. *Pecopteris linearis* (Clent Hills). 4. *Vetebraria novæ-zealandiæ* (Clent Hills). 5. *Taxites maitai* (Clent Hills). 6. *Pecopteris ovata* (Clent Hills).

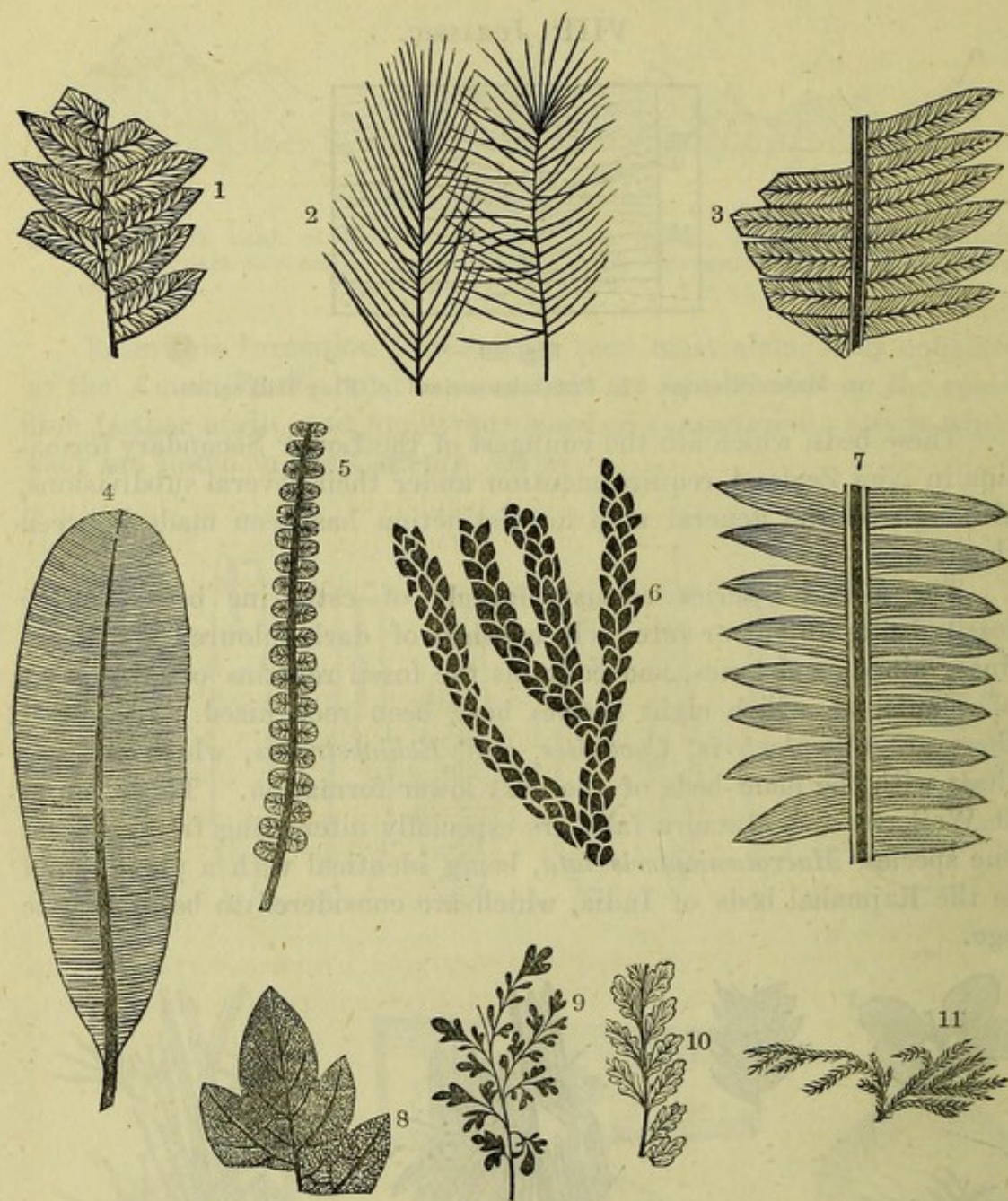


Fig. 30A.

Fossil plants of the New Zealand Oolite (see p. 65). 1. *Pecopteris obtusata* (Clent Hills). 2. *Taxites manawao* (Waikawa). 3. *Pecopteris grandis* (Waikawa). 4. *Macrotæniopteris lata* (Mataura Falls). 5. *Lomarites pectenata* (Mataura Falls). 6. *Taxites manawao* (Mataura Falls). 7. *Pterophyllum matauriensis* (Mataura Falls). 8. *Camptopteris incisa* (Clent Hills). 9. *Sphenopteris asplenoides* (Mataura Falls). 10. *Asplenites palæopteris* (Waikawa). 11. *Taxites kahikatea* (Mataura Falls).

The Mataura series shows its relationship to the other formations of the Lower Secondary sequence very clearly in the typical section.

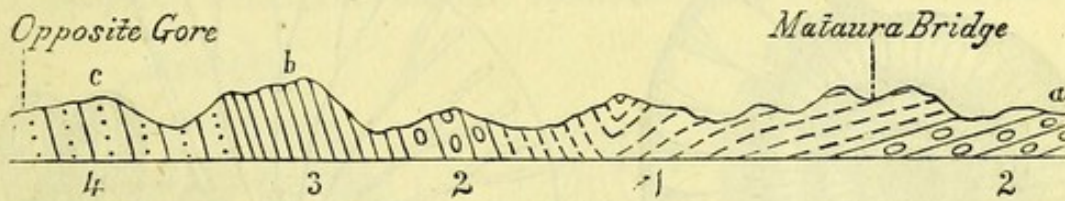


Fig. 31.

Section, Gore to Mātāura Falls, east bank of Mātāura River. 1. Mataura series. 2. Flag Hill series. 3. Bastion series, Otapiri series. 4. Wairoa series.

The Mataura series, overlying the Putataka series, closes the old secondary sequence at Kawhia, in the Auckland District, and the same plants are found in the Clent Hills plant-beds, and from the natural sections, and also from the very characteristic fossils immediately below them, there can be no doubt that they should be referred to the Upper Oolite period.

The Putataka series, which has its typical development at Waikato Heads as marlstones, is represented in southern districts by coarse-grained sandstones, which pass near the base of the formation into conglomerates with bands of indurated shale, enclosing plant-remains and irregular coal-seams, which have been included in the next group as its upper member.

The relation of this series to the overlying Cretaceo-tertiary group is well seen in the section Waingara to Kirikiri, Raglan district, Auckland.

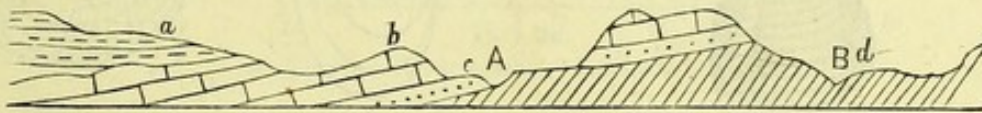


Fig. 32.

d. Putataka beds. a-c. Cretaceo-tertiary.

The Putataka beds are of marine origin, and contain Middle Oolite fossils, of which eleven species have been identified. The fossils figured are mainly from the Putataka beds exposed along the shores of Kawhia Harbour.

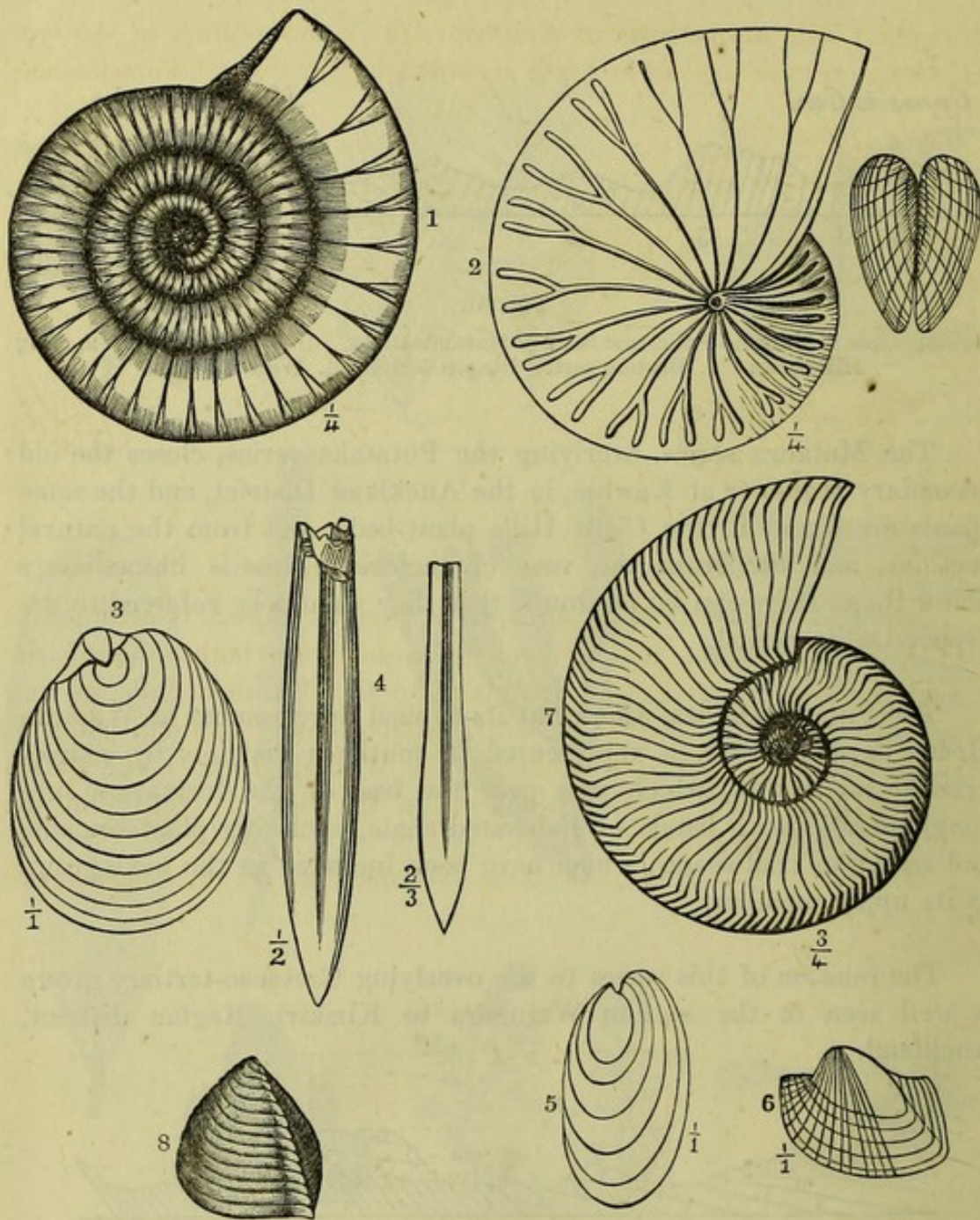


Fig. 33.

1. *Ammonites sisyphe*. 2. *Ammonites* (Kawhia). 3. *Aucella* (Kawhia). 4. *Belemnites aucklandica* (Kawhia). 5. *Aucella plicata* (Waikato Heads). 6. *Cucullæa*. 7. *Ammonites aucklandicus*. 8. *Trigonía costata*, var.

The Flag Hill series, which is principally developed in the Hokanui Range, Southland, is marine, and is characterized by eighteen forms of fossil shells which have been identified, besides many others which have yet to be examined.

The Brachiopoda are interesting, as, besides seven forms of *Rhynchonella* and three of *Terebratula*, *Spiriferina rostrata*, of the Lias, is

abundant, and also a form of *Epithyris* (i.e., a *Terebratula* of the type *T. elongata*), which is not hitherto recorded higher than of Permian age.

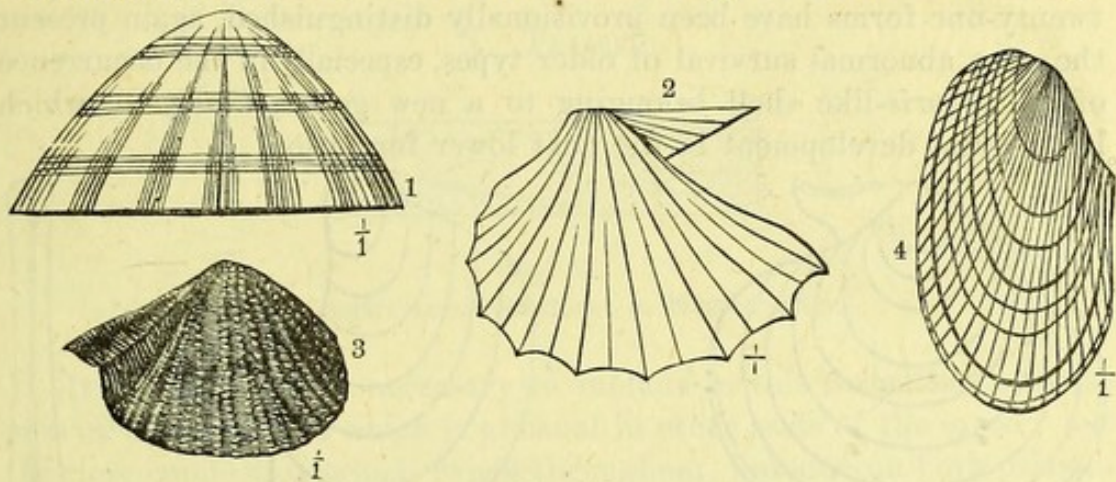


Fig. 34.

1. *Patella* (cast). 2. *Avicula cynipes*, var. 3. *Trigonina navis*, var. 4. *Pholadomya*, sp.

The distribution of these beds, as at present known, is confined to the Hokanui Ranges, and a block of country on both sides of the Waikawa River, and extending inland to the Mataura Falls, as well as a narrow strip on Catlin's River, in Southland; a small patch at Amuri Bluff; another at Kawhia and the Waikato Heads; and a strip of country running from Raukokore, in the Bay of Plenty, in the direction of Waikaremoana Lake.

The minor subdivisions of these beds have as yet only been made in the Hokanui Ranges.

IX. LIASSIC.



Fig. 35.

a. Catlin's River series. b. Bastion series.

This formation consists in its upper part of conglomerates and sandy grits, with plant-remains too indistinct for identification; and in the lower of marly sandstones in banded layers of different colours, at the base having a concretionary structure, which has led to their being termed the "cannon-ball sandstone." Similar sandstones also occur in the Otapiri formation.

Fossils are plentiful, and divide the strata into distinct horizons, ammonites being specially common. Fifteen species of fossils have been determined, but a large number of others are present which have not yet been identified.

The general facies of the fauna is on the whole Liassic, although many Lower Oolite forms occur; but the Brachiopoda, of which twenty-one forms have been provisionally distinguished, again present the same abnormal survival of older types, especially in the occurrence of an *Athyris*-like shell belonging to a new genus, *Clavigera*, which has a great development in the next lower formation.

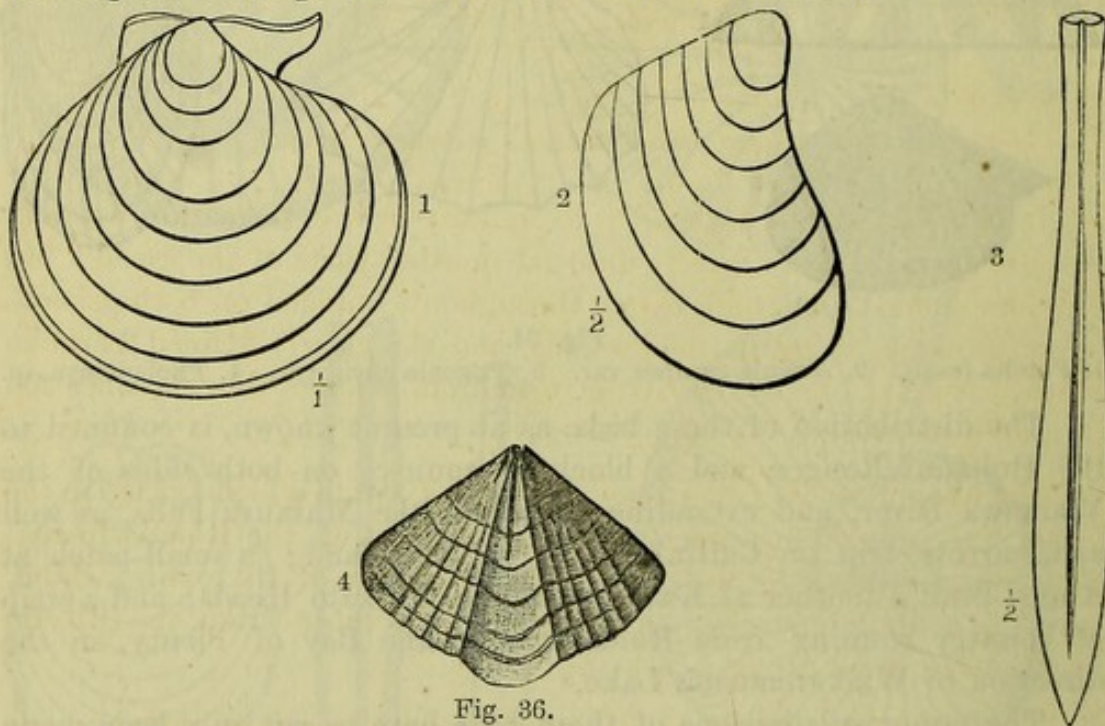


Fig. 36.

1. *Plagiostoma grandis*. 2. *Pholodomya tumida*. 3. *Belemnites catlinensis*. 4. *Spiriferina radiata*.

Our knowledge of this as a fossiliferous formation has until lately been confined to the Hokanui Range and the country between Gore and the sea-coast at the mouth of Catlin's River; but within the past two years it has been proved present at Kawhia and in the Raglan district, Auckland. When the Lower Mesozoic formations are examined in detail elsewhere, the Liassic strata will be found to have a much greater development than is at present ascribed to them. Though not yielding marine fossils, it has been shown that they are present in the Amuri district of the north-east part of the South Island, as shown in the woodcut below.

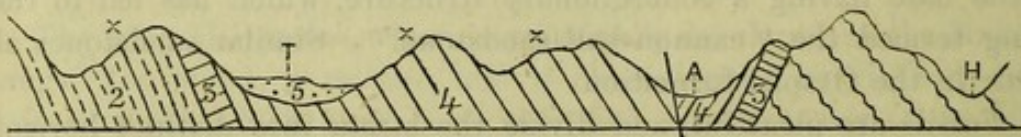


Fig. 37.

Section from mountains west of Tairāhema east across Alma Valley to Acheron River.
3. Trias (*Monotis* beds). 4. Upper Trias, Lias, &c.

X. TRIASSIC.



Fig. 38.

a. Otapiri series (Rhætic). b. Wairoa series.

It has been found necessary to include in this formation a thickness of marine strata which is unusual in other parts of the world; but the close connection which exists throughout, founded on both palæontological and stratigraphical grounds, and the clearly-defined Permian character of the next underlying formation, renders this classification absolutely necessary.

The Otapiri series consists of a group of strata which I place in the Upper Trias, or more properly as an equivalent of the Rhætic formation, and is remarkable for the mixed character of its fossils, which, however, contain many forms identical with those from the Rhætic formation of the European Alps.

This series constitutes an important group of strata in the northern part of the Canterbury Provincial District, the relation to the Middle Trias of the beds referred to it being as shown in the section below.

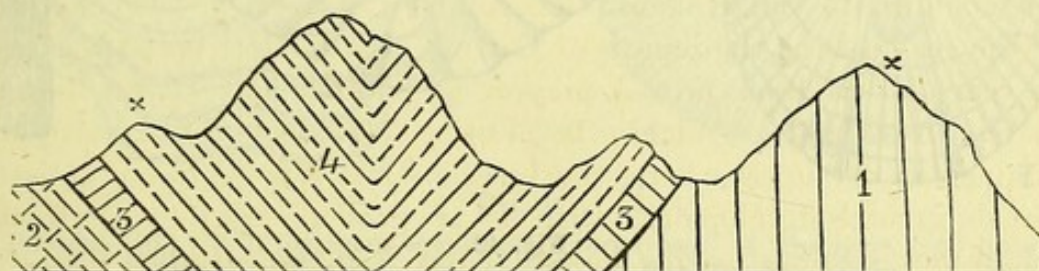


Fig. 39.

Section from Glentui Gorge across Mount Thomas Range, Ashley District, Canterbury.

2. Lower Trias. 3. Middle Trias (diabase, ash, &c., calcareous, with *Monotis*, &c.).

4. Upper Trias, Otapiri series (with *Trigonia*, fossil plants, &c.).

The mixed character of the fossils is shown by the presence of *Belemnites otapiriensis*, which is near to *B. elongatus* of the English Lias, along with *Pleurotomaria ornata* and *Tancredia truncata*, which are Oolite forms, associated with a preponderance of Triassic and even

Permian forms, fourteen species of which have been determined, amongst which are *Nautilus mesodiscus* and *Nautilus goniatites*, Cephalopoda found in the Hallstadt or Rhætic beds of Europe.

The remarkable feature of the Otapiri series is the abundance of Brachiopoda, which are elsewhere so rare in formations of this period; but, as might be expected, they are chiefly peculiar forms—*Clavigera*, which has seven species, representing the genus *Athyris*, and a sub-genus of *Spiriferina*, which I name *Rastelligera*, with five species, being almost entirely confined to this formation. Plant-remains also occur.

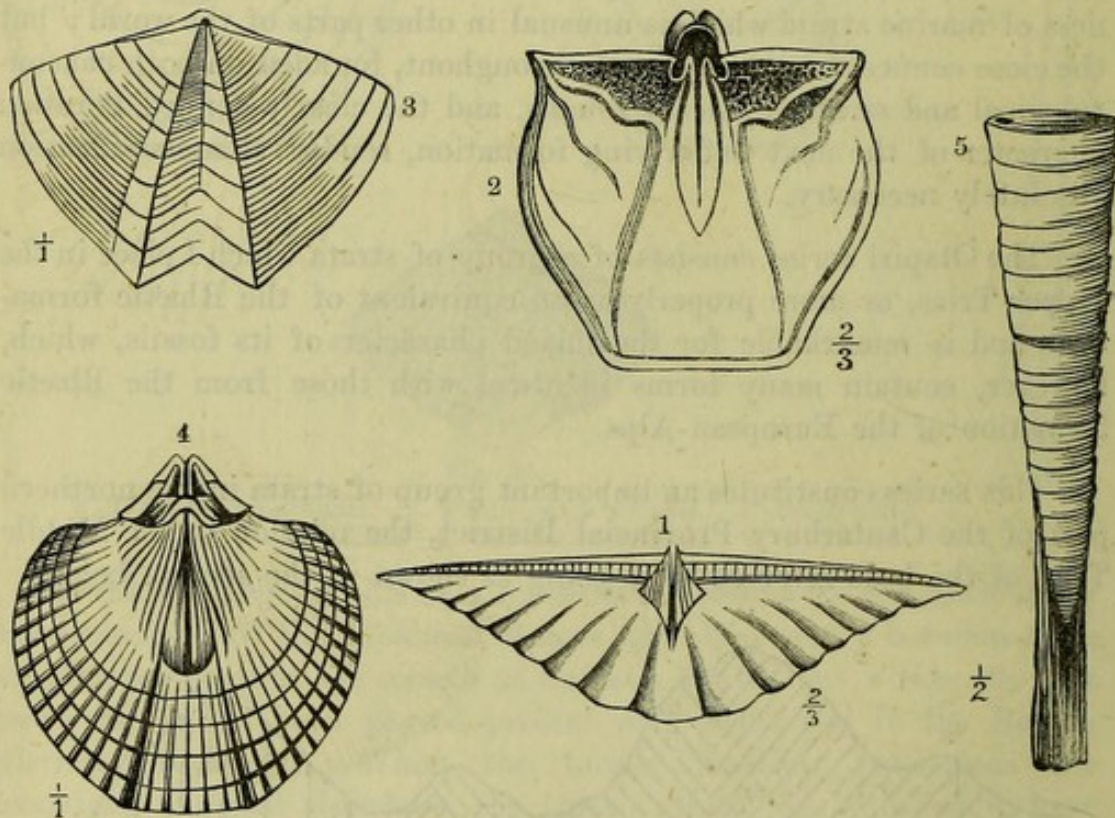


Fig. 40.

1. *Rastelligera*. 2. *Clavigera* (internal cast). 3. *Clavigera*. 4. *Spiriferina*.
5. *Belemnites otapiriensis*.

The Wairoa series has been generally admitted to be Trias since it was first described by Dr. von Hochstetter as characterized by *Monotis salinaria*, *Halobia lomelli*, &c. Eleven species have now been determined, and Brachiopoda are represented by the earliest appearance of *Clavigera*, *Rastelligera*, and a form allied to *Spiriferina*, but having the dental plates conjoined with the rostral septum (*Psioidea*).

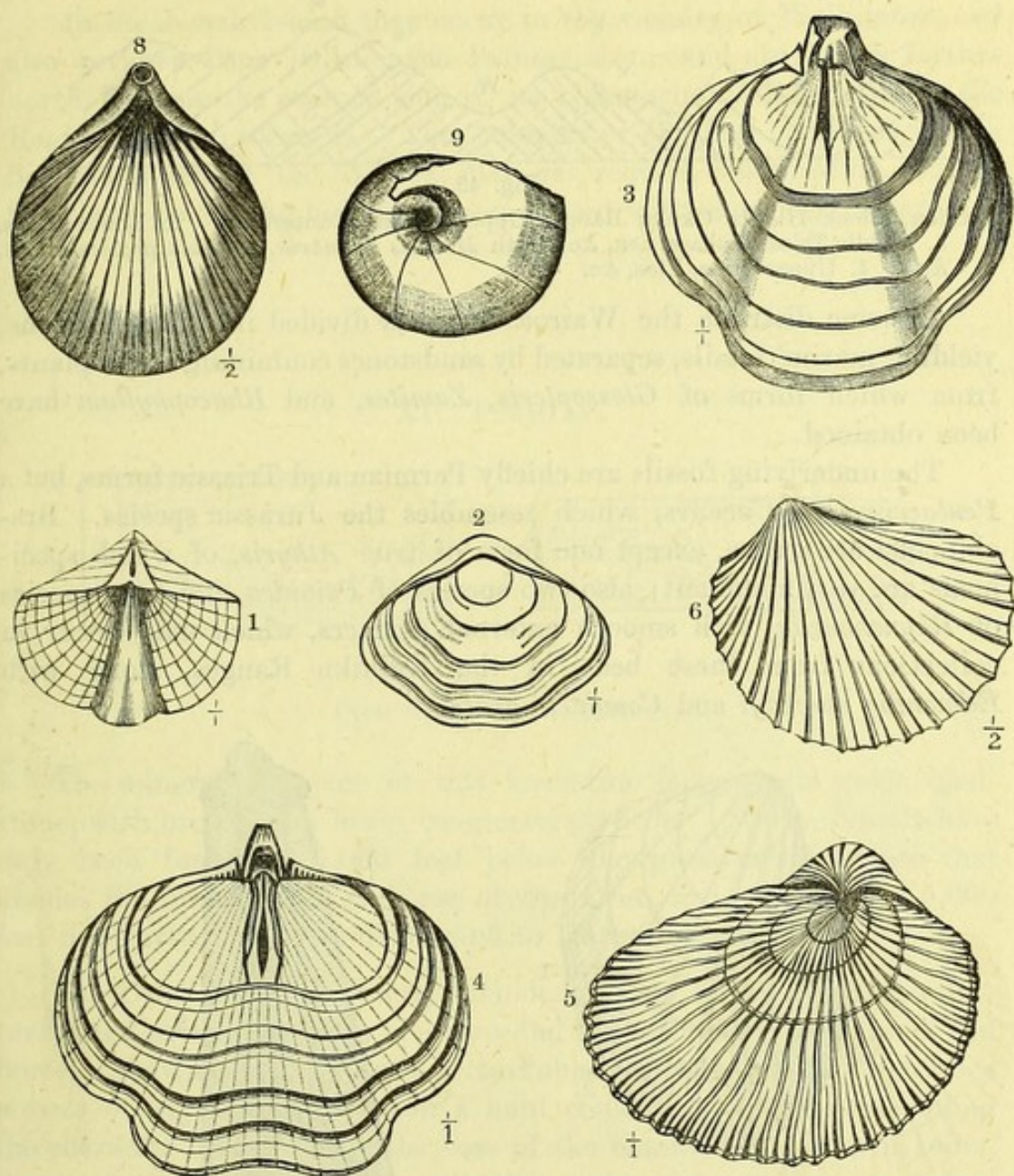


Fig. 41.

1. *Psioidea* (sp.). 2, 3. *Spirigera wreyii* and interior cast. 4. *Spirigera* (sp.) (interior cast). 5. *Monotis salinaria* (ventral valve). 6. *Monotis* (dorsal valve). 7. *Mytilus problematicus* (dorsal valve). 8. *Retzia* (sp.). 9. *Nautilus frieslibendi*.

In the typical district near Nelson, and in the Hokanui Hills, Southland, the presence and relationship of the Wairoa series is well understood; but there is not the same unanimity of opinion respecting the occurrence and stratigraphical importance of the beds in Northern Canterbury and Eastern Nelson. The section below is taken as showing the mode of occurrence and relation of the different divisions of the Trias within the Canterbury District.

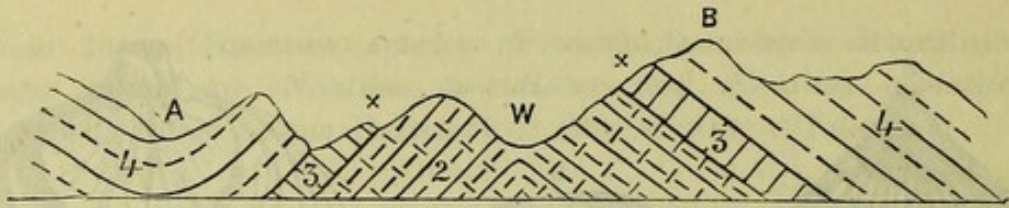


Fig. 42.

Section, Block Hill to Okuku Range, Upper Okuku, Canterbury. 2. Lower Trias.
3. Middle Trias (diabase, ash, &c., with *Monotis salinaria*, *Mytilus problematicus*,
&c.). 4. Upper Trias, Lias, &c.

In some districts the Wairoa series is divided into two horizons, yielding marine fossils, separated by sandstones containing fossil plants, from which forms of *Glossopteris*, *Zamites*, and *Rhacophyllum* have been obtained.

The underlying fossils are chiefly Permian and Triassic forms, but a *Pentacrinus* also occurs, which resembles the Jurassic species. Brachiopoda are scarce, except one form of true *Athyris*, of which specimens are very abundant; also two species of *Psioidea*, and four species of *Rhynchonella* with smooth external surfaces, which only occur in collections from these beds in the Kaihiku Ranges, along with *Edmondia mackayi* and *Conularia grata*.

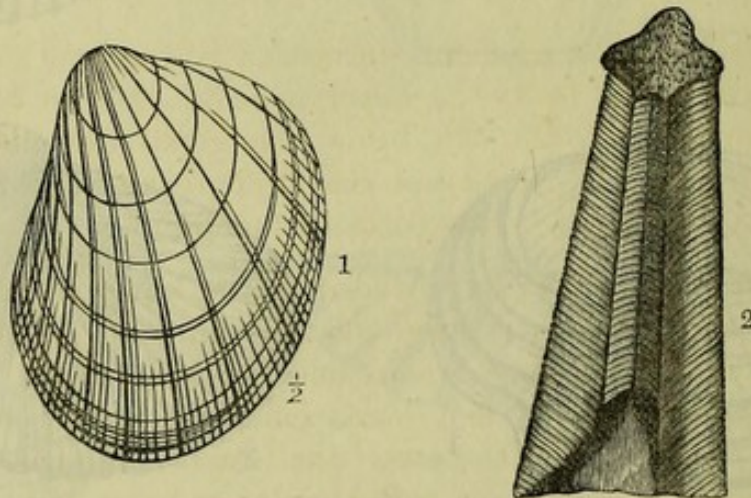


Fig. 43.

1. *Edmondia Mackayi*. 2. *Conularia grata*.

These Triassic beds are best known in the Moonlight and Hokanui Ranges in Southland, and extending as a narrow strip to the sea-coast at Nugget Point. They also occur at the Wairoa Gorge, in Nelson, where they were first discovered by Dr. von Hochstetter; but they are also found in the Jollie Range, at the head-waters of the Rakaia and Rangitata Rivers; bounding the Hanmer Plains and forming the Lowry Peaks; and also at the mouth of the Dillon River, and at the gorge of the Ashley, where the limestones are highly fossiliferous.

In the North Island they occur in the vicinity of Wellington, and also between Cape Palliser and Palliser Bay; and are found, farther north, flanking the western side of the Hakatarimata Range, where the Raglan track crosses it. The boundaries of these beds, except in Southland and at the Wairoa, may yet require modification, but in the above places the beds have been traced with considerable care.

XI. PERMIAN.

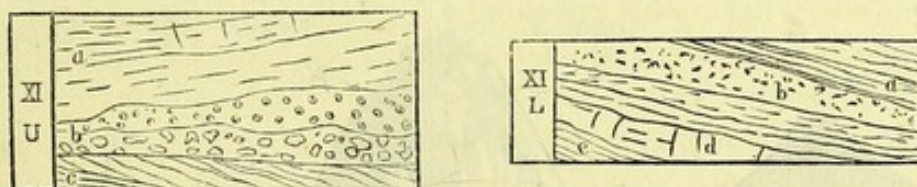


Fig. 44.

U. Oreti series. L. Kaihiku series.

The mineral character of this formation is grey and green sandstone, with breccia and heavy conglomerate beds. Marine fossils have only been found at 1,000 feet below the great conglomerate that divides the formation at the base of the Oreti series, the lower 5,000 feet not having yet been discovered to be fossiliferous.

The Oreti series (formerly included in the Lower Wairoa series) includes a great formation of green and grey tuffaceous sandstones and breccias, having at its base a remarkable conglomerate of enormous masses of crystalline rocks, in a hard cementing matrix, resembling the character described for the base of the Gondwinda series in India. Some of the blocks, which are both angular and rounded, are 5 feet in diameter. This conglomerate has a thickness varying from 50 feet to 400 feet, and is never absent from its proper sectional position in any part of the Hokanui district. These strata have been sometimes termed "ash-beds" on account of their tuffaceous and brecciated character.

The leading fossils are Permian species, of which a large number have been recognized; and the greater number which have been found in Southland also occur at Mount Potts in Canterbury, and also in Nelson, where beds of the same age are present. *Trigonotreta undulata* is a common and characteristic form.

Saurian remains are associated with these beds at Mount Potts, which in 1871 I referred to *Ichthyosaurus*.

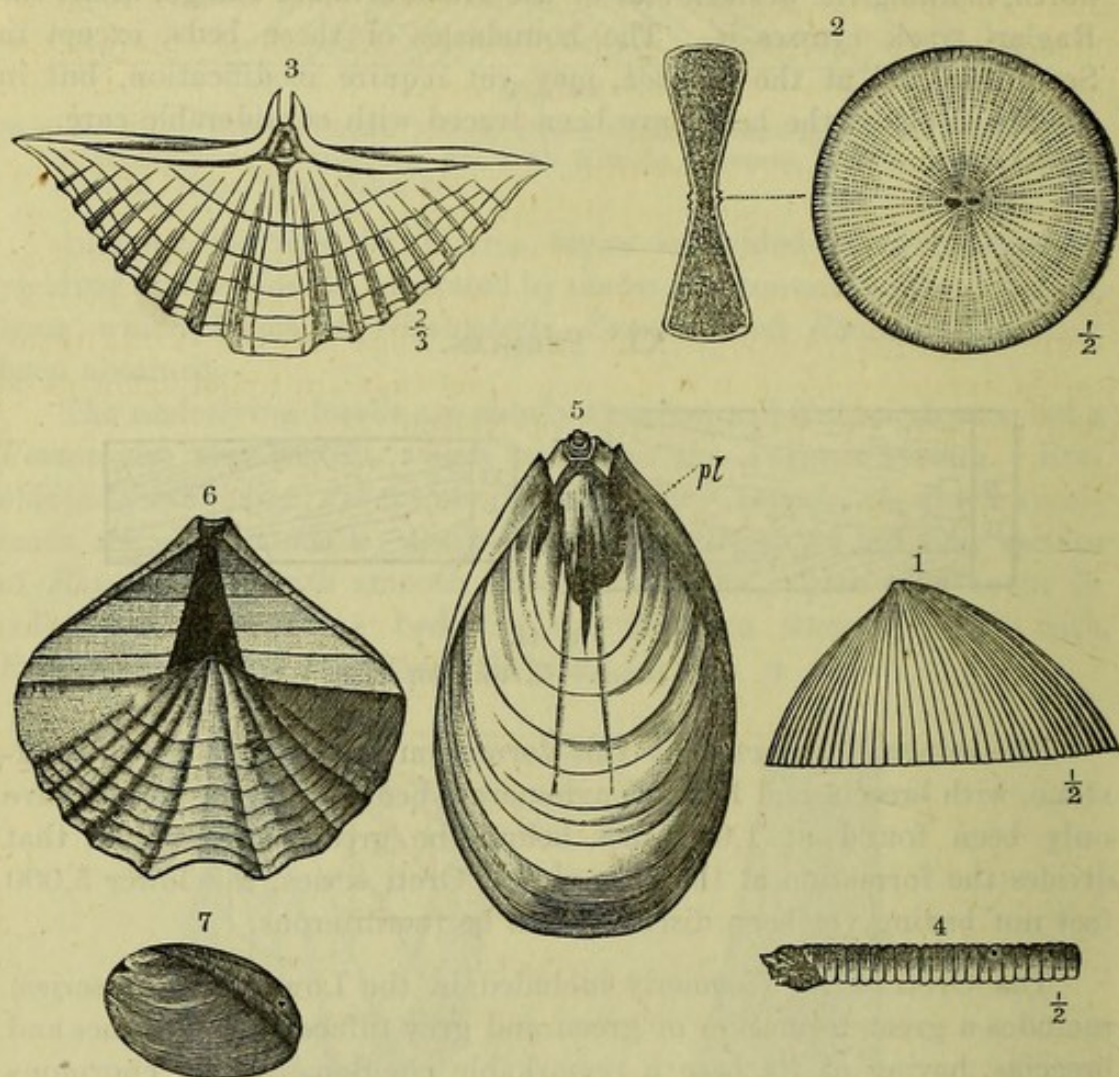


Fig. 45.

1. Patella. 2. Ichthyosaurus (vertebra). 3. Trigonotreta undulata. 4. Epithyrus elongatus. 5. Encrinite stem. 6. Spiriferina (cristata?). 7. Pleurophorus costatus.

It is worthy of note that from a formation of the same age, near Nugget Point, Otago, and also in the Otapiri series in the Wairoa district, Nelson, teeth having *Labyrinthodont* characters have been obtained.

The occurrence of these saurian remains, together with the survival of many Permian forms into the Wairoa and even the Otapiri series, and the absence of true *Spirifera*, *Productus*, and other usual Palæozoic elements of a Permian fauna, would seem to connect the Kaihiku series rather with the Mesozoic than the Palæozoic formations of New Zealand.

At the base of the Kaihiku series are the *Glossopteris* beds of Mount Potts; but these were not found in the Hokanui section, although from the thickness of the strata the relative beds must be included in it; while in the Kaihiku district *Glossopteris* occurs in the lower beds as developed in Popotunoa Gorge.

The distribution of these beds, so far as at present proved by fossils, is confined to the South Island, where they have been recognized in the Hokanui Ranges; extending from there to the coast at Nugget Point; in Mount Hamilton; and in the Mount Potts district, where they cover a considerable area, included between two belts of Carboniferous rocks in that district; and they are found again as a small patch in the Wairoa district of Nelson.

XII. CARBONIFEROUS.

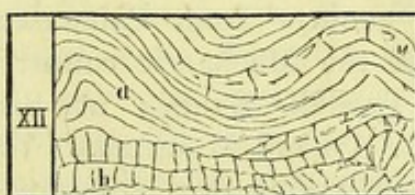


Fig. 46.

a. Maitai series. b. Limestone series.

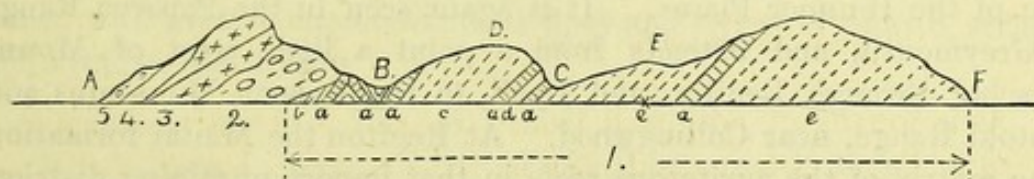


Fig. 47.

A. Taylor's Stream. B. North Ashburton. C. Pudding Hill Stream. D. Pudding Hill. E. Annelid tubes. F. Rakaia Terrace. a. Sandstone, with veins of quartz. b. Black, graphitic, earthy slates. c. Dark-coloured slates. d. Red and green slates. e. Dark-coloured slates. 2. Secondary strata. 3. Liparites. 4. Coal measures. 5. Liparite tufas and breccias.

This formation is of considerable importance from the large share it takes in the structure of the great mountain-ranges, and from the occasionally great development in it of contemporaneous igneous

rocks, with which are associated metalliferous deposits. In its upper part this formation consists of fine-grained argillaceous slates (Maitai slates of Hochstetter), becoming calcareous and passing into true limestones at their base. These limestones, which close the Maitai series, contain the following Lower Carboniferous fossils: *Spirifera bisulcata*, *S. glaber*, *Productus brachythærus*, *Cyathophyllum*, and *Cyathocrinus*.

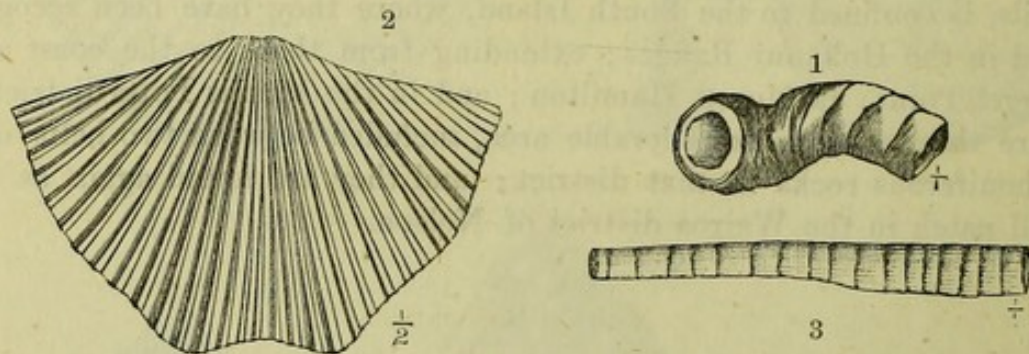


Fig. 48.

1. Tubicolar annelide. 2. *Spirifera bisulcata*. 3. Emericite.

In Northern Otago and Canterbury the Maitai formation makes a continuous belt of country from Palmerston to Mount Cook, embracing the whole of the Mackenzie country; from there north it is found in the Tyndall Range; at Browning's Pass; the Spencer Mountains; St. Arnaud Mountains; thence through Nelson to D'Urville Island; and, taking in a large area of the Marlborough District, it reappears from below the rocks in the Kaikoura Mountains. It is also found on the eastern side of the Permian rocks at Geraldine; Mount Peel; the Palmer Range; Big Ben Range; Okuku Range; crossing the Hurunui River, and appearing on the edge of the Hanmer Plains. It is again seen in the Paparoa Range at Greymouth, and extends from a point a little west of Mount Herschel, through Reefton and Lyell, to the Tasman Mountains and Anatoki Range, near Collingwood. At Reefton the Maitai formation is the matrix of the auriferous reefs in that important mining district, and is distinctly seen to rest unconformably upon richly-fossiliferous limestones and quartzites of Lower Devonian age. The auriferous cements which are worked at Reefton belong to the coal-bearing formation of the West Coast, which is of Cretaceous age.

In the North Island the principal development of this formation is through the Rimutaka, Tararua, Ruahine, and Kaimanawa Ranges, and thus on to the Whakatane country, where it reaches the sea-coast between Opotiki and Kotiki Point. It also occurs as several isolated patches

more to the westward, between Tuhua and Rangitoto; in the Haka-rimata, Pataroa, and Wairoa Ranges; in the gorge of the Waikato above Cambridge; again at the Thames and Cape Colville Peninsula; and, appearing once more at Whangarei, extends from there along the coast-line to the Bay of Islands, also appearing in the same district as several isolated patches.

XIII. DEVONIAN.

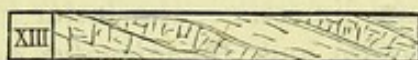


Fig. 49.

a. Te Anau and Reefton series.

Immediately underlying the Lower Carboniferous limestones of the Maitai series in the typical locality are the rocks of the Dun Mountain mineral belt, with respect to which there may be a doubt as to whether they should be placed with the Maitai or the Te Anau series, and so be regarded as of Devonian age. As, however, the rocks of the mineral belt pass downwards into rocks that are undoubtedly referable to the Te Anau series, and with which they are closely related stratigraphically, and much more in their mineralogical characters, it is not doubted that they find their proper position as here placed.

The Te Anau series in its typical locality comprises an enormous thickness of greenstone breccias, aphanite slates, and diorite sandstones, with great contemporaneous flocs and dykes of diorite, serpentine, syenite, and felsite.

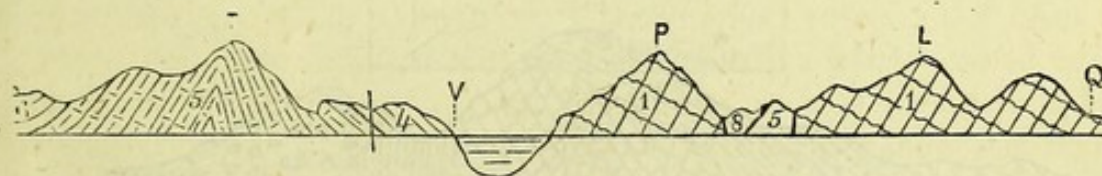


Fig. 50.

Across Wakatipu Lake. 1-3. Schists. 5. Te Anau series. 6. Maitai series.
8. Cretaceo-tertiary (in fault-line).

The beds occur in the Longwood Range, the Takitino Mountains, and between the mouth of the Molyneux River and Martin's Bay, occupying the area between Te Anau and Lake Wakatipu.

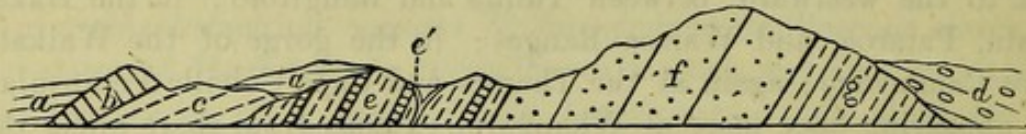


Fig. 51.

Longwood Range. *a.* Pliocene clays, with marine fossils. *b.* Vesicular basalts of Mount Pleasant. *c.* Sandstone. *d.* Coal and oil-shale beds at Orepuke, overlaid. Te Anau series.—(*e.*) Greenstone slates and breccia, auriferous quartz-veins; (*f.*) Syenites; (*g.*) Siliceous slates.

At Reefton beds of Lower Devonian age occur; but these are of a different character from the Te Anau series, and consist of alternating beds of quartz, chert, and limestone, the latter yielding many fossils, of which *Spirifera vespertilio* and *Homalonotus expansus* are the most characteristic forms; also *Avicula*, *Orthis*, and *Strophomena*.

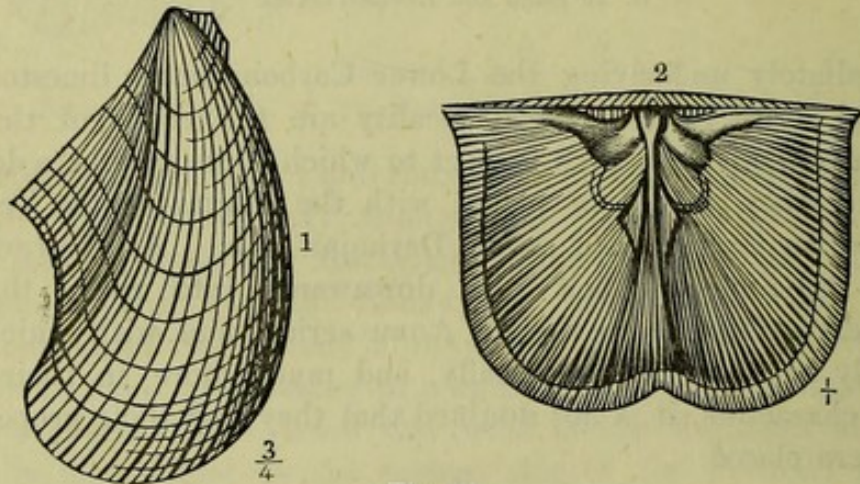


Fig. 52.

1. *Avicula*. 2. *Strophomena*.

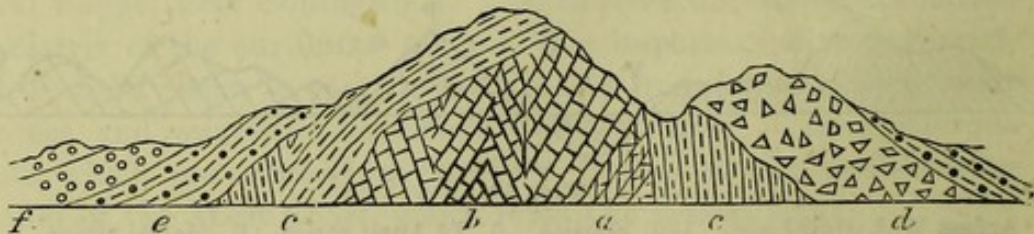


Fig. 53.

North beach of Inangahua. *a.*, *b.* Reefton series, Lower Devonian. *c.* Maitai (auriferous slates), Lower Carboniferous. *d.*, *e.*, *f.* Cretaceous-tertiary.

XIV. UPPER SILURIAN.



Fig. 54.

a. Baton River series. b. Limestones. c. Serpentine.

A great part of the area coloured on the map as metamorphic schists should probably be included in this formation, but it has only been distinguished by its fossil contents in the north-west district of Nelson, where both Upper and Lower Silurian rocks are present.

The Upper Silurian rocks consist of grey cherts, sandstones, and calcareous slates, with occasional beds of blue limestone.

In the Baton River they contain a great variety of fossils in the calcareous strata, and not infrequently in the sandstones and cherts, of which thirteen species have been determined, besides which a great variety of corals and corallines occur; crinoids also are very abundant.

Some few of the species are identical with those found in the Lower Devonian beds of Reefton, whilst others occur in the Lower Silurian rocks of America; but the prominent facies of the collections is undoubtedly Upper Silurian. The characteristic fossils are *Spirifera radiata*, *Stricklandia lyrata*, *Pterinea spinosa*, *Murchisonia terebralis*, and *Calymene blumenbachii*.

XV. LOWER SILURIAN.

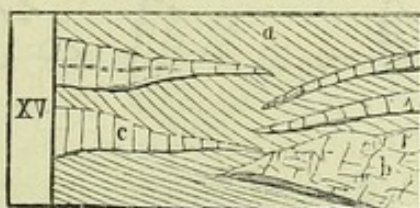


Fig. 55.

a. Aorere series. b. Marbles. c. Hornblende rock.

These rocks form the mass of Mount Arthur and the range to the north-east as far as Separation Point, and they consist chiefly of a dark bituminous slate, associated with a blue or grey sub-metamorphic limestone, which is in places developed to a very large extent. White crystalline limestones are also associated with these beds throughout the whole length of the district from Mount Owen to Motueka.

The whole series is disturbed by eruptive hornblendic and syenitic rocks, which are probably of Devonian age.

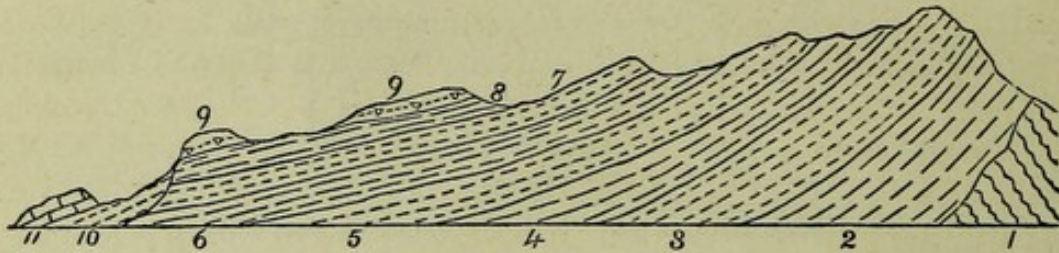


Fig. 56.

Aorere River, Collingwood to West Coast. Lower Silurian.—1. Metamorphic schists. 2. Blue slates. 3. Cherty sandstone. 4. Blue slates. 5. Cherty sandstone. 6. Dark-coloured slates. 7. Cherty sandstone. 8. Carbon slates (graptolites). 9. Cherty sandstone breccia (Cretaceo-tertiary). 10. Calcareous sandstones. 11. Limestone.

As proving the presence of Lower Silurian rocks, fossils have been found in two localities only, and these consist entirely of encrinuritic remains, one species of coral not yet determined, and a few graptolites, which occur in the slates.

The central axis of these beds consists of true mica schists, to the east and west of which the limestone and bituminous slates overlie.

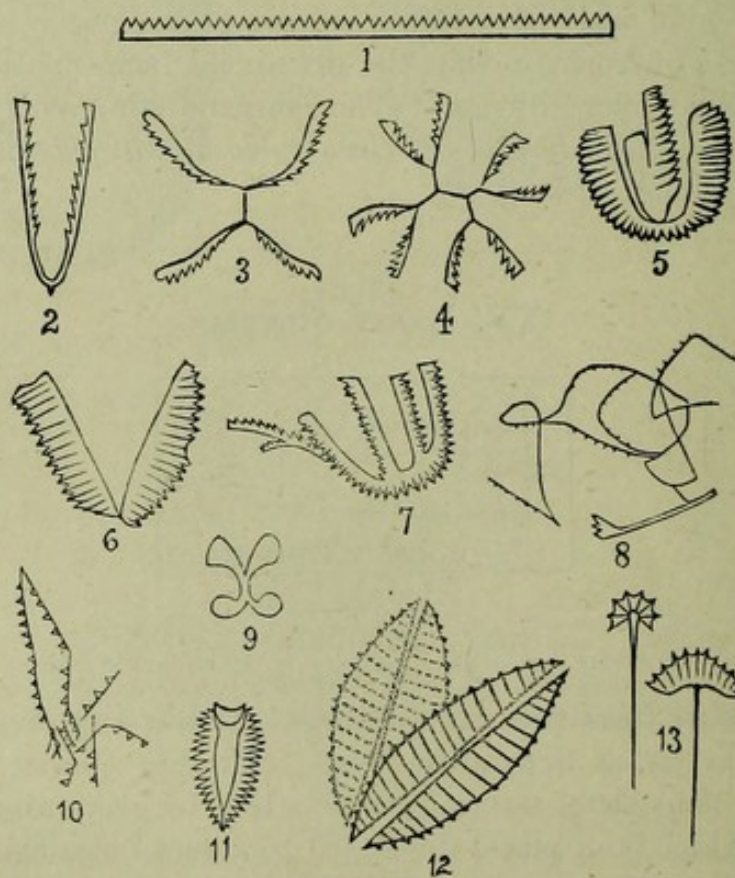


Fig. 57.

New Zealand graptolites, from the carbon slates, North-west Nelson District.

XVI. FOLIATED SCHISTS.

The metamorphic rocks under this division have as yet been only subdivided according to their mineral character; but they probably consist chiefly of altered Silurian rocks, and even those of formations as young as the Maitai or Lower Carboniferous beds. The less metamorphosed areas of Lower Palæozoic rocks in the south of New Zealand have yielded no fossils. They were formerly classed as the Kaihiku series, but this name has latterly been transferred to the Permian formation, of which the Kaihiku Range is more largely composed.

The schists occupy the central portion of the Otago District, where they have an area of nearly 8,000 square miles, and thence they crop out along the western flank of the central range through Westland and Nelson, a detached area also appearing in the Marlborough District, between Queen Charlotte Sound and the Pelorus. They are unknown in the North Island.

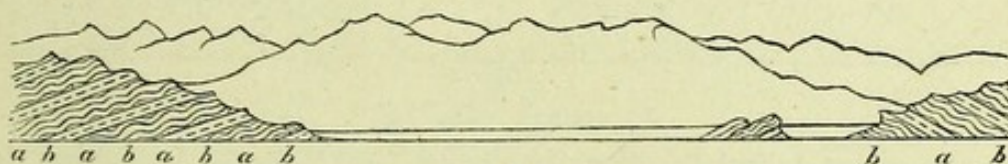


Fig. 58.

Moa Flat to Tapanui Mountains. *a*. Highly-contorted mica-schists, with interfoliated quartz, interbedded with *b*, Flaggy schists, without contortions, and with only small veins of quartz.

They have been subdivided as follows:—

Upper.—A grey arenaceous and slaty rock, containing a little quartz in the form of veins and laminæ, with fine-grained quartz breccias and roofing slates, and having massive beds of crystalline limestone locally developed.

Middle.—Soft blue slates, often highly micaceous, and intersected with quartz-veins of small size, the quartz being often rotten and decomposed. The thickness of this formation is not more than from 500 to 1,000 feet, and it is probably from this formation that most of the gold in the western or lake goldfields has been derived, by the direct erosion of glaciers and mountain-torrents. This blue-slate formation has been removed by denudation from the greater part of the central anticline of Otago, only remaining in a few localities, that are difficult of detection on account of its soft and perishable nature.

Lower Contorted Schist.—This is a clay-schist, foliated, not with mica nor felspar, but with quartz. It is often chloritic, when veins of magnetite occur in it, and also crystals of that mineral disseminated through the mass; and in the upper part the quartz is nearly wanting.

The schists, apparently, lie very flat, and cover a great extent of country. The foliated quartz does not commence at a distinct horizon, but beds thus altered occur in the regular sequence of the strata, separated by quartzless rock. In the lower part of the series, however, as exposed in the deep valleys that cut right through the central district of Otago, the whole mass of schist is intersected by concretionary laminæ of quartz (generally of a bluish tinge and horny appearance) that conform to the planes of foliation as in mica-schist. Gold occurs segregated in the interspaces of this contorted schist; but it is rarely found *in situ*. Quartz-reefs are confined to the upper schists; but there are but few instances of any other than true fissure-reefs having been discovered—that is, reefs that cut the strata nearly vertically, and have a true “back” or wall independent of the foliation-planes, and filled with brecciated material.

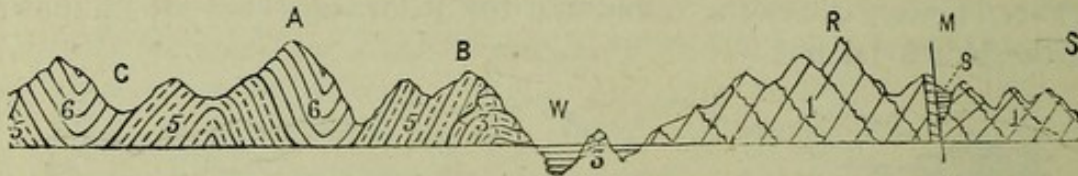


Fig. 59.

From west side of Livingstone Mountains across Lake Wakatipu to Shotover River. 1. Foliated schists. 3. Lake Harris schists. 5. Serpentine. 6. Te Anau series. 7. Maitai series. 8. Tertiary and Cretaceous rocks. A. Ailsa Mountains. B. Greenstone Spur. C. Greenstone Valley. M. Moonlight Gorge. R. Richardson Mountains. S. Shotover River. W. Lake Wakatipu.

XVII. CRYSTALLINE SCHISTS.

The south-western portion of the District of Otago is composed of crystalline rocks, forming lofty and rugged mountains, of which the chief characteristic is their cubical form, due to their being intersected in all directions by profound but narrow valleys, with abrupt precipitous sides to three-fourths of the extreme height of the adjacent mountains. The valleys are occupied on the west by arms of the sea, and on the east by those of inland lakes, that resemble the Norwegian fiords, and present most wonderful mountain scenery.



Fig. 60.

Coast north of Breaksea Sound. a. Basic rocks. b. Gneiss.

The base-rock of this formation is foliated and contorted gneiss, corresponding to Humboldt's gneiss-granite of South America, and associated with it are granite, syenite, and diorite, which belong to the next group.

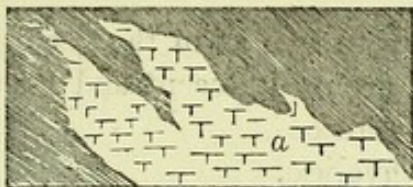


Fig. 61.

a. Eurite vein (metalliferous) invading basic rocks, Milford Sound.

Wrapping round these crystalline strata, and sometimes rising to an altitude of 5,000 feet on its surface, is a series of hornblende schists, soft micaceous and amphibolic gneiss, clay-slate, and quartzites, associated with felstone dykes, serpentine, and granular limestone. I believe these latter to be metamorphic rocks of not very ancient date—probably of Devonian age.

XVIII. GRANITE.

Areas within the crystalline schists where true granite occurs, either metamorphosed or in the form of perfect dykes, have been distinguished under this group.

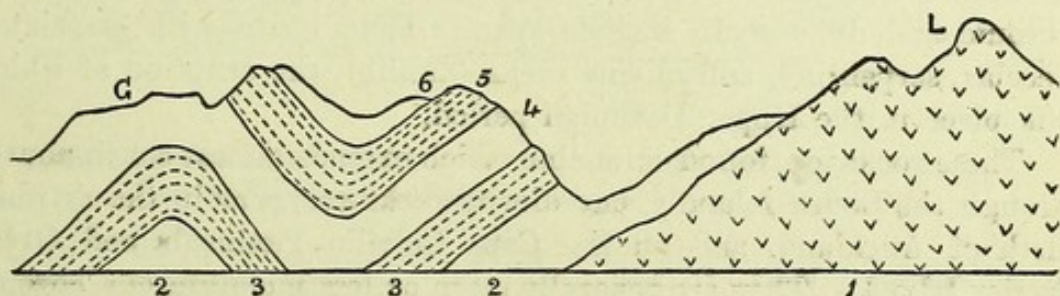


Fig. 62.

Lead Hill to Goulund Downs. 1. Granite. 2. Blue slates, with graptolites. 3. Cherty sandstone. 4. Blue siliceous slates. 5. Cherty sandstone. 6. Blue slates. L. Lead Hill. G. Goulund Downs.

Granites of pre-Silurian age, of a light-grey colour and very fine grain, are found in the Nelson and Westland districts, forming isolated hills along the boundary of the foliated schists on the east and Lower Devonian beds on the west. In the south-western extremity of New Zealand, at Preservation Inlet, coarsely-crystalline granites, of white and flesh-colour, appear to break through and overlie the younger members of the crystalline schists.

Igneous Rocks.

XIX. PLUTONIC AND DYKE ROCKS.

XX. BASIC VOLCANIC ROCKS.

XXI. ACIDIC VOLCANIC ROCKS.

Or, if grouped according to age, as in the geological sections,—

A. Volcanic group. Recent and Post-tertiary.

a. Basaltic.

b. Rhyolitic.

B. Trachytic group. Eocene.

a. Trachyte-porphyrries.

b. Trachyte-breccias.

C. Dolerite group. Upper Cretaceous.

a. Trachy-dolerites.

b. Anamesites.

D. Propylite group. Lower Cretaceous.

E. Diabase group. Triassic.

F. Diorite group. Lower Carboniferous.

The igneous rocks have played an important part in almost every formation in New Zealand, marking great movements of the earth's crust at the different geological periods, while the superficial and later-formed volcanic rocks occupy nearly one-third of the area of the North Island.

They are divided on the map into the above groups, of which the plutonic and dyke rocks include syenite and diorite, with associated breccias, serpentine, and olivine rocks (dunite), the eruption of which took place in the Upper Devonian period.

These rocks are found on a line which extends almost continuously through the South Island; but diorite rocks reappear in the extreme north of Auckland, and on the Cape Colville Peninsula and Great Barrier Island. They are generally more or less metalliferous, chrome and copper being the ores of most frequent occurrence.

Basic Volcanic Rocks.—These belong to three distinct periods, when there were active eruptions, attended by the formation of flöes of both compact igneous rocks and tufaceous breccias.

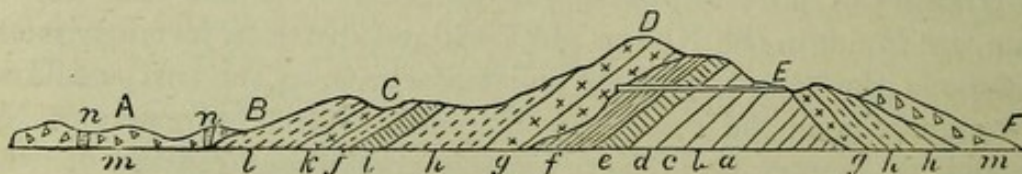


Fig. 63.

Beeson's Island, Kennedy's Bay. *a-f.* Palæozoic. *g-k.* Basic porphyry and tufas (propylite). *m, n.* Dolerites and breccias.

The earliest of these occurred during the Triassic period, and consists chiefly of diabase and serpentinous breccias. The next eruptions took place about the close of the Jurassic period, along the eastern base of the Canterbury Alps, where the rocks occur in dome-shaped mountains as melaphyres associated with felsite (quartz) porphyries, which belong to the next group.

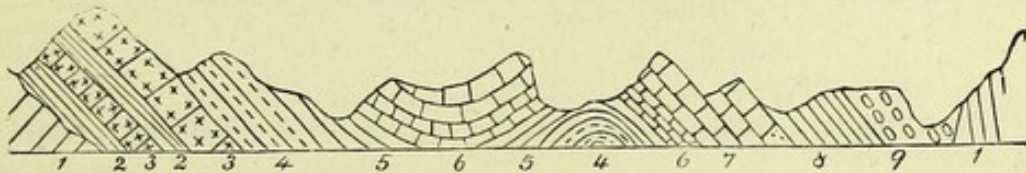


Fig. 64.

Left bank of Seymour River. 1. Palæozoic. 2-8. Waipara formation. 9. Interbedded basalts.

In the Cretaceo-tertiary period are massive trappean eruptions of trachy-dolerite and dolerite, which are clearly interbedded with the coal-beds at the base of the Waipara series; while in the same period must be placed the propylite group, consisting of greenstone trachytes and fine- and coarse-grained breccia rocks, which form the matrix of the auriferous reefs of the Thames Goldfields.

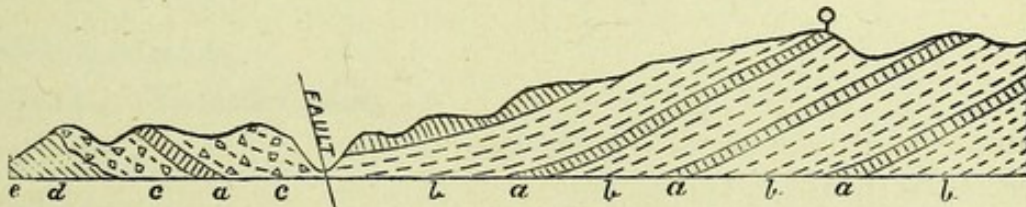


Fig. 65.

Section of Te Aroha Mountain. a. Bands of diorite, porphyry, or propylite. b. Decomposed tufas and sandstones. c. Breccia. d. Palæozoic.

In Eocene times dolerite flöes were contemporaneous with the limestones of the period of the Hutchinson's Quarry beds; while lastly in this group have been placed the basaltic lavas of Pliocene age in the northern parts of the colony, and also certain dykes of vesicular lava that cut through and alter the Upper Pliocene gold-drifts in the Maniototo Plain, in the interior of Otago.

Acidic Volcanic Rocks.—The rocks belonging to this group have a similar distribution in time to the foregoing, the earliest being the felsite (quartz) porphyries, while trachyte porphyries and breccias played an important part during Cretaceo-tertiary and older Tertiary periods, scoriaceous lavas and rhyolites being the characteristics of the later outbursts, which have continued down almost to the present time.

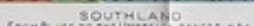
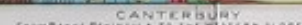
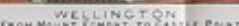
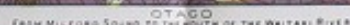
The geysers and boiling springs in the North Island give rise to the formation of siliceous sinter, which must be included as the most purely acidic products of volcanic action, and as due to the decomposition of the older rocks by the action upon them of fresh water ; but in the case of White Island, and other localities where the decomposition is brought about by the agency of sea-water, the sinter deposits are formed chiefly of sulphate of lime, and not silica.

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SKETCH MAP OF THE GEOLOGY OF NEW ZEALAND

BY
JAMES HECTOR CMG MGRS
1885.

EXPLANATORY SECTIONS.

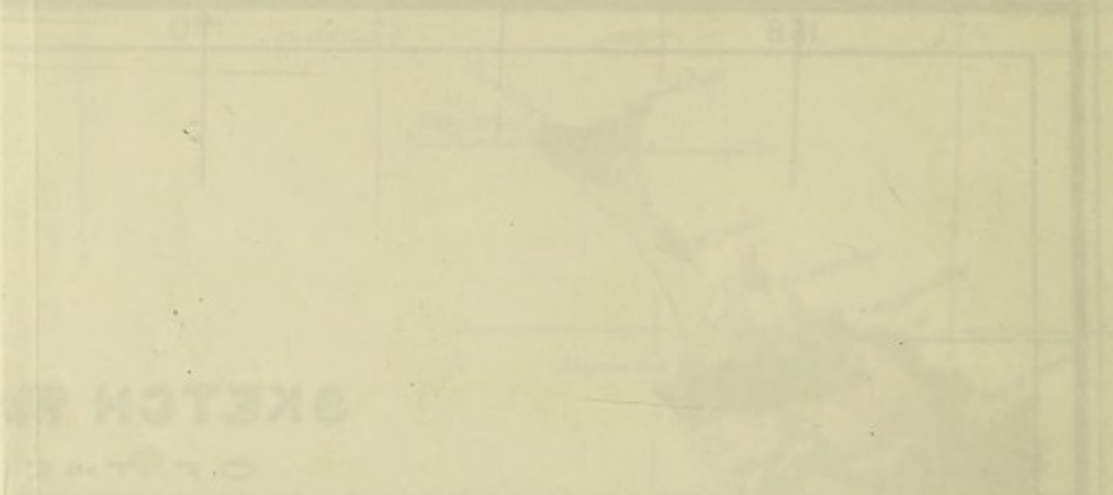


NORTH ISLAND

SOUTH ISLAND

REFERENCE TO MAP AND SECTIONS

- Post-Tertiary
Pliocene
- Upper Miocene
Lower Miocene
Upper Eocene
- Oolite-tertiary
Lower Greensand & Chert areas
- Tertiary
Eocene
Rhaetic & Trias
Permian
- Lower Carboniferous, Upper Devonian
Lower Devonian
Upper Silurian
Lower Silurian
- Filicited Schists
- Granite, Crystalline Schists
- Basic Volcanic rocks
Serpentine
- Acidic Volcanic rocks
- Coal outcrops
- Gold workings
- Auriferous rocks
- Copper & other ores

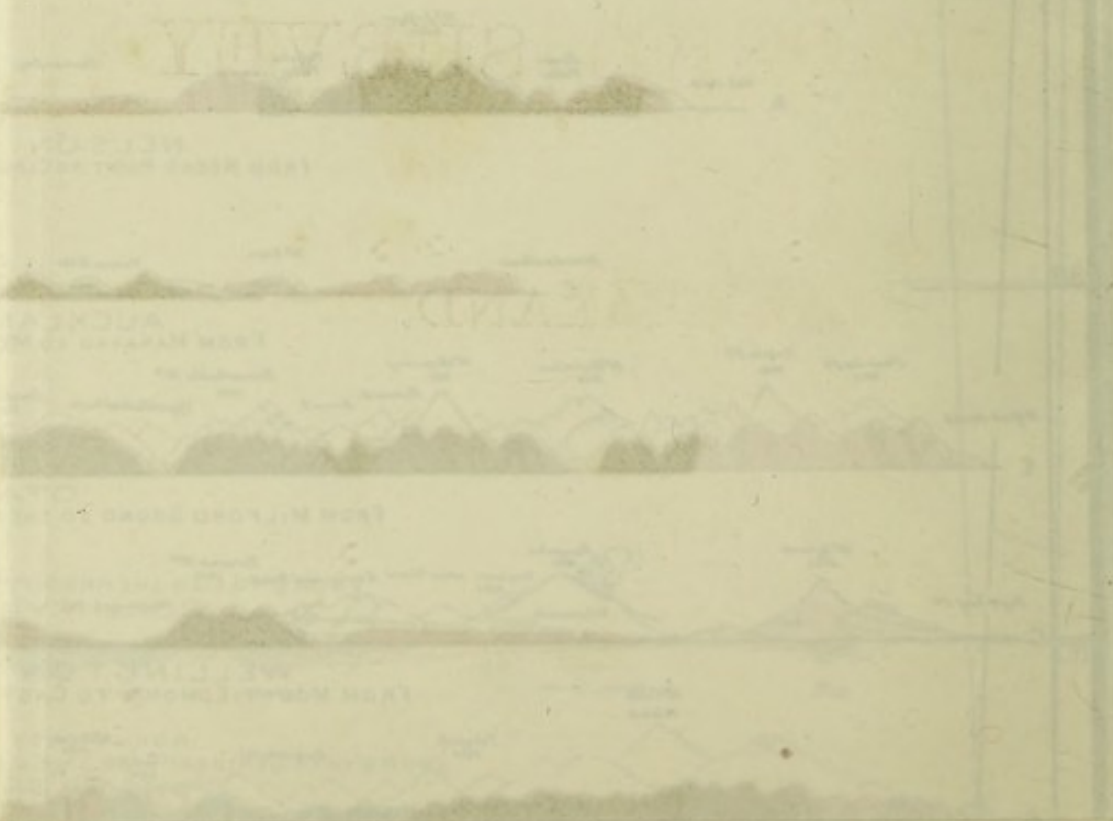


GEOLOGY OF THE

BY
JAMES HECTOR C.M.G.
1881

SOUTH ISLAND

EXPLANATORY



APPENDIX
TO
GENERAL INDEX TO REPORTS
AND
LIST OF PUBLICATIONS
OF THE
GEOLOGICAL SURVEY
OF
NEW ZEALAND.

APPENDIX

GENERAL INDEX TO REPORTS

LIST OF PUBLICATIONS

GEOLOGICAL SURVEY

IN

NEW ZEALAND

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Skey	W. Skey, Analyst, Geological Survey.
Ulrich	Professor G. H. F. Ulrich, F.G.S., &c.

INDEX.

A.

- ALPS, Central Portion of, Haast, 1870-71, p. 19.
 Amuri and Ashley Counties, McKay, 1879-80, p. 83.
 " Bluff. *See* Kaikoura.
 " District, Haast, 1870-71, p. 25.
 Aniseed Valley Copper Company's Mine, Cox, 1881, p. 10, 12.
 Antimony Lode and Quartz Reef, Langdon's Hill, McKay, 1882, p. 83.
 " Lodes of Carrick Ranges, McKay, 1882, p. 80.
 " " at Reefton, McKay, 1882, p. 88.
 " Mine at Hindon, Rowe, 1879-80, p. 153.
 " " Queen Charlotte Sound, Cox, 1874-76, p. 2.
 " " Stony Creek, Rowe, 1879-80, p. 155.
 Aorere River, Cox, 1883-84, p. 67.
 " and Takaka Valleys, District between, Cox, 1881, p. 42.
 Ashley and Amuri Counties. *See* Amuri.
 Auckland District, Certain Points connected with Geology of, Cox, 1881, p. 92.
 Auckland and Mahurangi, Coast between, McKay, 1883-84, p. 101.

B.

- BATON River, Wangapeka Districts, and Mount Arthur Range, McKay, 1878-79, p. 121.
 Big River and Collingwood. *See* Collingwood.
 Buller. *See* Maruia.
 Buller and Weka Pass Districts, McKay, 1874-76, p. 36.

C.

- CAPE Campbell District, McKay, 1874-76, p. 185.
 Cape Colville District, Hector, 1870-71, p. 88.
 " Peninsula, Gold Fields of. *See* Gold.
 " Kidnappers to Cape Turnagain, McKay, 1874-76, p. 43.
 " Turnagain. *See* Cape Kidnappers.
 Carrick Ranges. *See* Antimony.
 Caswell Sound Marble, McKay, 1881, p. 115.
 Chalk near Oxford, Ashley County, McKay, 1879-80, p. 49.
 Chrome Deposits of Nelson, Cox, 1881, pp. 3, 8.
 " Ores, Hector, 1881, p. 1.
 Clent Hills and Mount Somers Districts, Haast, 1873-74, p. 1.
 Coal—
 Ashburton District, Haast, 1871-72, p. 141.
 Auckland District, Denniston, 1876-77, p. 114.
 Brockley Mine and Surrounding District, Cox, 1882, p. 57.
 Buller Coal Fields, Cox, 1874-76, p. 17, 106.
 " " Detailed Notes, Denniston, 1874-76, p. 121.

Coal—*continued*.

- Clutha and Green Island, Hector, 1871-72, p. 165.
 Collingwood Company's Mine, Hutton, 1870-71, p. 157 ; Hector, 1871-72, p. 158.
 Comparative Value of Coals, Laird, 1876-77, p. 139.
 Coal Deposits of New Zealand, General Report on, Hector, 1866, 46 pp.
 Coals, General Report, Hector, 1871-72, p. 174.
 Drury Coal Field. *See* North Island District.
 Green Island. *See* Clutha.
 " " Collieries, Denniston, 1876-77, p. 143.
 Grey River. *See* Kanieri.
 Hart's Mine, Haast, 1883-84, p. 16.
 Jackson's Bay, Cox, 1874-76, p. 94.
 Kaitangata Mine, Hector, 1876-77, p. 140.
 Kanieri and Grey River Districts, Campbell, 1876-77, p. 31.
 Kawakawa, McKay, 1883-84, p. 95.
 Malvern Hills, Hector, 1871-72, p. 146.
 " Analysis, 1870-71, p. 54.
 Maramarua Creek, Waikato, Hutton, 1870-71, p. 1.
 Mines inspected, Cox, 1877-78, p. 160.
 Nelson, Western District of, Hector, 1871-72, p. 129.
 Northern Coal Fields, Hutton, 1871-72, p. 112.
 Otago Fields, Hector, 1876-77, p. 139.
 Shag Point, Haast, 1871-72, p. 148.
 Shakespeare Bay, McKay, 1874-76, p. 32 ; McKay, 1879-80, p. 147 ; McKay, 1881, p. 106.
 Springfield, Cox, 1883-84, p. 19.
 Wairarapa, Cox, 1874-76, p. 1.
 Wallsend, Collingwood, Cox, 1881, p. 16.
 Wangaroa and Mongonui, Hector, 1871-72, p. 153.
 Whangarei-Hokianga, McKay, 1883-84, p. 110.
 Whau, Cox, 1883-84, p. 19.
 Collingwood and Big River, District between, Cox, 1882, p. 62.
 Collingwood, Phoenix Mine, Hector, 1877-78, p. 6.
 Copper Lode, Champion, Cox, 1883-84, p. 84.
 " at Waitahuna, Rowe, 1879-80, p. 156.
 " D'Urville Island, Cox, 1877-78, p. 180 ; 1878-79, p. 55.
 " Mount Solitary, Cox, 1877-78, p. 10 ; Rowe, 1879-80, pp. 150, 159.
 Cook Strait to Rakaia, Hutton, 1873-74, p. 27.
 Coromandel, Hutton, 1870-71, p. 2.
 Curiosity Shop, Canterbury, McKay, 1879-80, p. 75.

D.

- DUKE of Wellington, Terawhiti, Cox, 1883-84, p. 66.
 D'Urville Island, Copper Mine, Cox, 1877-78, p. 180 ; Cox, 1878-79, p. 55.

E.

- EAST Cape District, Hutton, 1868-69, p. 7. *See also* Opotiki.
 " " of North Island, Fossils from, McKay, 1873-74, p. 116.

F.

- Fossil Localities, 1877-78, p. 205; 1881, p. 118.
 " " Geologically arranged, 1877-78, p. 191.
 " " Geographically arranged, 1877-78, p. 199.

G.

- GEOLOGICAL Classifications, Hector, 1878-79, p. 2; 1883-84, p. xii.
 Glentui, a Branch of the Ashley River, 1871-72, p. 85.
 Great Barrier Island, 1868-69, p. 1.
 Greenstone and Wakatipu District, 1878-79, p. 53.
 Gold—
 Albion Company, Terawhiti, McKay, 1882, p. 85.
 Caledonian, Thames, Hutton, 1870-71, p. 146.
 Cape Colville Peninsula, Gold Fields of, Cox, 1882, p. 4.
 Clark's Quartz Drifts, Otago, McKay, 1883-84, p. 91.
 Golden Point, Queen Charlotte Sound, Hector, 1877-78, p. 1.
 Gollan's Valley, Wellington, Cox, 1883-84, p. 11.
 Marlborough, Mines in, Hector, 1871-72, p. 119.
 Perseverance Mine, Collingwood, Hutton, 1870-71, p. 151.
 Thames Gold Fields, Hector, 1878-79, p. 22; Hutton, 1867, 12 pp.; 1868-69, p. 15.
 Thames Gold Fields, Rocks and Minerals mentioned in Hutton's Report, Davis, 1870-71, p. 56.
 Thames Gold Fields, Processes in Use for Extraction of Gold, Skey, 1870-71, p. 71.
 Terawhiti, McKay, 1883-84, p. 135. *See also* Albion; Duke; Success.
 Westland, Alluvial Workings, Cox, 1881, p. 51.
 " Sluicing Claims, Cox, 1883-84, p. 88.

H.

- HÆMATITE at Parapara, Binns, 1878-79, p. 59.
 Hawke's Bay District, Hector, 1870-71, p. 159.
 Hokanui Ranges, Cox, 1877-78, p. 25; McKay, 1877-78, p. 49.
 Hokitika River, Upper, Hector, 1878-79, p. 18.

J.

- JACKSON and Cascade Valleys, Macfarlane, 1876-77, p. 27.

K.

- KAIKOURA District, Buchanan, 1866-67, p. 34.
 Kaikoura Mountains and Mount Egmont, Botanical Notes, Buchanan, 1867, 16 pp.
 Kaikoura Peninsula and Amuri Bluff, McKay, 1874-76, p. 172.
 Kaituna Valley and Queen Charlotte Sound, Country between, McKay, 1878-79, p. 86.
 Kawau Island, Hector, 1868-69, p. 45.
 Kawhia District, McKay, 1883-84, p. 140.
 Kumara, Hector, 1878-79, p. 18.

L.

- LAKE Wakatipu, West and North of, McKay, 1879-80, p. 118.
 Langdon's Hill. *See* Antimony.
 " Reef, Hector, 1878-79, p. 19.
 Locality Numbers, 1877-78, p. 205.
 Lower Waikato. *See* Waikato.

M.

- MACETOWN Reefs, Hector, 1878-79, p. 23.
 Mahurangi. *See* Auckland.
 Makara, Wellington, McKay, 1874-76, p. 54.
 Malvern Hills, Haast, 1870-71, p. 135; 1871-72, p. 1.
 Malvern Hills District, Hector, 1870-71, p. 46. *See also* Mount Somers.
 Maruia and Upper Buller District, Cox, 1883-84, p. 1.
 Masterton and Napier, Country between, McKay, 1876-77, p. 67.
 Mataura Plant-Beds, Southland County, McKay, 1879-80, p. 39.
 Mines in Nelson and Collingwood, and Geology of Riwaka, Cox, 1879-80, p. 1.
 Moa Bones near Motunau, McKay, 1882, p. 74.
 " at Taradale, McKay, 1878-79, p. 64.
 Mokau District, with Maps, Hector, 1878-79, p. 20.
 Motueka Water-Supply, Cox, 1883-84, p. 87.
 Motunau District, McKay, 1879-80, p. 108.
 Mount Arthur Range. *See* Baton.
 " Bengier Mining District, Ulrich, 1883-84, p. 12.
 " Egmont. *See* Kaikouras.
 " Potts, McKay, 1877-78, p. 91.
 " Solitary. *See* Copper.
 " Somers District, Cox, 1876-77, p. 1.
 " " and Malvern Hills District, Cox, 1883-84, p. 22.
 " " Porphyries, Cox, 1883-84, p. 107.

N.

- NAPIER. *See* Masterton and Poverty Bay; and Waipukurau.
 Naseby, Deep Sinking, Hector, 1883-84, p. 44.
 Nelson District, Cox, 1874-76, p. 7.
 " Province, Certain Districts of, Davis, 1870-71, p. 103.
 North-East Portion of South Island, Hutton, 1873-74, p. 27.
 North Island District, including Thames, Coromandel, Kawau, and Drury Coal Field, Cox, 1881, p. 17.
 Norsewood, District around, Cox, 1882, p. 1.

O.

- OAMARU and Waitaki Districts, McKay, 1876-77, p. 41.
 Okarita District, Hackett, 1868-69, p. 8.
 Opotiki and East Cape, Country between, 1876-77, p. 107.
 Otago Lake Basins, McKay, 1883-84, p. 76.
 " North-East District, McKay, 1883-84, p. 44.
 " South-East District, Fossils from, McKay, 1873-74, p. 59.

P.

- PARAPARA Hæmatite. *See* Hæmatite.
 Phoenix Mine, Collingwood. *See* Collingwood.
 Poverty Bay to Napier, Cox, 1874-76, p. 96.
 Progress Reports, Hector, 1866-67 (Abstract), 48 pp.; 1868-69 (Abstract), p. i.; 1873-74, p. iii.; 1874-76, p. iii.; 1876-77, p. iii.; 1877-78, p. i.; 1878-79, p. i.; 1879-80, p. i.; 1881, p. ix.; 1882, p. ix.; 1883-84, p. x.

Q.

- QUEEN Charlotte Sound, Antimony Mine. *See* Antimony.
 " " Golden Point. *See* Gold.

R.

- RAGLAN and Waikato District, Cox, 1874-76, p. 9.
 Rangitoto Mine, Hector, 1878-79, p. 17.
 Rakaia. *See* Cook Strait to Rakaia.
 Reefton District, McKay, 1882, p. 91.
 Resolution Island, Cox, 1874-76, p. 30.
 Richmond Hill Silver Mine, Cox, 1874-76, p. 59; 1876-77, p. 155; Hector, 1877-78, p. 8; Cox, 1881, p. 13.
 Rimutaka Ranges, Auriferous Reefs, Cox, 1879-80, p. 11.
 Riwaka Range, Cox, 1879-80, p. 1.
 Rodney and Marsden Counties, Cox, 1879-80, p. 13.

S.

- SERPENTINE Dykes at Wade. *See* Wade.
 Shag Point District, Haast, 1873-74, p. 19.
 Shag Valley, Cox, 1882, p. 55.
 Southland, 1871-72, p. 89.
 " Plant-Beds. *See* Mataura.
 South-East District of Otago. *See* Otago.
 Success Mine, Terawhiti, Cox, 1883-84, p. 82.
 Synopsis of Younger Formations of New Zealand, Hutton, 1871-72, p. 182.

T.

- TAKAKA and Aorere. *See* Aorere.
 Te Anau District, Cox, 1877-78, p. 110.
 Terawhiti Gold Fields, McKay, 1883-84, p. 135. *See also* Albion, Duke; Success.
 Thames Gold Field. *See* Gold.
 Trelissick Basin, McKay, 1879-80, p. 53.
 Tuapeka Cements, Cox, 1878-79, p. 42.

W.

- WADE, Serpentinous Dykes at, McKay, 1883-84, p. 99.
 Waikato District, Cox, 1876-77, p. 11.
 " " Lower, Hutton, 1867, 8 pp.
 " and Raglan District. *See* Raglan.
 Waipara District, Haast, 1870-71, p. 5.
 Waipukurau and Napier, Country between, McKay, 1878-79, p. 69.
 Waitahuna Copper Lode. *See* Copper.

- Waitaki Lower. *See* Wharekauri Basin.
Waitaki Valley and Parts of Vincent and Lake Counties, McKay, 1881, p. 56. *See also* Oamaru.
Wairau and Motueka Valleys, District between, 1878-79, p. 97.
Wairarapa East, McKay, 1877-78, p. 14.
" " Southern Part of, McKay, 1878-79, p. 75.
Wairoa and Dun Mountain District, McKay, 1877-78, p. 119.
Wakatipu and Greenstone Districts. *See* Greenstone; and West and North.
Wangarei District, Cox, 1876-77, p. 95. *See also* Coal—Whangarei.
Wangaroa, North, McKay, 1874-76, p. 55.
Wangapeka. *See* Baton.
Weka Pass and Buller Districts. *See* Buller.
Wellington, Neighbourhood of, McKay, 1878-79, p. 131
" East, Igneous Rocks, 1883-84, p. 71.
West Coast of South Island, McKay, 1873-74, p. 74.
Westland District, Cox, 1874-76, p. 63.
West and North of Lake Wakatipu, McKay, 1879-80, p. 118.
Wharekauri Basin and Lower Waitaki Valley, McKay, 1881, p. 98.

Y.

YOUNGER Formations in New Zealand. *See* Synopsis.



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COLONIAL MUSEUM AND GEOLOGICAL SURVEY

DEPARTMENT OF NEW ZEALAND.

JAMES HECTOR, C.M.G., M.D., F.R.S., &c., DIRECTOR.

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G.—OTHER SCIENTIFIC WORKS RELATING TO NEW ZEALAND

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2. NEW ZEALAND. By Dr. HOCHSTETTER. 1867. [Out of print.]
3. HANDBOOK of the NEW ZEALAND FLORA. By Dr. HOOKER. 1867. [Out of print.]
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8

12

