

Komiti Point; and he makes no attempt to prove that the Orakei Bay beds are of cretaceo-tertiary age. He certainly says that the Mercer beds, which are generally thought to be the equivalents of the Waitemata series, "close the sequence of rocks succeeding the cretaceo-tertiary coal formation;" but this is a pure assumption unsupported by any evidence and abandoned by Mr. Cox as disproved.*

Mr. McKay also ignores altogether the opinion of the European palæontologists who have examined the fossils from Orakei Bay. Professor Rupert Jones examined the *Foraminifera*, and thought that they indicated a late tertiary period.† In the Palæontology of the Voyage of the Novara Herr Karrer says that these *Foraminifera* are probably of the same age as the Vienna Basin—i.e. miocene,—and Dr. Stoliczka thinks that the *Bryozoa* indicate a miocene or perhaps older pliocene age; while Professor Martin Duncan thinks that the Orakei Bay beds are probably the equivalents of the Mount Gambier series of South Australia, which he calls middle Cainozoic,‡ and which are considered by all Australian geologists to be miocene. So that four well-known palæontologists all agree that these beds are not older than miocene.

The reason why the Orakei Bay beds were considered by the Geological Survey to be of cretaceo-tertiary age is stated by Mr. Cox. He says it was because *Pecten zittelli* and *Pecten fischeri* occurred in them; and he further says that "we have always considered *P. zittelli* to be a typical fossil in the cretaceo-tertiary series—indeed, to be almost confined to the *Leda* marls; and now to find it associated with a large number of Pareora fossils is apt to throw discredit on those fossils which we have considered as distinctive of any special horizon."§ But I am not aware that either of these species of *Pecten* has ever been found associated with cretaceous fossils. Both were described from rocks at Papakura, considered by Dr. Stache to be oligocene, and by Dr. Zittel to be eocene. *P. zittelli* also occurs at Cape Kidnappers|| in beds acknowledged both by Dr. Hector¶ and by Mr. McKay** to be miocene, and the finding of both species by Mr. Cox, in 1880, with acknowledged miocene fossils at Komiti Point, proved decisively that neither species can be taken as characteristic of cretaceo-tertiary rocks.

But there is still another point altogether omitted in Mr. McKay's report. If the "marly grits" containing Orakei Bay fossils at Komiti Point belong to

* Reports of Geological Explorations, 1881, p. 86.

† Quar. Jour. Geol. Soc., xvi., p. 251 (1860).

‡ Quar. Jour. Geol. Soc., xxvi., p. 316 (1870).

§ Reports of Geological Explorations, 1870-80, p. 17.

|| Cat. Tertiary Mollusca of New Zealand, 1878, p. 82.

¶ Reports Geol. Exp., 1877-78, p. 190.

** Rep. Geol. Exp., 1874-76, p. 40, and Rep. Geol. Exp., 1878-79, p. 70.

the Waipara System, what is the age of the "chalk-marls and hydraulic limestone" which underlie them unconformably? These are also considered by Dr. Hector and Mr. McKay to be cretaceo-tertiary, and certainly they are not like any rocks in New Zealand that are older than the Waipara System. Again, if the Orakei beds belong to the Waipara System, what is the age of the green sandstones of Turanga and Papakura, which both Mr. Cox and myself have shown to underlie the Orakei Bay beds unconformably? Dr. Zittel considered the Papakura series to be of eocene age, that is, to belong to the Oamaru System, and if this be correct the Waitemata series must belong to the Pareora System. This conclusion is quite in accordance with the evidence, both stratigraphical and palæontological, at Komiti Point, and at Mahurangi, and is not contradicted by the fact that the Mercer beds are apparently conformable to the underlying marls, for it is quite possible that two systems may be conformable at one place although unconformable at other places.

It appears then (1.) That there is no evidence that the Orakei Bay beds are older than the Parnell grit; they may or may not be so; (2.) That there is no evidence of any unconformity in the Waitemata series between Auckland and the Tamaki; and (3.) That the evidence, both stratigraphical and palæontological, is altogether in favour of the Orakei Bay beds belonging to the Pareora System.

ART. XL.—Descriptions of new Tertiary Shells. PART I.

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

[Read before the Philosophical Institute of Canterbury, 27th November, 1884.]

Plate XVIII.

During the past year I have received several collections of fossils from Mr. S. H. Drew, of Wanganui, and from Mr. A. Hamilton, of Petane, near Napier, and I now offer descriptions of the new species so far as I have made them out. There are, in addition, a few species which, although not known in New Zealand, are living in Australia or Polynesia, e.g. *Drillia alabaster*, Reeve.

Ringicula uniplicata.

Shell minute, ovate, transversely finely striated. Whorls 4, those of the spire small and smooth. Aperture narrow, obliquely notched in front; the outer lip thickened, varicose; columella with a strong anterior plication.

Length, .08 inch.

Locality. Petane.

Oliva neozelanica. Pl. xviii., fig 1.

Shell oblong, the spire acuminate, of 4-5 whorls, each of which has an anterior callous band covering nearly half the whorl: suture excavated. Aperture narrow, the columella twisted and with four or five spiral grooves anteriorly.

Length, 1.5 inch; breadth, .68 inch.

Locality. Patea.

Perhaps the same as *O. australis*, Duclos.

Columbella varians. Pl. xviii., fig. 2.

Shell oblong, the spire prominent and acute. Whorls 7, flattened, spirally grooved. Grooves variable, sometimes only one on the anterior half of the whorl, sometimes several are equally distributed all over; generally there is a smooth band without grooves on each whorl; sometimes the spire whorls are quite smooth or with one or two grooves only. Suture deep. Aperture less than half the length of the shell, oval with the right lip flattened; the posterior canal well marked; columella smooth and rounded; the anterior canal very short; right lip toothed within.

Length, .37 inch; breadth, .15 inch. Length of aperture, .14 inch.

Locality. Wanganui and Petane.

A variety occurs at Wanganui in which the whorls are longitudinally plicated.

Columbella pisaniopsis.

Shell fusiform, the spire produced and sharp. Whorls 7; the two first embryonic, smooth, polished; the others rounded, rather gibbous behind, and with rather close spiral ribs. Spire whorls and posterior portion of the body whorl with regular, but not strong, longitudinal plications. There are eighteen or twenty longitudinal plicae on a whorl. The penultimate whorl has 7 or 8 spiral ribs, the body whorl has from 16 to 20. Suture well marked. Aperture narrow, roundly angled behind; the right lip sharp, toothed inside; the columella smooth.

Length, .38 inch; breadth, .17 inch. Length of aperture, .15 inch.

Locality. Petane.

Columbella cancellaria.

Shell fusiform, the spire produced and sharp. Whorls 6 or 7, the first two embryonic, polished; the others slightly rounded and with strong spiral ribs crossed by longitudinal ribs which are not so strong as the spiral ones, dividing the surface into squares. There are 5 spiral ribs on the penultimate whorl, and about 15 on the body whorl; the grooves are rather broader than the ribs, and are longitudinally striated. The longitudinal ribs die away anteriorly on the body whorl. Suture well marked. Aperture narrow; the outer lip sharp, but thickened and toothed inside; the columella smooth.

Length, .5 inch; breadth, .17 inch. Length of aperture, .25 inch.

Locality. Petane.

Turricula planata. Pl. xviii., fig. 3.

Shell ovato-fusiform, the spire acute, but not so long as the body whorl. Whorls 7, the first $1\frac{1}{2}$ embryonic, translucent, polished; the others flattened, distantly longitudinally ribbed and obscurely spirally striated. About 12 or 18 ribs in a whorl. Aperture narrow, the right lip not thickened; columella with four plaits.

Length, .56 inch; breadth, .24 inch. Aperture, .29 inch.

Locality. Wanganui.

Related to *T. microzonias*, Lam.

Turricula marginata. Pl. xviii., fig. 4.

Shell ovato-conical; the spire acute, longer than the body whorl. Whorls $6\frac{1}{2}$, the first $1\frac{1}{2}$ embryonic, smooth, polished; the next 4 or 5 with about 14 longitudinal ribs on each whorl, which are crossed by fine spiral striæ. Suture margined. Body whorl finely spirally striated with obsolete longitudinal ribs. Aperture narrow, contracted in front; the columella with four plaits.

Length, .8 inch; breadth, .1 inch.

Locality. Wanganui.

Siphonalia (?) *cingulata*.

Shell small, rather thin, fusiform, the spire acute but shorter than the body whorl, not nodose nor ribbed. Whorls 5, the first two embryonic, smooth, usually sharply-shouldered; the others rounded, finely spirally striated and delicately marked with growth-lines. Suture impressed. Aperture oval, the right lip thin; anterior canal short, nearly straight.

Length, .55 inch; breadth, .25 inch. Aperture, .32 inch.

Locality. Wanganui.

A distinct species which should, perhaps, be placed in a new genus.

Cominella elongata. Pl. xviii., fig. 5.

Shell elongated, the spire acute and much longer than the aperture. Whorls 8, the first $2\frac{1}{2}$ embryonic, polished; the next 3 or 4 with about 10 or 11 longitudinal ribs; the rest smooth. The spiral sculpture is five spiral lines, and, after the fourth or fifth whorl, some distant shallow grooves, of which there are about 9 on the body whorl. Aperture ovate, the posterior canal small but well marked; the anterior end deeply notched.

Length, 1.25; breadth, .5 inch.

Locality. Wanganui.

Terebra costata. Pl. xviii., fig. 6.

Shell turreted, smooth, polished, rather thick. Whorls 10-12; the first $2\frac{1}{2}$ embryonic; the others longitudinally ribbed; about 11-15 ribs on

a whorl. Suture well marked. No posterior band on the whorls. Aperture ovate; the columella twisted, produced into a short nearly straight canal. No posterior sinus.

Length, .58 inch; breadth .15 inch.

Locality. Wanganui.

Distinguished from *T. tristis* by the stronger and smaller number of the longitudinal ribs.

Clathurella hamiltoni. Pl. xviii., fig. 7.

Shell ovato-fusiform. Whorls 7-8, rather shouldered behind; the first $2\frac{1}{2}$ embryonic, smooth; the others strongly longitudinally ribbed and crossed with fine spiral liræ. There are about 12-15 rounded, longitudinal ribs in a whorl, and the spiral liræ are small and close set. Aperture ovate, rather angled behind; posterior sinus obsolete; the anterior end deeply notched; inner lip reflected over the columella.

Length, .65 inch; breadth, .93 inch. Length of aperture, .25 inch.

Locality. Petane. A small variety is also found at Wanganui.

Clathurella dictyota. Pl. xviii., fig. 8.

Shell minute, elongato-fusiform. Whorls 6, the first two embryonic; the others slightly angled and cancellated. Longitudinal ribs narrow and distant, about eleven in a whorl. Spire whorls with three strong distant spiral ribs, the interstices finely spirally striated; body whorl with about 9 spiral ribs, the posterior three larger, and alternating with a small rib between each, as well as the spiral striæ. Aperture oval, nearly half the length of the shell; posterior sinus broad and shallow; anterior canal moderate.

Length, .28 inch; breadth, .1 inch. Aperture, .11 inch.

Locality. Wanganui and Petane.

This species approaches *C. oeyclathrus*, Martens, but the spiral ribs are fewer and further apart.

Clathurella abnormis.

Shell minute, mitriform, the spire produced and acute. Whorls $6\frac{1}{2}$, the first $1\frac{1}{2}$ embryonic, polished; the others angled, strongly longitudinally costate and delicately spirally lined. There are eleven longitudinal ribs on a whorl, which are crossed by three or four spiral threads in front of the angle, none behind it. On the body whorl, the spiral threads in front of the angle are about 12, some of which are stronger than others. Aperture linear; the right lip rather thick but not grooved; a posterior shallow sinus above the angle; columella smooth.

Length, .2 inch; breadth, .08 inch. Aperture, .09 inch.

Locality. Petane.

Clathurella (?) *newilis*. Pl. xviii., fig. 9.

Shell minute, fusiform, cancellated. Whorls 6, the two first embryonic, polished; the others angled. Those of the spire with a prominent spiral keel crossed by rather oblique and rather distant spiral threads, forming an obtuse angle on the keel. Suture margined. Body whorl with 8 or 9 spiral ribs, the first and third larger than the others; all after the sixth very close together on the canal; these are crossed by rather distant longitudinal lines which form a very obtuse angle on the first spiral rib or keel; aperture less than half the length of the shell, rather constricted and angled behind; columella straight, produced into a short canal.

Length, .17 inch.

Locality. Wanganui and Petane.

Apparently near to *C. tricarinata*, Val., perhaps it should be considered as a species of *Drillia*.

Daphnella protensa.

Shell elongato-fusiform, with the spire longer than the body whorl, rather thin. Whorls 7, the first $2\frac{1}{2}$ embryonic; the others ornamented with delicate spiral threads crossed by growth-lines; those of the spire rounded more or less longitudinally plicated; about 15 plications in a whorl. Suture well marked. Aperture oval, the anterior canal broad and short; posterior sinus small but well marked and giving rise to a series of curved growth-lines on the posterior portion of each whorl.

Length, .88 inch; breadth, .1 inch. Aperture, .15 inch.

Locality. Petane.

Daphnella lacunosa.

Shell minute, sub-fusiform. Whorls 5, the first two embryonic, polished; the others slightly rounded, with strong spiral ribs at equal distances. Spire whorls with 8, body whorl with 10 or 12 of these ribs; the grooves are rather broader than the ribs and are smooth or very slightly longitudinally striated. Suture well marked. Aperture ovate, about half the length of the shell; the posterior sinus obsolete: anterior canal short; outer lip thin.

Length, .18 inch.

Locality. Wanganui.

Natica (*Ampullina*) *lavis*. Pl. xviii., fig. 10.

Shell sub-globose, transverse, smooth, without any spiral markings. Whorls 4, the two first polished. Aperture broadly ovate, rounded in front; columella curved, the callus covering the umbilicus.

Length, .78 inch; breadth, .9 inch. Aperture, length, .67 inch; breadth, .5 inch.

Locality. Wanganui and Petane.

Sigaretus undulatus. Pl. xviii., fig. 11.

Shell sub-globose, smooth, ornamented with delicate, close, undulating spiral lines. Whorls $4\frac{1}{2}$, the first $2\frac{1}{2}$ polished. Aperture ovate, produced anteriorly; columella curved, the callus completely covering up the umbilicus.

Length, .82 inch; breadth, .82 inch. Aperture, length, .65 inch; breadth, .47 inch.

Locality. Wanganui and Petane.

Sigaretus (Naticina) cinctus. Pl. xviii., fig. 12.

Shell globoso-ovate, smooth, closely spirally grooved, the grooves shallow. Whorls $4\frac{1}{2}$, the first three without spiral markings. Suture excavated. Aperture oblong; columella nearly straight; umbilicus widely open.

Length, .6 inch; breadth, .55 inch. Aperture, length, .5 inch; breadth, .28 inch.

Locality. Wanganui.

Eulima micans.

Shell minute, subulate, highly polished, slightly curved to the right. Whorls 6, flattened, suture almost obliterated, enamelled. Aperture oval, rounded in front and pointed behind, the columella curved.

Length, .14 inch.

Locality. Wanganui.

Eulima media. Pl. xviii., fig. 13.

Shell minute, slightly polished, straight. Whorls 6 or 7, slightly convex, smooth, without any markings; suture impressed. Aperture ovate rounded in front but not pointed behind; columella curved to the right. Not umbilicated.

Length, .14 inch.

Locality. Wanganui.

Doubtfully located; should perhaps be placed in *Eulimella*.

Eulimella deplexa.

Shell minute, slightly polished, straight. Whorls 6-7, flattened, smooth, without any markings; suture impressed. Aperture sub-quadrated; columella straight, callously reflected over the umbilical region.

Length, .14 inch.

Locality. Wanganui.

Eulimella obliqua.

Shell minute, smooth, almost polished, slightly curved to the right. Whorls 7 or 8, the last slightly keeled in the middle; suture rather obscure. Aperture sub-quadrated, pointed behind; columella straight and parallel with the outer lip.

Length .13 inch.

Locality. Petane.

Actis costellata. Pl. xviii., fig. 14.

Shell minute, subulate. Whorls 6, rounded; the first two smooth and polished, the rest spirally grooved. Spire whorls with the two posterior spiral grooves deeper and broader than the others, and the rib between them raised higher; crossed by delicate longitudinal plications. Body whorl like those of the spire; the whole of the base very finely spirally grooved. Suture well marked. Aperture ovate, less than half the length of the shell; columella arched; umbilicus covered.

Length, .13 inch.

Locality. Wanganui.

Odostomia sulcata. Pl. xviii., fig. 15.

Shell large, ovato-elongate, spirally grooved, the spire slightly gradated. Whorls 8, flattened; those of the spire with 5 to 7 narrow grooves crossed by longitudinal growth-lines; body whorl with 18 to 20 grooves, the anterior of which are sometimes closer than the posterior. Suture impressed. Aperture ovate, pointed behind; columella with a single, posterior, oblique fold, almost or quite covering the umbilicus.

Length, .62 to 1.0 inch; breadth, .34 to .43 inch.

Locality. Wanganui.

The form of this shell is very variable; the length is from 2 to $2\frac{1}{2}$ times the breadth.

Odostomia georgiana. Pl. xviii., fig. 16.

Shell rather elongated, shining. Whorls 10, flattened, polished, irregularly longitudinally marked, but without any spiral sculpture; body whorl very obtusely keeled. Suture impressed. Aperture oval, pointed behind; columella with a single deep, posterior, oblique fold, nearly or quite covering the umbilicus.

Length, .58 inch; breadth, .22 inch.

Locality. Wanganui.

Named after Mr S. H. Drew's son, an indefatigable collector.

Odostomia (Parthenia) plicata. Pl. xviii., fig. 17.

Shell minute, ovato-elongated, longitudinally plicated. Whorls 6, flattened, irregularly longitudinally, rather strongly, plicated on the posterior half only; the anterior half of the body whorl smooth; the whole shell faintly spirally striated. Suture impressed. Aperture ovate; columella with a single, rather strong, fold; the umbilicus covered.

Length, .12 inch.

Locality. Wanganui and Petane.

Odostomia (Pyramis) fasciata.

Shell minute, ovato-elongated, faintly spirally striated. Whorls 5, the first rounded and polished, the rest flattened; those of the spire with three shallow spiral grooves at the posterior end, a broad smooth band in the centre and a single spiral groove at the anterior end. Body whorl with numerous spiral grooves in front of the smooth band. Suture impressed. Aperture ovate; columella with a single nearly obsolete fold; umbilicus open.

Length, .14 inch.

Locality. Wanganui.

Cancellaria lacunosa.

Shell ovato-fusiform, not umbilicated, the spire produced. Whorls 6, the first two embryonic; the others rounded, spirally ribbed and longitudinally plicated. Spiral ribs three on the spire whorls, and seven or eight on the body whorl, with fine spiral threads between them. Longitudinal plications numerous and rather oblique, about 15 in a whorl. Aperture broadly ovate; columella with three strong folds; no anterior notch; outer lip acute.

Length, .43 inch; breadth, .86 inch.

Locality. Petane.

Admete (?) ambigua. Pl. xviii., fig. 18.

Shell minute, ovate, perforated, spirally striated. Whorls 4, the first two smooth, the others rather convex, spirally grooved, about 18 or 20 grooves on the body whorl. Suture well marked. Aperture ovate, more than half the length of the shell; columella smooth, rather produced in front, not covering the umbilicus.

Length, .08 inch.

Locality. Wanganui.

Turritella (Eglisia) planostoma. Pl. xviii., fig. 19.

Shell minute, turreted. Whorls 8 or 9, flattened, the anterior portion concave, smooth. Spire whorls with four strong, equal, spiral ribs. Body whorl with five or six spiral ribs and a smooth base. Suture well marked. Aperture ovate, flattened anteriorly, and the outer lip rather straight.

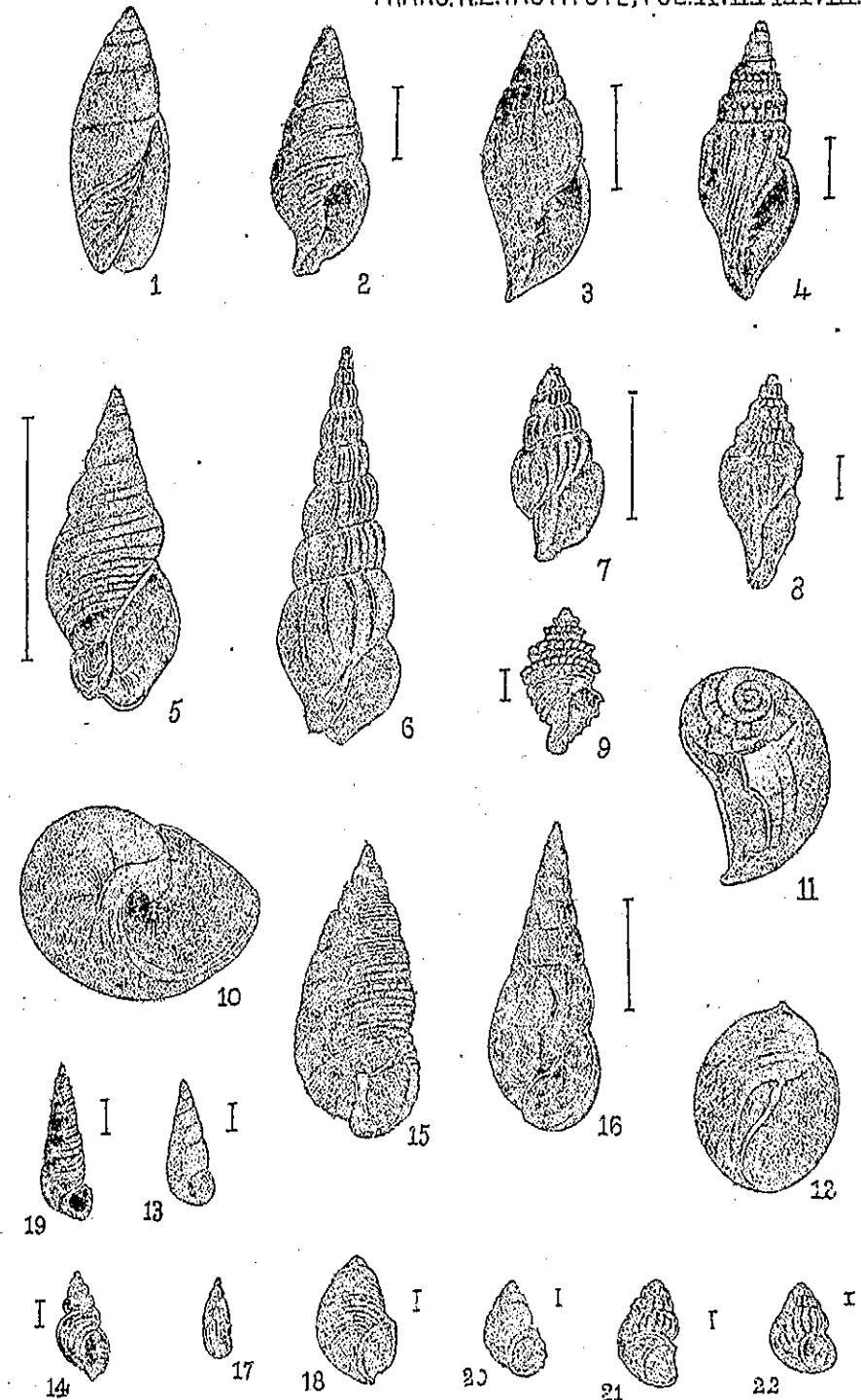
Length, .2 inch.

Locality. Wanganui and Petane.

Rissoa emarginata. Pl. xviii., fig. 20.

Shell minute, ovato-conical, smooth, polished, very delicately spirally striated. Whorls 6, flattened, the two first very small and smooth. Suture obscure. Aperture ovate, the peristome continuous; slightly notched anteriorly.

Length, .08 inch.



FOSSIL SHELLS.

F.W. Huston del.

Locality. Wanganui and Petane.

Rissoa semisulcata.

Shell minute, pupiform, thick. Whorls 5, flattened; the first three or four smooth; the last, or the two last, smooth anteriorly, but with four shallow but well marked spiral grooves on the posterior half. Suture distinct. Aperture roundly ovate, not notched anteriorly; peristome continuous.

Length, .1 inch.

Locality. Wanganui.

Rissoa rugosa.

Shell robust, pupiform, roughish. Whorls 6 or 7; the first $1\frac{1}{2}$ polished, the others of the spire longitudinally plicated with one spiral rib and a sulcus behind and two in front of the plications; plications more or less nodulose. Body whorl sometimes not longitudinally plicated, the posterior half with about 8 spiral ribs, the anterior half smooth. Aperture broadly ovate, the peritreme continuous and rather patulous.

Length, .17 inch.

Locality. Petane.

Rissoa impressa.

Shell small, pupiform. Whorls 5, the two first smooth; the others longitudinally plicated; base of the body whorl smooth; a single spiral groove just below the suture, which is margined. Aperture broadly ovate; peritreme continuous and rather patulous.

Length, .08 inch.

Locality. Petane.

Rissoa gradata. Pl. xviii., fig. 21.

Shell small, ovate, cancellated. Whorls 5, gradated; the two first smooth and polished; the others longitudinally and spirally ribbed. Longitudinal ribs about 15 in a whorl. Spirals—a posterior one near the angle, and two anterior ones with a smooth band between. On the body whorl there are about 7 spirals in front of the smooth band and the longitudinal ribs become obsolete. Suture impressed. Aperture roundly ovate, not notched in front; peritreme continuous.

Length, .1 inch.

Locality. Wanganui and Petane.

Scalaria nympha.

Shell small, turreted. Whorls slightly rounded, very finely spirally striated and longitudinally ribbed. About 18 or 20 ribs and one or two varices in each whorl. Suture impressed. Body whorl keeled anteriorly, all the longitudinal ribs ending abruptly at the keel; the base slightly concave and smooth below the keel. Aperture sub-rotund.

Length, .8 inch (? , specimen broken); breadth, .12 inch.

Locality. Petane.

Scalaria corulum. Pl. xviii., fig. 22.

Shell minute, ovate, slightly perforated. Whorls 5, very convex, the two first smooth, the others longitudinally ribbed; about 22 to 24 ribs in a whorl; the interstices finely spirally lined; suture deep; body whorl rounded. Aperture roundly ovate, the peritreme continuous.

Length, .06 inch.

Locality. Wanganui.

Zizyphinus ponderosus.

Shell large, solid. Whorls 5 or 6, flattened, the periphery roundly angled; with distant smooth spiral ribs, which are closer together on the posterior part of the whorls; suture distinct; base with about 12 fine spiral ribs. Aperture rhomboidal, the umbilical callus large.

Length, 1.4 inch; breadth, 1.7 inch.

Locality. Wanganui.

Differs from *Z. decarinatus* by the periphery being more rounded, the base not so flattened, and the umbilical callus larger, as well as in the whole shell being much thicker.

Hemimactra crassa.

Shell trigonal, sometimes nearly as high as long, massive, inequilateral, rather rudely concentrically striated. Anterior dorsal margin straight, or slightly concave; posterior dorsal margin slightly convex, larger than the anterior margin, the posterior slope barely keeled; ventral margin curved. Left valve with a single strong elongated lateral tooth on each side. Right valve (?). Pallial sinus very shallow and rounded.

Length, 1.6 inch; height, 1.4 inch.

Locality. Wanganui.

Tellina angulata.

Shell ovato-trigonal, transverse, compressed, inequilateral, anterior end longer, regularly concentrically grooved. Posterior end truncated, and with a well marked fold on the left valve. Anterior dorsal margin convex, the posterior dorsal margin slightly concave, ventral margin rounded in front and flattened behind. Right valve with two cardinals, the anterior bifid. Left valve with two cardinals, the posterior bifid. Posterior laterals obsolete.

Length, 1.8 inch; height, .85 inch; thickness, .85 inch.

Locality. Wanganui.

Tellina retiaria.

Shell ovato-trigonal, compressed, sub-equilateral, the anterior end shorter, finely and rather distantly concentrically lamellated, and decussated with radiating lines. Posterior fold obsolete. Anterior dorsal margin slightly

convex, the posterior also slightly convex, ventral margin rounded. Left valve with two cardinal teeth, the anterior bifid; posterior lateral tooth small, the anterior one obsolete. Right valve (?).

Length, .58 inch; height, .46 inch.

Locality. Wanganui.

Kellia robusta.

Shell orbiculo-triangular, nearly as high as long, compressed, nearly equilateral, very delicately regularly concentrically striated. Anterior and posterior dorsal margins nearly straight, sub-equal, the anterior rather the steeper; ventral margin and both ends rounded. Right valve with a lateral tooth on each side, both of which are nearly parallel with the margin. Anterior tooth the stronger of the two.

Length, .12 inch; height, .11 inch.

Locality. Petane.

Kellia effossa.

Shell oblongo-triangular, nearly equilateral, rather swollen, rather coarsely irregularly concentrically striated. Anterior dorsal margin rather concave, the posterior one rather convex, ventral margin flattened, the two ends rounded. Right valve with a lateral tooth on each side and a flattened concave portion in the centre; posterior lateral sharp and nearly parallel to the margin; the anterior thickened and curved inward forming a deepish pit between it and the dorsal margin. Left valve with a lateral tooth on each side and a cardinal tooth in the centre, sloping backward.

Length, .18 inch; breadth, .1 inch.

Locality. Petane.

Loripes concinna.

Shell small, sub-orbicular, the umbos turned forward, truncated behind, compressed, regularly very finely concentrically grooved. Anterior dorsal margin hollowed under the umbo, then convex; posterior dorsal margin slightly convex, descending suddenly near the posterior end; anterior end sometimes slightly undulated; ventral margin rounded. Lunule lanceolate. Anterior adductor impression elongated. Teeth: right valve one cardinal, the posterior lateral obsolete; left valve with two diverging cardinals, the laterals obsolete.

Length, .8 inch; height, .27 inch.

Locality. Wanganui and Petane.

Mysia ampla.

Shell sub-orbicular, rather thick, concentrically striated; posterior dorsal margin slightly concave, the anterior dorsal margin slightly arched. Interior rough, slightly radially striated, the adductor impressions and pallial line well marked. Hinge moderate; left valve with two diverging cardinal teeth, the anterior of which is grooved; lateral teeth obsolete,

Length, 1.55 inch; height, 1.47 inch.

Locality. Wanganui.

Mytilicardia trigonopsis.

Shell small, higher than long, strongly radiately ribbed. Ribs ten, nodular, the interstices strongly concentrically striated. Anterior margin straight, long; posterior dorsal margin straight, short, then suddenly bent down; ventral margin regularly curved.

Length, .13 inch; height, .15 inch.

Locality. Wanganui and Petane.

Anomia undata.

Placunomia, sp. ind., Cat. Tert. Moll. of N.Z. (1873), p. 34.

Shell broadly oval, transverse. Upper, or left, valve thin, rather inflated, the surface gently rather regularly waved; the undulations take different directions on different shells, but are more or less parallel on the same individual. Muscular impressions three, confluent, forming a long oval mark sloping from before the umbo to the centre of the shell; the upper one the largest, the other two sub-equal.

Length, .88 inch; breadth, .7 inch.

Locality. Petane.

EXPLANATION OF PLATE XVIII.

1. *Oliva neozelanica.*
2. *Columbella varians.*
3. *Turricula planata.*
4. *Turricula marginata.*
5. *Cominella elongata.*
6. *Terebra costata.*
7. *Clathurella hamiltoni.*
8. *Clathurella dictyota.*
9. *Clathurella noxilis.*
10. *Natica levis.*
11. *Sigaretus undulatus.*
12. *Sigaretus cinctus.*
13. *Eulima media.*
14. *Aclis costellata.*
15. *Odostomia sulcata.*
16. *Odostomia georgiana.*
17. *Odostomia plicata.*
18. *Admete ambigua.*
19. *Turritella planostoma.*
20. *Rissoa emarginata.*
21. *Rissoa gradata.*
22. *Scalaria corulum.*

PART II.

[Read before the Wellington Philosophical Society, 13th February, 1885.]

THE following new species are chiefly from the collection in the Canterbury Museum, which Dr. von Haast very kindly allowed me to examine. But I have also added a few which I obtained in the Hawke's Bay District last January.

Tornatellina ovalis.

Shell ovate rather thin, spirally grooved; whorls 5, rounded; the two first smooth, the others with smooth spiral ribs much broader than the grooves, which are longitudinally striated; ribs about 16 on the body whorl, and 6 or 7 on the penultimate whorl. Aperture ovate, pointed behind; columella with a single strong, sharp, fold about half-way up.

Length, .17 inch; breadth, .08 inch.

Locality. White Rock River.

Ancillaria lata.

Shell broad, tapering anteriorly; the spire short and obtuse, covered with a large callus extending over the posterior portion of the body whorl. The rest as in *A. australis*.

Length, 1.65 inch; breadth, .9 inch.

Locality. Petane and Wanganui.

Distinguished from *australis* by its greater breadth and obtuse spire, but there are intermediate varieties. *A. hebera*, with which it has been confounded, differs in having the sides nearly parallel and the spire longer.

Voluta aculeata.

Shell small, fusiform, the spire produced, acute; whorls 6 (?), longitudinally ribbed, the posterior end of each rib rising into a sharp tubercle pointing outwards; ribs low, rounded, 8 in a whorl; suture covered up. Aperture rather narrow, the outer lip not reflexed; columella with four plaits.

Length, .8 inch; breadth, .38 inch.

Locality. White Rock River.

Voluta kirikii, v. *kiriki*, Hutton, Cat. Tert. Moll., p. 7, 1873.

Shell ovato-fusiform; spiral short, acute, the whorls smooth; body whorl longitudinally subpliate, rounded at the shoulder and narrowing anteriorly; the plications rising into a row of tubercles below the shoulder; there are 8 or 9 in a whorl. Aperture moderate, with a posterior callus. Columella plaits not seen.

Length, 3.5 inch; breadth, 2.0 inch. Length of aperture, 2.6 inch.

Locality. Porter River.

Mitra inconspicua.

Shell fusiform, tapering nearly equally towards both ends from about the middle; quite smooth. Whorls 6-7, rather flattened, but the suture is well marked. Aperture narrow, produced anteriorly into a short canal, which is very faintly spirally striated; columella plaits four, subequal and equidistant.

Length, .65 inch; breadth, .28 inch.

Locality. Mount Harris and Waihao greensands.

Much like *M. granlandica*, Gray, but narrower anteriorly.

Turricula lineta.

Shell minute, fusiform, broadest in the middle, smooth and shining. Whorls 6, the two first embryonic, the others angled; those of the spire with numerous small longitudinal nodules, which get smaller and disappear altogether on the body whorl. Suture covered. Posterior portion of the whorls slightly concave. Body whorl spirally striated at the anterior end. Aperture narrow; columella with four plaits, the anterior one being very small.

Length, .2 inch.

Locality. Petane.

Siphonalia orbita.

Shell fusiform, spire produced, acute. Whorls 8, the first 2½ embryonic, the others with distant strong spiral ribs. Spire whorls shouldered and slightly longitudinally plicated, marked with growth-lines and with 8 or 4 spiral ribs; the space above the shoulder without any spiral ribs, slightly concave, overlapping the suture. Body whorl rounded, with about 14 spiral ribs, which are flattened and narrower than the grooves. Aperture oval; anterior canal moderate, slightly recurved.

Length, 1.45 inch; breadth, .75 inch.

Locality. Greta, Canterbury.

Like *mandarina* in shape, but distinguished by the regular distant spiral ribs.

Pisania media.

Shell fusiform, spire acute, without longitudinal ribs. Whorls 7, the first two embryonic, polished; the others finely spirally ribbed; about 14 of these ribs on the penultimate whorl just above the mouth; suture well marked. Aperture ovate; canal short.

Length, 1.0 inch; breadth, .45 inch.

Locality. Waikari; Pareora; and White Rock River.

Of the same shape as *P. lineata*. It is more strongly spirally marked than *P. striata* and less so than *P. drewii*; the latter having only about 6 or 7 spiral ribs on the penultimate whorl above the mouth.

Nassa (Tritiaria) cingulata.

Shell elongato-ovate, the spire produced, acute. Whorls 7½, the first two embryonic, the others rounded, spirally and longitudinally ribbed; about 6 spiral ribs on the spire whorls and 12-14 on the body whorl; about 18 longitudinal ribs on a whorl: some of the spiral ribs are double. Aperture ovate; a small posterior sinus; anterior canal very short and recurved; columella and right lip smooth; callus on inner lip small but defined.

Length, 1.05 inch; breadth, .47 inch. Aperture, .42 inch.

Locality. Greta, Canterbury.

Perhaps a *Cominella*.

Cominella monilifera.

Shell small, ovate, the spire rather short. Whorls 5-6, the first two embryonic, the others longitudinally and spirally ribbed; about 14 longitudinal low ribs on the body whorl, the intervals as broad as the ribs; 11-12 spiral ribs on the body whorl, close, making the longitudinal ribs nodulose; posterior portion of the whorls concave, covering the suture. Aperture ovate, the posterior canal strongly marked; anterior canal quite short; outer lip thickened, toothed inside.

Length, .68 inch; breadth, .44 inch.

Locality. Shepherd's Hut, Waipara.

Terebra biplex.

Shell turreted; whorls 9 or 10, flattened, longitudinally ribbed; ribs 18 in a whorl, sharp, straight or slightly curved, usually higher at each end than in the middle, especially on the anterior whorls of the shell; on the body whorl they end suddenly at the shoulder. Aperture oval; a posterior sinus apparent; anterior canal short, not much twisted.

Length, .7 inch; breadth, .2 inch.

Locality. Pareora.

Differs from other New Zealand species in the shouldered whorls and peculiar ribs.

Clathurella cincta.

Shell fusiform, the spire produced and acute. Whorls 7-8, rounded, the first two smooth, the others longitudinally plicated and spirally ribbed; plications low, about 10 in a whorl; spiral ribs strong, distant, narrow, 5 on the penultimate whorl, of which the two posterior are smaller. On the body whorl there are 16-18, some of which are alternately larger and smaller; suture well marked. Aperture ovate, produced into a short anterior canal.

Length, .95 inch; breadth, .15 inch.

Locality. White Rock River.

Clathurella rudis.

Shell fusiform. Whorls 7, convex, with large, rounded, longitudinal ribs, which are broader than the interstices; there are 9 on a whorl, rising abruptly at the posterior end and dying away anteriorly; those of the body whorl scarcely reaching half its length. Spiral ribs weak, about as broad as the interstices, 9 on the spire whorls and 20–25 on the body whorl. Aperture ovate, produced into a short anterior canal.

Length, .49 inch; breadth, .22 inch. Aperture, .22 inch.

Locality. Waihao, in green-sand.

Clathurella leptosoma.

Shell small, elongato-fusiform, the spire produced and acute. Whorls 6–7, the first two smooth, the third spirally striated, the others longitudinally ribbed and spirally striated; all the whorls after the third slightly angled. On the body whorl the longitudinal ribs are obsolete; spire whorls with two strong spiral striæ and other smaller ones; body whorl with the two strong spiral striæ followed by about 20 small ones, regular and equidistant. Aperture narrow, angled behind, produced anteriorly into a short canal.

Length, .25 inch; breadth, .08 inch.

Locality. White Rock River.

Clathurella incisa.

Shell fusiform. Whorls 6–7, rounded, the first two embryonic, the others longitudinally plicated and strongly spirally ribbed. Longitudinal plications 16 in a whorl; spiral ribs 9 on the penultimate, and 18 on the body whorl; posterior spiral ribs about their own breadth apart, but the four anterior ones on the body whorl further apart. Aperture ovate, produced into a short anterior canal.

Length, .8 inch; breadth, .42 inch.

Locality. Te Aute, Hawke's Bay. Collected by Mr. A. Hamilton.

Spiral ribs much stronger than in *C. hamiltoni*.

Cassis senca.

Struthiolaria senca, Hutton, Cat. Tert. Moll. of N.Z., p. 11.

Purpura excursa, Hutton, l.c., p. 6 (1878).

An excellent specimen from Pareora shows that this species is a *Cassis*. The inner lip has a large callus and is slightly rugose in front. The whole shell is finely spirally striated, and there is sometimes a third row of nodules on the body whorl. There are 12–17 nodules in a row on each whorl.

Cerithium bicorona.

Shell subulate. Whorls flattened, spirally striated, the posterior half with two rows of longitudinally elongated nodules, of which there are about

19 or 20 in a whorl, the whole crossed by growth-lines. Aperture, apparently, ovate, produced anteriorly into a well-marked and much-twisted canal.

Length, (?); breadth, .27 inch.

Locality. Tutaekuri River, Hawke's Bay. Collected by Mr. Winkelman.

• A fragment only, but so well marked as to deserve description.

Struthiolaria obesa.

Shell globoso-ovate, smooth or finely spirally striated. Whorls 5–6, convex, the suture covered. Body whorl inflated, very slightly flattened in the middle. Aperture broadly ovate; columella much bent, and with a large callus extending to the posterior end of the aperture; outer lip thick, reflexed, slightly produced in the middle.

Length, 1.75 inch; breadth, 1.4 inch.

Locality. Shepherd's Hut, Waipara.

Struthiolaria frazeri.

Shell large, elongated, spirally grooved. Whorls 6–7, keeled and flattened laterally so that the spire is distinctly gradated. Usually a row of small tubercles on the keel, about 10 on a whorl. On both sides of the keel the whorls are deeply spirally grooved; three or four grooves behind the keel, and four or five in front of it, on the spire whorls. Body whorl with about ten spiral grooves in front of the keel; the anterior part of the shell is spirally striated only. Aperture ovate; inner lip with a large continuous callus, the columella slightly bent; outer lip reflexed, produced in the middle.

Length, 8.0 inch; breadth, 1.8 inch.

Locality. Kikowheru Creek, Hawke's Bay.

This species has been thus named by Dr. Hector.

Trochita alta.

Shell sub-circular, conical, high. Apex sub-central.

Height, .65 inch; diameter, 1.0 inch.

Locality. Kikowheru Creek, Hawke's Bay.

Distinguished from *T. scutum* by its great height; but intermediate forms occur.

Eglisia striolata.

Shell minute turreted. Whorls 8, rounded, the suture deeply impressed, delicately spirally striated; two of the striations usually more prominent than the rest; sometimes almost smooth. Aperture broadly ovate or sub-rotund, the columella bent.

Length, .15 inch.

Locality. White Rock River.

Scalaria marginata.

Shell large, elongated, imperforate. Whorls (?), flattened, distantly longitudinally ribbed, 8 in a whorl, sub-equal, the interstices smooth or very delicately spirally lined; the whorls sharply keeled at the base, the keel shows in the spire whorls just above the suture; the longitudinal ribs end at the spiral keel; base of the body whorl concave, smooth. Aperture (?).

Length, (?); breadth, .7 inch.

Locality. Curiosity Shop.

A fragment only of this very well-marked species is in the Canterbury Museum.

Trochus nodosus.

Shell small, conical, imperforate, the spire acute. Whorls 6-7, flattened, keeled, below the keel bent parallel to the axis; keel placed a little above the suture and with a single row of tubercles, about 9 on a whorl. Body whorl bent vertically below the keel for a short distance and then flattened, giving a double keel to the body whorl, the lower of which is smooth; base spirally striated; apparently no umbilical callus. Aperture rhomboidal. The whole surface of the shells appears to be finely cancellated with spiral and longitudinal lines.

Length, .54 inch; breadth, .45 inch.

Locality. White Rock River.

Corbula humerosa.

Shell small ovato-trigonal, much inflated, smooth, with irregular growth lines; sub-equilateral, slightly produced and rounded posteriorly, not carinated.

Length, .25 inch; height, .18 inch.

Locality. White Rock River.

Corbula pumila.

Shell small, ovate, concentrically sulcated; sub-equilateral, slightly produced and truncated posteriorly; slightly angled.

Length, .8 inch; height, .22 inch.

Locality. White Rock River.

Differs from *C. erythron* in being shorter and less angled behind. From *C. sulcata* it differs in being larger, more compressed, and in the sulci being smaller and more numerous.

Pholadomya neozelanica.

Shell oblong, very inequilateral, moderately ventricose, the posterior end compressed. Concentrically ridged, about 12 to an inch; the ridges rounded, broader than the grooves. Central portion radiately ribbed, ribs moniliform, not so strong as the concentric ornamentation, about 20 in number, the two

anterior further apart. Anterior dorsal margin very short; the posterior dorsal margin slightly concave. Anterior end flatly rounded. Ventral margin flatly rounded. Posterior end rounded.

Length, 2.75 inch; height, 2.0 inch.

Locality. Oamaru and Broken River.

The type is in the Otago University Museum, from Oamaru. It was presented by Mr. J. Ashcroft, but the exact locality is not known.

Maetra lavata.

Shell oval, thin, inequilateral, smooth, rather compressed. Dorsal slopes nearly straight, the posterior much longer. Ventral margin rounded. Posterior end tapering, but not truncated nor angled. The whole shell with very fine concentric lines which are seen, under a lens, to be crossed by excessively minute radiating lines, giving a delicate granulated appearance. Right valve with two strong anterior and two equally strong posterior lateral teeth; short and high, the inner on both sides being higher than the outer. Left valve with one lateral on each side; longer than those of the right valve.

Length, .9 inch; height, .75 inch; thickness, .42 inch.

Locality. Petane. Collected by Mr. A. Hamilton.

Loripes laminata.

Shell small, orbicular, the umbo turned forwards, compressed, finely distantly laminated and radiately striated between the lamellæ. Dorsal anterior margin hollowed; the posterior dorsal margin slightly convex; the ventral margin rounded. Anterior muscular impression elongated.

Length, .28 inch; height, .27 inch.

Locality. White Rock River.

Differs from *L. concinna* in the greater distance of the lamellæ and in the radiate striation.

Macrodon (Cucullaria) australis.

Right valve. Shell transversely sub-oval, inequilateral, moderately inflated, radiately finely ribbed, the ribs apparently scaly. There are about 60 of these ribs near the margin, but many die out towards the umbo. Margin of shell crenated; the posterior margin perpendicular to the hinge line. Umbos rather anterior, incurved, slightly separated. Hinge area narrow, crossed obliquely by one anterior and one posterior line radiating from the umbo. Hinge line very slightly curved; two or three small teeth below the umbo, in front of which are four and behind it five teeth, all of which are nearly parallel to the hinge line; making about 12 teeth in all.

Length, .5 inch; height .4 inch.

Locality. White Rock River and Mount Horrible.

Scaphula (?) lanceolata.

Right valve. Shell small, thin, compressed, smooth, much elongated, not carinated behind, very inequilateral. Anterior portion short, rounded. Posterior portion elongated, gradually tapering, truncated at the end. Posterior dorsal margin straight. Hinge line straight posteriorly, curved anteriorly, edentulous in the centre. Eight anterior and eleven posterior teeth all nearly parallel to the hinge line. The three or four most anterior teeth are short, all the rest are elongated. From the umbo a narrow concave cartilage pit slopes very obliquely backwards, and divides the two sets of teeth.

Length, .7 inch; height, .25 inch.

Locality. Petane. Collected by Mr. A. Hamilton.

Probably a new genus, as the shape is very different from the Indian shells and the posterior teeth are not branched.

Mytilus striatus.

Shell elongated, inflated anteriorly, compressed posteriorly; finely radiately ridged and crossed by concentric rugose growth-marks. Umbo acute, terminal, compressed, strongly curved ventrally. Ventral margin slightly undulating; dorsal margin rapidly rising from the umbo to about a third of the length, then parallel to the ventral margin; posterior end truncated.

Length, 1.15 inch; height, .52 inch.

Locality. Broken River.

ART. XLI.—*On the Geological Structure of the Southern Alps of New Zealand, in the Provincial Districts of Canterbury and Westland.* By Professor JULIUS VON HAAST, C.M.G., PH.D., F.R.S.

[Read before the Philosophical Institute of Canterbury, 27th November, 1884.]

THE publication of a new geological map of New Zealand accompanied by sections, issued by the Geological Survey Department, induces me to offer the following remarks on the geological structure of the Southern Alps, which I consider in some of its most essential features to have been altogether misunderstood by the officers of that survey.

In my former publications I stated that the Southern Alps are only the eastern wing of a huge anticlinal arrangement, of which the western portion has been either destroyed or submerged below the Pacific Ocean. It thus exhibits the same one-sided features so conspicuous in almost every alpine chain of which the geological structure is known.

The lowest beds on the western slope are gneiss-granites, overlaid by mica, chlorite and other metamorphic schists of similar origin. These rocks are followed by clay-slates, semi-crystalline sandstones and fclstones, which in some instances form not only the summits of the central chain, but even reach several miles across to its eastern slopes. They generally contain quartz veins. Upon them reposes the great sandstone, conglomerate, clay-slate and shale formation, of which the greatest portion of the Provincial District of Canterbury is composed, and which in many instances can be followed for nearly seventy miles to the east. I have named this extensive series of rocks the Mount Torlesse formation. On the eastern side of the great anticlinal it forms a succession of huge folds, dipping throughout at high angles, but these folds have been so much destroyed during numberless ages, that at present their synclinals generally form the summits of the mountains, while the deep broad valleys often run along their anticlinals. Besides this folding a great deal of crumpling has taken place, so that, although the general character of the arrangement has been preserved, over a short space of ground the strata often strike and dip in all directions of the compass. During my first journey to the head-waters of the river Rangitata, in 1861, I discovered in the Clent Hills a series of beds containing numerous impressions of plants, and some twelve miles distant in the Rangitata Valley at Mount Potts other beds containing fossil shells and saurian bones. Professor F. McCoy, in Melbourne, to whom I sent the collections made, for identification and description, informed me that the plants were of Jurassic and the molluscs mostly brachiopods of Upper Devonian or Lower Carboniferous age, both being identical with exuvie found in the coal fields of New South Wales. However, judging from the position and sequence of the strata in both localities, agreeing with each other in a remarkable manner, though the Mount Potts beds are of much greater thickness, I could not accept this conclusion, being convinced that they were of the same age. Since that time it has been proved by a number of experienced geologists, that the beds in New South Wales, to which Professor McCoy alluded, are interstratified, and that consequently they must be of the same age.

Both palæontologists and geologists have agreed that if there exist in any geological horizon beds containing a marine fauna of an older together with a terrestrial flora of a younger aspect, the former will more correctly indicate the age of the beds. Thus, if the fossil shells of any given formation have a palæozoic and the plants a mesozoic character, the beds in which both occur have to be classified as palæozoic.

It would be foreign to the object of this paper were I to enter more fully into this important question, but I may observe that both in India and