Art. XLII.—*Brachiopod Genera : The Position of Shells with Magaselliform Loops, and of Shells with Bouchardiform Beak Characters.*

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[*Read before the Wellington Philosphical Society, 28th October, 1914.*]

The genus *Magasella* was founded in 1870 by Dall* for shells for erly included under *Terebratella*, but distinguished from *Terebratellae* proper by the possession of a high septum and by the fact that the reflected portion of the loop forms a ring behind the upper portion of the septum.

It was subsequently discovered that during growth *Terebratella* passes through a stage exactly comparable to *Magasella*, and that *Magellania* (*M. venosa*) passes through stages comparable to *Magasella* and *Terebratella*† ; and, further, that a large number of species that had been described as *Magasellae* were in reality only the young of known species of *Terebratella* and *Magellania*. This proved to be the case with *Terebratella evansi* Davidson, which Dall had chosen as the type of his genus *Magasella*, for this species, originally described from Lyall Bay, Wellington, is a young form of the common New Zealand shell *Terebratella sanguinea* Leach. According to a strict application of the law of priority, then, *Magasella* is a synonym of *Terebratella*. As there are, however, shells with Magaselliform loops which are undoubtedly adult, a generic name embodying Dall's intentions is necessary, and at first sight it appears to be a case in which the law of priority might be set aside with advantage. This course was followed by Deslongschamps,‡ who proposed the South Australian Recent shell *Terebratella cumingi* Davidson as the genotype, in place of *T. evansi*. If all shells with Magaselliform loop characters could be placed in *Magasella* thus emended, this course would have no other objection than the lack of finality that must always attach to any alteration of the law of priority. As will be shown below, however, Magaselliform loop characters may be attained independently in more than one stock, and a different procedure becomes necessary. Buclman has already pointed out this polygenetic origin of loop characters in the case of shells hitherto placed under *Magellania* and *Terebratella*.§

" It may be remarked that as species of *Magellania* pass through a Terebratelliform stage in their ontogeny, pointing to a Terebratelliform stage of phylogeny, the names *Magellania* and *Terebratella* do no indicate proper generic divisions, but mark the stage of loop-development attained. It is therefore more likely that certain *Magellaniae* are really *Terebratellae* which have attained the Magellaniform loop, and that certain *Terebratellae* are really *Magellaniae* which have not yet lost the Terebratelliform loop. This means that a rearrangement of these genera to correspond with vertical lines of descent instead of to indicate horizontal lines of developmental stages may be anticipated. It is known that among Terebratuloid forms the shape (test and ornament) may change considerably while the loop remains without much modification ; and, on the other hand, that the loop may change considerably while the shape remains little altered."

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* Am. Journ. Conch., vol. 6 (1870), p. 97, fig. 18.
† P. Fischer and D.-P. Oehlert, Bull. Soc. Hist. nat. d'Autun, t. 5 (1892), pp. 254–334.
‡ Etudes critiques sur des Brachiopodes, &c. (1884), p. 204.
§ Wissensch. Ergebn. Schwed. Südpolar-Exped., 1901–3, bd. iii, lief. 7 (1910), pp. 21, 22.

It will clear the ground to indicate first the validity of the genera *Neothyris* Douvillé and *Pachymagas* Ihering. Douvillé[*] separated *Neothyris* (genotype, *Terebratula lenticularis* Desh.) from *Waldheimia*[†] (genotype, *Terebratula australis* Quoy and Gaimard = *T. flavescens* Lamarck) on grounds of different types of folding. The former he placed among the *Cinctae*, stating that the valves are without folds and the commissure almost plane. It is true that the valves are almost without folds, but the anterior commissure exhibits a slight but distinct anterior depression, a feature more strongly marked in related species, and due to incipient ventral uniplication. The folding, therefore, places this species among the *Nucleatae*, and not among the *Cinctae*. In the other species, *Waldheimia flavescens* (*Magellania*), Douvillé distinguished primary and secondary folds, and placed the species, on account of its primary folds, in the group of *Coarctatae*—i.e., antiplicate or ventrally biplicate. In this respect Douvillé was, I believe, justified.[‡] The biplication is certainly slight in *M. flavescens*, but it is quite well marked in certain Australian Tertiary forms, such as *M. grandis, M. garribaldiana*, and *M. divaricata*. Nevertheless, it is not in itself a character of generic importance in this case. The whole of the *Magellaninae*, if folded at all, show a dominant ventral uniplication,[§] and the feeble ventral biplication is only a slight modification of this, and has arisen independently in more than one evolutionary stock. Actually it appears to be confined to Australian forms, but it is not yet certain that they will all come under *Magellania* s. str.

There is, however, another important difference between *M. lenticularis* and *M. flavescens*, and it is precisely that used by Ihering in 1903 to distinguish *Pachymagas* from *Terebratella*—viz., the difference in the hinge-plate and cardinal process. "*Comparée avec* T. dorsata, *le plateau cardinal, comme aussi ses annexes et le septum, sont extrêmement grossis et ces caractères servent pour établir un sous-genre, pour lequel je propose le nom de* Pachymagas. *L'espèce typique est* T. tehuelca *et il faut placer dans le même sous-genre,* T. gigantea Ortm. *et venter* Ih. *Toutes ces espèces sont éteintes et restreintes aux dépôts tertiares de la Patagonie ; toutes ont la coquille lisse, tandis que dans* Terebratella *s. str., le processus cardinal, les crura et le septum sont minces, plus ou moins lamellaires et la surface externe des valves est munie de larges côtes rayonnantes.*"[‖]

Before discussing the cardinal process and other hinge parts it will be convenient to dispose of the accessory character of multicostation, which is shared both by *M. flavescens* and *T. dorsata*, the genotypes of *Magellania* and *Terebratella* respectively. It is confined, among the higher genera of

[*] Bull. Soc. Geol. Fr., t. 7 (1879), pp. 273–75.

[†] *Waldheimia* was found to be preoccupied, and the name was changed to *Magellania* by Bayle in 1880.

[‡] Buckman apparently did not recognize the biplication. He says (Quart. Journ. Geol. Soc., vol. 63 (1907), p. 342), "Hall and Clarke speak of *Magellania numismalis*, the present *Cincta ;* but *M. flavescens* has not come through a *Cincta* stage, and shows no sign of anterior retardation of the *Cincta* type. What it does show a little indication of is a uniplicate stage, but reversed as compared with *Terebratula whitakeri*—that is, it is ventrally, not dorsally, plicate."

[§] With the exception only of *Magasella vercoi* Blockman, which shows slight dorsal uniplication, and of *M. adamsi* Davidson, a species whose position in the *Magellaninae* is not unequivocal. It is probably not an adult shell, and may be the young of some member of the *Dallininae*.

[‖] H. von Ihering, "Les Brachiopodes Tertiares de Patagonie," Ann. Mus. Nac. Buenos Aires, tom. 9 (1903), p. 332.

the *Magellaninae,* to species which come under *Terebratella* and *Magellania* s. str., if these be defined by the type of hinge; but there are species in each of these genera which do not exhibit this property. *Terebratella rubicunda* is nearly smooth, showing only a slight crinkling near the margin in old shells, while *Terebratella oamarutica* Hutton is perfectly smooth. A Recent species of *Magellania* from Macquarie Island collected on the Mawson Expedition by Mr. H. Hamilton is also perfectly smooth. Multicostation, therefore, although constantly absent in *Pachymagas* and *Neothyris,* cannot be considered a property on which to base generic distinctions. These must rest primarily on the types of hinge parts and cardinal process.*

Types of Hinge Parts and Cardinal Process.

(a.) *The Terebratelliform Type.* Fig. 1.

In *M. flavescens, T. dorsata, T. sanguinea,* and *T. rubicunda*—i.e., in *Magellania* s. str. and *Terebratella* s. str.—the socket-ridges, hinge-plates, septum, &c., are frequently described as lamellae, in reference to the fact that they are thin and sometimes almost transparent. The hinge-plates are hollowed underneath (fig. 1, *b*), and if they be broken away it is found that the septum extends beneath them right to the umbo of the valve. The cardinal process is superimposed on the posterior end of the hinge-plates, and consists of a thin plate, broader than long, curving forward, and excavated on the upper side to form a rounded cup or socket to which the diductor muscles are attached.
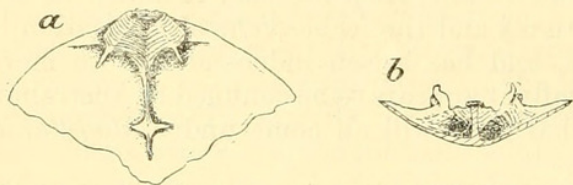

Fig. 1.—*Terebratella sanguinea* (Leach), Wellington Harbour. Interior of dorsal valve. *a.* View from above. *b.* Front view of hinder end broken off, showing shell and septum in section, lower sides of hinge-plates in perspective.

(b.) *Pachymagoid and Neothyroid Types.* Fig. 2.

In *Terebratella parki* Hutton and in other species referable to *Pachymagas,* and in *M. lenticularis* and other species referable to *Neothyris,* the socket-ridges, crural bases, and septum are thick and solid, and cannot be described as lamellae. The socket-ridges nearly meet at the umbo, and thence diverge more or less obliquely. The crural bases make junction with them on their inner anterior corners, and are so intimately fused with them at this point that they cannot generally be traced any farther posteriorly; but in some species (*N. lenticularis, N. ovalis*) they can be distinguished along the inner sides of the socket-ridges for their whole length. The septum does not extend as such to the umbo, but bifurcates posteriorly to join the inner anterior ends of the socket-ridges (near the point of origin of the crural bases as distinct processes). There are no definite hinge-plates as in Terebratelliform types, their place being taken by the more or less steep inner walls of the socket-ridges, which, with the bifurcating process of the septum, enclose a trough which we may term the "hinge-trough." The cardinal process rises from the bottom of the hinge-trough, and varies greatly in different species. In New Zealand older Tertiary examples of *Pachymagas* it is always fairly simple, but differs greatly in size and height. In its most

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* That is to say, these characters best serve to distinguish the evolutionary stocks.

primitive form it is very short, being confined to the posterior part of the hinge-trough, and is also very low, in shape being a pyramid with an edge facing forwards and a hollowed side behind. In more advanced types the process gains both in length, occupying more and more of the hinge-
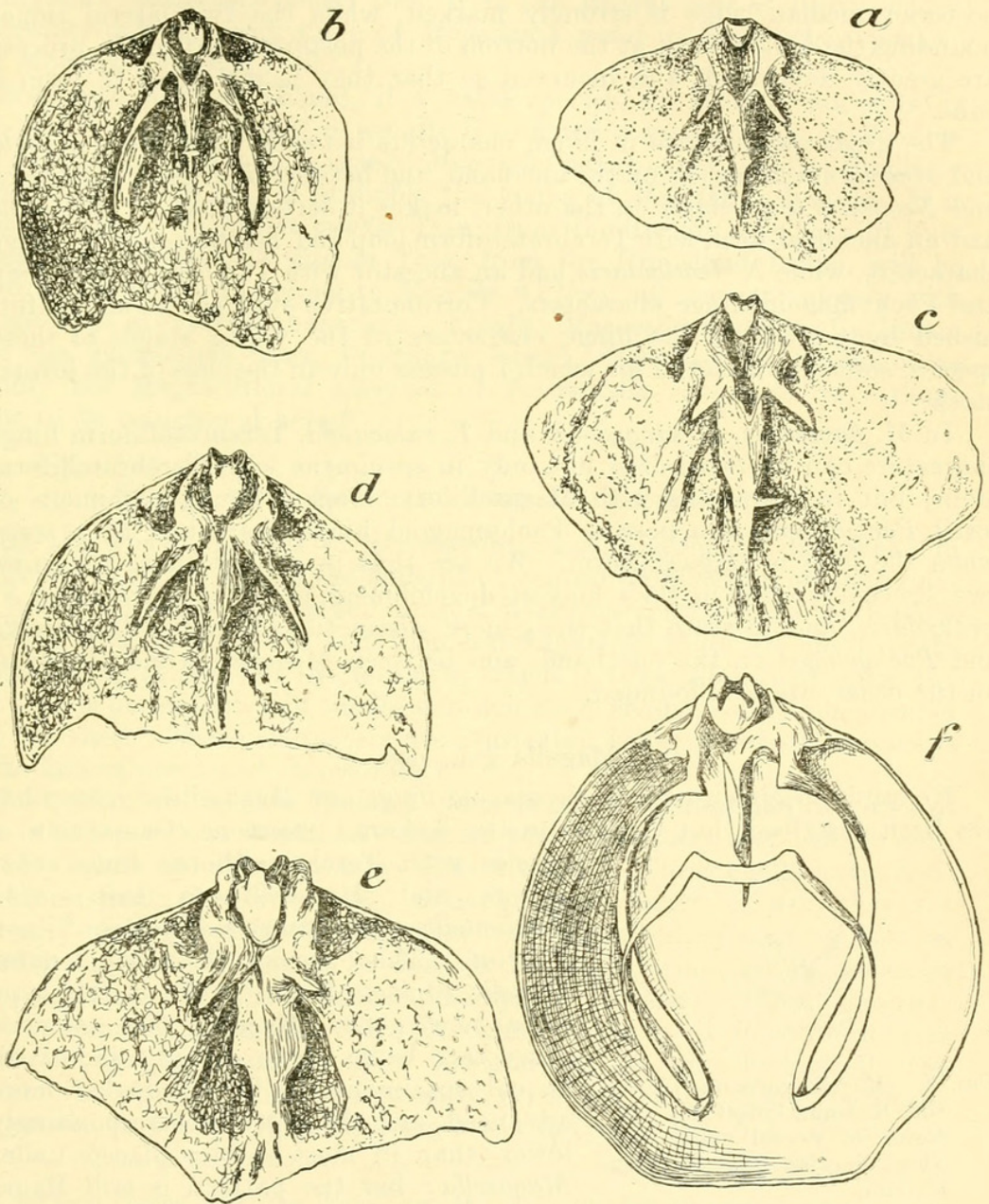
FIG. 2.—Interiors of dorsal valves of *Pachymagas* and *Neothyris*, showing evolution of cardinal process. *a. P. parki* (Hutton), Kakanui greensands. *b. P. parki* (Hutton), Hutchinson's Quarry greensands. *c. P. huttoni* sp. nov. (see appendix), Wharekuri greensands. *d. N. ovalis* (Hutton), Shakespeare Cliff, Wanganui. *e. N. ovalis* (Hutton), Castlecliff, Wanganui. *f. N. lenticularis* (Desh.), Recent (after Davidson).

trough, and in height, projecting above the socket-ridges, while the hollow behind is now confined to its base, and is bounded by two lateral ridges. In the most advanced types met with in New Zealand species of *Pachymagas* there is a slight posterior median ridge in the

upper part of the process, and this ridge becomes still more accentuated in the Patagonian late Tertiary species, including *P. tehuelca*, the genotype, and in the most primitive species of *Neothyris* in New Zealand, while at the same time the process gains still further in length and height. Finally, in *N. lenticularis* the process is so large that it fills the whole of the hinge-trough, and almost hides the bifurcation of the septum; the posterior median ridge is strongly marked, while the two lateral ridges bounding the hollow facet at the bottom of the posterior part of the process are greatly developed, and incurved so that they nearly meet to form a tube.

The great resemblance in hinge characters between *Terebratella dorsata* and *Magellania flavescens* on the one hand, and between *Pachymagas tehuelca* and *Neothyris lenticularis* on the other, makes it certain that *M. flavescens* had an ancestral form with Terebratelliform loop and Terebratelliform hinge characters, while *N. lenticularis* had an ancestor with Terebratelliform loop and Pachymagoid hinge characters. Corroborative evidence would be furnished by a study of the hinge characters of the young stages of these species, sufficient material for which I possess only in the case of the former stock.

In *M. flavescens*, *T. sanguinea*, and *T. rubicunda*, Terebratelliform hinge characters can be recognized not only in specimens with Terebratelliform loops, but in specimens with Magaselliform loops. Young specimens of fossil *Pachymagas* also possess Pachymagoid hinge characters at a stage when the loop is Magaselliform. We are thus in a position to recognize two stocks, typified in their highest development by *M. flavescens* and *N. lenticularis*, and to state that the generic distinctions between *Terebratella* and *Pachymagas* on the one hand, and between *Magellania* and *Neothyris* on the other, are well founded.

Magella gen. nov.

No adult specimen with Pachymagoid hinge and Magaselliform loop has yet been described, but there is in the Kakanui limestone (Oamaruian) a species with Terebratelliform hinge characters and Magaselliform loop — viz., *Terebratella kakanuiensis* Thomson* *non* Hutton. This species I now rename *Magella carinata*,† and make it the type of a new genus *Magel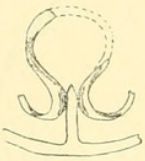la*, the essential characters being those already indicated. In old specimens the loop is rather more advanced, and the septum correspondingly lower, than in most species placed under *Magasella;* but the pattern is still Magaselliform and not Terebratelliform, as fig. 3 shows, and the septum is still much higher in front than behind. The deltidial plates are discrete, as in the young of *Terebratella* and *Magellania*.

Fig. 3.—*Magella carinata* Thomson, Kakanui limestone. Interior of dorsal valve, end view, showing loop touching septum.

There are probably a large number of described species which may be transferred to *Magella*. In some with Terebratelliform hinge the loop is more primitive, being in the stage called by Fischer and Oehlert

* Trans. N.Z. Inst., vol. 40 (1908), p. 102, pl. xiv, fig. 4, *a–c*.
† The holotype of this species is the specimen figured by me in 1908, and now in the Otago Museum.

" Magadiform." These may, nevertheless, be placed in *Magella*, which will then include all species of the *Terebratella-Magellania* stock which have not attained at maturity the *Terebratella* stage of loop. Amongst such species with primitive loops are *Magasella australis* Buckman, from the *Pecten* conglomerate (Pleistocene) of Cockburn Island, off Graham Land, West Antarctica; *Magasella gouldi* Dall, from the Recent seas of Japan, which is possibly only a young stage of *Magellania grayi* or some other species ; and *Magasella aleutica* Dall.

Magasella flexuosa (King), if a valid species, as Ihering contends, is certainly a *Magella*, but it is usually considered a young stage of *Terebratella dorsata*, and the same is true of *Magasella patagonica* (Gould). Similarly *Magasella* (?) *laevis* Dall is probably the young of *Magellania venosa*. It is probable that *Terebratella woodsi* Tate, from the Table Cape beds of Tasmania, and *Terebratella pumila* Tate, from the Gippsland Lakes, will be found on dissection to belong to *Magella*, as they agree pretty closely with the genotype in external characters. Finally, *Magasella antarctica* Buckman, from the glauconitic bank, Cockburn Island, described by Buckman as possibly the Magaselliform ancestor of *Terebratella rubicunda*, is without doubt to be transferred here.*

Shells with Bouchardiform Beak Characters.

All the known species of *Bouchardia*, though differing somewhat in length and breadth, and in the amount of ventral uniplication or unicarination, possess similar and rather unusual beak characters—viz., the beak is incurved only at its apex, and then but slightly ; there are sharp beak-ridges uniting in front of the foramen, which is thus behind the apex, the false area is prominent, and the pseudo-deltidium strong, solid, and blended with the shell. These characters are illustrated in fig. 4, which comprises all the known species of *Bouchardia*.†

Now, there are in New Zealand older Tertiary (Oamaruian) a series of shells which bear out Buckman's dictum that " the loop may change considerably while the shape remains little altered." These shells have Bouchardiform beak characters, and, although much larger in size, they are externally so like *Bouchardia* that they were described as such by Hutton in 1905‡ under the names of *B. rhizoida* and *B. tapirina* (not *Waldheimia tapirina* Hutton, 1873). Buckman, accepting Hutton's generic determination, compared them with the other known species of *Bouchardia*, and considered that in shape the New Zealand species were biologically the earliest. In spite of this undoubtedly primitive shape, these specimens have proved to possess Magellaniform loops and septa (fig. 5).§ It is more

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* Jackson (Trans. Roy. Soc. Edin., vol. 48 (1912), pp. 384–85) considers this species the young of *Terebratella dorsata*, erroneously ascribing the glauconitic bank to Pleistocene, whereas Buckman gives its age as Miocene-Oligocene. This greater age makes it more probable that *M. antarctica* is an ancestral form of *Terebratella dorsata* than a young specimen. Buckman considered it ancestral to *T. rubicunda*, but one would hardly expect even incipient multicostation, such as *M. antarctica* shows, on a Miocene ancestor of *T. rubicunda*.

† With the exception of *B. patagonica jorgensis* Ihering, the original description of which I have been unable to consult.

‡ Trans. N.Z. Inst., vol. 37 (1905), p. 480, pl. xlvi, figs. 6, 7. The beak characters are not correctly rendered in the figures.

§ I obtained from Target Gully, Oamaru, a hollow specimen of *B. rhizoida* with a complete loop, but unfortunately it was destroyed in removal.

than probable, therefore, that the ancestors of these species which possessed Magaselliform and Terebratelliform loops also had Bouchardiform shape
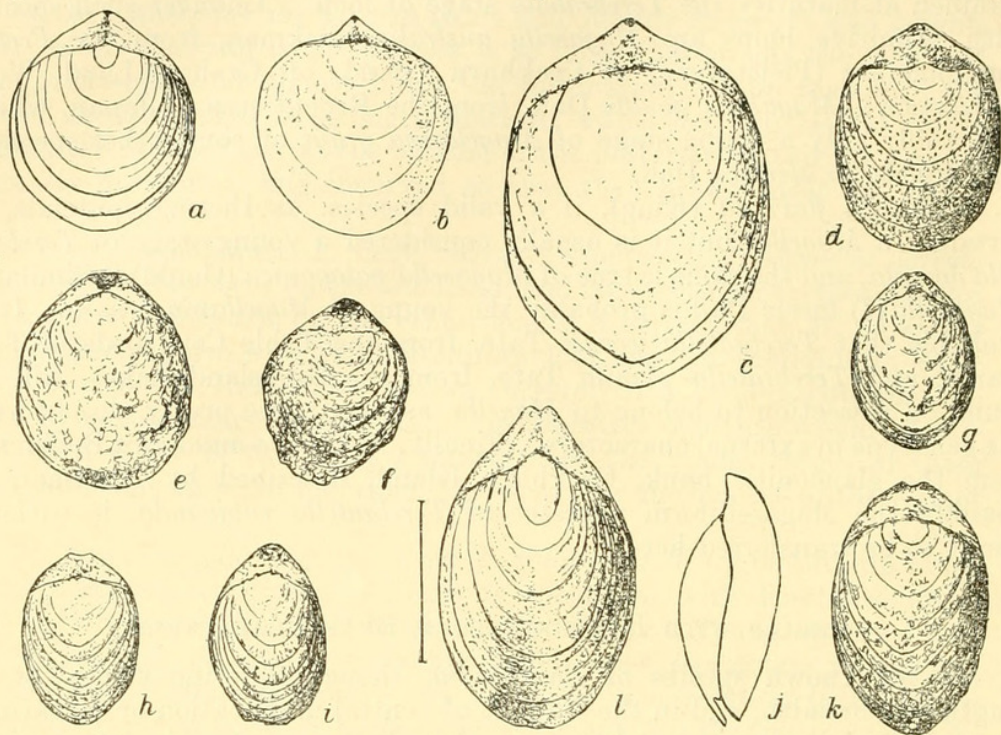

FIG. 4.—Species of *Bouchardia*. *a–d*. South American (after Ihering). *a*. *B. zitteli* Ihering (twice natural size). *b*. *B. patagonica* Ihering (twice natural size), Patagonian formation. *c*. *B. zitteli* Ihering, holotype (twice natural size), Patagonian formation. *d*. *B. transplatina* Ihering (very slightly enlarged), Entrerian formation. *e–k*. Younger beds, Seymour Island, off Graham Land, Antarctica (after Buckman), (natural size). *e*. *B. ovalis* Buckman. *f, j, k*. *B. antarctica* Buckman. *g*. *B. elliptica* Buckman. *h*. *B. angusta* Buckman. *i*. *B. attenuata* Buckman. *l*. *B. rosea* (Mawe), Recent, Brazil (after Davidson).
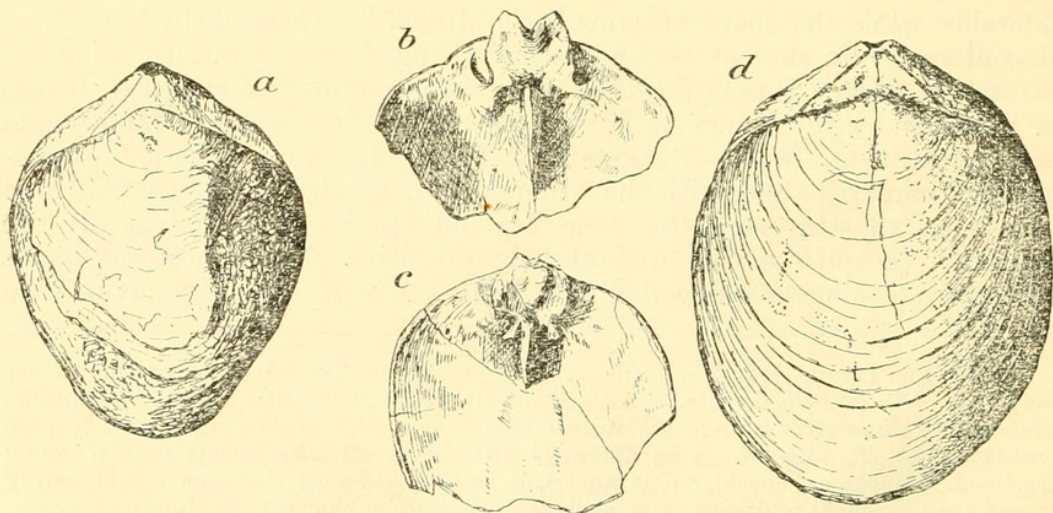

FIG. 5.—*Rhizothyris rhizoida* (Hutton). *a*. Holotype, Mount Brown beds, Weka Pass (specimen in the Canterbury Museum). *b*. Interior of dorsal valve, Weka Pass. *c*. Interior of dorsal valve, Huchinson's Quarry. *d*. Form with nearly straight sides, Weka Pass. (Figs. *a–c* by Dr. C. A. Cotton.)

and beak characters, and, if this be so, we must be dealing with a third stock which has attained independently the Magellaniform loop. In any

case, the hinge-pattern of these shells prevents their inclusion in either *Magellania* or *Neothyris*. Consequently a new genus is necessary, for which I propose—

Rhizothyris gen. nov.

Genotype, *Bouchardia rhizoida* Hutton.

The other species, *Bouchardia tapirina* Hutton (non *Waldheimia tapirina* Hutton), I now rename *Rhizothyris curiosa*, the holotype being a specimen in the Dominion Museum from the Curiosity Shop beds, Rakaia River, Canterbury (fig. 6).
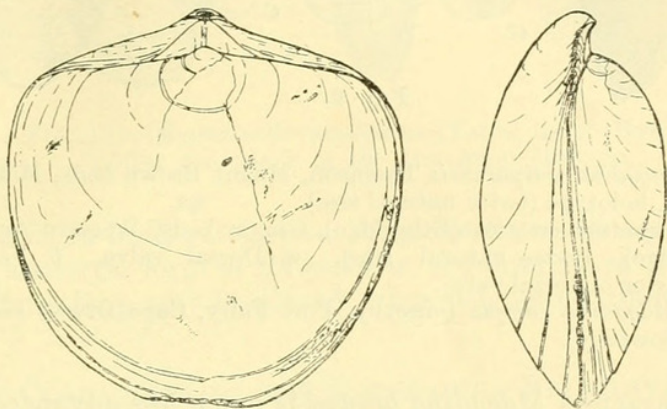

FIG. 6.—*Rhizothyris curiosa* Thomson, holotype, Curiosity Shop. (Figs. by Dr. C. A. Cotton.)

Fortunately, we can point to shells both with Magaselliform and with Terebratelliform loops which possess Bouchardiform shape and beak characters, and thus fill the gap between *Bouchardia* and *Rhizothyris* These shells require separate generic recognition, and for the former I propose—

Magadina gen. nov.

Genotype, *Magadina browni* sp. nov., Mount Brown beds, Waipara district, North Canterbury (fig. 7). (See appendix.)

Besides the genotype and *Magadina waiparensis* (fig. 8), another new species from the Mount Brown beds, there are several already-described
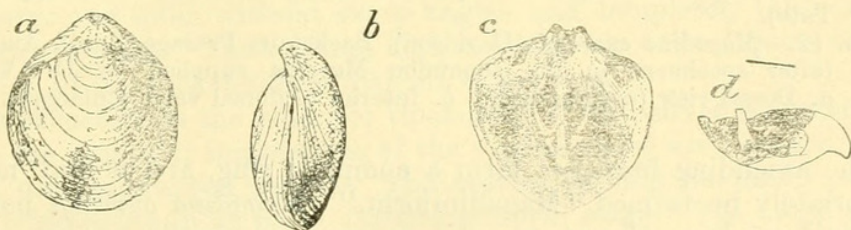

FIG. 7.—*Magadina browni* Thomson, Mount Brown beds, Waipara, Weka Pass district. *a, b.* Holotype (twice natural size). *c.* Interior of dorsal valve, paratype (twice natural size). *d.* Partial interior of both valves, paratype (natural size).

forms, all Australian, which combine Bouchardiform shape with Magaselliform loops. Such are *Magasella cretacea* Etheridge (fig. 9), *Terebratula compta* Sowerby (fig. 10), *Magasella compta* Tate (? of Sowerby), a species

which has attained biplication (fig. 11), and the Recent well-known *Terebratella cumingi* Davidson (fig. 12). Possibly also *Magasella tenisoni* Tenison-Woods belongs here. The unity in shape of these species and their distinctness from those ascribed above to *Magella* will be easily recognized.
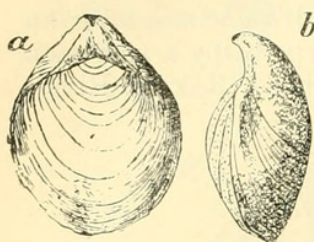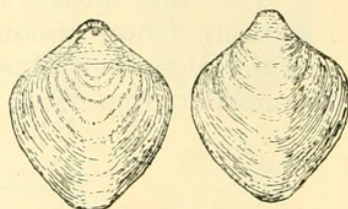

Fig. 8.

Fig. 9.

Fig. 10.

Fig. 8.—*Magadina waiparensis* Thomson, Mount Brown beds, Middle Waipara district, holotype (twice natural size).

Fig. 9.—*Magadina cretacea* (Etheridge), Gingin beds, Western Australia (after Etheridge), (twice natural size). *a.* Dorsal valve. *b.* Ventral valve. *c.* Interior of dorsal valve.

Fig. 10.—*Magadina compta* Sowerby, Port Fairy, Cape Otway coast, Victoria (after Sowerby).

In loop characters *Magadina browni* is much less advanced than *Magella carinata*, the descending and ascending branches being separately attached to the septum, which reaches to the opposite valve. This stage, termed "Magadiform" by Fischer and Oehlert, differs from that of *Magas* in
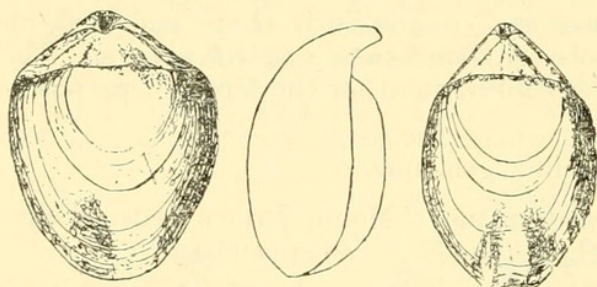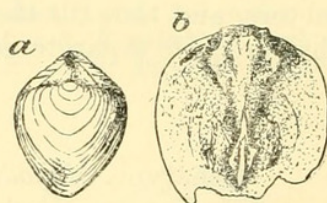

Fig. 11.

Fig. 12.

Fig. 11.—*Magadina compta* Tate (? of Sowerby), Mannum, R. Murray (after Tate).

Fig. 12.—*Magadina cumingi* (Davidson), Backstairs Passage, South Australia (after specimens in the Dominion Museum supplied by Dr. Verco). *a.* Dorsal view (natural size). *b.* Interior of dorsal valve (enlarged).

that the ascending branches form a complete ring, and it may now more appropriately be termed "Magadiniform." *Magadina cumingi* possesses a Magadiniform loop almost to adolescence, and finally attains an early Magelliform loop.

Magadinella gen. nov.

Genotype, *Magasella woodsiana* Tate* (fig. 13).

The beak characters of this species are not strictly Bouchardiform, the modifications being slightly greater incurvature and less sharp beak-ridges.

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* Trans. Roy. Soc. S. Austral., vol. 3 (1880), pp. 163–64, pl. x, fig. 3, *a–d.*

Nevertheless, its nearness in shape to *Magadina* is shown by the fact that
Tate states that it bears considerable external resemblance to *M. cumingi*,
while Pritchard has placed it as a synonym of *M. compta.** The loop is
much more advanced than that of *Magadina*, however, being an early
Terebratelliform stage. Its hinge characters, described below, are quite
distinct from those of *Terebratella* and *Pachymagas*. Although, from the
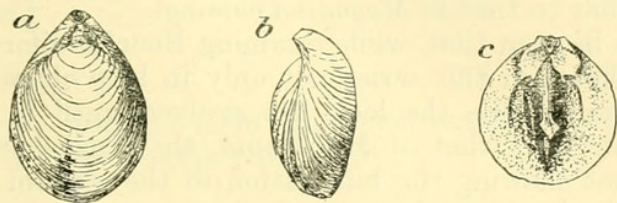

FIG. 13.—*Magadinella woodsiana* (Tate), River Murray.
(After specimens in the Dominion Museum.)

slight difference in beak characters, *Magadinella woodsiana* cannot possibly
itself be an ancestral form of *Rhizothyris*, the forerunner of *Rhizothyris* with
Terebratelliform loop may be placed, when it is found, under *Magadinella*.

HINGE CHARACTERS OF THE BOUCHARDIA-RHIZOTHYRIS SERIES.

In *Bouchardia* the posterior parts of the valves are much thickened,
the hinge-teeth of the ventral valve are strongly bifid, while in the dorsal
valve the fusion of the parts prevents exact comparison with the socket-
ridges, cardinal process, &c., of more advanced genera. The adductor and
diductor muscular impressions are situated anteriorly in the ventral valve,
and are divided by a low median ridge. In *Magadina* the valves are still
somewhat thickened posteriorly, the hinge-teeth are more strongly bifid
than in advanced genera, while the median ridge separating the muscular
impressions on the ventral valve is still situated anteriorly. The thickened
hinge parts of the dorsal valve consist principally of two socket-ridges,
which posteriorly are separate and taper each nearly to a point, projecting
considerably behind the umbo, but anteriorly are very solid, and unite with
one another in front of the septum. Between them, behind their anterior
junction, there is a small but deep hinge-trough, in which a cardinal process
lies. In *Magadina browni* this process is very small, but in *M. cumingi*
it is large and solid, without sharp angles, and completely fills and obscures
the hinge-trough. The septum, high in front, low behind, joins the anterior
junction of the socket-ridges without bifurcation.

In *Magadinella* the posterior thickening of the valves is greatly reduced,
while the muscular impressions of the ventral valve are situated posteriorly
as in other advanced genera. The septum is long but low,† so that the
loop is probably in an early Terebratelliform stage. The hinge characters,
however, still present considerable resemblance to those of *Magadina*. The
socket-ridges are swollen anteriorly, almost uniting in the middle, where
they are joined by an unbifurcated septum; posteriorly they become
attenuated, and project considerably behind the umbo. The hinge-trough

* Proc. Roy. Soc. Vict., n.s., vol. 8 (1896), p. 143.
† Tate's figure shows a septum moderately high anteriorly, due probably to the
youth of the shell figured.

is roomy, and only partially filled by a small cardinal process pointing obliquely forward, and expanded to form an excavated trefoil above.

In *Rhizothyris* the socket-ridges are thickened, and almost unite anteriorly, where they are joined by a short stout unbifurcated septum. In *R. curiosa* the cardinal process is small and similar to that of *Magadina browni;* in *R. rhizoida* it is large and swollen, and often fused with the septum and socket-ridges, but in specimens where it is distinct it is essentially similar to that of *Magadina cumingi.*

It will thus be seen that, while retaining Bouchardiform shape, there is an evolution shown in this series not only in loop characters, but also in hinge characters. While the loop has evolved until in *Rhizothyris* it is indistinguishable from that of *Magellania*, the hinge has remained much more simple, not showing the bifurcation of the septum which is so prominent in *Neothyris* and *Pachymagas*.

OTHER STOCKS.

In the above account all known shells with Bouchardiform beak characters have been discussed, and the majority of the known species of *Magasella* have been transferred to the Magaselloid genera, *Magella* and *Magadina*, while the probable existence of a third Magaselloid genera belonging to the *Pachymagas-Neothyris* stock has been indicated. There are still numerous species of *Terebratella* and *Magellania*, sensu lato, which will not fit into any of the genera above described, but their treatment must be postponed until a revision of the Tertiary Brachiopods of Australia and South America has been made with special regard to the hinge characters. There are also certain Recent species of *Magasella* still unplaced, notably the South Australian forms *Magasella vercoi* Blockman and *M. exarata* Verco. The name *Magasella* may still conveniently be retained in a wide sense as a temporary designation for species whose relationship is not clear.

With regard to the relationship of the evolutionary stocks already indicated, it is probable that *Bouchardia* is a retrograde genus from a forerunner of *Magadina*, and that from the latter genus, by an anterior enlargement of the hinge-trough, the Magaselliform forerunner of *Pachymagas* has evolved. From this suppositional genus, by evolution of loop characters *Pachymagas* and *Neothyris* have evolved on the one side, and by a further reduction in the calcification of the hinge *Magella* has evolved on the other side, giving rise later by evolution of the loop to *Terebratella* and *Magellania*.

APPENDIX: DESCRIPTIONS OF NEW SPECIES.

Magadina browni sp. nov. Fig. 7, a–d.

Description.—Shell rounded pentagonal, slightly longer than broad, greatest breadth posterior to the middle, sides nearly straight, front more or less tapering ; hinge-line nearly straight ; dorsal valve nearly flat, with a short but often pronounced anterior sinus; ventral valve moderately convex, with a median carination ; commissures with a well-marked anterior sinuation, sometimes narrow and deep, sometimes broad and shallower ; beak short, not incurved, truncated obliquely by a relatively large, nearly

round foramen whose anterior lip projects slightly forward; beak-ridges fairly sharp, delimiting a false area, the greater part of which is occupied by a large solid concave pseudo-deltidium. Surface of valves smooth with numerous strong growth-lines.

Dimensions in Millimetres.—			Length.	Breadth.	Thickness.
Holotype	..	..	.. 10	8·5	5·3
Paratypes	..	..	.. 10·6	7	5
			11	10	4·8
			9·8	9	4·8

Type Locality.—Base of main limestone, cuesta between Mount Brown and the Waipara River, North Canterbury.

Magadina waiparensis sp. nov. Fig. 8, *a, b.*

This species so closely resembles *M. browni* that the differences only need be indicated. *M. waiparensis* is slightly more elongate, more convex, and the dorsal valve more arched from back to front. The beak is much more produced, and more incurved, and in consequence the pseudo-deltitidium is higher and more concave.

Dimensions in Millimetres.—			Length.	Breadth.	Thickness.
Holotype	..	..	.. 11	8·3	5·5
Paratypes	..	..	.. 10·4	7·8	5·8
			11·3	9	5·5

Type Locality.—Lowest Mount Brown limestone, in cliffs of the Deans-Waipara cuesta opposite the Ram's Paddock, Middle Waipara district, North Canterbury.

Pachymagas huttoni sp. nov. Fig. 2, *c.*

1905. *Magellania triangularis* Hutton, Trans. N.Z. Inst., vol. 37, p. 477 (not the species of 1873).

Description.—Shell suborbicular, greatest width about the middle; hinge-line short, obtusely angular. Dorsal valve depressed, with a faint anterior sinus, slightly produced and reflected in front; ventral valve strongly and broadly carinated, sides rather flattened; margins of valves fairly sharp; anterior commissure with a broad moderately deep anterior sinuation. Beak small, inflated, not greatly incurved, truncated by a moderately large circular foramen; beak-ridges fairly sharp, pseudo-deltidium broad, low, concave. Surface of valves smooth with numerous growth-lines.

Dimensions of Holotype.—*	Length.	Breadth.	Thickness.
	43 mm.	41 mm.	23 mm.

Type Locality.—Maerewhenua limestone, crossing of Awamoko River, north of Ngapara.

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* The holotype is in the Dominion Museum, and is not the specimen here figured.