Art. IV.—*Additions to the Knowledge of the Recent and Tertiary* Brachiopoda *of New Zealand and Australia.*

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Plate I.

Contents.

(1.) A New Species of Crania from New Zealand Waters.

Crania huttoni sp. nov. Plate I, figs. 1, 2.

1873. *Crania* sp. ind. Hutton, Cat. Mar. Moll. N.Z., p. 87.
1906. *Crania* sp. Hamilton, Bull. Col. Mus., No. 1, p. 41.

"Dorsal valve rugose, with a few radiating lines in places; ventral valve smooth. Light brown. Diameter about 0·5 (inch)."—Hutton.

There is in the Dominion Museum a tablet holding three valves from an unknown locality which purport to be the specimens upon which Hutton based the above brief description. All three valves, however, appear to be dorsal valves, and the apparent absence of radiating lines on two of them is due in one case to attrition on the sea-bottom and in the other to an encrusting organism. There is also in the Museum another tablet of seven valves which are those mentioned by Hamilton as "Trail; Whangaroa, Cook Strait." Of these seven, the two smallest are the young of *Anomia* sp., but the other five are dorsal valves of the same species of *Crania* as Hutton's specimens. In view of the locality record attaching to the latter specimens, the best preserved of these is chosen as the holotype.

In outline the shell tends to be nearly square, with rounded angles, but there is considerable irregularity among the eight specimens, and in two the posterior margin is slightly embayed in the middle. In the nearly square shells the commissures are practically in one plane, but in the more irregularly shaped specimens they are sinuous. The dorsal valve is conical or limpet-shaped, with the vertex generally in the middle line of the shell, although in the holotype it is slightly to one side; it is directed obliquely backward, and is situated at from one-third to one-fifth of the length of

the shell from the posterior margin. The surface of the valve is ornamented by fine radial ribs, which are obsolete, or may never have been developed, near the apex, and are crossed by irregularly developed growth-lines. The shell is thick and solid in the older specimens, and the fine punctuation can be seen in the interior by means of a lens. The colour varies from light brown to almost colourless.

In the interior of the dorsal valve there is a narrow margin encircling the valve, separated from the rest of the interior by a rounded shoulder, and not granulated. The muscular impressions are white and porcellanous, and afford an easy means of distinguishing the species from the molluscan limpets. The posterior adductor-scars are large, nearly round, and situated near the posterior angles of the shell. The unpaired (posterior) muscle has left practically no impression in any of the specimens. The anterior adductor-scars are smaller than those of the posterior adductors, are crescentic in shape with the convex sides directed posteriorly inwards, and approach one another on their inner ends. On their concave sides there are well-marked depressions in the floor of the valve. The impressions of the dorsal protractors lie close to the outer and hinder sides of the posterior adductor-scars, and are small and oval in shape. The impressions of the retractors of the arms lie close to the outer ends of the anterior adductor-scars, and are small and rounded in shape. The protractors of the arms have left a single minute impression situated mesially in front of the anterior adductors, and from it a well-marked groove extends nearly to the front margin. This groove appears to be one of the pallial-sinus impressions, and on each side of it lie four similar grooves of irregular length.

The dimensions of the holotype are : Length, 12 mm. ; breadth, 11 mm. ; height of dorsal valve, 4·5 mm.

C. huttoni differs from most living species of *Crania* by the absence of a granulated rim in the interior of the dorsal valve, and in this respect, as well as in shape, agrees with *Crania japonica* Adams. From this species, however, it is easily distinguished by the radiating ornament as well as by internal characters. The only other Recent species with radiating ornament is the Australian *Crania suessi* Reeve, which is described as suborbicular, and therefore differs in shape. The genus is not yet known fossil in the Tertiary of the Southern Hemisphere.

(2.) On the Generic Position of the Tertiary Terebratulids of the Southern Hemisphere.

The correct generic assignment of the New Zealand, Australian, and Western Antarctic Tertiary fossils formerly known as species of *Terebratula* is a matter of no little difficulty in view of the close restriction of that genus by Buckman (1907). *Terebratula terebratula*, the genotype, is a biplicate Pliocene shell from Italy, and only those species in actual genetic connection with it may be admitted to the genus. The biplicate Cretaceous and Jurassic species may be excluded easily enough, since the great difference in time is alone sufficient to prove that these species have attained biplication from different ancestral forms ; but a difficulty arises in connection with the uniplicate and biplicate older and middle Tertiary species, for there is no *a priori* reason why these should not be in actual genetic connection with *Terebratula terebratula*. Some of them, however, must belong to *Liothyrina*, which is believed to have existed since the

Cretaceous, and there may be a number of other stocks equally worthy of generic rank. Owing to the simplicity in external form of Terebratulids, and the narrow limits of possible variation, the chances of homoeomorphy are very considerable, and, unless genera are closely restricted and homoeomorphy thus excluded, zoological comparisons between the fossils of different countries cannot carry much weight for purposes of correlation.

Since the geological record is too imperfect and the differences in external form are too slight to enable the species to be grouped in linear series, thus allowing their phylogenetic relationships to be traced, it is necessary, if the genera are to be closely restricted, to find some anatomical characters common to groups of related species by which they may be distinguished from other groups of species. The characters chosen may be such as have hitherto been considered unimportant, even in specific differentia, provided that they are persistent within the group. The chances are that a group thus defined will prove to be a good genetic series.

Buckman (1910) has taken the first step, so far as fossils are concerned, towards the discovery of such characters in his treatment of the Tertiary Brachiopods from the islands of the Weddell Sea collected by the Swedish Antarctic Expedition. His words are worth quoting in full :—

" Among the material brought from the Antarctic are several specimens which belong to various species of *Terebratula*, using that term in its wide sense ; but it is probable that none of them really belongs to the typical series which would be grouped around the genotype *Terebratula terebratula* Linné sp. There are two series which differ conspicuously in the character of their test. The first series shows coarse and distant punctae associated with a rather thick test. . . . The second series shows a finely and closely punctate test . . . which is also thin, as if it were a deep-water series. Further, in the older specimens particularly, there is an outer layer of test which is undoubtedly grooved—the grooves waved and irregular . . . very suggestive of the ornament seen in certain species of Lower Jurassic *Lima* (*Plagiostoma*). This finely punctate series is not punctate so finely and minutely as *Terebratula variabilis* of the English Tertiary, which is presumably a true *Terebratula :* the punctae of the Antarctic species are larger and therefore seem more approximate. There is evidently much yet to be learnt concerning these differences of punctuation. . . . These [finely punctate] species with their thin test have much the appearance of species of *Liothyrina ;* but it has not seemed desirable to place them in that genus, of which the characters and limits are none too fully known. Of these species the loop cannot be seen, and they show no indication of the four internal radiating furrows which serve for the attachment of the pallial sinuses ; and these furrows so marked in the type species *Liothyrina vitrea* would serve in fossil species as an outward index where interior details could not be seen : thus they show well through the test of the Chalk species assigned to *Liothyrina*—namely, *T. carnea*, *T. subrotunda*, *T. semiglobosa*, &c."

There are at least two Australasian Tertiary species which agree closely with those of Buckman's finely punctate species—namely, *Terebralula tateana* Tenison-Woods* and *Terebratula concentrica* (Hutton). Both these shells have a thin and finely punctate test, and *T. tateana* shows in addition a

* It may be remarked that Buckman identified one of his species as " *Terebratula vitreoides* Tate (1880) ? of Woods," a name which Tate in 1899 corrected to *Terebratula tateana* T.-Woods.

fine but irregular radial ribbing similar to that described by Buckman. Another character which they have in common is the possession of a short, low, thin, mesial septum in the dorsal valve, perhaps hardly strong enough to be worthy of the name of septum, but sufficiently marked to leave a distinct groove on well-preserved internal casts. This character is additional to that mentioned by Buckman as separating this series from typical *Liothyrinae*. Apparently, also, it serves to distinguish it from *Terebratula*, for, although we are in ignorance of the internal characters of *Terebratula terebratula*, the English Crag species, *T. spondylodes*, *T. variabilis*, &c., considered by Buckman (1908) as probably true *Terebratulae*, possess very strong and widely separated adductor muscular impressions, between and behind which is a broad, raised, nearly flat platform, apparently corresponding to the thin septum mentioned above. (Plate I, fig. 5.)

There is, moreover, a series of Recent Terebratulids commonly ascribed to *Liothyrina* which possess all the above-mentioned peculiarities. Clearly, then, we are in a position to recognize a distinct genetic series.

Liothyrella gen. nov. Genotype, *Terebratula uva* Broderip.

Type of folding from non-plicate, through dorsally uniplicate, to dorsally biplicate. Loop short, terebratuloid. Muscular impressions of the dorsal valve separated by a thin, low, short, mesial septum. Test thin and hyaline, but becoming thick and opaque in old age, finely punctate, with grooves for the reception of the pallial sinus, which are, however, only occasionally visible through the shell in fossil examples. Surface ornamented with a fine radial ribbing, very irregularly distributed, and absent on some individuals.

The following species may safely be included in the genus: *Liothyrina uva* var. *notocardensis* Jackson, *Terebratula tateana* Tenison-Woods, *Waldheimia concentrica* Hutton, and a new species dredged off Tasmania by the Mawson Expedition. Probably also many of the other southern species ascribed to *Liothyrina* will be included here, but the descriptions do not state whether or not a mesial septum is present.

Liothyrella uva has been described in great detail by Blochmann (1908 and 1912) under the name of *Liothyrina*. He divides the *Liothyrinae* into two groups, according to the presence or absence of certain spicules at the base of the cirrhi (Cirrensockeln). The group in which they are absent, which includes *Liothyrina vitrea*, occurs chiefly in the Atlantic Ocean and the Mediterranean Sea, with the exception of one species in Japan and one off Madagascar. The group in which they are present, which includes *Liothyrella uva*, is restricted to the Antarctic and South Temperate seas, with the exception of one species in the Mediterranean, while *L. uva* itself ranges from the Argentine coast, around the Horn, and up the western American coast as far as the Gulf of Tehuantepec in Mexico. The spicules of several species, however, are as yet unknown. It does not seem probable that the presence or absence of these basal spicules will, taken by itself, separate genetic groups, but it is quite probable that their presence will be found to be a constant character of Recent *Liothyrellae*. For fossils, however, this criterion cannot be used.

In the thickness of the shell, *Liothyrella* stands between *Liothyrina* and *Terebratula*, while all three genera are finely punctate. In view of the known occurrence of *Liothyrella* in the Recent seas both of South America and Tasmania, and in the Tertiaries of these countries and also of New Zealand, it will be preferable to include the finely punctate fossils from

these countries of which the interiors are unknown in *Liothyrella* rather than in *Terebratula senso latu*. Buckman's coarsely punctate series, however, must be regarded as a distinct genetic stock.

(3.) The Generic Position of Terebratulina davidsoni *Etheridge* and Magasella exarata *Verco*.

Terebratulina davidsoni Etheridge, an Australian Tertiary fossil, differs from typical *Terebratulinae* in its type of folding. The dorsal valve is almost flat, but there is a faint medial sinus revealed by the course of the anterior commissure. In *Terebratulina caput-serpentis*, on the other hand, the dorsal valve shows a fold. It becomes, therefore, a matter of considerable interest to know the type of the loop of *Terebratulina davidsoni*. Tate (1880, p. 159) makes the following statement : " The founder of this species, being unacquainted with its internal portions, placed it with a doubt in the genus *Terebratulina*, but having seen the loop, which offers no special character, I can confidently refer it to that genus." This statement does not help us much, for at the time at which Tate wrote the genus *Terebratulina* was made to include such divergent loop forms as *Dyscolia wyvillei* and *Eucalathis murrayi*, while in 1886 Davidson also referred the shell subsequently known as *Chlidonophora incerta* to *Terebratulina* (?). It is quite possible, then, that the loop of *Terebratulina davidsoni* is not that of a typical *Terebratulina*. I have endeavoured to expose the loop of some specimens in the Dominion Museum from the River Murray, but without success, owing to the hardness of the matrix. My preparations, however, reveal several important characters. In the first place, the internal margin of both valves is strongly crenate, a character not found in typical *Terebratulina*. There is no median septum on either valve, so that the loop is probably short and simple as in *Terebratula* and *Terebratulina*. The socket-ridges and cardinal process, however, are much stronger than in typical *Terebratulina*, and recall those of primitive *Pachymagas* and of *Campages*, except for the absence of the bifurcating septum. The origin of the crura from small processes below the inner anterior ends of the socket-ridges is also distinct from the conditions in *Terebratulina*, where the crural bases are united to the inner sides of the socket-ridges at a slightly higher level.

All these peculiarities exist also in *Magasella exarata* Verco, a Recent shell from South Australia of which also the loop is imperfectly known. It cannot belong to any Magaselloid genus, since it does not possess a high septum, but only a low median ridge. We have, therefore, a new genus, which we may designate as follows :—

Murravia gen. nov. Genotype, *Terebratulina davidsoni* Etheridge. Plate I, fig. 4.

Shell with incipient ventral uniplication, the dorsal valve flattened. Delthyrium partially closed by two lateral deltidial plates, leaving a submesothyrid foramen which is margined anteriorly by the dorsal valve. Surface of valves ornamented with radiating ribs, which are continued as crenulations on the inner margins of the valves. Dorsal valve without a median septum, and with strong socket-ridges and a stout pyramidal cardinal process. Loop unknown, but crura springing from swollen bases below the inner anterior ends of the socket-ridges.

Besides the genotype, *Murravia exarata* is the only other species which may be included in the genus with certainty. *Terebratulina ornata* Giebel from the Oligocene of Latdorf, Germany, and Hoesfelt, Belguim (*cf.* Davidson, 1874), agrees in possessing the internal crenulation, but has, according to Davidson's figure, a different type of cardinal process. It also certainly cannot be a *Terebratulina*.

A genus nearly related in shape is *Disculina* Deslongchamps, 1884, based on *Terebratula hemisphaerica* Sowerby. This species is radially costate, and has a flat dorsal valve and a foramen similar to that of *Murravia*, but there are no internal crenulations in the dorsal valve.

(4.) On a New Form of Terebratella from New Zealand Waters. Plate I, fig. 3.

A small collection of Brachiopods dredged off Cape Colville, Auckland, in 20 fathoms, by Mr. Anderton, of the Portobello Marine Fish-hatchery, and presented through Mr. G. M. Thomson to the Dominion Museum, consists of a form closely allied to *Terebratella sanguinea* (Leach), but presenting some interesting differences. As it is possibly only a local race of that species, and may be linked to it by a series of intermediate forms, I do not propose to burden the literature with a new name, that may prove synonymous, until collections from other northern localities have dispelled the doubt.

The collection consists of one adult shell and seven half-grown or still smaller specimens. In shape the adult, which is slightly unsymmetrical, agrees fairly well with moderately elongate examples of *T. sanguinea*, but the beak is suberect instead of erect, and in consequence the foramen is farther removed from the dorsal umbo and the pseudo-deltidium is higher. The beak-ridges also are less pronounced, and the sinus on the dorsal valve is broader, shallower, and commences more imperceptibly, so that the anterior commissure presents a regular ventrally directed curve instead of a nearly rectilinear angled trough, and the front margin is rounded instead of straight. The most striking difference, however, lies in the almost complete reduction of the radial multicostation. The radial ornament that still exists is irregularly distributed on all the specimens, and varies in its distribution in different individuals, in some being more marked on the sides, and in others along the fold and sinus. One shell shows an area corresponding to the middle period of growth in which the ribbing is entirely absent on the sides, although it was present at an earlier stage and appears again at a later stage. The ribbing in no case commences near the umbo, the earliest stage for about 5 mm. being completely smooth, but it is much better developed in shells of about 15 mm. than it is in the adult, which measures 31 mm. in length.

A somewhat analogous case in the same genus is furnished by *T. dorsata* var. *submutica* Fischer and Oehlert (1892), in which the shells start with a smooth stage, develop multicostation for a short period, and finally become smooth again before adolescence.

List of Papers referred to.

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