ART. XXX.—*Pedunculate* Cirripedia *of New Zealand and Neighbouring Islands.*

By L. S. JENNINGS, M.Sc.

[*Read before the Canterbury Philosophical Institute, 2nd December, 1914.*]

THE objects of this paper are—(1) to give a reliable list of stalked barnacles collected from the New Zealand region; (2) to discuss the characters which are at present regarded as specific in the cases of *Lepas anatifera* and *Pollicipes darwini*.

The specimens the work is based on belong to the only two important existing collections in New Zealand that I am aware of—viz., that of the Otago Museum, which includes Captain F. W. Hutton's original collection, and my own collection at the Biological Laboratory, Canterbury College, which includes a large amount of material collected and in some cases already described by Dr. Charles Chilton.

The works of reference I have made most use of are—(1) Darwin, C. (1851), "Monograph on the *Cirripedia: Lepadidae*"; (2) Hutton, F W. (1879), "List of New Zealand *Cirripedia*," Trans. N.Z. Inst., vol. 11, p. 329; (3) Gruvel, A. (1905), "*Cirrhipèdes*"; (4) Pilsbry, (1907), "Barnacles of the United States National Museum"; (5) Chilton, C. (1911), "*Crustacea*, Trawling Expedition, 'Nora Niven,'" Records Canterbury Museum, vol. 1, No. 3, p. 311; (6) Chilton, C. (1911), "Dispersal of Marine *Crustacea* by Means of Ships," Trans. N.Z. Inst., vol. 43, p. 132; (7) Chilton, C. (1911), "*Crustacea* of the Kermadec Islands," Trans. N.Z. Inst., vol. 43, p. 571.

I. LIST OF PEDUNCULATE CIRRIPEDIA.

[Those marked * are to be found in the Otago Museum; the rest are in my collection at the Biological Laboratory, Canterbury College, Christchurch.]

The following is a complete list of pedunculate *Cirripedia* gathered from the region of New Zealand and the surrounding islands (Auckland, Campbell, Chatham, and Kermadec Groups) up till December, 1914. In this list I have included only those species of which I have been able to examine specimens definitely known to occur at the localities mentioned.

1. **Lepas anatifera** Linnaeus.

General type: Kermadec Islands; collected by Oliver, 1908. Var. (*b*) *dentata* Darwin: Kermadec Islands; Oliver, 1908. Var. (*c*), new variety: Kermadec Islands; Oliver, 1908, and Bell, 1909–10: Chatham Islands: Miss Shand, 1910: "Terra Nova" hull, Lyttelton, November, 1910.

2. **Lepas australis** Darwin.

New Brighton and Sumner, New Zealand; common. *Waikouaiti, Otago; attached to penguin's foot. "Terra Nova" hull, Lyttelton, November, 1910.

3. **Lepas fascicularis** Ellis and Solander.

New Brighton, New Zealand; Dr. Dendy, 1895. Kermadec Islands; Oliver, 1908. *The Nuggets, Otago; and North Cape, Auckland.

4. **Lepas pectinata** Darwin.

General type: Chatham Islands; Dr. Dendy, 1901. Var. (*a*) Darwin: Kermadec Islands; Oliver, 1908. *North Island, New Zealand (dry).

5. **Lepas denticulata** Gruvel.

Kermadec Islands; Captain Bollons, 1907.

6. **Pollicipes sertus** Darwin.

Kaikoura, New Zealand, 1898; Port Pegasus, Stewart Island, 1907; Oamaru, 1914.

7. **Pollicipes spinosus** Quoy and Gaimard.

Kaikoura, New Zealand; 1898; Taylor's Mistake Bay, Lyttelton, New Zealand: *Wellington; F. W. Hutton (dry).

8. **Pollicipes darwini** Hutton.

*Dunedin A. Montgomery (type), (dry). *St. Clair, Dunedin; F. W. Hutton. Port Pegasus, Stewart Island, 1907; Kaikoura, Oamaru, Dunedin, 1914.

9. **Scalpellum (Smilium) spinosum** Annandale.

*Farewell Spit, Nelson, Annandale. "Nora Niven" Expedition, Station 5, 1907.

10. **Scalpellum villosum** Leach.

Port Robinson, Marlborough, 1910; Oamaru, 1914; *St. Clair, Dunedin.

The above list is as complete as I can make it, and contains all that can be considered absolutely reliable material as regards identity and locality so far collected. Except in the three cases noted, the specimens are all well-preserved spirit ones, and located in the Otago University Museum, Dunedin, or in the Biological Laboratory, Canterbury College, Christchurch. I have carefully dissected several specimens of each of the species given, and examined all the main points of identification, including the mouth parts, and have repeated my work at intervals of several months. I am reasonably certain, therefore, that the specimens handled should be referred to these species as at present constituted, and described by Darwin (1851) and Gruvel (1905).

There is a large amount of material which should be recorded here, but which must be kept out of the reliable list for this region. Thus, I have examined well-preserved spirit specimens belonging to the following species, but have not included them in the list given above, as the locality is doubtful and it is not certain that they are indigenous to the New Zealand region:—

1. *Lepas anatifera* Linnaeus.

General type: Canterbury Museum; locality unknown. *Otago Museum, "Ship's bottom, 1905."

As noted in the list above, this species has been collected at the Kermadecs and at Chatham Islands, but it is not certainly known to occur in New Zealand proper.

2. *Lepas hillii* Leach.

"Terra Nova" hull, Lyttelton, 1910.

3. *Conchoderma aurita* Linnaeus.

"Terra Nova" hull, Lyttelton, 1910. *Otago Museum and Auckland Museum, attached to whale.

4. *Conchoderma virgata* Spengler.

"Terra Nova" hull, Lyttelton, 1910. *Ship's hull, Dunedin.

5. *Lithotrya dorsalis* Sowerby.

Canterbury Museum; locality unknown.

6. *Ibla quadrivalvis* Cuvier.

Canterbury Museum; locality unknown.

I have included specimens obtained from the "Terra Nova" in my reliable list only when the species from other information is definitely known to occur in the New Zealand region. The "Terra Nova" was Captain Scott's Antarctic exploring vessel, with a wooden hull. Her route from England to New Zealand was via Cape Town, Hobart, and Melbourne, and the specimens were gathered shortly after her arrival in Lyttelton in October, 1910.

In addition to the above well-preserved material, there are dry specimens, mounted on cardboard, in my collection and in the museums throughout New Zealand. They are not of much value in this connection, and do not add to the list. Hutton's type specimen for his new species *Pollicipes darwini* is unfortunately in this condition. It was briefly described on external characters only, and never figured.

It is hoped that this list will form a reliable foundation for additions to the group, which are certainly to be found in this region. So far it has been very imperfectly explored, and the material already collected has often been wrongly named, owing to the difficulty of the classification.

NOTE.—Hutton's list of New Zealand pedunculate *Cirripedia* (1879) is as follows: *Lepas hillii, Lepas pectinata, Lepas australis, Lepas fascicularis, Scalpellum villosum, Pollicipes spinosus, Pollicipes darwini.*

The identity of the specimens identified by Hutton as *L. hillii* is not certain now. They are dry, rather small, with no umbonal teeth, and a carina not strongly forked. As will be seen in the following section, this is not sufficient to distinguish them from certain forms of *L. anatifera* and *L. australis*. The filaments would decide the matter, but these cannot be made out from the shrivelled animals. There is no certain evidence of *L. hillii* yet having been collected from the New Zealand region.

II. A Discussion of the Specific Characters of Lepas anatifera Linnaeus.

Lepas anatifera Linnaeus, 1758.

1851. Darwin, "Monograph *Cirripedia: Lepadidae*," p. 73.

1905. Gruvel, "*Cirrhipèdes*," p. 108.

1907. Pilsbury, "The Barnacles of the United States National Museum," p. 79.

This species includes—(1) the general type; (2) var. (*a*) *punctata* Darwin; (3) var. (*b*) *dentata* Darwin; (4) var. (*c*), new variety.

The general type has—(1) a distinct umbonal tooth on the right scutum only; (2) two well-developed filaments on each side of the body.

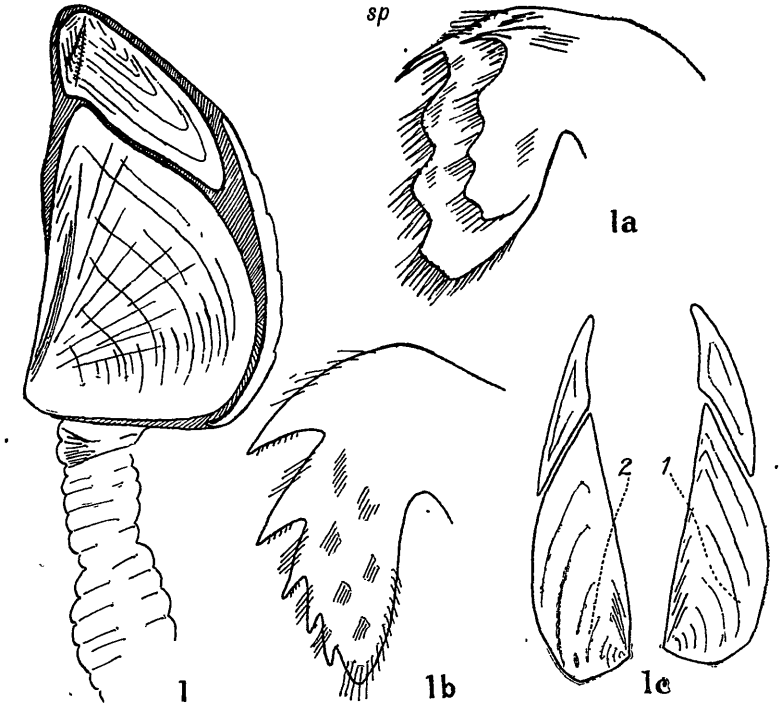

Fig. 1.—*Lepas anatifera* var. (*c*), new variety. Kermadec Islands (Bell), 1909–10. External view, right side. Length of capitulum, 33 mm; width of capitulum, 21 mm.; length of peduncle, over 100 mm.

Fig. 1*a*.—Maxilla of same specimen. *sp.*, two prominent spines Length (from top to bottom), 2 mm.

Fig. 1*b*.—Mandible of same specimen. Length (from top to bottom), 3 mm

Fig. 1c.—Opercular valves of same specimen, viewed along occludent margin. 1 Right scutum; 2 left scutum.

Var. (*a*) *punctata* has, in addition, square patches across the capitulum. Var. (*b*) *dentata* has, in addition to the characters of the general type, a strongly barbed carina Var. (*a*) has not been collected in the New Zealand region. The others have

The main characters of var. (*c*) need setting down. They are quite definitely as follows: (1) No trace of an umbonal tooth on either scutum;

(2) two well-developed filaments on each side of the body. The carina is not barbed, and square patches on the capitulum are not visible. In size and remaining characters it is indistinguishable from the general type.

The numerous specimens of this variety, collected as mentioned in the first part of this paper, all agree distinctly with *L. anatifera* Linn., general type, of which excellent specimens were also obtained from the Marine Biological Laboratory, Plymouth, England, for purposes of comparison, with this uniformly exceptional character: that there is no trace of an umbonal tooth on either scutum. The umbonal angles may be slightly incurved, their apices may sometimes slightly overlap, but there is no more definite tooth than in *L. hillii*, and nothing approaching the distinct tooth of the general type of *L. anatifera* nor the distinct teeth of *L. australis*.

Possible confusion of *L. australis* and *L. anatifera:* The wide forking of the carina below the basal margin of the scuta, and the umbonal tooth on each scutum, would ordinarily allow one to recognize *L. australis* from this new variety. But I have specimens among others undoubtedly *L. australis* in which the prongs of the carinal fork are scarcely developed, and no more than an incurving occurs at the umbo of either scutum. I have decided that these are immature specimens of *L. australis:* the carinal fork is undeveloped and the penis does not project through the cirri. They were collected alive in midsummer, were apparently full size, and contained ova. I have specimens from the same lot showing in gradation just one small tooth on the right scutum, and then the two small teeth accompanied by a wider forking of the carina and lengthening of the penis. I think the view of immaturity is therefore a correct one. All have the two distinct filaments on each side of the body.

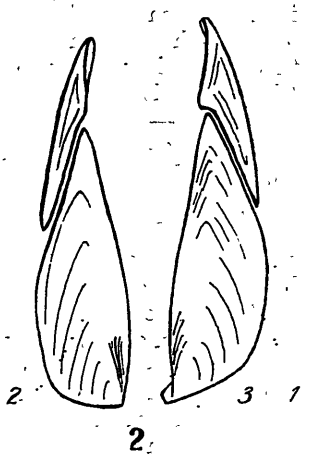

FIG. 2.—*Lepas anatifera* Linnaeus general type. Marine Biological Laboratory, Plymouth. Opercular valves. 1, Right scutum; 2, left scutum; 3, umbonal tooth. Length of capitulum, 34 mm.

One can easily see that a slightly immature specimen of *L. australis* could be selected which the specific characters as at present given in the standard works quoted would fail to distinguish from *L. anatifera* general type or *L. anatifera* var. (*c*) new var. Only a collector familiar with general appearances could distinguish them, and he would have a difficulty in basing his distinction on constant characters. He would have to fall back on the curvature of the occludent margin, the thinness of the valves, and possession of 3 prominent spines at the upper angle of the maxilla, which seem fairly constant.* The adult *L. australis* is, however, apparently the certain possessor of 2 distinct umbonal teeth and a specially wide carinal fork, and therefore can be readily identified. The point is, can *L. anatifera* var. (*c*)

* (1.) Most maxillae of *L. antifera* and *L. hillii* have 1 or 2 prominent spines at the upper angle. (2.) Further, without dissection, or if the specimen were dry, it appears impossible to state definitely whether certain forms are *L. australis*, *L. hillii*, or *L. anatifera*. The dry specimens of these in the museums are, therefore, scarcely reliable.

new var. be immature forms of the general type, and the non-development of the umbonal teeth be thus accounted for? It seems certainly not possible. The umbonal teeth are uniformly absent in fully developed forms down to the smallest. And in *L. anatifera* general type the tooth is uniformly present from the smallest to the best-developed specimens. This ensures that the new variety is not an immature form of *L. anatifera* general type nor of *L. australis*.

This new variety of *L. anatifera* next affects the present classification and distinction of *L. anatifera* and *L. hillii*. The latter is known by—(1) no umbonal teeth on either scutum; (2) 3 filaments on each side of the body.

In other respects, including the mouth parts, it is closely similar to the general type of *L. anatifera*. The maxillae and mandibles in all the varieties of *L. anatifera* and in *L. hillii* are practically indistinguishable. I have put my new variety under *L. anatifera*, rather than under *L. hillii*, because the former is a most widely distributed species, and because an external umbonal tooth seems more likely to vary than a filament. The calling of this new variety a new species would have certainly nothing to justify it. What is left is to regard the following specific characters now as certainly distinctive:—

L. anatifera: 2 filaments; umbonal teeth absent or on right scutum only.

L. hillii: 3 filaments; umbonal teeth absent.

L. australis: 2 filaments; umbonal teeth on each scutum in adult; and the following small, fairly reliable characters: wide carinal fork, brittle valves showing curved occludent margin, and 3 spines on maxilla.

Any one can then distinguish the known specimens of these without the confusion and difficulty at present attending their classification.

When preserved in spirit, certainly all three species are very similar in size and general appearance.

The other members of the genus will give little difficulty.

As for other characters often given, I know of no others certainly distinctive. I have specimens from each of the three species which show that (*a*) radiating lines on the valves, (*b*) proximity of carina to the other valves, (*c*) apex of carina being rounded or acuminate, (*d*) the distance the carina extends up between the terga, and (*e*) the curvature of the occludent margin, cannot be used as accurate guides in distinction. The great variability of all these characters in specimens I have examined belonging to *L. anatifera* alone makes them of little use in distinguishing *L. hillii* and *L. australis*.

It will be seen, then, that such statements as the following now require modification:—

(1.) "The smoothness of the valves, together with the presence of a tooth on the right-hand scutum, and its entire absence on the left-hand side, is an unfailing diagnostic mark" of *L. anatifera*. (Darwin, "Monograph *Cirripedia: Lepadidae*," p. 77.)

(2.) *L. anatifera* "*Carène séparée des autres plaques par un espèce membraneux très étroit ou nul.*" (Gruvel, "*Cirrhipèdes*," p. 108, 1905.)

(3.) *L. anatifera:* "It resembles *L. hillii*, but may be distinguished by the faintly striated valves, the presence of an umbonal tooth in the right scutum, none in the left, and the proximity of the base of the carina to the scutum." (Pilsbry, "Barnacles of United States National Museum, 1907.)

III. THE NEW ZEALAND SPECIES OF POLLICIPES.

The species of this genus recorded for New Zealand are :—

1. **Pollicipes spinosus** Quoy and Gaimard, 1834.
   1851. Darwin, " Monograph *Cirripedia: Lepadidae,*" p. 324.
   1879. Hutton, " List of New Zealand *Cirripedia,*" Trans. N.Z. Inst., vol. 11, p. 329.
   1905. Gruvel, " *Cirrhipèdes,*" p. 20.

2. **Pollicipes sertus** Darwin, 1851.
   1905. Gruvel, " *Cirrhipèdes,*" p. 22.

3. **Pollicipes darwini** Hutton, 1878.
   1905. Gruvel, " *Cirrhipèdes,*" p. 21.

These three species belong entirely to New Zealand. Just as the bulk of *Lepas* forms met with in New Zealand will come under the three species already treated, so the bulk of New Zealand *Pollicipes* will be referred to these three; and, with the present descriptions of them also, the classification of the forms is a complicated puzzle.

The distinct characters, taken from Darwin and Gruvel, are: For *P. spinosus*—(1) yellow membrane covering the valves; (2) rostrum short, wide, and curled inwards; (3) apex of carina not projecting, and terga not rising much above the scuta: for *P. sertus*—(1) dark red-brown membrane; (2) rostrum longer and more projecting; (3) apex of carina projecting, and terga not rising much above the scuta.

Then, according to Hutton's description, *P. darwini* is " easily distinguished from *P. spinosus* by the projection of the terga beyond the scuta, and from *P. sertus* by the short rostrum and apex of carina not projecting."

The history of these species is briefly this: Darwin (1851) recognized from New Zealand specimens *P. sertus* and *P. spinosus.* Hutton (1878), when living in New Zealand, added *P. darwini;* it appears in his list of New Zealand *Cirripedia,* with a brief description of external characters, not accompanied by drawings. Gruvel (1905) described *P. sertus* and *P. spinosus,* and includes *P. darwini,* but questions it, suggesting it to be a variety of *P. sertus:* " *Cette espèce semble très étroitement unie a* P. spinosus *et surtout a* P. sertus . . . . *Nous avons rencontré un* Pollicipes, *répondant à tous ces caractères provenant de l' 'Astrolabe' et nous n'avons pu le distinguer de certaines formes de* P. sertus. Pollicipes darwini *ne serait-il qu'une variété de forme de* P. sertus ? " (" Cirrhipèdes," p. 21.)

I have examined carefully hundreds of forms of these species. They occur by the thousand in the dark crevices of rocks between high-tide and half-tide mark. I have gathered them from Kaikoura, from Oamaru, and from St. Clair, Dunedin, the last place being the locality from which Hutton obtained his specimens. They are very common, but are easily overlooked, since the black and white of the rocks exactly matches the black peduncle and the white worn valves. No explanation has been offered of this as a protective resemblance. I have also examined the specimens labelled by Dr. Dendy, Canterbury College, as *P. spinosus,* and those labelled by Captain Hutton as *P. spinosus* and as *P. darwini.*

The great majority have the valves much worn and variously worn. These are the forms which have been classified as *P. spinosus* and *P. darwini,*

the distinction being in the height the terga rises above the scuta. But from the wearing received, not only will this character be found highly variable, but also other external characters relied on in the classification, including (*a*) the size of the rostrum and its projection, (*b*) the projection of the carinal apex, (*c*) the size of the valves and the number of lateral plates developed. Taking this into account, I could see no valid distinction between the specimens labelled by Hutton *P. spinosus* and *P. darwini*, when placed side by side.

But there were in my original collection, and I found others by careful search in the rocks, a few specimens from sheltered positions with the

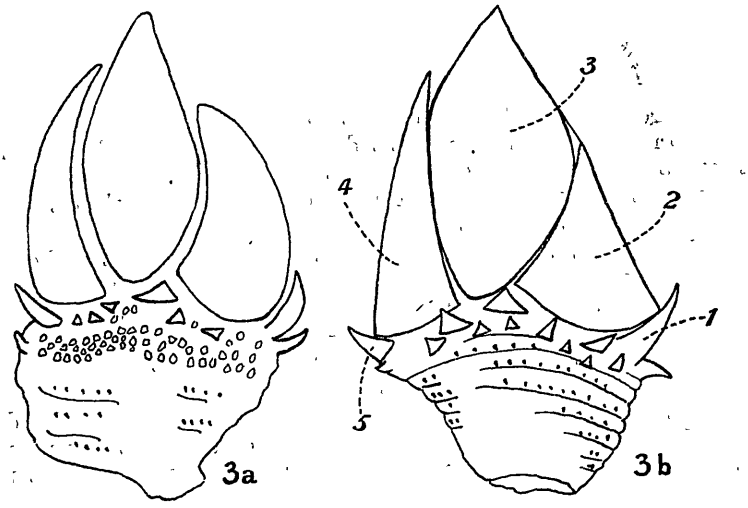

FIG. 3*a*.—*Pollicipes darwini* Hutton. Type specimen, dry and worn. Diagram showing shape and position of plates. Height of specimen, 27 mm.; width, 19 mm.

FIG. 3*b*.—*Pollicipes* sp. Well-preserved immature form, with the characters of *P. sertus*. Height, 19 mm.; width, 13 mm. 1, Rostrum; 2, left scutum; 3, left tergum; 4, carina; 5, subcarina.

points of the valves and plates sharp and the surfaces uncorroded. They are mostly immature, but there is an occasional full-sized one. If these were examined independently they would certain be classed as *P. sertus*. They have the distinctly projecting rostrum and carinal apex. I have figured one in fig. 3*b*. They are found amongst the very common worn specimens which, I have not the slightest hesitation in stating, after examining his type and visiting the locality where he obtained them, are what Hutton meant to distinguish as *P. darwini*.

Yet, beginning with these well-preserved forms, can be found practically all stages leading by growth and wearing into the common form.

I am practically convinced that there is only one species in all these New Zealand *Pollicipes*, whose external characters get highy modified by wearing; that it is the young and well-preserved forms of it which have been called *P. sertus;* that the somewhat worn specimens, with therefore a shorter and wider rostrum, apex of carina not projecting, apex of terga not rising much above apex of scuta, and a good showing of lateral plates and spines, are those which have been called *P. spinosus;* and that the

average worn specimens, at the most distinguished from the last by the prominence of the terga, have been called *P. darwini*.

I could readily find specimens, I believe, from the same bunch, certainly from the same locality, to match each of these species. However, since these species are at present accepted, I have included all three in my list.

In addition, I have examined the mouth parts from a number of representative specimens. So far I have found the mandibles and maxillae rather variable, and not uniformly so.

As for the colour on the membrane covering the peduncle and valves, those that have been some years in spirits are yellow; fresh specimens are blackish; dried ones grade from black to dark brown to yellow. All varieties when first put into methylated spirits turn quickly red. The colour differences given by Darwin and Gruvel would scarcely, then, seem to afford any valid distinction of species.

To conclude, I am practically certain that the New Zealand *Pollicipes* so far recorded come under one species only, which, by priority, should be called *Pollicipes spinosus* Quoy and Gaimard.

ART. XXXI.—*The Occurrence in New Zealand of* Myriapoda *of the Genus* Scutigerella, *Order* Symphyla.

By GILBERT ARCHEY, M.A., Assistant Curator, Canterbury Museum.

[*Read before the Philosophical Institute of Canterbury, 2nd December, 1914.*]

THE group *Symphyla* is of considerable interest and importance, for, as its name, given so appropriately by Ryder,* implies, it forms a connecting-link between two classes of animals—the *Insecta* and the remainder of the *Myriapoda* The characters which indicate insectan affinities are the number and arrangement of the mouth-parts, and the presence, at the base of the legs, of small processes called exopods. The insects which show these characters are the simplest and most primitive groups—*Thysanura* and *Collembola*—a significant fact, for similarity of structure in primitive, unspecialized forms of two groups is more likely to indicate affinity than resemblances in highly specialized and otherwise extremely differentiated forms.

The *Symphyla* contain two genera, *Scolopendrella* and *Scutigerella*, the species of which have been found in most parts of the world, but not hitherto from either Australia or New Zealand. Dr. H. J Hansen, of Copenhagen, who has written a monograph on the *Symphyla*,† stated in a letter, dated 2nd November, 1903, to Dr. Chilton that he had had no specimens from New Zealand or Australia, and suggested that search would show that several forms of *Symphyla* would certainly be found in both of these countries. Dr. Hansen's opinion has now been confirmed as far as New Zealand is concerned.

The specimen I am describing in this paper was among some *Myriapoda* from Ben Lomond, Lake Wakatipu, collected by Mr. T. Hall, and forwarded

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* Ryder, F. A. Amer. Naturalist, vol. 14, pp. 821, 822, 1880.

† Hansen, H. J. Q.J.M.S., vol. 47, pp. 1–101, pl. 1–7, 1904.