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(Plates 12–18 and Map.)

Read 19th November, 1908.

Part I.—GENERAL.

Historical.

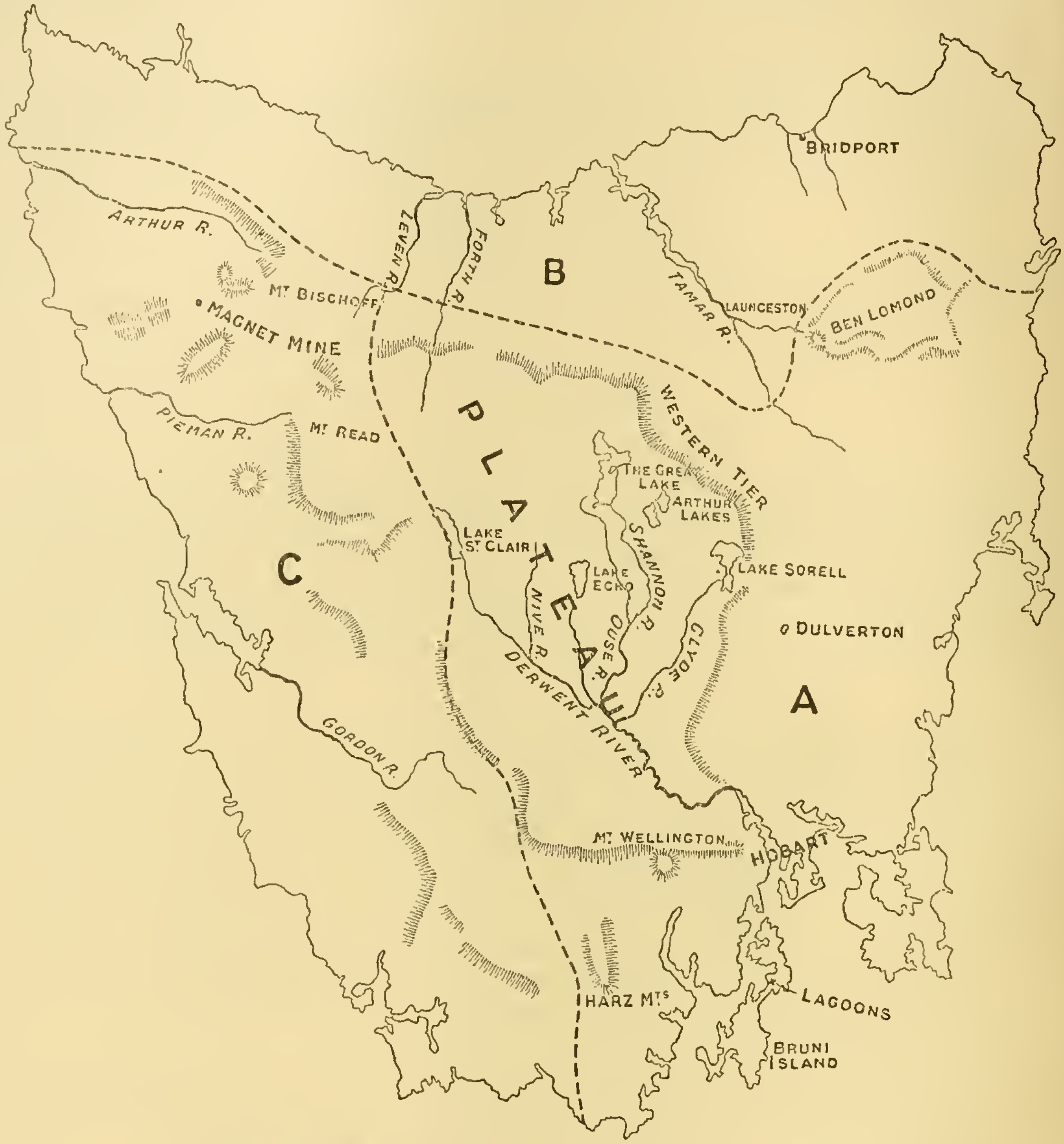
During a six months' stay in Tasmania (October 1907 to March 1908), undertaken at the suggestion and through the assistance of Prof. G. C. Bourne of Oxford, I visited a great number of freshwater localities in the island with the object of making a collection and study of the Crustacea. Tasmania is a particularly favourable place for studying the Australian freshwater fauna, as its highlands are covered with numerous large lakes and tarns, and the country everywhere is watered by large rivers and streams.

Previous to my visit, the only naturalist who had made a study of the Crustacea was G. M. Thomson, F.L.S. (Proc. Roy. Soc. Tasmania, 1892, p. 51), who confined himself to the Malacostraca from a few localities. Most of the Tasmanian genera are, however, common to Victoria and New South Wales, so that the works of Sars and Sayce (see Systematic Part) have been of great use to me in assigning species to their proper systematic positions. Besides the discovery of several new forms of interest, I believe that my collections are sufficiently thorough and cover a wide enough area to establish clearly not only what are the dominant genera in Tasmanian freshwaters, but also what genera characteristic of other countries are absent.

In the account of the localities visited and the nature of their Crustacean fauna I confine myself to stating the most important physical characters; but if the reader is desirous of knowing more about the nature of the country and the means of transit I may refer him to my book, 'A Naturalist in Tasmania' (Clarendon Press).

Localities; with their Crustacea.

Tasmania falls naturally into three chief regions:—(1) The Greenstone Plateau. The plateau itself, formed of igneous dolerite or diabase, occupies the centre of the island, the various large lakes being situated on the tableland at an elevation of 2000–3000 ft. above sea-level. The diabase plateau is everywhere flanked by Permo-Carboniferous sand- and mud-stones, beneath which the diabase was originally thrust upwards. To



SKETCH MAP OF TASMANIA

Scale 30 Miles to the inch
0 15 30 60 MLS

A. Greenstone & Palaeozoic Sandstones.
B. Northern Region.
C. West Coast Region.

the east and south the plateau is broken up and irregular, with extensive undulating plains in the lowlands formed chiefly of the sandstones, but with occasional high upstanding mountains of diabase, *e. g.* Ben Lomond in the north-east, Mt. Wellington and the Harz Mountains in the south. The waters in this region, where they flow chiefly over the diabase, are very pure and unclouded; but where they flow over the sandstones, especially in the valleys, they are yellow and cloudy.—(2) The North Coast. The strip of the north coast is very varied geologically, with outcrops of granite and basalt and rather extensive tertiary estuarine deposits, especially round the Tamar.—(3) The West Coast. The west coast is a very mountainous and rugged district, the mountains being formed of schists, and other metamorphic rocks of Archæan, Cambrian, and Silurian age. The rainfall here is excessive (about 100 inches per annum) and the mountains are clothed with forests of the evergreen beech (*Fagus Cunninghami*), which replaces Eucalypts, characteristic of the other districts.

1. *The Greenstone Plateau.*

The Great Lake.—At about 3000 ft. above sea-level is an extensive sheet of water, 90 miles in circumference, but nowhere deeper than 20 ft. The water is always somewhat discoloured by the sand stirred up by the waves. Round the edges are blocks of greenstone with a good deal of weedy growth. The Crustacean fauna is very rich both in point of variety of species and in number of individuals representing them. Almost all the species are confined to the shallow littoral zone, the dredge in the deeper zones bringing up nothing but fine mud without any life. In the littoral zone I found a new genus of the Anaspidacea, named *Paranaspides lacustris* (Proc. R. S. ser. B, vol. 80, p. 470, 1908), a transparent green *Mysis*-like shrimp attaining an inch in length. Crawling about in the weeds the very handsome *Phreatoicus spinosus* (Pl. 12. fig. 7), a new species, was abundant, and also the common *P. australis* (Pl. 12. fig. 1). In the deeper muddier zone the straw-coloured *P. brevicaudatus*, sp. n. (Pl. 12. fig. 5), was especially common. These three very distinct species were perhaps the commonest Crustacea in the lake. Together with these were two abundant species of Amphipod, *Neoniphargus tasmanicus*, sp. n., and *Gammarus ripensis*, sp. n. (Pl. 14. figs. 5–8 and Pl. 14. figs. 23–26).

The only native fish which inhabit the Great Lake are the little Galaxias, or native "trout," *G. auratus* and *G. truttaceus*, which can never have been formidable enemies. In the last 50 years the English Brown Trout has been introduced here and grows to an enormous size in the lake (up to 25 lbs.). The trout examined by me all had very deep pink flesh, and their stomachs were full of the above-mentioned Malacostraca, so there is no doubt that they chiefly feed upon the Crustacea of the lake. Tow-netting during the daytime produced very little result, but at night a rather poor quantity of plankton was obtained consisting of the Cladoceran *Bosmina brevirostris*, sp. n. (Pl. 16. fig. 1), the first *Bosmina* to be taken in Australasia, and the common *Cyclops albicans*, sp. n. (Pl. 16. fig. 8).

Lake Sorell.—This lake, at a rather lower elevation than the Great Lake, is of a similar shallow type with discoloured water. Owing to the absence of a boat I was unable to explore it thoroughly. The littoral region of the lake seemed destitute of Amphipods or *Phreatoicus*, but there were numerous prawns of the widely distributed *Xiphocaris compressa*. The plankton was well-developed and consisted of the two Cladocera *Bosmina sorelli*, sp. n. (Pl. 16. fig. 2), and *Ceriodaphnia planifrons*, sp. n. (Pl. 15. fig. 17), and the Copepod *Boeckella longisetosa*, sp. n. (Pl. 17. fig. 13), belonging to the Diaptomidæ.

Lake St. Ctair is very different in type to the other Tasmanian lakes, being exceedingly deep (in places 600 ft.) and the water absolutely clear and ice-cold. The elevation is about 2500 ft. The dredge from the deep holes brought up absolutely nothing but fine mud. Round the sandy margins the widely distributed Amphipod *Chiltonia australis* was common. The plankton, which was exceedingly rich, consisted of *Bosmina rotunda*, sp. n. (Pl. 15. fig. 18), *Ceriodaphnia hakea*, sp. n. (Pl. 15. fig. 10), and the Copepod *Boeckella longisetosa*.

Mt. Wellington.—On the flat top of this mountain, at about 4000 ft., are numerous small pools of clear water which never completely dry up, with blackish mud at the bottom of them. In these pools the common *Phreatoicus australis* is abundant and with it the little yellow Amphipod *Neoniphargus montanus* (Thomson).

In a few of the deeper pools the mountain shrimp *Anaspides tasmaniæ* is met with, but this species is found in greater abundance in the deep pools of the mountain torrent which rises on the top of Mt. Wellington and flows down into the North-West Bay River. It does not occur, however, in this river below the Wellington Falls at about 2000 ft. In the little rivulets which everywhere course down the sides of Mt. Wellington several Amphipods are found under the stones, viz. *Neoniphargus wellingtoni* and *Gammarus mortoni*.

Round the base of the mountain in the smaller branches of the streams the smaller species of crayfish or freshwater lobster, *Astacopsis tasmanicus*, is found, though not so abundantly as formerly.

Harz Mountains.—These mountains lie at the extreme edge of the greenstone country bordering on the West Coast Mountains. Near the top are several large and very deep tarns of clear water: in them *Anaspides tasmaniæ* is very abundant, and round the edge a little black Amphipod, *Neoniphargus niger*, sp. n. (Pl. 15. figs. 1–4). The plankton consists of a very numerous bright red Copepod, *Boeckella rubra*, sp. n. (Pl. 18. fig. 1), only found in these tarns and in similar tarns on the West Coast (Mt. Read).

Mt. Field has similar tarns to the above, which, however, I did not visit. *Anaspides tasmaniæ* is found here.

Ben Lomond.—On the top of this mountain, at an elevation of about 4000 ft., is a shallow lake, Yule's Lake, in which are very numerous *Phreatoicus australis* and *Neoniphargus yuli* (Pl. 13. fig. 1).

Adventure Bay Lagoon, Bruni Island.—This is a large shallow freshwater lagoon, only separated from the sea by a line of sand hummocks. The water is, however, perfectly fresh, and the water-weeds and fauna are typical of freshwater. *Phreatoicus australis* was abundant here—a curious fact, since otherwise the genus is found only at high elevations. Among the weeds the Copepod *Brunella tasmanica* (Pl. 18. fig. 6), representing a new genus of the Diaptomidæ, was very abundant. This genus was not met with elsewhere.

Small Ponds &c. round Hobart.—As was to be expected, the Entomostraca from the small ponds and puddles did not yield anything of particular interest, some of the species being identical with Australian forms, while all the genera, except *Boeckelta*, are of world-wide distribution. The large *Boeckella robusta* was common in small ponds round Hobart. In a very small rivulet at Huntingfields, at sea-level, I again met with *Phreatoicus australis* and a *Neoniphargus*, *N. exiguus*, sp. n. (Pl. **14**. figs. 1–12).

Lake Dulverton really belongs to this category, as, although it is of a large size, it is entirely overgrown with weed. It was found to harbour only those Entomostraca, such as *Alonella*, *Macrothrix*, *Cyclops*, &c., characteristic of small weedy ponds. It had besides a *Boeckella*, *B. insignis* (Pl. **17**. fig. 4), and the widely distributed *Chiltonia australis*. It may be mentioned here that the Prawn *Xiphocaris compressa* is found all over Tasmania in streams and lakes where the water is cloudy and there is a great deal of weed, and the same is true of *Chiltonia australis*. The only Phyllopod obtained was the common *Lepidurus viridis*.

2. *The North Coast.*

In this district all the streams and rivers tend to be rather discoloured and there are no extensive lakes. The rivers are characterised by certain fish which are entirely absent from the rivers of the south, east, or centre of the island. These are the Blackfish (*Gadopsis marmoratus*), the Cucumber Herring (*Prototroctes marœna*), and the Freshwater Flathead (*Aphritis*).

The Anaspidacea appear to be entirely absent from this region and also the genus *Phreatoicus*. I also failed to find any *Neoniphargus*. *Gammarus antipodeus* (Pl. **14**. figs. 17–22) was found in a little limestone stream (Mole Creek) near Chudleigh. The small Crayfish *Astacopsis tasmanicus* appears to be entirely absent, its place being taken by the gigantic *A. franklinii*, which may scale 8 or 9 lbs. This huge species is found in the rivers and even in the smallest rivulets along the north coast and on to the west coast, but it is nowhere very abundant. On the north coast upon mud-flats and swamps the Land-Crab or Crayfish, *Engæus fossor*, is fairly frequent, though nowhere so abundant as on the West Coast Mountains.

3. *The West Coast.*

The mountainous and forest-clad region is only opened up to the traveller in the mining districts, where tracks have been cleared through the forest. The south-western corner of Tasmania, where no mines have been hitherto opened, is uninhabited, and the forests can only be penetrated by the traveller cutting a track in front of him.

Two localities were visited on the West Coast:—(1) The beech forest round the Magnet Mine. Here the burrows of the land-crab, *Engæus fossor*, were present in all the moist gullies, and in one place, where a dam was being constructed for mining purposes, the banks were absolutely riddled by these creatures, which seriously interfered with the construction of the dam. Under logs and the fallen leaves of the beeches, the Hopper (*Talitrus sylvaticus*) was very abundant. In a little rivulet I collected some specimens of the Amphipod *Gammarus australis*.—(2) Near the top of Mt. Read, at an elevation of about 3000 ft., I visited a tarn of exceedingly deep and clear water. In this tarn *Anaspides tasmaniæ* was fairly abundant and a species of *Neoniphargus*, *N. alpinus*, sp. n. (Pl. 14. figs. 13–16). The water swarmed with the little red Copepod *Boeckella rubra* (Pl. 18. fig. 1), so that the fauna of this tarn closely resembled that of the tarns on the Harz Mountains. I was surprised here by the quantity and tameness of the *Platypus*, which swam round our raft with the greater part of their bodies exposed to view—no doubt owing to their little acquaintance with human beings, as the tarn had only been visited at long intervals on two or three occasions by miners.

General Remarks on Geographical Distribution.

From a zoological and botanical standpoint Tasmania belongs to what Professor Baldwin Spencer (' Narrative of the Horn Expedition to Central Australia,' 1895) has called the Bassian Subregion of Australia, which includes Tasmania and Victoria south of the Dividing Range of mountains. This subregion is characterised by a moderate or great rainfall and a temperate climate.

The freshwater Crustacea of Tasmania are for the most part represented by closely allied or, in some cases, identical species on the mainland of Victoria, and very few of the commonest and most typical forms (e. g. *Anaspides*, *Phreatoicus*, *Chiltonia*, *Neoniphargus*, *Gammarus*, *Boeckella*) range north of the Dividing Range into tropical or subtropical Australia. These characteristic genera of Southern Australia belong, in fact, to an essentially temperate fauna, by far the greater number of species being found on the high alpine ranges of Tasmania and on the slopes of the Dividing Range of Victoria and New South Wales. They are, however, again represented by closely allied species in the temperate climate of New Zealand, especially in the subterranean waters of that island (Chilton, Trans. Linn. Soc. London, ser. 2, Zool. vol. vi. pt. 2, p. 163). These facts are of the greatest importance in considering the probable derivation of this fauna.

Two of the most characteristic genera of the Tasmanian freshwaters, viz. the Amphipod *Chiltonia* and the Copepod *Boeckella*, which also occur in the temperate parts of Southern Australia, are represented not only in New Zealand but also in temperate South America, where *Boeckella* has been several times recorded (see Daday, Termés. Füzetek, Bd. xxi. 1902, p. 201) and *Chiltonia* is replaced by the closely allied *Hyalella* of Lake Titicaca and the southern ranges of the Andes. These two genera (*Chiltonia* and *Boeckella*) are therefore confined in their distribution to the temperate parts of the Southern Hemisphere, with the exception of S. Africa. The Copepod *Boeckella* occupies the same position in the Southern Hemisphere as *Diaptomus* in the Northern, which in the south it almost entirely replaces. Although some of the species occur in small ponds, the majority live in lakes and are particularly characteristic of the cold highland tarns of Tasmania. The Parastacine group of Crayfishes has a similar distribution, being found in New Zealand (*Paranephrops*), Tasmania and Southern

Australia (*Astacopsis* and *Engæus*), South America (*Parastacus*), and an isolated form in Madagascar (*Astacoides*).

There is, therefore, a strong presumption in favour of the view that at any rate these elements in the temperate Crustacean fauna of Southern Australasia have reached their present range by means of an Antarctic connection between the southernmost projections of Australia, S. America, and New Zealand—a connection which is now more than ever postulated to account for the presence of common elements in the temperate fauna and flora of these countries.

Starting with this strong presumption in favour of an antarctic derivation of certain of the Tasmanian and Southern Australian Crustacea, it is interesting to examine another element which has evidently been derived primarily from the Northern Hemisphere. This element consists of the Amphipodan genera *Gammarus* and *Neoniphargus*, the Cladoceran *Bosmina*, and probably the Anaspidacea.

The genus *Neoniphargus*, the members of which form so dominant a feature in the Crustacean fauna of Tasmania, is very closely related to *Gammarus*, but it shows an approach to the subterranean European genus *Niphargus*, especially in the form of the first maxilla (Pl. 13. fig. 5), the inner plate of which is narrow and bears only two or three plumed setæ at its apex, in the small number of joints composing the secondary appendage of the first antenna (Pl. 13. fig. 2), and in the greatly reduced endopodites of the last pair of uropods (Pl. 13. fig. 13).

Undoubted representatives of the genus *Gammarus* also occur in Tasmania (e. g. *G. australis*), and certain species (e. g. *G. ripensis* and *G. antipodeus*) are almost exactly intermediate between the genera *Neoniphargus* and *Gammarus* (see Pl. 14. fig. 27) in the structure of the maxilla and of the first antenna (Pl. 14. figs. 17, 22, 23). The special resemblance of *Neoniphargus* to the European *Niphargus* may therefore be due to convergence. However this may be, the occurrence of *Gammarus* and the closely related *Neoniphargus* in the temperate region of Southern Australasia and in New Zealand affords a peculiar instance of discontinuous distribution, because *Gammarus* and its close allies are otherwise confined to the north temperate hemisphere, being absolutely unknown from the tropics of either hemisphere. In enquiring how they have reached their present position in Southern Australasia we must bear in mind that temperature in this case, as in the case of all Crustacea, whether freshwater or marine, is the chief condition determining the dispersal of these forms. There are two routes by which they could have reached Southern Australasia, either through the tropics of Asia and Northern Australia or else through South America and the lost Antarctic connection. It is extremely difficult to see how an animal apparently incapable of living in a tropical climate could have followed the first-named route, as there is no range of mountains in the Eastern Hemisphere running north and south which could be used by such an animal as a bridge to pass through the tropics; but in America there is the range of the Andes to permit this migration. It may therefore be suggested that the Tasmanian and Southern Australian *Gammarus* and *Neoniphargus* reached these countries from the Northern Hemisphere through S. America and Antarctica, and it is reasonable to suppose that some of their representatives will still be found in the Andes.

The same theory applies with even more force to the Cladoceran *Bosmina*, which was found by me as one of the chief constituents of the plankton in the highland lakes of Tasmania, though this is the first record of its occurrence in Australasia. This genus ranges all over the Northern Hemisphere, but is apparently absent from the tropics of the Old World. In America, however, it follows the route of the Andes right down into Patagonia, and, as we have said, turns up again in the extreme southern corner of Australasia. It may be objected that it is not legitimate to use an animal of this kind as an argument in a discussion on geographical distribution, because it is easily distributed by means of birds transporting its resting-eggs to great distances. We must remark, however, that *Bosmina* only inhabits large pieces of water not liable to dry up, and that its propagation is chiefly parthenogenetic, the resting-eggs being produced in any quantities only once a year, and then falling to the bottom of the lake or tarn out of reach of any water-bird. Moreover, it does not appear that even those Cladocera which inhabit small ponds and puddles liable to desiccation are distributed haphazard all over the world by wind or water-birds. It is true that practically all the genera are cosmopolitan, but the fact that each country has for the most part its well-marked and distinct specific forms shows clearly that the wide distribution of the genera has taken place by a gradual extension of range, facilitated no doubt by their special adaptation for transport.

In the case of the Anaspidacea, which are at the present time represented by three distinct forms (*Anaspides*, *Paranaspides*, and *Koonunga*—the first two being confined to the highlands of Tasmania and the last to Western Victoria), the fact that in Permian and Carboniferous times closely related marine forms (*Gampsonyx*, *Palæocaris*, &c.) existed in the Northern Hemisphere suggests that these animals have followed a similar route to *Gammarus* and *Bosmina* and have reached temperate Australia through Antarctica.

The Phreatoicidea, constituting an isolated suborder of Isopods, are at the present time confined to the freshwaters of temperate Australia and New Zealand, and we know nothing about their geological history. They are, however, so characteristically a part of the temperate Australian fauna, for the most part being inhabitants, like the Anaspidacea, of alpine stations, that they probably also belong to the same element of Antarctic derivation as all the above-mentioned Crustacea. Leaving aside the small Entomostraca of world-wide distribution, the only freshwater Crustacean in Tasmania which has clearly been derived from the Asiatic tropics is the prawn *Xiphocaris compressa*, which at the present day ranges into Queensland and whose near allies extend through the East Indies into China.

The distribution of the two common genera of Phyllopods, *Lepidurus* and *Apus*, is of interest. Both these genera occur in the Northern Hemisphere, and of the two *Lepidurus* is the more characteristic of cold alpine stations. Now *Lepidurus* has a representative in temperate South America (*L. patagonicus*), and another in Tasmania and the temperate parts of Australia (*L. viridis*), but it is entirely absent from central and tropical Australia, where it is replaced by *Apus*. The latter genus, on the other hand, is not known in the temperate parts of Australia or S. America. It would appear therefore that *Lepidurus* has reached Australia by way of S. America and Antarctica, while *Apus* entered by way of the Asiatic tropics.

The evidence of an Antarctic connection between New Zealand, Southern Australia, and South America, derived from a consideration of the freshwater Crustacea of Tasmania, is thus particularly cogent, because we are dealing with a group of animals whose distribution is closely dependent on temperature, and unless we are to suppose that tropical Asia and Australia have in the not very distant past possessed a totally different climate and physical character from their present condition, it is impossible to conceive that these essentially temperate and for the most part alpine creatures have reached their present isolated position in Tasmania by this route.

And when we take into consideration the fact that the freshwater fish of Tasmania (*Galaxias*, *Prototroctes*, and *Aphritis*), the Mollusca for the most part, and the most typical of the Alpine trees (*e. g.* the two species of *Fagus*, *F. Cunninghamii* and *F. Gunnii*) have their closest allies in one or more of the countries of the temperate Southern Hemisphere, we are forced back on the existence in the past of a land-connection, probably, as Mr. C. Hedley originally suggested (Ann. Mag. Nat. Hist. (6) xvii. 1896, p. 113), by means of rays of land passing southwards to meet an antarctic continent, uniting these southern lands, which at the present time are separated by so vast and so deep stretches of ocean.

Part II.—SYSTEMATIC.

Subclass *MALACOSTRACA*.

With the exception of the Isopods and Amphipods, it is not proposed here to give a systematic description of the Malacostraca, as they have either been described elsewhere or else will form the subject of future memoirs ("A Monograph of the Anaspidacea," in preparation for the Quarterly Journal of Microscopical Science; and "The Crayfishes of Australia and Tasmania," in preparation for the Memoirs of the Melbourne Museum). A sufficient account of them will be given, however, to facilitate their recognition.

Order DECAPODA.

Family Atyidæ.

Genus Xiphocaris.

Xiphocaris compressa, v. Mart.

This freshwater prawn is very abundant in those streams of Tasmania which are discoloured by flowing over the sandstones, *e. g.* the Clyde and Jordan Rivers, and also in some of the lakes with similar cloudy water, *e. g.* Lakes Sorell and Crescent and Tiberias Swamp. It is a widely ranging species, extending into Victoria, New South Wales, and Queensland. As no other prawn occurs in the freshwaters of Tasmania, it is unnecessary to give a description of this species.

Family Parastacidæ.

The classification of the Australian and Tasmanian Crayfishes is at present in the greatest confusion, owing to the imperfect descriptions given by the earlier observers. I must postpone a detailed account of the Tasmanian species until the large collection now in my hands, from all parts of Australia, has been carefully examined.

Four distinct members of the family, and possibly more, exist in Tasmania.

There is, first of all, the very large Crayfish found in the cloudy streams and rivers of the north coast, and on the west coast as far south as the Gordon River. This species may attain to the weight of 8 or 9 lbs. and exceed in size our marine lobster. The name *Astacopsis franklinii* (Gray) should be reserved for this species. There is another much smaller, but closely allied, species, to which the name *A. tasmanicus* (Erichson) will be applied. This species is never, when adult, more than six or seven inches long, and it inhabits the small mountain-streams of Southern Tasmania, *e. g.* the streams round the base of Mt. Wellington. It is distinguished from the large species by a number of small constant characters: *e. g.*, the pincers of the great chela in *A. franklinii* have two enlarged tubercles on their internal edges, while there is only one in *A. tasmanicus*; the wrist in *A. franklinii* has only two spines on its upper internal border, while *A. tasmanicus* has three or more; the branchiostegites in *A. tasmanicus* are uniformly rugose, while those of *A. franklinii* are smooth with a few enlarged rounded tubercles.

The Land-Crayfish, known locally as the Land-Crab, occurs all over the northern and western parts of Tasmania, from sea-level to the tops of the mountains at 4000 ft., on marshy plains or in damp situations in the "myrtle" forests (*Fagus Cunninghamii*, Hook.) of the West Coast. It belongs to Erichson's species *Engæus cunicularis*.

There also appears to be a very interesting form in Tasmania intermediate both in structure and habits between *Engæus* and *Astacopsis*. I did not myself meet with this form, but Prof. Haswell, Sydney, has given me some which were collected in the western Lake District of Tasmania, and there are some very similar specimens from Victoria in the large collection entrusted to me by Professor Spencer of Melbourne.

Order ANASPIDACEA.

Family Anaspididæ.

Thomson, Proc. Roy. Soc. Tasmania, 1892, p. 51; id. Trans. Linn. Soc. Lond. ser. 2, Zool. vol. vi. (1894) p. 285; Calman, Trans. Roy. Soc. Edinburgh, vol. xxxviii. p. 787; Smith, Proc. Roy. Soc. London, ser. B, vol. lxxx. (1908) p. 465.

Genus Anaspides, Thomson.

Anaspides tasmaniæ.

This species occurs in isolated pools and in the pools of the North-West Bay River on the top of Mt. Wellington, in the tarns on the top of the Harz Mountains and on Mt. Field, and in the tarns on Mt. Read, and probably other mountains on the West

Coast. The water in all these localities is very clear and cold. The species is at once distinguished by its straight, unbent body and the dark brown pigmentation with yellow markings.

Genus Paranaspides, Smith.

Paranaspides lacustris.

This species occurs only, so far as is known, in the littoral region of the Great Lake; the waters of this lake are never very clear, but always discoloured to a certain extent with sand. *P. lacustris* is distinguished by its pale green transparent colour, finely powdered with black dots, by its sharply bent body, and by the great size of the antennal scales and tail-fan.

Order ISOPODA.

Family Phreatoicidæ.

Genus Phreatoicus.

Chilton, Trans. Linn. Soc. Lond. ser. 2, Zool. vol. vi. (1894) p. 185.

Remarks.—Besides the New Zealand species *P. typicus* and *assimilis*, *P. australis* has been described (Chilton, Records of the Australian Museum, 1 & 2, 1890–95, p. 149) from Mt. Kosciusko in Victoria and also recorded by Thomson (Proc. Roy. Soc. Tasmania, 1892, p. 76) from Mt. Wellington. Besides this a blind species, *P. shephardi*, has been described by Sayce (Proc. Roy. Soc. Victoria, vol. xiii. 1900, p. 25) from Victoria.

The other genera are *Phreatoicoides* (Sayce, Proc. Roy. Soc. Victoria, vol. xii. 1900, p. 122) from Gippsland, *Hypsometopus* (Sayce, *loc. cit.* vol. xiv. p. 218) from burrows of the land-crayfish *Engæus* in Tasmania, and *Phreatoicopsis* (Spencer & Hall, *loc. cit.* vol. xix. 1896, p. 14), a large terrestrial form from Gippsland.

As very little has been recorded of the habits or internal structure of these animals, the following notes may be given:—Their movements are exceedingly sluggish, so that when alive they are easily distinguished from the rapidly moving Amphipods, which in external structure they so closely resemble. They appear to be entirely vegetable-feeders, and subsist by passing a great quantity of vegetable mud, &c., through their intestine, much in the same manner as an earthworm. This also appears to be the habit in the land-form *Phreatoicopsis*. In specimens of this form which I dissected I first noticed that the gut, which was full of earth, was provided with a highly developed typhlosole or double fold, running its whole length, and quite unlike any structure met with elsewhere among the Crustacea. The anterior portion of the gut, slit open along the dorsal surface and displaying the gastric mill and the beginning of the double typhlosole, is shown on Pl. 12. fig. 13, while a diagrammatic transverse section (Pl. 12. fig. 12) shows the relation of the typhlosole to the wall of the alimentary canal. It is evident that the vegetable mould, after being pounded up by the action of the ridges and pads of the gastric mill, is passed underneath the typhlosolar flaps, which enormously increase the area for absorption. A similar typhlosole was found to exist in the various species of *Phreatoicus*, so that it is probably a characteristic of the whole suborder. The alimentary canal is supplied with four hepatic cæca, which lie ventrally and open at the base of the gastric mill.

A pair of very large maxillary glands are present.

The above points in the internal anatomy of the Phreatoicidea confirm the opinion that they constitute a rather isolated suborder of the Isopoda, but does not lend support to the view that they are related to the Amphipoda.

Phreatoicus australis, Chilton, Records of the Australian Museum, 1 & 2, 1890–95, p. 149. (Pl. 12. fig. 1.)

The thoracic segments are not much sculptured or tuberculated, and carry very few spines dorsally.

The head is as long as the two following segments.

The second antenna has the peduncle and flagellum rather short, and the former has the margin of only the first two joints serrated (Pl. 12. fig. 9).

The telson and uropod have the forms shown in Pl. 12. fig. 2.

The colour is uniformly black and the length about 10 mm. Occasionally yellowish specimens occur.

Occurrence. Recorded by Chilton from Mt. Kosciusko and Thomson from Mt. Wellington. I have taken it in the small pools on the top of Mt. Wellington, in a small stream at sea-level at Huntingfields, and in a lagoon at sea-level on Bruni Island. Also in Yule's Lake on the top of Ben Lomond and in the littoral region of the Great Lake. The uropod differs slightly in the arrangement of the spines from the various localities. The Ben Lomond (Pl. 12. fig. 3), Great Lake (Pl. 12. fig. 2), and the specimens from the other localities (Pl. 12. fig. 4) form three different varieties.

Phreatoicus spinosus, sp. n. (Pl. 12. fig. 7.)

The head is shorter than the two following segments.

The body is markedly sculptured, and the thoracic segments bear two distinct tubercular ridges dorsally with a concavity between them; the abdominal segments are also ridged. All the segments are furnished very richly with long and conspicuous spines dorsally, and the legs are also covered with long spines.

The second antenna (Pl. 12. fig. 11) has the peduncle and flagellum very long, only the first two joints of the peduncle having a serrated margin.

The telson ends in a long projection and the uropods are also very long (Pl. 12. fig. 8).

The colour is blackish grey, with the extremities of the antennæ and often of the limbs bright orange.

Length up to 25 mm., but also adult at 15 mm.

Occurrence. Among weeds in the littoral region of the Great Lake.

Phreatoicus brevicaudatus, sp. n. (Pl. 12. fig. 5.)

The head is shorter than the two following segments.

The body is markedly sculptured as in *P. spinosus*, but is not spinous, only a few inconspicuous setæ being present on the dorsum. The segments of the pleon are rather broader than usual.

The second antennæ are not very long; the whole of the peduncle and most of the flagellum has a serrated margin (Pl. 12. fig. 10).

The telson has the form shown in Pl. 12. fig. 6; the uropods do not project much beyond the end of the telson and are poorly furnished with stout spines.

The colour is straw-yellow.

Length 15 mm.

Occurrence. In the deeper littoral of the Great Lake, where the bottom is chiefly composed of a fine yellowish mud.

Order AMPHIPODA.

Family Gammaridæ.

Genus Neoniphargus.

Neoniphargus, Stebbing, Trans. Linn. Soc. Lond. ser. 2, vol. vii. (1899) p. 424.
Niphargus, Thomson, Proc. Roy. Soc. Tasmania, 1892 (1893), p. 67.
Unimelita, Sayce, Proc. Roy. Soc. Victoria, vol. xiii. (1901) p. 238.

Diagnosis (see also Pl. 13).—Body much compressed, without dorsal projections and with few setæ. Coxal plates wide and deep, the fifth very wide and emarginated.

First antennæ longer than second, with a small secondary appendage of one or two joints.

Inner plate of first maxillæ very narrow, bearing apically two or three plumose setæ (Pl. 13. fig. 5). Outer plate of maxillipeds with stout spine-teeth (Pl. 13. fig. 8).

Gnathopoda subequal; hands small, quadrate, and subchelate, with no conspicuous sexual differences. Pereiopods normal, the three posterior pairs with coxal joints much expanded. The two anterior pairs of uropoda with rami subequal; the third pair only just projects beyond the others posteriorly and has the inner ramus very small and scale-like tipped with a single seta, the outer ramus one-jointed or with an additional rudimentary joint at tip. Telson cleft, but not entirely to the base.

Neoniphargus yuli, sp. n. (Pl. 13. fig. 1.)

Head not longer than first segment. Eyes large, crescent-shaped.

First antennæ not half as long as body, the three segments of the peduncle subequal, with a few bunches of setæ; secondary appendage two-jointed, not distinctly longer than first joint of flagellum (Pl. 13. fig. 2).

Pereiopods armed with bunches of very stout setæ; terminal joint not much elongated (Pl. 13. fig. 10).

The three pairs of uropods reach to approximately the same point posteriorly and do not project one beyond the other. All are armed with very prominent spines. In uropod 3 the outer ramus is short, and bears a rudimentary terminal joint; no plumose setæ (Pl. 13. figs. 12 & 13).

The telson is obtusely cleft rather less than halfway to the base; the lobes carry about six stout spines apiece (Pl. 13. fig. 14).

The metasome is devoid of spines or setæ, except on the last two segments, which bear a few spines dorsally.

Length 10 mm.

Colour. Dark blackish green to pale yellow.

Occurrence. In Yule's Lake on the top of Ben Lomond, at about 4000 ft.

NEONIPHARGUS EXIGUUS, sp. n.

Head longer than first segment. Eyes large, irregularly crescentic.

First antennæ not long; segments of peduncle stout, the third distinctly shorter than second, with bunches of setæ. Secondary appendage two-jointed, distinctly longer than first joint of flagellum (Pl. 14. fig. 1).

Pereiopods thickly clothed with rather stout setæ; terminal joint elongated (Pl. 14. fig. 4).

The third pair of uropods project slightly beyond the other two pairs, which carry the normal spines.

In uropod 3 the outer ramus is fairly long and stout, well armed with spines, with a terminal joint and without plumose setæ (Pl. 14. fig. 2).

The telson is acutely cleft rather more than halfway to the base; the lobes are slightly concave at the end, carry three terminal spines and a few lateral ones (Pl. 14. fig. 3).

The segments of the metasome carry a few long spinules.

Length 6 mm.

Colour. Dirty yellow.

Occurrence. In weed and mud in small stream near Huntingfields.

NEONIPHARGUS TASMANICUS, sp. n.

Head slightly longer than first segment. Eyes large, crescent-shaped.

First antennæ more than half as long as body, the third segment of peduncle distinctly shorter than second; a few bunches of setæ on peduncle; secondary appendage two-jointed, distinctly longer than first joint of flagellum (Pl. 14. fig. 5).

Pereiopods armed with setæ, which are not very stout or conspicuous; terminal joint elongated (Pl. 14. fig. 8).

The third pair of uropods project distinctly beyond the second and first; the uropods are armed with not very strong spines.

In uropod 3 the outer ramus is long, bears a rudimentary terminal joint, is feebly armed with spines, and carries three plumose setæ (Pl. 14. fig. 6).

The telson is acutely cleft more than halfway to the base; the lobes have a pointed angle and carry a single stout spine each (Pl. 14. fig. 11).

The metasome is devoid of spines, except on the last two segments as in *N. yuli*.

Length 8 mm.

Colour. Dark brown.

Occurrence. In the littoral zone of the Great Lake.

NEONIPHARGUS WELLINGTONI, sp. n.

Head as long as two succeeding segments. Eyes small, oval.

First antennæ stout, not long, the third segment of peduncle subequal to second; peduncle with a continuous row of long simple setæ, the whole of antennæ having very setose appearance.

Secondary appendage single-jointed, very short, much shorter than first joint of flagellum (Pl. 14. fig. 9).

Pereiopods armed with long but slender setæ; terminal joint short, stout, with recurved claw (Pl. 14. fig. 12).

The first pair of uropods project slightly beyond the other two pairs; all are armed with very long but not stout spines.

In uropod 3 the outer ramus is short and without rudimentary terminal joint, bearing at the end four or five spines instead. No plumose setæ (Pl. 14. fig. 10).

The telson is rather acutely cleft more than halfway to the base; the lobes are blunt at the end and carry five stout spines (Pl. 14. fig. 11).

The metasome has all the segments spiny dorsally, especially the posterior ones.

Length 7 mm.

Colour. Very dark greenish.

Occurrence. Under stones &c. in small streams on eastern face of Mt. Wellington, about 3000 ft.

NEONIPHARGUS ALPINUS, sp. n.

Head slightly longer than first segment. Eyes small, crescentic.

First antennæ not long; segments of peduncle stout, the third slightly shorter than second, with bunches of setæ. Secondary appendage two-jointed, distinctly longer than first joint of flagellum (Pl. 14. fig. 13).

Pereiopods not very thickly clothed with long and rather fine setæ; terminal joint much elongated. Joints of pereiopods, as a whole, longer and thinner than in *N. exiguus*, which this species closely resembles (Pl. 14. fig. 16).

The third pair of uropods project slightly beyond the other two pairs.

Uropod 3 has the outer ramus long and rather slender, with a terminal joint and without plumose setæ (Pl. 14. fig. 14).

The telson is acutely cleft more than halfway to the base; the lobes are slightly concave at the end, carry two terminal spines and no lateral ones (Pl. 14. fig. 15).

The segments of the metasome are smooth and without spines, except the last two.

Length 8 mm.

Colour. Olivaceous grey.

Occurrence. In mountain tarns on the West Coast (Mt. Read) at about 3000 ft.

NEONIPHARGUS NIGER, sp. n.

Head as long as two following segments. Eyes small, oval.

First antennæ very long; the third segment of peduncle not so long as second; bunches of slender setæ; secondary appendage with three short joints, the whole not as long as first segment of flagellum (Pl. 15. fig. 1).

Pereiopods armed with slender numerous setæ; terminal joint not slender or elongated.

Uropod 3 extends a great way behind the other two pairs; its outer ramus is long, armed with long and rather slender setæ, without a small terminal joint; the inner ramus is minute and normal (Pl. 15. fig. 2).

The telson is acutely cleft for about three-fourths to the base; the lobes carry three stout spines apiece and several slender long setæ (Pl. 15. fig. 4).

The segments of the metasome are furnished dorsally and dorso-ventrally with bunches of exceedingly long and conspicuous setæ.

The gnathopods (Pl. 15. fig. 3), of which the second pair is distinctly the larger, have the two penultimate joints more elongated than is usual in this genus, and more heavily armed with setæ. They resemble rather more the gnathopods of *Gammarus*.

Length 8 mm.

Colour. Black.

Occurrence. Under stones in Lake Perry, Harz Mountains.

NEONIPHARGUS MONTANUS, Thomson, Proc. Roy. Soc. Tasmania, 1892 (1893), p. 70.

This species agrees very closely with *N. yuli*, but differs in the absence of a rudimentary terminal joint to uropod 3, in the fewer setæ on the lobes of the telson, and in the less spinose pereiopods.

I have been unable to examine this species closely, as the tube in which I had collected some was broken.

From pools on the top of Mt. Wellington.

NEONIPHARGUS SPENCERI.

Unimelita spenceri, Sayce, Proc. Roy. Soc. Victoria, vol. xiii. (1900) p. 238.

This species agrees most closely with *N. tasmanicus* from the Great Lake. It differs, however, in a number of essential points—*e. g.*, shape of telson, great length of uropod 3, shortness of secondary appendage, &c.

From Lake Petrarch.

Genus GAMMARUS, Fabr.

Remarks.—The genus *Gammarus* as restricted by Stebbing (Das Tierreich, Crustacea, Amphipoda Gammaridea, 1906) is confined chiefly to the freshwaters of the Northern Hemisphere. It is absent from the tropics and the Southern Hemisphere. Sayce has, however, described two species, *G. australis* and *G. haasei*, from Victoria, which clearly belong to this genus, and he has suggested that *Niphargus mortoni* described by Thomson also belongs to *Gammarus*.

The two species described below, *G. ripensis* and *antipodeus*, are evidently closely allied to Thomson's *N. mortoni*, and a careful examination of their characters has shown that they are exactly intermediate in structure between the genera *Neoniphargus* and *Gammarus*.

Thus the telson (Pl. 14. figs. 19 & 25) cleft to the base and the form of the gnathopods (Pl. 14. figs. 20 & 26) are Gammarid, while the three-jointed secondary appendage of the 1st antennæ (Pl. 14. figs. 17 & 23), the inner ramus of uropod 3 (Pl. 14. fig. 18), the condition of the inner plate of the maxilla (Pl. 14. fig. 22) are very close to *Neoniphargus*, but with distinct Gammarid tendencies. With regard to the first maxilla especially, it is to be noted that of *G. antipodeus* (Pl. 14. fig. 22) is exactly intermediate between that of *Neoniphargus* (Pl. 13. fig. 5) and *Gammarus* (Pl. 14. fig. 27). It is, in fact, very difficult to say to which genus they are more nearly allied, and it would perhaps be permissible to erect a new genus to receive these three species. The occurrence of these intermediate forms between *Gammarus* and *Neoniphargus* certainly suggests that *Neoniphargus* has been derived independently from *Gammarus* in the Southern Hemisphere and that it is not genetically related to the *Niphargus* of the Northern Hemisphere. In this case, the species described by Sayce as *Niphargus putchellus* from Victoria (Proc. Roy. Soc. Victoria, 1899, vol. xii.) should not be placed in *Niphargus*, with which, indeed, it does not closely agree, but in a separate genus. The resemblance of this species and of the numerous species of *Neoniphargus* to the European *Niphargus* must then be looked upon as a remarkable case of convergence.

Gammarus mortoni.

Niphargus mortoni, Thomson, Proc. Roy. Soc. Tasmania, 1892 (1893), p. 68.

This species is evidently closely related to the two described below, but probably not identical with either. Thomson's figures do not give quite the requisite details. The form of the telson is, however, different to that in the two following species.

Occurrence. In a small stream above Franklin on the Huon River and on Mt. Wellington.

Gammarus ripensis, sp. n.

The coxal plates of the fourth pair are normally quadrate in shape. The eyes are oval.

The first antennæ have the peduncle of three subequal joints, clothed with a continuous row of fairly long setæ. The secondary appendage consists of three joints (Pl. 14. fig. 23).

The gnathopods have the two penultimate joints normal in shape, longer than broad, with the inner surface provided with rows of stout bristles (Pl. 14. fig. 20).

The pereiopods are armed with fairly numerous and long setæ; the terminal joint with its claw is slender and rather elongated.

The third pair of uropods projects distinctly behind the outer two pairs.

The outer ramus of uropod 3 has a minute terminal joint, and there are three groups of spines, with one plumose seta. The inner ramus is small and scale-like with a single terminal seta (Pl. 14. fig. 24).

The telson is cleft to the base; the lobes are slightly concave posteriorly and carry two stout spines (Pl. 14. fig. 25).

The segments of the abdomen are very spinous.

Length 13 mm.

Colour. Dark greenish brown.

Occurrence. Among weed and under stones in the littoral region of the Great Lake.

GAMMARUS ANTIPODEUS.

The coxal plates of the fourth pair have the hind margin produced to form a triangular lobe (Pl. 14. fig. 21). The eyes are narrow and elongately oval.

The first antennæ have the third joint of the peduncle shorter than the second; clothed with a continuous row of short setæ. The secondary appendage is of three joints (Pl. 14. fig. 17).

The gnathopods are similar to those of *G. ripensis*, but the distal outline of the carpopodite is more sinuous (Pl. 14. fig. 20).

The pereiopods are feebly armed with very short setæ; the terminal joint with its claw is stout and not long.

The third pair of uropods project distinctly behind the other two pairs.

The outer ramus of uropod 3 is without a terminal joint, and there are more than three groups of stout spines with several plumose setæ. The inner ramus is rather large and has four terminal setæ (Pl. 14. fig. 18).

The telson is cleft to the base; the lobes are concave posteriorly and carry a single stout spine and several small ones (Pl. 14. fig. 19).

The segments of the abdomen are quite smooth.

Length 20 mm.

Colour. Dark greenish brown.

Occurrence. In Mole Creek, just after issuing from a number of large limestone caves. In the caves themselves, which are quite dark, a colourless specimen was found with very much reduced eyes, and more numerous plumose setæ on uropod 3. Otherwise it agrees exactly with the species described.

GAMMARUS AUSTRALIS, Sayce, Proc. Roy. Soc. Victoria, vol. xiii. (1901) p. 233, & ibid. vol. xv. (1902) p. 51.

This species shows more clearly than the above-described the true characteristics of the genus *Gammarus*. Thus, besides the cleft telson and the broad internal plate of the 1st maxilla (Pl. 14. fig. 27), there are distinct sexual differences in the gnathopods, the inner ramus of uropod 3 is quite long, and the secondary appendage of the first antenna has six or seven joints.

Occurrence. In a small stream near the Magnet Mine on the west coast of Tasmania. Also in Victoria, Dandenong Creek; and a blind species, *G. haasei* (Sayce), also from Victoria.

Genus CHILTONIA.

Stebbing, Trans. Linn. Soc. Lond. ser. 2, Zool. vol. vii. (1899) p. 408.

The type species of this genus was described as *Hyalella mihiwaka* by Dr. Chilton from New Zealand. Subsequently Sayce described *H. australis* from numerous localities in Victoria and from Lake Petrarch in Tasmania. The genus *Hyalella* is otherwise confined to S. America. Stebbing pointed out some differences between the New Zealand species and the S. American *Hyalella* and proposed a new genus *Chiltonia*. The chief differences between *Hyalella* and *Chiltonia* are the presence in the former of a minute rudimentary palp to the first maxillæ, and also the presence of a lobe on the wrist of the second gnathopoda in the male. Evidently the two genera are closely allied, and can hardly have been independently derived.

CHILTONIA AUSTRALIS (Sayce).

This species can be at once distinguished from the other freshwater Gammarids in Tasmania by the short first antennæ and the entire absence of a secondary appendage, by the pronounced sexual difference in the gnathopods (the second pair in the male being greatly enlarged), by the absence of a palp on the first maxillæ, and by the undivided telson. The colour is pale green and the length about 8 mm.

Occurrence. Southern Victoria (*Sayce*); in Tasmania the localities are Lake St. Clair, the Great Lake, Lagoons on Bruni Island, Clyde River near Bothwell; in fact, it is the most widely distributed species in Tasmania.

Genus TALITRUS, Latr.

TALITRUS SYLVATICUS, Haswell, Proc. Linn. Soc. N.S.W. vol. iv. (1880) p. 246; also see Thomson, Proc. Roy. Soc. Tasmania, 1892 (1893), p. 15.

This species of land-hopper is widely distributed in the highlands of Tasmania, being found under logs and leaves in the forests on Mt. Wellington and in very great abundance in the beech-forests on the mountains of the West Coast. It also occurs in Victoria (Mt. Kosciusko).

Subclass *ENTOMOSTRACA*.

Order PHYLLOPODA.

Family Apodidæ.

Genus Lepidurus.

Large numbers of the common *L. viridis*, Baird (see also Sayce, Proc. Roy. Soc. Victoria, xv. 1903, p. 242), were taken in a small roadside pond near Bridgewater, on the Derwent.

Only the genus *Lepidurus* is represented in Tasmania and Southern Australia, *Apus* being entirely absent. *Lepidurus*, on the other hand, is altogether absent from Northern, Central, and Western Australia, where it is replaced by *Apus*.

Family Daphnidæ.

Genus Ceriodaphnia (Dana).

The species described below agree with the northern *Ceriodaphnia* closely in their appendages, but differ considerably in the general form of the body. *C. cornuta* (Sars, Forhand. Videns. Selsk. Christiania, 1885), the only other Ceriodaphnid from Australia, seems to be closer to the northern species.

Ceriodaphnia hakea, sp. n. (Pl. 15. figs. 10–16.)

Female.—The form of the carapace is rounded, and there is no posterior spine, only a slight angle. The constriction between the thorax and the head is not very sharply marked. The head bears dorsally a remarkable recurved hook, a character not known in any other member of the genus. The outline of the head is regularly curved and not in the least sinuous. There is no spine or tumescence on the head in front of where the first antennæ spring from.

The ocellus is very clearly marked.

The first antennæ carry very short terminal setæ, and a fairly long single seta on a ridge some distance away from the apex.

The distal joint of the second antennæ bears only two compound plumose setæ (Pl. 15. fig. 15).

The anal claws are long and are not furnished with any small spines; behind the claws the telson bears laterally five large spines decreasing in size anteriorly. Between the anal claws and the two plumose setæ on the back, the hind end of the body is regularly arched without any distinct angulation or sinuosity (Pl. 15. fig. 14).

Length 1 mm.

Colour. Green.

Occurrence. In the plankton of Lake St. Clair. No males were observed.

CERIODAPHNIA PLANIFRONS, sp. n. (Pl. 15. fig. 17.)

This small species has the carapace more elongated than *C. hakea*, and has the posterior angle of the carapace clearly marked and almost forming a distinct spine. The constriction between the thorax and the head is not very clearly marked. The head is not furnished with any spines, and its outline is regularly curved without any distinct sinuosity; nor is there any spine or turgescence in front of the insertion of the first antennæ.

The first antennæ have short terminal setæ, and one rather long seta on a ridge close to the apex.

The ocellus is clearly marked.

The second antennæ are similar to those of *C. hakea.* The anal claws are long and unarmed, and there are five lateral spines behind them. These spines nearly reach to a fairly distinct angle, which is not marked in *C. hakea.*

Length ·9 mm.

Colour. Green.

Occurrence. In the plankton of Lake Sorell. No males observed.

Genus SIMOCEPHALUS (Schœdler).

Four species have been described from Australia by Sars (Archiv for Math. og Naturvid. vol. xviii. (1896); and Forhand. Vidensk. Selsk. Christiania, 1885), agreeing fairly closely with northern members of the genus. The species described below does not offer any marked characters.

SIMOCEPHALUS DULVERTONENSIS, sp. n. (Pl. 15. figs. 5–7.)

The carapace is rather quadrate in form; the posterior angle is rounded and dorsal in position, with its margin carrying a few short spines. The ventral margin is uniformly clothed with setæ, which towards the posterior end are stout and spiniform. The under surface of the head is greatly elongated, and there is a small projection just in front of the insertion of the first antennæ.

The first antennæ have their sides hollowed out; they carry about ten hollow setæ, and a single small seta on a projection about halfway down the stem (Pl. 15. fig. 6).

The second antennæ have the structure characteristic of the genus; the tops of the segments are very distinctly serrated.

The anal claws are long and without any additional spines at their base. Behind the claws are about eight strong spines, the anterior ones being very small. The angle behind these spines is fairly prominent and carries several rows of small bristles (Pl. 15. fig. 7). The hind part of the body between this angle and the two dorsal setæ is also slightly angular.

Length 2 mm.

Colour. Green.

Occurrence. Among thick weed in Lake Dulverton. No males. Also among weed in Great Lake.

Simocephalus australiensis, Dana, United States Exploring Expedition, Crustacea, ii. p. 1271; also Sars, Forhandlinger, Christiania, 1888, p. 15.

This species can be readily distinguished from the foregoing by the distinct projection on the underside of the head just in front of the insertion of the first antennæ (Pl. 15. fig. 8), and also by the form of the telson, which has the anal claws armed with a conspicuous row of spines at their bases (Pl. 15. fig. 9). There is a good deal of variation in the shape of the hind part of the carapace, the posterior angle being sometimes pronounced and sometimes almost absent.

The species occurs in quite small puddles and ponds, and is evidently universally distributed in Tasmania. Dana and Sars report it from near Sydney.

Genus Daphnia, O. F. Müller.

Daphnia carinata, King, Proc. Roy. Soc. Tasmania, 1853, p. 253.

This species was found by Mr. King in the neighbourhood of Sydney.

I found some very large specimens, measuring 3 millimetres in length, in a few cupfuls of water in a cart-rut near Plenty, Tasmania. These specimens were among the tubes in my collection that were destroyed, so that I cannot give a full description of them. They agree, however, with King's figure of *D. carinata*, variety C, in having the spine at the back of the carapace very short.

Family Bosminidæ (Sars).

Genus Bosmina (Baird).

The three species described below, which are the only Bosminidæ hitherto found in Australasia, are closely related to the common northern *B. longirostris*. They possibly only represent varieties of one species.

Bosmina rotunda, sp. n. (Pl. 15. fig. 18.)

Female.—Form of the carapace very round, with the posterior angle not distinctly marked. A seta is present on each valve close to the posterior spine. There is a slight projection where the forehead passes into the first antennæ.

The first antennæ are long, slightly curved, and with about eleven joints below the antennal spine and sensory setæ.

The second antennæ are short and do not project as far as the anterior angles of the valves of the carapace; their structure is normal.

The anal claws are long, and carry about four small spines near their base; the telsonic angle is furnished with about three rows of small bristles.

Length ·9 mm.

Colour. Green.

Occurrence. In the plankton of Lake St. Clair. Males were not observed.

BOSMINA BREVIROSTRIS, sp. n. (Pl. 16. fig. 1.)

Female.—The carapace is more elongated than in *B. rotunda* and the posterior angle is distinctly marked. A seta is present on each valve close to the posterior spine.

There is a slight projection where the forehead passes into the first antennæ.

The first antennæ are short, slightly curved, and with about 8 joints below the antennal spine and sensory setæ.

The second antennæ are short and do not project as far as the anterior angle of the valves of the carapace.

The anal claws are rather short and carry about six small spines, which extend nearly to the tip of the claws.

Length ·5 mm.

Colour. Green.

Occurrence. In the plankton of the Great Lake. No males were observed.

BOSMINA SORELLI. (Pl. 16. fig. 2.)

Female.—This very small species has the carapace elongated and sloping rather suddenly to the posterior angle from the dorsal surface; the angle is well marked.

There is practically no projection where the forehead passes into the first antennæ.

The first antennæ are long with about 11 joints below the antennal spine and sensory setæ.

The second antennæ are short and do not project as far as the anterior angle of the valves of the carapace.

The anal claws are long, with about 4 spines near their base.

Length ·35 mm.

Colour. Green.

Occurrence. In the plankton of Lake Sorell. No males were observed.

Family LYNCODAPHNIDÆ.

Genus MACROTHRIX (Baird).

Sars (Forhand. Christiania, 1885) has described *M. spinosa* from Australia.

MACROTHRIX BURSTALIS, sp. n. (Pl. 16. fig. 3)

The carapace is oval in shape, with the posterior angle rounded and situated rather dorsally.

The ventral margin of the carapace is fringed with exceedingly long and conspicuous setæ.

There is practically no constriction between head and thorax.

The first antennæ are not dilated at the end, are tipped with a few very long setæ, and carry about 8 short spines on their stems interiorly.

The second antennæ have the normal structure; the compound setæ are very long and all subequal in length.

The anal claws are rather small and simple, without spines; behind them is a continuous row of bristles fringing the whole posterior region of the body; posteriorly in the neighbourhood of the dorsal setæ these bristles become strong and spiniform. There is a distinct indentation in the contour of the hind region of the body.

The dorsal setæ are unique in structure, in that they end in a bunch of simple non-plumose bristles.

Length ·4 mm.

Colour. Green.

Occurrence. Among weed in Lake Dulverton. No males observed.

Family Lynceidæ.

Genus Alonella (Sars).

This genus and the related *Alona* and *Dunhevedia* appear to be abundantly represented in Southern Australian waters.

Alonella nasuta, sp. n. (Pl. 16. fig. 4.)

Form of the carapace is regularly oval without any marked angles. The usual striations and ventral fringe of setæ are present.

The head is drawn out into an exceedingly long and tapering nose, which projects far beyond the end of the first antennæ.

The first and second antennæ are normal in structure and do not call for any special remark.

The anal spines are long and furnished at the base with one strong spine and several bristles. On the telson are four stout short spines, and then follow about five groups of bristles. Beyond these bristles comes a marked concavity, and the margin is continued rather sinuously to the dorsal setæ (Pl. 16. fig. 5).

Length ·5 mm.

Colour. Yellow.

Occurrence. Among thick weed in Lake Dulverton. No males observed.

Alonella propinqua, sp. n. (Pl. 16. fig. 6.)

The carapace is rather square-shaped, but without any distinctly marked angles. It is fringed ventrally with setæ, and the striæ on the carapace are densely broken up into roughly quadrangular blocks.

The head is drawn out into a moderately long proboscis; but both the first and second antennæ project nearly as far as the proboscis, thus differing from *A. nasuta.*

The appendages do not offer any characters of specific importance.

The anal claws are long and furnished each with a single strong spine at its base.

The telson rises abruptly above the anal claws and is furnished with a row of 9 lateral fairly stout spines, behind which are one or two very small bristles of insignificant appearance. Between the end of the spine-row and the dorsal setæ the back is smooth and rises to a prominence about midway (Pl. 16. fig. 7).

Length ·35 mm.

Colour. Yellow.

Occurrence. Among thick weed in freshwater lagoon near Adventure Bay.

Order COPEPODA.

Family Diaptomidæ.

Genus Boeckella.

Boeckella, Guerne & Richard, Mémoires de la Société Zool. France, vol. ii. (1888) p. 151; Davay, Termész. Füzetek, Bd. xxiv. p. 1, and Bd. xxv. pp. 101, 436; Mrázek, Ergeb. Hamburg. Magalh. Sammel. Lief. 6 (1902).

This genus hitherto consists of several species from Patagonia and temperate S. America, *B. triarticulata*, Thomson, from New Zealand, *B. robusta*, Sars (Archiv for Math. og Naturvid. Christiania, xviii.), and *B. minuta*, Sars (*loc. cit.*), from S. Australia. It differs from *Diaptomus* in several quite constant characters, especially in the conformation of the last pair of limbs in the male. The antennæ, mouth-parts, and other limbs are built very much on the *Diaptomus* plan.

The genus appears to be entirely confined to the temperate Southern Hemisphere.

Boeckella insignis, sp. n. (Pl. 17. figs. 4–12.)

Female.—The anterior portion of the body is cylindrical; the head and first segment fused with it are equal to the succeeding anterior segments. The fifth segment is small, with inconspicuous lateral prolongations which do not project far over the abdominal segments.

The first abdominal segment is not swollen in the middle. The abdomen consists of 3 segments.

The first antenna consists of 24 joints. The second antenna, mandible, maxilla, and first maxillipede have the form shown in Pl. 17. figs. 7–10.

The last leg has the form shown in Pl. 17. fig. 11. It closely resembles that of *B. robusta*, Sars.

The uropods bear 5 setæ each, exceeding in length the uropods and the last two abdominal segments (Pl. 17. fig. 5).

Length 2 mm.

Colour. Green.

Male.—The male is a good deal smaller and has a narrower body. The fifth segment has very small lateral projections. The abdomen consists of 5 distinct segments, not counting the uropods (Pl. 17. fig. 5). The last pair of legs have the form shown in Pl. 17. fig. 12. The right limb has the external ramus biarticulate, with rather a short claw. The left limb has the external ramus uniarticulate, with a longer claw. They resemble closely those of the male *B. robusta*, Sars.

The first antenna, which is distinctly geniculated, has 23 joints (Pl. 17. fig. 6).

Occurrence. Among weed in Lake Dulverton.

Boeckella longisetosa, sp. n. (Pl. 17. figs. 13–17.)

Female.—The head and first segment fused with it are shorter than succeeding anterior segments. The fifth segment is fairly large, with fairly conspicuous lateral projections which are distinctly bilobed, the outer lobe being spiniform, the inner rounded.

The first abdominal segment is rather swollen in the middle, and the abdomen consists of 3 distinct segments, and also the uropods are rather distinctly segmented off, making a fourth indistinct segment (Pl. 17. fig. 14).

The first antenna has 24 joints and the other limbs are similar to *B. insignis*.

The last leg is slender and feebly armed with setæ, the internal ramus being tipped terminally with 3 setæ, but otherwise unarmed (Pl. 17. fig. 16).

The uropods bear five compound setæ, which are exceedingly long, equalling in length the whole abdomen.

Length 1·5 mm.

Colour. Green.

Male.—Agrees with the male of *B. insignis* in having a five-segmented abdomen, a more slender body, and no conspicuous projections on the fifth thoracic segment.

The first antenna, which is geniculated, has 22 joints (Pl. 17. fig. 15).

The fifth pair of limbs have the form shown in Pl. 17. fig. 17. The internal ramus of the right limb is two-jointed and bilobed at the end.

Occurrence. In the plankton of Lake St. Clair and Lake Sorell.

BOECKELLA RUBRA, sp. n. (Pl. 18. figs. 1–5.)

Female.—Anterior portion of body narrow and cylindrical; the head and anterior segment fused with it are about equal to the two succeeding segments.

The fifth segment is large, with very conspicuous lateral projections, consisting of two lobes, the external lobe being very long and spiniform and nearly as long as the first abdominal segment, the internal lobe being smaller and rounded at the end. The first abdominal segment is distinctly swollen in the middle. The abdomen consists of three segments.

The first antenna consists of 25 joints.

The last leg has the form shown in Pl. 18. fig. 3, from which it is seen that the setæ on the inner margin of the terminal joint of the external ramus are smaller than in *B. insignis*, while the inner ramus is well armed with small setæ and thus differs from that of *B. longisetosa*.

The uropods have five simple setæ apiece, about equal in length to the abdomen, thus intermediate in length between those of *B. insignis* and *B. longisetosa*.

Length ·7 mm.

Colour. Bright red.

Male.—Similar in form to the female, save that the lateral projections are absent on the fifth segment, and the abdomen consists of 5 segments.

The first antenna, which is geniculated, has 23 joints, and the penultimate joint has a very marked projection at its end (Pl. 18. fig. 2).

The fifth pair of legs have the form shown in Pl. 18. figs. 4 & 5. They differ from the legs of the other species in the presence of an extra seta near the internal ramus of the left limb, and in the presence of an extra seta on the claw of the external ramus of the right limb.

Occurrence. This species occurs in vast swarms in the very old and deep tarns on the Harz Mountains and on Mt. Read. It was never met with in small bodies of water or at lower levels than about 3000 ft.

Boeckella robusta, Sars, Archiv for Math. og Naturvid. xviii.

This large and handsome species was found in great abundance in several small muddy ponds near Hobart (in a pond near the road at Sandy Bay and in a small pond near the Cascade Brewery). Sars describes it from the neighbourhood of Sydney, so that it is evidently a widely distributed form in Southern Australia. It can at once be distinguished from the other species by its great size, by the comparative shortness of the setæ on the uropods, by its pale livid colour, and by the great length of the lateral projections on the fifth segment.

Genus Brunella, gen. n.

I have made this new genus of the Diaptomidæ to include a species found in a large weedy freshwater lagoon near Adventure Bay, Bruni Island. It was present in great quantities, but I did not meet with it anywhere else. It is impossible to include it in any existing genus, as the structure of the thoracic limbs, and especially of the fifth pair in the male, is quite peculiar. In its other characters (*e. g.* structure of antennæ and mouth-parts) it agrees very well with *Diaptomus* or *Boeckella*.

The diagnostic characters which concern the thoracic limbs are:—

1. The first thoracic limb has the external ramus biarticulate and the internal ramus uniarticulate (Pl. 18. fig. 12).
2. The second, third, and fourth limbs have the external ramus triarticulate and the internal ramus biarticulate (Pl. 18. fig. 13).
3. The fifth thoracic limbs in the male differ on the right and left side. The right limb has the external ramus 2-jointed, the last joint being spatulate and carrying a very small terminal spine; the internal ramus of this limb is 2-jointed with an extra internal lobe. The left limb has the external ramus 3-jointed and ending in a greatly elongated claw; the internal ramus of this limb is 3-jointed (Pl. 18. figs. 15 & 16).
4. The fifth thoracic limbs of the female have the external ramus 3-jointed and the internal ramus 2-jointed (Pl. 18. fig. 14).

This combination of characters is very peculiar. Thus the first two characters point to affinities with *Eurytemora*, but the character no. 4 is unparalleled in any freshwater Diaptomid, and one has to go to some marine genus (e. g. *Centropages*) for comparison. Character 3 shows some agreement with *Parabroteas michaelseni*, described by Mrázek from S. America, but in its other characters it differs widely from that genus.

Brunella tasmanica, sp. n. (Pl. 18. figs. 6–16.)

Female.—The fore-body is narrow and cylindrical; the head-segment tapers anteriorly and has a slight depression laterally near the anterior end; this segment exceeds in length the two following segments.

The fifth segment has small lateral projections, which are bilobed, the external lobe being the larger and rounded at the end; the internal lobe is small and more acute. The first abdominal segment is rather tumid; the abdomen has three distinct segments, not counting the segmented bases of the uropods.

The uropods are long, equalling in length the first abdominal segment. They are furnished each with four terminal plumose setæ and one lateral; these setæ are not quite half as long again as the uropods.

The first antennæ are long, equalling the length of the body; they consist of 27 joints.

The second antennæ are similar in structure to those of *Boeckella*, and so are the mandibular palps; the biting-edge of the mandible has the form shown in Pl. 18. fig. 8.

The maxilla (Pl. 18. fig. 9) resembles that of *Boeckella* very closely, but has rather fewer setæ. The same applies to the first maxillipede (Pl. 18. fig. 10).

The second maxillipede (Pl. 18. fig. 11) closely resembles that of *Boeckella*, but the internal lobe on the first joint is more prominent.

The first thoracic limb (Pl. 18. fig. 12) has the external ramus 2-jointed and the internal ramus 1-jointed.

The third limb (which resembles closely the second and fourth) has the form shown in Pl. 18. fig. 13. The external ramus is 3-jointed; the internal is 2-jointed. The arrangement of the spines and setæ is always constant as in the figure.

The fifth leg of the female (Pl. 18. fig. 14) has the external ramus 3-jointed and the internal 2-jointed. The stout spine on the penultimate joint of the external ramus is not plumose.

Length ·7 mm.

Colour. Green.

Occurrence. In great numbers in a weedy freshwater lagoon near Adventure Bay, Bruni Island.

Male.—The male differs from the female in having the first antenna normally geniculated (Pl. 18. fig. 8) and in having five distinct segments in the abdomen.

The last pair of legs are very peculiar.

The right leg (Pl. 18. fig. 16) has the external ramus 2-jointed; the joints are flattened and expanded, and there is a short stout spine on the terminal joint. Otherwise setæ are absent. The internal ramus is 2-jointed, the terminal joint bearing four long setæ. The other joint has a peculiar lobe upon it, and also another internal lobe springs from its base.

The left leg (Pl. 18. fig. 15) has the external ramus 3-jointed, if we count the terminal claw as a joint. There is a small spine at the top of the first joint and another small spine on the base of the claw. The internal ramus is 3-jointed, the terminal joint carrying four setæ.

Family CYCLOPIDÆ.

Genus CYCLOPS, O. F. Müller.

Besides one species, *C. australis*, King, characterised by Sars as peculiar to Australia (Archiv for Math. og Naturvid. xviii.), the latter author reports (*loc. cit.*) several common European species from small pools in and around Sydney (e. g., *C. albidus*, *C. serrulatus*, *C. affinis*, &c.). This occurrence of species identical with those found in Europe is a little suspicious, as nothing of the sort occurs among the other groups of Entomostraca, almost all the species of Cladocera being peculiar. The species found in Tasmania, although very closely related to European forms, are distinguishable as separate species.

Cyclops albicans, sp. n. (Pl. 16. figs. 8–12.)

The head-segment is broad and blunt; the succeeding segments have rounded edges, which do not project laterally to any extent.

The uropods are about as long as the last two abdominal segments. They are furnished each with four terminally placed setæ, of which the innermost is much longer than the outermost, but none of them are as long as the abdomen (Pl. 16. fig. 12).

The first antenna, which is as long as the first two segments of the cephalothorax, consists of 17 joints. The terminal segments are without a row of spines or hyaline membrane (Pl. 16. fig. 12).

The first swimming-leg (Pl. 16. fig. 9) has both branches consisting of three joints, and so have the succeeding swimming-legs. The last two joints of the inner ramus of all but the first pair have their internal margin serrated (Pl. 16. fig. 10).

The rudimentary fifth pair of limbs consist of two distinct joints; the terminal joint carries a plumose seta at its tip, and on its inner margin a serrated spine nearly as long as the seta and situated on the inner margin near the tip. The basal joint carries a fairly long seta on its external border (Pl. 16. fig. 11).

Length ·8 mm.

Colour. Very pale green or white.

Occurrence. In the plankton of the Great Lake, and also in many small ponds, widely distributed.

Cyclops dulvertonensis, sp. n. (Pl. 17. figs. 1–3.)

The head-segment is broad and blunt, but equal in length to the rest of the thorax. The thoracic segments have their hinder edges distinctly produced and overlapping the segments behind them.

The uropods are rather longer than the last two abdominal segments. They are furnished each with four terminal setæ, the innermost being very slightly longer than the outermost, and the longest is as long or longer than the abdomen (Pl. 17. fig. 3).

The first antenna (♀), which consists of 12 joints, is about as long as the head-segment. The terminal segments are without a row of spines or hyaline membrane.

The first swimming-leg has the inner ramus 2-jointed and the outer 3-jointed, the basal joint being rudimentary. The succeeding legs have both rami 3-jointed, but without any serration on the inner ramus.

The rudimentary fifth pair resemble closely that of the foregoing species.

Length ·5 mm.

Colour. Dark green.

Occurrence. Among thick weed in Lake Dulverton.

EXPLANATION OF THE PLATES.

Plate 12.

Fig. 1. *Phreatoicus australis* (Chilton).
2. Lateral view of telson and uropod, *P. australis,* from the Great Lake.
3. Uropod of *P. australis* from Ben Lomond.
4. Uropod of *P. australis* from Mt. Wellington.
5. *Phreatoicus brevicaudatus,* sp. n.
6. Lateral view of telson and uropod, *P. brevicaudatus.*
7. *Phreatoicus spinosus,* sp. n.
8. Lateral view of telson and uropod, *P. spinosus.*
9. Second antenna of *P. australis.*
10. Ditto of *P. brevicaudatus.*
11. Ditto of *P. spinosus.*
12. Alimentary canal of *Phreatoicopsis terricola* (Spencer). Diagrammatic transverse section.
13. Anterior part of alimentary canal of above, opened to show structure of stomach and typhlosole.

Plate 13.

All figures of *Neoniphargus yuli,* sp. n.

Fig. 1. The animal in lateral view.
2. First antenna. *Sec.app.*, secondary appendage.
3. Second antenna.
4. Right mandible.
5. Left first maxilla.
6. Palp of right first maxilla.
7. Second maxilla.
8. Maxillipede.
9. First gnathopod.
10. Third pereiopod.
11. Terminal claw of first pereiopod.
12. Second uropod.
13. Third uropod.
14. Telson.

Plate 14.

Fig. 1. First antenna of *Neoniphargus exiguus.*
2. Third uropod of ditto.
3. Telson of ditto.
4. Terminal joint of 3rd pereiopod of ditto.
5. First antenna of *N. tasmanicus.*
6. Third uropod of ditto.
7. Telson of ditto.
8. Terminal joint of 3rd pereiopod of ditto.
9. First antenna of *N. wellingtoni.*

Fig. 10. Third uropod of *Neoniphargus wellingtoni.*
11. Telson of ditto.
12. Terminal joint of 3rd pereiopod of ditto.
13. First antenna of *N. alpinus.*
14. Third uropod of ditto.
15. Telson of ditto.
16. Terminal joint of 3rd pereiopod of ditto.
17. First antenna of *Gammarus antipodeus.*
18. Third uropod of ditto.
19. Telson of ditto.
20. Gnathopod of 2nd pair of ditto.
21. Fourth coxal plate of ditto.
22. First maxilla (left) of ditto.
23. First antenna of *G. ripensis.*
24. Third uropod of ditto.
25. Telson of ditto.
26. Gnathopod of 2nd pair of ditto.
27. First maxilla (left) of *G. australis.*

Plate 15.

Fig. 1. First antenna of *N. niger.*
2. Third uropod of ditto.
3. Second gnathopod of ditto.
4. Telson of ditto.
5. *Simocephalus dulvertonensis.* × 56.
6. First antenna of ditto.
7. Telson of ditto.
8. Head of first antenna of *S. australiensis.*
9. Telson of ditto.
10. *Ceriodaphnia hakea.* × 92.
11. First thoracic limb of ditto.
12. Second thoracic limb of ditto.
13. Third thoracic limb of ditto.
14. Telson of ditto.
15. Second antenna of ditto.
16. Mandible of ditto.
17. *Ceriodaphnia planifrons.* × 92.
18. *Bosmina rotunda.* × 90.

Plate 16.

Fig. 1. *Bosmina brevirostris,* ♀. × 125.
2. *Bosmina sorelli,* ♀. × 125.
3. *Macrothrix burstalis,* ♀. × 125.
4. *Alonella nasuta,* ♀. × 125.
5. Telson of ditto.
6. *Alonella propinqua,* ♀. × 125.

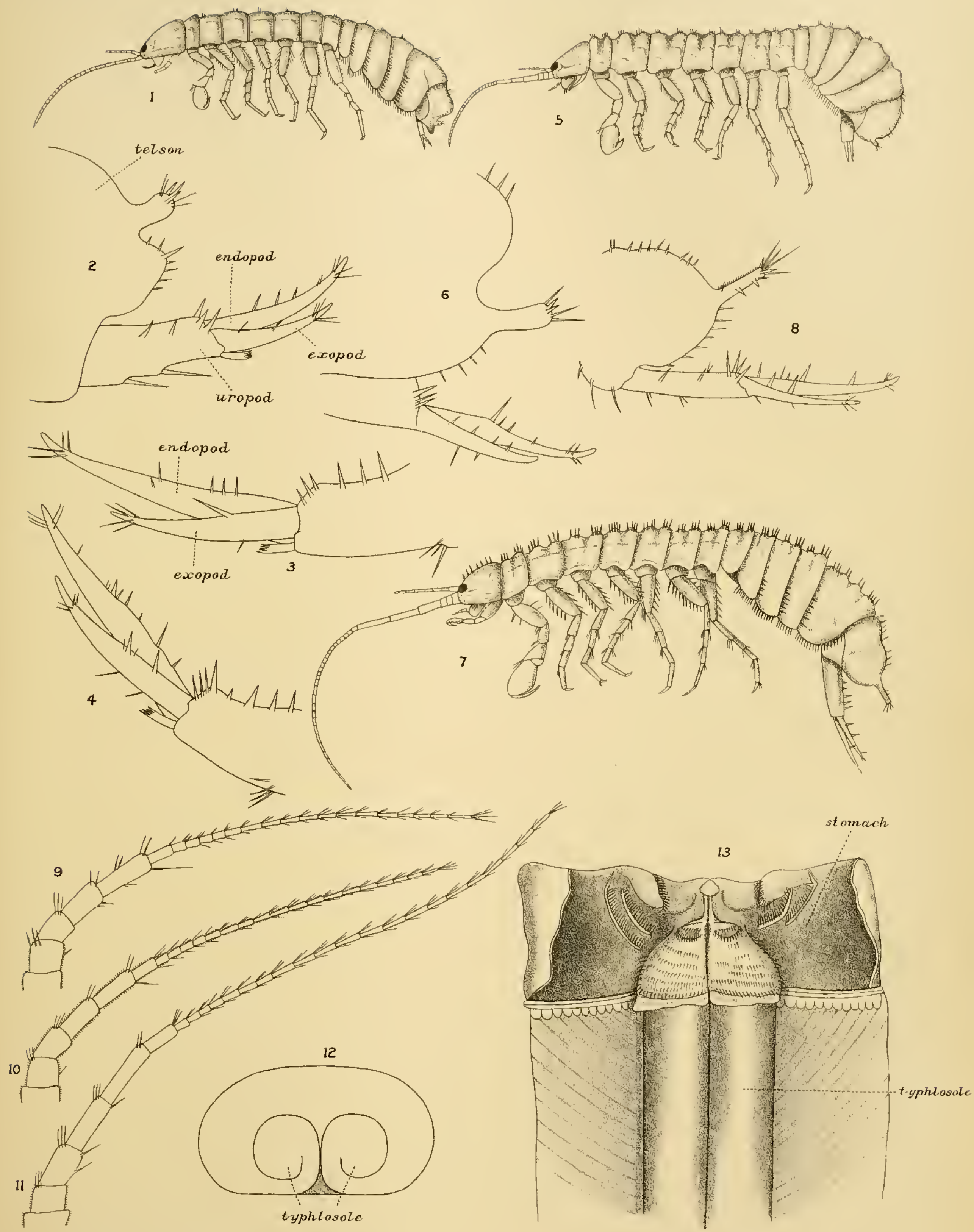
Fig. 7. Telson of *Allonella propinqua*, ♀.
8. *Cyclops albicans*, ♀. × 80.
9. First leg of ditto.
10. Second leg of ditto.
11. Last leg of ditto.
12. First antenna of ditto.

Plate 17.

Fig. 1. *Cyclops dulvertonensis*, ♀. × 86.
2. First pair of legs of ditto.
3. Hind body of ditto.
4. *Boeckella insignis*, ♀. × 50.
5. Hind body of ditto, ♂.
6. First antenna of ditto, ♂.
7. Second antenna of ditto, ♀.
8. Mandible of ditto.
9. Maxilla of ditto.
10. First maxillipede of ditto.
11. Last leg of ditto (♀).
12. Last legs of ditto (♂). R, right limb. L, left limb.
13. *Boeckella longisetosa*, ♀. × 50.
14. Hind body of ditto.
15. First antenna of ditto, ♂.
16. Last leg of ditto, ♀.
17. Last legs of ditto, ♂.

Plate 18.

Fig. 1. *Boeckella rubra*, ♀. × 86.
2. Terminal joints of first antenna of ditto, ♂.
3. Last leg of ditto, ♀.
4. Last right leg of ditto, ♂.
5. Last left leg of ditto, ♂.
6. *Brunella tasmanica*, ♀. × 86.
7. Terminal joints of first antenna of ditto, ♂.
8. Biting-edge of mandible of ditto. Right.
9. Maxilla of ditto.
10. First maxillipede of ditto.
11. Second maxillipede of ditto.
12. First limb of ditto, ♀.
13. Third limb of ditto, ♀.
14. Last limb of ditto, ♀.
15. Last left limb of ditto, ♂.
16. Last right limb of ditto, ♂.



G. W. S. del.

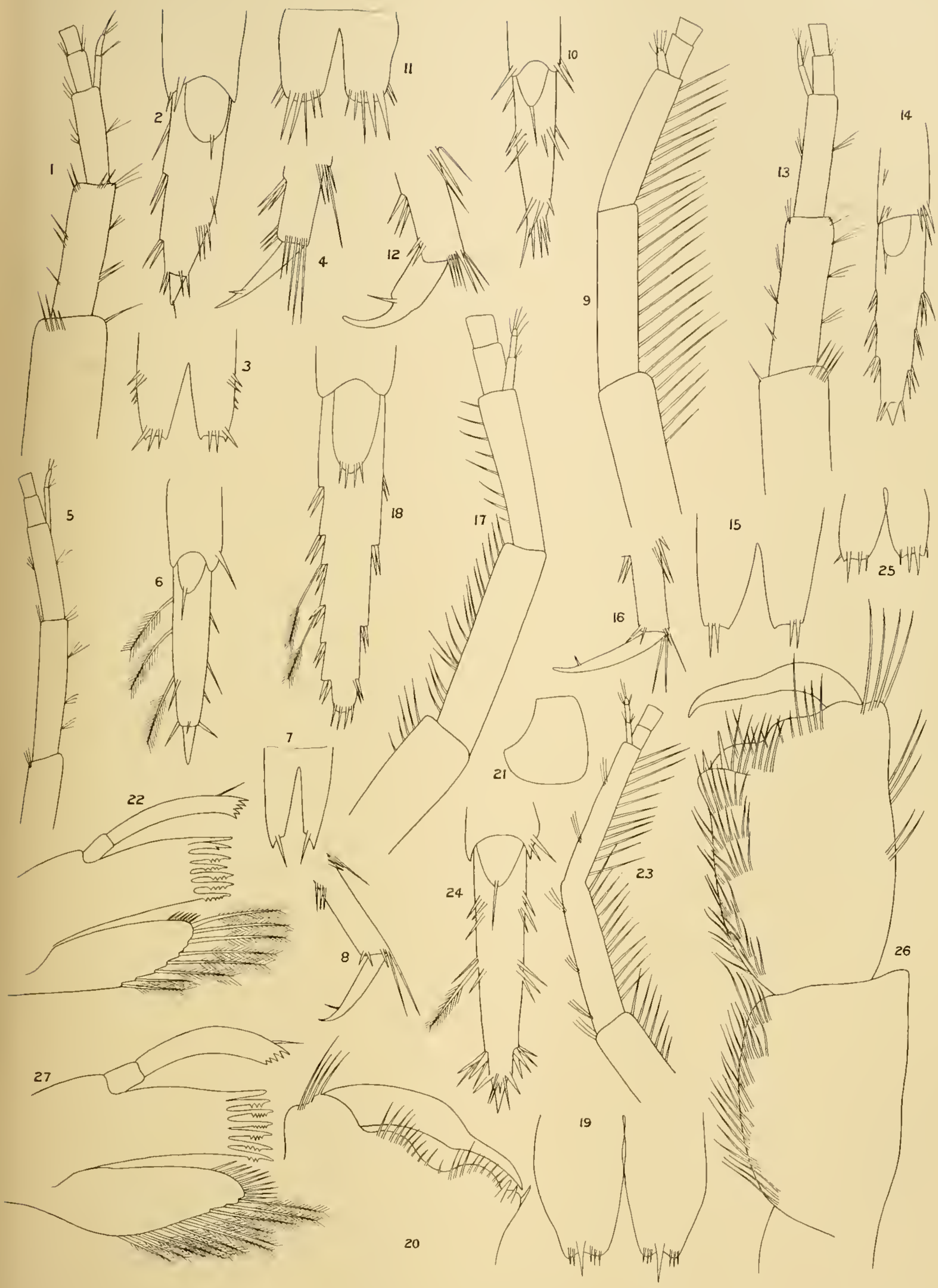
TASMANIAN CRUSTACEA.

M. P. Parker lith.
Parker & West imp.

G. W. S. del

TASMANIAN CRUSTACEA.

M. P. Parker lith.
Parker & West imp



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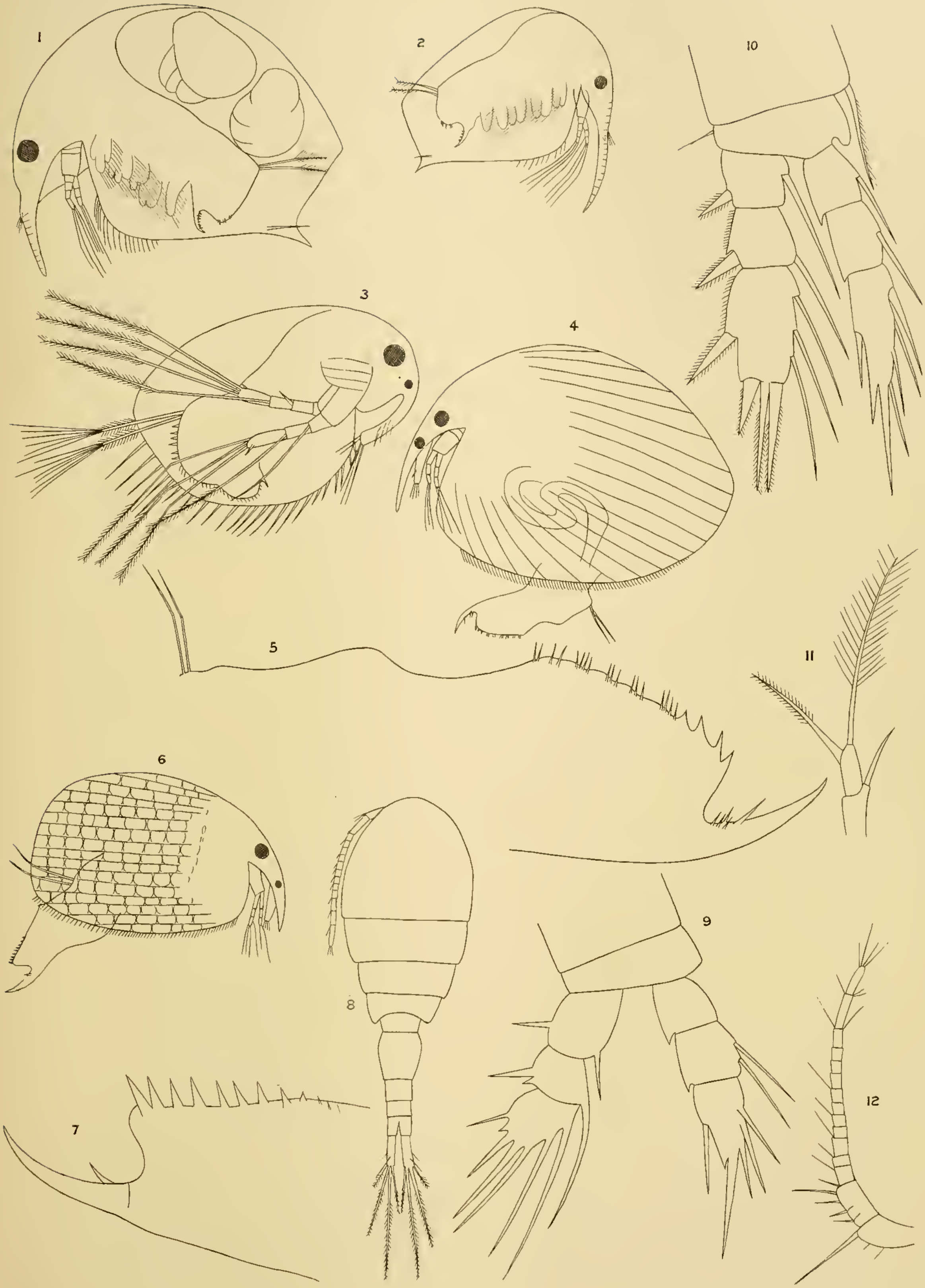

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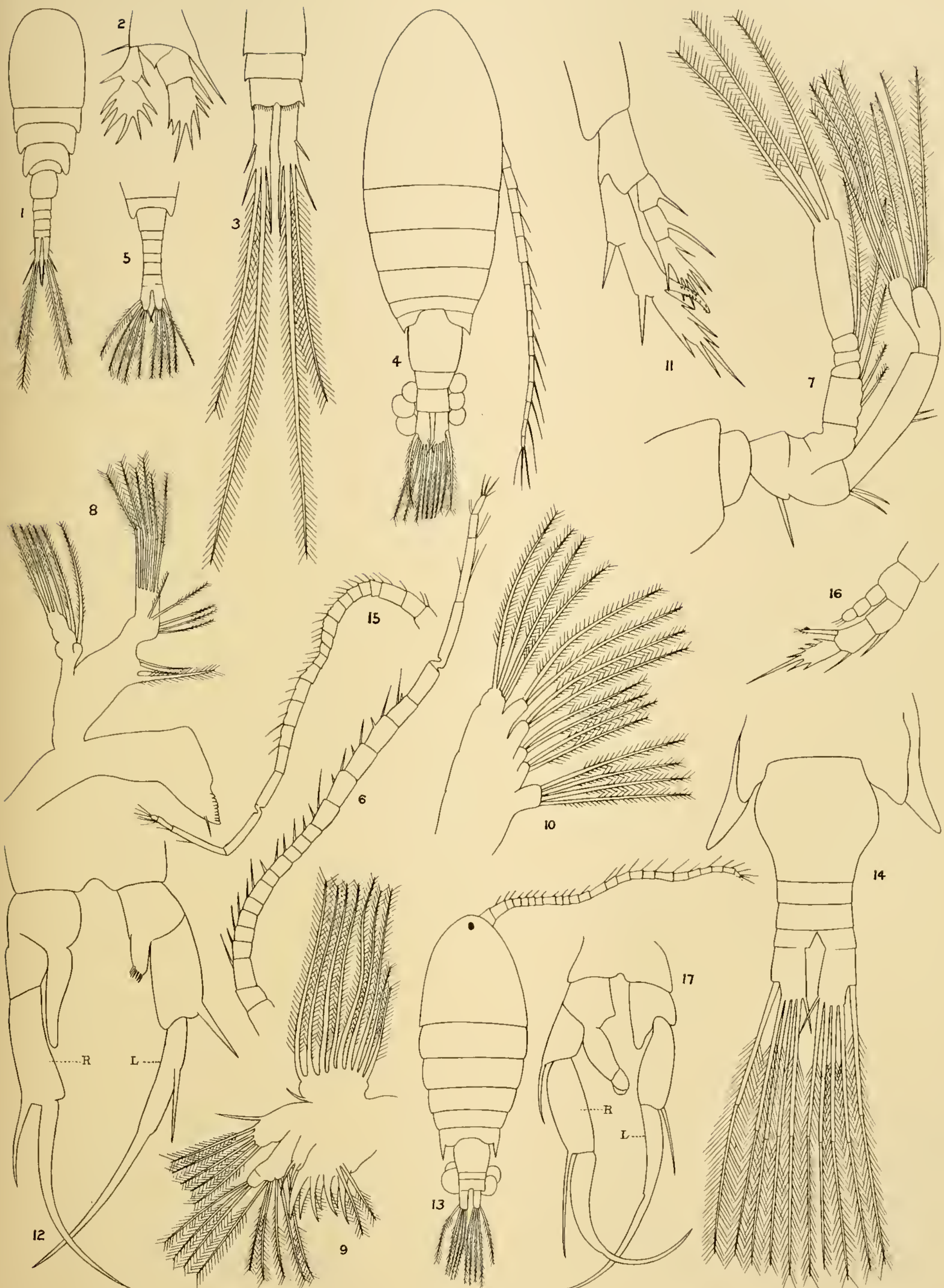

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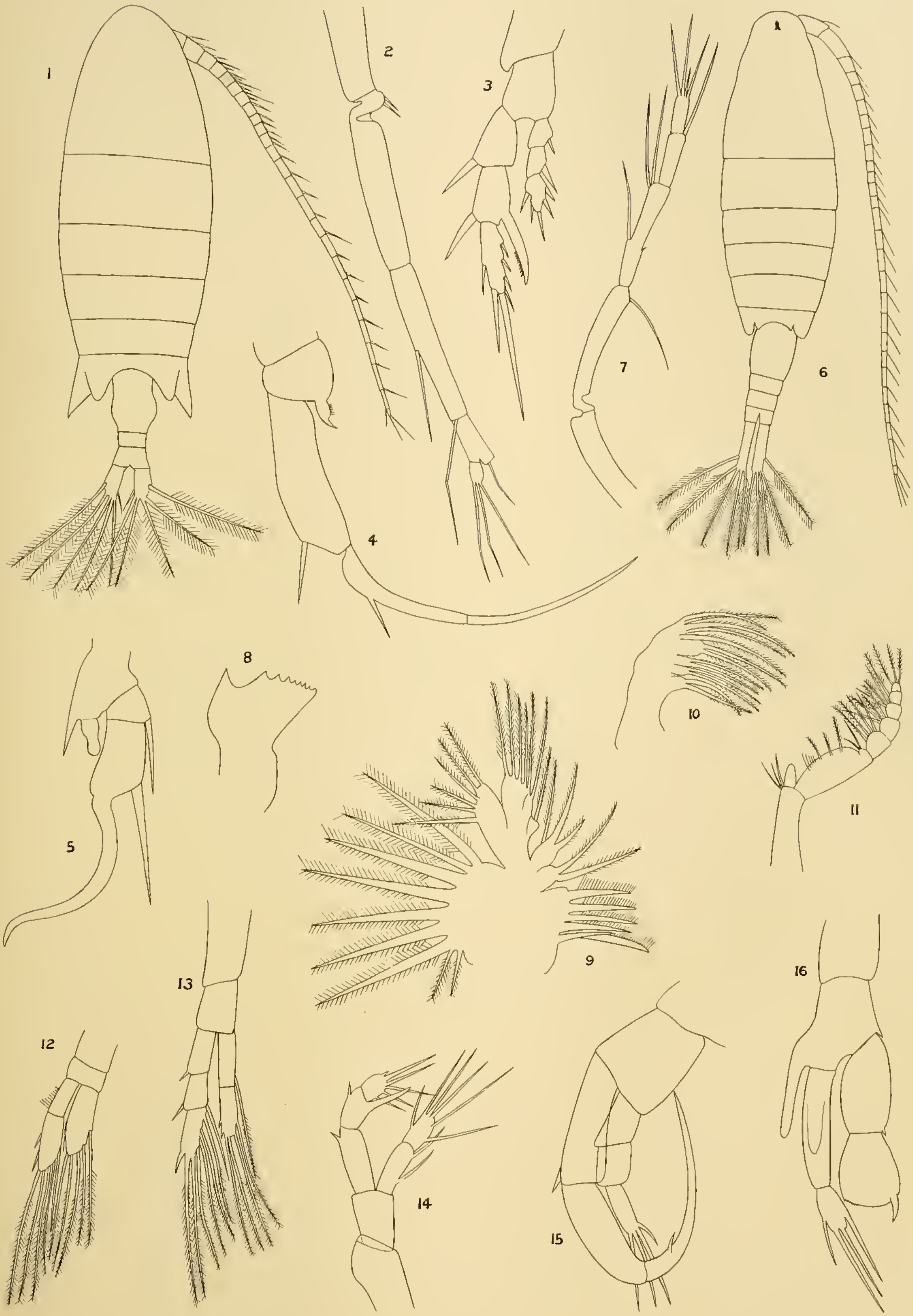

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