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PLANKTONIC CEPHALOPOD LARVAE FROM THE EASTERN AUSTRALIAN COAST.

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(Plates xxiv–xxvii, and Map.)

Introduction.

The larval cephalopod material upon which this report is based was obtained in plankton hauls of the Research Ship *Warreen* along the eastern Australian coast in 1938–1941, during investigations by the Fisheries Division, Council for Scientific and Industrial Research. I am indebted to Dr. H. Thompson, Chief, Fisheries Division, for the opportunity to report on this interesting and unusual material, and to Dr. D. L. Serventy and Mr. K. Sheard for help in matters relating to stations, depths and other factors associated with the collection. My thanks are also due to Miss Betty McKinnon, Lands Department, Sydney, for preparation of the map.

The material is extremely important in the study of this molluscan class. One hundred and thirty specimens examined from stations over an area extending from Port Arthur, S.E. Tasmania, to Heron Island, Great Barrier Reef in the north, represented 13 families, 19 genera, and 20 species, a number of which are bizarre forms belonging to families hitherto unrecorded from the South Pacific. The minute size, delicate nature, and rarity of the majority of specimens permitted only the simplest dissection in a few cases. Practically all forms appear quite larval and no signs of hectocotylization were evident.

Character and Relationships.

A surprising feature of the collection is the large number of families represented by only a single specimen, the only species occurring in any considerable number being *Pyrgopsis pacificus* (Issel), and the larval *Rhyncoteuthion* form of an Omnastrephid, *Nototodarus gouldi* (McCoy), young of which are removed at times from the stomachs of Tuna taken off this coast. The almost certain association of this larva with the adult *gouldi* has proved one of the most interesting surprises in the collection. The predominance of Oegopsid and the scarcity of Myopsid cephalopods are very marked, only three species of the latter suborder being present.

Another striking feature is that, with few exceptions, the new or little known species either belong to genera previously known only from a comparatively small area in another part of the world or to genera with a wide range. For instance, the appearance on this coast of the extraordinary little species *Ctenopteryx sicula* Appellof, hitherto known only from the Mediterranean and North Atlantic regions, is most surprising. Similarly, the appearance of the genera *Tetronychoteuthis* Pfeffer (Atlantic), *Mastigoteuthis* Verrill (Atlantic and Pacific), and *Heteroteuthis* Gray (Mediterranean, East Indies, Hawaii), and the occurrence of the family Bolitaenidae, represented by only a single specimen, so far south of its known Pacific range, gives a new aspect to our cephalopod fauna.

On the other hand, the appearance of *Brachioteuthis riisei* in a local collection for the first time, further extends its already wide range, and gives support to Hoyle's statement (1912, p. 338), that this curious little pelagic species will eventually prove to have an almost universal range. In contradiction to the presence of these unusual forms, so far removed from their accepted range, some rare species have been found

in close proximity to their type localities in the Australian region, e.g. *Idiosepius notoides* Berry, *Euprymna tasmanica* Pfeffer, *Calliteuthis miranda* Berry, and *Amphitretus pelagicus* Hoyle. Only a few of the species in the collection had been previously taken by the *Challenger*, *Endeavour* and *Terra Nova*.

Far too little is yet known of the Australian cephalopod fauna, and material in the present collection is too scanty to permit generalizing with any degree of safety on its zoo-geographical relationships with that of other regions. It will be seen, however, that a definite Mediterranean affinity exists in the case of one species at least, and a number of species have Atlantic and North Pacific forms as their nearest allies. A leaning towards the Japanese fauna, and possibly a closer affinity with the Hawaiian planktonic cephalopods, is noticed. Regarding relationships in the home waters, two examples may be quoted. The presence of *Amphitretus pelagicus* off S.E. Tasmania associates that region with the Kermadecs, and similarly *Pyrgopsis pacificus*, from stations extending from S.E. Tasmania to Coffs Harbour, north coast of New South Wales, indicates a correlation between our eastern coastal waters and those of north New Zealand, whence the species has already been recorded.

Classification.

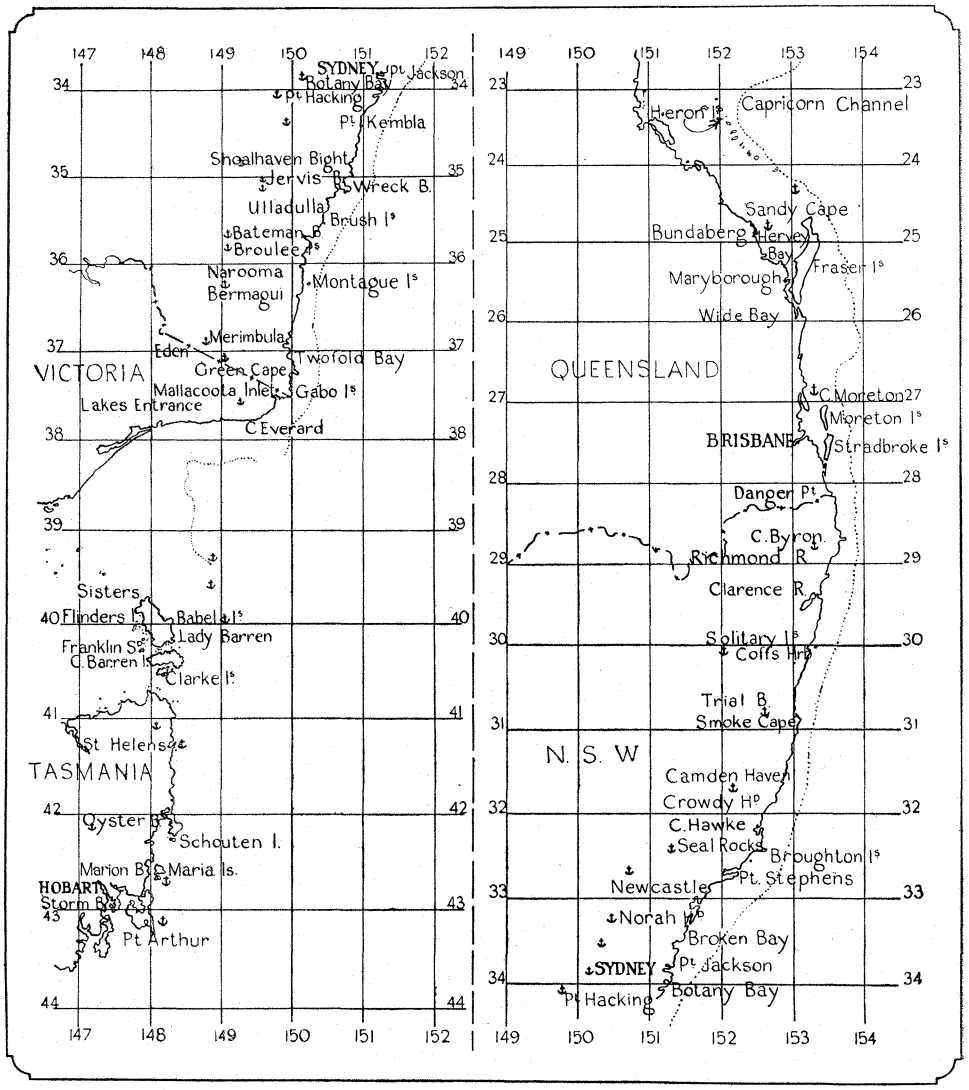
The only comprehensive work on Australian planktology is the monograph by Dakin and Colefax (1940), an excellent guide for the identification of planktonic organisms of Australian coastal waters off New South Wales, which I have found most helpful for general planktonic conditions, during the preparation of this paper. No cephalopods are included in this monograph; the authors indicated that although molluscan larvae play an important part in the plankton, especially near the coast (p. 205), they found that the occurrence of young cephalopods on odd occasions was so spasmodic that it was not considered worth while to include them in the work.

No work especially devoted to Australian planktonic cephalopods has yet appeared; indeed, published work on Australian Cephalopoda generally has been almost negligible. A considerable search through scattered volumes, in which many descriptions are brief and many species unfigured, has therefore been necessary. The investigations of the *Challenger*, *Endeavour*, *Terra Nova* and others, though providing us with a few species, barely touched the cephalopod fauna of these coastal waters. In particular, the works of Chun, Pfeffer, Hoyle, Berry, Sasaki, and Thiele, whose general lines of classification I have followed, have been the main source of investigation. Where Thiele and modern authors have differed I have endeavoured to point this out, and have adopted the name which I think applies more satisfactorily to our species. Some of the specimens named tentatively may later prove to be new species; one or two others may be better placed in an allied genus, but on a single or perhaps two larval specimens, without other material for comparison, it seems wiser to ally them to the species they most closely resemble than to propose new species for perhaps geographical reasons only. On the other hand, where a species does not conform to others in characters which appear specifically constant, as with two species, I have considered them new.

Since the international situation at the present time prevents the elucidation of many points connected with a paper of this nature, I will welcome opinions concerning the classification of the rare forms obtained in these hauls, as the opportunity occurs. Undoubtedly many taxonomic problems exist with regard to the planktonic cephalopods, some of which have been encountered in working over the material, but the main object here is to place on record the existence of larval forms whose genera or even families were previously unrepresented in Australian waters. For this reason each species has been figured as a quick initial guide in identification.

Distribution.

At the suggestion of Mr. K. Sheard, the *bathymetrical* distribution is indicated as *shallow* and *slope* (*deep*), for the purpose of this report. As will be seen from the table below, some of the species occur in both distributions.



The East Coast of Australia showing position of stations (indicated by anchors) from which cephalopods were obtained.

Shallow.	Slope.
Euprymna tasmanica Pfeffer	
Heteroteuthis serventyi sp. nov.	
Idiosepius notoides Berry	
Abralia ?astrosticta Berry	
Abraliopsis ?hoylei Pfeffer	*Abraliopsis hoylei* Pfeffer
Pterygioteuthis giardi Fischer	*Pterygioteuthis giardi* Fisch.
Onychoteuthis ?rutilus Gould	*Onychoteuthis ?rutilis* Gould
Tetronychoteuthis ?massyae Pf.	
Brachioteuthis riisei (Steen.)	*Brachioteuthis riisei* (Steen.)
	Ctenopteryx sicula Appellof
	Nototodarus gouldi (McCoy)
Rhyncoteuthion, larvae of	*Rhyncoteuthion*, larvae of
Nototodarus gouldi (McCoy)	*Nototodarus gouldi* (McCoy), 85%
	Calliteuthis miranda Berry

Shallow.	Slope.
Mastigoteuthis grimaldi (Joubin)	
	Bathothauma lyromma Chun
Pyrgopsis pacificus (Issel)	*Pyrgopsis pacificus* (Issel), 70%
Octopus ?pallida Hoyle	*Octopus ?pallida* Hoyle
Octopus ?tetricus Gould	
	Eledonella sheardi sp. nov.
	Amphitretus pelagicus Hoyle

No conclusion regarding *seasonal distribution* could be deduced from this small collection. With regard to local *geographical distribution*, apart from those species indicated in the text as having increased their Australian range, the distribution up the coast from Twofold Bay, New South Wales, to southern Queensland, of the *Rhyncoteuthion* larval form of the common squid, *Nototodarus gouldi*, is most interesting, since it is the first record of this larva along the eastern Australian coast. Similarly, the progression through numerous stations from Tasmania to the north coast of N.S.Wales, of *Pyrgopsis pacificus*, the most abundant species in the collection, previously unrecorded from the South Pacific except for two specimens off north New Zealand, provides a striking instance of the unusual cephalopods existing in our waters.

As this is the first paper to appear on Australian planktonic cephalopods, its possible value as a means of identification for the general planktonic worker, as well as a record, from a purely conchological aspect, of new and interesting material added to our list, has been taken into consideration. Keys and family characters, therefore, have been included to simplify identification.

Class CEPHALOPODA.

Subclass **Dibranchia.**

Two orders of dibranchiate Cephalopoda are represented in the collection, distinguished by the following key:

a. Animal generally with elongate body, pointed posteriorly, fins present, well developed. Ten arms (two tentacular arms) : suckers pedunculate, with horny chitinous rings. Suckers sometimes replaced by hooks. Head and mantle often free in nuchal region. Gladius rarely absent. Highly specialized photogenic organs of many types often present .... Order *Decembrachiata* (*Decapoda*)

b. Eyelids perforate over the cornea. Suckers frequently transformed into hooks. Photogenic organs often present on or within the body .. Suborder *Oegopsida*

bb. Eyes almost invariably covered by imperforate membrane. Horny rings to suckers, either smooth or dentate. No hooks on arms. Photogenic organs usually absent but may occur in mantle cavity ..... Suborder *Myopsida*

aa. Animal normally with short body, rounded posteriorly, fins absent or very rudimentary. Arms similar in appearance, eight in number. Suckers sessile, without chitinous rings. Head and mantle continuous in nuchal region. Gladius absent. Specialized photogenic organs rarely present ..... Order *Octobrachiata* (*Octopoda*)

Winckworth (1932, p. 248, 251) proposes *Decembrachiata* Latreille as a substitute for the order Decapoda Leach 1817, to avoid confusion with the crustacean order Decapoda and, for symmetry, alters Octopoda to Octobrachiata. Bouxin and Legendre (1936, p. 12) and Cotton and Godfrey (1940, p. 370, 442) follow this substitution.

Suborder **Oegopsida.**

Family **Enoploteuthidae.**

Animal small to moderate size. Fins sagittate or rounded, terminal or subterminal. Arms with two rows of suckers and hooks; tentacle clubs little or not at all expanded, their suckers in four rows, usually part of them transformed into hooks (suckers only are found in the young of some genera). Photophores almost invariably present on the ventral surface of the eyeball and in addition may occur within the mantle cavity or scattered over the outer integument. Buccal membrane eight-pointed. Gladius plume-shaped with broad wings and no end cone.

Distribution.—Atlantic, Pacific, and Indian Oceans, Mediterranean.

Two subfamilies are represented in the collection, the characters of which are as follows:

a. Body roundly pointed posteriorly, extending very little or not at all beyond fins. Fins large and usually sagittate, not separated. Tentacles with a row of hooks in adult. Photogenic organs often in large numbers on ventral aspect of mantle and usually on head and arms: almost invariably present as single series of large organs on ventral eyeballs. No luminous organs in pallial chamber ..... *Abraliinae*

aa. Body sharply pointed posteriorly, notably exceeding fins. Fins rounded, separated. Photogenic organs lacking from outer integument, but numerous on eyeball as well as within pallial chamber ..... *Pyroteuthinae*

I have followed Thiele in using the name Abraliinae rather than Enoploteuthinae.

Subfamily Abraliinae.

Genus Abralia Gray, 1849.

Abralia Gray, 1849, p. 46, 50. Type, *Onychoteuthis armata* Quoy & Gaim., 1832 (species first mentioned), near Island of Celebes.

Fins large, somewhat sagittate. Arms with two rows of hooks for greater part of length, but with true suckers at tips. Dorsal row of suckers on proximal portion of tentacle club suppressed in adult, leaving one row of hooks and two rows of suckers which give way to four rows of suckers distally.

This is the first record of the genus from Australia.

Abralia ?astrosticta Berry, 1909.

(Plate xxiv, figs. 1–10.)

Abralia astrosticta Berry, 1909, pp. 412, 419. Type locality, Oahu, Hawaiian Islands.

Animal small, firm and rounded. *Mantle* almost equal width for more than half its length, gradually sloping off to roundly pointed tail; margin only slightly raised mid-dorsally, otherwise straight except for two slight points ventrally indicating position of *interlocking system*, with slight emargination between them. *Fins* about two-fifths length of mantle, fairly wide. *Head* large, about as wide as mantle and almost half its length. *Eyes* set far apart and high up, separated ventrally by a fairly wide groove. *Siphon* reaching to about lower level of eye area, hooded, attached to head by two bands; valve within. Two elongated ridge-like pustules on each *olfactory crest.*

Arms broad, long, flattened and strong; order 2, 3, 4, 1. Third and fourth pairs with thin wavy membranes along outer edges. Ventral pair widened conspicuously at base. *Suckers* well developed, in two slightly oblique rows replaced in part further down the arm by a few conspicuous hooks and mounds enclosing hooks. Dorsal pair has about 13 rows of suckers and 2 spine mounds; second pair has about 12 rows of suckers and a single sucker (fig. 3); about the same arrangement on the 3rd pair of arms; and on the ventral arms are 14 rows of suckers only. *Tentacular arms* long and well developed, *clubs* forming about one-third length of exposed tentacle. Suckers *only* present on clubs, due doubtless to immaturity of specimens. First six rows of suckers small, increasing rapidly in size in the next six rows of slightly stalked suckers. Suckers on clubs arranged in rows of four, except the last three rows which contain three, two, and one respectively. Suckers on both arms and tentacular clubs appear to have serrated edges.

Gladius shown as a dark streak mid-dorsally. Typical *Abralia* shape, thickened mid-rib, tapering anteriorly to a fine point posteriorly, wings very delicate, widening considerably half-way down, gradually sloping to a rounded, slightly inturned point posteriorly.

Body, in particular the ventral surface, studded with small but conspicuous *photogenic organs* in more or less regular rows on the mantle, siphon, head, and along backs of arms: inconspicuous dorsally. A few larger *photophores* surround the ventral surface of eyes.

Colour.—General colour dark buffish-brown, with rather large chromatophores round the head and along the dorsal surface of mantle. Photophores appear dark bluish colour.

Measurements.—Mantle margin to tail tip, 10 mm. long, 5 mm. broad. Fins, 6 mm. complete width, 3 mm. high. Head, 4 mm. long, 4 mm. broad. Dorsal arm, 5 mm. long, 2nd pair 7 mm. long, 3rd 6 mm. long, ventral arms 5 mm. long, 1 mm. broad at base. Tentacular arms, 9 mm. long, 1 mm. broad.

Locality.—Station 201/39. 17/7/39. N.70. D.25. Obl. (off Coffs Harbour, N. Coast, N.S.Wales). Shallow. 1 specimen (figured). Station 221/39. 16/9/39. N.200. Hor. D.O. 15 mm. 31°17′S., 153°34′E. (near Smoky Cape, North Coast, N.S.Wales). Shallow. Two specimens about same size and similar in appearance to above, have small dark brown marks along arms.

Remarks.—The genus *Abralia* has not been recorded from eastern Australia, and it is with some doubt that I have identified the species under consideration as a probable juvenile of *Abralia astrosticta* Berry, an Hawaiian species, the adult of which it very closely approaches. This course seems wiser than to propose a new species for an immature form practically on geographical reasons, since it exhibits no outstanding characters to distinguish it from those of *astrosticta.* Should adult specimens appear at a later date, a new specific name may be necessary or it may prove to be more allied to one or other of the recorded Japanese species.

Berry (1913 (1914), p. 145) records a new species as *Abralia astrolineata* from the Kermadecs, which, he points out, shows a condition intermediate between *Abralia* and *Abraliopsis* on account of a series of minute, heavily pigmented photophores on the ventral arms, characteristic of the latter genus. On account of this and the extensive banded arrangements of the photophores on the ventral surface of the mantle, the possibility of it being an immature form of *astrolineata* Berry is discarded.

The possibility of our species being juvenile of *Enoploteuthis galaxias* Berry (1918, pp. 211–221) is also discountenanced on general differences, and in particular on the extent to which the tail extends beyond the fins in *galaxias*, a character usually consistent in young forms of any species possessing such, but not present in our species.

Among the Enoploteuthidae in the *Warreen* collection were some very attractive larval forms with most conspicuous eye photophores. These appeared to resemble in detail *Asthenoteuthion planctonicum* Pfeffer (1912, pp. 172–3), a genus and species created by Pfeffer for a larval form from the North Atlantic. Pfeffer draws attention to its similarity to the genus *Lycoteuthis* Pfeffer, but points out that the gladius is definitely that of Enoploteuthidae, not Lycoteuthidae. Thiele (1934, p. 962), in referring to some larval forms of *Abraliopsis* Joubin, is uncertain to which genus of Enoploteuthidae *Asthenoteuthion* belongs. I think after careful examination of the Australian specimens, that these (Australian) may be smaller larval forms of the species I have tentatively designated *Abralia astrosticta* Berry. For reference, figures of one of these are given (figs. 5–10).

Localities from which they were obtained are as follows: Station 27/40. 21/4/40. N.200. Hor. (near Smoky Cape, North Coast, N.S.Wales), 31°08′, 153°05′. Shallow. One specimen (figs. 5–6, 8, 10).

Measurements.—Mantle, 5 mm. long, 2 mm. broad. Head, 2 mm. long, 2·5 mm. broad. Arms, 2nd pair (longest) 3 mm. Tentacular arms, 5 mm. Fins, 4·5 mm. across, 1·75 mm. long.—Station 57/38. 29/9/38. N.70. Hor. D.100–15 mm. (near North Head, Sydney, N.S.W.). Slope. A very immature specimen, mantle measurement only 3 mm.—Station 26/40. 20/4/40. N.200. Hor. 32°43′S., 152°55′ (near Seal Rocks, North Coast, N.S.W.). Slope. A minute, mutilated specimen (figs. 7, 9).—Station 106/38. 17/12/38. N.200. Hor. Two specimens, mantle lengths 4 mm. and 5 mm. respectively. 33°30′S., 152°21′E. (near Norah Heads, N.S.W.).—Station 39/38. 7/9/38. 28°S., 133°3′E. (near Danger Pt., North Coast, N.S.W.). Shallow. One specimen, mantle length 4 mm.

Genus Abraliopsis Joubin, 1896.

Abraliopsis Joubin (1896, pp. 19–35). Type, *Abraliopsis* (*Enoploteuthis*) *hoylei* Pfeffer, 1884 (designation), Mascarene Islands.

Animal like *Abralia* with large fins reaching to tail point. Extremities of ventral arms (4th pair) with a conspicuous series of heavily pigmented black bead-like photo-

phores. A single series of five large photophores occur on the ventral periphery of the eyeball.

Distribution.—Indian and Pacific Oceans. First record of the genus from Australian waters.

Abraliopsis ?hoylei Pfeffer.

(Plate xxiv, figs. 11–17.)

Enoploteuthis hoylei Pfeffer (1884, p. 17).

Animal small solid, and well developed. *Mantle*, rounded, gradually sloping from about half-way down to a conical point, raised to fairly sharp point mid-dorsally and on either side of the funnel ventrally, with slight emargination between. *Fins* large, cordate, just more than half the total length of the mantle; united, forming a rounded point posteriorly, and attached to mantle well in towards mid-dorsal line. *Head* large, slightly longer than broad, narrower towards its junction with mantle. *Eyes* large, globular, set high up, wide apart. *Arms* long and graceful, order 3, 2, 4, 1 (3 and 2 close). About twelve crowded very small *suckers* towards the distal part of arms, replaced for the remainder of their length by alternating rows of closely packed fleshy *hooks* along the inner sides of the arms, bounded on the outer side for about half the length by a wavy fold consisting of fleshy ridges running from a centre furrow to the edge; the arrangement developed strongly in second and third pairs of arms, to a lesser degree in the first (dorsal) pair, and absent on the ventral arms. The ridge-like knobs possibly develop into a second row of hooks as characteristic of the genus (see fig. 14). Hooks on ventral arms are scattered and immature. They cease on all arms a short distance before base. *Tentacular arms* without enlarged *clubs*, the areas simply being a hook- and sucker-covered portion embracing about one-fourth of the whole length of exposed tentacle, thinning out towards the tip of the tentacles. About 14 rows (four in a row) of closely packed, small suckers from tip to a little way down the club followed by four very large spines along one side with small scattered suckers along the other side, and a few rows of suckers only in oblique rows of two (fig. 13).

Funnel large and wide, not reaching much beyond lower level of eyes. *Interlocking system* as in genus. Buccal membrane 8-pointed, pustulose within. Gladius typical of family.

Colour.—Creamy-buff, with some irregular, very dark brown chromatophores scattered over mantle, head and arms in more or less regular pattern. About 14 very dark chromatophores occur along the backs of the tentacular clubs with larger, more widely spaced ones along the stalks. There are regular rows of photophores round the eyes, on the ventral surface of the head, in approximately two rows up the backs of the arms, and on the ventral mantle surface. A few larger photophores, possibly five, are on the ventral surface of each eyeball. The photophores throughout are conspicuous and on the mantle appear to run in about 6 longitudinal rows with a suggestion of some minute ones between them.

Measurements.—Mantle, 10 mm. long, 4 mm. broad. Fins, 5 mm. long, 7·5 mm. full width. Head, 4 mm. base of arms to mantle edge, 3 mm. broad. Dorsal arms 6 mm., 2nd arms 7 mm., 3rd arms, 7–7·5 mm., 4th arms 6·5 mm. Tentacular arms, 12 mm. long, 1 mm. broad.

Locality.—Station 66/38. 12/11/38. N.200. Hor. 35°07′S., 150°51′E. (near Jervis Bay, S. Coast, N.S.W.). Shallow. One specimen (figs. 11–14).—Station 217/39. 6/9/39. Obl. N.100. D.200. 24 miles east of Port Hacking, nr. Sydney, N.S.W. Slope. A slightly smaller specimen (figs. 15–17).—Station 223/39. 2/10/39. N.70. Obl. D.200. 34°05′S., 151°36′E. (Port Hacking). Slope. One very small immature specimen.—Station 145/39. 31/5/39. N.200. Hor. 36°15′S., 150°16′E. (near Montague Is., S. Coast, N.S.W.). Shallow. One small specimen.—Station 31/40. 25/4/40. (24 miles E. of Sydney Heads). Slope. Seven specimens (probably *A. hoylei*), 7 mm. long.—Station 60/38. 12/10/38. 43°13′S., 148°37′E. Slope. One specimen (near Port Arthur, Tasmania).

Remarks.—Like *Abralia*, the genus *Abraliopsis* has not been recorded from the Australian coast, the nearest habitat being the Kermadecs, where Berry (1913 (1914),

p. 148; 1916, p. 58) records an immature species which he refers with considerable uncertainty to *Abraliopsis hoylei* (Pfeffer, 1884). From the material on hand, it seems that the Australian specimens are immature forms of Berry's Kermadec species, but whether they are correctly regarded as *Abraliopsis hoylei* is uncertain until more material is available. In the meantime, I have followed Berry in classifying them as *hoylei*, rather than institute a new name for immature specimens. It is possible that a relationship may later be found to exist between the species and the common Japanese species *Watsenia scintillans* Berry (1911, p. 93).

Subfamily **Pyroteuthinae.**

Genus **Pterygioteuthis** Fischer, 1895.

Pterygioteuthis Fischer, 1895, p. 205. Type, *Pterygioteuthis giardi* Fischer, Morocco.

Characters of the subfamily. A genus created for *giardi* by Fischer.

Pterygioteuthis giardi Fischer, 1895.

((Plate xxiv, figs. 18–20.)

Pterygioteuthis giardi Fischer, 1895, p. 205.

Animal small, smooth, with narrow elongated *mantle* sloping sharply to a tail point. *Mantle margin* raised mid-dorsally, slightly raised ventrally each side of siphon at interlocking points, with rather deep emargination between. *Fins* fairly large, rounded, separated, much narrower at their point of attachment to mantle; situated well up mantle from tail tip, approximately their width away. *Head* large, rounded, slightly wider than mantle, dorsal surface flattish. *Eyes* large, globular, occupying main portion of ventral head area.

Arms irregular, strong, long and flattish, order 3, 2, 1, 4 (a smaller specimen from Station 132/39, 5/5/39, has order 2, 3, 1, 4). Very conspicuous, wide, fin-like membranes along ventral sides of the 1st, 2nd, and 3rd pairs of arms in particular, and only very slight suggestion on the ventral pair. Fin-like appearance due to parallel fleshy *trabeculae* extending from beyond edge of membrane to arm, which in specimen described appear to have become separated. The trabeculae diminish in length as they approach the arm tips. Ventral arms much more slender than remainder. Two rows of small, delicate *suckers* occur along the sessile arms, but no hooks are apparent, due no doubt to immaturity. There is only a slight indication of suckers on the ventral arms. *Tentacular arms* fairly stout, not very long, reaching about twice the length of the shortest arms. Constricted at their base, beyond which state they swell, constrict again, then taper gradually to a short unexpanded *club*. Fine fleshy circular cords attached to the second swelling of each *tentacular stalk* meet together under the base of the 3rd pair of arms. Minute suckers are arranged in rows of four on the club, finishing with a row of 3, 2, and 1 suckers respectively

Funnel wide at base reaching to lower level of eyeball, hooded, with small *valve* within. Interlocking system as in family. *Olfactory organ* as small pustule under each eye, slightly towards funnel. *Gladius* consists of a narrow rachis with sharply widened wings each side, which curl towards their point round the fleshy tail of the animal, and enclose it. *Buccal membrane* extensive, attached to inner surface of all arms, to a lesser degree with ventral arms.

A number of prominent *photophores* are present round the eyes, but the exact number is difficult to determine through the integument. They seem similar in distribution to those on the illustrations of *P. giardi*, that is, about five large main ones in a more or less regular row along the ventral surface of each eye, one or two at the base of each eyeball, and a number of others scattered over the eyeball. The small size and delicate nature of the specimen prevented too close an examination of these. Located within the mantle are *siphonal*, *branchial* and *abdominal* photophores, as characteristic of *giardi*. The siphonal organs are paired and lie below the base of the siphon; the branchial organs are also paired, one situated at the base of each gill, but only a suggestion of abdominal photophores can be noted, due no doubt to immaturity

and to the photophores being imbedded in the tissues. Hoyle (1904, pp. 39–43, 51–58) gives an excellent description, in particular of the luminous organs, of specimens of *P. giardi* dredged by the *Albatross* off the west coast of Central America.

Colour.—Buff, head much darker round eyes. Photophores dark. A suggestion of dark chromatophores scattered over ventral surface of body.

Measurements.—Mantle to tail tip, 7 mm. long, 2 mm. broad. Head, almost 3 mm. broad, 2 mm. long. Dorsal arms (1st pair), 2 mm. long; 2nd pair 2·5 mm., 3rd pair 3 mm., 4th pair (ventral) approximately 2 mm. Fins, 2 mm. long. Tentacular arms, 5 mm. long.

Locality.—Station 140/39. 29/5/39. N.100. Hor. D.0. Slope (24 miles east of Sydney Heads). One specimen, figured.—Station 210/39. 23/8/39. N.200. Hor. 35°07′S., 150°51′E. (near Wreck Bay, S. Coast, N.S.W.). Shallow. One specimen.—Station 132/39. 5/5/39. 30°15′S., 153°35′E. (near Coffs Harbour, N.S.W.). Slope. One specimen 6 mm. total length.

Remarks.—The fin-like membranes on the arms of this interesting little larval animal give the species on first acquaintance a resemblance to *Thysanoteuthis rhombus* Troschel, with which, of course, it has no relationship. Berry (1913, p. 566) describes a new species, *Pterygioteuthis microlampus*, from Hawaiian Islands, differing from *P. giardi* mainly in the *photophores* round the eyeballs and the nature of suckers and hooks on the arms. Since our species compares more favourably with Fischer's original figures and those of Chun (1910, Taf xii–xvi) and others; and as Massy (1916, p. 164–5) records *Pterygioteuthis giardi* from the summit of Great King, and off Three Kings Island, bringing the species into the South-West Pacific, it can be assumed that the species under consideration is a larval form of *giardi*. The species has been recorded from North and South Atlantic, North and South Pacific, and the Indian Ocean.

A few minute specimens (4–6 mm. length) of possible Enoploteuthidae came from the following stations, but are too immature for identification:

Station 136/39. 14/5/39 (near Cape Moreton, Queensland). Shallow. Two specimens.—Station 219/39. 15/9/39 (S. of Cape Byron, N.S.W.). One specimen.—Station 27/40. 21/4/40 (near Smoky Cape, N.S.W.). One specimen.—Station 131/39. 5/5/39 (near Coffs Harbour, N.S.W.). One specimen.—Station 125/39. 2/5/39 (Long Bay, near Sydney, N.S.W.). One specimen.

Family Onychoteuthidae.

Animals of moderate or large size, muscular, firm. Body elongate, attenuated posteriorly; nuchal fold sometimes present. Fins terminal, sagittate. Arms with biserial suckers only, no hooks. Tentacular arms in young armed with quadriserial suckers, the inner row of which in the adult usually undergo a change into hooks, and the outer two rows disappear. Gladius slender, its posterior portion expanded into a spoon-shaped lanceola with end cone and cartilaginous spine. Buccal membrane seven- rarely eight-pointed.

Pfeffer in 1912 introduced the subfamily Onychoteuthinae which, however, Thiele does not use. Distribution—all seas.

Genus Onychoteuthis Lichenstein, 1818.

Onychoteuthis Lichenstein (1818, p. 1591).

Characters of the family. Nuchal fold present. Biserial hooks only on adult tentacular clubs. Photophores have been observed within mantle cavity. Genotype, *O. bergii* Lich., 1818 = *O. banksii* Leach, 1817.

Onychoteuthis ?rutilus Gould, 1852.

(Plate xxv, figs. 6–11.)

Onychoteuthis rutilus Gould (1852, p. 482). Near Sydney, N.S.W.

Three minute specimens, only a few millimetres in total length. The *mantle* is arched mid-dorsally, sloping posteriorly to a sharp point through which the sharp spine of the *gladius* protrudes, seen as a dark streak along the back. The gladius is flexible and seems adaptable to the bent shape assumed by the larvae. The *head* has sunk down

into the mantle in two specimens. *Eyes* and *funnel* large; *arms* fairly long, 3rd pair the longest. *Suckers* arranged in two rows on arms, 2–4 rows on *tentacle clubs*. No *photophores* observed within mantle cavity.

Colour.—General colour dark buff.

Measurements.—Total length from tail tip to end of tentacles, 7 mm.

Locality.—Station 127/39. 3/5/39. N.100. Hor. 33°18′S., 152°22′E. (near Norah Head, N.S.W.). Slope. Two minute specimens (figured). Few millimetres in length.—Station 198/39. 16/7/39. N.70. Obl. 28°47′S., 153°56′E. (near Cape Byron, N.S.W.). shallow. One minute specimen.—Station 39/40. 6/5/40. N.200. Hor. 39°20′S., 148°50′E. (north of Babel Is., Bass Strait). Slope. One specimen 5 mm. total length.

Remarks.—There is a very close similarity between the illustrations of larval forms of *Onychoteuthis banksi* Leach, 1817, as given by Pfeffer (1912, t. 3, f. 13–25; t. 6, f. 1–15) and our specimens. Although the larval form of *O. rutilus* is not known, I am associating these specimens with this species, rather than *banksi* owing to the close proximity of their stations to the type locality of *rutilus*. *O. rutilus* is said to differ from *banksi* in proportions and colouring, but in such larval forms it is not expected that difference in proportions would be apparent, and no deduction can be made from their colouring.

As *O. banksi* has an almost universal distribution, and has been already recorded from New Zealand and South Australia, its range is quite likely to extend into N.S.Wales. Whether *rutilus* will remain a distinct species, or prove eventually to be only a local form of *banksi* remains to be seen.

An interesting specimen from 60/38. 12/10/38. 43°13′S., 148°17′E. (near Port Arthur, S.E. Tasmania). Slope. (Mantle, 15 mm. × 6 mm., mantle edge to tip of second arm, 7 mm., width across fins, 9 mm., depth 5 mm.) is undoubtedly a young Onychoteuthid, and for the present may be regarded as possibly an immature form of *rutilus* (fig. 9).

A strong feature of this specimen is the surface sculpture of the mantle, which consists of numerous longitudinal ridges running parallel for their greater length, but here and there uniting (fig. 10). They are very defined to almost the middle of the fins. There is also a suggestion of transverse parallel lines. The minute specimen from Station 39/40 (above) shows similar fine ridging. I have examined specimens in our collection marked *O. banksii* Leach (North Pacific) and *O. rutilus* Gould (N.S.W.), and find the same longitudinal lines present; but even more pronounced, especially on the ventral surface of the fins, are transverse lines. Sasaki (1929, p. 230) in a description of *Moroteuthis robusta* (Dall) Verrill, from Japanese localities, points out the peculiarity of this same sculpture in his species, which is indicated in his illustration (p. 231, f. 171). The parallel-lined sculpture noted by Sasaki, however, does not seem to fall in with the pustulose sculpture characteristic of the genus *Moroteuthis*.

From a comparison of the small species from Station 60/38, and the following species from Station 17/38, which are approximately the same size, it will be seen that parallel lines and pustules as surface sculpture provide strong distinguishing characters amongst various forms of Onychoteuthidae.

Genus **Tetronychoteuthis** Pfeffer (1899), 1900.

Tetronychoteuthis Pfeffer (1899, pp. 155, 161). Type, *T. dussumieri* (Orbigny), 1839. Mauritius.

Members of the family Onychoteuthidae in which the adults have four rows of hooks on the main portion of the club; suckers on the arms are rudimentary, and the mantle integument has the appearance of very tubular shagreen.

Tetronychoteuthis ?massyae Pfeffer, 1912.

(Plate xxv, figs. 1–5.)

Tetronychoteuthis massyae Pfeffer (1912, pp. 102–4), North Atlantic.

Animal small, typical Onychoteuthid in shape. *Mantle* wide anteriorly, faintly sloping towards fins where there is a slight bulge, then sudden slope to sharp tail-point.

Mantle margin has a rather pronounced nuchal point, with a straight margin ventrally, except for sharp point at each interlocking ridge. *Fins* conspicuous, almost rectangular, wider than long, set well in towards centre anteriorly, almost touching at tail-point.

Head fairly long, eyes set well up with deep sinus anteriorly, and eyeball occupying large area ventrally. *Funnel* very broad at base, not reaching further than the level of the base of the eyeballs; hooded, valved within a deep furrow and then a bulge below the open. Funnel cartilage grooves simple, fairly deep and corresponding mantle ridge narrowly linear. *Funnel groove* very deep, but not fully developed, funnel attached by two bands dorsally uniting within the groove; and each showing a slight splitting into two at their point of attachment to funnel.

Arms long, rounded, sloping from fairly wide base to narrow curling tip, order 2, 3, 1, 4, but except second pair, are almost level. *Suckers* rather small, bowl-shaped, stalked, arranged in two crowded oblique rows to base of arms. There is a slight suggestion of a wing along the outer edge of the third arms. *Tentacles* almost twice as thick and long as arms, almost rectangular in shape, with furrow down inner centre. *Club* consists of almost half-exposed portion and is a slightly expanded area with a slight wing on the upper portion. *Suckers* fairly small, crowded, long stalked, mostly in four rows, but in some places appear to be in rows of six, but this may be due to crowding. Slightly down the club, they separate into two closely-set rows on either side of the club, with a median groove between them and gradually dwindle away as they approach the stalk of the tentacle. There is no sign of hooks on either tentacle. The suckers are easily removed from the club. Numerous minute tubercles can be seen jutting from the edge of the ring of the suckers and, as far as can be distinguished, are present also, in a lesser degree, on the inner edge of the ring.

There are about 3–4 longitudinal folds on each olfactory crest. Buccal membrane is seven-pointed.

The most distinguishing feature about this small cephalopod is the surface structure of the mantle, which consists of irregular, divaricating rows of very closely set rounded pustules, like the sculpture on certain dorid nudibranchs, giving the mantle integument the appearance of tubercular shagreen. The structure is mainly confined to the mantle and fins, only faintly appearing on the head. Magnified, each pustule, appears rosette-shaped on a short, stumpy stalk, its edge with about six or more rounded points and the centre of the pustule rounded and slightly elevated (fig. 5).

Colour.—Uniform dull liverish-yellow, with suggestion of dark brown small patches scattered over body and backs of arms.

Measurements.—Length of mantle, 17 mm., breadth, 5mm. Fins, 5 mm. long, 6 mm. broad. Head, mantle margin to base of arms 5 mm., breadth across eyes, approximately, 5 mm. Tentacles, 13 mm. 2nd arm, 10 mm., 1st arm, 6 mm.

Locality.—Station 17/38. 18/10/38. 42°40′S., 148°16′E. (near Maria Island, S.E. Tasmania). Shallow. One specimen.

Remarks.—The rosette-shaped tubercles on the integument of the specimen allies it more with *Tetronychoteuthis massyae* Pfeffer than *T. dussumierii* Orbigny, 1839, the other species of the genus. The tubercles of *T. massyae* as shown in Pfeffer's illustration (1912, Taf. 14, f. 19) exhibit the same rosette shape with short stalk as in ours, whereas, in his illustration of those on *dussumierii*, they seem totally different in appearance and their margins are entire. The type of *massyae* is almost twice the size of our specimen, having a mantle length 30 mm., but is nevertheless a young specimen and, although it shows sufficient differences to regard it as separate from the adult *T. dussumierii*, Pfeffer admits it may probably prove to be a juvenile of *dussumierii*, in which event our specimen would most likely prove the same. Little can be done to substantiate this probability of Pfeffer, however, until more material is available to work upon.

Massy (1916, p. 165) records a species, *Moroteuthis* (*Moroteuthopsis*) *ingens* (E. A. Smith), from off Three Kings Island, New Zealand, with a mantle length of 20 mm. Although this is practically same size as our specimen, it has one hook in the centre of

the tentacular club, and what appear to be sockets of many others in the median part of the club, disagreeing with the former specimen. Massy does not mention the structure of her species, nor does she give a full description, so it is difficult to judge whether it is the same as the Tasmanian species. In any event, the latter species seems better placed in the genus *Tetronychoteuthis* than in *Moroteuthis* which seems to have different sculpture again.

Beyond Massy's recorded *M. ingens*, the Tasmanian species is the only other record of a tuberculated form of *Onychoteuthidae* from the South-West Pacific.

Family Ctenopterygidae, nov.

Animal small, rounded, firm, with head and mantle about same width. Mantle slopes posteriorly to a rounded tail. Head short, arms fairly long, almost equal, pointed at extremities, ventral pair very broad at base. Head and arms together about equal half length of mantle. Tentacles fairly long, slender, clubs not markedly expanded. Suckers minute, in more than two rows at extremities on arms, and more than four rows on tentacle clubs. Eyes large, globular. Olfactory papillae elongate. Fins conspicuous, lateral, extending more than half-way up mantle sides, comb-like, separated into fleshy parallel filaments attached to mantle at the base by a fleshy membrane. Funnel large, reaching almost to base of ventral arms, slightly hooded, valve within, attached to head by pair of dorsal bridles. Interlocking system consists of simple elongated groove widened at base, and a long thin ridge.

The genus *Ctenopteryx* Appellof (1889), 1890, for which I here propose the family name Ctenopterygidae, is so distinct that I cannot see clearly the reason for its inclusion by Pfeffer (1900, p. 171) in the family Bathyteuthidae, since there seems little relationship between it and the genus *Bathyteuthis* Hoyle. Grimpe (1922), in establishing the subfamily Ctenopteryginae for *Ctenopteryx*, apparently recognized their differences as more than generic, but Thiele does not include this subfamily in his handbook.

The comb-like fins extending along the greater part of the mantle, equal width of head and mantle, the greater length of the latter in comparison with that of the former, and other characters, are so unlike features of *Bathyteuthis* as described by Hoyle (1886, p. 167) that its removal altogether from the family Bathyteuthidae seems warranted. The arrangements of the suckers on arms and tentacles seem one of the few characters the two genera have in common. The fins of *Bathyteuthis* are described by Hoyle as "subterminal, small and separated", and in his description of *B. abyssicola* (1886, p. 168), as "separate", meaning apparently that they do not meet or unite at their points of attachment to the mantle. In placing *Ctenopteryx* in the family Bathyteuthidae, Pfeffer may have misunderstood "separate" as meaning an individual fin was separated, i.e. into filaments.

As Hoyle points out, Verrill remarks on the marked embryonic or primitive characters displayed by his genus *Benthoteuthis* Verrill (1885, p. 401)—since proved synonymous with *Bathyteuthis*—which are not characteristic of *Ctenopteryx*. On general appearances alone, and in their comparative proportions, the two genera seem quite distant.

Genus Ctenopteryx Appellof (1889), 1890.

Ctenopteryx Appellof (1889), 1890, p. 3. Type, *Ctenopteryx sicula* Ruppell (Verany).

A genus created by Appellof for a small cephalopod 15 mm. long, from Messina, *Ctenopteryx fimbriatus* Appellof. Ashworth and Hoyle ((1905) 1906, pp. 1–7), in a review of this genus, regard *Ctenopteryx cyprinoides* Joubin (1894) from Corsica as a synonym of *C. fimbriatus*, likewise *Ctenopteryx* (*Calliteuthis*) *nevroptera* Jatta, 1896, as a possible synonym, and *Sepioteuthis sicula* Ruppell (Verany), 1851, as a doubtful form, although admitting it had been considered identical with *fimbriatus*. Pfeffer, however (1912, pp. 337–339), makes *cyprinoides*, *fimbriatus*, *and nevroptera* all synonyms of *Ctenopteryx* (*Sepioteuthis*) *sicula* Ruppell (Verany), which becomes the type of the genus. This classification is maintained by Thiele (1934, p. 471).

Characters of the genus are those of the family, the extraordinary comb-like fins immediately distinguishing it from other genera. Suckers are minute, arranged on the arms in probably four rows towards the upper parts and in two rows lower down (two rows throughout length of ventral arms, in specimen described below). Suckers on tentacular clubs very small, in about six rows.

The distribution of the genus so far has been confined to the Mediterranean and Atlantic. The specimen described below provides the first record of the genus from the South-west Pacific.

Ctenopteryx sicula Ruppell (Verany).

(Plate xxv, figs. 16, 17.)

Sepioteuthis sicula Ruppell (Verany, 1851, p. 51).

Animal small, plump, rounded. *Mantle* oblong, gradually tapering to rounded tail. *Mantle edge* slightly pointed mid-dorsally, and ventrally at position of interlocking ridge. *Head* short, as wide as mantle. *Eyes* large globular, shiny gold in appearance. *Olfactory* pustule elongated; a suggestion of a few small pustules round eye area on ventral surface.

Fins comb-like, conspicuous, consisting of about 24 long, narrow, fleshy filaments extending from the tail to about half-way up each side of the mantle, to which they are attached by means of a narrow fleshy strip running the length of the fin. Their greatest width is reached at about the 8th or 9th filament from the posterior end, after which they diminish in width as they proceed up the mantle sides. The filaments are free from their base, as figured by Appellof ((1889) 1890, fig. 1) in his description of *Ctenopteryx fimbriatus*, differing slightly from those in *Ctenopteryx sicula*, as figured by Pfeffer (1912, T. 27, f. 16–23), which appear to have membrane between them, as in fish fins. As there is a suggestion of inter-membrane between some filaments on the *Warreen* specimen, it is possible it tears easily.

Arms fairly long, tapering towards tip, ventral pair very broad at base forming a fold round the *tentacular arms*; order 4, 3, 2, 1, but 2nd and 3rd arms almost equal. *Suckers* on arms in four rows, replaced by two rows towards the base. *Tentacles* long, narrow; *clubs* not markedly expanded. *Funnel* stout, reaching almost to base of ventral arms; slightly hooded, valved within, attached to head by two fleshy bands well down at base of funnel. *Interlocking system* consists of a long simple groove, widened at base, and corresponding long, thin ridges on ventral mantle. A dark streak along dorsal surface indicates the *gladius*, which was not removed owing to the rarity of the specimen.

Colour.—Uniform dark buff; mantle with minute speckling of darker colour over surface and arms.

Measurements.—Mantle margin to tail tip, length 11 mm., breadth 5 mm. Head, 2 mm. long, 5 mm. broad. Largest filament of fin, 3 mm. long. Arm, ventral, 5 mm. long, 2 mm. broad at base. Other arms slightly smaller, about 4·5 mm. long, 1 mm. broad. Tentacular arms, 7 mm. long, 1 mm. broad.

Locality.—Station 266/39. 1/11/39. 36°17′S., 150°25′E. (near Montague Is., N.S.W.), N. 100. Slope. One specimen.

Remarks.—This fascinating little species, appearing in waters so far removed from its known habitat, the Mediterranean regions, provides one of the most interesting and important additions to the Pacific cephalopod fauna. Our specimen exhibits no characters to determine it other than *Ctenopteryx sicula*; and since little is yet known of planktonic cephalopods in the South Pacific, it may be that the range of this species will be found later to extend over a much greater area than previously known, as in the case of the extremely graceful *Brachioteuthis riisei* (Steenstrup), which by degrees is being found to have an almost universal dispersion.

Family **Brachioteuthidae.**

A family represented to date by only a single genus.

Body slender, loligoform, fins rhomboid. Arms with two rows of small, rounded suckers. Tentacular arms very broad, pointed distally; suckers in four or more rows extending well down their length. Siphonal interlocking system simple and linear. Gladius slender, consisting for the most part of little but the rachis, terminating in a long pointed cone, the broader, lanceolate posterior sides infolded. *Distribution* almost universal.

Genus **Brachioteuthis** Verrill, 1881.

Brachioteuthis Verrill, 1881, p. 405. Type, *Brachioteuthis beanii* Verrill (designation). New England region.

Tracheloteuthis Steenstrup, 1881 (1882), pp. 293–4. Type, *Tracheloteuthis riisei* Steenst. (des. Hoyle, 1905).

Characters of the family. Funnel has internal valve and dorsal bridle. *Gladius* simple, linear for some length, suddenly branching into a much broader posterior portion, sides of which fold inwards. Second pair of arms longer than others.

Both Pfeffer and Hoyle (Hoyle, 1904, pp. 14, 20) independently came to the conclusion that the genera *Brachioteuthis* Verrill and *Tracheloteuthis* Steenstrup were identical. Thiele (1934, p. 971) maintains *Tracheloteuthis* as a synonym, and follows Pfeffer (1912, p. 345) in using the family name Brachioteuthidae.

Brachioteuthis riisei (Steenstrup).

(Plates xxvi, figs. 15–17; xxvii, fig. 25.)

Tracheloteuthis riisei, Steenstrup, 1881, p. 294.

Animal very small, *body* cylindrical, slightly bell-shaped anteriorly. *Head* squarish, much narrower than *mantle*, from which it stands out by means of a well developed "neck". *Eyes* well developed, set fairly high up in head. *Mantle margin* almost straight across, rising dorsally to a slight peak in the nuchal region, but with a more pronounced peak on each side of the ventral margin, indicating the mantle cartilages of the interlocking system. About half-way down its length, the mantle tapers towards a sharp tail point.

Fins small, rather longer than broad, with rounded edges. *Arms* fairly short, order 2, 3, 4, 1; second pair, almost twice length of the others. *Suckers* cup-shaped, slightly stalked, biserial. *Tentacular* arms stout, more or less uniform width throughout, except at tips; *tentacular club* not distinct. Stalked suckers present for about three-quarters of the way down, confined to a few minute ones on the extreme tip, followed by about 8 irregular rows containing 6–8 suckers in a row, then a few rows of four, gradually diminishing into two in a row. *Funnel* small, does not protrude to any extent beyond mantle; simple linear interlocking cartilaginous groove on either side.

Colour.—Creamy-white, without colour markings on the mantle or fins. Head appears darker than mantle, due to dark red-brown bands round eyes and a dark spot over each eye, more conspicuous on ventral surface. A dark brown line runs from beneath each eye on the ventral surface in towards the centre where they meet to form a single line extending down to behind the funnel.

Measurements.—Mantle margin to tail, 13 mm., breadth 5 mm. Fin, approximately 2 mm. × 2 mm. Head, mantle margin to base of arms, 4 mm. long, 3 mm. broad. Arms, 2nd pair 2 mm. long, others correspondingly shorter. Tentacular arms, 5 mm. long, 1 mm. broad. Total length from tentacular arm tip to tail, 21 mm. (approx.).

Locality.—Station 255/39. 25/10/39 (24 miles east Port Hacking, N.S.Wales). Slope. One specimen (figured). Specimens from other Stations as follows:

Station 224/39. 4/10/39. N.70. Hor. D-0. 15 mm. 35°12′S., 150°40′E. (near Wreck Bay, south coast, N.S.W.). Shallow. One specimen. Length, mantle to tail 3 mm., breadth 2 mm. (Fig. 25).—Station 217/39. 6/9/39. N.70. Hor. D-0. 15 mm. (24 miles east of Port Hacking). Slope. One specimen, 5 mm. long (mantle to tail), 3 mm. broad.—Station 137/39. 16/5/39. N.70. D-25. Hor. 30°55′S. 153°08′E. (near Smoky

Cape, north coast, N.S.W.). Shallow. One specimen 3 mm. × 2 mm.—Station 187/39. 12/6/39. Hor. N.200. 41°14′S., 148°40′E. (near St. Helens, N.E. Tasmania). This specimen is slightly larger than that figured, its total length being approximately 27 mm.—Station 302/39. 15/11/39. N.100. Obl. (N.E. of Gabo Is.). One specimen.

Remarks.—This species is a small semi-transparent, gelatinous animal. Its mantle is capable of becoming very inflated, causing the margin to stand out widely round the narrow head.

Berry (1912, pp. 336–8), in recording its occurrence in the Hawaiian Islands, remarks that *Brachioteuthis riisei* is a species of almost cosmopolitan distribution, and substantiates this with a list of its recorded localities at that time, embracing the Mediterranean, Pacific, Indian, and Indo-Pacific regions. The presence of this species in Australian waters, therefore, is of considerable interest, permitting the family to be recorded for the first time from the South-west Pacific.

Nothing about the specimens examined, which show little or no variation from one another, suggests that they are other than *Brachioteuthis riisei.* That the species should be found so far south as Tasmania, adds still further to its interest.

Family **Ommastrephidae.**

Animals of moderate or considerable size. Loliginiform, fins sagittate, subterminal. Suckers in two rows on arms, four rows on tentacular clubs; none of the suckers modified into hooks. Funnel groove well-defined, open, forming foveola or other folds at anterior part. Funnel adductors *bipaired,* one pair submedian, the other lateral in position. Funnel cartilages highly developed and complex, the groove an inverted T-shape. Buccal membrane with seven projecting ribs. Gladius consisting of little but the rachis throughout its length, terminating in a deep hollow cone.

Subfamily **Ommastrephinae.**

Main characters of family. Foveola in funnel groove often showing longitudinal folds internally, but invariably devoid of pocket-like folds.

Genus **Nototodarus** Pfeffer.

Nototodarus Pfeffer, 1912, p. 223. Genotype, *Ommastrephes insignis* Gould, New Zealand.

Characters of family. Body large, subcylindrical, gradually narrowing to point behind. Fins transversely rhomboidal, about one-third length of body in adult. Arms rather long, order 2, 3, 4, 1, but nearly equal. Suckers in two compressed rows. Tentacular arms about one-third longer than arms; suckers fairly large, occupying a fair amount of club. 8–15 teeth on sucker rings. Gladius slender.

Nototodarus gouldi (McCoy).

(Plate xxvi, figs. 1–14.)

Ommastrephes gouldi McCoy, 1888, pp. 255–257. Type locality, Victorian coast.

Animal small, well developed. *Mantle* subcylindrical tapering to point behind. *Fins* squarely emarginate, fairly large, triangular. *Head* large, squarish, ridge along dorsal surface at mantle margin. *Eyes* situated well up head, with large indented sinus anteriorly. *Siphonal cartilaginous* grooves well developed, usual inverted T-shape, corresponding ridges on inner ventral mantle short, narrow anteriorly, widening into rounded portion posteriorly.

Funnel short, stout, attached to head by two sets of strong *adductors.* Internal *valve* present. *Funnel groove* has a shallow semicircular membraneous fold cutting off the apical portion of the groove. *Arms* moderate length, flattened; order 2, 3, 4, 1, second arm decidedly longer. Large cauldron-shaped *suckers* in two, regularly alternating rows. *Keels* well developed on outer angles of arms. *Tentacular arms* partly retracted, *clubs* not strongly differentiated; sucker-bearing portion comprising more than half the exposed length. Suckers in four rows. *Buccal membrane* seven-pointed.

Colour.—Creamy-buff; dorsal surface of head with rounded dark brown chromatophores; smaller ones extend in several rows up dorsal sides of arms and regularly

between each sucker on the inner surface of the arms. Similar chromatophores appear on mantle integument. There is a bronze sheen round each eye.

Measurements.—Mantle margin to tail tip, 23 mm. long, 8 mm. broad. Mantle margin to base of arms, 6 mm. Longest arm (2nd pair), 9 mm. Tentacular arm, 12 mm. Width across fins, 12 mm., depth 6 mm.

Locality.—Station 73/38. 25/11/38. 39°57′S., 148°35′E. (off Babel Is., Bass Strait). Slope. One specimen (fig.).—Station 39/40. 6/5/40. N.200. Hor. 39°20′S., 148°50′E. (north of Babel Is., Bass Strait). Slope. One minute specimen, only few millimetres total length.

Rhyncoteuthion larval form.—From 17 different stations off the coast were taken a number of most interesting cephalopod larvae of the family Ommastrephidae. This larval form is immediately recognized as, during a curious stage in its development, the two tentacular arms, instead of being free, are fused along a portion or the whole of their inner faces to form either an elongate proboscis-like organ or a pincer-shaped one. It has been found convenient in the past to give these curious little animals provisional consideration by themselves, since their development and relationships have been insufficiently known to refer them to the proper adult form.

No type has been given for the forms, but the generic name *Rhyncoteuthion* was applied to them by Pfeffer (1908, p. 88), and one species has been given a name, *Rhyncoteuthion chuni* Hoyle (1904, pp. 32–33). Chun (1910, p. 202) considered there were more than one species of Ommastrephidae amongst the 35 larvae of *Rhyncoteuthion* he had met from the Indian and Atlantic Oceans, one with a slender body and moderate eyes, the other with plump body and large eyes. Pfeffer (1912, p. 383), on the other hand, regards them more probably as one species; the fluctuating conditions of environment may account for their individual variation. Massy (1916, pp. 166–167), in describing species of *Rhyncoteuthion* from the west of the Canary Islands, and off North Island, New Zealand, thinks future material may prove Chun correct in surmising two forms exist.

Pfeffer (p. 383) arrived at the conclusion that both Chun's types are probably referable to *Sthenoteuthis bartrami* (Lesueur), which is of interest here since Berry (1914, p 148) recorded *S. bartrami* from the Kermadecs.

A close examination of more than thirty specimens, measuring from 2 to 13 mm., but mostly 2–5 mm., from the different stations off the east Australian coast, shows slight variations which appear due to their different stages of growth, and not to difference of species.

The specimens display typical *Rhyncoteuthion* characters—large eyes and few but conspicuous suckers; the ventral arms very much smaller than the remainder, and the 2nd pair longer. In all but two the tentacles are fused almost throughout their stalks, a furrow indicating their future line of separation. In the two specimens from Station 31/40. 25/4/40. N.70. Hor. (24 miles east of Sydney Heads, N.S.W.). Slope (figs. 3, 4, 5), one of which has a total length of 12 mm. and the other 16 mm., the tentacles show a marked separation from their base in fig. 3, and in fig. 5 have separated as far as the base of the club. These examples of separation are interesting in the light of Robson's findings (1931 (1932), p. 102) that the tubular structure formed by the fused tentacles, and known as "Rüssell" by German authors, continued in the fused stage until the squid is 8–10 mm. long; the tentacles then commence to come apart and assume normal form and position as the animal develops.

From a comparison of specimens (figs. 3, 4, 5), and that in Fig. 1, and then in turn with a number of specimens of different growth of *Nototodarus gouldi* removed from stomachs of Bluefin taken off our coast, I feel sure that the *Rhyncoteuthion* forms in this collection are none other than a larval stage in the development of *Nototodarus gouldi* McCoy, a cephalopod plentifully represented in New South Wales, Victoria, Bass Strait, Tasmania, and South Australia.

Other stations from which these larval forms were taken are enumerated below. It will be seen their localities are well within range of those favoured by *Nototodarus gouldi.*

Station 141/39. 7/9/39. N.70. Hor. D-0. 30 mm. (Port Hacking, N.S.W.). Slope. One specimen, total length 8 mm. (fig. 10).—Station 31/40. 25/4/40. N.200. Hor. (24 miles E. Sydney Heads, N.S.W.). Slope. Ten specimens, total length approximately 5–10 mm.—Station 106/38. 17/12/38. N.200. Hor. 33°30′S., 152°21′E. (near Broken Bay). Slope. One specimen.—Station 6/39. 7/1/39. N.70. Hor. D.25–30. 35°07′S., 150°31′E. (near Wreck Bay, South Coast, N.S.W.). Slope. One specimen, 2 mm. total length.—Station 24/40. 27/2/40. N.100 (24 miles E. Port Hacking, N.S.W.). Three specimens. Total length less than 7 mm. One specimen figured (fig. 8).—Station 134/39. 6/5/39. N.70. Hor. D-100. 28°36′S., 153°57′E. (near Cape Byron, North Coast, N.S.W.). One specimen, total length 3 mm. Slope (fig. 14).—Station 47/38. 20/9/38. N.70. Hor. 26°54′S., 153°24′E. (north of Cape Moreton, Q'land). Slope. One specimen, 2 mm. total length (fig. 12).—Station 30/40. 22/4/40. N.100. Hor. 30°18′S., 153°20′E. Slope (south of Coffs Harbour, N.S.W.). One specimen, 3 mm. total length.—Station 28/40. 21/4/40. N.200. Hor. 31°08′S., 153°20′E. (near Smoky Cape, N.S.W.). Slope. One specimen, mantle length 6 mm. (figs. 6, 7).—Station 129/39. 3/5/39. N.70. Hor. D-0. 32°34′S., 152°55′E. (near Seal Rocks, N.S.W.). Slope. One specimen, 2 mm. total length.—Station 30A/38. 29/9/38. No.200. Hor. D-25 (24 miles E. Port Hacking, N.S.W.). Slope. One specimen, total length 5 mm.—Station 40/38. 12/9/38. N.70. Hor. 26°54′S., 153°24′E. (north of Cape Moreton, Queensland). Shallow. One specimen, 5 mm. (fig. 9).—Station 104/38. 15/12/38. N.70. Hor. (24 miles E. Port Hacking). Slope. One specimen, 3 mm. length.—Station 132/39. 5/5/39. N.70. Hor. 30°15′S., 153°33′E. (south of Coffs Harbour). Slope. Three specimens, less than 3 mm. in length.—Station 193/39. 14/6/39. 37°05′S., 150°04′ E. (near Twofold Bay, South Coast, N.S.W.). Shallow. One specimen (fig. 11).—Station 141/39. 30/5/39. N.100. Hor. (Port Hacking). Shallow.—Station 24/40. 27/2/40. N.100–200 (24 miles E. Port Hacking, N.S.W.). Slope. Three specimens, 5 mm. (fig. 13).

Apart from Massy's record of *Rhyncoteuthion* larval cephalopod off North Island, New Zealand, the above specimens are the only other records of this extraordinary little creature in the South-West Pacific. In a comparatively small collection of planktonic cephalopods, which has nevertheless provided a surprising number of new records for these regions, this has proved to be one of the most interesting, since it can almost without doubt be regarded as a larval condition of a definite species of Ommastrephidae, *Nototodarus gouldi* (McCoy). Massy does not apply her larval species to any particular Ommastrephid, and Pfeffer (1912, p. 380), as stated above, regards the Atlantic and Indian Ocean species as probably referable to *Sthenoteuthis bartrami.*

Family **Histioteuthidae.**

Animals moderate sized, body short, barrel-shaped, mantle thick and fleshy, fins subterminal, medium sized. Arms and tentacles long and thick; suckers only, in two rows on sessile arms, four rows on tentacular clubs. Siphonal interlocking cartilages simple linear grooves and ridges. Photogenic organs well developed, plentifully distributed over the surface of mantle, head and arms. Some members have an extraordinarily enlarged left eye. Gladius simple, with broad wings. Distribution.—Atlantic; Mediterranean; Pacific. A family of few genera and species.

Genus **Calliteuthis** Verrill, 1880.

Calliteuthis Verrill, 1880 (1881*a*), p. 295.

Main characters of the family. Body short; fins rounded, united behind the posterior extremity of body. Funnel attached to head by two muscular bands. Arms long, free, without interbrachial membrane. Dorsal and lateral arms with one row of large and one row of small photophores; ventrolateral and ventral arms with three rows of luminous organs.

Two species of this interesting genus have been recorded from the South Pacific, an immature surface specimen by the "Challenger" off North New Zealand, and with considerable uncertainty designated *Calliteuthis reversa* Verrill 1880, and an adult species, *Calliteuthis miranda* Berry 1918, from 270 fathoms, S.E. × S. off Gabo Island, Victoria, by the "Endeavour". As the type locality of *C. reversa* is off New England, North Atlantic, and as the name has been applied doubtfully to the immature New Zealand specimen, it seems possible that the latter species may later be found more closely allied to the Australian *C. miranda* Berry.

Calliteuthis miranda Berry.

(Plate xxv, figs. 12–15.)

Calliteuthis miranda Berry, 1918, pp. 221–228. Type locality, 270 fathoms, S.E. × S. of Gabo Island, Victoria.

Animal very small, solid; body short conical, tapering to a sudden point posteriorly. *Fins* rounded, united behind. *Head* large, strongly asymmetrical. *Eyes* large, prominent, especially left one, which is extraordinarily large, being twice the size of the right eye and taking up the whole side of head. *Mantle margin* pointed mid-dorsally, slightly pointed ventrally with little emargination below the funnel. *Arms* stout, long, tapering to point anteriorly, about equal length, except dorsal and ventral pair. The dorsal pair are much smaller and more slender. *Suckers* large, hood-shaped, in two well-separated rows on all arms. *Tentacular arms* long, with a pronounced expanded *club* thinning out to a point. *Suckers* smaller than on arms, crowded, in about 6 rows for part of the club, then in rows of four; fixing apparatus extends down stalk for about one-fifth its distance. A fine muscular cord runs from the base of each tentacle into a separate pouch between the buccal membrane and the true tentacular pockets, similar to that described by Berry (p. 223, fig. 6). Gladius not examined.

Funnel short, broad, attached to head by pair of wide fleshy bands. A simple, conical *olfactory papilla* is below each eye. Many large *photophores* are scattered profusely over the mantle, head, and arms, and in a circle round the eyes. These are very pustulose in appearance, dark coloured, with a light spot in front.

Colour.—Deep buff-colour, with bronze-purple tinge over the whole surface, and rather large dark brown *chromatophores*. Eyes reddish-purple with very dark, broad band round the pupil. Along inside of arms are chocolate-coloured bands alternating with the suckers, running from the outer edge of arm to mid-line. The above colours refer to the preserved specimen.

Measurements.—Mantle to tail tip, 10 mm. long, 5 mm. broad. Head, 4 mm. long, 5 mm. broad. Fins, 5 mm. long, 8 mm. full width. Dorsal arms, 6 mm., 2nd arms, 7 mm., 3rd arms, 7 mm., 4th (ventral), 5–6 mm. Tentacles, 12 mm.

Locality.—Station 65/38. 11/11/38. N.200. Hor. (24 miles E. Port Hacking, N.S.W.). Slope. One specimen, good condition (figured). A much smaller, immature specimen [from Station 60/38. 12/10/38. N.200 (near Port Arthur, Tasmania). Slope (figs. 14, 15)] is the same species, although the left eye has not enlarged to any extent.

Remarks.—Though immature, there is no doubt the above specimens are young of *C. miranda* Berry, and thus extend the Australasian range of this extraordinary cephalopod. Berry has given a detailed description of his species, but the discovery of young forms from new localities, warrants the above rather full description.

Family Chiroteuthidae.

Body slender, spindle-shaped. Fins large, rounded or leaf-shaped; sometimes lateral flaps on an extension of the gladius give impression of second pair of fins. Arms fairly long but extraordinary length and breadth of ventral pair in comparison with others forms a marked character. Suckers in two rows. Tentacular arms extemely long, with photophores along their backs; very thin and sometimes becoming detached in part. Suckers on clubs in four, eight or more rows. Cartilaginous interlocking system present; cartilaginous groove ear-shaped, often elaborately constructed forming a strong generic character. Photophores may or may not be present on eyes, backs of arms, fins, head, and mantle. Gladius slender with narrow wings and long cone.

Genus **Mastigoteuthis** Verrill, 1881.

Mastigoteuthis Verrill, 1881*b*, p. 100. *Type*, M. agassizii Verrill. N. Atlantic.

Main characters of the family. Tentacular arms long, slender, with numerous rows of small suckers on clubs; clubs not expanded. Interlocking cavity ear-shaped, but simple. Photogenic organs numerous in some members, missing in others.

Chun (1908, p. 87) and Thiele (1934, p. 976) place *Mastigoteuthis* in the subfamily Mastigoteuthinae. MacDonald and Clench (1934, pp. 145–152) consider it inadvisable to retain this subfamily, since a new genus and species they describe from the North Atlantic is intermediate between the subfamilies Chiroteuthinae and Mastigoteuthinae. They prefer to regard *Mastigoteuthis* a member of the subfamily Chiroteuthinae. Further study of the group would have to be undertaken to substantiate this consideration.

Mastigoteuthis grimaldii (Joubin).

(Plate xxvi, figs. 18–21).

Chiroteuthis grimaldii Joubin, 1895, p. 38. North Atlantic.

Animal immature, slender, delicate. *Mantle* rising to a sharp point mid-dorsally: *ventral mantle* surface with little emargination. Mantle broad at anterior end, sloping rather rapidly to *fins*, from whence it forms a sharp spine-like portion throughout the length of the fins, and terminating just beyond them. *Fins* large, rounded, appearing very wide in proportion to body, mainly due to narrowness of mantle in their region. *Head* small, almost square. *Eyes* large, globular and protruding, set high in head.

Arms rather slender, short, except ventral pair, which are excessively long and broad, rather flattened, with a slight wing along the outer edges. Order of arms, 4, 2, 1, 3. *Suckers* on sessile arms, immature, delicate, scattered, and rather indistinct; on ventral arms in particular, they appear to be in more or less single irregular row, varying numbers being grouped together with a bare space between each group (fig. 20). *Tentacular arms* about half the width of ventral pair, very slender, but unfortunately their full length and the nature of the clubs are unknown as they are incomplete.

Funnel moderate size. *Cartilaginous groove* of interlocking system ear-shaped without tragus or anti-tragus, the corresponding *ridges* on inner ventral mantle elongate and fairly broad. Buccal area elevated, rounded, pustulose.

Small but conspicuous *photogenic tubercles* are scattered profusely over the ventral and dorsal surface of the mantle and head and round eyes, in a less degree on the fins, funnel, and up the back of the arms. A few almost indistinct ones appear to be on the back of the tentacular arms towards their base.

Colour.—Creamy-buff with dark chromatophores along back of arms and scattered over mantle in rather regular rows.

Measurements.—Mantle edge to tail, 13 mm. long, 4 mm. broad, tapering to 2 mm. at junction with fins. Fins, 10 mm. wide, 6 mm. long. Head, 2 mm. × 2 mm. (mantle edge to base of arms). Arms, 1st pair, 1 mm. long, 2nd pair, 3 mm., 3rd pair, 1 mm., 4th pair, 6 mm. long. Tentacular arms, incomplete, little more than length of ventral arms, but more slender.

Locality.—Station 17/38. 18/10/38. N.200. Hor. 42°40′S., 148°16′E. (near Maria Is., east coast, Tasmania). Shallow. One specimen.

Remarks.—As only one minute specimen of the family has apparently come to light in the collection, it is with reservation that I have identified it as *Mastigoteuthis grimaldii* (Joubin), the species I find it most closely allied to. The presence of photogenic tubercles scattered plentifully over the integument and other similarities bring it more into line with this than with others of the family, excepting perhaps *Mastigoteuthis flammeus* Chun (1910, p. 229, S. Atlantic). On the other hand, as only portion of the tentacles is present, a principal distinguishing characteristic, i.e., the structure of the clubs, is absent.

Our species does not resemble either *M. cordiformis* Chun, or *M. latipinna* (Sasaki), both of which have been recorded from Japan; nor does it coincide with *M. famelica* (Berry) from the Hawaiian Islands. In view of the immaturity of the specimen, and

the absence of the principal portion of the tentacles, it seems reasonable to regard it as a larval form of *grimaldii*, from which it is difficult to separate it, rather than a new species.

This interesting little specimen, appearing for the first time in these waters, has enabled the family to be recorded for the first time from the South Pacific.

Family Cranchiidae.

Body usually membraneous and transparent, with or without crystalline tubercles; nearly colourless. Mantle border firmly fused with head in nuchal region and with base of funnel on either side. Eyes usually large, often pedunculate. Sessile arms with two rows of suckers; tentacles with four rows of suckers, which may extend down the stalk for greater part of length. Hooks may occur in a few genera on tentacle clubs. Photogenic organs may be present on ventral eyeball, within pallial chamber, or may be entirely absent. Gladius slender. Pelagic or abyssal.

Two subfamilies are represented in the collection as set out in the following key:

a. Mantle smooth, without even a tubercled hyaline streak; a few tubercles may occur at point where mantle margin is attached to funnel or nape. Eyeball usually with one or two large photophores on ventral aspect. Stomach larger than caecum ..... *Taoniinae* Pfeffer 1912

aa. Mantle evenly beset with crystalline tubercles all over, or with tubercled hyaline streaks on ventral surface. Eyeball with 4-14 small rounded photophores. Stomach smaller than caecum ..... *Cranchiinae* Pfeffer 1912

Subfamily Taoniinae.

Genus Megalochranchia Pfeffer, 1884.

Megalocranchia Pfeffer, 1884, p. 24. Type, *Megalocranchia maxima* Pf. Cape of Good Hope.

? Megalocranchia pardus Berry, 1916.

(Plate xxvii, figs. 1–4.)

Megalocranchia pardus Berry, 1916, pp. 61–64. Type locality, Sunday Is., Kermadecs.

Animal small, delicate, with elongate cylindrical body tapering to slightly rounded point posteriorly, widest part little distance below *mantle margin*. *Fins* rounded, slightly more depth than breadth. *Head* short but broad; *eyes* large, protruding, globular, on short stumpy stalks, a large *photophore* with smaller one above it on each ventral eyeball. *Olfactory tubercle* on ventral surface of eye. *Arms* short and fairly stumpy, order 3, 2, 1, 4 (1 and 4 almost equal). *Tentacular arms* fairly long, very broad and strong, practically uniform width throughout, but in larger specimen have widened slightly to form definite *clubs* which have a keel on their outer angle. *Arm suckers* rounded, conspicuous, in two crowded rows; weakly dentate round edge; *tentacle suckers* profusely scattered over whole length of tentacle and club, in about 4–6 rows on club, changing to four rows on the lower portion, and for a considerable distance down stalk, towards the base of which the suckers are in two rows.

Funnel broad at base, hooded, reaching almost to level of eyes. Attached to mantle permanently on either side, in same manner as dorsal surface is attached to nuchal region. *Gladius* shows as a thin dark strip, widening towards base.

Colour.—Creamy-buff, upper part of eyes very dark. Dark red-brown *chromatophores* appear as regular bands round the backs of the tentacles, and rows of small dark *chromatophores* occur in regular rows on both dorsal and ventral mantle surfaces. These have become rather indistinct through preservation.

Measurements.—Mantle edge to tail tip, 11 mm. long, 5 mm. broad. Mantle edge to base of arms, 2 mm. long, 3 mm. broad. Eyes, 2 mm. long, 1 mm. broad. Largest arm less than 1 mm. long, ½ mm. broad. Tentacular arm 4mm. long, 1 mm. broad. Fins, approximately 1 mm. across. Total length, approximately 17 mm. (animal figured).

Locality.—Station 217/39. 6/9/39. N.200. D-0. 15 mm. (24 miles E. of Port Hacking, N.S.W.). Slope. One specimen, as above (figs. 1–3).—Station 63/38. 21/10/38. N.70. Vert. D.50–0. 43°13′S., 148°17′E. (near Port Arthur, S.E. Tasmania). Slope. One specimen (fig. 4), very much larger, which came to light after the examination of the

smaller specimen described above, and which seems a more mature form of the same species. Its measurements are: Mantle to tail, 30 mm., breadth 14 mm. Mantle edge to base of arms, 3 mm. Largest arm (3rd), 4 mm. long. Tentacular arm, 12 mm. Total length, approximately 45 mm. Other than considerable difference in size, no marked characters distinguish the two specimens.

Remarks.—I am in full accord with Berry (1916, p. 64), who remarked that the elucidation of the *Taoniinae* forms one of the most difficult taxonomic problems encountered in the study of the Cephalopoda. Species are represented in the collections by such scanty material, and their distinguishing characters are of such trivial nature, that the whole group needs careful rechecking by someone with access to types of older species and with sufficient fresh material for comparison. Only in this way can the difficulties associated with classification be overcome.

More so than perhaps elsewhere, does this apply to the few species recorded from the South Pacific. For this reason I have had considerable difficulty in allying the species above even with certainty to a genus, and since the larger specimen, in particular, seems to resemble Berry's illustration (1916, pl. ix, fig. 2) and description of *Megalocranchia pardus* from the Kermadecs so closely, I have with some hesitation named it as such, until more is known of the group in these regions.

In doing this, I have had to take into consideration the fact that both our specimens bear close resemblance to figures of *Teuthowenia megalops* (Prosch.) (N. Atlantic) and *Teuthowenia antarctica* Chun (S. Atlantic), the latter having been recorded from off North Island, New Zealand, by Massy (1916, pp. 170–1). Massy does not figure her species, other than radula and jaw, so it is difficult to know whether the species she names *T. antarctica* Chun is the same as our specimens, and whether it is a true *antarctica* rather than another species. However, the two localities—Kermadecs, and off North Island, New Zealand—are sufficiently close to cause one to wonder what relationship *Megalocranchia pardus* Berry may bear specifically to the *antarctica* recorded by Massy, particularly since some of the characters given by Berry appear to indicate *Teuthowenia* rather than *Megalocranchia.* Eventually Massy's species may prove to be identical with Berry's species.

The presence of another allied species in these waters has not been overlooked, namely, *Taonidium suhmii* (Lankester) (1884, p. 311), from between Sydney and Wellington, the type of which Hoyle (1886, p. 197) regards as two specimens from due south of Australia. This species is practically unknown, and until it is more firmly established, its relationships with the other allied species from these waters must remain uncertain. The four teeth on some of the tentacular suckers in Massy's *antarctica* appear to bring that species more in line with *suhmii* than with *M. pardus.* Further material, on the other hand, may prove the several species one and the same. I have endeavoured to supply accurate figures of our species that these may assist in future identification. In the meantime, the species has been determined, with reservation, as *Megalocranchia pardus* Berry.

Genus **Bathothauma** Chun, 1906.

Bathothauma Chun, 1906, p. 86. Haplotype, *Bathothauma lyromma* Chun.

Bathothauma lyromma Chun.

(Plate xxv, fig. 18.)

Bathothauma lyromma Chun, 1906, p. 86; 1910, pp. 389–391; Allan, 1940, pp. 321–324.

In 1940 I recorded the Cranchiid cephalopod, *Bathothauma lyromma* Chun, for the first time from the South-West Pacific, this interesting little species having been brought to light in a surface net of the *Warreen*, off Tasmania. In the present collection from the following stations are now further specimens which appear to be this species: Station 3A/38. 17/10/38 (off St. Helens, N.E. Tasmania). Slope. Three specimens. Total length, largest, approximately 10 mm.—Station 18/38. 24/10/38. N.100. Hor. 42°35′S., 148°37′E. (near Maria Is., E. Tasmania). Slope. One specimen, approximately 10 mm. total length.—Station 22A/38. 16/10/38. N.200. Hor. 39°42′S., 148°49′E. (off

Babel Is., N. Tasmania). Slope. One specimen. Total length, 23 mm.; mantle, 13 mm. × 9 mm. (figured).

They are similar to the specimen described in 1940, showing remarkably well the two-row arrangement of suckers along the stalks of the tentacular arms. The wrinkle-like folds at regular intervals round the whole mantle, which I considered then to be either a normal characteristic or due to preservation, have appeared in the same persistent manner in these later specimens, and I am still uncertain what to make of them. As similar ones do not show in this manner on other Cranchiids in the collection, the possibility of them being a characteristic of this species cannot be discountenanced.

The earlier specimen was collected on the same date in the same locality (off Babel Is., N. Tasmania), but from a different station, as the specimen in the present collection from Station 22A/38; the latter specimen shows most distinctly the folds referred to above.

Subfamily **Cranchiinae.**

Genus **Pyrgopsis** Rochebrune, 1884.

Pyrgopsis Rochebrune, 1884, p. 23. Type, *P. rhynchophorus* Rochebrune 1884.

Body elongate, sharply pointed, quite smooth, except for a tubercular longitudinal, crystalline streak running along each side of the ventral surface of the mantle. Mantle wide at anterior margin, very thin, membraneous. Fins terminal, moderate size, transverse-oval. Eyes pedunculate, eyeballs small, with 4–5 photophores on ventral periphery. Arms unequal, third pair longest, all bordered with membranes. Tentacular club well defined. Suckers on arms biserial, on clubs quadriserial, extending down stem for little way in single zig-zag fashion. Gladius broad.

Synonyms of this genus are *Zygaenopsis* Rochebrune 1884; *Zygocranchia* Hoyle 1908; and *Euzygaena* Chun. I have not seen Rochebrune's paper in which appeared his original descriptions of the genera *Pyrgopsis* and *Zygaenopsis*, but have studied their respective characters as set out by Mayer (1884, p. 23). Rochebrune apparently thought their distinguishing characters sufficiently strong to separate them generically, but Pfeffer (1900, p. 193) regarded them as synonymous, a synonymy retained by Thiele (1931, p. 978).

Pyrgopsis pacificus (Issel).

(Plate xxvii, figs. 5–11.)

Zygaenopsis pacificus, Issel, 1908, p. 223.

Animal long, slender, gelatinous, very transparent in immature specimens; *mantle* much wider than head at margin, sloping rapidly to a sharp point posteriorly. Mantle attached permanently at *nuchal point* mid-dorsally, and on each side of *funnel*, as in family. From the points of attachment to funnel, to about half-way down each side of ventral surface, is a conspicuous row of crystalline tubercles. The upper half of the line consists of about eight very conspicuous compound tubercles arranged on a continuous fleshy ridge, with about 1–4 small simple tubercles between each one. After about the eighth large tubercle, approximately 10–12 equally-spaced crystalline tubercles are attached direct to the mantle. In a series of specimens from various Stations, from minute forms of a few millimetres to those of appreciable size, the tubercles were always present, although sometimes reduced in size and number in the less mature specimens.

Fins fairly wide and large, roundly pointed, meeting at extreme posterior end. *Head* small, widest towards its junction with mantle, becoming very narrow and elongated from the base of eyes towards arm-bearing portion of animal. *Eyes* large, conspicuous, on long, plump stalks; a few small indistinct *photophores* indicated on ventral surface of eyes in some specimens. *Funnel* large and wide at base, hood shaped, with upper margin indented in centre. *Sessile arms* short, firm, order of length 3, 2, 4, 1, the third pair very much longer and broader than the others; *suckers* fairly large, round, flattish, arranged in two slightly oblique rows on the arms, about 10 rows on the dorsal arms and 29 rows on third pair of arms. *Tentacular arms* fairly long, strong, widened into a club head at the end, with a pronounced wing. Suckers on club in rows of four, minute

at tip, increasing gradually in size until about the 16th row; then follow four rows of two very large suckers with a smaller sucker on each side (fig. 7), a few rows of small suckers again and some scattered suckers for a short distance along stalk in a single row. On the inner ring of the suckers are numerous minute pustules, the innermost row of which in certain lights extends beyond the ring, suggesting a serrated appearance.

Gladius appears as a reddish-brown ridge down dorsal surface.

Colour.—General colour of larger specimens creamy-buff with dark reddish-brown *chromatophores* round eyes. Brown chromatophores, indistinct in many specimens, are arranged in about 9 rows round dorsal and ventral mantle surface, and along the backs of the tentacular arms. Brown speckling also occurs along the backs and sides of the latter. There is a large chromatophore at base of dorsal arms, and behind funnel. Smaller specimens are colourless, with little or no marking.

Measurements (fig. specimen).—Mantle to tail, 72 mm. long, 20 mm. broad. Fins, 18 mm. long, 30 mm. width across. Mantle edge to base of arms, 8 mm. Width of neck at base of arms, 4 mm. Tentacular arms, 30 mm. long. Arms, 1st pair 4 mm., 2nd pair 7 mm., 3rd 20 mm., 4th 5 mm. Eye—plus stalk—10 mm. long, 4 mm. broad. Approximate total length, tail to tip of tentacular arm, 110 mm.

Locality (figured specimen).—Station 62/38. 16/10/38. N.100. Hor. 39°37′S., 148°52′E. (Bass Strait, near Babel Is., Tasmania). Slope. One specimen.

Localities of other specimens taken, with their mantle measurements, are as follows: Station 217/39. 6/9/39. N.70. Obl. D-200 (24 miles E. Port Hacking). Slope. One specimen. Mantle 23 mm. × 6 mm.—Station 200/39. 7/10/39. 30°17′S., 153°34′E. (near Coffs Harbour, N. Coast, N.S.W.). Shallow. One specimen. Mantle 15 mm. × 6 mm.—Station 187/39. 12/6/39. Off St. Helens, Tasmania. Slope. Two specimens. Mantle 22 mm. × 6 mm.—Station 217/39. 6/9/39. N.70. Vert. D.100–50 (24 miles E. Port Hacking). Slope. One specimen. Mantle 15 mm. × 6 mm.—Station 138/39. 16/5/39. N.70. Hor. 30°56′S., 153°21′E. (near Trial Bay, N. N.S.W.). Slope. Nineteen specimens. Mantle, largest 16 mm. × 5 mm., smallest 5 mm. × 2 mm.—Station 144/39. 31/5/39. N.100. Hor. 36°15′S., 150°25′E. (near Montague Is., S. coast, N.S.W.). Slope. Four specimens, 28 mm. × 8 mm., 11 mm. × 4 mm., 9 mm. × 4 mm., 8 mm. × 3 mm.—Station 188/39. 13/6/39. N.200. Hor. 39°54′S., 149°36′E. (north of Babel Is.). Shallow. Three specimens. Mantle, largest 15 mm. × 6 mm.—Station 214/39. 5/9/39. N.70. Obl. (N.S.W.). One specimen. Mantle, 24 mm. × 8 mm.—Station 127/39. 3/5/39. N.100. Hor. 33°18′S., 152°13′E. (near Norah Head, N.S.W.). Slope. Two specimens, 13 mm. × 4 mm., 5 mm. × 2 mm.—Station 128/39. 3/5/39. N.100. Hor. 32°37′S., 152°22-30′E. (near Seal Rocks, N. coast, N.S.W.). Shallow. Two specimens, 10 mm. × 5 mm., 6 mm. × 3 mm.—Station 143/39. 31/5/39. N.200. Hor. 35°07′S., 150°50′E. (near Jervis Bay, N.S.W.). Shallow. One specimen. 10 mm. × 4 mm.—Station 66/38. 12/11/38. N.200. Hor. 35°07′S., 150°51′E. (near Jervis Bay). Shallow. One specimen. Mantle 50 mm. × 12 mm.

Remarks.—This very graceful cephalopod was the most common species in the collection. Apart from a single specimen recorded from off Three Kings Island, N. Zealand, and off North Island, N.Z., by Massy (1916, p. 168–9), the genus has not been recorded before from the South-West Pacific, but has been described from Japan (Sasaki), Tahiti and South Africa (Issel), and Atlantic (Chun). This is the first occasion therefore that it has been associated with Australia or Tasmania. The large number of specimens, especially nineteen from one locality—Station 138/39—provides another interesting factor.

In view of the distribution so far recorded for *Pyrgopsis pacificus* (Issel), I have identified the above specimens as this species rather than *P. schneehagenii* (Pfeffer, 1884, p. 23, fig. 21), type locality Chili, which it also resembles. The difference between *pacificus* and *schneehagenii*, indeed, seems such that it is conceivable at some future date they may prove synonymous. The crystalline tubercles on some of our specimens appear to extend further down the mantle than they do in the illustration of Chun's specimen (1910, taf. lii, figs. 1–3).

Suborder MYOPSIDA.

Family Sepiolidae.

Body short, thick, rounded posteriorly. Fins large, separate, rounded or ovate, attached laterally towards middle of body. Mantle joined to body by a retractor muscle reinforcing the median septum of mantle cavity. Gladius rudimentary or absent. Large saddle-shaped photogenic organ sometimes present overlying the ink-sac, emitting a luminous secretion. Distribution—all seas.

Two subfamilies are represented in the collection, as set out in the following key:

a. Mantle margin free all round; a cartilaginous articulation in the nuchal region of dorsal margin but dorsal mantle and viscera may be fused further back along mid-dorsal line. Fins large; arms with fairly broad web uniting them. Right dorsal arm hectocotylized. Photogenic organs usually very large, nearly covering ventral surface of ink-sac, closely conjoined down medium line. Pelagic subfamily of few genera and species .... *Heteroteuthinae,* Appellof 1898

aa. Mantle continuous with head at nape of neck dorsally, its ventral margin articulating with funnel by cartilaginous locking system. Fins ear-shaped anteriorly. Web between third and fourth pairs of arms forming a sheath for each tentacular arm. Left dorsal arm of male hectocotylized. Saddle-shaped photogenic organ large and well developed, except in genus *Inioteuthis* ..... *Sepiolinae* Hoyle 1904

Subfamily Heteroteuthinae Appellof.

Genus Heteroteuthis (Gray), 1849.

Rossia (*Heteroteuthis*) Gray, 1849, p. 90.

Body plump, compact, obtusely pointed behind. *Fins* large, semicircular; *ventral margin* produced forward above head, almost or entirely covering the funnel. *Arms* short, webbed except between ventral pair. Right dorsal arm (hectocotylized) united at base with 2nd right arm. Type, *Sepiola dispar* Ruppell 1844, Mediterranean region.

This is the first record of this subfamily in Australian waters. Berry (1909, pp. 409, 418) records a new species, *Stephonoteuthis hawaiiensis*, later placed under *Heteroteuthis* by Naef (1912, p. 246), from Hawaiian Islands. The only other species of the genus appears to be *H. weberi* Joubin (1902, p. 113) from Dutch East Indies, which unfortunately is not figured by Joubin. The recorded distribution of the genus *Heteroteuthis* now becomes Mediterranean, Dutch East Indies, Hawaiian Islands, and Australia.

Heteroteuthis serventyi, sp. nov.

(Plate xxvii, figs. 22, 23.)

Animal well developed, small, solid, plump, but the skin loose to touch. *Mantle* almost straight sided, tapering to rounded point posteriorly. *Mantle edge* free all round, connected to head by strong interlocking cartilages ventrally, the ridges of which commence some little distance from the ventral edge. Dorsal mantle edge is slightly but broadly arched, rising to a high peak behind each eye on the ventral surface; between the peaks the ventral margin forms a broad emargination just below the top of the *funnel.* Ventral surface of mantle is very broad and swollen, much more so than the dorsal surface, flattening just below half-way to the tail. *Fins* large, oval, situated laterally, about midway along the sides; their anterior and posterior edges are equidistant from mantle edge and tail respectively.

Head very broad, narrowing in above eyes towards base of arms. *Eyes* very large, rounded; ventral head area deeply excavated between them. *Arms* very short, web about half-way up their length; shorter dorsally, increasing in size towards ventral pair which are longest and strongest. Order of sessile arms, 4, 3, 2, 1. *Suckers* on arms biserial, quite large but smaller towards tips. *Tentacles* long, about as thick as arms, with a ridge down the inside centre. The *club* on each tentacular arm is curled over and resting on an expanded portion of the tentacle just below the club. Club bears numerous minute suckers.

Funnel rather small, narrowing towards opening. Funnel groove wide at top, narrower towards base, with a notch towards the inner edge.

Colour.—General appearance of body dark reddish-brown with light-buff fins, arms, and tentacles, and a luminous glow all over. There is a patch of rich dark-purple colour between the eyes dorsally. The eyes are very beautiful with golden-bronze hue. Two brilliant, very large green-bronze photogenic (luminous) organs lie at the base of the funnel, completely covering the ink-sac; they are united along their inner sides, and have a small rounded pore on their upper surface.

Measurements.—Mantle, dorsal edge to tail tip, 7 mm. long, 6 mm. wide. Head, mantle to web, 5 mm. long, 5 mm. wide. Dorsal arms, web edge to arm tip, 2 mm., ventral arms, web to tip, 3 mm. Fins, 5 mm. long, 3 mm. wide at widest part.

Locality.—Station 66/38. 12/11/38. N.200. Hor. 35°07′S., 150°51′E. (near Jervis Bay, S.E. New South Wales). Shallow. One specimen.

Remarks.—This little cephalopod must be very beautiful in life, and it is regretted that only one specimen has so far come to light. It is fortunate, however, that the subfamily can now be recorded for the first time from these waters. The species is close to *H. hawaiiensis* Berry, but differs in a number of points and particularly in the ventral mantle margin not entirely concealing the funnel and head. The description of *H. weberi* Joubin also suggests a close association with that species, but in view of the location of the Australian species, I doubt that these are other than closely allied species to it, and therefore propose the specific name of *serventyi* for our species.

Subfamily **Sepiolinae** Hoyle, 1904.

Genus **Euprymna** Steenstrup, 1887.

Euprymna Steenstrup, 1887*a*, p. 66; 1887*b*, pp. 89, 90. Genotype *Inioteuthis morsei* Verrill, 1881. Japan.

Nuchal commissure far broader than one-third breadth of head. Fins small, attached little nearer mantle margin than posterior end. Arm suckers in four oblique rows, small and similar in female, unequal in male, several in one or both marginal rows being especially enlarged. Suckers on tentacles minute, crowded. Left dorsal arm hectocotylized, provided with swollen, modified suckers tightly palisaded together in 2–4 series on distal half. Saddle-shaped photogenic organ present, conspicuous. Gladius absent.

Euprymna tasmanica (Pfeffer), 1844.

(Plate xxvii, figs. 20, 21.)

Sepiola tasmanica Pfeffer, 1884, p. 6. Holotype, Bass Strait.

Animal small, very immature, *body* oblong-rounded, *mantle* sides almost straight, sloping to rounded point towards posterior end. Attached to nape of neck from just below dorsal edge of eyeball, *nuchal commissure* being almost half width of head. Ventral margin interlocking with head, and has a bare area running along its breadth and extending a short distance down mantle, as illlustrated in figure of *Euprymna tasmanica* Pfeffer by Cotton and Godfrey (1940, p. 406).

Fins small, about one-third length of mantle, slightly narrower at junction with mantle, rounded, but anterior end lobed. *Head* squarish; *eyes* normal, set fairly far apart. *Arms* rather long, tapering, about same length as head, order 2, 3, 4, 1, but close in size; a pronounced web between 3 and 4. *Suckers* on arms irregular in size, globular. They are easily rubbed off, and most of them are absent, only a small mound indicating their original position. The remaining suckers, many of which appear tc be in biserial order, resemble those of a male *Euprymna*, although there is no modification in the left dorsal arm. *Tentacles* exposed short distance beyond arms, almost same thickness. *Clubs* curled over; suckers minute, numerous in about eight rows.

Funnel elongated and almost tubular, extending almost to base of ventral arms, widened at base. Two large, whitish, saddle-shaped *photogenic organs* overlie the *ink-sac*; they have a dark border, and are united down their inner margins.

Colour.—Creamy-buff mantle and arms; head darker; *eyeball* bronze-gold. The same luminous tinge is present over the ventral surface of head. A few scattered minute dark-brown spots overlie the mantle.

Measurements.—Mantle, tail tip to nape, 5 mm. long, 4 mm. broad. Head 3 mm. long, 3 mm. broad. Longest arm 3 mm.

Locality.—Station 184/39. 11/6/39. 42°38′S., 148°13′E. (near Maria Is., east coast, Tasmania). N.200. Hor. Shallow. One specimen (figured).—Three minute specimens from Station 45/38. 17/9/38. N.70. Vert. D.50–0. 24°20′S., 153°02′E., seem larval *Euprymna* but, owing to the extreme northerly locality of these specimens (near Heron Island, Great Barrier Reef), they may be larval forms of *Euprymna stenodactyla* Grant, a north-eastern Australian species. The total length of the largest specimen being only 3 mm., it is impossible to place them with certainty in that species.

Remarks.—Although in places there appear to be only two rows of irregular sized suckers on the arms of the specimen here identified as *tasmanica*, they are so easily removed that it is quite possible there could be two rows of much smaller ones intermixed with the larger marginal suckers, as shown in Sasaki's illustration of *E. morsei* Verrill (Sasaki, 1929, p. 144). The broad nuchal commissure reaching more than half the width of the head removes it from *Sepiola* Leach 1817, a genus which it superficially seems to approach. Its southern locality, so closely approaching that of the holotype, leaves little doubt that this is a larval form of *Euprymna tasmanica* Pfeffer.

Family Idiosepiidae.

Myopsid cephalopods with elongate bodies and rudimentary subterminal fins. Gladius lost and replaced by a singular ring-like tendinous support. Head separated from dorsal margin of mantle. Arm suckers biserial, tentacle suckers bi-quadriserial. Both ventral arms hectocotylized. Distribution, Indian and Pacific Oceans.

Berry (1921, p. 353–362), in his review of the family, erected a new species *Idiosepius notoides*, carrying the distribution of known species to southern Australia. Cotton and Godfrey (1940, p. 398–400) have recently dealt briefly with the four known species of the family.

Genus Idiosepius Steenstrup, 1881.

Idiosepius Steenstrup 1881, p. 219–224. Genotype, *Idiosepius pygmaeus* Steen. Dutch East Indies and Zamboanga, Philippines.

Characters of the family. Interlocking cartilage broadly oval with corresponding small ridge. The only genus of an unusual family; few species are so far known.

Idiosepius notoides Berry, 1921.

(Plate xxv, figs. 19, 20.)

Idiosepius notoides, Berry, 1921, p. 361–362. Goolwa, South Australia.

Animal small, *mantle* roundly pointed, cylindrical; *fins* small, almost terminal in position, semi-circular. *Head* large, almost as wide as body, to which it is attached ventrally by a strongly developed button-like, interlocking system, the ridges on the inner ventral mantle surface being short, but prominent (fig. 19). *Eyes* large, set high up in head, slightly oval in shape, with rather elongate pupil. Olfactory *papillae* present.

Arms short, rounded on back, 2nd pair longest, remainder fairly equal, 3rd and 4th arms on each side united by a web forming a sheath for the tentacular arms. *Suckers* on arms fairly crowded, small, biserial. *Tentacles* short and stout, retracted almost to level of arms in the specimen. *Clubs* large, occupying the whole of the exposed length of tentacles. Suckers extending well down tentacles, in two rows on upper portions, crowding to four rows lower down. The outline of the tentacles can be traced well down between the eyes ventrally (fig. 19). *Funnel* rather short, hood-shaped, reaching to about level of olfactory papillae. There is a conspicuous bronze-gold *photogenic organ* over the *ink-sac*. I am unable to make out the structure of the *gladius*, and can see no evidence of hectocotylization on the ventral arms as indicated by Berry.

Colour.—Deep uniform cream with small blackish-brown dots scattered more or less regularly over the entire surface of the mantle, some of which appear almost slightly elevated. Larger but fewer patches of the same colour occur along the backs of arms and on the head. Eye areas very dark.

Measurements.—Mantle edge to tail, 5 mm. long, 3 mm. broad. Head 2 mm. long, 2 mm. broad. Longest arm (2nd pair) 2 mm. (figured specimen).

Locality.—Station 188/39. 13/6/39. N.200. Hor. 39°54′S., 148°36′E. (near Babel Island, Bass Strait). Shallow. Two specimens, one minute, the other described above.

Remarks.—Various authors, in reviewing the family Idiosepiidae, make no reference to a photogenic organ overlying the ink-sac, as has been noticed in this specimen from Bass Strait. That this has been overlooked is quite possible, since there seems little doubt our species belongs to this family. The large head, small, separated, subterminal fins, and the character of the arms and suckers are typical of the genus, and in view of its southern locality, it can safely be identified as an immature form of *Idiosepius notoides* Berry. None of the species so far described appear to have a mantle length much more than 25 mm. (the male being slightly smaller than the female). The type of *Idiosepius notoides*, which is the second largest species described, has a mantle length of approximately three to four times that of the "Warreen" specimen from Bass Strait.

As far as I am aware, this is the first occasion on which the complete animal has been figured. It is regretted that more and larger specimens were not available for examination.

Sasaki (1929, p. 134) gives some interesting habits of *Idiosepius paradoxus* Ortmann, the only species known by Sasaki to inhabit Japanese waters. He says it is littoral in habit, usually adhering its back (dorsal surface) on the undersurface of seaweeds, for which purpose a special adhesive organ—a wrinkled and glandular area occupying the posterior portion—is developed on the back. Sasaki also gives an interesting account of its feeding and mating habits.

Order OCTOBRACHIATA (OCTOPODA).

The octopods were poorly represented in comparison to the Decapoda, only three families occurring in the collection, but two of these, Amphitretidae and Bolitaenidae, are placed on the Australian list for the first time.

The key to the families is as follows:

a. Mostly littoral animals, body usually firm, no fins. Arms with one or two rows of suckers and more or less well developed basal web ..... *Octopodidae*

aa. Pelagic or abyssal. Body gelatinous. Umbrella present in varying degrees, sometimes greatly developed. Suckers mostly in single row. No fins.

b. Ventral margin free and wide, animal semi-transparent and semi-gelatinous. Eyes elongate, situated dorso-laterally. Umbrella present in varying degrees. Suckers uniserial on arms ..... *Bolitaenidae*

bb. Ventral margin only free at two small orifices between the eyes and siphon, forming pallial apertures. Eyes dorsal, close together, telescopic in appearance. Umbrella greatly developed ..... *Amphitretidae*

Family Octopodidae.

Genus **Octopus** Lam., 1798.

Octopus Lamarck (1798, p. 130). Genotype.—*Octopus vulgaris* Lam.

Body short, rounded, thick; surface either smooth or warty, usually with one or more tentacular cirri over each eye. Length of arms or size of web variable. Suckers in two alternating rows, at times appearing as a single zig-zag row. Third right arm hectocotylized.

Octopus pallida Hoyle, 1885.

(Plate xxvii, fig. 15–18.)

Octopus pallida Hoyle, 1885*a*, p. 223; 1886, pp. 81–83, 88.—Bass Strait; Twofold Bay, N.S.W.

Animal rounded, very small, *mantle* free ventrally, from just below eye. *Head* almost as wide as body. *Eye* fairly small. *Arms* rather short, fairly equal, 2nd and 3rd pairs slightly longer. *Suckers* crowded, large, especially the middle ones; last two in a single row on each arm. *Web* about one-third length of arm.

Funnel broad at base, sloping to narrow opening anteriorly, reaching almost to base of ventral arms, between which there appears very little web. Over surface of head, backs of arms and body is fine sprinkling of small scattered *pustules*, not very conspicuous or prominent except in one or two specimens in which suggestion of rosette-shape is noticed and some cirri can be faintly recognised.

Colour.—Creamy-buff, darker round head. In a small species which seems the same, a single row of well-separated dark red-brown squarish *chromatophores* runs along the centre of the back of each arm, whilst a row of minute dark dots is present between the base of each sucker along both sides of the arms (see fig. 18). Large markings are scattered over ventral surface of body.

Measurements.—Mantle, 7 mm. long, 7 mm. maximum width. Head, mantle edge to web edge, 4 mm. long, 6 mm. broad. Ventral arms, 6 mm. from mouth to tip.

Locality.—Station 60/38. 12/10/38. N.200. Hor. 43°13′S., 148°17′E. (near Pt. Arthur, S.E. Tasmania). Slope. One specimen (fig. 17).—Station 22A/38. 16/10/38. N.200. Hor. 39°42′S., 148°49′E. (N. of Babel Is., Bass Strait). Slope. One specimen, 6 mm.—Station 96/38. 12/12/38. N.100. Hor. 36°19′S., 150°26′E. (near Montague Is., N.S.W.). Slope. One specimen (fig. 18).—Station 43/38. 14/9/38. N.70. 30 mm. Hor. 24°41′30″S., 152°45′E. (near Bundaberg, Queensland). Shallow. One specimen, 7 mm. × 3 mm.—Station 103/39. 9/8/39. N.200. Hor. (near Broughton Is., N. Coast, N.S.W.). One specimen, 7 mm. total length.—Station 192/39. 14/6/39. N.70. Vert. 37°13′S., 150°22′E. (near Twofold Bay, N.S.W.). Slope. One specimen, 2 mm. total length.—Station 41/40. 7/5/40. N.100. 42°23′S., 148°43′E. (near Oyster Bay, E. Tasmania). Slope. One specimen, total length 5 mm.—Station 186/39. 12/6/39. N.200. Hor. Slope. 41°14′S., 148° 25′E. (N.E. Coast, Tasmania). One specimen, 5 mm.—Station 63/38. 21/10/38. N.70. Vert. 43°13′S., 148°17′E. (near Oyster Bay, Tasmania). Slope. One specimen, 5 mm.—Station 62/38. 16/10/38. N.200. 39°37′S., 148°52′E. (N. of Babel Is., Bass Strait). Slope. Two specimens, 7 mm. total length.—Station 212/39. 25/8/39. N.70. Obl. (near Twofold Bay, N.S.W.). Shallow. One specimen.—Station 144/39. 31/5/39. N.200. Hor. 36°15′S., 150°25′E. (near Montague Is., N.S.W.). Slope. One specimen, 8 mm. × 4 mm.—Station 6A/38. 18/10/38. N.200. 42°40′S., 148°16′E. (near Maria Is., Tasmania). Shallow. One specimen, 5 mm.

Remarks.—Though larval, the above forms show characteristics of *O. pallida* rather than other known species from Australian waters, the majority of stations from which they were taken falling within the range of *pallida*, namely, southern Australian regions, New South Wales, and New Zealand. I have therefore regarded them as approaching most closely to this species. The Queensland specimen from Station 43/38. 14/9/38 has a more elongate body than the other forms, and is attractively marked with dark chromatophores (figs. 15–16). It is possible that this is a different species.

Octopus ?tetricus Gould, 1852.

((Plate xxvii, fig. 19.)

Octopus tetricus Gould, 1852, p. 474, f. 588. Type locality, Twofold Bay, N.S.W.

Animal small, immature, more elongated than previous species. *Mantle* elongate-oval with furrow down mid-ventral surface; about same length as arms and web combined; free ventrally from just below mid-eye level. *Arms* fairly even, *2nd* and *3rd* pairs seem slightly longer than remainder; web extends about two-thirds up arms. Funnel seems attached to head due doubtless to its immaturity. *Suckers* on arms are crowded, small, very minute for a number of rows at tips.

Body marked with small, closely-set *tubercles*, crowded and conspicuous on the backs of arms in particular, giving a strong granulated appearance.

Colour.—Dark greenish with bronze hue round the anterior portion of the eye area. Underlying the greenish colour can be faintly seen small brown chromatophores in two rows up the backs of arms and smaller rounded ones over the tail.

Measurements.—Mantle, 6 mm. × 4 mm. Head, 3 mm. × 3mm. Mantle edge to web, 4 mm. Longest arm, 4 mm. Total length, approximately 14 mm.

Locality.—Station 104/39. 10/4/39. 40°38′S., 147°57′E. (N.E. Tasmania, Bass Strait). Shallow. 2 specimens (fig. 19).—Station 103/38. 4/12/38. N.70. Hor. 34°5′S., 151°14′E. (near Port Hacking, N.S.W.). Shallow. Two specimens; though only 2 mm. total length, these have granulated appearance of the above specimens and may be regarded as still younger forms of the same species.

Remarks.—The specimens I have considered young of *tetricus* are about the same size as the previous species, but are readily distinguishable from it by the much smaller suckers, longer and narrower head, small eyes and the tuberculate nature of the surface, intensified on the backs of the arms. They somewhat resemble the illustrations given by Berry (1918, pls. lxxix, lxxxi) of *O. variolatus* Blainville, but in general outline do not resemble Hoyle's figure of *O. pallida* Hoyle (1886, pl. i), of which *variolatus* is considered a synonym.

Family **Bolitaenidae** (Chun) Naef.

Sasaki (1920, p. 170; 1929, p. 12) uses the family name Eledonellidae for three genera, *Eledonella* Verrill, 1884, *Chunella* Sasaki, 1920, *Japetella* Hoyle, 1885, and *Vitreledonella* Joubin, 1918, but Thiele (1934, p. 988) and Robson (1931 (1932*b*), p. 326) prefer Bolitaenidae Chun, 1910, as the more acceptable family name for this group of peculiar little cephalopods. Also Thiele and Robson place *Vitreledonella* in the family Vitreledonellidae, and not in Bolitaenidae, but are at variance, however, in the position of some genera in Bolitaenidae. Thiele, for instance, regards *Japetella* Hoyle and *Bolitaena* Steenstrup as the two main genera, with two subgenera to the latter genus, *Bolitaena* s.s., and *Eledonella* Verrill (type, *B.* (*E.*) *pygmaea* Ver.). Robson, however, maintains *Eledonella* as a genus.

That the status and relationships of the various genera in this family have caused much uncertainty is shown by Bouxin and Legendre (1936, pp. 12–22) in their systematic account of the group. Unlike Robson and Thiele, they follow Sasaki in the use of the family name Eledonellidae, and use *Bolitaenella* Grimpe, 1922, rather than *Japetella* for the species *diaphana* Hoyle. Classification of the genera seems based largely on the structure of the peduncular and optical ganglion, necessitating ample material for comparison. The appearance of a representative of the family in Australian waters provides a further instance of the extraordinary planktonic fauna hitherto unrecorded from these regions.

Genus **Eledonella** Verrill, 1884.

Eledonella Verrill, 1884, p. 144. Type, *E. pygmaea* Verrill. New England Coast.

Characters of family. Body soft, saccular; mantle extending forward as far as eyes; arms slender, third pair longest, third right arm hectocotylized by having terminal half thickened and somewhat shortened, and bearing on its distal half a few very large suckers. Interbrachial membrane short. Eyes well developed, nearly covered by skin; a mucus-pore close to the anterior ventral border of the orbit. Siphon moderately developed, free only near the tip. A large median ventral commissure joins mantle to viscera, dividing gill chamber into right or left. Optic nerve long.

Eledonella sheardi, sp. nov.

(Plate xxvi, figs. 22–27.)

Animal very small, soft, gelatinous, semi-transparent. *Body* somewhat broad, rounded, continuous with head dorsally, free ventrally. *Mantle* edge extending to about mid-eye, reaching well over head ventrally, capable of being flattened; *pallial opening* very wide. *Head* fairly short, appearing especially so ventrally. *Eyes* enormous, situated laterally, but produced dorsally and ventrally into prominent rounded prolongations. The *eyes* are covered with skin, which forms a conspicuous *mucus-pore* on the ventral surface about in centre of pupil and shows signs of similar puckering on each extended portion. On removing the skin from one eye, the pupil is found to be very globular, with a dark greenish bronze luminous sheen. The prominences on each end are very dark, resembling those on the eyes of some of the Cranchiidae and, I feel sure, possess some luminous quality, but I refrained from interfering with them on account of the rarity of the species and the delicateness of its structure (fig. 27). The eyes on first appearance give the impression of double eyes, due to the pupil being hidden, and the ventral and dorsal extended portions being so prominent. The size of the eyes considerably increases the width of the head which would be otherwise narrow. A slight depression indicates the junction of the head and mantle dorsally. Round the base of

the eyeball on the ventral surface runs a fairly wide furrow. An *olfactory papilla* is present below each eye.

Arms fairly short, third pair the longest and broadest, others almost equal. *Suckers* large, rounded, sessile with wide openings, arranged in single straight row, 5–6 in a row with suggestion of minute ones at extremity (fig. 24). *Umbrella* between arms very delicate and easily torn, reaching only a little way up arms. No sign of hectocotylization.

Funnel almost hidden by mantle edge, reaching only about mid-eye; fused throughout its length to ventral surface of head; slipper-shaped in appearance, fairly small, elevated and rounded anteriorly, sloping to almost a point posteriorly. *Funnel opening* situated half-way down the funnel, conspicuous, oblong and wide. In other members of the family, the funnel opening is either right at the extremity or just below it. The opening is completely hidden by the mantle, although its outline can be seen through the semitransparent tissue. Ventral mantle adheres to the viscera by a muscular band, some distance below the funnel base. The *gills* are small, consisting of about 5–7 filaments on the outer demibranch, as far as can be ascertained.

Colour.—Yellow-liverish with suggestions of minute dark chromatophores over the body. A darker area on the head and round the eyeballs. Through the back of the arms may be seen two parallel dark bands running down their length.

Measurements.—Mantle, 7 mm. long, 5 mm. broad. Nape (junction of head and mantle) to arm tips, 4 mm. Head, width from eye to eye, 3 mm.

Locality.—Station 219/39. 15/9/39. N.200. Obl. 28°44′S., 153°57′E (near Cape Byron, N. Coast, N.S.W.). Slope. One specimen.

Remarks.—The large eyes, covered with skin, forming a mucus-pore on the ventral side, the widely extending mantle, and the funnel attached to the head approach more closely the characters of Verrill's genus *Eledonella* than other genera in the family. Certainly in Verrill's description the funnel is not attached completely throughout its length, but "free only near the tip", which may be a specific difference. Also Verrill does not mention generically or specifically the position of the funnel opening, or the prominent dorsal and ventral extensions of the eyes, but he does mention the skin over the eyes forming a mucus-pore, as in the above species.

The specimen under consideration does not appear to be *Japetella diaphana* (Hoyle) from various localities, including New Guinea (*Challenger*) and Japan (Sasaki); or *J. prismatica* Hoyle, owing to differences in the eyes and funnel. It more closely approaches *Eledonella ijimai* Sasaki (1929, p. 13), but the web in that species extends further up the arms, the funnel is completely covered by head tissues, and the eye "rather small projecting dorsally and lateral", whilst the large eye, dorso-ventrally extending from the base of the head to base of arms; and the slipper-shaped funnel, with opening half-way down, attached throughout its length to the head, seems definitely to remove the Australian species from any previously described form of the family Bolitaenidae, and I therefore propose the new specific name *sheardi* for it.

Although I have placed this species in the genus *Eledonella* for the time being, it is not without lengthy consideration of available literature on the family and the status of the various genera and species. Robson's comprehensive monograph of the cephalopods (1931 (1932)*b*, pp. 326–335) clearly shows the difficulty experienced in trying to elucidate this family, and the extent to which some members, such as *Japetella diaphana* (Hoyle) have been classified and reclassified generically again and again. Even in removing Sasaki's species *ijimai* from the genus *Eledonella* into *Bolitaena*, Robson admits the position is by no means certain and its inclusion in that genus is somewhat arbitrary. It is quite possible that our species will later prove a distinct genus, but I do not feel justified in assuming this on the single, apparently immature specimen in the collection.

The fact that the family Bolitaenidae has not previously been recorded from Australia, and is now only represented by this extraordinary little cephalopod, seems to warrant the rather full explanation given above. Should it later be found to possess *photophores* on the extensions of the eyes, as their appearance suggests, this will prove a

most interesting revelation, since the genus *Melanoteuthis* Joubin, 1912, has been the only group of Octopods so far regarded as possessing luminous organs.

Family Amphitretidae Hoyle, 1885.

A pelagic family of graceful appearance represented so far by a single genus, *Amphitretus* Hoyle. Distribution, S.W. Pacific, Japan, Cape Town.

Genus Amphitretus Hoyle, 1885.

Amphitretus Hoyle, 1885*a*, p. 235; 1885*b*, p. 271; 1885*c*, p. 113; 1886, p. 67.

The pallial aperture is reduced to two small orifices between the eyes and the funnel. Eyes are dorsal in position, close together and telescopic in appearance. Umbrella greatly developed with little or no differentiation between it and the head. The outer skin of animal is very soft, loose and gelatinous, forming a layer over body, head and umbrella. Represented by two species, *pelagicus* Hoyle, and *thielei* Robson, 1930.

Amphitretus pelagicus Hoyle, 1885.

(Plate xxvii, figs. 12–14.)

Amphitretus pelagicus Hoyle, 1885*a*, p. 235; 1885*b*, p. 271; 1885*c*, p. 113; 1886, p. 67.

Kermadec Islands.

Animal very small, immature. Integument soft, gelatinous, almost transparent and sufficiently loose to enable the animal to be moved into various shapes, but at the same time rendering it very difficult to handle. *Body* rounded, no demarcation between *head* and *umbrella*, but muscular parts of arms are discernible through the skin of the umbrella. *Eyes* large prominent, telescopic-looking knobs situated close together on dorsal surface. *Umbrella* is very wide, transparent, extending about two-thirds up the length of arms. *Arms* very short and delicate, especially 3rd and 4th pairs. Within the umbrella they provide little support, but serve mainly as soft tissues for the reception of sessile *suckers*. *Suckers* fairly firm, rounded, 13–16 in a single straight row on each arm, crowded at tips, becoming more spaced towards their base. No biserial arrangement towards the free extremities of the arms, as referred to by Hoyle, can be seen.

Funnel very soft, flabby, fairly long with small opening. Free throughout its length, but adhering to mantle at its sides ventrally. *Mantle* opening reduced to small, well-developed opening each side of ventral surface between funnel and eyes, a little nearer to latter and on about the same level (fig. 14). The opening seems capable of stretching, and appears as a depression in the skin, but in reality opens into an inner pocket-like area leading into a compressed passage, which in turn appears to lead into the branchial cavity. The pallial openings arise approximately between, and just at the base of, the 2nd and 3rd pair of arms, and extend to between the 3rd and 4th pairs. The integument of the mantle seems in parts tough and fibrous, and there is a suggestion also of faint minute pustulation.

Colour.—Uniform dingy-yellow, with scattered small brown chromatophores.

Measurements.—Posterior end of body to eye pupils, 4 mm.; eyes to longest arm tip, 8 mm. Total length, 12 mm. Width of body, 5 mm. Total length of type is 45 mm., and of a Japanese species 135 mm. (Sasaki).

Locality.—Station 18A/38. 24/10/38. N.100. Hor. 42°35′S., 148°37′E. (near Maria Island, E. Tasmania). Slope. One specimen.

Remarks.—This little species is obviously the same as Hoyle's type, and provides the first record for Tasmanian waters, thus bringing its range still further south.

Indeterminable Larval Cephalopods.

A small number of minute specimens were not in a condition for determination, other than as cephalopods.

Cephalopod Egg.

A minute, gelatinous rounded cephalopod egg, 2 mm. in diameter, from Station 132/39. 5/5/39. N.70. Hor. 30°15′S., 153°33′E. (near Coffs Harbour, N.S.W.). Slope, showed a larval Decembrachiate cephalopod emerging head first through a break towards one edge (fig. 24).

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EXPLANATION OF PLATES XXIV-XXVII.

PLATE XXIV.

Fig. 1.—*Abralia ? astrosticta* Berry. Dorsal view. Station 201/39. 17/7/39.
Fig. 2.—*Abralia ? astrosticta* Berry. Ventral view. Station 201/39. 17/7/39.
Fig. 3.—*Abralia ? astrosticta* Berry. Portion of arm, with magnified spine alongside. Same specimen.
Fig. 4.—*Abralia ? astrosticta* Berry. Tentacular club. Same specimen.
Fig. 5.—*Abralia ? astrosticta* Berry. ? larval form (cf. *Asthenoteuthion planctonicum* Pfeffer). Dorsal view. Station 27/40. 21/4/40.
Fig. 6.—*Abralia ? astrosticta* Berry. Ventral view of same specimen.
Fig. 7.—*Abralia ? astrosticta* Berry. Eye of same species from Station 26/40. 20/4/40.
Fig. 8.—*Abralia ? astrosticta* Berry. Funnel of same species from Station 27/40. 21/4/40.
Fig. 9.—*Abralia ? astrosticta* Berry. Gladius of specimen, Station 27/40.
Fig. 10.—*Abralia ? astrosticta* Berry. Tentacular club of same.
Fig. 11.—*Abraliopsis ? hoylei* Pfeffer. Dorsal view. Station 66/38.
Fig. 12.—*Abraliopsis ? hoylei* Pfeffer. Ventral view of same.
Fig. 13.—*Abraliopsis ? hoylei* Pfeffer. Left tentacular club of same.
Fig. 14.—*Abraliopsis ? hoylei* Pfeffer. Portion of arm of same.
Fig. 15.—*Abraliopsis ? hoylei* Pfeffer. Immature specimen. Dorsal view. Station 217/39.
Fig. 16.—*Abraliopsis ? hoylei* Pfeffer. Immature specimen. Ventral view.
Fig. 17.—*Abraliopsis ? hoylei* Pfeffer. Tentacle of same.
Fig. 18.—*Pterygioteuthis giardi* Fischer. Dorsal view. Station 140/39.
Fig. 19.—*Pterygioteuthis giardi* Fischer. Ventral view. Station 140/39.
Fig. 20.—*Pterygioteuthis giardi* Fischer. Third arm, back view. Station 140/39.

PLATE XXV.

Fig. 1.—*Tetronychoteuthis massyae* Pfeffer. Dorsal view. Station 17/38.
Fig. 2.—*Tetronychoteuthis massyae* Pfeffer. Ventral view, head and arms.
Fig. 3.—*Tetronychoteuthis massyae* Pfeffer. A sucker from a tentacle.
Fig. 4.—*Tetronychoteuthis massyae* Pfeffer. Portion of integument of same specimen, showing pustules.
Fig. 5.—*Tetronychoteuthis massyae* Pfeffer. Pustules enlarged.
Fig. 6.—*Onychoteuthis rutilus* Gould. Dorsal view. Station 127/39.
Fig. 7.—*Onychoteuthis rutilus Gould.* Ventral view. Station 127/39.
Fig. 8.—*Onychoteuthis rutilus* Gould. Side view. Station 127/39.
Fig. 9.—*Onychoteuthis rutilus* Gould. Dorsal view. Station 60/38.
Fig. 10.—*Onychoteuthis rutilus* Gould. Section of integument. Station 60/38.
Fig. 11.—*Onychoteuthis rutilus* Gould. Siphonal groove of same specimen. Station 60/38.
Fig. 12.—*Calliteuthis miranda* Berry. Ventral view. Station 65/38.
Fig. 13.—*Calliteuthis miranda* Berry. Dorsal view. Station 65/38.
Fig. 14.—*Calliteuthis miranda* Berry. Dorsal view. Station 60/38.
Fig. 15.—*Calliteuthis miranda* Berry. Ventral view. Station 60/38.
Fig. 16.—*Ctenopteryx sicula* Rüppell (Verany). Dorsal view. Station 266/39.
Fig. 17.—*Ctenopteryx sicula* Rüppell (Verany). Ventral view. Station 266/39.
Fig. 18.—*Bathothauma lyromma* Chun. Dorsal view. Station 22A/38.
Fig. 19.—*Idiosepius notoides* Berry. Ventral view of head and arms. Station 188/39.
Fig. 20.—*Idiosepius notoides* Berry. Dorsal view of whole animal. Station 188/39.

PLATE XXVI.

Fig. 1.—*Nototodarus gouldi* (McCoy). Ventral view. Station 73/38.
Fig. 2.—*Nototodarus gouldi* (McCoy). Siphonal groove. Station 73/38.
Fig. 3.—*Nototodarus gouldi* (McCoy). Fused tentacular arms of *Rhyncoteuthion* larval form. Station 31/40.
Fig. 4.—*Nototodarus gouldi* (McCoy). Dorsal view of more mature specimen. Station 31/40.
Fig. 5.—*Nototodarus gouldi* (McCoy). Ventral view of head and arms of same, showing tentacles united only at clubs. Station 31/40.
Fig. 6.—*Nototodarus gouldi* (McCoy). *Rhyncoteuthion* larval form. Dorsal head. Station 28/40.
Fig. 7.—*Nototodarus gouldi* (McCoy). *Rhyncoteuthion* larval form. Ventral view of same.
Fig. 8.—*Nototodarus gouldi* (McCoy). *Rhyncoteuthion* larval form. Dorsal head. Station 24/40.
Fig. 9.—*Nototodarus gouldi* (McCoy). *Rhyncoteuthion* larval form. Ventral head. Station 40/38.
Fig. 10.—*Nototodarus gouldi* (McCoy). *Rhyncoteuthion* larval form. Ventral view of fused tentacles. Station 141/39.
Fig. 11.—*Nototodarus gouldi* (McCoy). *Rhyncoteuthion* larval form. Ventral head. Station 193/39.

Fig. 12.—*Nototodarus gouldi* (McCoy). *Rhyncoteuthion* larval form. Dorsal view. Station 47/38.

Fig. 13.—*Nototodarus gouldi* (McCoy). *Rhyncoteuthion* larval form. Ventral view. Station 24/40.

Fig. 14.—*Nototodarus gouldi* (McCoy). *Rhyncoteuthion* larval form. Side view. Station 134/39.

Fig. 15.—*Brachioteuthis riisei* (Steenstrup). Dorsal view. Station 255/39.

Fig. 16.—*Brachioteuthis riisei* (Steenstrup). Ventral view. Station 255/39.

Fig. 17.—*Brachioteuthis riisei* (Steenstrup). Tentacle club. Station 255/39.

Fig. 18.—*Mastigoteuthis grimaldii* (Joubin). Dorsal view. Station 17/38.

Fig. 19.—*Mastigoteuthis grimaldii* (Joubin). Ventral view. Station 17/38.

Fig. 20.—*Mastigoteuthis grimaldii* (Joubin). Portion of left ventral arm of same specimen.

Fig. 21.—*Mastigoteuthis grimaldii* (Joubin). Buccal area of same specimen.

Fig. 22.—*Eledonella sheardi* sp. nov. Dorsal view. Station 219/39.

Fig. 23.—*Eledonella sheardi* sp. nov. Ventral view. Station 219/39.

Fig. 24.—*Eledonella sheardi* sp. nov. Third and fourth right arms of same specimen.

Fig. 25.—*Eledonella sheardi* sp. nov. Front view of funnel of same specimen.

Fig. 26.—*Eledonella sheardi* sp. nov. Side view of funnel.

Fig. 27.—*Eledonella sheardi* sp. nov. Right eye.

PLATE XXVII.

Fig. 1.—*Megalocranchia pardus* Berry. Ventral view. Station 217/39.

Fig. 2.—*Megalocranchia pardus* Berry. Dorsal view head and arms. Station 217/39.

Fig. 3.—*Megalocranchia pardus* Berry. Tentacle of same.

Fig. 4.—*Megalocranchia pardus* Berry. Head and arms of larger specimen. Station 63/38.

Fig. 5.—*Pyrgopsis pacificus* (Issel). Dorsal view. Station 62/38.

Fig. 6.—*Pyrgopsis pacificus* (Issel). Ventral view. Station 62/38.

Fig. 7.—*Pyrgopsis pacificus* (Issel). Tentacle club. Station 62/38.

Fig. 8.—*Pyrgopsis pacificus* (Issel). Portion of arm. Station 62/38.

Fig. 9.—*Pyrgopsis pacificus* (Issel). Some tubercles of the cartilaginous ridge on ventral surface.

Fig. 10.—*Pyrgopsis pacificus* (Issel). Side view of same. Magnified.

Fig. 11.—*Pyrgopsis pacificus* (Issel). Gladius of specimen from 62/38.

Fig. 12.—*Amphitretus pelagicus* Hoyle. Dorsal view. Station 18A/38.

Fig. 13.—*Amphitretus pelagicus* Hoyle. Ventral view. Station 18A/38.

Fig. 14.—*Amphitretus pelagicus* Hoyle. Side view of pallial opening. Station 18A/38.

Fig. 15.—*Octopus pallida* Hoyle. Dorsal view. Station 43/38.

Fig. 16.—*Octopus pallida* Hoyle. Ventral view. Station 43/38.

Fig. 17.—*Octopus pallida* Hoyle. Dorsal view. Station 60/38.

Fig. 18.—*Octopus pallida* Hoyle. Arm, side view. Station 96/38.

Fig. 19.—*Octopus tetricus* Gould. Dorsal view. Station 104/39.

Fig. 20.—*Euprymna tasmanica* Pfeffer. Dorsal view. Station 184/39.

Fig. 21.—*Euprymna tasmanica* Pfeffer. Ventral view. Station 184/39.

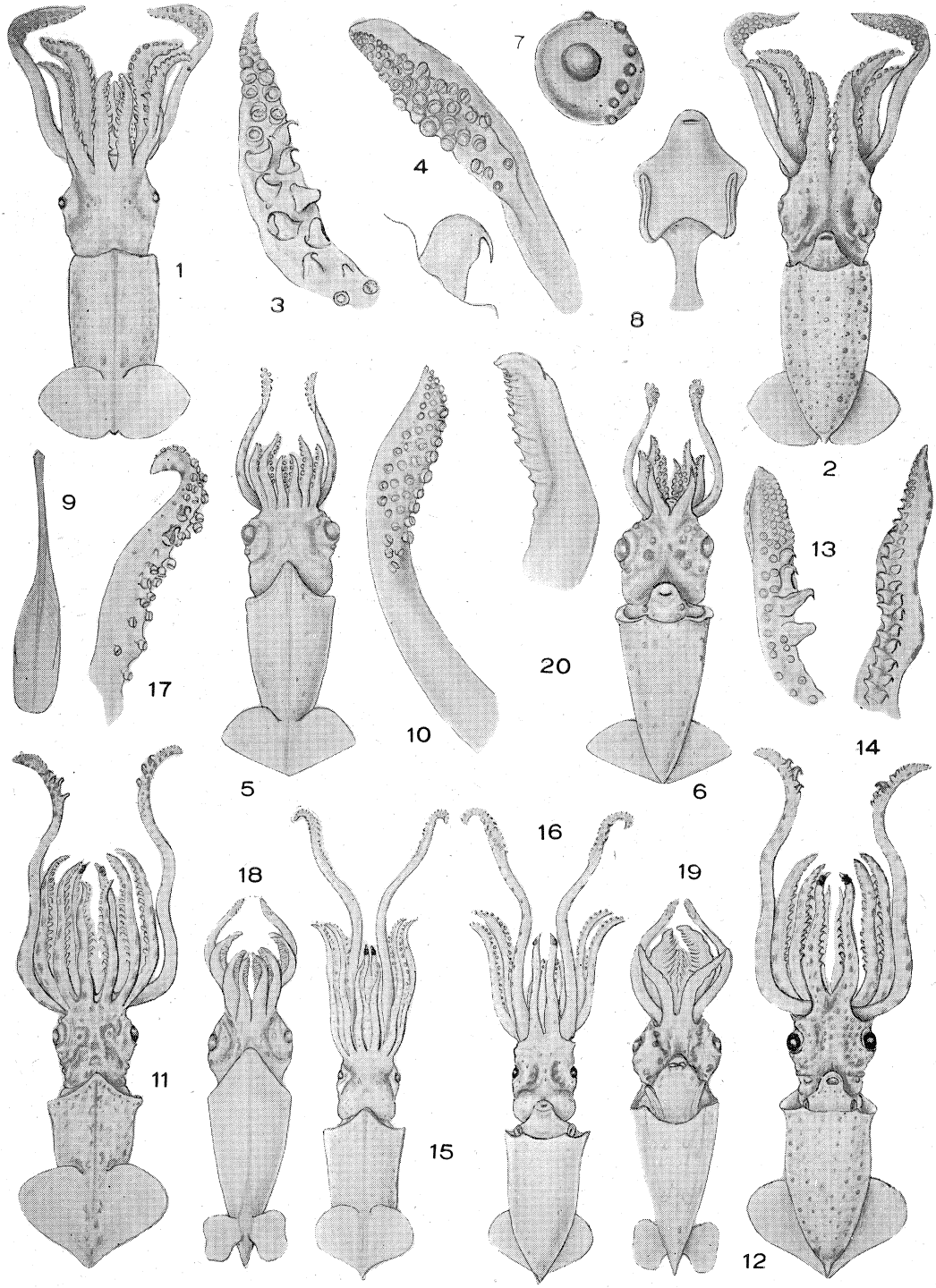
Fig. 22.—*Heteroteuthis serventyi* sp. nov. Dorsal view. Station 66/38.

Fig. 23.—*Heteroteuthis serventyi* sp. nov. Side view. Station 66/38.

Fig. 24.—Larval cephalopod emerging from egg. Station 132/39.

Fig. 25.—*Brachioteuthis riisei* (Steenstrup). Side view of very young specimen showing large ventral arm. Station 224/39.

Joyce Allan, *del.*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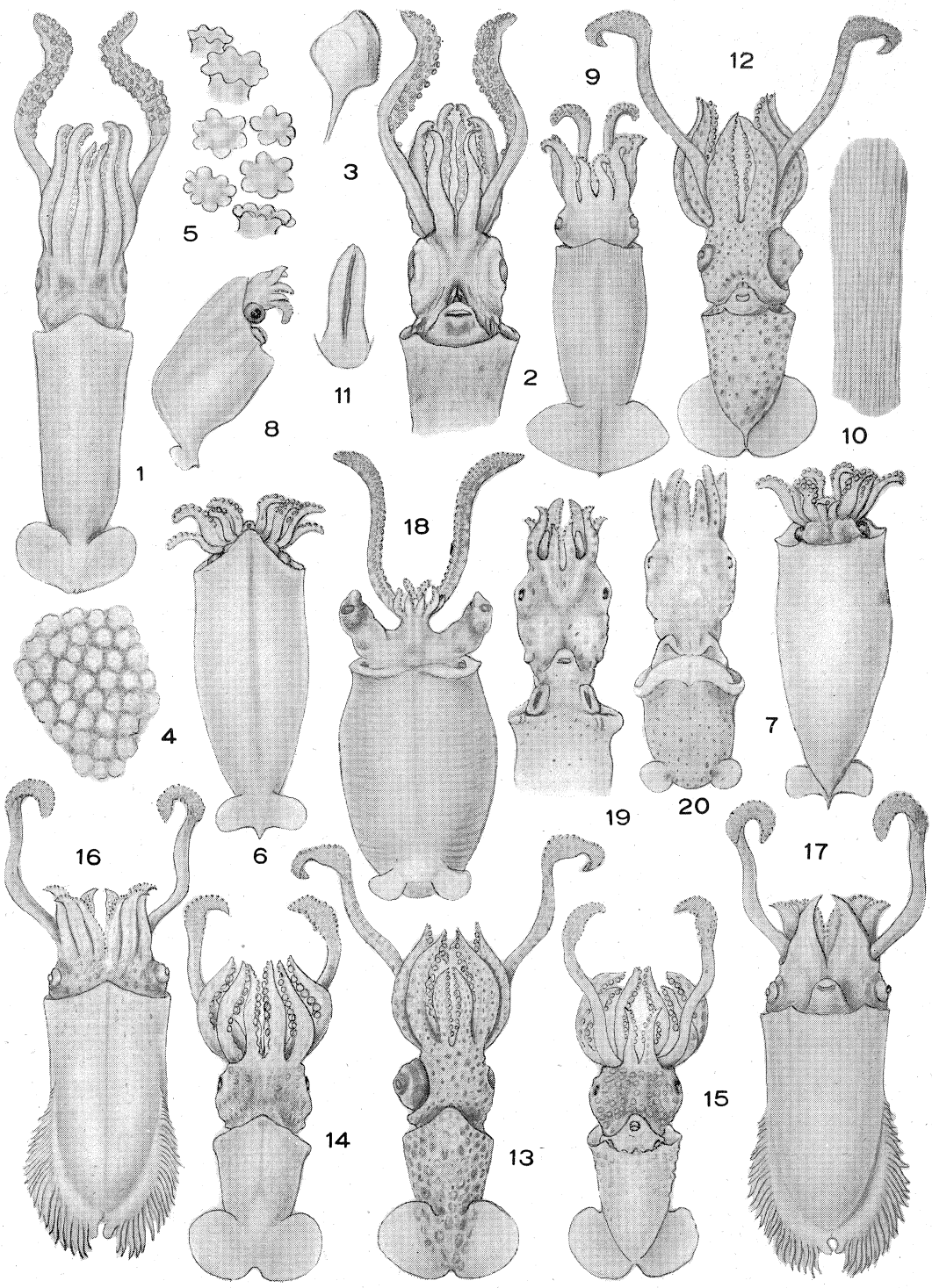
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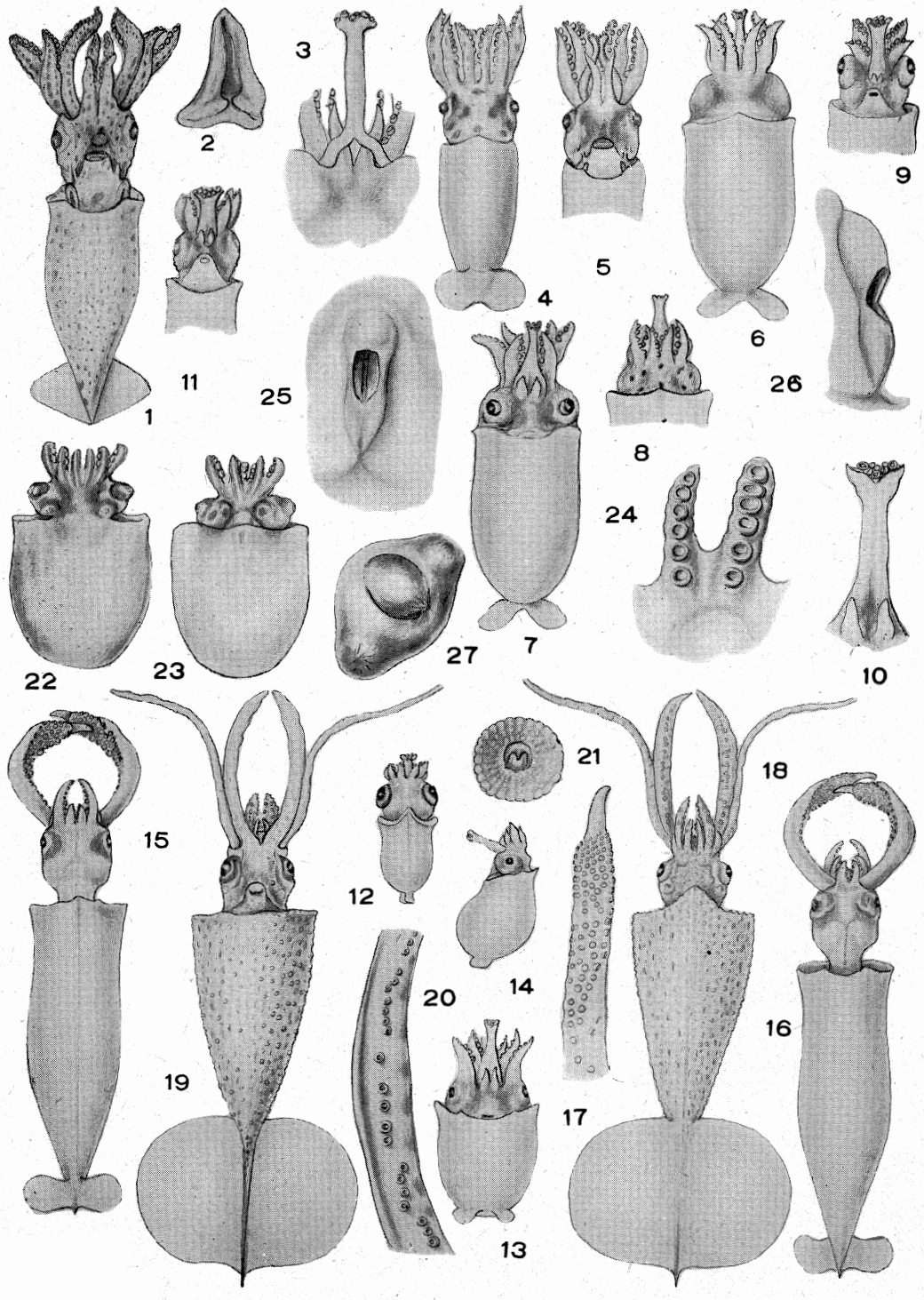
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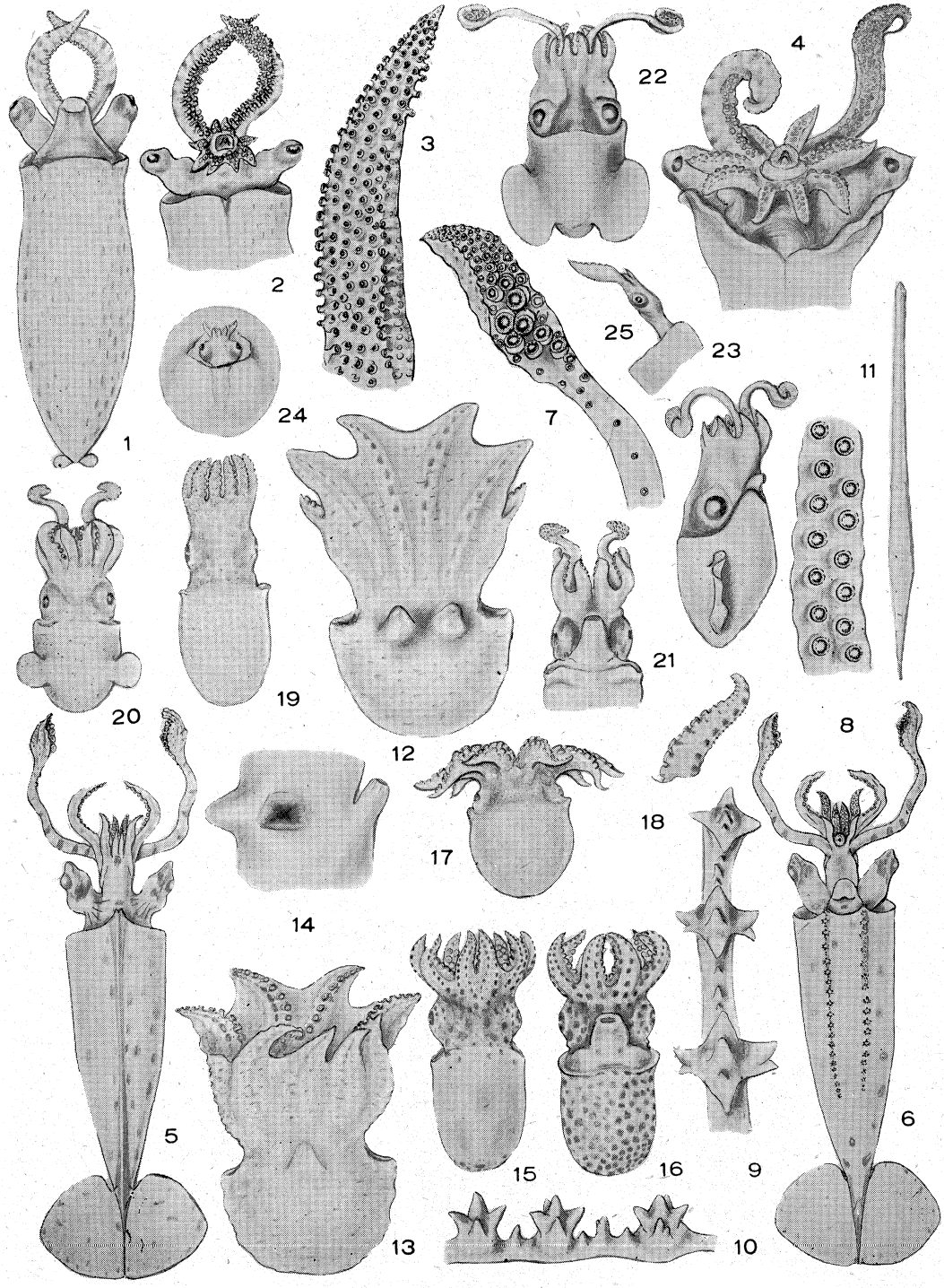
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