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The Anatomy and Relationships of *Emblanda emblematica* (Hedley) (Mollusca: Mesogastropoda: Emblandidae n.fam.)

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ABSTRACT. A new monotypic family is created for *Emblanda emblematica* (Hedley), a minute rissoacean gastropod from south- eastern Australia. It is unique in the Rissoacea in possessing a triseriate radula and a penial sheath behind the hypobranchial gland. The alimentary canal is modified for specialized feeding on Foraminifera, especially the wide, simple oesophagus, the spacious stomach with an elongate posterior chamber and the very reduced crystalline style. The female has a glandular section of the oviduct behind the albumen gland, which is of importance in separating *Emblanda* from the related family, Barleeidae.

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KEYWORDS: *Emblanda*, Emblandidae, Rissoacea, anatomy, radula.

Convergence in minute gastropods has proved to be one of the main problems in achieving a reliable classification. Historically shell characters have been used as the primary means of classification but, in many cases, where the much larger numbers of characters available from anatomical studies have been used to test these classifications, they have been shown to require considerable modification.

The minute, marine gastropod that is the subject of this paper has a shell very similar in appearance to that of some members of the Barleeidae (see Ponder, 1984) and Rissoidae (see Ponder, 1985). An examination of the radula, however, showed it to be very unusual. An anatomical investigation was carried out to establish the relationships of this otherwise rather undistinguished species.

Emblanda emblematica, the only known species of *Emblanda*, is a tiny, rare, prosobranch snail found living in algae in the lowest littoral and shallow sublittoral zones in New South Wales, Australia. It has been mentioned only occasionally in the literature. Hedley (1906), when he first described the species thought it was related to the '*Rissoa cheilostoma* group' (i.e. genus *Merelina*, Rissoidae), a suggestion also made by Laseron (1956). Iredale (1924) placed it in *Anabathron*. Iredale (1955: 81) later introduced a new generic name for this species stating that it differed from *Anabathron* 'in size, coloration and mouth-features'. I have recently indicated that a new family-group taxon might be required for *Emblanda* (Ponder, 1985).

The present account is incomplete, particularly regarding some aspects of the female genital system, mainly because of the small number of specimens available for study. The available material is all that has accumulated over the last fifteen years of collecting micromolluscs in New South Wales. Nonetheless the information presented below is sufficient for a reasonable estimate of the relationships of this genus.

Material and methods.

The methods used for radular extraction and mounting are given by Ponder & Yoo (1976). Mounts of five radulae were prepared, one being accidentally mounted upside down. Six specimens were fixed in Bouin's fluid and embedded in paraffin. Serial sections were cut at about 4-6 mm and stained with Mallory's triple stain. Three male specimens were dissected but, mainly because of the small size of this animal, the dissections were not very useful; most of the anatomical information has been ascertained from serial sections. No female specimens have been available for dissection and only one mature and two immature females have been sectioned.

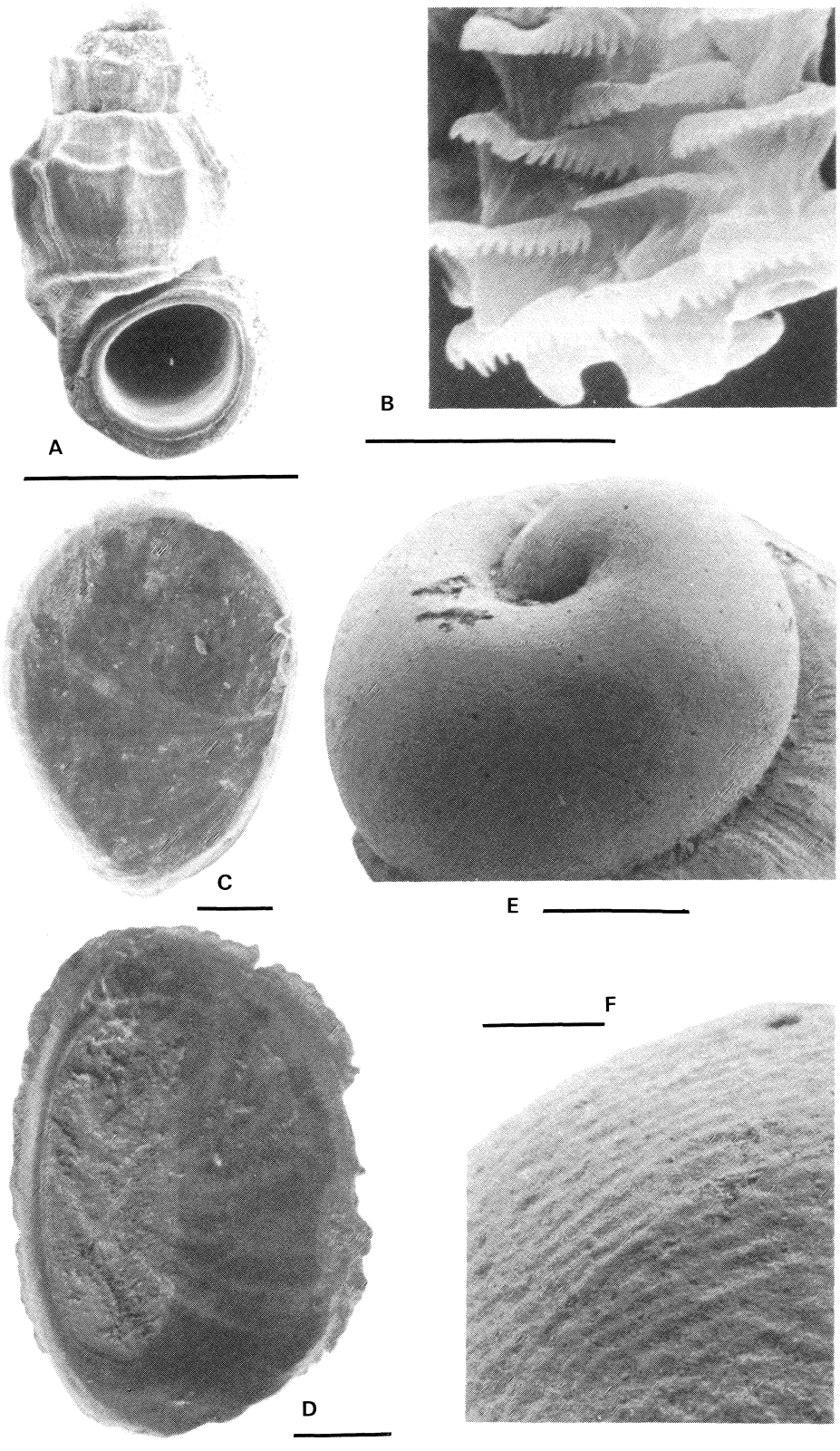

Fig. 1. **A:** Shell. **B:** Radula. **C, D:** Operculum; **C,** outer side, **D,** inner side. **E, F:** Protoconch; **F,** microsculpture. **Scales:** A, 1mm; B,F, 0.01mm; C-E, 0.1mm. A-C, Batehaven, Batemans Bay, N.S.W.; D-F, Fingal Head, Port Stephens, N.S.W.

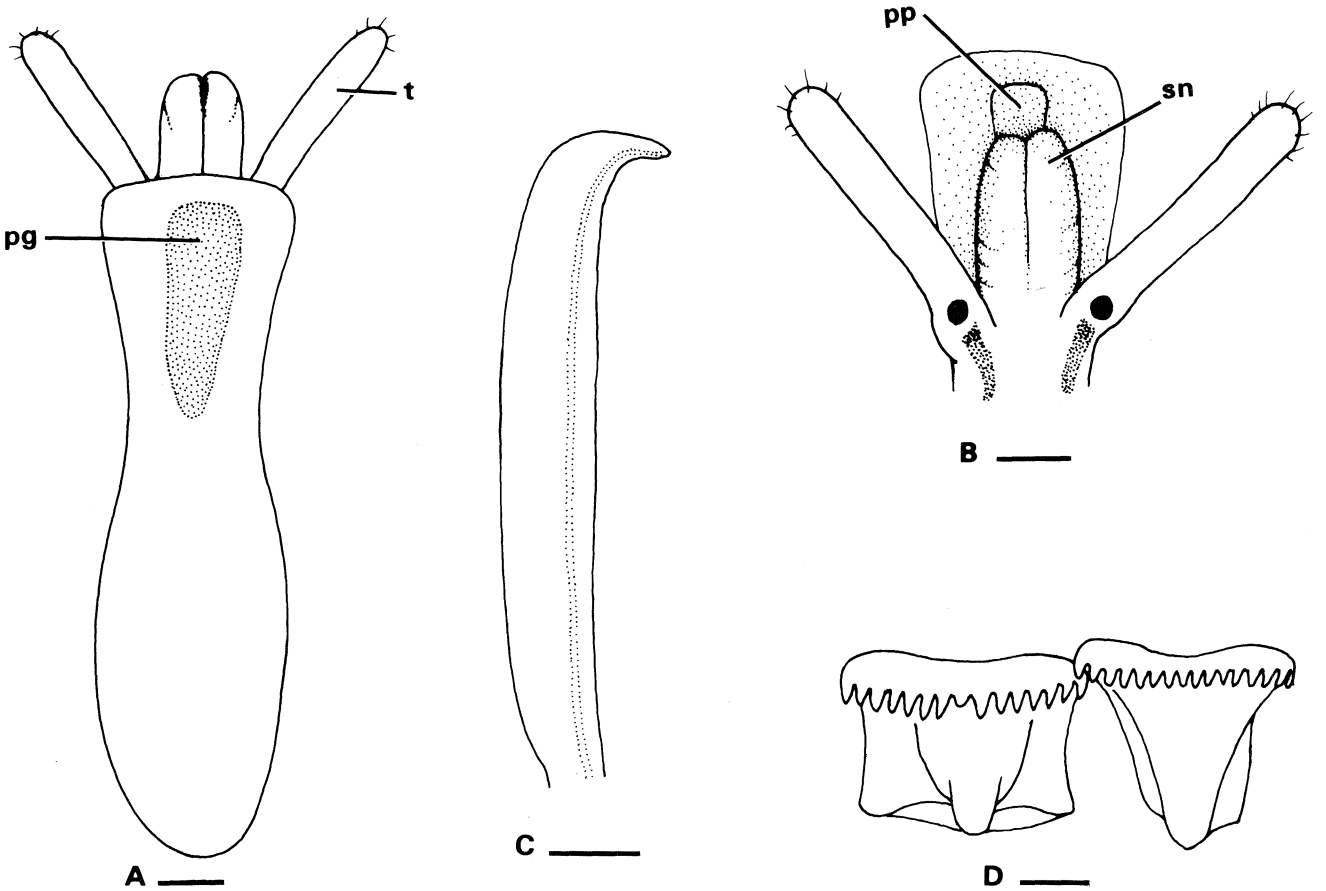

Fig. 2. Head-foot. **A:** Ventral view of head-foot. Opercular lobe and operculum not shown. **B:** Dorsal view of head and anterior foot. **C:** Penis. **D:** A diagrammatic representation of the central and one lateral radular tooth. **pg,** anterior pedal gland; **pp,** propodium; **sn,** snout; **t,** cephalic tentacle. **Scales:** A-C, 0.1mm; D, 0.001mm.

Description

Shell (Fig. 1A, E, F). The shell is minute (adults range from 1.47 to 2.03 mm in length), solid and non-umbilicate. There is a thin, dark red to colourless, inner chitinous layer present (see Ponder & Yoo, 1976). The protoconch (Fig. 1E, F) of about 1¼ whorls, is dome-shaped, the first half whorl minute and tilted. It is sculptured with spirally-aligned irregular wrinkles and the whole surface is covered with extremely minute, shallow pits (Fig. 1F). The teleoconch consists of 2 to 3 whorls and is sculptured with strong axial ribs (about 10–12 on the body whorl) which are angulated and nodulose where crossed by a prominant spiral cord on the periphery. A weaker spiral is present on the upper base in most specimens, below which the axial ribs disappear. Two prominent spiral cords encircle the lower base. The aperture is simple, subcircular and lacks any channels or notches. The peristome is duplicated and there is a prominent varix on the outer lip. The inner lip is separated from the parietal wall by a narrow, deep channel. The shell is chocolate brown, fading to orange when dead. Some specimens have narrow, indistinct yellowish bands at the periphery, suture and upper base but these are usually only visible in fresh material.

Head-foot (Fig.2). The cephalic tentacles (t) are strap-shaped and oval in section with a narrow, longitudinal strip of actively-beating cilia ventrally. The rest of the tentacles are unciliated except for a few stiff 'setae' distally. The eyes lie a little above the tentacle bases on their outer sides in small bulges. They have a well-developed pigmented retina and a lens. The rather long snout (sn) is distally bilobed, non-ciliated and non-retractile.

The foot is simple, being slightly wider anteriorly and posteriorly than in the middle, rounded behind and with a more-or-less straight anterior edge with rounded outer ends. The anterior pedal mucous gland (pg) lies in the anterior third of the foot and is narrower and longer than usual in rissoaceans, occupying only about half the width. It opens dorsally beneath a very narrow dorsal flap, all that remains of the propodium (pp), and extends posteriorly as far back as the anterior edge of the pedal ganglia in retracted animals.

The sole is covered with a columnar epithelium of non-staining mucous cells with wedge-shaped ciliated cells between. Dorsally the foot is covered with a ciliated cuboidal epithelium.

The head-foot is translucent white, except for the

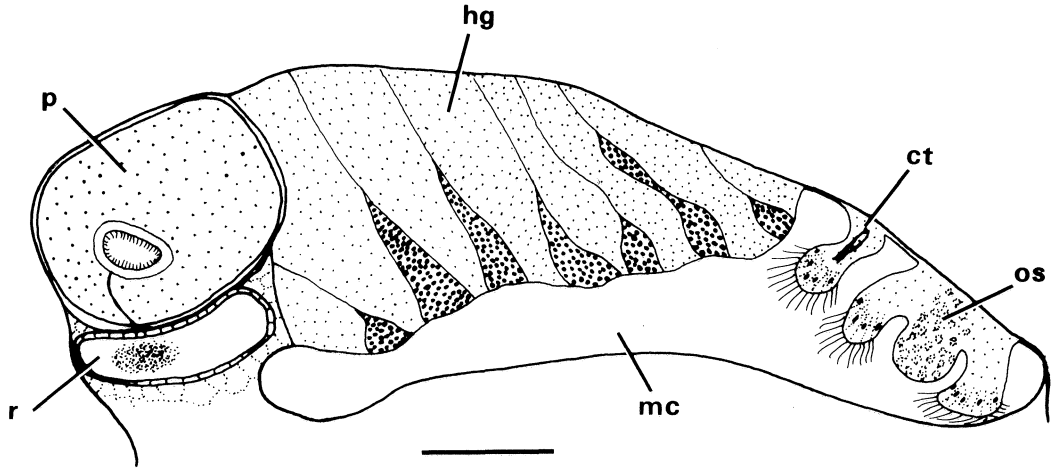

Fig. 3. A section through the pallial cavity of a male. **ct,** ctenidial filament; **hg,** hypobranchial gland; **mc,** mantle cavity; **os,** osphradium; **p,** penis; **r,** rectum. **Scale**: 0.05mm.

more opaque-white pedal gland and a small, triangular dense white patch behind the black eyes. Some specimens have a grey smudge on the narrow opercular lobes.

The operculum (Fig. 1C,D) is white in the living animal, transparent yellow when removed. It is thin, flat and lacks any projections on the inner surface except for a low ridge just inside the columellar edge and along the outer edge of the elongately oval muscle scar. The nucleus is eccentric and the last whorl is very large. In section it can be seen to be composed of two layers but these are not as clearly differentiated as they are in the Anabathrinae (Ponder, 1985).

Pallial cavity (Fig. 3). The osphradium (os) is large and conspicuous, occupying the left side of the pallial cavity. It consists of an unciliated, elongately oval sensory central area containing the osphradial ganglion which is surrounded by a ciliated ridge. A few (at least five) short, finger-shaped ctenidial filaments (ct) lie in the posterior end of the pallial cavity, near the posterior end of the osphradium. These are ciliated and contain skeletal rods. A massive hypobranchial gland (hg) occupies much of the cavity. Large, colourless cells, up to 0.13 mm in length, make up the bulk of the gland and wedge-shaped, dark red-staining cells lie distally. In males, the penis (p) is folded backwards into a sheath behind this gland.

Alimentary canal (Figs 4,5). The mouth is a ventral, longitudinal slit which opens to a spacious oral tube lined dorsally with a cuboidal, ciliated epithelium and with a pair of large folds ventrally. These folds are composed of a ciliated columnar epithelium which contains many mucous and red-staining gland cells. The salivary glands open from these folds opposite the anterior end of the odontophore. Behind this point the salivary glands lie within the folds (Fig.4, sg) and are thus latero-ventral to the buccal cavity. There are no jaws. The odontophoral cartilages (Fig. 4, od) are weakly developed and only a thin sheath of muscle surrounds them. The entire odontophore is only about half the width of the buccal mass.

The radula (Figs 1B, 2D) is small relative to the size of the animal, compared with other members of the superfamily, being only about 0.07 mm in length and 0.012 mm wide. It is particularly unusual in being triseriate. The squarish central teeth have a straight cutting edge with about seven small, equal-sized cusps on either side of a smaller median cusp. There are no basal processes but a prominent V-shaped projection lies on the inner face of each tooth and extends to the straight ventral margin. The subrectangular lateral teeth are about the same size as the central teeth. They have an almost straight cutting edge which extends over the whole length of each tooth and bears about 15 small, approximately equal-sized, sharp cusps. Each tooth has a thick, pillar-like supporting structure in the middle of the face which extends from just below the cutting edge to the ventral edge.

The short, tubular salivary glands contain only a single, pale-staining type of gland cell, and lie anterior to the cerebral ganglia. They disappear, along with the ventral folds, a little behind the odontophore. The posterior buccal cavity then becomes oval and can be regarded as the anterior oesophagus. It is lined with an irregular, ciliated epithelium in which are embedded many goblet cells. There is little clear distinction between the anterior oesophagus and posterior buccal cavity in size or in histology. As it passes through the nerve ring it is only slightly constricted. There is an ill-defined pair of low ventral folds and a very small mid-dorsal cleft is probably the food groove. The oesophagus appears to rotate as it passes through the nerve ring but the epithelium becomes very irregular behind the ring and any identifiable structures are lost. This epithelium consists of ciliated cells that range from very small cuboidal to elongate, finger-shaped cells that protrude from the epithelium. All of these cells have a similar simple cytoplasm, there being no gland cells present.

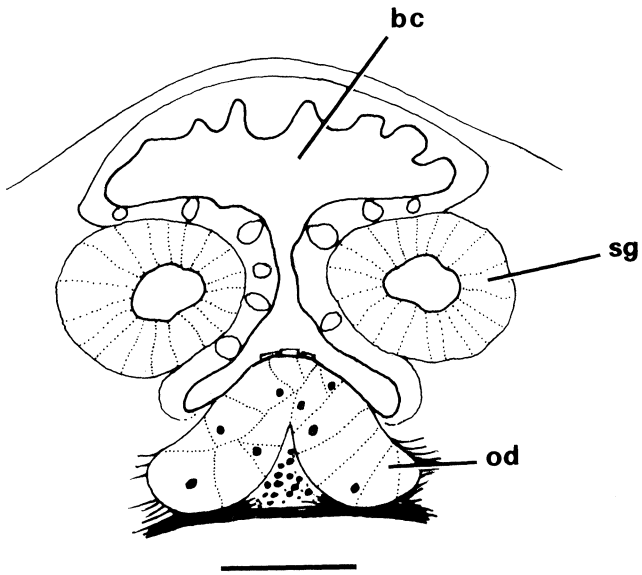

Fig. 4. A transverse section of the buccal mass. **bc,** buccal cavity; **od,** odontophoral cartilage; **sg,** salivary gland. **Scale:** 0.05mm.

The short posterior oesophagus has a simple, ciliated epithelium. There are no obvious muscle fibres in the wall of any part of the oesophagus.

The large stomach (Fig. 5) is about 0.5–0.6 mm in length and occupies the width of the visceral coil. It is divided into three parts, large posterior (pc) and anterior chambers (ac) and a very small style sac (ss). The posterior chamber is approximately circular in section and slightly longer than wide. It is lined with an irregular, approximately cuboidal, epithelium with very finely granular, pale-staining cytoplasm which contains large, clear vacuoles and irregularly placed nuclei. This chamber opens to the anterior chamber via an opening smaller than the diameter of the stomach, resulting in the two chambers being separated by a circular ridge of tissue. The lining of the anterior chamber is more typical of the gastric epithelium found in other prosobranchs. It is composed of a more regular epithelium in which the cells are, in places, elongated to form ridges/typhlosoles. Parts of this epithelium are ciliated, but most of it is not. The style sac lies at the anterior end of the stomach and is only about 0.09 mm in length. It is a small pocket lined with small cuboidal

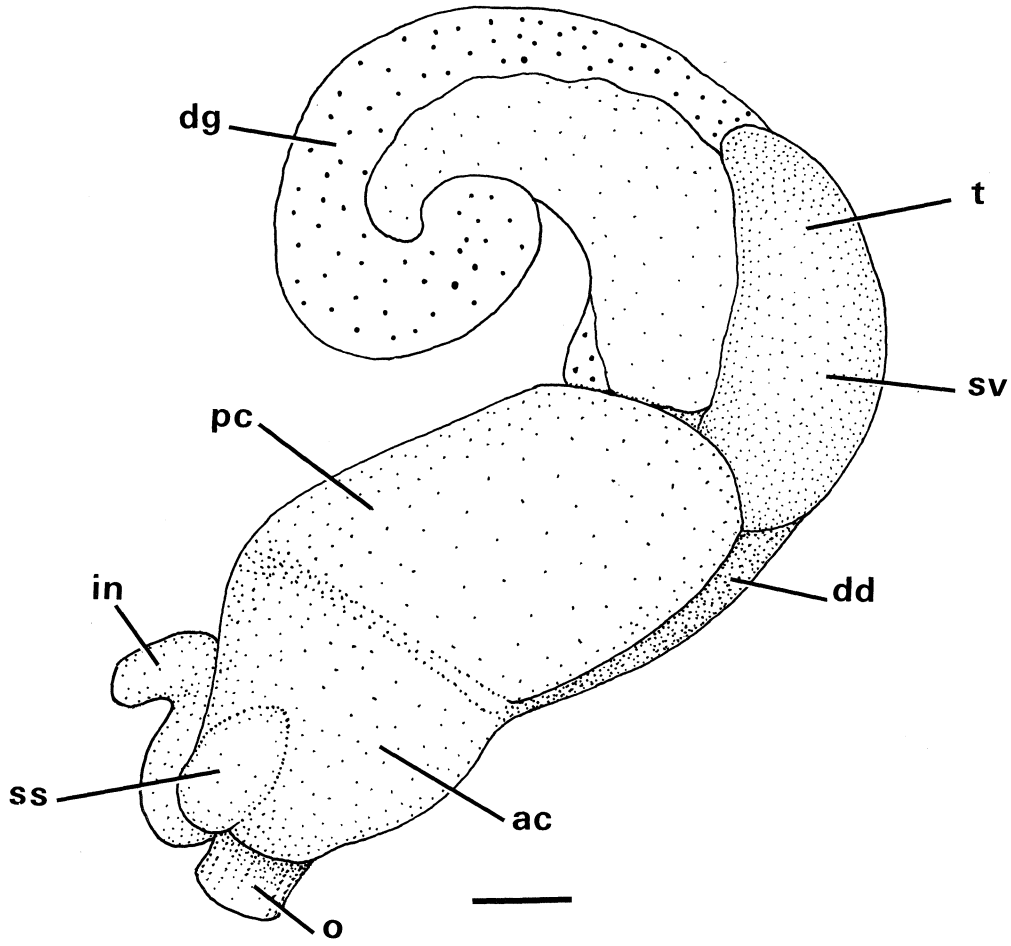

Fig. 5. The stomach and visceral coil of a male. **ac,** anterior chamber of stomach; **dd,** digestive gland duct; **dg,** digestive gland; **in,** intestine; **o,** oesophagus; **pc,** posterior chamber of stomach; **ss,** style sac; **sv,** seminal vesicle; **t,** testis. **Scale:** 0.1mm.

cells supporting conspicuous, short cilia, as is typical of the epithelium of this structure in many mesogastropods. An oval hyaline secretion lies within the style sac which may be a tiny crystalline style. The intestine opens to the proximal end of the sac, the distal end being a very short, separate bud. All of the gastric epithelium contains small numbers of tiny, dark, refringent granules. The oesophagus opens adjacent to the style sac and the long, narrow digestive gland duct (dd) opens at the junction of the two chambers.

The cytoplasm of spirally coiled foraminiferans, their tests dissolved either by the fixative or by digestive secretions, lie in both chambers and were present in all the specimens sectioned. They are up to about 0.25 mm in diameter and exist in all stages of digestion, some looking like large, ovoid amoebocytes. No other food particles are present in the stomach.

The posterior part of the posterior chamber lies alongside the anterior end of the single digestive gland tubule (dg) which forms the visceral coil, together with the gonad, behind the stomach. The digestive gland epithelium is composed mainly of columnar digestive cells up to about 0.04 mm in length, but small, triangular secretory cells, some containing dark brown spherules, are also present.

The intestine (in) is a simple tube that, after emerging from the style sac, bends at right angles to pass through the kidney parallel to the posterior end of the pallial cavity, and then enters the right pallial roof. It is lined with rather loosely packed, cuboidal cells with large vacuoles and non-staining cytoplasm that contains small numbers of refringent granules similar to those in the gastric epithelium. The intestinal epithelium adjacent to the style sac consists of larger, more irregular cells than the rest of the intestine, giving this initial section a spongy appearance in sections. The ciliated epithelium of the rectum consists of slightly smaller cells than those of the intestine, which may be cuboidal or pavement, depending on the amount of expansion of the lumen, and contain small, black pigment granules. The rectum (Fig. 3, r) forms a convoluted knot in the posterior corner of the pallial roof, the remainder undulating along the right side of the pallial roof to open well inside the pallial edge. It contains loose faecal pellets consisting mainly of minute brown to yellow granules and very occasional minute sand grains, etc. It is possible that calcareous material from the foram shells is also present in the faeces but this, like the foram tests in the stomach, would have been dissolved by the fixative.

Reproductive system. MALE: The testis (Fig. 5,t) consists of a single tubule which lies along the digestive gland and occupies nearly a whorl of the visceral coil, being about 0.43 mm in length. The testis opening is at its anterior edge where it opens to the seminal vesicle. The most conspicuous part of the seminal vesicle is a large diverticulum (sv) which lies on the outside of the testis/digestive gland, and extends behind the anterior edge of the testis for about 0.27–0.29 mm. Anteriorly the seminal vesicle continues behind the stomach as a swollen, sperm-filled tube which is about as long as the diverticulum. It then narrows to form the renal part of the vas deferens which is lined with ciliated, cuboidal cells containing black pigment granules, and enters the prostate gland just behind the posterior pallial wall. There are both typical and atypical sperm present, the atypical sperm being spherical and somewhat similar to those described in *Barleeia* (Slavoshevskaya, 1976).

The prostate gland is composed of pale, blue-staining columnar cells amongst which are scattered a few cells with red-staining granular contents. The prostate is circular in section and is embedded in the posterior-most part of the junction of the pallial roof and floor. It opens to a sperm groove in the posterior part of the pallial cavity which lies in the crease between the floor and roof of the pallial cavity. This groove passes up the neck, where its sides are raised and stronger cilia are developed, to the base of the penis. It then enters the penis where it becomes a closed penial duct. A line of fusion is, however, visible between the duct and the external epithelium.

The penis (Figs 2C; 3, p) is attached behind the right eye by a narrow base. It is as long as the pallial cavity (about 0.7 mm), approximately parallel-sided over the majority of its length, and tapers distally to a point. Almost the entire penis is enclosed in a sheath behind the hypobranchial gland (Fig. 3), with an opening on the anterior edge of the gland, and that extends to the posterior end of the pallial cavity.

FEMALE: The large, yolky eggs are up to about 0.18 mm in diameter in the only mature female sectioned. The ovary appears to consist of a single tubule and is probably shorter than the testis. The sections of this specimen are, unfortunately, not a complete series so that the description of this system is incomplete. There is a coiling upper glandular oviduct (Fig. 6, uog) composed of cells with orange-staining, granular contents. This probably opens to the blue-staining albumen gland (ag) (this connection was not actually observed because of missing sections) which, in turn, is continuous with the capsule gland (cg). This gland is composed of two sections, a posterior, mostly red-staining gland, a middle, thin-walled section and an anterior vestibule lined with goblet and ciliated cells. Most of the albumen gland and all of the capsule gland lie in the right side of the pallial roof. This pallial part of the oviduct appears to open to the pallial cavity by a terminal opening. Two immature females have most of the pallial oviduct open ventrally to the pallial cavity. No seminal receptacle or bursa copulatrix were observed but the absense of these structures is by no means certain.

Reno-pericardial system. The small kidney lies across the posterior end of the pallial cavity immediately anterior to the anterior wall of the stomach. It opens to the pallial cavity by way of a small pore that lacks any noticeable modification. A conspicuous renal gland on the outside wall of the kidney stains orange in Mallory's triple stain. The remainder of the epithelium

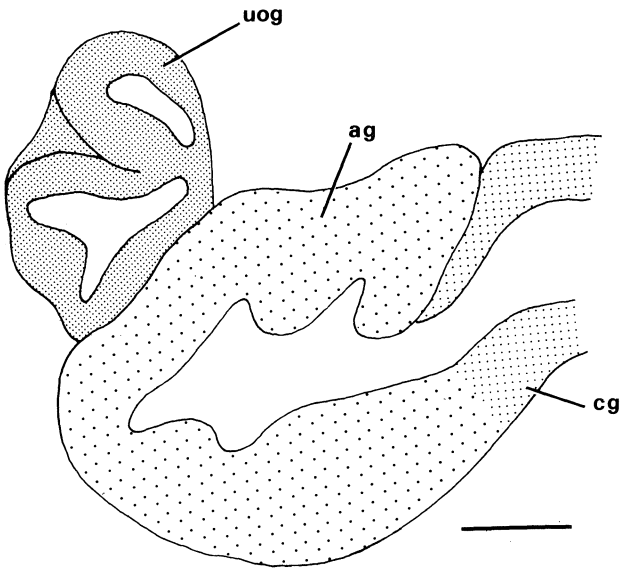

Fig. 6. Section through the upper part of the glandular oviduct. **ag,** albumen gland; **cg,** capsule gland; **uog,** upper oviduct gland. **Scale:** 0.05mm.

consists of a single layer of cells.

The small pericardium contains a typical mesogastropod heart which lies immediately behind the posterior-most ctenidial filament. A portion of the common wall between the pericardium and the kidney is very thin in both sexes, but there is no reno-pericardial duct.

Nervous system. The circum-oesophageal ganglia lie immediately behind, and partly overlie, the buccal mass. They form a concentrated ring with a very short connective (virtually abutting) between the cerebro-pleural and pedal ganglia; the cerebral ganglia abut one another as do the pedal ganglia. The oval pedal ganglia are about the same size as the cerebral ganglia and lie immediately anterior to them. They have a large (about half the length of the pedal ganglion) pair of statocysts, each containing a single statolith, partially embedded posteriorly. The pleural ganglia are markedly smaller than the cerebral ganglia (approx. ¼ of the size) to which they are fused. The suboesophageal ganglion lies immediately behind the statocyst attached to the left pedal ganglion and is about half the length of the cerebral ganglia. It is attached to the left pleural ganglion by a very short connective, so that it is virtually abutting. The supraoesophageal ganglion is about half the size of the suboesophageal ganglion and is attached by a short connective, about the same length as the ganglion.

Discussion

The main characters separating *Emblanda* from the subfamilies of the Barleeidae and the families judged to be most similar to the Barleeidae (although not necessarily closely related), are listed in Table 1. These families, the Barleeidae, Cingulopsidae, Eatoniellidae and Rissoidae, have been the subject of recent revisions and the family characters and limits are well established.

Table 1 shows that, of the characters listed, four are unique to *Emblanda* when compared with the Barleeidae (by combining the data for the two subfamilies Barleeinae and Anabathrinae). These are the triseriate radula, the narrow digestive gland duct, the penial sheath behind the hypobranchial gland and the glandular upper oviduct. This latter character alone excludes *Emblanda* from the Barleeidae, all barleeids having a simple, narrow oviduct behind the albumen gland (Ponder, 1984). It is unfortunate, however, that more details of the female genital system are not known as it seems likely that additional differences may exist.

The Rissoidae, differs in five characters. The shell of *Emblanda* resembles the rissoid genus *Merelina* and the glandular upper oviduct is an important shared character. There are, however, significant differences, apart from the penial sheath and the radula. No rissoid has an inner chitinous shell layer, a double-layered operculum or lacks jaws. Most have pallial and/or metapodial tentacles and all have a multitubular digestive gland with a wide opening to the stomach, including those that feed on forams. The Cingulopsidae and Eatoniellidae differ in 12 and 15 characters respectively.

A new suprageneric taxon appears to be justified because of the unique combination of characters, the most remarkable being the very unusual radula. There are very few examples in the Taenioglossa in which the radula is considerably modified. The conservative nature of this structure in the group is in marked contrast to the plasticity that can be observed in the Neogastropoda (Ponder, 1973) and in the Archaeogastropoda (e.g. Hickman, 1983). Warén (pers. comm.) has found considerable plasticity in the radulae of some cerithiaceans but the vast majority of this group have a normal taenioglossan radula.

The radula alone is, against this background, probably sufficient reason for giving *Emblanda* higher category status. The anatomical studies have provided strong additional evidence to support the erection of a new suprageneric taxon.

There are only a few characters known to separate *Emblanda* from the Barleeidae. Three of these are, however, judged to be of considerable importance. The glandular upper oviduct is a character that alone should exclude *Emblanda* from the Barleeidae; a similar, but probably convergent, structure occurs in the Rissoidae. A triseriate radula is known in only one other possible mesogastropod, *Turritellopsis* (Turritellidae? or possibly Mathildidae)(Sars, 1878). This genus is not, in any other way, similar to *Emblanda*. The penial sheath behind the hypobranchial gland does not appear to have been described in any other gastropod.

The evidence suggests that *Emblanda* may be derived from a barleeid ancestor but has diverged by acquiring a number of specialized characters. Some of these, the

Table 1. Comparison of selected characters of *Emblanda* with the families judged to be most similar.

	Emblandidae	Barleeinae	Anabathrinae	Cingulopsinae	Eatoniellidae	Rissoidae
Protoconch	2	2	2	1	1	1(2)
Inner chitinous Layer	1	1	1	1	1	2
Operculum	2	1	2(1)	1	1	1,2
Cephalic tentacles	2	1	3	1,2	1	2
Pallial tentacles	2	2(1)	2	2	2(1)	1,2
Metapodial tentacles	[1]	2(1)	2	2	2	1,2
Opercular lobe tentacles	2	2	2	2	1,2	2
Posterior pedal gland	2	1a	1a,2	1a	1a	1b,2
Radula	2	1	1	1	1	1
Jaws	2	1,2	1,2	2	1	1
Salivary glands	2	2	2	1	1	2
Oesophagus	2	2(1)	2	1	1	2
Stomach	2	2	2	1	1	2
Digestive gland duct	2	1	1	1	1	1
Prostate gland	2	2(1)	2	2	1	2(1)
Pallial vas deferens	1	2(1)	2	2	1	2(1)
Penis	2b	2a	2a	1	1	2a
Upper oviduct gland	2	1	1	1	1	2
Pallial oviduct	2?	2	2	2	1	2(1)

Numbers enclosed in brackets are states rarely encountered, those enclosed in square brackets are weakly developed. The character states are arranged with that state judged to be the most primitive (within the families being considered) first. I have discussed in detail these characters and their states elsewhere (Ponder, 1984, 1985).

Character states used in Table 1 follows. Information is mostly from: Barleeidae (Ponder, 1984), Cingulopsidae (Fretter & Patil, 1958 and Ponder, 1968), Eatoniellidae (Ponder, 1968), Rissoidae (Ponder, 1985).

Protoconch: 1, smooth or with raised sculpture; 2, punctate. **Inner chitinous layer:** 1, present; 2, absent. **Operculum:** 1, with peg on inner surface; 2, lacking peg. **Cephalic tentacles:** 1, tapering; 2, parallel-sided; 3, paddle-shaped. **Pallial tentacle(s):** 1, present; 2, absent. **Metapodial tentacle(s):** 1, present; 2, absent. **Opercular lobe tentacle(s):** 1, present; 2, absent. **Posterior pedal gland:** 1, present; la, with groove to posterior end of foot; 1b, without groove to posterior end of foot; 2, absent. **Radula:** 1, taenioglossate; 2, triserial. **Jaws:** 1, present; 2, absent. **Salivary glands:** 1, glands or their ducts pass through nerve ring; 2, glands or their ducts do not pass through nerve ring. **Oesophagus:** 1, with oesophageal gland or pouches; 2, without gland or pouches. **Stomach:** 1, without crystalline style; 2, with crystalline style. **Digestive gland duct:** 1, wide opening to stomach; 2, long and narrow. **Prostate gland:** 1, open; 2 closed. **Penis:** 1, absent; 2, present; 2a, housed in mantle cavity; 2b, housed in sheath behind hypobranchial gland. **Upper oviduct gland:** 1, absent; 2, present. **Pallial oviduct:** 1, open along most of length; 2, terminal opening only.

features of the alimentary canal including, possibly, the radula, may be associated with feeding on foraminiferans. *Rissoina chathamensis* (Hutton) (Ponder, 1968) feeds on foraminiferans and, like *Emblanda*, has a long posterior chamber and a relatively small style sac. The rest of the alimentary canal, including the radula, is, however, like that of other Rissoidae. The characters of the reproductive system are clearly not related to the feeding specialization and provide important supporting evidence of the morphological separation of *Emblanda* from the Barleeidae.

A new family-level taxon within the Rissoacea appears to be justified and a new family Emblandidae is proposed and diagnosed below.

EMBLANDIDAE n.fam.

Diagnosis. *Shell.* Minute (up to about 2 mm in length), ovate-conic, solid, non-umbilicate, with axial and spiral ribs. Protoconch paucispiral, dome-shaped, first half whorl deviated, very minutely and irregularly pitted. Aperture subcircular (separated from parietal wall in only known species), peristome entire, duplicated, lacking distinct notches. Outer lip with varix.

Operculum. Oval, simple, thin, composed of two layers, with eccentric nucleus, last whorl large.

Radula. Triseriate, cusps small, equal-sized, numerous.

Head-foot. Cephalic tentacles long, parallel-sided, ciliated. Snout long, rather narrow, bilobed distally.

Foot simple, with approximately straight anterior edge, rounded behind and with elongate, narrow anterior pedal gland opening beneath propodium. Propodium much narrower than anterior edge of foot and placed behind it. No pallial tentacles. Rudimentary metapodial tentacle.

Anatomy. Osphradium large, surrounded by cilated ridges; ctenidium vestigial to small. Hypobranchial gland massive, occupying most of pallial roof and with a sheath behind to accommodate penis in males.

Jaws absent, odontophore (and radula) much reduced, salivary glands paired, contained within ventro-lateral buccal folds and, therefore, terminate anterior to cerebral ganglia and never dorsal to posterior buccal mass. Anterior oesophagus about equal in width to buccal cavity, mid-oesophagus simple. Stomach with very small style sac (containing style) into which intestine opens; posterior chamber longer than anterior chamber and histologically distinct. Digestive gland a single tubule, opening to stomach at junction of anterior and posterior chambers by way of long, narrow duct.

Male with long penis attached to head behind right eye and held in sheath behind hypobranchial gland. Penial duct closed but pallial vas deferens an open, ciliated groove. Prostate gland small, closed, in posterior pallial wall. Seminal vesicle with diverticulum. Female with coiled glandular duct posterior to albumen gland. Albumen and capsule glands continuous, closed ventrally when mature, open when immature.

Genus *Emblanda* Iredale, 1955.

Type-species. *Rissoa emblematica* Hedley, 1906; original designation.

Diagnosis. As for family.

Emblanda emblematica (Hedley, 1906)

Rissoa emblematica Hedley, 1906:526, pl.32, fig.24 (type locality: Manly Beach, Sydney, New South Wales). —
Anabathron emblematicum.—Iredale, 1924:244; Cotton, 1944:312 (in part); Laseron, 1950:276, fig. 59.
Emblanda emblematica. — Iredale, 1955:81; Laseron, 1956: 445, fig.160.

Material examined. Holotype and 58 lots in the Australian Museum.

Distribution. Port Curtis, Queensland to Mallacoota, eastern Victoria. Found living in the lower littoral and shallow sublittoral zones amongst short algae.

Remarks. The shell of this species is very distinctive and there are no similar Australian species. Nor are any species known from other parts of the world that could be considered to be related. Virtually all of the available material on which the above records are based are empty shells. Such shells are rather rare in samples of 'shell sand' suggesting that the lack of success in finding numbers of this species alive may not be because the most favoured habitat has yet to be discovered.

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References

Cotton, B.C., 1944. Recent Australian species of Rissoidae. Transactions of the Royal Society of South Australia 68: 286–314.

Fretter, V. & A.M.Patil, 1958. A revision of the systematic position of the prosobranch gastropod *Cingulopsis* (=*Cingula*) *fulgida* (J.Adams). Proceedings of the Malacological Society of London 33: 114–126.

Hedley, C., 1906. Studies on Australian Mollusca. Part 9. Proceedings of the Linnean Society of New South Wales 30: 520–546.

Hickman, C. S., 1983. Radular patterns, systematics, diversity, and ecology of deep-sea limpets. The Veliger 26: 73–92.

Iredale, T., 1924. Results from Roy Bell's molluscan collections. Proceedings of the Linnean Society of New South Wales 49: 179–278.

————1955. Rissoid sectional names. Proceedings of the Royal Zoological Society of New South Wales 1953–54: 81.

Laseron, C.F., 1950. Review of the Rissoidae of New South Wales. Records of the Australian Museum 22: 257–287.

————1956. The families Rissoinidae and Rissoidae (Mollusca) from the Solanderian and Dampierian Zoogeographical Provinces. Australian Journal of Marine and Freshwater Research 7: 384–484.

Ponder, W.F., 1968. The morphology of some small New Zealand prosobranchs. Records of the Dominion Museum, Wellington 6: 61–95.

————1973. The origin and evolution of the Neogastropoda. Malacologia 12: 295–338.

————1984. Review of the genera of the Barleeidae (Mollusca: Gastropoda: Rissoacea). Records of the Australian Museum 35: 231–281.

————1985. A review of the genera of the Rissoidae (Mollusca: Mesogastropoda: Rissoacea). Records of the Australian Museum (1984), Supplement 4: 1–221.

Ponder, W.F. & E.K. Yoo, 1976. A revision of the Australian and Tropical Indo-Pacific Tertiary and Recent species of *Pisinna* (=*Estea*) (Mollusca: Gastropoda: Rissoidae). Records of the Australian Museum 30: 150–247.

Sars, G.O., 1878. Mollusca regionis Articae Norvegiae. Bidrag til Kundskaben om Norges Arktiske fauna 1: i-xiii,1–466, pls 1– 34, i-xviii.

Slavoshevskaya, L.V., 1976. Organisation of *Ansola angustata* (Pilsbry) (Gastropoda, Prosobranchia) from the Sea of Japan. Biologiya Morya 3: 34–41 (in Russian).

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