A BROODING ECHINOID FROM TASMANIA

ALAN J. DARTNALL
The Tasmanian Museum, Hobart, Tasmania

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Synopsis

A brooding species of echinoid which belongs to the genus *Pachycentrotus* is described. It is of interest because only one other non-cidaroid, regular urchin is known to brood its young. The species is also endemic to the Maugean marine fauna of south-eastern Tasmania.

INTRODUCTION

The sea urchin genus *Pachycentrotus* was erected by H. L. Clark (1912) to accommodate *Sphaerechinus australiae* A. Agassiz. The genus is restricted to the waters of south and south-eastern Australia and, hitherto, was considered to contain only the one species. A further species considered to belong to the genus is described below.

Family STRONGYLOCENTROTIDAE

Genus *Pachycentrotus* H. L. Clark, 1912

Pachycentrotus bajulus sp. nov.

Description of Holotype

A small echinoid with a slightly depressed test ; *hd.*=33 mm., *vd.*=21 mm. The diameter of the apical system is 10·6% *hd.* and the diameter of the peristome is 30% *hd.* Viewed from above the test looks like a rounded pentagon because the ambulacral areas are slightly inflated and project beyond the level of the interambulacra.

There are 22–23 plates in each column of the ambulacra. Each plate carries a large, centrally placed primary tubercle which increases in size from the apical system to about the eighteenth plate and then becomes smaller as the ambulacra approach the peristome. Two other tubercles are distinct features of the ambulacral plates (Fig. 1 (*b*)). Firstly, one tubercle is set on the lateral apex of the ambulacral edge of the plate, and secondly, a tubercle is situated beside and below the large primary tubercle and between that tubercle and the poriferous area of the plate. Other small tubercles are present on the ambulacral plates, two or three being present on the plates near the apical system and about sixteen on the largest ambulacral plates. Most of the ambulacral plates are perforated by four pairs of pores arranged in an arc of three pore-pairs on the outside edge with the extra pair placed towards and below the primary tubercle of each plate. Towards the periproct and peristome only three pairs of pores are present, two at the edge and one inset. On preliminary examination it appears that the pore-pairs are arranged in arcs of three or four because the inner pair of pores of the preceding plate is aligned with the outer pore-pairs of the following plate.

There are 18–19 plates in each column of the interambulacra. Each inter-ambulacral plate carries a large primary tubercle towards the lower edge of the plate (Fig. 1 (*a*)). The arrangement of smaller primary and secondary tubercles is also shown in the figure. The tubercles on the test are all smooth and imperforate.

The apical system of the holotype is illustrated in Fig. 2. The genital and ocular plates each carry a large primary tubercle similar to those found on the ambulacral and interambulacral plates. Ocular plates II and III are exsert,

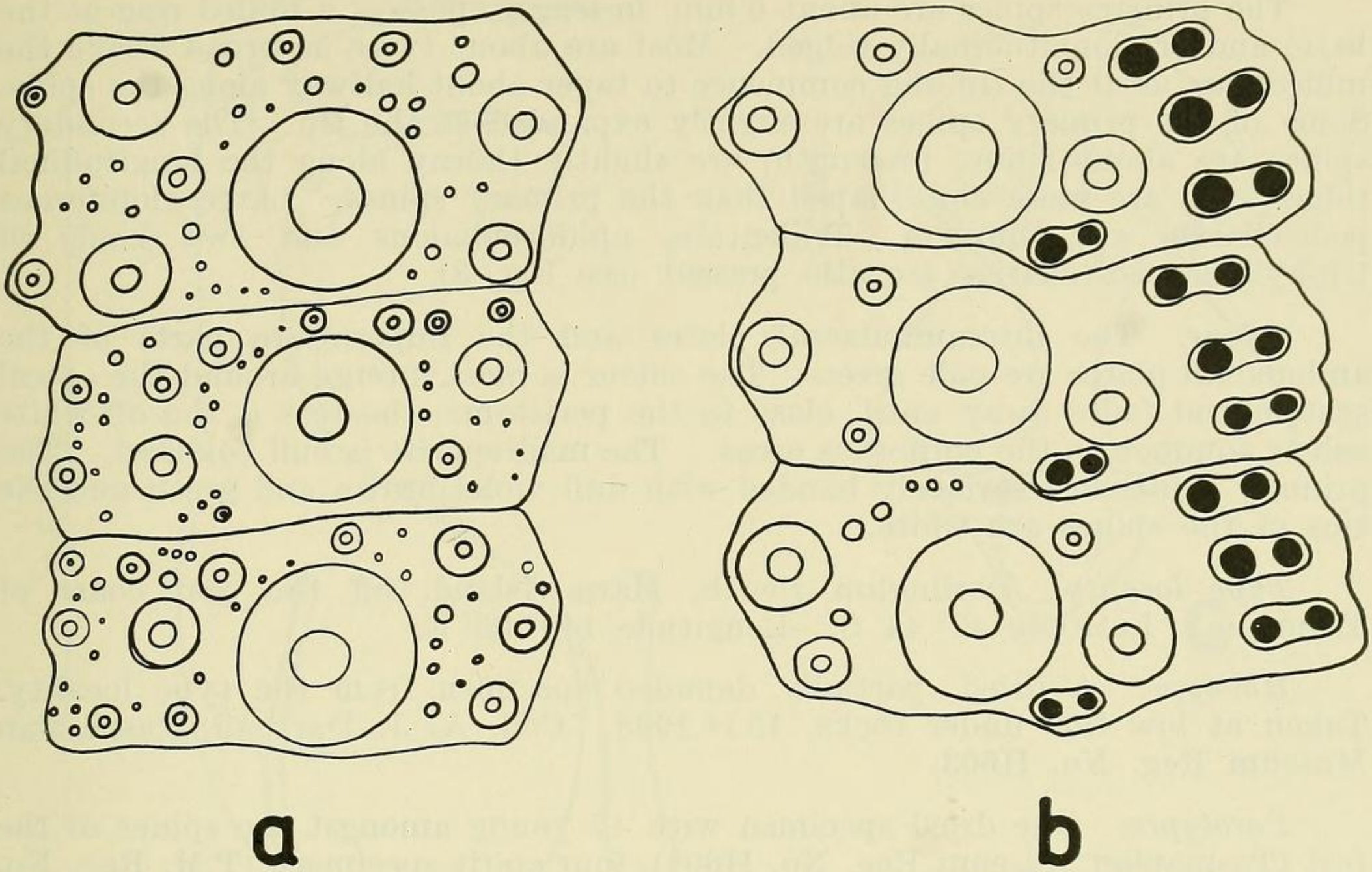


Fig. 1. *Pachycentrotus bajulus* sp. nov. (*a*) Interambulacral plates 6–8 from apical system. (*b*) Ambulacral plates 6–8 from apical system.

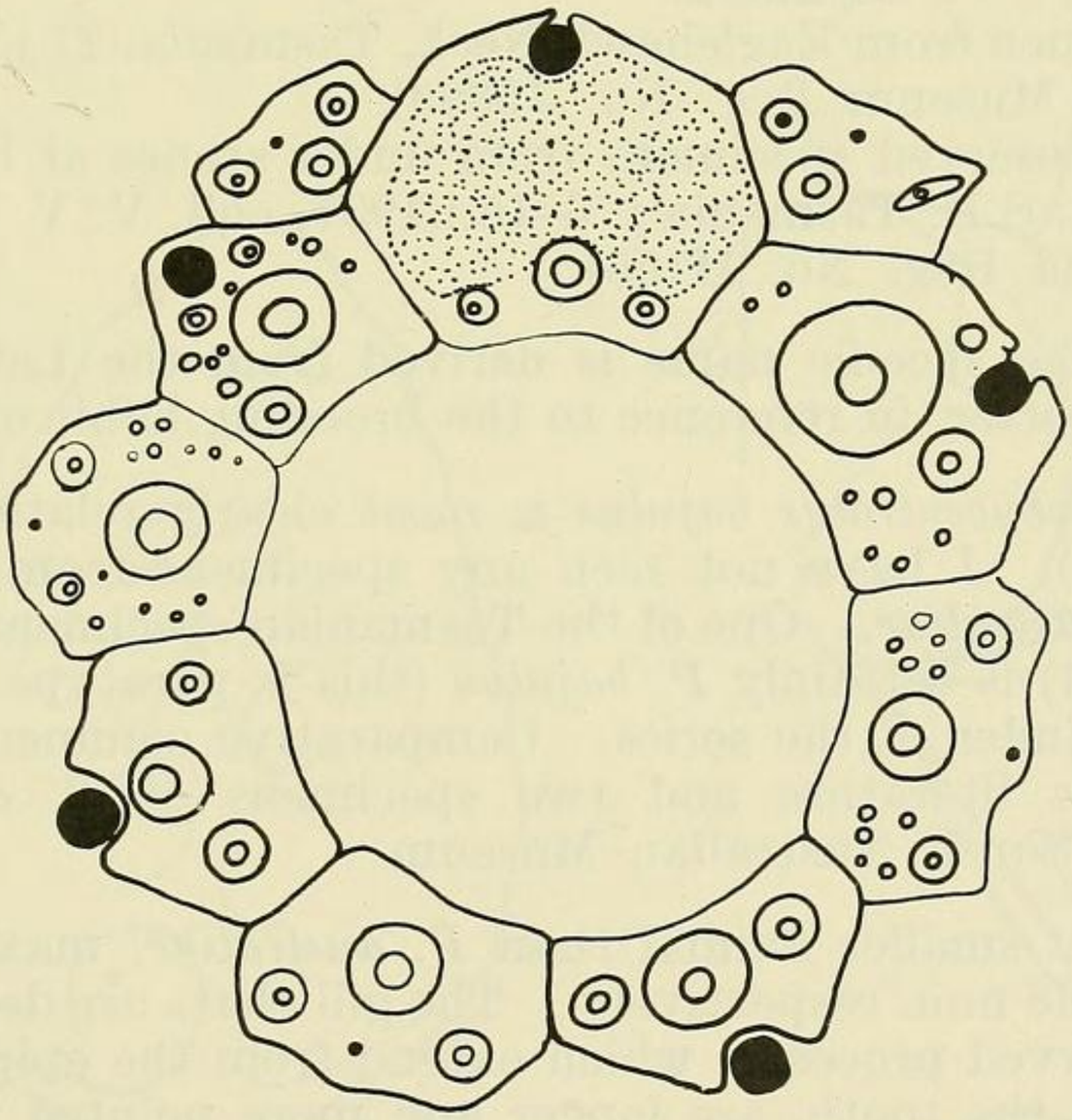


Fig. 2. *Pachycentrotus bajulus* sp. nov. Genital and ocular plates.

the remainder insert. The madreporite occupies most of genital plate II and is inflated, projecting above the level of the other ocular plates. In the holotype the periproctal plates are lost. About a dozen, irregularly arranged, imbricate plates are present in a denuded specimen of 20 mm. *hd.* The anus is situated to one side of the periproct.

The peristomial membrane carries numerous small slightly imbricating plates and ten ovoid, perforate plates for passage of the buccal tube feet. Small open gill slits are present at the perimeter of the peristome.

The primary spines are about 6 mm. in length, possess a milled ring at the base, and are longitudinally ridged. Most are about twice as broad above the milled ring as at the tip and commence to taper about halfway along the spine. Some of the primary spines are slightly expanded at the tip. The secondary spines are about 2 mm. in length, are slightly thorny along the longitudinal ridges, and are more club-shaped than the primary spines. Large globiferous pedicellariae are common. Tridentate, ophiocephalous and two kinds of triphyllous pedicellariae are also present (see Fig. 3).

Colour. The interambulacral plates and the imperforate parts of the ambulacral plates are pale green. The colour is most intense around the apical system and fades away until, close to the peristome, the test is the off-white colour common to the poriferous areas. The madreporite is buff coloured. The primary spines are variously banded with dull violet-brown and green and the tips of the spines are white.

Type locality. Darlington Beach, Maria Island, off the east coast of Tasmania. Latitude 42° 44′ S. Longitude 149° 05′ E.

Holotype. A dried, partially denuded specimen from the type locality. Taken at low tide under rocks, 15.iv.1968. Coll. A. J. Dartnall, Tasmanian Museum Reg. No. H603.

Paratypes. One dried specimen with 17 young amongst the spines of the test (Tasmanian Museum Reg. No. H604), four spirit specimens (T.M. Reg. No. H605), and three spirit specimens (Australian Museum Reg. No. J7801). All taken from under stones at low tide. February, 1948, Eaglehawk Neck, S.E. Tasmania. Coll. V. V. Hickman.

One dry specimen from Eaglehawk Neck, Tasmania, 27.i.1928, coll. W. Irwin Smith (Australian Museum Reg. No. J6393).

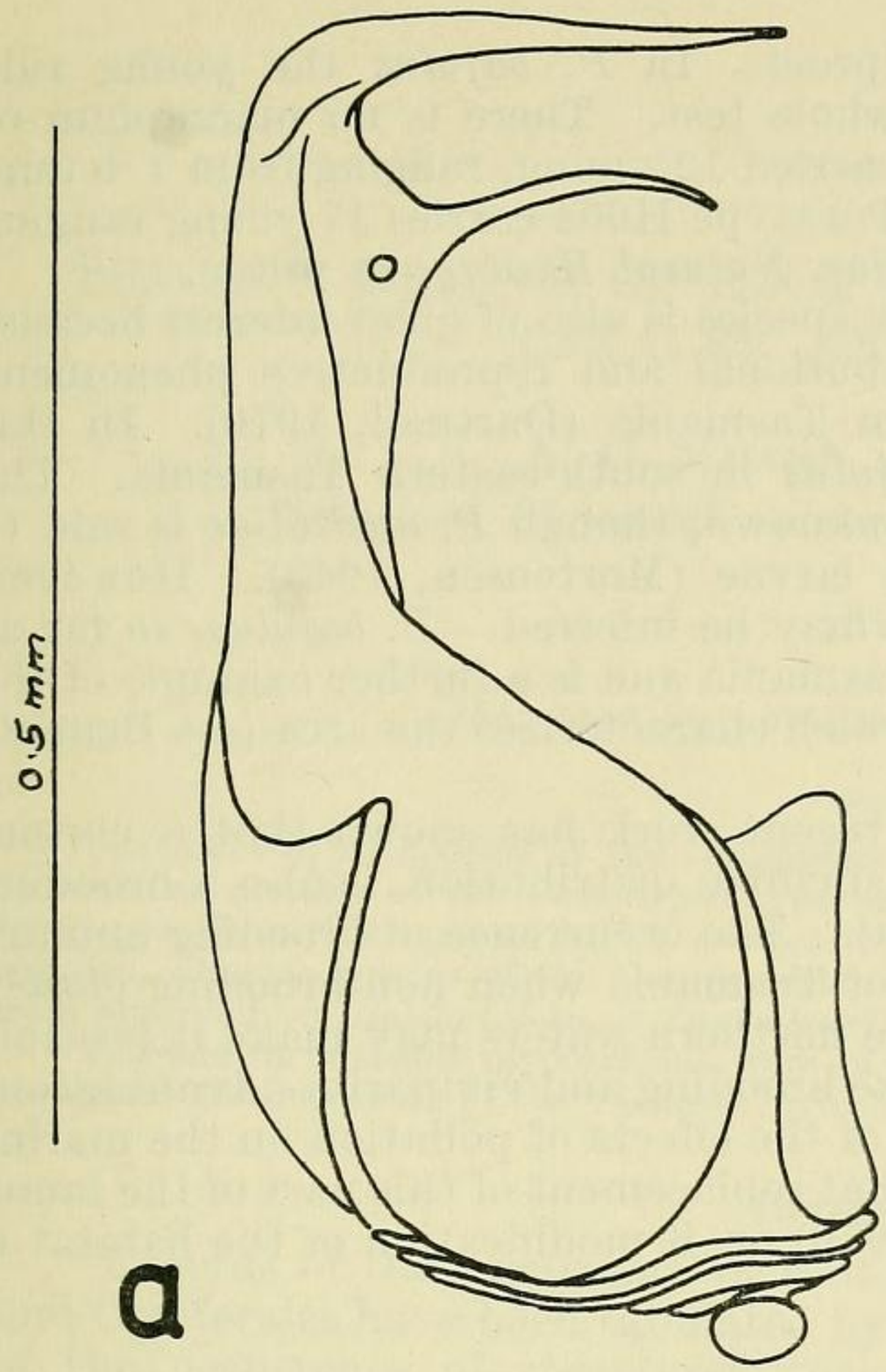
Three spirit-preserved specimens from under stones at low tide, Adventure Bay, Bruny Island, S.E. Tasmania ; 6–15.i.1937, coll. V. V. Hickman (National Museum of Victoria Reg. No. H155).

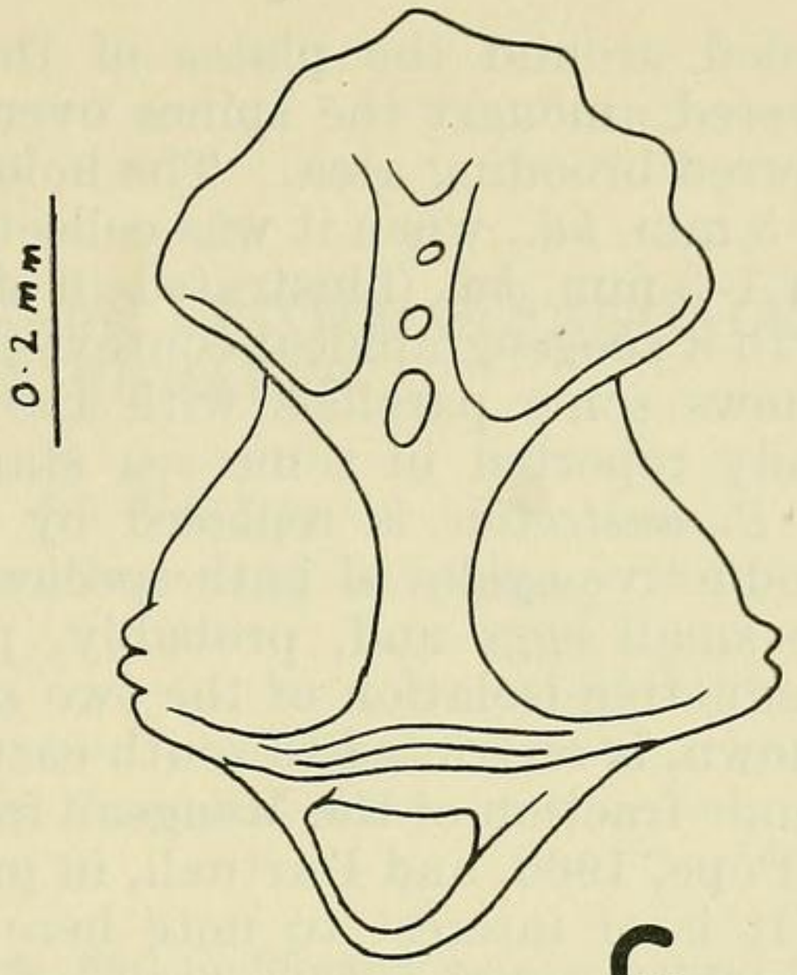
Etymology. The specific name is derived from the Latin masculine noun *bajulus*, meaning porter, in reference to the brooding habit of the animal.

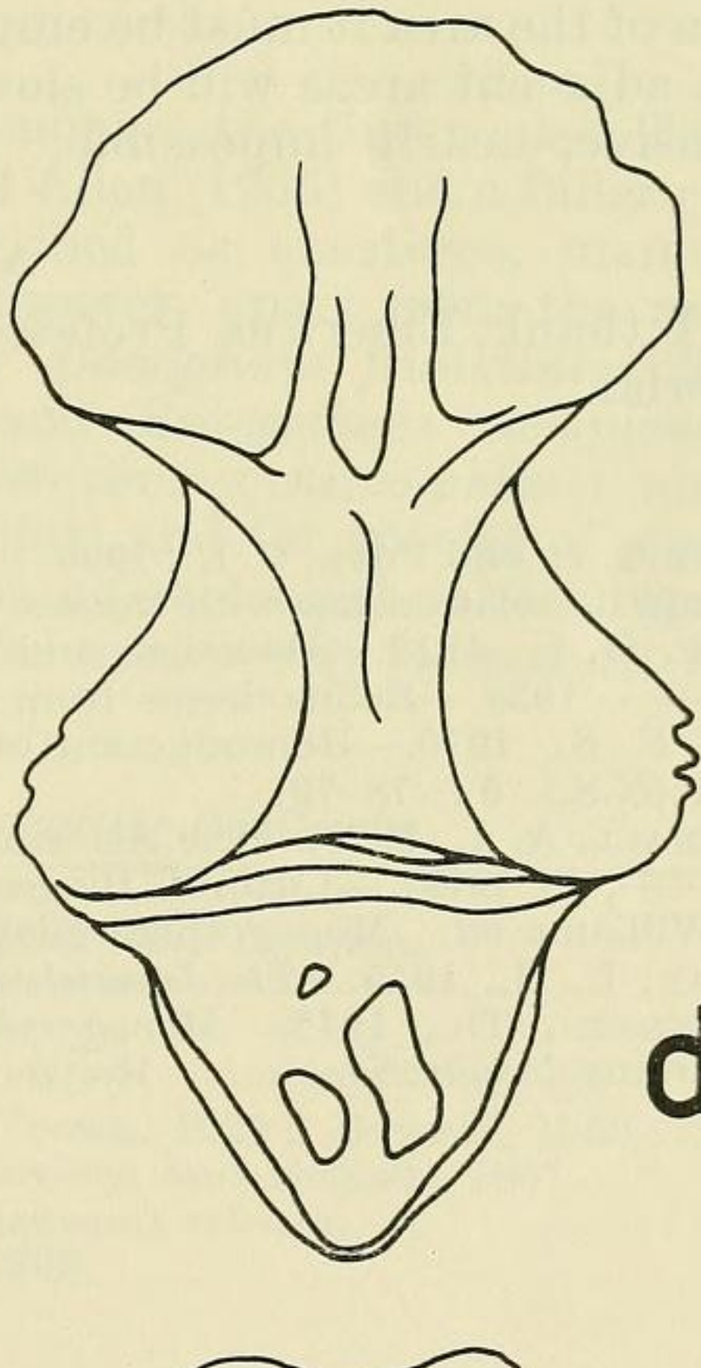
Affinities. Pachycentrotus bajulus is most clearly related to *Pachycentrotus australiae* (Agassiz). I have not seen any specimens from Tasmania which I would refer to *P. australiae*. One of the Tasmanian specimens described by H. L. Clark (1938, p. 404) is certainly *P. bajulus* (this is paratype J6393), but I have not seen the remainder of the series. Comparative comments here rest on the information in the literature and two specimens of *P. australiae* from the collections of the South Australian Museum.

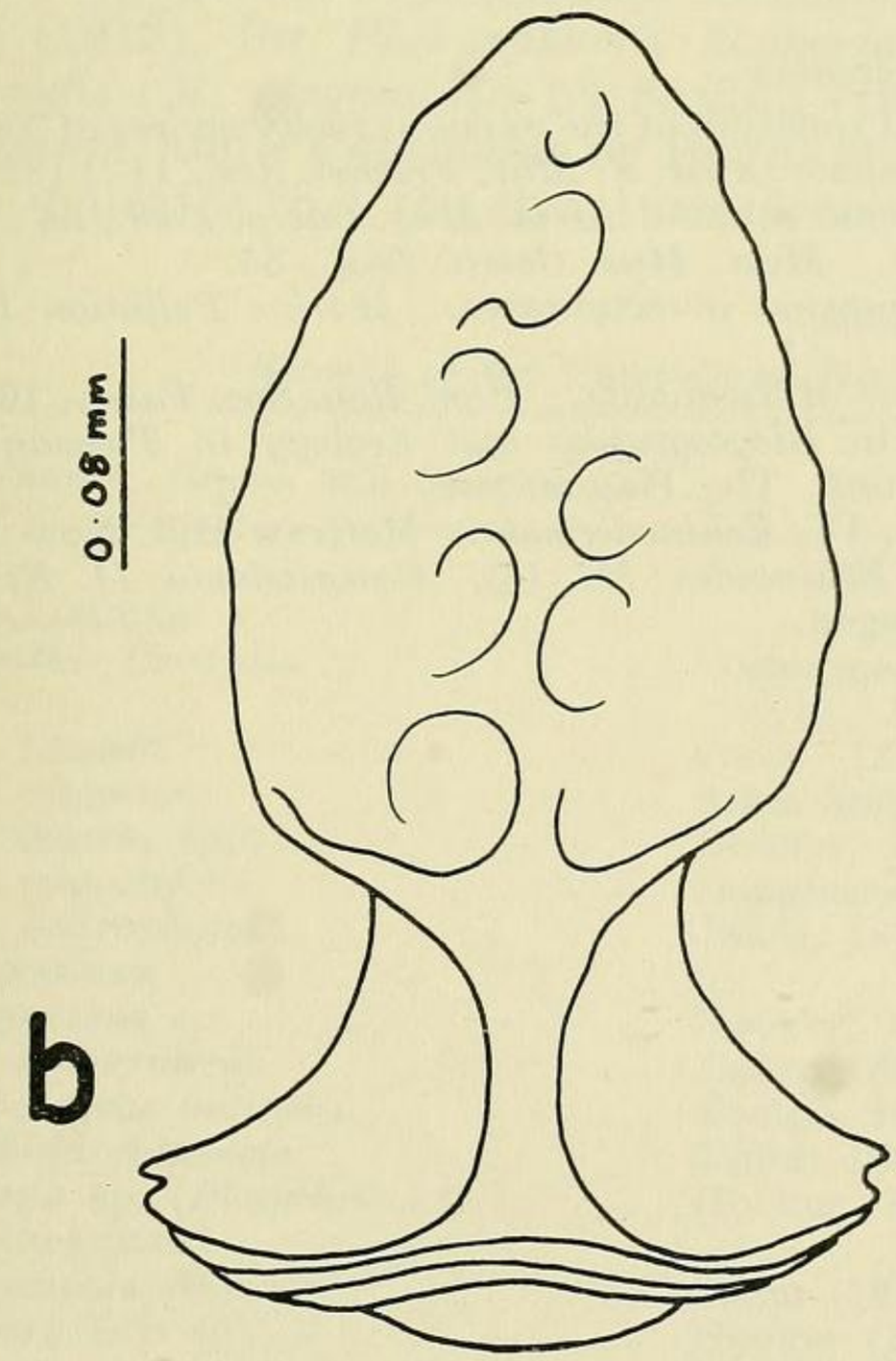
P. bajulus is a smaller animal than *P. australiae*, maximum recorded *hd.* being 33 mm. and 38 mm. respectively. The gill clefts are deeper in *P. australiae* and the pair of curved processes which extend from the epiphyses of Aristotle's lantern and retain the tooth, are longer and more pointed in *P. bajulus*. The interambulacral plates of *P. australiae* carry more spines than those of the new species and the large, primary boss characteristic of *P. bajulus* is not present in that species. The globiferous pedicellariae of *P. bajulus* have deeper shoulders with more acute corners than those of *P. australiae* and the palms of the triphyllous pedicellariae are more expanded in the new species.

Remarks. Pachycentrotus bajulus is the only non-cidaroid, regular urchin from Australia known to brood its young. The only other echinoid in this category is *Hypsiechinus coronatus* (family Temnopleuridae), which is limited to the far northern North Atlantic (Hyman, 1955). In *H. coronatus* the young are









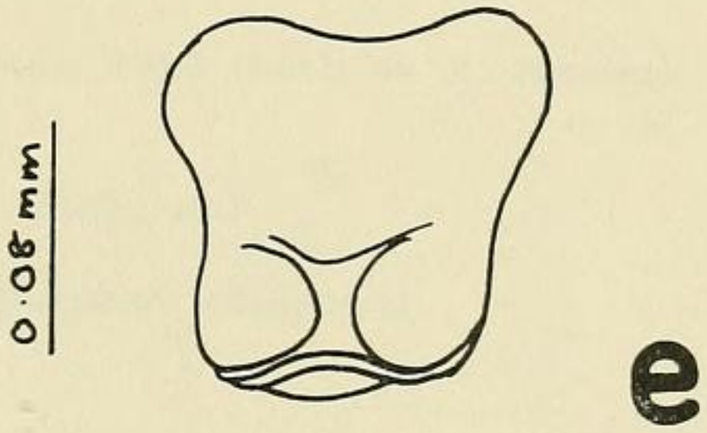


Fig. 3. *Pachycentrotus bajulus* sp. nov. (*a*) Jaw of globiferous pedicellaria. (*b*) Jaw of tridentate pedicellaria. (*c*) Jaw of small triphyllous pedicellaria. (*d*) Jaw of large triphyllous pedicellaria. (*e*) Jaw of ophiocephalous pedicellaria.

brooded around the plates of the periproct. In *P. bajulus* the young ride scattered amongst the spines over the whole test. There is no marsupium or preferred brooding area. The holotype carried 12 young, ranging from 1·5 mm. to 5·5 mm. *hd.*, when it was collected. Paratype H604 carries 17 young ranging from 1–3 mm. *hd.* (illustrated in *Australian Natural History*, in press).

In a zoogeographical context the new species is also of great interest because it shows some parallels with the distributional and reproductive phenomena already reported in some sea stars from Tasmania (Dartnall, 1970). In this case *P. australiae* is replaced by *P. bajulus* in south-eastern Tasmania. The reproductive cycles of both species are unknown, though *P. australiae* is said to have small eggs and, probably, pelagic larvae (Mortensen, 1943). However, reproductive isolation of the two species may be inferred. *P. bajulus*, so far as is known, is restricted to south-eastern Tasmania and is a further example of the endemic fraction of the Maugean fauna which characterizes the area (see Bennett and Pope, 1960, and Dartnall, in press).

It is of interest to note here that recent work has shown that a chiton, *Ischnochiton mayi*, with a similar S.E. Tasmanian distribution, is also a brooding form (E. Turner, personal communication). The occurrence of brooding animals in the shallow water fauna of the south of Tasmania when non-brooding closely related species are found in warmer, more northern waters may make it possible to elucidate some of the factors which make brooding and viviparity advantageous in a habitat. Also, in any consideration of the effects of pollution on the marine fauna of the area it must be emphasized that replacement of this part of the fauna from adjacent areas will be slow (Chia, 1970) or, if modification of the habitat is extensive, nearly impossible.

Acknowledgements

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