



On a small collection of  
**Hawaiian Brachiopoda (Lophophorata).**

by  
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All photographs by Wes Thorsson.

Recently Wes Thorsson most kindly donated 35 samples of Brachiopoda from Hawaii to me. The only condition that came with the generous donation of this material is that I was expected to compose a short article on the subject for Internet HSN, which I hereby present with pleasure.

The 35 samples were collected over a period of ten years, from 1980 to 1989. Most were dredged (from Wes' own boat and that of Tom Burch), some obtained by snorkeling or SCUBA diving. Although a substantial amount of information on Hawaiian brachiopods is available from literature, most of it is scattered over a wide range of scientific magazines. For as far as I know, no

monographic work has yet been published on this interesting group of animals from Hawaii.

### **Introduction to the Brachiopoda**

Most shell collectors will probably have heard of brachiopods, or lampshells, but a brief introduction is probably desired. The Brachiopoda are animals, which, at first glance, bear a close resemblance to bivalve molluscs. Actually, the first extant brachiopods to be described, by Linnaeus in 1758, were included under the genus name *Anomia*. During the 18<sup>th</sup> century and early 19<sup>th</sup> century most people working on the group were conchologists like Broderip, Reeve and the Sowerbys. William Henry Dall, an eminent American malacologist, also remained interested in the group during his entire productive life.

The resemblance to bivalves is only superficial. Where bivalves carry a left and a right valve, brachiopods carry a dorsal and a ventral valve. There are two types of brachiopods, the Inarticulata and the Articulata. The Inarticulata are the most primitive brachiopods, which lack a

## Brachiopods Continued

hinge. Furthermore, the chemical composition of the shells differs from that of the articulates. The Inarticulata are represented in Hawaii by several species, of which the best known is *Lingula reeveii* Davidson, 1880. No inarticulate brachiopods were found among the material donated by Wes Thorsson. The Articulata are the more advanced group, characterized by shells that have a hinge. Furthermore, this group carries an internal structure, which supports the lophophore, an organ that serves as a respiratory and feeding organ. The internal structure consists of two simple prongs (each named crura, plur. crus) in the most primitive articulate brachiopods to a very complexly formed one. Structures ranging from a horseshoe-shaped to more complex are named the loop or brachidium. The lophophore and supporting structure are found in the dorsal or brachial valve. The other valve, which is named the ventral or pedicle valve, usually the larger one, within most articulates carries an opening (named foramen) for an organ named the pedicle. With this organ, the animal is anchored to the substrate. An exception to this type of attachment is formed by members of the families Thecideidae and Thecidellinidae, of which the ventral valves are cemented to the substrate and lack a foramen.

An excellent introduction to the Brachiopoda (morphology, anatomy, biogeography, terminology, etc.) can be

found in Kaesler (1997).

At present, between 300 and 400 recent brachiopods are currently recognized, depending on who counts: a “lumper” or a “splitter”. Many genera are in need of a thorough revision, as they contain species that are hardly separable. A generous measure of over-splitting has been applied to brachiopod taxonomy, which is probably due to the simple fact that most brachiopodologists are originally paleontologists who handle a type of species concept that differentiates between populations rather than species. Only very few species are known to occur intertidally, most live on the continental slopes, several only occur in abyssal depths. A substantial percentage of the recognized extant taxa is only represented by type material in scientific collections. Brachiopods are almost never a dominant factor within any habitat, except at high latitudes in the southern hemisphere. The Indo-Pacific marine fauna province, and Hawaii is no exception, is not very rich in species and population densities are usually low.

The Brachiopoda were formerly considered a separate phylum but recent phylogenetic studies have pointed out that a grouping with the Phoronida (horseshoe worms) and probably (part of) the Ectoprocta under the phylum named Lophophorata is more appropriate.

**Hawaiian Brachiopoda**

In the material donated by Wes Thorsson, six species were found, which are discussed hereunder:

1. *Basiliola beecheri* (Dall, 1895). [family Basiliolidae] A single ventral valve, from the Molokai-Maui Channel, of this species was found among the material. The species belongs to the superfamily Rhynchonelloidea, which are the most primitive living articulate brachiopods, with most species living in deep water to abyssal depths. The dorsal valves in this group only carry two simple prongs (the crus), instead of a loop. Although a ventral valve is usually insufficient for positive identifications, this valve shows all the characters known for the species (general shell outline, prominent pedicle collar, and shape of foramen). The species was originally



*Basiliola beecheri* (Dall, 1895)

Photo 465-15. Top valve exterior

Photo 465-16. Lower Valve Interior.



↑ *Basiliola beecheri* (Dall, 1895)

Photo 465-17. Lower valve Foramen which holds the pedicale

described from Hawaii.  
Depth range: 219-237 m (single dredge haul).

2. *Frenulina sanguinolenta* (Gmelin, 1791). [family Laqueidae]

## Brachiopods Continued

This species was also previously reported from Hawaii and belongs to the most common Indo-West Pacific articulate brachiopods. It is always associated with coral reefs and may even be found in very shallow water. It usually is streaked with bright red but solid white morphs are also reported. The dense punctation, the shape of the loop and the shape of the foramen characterize the species. This is the commonest species among Wes Thorsson's material, represented by 15 samples, 14 from Maui, one from Kauai. Depth range: 16-274 m.

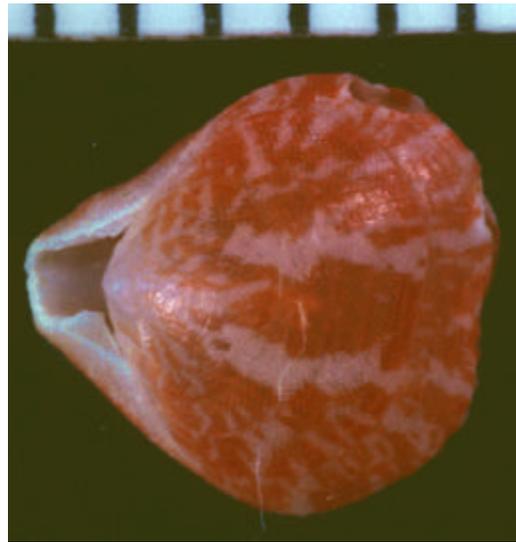


Photo 465-9  Both valves

*Frenulina sanguinolenta*  
(Gmelin, 1791).

Photo 465-8 Bottom valve 



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### 3. *Frenulina cf. mauiensis* Dall, 1920. [family Laqueidae] (photographs BR-11)

This species was described by Dall (1920: 338) from Hawaii but the original diagnosis was unfortunately not accompanied by figures. The original diagnosis reads: "Shell large for the genus, pale brown, medially slightly compressed, moderately convex; valves sculptured only with concentric growth lines at wide intervals, and a

## Brachiopods Continued

very obvious minute and dense punctuation; pedicle valve with rather elevated and incurved beak, the foramen entire, the deltidia more or less coarsely wrinkled and seemingly not meeting but united by an irregular plug between their proximal edges; hinge teeth strong and close together with props in the younger shells which are solidly cemented to the wall of the shell in the adult; no traces of any medial ridge or septum; the anterior margins of the valves pinched together medially but not perceptibly folded; brachial valve less convex, cardinal plate solidly united over the septum, excavated in the middle, with strong dental sockets and no cardinal process, the septum thin, high and short, not extending beyond the middle of the valve distally; crura short, widely triangular; the lower limbs of the loop of almost hair-like tenuity, the reflected limb broad behind; height of shell 22; breadth 21; diameter 10 mm.”. Type material of this species is kept in the United States National Museum.

Among Wes Thorsson's material, a single ventral valve, from Oahu, was found which may well be this species. It agrees fairly well with Dall's description of the ventral valve but positive identification awaits additional material.

Depth range: 219-265 m (single dredge haul).

4. Unidentifiable species [family Terebratulidae?] (photographs BR-12)  
A single ventral valve, from Oahu, of a species was found that could not

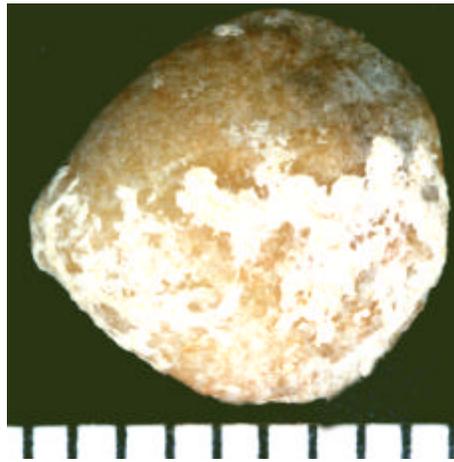


Photo 466-17.  Bottom valve exterior  
*Frenulina* cf. *mauiensis* Dall, 1920.

Photo 466-19.  Bottom valve interior

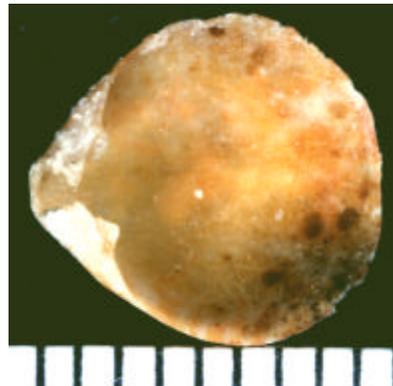


Photo 466-21 Botom valve foramen   
*Frenulina* cf. *mauiensis* Dall, 1920.

Brachiopods Continued

positively be identified. The ventral valve lacks the diagnostic characters (loop and muscle impressions) needed to identify a species in this group on genus or species level. The characters of the valve, however, are suggestive of the family Terebratulidae, which have a simple, horseshoe-shaped loop in the dorsal valve. The valve may belong to *Gryphus tokionis* Dall, 1920, which was originally described from Japan, but this is a guess rather than a positive identification.

Positive identification awaits more and better-preserved material.

Depth range: 274-320 m (single dredge haul).

5. *Thecidellina* sp. 1 [family Thecidellinidae] (photographs Stony-465)

Wes Thorsson, in his correspondence with me, described this and the following



Photo 466-22. ↑ Lower (only) valve exterior  
Possibly *Gryphus tokionis* Dall, 1920  
Photo 466-23. ↓ Lower valve interior.

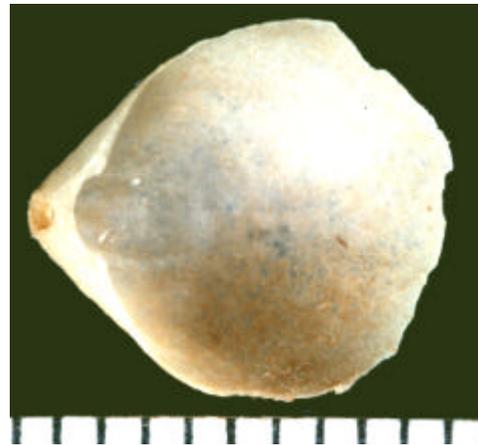


Photo 466-24. Bottom valve foramen.  
← Possible *Gryphus tokionis* Dall, 1920

Brachiopods Continued

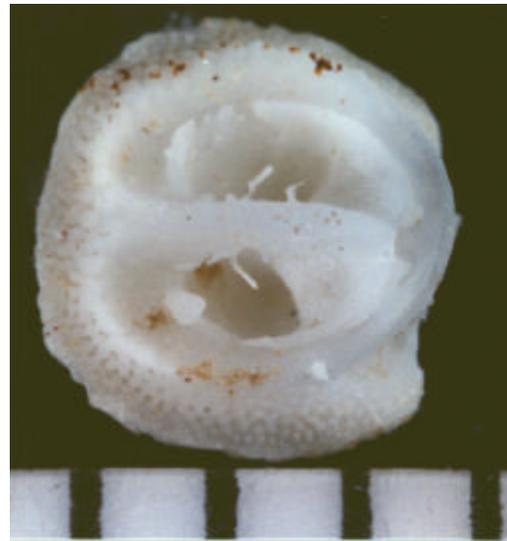
species as “coral toilets with a lid”, which is most appropriate. As already mentioned in the introduction, these animals are cemented to the substrate, instead of being attached by a pedicle. As a consequence, there is no foramen in the pedicle valve. The internal structure of both valves differs considerably from that of other articulate brachiopods. This is the second commonest species among Wes Thorsson’s material, represented by 13 samples, all from Oahu. Although the species resembles *Thecidellina japonica* Hayasaka, 1938, from Japan, I hesitate to identify it as being that species. Its identity therefore remains uncertain at the moment.

Depth range: 14-374 m.

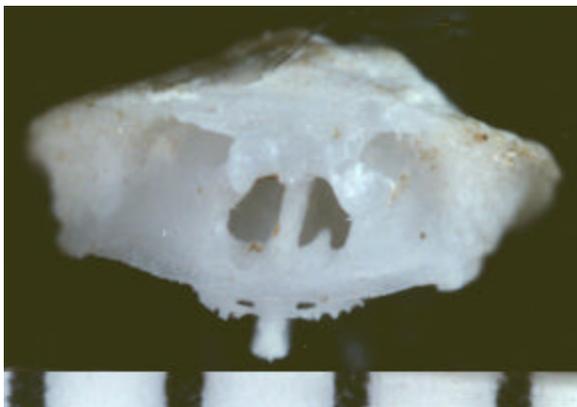
6. *Thecidellina* sp. 2 [family Thecidellinidae] (photographs Ribbed-2)  
This species is represented by three samples, one from Maui, one from Molokai and one from Kauai. Unfortunately, each sample only contains



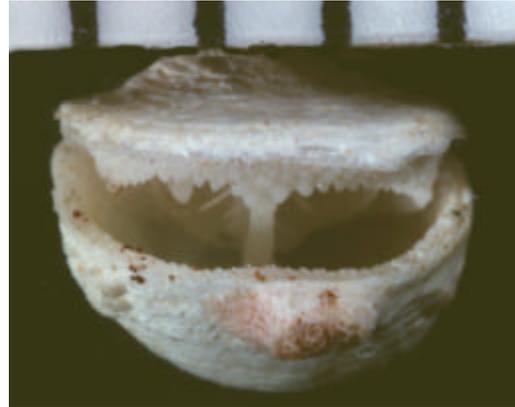
Photo 465—13. Top view of both valves   
*Thecidellina* sp. 1  
Photo 465-18. Top valve,  
interior side. 



*Thecidellina* sp. 1  
Top valve, Hinge view  
 Photo 465-21



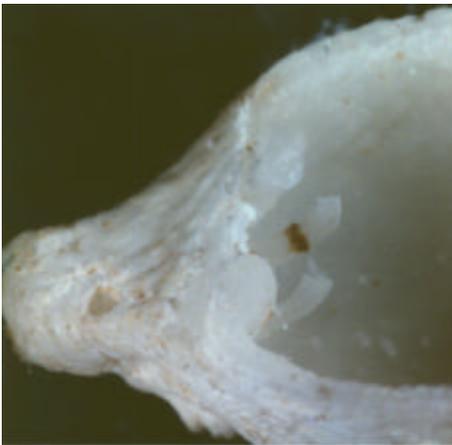
Brachiopods Continued



↑ Photo 465-13 Bottom view, both valves *Thecidellina* sp. 1 Photo 465-14 ↑ Apertural view



↑ Photo 465-13 Bottom valve, Interior *Thecidellina* sp. 1 Photo 465-14 ↑ Bottom valve, Side view.



← Photo 465-17 Bottom valve, Hinge detail.

## Brachiopods Continued

a single ventral valve. These valves, however, differ in several aspects from those of the preceding species. The external surface of the valves carries longitudinal ribs and the hinge teeth are very close to each other and clearly more prominent than in the preceding species. At the moment, I have no clue as to the identity of this species. It is very well possible that it is new to science. Depth range: 67-109 m.



Photo 466-7. Exterior of valve. ↑

*Thecidellina* sp. 2

Photo 466-4 Interior of valve ↓



Photo 466-05. Hinge detail  
*Thecidellina* sp. 2



Brachiopods Continued



← Photo 466-6  
Angled view of hinge teeth.  
*Thecidellina* sp. 2



↑ Photo 466-8 Exterior of lower valve.

Photo 466-9 hinge detail ↑

Second specimen of *Thecidellina* sp. 2

## Brachiopods Continued

### Discussion

On July 28, 1998, the on-line fossil and Recent brachiopod type catalogue of the United States National Museum (<http://nmnhwww.si.edu/gopher-menus/Brachiopods.html>) was queried and listed the following species from Hawaii (true type material as well as hypotypes, which are a kind of voucher specimens). Without any doubt many more species are present in their collections, which is by far the largest collection of Recent brachiopods in the world.

Inarticulata	Lingulidae	<i>Lingula reeveii</i> Davidson, 1880
	Craniidae	<i>Neocrania hawaiiensis</i> (Dall, 1920)
Articulata	Basiliolidae	<i>Basiliola beecheri</i> (Dall, 1895)
	Cancellothyrididae	<i>Terebratulina hawaiiensis</i> Dall, 1920
	Laqueidae	<i>Laqueus rubellus</i> (Sowerby, 1846)
		<i>Frenulina sanguinolenta</i> (Gmelin, 1791) (also listed as <i>Ismenia sanguinea</i> )

*Frenulina mauiensis* Dall, 1920

From the list we did not find the two inarticulates, the *Terebratulina* and the *Laqueus* in our material. Considering this list, the following should be noted:

1. The absence of *Lingula reeveii* among Wes Thorsson's material is not surprising; it is a burrowing shallow water species,
2. *Neocrania* species are commonly misidentified in collections, often bearing mollusc names. Wes Thorsson, however, has informed me that neither he nor Mrs. B.
3. The *Terebratulina hawaiiensis* Dall, 1920, should, when encountered, be easily recognizable by its internal (a short, closed horseshoe shaped loop) and external (shell shape and delicate ribbing) morphology. For as far as we know, the species was not subsequently reported from Hawaii after its original description.

Burch of the Bishop Museum, Honolulu, have ever seen a specimen from Hawaii that could be identified as a *Neocrania*. It is very well possible that the holotype was mislabeled, originating from another locality and not being genuinely Hawaiian.

## Brachiopods Continued

4. The presence of *Laqueus rubellus* in Hawaiian waters (only a single specimen was reported by Dall in 1920) is rather doubtful, as it is a Japanese species.

On the other hand, the two *Thecidellina* species, of which one is comparatively common in Hawaii, are not mentioned in the USNM list.

I sincerely hope that this short article is of any interest to you all and that it will contribute to the knowledge of Hawaiian brachiopods. If you have additional material available, from Hawaii as well as other parts of the world, I hope that you will contact me.

## References

- Dall, W.H., 1920. Annotated list of the Recent Brachiopoda in the collection of the United States National Museum, with additional descriptions of thirty-three new forms. — Proceedings of the United States National Museum, 57(2314): 261-377.
- Kaesler, R.L., 1997 (Editor). Treatise on Invertebrate Paleontology. Part H. Brachiopoda (Revised), Vol. 1: i-xx + 1-539. Boulder/Lawrence.



Brachiopod



Bivalve

Cartoon & photos by Wes Thorsson