

# Brachiopods from Eniwetok and Bikini Drill Holes

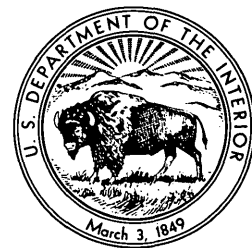
By G. A. COOPER

BIKINI AND NEARBY ATOLLS, MARSHALL ISLANDS

---

GEOLOGICAL SURVEY PROFESSIONAL PAPER 260-FF

*Representatives of two genera  
described from Miocene to  
Recent sediments*





## CONTENTS

---

	Page		Page
Abstract.....	1117	Summary remarks.....	1119
Introduction.....	1117	Reference.....	1120
Systematic descriptions.....	1117		
<i>Argyrotheca</i> .....	1117		
<i>Thecidellina</i> .....	1118		

## ILLUSTRATIONS

---

[Plate follows p. 1120]

PLATE 301. *Argyrotheca* and *Thecidellina*.

III

BIKINI AND NEARBY ATOLLS, MARSHALL ISLANDS

BRACHIOPODS FROM ENIWETOK AND BIKINI DRILL HOLES

By G. A. COOPER<sup>1</sup>

ABSTRACT

Forty-five lots of brachiopods from deep drill holes on Eniwetok, Bikini, and Funafuti were submitted for study. In addition a survey was made of brachiopod material from Bikini that was received after publication of the "Recent Brachiopods" from Bikini (Cooper, 1954). A Recent specimen from Rongelap is introduced for comparison with those of Eniwetok and Bikini. Twenty-five lots were taken from Eniwetok, 19 from Bikini, and 1 from Funafuti.

INTRODUCTION

Two genera are represented, *Argyrotheca* and *Thecidellina*. Both of these were previously found living around Bikini Atoll (Cooper, 1954). *Crania* is another living brachiopod from Bikini, but it was not seen in any of the material from the drill holes. Unfortunately, the fossils are represented in most occurrences by single specimens or lots too small to provide a clear idea of the species involved. It has thus proved impossible, except for a few, to identify the species represented, and the supply of specimens is inadequate for the establishment of new species.

The specimens of *Argyrotheca* could not be identified with the living specimens. A few specimens of *Thecidellina* are referred tentatively to a living species, but the remainder could not be identified as to species.

SYSTEMATIC DESCRIPTIONS

*Argyrotheca* sp.

Plate 301, figures 1-11

This genus is represented by 11 lots, all but 1 of them coming from Eniwetok. The range in depth from which the specimens come is from 290 to 1,110 feet.

Specimens small, subquadrate in outline with the width slightly greater than the length, and the hinge slightly less than midwidth. Sides gently rounded; anterior margin medially indented. Cardinal extremities rounded, obtuse. Valves unequal in depth, the

brachial valve being the deeper. Anterior commissure rectimarginate. Surface with obscure irregular low radial plications. Shell substance coarsely punctate.

Pedicle valve with lateral profile unevenly convex, the posterior part gently convex but the anterior part flattened. Anterior profile broadly but gently convex. Apical angle broadly obtuse, about 120°; umbonal region moderately swollen; median region gently swollen but with a poorly defined sulcus extending from the anterior side of the umbonal region to the anterior margin. Sulcus occupied by a low plication. Flanks bounding sulcus slightly convex and with low slopes. Flanks obscurely plicated.

Brachial valve with gently convex lateral profile but more convex than the pedicle valve and with the maximum convexity in the posterior third; anterior profile broadly and gently convex but more convex than the opposite valve. Umbonal region narrowly convex with moderately steep slopes. Sulcus originating on the anterior side of the umbonal region, widening and deepening anteriorly to the margin. Sulcus moderately deep and bounded by moderately convex flanks. Lateral extremities slightly deflected.

Figured specimens: USNM 549695, 549696, 549701.

USNM	Measurements, in millimeters				
	Length	Brachial valve	Hinge	Midvalve	Thickness
549696-----	2.3	2.0	2.1	2.5	1.1
549701-----	1.9	1.5	1.6	2.0	.9

*Stratigraphic occurrence and localities.*—Eniwetok (F-1): Post-Miocene at levels 290-300 feet, 300-310 feet, 320-330 feet, 330-340 feet, 450-460 feet, 500-510 feet, 580-590 feet. Miocene (Tertiary *f*) at levels 1,050-1,060 feet and Miocene (Tertiary *e*) at 1,100-1,110 feet. Eniwetok (E-1): Miocene (Tertiary *g*) at 740-750 feet. Bikini drill hole (2-B): Miocene (Tertiary *g*) from 873-883½ feet.

<sup>1</sup> U.S. National Museum. This report is published by permission of the Secretary of the Smithsonian Institution.

*Comparison.*—The only specimens to which direct comparison can be made, from the Pacific realm where *Argyrotheca* is rare, are those from Bikini Atoll described by Cooper (1954) as *Argyrotheca* sp. These, like the Eniwetok specimens, are very small and, as previously noted, may not be adults. The small size, coarse punctae, and poor development of the loop in the fossil specimens favor the interpretation that they may be young specimens, but the fact that no larger specimens have been found, either fossil or Recent, suggests that these may really be adults.

The fossil specimens from Eniwetok differ from the specimens living in the waters around Bikini. They are slightly larger and thicker than the Recent shells and have plications, even though obscure, on the pedicle valve. Furthermore, the brachial valve is more convex but the length to width indexes of the fossil specimens are smaller.

The single specimen from the Bikini drill hole is regarded as belonging to the fossil species rather than the Recent one.

#### *Thecidellina*

The commonest brachiopod from the drill holes is *Thecidellina*, of which 34 lots were taken: 1 from Funafuti, 11 from Eniwetok, and 22 from Bikini. In addition to these a Recent specimen from Rongelap was studied. Most specimens are poorly preserved or damaged detached brachial valves. *Thecidellina* is a cemented form, and its shape is usually controlled by the surface to which it attaches. This fact, taken with the generally poor preservation of the specimens, makes it difficult to identify them with known species, and it is also difficult to establish more than one species from such a numerically poor supply of specimens. It proved impossible to identify any of the specimens of *Thecidellina* with *T. congregata* Cooper, which is fairly common in the waters over the steep slope around Bikini.

A species strongly suggesting *Thecidellina maxilla*, another Recent species, appears in the cores. This species, which is more robust and elongate than *T. congregata* Cooper, was identified at Bikini and some specimens from the drill hole seem to be referable to it.

The following remarks are based on the best preserved of the fossil *Thecidellinas*:

#### *Thecidellina* from Eniwetok *Thecidellina* cf. *T. maxilla* (Hedley)

Plate 301, figures 15, 16

*Thecidellina* cf. *T. maxilla* (Hedley) is represented by two specimens, a pedicle valve and a brachial valve. The pedicle valve (USNM 549699) is fairly deep and the shell substance thick. The hemispondylium is ses-

sile and the teeth large. The posterior is fairly small, but the anterior is strongly elevated. This valve appears to be thicker and deeper than *T. congregata*. A small entire specimen is lodged in one side of a larger pedicle valve interior. Both valves have large interareas, but the brachial valve of this youthful specimen has a much larger interarea than that of *T. congregata* of comparable size, or even larger. Measurements in millimeters, length 5.0, width 4.2.

A brachial valve (USNM 549698), probably of the same species as the foregoing pedicle valve, is thick shelled, moderately convex on the exterior, and well preserved. The interior of this valve is quite unlike that of *T. congregata*. The median septum is more slender and does not flare anteriorly like that of the modern Bikini species. The cardinal process is stouter, the ridge in the cardinal process is thicker, and the posterolateral extremities are somewhat hooklike and naked. The deposits on each side of the median septum on which the lophophore filaments lie are massive and thick in the Eniwetok species and entirely unlike those of *T. congregata*. Measurements, in millimeters: length 3.9, width 4.5.

*Figured specimens:* USNM 549698, 549699.

The figured specimens described above are from the Post-Miocene part of the Eniwetok core between 50 and 70 feet. Several brachial interiors from 30 to 40 feet are also referable here.

#### *Thecidellina* cf. *T. maxilla* (Hedley) from Rongelap

Plate 301, figures 18, 19

A single brachial valve (USNM 549697) was dredged from a depth of 130 feet at Rongelap (RAP 348). The specimen is poorly preserved and is much worn. The bridge is missing and the brachial lamellae are greatly worn, as are the granules of the outer border which is almost smooth. Measurements, in millimeters: length 4.0, width 4.0.

*Figured specimen:* USNM 549697.

Direct comparison with better preserved specimens is difficult. In lateral profile the specimen is fairly strongly convex in the posterior third and is thus unlike *T. congregata* Cooper. In this respect it is similar to *Thecidellina* cf. *T. maxilla* from Eniwetok (F-1, 30-40 ft., 50-70 ft.), but is still more convex. The Rongelap specimen on the interior has a shorter but stouter median septum, a broader lateral and anterior margin, less thickened and less elaborate brachial lamellae, deeper sockets, and a thicker ridge in the concavity of the cardinal process than the Recent *T. congregata* Cooper. The Rongelap specimen is more elongate than

*T. congregata*, and it seems to be related to *T. maxilla* rather than to *T. congregata*.

Other Eniwetok species of *Thecidellina*

Plate 301, figure 17

*Post Miocene*.—E-1, 270-280 feet: A small complete specimen with valves sprung apart but not separated. This is a deep-shelled form with sessile hemispondylium in the pedicle valve and a strongly elevated septum in the brachial valve. Loop deposits are beaded and quite unlike the specimen described above. This appears to be a species different from the specimens higher in the well at 50-70 feet.

E-1, 470-480 feet: One brachial valve too poor for determination or comparison.

E-1, 630-640 feet: A small brachial valve, well preserved but incomplete and unlike those above.

F-1, 45-55 feet: Incomplete brachial valve, elongate in form, possibly related to *T. maxilla* Hedley, a Recent species from Funafuti and Bikini.

F-1, 160-170 feet: A thick-shelled widely triangular pedicle valve (USNM 549702) with a thick callosity almost obscuring the hemispondylium. It cannot be identified satisfactorily. Measurements, in millimeters: length 4.0, width 4.3. (See pl. 301, fig. 17.)

*Figured specimen*: USNM 549702.

F-1, 0-150 feet above 3,562 feet: This is an interior filling with all the shell dissolved away. The specimen is difficult to interpret and impossible to identify.

*Miocene (g)*.—E-1, 690-700 feet: Small incomplete brachial valve unlike any of the above.

E-1, 720-730 feet: Small brachial valve, incomplete but with septum similar to preceding specimen and probably the same.

*Miocene (f)*.—E-1, 990-1,000 feet: Brachial valve different from all the preceding in being fairly strongly transverse.

E-1, 2,120-2,130 feet: Small brachial valve with a high-median septum and unlike any of the foregoing.

*Thecidellina* from Bikini

*Thecidellina* sp. A

Plate 301, figures 12-14

*Thecidellina* sp. A (USNM 549700).—The shell is of medium size for the genus, elongate triangular in outline, with a moderately deep pedicle valve and fairly convex brachial valve. The maximum convexity is near midvalve. The cicatrix of attachment is variable, one specimen having a small area and another was at-

tached by fully half the pedicle valve. Pedicle valve interior not known. Measurements, in millimeters: length 3.4, with 2.7, thickness 1.8.

The brachial valve (USNM 549703a) interior has a thick median septum and narrow pustulose margin. The brachial lamellae are thickened and have thick nodes from anterior to posterior. The bridge is thick. Measurements, in millimeters: length 3.5, width 4.0.

*Figured specimens*: USNM 549700, 549703a.

This species is unlike *T. congregata* Cooper in its elongate outline and details of the brachial valve. Externally the brachial valve is more convex than that of the Recent genus. Inside, the median septum is stouter, the granulose margin narrower, and the brachial lamellae are more uniformly and more strongly thickened.

The brachial valves are different from that from Rongelap in having a more transverse outline and stronger granulose margin. *Thecidellina* cf. *T. maxilla* from the Eniwetok well is a wider and differently shaped species and its brachial valve has a more slender median septum and much more strongly and massively thickened brachial lamellae.

*Age*: Miocene (g).

*Locality*: Bikini (B-2) at 715½-736½ ft.

Unidentifiable *Thecidellina*

Single and damaged specimens of *Thecidellina* from Bikini that could not be identified are as follows:

Bikini 1: Post-Miocene at 253-258 feet.

Bikini (2-A): Post-Miocene at 368½-373½ feet and 657½-663 feet; Miocene (Tertiary g) at 925-935½ feet.

Bikini (2-B): Post-Miocene at 442½-453 feet and 694½-705 feet. Miocene (Tertiary g) at 736½-747 feet, 778½-789 feet, 820½-831 feet, 831-841½ feet, 883½-894 feet, and 925½-936 feet. Miocene (Tertiary e) at 1,167-1,177½ feet and 1,461-1,471½ feet.

*Thecidellina* from Funafuti

*Thecidellina* from Funafuti in a drill hole at 70 feet.—A small brachial interior, badly damaged and not identifiable.

SUMMARY REMARKS

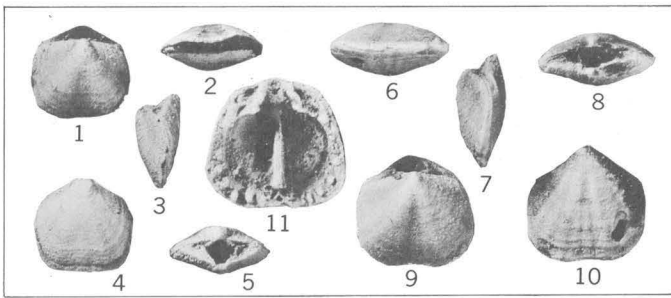
The living species of *Argyrotheca* was not identified in the drill holes at Eniwetok and Bikini. In the living fauna this genus was found only on the outer slope of the atoll. *Thecidellina* was found on the slope and in the lagoon as well. Two species were identified at Bikini and both of them have a considerable range of

depth. *Thecidellina maxilla* ranged down to 450 feet on the outer slope and was found in the lagoon at 180–200 feet. *Thecidellina congregata* was taken not only on the slope but from depths down to 800 feet. Inasmuch as *T. maxilla* occurs in the lagoon as well as on the slope, it is impossible to be sure whether the speci-

mens from the drill holes come from the lagoonal or some other facies.

#### REFERENCE

- Cooper, G. A., 1954, Recent Brachiopods, *in* Bikini and nearby Atolls, Marshall Islands. Pt. 2, Oceanography (biologic): U.S. Geol. Survey Prof. Paper 260-G, p. 315–318, pls. 80, 81.

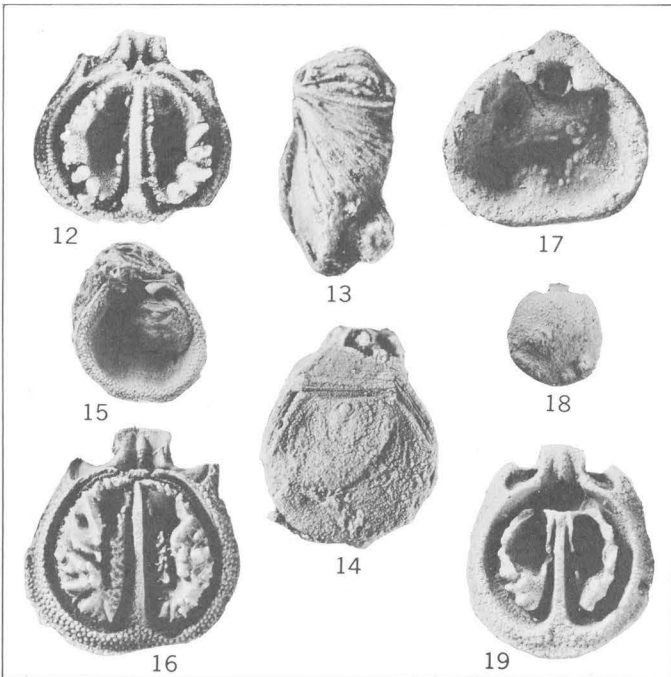


ARGYROTHECA

PLATE 301

FIGURE 1-11. *Argyrotheca* sp. (p. 1117).

- 1-5. Respectively, dorsal, anterior, side, ventral, and posterior views of a small specimen from 1,050 to 1,060 ft, Eniwetok F-1,  $\times 6$ . USNM 549701.
- 6-10. Respectively, anterior, side, posterior, dorsal, and ventral views of a large complete specimen from 290 to 300 ft, Eniwetok F-1,  $\times 6$ . USNM 549695.
- 11. Interior of a brachial valve, same as preceding, showing large median septum and anterior ring of nodes, from 300 to 310 ft, Eniwetok, F-1,  $\times 8$ . USNM 549696.
- 12-14. *Thecidellina* sp. A (p. 1119).
  - 12. Interior of the brachial valve showing median septum, bridge, and cardinal process,  $\times 6$ , from 726 to 736½ ft, Bikini 2-B. USNM 549703a.
  - 13, 14. Side and dorsal views of a complete specimen showing interareas on both valves,  $\times 8$ , from 715½ to 726 ft, Bikini 2-B. USNM 549700.
- 15, 16. *Thecidellina* cf. *T. maxilla* (Hedley) (p. 1118).
  - 15. Interior of a large pedicle valve with a smaller one lodged within,  $\times 4$ , from 60 to 70 ft, Eniwetok E-1. USNM 549699.
  - 16. Interior of a brachial valve, possibly the same species as the above pedicle valve, showing septum and papillos anterior border,  $\times 6$ , from 50 to 60 ft, Eniwetok E-1. USNM 549698.
- 17. *Thecidellina* sp. from Eniwetok (p. 1119).
  - 17. Interior of a large pedicle valve showing thick shell and part of hemispondylium,  $\times 6$ , from 160 to 170 ft, Eniwetok F-1. USNM 549702.
- 18, 19. *Thecidellina* cf. *T. maxilla* (Hedley) (p. 1118).
  - 18, 19. Respectively, exterior,  $\times 3$ , and interior,  $\times 6$ , of the same specimen showing median septum and cardinal process but minus the bridge; dredged from depth of 130 ft, RAP 348, Rongelap. USNM 549697.



THECIDELLINA