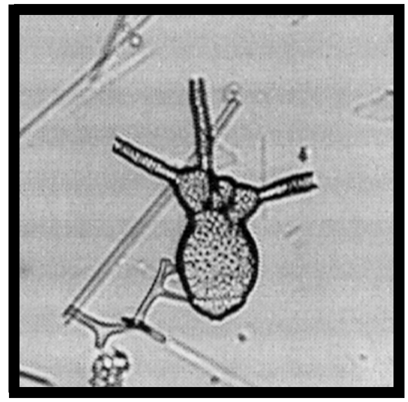
Acrobotrys tritubus Riedel



Acrobotrys tritubus Riedel, 1957, p.80, pl.1, fig.5

DESCRIPTION

Cephalis trilobate, with large subglobular [antecephalic] lobe, smaller globular [cephalic] lobe, and inflated-conical [postcephalic] lobe, lying in the same plane. [Antecephalic] lobe bears two slender cylindrical tubes, one directed apically and the other posteriorly. [Postcephalic] lobe bears a slender cylindrical tube directed anteriorly. Thorax subcylindrical, inflated, or ovate, often with somewhat constricted mouth. Shell surface smooth, perforated by numerous small circular or subcircular pores, irregularly arranged (Riedel, 1957).

DIMENSIONS

Length of cephalis plus thorax 90-125 μm, of tubes 15-120 μm. Maximum breadth of thorax 50-60 μm (Riedel, 1957).

DISTINGUISHING CHARACTERS

From the cephalis arise three long, widely divergent tubes, one from the postcephalic lobe and two from the antecephalic lobe. Early in the range of the species the tubes are not so widely divergent (Riedel and Sanfilippo, 1978a).

VARIABILITY

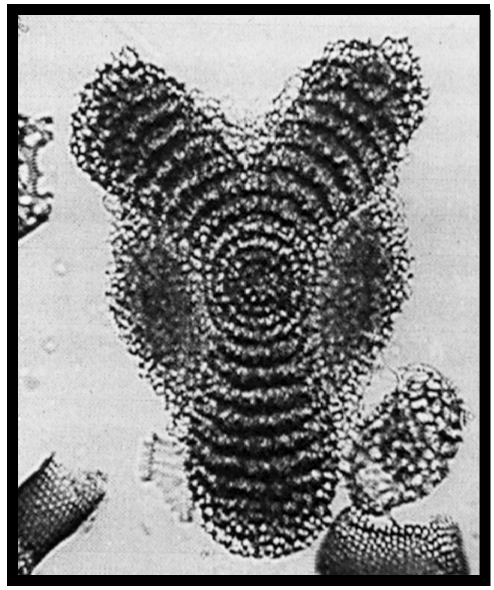
The ante- and post-cephalic lobes vary in size and amount of inflation. The angle between the posteriorly and anteriorly directed tubes varies from 180° to 110°. The length of the tubes and numbers of pores on the thorax are variable. Thorax may in some specimens be completely closed (Sanfilippo, unpubl. data).

DISTRIBUTION

This species occurs in tropical sediments from all oceans. It is relatively rare, but sufficiently distinctive to be identifiable from fragments. Its morphotypic first appearance occurs within the

Didymocyrtis antepenultima Zone and its morphotypic last appearance is within the *Stichocorys peregrina* Zone.

Amphirhopalum ypsilon Haeckel



Amphirhopalum ypsilon Haeckel, 1887, p.522; Nigrini, 1967,p.35, pl.3, figs.3a-3d (with synonymy)

DESCRIPTION

Shell with 2 opposite, chambered arms, one of which is forked distally. Arms arise from a central structure composed of 2 inner spherical shells and an outer oblate spheroidal shell, all quite smooth and connected by numerous, discontinuous, radial beams. In addition, there is an outer ring of mesh in the plane of the shell that is normally oriented perpendicular to the microscope axis. This orientation makes the central structure appear as a "central, concentrically annulated disc" (cf. Haeckel, 1887, p.516, Subfamily Euchitonida), because the spheroidal shell has its minor axis along the microscope axis and the external ring, or rings, are in the plane of the slide.

In cross section arms are elliptical with their shortest dimension normally oriented along the microscope axis. Unforked arm is narrow proximally, expands distally to a maximum breadth about two-thirds of the way along its length, then decreases slightly in breadth to a blunt termination. Usually 4-9 distinct chambers, convex distally, can be seen; however, shell may become spongy over the distal one-third of the arm. Similarly, the forked arm expands distally and branches where its breadth reaches a maximum. Usually 5-9 distinct chambers, including those on the branches, convex distally; chambers on branches sometimes obscured by spongy meshwork.

Internal spines form a basic framework that is covered by a lattice of small circular to subcircular pores.

In some specimens a patagium is present around the central structure and arms, sometimes with 4 or 5 chambered rows, concave inwards; sometimes simply a spongy mass. It seems probable that a complete patagium (i.e., on a fully developed specimen) might surround the whole basic shell structure, but in all specimens examined the patagium had developed only between the 2 main arms and around the central structure. Patagium generally more delicate than the main shell (Nigrini, 1967).

Specimens from the upper parts of the cores examined [late Quaternary] average four or five proximal chambers on the forked arm before it bifurcates. Lower down in the cores [early Quaternary] this number decreases, and forms with two or three (sometimes one) such chambers predominate. The decrease coincides approximately with an increase in abundance (Nigrini, 1971).

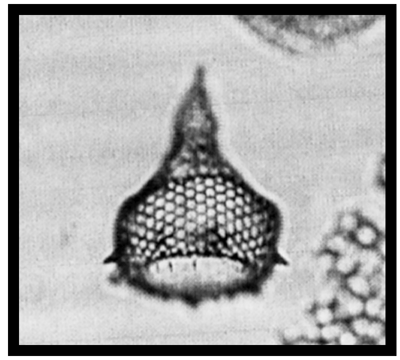
DIMENSIONS

Total length 236-307 μm. Radius of simple arm 119-155 μm; of forked arm 119-155 μm. Maximum breadth of simple arm 63-119 μm; of branches on forked arm 36-63 μm (Nigrini, 1967).

DISTRIBUTION

This species is common in tropical sediments from all oceans. Its morphotypic first appearance is in the early part of the *Spongaster pentas* Zone and it is extant. Rare at the lower end of its range, but easily recognizable, even from fragmentary specimens. Morphotypic first appearance is synchronous.

Anthocyrtidium angulare Nigrini



Anthocyrtidium angulare Nigrini, 1971, p.445, pl.34.1, figs.3a-3b

DESCRIPTION

Cephalis trilobate, elongate, with subcircular pores, bearing a stout three-bladed apical spine of approximately the same length as the cephalis. Thorax shaped like a biretta. Three stout thoracic ribs, which may become external to form short, thorn-like wings, control the shape of the upper thorax. There is a sharp break in shell contour where the ribs terminate, and the lower thorax is approximately cylindrical. Pores circular to subcircular, usually arranged longitudinally. Eight to eleven, three-bladed subterminal teeth, directed outwards, are usually present, but may be absent or much reduced. Distally from the subterminal teeth, the thoracic wall curves sharply inwards and terminates at a narrow, poreless peristome that often bears numerous short, delicate, lamellar, terminal teeth, directed downwards and inwards (Nigrini, 1971).

DIMENSIONS

Based on 20 specimens. Length of apical horn 18-27 μm; of cephalis 18-36 μm; of thorax 36-81 μm; of subterminal teeth 9-18 μm. Maximum breadth of cephalis 18-27 μm; of thorax 72-100 μm (Nigrini, 1971).

DISTINGUISHING CHARACTERS

Three stout thoracic ribs, which may become external to form thorn-like wings and which control the biretta shape of the thorax (Nigrini and Caulet, 1988).

A. angulare may be distinguished from *A. ophirense* (Ehrenberg, 1872a, p.301) by its smaller size (thoracic length in *A. ophirense* 81-119 μm, and in *A. angulare* 36-81 μm) and by the distinctive shape of its thorax (Sanfilippo et al., 1985).

VARIABILITY

This two-segmented pterocorythid is characterized by angular "shoulders". Some forms show thorn-like projections at the shoulders. When such projections are not present, the shoulder may be rounded, but the shell always has a distinct break in contour between the upper, biretta-shaped part and the lower cylindrical part (Sanfilippo et al., 1985).

DISTRIBUTION

Rare in the tropical Indian Ocean; few to common in the tropical Pacific Ocean.

Rare to common from the upper part of the *Pterocanium prismatium* Zone to the top of the *Anthocyrtidium angulare* Zone. Morphotypic last appearance marks the upper limit of the early Quaternary *Anthocyrtidium angulare* Zone. Both morphotypic first and last appearances are reliable and synchronous datum levels. More common in the Pacific Ocean than in the Indian Ocean.

PHYLOGENY

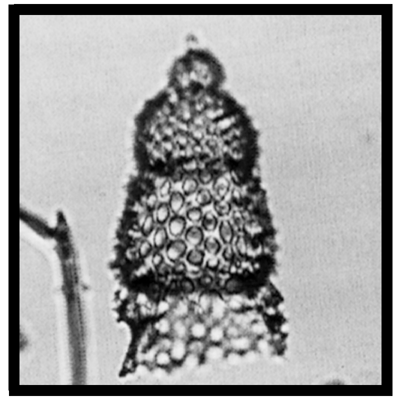
Possibly derived from *A. ophirense* (Nigrini and Caulet, 1988).

Subsequent unpublished studies by Nigrini and Caulet suggest that *Anthocyrtidium jenghisi* (Streeter, 1988, p.63) might be a more likely ancestor for this species.

REMARKS

Additional illustrations can be found in Johnson and Knoll, 1975, pl.1, figs.3a-3b.

Artophormis barbadensis (Ehrenberg)



Calocyclas barbadensis Ehrenberg, 1873, p.217; 1875, pl.18, fig.8

Artophormis barbadensis (Ehrenberg), Haeckel, 1887, p.1459

Artophormis barbadensis (Ehrenberg), Riedel and Sanfilippo, 1970, p.532, pl.13, fig.5

DESCRIPTION

Cephalis spherical, with thorny surface and a moderate number of small subcircular pores, bearing a loosely spongy (occasionally latticed-bladed) apical horn. Collar stricture pronounced. Thorax inflated-campanulate, with thorny surface and subcircular pores. Lumbar stricture distinct. Abdomen tending to be somewhat longer than thorax and with slightly thinner wall, truncate-conical, with thorny surface and irregular subcircular pores. Fourth segment short, formed of very irregular latticework of which some elements are longitudinal ribs that commonly extend a short distance as free terminal spines. No differentiated termination of fourth segment (Riedel and Sanfilippo, 1970).

DIMENSIONS

Based on 44 specimens. Length of first three segments (excluding horn) 95-145 μm. Maximum breadth of the abdomen 70-120 μm. Ratio of abdomen length : thorax length 0.8-1.8 : 1 (Riedel and Sanfilippo, 1970).

DISTINGUISHING CHARACTERS

Artophormis barbadensis differs from practically all other four-segmented Cenozoic theoperids by the fourth segment constructed proximally of longitudinal bars connected by discontinuous transverse ones. In *A. gracilis*, which has a similarly constructed fourth segment, the third segment is inflated-annular rather than truncate-conical (Sanfilippo et al., 1985).

VARIABILITY

The sparsely porous cephalis and inflated-campanulate to hemispherical thorax are relatively constant characters of the species, but otherwise it is quite variable. The third segment is truncate conical, usually longer than the thorax. The fourth segment proximally consists of longitudinal bars connected by discontinuous transverse ones, but distally becomes a less regular lattice. In some specimens the apical structure consists of a few short horns, while in others it is a complex, occasionally spongy structure. Pores of the thorax and abdomen are subcircular, with no prominent alignment, and the shell surface varies from smooth to very thorny (Sanfilippo et al., 1985).

DISTRIBUTION

This species is found in late middle Eocene to earliest Oligocene assemblages from the tropical parts of the Pacific and Indian Oceans, and from the Caribbean region. Its morphotypic first appearance is within the *Podocyrtis mitra* Zone and it evolves into *Artophormis gracilis* within the *Theocyrtis tuberosa* Zone.

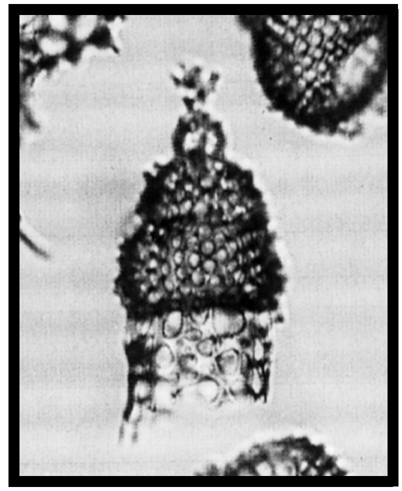
PHYLOGENY

The antecedents of *A. barbadensis* are obscure, but it evolved to *A. gracilis* just above the Eocene-Oligocene boundary.

REMARKS

Additional illustrations can be found in Riedel and Sanfilippo, 1971, pl.3B, fig.9.

Artophormis gracilis Riedel



Artophormis gracilis Riedel, 1959, p.300, pl.2, figs.12-13; Riedel and Sanfilippo, 1970, p.532, pl.13, fig.6; 1971, pl.3B, figs.5-7, pl.3B, figs.5-7, pl.6, fig.7

DESCRIPTION

Shell conical above, subcylindrical below, consisting of four segments separated by moderately distinct strictures. Cephalis globular, hyaline or with a few small pores, bearing an apical spine, which may be simple conical, multiple, or latticed. Thorax truncate-conical and abdomen inflated annular, both of these segments rather thick-walled, with rough surface and pores subcircular or circular, irregular in size and arrangement. Fourth segment consisting essentially of four to twenty longitudinal ribs joined together by a rather delicate lamellar meshwork with irregular pores; the longitudinal ribs terminate in free spines, and in some specimens are not clearly distinguishable from the meshwork (Riedel, 1959).

DIMENSIONS

Based on 30 specimens. Length of apical horn 3-63 μm; of cephalis 20-30 μm; of thorax 38-58 μm; of abdomen 43-78 μm; of fourth segment (including terminal spines) 25-145 μm. Maximum breadth (at third or fourth segment) 95-145 μm (Riedel, 1959).

DISTINGUISHING CHARACTERS

Artophormis gracilis is distinguished from its ancestor, *A. barbadensis*, by the third segment being generally shorter, and inflated-annular rather than truncate-conical.

Poorly preserved specimens, lacking most of the fourth segment, must frequently be identified by the general form of the first three segments, and the remaining stubs of the longitudinal ribs, which are more widely spaced than the bars between the pores of the distal part of the third segment. Unless care is taken to ensure that the top of the third segment does not have a single row of large pores, incomplete specimens of *Eucyrtidium diaphanes* Sanfilippo and Riedel (in Sanfilippo et al., 1973, p.221, pl.5, figs.12-14) can be mistakenly identified as *A. gracilis*. Another character useful in their distinction is that the thorax of *E. diaphanes* is more spherical than that of *Artophormis gracilis* (Sanfilippo et al., 1985).

VARIABILITY

This species is broadly defined, to include forms in which the wall of the second and third segments is moderately thick and regularly latticed, or (in some early specimens) irregularly thickened by a network of ridges, and in which the apical horn is simple, multiple, composed of a spongy meshwork, or cylindrical with thorns distally. The total length of the first three segments (excluding the horn) is usually 110-135 μm, and the maximum breadth of the third segment is usually 85-125 μm.

The fourth segment is more delicately constructed than the first three, and consists of 15-20 longitudinal ribs about 25 μm long in early specimens, changing gradually to 6-10 much longer ones in late specimens, these ribs being followed by a porous lamellar subcylinder in the early specimens, and connected by an irregular meshwork in later specimens. Toward the end of its range, many specimens completely lack the meshwork of the fourth segment, which is reduced to 4-8 terminal feet up to 100 μm in length. Thus, the fourth segment in early specimens is subcylindrical and latticed, with a row of larger pores (between the short longitudinal ribs) at its junction with the third, in the mid-part of its range consists of irregular lattice between longer ribs, and at the end of its range consists only of a small number of terminal feet (Sanfilippo et al., 1985).

DISTRIBUTION

This species is widespread in assemblages of early Oligocene to early early Miocene age in low and middle latitudes of all oceans, including the Mediterranean region. It evolved from *Artophormis barbadensis* within the *Theocyrtis tuberosa* Zone and became extinct at approximately the lower limit of the *Cyrtocapsella tetrapera* Zone.

PHYLOGENY

Evolved from *Artophormis barbadensis* just above the Eocene-Oligocene boundary.

REMARKS

Additional illustrations can be found in Moore, 1971, pl.5, figs.10-11; Sanfilippo et al., 1973, pl.2, figs.12-13.