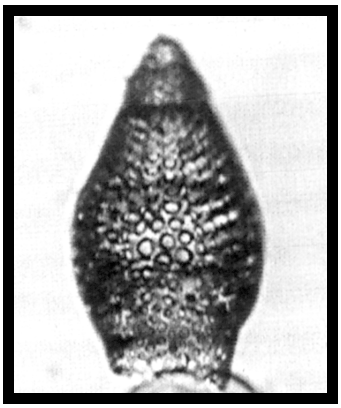
Eucyrtidium calvertense Martin



Eucyrtidium calvertense Martin, 1904, p.450, pl.130, fig.5; Hays, 1965, p.181, pl.III, fig.6

DESCRIPTION

Shell spindle-shaped, with six or seven joints, all strictures marked by internal transverse septa. Cephalis spherical to subspherical with small circular pores scattered over its surface, bearing a short conical, vertical, approximately apical spine. Thorax conical, about twice the length of cephalis, with widely, irregularly spaced circular pores of about the same size as those of the cephalis. Thickness of wall of cephalis and thorax about equal, thorax in some specimens thickened. The third, fourth, and fifth segments are of similar length, about twice that of thorax, and have a considerably thicker wall. These thicker segments have 24-30 longitudinal furrows in which lie circular pores 2 to 3 times the size of thoracic pores. Shell usually reaches its maximum breadth at the fourth segment and then tapers to a constricted mouth. Pores of last segment irregular in size and arrangement (Hays, 1965).

DIMENSIONS

Total length 175-220 µm, maximum breadth 90-100 µm, length of cephalis 10-17 µm, of thorax 20-30 µm, of third segment 25-55 µm, of fourth 25-40 µm, of fifth 28-40 µm, of sixth 35-45 µm (Hays, 1965).

DISTINGUISHING CHARACTERS

Similar to *E. matuyamai* but smaller and having a less inflated fourth segment resulting in a more streamlined outline. Longitudinal ridges are less pronounced on the abdomen and subsequent segments than on *E. matuyamai*. See also *E. inflatum*.

VARIABILITY

The above description was based on a study of Antarctic forms. Hays (1970) notes that North Pacific forms are very similar, but that the thorax is usually inflated in the North Pacific specimens while it is not in the Antarctic. Also, the longitudinal furrows are often not as pronounced on

the North Pacific forms. Dimensions fall within the same range for both areas.

Detailed morphometrics (Kellogg and Hays, 1975; Kellogg, 1976) show that there is a decrease in the maximum width of the fourth segment of *E. calvertense* during the time that *E. matuyamai* became established.

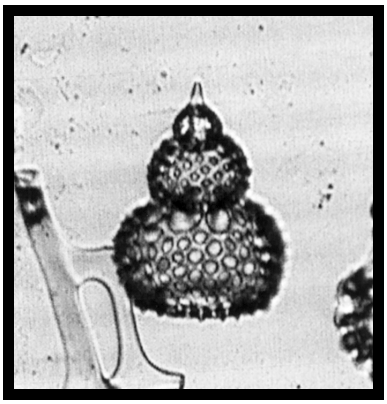
DISTRIBUTION

Extant in the North Pacific, but became extinct in the Antarctic about 2 Ma. Found rarely in equatorial sediments. The morphotypic first appearance of *E. calvertense* is in the early Miocene.

PHYLOGENY

Ancestor of *Eucyrtidium matuyamai*.

Eucyrtidium diaphanes Sanfilippo and Riedel



Calocyclas coronata Carnevale, 1908, p.33, pl.4, fig.24 (*non Eucyrtidium coronatum* Ehrenberg, 1873)

Eucyrtidium diaphanes Sanfilippo and Riedel in Sanfilippo et al., 1973, p.221, pl.5, figs.12-14 (new name)

DESCRIPTION

Shell thick and with numerous ridges. The pores are circular, unequal, and arranged in lines transverse to the axis of the shell. The spine is moderately developed, conical and inclined to one side. The apex, thorax, and abdomen are separated from one another by the respective basal constrictions. At the top of the abdomen, along the re-entrant zone where it is attached to the thorax, there are 10 pores, which exceed all the others in size. The appendages are numerous acuminate, slightly developed, and arise at unequal intervals (translated from Carnevale, 1908).

DIMENSIONS

Length of cephalis 19 μm; of thorax 44 μm; of abdomen 78 μm modified from Carnevale, 1908).

DISTINGUISHING CHARACTERS

Shell of more than three segments, with a single row of large pores just below the lumbar stricture (Riedel and Sanfilippo, 1978a).

In addition, to the single row of large pores just below the lumbar stricture, the small, robust, subspherical thorax distinguishes this species from co-occurring members of the genera *Eucyrtidium* and *Stichocorys*.

VARIABILITY

Segments subsequent to the third are very variable in number and size - in some specimens wider and in others narrower than the third segment, sometimes only one additional, distally tapering segment is

present. The size of the pores in the single row of large pores just below the lumbar stricture vary from 1 1/2 to 2 1/2 times the size of the abdominal pores. A similar row of larger pores may also be present just below the collar stricture in the proximal part of the thorax (Sanfilippo, unpubl. data).

DISTRIBUTION

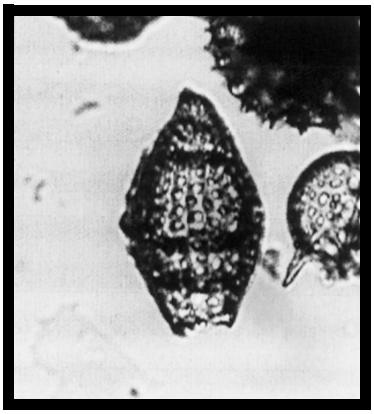
This species is found in both low and middle latitudes of all oceans including the Mediterranean. Its morphotypic first appearance lies within the *Cyrtocapsella tetrapera* Zone and its morphotypic last appearance lies within the *Calocycletta costata* Zone.

REMARKS

Additional illustrations can be found in Riedel and Sanfilippo, 1978a, pl.5, fig.5.

See Sanfilippo et al., 1973, p.221 for discussion of new name.

Eucyrtidium inflatum Kling



Eucyrtidium inflatum Kling, 1973, p.636, pl.11, figs.7-8, pl.15, figs.7-10

DESCRIPTION

Cephalis subspherical to hemispherical, with sparse circular pores; bears a tiny apical spine that is inconspicuous or lacking in many specimens. Collar stricture indistinct. Thorax slightly inflated conical, moderate rough-surfaced, with longitudinal ribs on lower part separating longitudinal rows of circular pores. Lumbar stricture distinct. Abdomen and one or more postabdominal segments define characteristic inflated, truncate fusiform section of the test without externally expressed strictures. Pores in this section are circular, arranged in strict longitudinal rows separated by distinct, sharp-crested ridges. Widest part of shell in abdomen or spanning division between abdomen and fourth segment. In some specimens, gentle stricture separates symmetrical fusiform section from fragmentary lower chamber (Kling, 1973).

DIMENSIONS

Based on 15 specimens. Maximum width 80-94 µm, length of cephalis to distal end of thorax 36-44 µm, to end of abdomen 90-100 µm, to end of fourth segment 120-136 µm; abdominal pore minimum 2-4 µm, maximum 5-9 µm, average close to maximum (Kling, 1973).

DISTINGUISHING CHARACTERS

This species differs from *E. calvertense* in the inflated fusiform section of the shell and relatively large and widely spaced pores. *E. calvertense* is seldom widest at the abdomen, as *E. inflatum* nearly always is. *E. matuyamai* is larger and inflated at more distal segments (Kling, 1973).

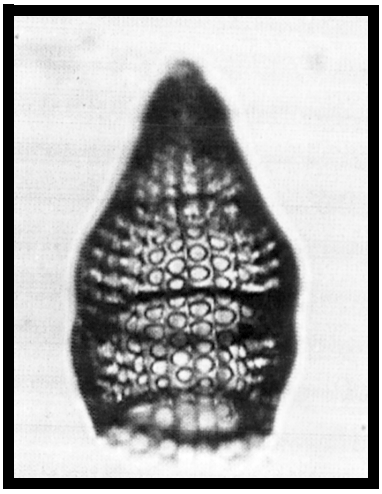
DISTRIBUTION

The morphotypic last appearance of this middle- and high-latitude species lies within the *Diartus petterssoni* Zone. Its morphotypic first appearance is in the middle Miocene.

PHYLOGENY

E. inflatum evolves from *E. calvertense* in the middle (?) Miocene and reaches extinction without apparent descendants in the upper (?) Miocene (Kling, 1973).

Eucyrtidium matuyamai Hays



Eucyrtidium matuyamai Hays, 1970, p.213, pl.1, figs.7-9

DESCRIPTION

Cephalis spherical to hemispherical bearing short thorn-like apical spine. Pores either absent or very small scattered over surface. Thorax usually inflated, heavy with rough surface, pores circular arranged in longitudinal rows bordered by raised hexagonal frames. Lumbar stricture distinct. Abdomen conical, pores circular regularly increasing in size distally, arranged in longitudinal rows set in shallow furrows. Fourth segment usually inflated, shell has greatest width at this segment, pores circular of uniform size arranged in longitudinal rows set in shallow furrows. Fifth segment tapering distally, pores circular arranged in longitudinal rows set in shallow furrows decreasing in size distally. Sixth segment short, usually terminal segment in complete specimens, thinner than other segments, pores irregular in size and arrangement (Hays, 1970).

DIMENSIONS

Measurements made on mature specimens near the end of the range of the species. Length of cephalis 15-23 µm, of thorax 17-30 µm, of 3rd segment 35-50 µm, of 4th segment 36-68 µm, of 5th segment 30-70 µm, of 6th segment 23-60 µm. Width of cephalis 20-35 µm, of 4th segment 118-150 µm (near end of range), 72-110 (near beginning of range). Length of apical horn 3-6 µm. Diameter of pores, thorax 2-6 µm, 3rd segment 3-9 µm, 4th segment 6-12 µm, 5th segment 6-12 µm, 6th segment 3-12 µm (Hays, 1970).

DISTINGUISHING CHARACTERS

See *E. calvertense* and *E. inflatum*.

VARIABILITY AND DISTRIBUTION

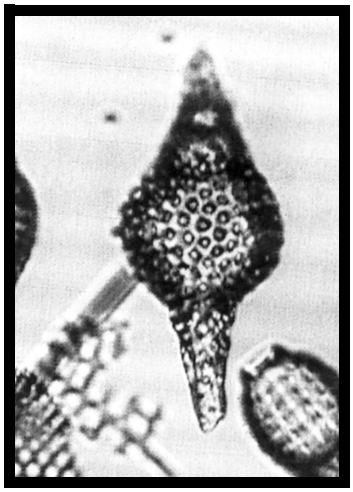
E. matuyamai ranges from near the base of the Olduvai event (about 2 m.y. B.P.) to the base of the Jaramillo event (about 0.95 m.y. B.P.). During this time it increases in size reaching its maximum dimensions near the end of its range. This species ranged from the Bering Sea to 34°N. It has not been seen in either equatorial Pacific sediments or Antarctic sediments.

The evolutionary transition of this species from *E. calvertense* defines the base of the middle-latitude *Eucyrtidium matuyamai* Zone. Its morphotypic last appearance defines the top of the same zone.

PHYLOGENY

E. matuyamai evolved from *E. calvertense* between about 2 Ma and 1.6 Ma in subarctic waters and subsequently invaded subtropical waters. It became extinct about 0.9 Ma. Details of this evolutionary sequence can be found in Hays (1970).

Eusyringium fistuligerum (Ehrenberg)



Eucyrtidium fistuligerum Ehrenberg, 1873, p.229; 1875, pl.9, fig.3.

Eusyringium fistuligerum (Ehrenberg), Riedel and Sanfilippo, 1970, p.527, pl.8, figs.8-9; Foreman, 1973, p.435, pl.11, fig.6

DESCRIPTION

Cephalis thick-walled, subspherical, with very few small pores, bearing a thick conical spine with rough surface, approximately as broad at the base as the cephalis itself. Collar stricture indistinct. Thorax thick-walled, pyriform in early specimens to almost fusiform in some later specimens, with circular pores that are larger distally than proximally. Occasionally, the thorax bears three inconspicuous wings proximally. In some specimens, a stricture separates off the narrower proximal part of the thorax. [The distal part of the thorax] narrow, tubular, of variable length, with irregular subcircular pores and wall that is thinner than that of the [proximal part of the] thorax in early specimens and similar to that of the [proximal part of the] thorax in late specimens. In late specimens the junction between [the two parts of the thorax] is obscure, the one merging imperceptibly into the other (Riedel and Sanfilippo, 1970).

DIMENSIONS

Length (excluding tubular prolongation) 135-255 µm, maximum breadth 60-150 µm.

DISTINGUISHING CHARACTERS

The inflated thorax is distally prolonged as a narrow latticed tube (Riedel and Sanfilippo, 1978a) *Eusyringium fistuligerum* is distinguished from its ancestor *E. lagena* by its [narrow latticed tube]. Forms with a narrow, very thin-walled terminal tube are assigned to *E. lagena*. *E. fistuligerum* differs from *Rhopalocanium ornatum* Ehrenberg (1847b) by lacking the feet and distinct lumbar stricture (Sanfilippo et al., 1985).

VARIABILITY

The thick-walled thorax is pyriform with a delicate tubular prolongation in early forms, and changes to almost fusiform in later forms, to inflated fusiform at the end of its range. Occasionally the thorax bears three inconspicuous wings proximally. In some specimens, a stricture separates off the uppermost small fraction of the thorax. This stricture is variable in its development. The terminal tubular prolongation is variable in length, its wall being somewhat thinner than the proximal thoracic wall in early specimens but similar in late specimens (Sanfilippo et al., 1985).

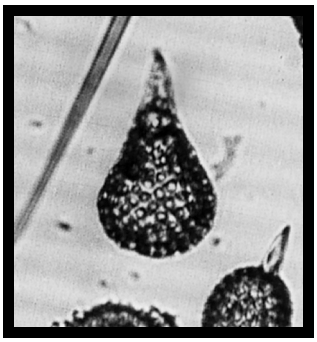
DISTRIBUTION

This form is found in tropical localities of late middle to early late Eocene age. It has not been found at DSDP Site 283, near Tasmania. It evolved from *Eucyrtidium lagena* within the *Podocyrtis ampla* Zone. Its morphotypic last appearance lies within the *Calocyclas bandyca* Zone.

PHYLOGENY

Eusyringium fistuligerum evolved from *E. lagena* by development of the tubular prolongation of the thorax. It apparently left no descendants.

Eusyringium lagena (Ehrenberg)



Lithopera lagena Ehrenberg, 1873, p.241; 1875, pl.3, fig.4

Eusyringium lagena (Ehrenberg), Riedel and Sanfilippo, 1970, p.527, pl.8, figs.5-7; Foreman, 1973, p.436, pl.11, figs.4-5

DESCRIPTION

Cephalis subspherical, with few small pores, bearing a stout conical horn. Thorax pyriform with no appendages, thick wall, subcircular pores, and very constricted mouth. Some late specimens have an abdomen in the form of a narrow tube with very thin wall and irregular pores (commonly elongated longitudinally) (Riedel and Sanfilippo, 1970).

DIMENSIONS

The cephalis and thorax together are 100-145 μm long, and the thorax is 70-125 μm wide.

DISTINGUISHING CHARACTERS

Shell pyriform, with a stout conical horn approximately as broad as the cephalis. The inflated thorax is not prolonged as a narrow tube (Riedel and Sanfilippo, 1978a).

The consistent recognition of this form is rendered difficult by its very simple structure, and by the co-occurrence of several rather similar species. Specimens are admitted to *Eusyringium lagena* only if feet are completely lacking, the thorax is pyriform rather than ovate, and the aperture is no wider than about one-sixth of the maximum thoracic breadth. The most reliable identifications can be made in a stratigraphic sequence, where it is possible to follow its development from the *Sethochytris babylonis* (Clark and Campbell, 1942) group Riedel and Sanfilippo (1970) through atrophy of the feet. The commonest of the co-occurring forms with which *Eusyringium lagena* may be confused are an ovate form with a relatively wider aperture, and horn absent or weak, and a rounded-conical form with short, three-bladed feet and thoracic pores in longitudinal rows (Sanfilippo et al., 1985).

VARIABILITY

Through its short stratigraphic range, *E. lagena* exhibits only slight variability in the stoutness of the horn and breadth and length of the thorax, the latter having a tendency to become more elongate toward the end of the range. In addition, near the evolutionary transition to *E. fistuligerum*, a narrow terminal tube with a very thin wall is present. In some specimens, the thorax bears one or occasionally more wings proximally (Sanfilippo et al., 1985).

DISTRIBUTION

The morphotypic first appearance of this species defines the base of the *Thyrsocyrtis triacantha* Zone. Its morphotypic last appearance lies within the *Podocyrtis mitra* Zone.

Although this form is found in tropical assemblages of middle middle Eocene age, in the Indian Ocean it is very rare in the early part of its range, and therefore the base of the *Thyrsocyrtis triacantha* Zone might more conveniently be approximated there on the basis of the evolutionary transition from *Thyrsocyrtis tensa* to *T. triacantha*.

PHYLOGENY

This species evolved from the *Sethochytris babylonis* group and into *Eusyringium fistuligerum*.