Group: Acritarcha (unknown affinity) (uncertain)

Fossils like dinoflagellates, are microscopic fossil cyst, of uncertain affinity derived from ancient plankton. Their wall is believed to be composed of sporopollenin. (from the greek acritos = uncertain and archas = origin). Lister (1970) has concluded the majority of lower Paleozoic acritarch are the cysts of unicellular phytoplankton. Those cysts possessing excystemenment apertures, but without tabulation ranged from (Precambrian – Cenozoic)

Morphology of Acritarch: acritarchs are informal rag-bag group to which any hollow organic walled unicellular vesicle. Most are 20-150 micron, composed of a single layerd wall enclosing a central cavity, they may be entire or provided with an archaeopyle-like opening, ranging (Precambrian-Recent). They are useful for interregional Stratigraphic correlation but more limited environment valve.

The Vesicle: The acritarch vesicle consists of a central body enclosing a central cavity from which may arise spine-like processes and crests. These processes may be hollow and connected with the central cavity (open) are closed at the base, or solid (fig.1). The ttips of the processes can be simple, bifurcated or complexity branched.

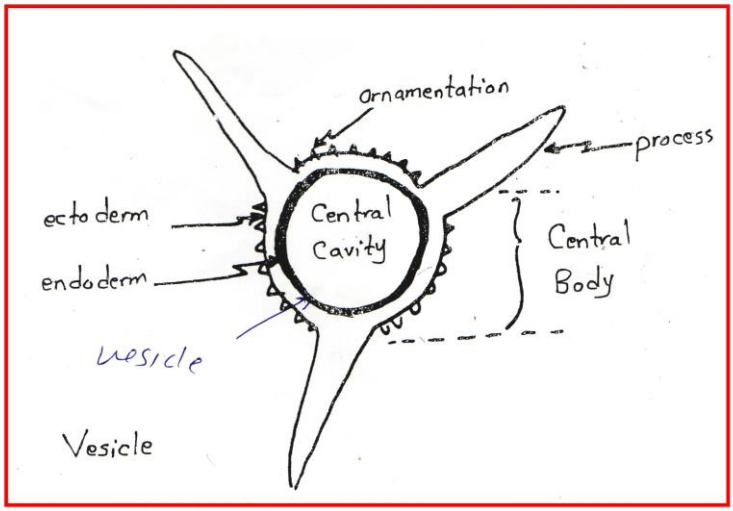


Fig.1: main parts of the standard shape of acritarch

Wall Composition and structures: The acritarch wall consists of (sporopollenin), generally this wall is single and homogenous. Laminar walls with narrow radial pores in some types. Double walls arise in

Visbysphaera from the growth of an inner body of slightly smaller diameter inside the outer vesicle (fig.2).

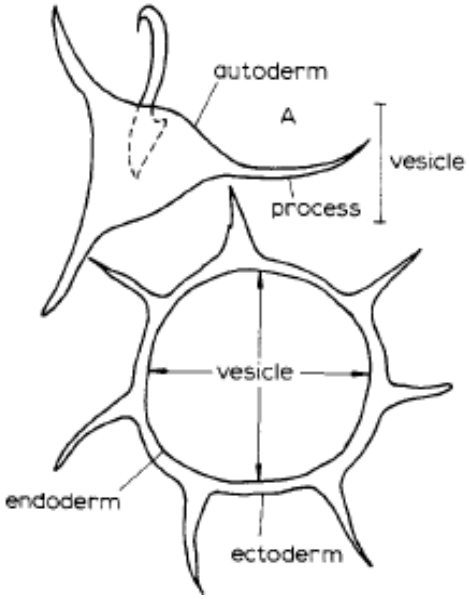
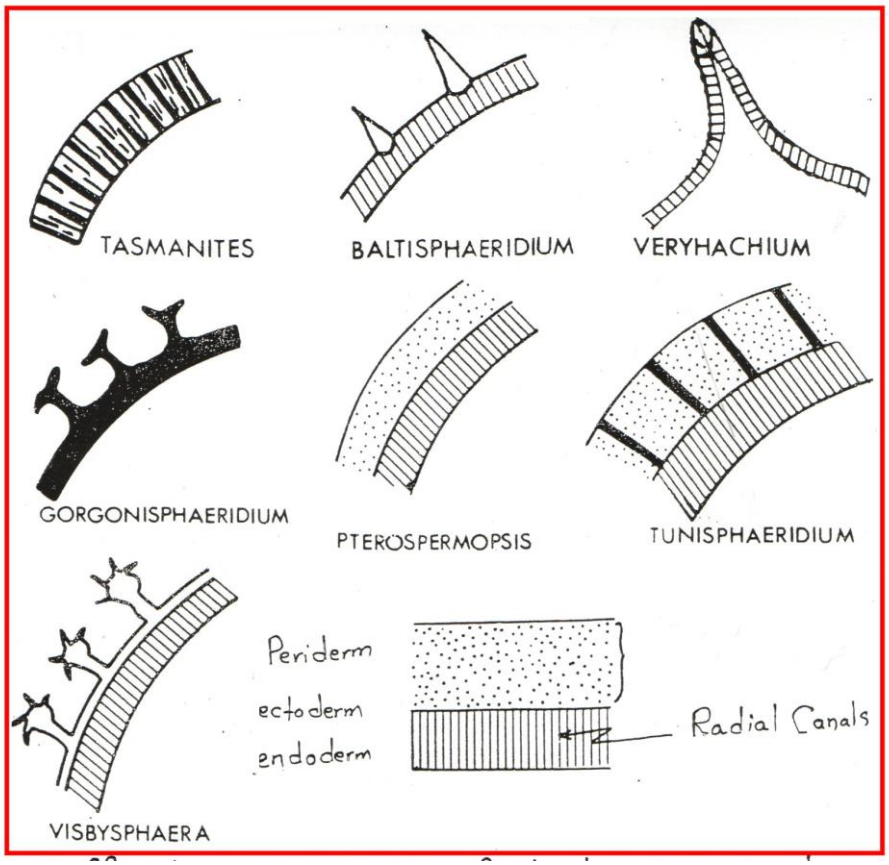


Fig.2: Wall of acritarch up: single wall layer acritarch, down: double wall layers acritarch

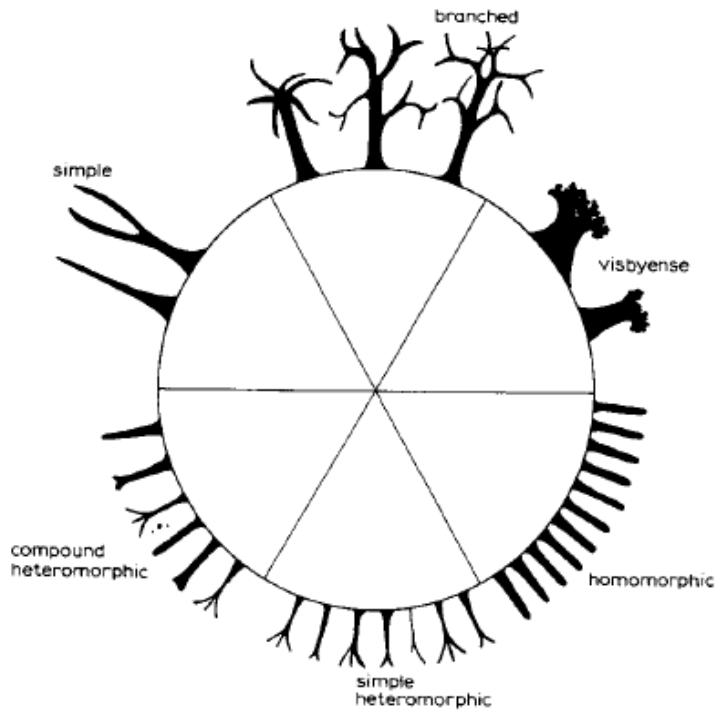


Different types of acritarch groups

Acritarch ornamentation:

Vesicles may be smooth, or finely ornamented with granules. Short spines, indentations or pores (fig.1). there are two major types of out growths of the

vesicle wall: sculpture elements (<5 micron) and processes which may be hollow or solid and branched or unbranched



Process types in acanthomorphitic acritarchs

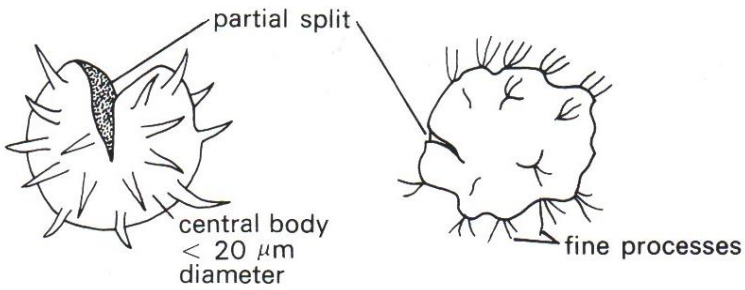
The Pylome:

The escape hole in a vesicle is called a Pylome, which because it resembles a dinoflagellate archaeopyle, it thought to have allowed release of a motile stage from the cyst (i.e. excystment). However, pylomes being scarce in Precambrian and Cambrian age species.

Acritarch Pylome types (kinds) (classification according to excystment style)

1-Partial split

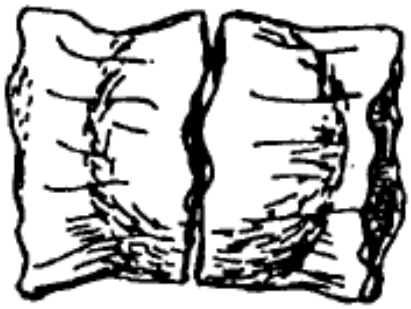
A simplex form of opening of the vesicle it's a partial ruptine of vesicle wall (e.g. *Micrhystridium*)

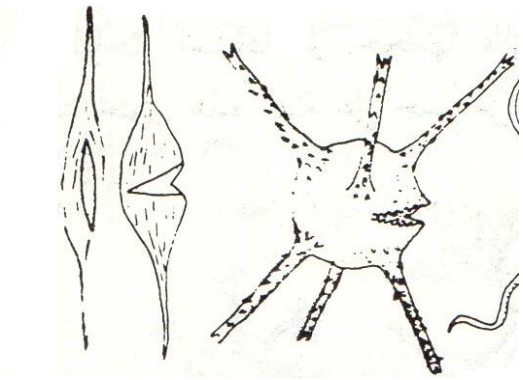


Micrhystridium *Vulcanisphaera*

2-Median splitting

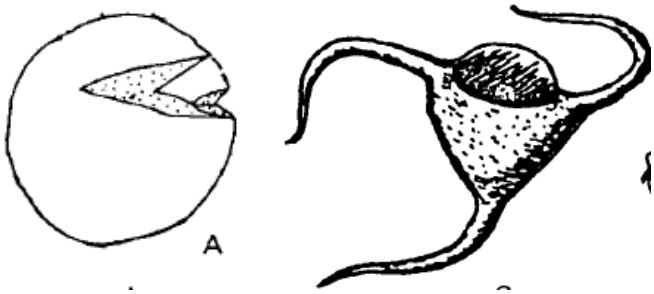
Pylome envolved a complete division of the vesicle into two equal halves as *Leiofusa* and *Diexallophasis*.



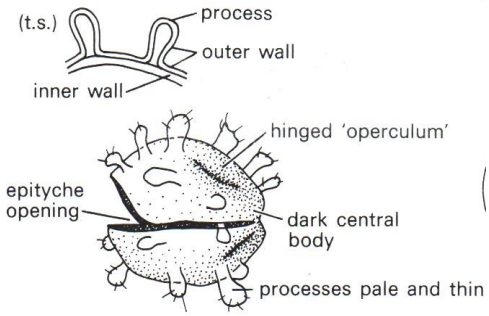


3-Epitych opening

If the splitting is less complete and proceeds along an arcuate fissure to leave a hinged flap e.g. *Visbysphaera*.



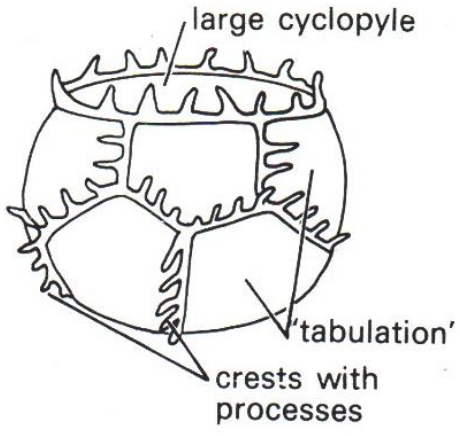
Leiosphaeridium *Veryhachium*



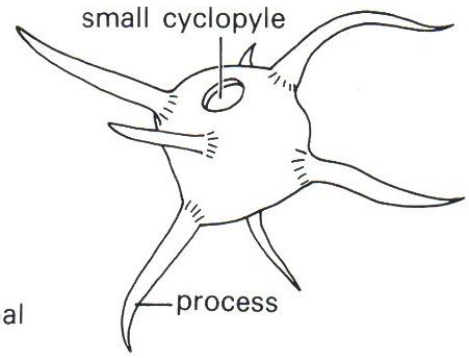
Visbysphaera

Cyclopyle

A circular or a polygonal opening in outline situated above the equator (e.g. *Cymatiogalea*)

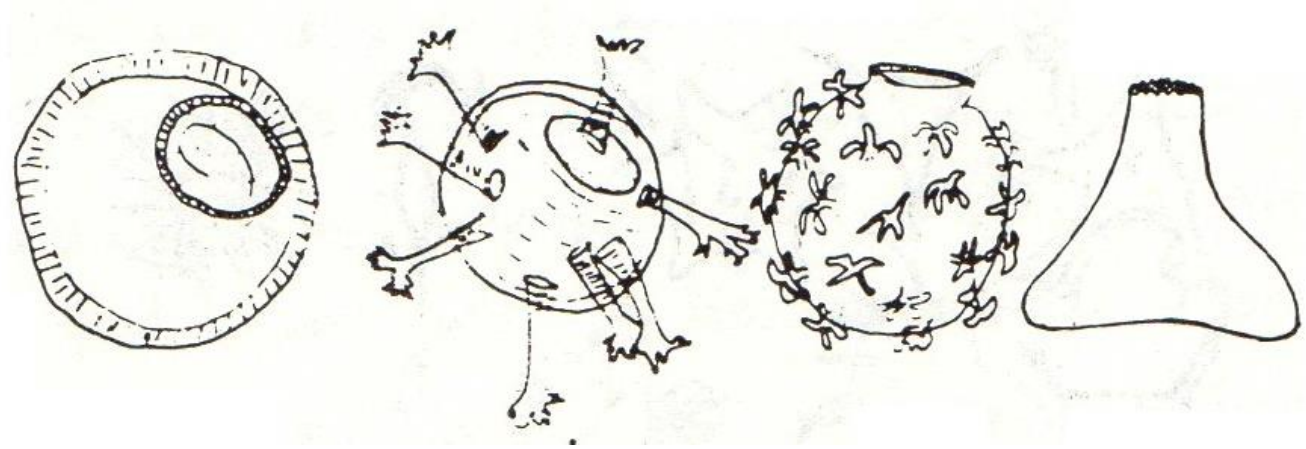


Cymatiogalea

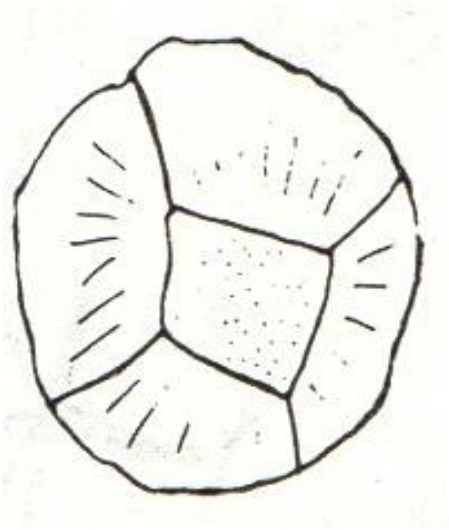


Baltisphaeridium

Cyclopyles tend to form an operculum which may be hinged released or fall inside the central cavity after excystment, in *Tasmenites* or in process position.



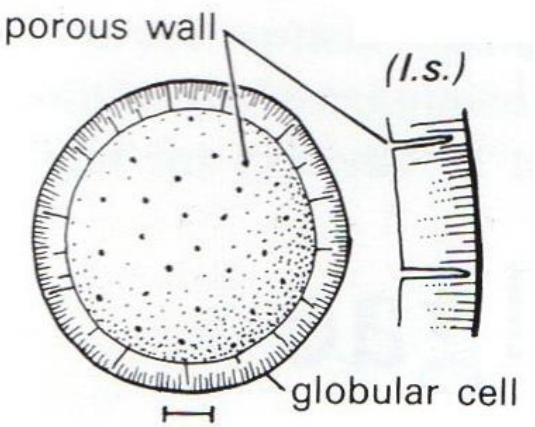
Archeopyle: should be reserved for dinoflagellate cysts, a few acritarch excystment openings similar.



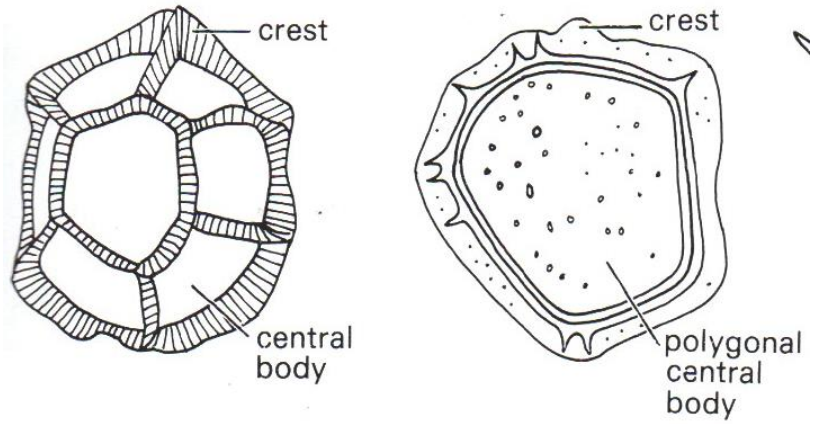
Acritarch Classification

Subdivision of the acritarchs has been hampered by a lack a biological information so that most classifications have been artificial. The following criteria may prove useful for a more natural classification in order of importance: 1-wall structure 2-pylome type 3-nature of processes and crests 4-the form of the central body of the vesicle, according to these criteria about eight basic types of acritarch can be distinguished (Downie, 1973).

1-Tasmenites group: have perforate wall with a cyclopyle or median-split opening. Spherical vesicles, lacked spines or crests (i.e. *Sphaeromorph*). Such forms (e.g. *Tasmenites*)

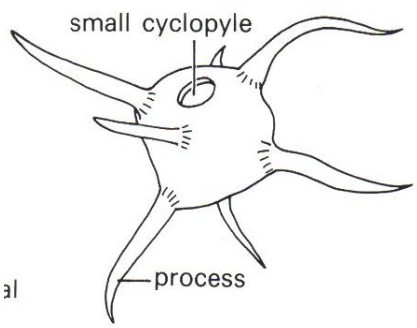


2-Cymatiosphaera group: perforate wall without known excystment openings. Originally spherical or polygonal vesicle, divided into fields by crests. In *Cymatiosphaera* (L. Cam.-Recent) these fields are polygonal *Duvernaysphaera* (M. Sil.-U. Dev.) the crests from an equatorial flange.

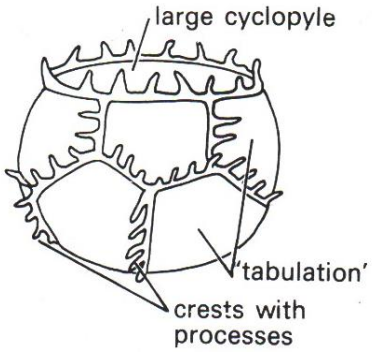


Cymatiosphaera *Duvernaysphaera*

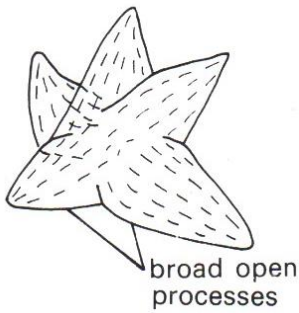
3-Baltisphaeridium group: perforate wall, a cyclopyle or median split opening. Spherical or polygonal vesicle but armored with processes or crests. *Baltisphaeridium* (L. Cam. – L. Sil.) have a spherical central body, over 20 micron in diameter, with simple hollow or solid processes with closed tips. In *Cymatiogalea* (M. Cam. – L. Sil.) the vesicle is devided into polygonal fields with crests between, has a large cyclopyle opening. *Estiastra* (M. Ord. – U. Sil.) a Star shaped with wide processes.



Baltisphaeridium

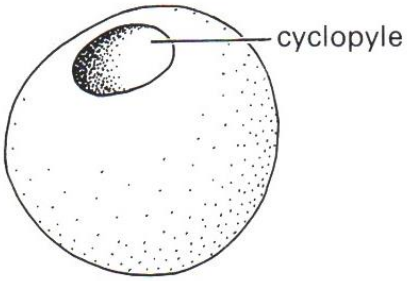


Cymatiogalea



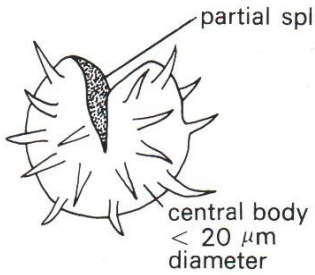
Estiastra

4-Leisphaeridia group: these have a simple imperforate wall with an irregular or cyclopyle opening. These vesicle were spherical and lacked processes and crests. Corresponding with the group "Sphaeromorphitae" of some classification. *Leiosphaeridia* (U. Precamb – Paleozoic) may have had green algal affinities like *Tasmenites*.

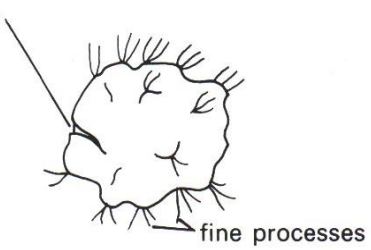


Leiosphaeridia

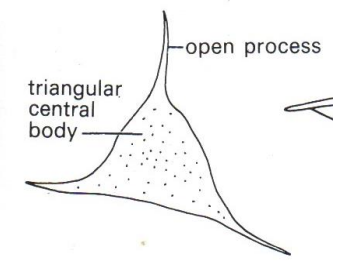
5-Micrhystridium group: has simple wall with partial split or epityche opening. The vesicles are small and spherical, polygonal or elongate with hollow processes e.g. *Micrhystridium* L. Cam. – Rec.) has a spherical central body less than 20 micron in diameter with simple processes *Veryhachium* (U. Cam. – Mioc) has a polygonal central body with from (3-8) hollow pointed spines with closed tips *Vulcanisphaera* U. Cam- U. Sil has irregular protuberances which bear a bunch of from (2-5) spines of varying length.



Micrhystridium

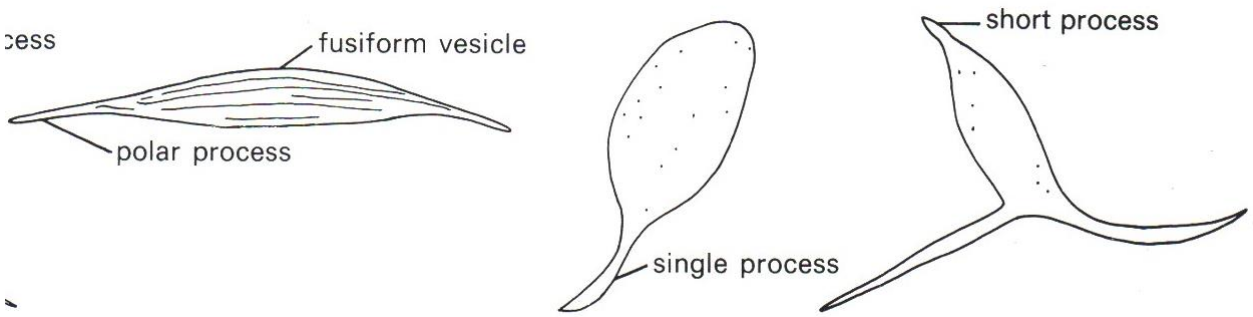


Vulcanisphaera



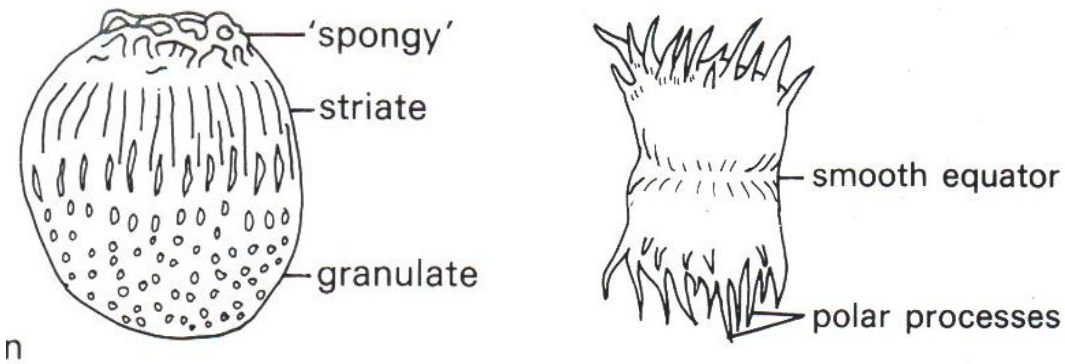
Veryhachium

6-Leiofusa group: simple wall, either median or lateral split or a C shaped epityche opening. Typically the vesicle are elongate with processes at the poles. As in fusiform *Leiofusa* (U. Camb – U. Carb). *Deumffia* (Sil.) bears a single process whilst *Domasia* has three processes (Sil.).



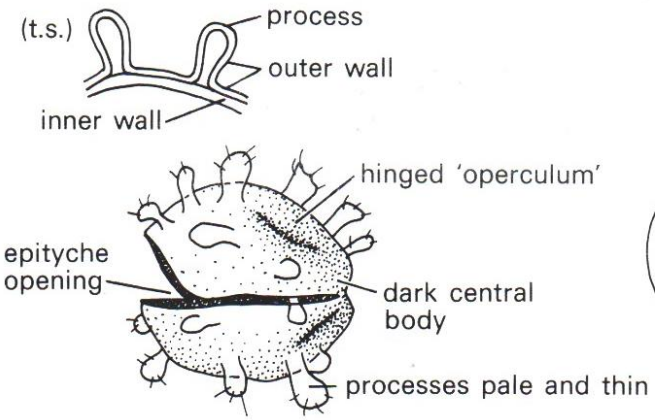
Leiofusa *Deumffia* *Domasia*

7-Acanthodiacrodium group: has a simple wall which tends to split up into angular plates when damaged. The openings are of varying kinds but the vesicles are typically elongate with the sculpture concentrated at one or both poles. *Acanthodiacradium* (M. Camb – M. Ord.) has small processes at both poles and a waist-like constriction. *Ooidium* (Cam.) is more ovate with a granular sculpture at one pole and a spongy sculpture at the other, with fine striae between.



Ooidium *Acanthodiacradium*

8-Visbysphaera group: double layered wall, epitych opening, elongate, triangular or spherical vesicle e.g. in *Visbysphaera* (L. Sil. – L. Dev.) which bears processes that are produced from outer wall.



Visbysphaera

Acritarch affinities and biology: Sporopollenin wall. Acritarchs resemble organic structures e.g. vascular plant spores, algal spores and cysts and dinoflagellate. The wall of *Tasmenites*, *Cymatiosphaera* and *Baltisphaeridium* groups compare closely with recent prasinophycean cyst and cells.
The *Leiosphaeridea* group compares with the spores of multicellular algae. The remainder may have affinity with the marked dinoflagellates (Gymnodiniales) and armouned *Dinophysiales* which are known to developed non tabulate cysts. Some suggested that they are the spores of multicellular algae.

Ecology: Acritarch abundance and diversity tends to increase from the shore line.
1) Lagoonal facies: are of low diversity, monospecific assemblage of group *Tasmenites*, *Leiosphaeridia* or *Leiofusa*.
2) Inshore facies: abundant of *Micrhystridium*.
3) Quieter off shore facies: assemblage with longer more delicate and elaborate processes and crests

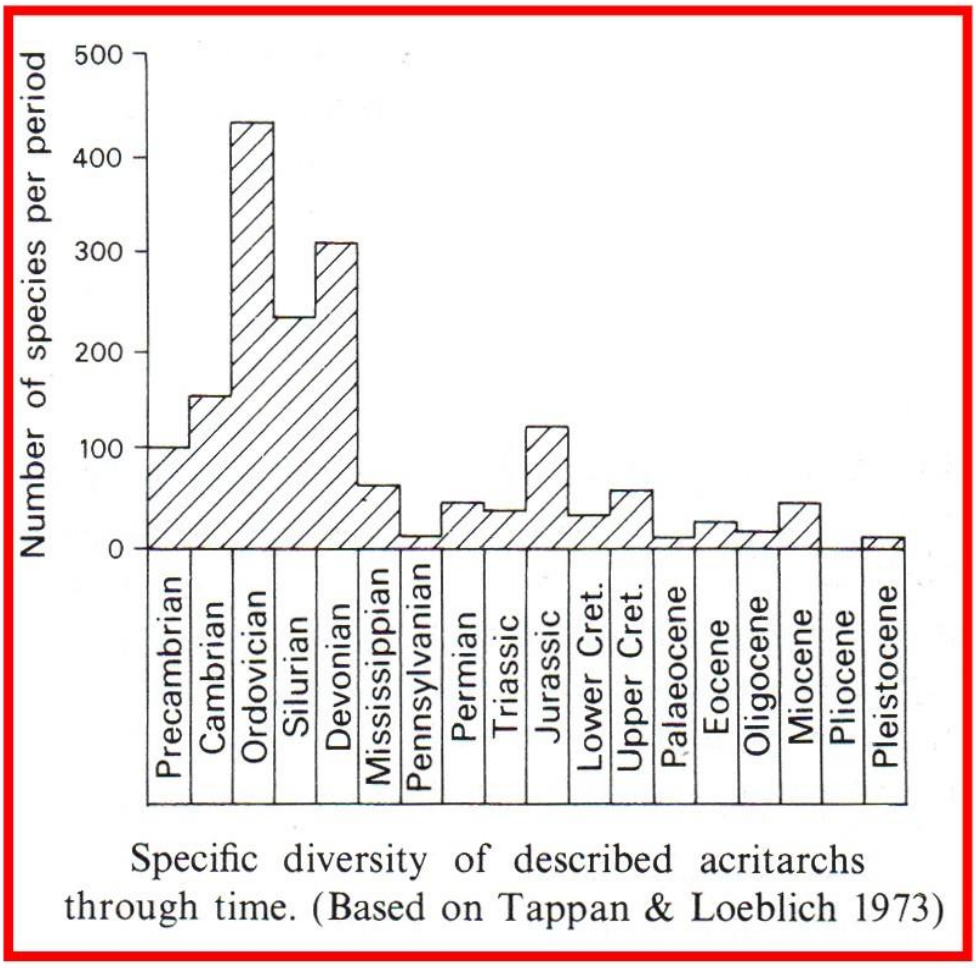
Temperature are primary control of acritarch distribution, they found from periglacial to tropical paleoenvironment.

The geographical distribution of acritarch suggested a partially or wholly planktonic mode of life

History of acritarch: Acritarchs of largely spherical vesicle without of excystment opening forms occurred from (Late Precambrian about 1000

Ma) in E. Camb. Forms of spinose acritarch (e.g. *Micrhystridium*, *Baltisphaeridium*). Crested forms (e.g. *Cymatiosphaera*) and *Leiofusa* and *Acanthodiacradium* groups were acme in Late Cambrian and Early Ordovician times. *Baltisphaeridium* flourished throughout the Ordovician but died out in early Silurian, a period dominated by *Micrhystridium*, *Veryhachium*. Rich early Devonian assemblages of this kind were followed by a general decline in acritarch diversity and abundance ( ); the group then became scarce, throughout the Carboiferous – Permian and Triassic, certain genera made a limited come back in the Jurassic, Cretaceous and Tertiary e.g. *Tasmenites, Cymatiosphaera* and *Micrhystridium*

The radiation of sculptured acritarchs in early Cambrian coincides with the major radiation of invertebrate suspension feeders.



Specific diversity of described acritarchs through time. (Based on Tappan & Loeblich 1973)