

# Sieve-type pores on the valves of Timiriaseviinae ostracods. Their interest for the systematics of selected taxa

Les plaques de pores en tamis sur les valves des Timiriaseviinae.  
Leur intérêt pour la systématique de quelques taxons

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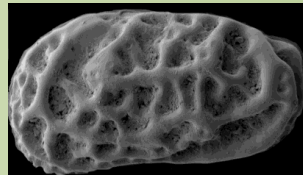
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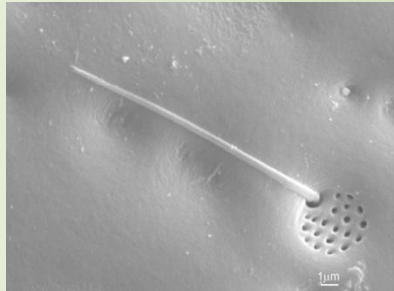
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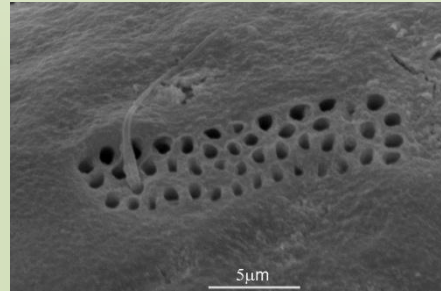
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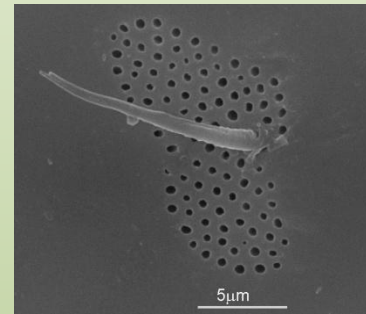
**Sieve-type pores** – they occur in marine and non-marine ostracod groups (less well documented), both live and fossil; they vary in type, shape, number and distribution. Their diversity has already been used for systematics and palaeoecological studies.



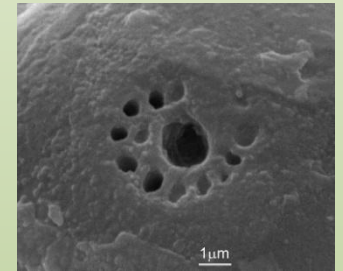
*Tuberoloxoconcha* sp.



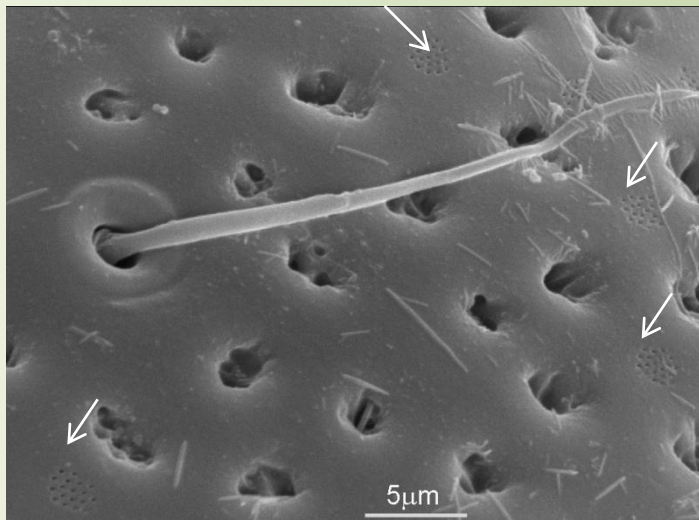
*Loxoconcha elliptica* Brady, 1868



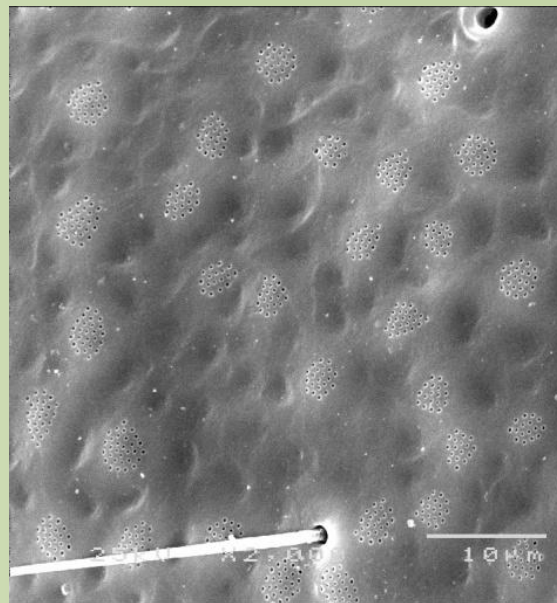
*Cyprideis torosa* (Jones, 1857)



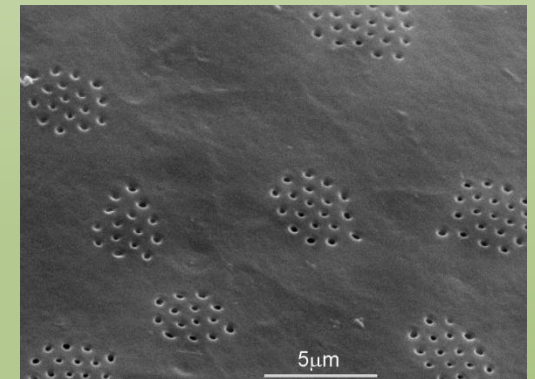
*Microceratina* sp.



*Gomphodella maia* De Deckker, 1981



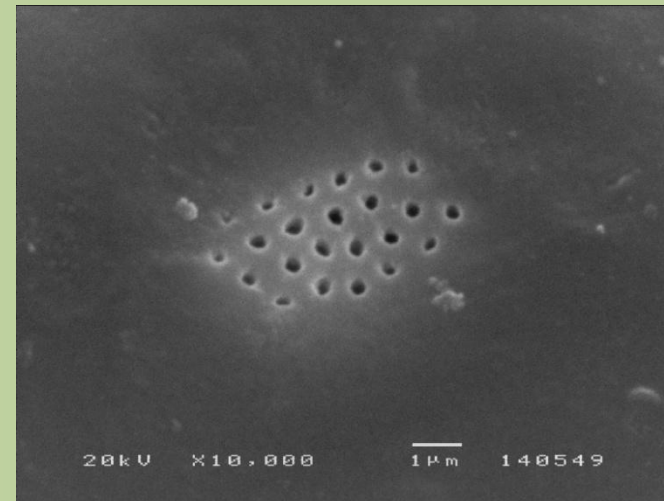
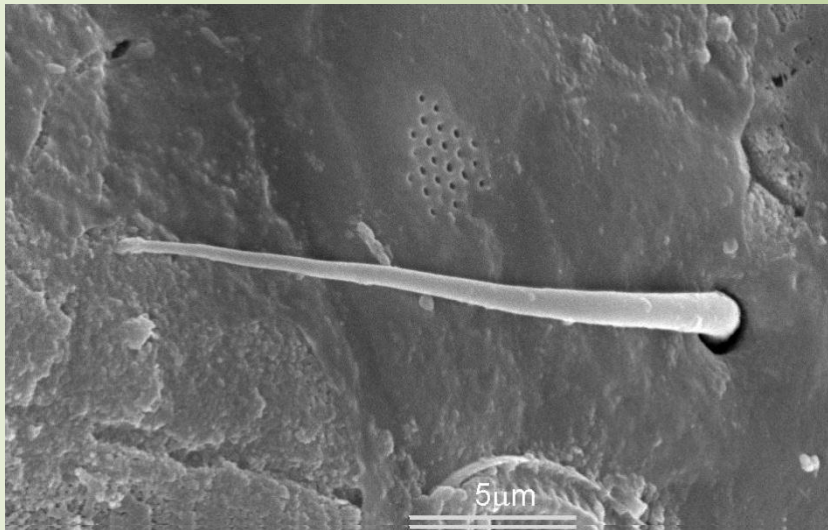
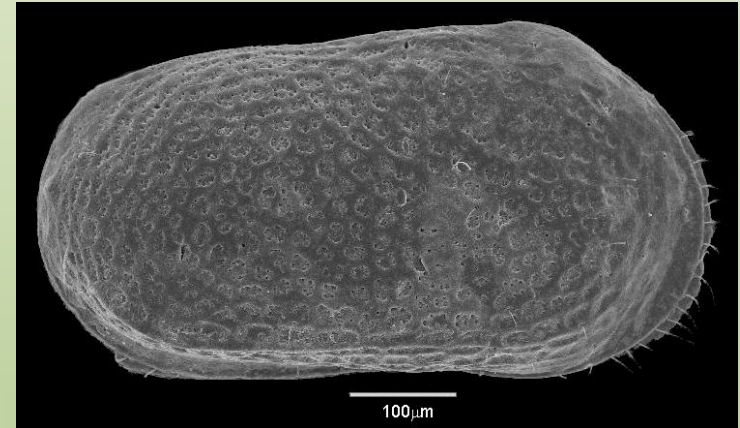
*Gomphodella quasihirsuta* Karanovic, 2009



*Gomphodella quasihirsuta* Karanovic, 2009

It was **Jean-Paul Colin** who realized the potential interest of the sieve-type pores when studying with several of us a new species of *Gomphocythere* Sars, 1924, from Turkey. His idea was that sieve pores occur in fixed positions on the valves of *Gomphocythere*, typical for each species, thus having a systematic value for selected taxa of Timiriaseviinae.

*Gomphocythere* sp. (Adiyaman,  
Turkey)





# To check Jean-Paul Colin's ideas we used several working methods

## Review the general literature on the sieve type-pores.

### USE OF NORMAL PORES IN TAXONOMY OF OSTRACODA<sup>1</sup>

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#### ABSTRACT

On the lateral surface of the carapace ostracodes have radial pores of two types: "simple" and sieve. The functions of these two pore types are not fully known. Studies of the carapace with a scanning electron microscope reveals differences between the pores of Myodocopa, Platycopina, Cladocopa, and Podocopina. Sieve pores demonstrate the greatest dimorphism and are confined to the superfamily Cytheracea. A basic pattern of pores was formulated:

Type A. Single pore with a sensory hair.  
A' Normal pore without a lip.  
A'' Normal pore with a lip.

Type B. A sieve plate without a well-defined central or subcentral pore with a sensory hair.

Type C. Type A superimposed on Type B.

A sieve plate with a pore and sensory hair emerging from its center.

Type D. Combination of Type A and Type B.

A sieve plate, and a separate single pore with a sensory hair.

These types can be utilized in future systematic studies of Ostracoda.

#### INTRODUCTION

Two types of pore canals penetrate the valves of ostracodes. The canals which parallel the carapace surface and occur in the margins are called marginal pores. Those canals perpendicular to the carapace are called normal pores and consist of two types: "simple" and sieve. The "simple" pores consist of a single pore with a sensory hair (Pl. 1, Fig. 2). The internal structure is composed of a short, narrow canal with a short, thick beak, or a long narrow hair protruding externally. The bulbous internal base of the hair is innervated providing the ostracode with a sensory device that reaches through the carapace.

Müller (1894) considered the internal structure of a sieve pore to consist of a central canal containing an internal sensory hair enclosed by blind canals. In 1967, the blind canals were shown to be open to the surface in *Paracyclops brachyformis* Swain in scanning electron photomicrographs taken by Sandberg and Hay (1967).

The function of sieve pores is not known. Müller (1894) speculated that sieve pores may serve a light-sensory function and illustrated a specimen of *Laccocochia striatiformis* Müller, with pigmentation radiating from the pores as would a chromatophore. Because of the diversity of form exhibited by the sieve pores, he did not consider light-sensing as the only possible function.

The use of normal pores in taxonomy has been confined to distinguishing between open ("simple") and sieve pores. A further distinction was made in the distribution of pores on the carapace, which, except for some sexual variation, appears constant within a species. In actual practice neither of the two uses have been very important. Thus, many investigations completely omit a description of the pores. It is the aim of this paper to bring together what is presently known of normal pores and

establish some new criteria to increase their taxonomic usefulness.

#### BASIC TYPES

Normal pores are of two types: "simple" and sieve. The "simple" pores consist of a single pore with a sensory hair (Pl. 1, Fig. 2), that will be either straight (Pl. 3, Figs. 1b, 2b) or dendritic (Pl. 1, Fig. 2). The most common modification of the "simple" pores are those with a lip around the pore (Pl. 1, Fig. 4) and those without a lip (Pl. 1, Fig. 2). There is a third variation which has the pore canal surfacing atop a node or a spine as in *Paracyclops jonesi* (Baird) (Pl. 3, Fig. 4a, b) and *Echinocythereis* species, respectively.

The most common configuration for a sieve pore is a sieve plate with a sensory hair emerging from it (Pl. 1, Fig. 1, 5). Other typical sieve pores of this type can be seen in *Arctia*, *Halimene*, *Megacythereis*, and *Laccocochia* species. Modification from these forms can be seen in pores at the bottom of pits (*Cythereis maculifera* Kolbman; Pl. 5, Fig. 2a, b) or stop nodes (*Halimene sandersi* Puri; Pl. 2, Fig. 3a, b) and sieve pores exemplified by "Sabine's subulata" (Brady) (Pl. 5, Fig. 4a, b) an quite common in the brachytherid and trachytherid genera and may have a pronounced rib across it.

The simplest sieve pore arrangement, consists of a sieve plate with no sensory hair (*Myodocopa* sp.; Pl. 1, Fig. 3). A similar configuration is found in *Acaulocythereis jonesi* (Baird) (Pl. 1, Fig. 6) which possesses a sieve plate and a separate sensory hair.

From the polymorphism observed in the normal pores of approximately fifty genera, the basic pore structures are divisible into four types: (Pl. 1).

Type A. Single pore with a sensory hair.

A' Normal pore without a lip.

A'' Normal pore with a lip.

Type B. A sieve plate without a well-defined central or subcentral pore with a sensory hair.

Type C. Type A superimposed on Type B.

A sieve plate with a pore and sensory hair emerging from its center.

Type D. Combination of Type A and Type B.

A sieve plate, and a separate single pore with a sensory hair.

353

### USE OF NORMAL PORES IN TAXONOMY OF OSTRACODA<sup>1</sup>

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A sieve plate, and a separate single pore with a sensory hair.

These types can be utilized in future systematic studies of Ostracoda.

1 - Puri, H. S., 1974. Normal pores and the phylogeny of Ostracoda.

*Geoscience and Man*, 6: 137-151.

2 - Puri, H. S., Dickau, B. E., 1969. Use of normal pores in taxonomy of Ostracoda. *Gulf Coast Assoc. Geol. Soc., Trans*, 19: 353-367.

3 - Rosenfeld, A., Vesper, B., 1977. The variability of the sieve-pores in *Cyprideis torosa* (Jones, 1850), recent and fossil, as an indicator for salinity and paleosalinity. In: Löffler, H. & Danielopol, D. (eds.). *Aspects of Ecology and Zoogeography of Recent and Fossil Ostracoda*, 55-66. The Hague: Junk b. v. Publishers.

### NORMAL PORES AND THE PHYLOGENY OF OSTRACODA

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#### ABSTRACT

Three types of pore canals penetrate the valves of ostracodes. The canals that parallel the carapace surface and occur in the marginal area are called marginal pore canals. The long canals that run from the outer margin to the line of concrescence are called true marginal pores. False marginal pore canals reach the surface between the line of concrescence and the outer margin. Those canals perpendicular to the carapace are called normal pores and consist of two types: "simple" and sieve. The "simple" pores consist of a single pore with a sensory hair. The internal structure consists of a short, narrow canal, with a short, thick beak, or a long, narrow hair protruding externally. The bulbous internal base of the seta is innervated, providing the ostracode with

a sensory device that reaches through the carapace.

The following four basic pore types are: Type A. Single pore with a sensory hair; A' Normal pore without a lip; A'' Normal pore with a lip; Type B. A sieve plate without a well-defined central or subcentral pore with a sensory hair; Type C. Type A superimposed on Type B; a sieve plate with a pore and sensory hair emerging from its center; Type D. Combination of Type A and Type B; a sieve plate and a separate, single pore with a sensory hair.

Three different species, each representing a different sieve type—Type B (*Cyprideis* sp.), Type C (*Arctia conradi floridana* Benson and Coleman), and Type D (*Retziocythereis floridana* Puri)—were studied with the aid of the Electron Transmission Microscope.

#### PLATE 1

##### Scanning Electron Micrographs

1. Structure of sieve pores in *Cyprideis* sp., a, external lateral view of RV, showing distribution of sieve pores, x75; b, enlargement of central muscle pore area, showing distribution of elongate and Y-shaped sieve pores, x150; c, enlargement of Y-shaped sieve pore plate, showing individual pores, a subcentral opening of main pore; and inflex sensory hair, x2500; d, enlargement of an elongate sieve pore plate, showing a circular subcentral opening and a sensory hair. The white ring around each individual pore can be seen only in living specimens, and they appear to be formed by a gelatinous ooze, x2500.
2. Section through outer lamella showing chitin coating.

- (d.c.) of calcareous layer (c.l.), fibrous supporting structures, main pore canal (m.p.), and a sensory hair (h.) leading into a bulbous cavity, x2850.
- Electron Transmission Micrographs
3. Section through outer lamella, showing sieve pore plate (s.p.p.), with individual pores opening to surface, a cross section of sensory hair (h.), and bulbous cavity, which is surrounded by fibrous supporting structures in calcareous layer (c.l., x1700; b, enlargement of entire sieve plate, showing tubular sieve pores (t.s.p.) aperture by fibrous plates (f.p.). Large tubular structures on the left are cross sections of sieve pores that do not open to the surface; structure of the fibrous supporting features is clearly shown on the lower right, x8450.

Sixth Intern. Ostracod Symposium, Saafeelden

### THE VARIABILITY OF THE SIEVE-PORES IN RECENT AND FOSSIL SPECIES OF CYPRIDEIS TOROSA (JONES, 1850) AS AN INDICATOR FOR SALINITY AND PALAEO-SALINITY

AMNON ROSENFELD & BERND VESPER

#### Abstract

Observations were made of recent species of *Cyprideis torosa* from different saline environments in Northern Germany and Israel. This species possesses sieve-pores of different shapes: "round", "oblong", and "irregular". An inverse relationship between the percentage of "round" pores and salinity appears to exist. "Irregular" pores predominate in hypersaline waters. A correlation graph (Fig. 3) between pore shape and salinity is presented.

Applying this relationship to Pleistocene occurrences of *C. torosa* from Northern Germany (Holsteinian), Denmark (Eemian) and Israel (Lisan Formation), different paleosaline environments of deposition were established. Other paleoecological studies are in agreement with the results obtained in this investigation.

The method offers the possibility of paleosalinity estimations for the Pleistocene. Further studies on the other salinity tolerant ostracod species in other stratigraphical ranges may supply a simple method for paleosalinity determinations.

#### Introduction

*Cyprideis torosa* is a cosmopolitan holohyaline species (for a list of occurrences, see Vesper, 1972a) which tolerates a wide range of water salt concentrations (occurring in fresh, brackish, hypersaline water). The relationship between the morphology of the carapace and the water salt concentration has been investigated for this species on numerous occasions (Vesper, 1972 a-b). See Vesper (1972b), for an account of the phenomenon of node formation.

From investigations of populations of the species from different localities, with water of different salt concentrations, it became apparent that variations occur in the shape of the opening of the sieve-pore. Thus this study was begun to establish whether there is a causal relationship between the variability of the shape of the sieve-pore of the ostracode valve and the salinity.

The soft body of the ostracode is completely enclosed in a shell, the valves of which are penetrated on the exterior surface by numerous pore-canals (the number of which may vary). Canals which run vertically through the valve towards the surface are referred to as superficial pore canals ("normal pores"). These can be divided into two categories on the basis of the opening: "single pores" and "sieve-pores".

Whereas Müller (1894) described the sieve pore as a central canal, carrying a beak and surrounded by "blind" canals ("blind canals"), other authors (Sandberg & Hay 1967, Sandberg & Plusquelieu 1969, Omatsola 1970, Puri 1974) have established that the "blind canals" of Müller similarly open to the exterior.

Puri & Dickau (1969) set up a classification of the "normal pores" according to types. Based on this, the type of sieve pore which occurs in *Cyprideis torosa* can

# Review the general literature on the Timiriaseviinae, Limnocytheridae.

## PALEOBIOLOGIE CONTINENTALE

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"L'imagination grossit les petits objets  
jusqu'à en remplir notre âme par une  
estimation fantastique."  
B. PASCAL (Pensées 108)

J.P. COLIN et D.L. DANIELOPOL  
SUR LA MORPHOLOGIE, LA SYSTÉMATIQUE, LA BIOGÉOGRAPHIE ET L'ÉVOLUTION  
DES OSTRACODES TIMIRIASEVIINAE (LIMNOCYTHERIDAE)

BULLETIN DE L'INSTITUT ROYAL DES SCIENCES NATURELLES DE BELGIQUE. BIOLOGIE, 59, 63-84, 1980  
BULLETIN VAN HET KONINKLIJKE BELGISCH INSTITUUT VOOR NATUURWETENSCHAPPEN. BIOLOGIE, 59, 63-84, 1980

### Revision of the genus *Leucocythere* KAUFMANN, 1892 (Crustacea, Ostracoda, Limnocytheridae), with the description of a new species and two new tribes.

by Dan L. DANIELOPOL, Koen MARTENS & Livia M. CASALE

#### Summary

The main aim of the present contribution is to provide an unequivocal diagnosis of the genus *Leucocythere*. It appears, however, that this could only be effected when embedded in a broader taxonomic framework. The subfamily Limnocytherinae is thus divided into four tribes: Limnocytherini, Diansocytherini, Cytheridellini and Limnocytherini and diagnoses are provided for these taxa. The latter two are new to science, while the rest of Diansocytherinae was changed from subfamily to tribe. Three genera are lodged in the Limnocytherini: *Leucocythere* KAUFMANN, 1892, *Fransuocythere* SCHROEDER, 1986 and *Ombrocythere* MARTENS, 1989. The former, nominate, genus is characterized and its type species, *L. mirabilis*, is extensively redescribed. A comparative description of a limnocytherid with a somewhat similar appearance, *Leucocythere (Leucocytherella) aegyptiaca*, is offered. A second species of *Leucocythere*, *L. algeriensis* nov. sp., is described from a temporary pool in Algeria. *L. huberi* (GIBBER) is retained as a third species in the genus. A large number of fossil records is reassessed. Most of the Asian fossils, previously assigned to *Leucocythere*, do not belong in this genus and a revision of their status appears urgent. Some remarks on the validity and position of *Leucocytherella* are also offered.

*L. mirabilis* is a cold-temperate species, with a preference for oligohaline waters and the grand estuaries. Its status in Europe can at present best be described as enigmatic, due to rapid degradation of native biotas.

*L. algeriensis* nov. sp. and *Ombrocythere mirabilis* MARTENS are probably best regarded as prodromic stages. This is the first time that *L. mirabilis* has been described as endemism, due to rapid degradation of native biotas.

Some comments on the phylogeny and historical biogeography are presented. *Leucocythere* appears to be the most advanced group in the Limnocytherinae, the other two genera show more plesiomorphic character states. It is here postulated that the three genera evolved by vicariance from a most widely spread ancestor *Leucocythere* in Europe. *Fransuocythere* in Asia and *Ombrocythere* in Africa. *L. algeriensis* from northern Africa is doubtfully from Palaeozoic rock and its separation from *L. mirabilis* must have occurred fairly recently. A number of morphological peculiarities of *L. mirabilis* are discussed with special attention for the carapace and for those old parts that are used for the mating process. In spite of the fact that many of the peculiarities appear maladaptive of the genus, it must be assumed that *L. mirabilis* has far maintained itself very well in its environment, until recent anthropogenic pollution rendered it many localities.

**Keywords:** *Leucocythere*, Ostracoda, Limnocytherini, Cytheridellini, morphology, biogeography, functional morphology.

#### Résumé

Le but principal de cet article est de fournir une diagnose claire du genre *Leucocythere*. Pour cet effet, il apparaît que cet ne peut être effectué que

dans un cadre taxonomique plus large. La sous-famille des Limnocytherinae est donc divisée en quatre tribus: Limnocytherini, Diansocytherini, Cytheridellini et Limnocytherini et des diagnoses sont fournies pour ces taxa. Les deux dernières sont nouvelles pour la science. Trois genres se situent dans les Limnocytherini: *Leucocythere* KAUFMANN, 1892, *Fransuocythere* SCHROEDER, 1986 et *Ombrocythere* MARTENS, 1989. Le genre nominal est caractérisé et l'espèce type, *L. mirabilis*, est largement redécrite. Une description comparative est effectuée avec un limnocytheride semblable: *Leucocythere (Leucocytherella) aegyptiaca*. Un deuxième espèce du genre *Leucocythere*, *L. algeriensis* nov. sp., provenant d'un habitat temporaire en Algérie, est décrite. *L. huberi* (GIBBER) est remise comme une troisième espèce de ce genre.

Un important matériel fossile est réexaminé. La majorité des fossiles asiatiques, qui dans le passé furent considérés comme les *Leucocythere*, ne peuvent plus rester dans ce genre et leur situation reste énigmatique. Quelques remarques sur la validité et la position de *Leucocytherella* sont discutées en même temps.

*L. mirabilis* est décrite comme une espèce endémique et marque une préférence pour les eaux oligohalines et les grands estuaires. Son statut en Europe peut être actuellement considéré comme précaire, étant donné la dégradation rapide de nos biotes.

*L. algeriensis* nov. sp. et *Ombrocythere mirabilis* MARTENS sont probablement les meilleures formes prodromiques de formes existantes à la présente. Ceci est unique dans les Cytheridellini, mais la question taxonomique exacte de ce caractère n'est pas bien connue.

Quelques commentaires sur la phylogénie et la biogéographie historique sont présentés. *Leucocythere* semble le groupe le plus évolué dans les Limnocytherini, les deux autres genres montrent des caractères plus plesiomorphes. Il est postulé que les trois genres ont évolué par vicariance à partir d'un ancêtre commun *Leucocythere* en Europe. *Fransuocythere* en Asie et *Ombrocythere* en Afrique. *L. algeriensis* de l'Afrique du Nord peut-être un stade paléontologique et spécifique de *L. mirabilis* à dire le fait est tout rétrospectif. Un nombre de particularités morphologiques de *L. mirabilis* sont discutées, avec une attention spéciale pour la carapace et les parties molles qui sont utilisées dans la copulation. Malgré qu'il semble que beaucoup de ces particularités ne semblent pas bien adaptées, il est assumé que *L. mirabilis* se maintient très bien dans son milieu, jusqu'à ce que la pollution anthropogénique récente ne cause pas son extinction dans beaucoup de localités.

**Mots-clés:** *Leucocythere*, Ostracoda, Limnocytherini, Cytheridellini, Diansocytherini, morphologie, biogéographie, morphologie fonctionnelle.

#### 1. Introduction

The family Limnocytheridae Sars, 1925 is one of the most common non-marine ostracod groups. The oldest species were found in the early Mesozoic and since that time, this group expanded on all continents

Mitt. Hamb. zool. Mus. Inst. Band 92, Ergbd. S. 273 - 280 Hamburg, April 1995

### On the validity and the taxonomic position of the Cytheridellini (Crustacea, Ostracoda, Limnocytheridae)

KOEN MARTENS

**ABSTRACT:** Relying on the morphology of both carapae and appendages of the three cytheridellid genera *Cytheridella*, *Gomphocythere* and *Gomphodella*, the position and the validity of the tribe Cytheridellini are reassessed. Most anatomical features of valves (brood pouch, hinge structure) and appendages (Antennula, Maxilla, mandibular palp, furcae and hemipenes), indicate that the above three genera belong in the Timiriasevinae, not in the Limnocytherinae. Only the presence of sieve pores in these three genera (completely absent in the Timiriasevinae, but present in all Limnocytherinae) contradicts this conclusion. The three genera are nevertheless here formally transferred to the Timiriasevinae. Sieve pores are furthermore the only feature using the three genera within the Timiriasevinae. Relying on hinge type and mandibular palps, the three cytheridellid genera appear to belong to three different lineages within the Timiriasevinae.

**KEYWORDS:** Limnocytherinae, Timiriasevinae, Ostracoda, Taxonomy.

#### Introduction

DANIELOPOL (1965) distinguished two tribes of Limnocytheridae Sars, 1925: the Limnocytherini and the Metacypridini. HARTMANN & PURI (1974) elevated these tribes to subfamily rank, and placed the genera *Afrocycthere*, *Cordocycthere* (now regarded as a synonym of *Kovalevskella*), *Cytheridella*, *Eldadina*, *Gomphocythere*, *Metacypris*, *Bulocycpris* and the extinct genus *Theriosynocum* in the Metacypridinae; *Timiriasevina* MANDELSTAM, 1947 was listed as *familia incerta*. COLIN & DANIELOPOL (1978, 1980) considered Metacypridinae (DANIELOPOL, 1965) a junior synonym of Timiriasevinae MANDELSTAM, 1947 and gave new diagnoses of family, subfamilies and genera. Following DANIELOPOL (1965), COLIN & DANIELOPOL (*loc. cit.*) argued that *Gomphocythere* and *Cytheridella*, although superficially resembling the Timiriasevinae, actually belonged to the Limnocytherinae, thus constituting a case of parallel evolution in the two subfamilies. Relying on this extensive revision of the Timiriasevinae, DANIELOPOL *et al.* (1990) maintained this decision and created a special tribe within the Limnocytherinae, the Cytheridellini DANIELOPOL & MARTENS, to comprise *Cytheridella* DADAY, *Gomphocythere* Sars and *Gomphodella* DE DECKER, MARTENS (1993), amended the diagnosis of both the tribe Cytheridellini and the genus *Gomphocythere*, still considering both to belong to the Timiriasevinae.

A workshop on biology and taxonomy of Recent and fossil Timiriasevinae (Moulis, France, June 1993) has provided a reassessment of the morphology of various genera within this subfamily, based on both extant literature and new observations. It was found that several morphological characteristics are shared by both Cytheridellini and Timiriasevinae. The present paper reports on these results and reassesses the taxonomic position of the three cytheridellid genera and the validity of the tribe itself. It will be shown that the three genera belong to the Timiriasevinae and not the Limnocytherinae and that the tribe Cytheridellini most probably constitutes a

80

## On the validity and the taxonomic position of the Cytheridellini (Crustacea, Ostracoda, Limnocytheridae)

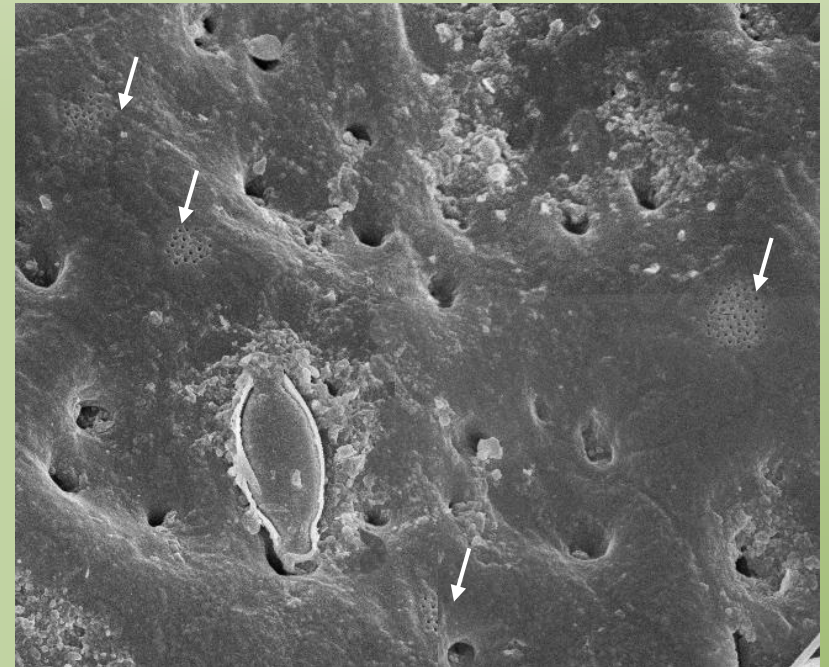
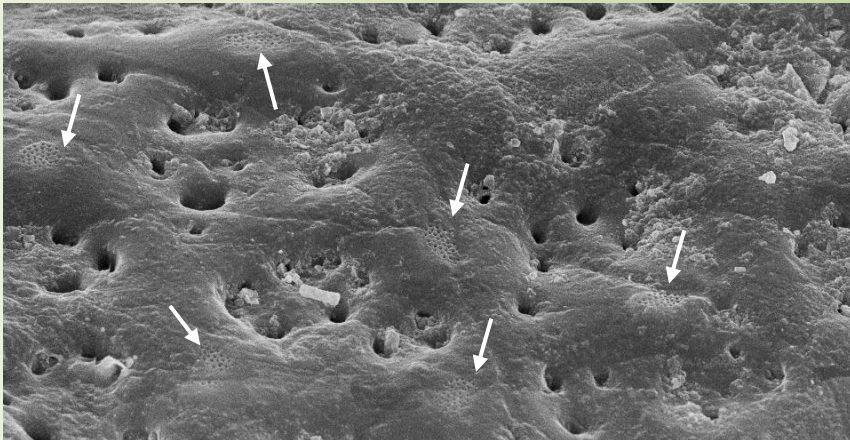
KOEN MARTENS

### Revision of the genus *Leucocythere* KAUFMANN, 1892 (Crustacea, Ostracoda, Limnocytheridae), with the description of a new species and two new tribes.

by Dan L. DANIELOPOL, Koen MARTENS & Livia M. CASALE

Try to map the complete distribution of the sieve plates on a valve of *Gomphocythere*, in this case, *Gomphocythere* sp., from Turkey.

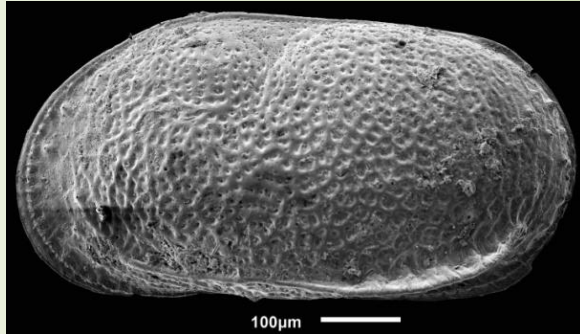
- 72 photos, 1500x magnification (minimum for sieve plates to be visible) were taken from the valve.
- Each photo had at least a common reference point with the previous photo, to be easily overlaid.
- After photographing the whole valve surface, we joined all the photos with Photoshop using the common points.
- We thus have a complete valve image that can be zoom in to see each sieve plate.
- Using a grid we can count all the valve's sieve plates, the number of the tubuli in each sieve plate, and see the sieve plates' shapes.



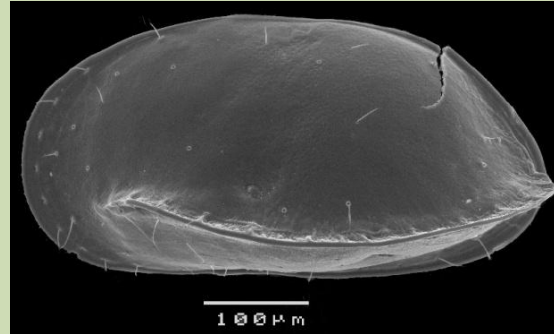


Provide information on the general shape, size variation and density of the sieve plates on the valves of species belonging to different genera of Timiriaseviinae, from recent and fossil specimens, coming from environments differing in salinity: *Gomphocythere*, *Gomphodella* De Deckker, 1981, *Cytheridella* Daday, 1905, *Theriosynoecum* (Branson, 1935), *Sinuocythere* Colin et al., 2000.

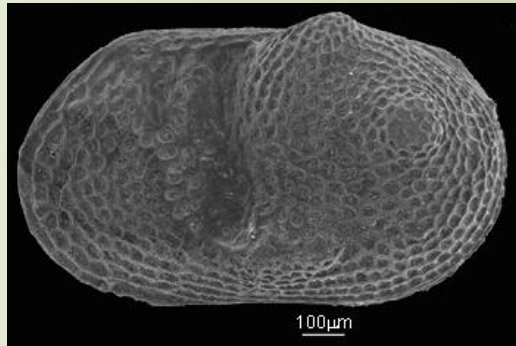
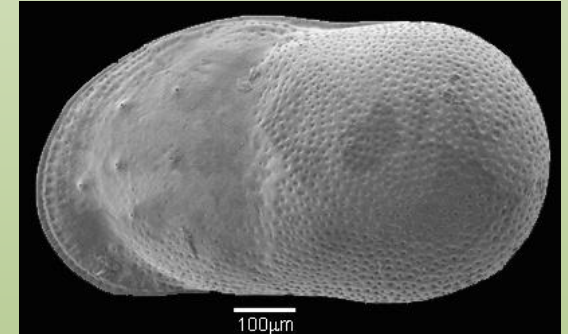
*Gomphocythere* cf. *angulata* Lowndes, 1932 - Kenya



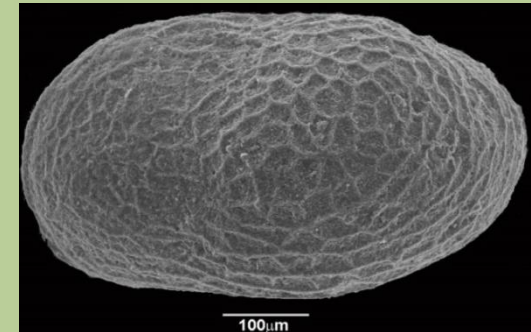
*Gomphodella aura* Karanovic, 2009 - Australia



*Cytheridella ilosvayi* Daday, 1905 - Jamaica



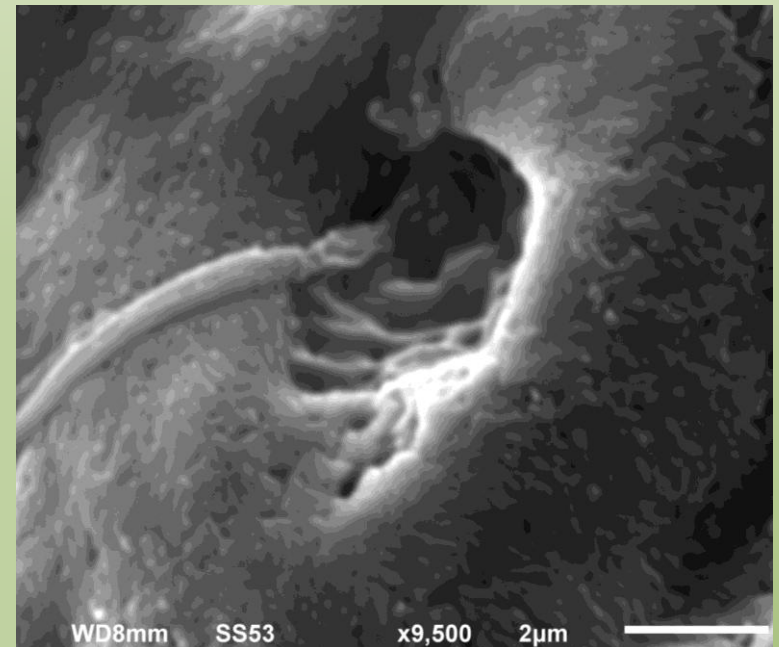
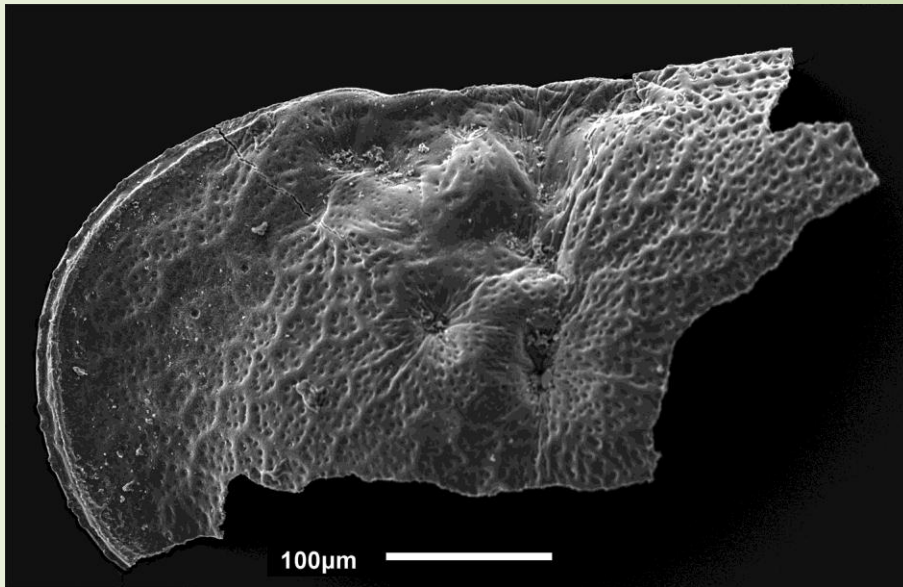
*Theriosynoecum* gr. *wyomingensis* (Branson, 1935) - Portugal



*Sinuocythere pedrogaensis* Cabral & Colin, 2000 - Portugal

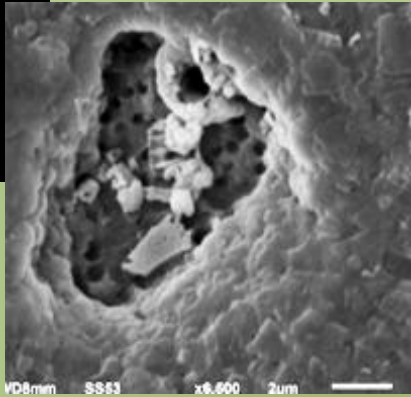
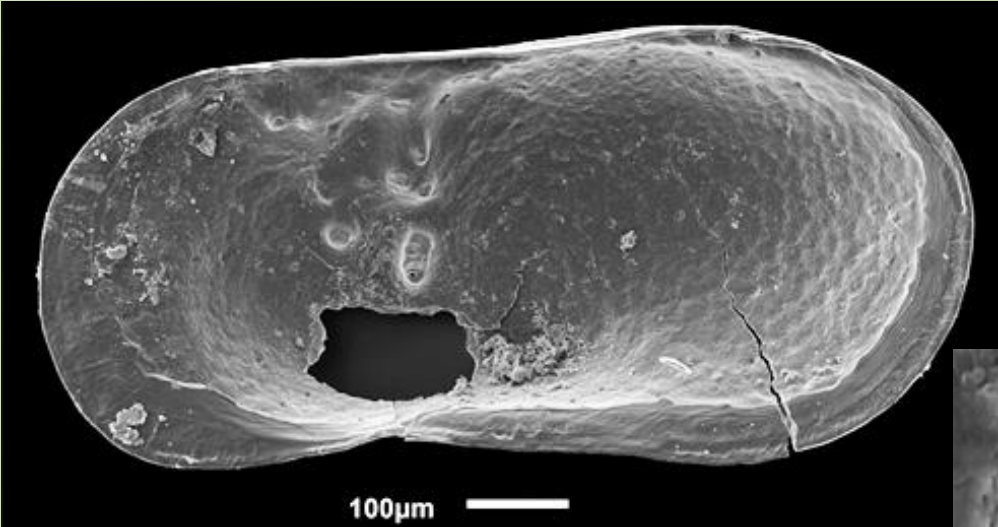
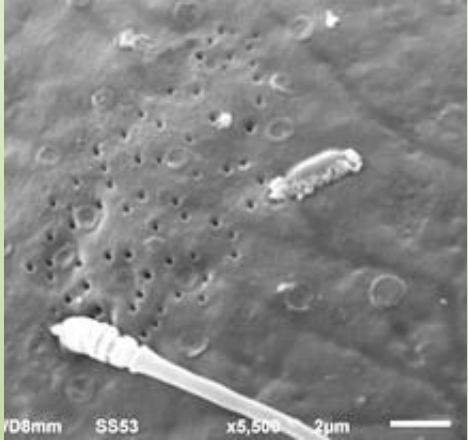
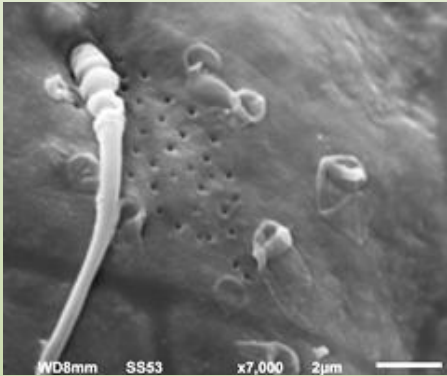
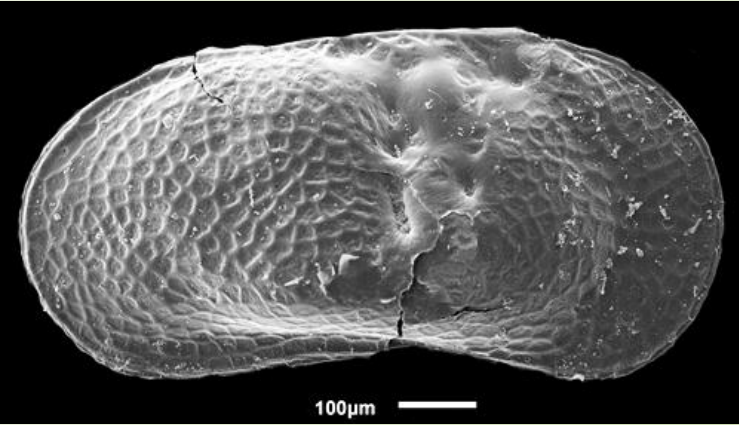
Provide comparative information on genera of *Limnocytherinae*, which though belonging to the same family as *Timiriaseviinae* show different type of sieve-plates

*Limnocythere inopinata* (Baird, 1843) - Lake Wigry, Poland



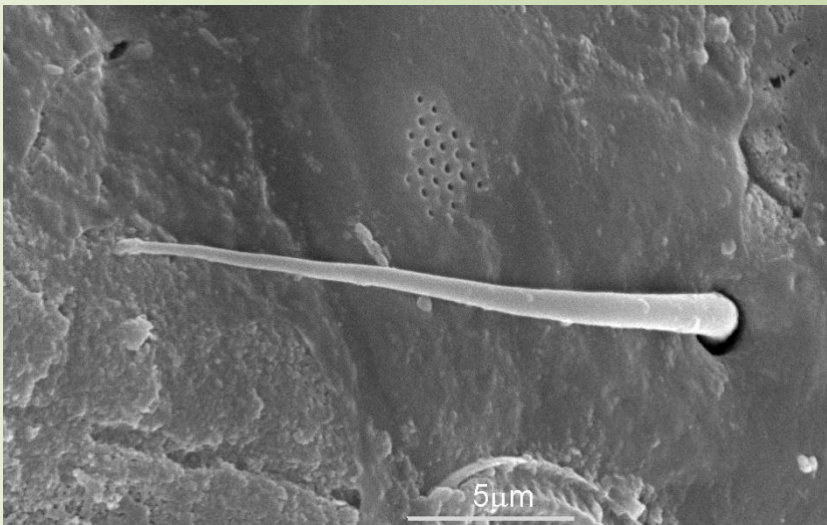


*Limnocytherina sanctipatricii* (Brady & Robertson, 1869) - Lake Wigry, Poland



## RESULTS

Timiriaseviinae taxa generally display a special type of sieve-pores, namely plates with a variable number of minute tubuli and devoid of a normal seta within the “sieve” area and a separate single pore with a seta – Type D of sieve pores in Puri & Dickau (1969), different from Type C (sieve plates with a normal seta within the sieve plate area) found in Limnocytherinae.



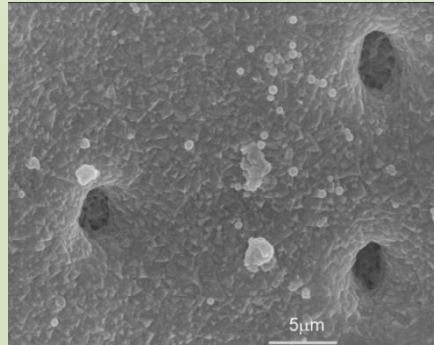
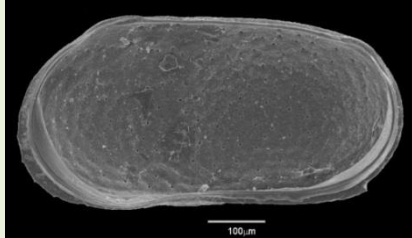
Type D - Timiriaseviinae



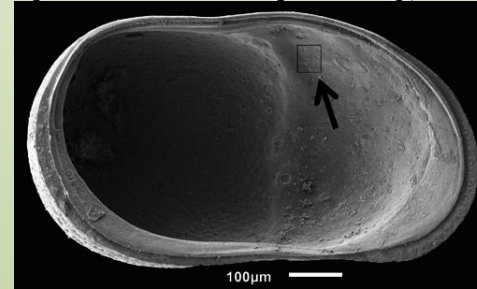
Type C - Limnocytherinae

In almost all of the studied specimens the sieve plates are also visible in the interior of the valves, where they show less shape variation.

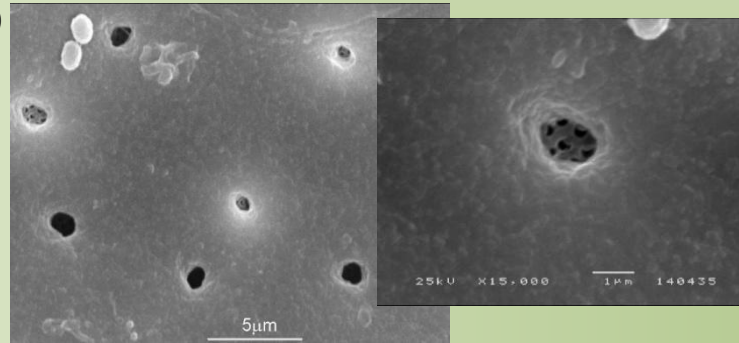
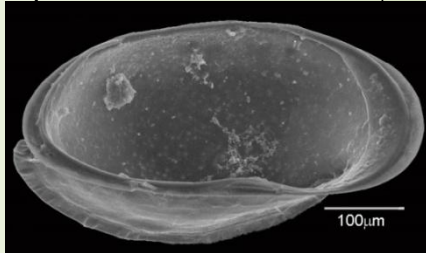
*Gomphocythere* sp.



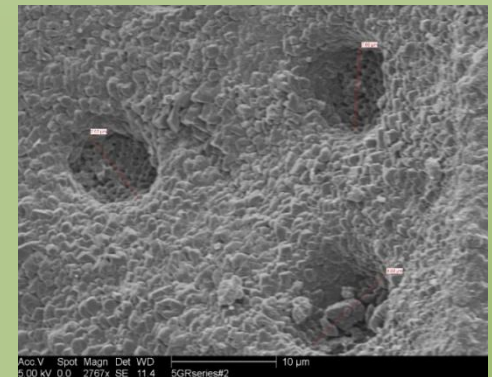
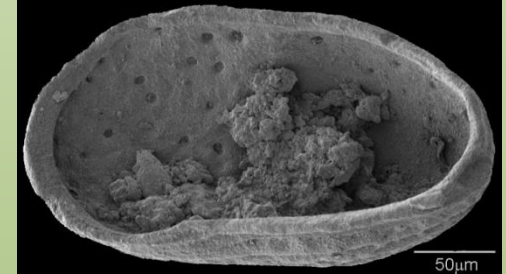
*Cytheridella ilosvayi* Daday, 1905



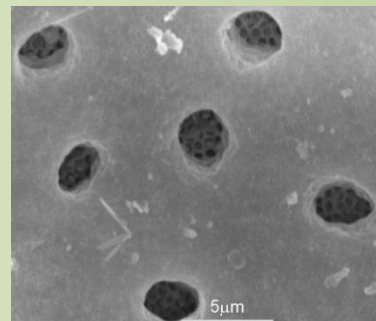
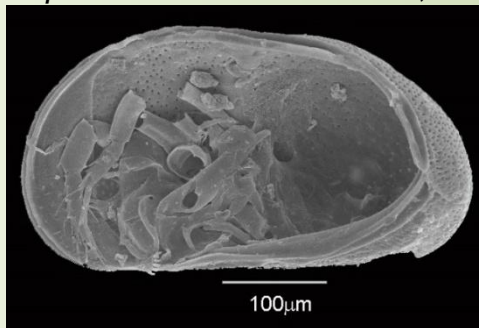
*Gomphodella aura* Karanovic, 2009



*Sinuocythere pygmaea* (Stoica, 2007)

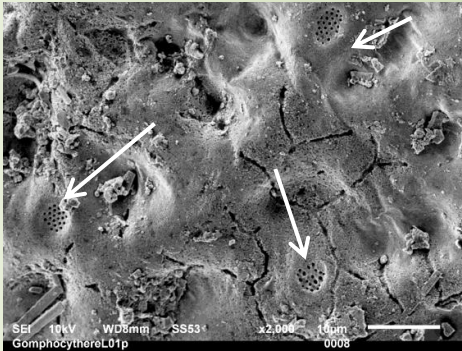
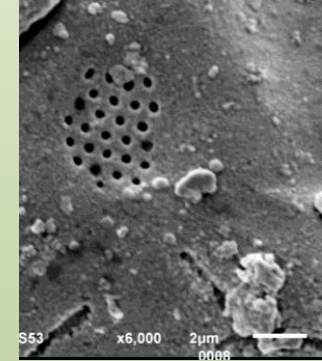
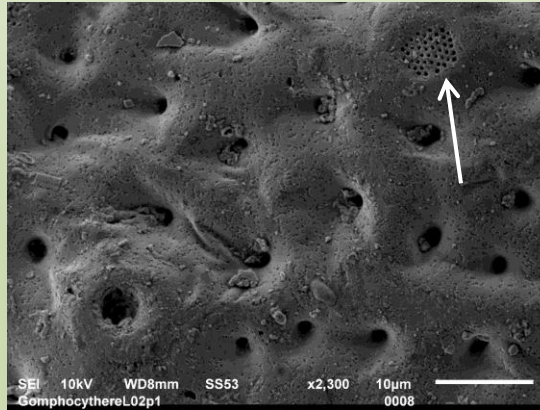
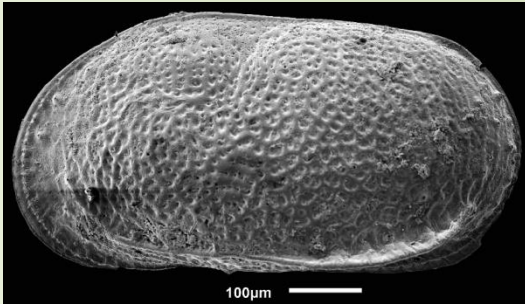


*Gomphodella maia* De Deckker, 1981



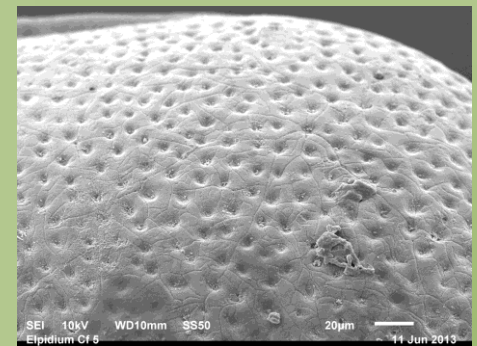
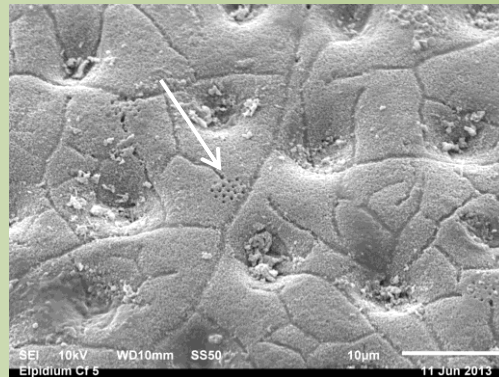
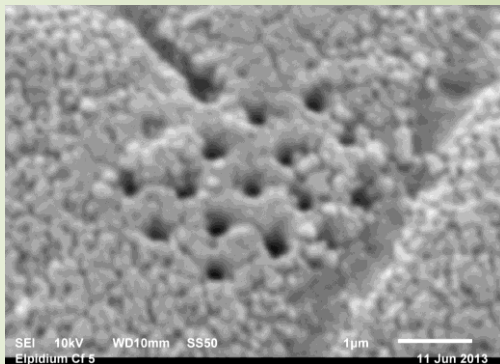
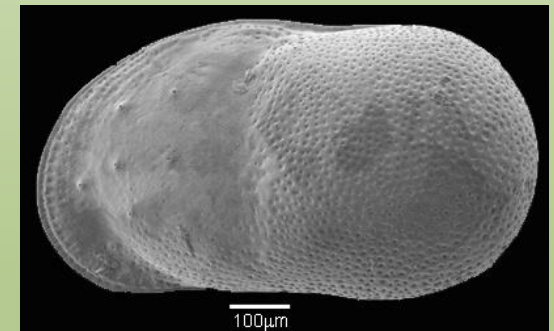


The distribution of the sieve plates on the carapace appears to be similar within a genus: for instance, covering all the surface and with a round or elongated shape in *Gomphocythere* at a mean density of 2.3 plates for a standard unit of 3876  $\mu\text{m}^2$ ; sparsely distributed, mainly on the posterior part of the valve, very small and roughly circular in *Cytheridella*.



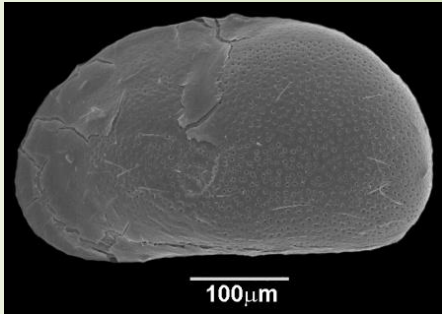
*Gomphocythere cf. angulata*  
Lowndes, 1932 - Kenya

*Cytheridella ilosvayi* Daday, 1905 -  
Jamaica

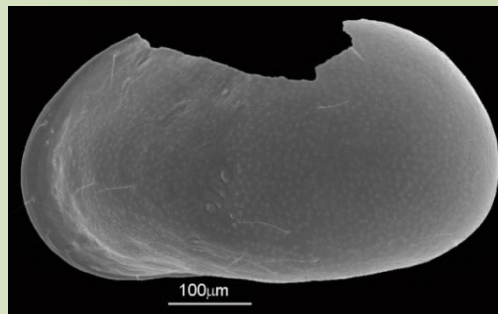


In *Gomphodella* the sieve plates, generally round, are extremely abundant, covering all the surface and at a density of 14 to 23 plates for standardized surfaces of  $1517 \mu\text{m}^2$ . In *Sinuocythere*, a fossil form, for which we have information especially from the inner side of the valve (the exterior is very recrystallized) we found few sieve plates but of very large size.

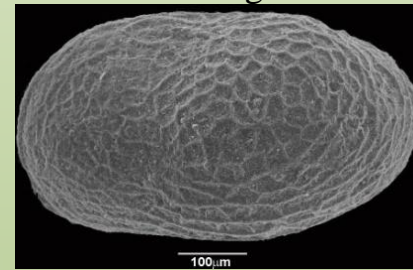
*G. maia* - Australia



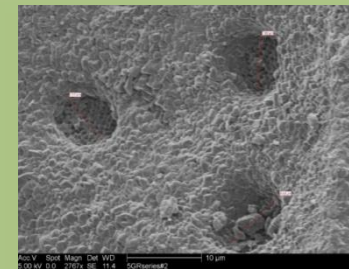
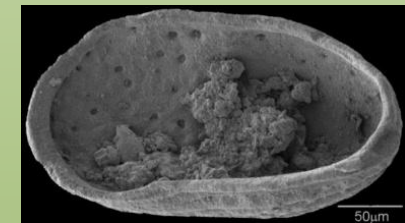
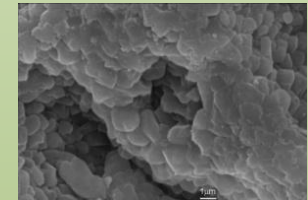
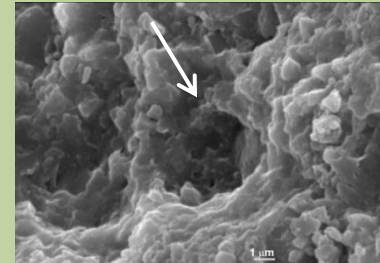
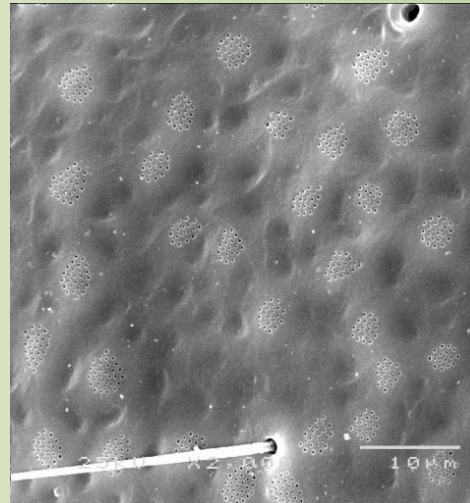
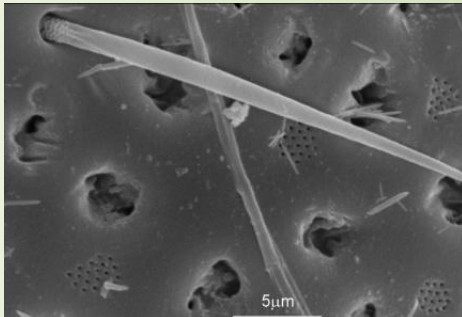
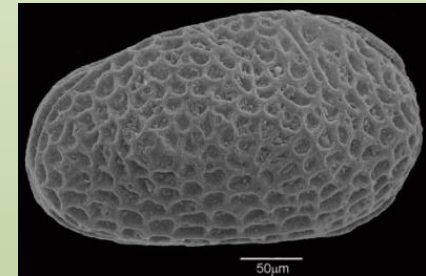
*G. quasihirsuta* - Australia



*S. pedrogaensis* - Portugal



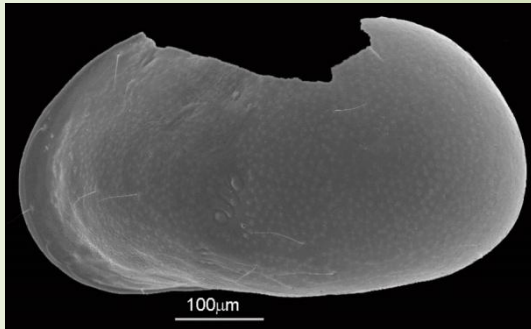
*S. pygmaea* - Romania



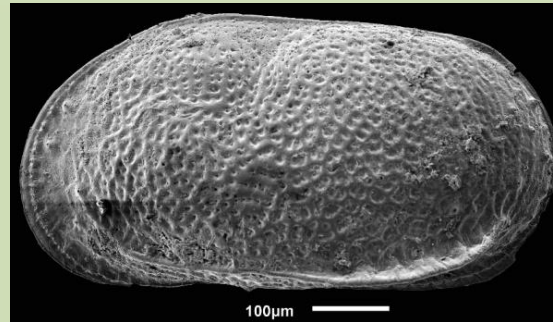


The number of sieve plates, their shape and the number of tubuli within a plate on the carapace are morphologic traits which could be useful for **taxonomic purposes** e.g. species of the genus *Gomphodella* have a high number of sieve plates whereas in the case of *Gomphocythere* and *Cytheridella* species the number of plates is much lower.

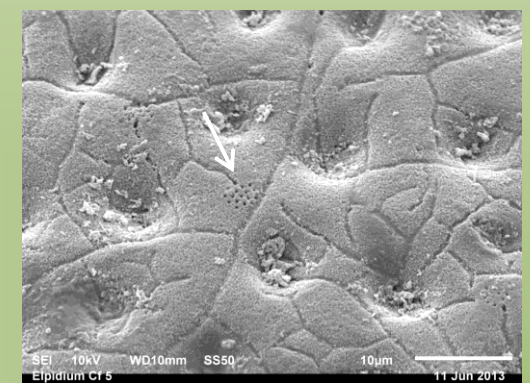
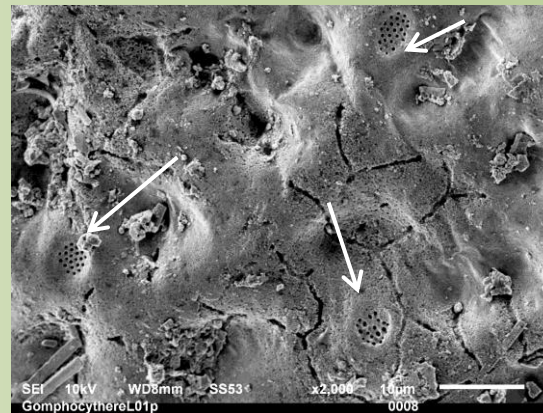
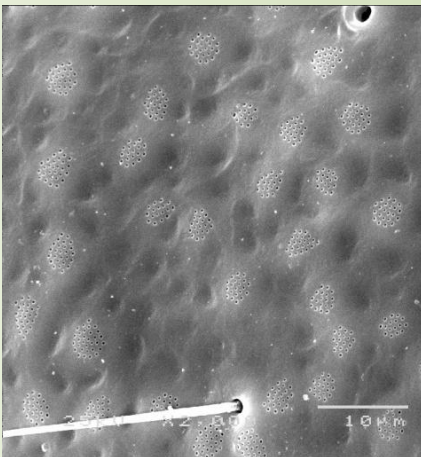
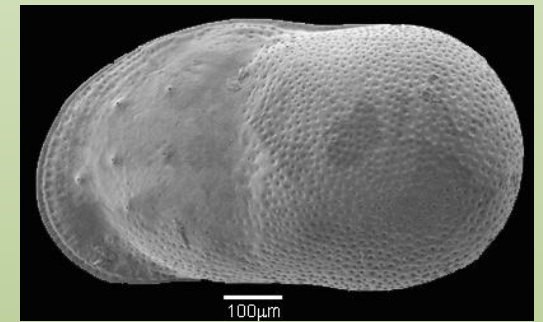
*Gomphodella*



*Gomphocythere*



*Cytheridella*

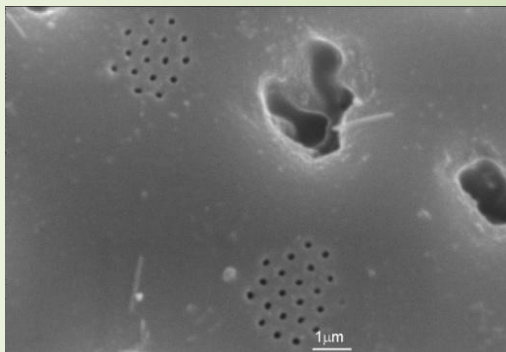
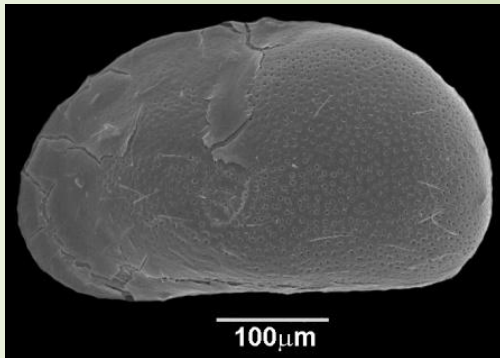




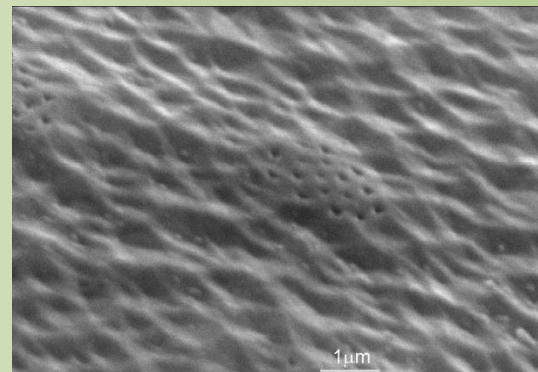
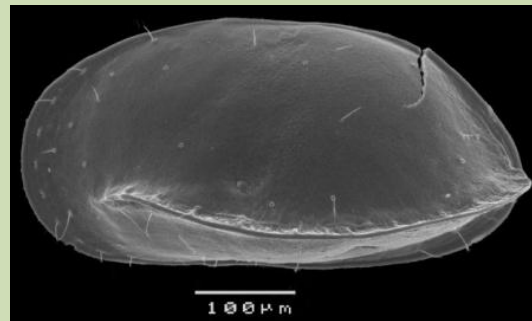
Within the genus *Gomphodella*, *G. maia* De Deckker, 1981 has small round sieve plates (~2  $\mu\text{m}$ ) with around 14-17 tubuli, *G. aura* Karanovic, 2009 has roughly circular sieve plates (~2  $\mu\text{m}$ ) with around 18-26 tubuli, whereas *G. quasihirsuta* Karanovic, 2009 has more ovoid sieve plates (~3.5-4.6  $\mu\text{m}$ ) with a range of tubuli similar to those of *G. aura*.

The difference in size and shape of the sieve-plates of *G. quasihirsuta*, as compared to the other two *Gomphodella* species, may also be related to the habitat salinity, since this species is found in higher salinity waters.

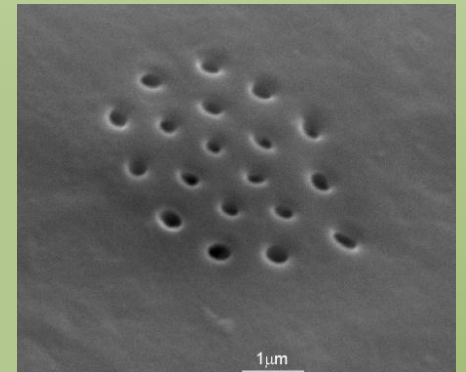
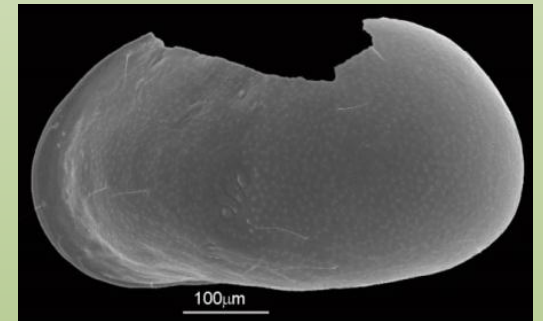
*G. maia* - Australia



*G. aura* - Australia

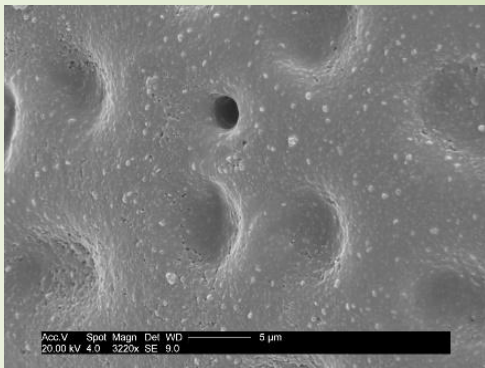
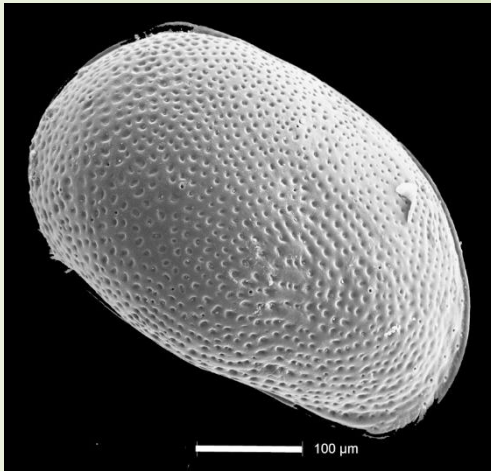


*G. quasihirsuta* - Australia



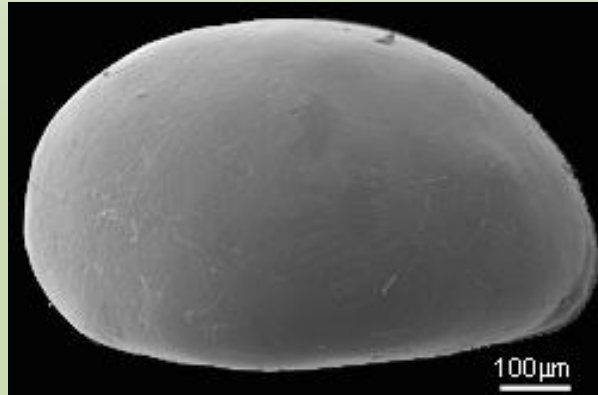
Some Timiriaseviinae genera do not display sieve plates, as *Metacypris* Brady & Robertson, 1870, *Elpidium* Müller, 1880, *Kovalevskiella* Klein, 1963, *Dolekiella* Gidó et al., 2007

*Metacypris cordata* Brady & Robertson, 1870 -Romania

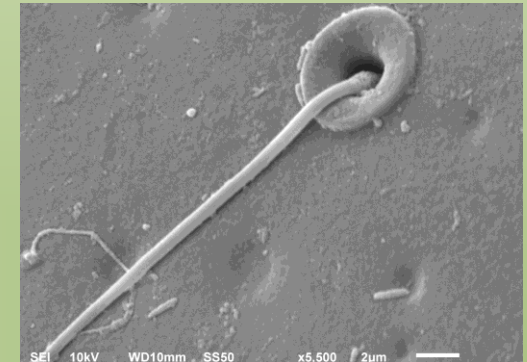


Normal pore surrounded by foveolae – no sieve plates

*Elpidium* sp. - Jamaica



Normal pore with a lip and a seta



# Conclusions

Up to now:

- We verify that the study in fossil forms is very difficult, often impossible, due to frequent recrystallization which prevents us to see the sieve plates.

Using our method, we will map the sieve plates of a new valve of *Gomphocythere* sp., from Turkey, to try to prove Jean-Paul's Colin initial idea.

- We can already propose a tentative model for further taxonomy and phylogeny of Limnocytheridae. It is based on sieve-plates form, size and density: the **subfamily Limnocytherinae** with sieve plates of type B (i.e. with a normal seta within the sieve plate area; the **subfamily Timiriaseviinae** with sieve plates without normal seta and/or completely deprived of sieve-plates.

- The subfamily Timiriaseviinae could be separated in the **tribes Cytheridellini** Danielopol & Martens, 1989 and **Metacyprini** Danielopol, 1965 (emend.) if we can prove that most of the genera related to Metacyprini have no sieve plates (we have information on *Metacypris*, *Elpidium*, *Kovalevskiella*, *Dolekiella* and 99% sure for *Frambocythere*; trials are being done with *Rosacythere*).

- The genus *Sinuocythere* which was originally related to Metacyprini and that we show that has sieve plates will be classified within the Cytheridellini.

In conclusion, we hope the information presented here will stimulate new research for the progress of the systematics and phylogeny of Timiriaseviinae, as well as for new observations on the possible variation of sieve plates related to water chemistry (studies are in progress with *Limnocythere*, *Limnocytherina*, *Gomphodella*). In that way, this project is the best tribute we can offer to the late **Jean-Paul Colin**.



# Acknowledgements

We are grateful to **Telmo Nunes** (Centro de Biologia Ambiental, University of Lisbon) for preparing the SEM images and the “map” of the *Gomphocythere* valve and to **Dr. Stefan Eberhard** (Environmental Services, Perth Area) who offered data for the water chemistry of *G. maia* from Turners Spring, Western Australia.

One of us (D. L. D.) is much indebted to:

**Dr. Wolf-Dietrich Krautgartner** (University of Salzburg) for taking SEM pictures of various Timiriaseviinae species used in this project;

**Dr. Dietmar Keyser** (University of Hamburg) explained the ultra structure of sieve-plates of cytherids he studied;

**Prof. Koen Martens** (Royal Belgian Institute of Natural Sciences, Brussels) helped with information on the sieve plates of Limnocytheridae;

**Prof. Jonathan A. Holmes** (University College, London) offered material of *Cytheridella ilosvayi*;

**Prof. Francesc Mesquita** (University of Valencia) helped with general data on salinity of non-marine inland waters;

Merci beaucoup

Thank you very much