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 interêt pour la systématique de quelques taxons

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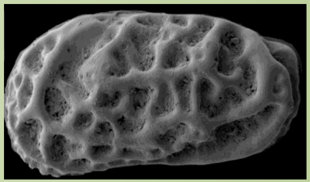
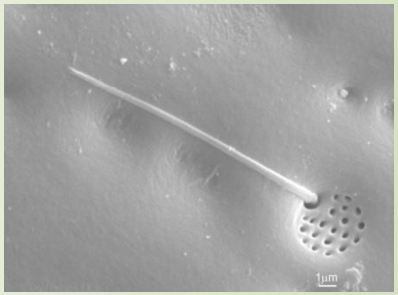
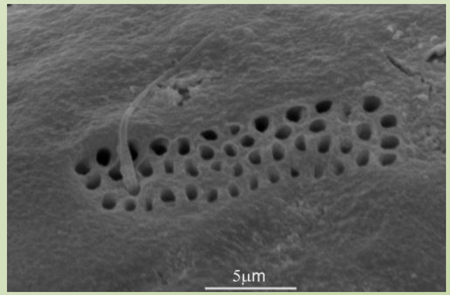


ROLF 2014
25éme Réunion des Ostracodologistes de Langue Française

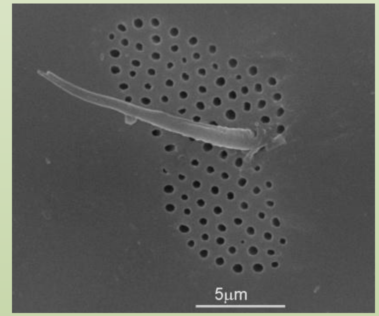
Sieve-type pores – they occur in marine and nom-marine ostracod groups (less well documented), both live and fossil; they vary in type, shape, number and distribution. Their diversity has already been used for systematics and palaeoecological studies.



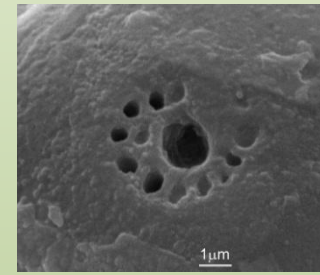
Tuberoloxoconcha sp.



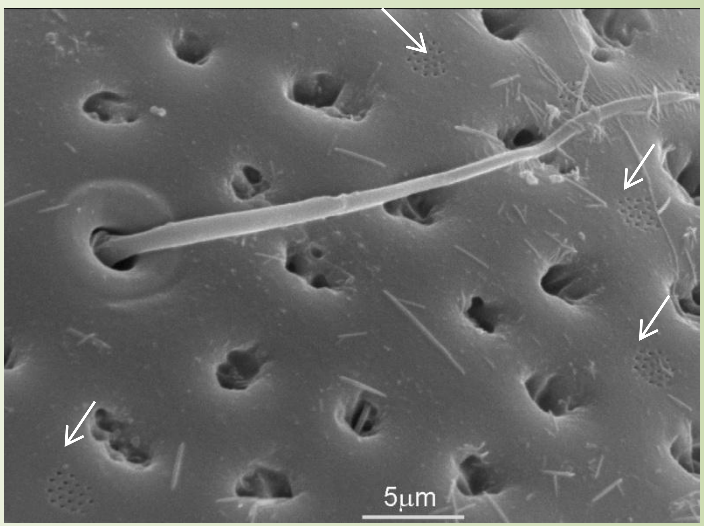
Loxoconcha elliptica Brady, 1868



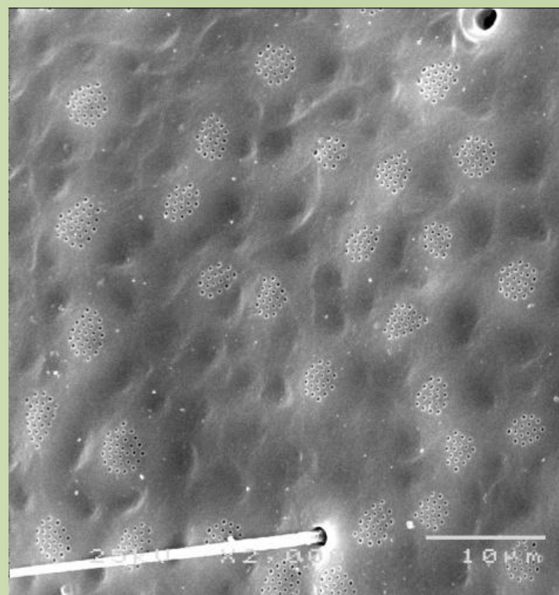
Cyprideis torosa (Jones, 1857)

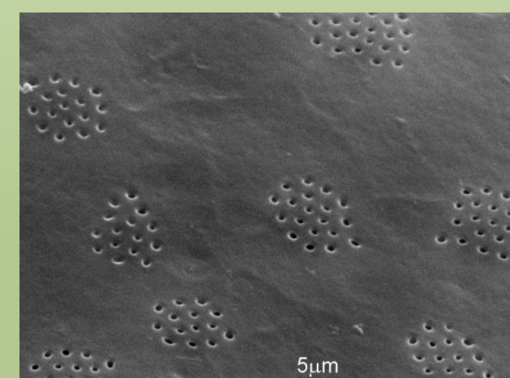


Microceratina sp.



Gomphodella maia De Deckker, 1981

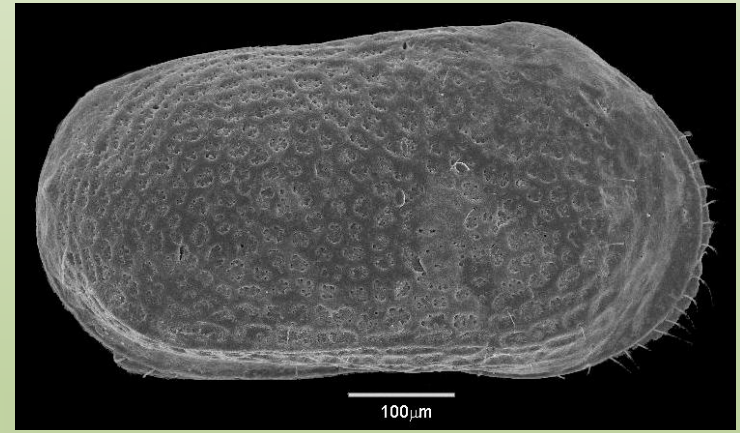

Gomphodella quasihirsuta Karanovic, 2009

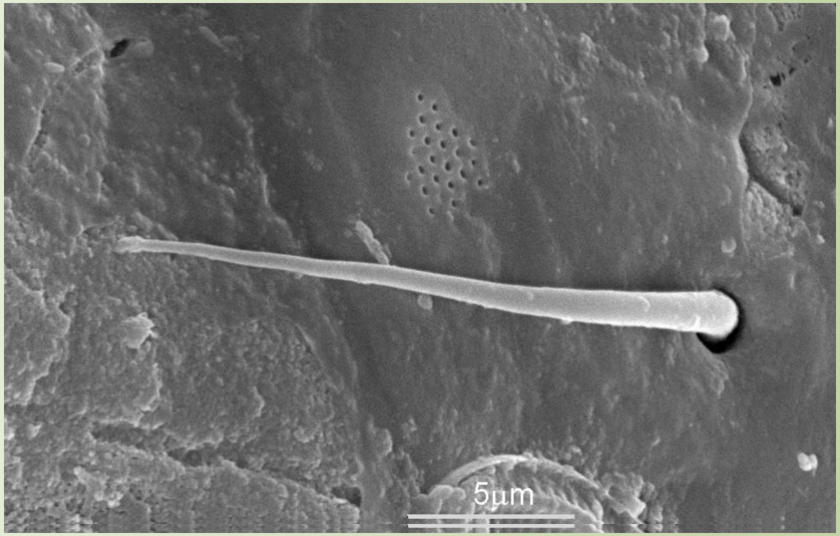


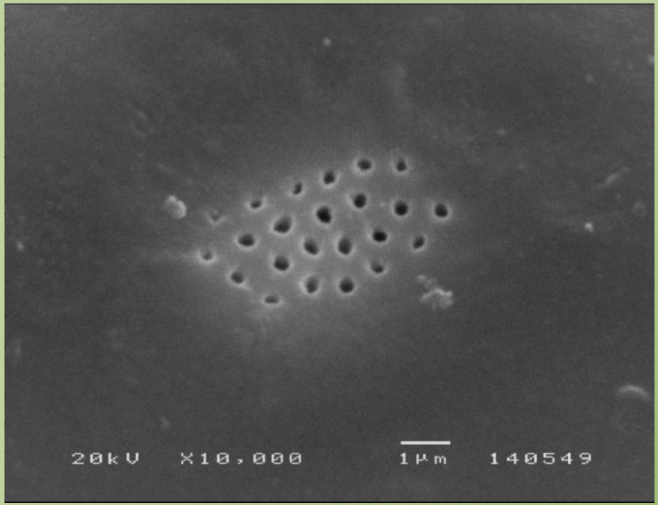
Gomphodella quasihirsuta Karanovic, 2009

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. (Adıyaman, Turkey)







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

Review the general literature on the sieve type-pores.

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: Loffler, H. & Danielopol, D. (eds.). *Aspects of Ecology and Zoogeography of Recent and Fossil Ostracoda*, 55-66. The Hague: Junk b. v. Publishers.

USE OF NORMAL PORES IN TAXONOMY OF OSTRACODA[1]

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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.

NORMAL PORES AND THE PHYLOGENY OF OSTRACODA

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GEOSCIENCE AND MAN, VOLUME VI, OCTOBER 1, 1974, P. 137–151, 13 PLATES, 1 TEXT-FIGURE 137

Sixth Intern. Ostracod Symposium, Saalfelden

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

AMNON ROSENFELD & BERND VESPER

Review the general literature on the Timiriaseviinae, Limnocytheridae.

PALEOBIOLOGIE
CONTINENTALE

Vol. XI, N° 1

MONTPELLIER 1980

"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 : 63-94, 1989
BULLETIN VAN HET KONINKLIJK BELGISCH INSTITUUT VOOR NATUURWETENSCHAPPEN, BIOLOGIE, 59 : 63-94, 1989

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 appeared, however, that this could only be effected when embodied in a broader taxonomic framework. The subfamily Limnocytherinae is thus divided into four tribes: Limnocytherini, Dinarocytherini, Cytheridellini and Leucocytherini and diagnoses are provided for these taxa. The latter two are new to science, while the rank of Dinarocytherini was changed from subfamily to tribe. Three genera are lodged in the Leucocytherini: *Leucocythere* KAUFMANN, 1892, *Potamocythere* SCHORNIKOV, 1986 and *Ovambocythere* MARTENS, 1989. The former, nominate, genus is characterized and its type species, *L. mirabilis*, is extensively redescribed. A comparative description of a limnocytheridid with a somewhat similar appearance, *Limnocythere (Limnocytherina) sanctipatricii*, is offered. A second species of *Leucocythere*, *L. algeriensis* nov. sp., is described from a temporary pool in Algeria. *L. baltica* (DIEBEL) 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-stenothermic species, with a preference for oligotrophic waters and fine grained sediments. Its status in Europe can at present best be described as endangered, due to rapid degradation of suitable habitats.
L. algeriensis nov. sp. and *Ovambocythere milani* MARTENS are probably both capable of producing dry resistant stages. This is thus far unique in Cytherids, but the exact taxonomic distribution of this feature remains as yet unknown.
Some comments on the phylogeny and historical biogeography are presented. *Leucocythere* appears to be the more advanced group in the Leucocytherini, the other two genera show more plesiomorphic character states. It is here postulated that the three genera evolved by vicariance from a more widely spread ancestor: *Leucocythere* in Europe, *Potamocythere* in Asia and *Ovambocythere* in Africa. *L. algeriensis* from northern Africa is doubtlessly from Palaearctic stock and its speciation 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 soft parts that are used for the mating process. In spite of the fact that many of the peculiarities appear maladaptive at first glance, it must be stressed that *L. mirabilis* thus far maintained itself very well in its environment, until recent anthropogenic pollution caused its extinction in many localities.
Keywords: *Leucocythere*, Ostracoda, Leucocytherini, Cytheridellini, morphology, biogeography, functional morphology.

Résumé

Le but principal de cet article est de fournir une diagnose claire du genre *Leucocythere*. Pourtant, il apparaît que ceci ne peut être effectué que dans un cadre taxonomique plus large. La sous-famille des Limnocytherinae est donc divisée en quatre tribus: Limnocytherini, Dinarocytherini, Cytheridellini et Leucocytherini et des diagnoses sont fournies pour ces taxa. Les deux dernières sont nouvelles pour la science. Trois genres se situent dans les Leucocytherini: *Leucocythere* KAUFMANN, 1892, *Potamocythere* SCHORNIKOV, 1986 and *Ovambocythere* MARTENS, 1989. Le genre nominal est caractérisé et l'espèce-type, *L. mirabilis*, est réddécrite extensivement. Une description comparative est effectuée avec un limnocytheride semblable: *Limnocythere (Limnocytherina) sanctipatricii*. Une deuxième espèce du genre *Leucocythere*, *L. algeriensis* nov. spec., provenant d'un habitat temporaire en Algérie, est décrite. *L. baltica* (DIEBEL) est retenue comme une troisième espèce de ce genre.
Un important matériau fossile est réexaminé. La majorité des fossiles asiatiques, qui dans le passé étaient considérés comme les *Leucocythere*, ne peuvent plus rester dans ce genre et leur révision reste nécessaire. Quelques remarques sur la validité et la position de *Leucocytherella* sont développées en même temps.
L. mirabilis est sténotherme des eaux froides et marque une préférence pour les eaux oligotrophes et les sédiments fins. Son statut en Europe peut être actuellement considéré comme précaire, étant donné la dégradation rapide de son milieu.
L. algeriensis nov. sp. et *Ovambocythere milani* MARTENS sont probablement tous deux capables de produire des formes résistantes à la sécheresse. Ceci est unique dans les Cythérides, mais la repartition 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 Leucocytherini; les deux autres genres montrent des caractères plus plésiomorphes. Il est postulé que les trois genres ont évolué par vicariance, d'un ancêtre plus répandu: *Leucocythere* en Europe, *Potamocythere* en Asie et *Ovambocythere* en Afrique. *L. algeriensis* de l'Afrique du Nord provient du stock paléarctique et spéciation de *L. mirabilis* a dû se faire tout récemment. Un nombre de particularités morphologiques de *L. mirabilis* sont discutées, avec une attention spéciale pour la carapace et les pièces molles qui sont utilisées dans la copulation. Malgré qu'à première vue beaucoup de ces particularités ne semblent pas bien adaptées, il est incontestable que *L. mirabilis* se maintient très bien dans son milieu, pourvu qu'une pollution anthropogèe récente ne cause pas son extinction dans beaucoup d'endroits.
Mots-clefs: *Leucocythere*, Ostracoda, Leucocytherini, Cytheridellini, Dinarocytherini, morphologie, biogéographie, morphologie fonctionnelle.

1. Introduction

The family Limnocytheridae SARS, 1925 is one of the most common non-marine ostracods 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 carapace and appendages of the three cytheridellinid 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 (Antenulla, Maxillula, mandibular palp, furcae and hemipenes), indicate that the above three genera belong in the Timiriaseviinae, not in the Limnocytherinae. Only the presence of sieve pores in these three genera (completely absent in the Timiriaseviinae, but present in all Limnocytherinae) contradicts this conclusion. The three genera are nevertheless here formally transferred to the Timiriaseviinae.
Sieve pores are furthermore the only feature uniting the three genera within the Timiriaseviinae. Relying on hinge type and mandibular palps, the three cytheridellinid genera appear to belong to three different lineages within the Timiriaseviinae.
KEYWORDS: Limnocytherinae, Timiriaseviinae, 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 *Afrocythere*, *Cordocythere* (now regarded as a synonym of *Kovalesvskiella*), *Cytheridella*, *Elpidium*, *Gomphocythere*, *Metacypris*, *Bisulcocypris* and the extinct genus *Theriosynoecum* in the Metacypridinae; *Timiriasevia* MANDELSTAM, 1947 was listed as *'familia incerta'*. COLIN & DANIELOPOL (1978, 1980) considered Metacypridinae (DANIELOPOL, 1965) a junior synonym of Timiriaseviinae MANDELSTAM, 1960 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 Timiriaseviinae, actually belonged to the Limnocytherinae, thus constituting a case of parallel evolution in the two subfamilies. Relying on this extensive revision of the Timiriaseviinae, 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 DECKKER. MARTENS (1993), amended the diagnosis of both the tribe Cytheridellini and the genus *Gomphocythere*, still considering both to belong to the Limnocytherinae.

A workshop on biology and taxonomy of Recent and fossil Timiriaseviinae (Moulis, France, June 1993) has provoked 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 Timiriaseviinae. The present paper reports on these results and reassesses the taxonomic position of the three cytheridellinid genera and the validity of the tribe itself. It will be shown that the three genera belong to the Timiriaseviinae and not the Limnocytherinae and that the tribe Cytheridellini most probably constitutes a

J.P. COLIN et D.L. DANIELOPOL

SUR LA MORPHOLOGIE, LA SYSTÉMATIQUE, LA BIOGÉOGRAPHIE ET L'ÉVOLUTION DES OSTRACODES *TIMIRIASEVIINAE (LIMNOCYTHERIDAE)*

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

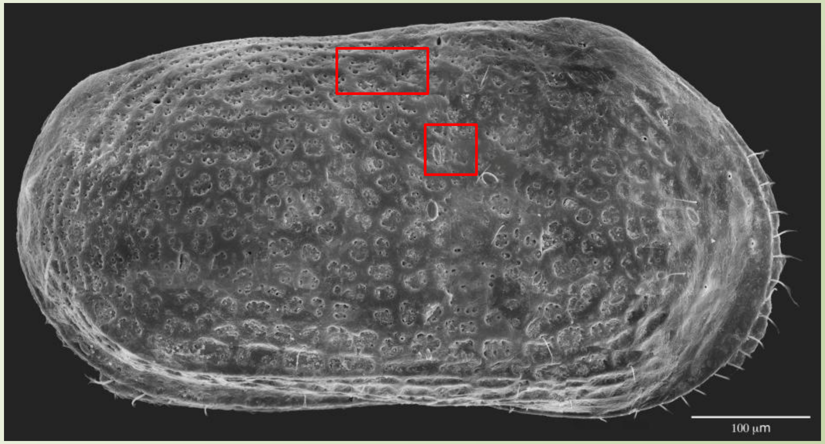
KOEN MARTENS

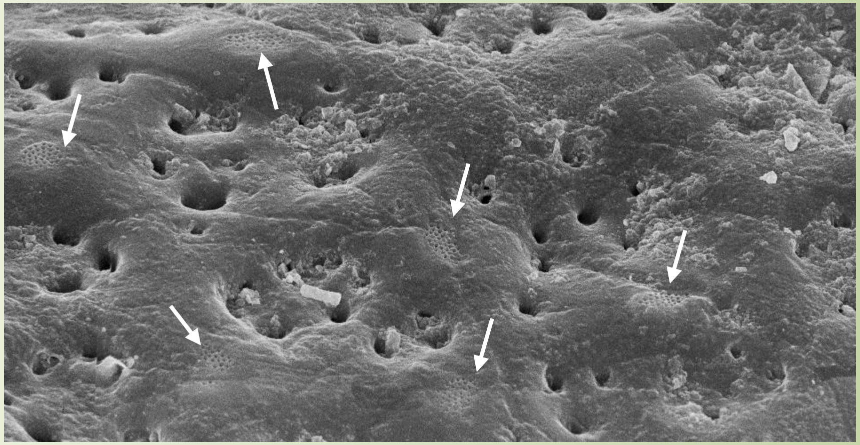
Revision of the genus *Leucocythere* KAUFMANN, 1892 (Crustacea, Ostracoda, Limnocytheridae), with the description of a new species and two new tribes.

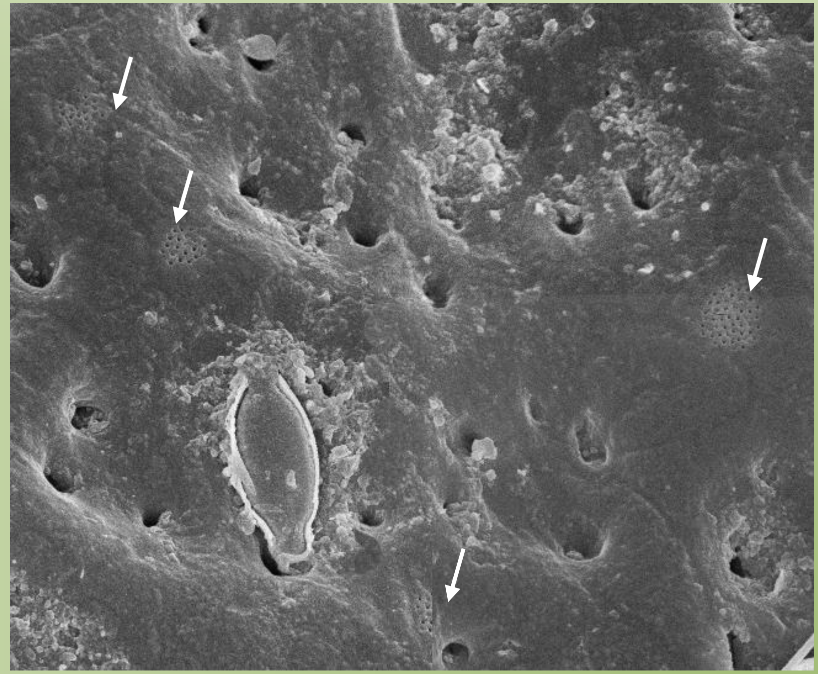
by Dan L. DANIELOPOL, Koen MARTENS & Livia M. CASALE

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 (minimun 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.

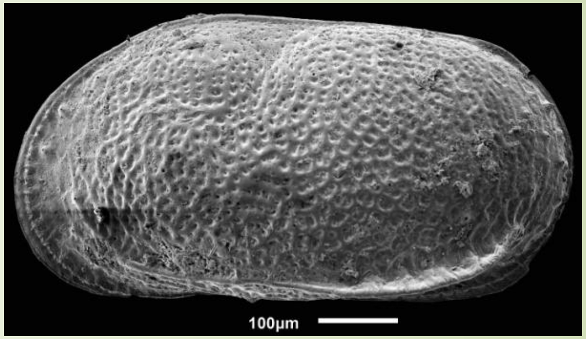




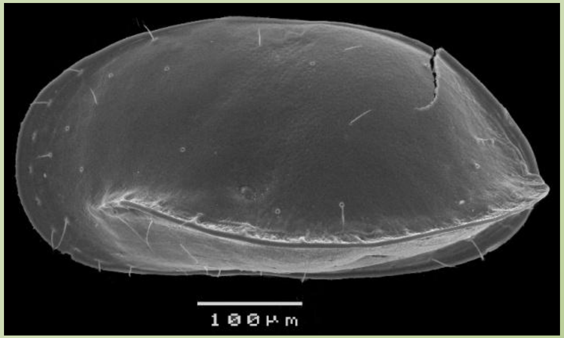


Provide information on the general shape, size variation and density of the sieve plates on the valves of species belonging to different genera of Timiriaseviinae, from recent and fossil specimens, coming from environments differing in salinity: *Gomphocythere*, *Gomphodella* De Deckker, 1981, *Cytheridella*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

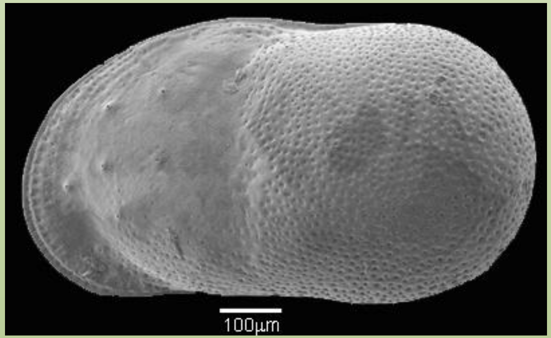
Gomphocythere cf. *angulata* Lowndes, 1932 - Kenya

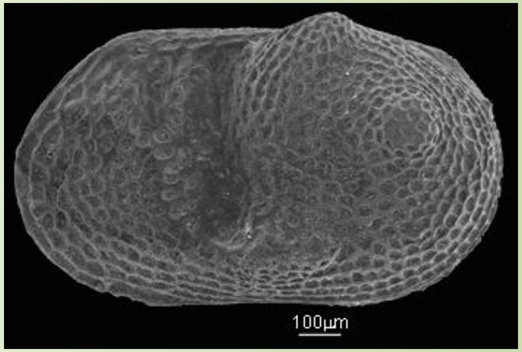


Gomphodella aura Karanovic, 2009 - Australia

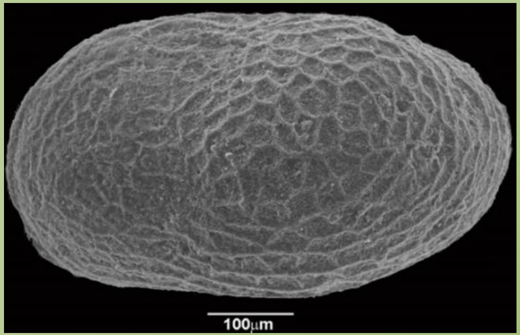


Cytheridella ilosvayi Daday, 1905 - Jamaica





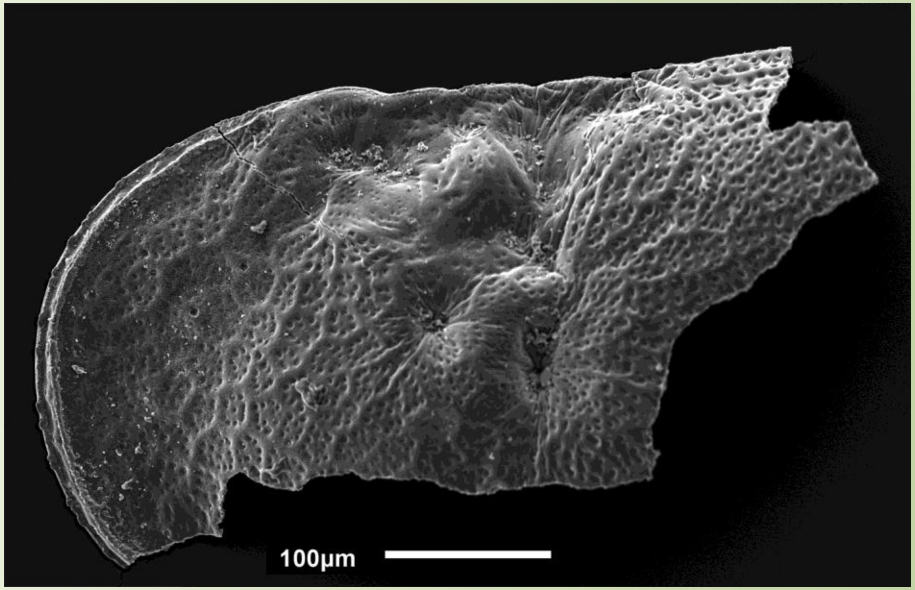
Theryosynoecum gr. *wyomingensis* (Branson, 1935) - Portugal

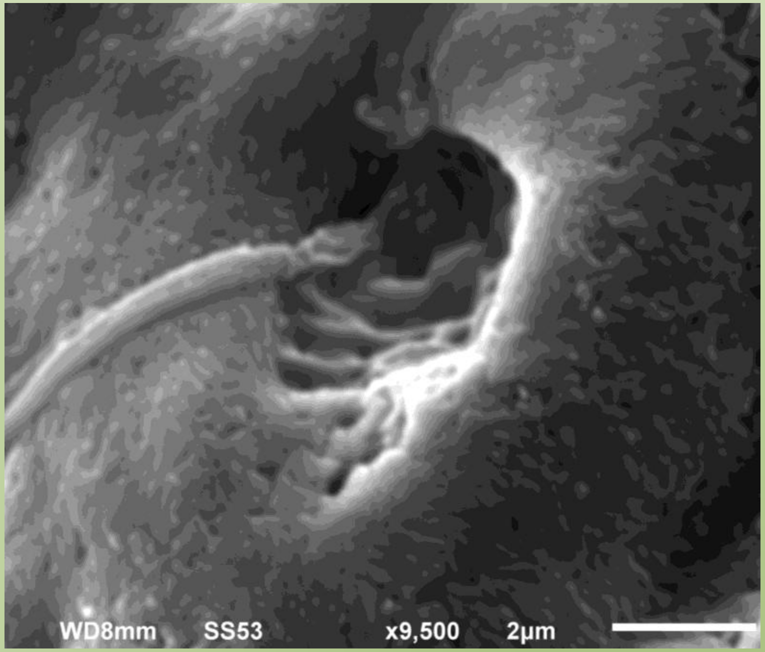


Sinuocythere pedrogaensis Cabral & Colin, 2000 - Portugal

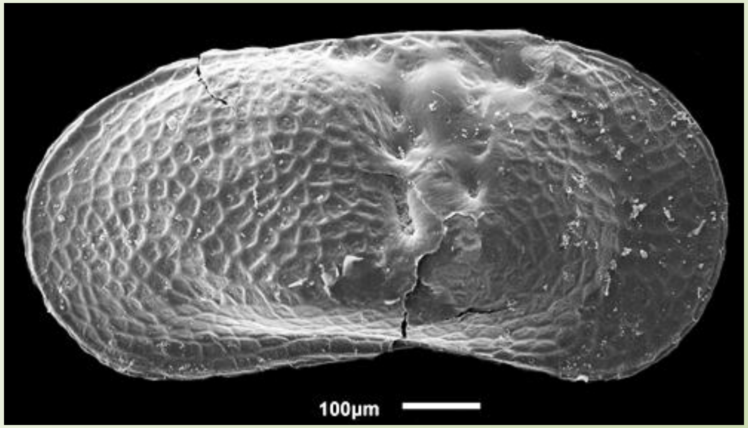
Provide comparative information on genera of Limnocytherinae, which though belonging to the same family as Timiriaseviinae show different type of sieve-plates

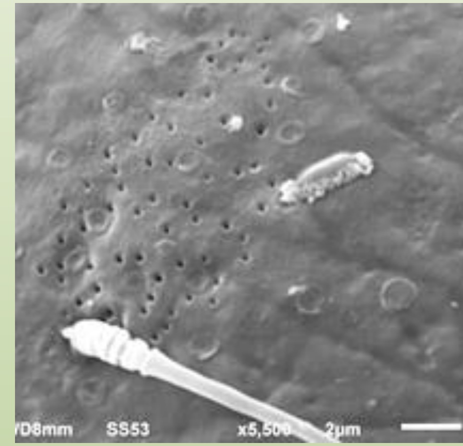
Limnocythere inopinata (Baird, 1843) - Lake Wigry, Poland

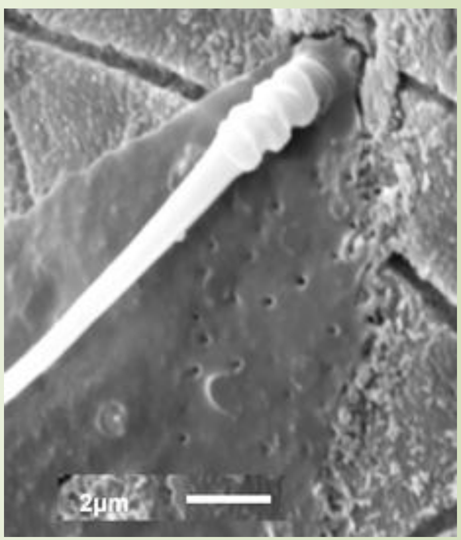


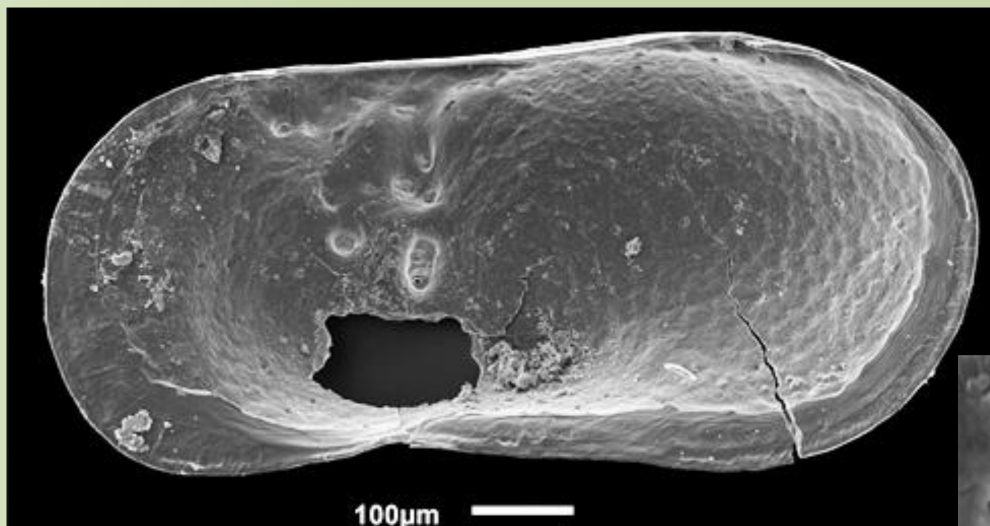


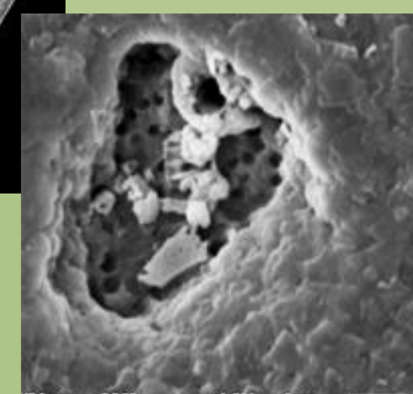
Limnocytherina sanctipatricii (Brady & Robertson, 1869) - Lake Wigry, Poland





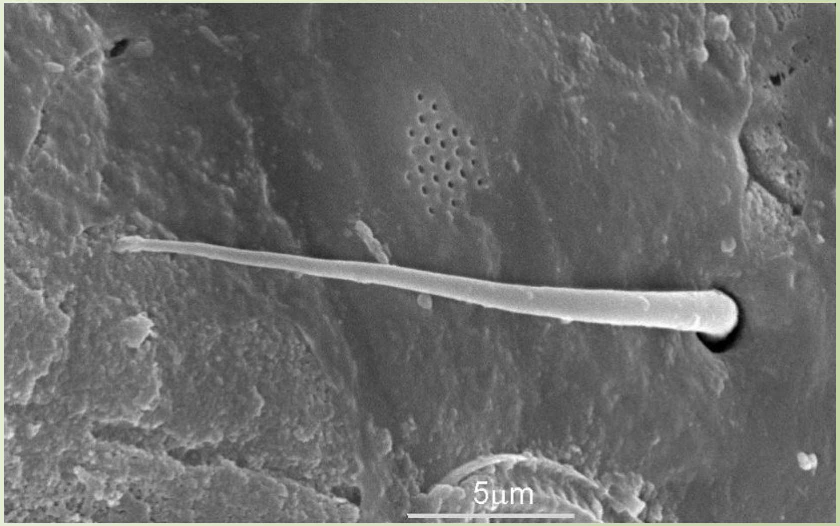






RESULTS

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.

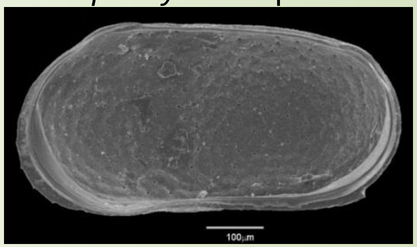


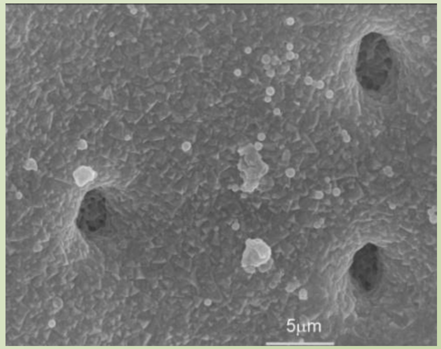
Type D - Timiriaseviinae

Type C - Limnocytherinae

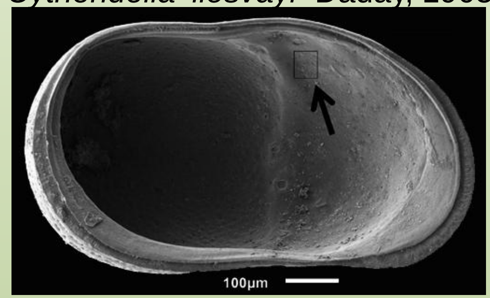
In almost all of the studied specimens the sieve plates are also visible in the interior of the valves, where they show less shape variation.

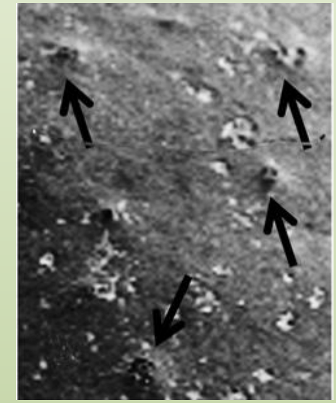
Gomphocythere sp.



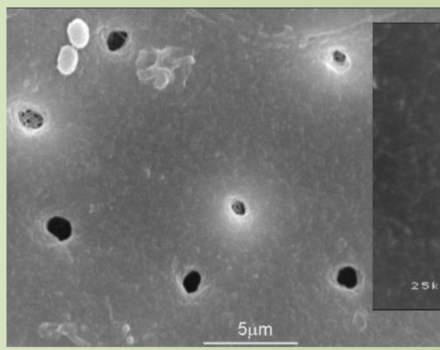


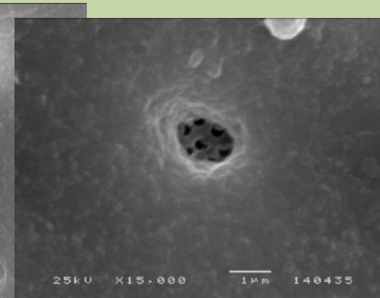
Cytheridella ilosvayi Daday, 1905



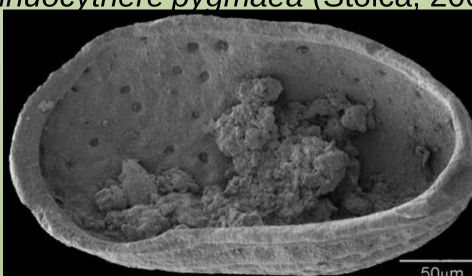


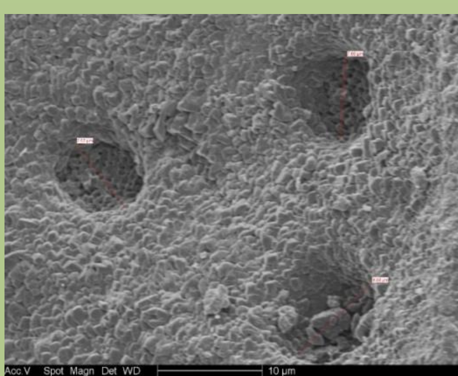
Gomphodella aura Karanovic, 2009



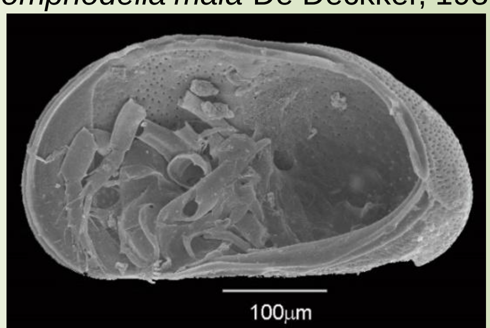


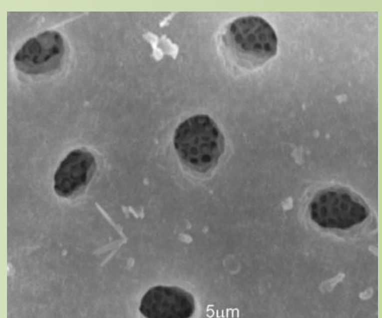
Sinuocythere pygmaea (Stoica, 2007)



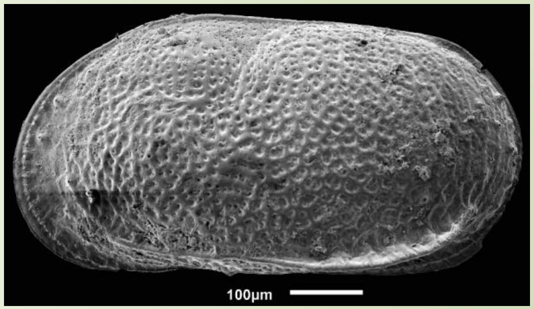


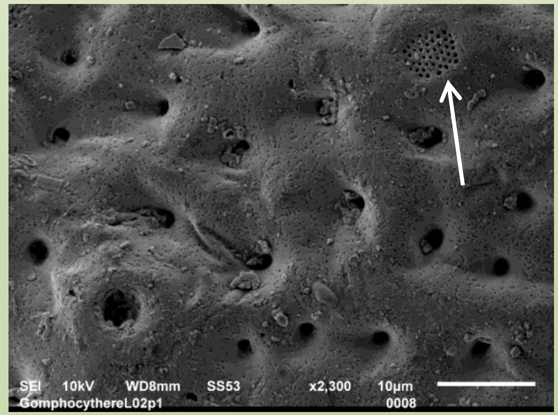
Gomphodella maia De Deckker, 1981

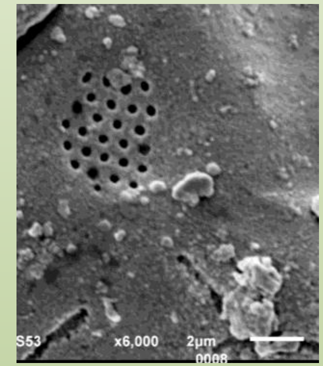


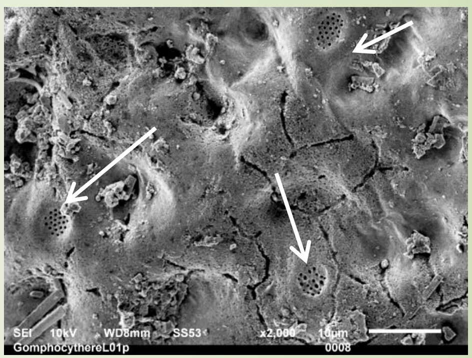


The distribution of the sieve plates on the carapace appears to be similar within a genus: for instance, covering all the surface and with a round or elongated shape in *Gomphocythere* at a mean density of 2.3 plates for a standard unit of 3876 µm^2; sparsely distributed, mainly on the posterior part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

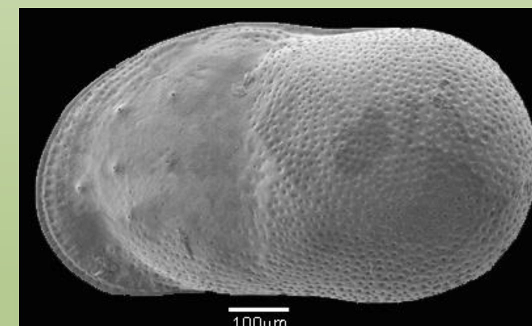




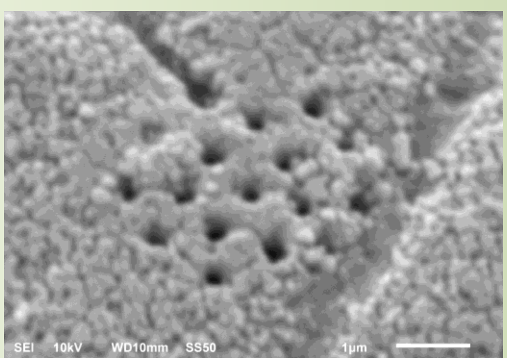


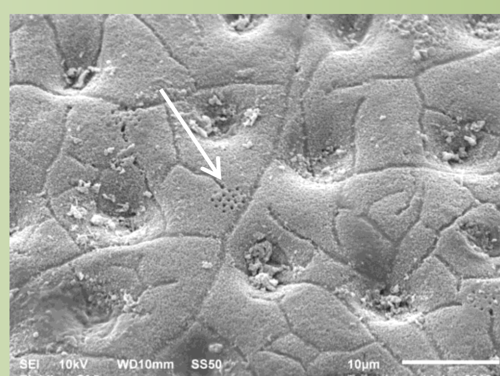


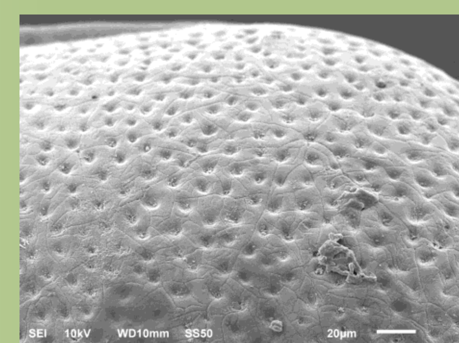
Gomphocythere cf. *angulata* Lowndes, 1932 - Kenya



Cytheridella ilosvayi Daday,1905 - Jamaica

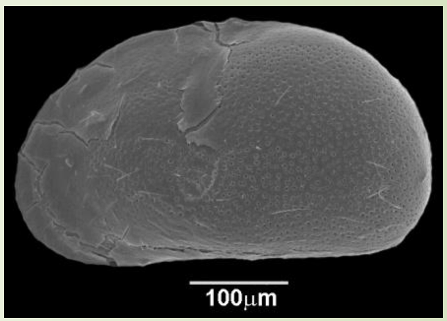


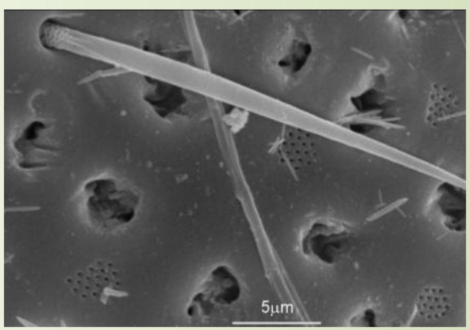




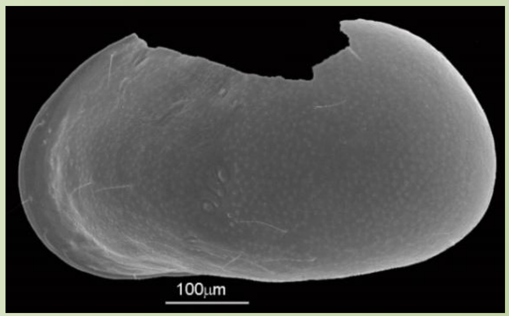
In *Gomphodella* the sieve plates, generally round, are extremely abundant, covering all the surface and at a density of 14 to 23 plates for standardized surfaces of 1517 µm^2.
In *Sinuocythere*, a fossil form, for which we have information especially from the inner side of the valve (the exterior is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

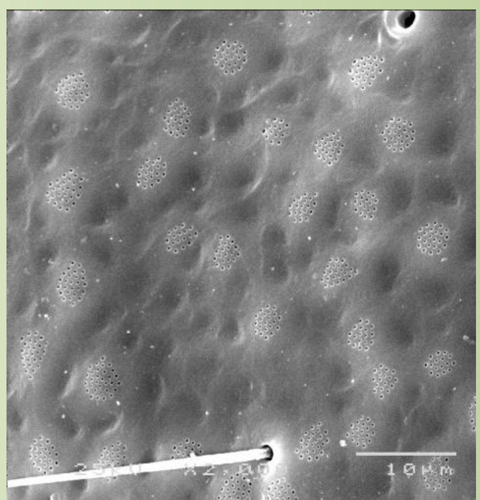
G. maia - Australia



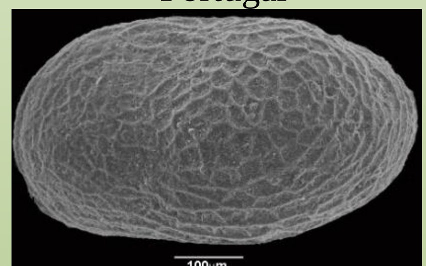


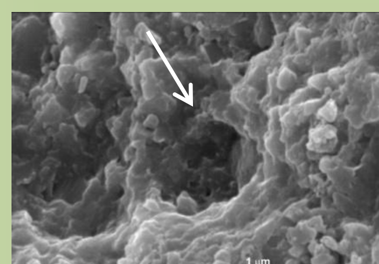
G. quasihirsuta - Australia



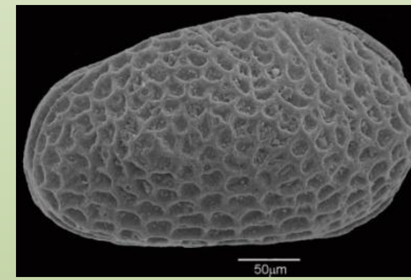


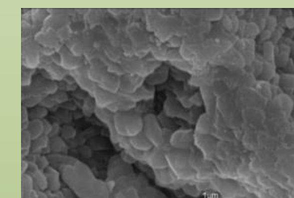
S. pedrogaensis - Portugal

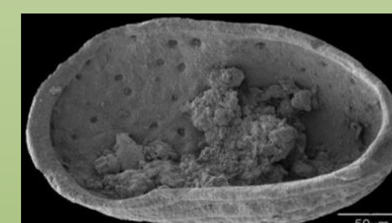


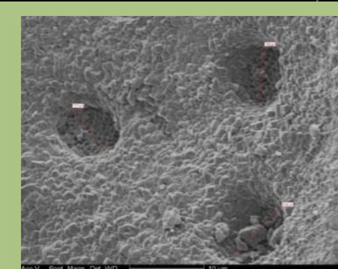


S. pygmaea - Romania



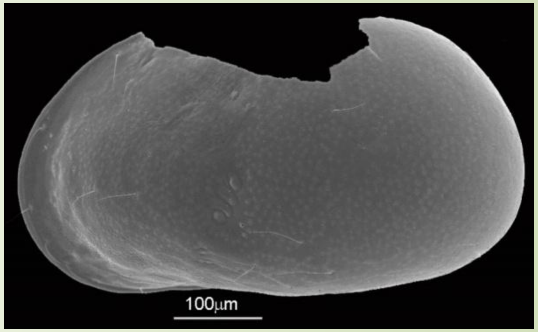


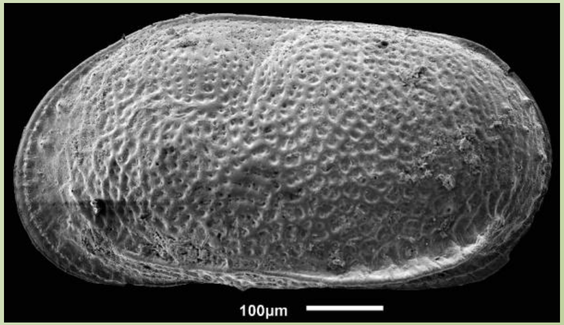


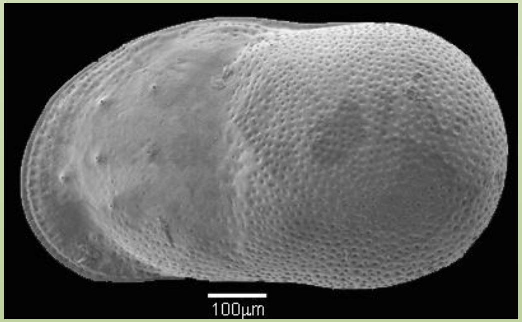


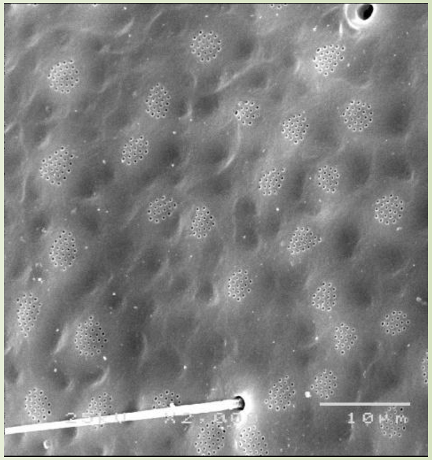
The number of sieve plates, their shape and the number of tubuli within a plate on the carapace are morphologic traits which could be useful for **taxonomic purposes** *e.g.* species of the genus *Gomphodella* have a high number of sieve plates whereas in the case of *Gomphocythere* and *Cytheridella*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

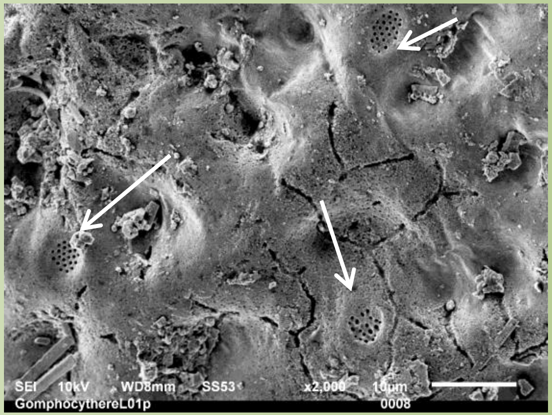
Gomphodella	*Gomphocythere*	*Cytheridella*

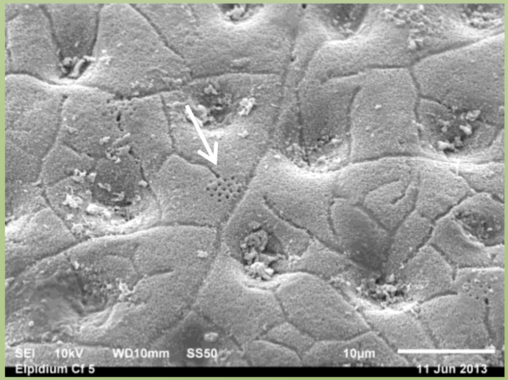








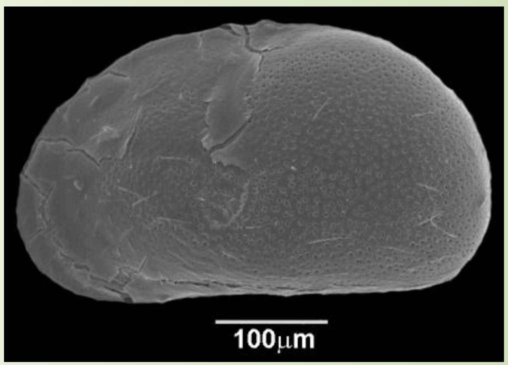


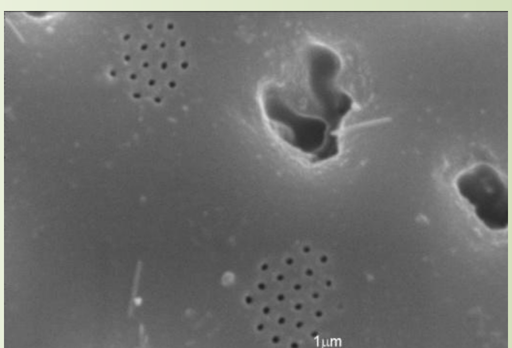


Within the genus *Gomphodella*, ***G. maia*** De Deckker, 1981 has small round sieve plates (~2 μm) with around 14-17 tubuli, ***G. aura*** Karanovic, 2009 has roughly circular sieve plates (~2 μm) with around 18-26 tubuli, whereas ***G. quasihirsuta*** Karanovic, 2009 has more ovoid sieve plates (~3.5-4.6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

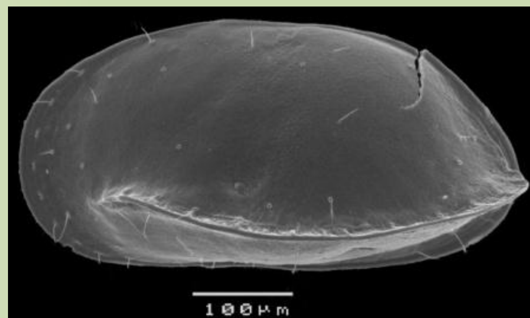
The difference in size and shape of the sieve-plates of *G. quasihirsuta*, as compared to the other two *Gomphodella* species, may also be related to the habitat salinity, since this species is found in higher salinity waters.

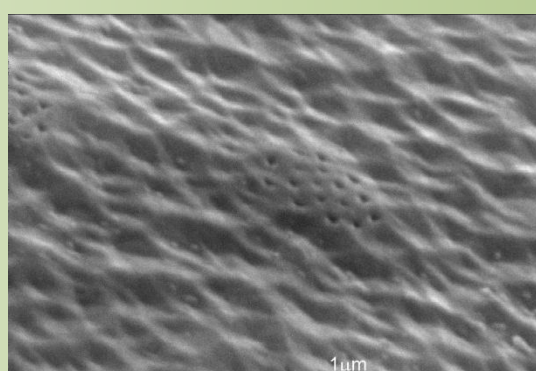
G. maia - Australia



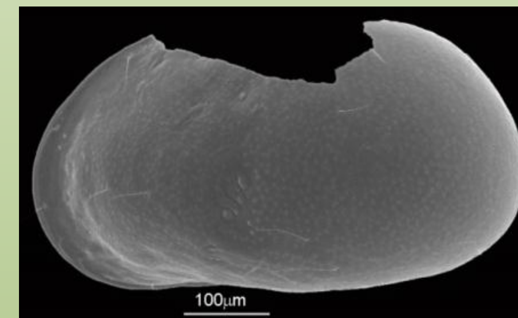


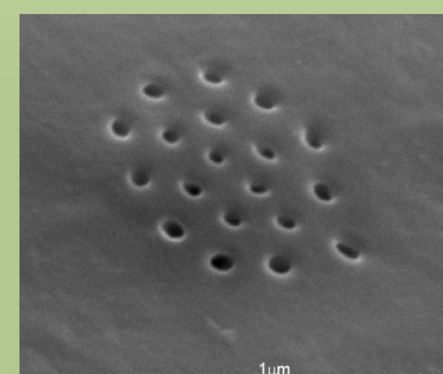
G. aura - Australia





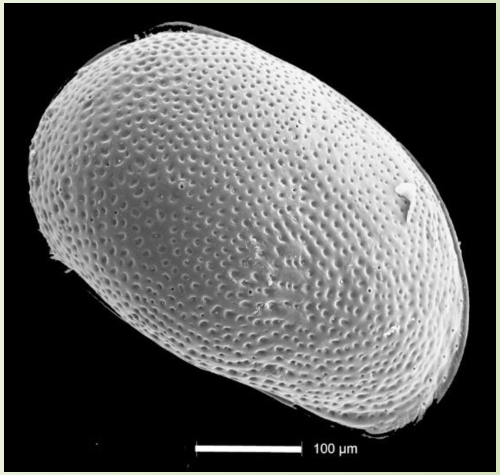
G. quasihirsuta - Australia

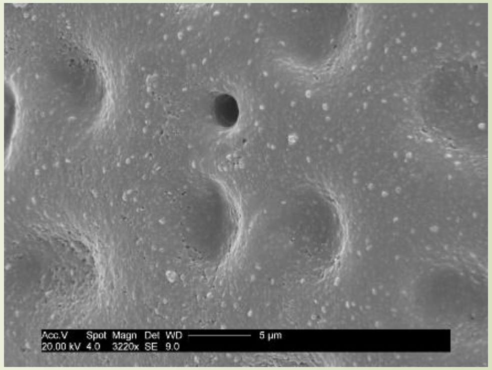




Some Timiriaseviinae genera do not display sieve plates, as *Metacypris* Brady & Robertson, 1870, *Elpidium* Müller, 1880, *Kovalevskiella* Klein, 1963, *Dolekiella* Gidó et al., 2007

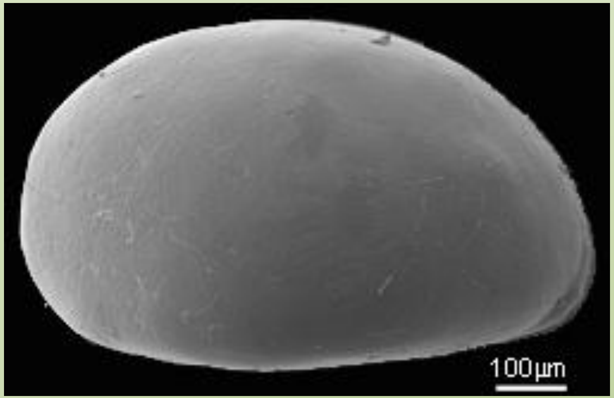
Metacypris cordata Brady & Robertson, 1870 -Romania





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 recristalization 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