THE HINGE CHANGES WITHIN CYTHERIDEINAE GROUP TAXONOMIC AND SYSTEMATIC SIGNIFICANCES

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Abstract: It is a well-established fact that all organisms have another mode of life, therefore other adaptive reactions within brackish-water biotops. The hinge and external ornamentation changes of closely related Cytherideinae groups are herewith, more or less, demonstrated.

Key words: Ostracods, hinge, brackish-water, Oligocene, Sarmatian

We know from the paleontological practice that the paleontologist does not work with entire species (population), but classifies a number of species that are assumed to be valid samples of the species characteristic morphological features. From here, the obsession of the holotypus and its effects: what is not similar to it is anything else (even a new species). On the assumption that the similarities have a common origin, they are genetically continuous with this ancestor. Putting them in stratigraphic succession, a kind of direction of change can be directly observed. This is a lineage regarded in different ways: parallel changes, divergent and convergent changes. All these formulas can explain almost anything. Any paleontologist knows that, from time to time, an exuberant diversification of species, but also a "vibration" within species, occurred. We called it "adaptive zone", such as a time and a space when and where such as processes took place. The explanation for it involves ecological and functional arguments.

The idea of a genetic program within an egg that specifies all the details of the organism by the information it contains is another version of this story. All is written in its DNA, like a "creator" whose word is written down in some form. Weissmann's barrier persists in the idea that the DNA cannot be changed in an adaptive manner in response to environmental stimuli. But the capacity to reproduce is a property of the whole organism, not a special replicating part that is distinct from the rest of the reproducing body.

However, we see that Weissmann divided organisms into a mortal body and a potentially immortal germ of line (as its hereditary essence) that is transmitted from generation to generation. This dualism is very familiar, it is like the mortal body and immortal soul of Man with a long established historic tradition.

The paleontological data are always interesting for they reflect the power and persuasiveness of a particular way of seeing that has such deep cultural roots as indeed Darwinism does. So that the basic assumptions of current paleontology are inconsistent with the evidence. But, of course, inconsistency in paleontology is no great sin, it is a spur to clarification. It is like the process of making sense of one of these ambiguous figures which can be seen in either way. Both are real, and we can switch back and forth once we recognise them. Sometimes, the one is better than the other.

The most notorious paleontologists accepted the high role of the hinge in fossil bivalve taxonomy. It seems to be a more conservative morphological element than the lateral surface ornamentation, muscle scars pattern or in the case of ostracods, the marginal pore canals. For Van Morkhoven (1963) the hinge plays an important role in ostracode taxonomy although the multitude of variations in hinge structure certainly deserves the full attention of the taxonomist, and constitutes a valuable aid in comparative morpho-logical studies it must be pointed out that their importance as a taxonomic criterion for the distinction of the various systematic categories should not be overemphasised. He listed seven main hinge types and four "aberrant" types, and also suggested one must reject the "stale" principle on the same hinge means the same genus, and of course another hinge means another genus (or subgenus).

In the Cytherideinae Subfamily many genera and species are grouped, which show an unstable pattern of the hinge, mainly for brackish-water taxa. In the top of the hinge-complexity there is the Cyprideis, an omnipresent genus from the Oligocene to Recent times, but it is always in brackish-water and fresh-water biotops. At the opposite pole is Cytherissa genus with its simple and stable hinge-structure, although it lives in similar facies-types. Between these two poles pendulated a large number of genera which enormously complicated any possible phylogeny.

However, something is real, the change of salinity always produces an important set of morphological changes, including the hinge. The change differs from one group to another. The lineage Mutillus (Aurula) - Hemicytheria - Tyrhenocythere kept, all of them, the same hinge-type. The modifications of the valves consists in either the marginal pore canals structure or the lateral ornamentation. The Laxoconcha genus changed, during a long history, only the number and shape (simple or bifided) median denticles. The extreme diversity of the Leptocytherinidae essentially changed all morphological elements, in both ontogeny and phylogeny.

Tribus Cytherideini (according to Van Morkhoven, op.cit.) includes 11-12 genera (and subgenera), but a part of them such as Paracyprideis, Eucytheridea, Dolocytheridea, Gallacaeocytheridea and Cytherissa should be grouped within others taxonomic groups. Only seven or eight (Clithrocycytheridea, Vetusto-cytheridea, Cytheridea, Haplocytheridea, Nepocyprideis, Miocyprideis, Cyanocytheridea and Cyprideis) can be placed among the Cytherideines, all of them having a similar mode of life (they exclusively pendulated within brackish-water biotops), shape, size and evolutionary tendencies. Their temporal distribution according to the common data is presented in the text. (Fig. 1).
Interesting is the fact that almost each species has another arrangement of the hinge elements (and even new details) and, sometimes, some hinge elements fluctuate from specimen to specimen.

Colin and Carbonel (1990) suggested that Clithrocytheridea would be similar to Miocyprideis and implicitly ought to be a descendant of the Neocyprideis s.str. which is a developed form of the so-called “primitive Neocyprideis”. The point of start is the Fabanella genus (from the Cenomanian). From the same Fabanella the Saralina genus evolved (of the Cenomanian and the Aptian) which is the ancestor of the Cyprideis genus (from the Miocene to Recent).

The authors figured two valves similar to the Neocyprideis (in the Upper Maastrichtian and the Danian), much closer to the true Neocyprideis (of the Oligocene) seems to be Neocyprideis grandinatus and N. durocorotienis (of the Paleocene). Sometimes they bear two or more lateral nodes. The hinge is quasi-similar to Oligocene specimens (the cardinal elements are shorter than in Oligocene species, 16 front teeth and 7 hind ones).

The Miocyprideis seems to be closely related to the Neocyprideis. It appeared at the Oligocene-Miocene boundary (Kollmann, 1958, Moyes, 1965). But, no doubt, it is a “secretion” of the brackish-water ecosystem. During the Middle Sarmatian it had a strong dispersion in new forms (as morphotypes), many of them being regarded as new species.

Absolutely impressive are the similarities between the Saralina merleriis (from the Cenomanian, France) and the Cyprideis tarosa (of the Holocene, Algeria, op.cit., Pl. III, Figs. 3, 4 and 7, 8, both species without nodes). The first conclusion is that the specimens without phenotypic tubercles existed before those with tubercles. The nodes are an adaptive reaction to the fluctuating salinity and unstable facies (in the general sense). During the Pantalyn history (from Sarmatian to Quaternary), I found both noded specimens and unnoded specimens in the same level (and the same population).

The morphological adaptive changes, coupled with likely evolutionary trends, cannot be decoupled on the ecological changes grounds. It is possible (but improbable) that the ancestors had lived in marine biotops (during the Cretaceous or the Paleocene), although the presence of some noded specimens contradicts this assumption. We have no other reasons for them.

### Hinge structure

The simplest hinge-structure is of Clithrocytheridea (see text, Fig. 2) with two cardinal portions and a median crenulate groove. The hinge-formula is 17 anterior denticles, 18 median and 5-9 posterior denticles. It seems to be quasi-similar to the Cyamocytheridea type-hinge. The posterior part of the hinge bears a variable number of denticles from species to species.

More complicated is Cytheridea s.str., with 7-9 anterior denticles. Almost all are bifid (with one exception), or only part of them, or all denticles are not bifid.

The median part of the hinge has two portions: a crenulate anterior one (with 7-9 smaller denticles) and a crenulate groove with 10-12 sockets. The number of denticles for both portions varies from species to species. The posterior sequence is more stable (six denticles, sometimes seven for each species), but they are either bifid or not at all. There is a kind of symmetry: two species without bifid denticles (C. intermedia, C. pernota), one only with bifid cardinal denticles (C. mulleri) and another (C. curvata) with only four bifid denticles. The champion of complexity is the Cytheridea mulleri and the C. curvata (see Fig.3).

Sandberg (1964) examined the right hinge of the Cytheridea (?) bronnianni (V.d.Bold) and found that it consists of eight or nine slightly bifid anterior denticles, followed by a shorter, deep median groove divided into 5-6 sockets. Behind it is a long posterior element of hinge composed of 11-13 large and bifid denticles which begin immediately behind the median groove. Cytheridea hungarica (Zalany) (Sandberg, op.cit., Pl. XVII, Fig. 5) has 8-9 bifid denticles. Between them are a postero-median crenulate bar (with unequal denticles) and an antero-median crenulate groove.

Stanceva (1990) found three different species in the Lower Sarmatian: C. hungarica with 7-8 anterior marginal thorns, the larger lateral alveolae and, sometimes with a postero-ventral tubercle, Cytheridea variolata (Stanceva) with 7-8 antero-marginal thorns, 3-4 postero-ventral thorns.
and valves covered with minute pits. *Haplocytheridea dacica dacica* (Hejjas), a smooth valve, is in fact a smooth *Cytheridea*, frequently found in the Middle Sarmatian. Such gradual changes of lateral ornamentation (from strong alveolae to punctuations and even smooth valves or from valves with marginal thorns to valves without any thorns) occurring during both the Oligocene and the Sarmatian times are the effect of the same ecological circumstances (reduction of the salinity, for instance).

*Haplocytheridea* reiterated the same pattern of cardinal elements but it is without the median groove. It is major modification of the hinge-structure but is this a gain or a loss? The total number of denticles are 38-40 (more than with *Cytheridea s str.*), generally rigorously distributed on three sequences of the hinge. The anarchy is similar to the *Cytheridea curvata* and the *Haplocytheridea striolosus*, that has all its denticles non-bifided.

The *Cyamocytheridea leptostigma leptostigma* (Reuss) has 10-11 anterior cardinal denticles (and only seven to Eocene species) and 6-7 posterior denticles. In exchange, according to Keij’s description (1957), *Clithrectytheridea* has a variable number of denticles (5 to 9). The Eocene species have 9 anterior denticles, 12-17 median denticles, no median groove and 5 to 8 posterior cardinal denticles. *Cyamocytheridea fabaeformis* (of the Oligocene, Faupel, 1975) has the cardinal denticles bifided and the median sequence of the hinge divided into a crenulate bar and a crenulate groove. The Sarmatian “leptostigma”, simplified this hinge-structure (Pl. VI, Fig. 5-8).

With the *Neozyprides genus* (of the Oligocene, Pl. I, Fig. 1-8) the most cardinal denticles are bifided (excepting the first and the last 3-4 posterior ones). The median sequence begins with two small sockets, a vertical larger bar, other three sockets, each of them divided into three smaller and vertically elongated secondary sockets, four sockets divided into smaller of second-order sockets and six other sockets divided into two secondary sockets. The posterior cardinal part of the hinge begins with a pear-like tooth (Fig. 6), a triangle-like tooth and other 6-7 teeth. In some juveniles there is a visible tendency to be bifided. Such as hinge structure can be seen only in the *Cyprides*. Unfortunately few juvenile specimens have been studied and one cannot state conclusively that their ontogeny is similar or strongly differentiated. Pokorny (1958) suggested a phylogenetic trend toward a reduction in length of the median hinge-element. It is just an impression. It seems to be just on the contrary. However, all these different types of hinges, many of them allied under the same umbrella, can be regarded as separate subgenera but in this case where do we put the limit between them and how clearly do we delimit one from another?

Moreover, we can fall into the sin of *Limnicardididae* (above 50 genera and subgenera). We want to quantify the change, to find out its causes and to organise its effects within a rational and rationalisation system. It is, in fact an imaginative process. Someone will find a clever solution and it will be accepted as a reality. According to the complexity of the hinge-structure, their succession would be: *Cyamocytheridea, Haplocytheridea, Cytheridea, Clithrectytheridea, Vetustocytheridea, Neozyprides, Miozyprides* and finally, *Cyprides*.

The *Cyprides* hinge has been presented in many works, thus it is well known. Sandberg (op.cit.) described and figured the hinge ontogeny. Although I found a more complex hinge structure of the *Cyprides* species of the brackish-water Panteléhys times (many of them somewhat different by Sandberg’s photos), the conclusion would be its largest variability of the hinge elements as an effect of ecological conditions. Moreover, their ontogeny might be different from species to species.

For *Cyprides salebrosa* (of the Pliocene, Florida) Sandberg (op.cit.) described six stages of juvenile succession: in the A-6 instar the right median groove occupies the entire

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**Fig. 2 - Hinge structure of the Cytherideines group (I-IV, after Van Morkhoven, 1963)**

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<th>I</th>
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| Clithrectytheridea = 30-34 |
| Cytheridea = 30-37 |
| Haplocytheridea = 40-38 |
| Cyamocytheridea = 23-35 |

| Neocyprides = 35-36 |
| Cyprides = 35 |

1 - IV after Van Morkhoven, 63
<table>
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<tr>
<th>Right valve</th>
<th>anterior</th>
<th>median</th>
<th>posterior</th>
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<td>Clithocytheridea appendiculata</td>
<td>7</td>
<td>?</td>
<td>5</td>
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<td>- w- lericheii</td>
<td>7</td>
<td>10/19</td>
<td>9</td>
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<td>Cytheridea müllerii</td>
<td>7(12)</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>- w- intermedia *</td>
<td>9</td>
<td>10</td>
<td>5</td>
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<tr>
<td>- w- pernalta *</td>
<td>7</td>
<td>7</td>
<td>6</td>
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<td>- w- curvata *</td>
<td>7</td>
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<td>(4 bifided)</td>
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<td>(4 bifided)</td>
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<td>Haplocytheridea punctatella *</td>
<td>7</td>
<td>13</td>
<td>5(1 bifided)</td>
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<td>- w- striplgosa *</td>
<td>7</td>
<td>25</td>
<td>6</td>
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<td>- w- helvetica</td>
<td>7(3 bifided)</td>
<td>20</td>
<td>6(3 bifided)</td>
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<td>Cyamocytheridea tabaeformis **</td>
<td>7(1 bifided)</td>
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<td>4(5)</td>
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<td>- w- hebertiana *</td>
<td>9</td>
<td>12</td>
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<td>- w- heinzeliini *</td>
<td>9</td>
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<td>6</td>
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<tr>
<td>Neocyprideis williamsoniana</td>
<td>14</td>
<td>6/10</td>
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Fig. 3 - Hinge structure of the Cytherideinae group (after *Keij, 1957, **Faupel, 1975)

median element. In the A-5 a very short bar appears just anterior to the posterior cardinal portion of the right valve. In the latter instars (A-4 to adults) the postero-median bar and the anterior and posterior terminal elements increase steadily in length, whereas the antero-median groove has an almost constant length throughout the ontogeny. The cardinal elements are undulating but not toothed in the A-6 juvenile. In the A-5, very fine subdivisions of the terminal elements are evident. In the A-4, distinct small teeth are present and the number of teeth increases steadily to the adult. In the A-1 juvenile and the adult the teeth of the posterior element and the larger proximal teeth of the anterior element may be bifid. What is strongly modified during this ontogeny is the median sequence of the hinge. More stable are the posterior elements which increase regularly in length with each molt. The anterior cardinal denticles become bifid or even tridid only in the last juvenile stage.

This juvenile succession occupies all the possibilities of the evolution of the Cytherideini taxa.

The Vetustocytheridea is hardly differentiated from other related noded genera (the Haplocytheridea group, for instance). It has 7-8 anterior marginal thorns and three postero-ventral ones. The right hinge consists of 12-13 anterior bifid denticles, followed by "a very short area which is essentially level with the valve edge. Behind this a long crenulate bar which rises up a short posterior element composed of 5 to 6 large bifid teeth, largest medially " (Sandberg, op.cit.).

Miocyprideis of the Sarmatian, can be situated in the same dynamic flow of the Clithocytheridea and brackish-water the Cyamocytheridea species and specimens. The Miocyprideis hinge is the amplified one, having 16 anterior cardinal denticles (three non-bifided, 10 bifided and the last non-bifided). The median sequence consists of 5 sockets and 6-7 teeth. The posterior cardinal part of the hinge has 15 non-bifided denticles.

If we overlap the map of the hinge patterns (Fig.2) and their temporal distributions (Fig.1) all become either like a very branched bush or a nonsense. It is much more comfortable and simpler to push their origins far away towards a deeper and unknown history. Clearly something is missing for interpretations. Coln and Carbonel (op.cit.) placed the origins of the Cytherissa, Cyprideis and Miocyprideis somewhere in an Eden Garden or beyond it. The Lower Jurassic, for instance, is a very good point for a beginning.

But it seems that almost all fauna changes occurred within the brackish-water environments. It was a kind of catalyst for biological changes. The Paraethys faunas are the best example with the "boom" of new forms within a relatively short time (more than 1,000 species of mollusks, ostracods and foraminifers, part of them with curious and even bizarre shapes).

It has perfectly logical consequences, in the way Darwin chose to describe evolution in terms of inheritance, random variation, natural selection and the survival of adapted species. Of course, Darwin did not foresee how this story would unfold. This theory was perfect for a long time, and explained nearly all paleontological observations. The detailed observations about fossils are simply "reframed", located within the "similarities and dissimilarity perimeter" (according to a long tradition), excepting the common facts of ecology. At all first glance, we see two types of genera: marine and brackish-water ones, although it does not look too significant. However, its consequences become more dramatic the further we follow them, because only a little part of the marine species penetrated the brackish-water ecosystem and never vice-versa. The two aquatic ecosystems have, either of them, a strong delimited mode of life, their
own "private" species, communities, strategy and adaptive tendencies. Moreover, the brackish-water area is not a unique ecological niche. It is a 'unicum biologicum' just because it is always unstable and mosaic ecological - system like a perpetual challenge for all organisms. In this case, possibly excepting _Clithrocytheridea_ (it seems to be exclusively marine), all the genera and species are brackish-water. _Cytheridea_ species are commonly in marine biotops, but part of them traversed the "salinity filter" of the Lower Sarmatian, allied with the _Painjenborchella, Pterigocythereis_ , and many others. The same genera exist in the Black Sea. Not all species and not for a long time. _Cytheridea mulleri_ (von Münster), for instance, is extremely frequent in the so-called Buglovian stage (substage or paleontological zone) of the Lowermost Sarmatian levels. It soon disappeared, not before being "dissociated" into a few new forms (smooth valves as _Haplocytheridea dacica_ dacica, with large and deep alveolae and with a postero-ventral tubercle ( _C. hungarica_) and pitted valves ( _C. variolata_). The _Cyamocytheridea_ species are more or less frequent within littoral biotops of the Lower and Middle Sarmatian. The _Miocyprideis_, the most "offensive" genus divided into numerous morphological details, in the same time and space. It stopped in the Middle Sarmatian. None of them have been found up in the stratigraphical column (in the Paratethys areas, at least). During the Oligocene times, a subtle pendulation between marine and brackish-water facies occurred and the degree of involvement of these genera was absolutely similar. But it was not with the same morphological modifications. For more details about this question, see the plates. In other words, there is a double dimension of change as well as two dimensions of inequalities in the environments and the morpho-logical changes.

References


Captions of Plates

PLATE 28. I

Fig. 1 - _Neocypridris williamsoniana_ (Bosquet), adult, left valve, Lower Oligocene, Berecoaia Valley (Mera), Transylvania, Romania

Fig. 2 - the central field of the valve with minute punctuations and small callosities.

Fig. 3 - the anterior field of the valve, fine punctuations and sieve-pores.

Fig. 4 - the hinge structure of the right valve.

Fig. 5 - the muscle scars field.

Fig. 6 - the first denticles of the posterior sequence of the right hinge.

Fig. 7 - _Neocypridris williamsoniana_ (Bosquet), inside structure.

PLATE 28. II

Fig. 1 - _Miocyprideis_ sp., specimen with postero-ventral thorns. Anterior denticles of the adult, right hinge, Lower Badenian, brackish-water level, Borod basin (northern region of the West Carpathians), Borehole 3073, depth 184 and 133 m. The hinge structure is more stable in spite of external ornamentation details.
Fig. 2 - 6 - *Miocyprideis* sp., adult from the Lower Badenian, brackish-water levels, Borehole 133, depth 133 m. All figured specimens are without marginal denticles excepting the specimen of Fig. 5.

Fig. 7 - *Miocyprideis janoscheki* Kollmann, morphotype A, adult, left valve, Sarmatian, Beius basin. The specimen has eight strong anterior marginal denticles (or thorns).

Fig. 8 - *Miocyprideis janoscheki* Kollmann, morphotype B, adult, right valve, Middle Sarmatian, Šipote Valley (Dobrogea), specimen with almost 25 small antero-marginal denticles.

Fig. 9 - *Miocyprideis janoscheki* Kollmann, morphotype C, adult, right valve, Middle Sarmatian, Šipote Valley, a specimen with a strong postero-ventral thorn and 31-32 antero-marginal denticles.

Fig. 10 - *Miocyprideis aff. janoscheki* Kollmann, adult (?), left valve, Middle Sarmatian, Raul Alb Valley (Hatzeg), a smooth specimen with 9-10 antero-marginal gross denticles.

**PLATE 28. III**

*Miocyprideis ex gr. sarmatica* (Zalany). Within the same population it seems to be an unequal development of the hinge-elements.

Fig. 1 - juvenile, right valve. The anterior sequence has 17 hardly visible denticles. The denticles are clearly outlined on the posterior portion. The median sequence has four-socket groups: the first with two small sockets; 2nd, 3rd and 4th with three sockets and finally one small socket. The posterior portion begins with four pear-like teeth, ten round or oval well delimited protuberances and 8-9 posterior denticles with slightly visible apical fissure.

Fig. 2 - smaller juvenile, right valve. The anterior teeth are better delimited from one another and their tendency to be lobed is clearer. The median sequence is similar. The posterior protuberances and teeth are different: 11 unequal protuberances and 10-11 more or less clearly outlined teeth. Only two of them are bifid.

Fig. 3 - *Cytheridea* sp., (L = 0.40 mm), juvenile, smooth specimen, Middle Sarmatian, Raul Alb Valley. The anterior bar is hardly fragmented into teeth. The last 3 denticles are better outlined. In top of them is a visible fissure. The median hinge sequence is divided into "caskets" with 2 or 3 small sockets inside them, larger in the anterior and smaller in the posterior parts. The posterior sequence is formed by a strong bar divided into 15 small and round denticles.

Fig. 4 - *Miocyprideis ex gr. sarmatica*, juvenile, right valve, Middle Sarmatian, Šipote Valley. It is almost similar to Fig. 1. The anterior bar is minutely divided. The "casket" 1, 2, 3 and 4 with two smaller sockets. "Casket" 5 with 4 sockets, "caskets" 6 and 7 with two sockets, a long pear-like dентicle, another casket with two sockets and posterior denticles. The posterior portion of the hinge begins with two twin denticles, another with trisected denticles, the one with four lobes and another with three lobes. The posterior bar is divided into 9 (?!) unequal denticles. The last is stronger.

Fig. 5 - *Miocyprideis* sp., adult, left valve, Middle Sarmatian, Šipote Valley. The anterior portion of the hinge consists of 13 sockets. In their upper part a thin prolongation is visible that corresponds to the denticule fissure of the opposite valve. The posterior sockets (6) are undivided (1), divided into two, small, secondary sockets (2 and 3), three secondary sockets (4 and 5) and two sockets (6). The median interval of the hinge is divided into numerous, small sockets, grouped in more or less separate groups.

Fig. 6 - sieve-pores of *Miocyprideis*, Middle Sarmatian, Šipote Valley.

Fig. 7 - *Miocyprideis janoscheki* Kollmann, inside view. The central muscle scars are normally single (four scars in the vertical row, a frontal scar and two mandibular scars. Their shape and size differ from individual to individual).

**PLATE 28. IV**

Fig. 1 - *Cytheridea pernota* Oerlli and Keij, adult, right valve, Lowermost Oligocene, Berecoa Valley, Transylvania, Romania

Fig. 2 - *Cytheridea pernota* Oerlli and Keij, adult, left valve, Ciocmani Beds, Middle Oligocene, Prodaineștii, Transylvania, Romania
idem, inside structure.

Idem, juvenile (L = 0.43 mm).

Cytheridea muelleri (von Munster), adult, right valve, Uppermost Badenian, Buituri, Transylvania, Romania.

Cytheridea aff hungarica (Zalany), adult, left valve, Middle Badenian, Coștei, Transylvania, Romania.

the hinge structure of C. pernota, adult, left valve, Middle Oligocene, Prodănesti, Transylvania, Romania. The seven posterior teeth are longer, slightly bended (see Fig. 8). Between them are deep sockets open towards the inside of the valve. All of them are placed in a well delimited groove. The median sequence consists of 19 long denticles. Interesting is the fact that between them are hardly marked upper protuberances, sometimes well developed (see Fig. 9). In the posterior direction, the median denticles tend to group together.

PLATE 28. V

Fig. 1 - 2 - Cytheridea muelleri (von Munster), adult, right valve, Middle Badenian, Coștei, Transylvania, Romania.

Fig. 3 - the hinge of the Badenian, marine, Cytheridea, right valve, adult. The seven anterior denticles (and a curious anterior outgrowth with a hole in its top) are pear-like, longer and arranged in a vertical position. Their tops are evidently bifid. The six posterior teeth are bi- or trilobed excepting the first of them (divided into only two denticles) and the last one with only a fissure in its top. The median sequence consists of 10 pear-like denticles (its apex slightly bifid). Between them, inside of the socket, a small denticle descent from the upper margin. Such an alternation of bigger and longer denticles with smaller denticles (arranged on the vertical plane) is just a promise of Oligocene specimens.

Fig. 4 - the opposite adult valve with seven anterior pear-like teeth. The first six median denticles are united in its base and swollen in its apex (few of them are bifid).

Fig. 5 - Cytheridea sp., smooth specimen, juvenile, Middle Sarmatian, Șipote Valley. The anterior marginal bar is gradually fragmented into simple denticles, then they are slightly fissured and (seven of them) are clearly trilobed. The median bar is smooth. The posterior denticles are either protuberance-like or bilobed.

Fig. 6 - Cytheridea sarmatica (Zalany), adult, left valve, Middle Sarmatian, Râul Alb Valley, Transylvania, Romania.

Fig. 7 - Cytheridea sp., left valve, adult, Lowermost Sarmatian, Morilor Valley, Dacian basin, (Oltenia). This specimen seems to be rather secondary eroded.

PLATE 28. VI

Fig. 1 - Cytheridea sp., adult, right valve, Middle Sarmatian, Serel, Transylvania, Romania. A specimen with seven antero-marginal thorns and two postero-ventral ones.

Fig. 2 - Cytheridea sp., adult, left valve, Middle Sarmatian, Serel (this specimen is located within the same lithological level and, of course, of the same population). It is a specimen without postero-ventral thorns. It is absolutely similar to some specimens of Cytheridea pernota Oerlli and Keij, of the brackish-water Oligocene sediments.

Fig. 3 - Cytheridea sp., adult, left valve, Middle Sarmatian, Râul Alb Valley. A specimen perfectly smooth with 25 antero-marginal thorns and 6 postero-ventral thorns.

Fig. 4 - Cytheridea sp., juvenile, left valve, Middle Sarmatian, Râul Alb Valley.

Fig. 5 - Cyamocytheridea leptostigma leptostigma (Reuss), adult, right valve, Lower Sarmatian, Beiuș basin.

Fig. 6 - sieve-pores.

Fig. 7 - the hinge structure of the left valve.

Fig. 8 - inside structure of the right valve.