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The "Cimpia Moment" (late Miocene, Romania) and the Pannonian-Pontian boundary, defined by ostracods.

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ABSTRACT—The boundary between the Pannonian and Pontian (late Miocene) of the Pannonian area is recognised on the basis of ostracod faunas. A comparison is made between the faunas of the Pannonian Basin and the Dacic-Euxine Basin. A transitional fauna with Pannonian elements, but a stronger Pontian component, is described from Cimpia (Romania). This indicates a more gradual transition between the two stages in the Pannonian Basin than in the Dacic-Euxine Basin, where there is a sharp faunal break indicating a period of non-deposition or erosion.

INTRODUCTION

Stage boundaries are frequently the focus of considerable debate in biostratigraphy. Correlation in the Neogene of central and eastern Europe presents the stratigrapher with particular problems, requiring the erection of purely regional stratigraphies; these difficulties are exacerbated in the late Miocene by the break-up of Paratethys into interconnected basins that were periodically isolated and contained their own endemic faunas. One of these, the Pannonian Basin (Fig. 1), was isolated during the Pannonian, but during the succeeding Pontian it became connected to the large Euxine (or Pontic) Basin of the Black Sea region and a gulf of the latter, referred to as the Dacic Basin (Fig. 1). In recent years the Pannonian Stage has been progressively shortened by stratigraphers, especially by the gradual downwards extension of the Pontian. In this study an attempt is made to elucidate some of the confusion created by too-elastic a chronostratigraphic framework.

The Pannonian is distinguished by a unitary and homogeneous fauna which evolved within the Pannonian Lake, a peculiar isolated habitat subject to various continental influences. Therefore, although the duration of the Pannonian can be disputed, its essence cannot be. The connection with the Euxine Sea occurred late; at the level of the Middle Pontian, the so-called "strata with *Congeria rhomboidea*" allow a well established correlation between the Pannonian and Euxine Basins. However the limits of the Pontian are ambiguous. In this study, its lower boundary with the Pannonian is discussed, with particular reference to the ostracod faunas.

PROBLEMS OF CORRELATION

The Pannonian stage is a unique entity within the intra-Carpathian area. The Pontian stage, however, is more extensive geographically, and in the Dacic Basin, separated from the Pannonian Lake by the Carpathian range, it shows an almost "classic" development. The Dacic-Euxine Pontian can be correlated easily with the Pontian of the Pannonian Basin at the level of the Portaferrian faunas (Fig.2), but the Lower Pontian of the two basins raises a series of question marks. In the Dacic Basin, the "grand coupure" (great break) between the rich Upper Meotian fauna and the restricted Lower Pontian fauna is a problem not only of quantitive difference (number of specimens and species), but also of a major change in faunal communities. It is believed that such a dramatic restructuring of communities cannot be solely accounted for by abrupt ecological changes, but that other causes must be invoked.

The lower part of the Odessian (Lower Pontian, Fig.2) has a very poor, but distinct ostracod fauna, characterised by the subgenus *Candona (Pontoniella)* with both smooth and striate species. The Candoniid genus *Bacunella* emerged somewhat later and in a wider faunal context associated with *Loxochoncha aspera* Olteanu, *Candona (Reticulocandona) elongata* Olteanu, *Leptocythere subcaspia* (Livental), *Leptocythere naca* (Mehes) and the whole group of tuberculate Leptocytherinae. This fauna, which is still limited compared with the faunal expansion seen at the level of the Portaferrian, characterises the upper part of the Odessian. Finally, the appearance of the genera *Tyrrhenocythere* and *Cytherissa* respectively mark the beginnings of the Portaferrian and Bosphorian.

All researchers who have been investigated post-Sarmatian macrofaunas in the Euxine Basin agree on the idea of successive waves of migration. Indeed, a migration may be seen to intervene as a balancing factor, introducing new genetic variants into an indigenous community, assuming that such a community exists. The phenomenon of migration has gained considerable popularity with biostratigraphers, seemingly being invoked whenever the descent of a fauna (or even a single taxon!) is not clear; there are numerous examples in the Dacian-Euxine literature. It is already accepted that Pontian ostracod faunas are migratory; but if a fauna of Pontian type had been grafted onto an indigenous community of Meotian type, the resultant Pontian community would

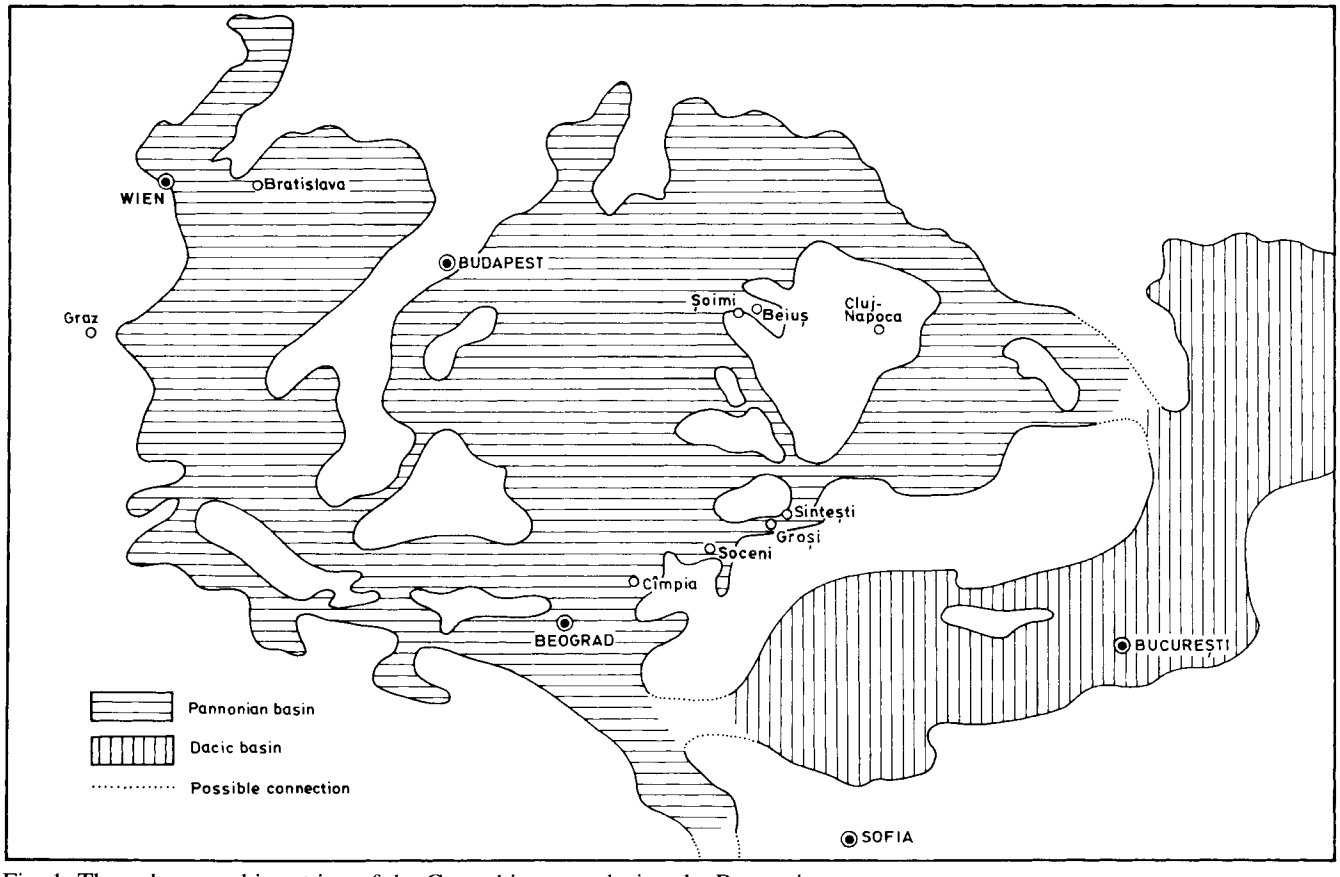


Fig. 1 The palaeographic setting of the Carpathian area during the Pannonian

certainly have been different from that which actually existed. In terms of the Pontian ostracod faunas at least, no Meotian affiliation or descent can be argued for. Time, the most important parameter in palaeontology, must be introduced between the Meotian and Pontian faunas. For this to be possible we must postulate a post-Meotian hiatus followed by a first Pontian migration bringing in an entirely new fauna. This not a new idea; the need for an intervening period has been felt before (Sokolov, 1889, *fide* Taktakisvili, 1978) and subsequently satisfied by the recognition of a "mixed" Eupatorian fauna (Davitaschvili, 1933). The Eupatorian passage from Meotian to Pontian is viewed as being equivalent to the complex of "*Congeria novorossica*" strata of the Dacic Basin and the preceding freshwater complex. It can be accepted as a time-point reflecting a crisis in the evolution of the Euxine Basin and implicitly in that of its fauna. Where the Eupatorian exists it is considered, on the evidence of its mollusc fauna, to represent the first important transgression of the Pontian.

What happened in the Pannonian Basin during this long period of time? Parallels must be drawn between the evolution of the ostracod communities in the Pannonian and Dacic/Euxine Basins. The evolution of the Pannonian Basin as an enclosed lake subject to continental influences took place in a specific ecological context which generated an extraordinary faunal diversity with an unmistakable character of its own. One should remember, however, that the ostracod fauna of at least the lower portion of the Pannonian is clearly of Sarmatian origin. The whole fauna passes gradually, with almost imperceptible modifications, into a new faunal community - the Pontian community. The difficulty lies in the choice of the taxon or group of taxa which will enable us to delineate the Pannonian/Pontian boundary as accurately as possible.

Some genera characterise the new Pontian community of the Pannonian Basin. *Candona (Pontoniella)* emerged with the Pontian, followed immediately by *Bacunella*; the appearance of *Tyrrhenocythere* at the level of the Portaferrian is less marked than it is in the Euxine Basin, however (only a single species, *T.pannonicum* Olteanu), and *Cytherissa* is unknown in the Pannonian Lake.

In the Pannonian Basin in a number of fossiliferous localities that have yielded a Lower Pontian macrofauna (e.g., Crivina), *Candona (Pontoniella)* is abundantly represented, especially by species which appear later in the Dacic Basin *C.(P.) truncata* Sokac, *C.(P.) hastata* Krstic, C.(P.) *saggitosa* Krstic, as well as eccentric eco-types considered as unitary species (see Krstic, 1972). In addition *Bacunella dorsoarcuata* (Zalanyi), which appears in the Dacic Basin in the second half of the Odessian, is frequently present. The

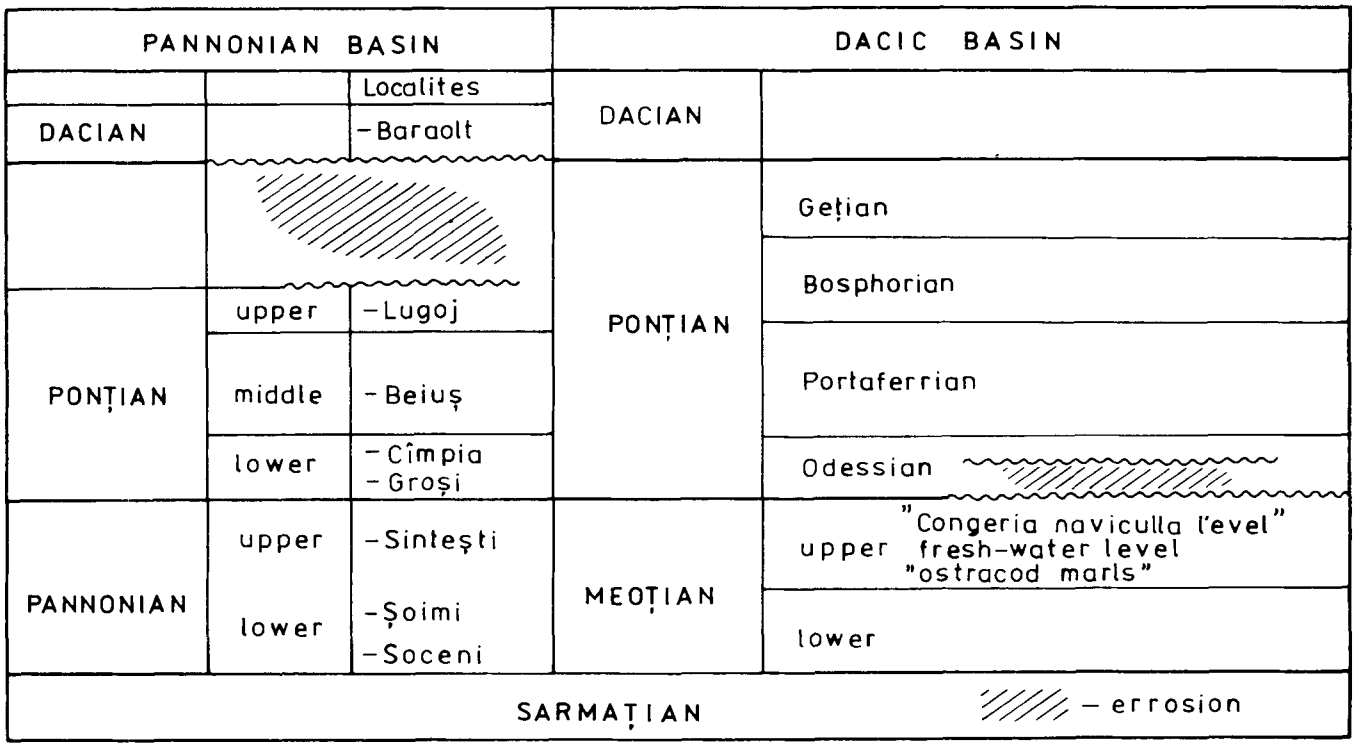


Fig. 2. Correlation table of several Upper Miocene Stratigraphic scales.

fauna of the lower part of the Odessian should therefore be sought somewhat below this level.

THE CIMPIA OSTRACOD FAUNA

The study of Ostracod assemblages from the fossiliferous deposits of Cimpia (=Langenfeld) in southern Banat (Romania) suggests answers to some of the questions posed above. These deposits were first investigated by Halavats (1883) who described two of the "marker" molluscs of the Pannonian, *Congeria zsigmondi* and *C. czizeki*, and later by Gillet (1943). The macrofauna is comparatively rich and includes, in addition to the two Congeriae, *Limnocyrdium boeckhi* (Halavats), *L. (A.) winkleri* (Halavats), *L. brunnensis* (Andrusov) and *Melanopsis textilis* Handmann; this places the deposits at the level of biozones D and E of Papp (1959), in other words at the top of the Pannonian Stage. The ostracod fauna, paradoxically, indicates a Pontian age. This apparently irreconcilable contradiction undermines the century of work that forms the basis for Papp's (1959) zonation of the "Pannonian" Neogene - a zonation which, if not accurate, was at least necessary, and was immediately adopted by other specialists.

The ostracod assemblage comprises the following species:

Amplocypris abscissa (Reuss)
Amplocypris matejici Krstic
Amplocypris subacuta Zalanyi
Candona (Pontoniella) saggitosa Krstic
Candona (Pontoniella) striata Mandelstam
Candona (Reticulocandona) elongata Olteanu
Candona (Typhlocypris) ornata Olteanu
Cypria tocorjescui Hanganu
Cyprideis sp.
Hemicytheria dubokensis Krstic
Hungarocypris hieroglyphica (Mehes)
Leptocythere lacunossa (Reuss)
Leptocythere aff. *lata* Schneider
Leptocythere naca (Mehes)
Leptocythere palimpsesta (Livental)
Leptocythere praebacuana (Livental)
Leptocythere servica Krstic
Leptocythere sinegubi Krstic
Leptocythere subcaspia (Livental)
Leptocythere n.sp. Krstic, 1985, pl.14, fig.10
Loxoconcha djaffarovi Schneider
Loxoconcha fistulosa Krstic
Loxoconcha granifera (Reuss)
Loxoconcha schweyeri Suzin
Loxoconcha subrugosa Zalanyi
Pontoleberis attillata (Stanceva)
Pontoleberis pontica (Stanceva)

Hungarocypris appears to be a taxon generated by conditions specific to the Pannonian Lake, although I have seen a single valve of this genus, in the collection of Dr Laura Pophadzae (Tbilisi), taken from the Upper Meotian deposits of Abhazia. At Cimpia specimens of *H.hieroglyphica* (Mehes) are present, a species which emerges in the Upper Pannonian and continues into the lower portion of the Pontian; it is abundant at the "Soceni level" and also in the fossiliferous localities at Holod, Sintesti and Grosi (Olteanu, 1984)(See Fig.2 for locality horizons).

Candona (Reticulocandona) elongata Olteanu is restricted to the upper part of the Odessian. I have found it, at least at this level, in the western part of the Dacic Basin.

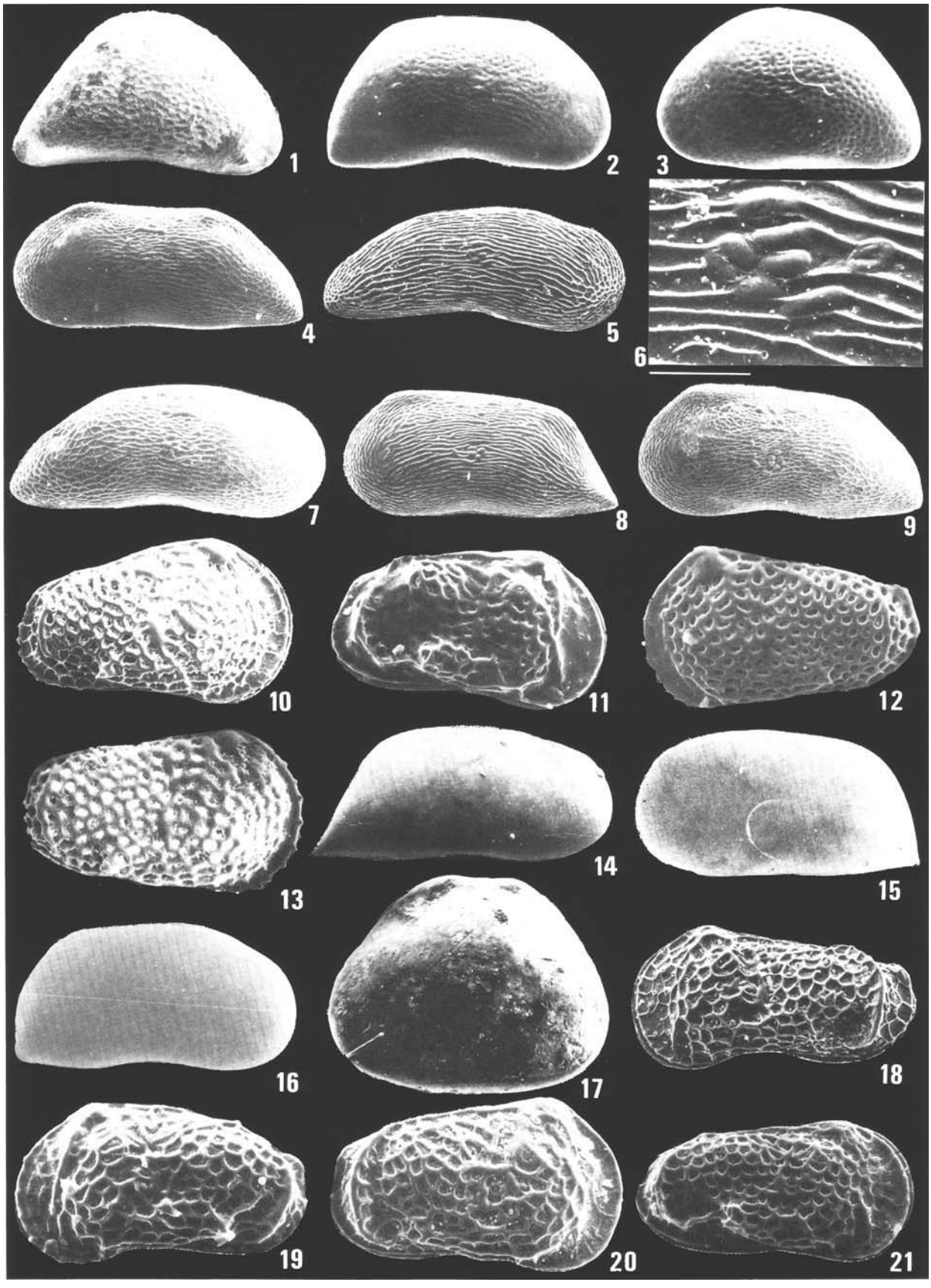
Candona (Typhlocypris) ornata Olteanu is common in the terminal portion of the Pannonian Stage and the basal level of the Pontian Stage in the Pannonian Basin. The valve outlines and ornamentation suggest that it is this species from which the genus *Bacunella* is derived in the Upper Odessian.

The subgenus *Candona (Pontoniella)* is exclusively Pontian. In the Pannonian Basin it appears abruptly at the beginning of the Pontian and disappears at its end. In the Dacic Basin some species survive into the Lower Dacian; this is one of the reasons for extending the Pontian Stage up to the base of what is at present the Upper Dacian. In this way a clear-cut beginning and end of a very characteristic faunal cycle could be delineated. In fact the boundary between Bosphorian (=Upper Pontian) and Getian (=Lower Dacian) is impossible to define (Fig.2). The *Pontoniella* species at Cimpia dominate the ostracod community in terms of numbers of individuals, with a wide morphological variability and obvious sexual dimorphism, an impressive number of new species have been described in recent years. It is important that nowhere in the Euxine area has this subgenus been found below the base of the Pontian. Amongst the striated species two trends are noticeable in the organisation of the ornament. Some species have free longitudinal striae without any cross-links to form polygonal meshes (see pl.1, figs 5,8), while others have a network of irregular polygons lying in rows parallel to the valve margins (pl.1, figs 4,7). In Middle Pontian pelitic facies eccentric specimens sometimes appear that are posteriorly prolonged, with the caudal process slightly upturned. This phenomenon has also been observed, although less pronounced, in the *Amplocypris subacuta* group in the section at Sintesti (Banat) (Which is believed to be stratigraphically below the Cimpia fauna). This exaggerated outline could be attributed to a reaction imposed by a particular ecological parameter during the Pontian. This might provide an additional argument for the establishment of the Pannonian/Pontian boundary. The origin of the *Pontoniella* group should be sought amongst species of the genus *Caspiolla*. In the Bosphorian of the Dacic Basin there are *Caspiolla* species with incipient striations in the anterior and posterior regions, the central region being the last to become ornamented. In addition, the "all-smooth" *Pontoniella* species are not perfectly smooth, but usually have finely reticulate margins.

Amplocypris is represented by three species, of which two, *A. subacuta* Zalanyi and *A. matejici* Krstic, have previously been recorded from the Pontian. The third, *A. abscissa* (Reuss), is a cosmopolitan species appearing as low as the

Explanation of Plate 1

Fig. 1 - *Candona (Typhlocypris) ornata* Olteanu, (Length = 745µm)
Fig. 2 - *Candona (Reticulocandona) elongata* Olteanu (Length = 835µm)
Fig. 3 - *Candona (Typhlocypris) ornata* Olteanu, juvenil, (Length = 615µm)
Fig. 4 - *Candona (Pontoniella) sagittosa* Krstic (Length = 985µm)
Fig. 5 - *Candona (Pontoniella) striata* (Mandelstam), the specimen with longitudinal ribs, (Length = 915µm)
Fig. 6 - *Candona (Pontoniella) striata* (Mandelstam), details with muscle scars area and normal pores; scale bar = 100µm
Fig. 7 - *Candona (Pontoniella) sagittosa* Krstic, with polygonal meshes which covered the whole of the surface of the valve (Length = 955µm)
Fig. 8 - *Candona (Pontoniella) af, sagittosa* Krstic, (Length = 920µm)
Fig. 9 - *Candona (Pontoniella) sagittosa* Krstic, (Length = 955µm)
Fig. 10 - *Leptocythere (Amnicythere) servica* Krstic, (Length = 500µm)
Fig. 11 - *Leptocythere* aff *praebacuana* (Livental), (Length = 455µm)
Fig. 12 - *Leptocythere lacunossa* (Reuss), topotype from Hodonin ("subglobosa" beds, Upper Pannonian) (Coll. Prof. V. Pokorny) (Length = 400µm)
Fig. 13 - *Leptocythere* (?) *lacunossa* (Reuss) (Length = 435µm)
Fig. 14 - *Amplocypris subacuta* Zalanyi, (Length = 1580µm)
Fig. 15 - *Amplocypris matejici* Krstic, (Length = 1490µm)
Fig. 16 - *Amplocypris abscissa* (Reuss), (Length = 1450µm)
Fig. 17 - *Cypria tocorjescui* Hanganu, (Length = 590µm)
Fig. 18 - *Leptocythere* sp. (Krstic, 1985, pl. XIV, fg.1) (Length = 140µm)
Fig. 19 - *Leptocythere* sp. (Krstic, 1985 nova species "radae", pl.XIV, fg.10) (Length = 400µm), adult, left valve.
Fig. 20 - *Leptocythere* sp. (Krstic 1985, nova species "radae"), adult, right valve (Length = 385µm)
Fig. 21 - *Leptocythere* sp. (Krstic 1985, nova species "radae"), juvenil, right valve (Length = 360µm)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lower part of the Pannonian and ranging up into the Pontian; however, it has not been found in the Portaferrian of the rich fossiliferous localities of the Beius Basin; it probably disappears somewhere in the Odessian.

Cypria tocorjescui Hanganu is another species typical of the Pontian community, but no similar forms have been found at Soceni (Middle Pannonian - Zones C-D of the "classical" stratigraphy).

The genus *Leptocythere*, by virtue of its abundance and diversity, is a major contributor to the special character of the Pontian ostracod fauna. *L. naca* (Mehes) displays considerable variation in response to ecological parameters. It is found as early as the Volhinian (=Lower Sarmatian) where it is common; it ranges (in the Carpathian area) up into the Pontian, and in the eastern regions of the Euxine Basin it seems to continue into the post-Pontian brackish water deposits. The characteristic ornament of *L. lacunossa* (Reuss) makes it easy to recognise, but confusion has been caused by the inevitable intra-populational variation. Two specimens are illustrated herein: one a topotype from the Upper Panonian of Hodonin (from the collection of Prof. V. Pokorny) (Pl. 1. fig. 12) and the other from Cimpia (Pl. 1, figs. 13) - they are virtually identical. Its reported occurrence in the Dacic Basin (Sokac, 1972) is erroneous. Homeomorphic species are to be found in the terminal part of the Meotian in the so-called "*Congeria navicula* strata" and then as late as the end of the Pontian, but these are not *L. lacunossa*. The species appears as a frequent faunal constituent as early as the "Soceni level" and continues through the Pontian of the Pannonian Basin, but was not, however, involved in possible eastward migrations. *L. praebacuana* (Livental) is common in the Upper Meotian and is one of the few to cross the Meotian/Pontian boundary, continuing up to the base of the Portaferrian in the Dacic Basin. In the eastern part of the Euxine Basin it ranges up into the Pleistocene.

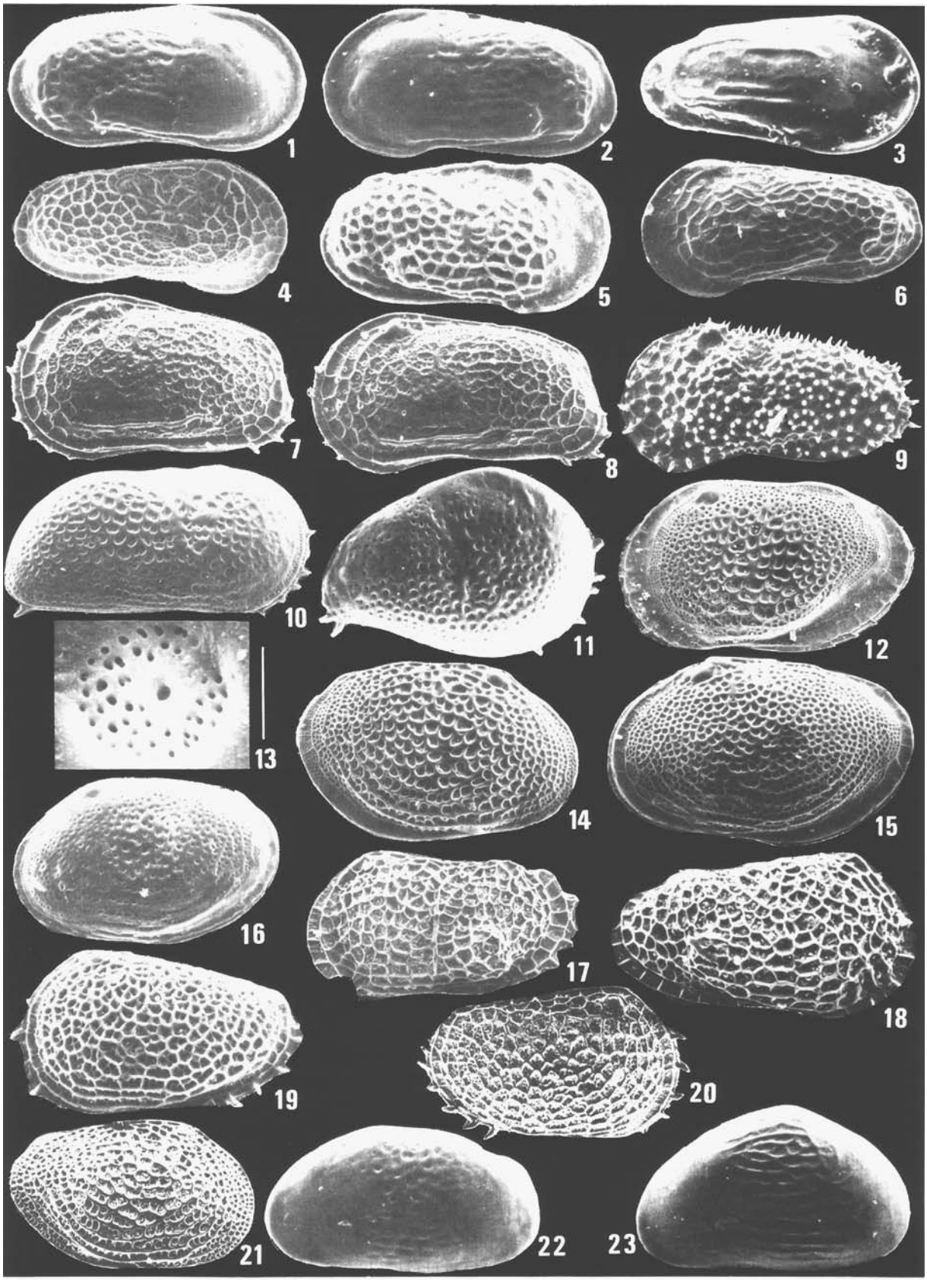
L. palimpsesta (Livental) was described from the Apsheronian deposits; in the Dacic Basin it appears with the great migration from the Portaferrian. *L. lata* Schneider is an exclusively Bosphorian species in the Dacic Basin. In the eastern Euxine Basin it ranges higher. My specimens do not correspond exactly to the "standard" of this species, which is larger and lacks the tendency towards thickening of the posteroventral ribs seen in my examples. *L. (A.) sinegubi* Krstic, *L. servica* Krstic and L.n.sp. Krstic (1985) are all Pontian species. *L. subcaspia* (Livental) is an exclusively Pontian species appearing in the Dacic Basin with the Odessian explosion of the Pontoniellae.

Hemicytheria is represented by many species in the Pontian of the Pannonian Basin. One of them is *H. dubokensis* Krstic, an exclusively Pontian species. It is paradoxical that this genus, so common and diverse in the Pannonian and Pontian of the Pannonian Basin, is not found in the Pontian of the Dacic Basin.

Loxoconcha is represented in the Pontian by many species

Explanation of Plate 2

Fig. 1 - *Leptocythere (Euxinocythere)* aff. *lata* Schneider, adult, right valve, (Length = 450μm)
Fig. 2 - *Leptocythere (Euxinocythere)* aff. *lata* Schneider, adult, left valve. ornamentation of second order is visible. This ornamentation often appears "unfinished". The two postero-ventral tubercles and a tendency for the longitudinal arrangement of the meshes, suggest a relationship with *Leptocythere cornutocostata* Schweyer. (Length = 400μm)
Fig. 3 - *Leptocythere subcaspia* (Livental), (Length = 400μm)
Fig. 4 - *Leptocythere (Euxinocythere) palimpsesta* (Livental), (Length = 435μm)
Fig. 5. - *Leptocythere (Amnicythere) sinegubi* Krstic (about similar with *Leptocythere stanchevae* Krstic!) (Length = 400μm)
Fig. 6 - *Leptocythere (Amnicythere) sinegubi* Krstic, juvenil (Length = 320μm)
Fig. 7 - *Hemicytheria dubokensis* Krstic, adult, left valve, (Length = 980μm)
Fig. 8. - *Hemicytheria dubokensis* Krstic, adult, right valve (Length = 1150μm)
Fig. 9 - *Leptocythere (Euxinocythere) naca* (Mehes), adult, left valve, (Length = 487μm) A delicate reticulation and ornamentation of second order, only found on Pontian specimens.
Fig. 10 - *Cyprideis* sp1, adult, left valve, (Length = 785μm)
Fig. 11 - *Cyprideis* sp1, juvenile, left valve, (Length = 410μm)
Fig. 12 - Loxoconcha fistulosa Krstic, (Length = 760 microns), adult, left valve.
Fig. 13 - *Loxoconcha fistulosa* Krstic, sieve-pore; scale bar= 10μm)
Fig. 14 - *Loxoconcha* aff *subrugosa* Zalanyi, adult, right valve, (Length = 615μm)
Fig. 15 - *Loxoconcha* aff *subrugosa* Zalanyi, juvenil, left valve, (Length = 505μm)
Fig. 16 - *Loxoconcha* aff *subrugosa*, juvenile left valve, (Length = 400μm)
Fig. 17 - *Loxoconcha djaffarovi* Schneider, adult, left valve, (Length = 400μm)
Fig. 18 - *Loxoconcha djaffarovi* Schneider, adult, right valve, (Length = 510μm)
Fig. 19 - *Loxoconcha granifera* (Reuss), juvenile, left valve, (Length = 355μm)
Fig. 20 - *Loxoconcha granifera* (Reuss), adult, right valve, (Length = 610μm)
Fig. 21 - *Loxoconcha schweyeri* Suzin, adult, right valve, (Length = 700μm)
Fig. 22 - *Pontoleberis pontica* (Stanceva), adult, left valve, (Length = 770μm)
Fig. 23 - *Pontoleberis atillata* (Stanceva), adult, right valve, (Length = 740μm)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and numerous morphological variants. Five species occur at Cimpia. *L. djaffarovi* Schneider is a controversial species as it is closely resembles *L.hodonica* Pokorny; the only difference seems to be the appearance of second-order reticulation in *L. hodonica*. If they are accepted as distinct species, then *L. hodonica* is supposedly restricted to the Pannonian and *L. djaffarovi* to the Pontian. In fact the "Pontian form" of *L. djaffarovi* is found as early as the "Soceni level" (zones C+D according to macrofaunal evidence) of the Pannonian. In the Dacic Basin, as in the rest of the Euxine area, *L. djaffarovi* is exclusively Pontian; its reported occurrence in the Meotian (Hanganu, 1966, *apud* Sokac, 1972) is erroneous.

L. subrugosa Zalanyi is considered to belong to the Upper Pannonian community; I have found it in relative abundance in the Bosphorian fauna of the Dacic Basin. *L. granifera* (Reuss) is a species frequently encountered in Pannonian as well as Pontian deposits. *L. schweyeri* Suzin is exclusively Pontian; it is common in the Dacic Basin from the Middle Pontian onwards.

Pontoleberis is represented at Cimpia by two species: *P.attilata* (Stanceva) and *P. pontica* (Stanceva). Sokac (1972) found *P. attilata* in the terminal part of the Pannonian and *P. pontica* in the Pontian; in the Dacic Basin these are Pontian species.

DISCUSSION

The ostracod fauna of Cimpia is clearly typically Pontian, despite the occurrence of a few Upper Pannonian species (*A. abscissa, L. granifera, H. hieroglyphica*). The genus *Bacunella* is absent, however; we are at a "moment" in time preceding the appearance of this genus, but in the presence of the taxon that is considered to be its predecessor, *Candona (T.) ornata*, and therefore somewhere at the level of the Lower Odessian with respect to the evolution of the ostracod fauna of the Dacic Basin.

The emergence of a new fauna marks a new stage, a new period of time, a new cycle. The fact that at Cimpia we are in the presence of a very rich, diverse and balanced fauna demands that a previous period of time must have existed to make this balancing possible. The molluscs indicate zones D+E at Cimpia and zone C at Soceni, so that according to Papp's (1959) zonation, both deposits therefore being of Pannonian age. The ostracods, on the other hand, show the Cimpia deposits to be of Pontian age; but the Pontoniellae, whose appearance marks the base of the Pontian, are absent at Soceni - those deposits are thus not Pontian. It follows that the Pannonian/Pontian boundary must be placed between zones C and D. The Pannonian then comprises only two palaeontologically defined zones, A and B of Papp (1959) (zone A being devoid of macro - or microfauna), while the rest (zones C-H) belong to the Pontian and post-Pontian. Various attempts of ostracod zonation of the Pannonian have been short-lived (Jiricek, 1974, 1985; Krstic, 1973, 1985).

The "Cimpia moment" is a particular time-point. The analysis of such a time-point is important not only for its own sake but also for the range of perspectives revealed in the process. Against this reference point we see that the succession of intimately related communities is one that flows not at a constant rate but in fits and starts. This diversity and inequality of flow is in fact what we call evolution. A particular fossil community, at one place and "moment", allows us to sample several "ages" - it comprises both old, "dying" species and new, emerging species.

In the "Cimpia moment", the proportions of long-established, Pannonian species and new, Pontian species are categorically in favour of the latter period of time. This apparently ambiguous moment (not seen in the outer Carpathian basins, where the Badenian/Sarmatian/Meotian/Pontian boundaries are clear-cut) possesses both "old" species (ranging from the base of the Pannonian") and a "new" essentially Pontian fauna, including the Pontoniellae and new species of *Hemicytheria*. We are certainly at the start of a new "hydrochemical pattern", with the regeneration of the biotype coincident with the dissolution of older populations.

In biostratigraphy we stand in need of fixed reference points which, however, are inevitably artificial. Each moment has its own physical characteristics, and we must identify the critical, explosive moments when taxa emerge to delineate a new period of time; for example, the appearance in the Paratethyan area of the Pontian genera *Caspiolla, Pontoniella, Bacunella, Tyrrhenocythere* and *Cytherissa*. In the succession of communities and populations there appear moments of frenzied activity interspersed with periods of relative calm or stagnation. Unfortunately biostratigraphy is considered as a sort of succession of exceptional moments; the ideal limit or boundary is marked by a "great break", the horizon where the "gold nail" may be driven in.

The succession of faunas is not an even curve or a straight line, however, but follows an extremely rugged and uneven path; there is no symmetry in evolution. The choice is difficult: which of the peaks on this saw-tooth line is not only the highest, but the most important? Which taxon or group of taxa delineates the clearest relief? The Cimpia moment is not homogeneous either, but the proliferation of *Pontoniella, Leptocythere* and *Pontoleberis* is convincing evidence of the first explosion of the Pontian fauna that later became firmly established and reached its acme in the Portaferrian. The descendants of this fauna survive today in the relicts of the old Paratethys: the Black Sea and the Caspian Lake. This "moment" is chosen to mark the beginning of the Pontian.

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