

MAEOTIAN / PONTIAN OSTRACODS IN THE BADISLAVA – TOPOLOG AREA (SOUTH CARPATHIAN FOREDEEP-ROMANIA)

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Abstract. We present the main characteristics of the ostracod assemblages of the Maeotian and Pontian stages in the Badislava-Topolog area (Getic Depression). The Maeotian ostracods fauna is represented by few species that populated ephemeral aquatic environments. The Pontian ostracod fauna is more diverse with species that developed in stable brackish lakes. This Pontian fauna is characteristic of the Upper Pontian (Bosphorian) stage. Our results indicate that the Maeotian / Pontian boundary in Arges-Topolog region is marked by a hiatus comprising the latest Maeotian, Early and Middle Pontian. This hiatus is probably caused by erosional processes during the Middle Pontian (Portaferrian) sea level drop in the Dacian Basin and local tectonic processes.

Key words: Ostracods, Maeotian, Pontian, Getic Depression, Dacian Basin

INTRODUCTION

The palaeogeographic and geological evolution of the Dacian Basin (and Eastern Paratethys, in general) during the Late Maeotian and Pontian is frequently discussed on the geological literature, because at this time interval the Mediterranean area experienced its so-called Messinian Salinity Crisis (MSC). Many authors consider that this event had more or less dramatical effects in the adjacent basins of the Paratethys including the Dacian Basin.

This paper presents the main features of ostracod assemblages from the Late Maeotian - Pontian sediments in Badislava-Topolog area, Getic Depression. Vasiliev *et al.*, 2005 suggests that the Maeotian / Pontian boundary from the Eastern Paratethys is at c. 5.8 Ma and postdates the onset of Messinian Salinity Crisis (MSC) at 5.96 Ma (Krijgsman *et al.*, 1999). A transgressive moment at the Maeotian / Pontian has previously been documented from wells and seismic data in the Dacian Basin (Jipa, 1997; Leever, 2007; Leever *et al.*, 2009) and is biostratigraphically marked by a short time migration of salty water fauna (including benthic and planktonic foraminifers) from the Mediterranean domain (alternatively Indian Ocean), followed by a migration of faunal elements from the Pannonian basin

into the Eastern Paratethys, after the brackish conditions have been re-established (Krijgsman *et al.*, 2010; Vasiliev *et al.*, 2011).

MATERIALS AND METHODS

A number of 140 micropaleontological samples have been collected from Late Maeotian and Pontian deposits that crop out on the Badislava and Topolog Valleys (Fig. 1), from the same location where paleomagnetic samples have been obtained (Vasiliev *et al.*, 2005). The lithology of the sampled levels consists, mainly, of fine grain sediments (clay and marls). All samples weighed about 1kg and were boiled ½-1 h with sodium carbonate solution for a better disaggregation. Before boiling, it was necessary to dry the sediments to eliminate interstitial water. After that, samples were washed through a battery of sieves (16-200 mesh). The residues have been dried in aluminium recipients. Samples have been picked using a black tray with horizontal and vertical lines and a ZEISS – GSZ microscope. Ostracods have been stored in special micropalaeontological slides, now located in the Laboratory of Paleontology from the Bucharest University. An electro-scanning microscope Phillips XL30 from the Utrecht University was used for the illustrations.

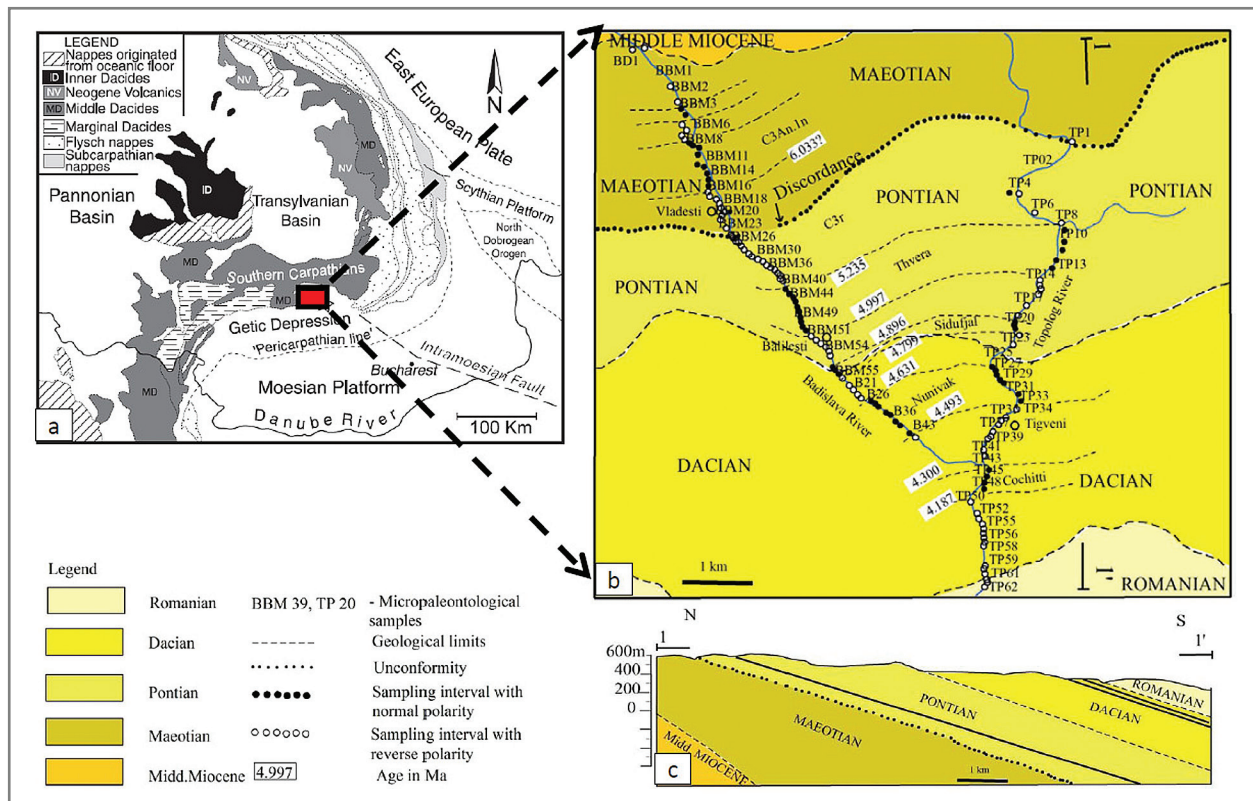


Fig. 1. a) Simplified geotectonic map of Romanian Carpathians with the location of the study area; b) Geological map of the Badislava and Topolog Valleys area with the position of micropaleontological samples; c) North–South schematic cross section on the studied area; Figures a) and b) modified from Vasiliev *et al.*, 2005

GEOLOGICAL BACKGROUND

The Getic Depression represents the sedimentary basin that developed at the contact between the South Carpathian nappe pile and the Moesian Platform (Sandulescu *et al.*, 1984). The Late Miocene-Pliocene sedimentary successions from Badislava and Topolog Valleys regions are integrated into a large monoclinical structure with 15°–20° plunge to the SSE (Fig. 1). This structure is affected by N-S oriented faults that can generate up to 200 m of horizontal displacements.

The Mio-Pliocene sedimentary successions are very well exposed in the northern part of the Getic Depression, especially in the Topolog Valley. A magnetostratigraphic time scale has been developed for the Maeotian-Romanian deposits from this area (Vasiliev *et al.*, 2005). The magnetic polarity pattern recorded in these sections shows a succession of four relatively short normal and three reversed zones, followed by a long reversed interval. The results were later integrated with biostratigraphical data based on mollusks (Stoica *et al.*, 2007).

The studied sections start in the Late Maeotian and end in the lower part of the Romanian, south of the confluence between the Badislava and Topolog Valleys (Fig. 1). The Upper Maeotian stage is here developed in a fluvial-deltaic facies with frequently continental type intercalations. The sediments are represented by coarse gravels, oblique lami-

nated sands, channel deposits interbedded with “flood-plain” deposits, fossil soils and lacustrine clay (Figs 2, 4).

The top of the Maeotian sequence is marked by an erosional surface. The overlying Pontian deposits have a transgressive character. They are represented by a fining-upward sequence that starts with coarse to medium-grained pebbles and sands in the lower part, passing to predominant fine-grained deposits very rich in mollusks and ostracods in the upper part (Figs 3, 4). This discontinuity in the marginal areas of central part of the Carpathian Foredeep can also be noticed on the interpretations of seismic lines from the westernmost part of the Dacian Basin (Leever, 2007; Leever *et al.*, 2009).

RESULTS AND DISCUSSION

Based on detailed mapping and sampling of the Maeotian and Pontian sequences from the investigated area we present here the main characteristics of the ostracod assemblages from this time interval and a reconstruction of the palaeoenvironments.

The Upper Maeotian deposits from the Badislava and Toplog sections reach up to 250 m in thickness. Sediments are represented by coarse gravels, oblique laminated sands, channel and “flood-plain” type deposits, fossil soils and lacustrine clays (Figs. 2, 4). The fine-grained intercalations are

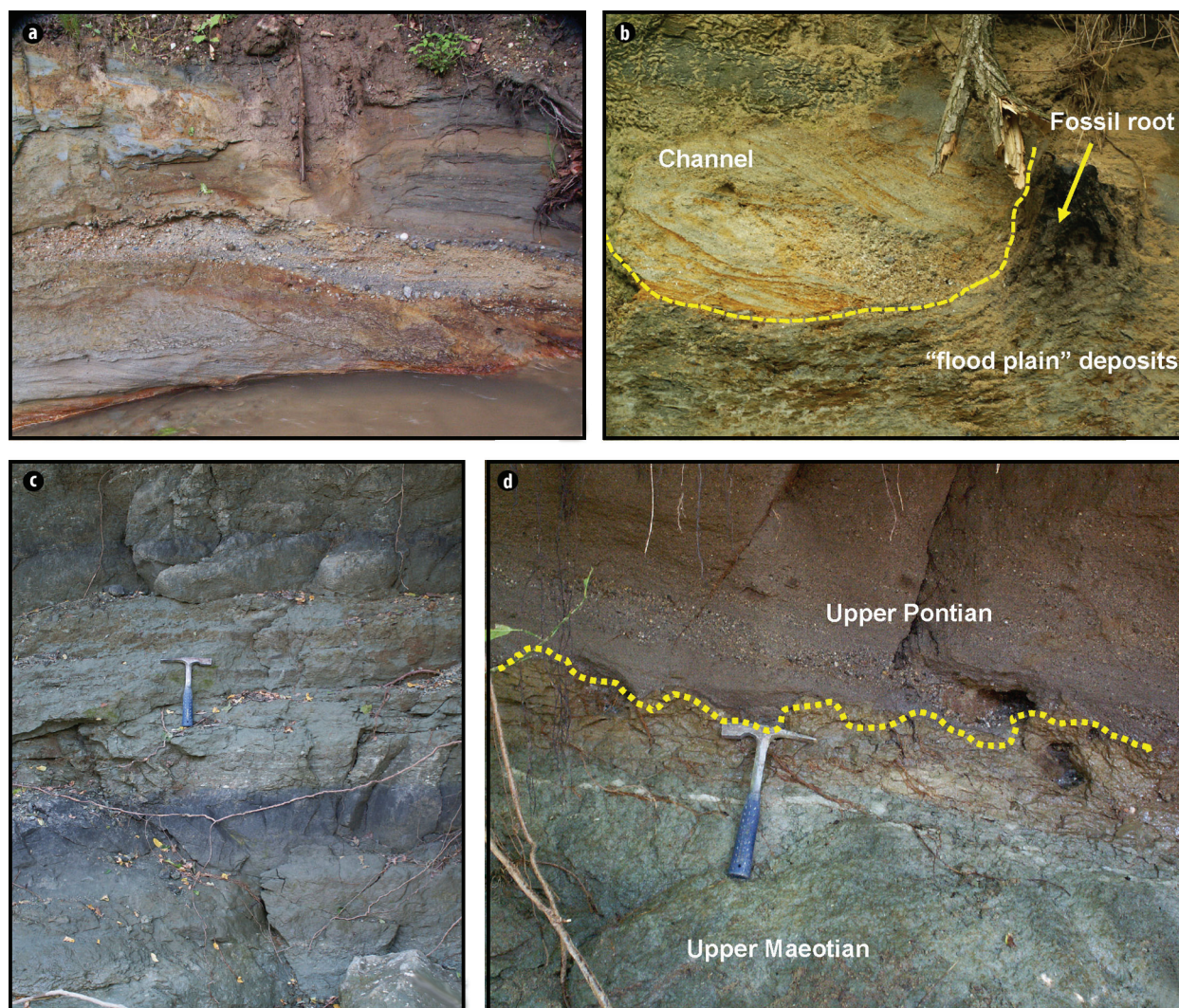


Fig. 2. Litho-facial aspects of Maeotian deposits from Badislava Valley section; **a)** Fluvial deposits with sands and gravel lenses; **b)** Small channel cut on flood plain deposits; on the edge of the channel, can be observed fossil roots in original position; **c)** Interbedded blackish fossil soils and flood-plain silts; **d)** Erosional contact between Upper Maeotian flood-plain deposits and Upper Pontian littoral sands and fine gravels

represented by gray or brownish clays and silts with frequent calcareous concretions, as well as blackish layers rich in plant debris. They are very scarce in fossil remains, only few bad preserved shells of continental or freshwater gastropods (species of *Helicidae* and *Planorbidae*) and bivalves (species of *Unio*-*nidae*) have been observed (Stoica *et al.*, 2007). The micro-fauna is represented by few species of fresh water ostracods: *Candoniella* sp.; *Candona* sp.; *Paracandona albicans* (Brady); *Ilyocypris bradyi* Sars (Fig 4, Plate 1). These species populated unstable environments, such as lakes, rivers with temporary existence and flood-plains. *Paracandona albicans*, (the adult specimens show reticulate valves easy to be confused with juveniles of *Pseudocandona* Kaufman), lives in fresh-water rivers, lakes and pools. In the Dacian Basin, it has been described in the Maeotian, Dacian and Romanian fresh water sediments associated with *Cyprideis heterostigma sublittoralis* and *Cyclo-**cypris* sp (Olteanu in Papaianopol *et al.*, 1987; Olteanu, 1995).

This scarce Maeotian ostracod fauna from investigated area differs essentially from the diversified one of the same stage from zones that evolved in basinal conditions.

Above the erosional surface, the Pontian starts with sands and silts, that frequent present wave ripples structures, which pass to more fine-grained deposits in the upper part. The fine-grained sediments provided a rich ostracod fauna, indicative of the Upper Pontian (Bosphorian): *Amplocypris dorsobrevis* Sokac; *Scottia* sp.; *Cypria tocorjescui* Hanganu; *Candona* (*Caspiocypris*) ex. gr. *alta* (Zal.); *Candona* (*Caspiolla*) *ossoinae* Krst.; *Candona* (*Caspiolla*) *venusta* (Zal.); *Candona* (*Pontoniella*) *acuminata striata* Mandelstam; *Candona* (*Pontoniella*) *excellens* Olteanu; *Candona* (*Pontoniella*) sp.; *Candona neglecta* Sars; *Bakunella dorsoarcuata* (Zal.); *Bakunella* sp.; *Cyprideis* sp.1; *Cyprideis* sp. 2; *Tyrrhenocythere filipescui* (Hanganu); *Tyrrhenocythere motasi* Olteanu; *Tyrrhenocythere* sp.1; *Tyrrhenocythere* sp.2; *Leptocythere* (*Amnocythere*) *palimpsesta* Liv.; *Leptocythere*

picturata Liv.; *Leptocythere* (*Amnicythere*) *multituberculata* (Liv.); *Leptocythere* sp.; *Leptocythere* (?) ex. gr. *bosqueti* (Liv.); *Loxoconcha babazanica* Liv.; *Loxoconcha schweyeri* Suzin; *Loxoconcha petasa* Liv.; *Loxoconcha* sp. (Fig. 4, Plate 1).

The Bosphorian ostracods are more abundant and are represented by typical species of this sub-stage, as well as by species that continue to exist in the Lower Dacian (Getian). In the Dacian Basin, *Cypria tocorjescui* was described for the first time (Hanganu, 1962) from so-called *Paradacna abichi* levels (Lower Pontian) and, apparently, it migrated from the Pannonian Basin (Pipick in Cziczter *et al.* 2009). This species was also noticed in the Upper Pontian sediments with *Phyllocardium planum planum* bivalve shells (Hanganu, 1974).

In our samples, we observed the high abundance of *Tyrrhenocythere* species. Most of them appeared in the Dacian Basin during the Middle Pontian (Portaferrian) and are well represented in the Upper Pontian (Bosphorian), too. The “bloom” of *Tyrrhenocythere filipescui* Hanganu in Bosphorian is accompanied by the presence of *Scottia* sp. (Hanganu,

1985). *T. filipescui* is the most conservative species of the genus having the most extended distribution in time, from the base of Middle Pontian up to the Lower Dacian (Olteanu and Vekua, 1989).

The first apparition of *Bakunella* genus is recorded, starting with the second part of the Lower Pontian. During the Pontian, this genus is represented by one species: *Bakunella dorsoarcuata* (Zal.). This species seems to be rather conservative concerning the ornamentation pattern along the Pontian, some changes appearing only during the Dacian (Olteanu, 1989). *B. dorsoarcuata* probably evolved in Lake Pannon and was endemic to that lake until the Latest Miocene (Pipick in Cziczter *et al.* 2009). This species is living today in sublittoral to profundal depths, in the central and southern Caspian Basin, at salinities of 11.5–13.5‰ (Gofman 1966, Boomer *et al.* 2005). Gliozzi, 2007, mentioned the presence of *B. dorsoarcuata* in the Late Tortonian - Early Messinian deposits from Mediterranean area together with other ostracods that migrated from Paratethys before the onset of MSC. *Pontoniella* genus emerged with the Lower Pontian, followed immediately by *Bakunella*.

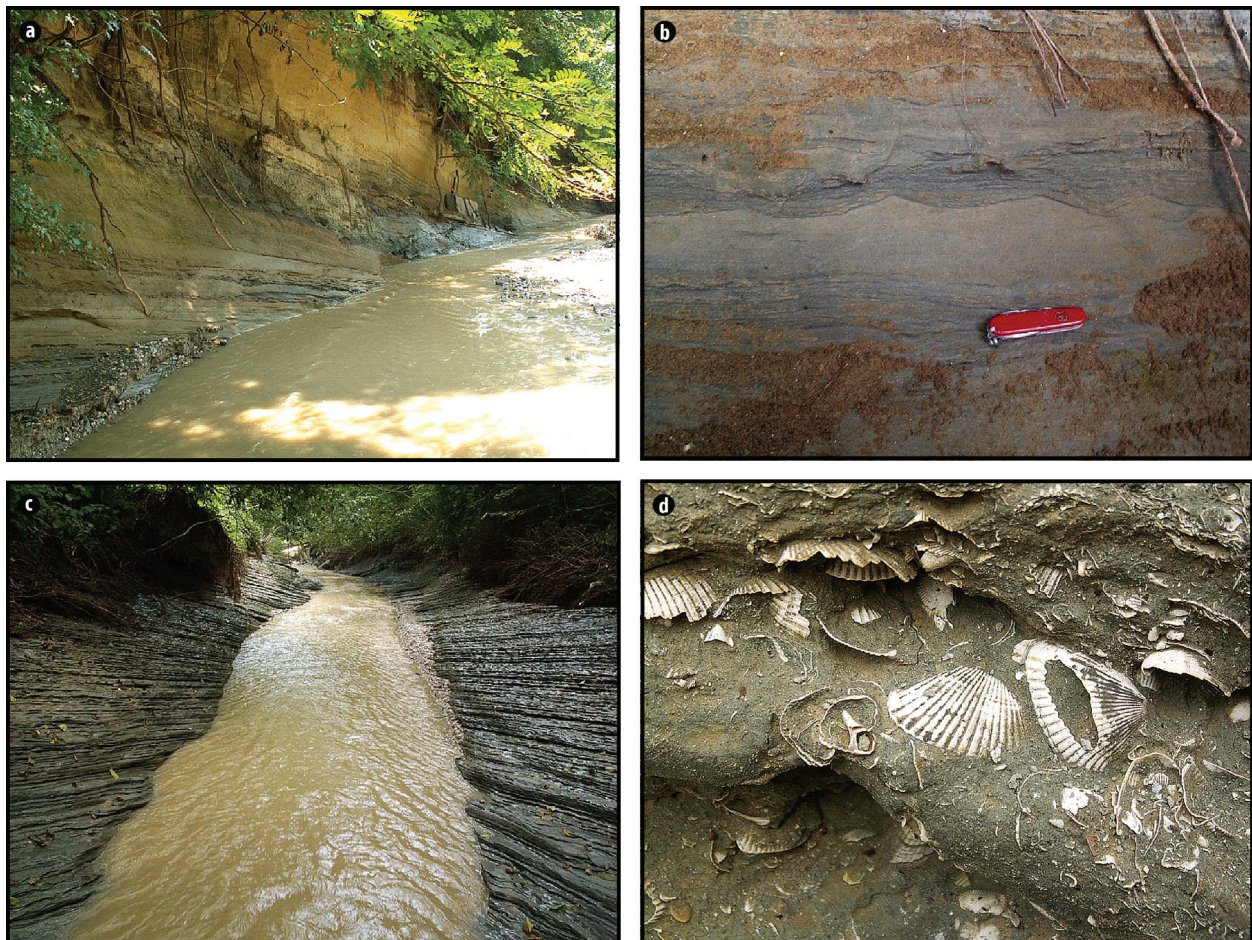


Fig. 3. Litho-facial aspects of Upper Pontian deposits from Badislava Valley section **a)** Sandy littoral deposits with pelitic intercalations transgressively overlaying the Meotian deposits (basal part of Upper Pontian, left bank of Badislava Valley); **b)** Symmetrical wave ripples on Upper Pontian sandy deposits; **c)** Upper Pontian interbedded marls and silts nicely exposed on the Badislava River; **d)** Silty layer very rich in mollusk shells (Limnocypridae bivalves and Vivipariidae gastropods)

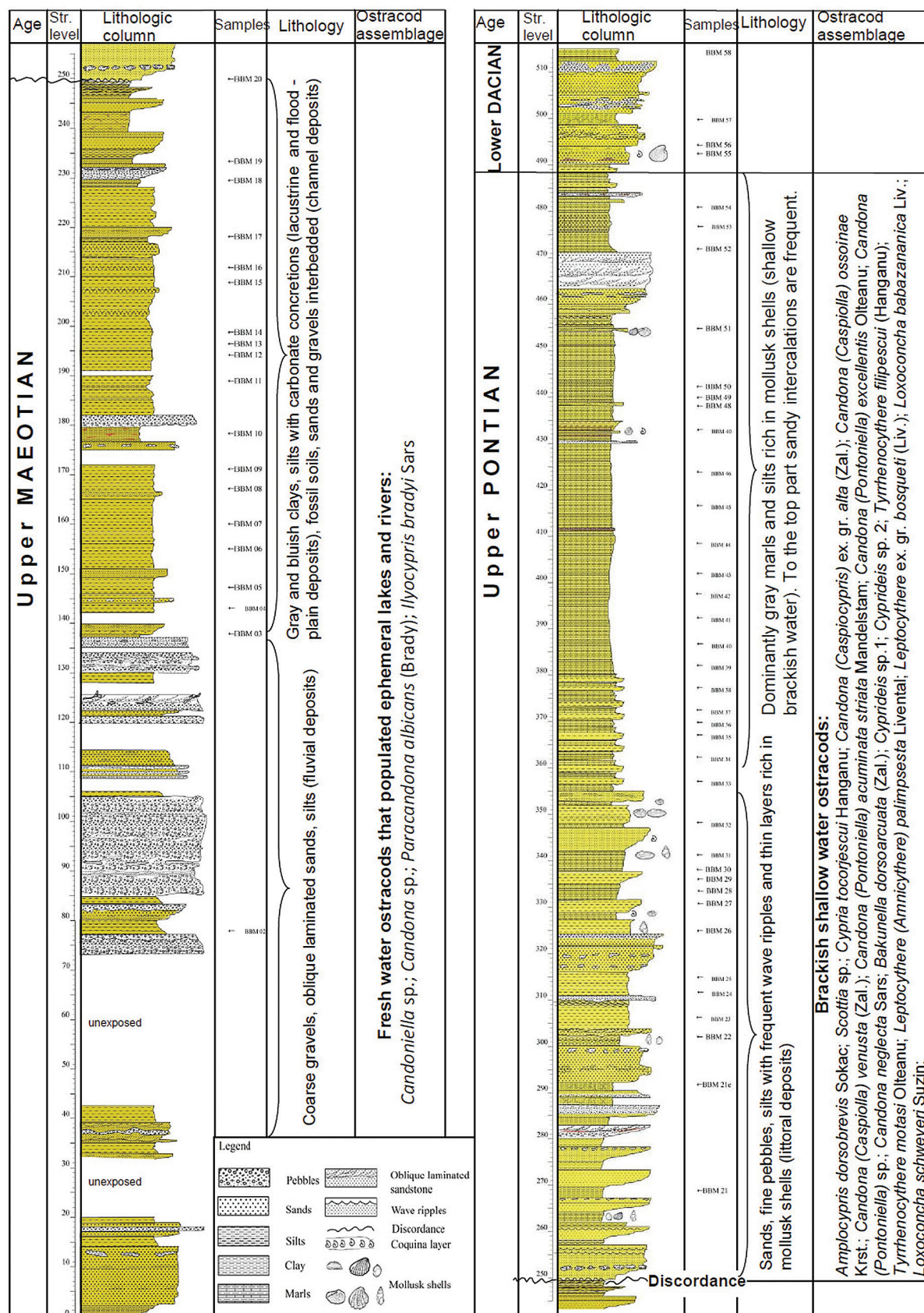


Fig. 4. Synthetic log, main litho-logical characteristics and ostracod assemblages of Upper Maeotian, Upper Pontian deposits from Badislava Valley section

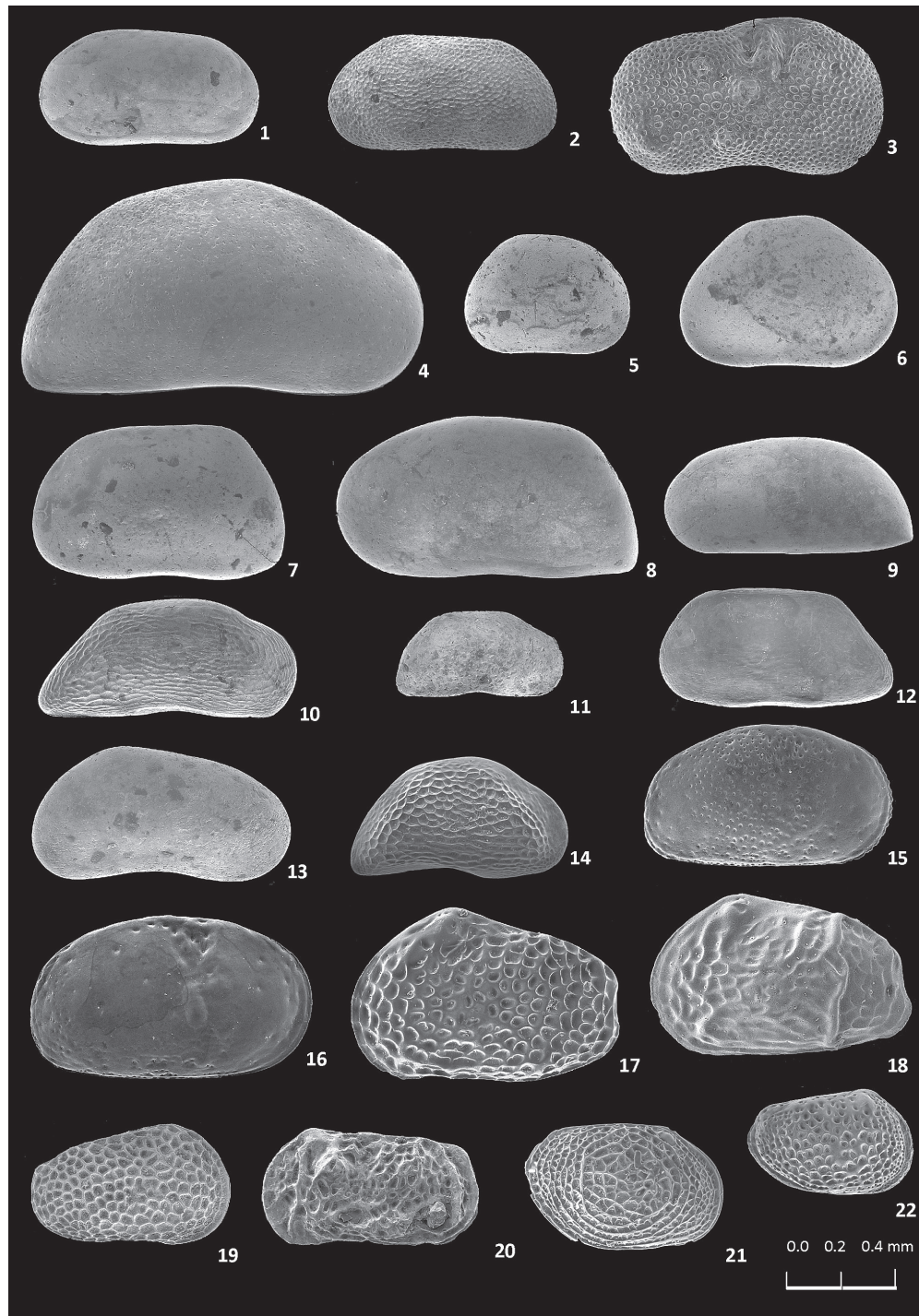


PLATE 1 Maeotian and Pontian ostracods from Badislava Valley section (all specimens represent adult valves, external lateral views, LV=left valve, RV=right valve, BBM 09-micropaleontological sample). **1.** *Candoniella* sp., LV, Maeotian, (BBM 09); **2.** *Paracandona albicans* (Brady), LV, Maeotian, (BBM 11); **3.** *Iliocypris bradyi* Sars, RV, Maeotian, (BBM 09); **4.** *Amplocypris dorsobrevis* Sokac, RV, Upper Pontian, (BBM 41); **5.** *Cypria tocorjes-cui* Hanganu, RV, Upper Pontian, (BBM 47); **6.** *Scottia* sp., RV, Upper Pontian, (BBM 39); **7.** *Candona (Casiocypris)* ex. gr. *alta* (Zal.), LV, Upper Pontian, (BBM 43); **8.** *Candona (Casiolla) ossoinae* Krst., LV, Upper Pontian, (BBM 39); **9.** *Candona (Casiolla) venusta* (Zal.), LV, Upper Pontian, (BBM 40); **10.** *Candona (Pontoniella) acuminata striata* Mandelstam, RV, Upper Pontian, (BBM 28); **11.** *Candona (Pontoniella)* sp., RV, Upper Pontian, (BBM 40); **12.** *Candona (Pontoniella) excellentis* Olteanu, LV, Upper Pontian, (BBM 28); **13.** *Candona neglecta* Sars, RV, Upper Pontian, (BBM 50); **14.** *Bakunella dorsoarcurata* (Zal.), RV, Upper Pontian, (BBM 52); **15.** *Cyprideis* sp. 1, RV, Upper Pontian, (BBM 40); **16.** *Cyprideis* sp. 2, RV, Upper Pontian, (BBM 41); **17.** *Tyrrhenocythere filipes-cui* (Hanganu), LV, Upper Pontian, (BBM 33); **18.** *Tyrrhenocythere motasi* Olteanu, LV, Upper Pontian, (BBM 33); **19.** *Leptocythere (Amnicythere) palimpsesta* Liv., RV, Upper Pontian, (BBM 47); **20.** *Leptocythere* (?) ex. gr. *bosqueti* (Liv.), LV, Upper Pontian, (BBM 38); **21.** *Loxoconcha schweyeri* Suzin, RV, Upper Pontian, (BBM 52); **22.** *Loxoconcha babazanatica* Liv., RV, Upper Pontian, (BBM 48)

An important characteristic of ostracod assemblage from the investigated area is represented by the high development of *Amplocypris* genus, in the second part of Upper Pontian. This genus, with a large shell is represented by *Amplocypris dorsobrevis* Sokač, and has been found in several localities with Pontian sediments from Dacian Basin, as well as in Yugoslavia (Hanganu, 1976, Sokač, 1989). A similar species is described by (Olteanu, 1995) from the Lower Dacian sediments (Mare Valley-Bengesti) as *A. odessaensis* (Ilitzkaia). However, some additional morphometric studies are needed to find out which are the real *Amplocypris* species in the Dacian Basin. The *Cyprideis* genus is represented by several different morphotypes, but, for the moment, it is difficult to mention their specific affiliation.

The Upper Pontian (Bosphorian) deposits from the study area contain also very rich mollusk assemblages dominated by brackish bivalves and gastropods (Stoica *et al.*, 2007).

CONCLUSIONS

The Maeotian / Pontian transition on Badislava Valley section comprises an erosional event, with Upper Pontian sedi-

ments discordantly overlying the Maeotian deposits, possibly, as a consequence of the Middle Pontian sea level drop in the Dacian Basin or local tectonic processes. There are no indications for the presence of the Lower and Middle Pontian (Odessian and Portaferran) substages.

This onset of the Upper Pontian littoral sediments followed by shallow basinal ones directly on the Maeotian fluvial deposits is related to a transgressive moment in the Dacian Basin. This is the last important high stand period in the Dacian Basin and can possibly be correlated with the Zanclean transgression (5.33 Ma) of the Mediterranean Basin. This event marks the Miocene / Pliocene boundary and illustrates the complex interactions between the Mediterranean and Oriental Paratethys Basins (including the Dacian Basin) in Late Miocene – Early Pliocene times.

The Maeotian ostracod fauna is poorly developed and is represented by few fresh water species able to populate ephemeral aquatic environments. By contrast, the Upper Pontian one is more diverse and contains numerous species characteristic for brackish and more stable shallow water environment.

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