Pannonian (late Miocene) ostracod fauna from Pécs-Danitzpuszta in Southern Hungary

CSOMA, Vivien1, MAGYAR, Imre2,3, SUZOMI-KORECZ, Andrea3, SEBE, Krisztina4, SZTANÓ, Örsolya5, BUCZKÓ, Krisztina6, TÓTH, Emőke1

1ELTE Eötvös Loránd University, Institute of Geography and Earth Sciences, Department of Palaeontology, 1117 Budapest, Pázmány Péter sétány 1/c, Hungary. csoma.vivien7@gmail.com, ORCID: 0000-0002-2593-5537; tothemoke.pal@gmail.com; ORCID: 0000-0002-1733-7828
2MOL Hungarian Oil and Gas Plc., Budapest, Hungary; immagyar@mol.hu; orcid.org/0000-0002-9236-0040; kaszuro@mol.hu
3University of Pécs, Department of Geology and Meteorology, 7624 Pécs, Ifjúság útja 6, Hungary; sebe@gamma.ttk.pte.hu; ORCID: 0000-0002-4647-2199
4Hungarian Natural History Museum, Department of Botany, Institute of Aquatic Ecology Centre for Ecological Research, 1113 Budapest, Karolina út 29., kristinazs@buczko.eu, orcid:0000-0001-9459-8311
5MTA-MTM-ELTE Research Group for Paleontology, Budapest, Hungary
6Hungarian History Museum, Department of Botany, Institute of Palaeontology, 1117 Budapest, Pázmány Péter sétány 1/c, Hungary. csoma.vivien7@gmail.com, ORCID: 0000-0002-2593-5537; tothemoke.pal@gmail.com; ORCID: 0000-0002-1733-7828

Abstract

The large outcrop at Pécs-Danitzpuszta, southern Hungary, exposes a 65-meter-thick succession of calcareous marls, clay marls and calcareous sands that were deposited during the early history of Lake Pannon, a vast, Caspian-type lake in Central Europe in the late Miocene. Within the framework of the complex stratigraphic investigation of this succession, well preserved, relatively diverse benthic ostracod assemblages containing 39 taxa were recovered from 29 samples (16 samples were barren). Palaeoecological interpretation of the ostracod genera suggests that deposition took place in a low-energy environment, in the shallow sublittoral zone of Lake Pannon, in ploshaline (9–16‰ salinity) water. The entire succession was divided into four interval zones based on the first occurrences of assumedly useful marker fossils: Hemicytheria lorethi Zone (from sample D29), Hemicytheria tenuistriata Zone (from sample D17), Propontoniella candeo Zone (from sample D115) and Amplocypris abscissa Zone (from sample D209). Based on comparison to the Beocin section 150 km to the SE, where a lithologically and stratigraphically similar section was dated magnetostatigraphically by an international team, we tentatively assume that the Pannonian marl succession of the Pécs-Danitzpuszta outcrop represents the time interval of 11.6 to ca. 10 Ma.

Keywords: late Miocene, Lake Pannon, ostracods, palaeoenviroment, biostratigraphy, Mescek Mts
Introduction

In the large sand pit of Pécs-Danitzpuszta, which is famous for its unique middle to late Miocene reworked terrestrial and marine vertebrate remains (SZABÓ et al. this volume), a 65-meter-thick, tectonically tilted succession is exposed that consists of calcareous marls, clay marls and calcareous sands (SEBE et al. 2021). This Pannonian (upper Miocene, Tortonian) succession represents fairly continuous sedimentation from the Sarmatian/Pannonian boundary to the top of the marl. The marl is overlain by a thick sand body that is exploited in the pit. This succession, deposited in Lake Pannon, offers a unique opportunity to investigate various fossil groups and to establish correlation between the biostratigraphic systems.

This study focuses on the ostracod fauna of the Pannonian marls. The primary objective of this work is the documentation of the ostracod assemblages along the profile in order to determine their biostratigraphic and palaeoecological significance. Early Pannonian ostracod records are poorly known in SW Hungary (SZELES 1982; SZUROMI-KORECZ 1991, 1992), but they were extensively studied in other parts of the southern Pannonian Basin where the lithology and thus the inferred palaeoenvironment was similar to that in Danitzpuszta, such as in the areas in the vicinity of Zagreb (SOKAČ 1972) and Belgrade (KRSTIĆ 1960, 1985; RUNDIĆ et al. 2011). Most recently, the ostracod record from the 120-meter-thick calcareous marl succession of Beočin (near Novi Sad, Serbia) was investigated and published by STOICA & RUNDIĆ in TER BORGH et al. (2013). The Beočin outcrop was also subject to magnetostratigraphic investigations, which dated the marl succession between 11.6 Ma (Sarmatian/Pannonian boundary) and ca. 9.9 Ma (TER BORGH et al. 2013). These papers, as well as some other modern, well-documented ostracod studies on thoroughly investigated lower Pannonian outcrops from the entire area of Lake Pannon (e.g., GROSS 2004, FILIPESCU et al. 2011, OLTEANU 2011, BOTKA et al. 2020) offer a good opportunity to place the Danitzpuszta ostracod record into a biostratigraphic and palaeoecological framework.

Geological setting and stratigraphy

The Pécs-Danitzpuszta sand pit is the best outcrop of the oldest Pannonian (upper Miocene) strata in the Mecsek area (KLEB 1973). The pit is located at the eastern boundary of Pécs, on the north side of Highway 6 (Figure 1). Sand has been produced here since the beginning of the 20th century.

The stratigraphically lower part of the exposed Pannonian succession belongs to the Endröd Formation (Figure 2; SEBE et al. 2015; SEBE et al. 2020). It consists of massive, greyish white calcareous marls, clay marls, sand, and even fine gravel, altogether amounting to 65 meters of stratigraphic thickness. The marls contain plant remains, a rich mollusk fauna and vertebrate fossils. Plant remains indicate a thermophilous flora with taxa suggesting extensive lakeshore swamp forests (HABLY & SEBE 2016). Based on the mollusk fauna, the bottom of the succession belongs to the Lymnocardium praeponticum Zone, whereas the top of the marl is assigned into the Lymnocardium schedelium Zone (11.6–11.4 Ma and 11–10.2 Ma respectively, according to MAGYAR & GEARY 2012, BOTKA et al. 2021). The overlying limonitic, coarse-grained sands contain reworked middle Miocene (Badenian and Sarmatian) and Pannonian aquatic and terrestrial vertebrate fossils (KAZÁR et al. 2001, 2007; KAZÁR 2003; ČSERPÁK 2018; SZABÓ et al. 2021), where the youngest terrestrial mammals, including the early form of Hippotherium primigenium, indicate the MN9/10 mammal zones (Vallesian, 11.1–8.7 Ma; KORDOS in KAZÁR et al. 2001, 2007; KAZÁR 2003; GASPARIK in SEBE et al. 2015).

The marl succession and partly the overlying sand and gravel beds were tilted into a near-vertical position by structural movements (KONRAD & SEBE 2010). We sampled the calcareous marl succession from two measured profiles. The upper part of the marl (D114 to D219) was sampled in 2015 in the eastern part of the northern wall of the sand pit, whereas the lower part (D35 to D1) was sampled in 2018, when a new trench was dug on the top of the northern wall across the almost vertical marl layers, exposing the oldest Pannonian, Sarmatian, and Badenian deposits (Figures 1, 2; SEBE et al. 2021).

Material and methods

Forty-five samples were examined from the 65-meter-thick Pannonian marl succession: 20 from its lower part, exposed in the trench at the northern wall of the pit, and 25 from the upper part of the succession, in the eastern part of the outcrop (Figure 1). Twenty-nine samples contained ostracod carapaces and single valves, the others were free of ostracods (Figure 3). The carbonate skeletal microfauna was processed with hydrogen-peroxide (10%) from about 500 g of air-dried sediments. The ostracod valves were selected under stereomicroscope. Hitachi S-2600N scanning electron microscope was used for SEM investigation. SEM images were taken at the Department of Botany of the Hungarian Natural History Museum in Budapest.

Ostracod assemblages and palaeoenvironments

The Danitzpuszta succession yielded a relatively diverse benthic ostracod material made up of 39 taxa with generally well-preserved valves (Appendix). Shed valves of juvenile specimens and valves of dead individuals can be preserved depending on delicacy of the valves and “valve-remains transport” (ZHAI et al. 2015).

Figure 1. A) Lake Pannon within the Pannonian Basin at ca. 10.8 Ma (after MAGYAR et al. 1999). B) Aerial view of the Pécs-Danitzpuszta sand pit with the collection sites (C: pit, D: trench). C–D) Logged strata with the sample locations (C: pit, D: trench)

1. ábra. A) A Pannon-térség központja körül, valamint a Madeleine-tó közelében kb. 10,8 millió évvel ezelőtt (MAGYAR et al. 1999 alapján). B) A pécs-danitzpuszta homokbánya környékének belső részét (C: bányafal, D: kutatóárok). C–D) A bányafal (C) és a kutatóárok (D) helyzete azután, hogy a működést megkezdik
Figure 2. Composite sedimentary log of the Pannonian marl with the sampled layers.

2. ábra. A feltárt pannoniai rétegsor finomszemű (uralkodás mészmárgából álló) részének kompozit szelvénye a mintázott rétegek számának feltüntetésével.

Figure 3. Distribution of Pannonian ostracod species across the investigated succession. First occurrences of biostratigraphic marker species (according to KRSTIĆ 1985) in black. The mollusk biozones are from BOTKA et al., 2021.

3. ábra. A pannoniai kagylórákok előfordulása a vizsgált szelvényben. Azoknak a fajoknak az első előfordulását, amelyeket KRSTIĆ (1985) biosztratigráfiai zóna jelzőknek használt, fekete téglalapok jelzik. A puhatestű biozonákot BOTKA et al. (2021) alapján tüntettük fel.
### Ostracod taxa

| Sample | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 | 129 | 130 | 131 | 132 | 133 | 134 | 135 | 136 | 137 | 138 | 139 | 140 | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | 172 | 173 | 174 | 175 | 176 | 177 | 178 | 179 | 180 | 181 | 182 | 183 | 184 | 185 | 186 | 187 | 188 | 189 | 190 | 191 | 192 | 193 | 194 | 195 | 196 | 197 | 198 | 199 | 200 | 201 | 202 | 203 | 204 | 205 | 206 | 207 | 208 | 209 | 210 | 211 | 212 | 213 | 214 | 215 | 216 | 217 | 218 | 219 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----- |
Sixteen samples were free of ostracods (Figure 3). No correlation was found between lithology and the barren samples; the presence or absence of benthic ostracods did not depend on the grain size of the sediments. Where ostracods were found, we did not see any indication of decreased oxygen levels. Changes in nutrient availability might have been a control on ostracod distribution, but this environmental factor is difficult to identify.

The composition of the ostracod fauna does not show any significant change across the section. Some of the identified genera (members of the Cytheroidea superfamily) are survivors of marine origin (Ammicythere, Loxoconcha, Loxocorniculina, Cyprideis, Hemicytheria), whereas others (members of the Cypridoidea superfamily) are considered freshwater and brackish immigrants (Candona, Cypria, Herpetocyprilla, Amplocypris). In the following we briefly review the known habitat and palaeoecological demand of each genus in order to create a basis for the environmental interpretation of our assemblages.

Ammicythere occurs in the lowermost part of the section (Figure 3). This genus appeared in the brackish marine Sarmatian and has radiated in the Paratethys. In addition to some sporadic occurrences in the Tortonian and lower Messinian of the Mediterranean, as many as 19 species were reported from the upper Messinian Lago-Mare deposits (Miocene of the Mediterranean), as many as 19 species were some sporadic occurrences in the Tortonian and lower Miocene (Figure 3). This genus appeared in the brackish marine (tiv...), Loxocorniculina, Cyprideis, Hemicytheria), whereas others (members of the Cypridoidea superfamily) are considered freshwater and brackish immigrants (Candona, Cypria, Herpetocyprilla, Amplocypris). In the following we briefly review the known habitat and (palaeo)ecological demand of each genus in order to create a basis for the environmental interpretation of our assemblages.

Ammicythere occurs in the lowermost part of the section (Figure 3). This genus appeared in the brackish marine Sarmatian and has radiated in the Paratethys. In addition to some sporadic occurrences in the Tortonian and lower Messinian of the Mediterranean, as many as 19 species were reported from the upper Messinian Lago-Mare deposits (Gliozzi et al. 2005). The genus has 10 living representatives, all inhabiting fresh to oligo−mesohaline waters of the Black-Azov, Caspian and Aral Seas (Gliozzi & Grossi 2008, Namiotko et al. 2011).

Representatives of genus Loxoconcha occur in the upper part of the section (Figure 3). This genus first appeared in the Cretaceous (Moore 1961) or in the Palaeocene (Morkhoven 1963). According to Savaternalinton & Martens (2009), family Loxoconchiidae includes 22 extant genera, most of them living in marine and brackish environments; only six species are known from freshwater ecosystems (Karanovic 2012). In the modern ostracod fauna of the Caspian Sea, Loxoconcha is the most eurytopic genus, hence its high density on the shelf of the South Caspian basin (Gofman 1966). It can be equally found on algae, on the bottom, or within the substrate (Elofson 1941, Puri et al. 1969). Some species dwell in the profundal zone of the Caspian (down to 875 m; Boomer et al. 2005), but only a few species live in the agitated littoral zone with freshwater influence (Gofman 1966).

Loxocorniculina, an extinct genus of the family Loxoconchiidae, was found in the lower part of the section (Figure 3). It is a typical Paratethyan form, which first appeared in the Sarmatian and spread into the Palaeo-Mediterranean during the late Messinian Lago-Mare event (Faranda et al. 2007). The fossil Loxocorniculina djafarovi indicates oligohaline to mesohaline water of variable depth (Iaccarino et al. 2008).

Cyprideis occurs in the outcrop upsection from sample D8 (Figure 3). It first appeared at the end of the Palaeogene and spread across Eurasia and America in the Miocene. Its relatively few extant species can be found worldwide, especially in brackish and hypersaline (or otherwise chemically extreme), shallow-water environments (Morkhoven 1963, Van Harten 1990). In the Caspian Sea, Cyprideis torosa was found in abundance in a sample from 13 m water depth, whereas it was completely missing from samples taken from 62 m depth and below (Boomer et al. 2005). The phenotype (including size, shape, pores and ornaments of the valves) is influenced by environmental factors such as salinity (Sandberg 1964; Van Harten 1975, 2000; Schweitzer & Lohmann 1990; Bowles 2013). The widespread Cyprideis pannonica, occurring in sample D8, was observed to be characteristic for shallow, hypersaline or alkaline waters (Benson 1973, 1978).

The extinct genus Hemicytheria, occurring throughout the outcrop (Figure 3), is mostly known from the Sarmatian and Pannonian layers of the Pannonian Basin System. It is interpreted to have lived in brackish (oligo−ploihaline) waters, although less typically it has also been found in freshwater layers (Sokac 1972).

Of the genera that immigrated into Lake Pannon from freshwater and athalassic waterbodies, Candona is widespread throughout the outcrop (Figure 3). The nominal subgenus Candona is known to have populated freshwater lakes of the Northern Hemisphere since the Eocene (Krstic 1972b), although a few species tolerate oligo− and miohaline environments as well. Boomer et al. (2005) reported specimens from 62 to 405 m water depth from the Caspian. Most Candona (Candona) species are infaunal (Morkhoven 1963). Subgenus Propontoniella, a probable ancestor of subgenus Serbiella (Krstic 1972b), is known exclusively from the older Pannonian deposits. The extant subgenus Lineocypris entered the palaeontological record in the Late Cretaceous. Today it lives in freshwater, especially in deep lakes (Morkhoven 1963). Subgenus Reticulocandona was originally endemic to Lake Pannon, but its fossils were recovered from the Pontian of Azerbaijan as well (Krstic 1972b). Subgenera Sinegubiella and Thaminocypris were endemic to Lake Pannon, although the latter was also found in the Mio-Pliocene of the Dacian basin. The first appearance of subgenus Typhlocypris was recorded in Lake Pannon. Its extant species are living in fresh- and athalassic waters of Europe (Sokac 1972).

The genus Cypria occurs in samples D204 and D209 (Figure 3). This genus is known from the Tertiary to the present day. Most of the extant species are active swimmers and prefer a freshwater, plant-rich environment (Morkhoven 1963; Sokac 1972). For instance, Cypria ophtalmica occurs in springs of five regions: Northern Italy, Eastern Iberia, Upper Danube, Southern Anatolia and Central and Western Europe (Rosati et al. 2014).

The species Herpetocyprilla auriculata and H. hieroglyphica occur throughout the succession (Figure 3). The only extant Herpetocyprilla species, H. mongolica lives in the saline lake of Issyk-Kul, Kyrgyzstan (Karanovic 2012), while fossil species were reported from the freshwater Pliocene deposits of Central Asia (Mandelshtam & Shneider 1963). Based on this distribution, Danielopoul et al. (2008) erected two hypotheses concerning the palaeo-
ecology and palaeobiogeography of *Herpetocyprella*. According to the first hypothesis, it originally inhabited shallow freshwaters, and its valves were transported into Lake Pannon. The second hypothesis claims that it was probably present in marginal environments of the Sarmatian Paratethys sea, and later it formed autochthonous populations in Lake Pannon. In the first case, adaptation of the originally freshwater genus to saline waters took place repeatedly and independently in Europe and later in Central Asia, whereas in the latter case a salt-tolerating species migrated from Lake Pannon to Central Asia in a stepping-stone manner, from lake to lake (DANIELOPOL et al. 2008). We think that the common occurrence and wide geographical distribution of *Herpetocyprella* in Lake Pannon deposits (see above), with our Danitzpuszta data added, favors the second model. RUNDIĆ (2006) found that *Herpetocyprella* species (“Hungarocypris” in that paper) were typical nearshore dwellers, preferring sandy substrates, and that they rarely occur in fine-grained sediments. In our material, however, both *Herpetocyprella* species were found in offshore clays and silts, similarly to the Transylvanian Basin samples of KOVÁCS et al. (2016) and BOTKA et al. (2020), and to the Kisélföld (“Danube”) Basin samples of CZICZER et al. (2009). *Herpetocyprella auriculata* and *H. hieroglyphica* thus appear to have been rather ubiquitous species that inhabited the littoral to sublittoral and perhaps even the profundal zones of the early Lake Pannon.

The extinct genus *Amphocypris*, occurring throughout the section (Figure 3), is represented by at least four species in the outcrop. This genus was apparently endemic to Lake Pannon and later migrated to the Dacian Basin.

Based on the modern distribution and environmental demand of *Loxoconcha*, *Cyprideis* and *Amnicythere*, the investigated assemblages probably lived in relatively shallow but low-energy, ploiohaline (9–16‰ salinity) waters in the sublittoral zone of Lake Pannon. Various subgenera of *Candona* obviously tolerated brackish water, as it is evidenced by the extant *Typhlocypris*. Probably the same species that are widespread in the *Candona* biostratigraphy in mind, we based the evaluation of our biostratigraphic evaluation.

Based on consecutive first occurrences, we distinguished four stratigraphic intervals (interval zones) in the Danitzpuszta succession: *Hemicytheria lorentheyi* Zone (D35 to D21), *Hemicytheria tenuistraita* Zone (D17 to D114), *Propontoniella candea* Zone (D115 to D208), and *Amphocypris absissa* Zone (D209 to D219) (Figure 3).

*Hemicytheria lorentheyi* occurs in only one sample (D29), but this species is known to be characteristic of the lowermost Pannonian interval in other sections (e.g., MÉHES 1908, GROSS 2004). Other species occurring in the *Hemicytheria lorentheyi* Zone in our material include *Hemicytheria parallela*, *Amnicythere* sp., *Herpetocyprella auriculata*, *Candona* (Cypridopsidae) cf. *fossulata* and *C. aff. postsarmatica* (Figure 3). *Candona postsarmatica* is also considered a very basal Pannonian species, a contemporary of *Hemicytheria lorentheyi* (SZUROMI-KORECZ 1992) identified it in the Nagykőzár–2 borehole, 4 km S of the Danitzpuszta outcrop, where it occurred in the lowermost Pannonian *Spiniferites pannonicus* Zone of the dinoflagellate biostratigraphy (SUTÓNÉ SZENTAI 2012).

*Hemicytheria tenuistraita* first occurs in sample D17 (Figure 3). The stratigraphic range of this species is known to overlap with that of *Hemicytheria lorentheyi*, but it has not been reported so far from the lowermost Pannonian layers. In Beőčin, *H. tenuistraita* first occurs in a reversed polarity interval, interpreted to be between C5r1n and C5r.2r-1n, and thus dated at 11.23 Ma (inferred by us from data available in TER BORGH 2013). The *Hemicytheria tenuistraita* Zone in Danitzpuszta contains the following species: *Amphocypris firmus*, *A. recta*, *Amphocypris* sp., *Candona* (Thamnocephalida) transylvanica, *C. (Typhlocypris) cf. *fossulata*, *C. (Propontoniella) macra*, *C. (Propontoniella) sp.*, *C. aff. postsarmatica*, *Candona* sp., *Cyprideis* cf. pannonica, *Hemicytheria hungarica*, *Herpetocyprella*...
hieroglyphica, H. auriculata, Herpetocyprilla sp., Annimicythere parallelata and Loxocorniculina hodonica (Figure 3). Amplocypris firmus and Loxocorniculina hodonica share their first occurrence with Hemicytheria tenuistriata both in the Danitzpuszta and Beočin records.

Candona (Propontoniella) candeo first occurs in sample D115 (Figure 3). This species is missing from the Beočin record, but it was recorded in the stratigraphically thoroughly investigated succession of Gușterița (Sibiu, Transylvanian Basin, Romania; BOTKA et al. 2020). In that outcrop, the first occurrence of Candona (Propontoniella) candeo was coeval with the first occurrence of the dinoflagellate species Pontiadinium pecsvaradense, and the age of their first occurrence was speculated to be about 10.75 Ma. In the Danitzpuszta outcrop, however, an occurrence of Pontiadinium pecsvaradense is known from D1–3 (KRIZMANIĆ et al., 2021), 14–15 m below the first occurrence of Candona (Propontoniella) candeo in sample D115. (In fact, specimens of subgenus Propontoniella from samples D1, D4, D5 and D7 might belong to Candona (Propontoniella) candeo, but their poor preservation hindered species-level identification.) The following species occur in our Candona

| Ostracod biozones | Taxa | Pannonian | Slavonian | Serbian |
|-------------------|------|-----------|-----------|---------|
|                   |      | alpha     | beta      | gamma   | delta   |
| Pokorný, 1944     | A    | B         | C         | D       | E       | F       | G       | H       |
| Kollmann, 1960    |      |           |           |         | E1      | E2      | E3      |         |
| Jiríček, 1985     |      |           |           |         |         |         |         |         |
| Krstić, 1985      |      |           |           |         |         |         |         |         |

Figure 4. Literature-based stratigraphic distribution of the ostracod species identified in the Pécs-Danitzpuszta outcrop, according to Pokorny (1944), Kollmann (1960), Jiríček (1985) and Krstic (1985). Compilation is based on Kővács et al. (2016)
similar to that reported from the Hennersdorf section (cf., Cardium schedelianum Zone). This latter relationship is the ticum auricula ta, H. hieroglyphica (sibo vi ki, Cyprideis deo, C. (Reticulocandona) reticulata, C. (Sinegubiella) include covering the time interval of 11.6–9.9 Ma; the Sarmatian/Pannonian boundary up to the highest sample, ex gr. taxonomically questionable form designated "Amplocypris. This species was not recorded in Beočin (although a ure 3 20 lorentheyi (assuming a constant de positional rate throughout C5n.2n in well; its first occurrence corresponds to ca. 10.25 Ma one of the latest appearing species in the Beočin section as one of the latest appearing species in the Beočin section as well; its first occurrence corresponds to ca. 10.25 Ma (assuming a constant depositional rate throughout C5n.2n in the Beočin succession).

Comparing the ostracod and mollusk zonations in the Danitzpuszta outcrop, we found that the Hemicytheria lorentheyi Zone and the lowermost part of the Hemicytheria tenuistriata Zone overlap with the Lymnocardium praeponticum – Radix croatica Zone. In the upper part of the section, the Amplocypris abscessa Zone overlaps with the Lymnocardium schedelianum Zone. This latter relationship is similar to that reported from the Hennersdorf section (cf., Harzhauser & Mandic 2004 and Danielopol et al. 2011).

Conclusions

The Pécs-Danitzpuszta outcrop yielded a characteristic limno-brackish Lake Pannon benthic ostracod fauna with well-preserved valves from 29 samples collected from the 65 meter thick Pannonian Endröd Marl succession. Thirty-nine ostracod taxa, which belong to 9 genera, 8 families and 1 order (Podocopida), were identified.

Based on the ecology of extant genera and palaeoecological interpretation of the extinct ones, the studied ostracod assemblages probably lived in relatively shallow but low-energy, plohaline (9–16‰ salinity) waters in the sublittoral zone of Lake Pannon.

Biostratigraphically, we divided the succession into four interval zones based on the first occurrence (supposed first appearance) of four species. The Hemicytheria lorentheyi Zone is 5.5 m thick, and represents the basal part of the Pannonian succession (from 11.6 Ma onwards). The overlying Hemicytheria tenuistriata Zone is 29 m thick; the first occurrence of H. tenuistriata in the Beočin outcrop was magnetostratigraphically dated as 11.23 Ma. The following Candonia (Propontiella) candeo Zone is 18 m thick. The overlying Amplocypris abscessa Zone was sampled in 6.5 m thickness. Because Candonia (Reticulocardium) reticulata, first appearing in the Beočin succession at ca. 10.2 Ma, has its first occurrence in the upper part of this 6.5 m interval, we tentatively suggest that the age of the investigated Pannonian interval is 11.6–10 Ma.

Acknowledgements

Radovan Pípík and Péter Oszvárt are thanked for their careful reviews. The palaeontological investigations were partly supported by the Hantken Foundation and the project EFOP 3.6.1-16-2016-00004 at the University of Pécs. The research was financially supported by the Hungarian National Research, Development and Innovation Office NKFIH No. 116618. The authors would like to dedicate this study to Dr Nadežda Krstić, the outstanding micropalaeontologist and expert of Pannonian ostracods. This is MTA–MTM–ELTE Paleo contribution No 352.

References–Irodalom

Bassiouni, M. A. 1979: Brakische und marine Ostrakoden (Cytherideinae, Hemicytherinae, Trachyleberidinae) aus dem Oligozän und Neogen der Türkei. – Geologisches Jahrbuch, B 31, 1–200.

Beker, K., Tunoglu, C. & Ertekin, I. K. 2008: Pliocene-Lower Pleistocene Ostracoda Fauna from Insuyu Limestone (Karapınar-Konya/Central Turkey) and its Paleoenvironmental Implications. – Türkiye Jeoloji Bülteni 51/1, 1–32.

Benson, R. H. 1973: 36.2 Psychrospheric and continental ostracoda from ancient sediments in the floor of the Mediterranean. – In: Ryan, W. B. F. & Hsu, K. J. (eds): Initial Reports of the Deep Sea Drilling Project 13, 1002–1008.

Benson, R. H. 1978: 35. The Paleooecology of the ostracodes of DSDP LEG 42A. – Deep Sea Drilling Project Initial Reports 42, 777–787.

Boomer, I., Grafenstein, U., Guichard, F. & Bieda, S. 2005: Modern and Holocene sublittoral ostracod assemblages (Crustacea) from the Caspian Sea: A unique brackish, deep-water environment. – Palaeogeography, Palaeoclimatology, Palaeoecology 225, 173–186. https://doi.org/10.1016/j.palaeo.2004.10.023

Botka, D., Magyar, I., Csoma, V., Tóth, E., Suian, M., Ruzsikczay-Rüdiger, Zs., Chyba, A., Braucher, R., Sant, K., Cori, C., Baranyi, V., Bakraci, K., Kriszmani, K., Barth, I. R., Szabo, M. & Silve, L. 2020: Integrated stratigraphy of the Güzteriş Clay pit: a key section for the early Pannonian (late Miocene) of the Transylvanian Basin (Romania). – Austrian Journal of Earth Sciences, 112/2, 221–247. https://doi.org/10.17738/ajes.2019.0013.
RSTIĆ, N. 1968b: Pontian Ostracods from Eastern Serbia: Candona and Cypria. – *Konzölmények*, 26/2b, 59–66.
RSTIĆ, N. 1980: Contribuição à cunhaoestudar da fauna de ostracode da basarabií de Moldova (Regiona dintre Siret si Moldova). – *Annals of Alexandru Ioan Cuca University of Iaşi* 26/2b, 59–66.
RSTIĆ, N. 1985: Ostracofaune des dépôts Besarabiens de la région Vâleni (Dobrogea du sud). – *Annals of Alexandru Ioan Cuca University of Iaşi. Geology, Geography* 31/2b, 32–36.
RSTIĆ, N. 1986: Contributions à la connaissance d’ostracofaune du Volhynien (Dobrogea du sud). – *Anuarul Muzeului de Stinte Naturla Piatra Neamt Geant Asociatie-Geografia* 5 (1980–1982), 83–91.
JRČEK, R. 1983: Redefinition of the Oligocene and Neogene ostracod zonation of the Paratethys. – *Knihoznik Zeměpisného plynu a nafty* 4, 195–236.
JRČEK, R. 1985: Die Ostracoden des Pannonien. – In: PAPP, A. (ed.): *Chronostratigraphie und Neostratotypen*, Miozän der Zentralen Paratethys 7, Pannonien, Akadémia Kiadó, Budapest, 378–425.

KAROFF, I. 1973: A mesecki pannon földtana. – *Földtani Közlöny* 107–151.

KÁRANOVIC, I. 2012: Recent freshwater ostracods of the world. *Crustacea, Ostracoda, Podocopida*. – Springer-Verlag Berlin Heidelberg, 607 p, https://doi.org/10.1007/978-3-642-21810-1

KÁZÁR E. 2007: Danitz-puszta leleve (Cetacea: Odontoceti) a Kárpát-medencében. – *Forstvés Loránd University, Budapest*. (in Hungarian)

KÁZÁR E., KORDOS L. & SZONOKY M. 2001: Danitz-puszta homokhánya. Pannon homok áthalmozott ősgerinces-maradványokkal. – *Excursion Guide, 4. Magyar Őslénytani Vándorgyűlé*, Pécsvárad: Budapest, Magyarhoni Földtani Társulat Őslénytani-Rétegtani Szakosztály, 42–43.

KÁZÁR E., KORDOS L. & SZONOKY M. 2007: Danitz-puszta. – In: PÁLFI J. & PÁZONFY P. (eds): *Őslénytani kirándulások Magyarországon és Erdélyben*. Hantian Kiadó, Budapest, 131–132.

KLEB B. 1973: A mesecki pannon földtana. – *A Magyar Állami Földtani Intézet Évkönyve* 53/3, 750–943.

KÖLLMANN, K. 1960: Cytherideinae und Schulerideinae n. subfam. (Ostracoidea) aus dem Neogen des östlichen Europas. – *Mitteilungen der Österreichischen Geologischen Gesellschaft* 51, 28–195.

KONRAD GY. & SEBE K. 2010: Fiatal tektonikai jelenségek új észlelései a Nyugati-Mecsekben és környezetében. – *Földtani Közlöny* 140/2, 445–468. https://doi.org/10.1007/978-3-642-21810-1

KOVAČ, M., BARÁTH, I., KOVAČOVÁ-SLAMKOVÁ, M., PIPIK, R., HLAVATÝ, I. & HUDÁČKOVÁ, N. 1998: Late Miocene paleoenvironments and sequence stratigraphy: northern Vienna Basin. – *Geologica Carpathica* 49/6, 445–458.

KOVAČS A., SEBE K., MAGYAR I., SZUROMI-KORECZ A. & KOVÁCS E. 2019: Pannonian unledgékképződés és szerkezeti mozgások az Északi-pikkely (Kelet-Mecsek) területén. – *Földtani Közlöny* 148/4, 327–340. https://doi.org/10.23928/foldt.kozl.2018.148.4.327

KOVAČS, E., MAGYAR, I., SZTÁNO, O. & PIPIK, R. 2016: Pannonian ostracods from the southwestern Transylvanian basin. – *Geologia Croatica* 69/2, 213–229. https://doi.org/10.4154/GC.2016.16

KRIZMANIĆ, K., SEBE K. & MAGYAR, I. 2021: Dinoflagellate cysts from the Pannonian (late Miocene) “white marls” in Pécs-Danitzpuszta, southern Hungary. – *Földtani Közlöny* 151/3, 267–274.

KRSTIĆ, N. 1960: Beitrag zur Kenntnis der pannonischen Ostracoden in der Umgebung von Beograd. – *Mitteilungen der Österreichischen Geologischen Gesellschaft* 51, 28–195.

KRSTIĆ, N. 1996a: Ostracodes des couches congeriennes, 1. Cyprideis I. – *Bulletin du Museum d’histoire naturelle de Belgrade, Series A* 23, 107–151.

KRSTIĆ, N. 1996b: Pontian Ostracods from Eastern Serbia: Candona and Cypria. – *Vesnik Zavoda za Geološka i Geofizička Istraživanja, Series A* 26, 243–251.

KRSTIĆ, N. 1972a: Ostrakodi kongerisksi slojeva: 10. Loxooconcha. – *Bulletin du Museum d’histoire naturelle de Belgrade, Series A* 27, 243–275.

KRSTIĆ, N. 1972b: Genus Candona (Ostracoda) from Congeria Beds of Southern Pannonian Basin. – *The Serbian Academy of Sciences and Arts, Monographs* 450/39, 1–145.

KRSTIĆ, N. 1973a: Ostracodes of the Congeria beds: 11. Amnicityhere. – *Radovi Instituza geološko-rudarska istraživanja ispitivanja nuklearnih i drugih mineralnih sirovina* 8, 53–99.

KRSTIĆ, N. 1973b: Plocenski Ostrakdi Metohije. 1. – *Bulletin du Museum d’histoire naturelle de Belgrade* 28, 151–173.

KRSTIĆ, N. 1973c: Biostratigraphy of the congerian beds in the Belgrade region on the basis of Ostracoda with the description of the species of the genus Amplocypris. – *Institute for Geological and Mining Explorations and Investigation of Nuclear and Other Mineral Raw Materia*, Monographs 4, 208.

KRSTIĆ, N. 1974: Biostratigraphy of the Pannonian and Pontian stages in the South-eastern part of the Pannonian Basin based upon the ostracod fauna. – *Memoire BRGM* 78, 459–467.

KRSTIĆ, N. 1975: Ostracods of the congerian beds: Species of the genus Cypria and some other insufficiently defined forms. – *Radovi GeoInstituta* 10, 195–206.

KRSTIĆ, N. 1980a: Nove vrste ostakoda sa parastratotipova Panona. – *Radovi GeoInstituta* 14, 147–158.

KRSTIĆ, N. 1980b: Some Miocene ostracods Aleskinac’s Pomoravlje. Rad. – *Radovi GeoInstituta* 14, 116–124.

KRSTIĆ, N. 1985: Ostracoden im Pannonien der Umgebung von Belgrad. – In: PAPP, A. (ed.): *Chronostratigraphie und Neostratotypen, Miozän der Zentralen Paratethys* 7, Pannonien, Akadémia Kiadó, Budapest, 103–143.

KRSTIĆ, N. 1990: Contribution by ostracods to the definition of the boundaries of the Pontian in the Pannonian Basin. – In: STEVANOVIC, P. M., NIEVESKAJA, L. A., MARINESCU, F., SOKAČ, A. & JAMBAR, Á. (eds): *Chronostratigraphie und Neostratotypen. Neogen der Westlichen (‘Zentrale’) Paratethys* 8, P11, Pontien 45–7.
SEBE, K., KOVÁCS, M., MAGYAR, I., KRIZMANIĆ, K., SPÉLIC, M., BIGUNAC, D., SUTÓ-SZENTA, M., KOVÁCS, Á., SZUROMI-KORECZ, A., BAKRÁI, K., HAJEK-TADESE, V., TROSKOT-CÔRBI, T. & SZTÁNO, O. 2020: Correlation of upper Miocene–Pliocene Lake Pannon deposits across the Drava Basin, Croatia and Hungary. – Geologia Croatica 73/3, 177–195. https://doi.org/10.4154/gc.2020.12
SEBE K., KONRÁD GY. & SZTÁNO O. 2021: An exceptional surface occurrence: the middle to upper Miocene succession of Pécs-Danitzpuszta (SW Hungary). – Földtani Közlöny 151/3, 235–252.
SISSINGH, W. 1972: Late Cenozoic ostracoda of the South Aegean island arc. – PhD thesis. Utrecht University. 187.
SOKÁC, A. 1962: Pannonische Ostrakodenfauna von Donje Selište südwestlich von Glina. – Geologski Vjesnik 152/3, 391–401.
SOKÁC, A. 1967: Pontska fauna ostrakoda jugo-istoročnog poboća Zagrebačke gore. – Geološki Vjesnik 20, 63–86.
SOKÁC, A. 1972: Pannonian and Pontian ostracode fauna of Mt. Medvednica. – Palaeontologia Jugoslavica 11, 1–140.
SOKÁC, A. 1990: Pontian ostracod fauna in the Pannonian Basin. In: STEVANOVIĆ, P. M., NEVESSKAJA, L. A., MARINESCU, F. I., SOKÁC, A. & JÁMBOR, Á. (eds): Chronostratigraphie und Neorastotyten Neogen der Westlichen (Zentrale) Paratethys 8, Pontien, JAZU-SANU, Zagreb-Belgrade, 672–721.
SPADI, M., GLOZZI, E., BOOMER, I., STOICA, M. & ATHERSUCH, J. 2019: Taxonomic harmonization of Neogene and Quaternary candonid genera (Crustacea, Ostracoda) of the Paratethys. – Journal of Systematic Palaeontology 17/19, 1–34. https://doi.org/10.1080/14772019.2018.1545708.
STOICA, M., LAZÁR, L., KRIJGSMAN, W., VASILEV, I., JIPA, & FLORIOU, A. 2013: Paleoenvironmental evolution of the East Carpathian foredeep during the late Miocene – early Pliocene (Dacian Basin; Romania). – Global and Planetary Change 103, 135–148. https://doi.org/10.1016/j.gloplacha.2012.04.004.
SÜTÖNE SZENTAI M. 2012: Szervesvázú mikroplankton zónák a szarmata és a pannoniai emeletek határán Magyarországról. (Organic-walled microplankton zones across the boundary of the Sarmatian and Pannonian stages in Hungary.) – e-Acta Naturalia Pannonica 4, 5–34.
SZABÓ, M., KOCSIS, L., BOSNAKOF, M. & SEBE, K. 2021: A diverse Miocene fish assemblage (Chondrichthyes and Osteichthyes) from the Pécs-Danitzpuszta sand pit (Mecsek Mts., Hungary). – Földtani Közlöny 151/4, 363–410.
SZÉLES M. 1963: Szármáciai és pannoniai korai kagylósrákfauna a Duna–Tisza közé sekély- és mélyfúrásokból. – Földtani Közlöny 93/1, 108–116.
SZÉLÉS M. 1982: A Tengelic–2. sz. fúrás pannoniai Ostracoda faunája. – A Magyar Állami Földtani Intézet Évkönyve 65, 235–289.
SZUROMI-KORECZ A. 1991: DK-Dunántúl pannoniai s. l. Ostracoda fauna vizsgálatának eredményei. – PhD thesis, ELTE Általános és Alkalmazott Földtani Tanszék, Budapest, 245.
SZUROMI-KORECZ A. 1992: A DK-Dunántúl pannoniai s.l. képződményeinek rétegtani értékelése Ostracoda faunájuk alapján. – Öszenyitani Viták 38, 5–20.
TÉR BORGHI, M. M. 2013: Connections between sedimentary basins during continental collision – how tectonic, surface and sedimentary processes shaped the Paratethys. – Utrecht Studies in Earth Sciences 45, 203 p.
TE R BORGHI, M., VASILEV, I., STOICA, M., KNEZEVIĆ, S., MATENCO, L., KRIJGSMAN, W. & CLOETENINGH, S. 2013: The isolation of the Pannonian basin (Central Paratethys): New constraints from magnetostratigraphy and biostratigraphy. – Global and Planetary Change 103, 99–118. https://doi.org/10.1016/j.gloplacha.2012.10.001.
TÓTH E. 2009: Öszenyitási változások a Középső-Paratethysben a szarmata folyamán a mikrofauna ősítőményeinek és geokémiai vizsgálata alapján. Changements paléoenvironnementaux dans la Paratéthys Centrale pendant le Sarmatien (miocene moyen): étude paléontologique de microfaunes et analyses géochimiques. – PhD thesis, Eötvös Loránd University, Budapest, 158.
TUREA-PAGHIJA, N., SIMINUESCU, T. & COSTESCHI, G. 1970: Ostracodele miocene din podiul Moldovenesc. – Annals of Alexandru Ioan Cuza University of Iași Sec. I, Zb. 16, 107–120.
TUNOGLU, C. & ÜNAL, A. 2001: Pannonian-Pontian Ostracoda fauna of Gelibolu Neogene Basin (NW Turkey). – Verbitilmileri 23, 167–187. ÜNAL, A. 1996: Gelibolu Yarımadası Neogen İstifinin ostrakod biyostratigrafisi, Yüksek Müh. – Ph.D. thesis, Hacettepe Üniversitesi, Ankara, 160.
Van HARTEN, D. 1975: Size and environmental salinity in the modern euryhaline ostracod Cyprideis torosa (Jones, 1850), a biometrical study. – Palaeogeography, Palaeoclimatology, Palaeoecology 31/1, 35–48. https://doi.org/10.1016/0031-0182(75)90028-0.
Van HARTEN, D. 1990: The Neogene evolutionary radiation in Cyprideis Jones (Ostracoda: Cytheracea) in the Mediterranean area and the Paratethys. – Courier Forschungsinstitut Senckenberg 123, 191–198.
Van HARTEN, D. 2000: Variable noding in Cyprideis torosa (Ostracoda, Crustacea): an overview, experimental results and a model from Catastrophe Theory. – Hydrobiologia 419/1, 131–139. https://doi.org/10.1023/A:1003935419364.
WITT, W. 2011: Mixed ostracod faunas, co-occurrence of marine Oligocene and non-marine Miocene taxa at Pinharisar, Thrace, Turkey. – Zittelianna 237–254.
ZALÁNYI, B. 1929: Morpho-systematische Studien über fossile Muschelkrebs. – Geologica Hungarica 5, 1–147.
ZALÁNYI, B. 1944: Magyarországi neogén ostrakodák (Tisztabereki neogén ostrakoda faunák leírása és rétegtani kiértékelése). – Geologica Hungarica 21, 5–144.
ZALÁNYI B. 1959: Tihanys felső pannon ostracodák. – A Magyar Állami Földtani Intézet Évkönyve 48, 196–216.
ZHAI, D., XIAO, J., FAN, J., WEN, R. & PANG, Q. 2015: Differential transport and preservation of the instars of Limnocythere inopinata (Crustacea, Ostracoda) in three large brackish lakes in northern China. – Hydrobiologia 747/1, 1–18. https://doi.org/10.1007/s10750-014-2118-8.
ZÖRN, I. 2010: Ostracodai type specimens stored in the palaeontological collection of the Geological Survey of Austria. – Jahrbuch der Geologischen Bundesanstalt 150, 263–299.

Manuscript received: 12/02/2021
Plate I – I. tábla

The depicted specimens are adult individuals. LV = left valve, RV = right valve / Az ábrákon felnőtt egyedek szerepelnek oldalnézetben. LV = bal teknő, RV = jobb teknő

1 – Amnicithere parallela (Méhes 1908), RV in lateral view, scale: 200 µm, D29
2 – Cyprideis pannonica (Méhes 1908), RV in lateral view, scale: 500 µm, D8
3 – Cyprideis ex gr. heterostigma Pokorný 1952, RV in lateral view, scale: 500 µm, D219
4 – Hemicytheria teniustrata (Méhes 1908), LV in lateral view, juvenile specimen, scale: 200 µm, D15.
5 – Hemicytheria teniustrata (Méhes 1908), RV in lateral view, scale: 200 µm, D12
6 – Hemicytheria lorenthey (Méhes 1908), RV in lateral view, scale: 500 µm, D29
7 – Hemicytheria hungarica (Méhes 1908), LV in lateral view, scale: 200 µm, D15
8 – Hemicytheria hungarica (Méhes 1908), RV in lateral view, scale: 250 µm, D7
9 – Loxocorniculina hodonica Pokorný 1952, RV in lateral view, scale: 250 µm, D15
10 – Candona (Candona) aff. postsarmatica Krstić 1972, LV in lateral view, scale: 500 µm, D8
11 – Candona (Candona) aff. postsarmatica Krstić 1972, RV in lateral view, scale: 500 µm, D8
12 – Candona (Propontoniella) macra Krstić 1972, RV in lateral view, scale: 250 µm, D4
13 – Candona (Propontoniella) candeo Krstić 1972, RV in lateral view, scale: 200 µm, D213
14 – Candona (Reticulocandona) reticulata (Méhes 1908), LV in lateral view, scale: 500 µm, D216
15 – Candona (Thaminocypris) transylvanica (Hejjas 1894), RV in lateral view, scale: 500 µm, D4
16 – Candona (Thaminocypris) transylvanica (Hejjas 1894), LV in lateral view, scale: 500 µm, D7
17 – Candona (Sinegubiella) rakosiensis (Méhes 1907), LV in lateral view, scale: 200 µm, D213
18 – Candona (Thyphlocypris) cf. fossulata Pokorný 1952, RV in lateral view, scale: 250 µm, D14
Where not indicated otherwise, the depicted specimens are adult individuals. LV = left valve, RV = right valve. 1, 2. juvenile LV, scale: 200 µm, D205
3. *Cypria siboviki* KRSTIĆ 1968, LV in lateral view, scale: 500 µm, D200
4. *Herpetocyprilla auriculata* (REUSS 1850), LV in lateral view, scale: 500 µm, D9
5. *Herpetocyprilla hieroglyphica* (MÉHES 1907), juvenile LV in lateral view, scale: 500 µm, D9
6. *Herpetocyprilla hieroglyphica* (MÉHES 1907), juvenile RV in lateral view, scale: 250 µm, D9
7. *Amplocypris abscissa* (REUSS 1850), RV in lateral view, scale: 500 µm, D213
8. *Amplocypris major* KRSTIĆ 1973, juvenile LV in lateral view, scale: 250 µm, D213
9. *Amplocypris firmus* KRSTIĆ 1973, RV in lateral view, scale: 500 µm, D4
10. *Amplocypris recta* (REUSS 1850), LV in lateral view, scale: 500 µm, D15
Appendix

Systematic Palaeontology

Here we follow the classification of Horne et al. (2002) and Hartmann & Purè (1974). The lists of synonyms and the stratigraphic range and geographic distribution sections contain items which were published with proper illustrations of specimens. The Pécs-Danitzpusza specimens are deposited in the Department of Palaeontology, Eötvös Loránd University, Budapest. Abbreviations: L: length, H: height.

Phylum Arthropoda Siebold & Stannius 1845
Subphylum Crustacea Pennant 1777
Class Ostracoda Latreille 1802
Order Podocopida Müllner 1894
Suborder Cytherocopina Baird, 1850
Superfamily Cytheroidea Baird, 1850
Family Leptocytheridae Hanai 1957
Genus Amnicythere Denoto 1965

Amnicythere parallela (Méhes, 1908)
Plate I, fig. 1

1908 Krithe parallela n. sp. – Méhes, pp. 550–551, pl. 10, figs 1–3.
1960 Leptocythere parallela (Méhes) – Kristić, p. 279, pl. 1, figs 19–20; pl. 2, figs 22–33; pl. 3, figs 16–17; pl. 4, figs 6, 7, 10–16.
1972 Leptocythere parallela (Méhes) – Sokač, p. 66, pl. 30, figs 4, 7–10.
1973a Leptocythere (Amnicythere) parallela (Méhes) – Kristić, pp. 57–58, figs 4–11; pl. 5, figs 1–3; pl. 6, fig. 5.
1973a Leptocythere (Amnicythere) aff. parallela (Méhes) – Kristić, pp. 58–59, figs 12–16; pl. 1, fig. 6.
1980 Leptocythere parallela (Méhes) – Ionesi & Chintauan, pl. 1, fig. 3.
1982 Leptocythere parallela (Méhes) – Széles, p. 252, fig.12.
1985 Leptocythere (Amnicythere) aff. parallela (Méhes) – Kristić, pl. 11, fig. 4.
1986 Leptocythere parallela (Méhes) – Ionesi & Chintauan, pl. 1, fig. 8.

Material: Danitzpusza trench (4 valves)
Dimensions: L = 485.930–583.422 µm, H = 242.577–288.425 µm, L/H = 2.003–2.23 µm

Stratigraphic range and geographic distribution: lower Sarmatian (Volhynian) and Maeotic of the Euxinian Basin and lower Pannonian of the Pannonian Basin: Sarmatian (upper Volhynian) of Southern Dobrogea (Ionesi & Chintauan 1986); Maeotic of Moldova (Ionesi & Chintauan, 1980); Pannonian of the Vienna Basin in the Czech Republic and Mt. Medvednica in Croatia (Sokač 1972), Sopron (Darufalva) (Méhes 1908) and Tengelic (Széles 1982) in Hungary, Prnjavor in Bosnia (Kristić 1985), and Malo Bučje, Velika Moštanica, Sibovik–5, Vrčin in Serbia (Kristić 1960, 1973a).

Family Cytherideidae Sars 1925
Subfamily Cytherideinae Sars 1925
Genus Cyprideis Jones 1857

Cyprideis pannonica (Méhes, 1908)
Plate I, fig. 2

1908 Cytheridea pannonica n. sp. – Méhes, pp. 553–555, pl. 11, figs 6–14.
1929 Cytheridea pannonica Méhes – Zalányi, p. 73, textfig 351: 10, 361: 6.
1944 Cytheridea pannonica Méhes – Zalányi, p. 90, p. 172.
1944 Cyprideis pannonica (Méhes) – Pokorny, pp. 292–293, pl. 1, figs 3–4.
1960 Cyprideis pannonica (Méhes) – Kollmann, p. 163, pl. 13, figs 1–4.
1959 Cyprideis pannonica (Méhes) – Zalányi, p. 213.
1963 Cyprideis pannonica (Méhes) – Széles, pl. 6, figs 1–2.
1966 Cyprideis pannonica (Méhes) – Hangaru, pl. 40, fig. 2.
1968a. Cyprideis (Cyprideis) cf. pannonica (Méhes) – Kristić, p. 111, pl. 1, figs 2–3.
1970 Cyprideis pannonica (Méhes) – Trelea et al. pp. 111–112, pl. 3, figs 10 a–c.
1973 Cyprideis pannonica (Méhes) – Benson, text–fig. 2, E–F.
1974 Cyprideis pannonica (Méhes) – Černaßek, pp. 473–474, pl. 2, fig. 5.
1975 Cyprideis pannonica (Méhes) – Ionesi & Chintauan, pl. 1, fig. 3.
1976 Cyprideis pannonica (Méhes) – Chintauan & Nicolaï, p. 12, pl. 1, figs 5–7.
1978 Cyprideis pannonica (Méhes) – Carbonnel, pl. 1, figs 11–13.
1978 Cyprideis pannonica (Méhes) – Benson, pl. 2, figs 4–8.
1979 Cyprideis (Cyprideis) pannonica (Méhes) – Bassiouni, pp. 84–85, pl. 1, figs 1–6.
1980 Cyprideis pannonica (Méhes) – Ionesi & Chintauan, pl. 1, fig. 2.
1983 Cyprideis pannonica (Méhes) – Jiriček, pl. 6, fig. 32.
1985 Cyprideis pannonica (Méhes) – Ionesi & Chintauan, pl. 1, fig. 2.
1985 Cyprideis pannonica (Méhes) – Jiriček, pl. 369, pl. 53, figs 1–4.
1990 Cyprideis (Cyprideis) ex. gr. pannonica – Kristić & Stancheva, pl. 9, fig. 10.
1996 Cyprideis pannonica (MÉHES) – ÜNAL, p. 92, pl. 1, fig. 9–11.
1998 Cyprideis pannonica (MÉHES) – KOVÁC et al., pl. 4, figs 5–6.
2000 Cyprideis pannonica (MÉHES) – CHINTAÚN, pl. 1, fig. 7.
2001 Cyprideis pannonica (MÉHES) – TUNOĞLU & ÜNAL, p. 171, pl. 1, fig. 8.
2005 Cyprideis pannonica (MÉHES) – RADU & STOICA, pl. 2, figs 9–11.
2008 Cyprideis pannonica (MÉHES) – NAZIK et al., pl. 1, figs 8–9.
2008 Cyprideis pannonica (MÉHES) – BEKER et al., p. 9, pl. 1, figs 1–3.
2011 Cyprideis pannonica (MÉHES, 1908) – WITT, pl. 1, fig. 1.
2011 Cyprideis pannonica (MÉHES) – FILIPESCU et al., text-fig. 5, fig. 15.
2013 Cyprideis pannonica (MÉHES) – STOICA et al., pl. 2, fig. 1.

**Material:** Danitzpuszta trench (4 valves)

**Dimensions:** L = 851.243–875 µm H = 475.02–501.493 µm, L/H = 1.745–1.792

**Stratigraphic range and geographic distribution:** Sarmatian to Pannonian of the Pannonian Basin system, Sarmatian to Meotian of the Dacian Basin, Sarmatian of the Euxinian Basin, upper Miocene of the Aegean, Messinian of the Eastern Mediterranean Basin, upper Miocene to Plio-Pleistocene of continental Turkey: Sarmatian in Naxing in Austria (CERNÁSEK 1974); Tusia (CHINTAÚN & NICORICI 1976), Lívezile (CHINTAÚN 2000), and Orba de Mureș (FILIPESCU et al. 2011) in Transylvania, Romania; Pannonian in Malacky M–16 borehole in Slovakia (KOVÁC et al. 1998); Hodonín (PORKÓNY 1944; JIRIČEK 1983, 1985) and Svatobořice–Mistřín (CARBONNEL 1978) in the Czech Republic; Drassburg in Austria (KOLLMANN 1960); Sopron, Peremarton, Budapest–Kőbánya, Tiszaberek, Duna–Tisza Interfluve (MÉHES, 1908, ZALÁNYI 1944, SZÉLES 1963) and Tihany (ZALÁNYI 1959) in Hungary; Badnjevac, Varovnica in Serbia (ZALÁNYI 1929, KRSTIĆ 1968a); Krško in Slovenia (KRSTIĆ & STANCHEVA 1990); Szósćán/Soceni in Transylvania, Romania (MÉHES 1908); Sarmatian in Hárfláu (TRELEA et al. 1970, RADU & STOICA 2005), Siret and Moldova valleys (IONESI & CHINTAÚN 1975, 1980) in Romania; Meotian at Teleajen river, Prahova, Brăești (HANGANU 1966, IONESI & CHINTAÚN, 1980) and Râmnicu Sărat (STOICA et al. 2013) in Romania; Sarmatian in Pinarhisar in Turkey (WITT 2011) and Văleni (Dobrogea) in Romania (IONESI & CHINTAÚN 1985); upper Miocene („Pannonian and Pontian”) in Glibelbou–18 in Turkey (ÜNAL 1996; TUNOĞLU & ÜNAL 2001); Messinian in DSDP Leg 42A, Site 376, Florence Rise, W of Cyprus (BENSON 1978) and DSDP Leg 13, Site 129, Hole 129A, Levantine Basin (BENSON 1973); upper Miocene in Arguvan, Malatya in Turkey (BASSIOUNI 1979; NAZIK et al. 2008); Plio-Pleistocene in Karapınar–Konya in Turkey (BEKER et al. 2008).

*Cyprideis ex gr. heterostigma* POKORNÝ, 1952

**Plate I, fig. 3**

**Material:** Danitzpuszta trench (256 valves, 1 carapace)

**Dimensions:** L = 570.382–1130 µm, H = 309.585–663 µm, L/H = 1.704–1.842

**Remarks:** The anterior dorsal outline shows a variability in convexity, maybe due to sexual dimorphism. There is significant variability in the convexity of the valves as well; it is difficult to decide whether it reflects intraspecific variation or higher convexity is a diagnostic morphological character of another species. There are more adults than juveniles.

Family Hemicytheridae PURI 1953
Subfamily Hemicytherinae PURI 1953
Genus *Hemicytheria* PORKÓNY 1952

**Hemicytheria tenuistriata** (MÉHES, 1908)

**Plate I, figs 4–5**

**Material:** Danitzpuszta trench (19 valves)

**Dimensions:** L = 399–802.624 µm H = 247–476.447 µm, L/H = 1.615–1.685

**Stratigraphic range and geographic distribution:** lower Pannonian in the Pannonian Basin: Sopron in Hungary (MÉHES 1908); Velika Moštanica (KRSTIĆ 1985) and Béocín (TER BORGH et al. 2013) in Serbia.

**Hemicytheria lorentheyi** (MÉHES, 1908)

**Plate I, fig. 6**

**Material:** Danitzpuszta trench (1 valve)

**Dimensions:** L = 1003.76 µm H = 591.47 µm, L/H = 1.697

**Stratigraphic range and geographic distribution:** Sarmatian of the Euxinian Basin, lower Pannonian of the Pannonian Basin, and Messinian (Meotian–Pontian) of the Aegean Basin: Sarmatian of the Aegean (Strymon) Basin: Sarmatian of Moldova (IONESI & CHINTAÚN, 1972); lower Pannonian of Sopron, Budapest–Kőbánya, Peremarton, Hungary (MÉHES 1908); Belgrade, Serbia (KRSTIĆ 1960); Matabichen, Austria (GROSS 2004); Bučany–48, Slovakia (JIRIČEK 1983); Mutěnice, Czech Republic (JIRIČEK, 1985); Messinian (Meotian–Pontian) of Strymon Basin (GRAMANN 1969).
**Hemicytheria hungarica** (MÉHES, 1908)
Plate I, figs 7–8
1908 *Cythereis hungarica* n. sp. – MÉHES, pp. 562–563, pl. 8, figs 7–9.
2009 *Hemicytheria hungarica* (MÉHES) – TÓTH, p. 89, pl. 5, figs 4–5 cum. syn.
2010 *Hemicytheria hungarica* (MÉHES) – ZORN, p. 266, pl. 1, fig. 13.

**Material:** Danitzpuszta pit (6 valves); Danitzpuszta trench (27 valves)

**Dimensions:** \( L = 531.444–823.895 \mu m \ H = 301.321–483.859 \mu m \ L/H = 1.703–1.763 \)

**Stratigraphic range and geographic distribution:** Sarmatian of the Euxinian Basin, Sarmatian and lower Pannonian of the Pannonian Basin system: Sarmatian of the Caucasus region (SCHNEIDER, 1925); Sarmatian of the Danube Basin, Slovakia (DORNÍC & KHEIL, 1963) and Csákvár, Hungary (TÓTH 2009); lower Pannonian of Sopron (Darulova) and Budapest–Kőbánya in Hungary (MÉHES 1980); Prnjavor in Bosnia (KRSTIĆ 1985); Drassburg in Austria (ZORN 2010).

Family Loxoconchidae SARS 1925
Genus *Loxoconchina* KRSTIĆ 1972

*Loxoconchina hodonica* POKORNÝ, 1952
Plate I, fig. 9
1952 *Loxoconcha hodonica* n. sp. – POKORNÝ, pp. 308–309, pl. 5, figs 1, 2, 9, figs 36–37.
1960 *Loxoconcha hodonica* POKORNÝ – KRSTIĆ, p. 281, pl. 2, fig. 28.
1963 *Loxoconcha hodonica* POKORNÝ – GREKKOFF & MOLINARI, p. 5, pl. 2, figs 5–6.
1966 *Loxoconcha hodonica* POKORNÝ – HANGANU, pl. 43, fig. 3.
1969 *Loxoconcha cf. hodonica* POKORNÝ – GRAMANN, pp. 509–510, pl. 34, figs 1–2.
1972 *Loxoconcha hodonica* POKORNÝ – SOKAČ, pp. 84–85, pl. 44, figs 6–7.
1972a. *Loxoconcha* (*Loxoconcholina*) *hodonica* POKORNÝ – KRSTIĆ, p. 253, pl. 4, fig. 7; pl. 6, figs 4–6.
1972 *Loxoconcha hodonica* POKORNÝ – SISSINGH, p. 133, pl. 10, figs 15–16.
1985 *Loxoconcholina* (*Loxoconcholina*) *hodonica* POKORNÝ – KRSTIĆ, pl. 12, fig. 10.
2013 *Loxoconcholina* *hodonica* (POKORNÝ) – TER BORGH et al., text–fig 8, 30.
2016 *Loxoconcholina* *hodonica* POKORNÝ – KOVÁCS et al., pl. 3, figs 2–3.

**Material:** Danitzpuszta trench (4 valves)

**Dimensions:** \( L = 475–535.852 \mu m \ H = 322.242–325 \mu m \ L/H = 1.474–1.648 \)

**Stratigraphic range and geographic distribution:** lower Pannonian of the Pannonian Basin system, Meotian of the Dacian Basin, Messinian of the Mediterranean Basin: lower Pannonian of Hodonín in the Czech Republic (POKORNÝ 1952); Mt. Medvednica in Croatia (SOKAČ 1972); Velika Moštanica, Sibovik–2a, Velika Plana, Vrčin, Belgrade, Makiš, and Beočin in Serbia (KRSTIĆ 1960, 1972a, 1985; TER BORGH et al. 2013); Lopadea Veche and Gârboviţa in Transylvania, Romania (KOVÁCS et al. 2016); Maeotian of Teleajen River valley, Prahova in Romania (HANGANU 1966); Messinian (Meotian–Pontian) of the Strymon Basin (GRAMANN 1969); Messinian (?) of Crete (SISSINGH 1972); Messinian of Reggio Emilia in Italy (GREKKOFF & MOLINARI 1963).

Superfamily Cypridoidea BAIRD 1845
Family Candonidae KAUFMANN 1900
Subfamily Candoninae KAUFMANN 1900
Genus *Candona* BAIRD 1845

*Candona (Candona)* aff. *post unarmedica* KRSTIĆ, 1972
Plate I, figs 10–11
1972b. *Candona (Candona)* post unarmedica n. sp. – KRSTIĆ, pp. 9–11, pl. 2, figs 4–6; p. 113.
1980a. *Candona (Candona)* aff. unarmedica n. sp. – KRSTIĆ, pl. 4, fig. 2.
1985 *Candona (Candona)* post unarmedica KRSTIĆ – KRSTIĆ, fig. 10.
2011 *Candona (Candona)* post unarmedica – OLTEANU, pl. 2, fig. 1.
2013 *Candona (Candona)* post unarmedica – MAZZINI et al., pl. 2, fig. e.

**Material:** Danitzpuszta trench (10 valves)

**Dimensions:** \( L = 971.880–1000.739 \mu m \ H = 511.266–554.633 \mu m \ L/H = 1.804–1.9 \)

**Remark:** In her original publication KRSTIĆ depicted only females, without giving their size. Our specimens have more rounded outline, but it is difficult to decide if this difference is due to sexual dimorphism, ontogenetic state, or our material represents a different species.

**Stratigraphic range and geographic distribution of *C. post unarmedica***: lower Pannonian of the Pannonian Basin system, Tortonian of Turkey: lower Pannonian of Belgrade and Aleksinac in Serbia (KRSTIĆ 1972b, 1980a, 1985); Carand in Transylvania, Romania (OLTEANU 2011); Tortonian of Çankiri Basin, Tuğlu, in Turkey (MAZZINI et al. 2013).

*Candona (Propontoniella) macra* KRSTIĆ, 1972
Plate I, fig. 12
1972b. *Candona (Propontoniella) macra* KRSTIĆ, pp. 35–36, pl. 11, figs 15–18, p. 123.
1985 *Candona (Propontoniella) macra* KRSTIĆ, pl. 1, fig. 9.
2016 *Candona (Propontoniella) macra* KRSTIĆ – KOVÁCS et al., pl. 2, figs 9–12.
2019 *Propontoniella macra* – SPADI et al., text–fig 3, I; text–fig 16, F–I.

**Material:** Danitzpuszta pit (2 valves); Danitzpuszta trench (15 valves)

**Dimensions:** \( L = 725–984.157 \mu m \ H = 350–442.223 \mu m \ L/H = 1.474–1.648 \)

**Stratigraphic range and geographic distribution:** lower Pannonian of the Pannonian Basin system: Vranović–1, Mt.
Krndija, Croatia (Spadi et al. 2019); Velika Moštanica, Sibovik (Belgrade) in Serbia (Kristić 1972b, 1985); Cunța in Transylvania, Romania (Kovács et al. 2016).

**Candona (Propontoniella) candeo** Kristić, 1972

Plate I, fig. 13

1972b. *Candona (Propontoniella) candeo* – Kristić, pp. 36–37, pl. 4, fig. 10; pl. 11, figs 1–4, figs 29–32; p. 124.

1985 *Candona (Propontoniella) candeo* – Kristić, pl. 2, fig. 3–6.

**Material:** Danitzpuszta pit (29 valves)

**Dimensions:** $L = 736.87–827.2 \mu m$ $H = 339.65–359.49 \mu m$ $L/H = 2.3–2.44$

**Stratigraphic range and geographic distribution:** lower Pannonian of the Pannonian Basin: Velika Moštanica, Sibovik creek in Serbia (Kristić 1972b, 1985).

**Candona (Reticulocandona) reticulata** (Méhes, 1907)

Plate I, fig. 14

1907 Aglea reticulata n. sp. – Méhes, pp. 442–443, pl. 3, figs 10–14.

1962 *Candona (Lineocypris) reticulata* (Méhes) – Sokáč, pl. 1, fig. 6.

1963 *Candona (Lineocypris) reticulata* Méhes – Széles, pl. 5, fig. 5.

1971 *Candona (Lineocypris) reticulata* (Méhes) – Olteanu, p. 91, pl. 3, fig. 3.

1972b. *Candona (Reticulocandona) reticulata* (Méhes) – Kristić, pp. 59–60, pl. 17, figs 1–2, 6–7; pl. 24, fig. 7; figs 48–49.

1972 *Candona (Lineocypris) reticulata* (Méhes) – Sokáč, pp. 53–54, pl. 23, figs 12–16.

1980b. *Candona (Reticulocandona) reticulata* (Méhes) – Kristić, pl. 2, figs 4–6.

1982 *Candona (Lineocypris) reticulata* Méhes – Széles, p. 241, pl. 4, figs 2, 4–5.

2011 *Candona (Reticulocandona) reticulata* (Méhes) – Olteanu, pl. 9, fig. 4.

2011 *Reticulocandona reticulata* (Méhes) – Runcić et al., pl. 9, figs 9–10.

**Material:** Danitzpuszta pit (10 valves)

**Dimensions:** $L = 476.585–530.056 \mu m$ $H = 276.246–333.957 \mu m$ $L/H = 1.587–1.725$

**Remark:** Although the the postero-dorsal rim is variable, each individual has a diagnostic fine reticulation on the valve surface.

**Stratigraphic range and geographic distribution:** Pannonian of the Pannonian Basin: Szőcsán/Soceni in Transylvania, Romania (Méhes 1907); Budapest–Kőbánya, Danube–Tisza Interfluve, Tengelic in Hungary (Méhes 1907; Széles 1963, 1982); Mt. Medvednica in Croatia (Sokáč 1962, 1972); Beocin, Belgrade (ZV–3) in Serbia (Kristić 1972b, 1980b; Runcić et al. 2011); Govci, Rieni in Transylvania, Romania (Olteanu 1971, 2011).

**Candona (Thaminocypris) transylvanica** (Héjjas, 1894)

Plate I, figs 15–16

1894 *Candona reticulata* n. sp. – Héjjas, p. 63, pl. 4, figs 14 a, b, c.

1972b. *Candona (Thaminocypris) cf. transylvanica* (Héjjas) – Kristić, pp. 63–64, pl. 18, fig. 8.

2016 *Candona (Cypriocypris) transylvanica* (Héjjas) – Kovács et al., pl. 2, figs 5–8, 13–15.

**Material:** Danitzpuszta trench (40 valves)

**Dimensions:** $L = 1035.667–1128.067 \mu m$ $H = 558.371–669.064 \mu m$ $L/H = 1.686–1.854$

**Stratigraphic range and geographic distribution:** lower Pannonian of the Pannonian Basin: Belgrade ("London" C–2) in Serbia (Kristić 1972b); Târgu Mureș, Băgău, Miercurea Nirajului, Lopadea Veche, Gârbovița, Cunța in Transylvania, Romania (Héjjas 1894, Kovács et al. 2016).

**Candona (Sinegubiella) rakosiensis** (Méhes, 1907)

Plate I, fig. 17

1907 Agleia rakosiensis n. sp. – Méhes, pp. 513–514, pl. 6, figs 8–13.

1972b. *Candona (Sinegubiella) rakosiensis* (Méhes) – Kristić, p. 80, pl. 25, figs 8–11, pl. 30, fig. 1.

1972 *Candona (Capiocypris) rakosiensis* (Méhes) – Sokáč, p. 39, pl. 15, figs 1–3.

**Material:** Danitzpuszta trench (4 valves)

**Dimensions:** $L = 440–549.131 \mu m$ $H = 230–289.469 \mu m$, $L/H = 1.897–1.913$

**Stratigraphic range and geographic distribution:** lower Pannonian of the Pannonian Basin: Sopron, Budapest–Kőbánya in Hungary (Méhes 1907); Mt. Medvednica in Croatia (Sokáč 1972); Durinci in Serbia (Kristić 1972b).

**Candona (Typhlocypris) cf. fossulata** Pokorny, 1952

Plate I, fig. 18

1952 *Candona fossulata* n. sp. – Pokorny, pp. 264–266, text–fig. 11, 12; pl. 2 fig. 1.

1972 *Candona (Typhlocypris) fossulata* Pokorny – Sokáč, pp. 59–60, pl. 28, fig. 1.

1972b. *Candona (Typhlocypris) aff. fossulata* Pokorny – Kristić, p. 84, pl. 24, fig. 12; pl. 27, figs 4–7.

1980 *Candona (Typhlocypris) ex. gr. fossulata* Pokorny – Freels, pp. 63–64, pl. 9, figs 21–26.

**Material:** Danitzpuszta trench (10 valves)

**Dimensions:** $L = 828.630–1025 \mu m$ $H = 460.177–550 \mu m$, $L/H = 1.801–1.863$

**Remark:** The postero-dorsal and the ventral margin is more rounded than in the holotype.

**Stratigraphic range and geographic distribution of C. fossulata:** lower Pannonian of the Pannonian Basin, upper Miocene of Turkey: lower Pannonian in Hodonín in Czech Republic (Pokorny 1952); Mt. Medvednica in Croatia (Sokáč 1972); Karagăa creek in Serbia (Kristić 1972b); upper Miocene of Denizli basin in Turkey (Freels 1980).

Subfamily Cyclocypridinae Kauffmann 1900

**Genus Cypria Fischer 1855**

**Cypria siboviki** Kristić, 1968

Plate II, fig 1

1968b. *Cypria siboviki* n. sp. – Kristić, p. 247–248, pl. 66, figs 1–2.

1972 *Cypria siboviki* Kristić – Sokáč, pp. 64, pl. 24, figs 15–16, 19.

1975 *Cypria siboviki* Kristić – Kristić, p. 195–196, pl. 1, figs 1–2.

1975 *Cypria aff. siboviki* Kristić – Kristić, pl. 1, fig. 3.
Material: Danitzpuszta pit (2 valves)
Dimensions: $L = 485$–$500.1 \mu m$, $H = 350$–$373.215 \mu m$, $L/H = 1.340$–$1.386$

Stratigraphic range and geographic distribution: lower Pannonian of the Pannonian Basin: Mt. Medvednica in Croatia (SOKAČ 1967, 1972); Vrćin, Karagača creek in Serbia (KRSTIĆ 1960, 1973b, 1985); Szócsán/Soceni (MÉHES 1907, DANIELOPOL et al. 2008), Soimi, Holod (OLTEANU 1971, 2011), Lopadea, Gârboviţa, Cunţa (KOVÁCS et al. 2016) in Transylvania, Romania.

Subfamily Cypridopsinae BRONSTEIN 1947
Genus Amplocypris ZALÁNYI 1944

Amplocypris abscissa (REUSS, 1850)
Plate II, fig. 5

1972 Amplocypris abscissa (REUSS) – SOKAČ, p. 36, pl. 11, figs 2–4, 6; pl. 13, figs 2–4, 5–6.
1973c. Amplocypris abscissa (REUSS) – KRSTIĆ, pp. 102–103, pl. 1 fig. 4; pl. 4, figs 3–4, pl. 8, fig. 1.
1983 Amplocypris abscissa (REUSS) – JIRIČEK, pl. 6, fig. 36.
1985 Amplocypris abscissa (REUSS) – JIRIČEK, p. 393, pl. 51, figs 13–15.
1989 Amplocypris abscissa (REUSS) – OLTEANU, pl. 1, fig. 16.
2011 Amplocypris abscissa (REUSS) – DANIELOPOL et al., text-figs 1 A–B, 2, 3, 7–10.
2011 Amplocypris aff. abscissa (REUSS) – OLTEANU, pl. 5, fig. 5; pl. 22, fig. 5.

Material: Danitzpuszta pit (22 valves)
Dimensions: $L = 726.027$–$1082.241 \mu m$, $H = 356.025$–$553.896 \mu m$, $L/H = 1.954$–$2.039$

Stratigraphic range and geographic distribution: lower Pannonian of the Pannonian Basin: Hodonín in the Czech Republic (JIRIČEK 1983, 1985); Sankt Margarethen, Hennersdorf in Austria (DANIELOPOL et al. 2011); Mt. Medvednica in Croatia (SOKAČ 1972); Belgrade in Serbia (KRSTIĆ 1973c); Sintești in Transylvania, Romania (OLTEANU 1989, 2011).

Amplocypris major KRSTIĆ, 1973
Plate II, fig. 6

1972 Amplocypris major KRSTIĆ – SOKAČ, p. 36, pl. 13, figs 1–3.
1973c. Amplocypris major – KRSTIĆ, pp. 100–102, figs 61–65; pl. 5, figs 1–2.
1985 Amplocypris major KRSTIĆ – OLTEANU, pl. 5, figs 6–8.
2011 Amplocypris major KRSTIĆ – OLTEANU, pl. 4, fig. 3.

Material: Danitzpuszta pit (5 valves)
Dimensions: $L = 964.906$–$1331 \mu m$, $H = 516.333$–$653 \mu m$, $L/H = 1.869$–$2.038$

Stratigraphic range and geographic distribution: Pannonian of the Pannonian Basin: Mt. Medvednica in Croatia (SOKAČ 1972); Belgrade in Serbia (KRSTIĆ 1973c, 1985); Soceni in Transylvania, Romania (OLTEANU 2011).

Amplocypris firmus KRSTIĆ, 1973
Plate II, fig. 7

1973c. Amplocypris firmus n. sp. – KRSTIĆ, pp. 103–104, pl. 1, fig. 1; pl. 3, fig. 2; pl. 10 figs 1–3.
1973c. Amplocypris cf. firmus KRSTIĆ – KRSTIĆ, pl. 8, fig. 4.
1985 Amplocypris firmus – KRSTIĆ, pl. 6, fig. 4.
2013 Amplocypris ex. gr. firmus KRSTIĆ – TER BORGH et al., fig. 7/1.
2016 Amplocypris firmus KRSTIĆ – KOVÁCS et al., pl. 1, figs 15–19.
Material: Danitzpuszta trench (7 valves)

Dimensions: L = 825–1082.267 µm H = 375–540.935 µm, L/H = 2.001–2.2

Stratigraphic range and geographic distribution: lower Pannonian of the Pannonian Basin system: Velika Moštanica, Sibovik 7/2, Beočin, Đurinci in Serbia (KRSTIĆ 1973c; TER BORGH et al. 2013); Gârboviţa, Cunţa in Transylvania, Romania (KOVÁCS et al. 2016).

Amplocypris recta (REUSS, 1850)
Plate II, fig. 8

1850 Cytherina recta n. sp. – REUSS, p. 52, pl. 8, fig. 11.
1972 Amplocypris recta (REUSS) – SOKAČ, p. 35, pl. 11, figs 5, 7–8.
1973c. Amplocypris recta (RSS.) – KRSTIĆ, p. 113, pl. 3, fig. 1; pl. 16, figs 6–7.
1973c. Amplocypris ex. gr. recta (RSS.) – KRSTIĆ, p. 113, pl. 16 figs 4–5.
1982 Amplocypris recta REUSS – SZÉLES, p. 246, pl. 7, figs 4–5.
1982 Amplocypris aff. recta REUSS – SZÉLES, pp. 246–247, pl. 7, fig. 6; pl. 7, figs 1, 3.
1983 Amplocypris recta (REUSS) – JÍŘIČEK, pl. 6, fig. 35.
1985 Amplocypris aff. recta (REUSS) – JÍŘIČEK, p. 392, pl. 51, figs 10–12.

1985 Amplocypris recta (REUSS) – KRSTIĆ, pl. 15, fig. 1.
1998 Amplocypris recta (REUSS) – KOVAČ et al., pl. 4, fig. 9.
1998 Amplocypris recta (REUSS) – PIPÍK & HOLEC, pl. 1, figs 1–2.
2004 Amplocypris recta (REUSS) – PIPÍK et al., pl. 1, fig. 14.
2011 Amplocypris recta – DANIELOLPO et al., fig. 4.
2011 Amplocypris recta (REUSS) – OLTÉANU, pl. 22, fig. 7.

Materials: Danitzpuszta trench (3 valves); Danitzpuszta trench (34 valves)

Diemensions: L= 631,410 – 1717,526 µm, H= 331,675 – 867,911 µm, L/H= 1,904 –1,979

Stratigraphic range and geographic distribution: Pannonian of the Pannonian Basin system: Moosbrunn (REUSS 1850) and Sankt Margarethen (DANIELPOL et al. 2011) in Austria; Studienka (PIPIK et al. 2004), Borsky Svätý Jur (PIPIK & HOLEC 1998), and boreholes in the Vienna Basin (KOVÁČ et al. 1998) in Slovakia; Hodonin in the Czech Republic (JÍŘIČEK 1983, 1985); Tengelic in Hungary (SZÉLES 1982); Mt. Medvednica in Croatia (SOKAČ 1972); Đurinci in Serbia (KRSTIĆ 1973c, 1985); Șoimi in Transylvania, Romania (OLTÉANU 2011).