



UDC [567.5:551.782.13](478.9)

LATE MIOCENE BONY FISHES FROM POCȘEȘTI (REPUBLIC OF MOLDOVA)

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Isolated pharyngeal and jaw teeth of bony fishes, as well as numerous bones of other vertebrates dated by Late Miocene (middle late Sarmatian s.l. = early Tortonian, 9.8 Ma), were found in the alluvial sediments of Pocșești site (Republic of Moldova). Six fish taxa were identified and described in the paper; the majority of them (4 species) are representatives of Cyprinidae family. Taxonomic list also includes sturgeons (Acipenseridae gen. et sp. indet.) and pikes (*Esox* sp.). Mixed character of fauna, joint presence of freshwater and marine species suggests that the burial of remnants took place in close proximity to large marine basin in river avandelta. Fish assemblage of Pocșești shows an affinity to other early Tortonian localities in Europe and reflects paleobiogeographic changes on the territory of Paratethys during the Late Miocene.

Keywords: bony fishes, Late Miocene, Sarmatian s.l., MN 10, Pocșești, Eastern Europe.

INTRODUCTION

European bony fish fauna began to be formed in the second half of the Paleogene. This process was continued in the Neogene, accompanied by a large-scale restructuring of ecosystems on the background of significant climatic changes. Numerous remnants of freshwater and marine bony fishes from the Late Miocene of Eastern Europe need careful handling and detailed study.

Pocșești (Pokshesht) site was discovered by G.M. Bilinskis in 1975 [11] and is dated to Balta suite. It is located near eponymous village on the border of Orgeevskiy and Strashenskiy districts in the Republic of Moldova (Fig. 1). Fossil bones are concentrated on the right side of Ikel River valley at the attitude of 195–200 m. According to palaeomagnetic analysis, provided by I.A. Pevzner with colleagues [18], fossiliferous horizon of Pocșești has right magnetization and dated to the 9th epoch of magnetic polarity (between 10 and 9 Ma).



Fig. 1. Location map of the late Miocene Pocșești locality

Рис. 1. Розташування пізньоміоценового місцезнаходження Покшешти

The following vertebrates are known from the Pocșești site: **mammals** (Lagomorpha: *Procochotona* cf. *kalfense* Lungu, 1981, *Alilepus* sp.; Rodentia: *Neocricetodon* (*Kowalskia*) sp., *Collimys* sp.; Sirenia: Dugongidae (cf. *Metaxytherium*), Dugongidae indet.; Cetacea: Physeteroidea indet., Delphinidae indet.; Carnivora: *Parataxidea* sp., *Protictitherium* sp., *Metailurus* cf. *parvulus* (Hensel, 1862), *Machairodus* cf. *giganteus* Wagner, 1848; Proboscidea: *Tetralophodon longirostris* Kaup, 1835; Perissodactyla: *Hipparion* aff. *verae* Gabunia, 1959, *Hipparion* aff. *giganteum* Gromova, 1952, *Chilotherium* (*Acerorhinus*) cf. *zernovi* Borissiak, 1914, *Chilotherium* (*Chilotherium*) aff. *sarmaticum* Korotkevich, 1958; Artiodactyla: *Achtiaria* aff. *moldavicus* Godina, 1975, *Miotragocerus leskevitschi* (Borissiak, 1914), *Gazella* (*Miogazella*) *schlosseri* Pavlow, 1913, *Gazella* cf. *deperdita* Gaudry, 1873, **birds** (*Struthio* sp.), **reptiles** (*Protestudo* sp.) and **amphibians** (*Hyla* sp., *Bombina* sp.) [6, 11–14].

Here we describe fossil bony fish bones from the middle late Sarmatian strata of Pocșești site.

ABBREVIATIONS USED IN TEXT: IZ – Institute of Zoology of the Academy of Sciences of the Republic of Moldova; Poc – locality Pocșești.

MATERIAL AND METHODS

The present article is based on the study of 12 fish bones, 8 of which are determinable to species or at least to genus level. The investigated material was collected by A.N. Lungu in 1980s and also V.A. Marareskul and T.F. Obada during the 2011–2013.

Collection of fossil fishes from Pocșești was obtained by the screen-washing (mesh diameter = 1.0 mm) of the bonyferous rock from the 6th layer and recently is housed in the IZ. This material contains by the following specimens: 1 – pharyngeal tooth *Leuciscus* sp. (IZ Poc/01); 2 – pharyngeal tooth *Rutilus frisii* (IZ Poc/02); 3 – pharyngeal tooth *Scardinius* sp. (IZ Poc/03); 4 – pharyngeal tooth *Tinca* sp. (IZ Poc/04); 5 – jaw tooth, 2 vertebrae *Esox* sp. (IZ Poc/05–07); 8–10 – 3 vertebrae (IZ Poc/8–10); 11 – fragment of dermalia Acipenseridae (IZ Poc/11); 12 – fragment of dermalia (IZ Poc/12).

A direct determination of fossil remnants was provided by authors using diagnostic features. For comparative purposes bones from the osteological collections of the National Museum of Natural History NAS of Ukraine were used. Ichthyologic systematics in this paper follows Yu.V. Movchan [15].

Current correlation of the Paratethys stages with European Mammal Neogene Zones was essentially taken from V.A. Nesin and A. Nadachowski [16]. Measurements were taken with digital caliper, with accuracy to 0.1 mm. Fossil remnants were photographed

using the research microscope Leica M168C. Pharyngeal tooth terminology, used in the article, follows E. Rutte [21], E.K. Sytchevskaya [24] and J. Lepiksaar [9] (Fig. 2).

GEOLOGICAL SETTING

The following layers were identified by A.N. Lungu in 1979 [11] in the geological section of Poçşeşti:

- 1) Top soil, 0.2–0.3 m;
- 2) Brown loam, 0.2–0.4 m;
- 3) Lumpy non-laminated greenish-gray clay with nodules of carbonates and charred plant remnants, 1.8 m;
- 4) Sandy gray clay with calcareous concretions, gradually moving up in dark green lumpy clay with bones of terrestrial vertebrates, 0.5 m;
- 5) Lumpy non-laminated gray clay with charred plant remnants and fragments of vertebrate bones, 0.5–1.0 m;
- 6) Sandy gray clay, contain with clay nodules and bones of terrestrial vertebrates, 1.0–2.5 m;
- 7) Fine clay, slightly cross-bedded sand with gravel lenses, 0.5–2.5 m;
- 8) Sandy shaly gray clay with rusty spots, 1.5–2.0 m.

Khersonian deposits on the Moldavian plate are composed by clastic sediments [20]. On the described territory only lower horizon is clearly identified and represented by marine greenish-gray clays interbedded with siltstone and fine-grained quartz sand.

Upper horizon is composed by alluvial sediments and is not separated from younger lithologically similar Balta suite formations. Balta sandy-clay deposits are widespread within the central and southern part of the Dniester–Prut interfluvium and between Dniester – Southern Bug. Formation time of these sediments is associated with the end of the middle Sarmatian to Pontian. They are represented by lake-marsh, river, and deltaic facies. Their stratigraphic division is not clear [8].

SYSTEMATIC PALEONTOLOGY

ACIPENSERIFORMES Berg, 1940

Family ACIPENSERIDAE Bonaparte, 1831

Acipenseridae gen. et sp. indet.

Referred specimen: fragment of dermalia (IZ Poc/11).

Description: Small dermal fragment (l = 8 mm) is preserved. There are small rounded recesses with smooth edges on the bone surface. Dense bone is laminar and so broken.

CYPRINIFORMES Goodrich, 1909

Family CYPRINIDAE Fleming, 1822

Leuciscus Cuvier, 1816

Leuciscus sp.

Referred specimen: pharyngeal tooth (IZ Poc/01) (Fig. 3, 1).

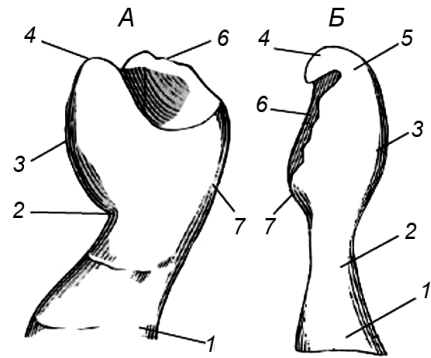


Fig. 2. Morphology of the pharyngeal teeth of carp fishes [24]: 1 – pedicle; 2 – tooth neck; 3 – tooth back; 4 – hook; 5 – hook base; 6 – grinding surface; 7 – tooth belly

Рис. 2. Морфологія глоткових зубів корошових риб [24]: 1 – ніжка; 2 – шийка зуба; 3 – спинка зуба; 4 – гачок; 5 – основа гачка; 6 – жувальна поверхня; 7 – черевце

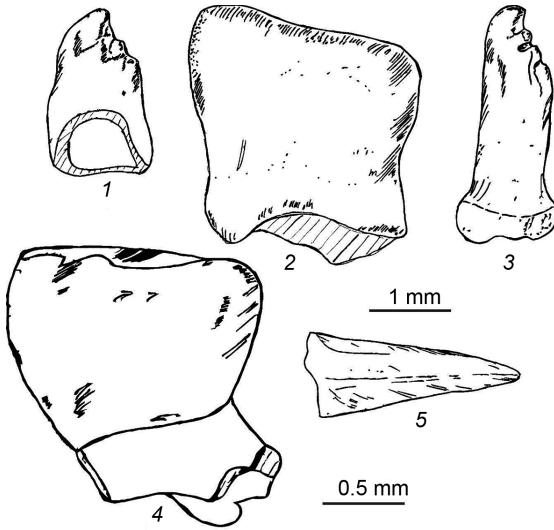


Fig. 3. Fossil bony fish bones from the Pocșești site in Moldova: 1 – *Leuciscus* sp. (IZ Poc/01); 2 – *Rutilus frisii* (IZ Poc/02); 3 – *Scardinius* sp. (IZ Poc/03); 4 – *Tinca* sp. (IZ Poc/04); 5 – *Esox* sp. (IZ Poc/05)

Рис. 3. Кістки викопних костистих риб із місцезнаходження Покшешти у Молдові: 1 – *Leuciscus* sp. (IZ Poc/01); 2 – *Rutilus frisii* (IZ Poc/02); 3 – *Scardinius* sp. (IZ Poc/03); 4 – *Tinca* sp. (IZ Poc/04); 5 – *Esox* sp. (IZ Poc/05)

Description: Pharyngeal tooth is slender, with relatively low rounded crown, broken at the base. Tooth back is straight, top of the tooth is elongated in the blunt robust hook. Its edge is targeted forward and upward. Grinding surface has two small jags. Tooth belly is slightly convex. Height of the crown is 2.3, width is 1.4 mm. Tooth belongs to small (juvenile?) specimen.

Rutilus Rafinesque, 1820

Rutilus frisii (Nordmann, 1840)

Referred specimen: pharyngeal tooth (IZ Poc/02) (Fig. 3, 2).

Description: Tooth is rough, with fungiform, laterally compressed crown. Tooth back is convex and arcuate, top without hook. Grinding surface is narrow, slightly convex, with weekly marked longitudinal furrow and has traces of intravital obliteration. Tooth belly is convex and hangs over the neck. Pedicle is partly broken, oval in the cross-section. Crown is coarcted to neck and a little larger than its width. Height of the tooth is 3.2, width of the crown is 3.1 mm.

Scardinius Bonaparte, 1837

***Scardinius* sp.**

Referred specimen: pharyngeal tooth (IZ Poc/03) (Fig. 3, 3).

Description: Small pharyngeal tooth on the long pedicle has high laterally slender cylindrical crown with broad base. Tooth back is straight, with robust hook at the top. Grinding surface is narrow with a higher edge that has 3 robust pointed jags and a lower edge without jags. Tooth belly is rounded and compressed, without keel. Height of the tooth is 3.2, width of the crown is 1.5 mm.

Tinca Cuvier, 1816

***Tinca* sp.**

Referred specimen: pharyngeal tooth (IZ Poc/04) (Fig. 3, 4).

Description: Flattened pharyngeal tooth has low crown. Pedicle is rounded and slightly deflexed. Neck is expressed well, tooth back is convex and arcuate. Tooth belly is also slightly convex. Grinding surface is narrow, laterally compressed, having a deep

longitudinal wrinkle with slightly convex roller edges. Wrinkle on the lower edge of the grinding surface is jagged by transverse corrugations and forms a fin scroll on the posterior surface of the crown. Height of the tooth is 5.6, width of the crown is 5.8 mm.

ESOCIFORMES Bleeker, 1858

Family ESOCIDAE Cuvier, 1816

Esox Linnaeus, 1758

***Esox* sp.**

Referred specimen: jaw tooth, 2 vertebrae (IZ Poc/05-07) (Fig. 3, 5).

Description: The long, slender, pointed tooth has two sharp edges. Its conical crown with slightly worn apex is partly broken. Cross-section is interiorly smooth and exteriorly convex. Height of the tooth is 5.5 mm, width of the crown is 2.1 mm. The attribution of vertebrae to pike was based on morphological similarities and remains more unclear.

DISCUSSION

All the above-mentioned bony fish species from Pocșești were identified based on single disarticulated specimens. Nevertheless, it is possible to provide a view on composition fish community in the late Sarmatian of that area. It includes reophiles (*Leuciscus*, *Rutilus*) and limnophiles (*Scardinius*, *Tinca*, *Esox*). Fishes from Pocșești are presented by four different trophic groups (herbivorous, malacophagous, piscivorous and omnivorous).

The majority of identified fish taxa (4 species) are representatives of the family Cyprinidae. Other families (Acipenseridae, Esocidae) are presented by single species. It must be noted that all identified genera are still available in the recent Dniester River delta fish community [4, 23].

Fish fauna from Pocșești is mixed – freshwater and marine species are presented together. It suggests that the burial of remnants took place in close proximity to large marine basin in the river avandelta [17]. Described fish assemblage shows affinity to other late Sarmatian (early Tortonian) localities in Europe on faunistic composition and taxonomic diversity. It is the most similar to Mikhailovka on Bug 1 and 2 in Ukraine (all species are common, except Acipenseridae). Bony fish complex from Poccoeti can be also compared with Sandberg near Gözendorf in Austria (remnants of *Leuciscus*, *Rutilus*, *Scardinius* and *Tinca* are common for both localities) [1, 5, 7], Schernham b. Haag (*Rutilus*, *Scardinius*, *Tinca*) [3], Hammerschmiede 1 and 3 (*Leuciscus* and *Esox*) [2], Höwenegg in Germany (*Rutilus* and *Tinca*) [26] and Borský Svätý Jur in Slovakia (*Scardinius* and *Tinca*) [3]. Other late Sarmatian localities (Csákvár in Hungary [3], Kocgasi ASK and Sofca in Turkey [3, 22], Baghmisheh-Marzdaran, Tabriz-Basin in Iran [19], München-Aufmeister (Isarufer) in Germany [26] and Richardhof-Golfplatz in Austria [7]) are less similar to the fish community of Pocșești.

Taxonomic composition of terrestrial oriktokomplex from Pocșești indicates its archaic appearance and brings it with hipparion fauna from Varnitsa, as well as hipparion assemblages from Eldar in Transcaucasia, Berislav and Grebeniki in Ukraine [10]. Terrestrial fauna of Pocșești occupies an intermediate position between the earliest and late hipparion faunas on the Northern Black Sea Coast and stands as an independent faunal complex [12]. Most of its representatives inhabited savanna landscapes of the steppe type, as well as wetlands, forested floodplains and riparian forests [10, 12]. This community suggests be related to the first half of the late Sarmatian s.l. (9.8 Ma, MN10).

CONCLUSIONS

1. Six bony fish taxa of 6 genera, 3 families (Acipenseridae, Cyprinidae, Esocidae) and 3 orders (Acipenseriformes, Cypriniformes, Esociformes), dated to the late Sarmatian s.l., were identified in the alluvial sediments of Pocșești site (Republic of Moldova, Eastern Europe).
2. Mixed character of fauna, joint presence of freshwater and marine species, suggests that the burial of remnants took place in close proximity of large marine basin in the river avandelta.
3. Bony fish assemblage of Pocșești is more or less similar to other late Sarmatian (early Tortonian) localities within the territory of Paratethys on faunistic composition and taxonomic diversity.
4. Described community can be dated by the first half of the late Sarmatian s.l. (= early Khersonian, early Tortonian, 9.8 Ma, MN10).

We sincerely thank to Dr. Stanislav Čermak (Prague, Czech Republic) who corrected our English, and Oleksandr Holovko (Kyiv, Ukraine) for his help in the technical preparation of the manuscript.

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ПІЗНЬОМІОЦЕНОВІ КОСТИСТІ РИБИ

3 МІСЦЕЗНАХОДЖЕННЯ ПОКШЕШТИ (РЕСПУБЛІКА МОЛДОВА)

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Ізольовані глоткові та щелепні зуби костистих риб, а також численні кістки інших хребетних тварин, датовані пізнім міоценом (серединою пізнього сармату = раннім

тортоном, 9,8 млн р.т.), були знайдені в алювіальних відкладах місцезнаходження Покшешти (Республіка Молдова). Установлено наявність решток шести таксонів риб, які описані у статті; більшість із них (4 види) є представниками родини Cyprinidae. Таксономічний список включає також осетрових (Acipenseridae gen. et sp. indet.) і щукоподібних (*Esox* sp.). Змішаний характер фауни, сумісне знаходження прісноводних і морських видів дає змогу висловити припущення, що захоронення решток відбувалось у безпосередній близькості від крупного морського басейну в річковій авандельті. Угрупування риб із Покшешт виявляє подібність до інших місцезнаходжень раннього тортону Європи і є відображенням палеобіогеографічних змін на території Паратетису протягом пізнього міоцену.

Ключові слова: костисті риби, пізній міоцен, сармат, MN 10, Покшешти, Східна Європа.

ПОЗДНЕМИОЦЕНОВЫЕ КОСТИСТЫЕ РЫБЫ ИЗ МЕСТОНАХОЖДЕНИЯ ПОКШЕШТЫ (РЕСПУБЛИКА МОЛДОВА)

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Изолированные глоточные и челюстные зубы костистых рыб, а также многочисленные кости других позвоночных, датированные поздним миоценом (серединой позднего сармата = ранним тортоном, 9,8 млн л.н.), были обнаружены в алювиальных отложениях местонахождения Покшешты (Республика Молдова). Установлено наличие остатков шести таксонов рыб, которые описаны в статье; большинство из них (4 вида) являются представителями семейства Cyprinidae. Таксономический список включает также осетровых (Acipenseridae gen. et sp. indet.) и щукообразных (*Esox* sp.). Смешанный характер фауны, совместное наличие пресноводных и морских видов позволяют предположить, что захоронение остатков происходило в непосредственной близости от крупного морского бассейна в речной авандельте. Сообщество рыб из Покшешт проявляет сходство с другими местонахождениями раннего тортона Европы и является отражением палеобіогеографических изменений на территории Паратетиса на протяжении позднего миоцена.

Ключевые слова: костистые рыбы, поздний миоцен, сармат, MN 10, Покшешты, Восточная Европа.

Одержано: 09.02.2014