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FOSSIL FISH FAUNA (TELEOSTEI, SELACHII) FROM THE DYNÓW MARLSTONE (RUPELIAN, NP 23) OF THE MENILITIC FORMATION AT THE LOCALITY OF LITENČICE (CZECH REPUBLIC)

FOSILNÍ RYBÍ FAUNA (TELEOSTEI, SELACHII) Z DYNÓWSKÝCH SLÍNOVCŮ MENILITOVÉHO SOUVRSTVÍ (RUPEL, NP 23) NA LOKALITĚ LITENČICE (ČESKÁ REPUBLIKA)

RŮŽENA GREGOROVÁ

Abstract

Gregorová, R. (2011): Fossil fish fauna (Teleostei, Selachii) from the Dynów marlstone (Rupelian, NP 23) of the Menilitic Formation at the locality of Litenčice (Czech Republic). – Acta Mus. Moraviae, Sci. geol., 96, 2, 3–33. With Czech summary.

Fosilní rybí fauna (Teleostei, Selachii) z dynówských slínovců menilitového souvrství (rupel, NP 23) na lokalitě Litenčice (Česká republika)

A complete faunal list of the fish fauna (Selachii, Teleostei) from the Dynów marsltone (NP23) of the Menilitic Formation at the locality of Litenčice is presented. The records consist of representatives of four shark families: Cetorhinidae (*Cetorhinus parvus* LERICHE, 1910), Odontaspidae (? *Carcharias* sp.), Squalidae (*Squalus* cf. *alsaticus* (ANDREAE, 1892)) and Alopiidae (*Alopias exigua* (PROBST, 1879)). The teleosts are represented by the families Clupeidae (*Clupea sardinites* (HECKEL, 1850)), Osmeridae (*Glossanodon musceli* (PAUCĂ, 1929)), Gonostomatidae (*Scopeloides glarisianus* (AGASSIZ, 1844)), Photichthyidae (*Vinciguerria obscura* (DANILTSHENKO, 1946)), Myctophidae (*Oligophus moravicus* (PAUCĂ, 1931)), Trichiuridae (*Anenchelum glarisianum* BLAINVILLE, 1818), Euzaphlegidae (*Palimphyes* sp.), Zeidae (*Zenopsis clarus* DANILTSHENKO, 1960), Trachichthyidae (*Gephyroberyx* cf. *darvinii* (JOHNSON, 1866)), Scopthalmidae (*Scopthalmus stamatini* (PAUCĂ, 1931)), Triglidae gen. indet., and Scombridae (*Scomber* sp.). Bird, turtle and heteropteran remains were also recorded in the assemblage (MS. in preparation). Palaeo-ecological analysis reveals a preponderance of mesopelagic and benthopelagic representatives. *Scopeloides glarisianus* (24%), *Oligophus moravicus* (21%), *Anenchelum glarisianum* (18%), *Vinciguerria obscura* (15%), *Glossanodon musceli* (15%) are statistically the most frequent taxa. Among the localities of the province of Moravia, the Litenčice assemblage constitutes the most diversified fauna.

Key words: Litenčice, Moravia, Menilitic Formation, Dynów marlstone, Teleostei, Selachii, Oligocene (Rupelian), *Scopthlamus*, *Gephyroberyx*, *Zenopsis*, *Palimphyes*.

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Introduction

The Litenčice fossil site (Rupelian stage of the Oligocene), 42 km east of the city of Brno, is located at the boundary of the Carpathian flysh zone and the Carpathian foredeep zone. Together with the localities of Nikolčice, Křepice, Mouchnice, Kelč, and Špičky, it is famous for its rich and well-preserved marine fish fauna. More than 20 years of field work at Litenčice have resulted in the largest collection of fish fauna from the Menilitic for-

mation; it is deposited in the Department of Geology and Palaeontology of the Moravian Museum in Brno.

The fish fauna from the Litenčice locality was first referenced by GREGOROVÁ (1986, 1987a, b). The importance of the Litenčice locality arises out of the presence of a relatively complete vertical profile of the entire Menilitic formation: Subchert beds, Chert beds, Dynów marlstone and Šitborice beds. This locality has yielded an abundant fish fauna from all parts of the formation, which differs not just in its sedimentary characteristics, but also in assemblage composition, and thus reflects palaeoecological changes in the Paratethys basin over a period of about 10 million years. This paper presents a complete faunal description of the fish fauna from the most fossiliferous part of the Menilitic formation, the Dynów marlstone, as the first results of the research project.

Representatives of the families Gonostomatidae, Photichthyidae, Myctophidae and Trichiuridae have been published by GREGOROVÁ (1989, 1997a, 2000, 2004, 2010), but a complete faunal description including the families Clupeidae, Argentinidae, Euzaphlegidae, Zeidae, Trachychthyidae, Triglidae, and Scombridae has not been published before this one.

GREGOROVÁ (1988) provides a geological description of the locality; JURAŠOVÁ and BUBÍK (1989) detail its biostratigraphical position.

General geological information concerning the Menilitic formation may be found in KRHOVSKÝ *et al.* (2001), BUBÍK *et al.* (2006), ŠVÁBENICKÁ *et al.* (2007).

The fish fauna described herein comes from the most fossiliferous part of the Dynów marlstone, e.g., from a *ca*. 100-cm-thick horizon just above the Chert beds (see GREGOROVÁ 1988).

Measurements and abbreviations

All measurements are straight-line projections between two reference points. Morphometric characters are given as percentages of the fish's standard length (SL).

A	anal fin
BD	total body depth
C	caudal fin
Cpd	caudal peduncle depth
D	dorsal fin
DA	distance between the insertion of the first and the last anal rays
DB	distance between the insertion of the first and the last dorsal rays
DO	maximum diameter of the orbit
DP-A	distance between the origins of pelvic and anal fins
HD	head depth
HL	head length
P	pectoral fin
PA	pre-anal distance
PD	predorsal distance
PDO	pre-orbital distance
PSDO	postorbital distance
PSL	pelvic spine length
PU1	preural vertebrae
PU2	second preural vertebra
PU3	third preural vertebra
PV	preventral distance
SL	standard length
TL	total length
V	pelvic fin

Terminology of photophores

AC	ventral series posterior to anal fin origin
IP	ventral series anterior to pectoral fin base
IV	ventral series anterior to pelvic fin base
PV	ventral series between bases of pectoral and pelvic fins
VAV	ventral series between pelvic fin base and origin of anal fin

Systematics

Class Chondrichthyes HUXLEY, 1880
Order Lamniformes BERG, 1958
Family Cetorhinidae GILL, 1862
Genus *Cetorhinus* BLAINVILLE, 1816
Cetorhinus parvus LERICHE, 1910

Pl. 1, figs. 1, 2, text fig. 1.

1910. *Cetorhinus parvus* LERICHE, 1908, p. 294, text figs. 91–94.
1974. *Cetorhinus parvus* LERICHE, 1908, KALABIS & SCHULTZ, p. 185–186, pl. 1, fig. 1.
1982. *Cetorhinus parvus* LERICHE, 1908, SCHULTZ, p. 51–52, pl. 1, fig. 1.
2003. *Cetorhinus parvus* LERICHE, 1908, GREGOROVÁ & POŽÁR, p. 194, text fig. 2.

The synonymy is based exclusively upon occurrence in the Moravian region.

Material: Isolated branchiospines (gill-rakers), isolated vertebrae (Ge 29560, Ge 29 502).

Comment

Isolated branchiospines occur frequently in the whole cross-section of the Dynów marlstone. Most records consist of only one or two branchiospines and only rarely are there more.

Description

Branchiospines or gill-rakers are laterally flattened, with a broad, proximal, hatched-shaped extremity, and a long, slender distal rod. The length of these elements does not exceed 30 mm. It is evident that they belonged to juvenile individuals (see below). The branchiospines consist of hair-like modified dermal denticles. In the natural position they are attached to the internal gill slits.

Fossil shark centra are often diagnostic at the generic level (KOZUCH & FITZGERALD, 1989). Those of *Cetorhinus* were first described by GOTTFRIED (1995) and recently by HOVESTADT *et al.* (2010). In the Moravian materials, the centra are slightly oval; their diameters average 12×11 mm. The vertebral centra are amphicoelous with an oval perforation in the middle that probably indicates an uncalcified or weakly calcified zone (GOTTFRIED 1995). There are no growth rings and because the vertebrae are small it is evident that they come from a young individual. This is also appropriate to the small size of the branchiospines. Interestingly, small gill rakers of *Cetorhinus* were found next to the centra Ge 29502, which could mean that both are derived from the same individual.

Ecology of related extant forms: The extant pelagic oceanodromous basking shark *Cetorhinus maximus* is known to occur at depths of between 150 and 2000 m in the temperate waters of all the world's oceans (FROESE & PAULY 2011).

Genus ? *Carcharias* RAFINESQUE, 1810
? *Carcharias* sp.

Pl. 2, fig. 3.

Material: 12 disarticulated vertebrae (Ge 29 776).

Description

Isolated and disarticulated round vertebrae, 22 mm in diameter, possessing seven to nine growth rings, show that the specimen was at least five to eight years old when it died. It is therefore certain that the specimen is not such a big shark as, for instance, *Cetorhinus parvus* because at that age this species would have been much larger. According Dr. DIRK HOVESTADT (pers. comm.) the vertebrae may belong to the genus *Carcharias*; those described from the Frauenweiler (Germany) and Froidfontaine (France) localities are of the same age (PHARISAT, 1991).

Ecology of related extant forms: The recent species Carcharias taurus is reef-associated and oceanodromous. It has a depth range of 1–191 m, usually 15–25 m, and occurs in the tropical and subtropical Atlantic and Indo-West Pacific oceans (FROESE & PAULY 2011).

Family Squalidae BONAPARTE, 1834
Genus *Squalus* LINNAEUS, 1758
Squalus cf. *alsaticus* (ANDREAE, 1892)

Pl. 2, fig. 1; Text fig. 1.

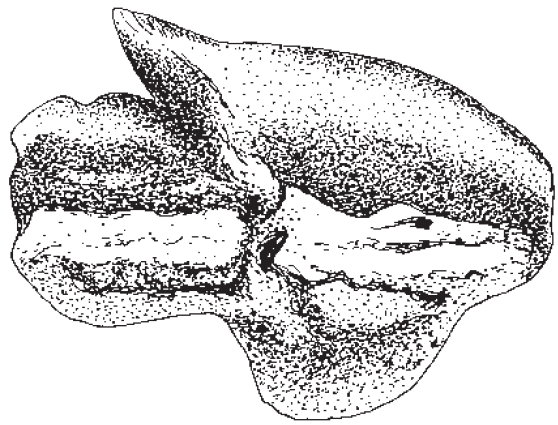

Fig. 1. *Squalus* cf. *alsaticus* (ANDREAE, 1892), length of tooth 4 mm, Ge 29 965.

1892. *Acanthias alsaticus* ANDREAE, p. 108, figs. 2a,b.
1928. *Squalus alsaticus* (ANDREAE), WEILER, p. 13, pl. 2, fig. 10.

1963. *Squalus alsaticus* (Andreae), Weiler, p. 12, text-figs. 19-20.
1970. *Squalus alsaticus* (Andreae), Brzobohatý & Kalabis, p. 42, pl. 1, figs. 1a, b.

Material: Two isolated teeth (Ge 29 965, Ge 29 966).

Description

The teeth are exposed in labial view, compressed labio-lingually. The cusp is broad, triangular and bent towards the rear. The crown possesses a medio-labial apron with parallel edges. The distal hill is short and of convex outline. The mesial cutting edge is smooth. The root is compressed.

Ecology of related extant forms: The recent dogfish (*Squalus acanthias*) is benthopelagic and oceanodromous but also brackish, with a depth range of 0–1 460 m, usually 200 m. It occurs in temperate regions (Froese & Pauly 2011).

Family Alopiidae Bonaparte, 1838
Genus *Alopias* Rafinesque, 1810
Alopias exigua (Probst, 1879)

Pl. 2, fig. 2; Text fig. 2.

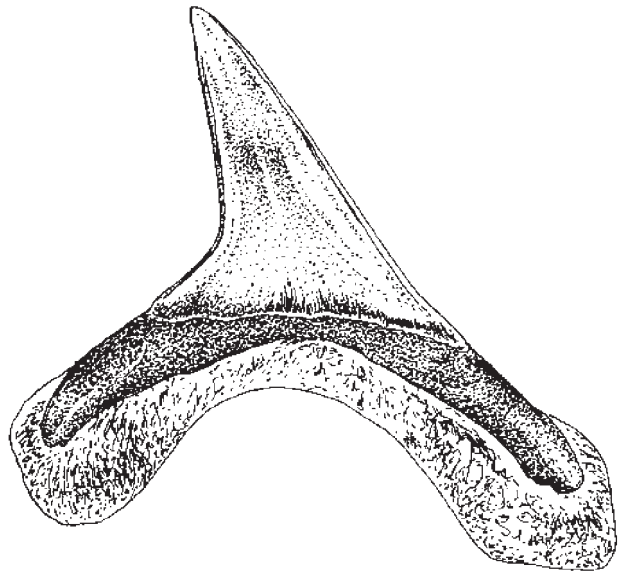

Fig. 2. *Alopias exigua* (Probst, 1879), length of crown 4 mm, Ge 29 592.

1879. *Oxyrhina exigua* Probst, p. 135, pl. 2, figs. 20–25.
1971. *Alopias exigua* (Probst, 1879), Brzobohatý & Schultz, p. 731.
1982. *Alopias exigua* (Probst, 1879), Schultz, p. 52, pl. 1, fig. 3.

Material: Two isolated teeth (Ge 29591, Ge 29 592) of lateral file.

Description

The lateral teeth have a long and slender cusp in labial view, bent towards the rear and overhanging the labial region of the root. The root possesses well-developed branches, transversely elongated.

Ecology of related extant forms: This is a thresher shark, a type with one genus and more than three species. One species, the cosmopolitan big-eye thresher *Alopias exigua*, is known to a depth of at least 500 m in temperate and tropical regions (Froese & Pauly 2011).

Order Clupeiformes Bleeker, 1859
Family Clupeidae Bonaparte, 1831
Genus *Clupea* Linnaeus, 1758
Clupea sardinites (Heckel, 1850)

1850. *Meletta sardinites* Heckel, 1850, p. 231, pl. 25.
1958. *Clupea sardinites* (Heckel, 1850), Jonet: 37, pl. 3, figs. 4, 5, 10.
1968. *Clupea sardinites* (Heckel, 1850), Jerzmanska, p. 90, figs. 2a,b.
1978. *Clupea sardinites* (Heckel, 1850), Szymczyk, p. 395, text-figs. 4, 5, pl. 85, figs. 1–3, 5, 6.
1991. *Clupea sardinites* (Heckel, 1850), Pharisat, 27, figs. 13–15.
2003. *Clupea sardinites* (Heckel, 1850), Gregorová & Požár, p. 191, fig. 3, photo 3.

Material: Two disarticulated specimens with isolated scales (Ge 29 498, Ge 29 503).

Comment

Clupeid remains consist largely of scales and disarticulated bones. Investigation based on the scales Szymnzcyk (1978) appears to indicate that the only representative of the family Clupeidae in the lower part of the Menilitic formation is *Clupea sardinites* (Heckel, 1850).

Ecology of related extant forms: The recent species *Clupea harengus* is oceanodromous, benthopelagic, marine and brackish. It occurs at a depth range of 0–364 m in the temperate regions of the North Atlantic (Froese & Pauly 2011).

Order Osmeriformes (sensu Nolf et Dockery, 1990)
Family Argentinidae Bonaparte, 1846
Genus *Glossanodon* Guichenot, 1867
Glossanodon musceli (Paucă, 1929)

Pl. 3, fig. 1.

1929. *Nemachilus musceli* Paucă, p. 114.
1933. *Nemachilus musceli* Paucă, 1929, Paucă, p. 30, pl. 2, figs. 1–2.
1958. *Nemachilus musceli* Paucă, 1929, Jonet, p. 44-46, pl. 5, fig. 7.
1967. *Glossanodon musceli* (Paucă, 1929), Jerzmanska, p. 195-211, pl. 1, figs. 1–2, text fig. 2, 4, 6–7, 9–10.
1974. *Glossanodon musceli* (Paucă, 1929), Kalabis & Schultz, p. 187, pl. 1, fig. 2.
1975. *Glossanodon musceli* (Paucă, 1929), Kalabis, p. 2, fig. 3.
2003. *Glossanodon musceli* (Paucă, 1929), Gregorová & Požár, p. 38, pl. 10, figs. 1, 2.

Material: 58 specimens (coll. 5/86, 6/2001, Ge 29967).

Diagnostic characters and osteological analysis: *vide* Jerzmanska (1967).
Vert. 50 (27+23), D10, A 16–17, V7.

Description

Table 1. Morphometric characters (in mm) of *Glossanodon musceli* (Paucă, 1929) of Ge 29 967 in % of SL.

SL 54	HL 14	BD 7	PD 27	PA 39	PV 27	DO 2.5
% SL	25.9	13	50	72.2	50	4.6

A small fish with an elongated body, a convex head profile, and a small terminal mouth ending in front of the orbit. A single dorsal fin with soft rays is situated at the midpoint of the body, while ventral fin HL is almost two times longer than HD.

The vertebral centra are quadrangular; the neural spines are long, well developed and bifurcated in the abdominal part, single in the caudal part. The pleural ribs are long, reaching the ventral profile of the body.

The anal fin is situated at almost two-thirds length of the body (measured without caudal fin). The pectoral fin is placed low, on the ventrolateral contours of the body. The lower jaw articulates with the skull under the the orbit, between the anterior third to and the middle of it.

Ecology of related extant forms: Recent adult Argentinidae are commonly taken at the margins of the continental shelves. Some species apparently reach depths of nearly 1 000 m, but they most usually occur in more shallow water (Froese & Pauly 2011).

Order Stomiiformes (sensu Harold & Weitzman, 1996)
Family Gonostomatidae Gill, 1893
Genus *Scopeloides* Wettstein, 1886
Scopeloides glarisianus (Agassiz, 1844)

Pl. 3, fig. 2.

1844. *Osmerus glarisianus* Agassiz, Agassiz, p. 109, pl. 12, figs. 3, 4.
1886. *Scopeloides glaronensis* (Agassiz), Wettstein, p. 55–57, pl. 2, figs. 7–13.
1948. *Scopeloides glarisianus* (Agassiz), Kalabis, p. 136–139, pl. 1, fig.1.
1960. *Scopeloides glarisianus* (Agassiz), Daniltshenko, p. 27–28, pl. 2, fig. 1.
1967. *Scopeloides glarisianus* (Agassiz), Arambourg, p. 43, pl. 2, figs. 2–7, 9, text figs. 14, 15, 17.
1968. *Scopeloides glarisianus* (Agassiz), Jerzmanska, p. 27–28, pl. 2, fig. 1.
1977. *Scopeloides glarisianus* (Agassiz), Ciobanu, p. 67, pl. 16, fig. 1.
1997. *Scopeloides glarisianus* (Agassiz) Gregorová, p. 123, Text figs. 1–5, pl. 1, figs. 1–5, pl. 2, figs. 1–6. (cum. syn.)

Material: 82 specimens (coll. 5/86, 6/2001, Ge 29 978).

Diagnostic characters:
Vert. 38–39 (17+22); D 14–15; A 27; P 11–12; V 8–9.
Photophores: IP 5; PV 9–10; IV 14–15; VAV 4–5; AC 21.

A detailed osteological analysis was published by Gregorová (1997) and only a shortened description is presented here.

Description

A fish with an elongated body, maximum depth just behind the head, or rather at the level of the posterior part of the head. HL ranges from 25 % to 29 % SL. The orbit is small and located near the anterior margin of the head. Its diameter is greater than the preorbital distance. The lower and upper jaws are of similar length. The dorsal and anal fins are long, situated beyond the mid-point of the body; PD on average 60 % SL, PA 63 % SL. These fins are situated approximately opposite one another, with the anal fin aligning one or two vertebra(e) behind the dorsal fin.

The pectoral fins are situated low, at the level of the ventral profile of the body. Their rays almost reach the base of the ventral fin. The latter is closer to the anal fin than to the pectoral fin; average PV is 48 % SL. The caudal fin is deeply forked.

The size of specimens ranges from 79 mm to 100 mm. Isolated lower jaws of 18 % SL indicate the presence of specimens up to 200 mm SL.

Comment

Post (1982) presents minimum and maximum SL in three recent species of *Gonostoma: Gonostoma bathyphilum*, *Gonostoma denudatum* and *Gonostoma elongatum*; maximum SL is in *G. elongatum* at 239 mm.

Ecology of related extant forms: Recent *Gonostoma* are primarily mesopelagic, but with some species bathypelagic to at least 2 700 m (Froese & Pauly 2011).

Family Photichthyidae Weitzman, 1974
Genus *Vinciguerria* Jordan et Evermann, 1896
Vinciguerria obscura Daniltshenko, 1946

Pl. 3, fig. 3.

1946. *Vinciguerria obscura* Daniltshenko, p. 641, text-fig. 2.
1968. *Vinciguerria obscura* Daniltshenko, Jerzmanska, p. 398–399, pl. 1, fig. 2.
1974. *Vinciguerria obscura* Daniltshenko, Kalabis & Schultz, p. 187–188.
1977. *Vinciguerria obscura* Daniltshenko, Ciobanu, p. 77–78, pl. 15, fig 4.
2000. *Vinciguerria obscura* Daniltshenko, Gregorová p. 151–161, text-fig. 1, 2, figs. 1–3, (cum. syn.).

Material: 53 specimens (coll. 5/86, 6/2001, Ge 29 979).

Diagnostic characters:
Formula: Vert. 39–41 (21–22 + 19); D13–14, A15–16; P7; V 7–8; C7/10+9/4.
Photophores: PV 11–13; IV 14–15; VAV 9; AC 17–18.

A detailed osteological analysis was published by Gregorová (2000).

Description

The maximum body depth is just behind the head and is equivalent to the length of 10 vertebrae of the central part of the body. The length of the head is almost two times that of maximum body depth. The eyes are round. The orbit is large, close to the upper profile of the head (given by narrow frontals); its diameter corresponds to 2/5 of the HL. The upper jaw overlies the posterior margin of the orbit by 1/4 of the diameter of the orbit.

The dorsal fin originates posterior to the mid-point of the body above the 17th–19th vertebrae; its base is equivalent to the length of eight vertebrae and the length of the longest dorsal rays to 7 vertebrae. The anal fin originates below the 22nd–27th vertebrae and almost below the last ray of the dorsal fin as well. The length of the anal fin base is equivalent to the length of 10 vertebrae.

The pectoral fins are situated ventrally, just posterior to the head; their rays almost reach the pelvic fin base. The pelvic fins are inserted anterior to the dorsal fin below the 14th–16th vertebrae. The length of the rays is equivalent to six vertebrae.

Ecology of related extant forms: Recent species of Vinciguerria are mesopelagic to bathypelagic with depth ranges from 20 to 5 000 m, usually 250–600 m. They undertake diurnal vertical migrations (Froese & Pauly 2011).

Order Myctophiformes Regan 1911
Family Myctophidae Gill, 1892
Genus *Oligophus* Gregorová, 2004
Oligophus moravicus (Paucă, 1931)

Pl. 4, fig. 1.

Material: 73 specimens (coll. 5/86, 6/2001, Ge 29 980).
1931a. *Leuciscus moravicus* Paucă, p. 151, pl. 4, figs. 3 a, b, c.
1948. *Diaphus moravicus* (Paucă, 1931), Kalabis, p. 12, text–fig. 1.
2004. *Oligophus moravicus* (Paucă, 1931), Gregorová, p. 81, Pl.1, figs. 1, 2, text-figs. 2–10 (cum. syn).

Diagnosis and detailed description – *vide* Gregorová (2004).
Vert. 36–37 (14–16 + 21–22), 13–14, A 11–14, P 15, V 8, C 6–7/9 + 10/7–8.

Description

A relatively small myctophid fish, ranging in size from 17 mm to 59 mm SL. The maximum BD is variable. The eye is relatively large and the snout is short. The jaws are long, reaching about one eye diameter beyond the posterior limit of the orbit. DB and DA are more or less equal, as are the number of fin rays. The origin of the dorsal is a little before the mid-point of the body (without the caudal fin), above the 9th–12th vertebrae, as is the origin of the pelvic fin. The dorsal fin ends above the 18th–21st vertebrae; the anal fin terminates below the 25th–27th vertebrae.

Ecology of related extant forms: Lanternfishes are mesopelagic to (sometimes) bathypelagic and are among the most common oceanic fishes. Many undertake diurnal vertical migrations, with some species reaching the surface at night, but most come to within only about 100 m of the surface. During the day most species, as far as is known, inhabit depths of about 300 m to about 1200 m (Paxton *et al.* 1984, Froese & Pauly 2011).

Order Beryciformes Regan, 1909
Family Trachichthyidae Bleeker, 1859
Genus *Gephyroberyx* Boulenger, 1902
Gephyroberyx cf. *darwinii* (Johnson, 1866)

Pl. 4, fig. 2.

1866. *Trachichthys darwinii* JOHNSON, 1866, p. 311, pl. 32.
1931b. *Holocentroides moldavicus* PAUCĂ, p. 5.
1933. *Holocentroides moldavicus* PAUCĂ, p. 10, text-fig. 2, fig. 6.
1933. *Priacanthus robustus* BOGATSHOV, p. 19, pl. 1, fig. 1.
1960. *Gephyroberyx robustus* (BOGATSHOV, 1933), DANILTSHENKO, p. 86, pl. 26, figs. 1–3.
2010. *Gephyroberyx robustus* (BOGATSHOV, 1933), BANNIKOV, p. 20, pl. 3, fig. 4.

Material: Two specimens (Ge 29 968, Ge 29 969).

Diagnostic characters:
Formula: Vert. 26 – (11 + 15), D VIII + 12–13, A III + 10 preserved, P 13–14, V I + 6.

Body oval, head with a concave forehead profile and with a cavity (covered by tough skin in living species; the mouth is large and oblique; opercle and preopercle each with a large strong spine. The ventral scales between the pelvic fin and anus are modified to form a median ridge of large, bony scutes.

Table 2. Morphometric characters (in mm) of *Gephyroberyx* cf *darwinii* (JOHNSON, 1866) and % of SL and * in HL.

SL	HL	BD	PD	PA	CPD	DO	LJL
18	8 (44.4)	10 (55.6)	8.5 (47.2)	13(72.2)	2 (11.1)	2.5 (31.6*)	5 (62.5 *)
30	11 (36.7)	12 (40)	13:5 (45)	20 (66.7)	3 (10)	3.5 (31.8*)	5.5 (50*)

Description

Skull: The frontals are quite short and broad, and do not extend beyond the posterior border of the orbit. The parasphenoid is straight. The infraorbital bones are characterized by typical spines or serrations at the lower margins. The lacrymal is shallow and rather elongate. All of the infraorbitals are deep and spinous.

The lower jaw is long, extending slightly in front of the posterior orbital margin.

The premaxillary and maxillary are identifiable, but their shapes cannot be clearly determined.

The opercle is roughly semicircular in shape with a distinctive radial sculpture. It bears a very strong, rear-oriented spine. The preopercle consists of a long (deep) dorsal limb and a well-developed ventral limb. The angle between the limbs is almost 90° and bears a prominent, prolonged spine at its posterior margin.

There are 12 (13) abdominal and 14 caudal vertebrae. They bear distinct pre- and postzygapopyses. Parapophyses are present on the 4th to the 12th vertebrae. The last four pairs of basapophyses are fused into unpaired spines, which resemble the spine towards the rear.

Pleural ribs are present on the 3rd to the 12th vertebrae. All are long and slender. Those of the anterior vertebrae articulate with the centrum; the other ribs articulate with the tips of the parapophyses.

There is a single continuous dorsal fin composed of eight spines and 10 preserved soft rays. The first two dorsal spines are supernumerary on the first dorsal-fin pterygiophore. The first spine is the shortest. The other spines are quite strong. The third and fourth spines are the longest; succeeding spines gradually decrease in length, but the last spine is longer than the preceding one. The length of the base of the soft portion of the dorsal fin is 1.2 times more than the length of the base of the spiny portion. The pterygiophores of the spiny dorsal fin are large, expanded anteroposteriorly, and each bears a longitudinal lateral ridge. The first pterygiophore is the longest; its ventral shaft situated opposite the second (third) neural spine. The pterygiophores of the soft dorsal fin are slender and decrease in length in the posterior section of the series. Each interneural spa-

ce in the posterior part of the vertebral column is occupied by one or two pterygiophores of the soft doral fin.

There are two free radials in front of the first dorsal pterygiophore; their ventral shafts are intercalated into the first interneural space.

There are three spines and 10 preserved soft rays in the anal fin. The first two anal fin spines are supernumerary on the first pterygiophore. The first spine is the shortest, the third is the longest. The first anal fin pterygiophore is long and stout; its dorsal shaft slopes slightly forwards, and is situated along the anterior edge of the spine of the first caudal vertebra. All the other anal fin pterygiophores are slender. In the posterior part of the vertebral column each inter space is occupied by one or two pterygiophores of the anal fin.

The pelvic fins are thoracic with one spine and six to seven soft rays. The pelvic bone is relatively short; it is oriented posteroventrally from the attachment to the cleithra. The pelvic spine is strong and long, its length equal to that of the longest dorsal spine.

The supracelithrum and cleithrum of the pelvic girdle are elongate, more or less straight and slender bones. The postcleithrum is long and plate-like dorsally but slender and rod-like ventrally; the ventral shaft of the postcleithrum is close to the ventral profile of the body, and posterior to the pelvic bone. The pectoral fin is inserted low on the body flank, approximately at the lower third between the vertebral column and the ventral margin of the body. There are 13–14 pectoral rays.

The neural and spines of PU3 are considerably longer than those of PU4. The neural spine of PU2 is reduced to a crest. The details of the hypurals, epurals and parhypural are not visible. The caudal fin is forked and possesses 4 procurrent rays on each lobe.

The ventral scales between the pelvic fin and anus have been modified into a median ridge of large, bony scutes. The body scales are small and ctenoid, and bear one or two tiny dark spots. These are preserved on both specimens.

Comments

Bailly (2010) did not accept the fossil species of Gephyroberyx robustus (Bogatchov, 1933) and ranked it with the recent species Gephyroberyx darwinii (Johnson, 1866).

Ecology of related extant forms: The recent species Gephyroberyx darwinii (Johnson, 1866) lives on the upper continental slope, close to the bottom or on it (Froese & Pauly 2011).

Order Zeiformes Regan, 1909
Family Zeidae Bonaparte, 1838
Genus *Zenopsis* Gill, 1862
Zenopsis clarus Daniltshenko, 1960

Pl. 5, fig. 1.

1960. *Zenopsis clarus* Daniltshenko, Daniltshenko, p. 88, pl. 10, fig. 1, text-fig. 18.
1968. *Zenopsis* sp., Jerzmanska, p. 441, pl. 5, fig. 2.
1986. *Zenopsis clarus* Daniltshenko, 1960, Swidnicki, p. 119-122, fig. 5.
1998. *Zenopsis clarus* Daniltshenko, 1960, Baciu & Florea, p. 43, fig. 1, 2, text-fig. 1, 2.
2005. Zenopsis clarus Daniltshenko, 1960, Baciu *et al.*, p. 99, figs. 1–4, 20b.

Material: Two specimens (Ge 29 970, Ge 29 971).

Diagnostic characters:

Table 4. Morphometric characters (in mm) of *Zenopsis clarus* Daniltshenko, 1960 in % SL.

SL [mm]	HL	BD	PD	PA	HD	LJL	DO
17	9 (52.9)	11(65)	7.5 (44.1)	14 (82.3)	8 (47.1)	4 (44.4) *	2.5 (27.8) *
15	7(47)	9 (60)	7.5 (50)	11.5 (76.7)	6.5 (43.3)	3.5 (31.8*)	2(28.6)

* in % HL

Vert. 34 (14 + 20), D IX + 23, A III + 23, P 12, V I + 5, C 13.

The body is deep to moderately deep, with a short and slender caudal peduncle. The head and body are laterally highly compressed, with BD distinctly greater than HL; the mouth is large and oblique, the upper jaw extremely protrusile, while the maxilla is widely expanded at its rear. No spines or serrations appear on the opercular bones. The dorsal fin has nine long spines and 23–24 short, unbranched soft rays, the caudal fin is convex, with 13 principal rays and 11 branched rays, while the pectoral fin has 12 soft rays, which are much shorter than those of the pelvic fin; the latter has one slender spine and five soft rays.

Description

The head is relatively large, its length equivalent to 90 % of body depth. The dorsal and ventral profiles of the body are equally convex, or the ventral profile is the more convex.

The head is almost as deep as it is long. The eye is of moderate size and the horizontal diameter of the orbit is equal to the postorbital distance as well as to the preorbital distance. The mouth is relatively large, terminal and, to judge by the long ascending premaxillary process, highly protractile. The lower jaw articulation is situated anterior to the anterior edge of the orbit. No infraorbital bones are recognizable with confidence, but a small elongate lacrymal is sometimes preserved.

The neurocranium is not deep and lacks a supra-occipital crest. The frontals are dotted with pits. The parasphenoid is exposed in the lowermost part of the orbit; it is slender and almost straight, without a ventral flange. The premaxilla has a long ascending process (longer than the alveolar process). The maxilla is large; its distal end is broadened.

The mandible is moderately deep, extending slightly forwards to the anterior border of the orbit. The hyomandibular shaft is slightly inclined anteroventrally. The symplectic is wedge-like, long and slender. The metapterygoid is highly reduced. The mesopterygoid (endopterygoid) is elongate and plate-like. The narrow ectopterygoid is tightly articulated to the quadrate, its upper part curved towards the rear. The quadrate is subtriangular in shape, long and narrow, with a distinct articular condyle.

The opercular region is narrow. The opercle is subtriangular, without any spines or indentations; the bone is slightly thickened along its anterior and upper margins. The preopercle is narrow and very slightly curved along its anterior edge; the dorsal limb (which is slightly shorter) is more slender than the ventral limb. No serration or spines are present on the posterior preopercular margin.

There are 14 abdominal and 20 caudal vertebrae, including the urostyle. The first two vertebrae are obscured by the supracleithrum. The axis of the vertebral column is slightly sigmoid, elevated at the front. The vertebral centra are foreshortened. The neural spines of the first eight abdominal vertebrae are slender and slope slightly to the rear. The neural spines of the 5th to 10th vertebrae become successively stouter and longer, almost straight and sloping slightly forwards. The neural spines of the rearmost vertebrae start to slope backwards once more. The anterior and middle spines of the caudal vertebrae are some-

what longer than the corresponding neural spines. The neural and spines of PU2 are stouter and longer than those of the preceding vertebrae. All the spines slope backwards. Parapophyses are present on the eight rearmost abdominal vertebrae; they increase in length progressively towards the rear. The three posterior parapophyses evidently lack ribs, resembling the spines, although shorter; they are bifurcated and accommodate the first anal pterygiophore. Five anterior parapophyses are lamellary, expanded distally, in contact with each other. The pleural ribs are associated with the 5th to 12th abdominal vertebrae and are very short and slender.

The dorsal fin is continuous, with an indentation between the spiny and soft portions. There are nine spines. The first and second spines are the longest, while succeeding spines decrease progressively in length towards the rear. There are about 23 soft-segmented rays; they are at their longest in the middle although still nearly twice as short as the anterior fin spines. The length of the base of the soft part is slightly more than that of the base of the spiny part. The pterygiophores of the spiny dorsal fin are large and sturdy, expanded anteroposteriorly, and each bears a longitudinal ridge. The first pterygiophore is not the longest; its ventral shaft extends into the first interneural space, being inserted between the halves of the bifid neural spine of the first vertebra. There is a slightly developed procumbent process directed anteroventrally in the upper part of the first dorsal fin pterygiophore. The ventral shafts of the dorsal fin pterygiophores slope slightly backwards. The pterygiophores of the soft dorsal fin are slender and decrease progressively in length towards the rear. The ventral shafts of one or two pterygiophores of the soft dorsal fin insert into each interneural space below them.

There are three spines and 22–24 soft segmented rays in the anal fin. The first two anal fin spines are supernumerary on the first pterygiophore. The first spine is the longest and the third spine is the shortest. There is a slight indentation between the spiny and soft parts of the anal fin. The soft part of the anal fin is similar to the soft dorsal fin in shape and size.

The first anal fin pterygiophore is long and very stout; its dorsal shaft slopes rearwards and is situated along the anterior edge of the haemal spine of the first caudal vertebra and inside the bifurcate parapophyses of the two rearmost abdominal vertebrae. The ventral end of this pterygiophore is slightly expanded antero-posteriorly. All the other anal fin pterygiophores are slender and slope backwards, their lengths progressivly decreasing towards the rear. The interhaemal spaces above the anal fin include the dorsal shafts of one or two pterygiophores.

The supracleithrum is an elongate, straight bone. The cleithrum is an elongate, robust, strongly curved bone. The ventral limb of the cleithrum meets the dorsal limb at an angle of somewhat more than 90 degrees. There is a short posterior projection in the corner of the cleithrum. The single postcleithrum is long, robust and rod-like; the ventral end of the postcleithrum is close to the ventral profile of the body, situated in close proximity to the distal end of the posterior process of the pelvic bone. The pectoral fin is inserted relatively low on the flank, just below the midpoint between the vertebral column and the ventral profile of the body. It is moderately long, with 12 recognizable rays.

The pelvic bone is relatively short and broad, oriented posteroventrally from its attachment to the cleithra. The pelvic fin is relatively long, with a slender spine and five long, soft rays. The unbranched pelvic spine is shorter than the anterior dorsal fin spines but much longer than the anal fin spines. The pelvic fin origin is situated under the pectoral fin base; the pelvic fin rays reach beyond the bases of the anal fin spines.

The caudal skeleton is difficult to interpret because of the small size of the specimen. The neural and haemal spines of PU2 are long and strong. The neural and haemal spines of PU3 and PU4 are slightly expanded in relation to those of the preceding vertebrae. The caudal fin is moderately long and rounded; it has 13 principal rays (I, 5 + 6,I), and one procurrent ray both above and below.

Squamation. Bony bucklers are developed along the dorsal spiny and soft fins and along the ventral profile of the body; their number cannot be determined.

Ecology of related extant forms: *Zenopsis* usually occurs in tropical and temperate areas. It lives near the bottom or in midwater at a depth range of 50–600 m, mainly at 200–300 m (Froese & Pauly 2011).

Order Scorpeniformes Cuvier, 1929
Family Triglidae Jordan & Evermann, 1896
Triglidae gen. et sp. indet.

Pl. 5, fig. 2.

Material: One specimen (Ge 29 972).

Diagnostic characters:

Vert. 30–31 (12–13 + 20); D1 X + D2 13, A 11, P12 + 3 three lower free rays.

The head is large and triangular, with an elongated rostrum and a big mouth, terminal or slightly inferior. The bony parts of the skull feature numerous ridges and spines. The body is moderately elongate. The dorsal fin is divided into separate spinous and soft-rayed parts. The anal fin is without spines. The three lowermost rays of the pectoral fin are free. The preorbital and postorbital distances are more or less equal.

Table 3. Morphometric characters (in mm) of the specimen of Triglidae gen. sp. indet. and in % of SL.

SL 26	PD 11	PDII 16	PA 16	HL 10	BD 6	MDspine 4	DO 2
% SL	42.3	61.5	61.5	38.5	23.1	15.4	7.7

Description

The frontals are narrow in the anterior part and broad in the posterior part. The pariatelas are tetragonal. The preorbital and postorbital distances are equal. The diameter of the orbit is about 20% of HL. The parasphenoid is straight. The infraorbital bones are characterized by typically spinous margins. The premaxillary and maxillary are identifiable, but their shapes cannot be clearly determined.

The articulation of the lower jaw is situated under the middle of the orbit. The lower jaw broadens at the rear. Small teeth are visible.

The vertebrae are slightly longer than they are deep. The neural spines of the abdominal vertebrae are long, sloping backwards and enlarged at their bases. The ribs are thin and moderately long. The neural spines of the abdominal part of the vertebral column are enlarged. Four hypurals are preserved in the caudal skeleton.

The first dorsal fin has 10 spines and originates just behind the head, directly above the bases of the pectoral and ventral fins. The spines are strong, while the second and third are the longest, their length equivalent to eight abdominal vertebrae (15.4% SL). There is a gap of a vertebra's length between the last spine of the first dorsal fin and the first rays of the second dorsal fin. There are 13 soft rays.

The anal fin is situated below the origin of the second (soft) dorsal fin, having 13 soft rays (no spinous rays). The first anal pterygiophore is well developed.

The pectoral fin base is broad, well developed, with 12 rays of which the three lowermost are free. The longest pectoral rays are equivalent to the length of 11–12 of the abdominal vertebrae above.

The pelvic fin lies below the pectoral fin; its spine is strong and represents 21% of the SL at the rear; it reaches the origin of the base of the anal fin. The pelvic bone is short (1/5 of the pelvic spine).

Ecology of related extant forms: The recent marine piper gurnard *Trigla lyra* is bathydemersal and lives at a depth range of 100–700 m, usually 150–400 m (Froese & Pauly 2011).

Order Perciformes Bleeker, 1859
FamilyTrichiuridae Rafinesque, 1810
Subfamily Aphanopodinae, Gill, 1864
Genus *Anenchelum* Blainville, 1818
Anenchelum glarisianum Blainville, 1818

Pl. 6, figs. 1, 2.

1818. *Anenchelum glarisianum* Blainville; p. 314 (non vidi, fide Wettstein, 1886).
1850. *Lepidopides leptospondylus* Heckel, p. 239.
1886. *Lepidopus glaronensis* (Blainville, 1818), Wettstein, p. 42, pl. 5, figs. 1, 3, 5, 10, pl. 6, figs. 1, 3, 5, 6, 7, 8.
1973. *Lepidopus glarisianus* (Blainville, 1818), Kalabis, 10, Fig. 5.
2003. *Anenchelum glarisianum* (Blainville, 1818), Gregorová & Požár, p. 200, text-fig. 5, figs. 8, 9, 10.
2010. *Anenchelum glarisianum* (Blainville, 1818), Gregorová, p. 141, figs. 1–11.

Material: 61 specimens (coll. 5/86, 6/2001, 1/2009, Ge 29 981).

Diagnostic characters:
Vert. 109 (33–35 + 75), ID XXXV, IID 74 + 77. A II + 68, V I, P 15–17.

Description

The orbits enter the upper profile of the head; the posterior margin of the opercle is convex. The snout slopes gently and the head profile rises steadily from the tip of the snout to the origin of the dorsal fin; it has no sagittal crest. There is a notch between the spinous and the soft parts of the dorsal fin. The spinous part of the dorsal fin is shorter than the soft part; the spinous dorsal fin has 35 rays while there are 76–77 soft dorsal rays, slightly more (2–4) than the number of the adjacent caudal vertebrae. For a detailed osteological analysis see Gregorová (2010)

Ecology of related extant forms: Recent representatives of Trichiuridae are benthopelagic (Nakamura and Parin 1993).

Scombridae Rafinesque, 1815
Genus *Scomber* Linnaeus, 1758
Scomber sp.

Pl. 7, fig. 1.

Material: One incomplete specimen (Ge 29 973).

Diagnostic characters and description:

The following characters allow the specimen to be ranked with the genus *Scomber*: Five dorsal and anal finlets, one spine in the anal fin and fused upper and lower hypurals that are separated from each other across the midline.

Of the caudal vertebrae, 15 are preserved including the urostyl, which is deeply forked. The recent *Scomber scombrus* has 31 vertebrae (13 precaudal plus 18 caudal). There are 5 dorsal and anal finlets.

Ecology of related extant forms: Recent representatives of *Scomber* are epipelagic, temperate (*S. scomber*), or subtropical (*S. japonicus*, inhabiting depth ranges of 50–200 m) (Froese & Pauly 2011).

Family Euzaphlegidae Daniltshenko, 1960
Genus *Palimphyes* Agassiz 1844
Palimphyes sp.

Pl. 7, figs. 2, 3, Pl. 8, fig. 1, text-fig. 3

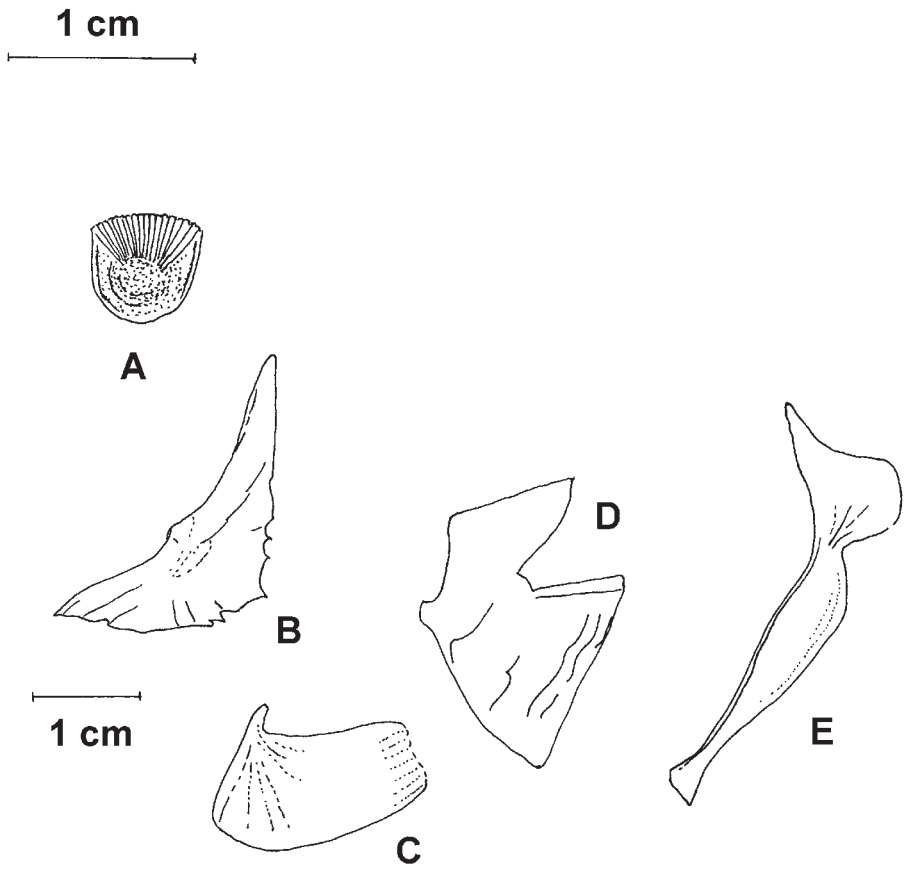

Fig. 3. *Palimphyes* sp. A. Scale, B. preopercle; C. Opercle; D. Subopercle; E. Cleithrum.

Material: 5 specimens (Ge 23 982, Ge 23 972, Ge 29 974, Ge 29975).

Diagnostic characters:

Vert. 37 (15+21), ID IX, IID I+20, A 20, P 12, V I+5

Elongated fusiform body with two separated dorsal fins and well-developed, very long pectoral fins. There are four free interneurals between the D1 and D2. The lower jaw is deep; its articulation is situated anterior to the middle of the orbit.

Comment

Several *Palimphyes* spp. have been described for the Oligocene of the Tethys and Paratethys: *P. elongatus* (Blainville, 1818), Switzerland; *P. lanceolatus* (Simionescu, 1904), *P. originis* (Ciobanu, 1976) Romania; *P. chadumicus* Daniltschenko, 1960, Caucasus; and *P. leptosomus* (Arambourg, 1967), Iran. The principal differences cited by the authors lie in the numbers of vertebrae and fin rays. However, these differences could be related to interspecific variability or based on different interpretations of the counts. For these reasons, the material from the Litenčice locality is assigned to *Palimphyes* sp. for the moment.

Table 5. Morphometric characters (in mm) of the *Palimphyes* sp. Daniltshenko, 1960 and % SL.

SL 63	PD 26	PDII 41	PA 41.5	HL 21	HD 15	LJL 10	DO 6
% SL	41.3	65.1	65.1	33.3	23.8	15.9	9.5

Description

The head is long and takes up about a third of SL. The teeth are uniserial and stronger in the lower jaw. Maximum body depth occurs at the base of the pelvic fin (and the end of the skull) and is equal to less than one fourth of SL. The head is tapered and large; it significantly exceeds body depth. The diameter of the orbit is large and takes up a fourth of HL. The snout is long and terminal.

The neurocranium is flat and has a low supra-ocipital. A narrow parasphenoid projects beneath the lower part of the orbit.

The premaxila has a well-developed processus ascendens, the depth of which increases in the posterior part. The maxilla is slightly curved and enlarged at the rear. There is no supramaxilla. The teeth are uniserial and there are incisiform teeth at the tip pf the upper jaw.

The dentary broadens towards the rear; the lower teeth are similar to those of the upper jaw, but are more robust. The ceratohyal is low and the branchiostegal rays are thin.

The hyomandibula slopes forewards, with its head including three distinctive joins: anterodorsally (to the sphenoticum), dorsally (to the pteroticum), and to the rear (to the). The quadrate is small and triangular.

The preopercle is slightly curved, relatively broad, radially serrated and toothed. The opercle is flattened and thick in the anterior part. There is a typical notch on the upper border of the bone The subopercle is subtriangular (fig. 3. B, C, D). Most of the bones exhibit typical surface sculpture consisting of an an irregular radial row of shallow fossettes.

There are 37–38 vertebrae, 15–16 abdominal and 22 caudal. They are subquadratic or slightly elongated in shape. The neural spines are short and slightly curved. In the anterior part of the vertebral column, the several rearward-sloping neural spines are stronger than in the posterior part. The centra are without parapophyses The ribs are short, thin and slope distinctively towards the rear.

The first dorsal fin is short and low, with 8–9 rays closely spaced in the anterior part and more widely spaced in the posterior part. The dorsal fin originates above the 7th vertebra; its base is equivalent to the lengths of vertebrae 4 - 5. The pterygiophores of the first dorsal fins are wedge-shaped and slope backwards. Between the two dorsal fins are four free, almost horizontal radials. The second dorsal fin is deep and prolonged in the anterior part, with its rays decreasing in length towards the rear: one spine and 20 soft rays. D2 originates above the 3rd caudal vertebra and ends at the 14th caudal vertebra. The pterygiophores are narrow, long, closely-spaced and strongly sloping in the anterior part, decreasing in length towards the rear and becoming almost perpendicular to the body profile.

The anal fin is situated below the second dorsal fin and and is similar to the second dorsal in size and shape. There are two short spines and 20 soft rays. The first haemal pterygiophore is long and enlarged; it bears both anal spines. The pterygiophores of the soft anal fin are similar to those in the soft part of the dorsal fin. Neither dorsal nor anal pterygiophores reach the distal end of the neural and haemal spines.

The post-temporal has two heads, anteroventral and anterodorsal. The supracleithrum is large. The cleithrum is massive and narrow in the middle and lower part; the upper dorsal rod is bent and situated at the level of the vertebral column The coracoid is narrow. The postcleithrum is rib-like and oriented posteroventrally. The pectoral fin is narrow and triangular. It is also very long, reaching the origin of the second dorsal fin. There are at least 12 rays.

The pelvic bone is well developed and situated beneath the pectoral fin and slightly posterior to it: one spine and five branched soft rays.

The first preural vertebra is fused with the ural centrum and hypurals 3–5. The parahypural is associated with the hypural plate. PU2 has a thick, massive haemal spine and a sharp neural spine. The epurals are badly preserved.

There are 17 principal caudal rays (15 branched). The procurrent rays are numerous, about eight on each side of the caudal lobe. The length of the longest rays is equivalent to rearmost vertebrae 11–12.

The scales are ctenoid (Fig. 3A).

Ecology of related extant forms: *Palimphyes* is an extinct genus of the scombroid fishes. The habitat type may be derived from the long, sharp teeth and assigned to that of the mesopelagic and benthopelagic scombroid fishes (Nakamura and Parin 1993; Gregorová 2010).

Order Pleuronectiformes Bleeker, 1959
Family Scophthalmidae Jordan, 1923
Genus *Scopthalmus* Rafinesque, 1810
Scopthalmus stamatini (Paucă, 1931)

Plate 8, fig. 2.

1931. *Rhombus stamatini* Paucă: 31.
1977. *Solea prisca* Ciobanu, 128–129, pl. 36, fig. 2.
2002. *Scopthalmus stamatini* (Paucă), Baciu & Chanet, p.17, fig. 3–8 (cum. syn.)

Material: Two almost complete specimens (Ge 29 976, Ge 29 977).

Diagnostic characters (vide Baciu & Chanet 2002):
Vert. 35 (11) + 24, A 53, C 19.

Table 6. Morphometric characters (in mm) of the *Scopthalmus stamatini* (Paucă, 1931) and in % of SL, * % in HL.

SL 41	HL 14	BD 13	LJL 7	AFRL 5	DFRL 5
% SL	31.1	31.7	50*	35.7*	35.7*

Description

A small flatfish that is not considered a juvenile individual because the the dorsal and anal pterygiophores are fully ossified (Baciu & Chanet 2002). The eyes are on the left side, the mouth is large with a prominent lower jaw; the preopercle has a free posterior border. Fins without spinous rays; dorsal origins in front of the upper eye.

The head region is relatively well preserved. The mouth is large; the lower jaw of the left side is about half the head length. The premaxillary and maxillary are identifiable, but their shapes cannot be clearly determined. In contrast, the lower jaw with the dentray and anguloarticular are easily identifiable and even the teeth are visible; these are narrow, conical and bent at the tip.

The skull is asymmetrical and both eyes are situated on the left side. A small protuberance is recognizable at the upper eye, located at the dorsolateral edge of the left side of the head. The placement of the lower eye may be deduced from the orbit, which is bounded by the lateral ethmoid at the anterior, the frontal dorsally and the entopterygoid mesially. The hyomayndibula is robust and straight. The opercular bones are relatively well preserved. The preopercle is curved, with both branches of the same length. The opercle is triangular and the subopercle is small and rectangular in shape. The interoperecle is relatively large and well developed.

Almost all the bones are preserved in the opercular and suspensorial regions,. The quadratum is located below the first third of the upper orbit. The entopterygoid is well developed and well preserved; it is triangular and situated ventrally, under the parasphenoid. Only the upper branch of the ectopterygoid is visible.

The vertebral centra are quadrangular and more elongated at the caudal region. The first neural spines of the abdominal vertebrae slope forwards, while the final two or three of them are perpendicular to the vertebral column; in the caudal part they become progressively more inclined to the rear. The ribs are short and feeble with the first attached to the third vertebra.

In the anal fin the foremost pterygiophore is well developed and enlarged with its proximal extremity in contact with the haemal spine of the first caudal vertebra. Ventrally this bone curves forward and supports 11–12 anal pterygiophores and rays; 40–41 rays and pterygiophores follow these, so that their total number is around 53 rays and pterygiphores. The distal extremities of all the haemal spines (except for the first) are in contact with a pair of the anal pterygiophores.

This number is in accord with data from Baciu & Chanet (2002), who record 52–54 rays.

In the dorsal fin the anteriormost part is not preserved. In totally, as it was if one follows Baciu and Chanet (2002), the dorsal fin should have 68–70 rays but our specimen has 44 rays and approximately 57 pterygiphores additionally preserved in the anteriormost part of the fin.

The distal extremities of the 29 neural spines (counted from the caudal) are in contact with a pair of the dorsal pterygiophores.

The longest dorsal and anal rays make up 40% of BD.

In the caudal skeleton, the three last caudal vertebrae (PU1, PU2, PU3) support the caudal fin. Baciu & Chanet (2002) give a detailed description of the caudal skeleton. The ventral lobe is composed of the haemal spines of PU3 and PU2 vertebrae, the parhypural and the first and second hypurals, which are fused. The neural spines of PU2, PU3, the epural and two hypural plates support the dorsal part of the caudal fin. The neural spine of PU2 is robust, distally enlarged. The uppermost (dorsal) hypural plate is formed by hypural 5. The second hypural plate is formed by the fusion of hypurals 3 and 4. This plate is fused to the centrum of PU1 The caudal fin is rounded and composed of 19 rays. The first marginal rays of both lobes are short, unsegmented and unbranched; the principal rays after them are segmented and bifurcated distally.

In the shoulder girdle, the supracleithum, cleithrum, coracoid and two postcleitra are preserved, but their shapes cannot be clearly determined. The cleithrum is robust and covers the first two abdominal vertebrae. The tiny postcleithrum is situated medially on the cleithurm. The long triangular coracoid supports the pectoral fin ventrally. The fin is si-

tuated in the upper half of the abdominal cavity. The pelvic girdle and fin are not preserved.

Ecology of related extant forms: Recent species, including e.g. the brill Scopthalmus *rhombus*, are marine, oceanodromous, demersal and temperate. They inhabit a depth range of 5–50 m (Froese & Pauly 2011).

Conclusion

Four shark taxa *Cetorhinus parvus* Leriche, 1910, ? *Carcharias* sp., *Squalus* cf. *alsaticus* (Andreae, 1892), and *Alopias exigua* (Probst, 1879) and 12 teleost taxa *Clupea sardinites* (Heckel, 1850), *Glossanodon musceli* (Paucă, 1929), *Scopeloides glarisianus* (Agassiz, 1844)), *Vinciguerria obscura* (Daniltshenko, 1946), *Oligophus moravicus* (Paucă, 1931), *Anenchelum glarisianum* Blainville, 1818, *Palimphyes* sp., *Zenopsis clarus* Daniltshenko, 1960, *Scopthalmus stamatini* (Paucă, 1931), Triglidae gen. indet. and *Scomber* sp. were recorded in the Dynów marlstone at the Litenčice locality. The basking shark *Cetorhinus parvus* and ? *Carcharias* sp. vertebrae are described as exceptional examples of cartilage preservation. On the basis of vertebra size it is presumed that the *Cetorhinus* individuals died as juveniles. The representatives of *Gephyroberyx* cf. *darwini*, *Scopthalmus stamatini*, Triglidae gen. sp. indet and *Scomber* sp. are recorded for the first time for the Dynów marlstone of the Moravian region. Among Moravian localities, the Litenčice assemblage contains the most diversified fauna.

Souhrn

Je presentováno složení doposud známých nálezů fosilních ryb a žraloků z Dynówských slínovců menilitového souvrství na lokalitě Litenčice. Co do zastoupení taxonů Litenčice zároveň představují nejbohatší lokalitu na Moravě. Ve společenstvu se vyskytují tito zástupci žraloků:

Cetorhinus parvus Leriche 1908 (Cetorhinidae); *Squalus* cf. *alsaticus* (Andreae, 1892) (Squalidae); *Alopias exigua* (Probst, 1879) (Alopiidae). Z kostnatých ryb jsou na lokalitě zastoupeny tyto taxony: *Clupea sardinites* (Heckel, 1850) (Clupeidae), *Glossanodon musceli* (Paucă, 1929) (Osmeridae); *Scopeloides glarisianus* (Agassiz, 1844) (Gonostomatidae) *Vinciguerria obscura* Daniltshenko, 1946 (Photichthyidae); *Oligophus* moravicus (Paucă, 1931) (Myctophidae), *Anenchelum glarisianum* Blainville, 1818 (Trichiuridae); *Zenopsis clarus* Daniltshenko, 1960 (Zeidae), *Palimphyes* sp., Daniltshenko, 1960 (Euzaphlegidae).

Jako vůbec první v Dynówských slínovcích menilitového souvrství Moravě jsou zaznamenány zástupci čeledí Trachychthidae (*Gephyroberyx* cf. *darvinii*), Scophathalmidae, (*Scopthalmus stamatini*), Scombridae (*Scomber* sp.). Statisticky nejčetnější jsou *Scopeloides glarisianus* (24 %), *Oligophus moravicus* (21 %), *Anenchelum glarisianum* (18 %), *Vinciguerria obscura* (15 %), *Glossanodon musceli* (15 %). Z paleoekologického hlediska toto společenstvo ryb patří k mezopelagickým a bentopelagickým druhům.

Kromě ryb se na lokalitě vyskytují plastrony želv (Gregorová & Mlynarsky 1993), ploštic zbytky ptáků. (in preparation)

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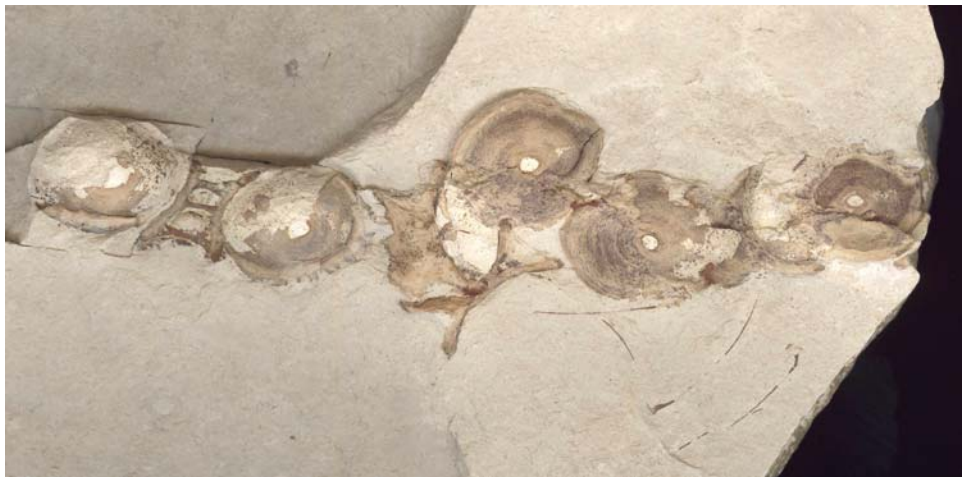

Fig. 1. *Cetorhinus parvus* LERICHE 1908, isolated vertebrae, length of one vertebral centrum 12 mm; Ge 29 502.

Fig. 2. *Cetorhinus parvus* LERICHE 1908, length of branchiospines 8 mm, Ge 29 560.

Fig. 1. *Squalus* cf. *alsaticus* (ANDREAE, 1892), length of tooth 4 mm, Ge 29 966.

Fig. 2. *Alopias exigua* (PROBST, 1879), length of crown 4 mm, Ge 29 592.

Fig. 3. *Carcharias* sp., isolated vertebrae, diameter of centrum 26 mm, Ge 29 796.

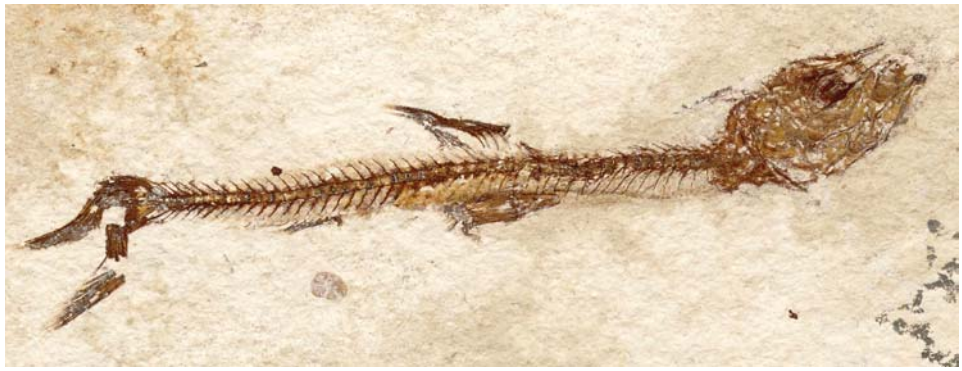

Fig. 1. *Glossanodon musceli* (Paucă, 1929), total length of specimen 60 mm, Ge 29 967.

Fig. 2. *Scopeloides glarisianus* (Agassiz, 1844), total length of specimen 95 mm, Ge 29 978.

Fig. 3. *Vinciguerria obscura* (Daniltshenko 1946), total length of specimen 41 mm, Ge 29 900.

Fig. 1. *Oligophus moravicus* (Paucă, 1931), total length of the whole specimen 45 mm, Ge 29 980.

Fig. 2. *Gephyroberyx cf. darvinii* (Johnson, 1866), total length of specimen 30 mm, Ge 29 968.

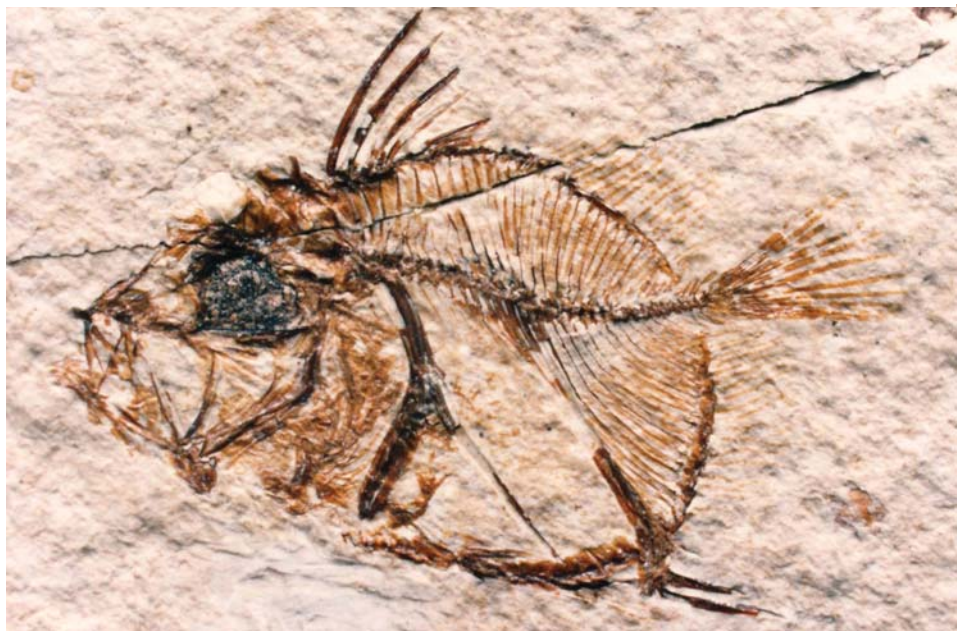

Fig. 1. *Zenopsis clarus* Daniltshenko, 1960, total length of specimen 21 mm, Ge 29 970.

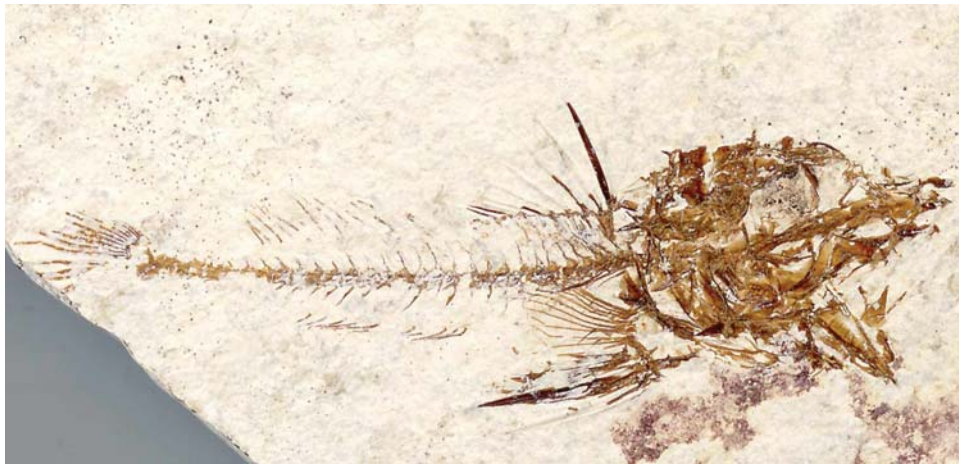

Fig. 2. *Triglidae* gen. indet., total length of specimen 30 mm, Ge 29 972.

Fig. 1. *Anenchelum glarisianum* BLAINVILLE, 1818, total length of specimen 54 mm, Ge 29 826.

Fig. 2. *Anenchelum glarisianum* BLAINVILLE, 1818, length of the preserved part of the specimen 180 mm, 29 981.

Fig. 1. Scombridae gen. sp. indet, length of the preserved part of the specimen 105 mm, 29 973.

Fig. 2. *Palimphyes* sp., total length of specimen 80 mm, Ge 29 974.

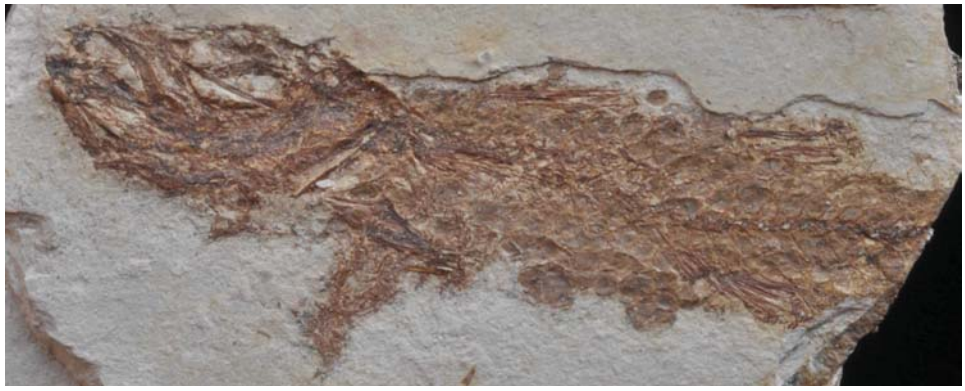

Fig. 3. *Palimphyes* sp, length of the preserved part of the specimen 82 mm, Ge 23 772.

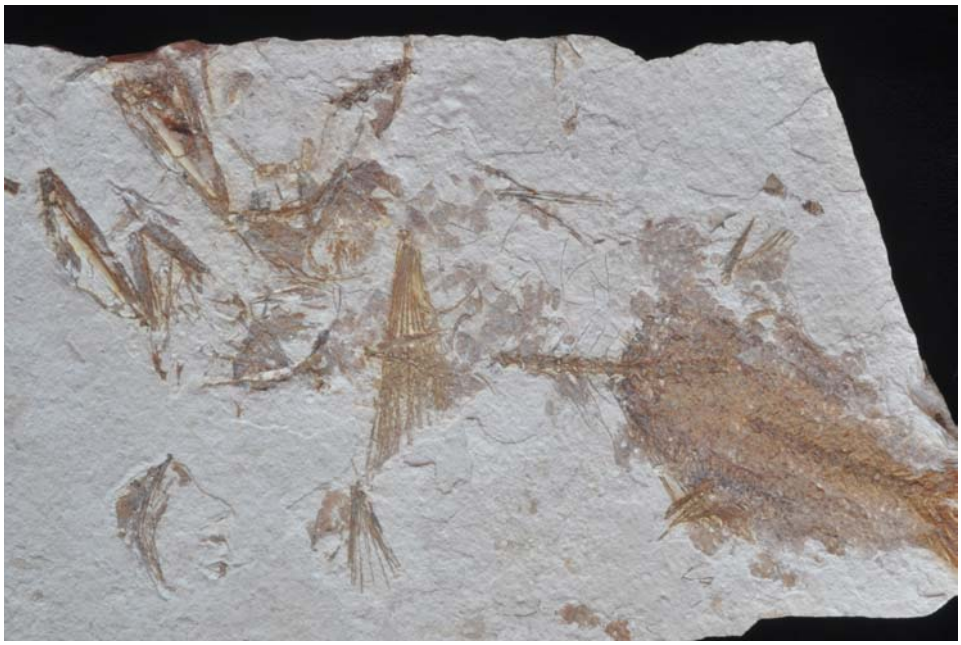

Fig. 1. *Palimphyes* sp, length of the preserved part of the specimen 74 mm, Ge 29 975.

Fig. 2. *Scophthalmus stamatini* (Paucă, 1931), total length of specimen 52 mm, 29 976.