

Eocene fish fauna from the Menilite Beds (Huty Formation) of the Central Carpathian Paleogene Basin (Orava region, NW Slovakia).

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Abstract: The Paleogene fishes belonging to the genus *Clupea*, *Trachinus*, *Alosa*, *Serranus* and *Lepidopus* were identified in the Menilite Beds of the Huty Formation. Deep-water (mesopelagial) type of the fishes were found in the Pribisko Brook and slide area near Zuberec, the littoral type of fishes in the Blatná Valley - Zásكالie. Determined fish remnants confirm deep sea condition during the deposition of the Menilite claystone layers (up to 2000 m depth), as well as paleoecological and paleoclimatological character of the sedimentary environment belonging to temperate up to tropical zone.

Key words: Palaeogene, Eocene and Oligocene, fish fauna, Menilite Beds, Huty Formation, Central Carpathian Paleogene Basin

Introduction

The Menilite Beds provide rich population of fish fossils, which were investigated mainly in Polish part of the outer Carpathians flysh belt (Gregorová, 1988). There were only one studies coming from last century (Mojsisowicz, 1867) which described fish scales (*Amphisele*, *Meletta*, *Lepidopites*) from the Central Carpathian Paleogene Basin „amphisile“ shale - later described as the Huty Fm. (Hesek, 1978). The fish association mentioned above is typical for the deepwater Paleogene turbidites and the Menilite Beds (Jerzmańska, 1968). In the area studied (Fig. 1), the Menilite Beds outcrops in a zone reaching in some places wide of more than 1 km. The beds are declined to the north (Gross et al., 1993).

The fossil materials was selected from three localities - Pribisko Brook, slide area by Zuberec and Brook in Blatná Valley - Zásكالie.

There are the same type of sediments (the menilite claystones) on all localities studied.

Characteristics of the Huty Formation

The Paleogene sedimentation in the Central Carpathian Paleogene Basin started by deposition of the Borovce Fm. The environment was shallow water with warm and good aerated conditions favorable for faunal and floral associations development.

During the Ilirian tectonic phase (Dovina et al., 1990) the sedimentary environment was turn over into pelagic deep-water sedimentation of calcareous claystone of the Huty Fm. The Huty Fm. consist of calcareous claystones, sandstones, fine-grained conglomerates and pelocarbonate lenses, rarely with layers of turbidites and claystones of the Menilite Beds as was defined by Gross (1984). The coal substance is common in claystones and sandstones.

The dominant structural component of claystones is clay of very complicated mineralogy composite with three dominant group: montmorillonite, olite and kaolinite (Gross et al., 1993). Usually, very hard silicified layers contain dark brown to black no calcareous, rarely weakly calcareous claystones with high content of the manganese and organic matter. The layers of the Menilite Beds decay on very firm and slim tables (50 x 50 cm). The thickness of claystones layers is variable, it reach from 5 to 10 m. On the surface they form large lenses covering the areas since several tens to hundred m².

The age of the Huty Fm. was determined as Lower and Middle Priabonian on the base of the microfauna, palinomorfs, nannoplankton and large foraminifers (Dovina et al., 1990). In claystones of the Menilite Beds are many fish scales (max. 1,5 x 0,9 cm) as well as no complete bad preserved fish bone were documented. Only



Fig. 1 Situation of studied localities

one complete fish body was found. The population investigated belong to the Teleostei fish, Clupeiformes and Perciformes orders. There were also common ostracods occurring among studied fish associations.

Systematics

Infra class *Teleostei*

Superorder *Clupeomorpha*

Order *Clupeiformes*

Suborder *Clupeoidei*

Family *Clupeidae* BONAPARTE, 1831

Genus *Clupea* LINNÉ, 1758

Clupea sardinites HECKEL, 1850

Fig. 2

Materials: Two no complete fishes; the first one with the tail, the second one with no complete body; as well as further two tails and many remnants of bones and cycloid scales.

Dimensions: No complete fish with the tail: L (long)-6,4 cm, H (height)- 1 cm, the length of the tail is 2,3 cm; no complete fish without the tail: L-1,6 cm, H-0,7 cm; the tails: L-2,2 cm and 2,4 cm and the size of the scales is 1,5 x 0,9 cm in average.

Description: The fish body is prolate and on the transverse section is oval with abdomen keel. The lower jaw-bone is less long as upper jaw-bone. It have a big eyes. The dorsal fin is short, it consist of 17-20 rays which are relatively high. The tail fin is cut out deeply having the shape of the letter „V„. The pelvic fins begin in the middle of the fish body. *Clupea sardinites* have expressive separate big cycloid scales. The greatness of the body reach up to 36 cm.

Thorax vertebrae: relatively short with long narrow neural prominences, strongly lean to back. The ribs are long and narrow.

Tail vertebrae: short, relatively with thin long dorsal and ventral prominences. The body of vertebrae are relatively short, their middle zones is not expressive narrow.

Caudalis: consist of relatively big no ramify rays (average 6-7) situated in the border part of the tail. There are 6-8 ramify rays in the middle part of the tail.

Scales: big, oval and cycloid shape with 4-6 drains on its both sides; the first drains are longer.

Paleoecology: The fish are social, herd living in open sea water, usually in 250 m depth.

Stratigraphic range: Eocene - Pleistocene of the Europe.

Occurrence: Pribisko Brook, Zuberec - slide area, Blatná Valley - Zásكالie.

Family *Clupeidae* BONAPARTE, 1831

Genus *Alosa* LINCK, 1790

Alosa sp.

Fig. 3

Material: One complete fish with destroyed head.

Dimensions: L - 2,1 cm, H - 0,3 cm; length of the tail - 0,5 cm.

Description: The fish body is prolate with big head part showing the abdomen keel in its transverse section of the oval body. There are big eyes and broad mouth on the head. The lower jaw-bone is less long as upper jaw-bone. The dorsal fin is high and short, beginning before the pelvic fins. It consist of 15-17 rays. The pelvic fins are short (6-7 rays). The tail fin is deeply cut out in shape „V“. It have the cycloid scales, it lose them easily. The greatness of the body is different, it reach 75 cm in length.

Thorax vertebrae: relatively short with long narrow neural prominences (21 vertebrae are visible).

Tail vertebrae: relatively short, with thin medium long dorsal and ventral prominences.

Caudalis: consist of the big no ramify rays (average 6-7) situated in the border part of the tail. Seven to eight ramify rays are in its middle part.

Pectoralis: it is a triangle shaped with 8-9 rays approximately.

Scales: big, oval and cycloid shape with 4-6 drains on the both sides of the scales; there are tiny points in their centre.

Paleoecology: This is social, herd fish living in shallow littoral water as well as in the mesopelagial zone.

Stratigraphic range: Oligocene - Pliocene of the Europe.

Occurrence: Blatná Valley - Zásكالie.

Superorder *Acanthopterygii*

Order *Perciformes*

Suborder *Percoidei*

Family *Serranidae* RICHARDSON, 1846

Genus *Serranus* CUVIER, 1817

Serranus budensis HECKEL, 1856

Fig. 4

Material: One no complete skeleton (without the head and with piece of tail).

Dimensions: Skeleton: L - 4,9 cm, H - 2,4 cm; length of the body without the tail is 4,3 cm.

Description: The fish oval body have high spine. It have big eyes, broad mouth and the eyelid thorn on the head. The dorsal fin is long, it begin behind the head reaching nearly the tail; it have 100-105 hard rays. The anal fin have three hard rays and nine soft rays. The pectoral fins consist of one hard ray and 5 soft rays. The back of the tail is rounded. The total greatness of the body is 13 cm.

Thorax vertebrae: relatively long with short narrow neural prominences, gently lean to back. The ribs are long and thick.

Paleoecology: This is social, herd fish living in littoral open sea water, into 100 m depth.

Stratigraphic range: Eocene - Miocene of the Europe.

Occurrence: Blatná Valley - Zásكالie.

Suborder *Trachinoidei*

Family *Trachinidae* RISSO, 1826

Genus *Trachinus* LINNE, 1758

Trachinus minutus JONET, 1958

Fig. 5

Material: One no complete fish, without head and tail.

Dimensions: L - 4,6 cm and H - 1,5 cm.

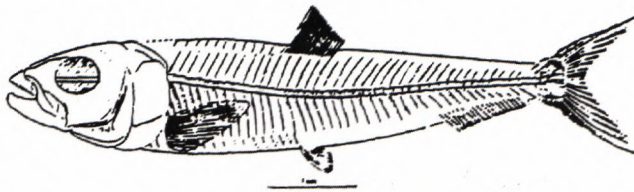


Fig. 2: Reconstruction by *Clupea sardinites* (HECKEL, 1850) from Pharissat 1991.

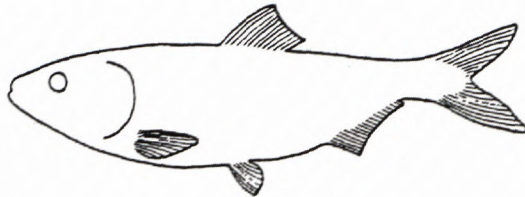


Fig. 3: Reconstruction by *Alosa* sp. from Szymczyk 1978.

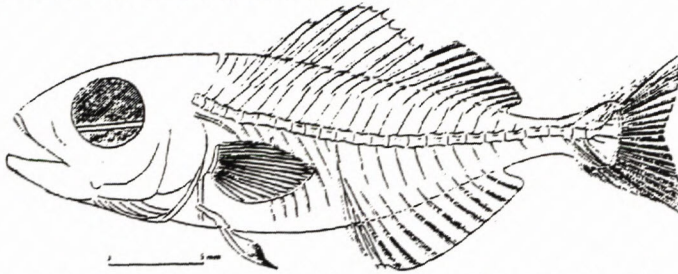


Fig. 4: Reconstruction by *Serranus budensis* (HECKEL, 1856) from Pharissat 1991.

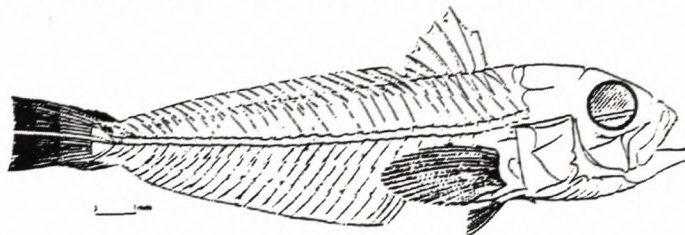


Fig. 5: Reconstruction by *Trachinus minutus* (JONET, 1958) from Pharissat 1991.

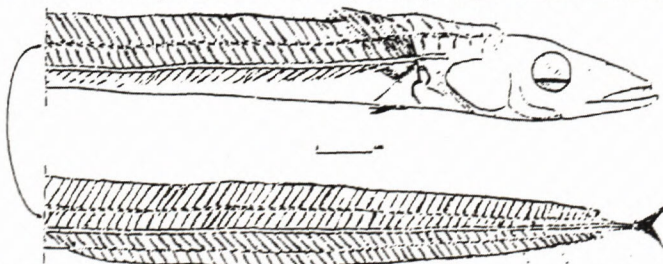


Fig. 6: Reconstruction by *Lepidopus glarisianus* (BLAINVILLE, 1818) from Pharissat 1991.

Description: The fish body is long and low lateral oblate with big head and with broad upper mouth. There are big eyes situated in the upper part of the head behind of them three big bony plates occur. The eyelid gills have strong spine with poison. *T. minutus* have a two dorsal fins, the first one is short, with six poison rays, the second one is very long, with 18-20 soft rays approximately. The anal fin is long with 22-23 rays approximately. The pelvic fins are situated on the throat. The total greatness of the body is 25 cm.

„scales“ shaped situated under the breast spine. The end of the tail is fork shaped. The total greatness of the fish body is 2 m.

Thorax vertebrae: are long with less narrow neural prominences, strongly leaning to the back. The anal fins pterygiophores are short and thick. The rays are long and narrow.

Upper jaw – bone: consist of seven long teeth (0,09 cm).

Lower jaw – bone: six teeth (0,1 cm), the first one of them is longer (0,2 cm).

Thorax vertebrae: are long with short narrow neural prominences gently lean to back. The anal fins are long and narrow, wider part of the fins joints are touched each other.

Paleoecology: It is solitary fish, living in deep water up to 2000 m.

Stratigraphic range: Eocene – Miocene of the Europe.

Occurrence: Zuberec – slide area.

Suborder *Scombridae*

Family *Trichiuridae* RAFINESQUE, 1810

Genus *Lepidopus* GOUAN, 1770

***Lepidopus glarisianus* BLAINVILLE, 1818**

Fig. 6

Materials: Ten no complete skeletons, without the heads and the tails and one no complete head with jaw – bone and two pieces of operculum.

Dimensions: L (cm): 3,6; 2,2; 6,2; 1,9; 2,3; 2,6; 2,8; 1,9; 2,5; 7,4; H (cm): 2,0; 1,7; 1,6; 0,9; 1,1; 1,0; 1,0; 1,3; 0,9; 1,0.

The upper jaw – bone is long 1,3 cm, the lower jaw – bone is long 1,9 cm.

Description: The fish body is prolate and fillete without the scales. On the vertical head section, shallow climbing from the snout to the border of the eyes is visible and than it is gradually steeping to beginning of the dorsal fin. The long head is approximately 1/7 of the body length. *L. glarisianus* have a final snout, broad mouth and the lower jaw – bone is longer than the upper jaw – bone. There are a strong teeth on the lower jaw – bone. The dorsal fin is long, beginning behind of the head and is reach nearly to the tail. It consist of 100-105 hard rays. The anal fin is short, it is situated in the middle part of the fish body, it have 31-36 hard rays rising from the skin, there are also 21-25 soft rays. The pelvic fins are small

Operculum: big triangle arched bone with small joint head. The crista opercularis is very good preserved on the first piece investigated, on the second one it is totally destroyed.

Paleoecology: This is social herd fish living in open water, in 100-250 m depth, on the continental shelf reaching 400 m as well as in littoral water too.

Stratigraphic range: Oligocene – Pliocene of the Europe.

Occurrence: Blatná Valley – Zásكالie.

Conclusions

Transgression of the Paleogene sea on the emerged Sub-Tatric Mesozoic Units in the Orava Region started during the Middle Eocene. The sea-level rise influenced essentially the changes of the sedimentary environment and living conditions of the fish fauna. The fish association investigated on the localities near Zuberec village document deep-water conditions (100 – 250 m depth) prevailing during the sedimentation of the Menilite Beds.

The fish association preserved on the selected localities Pribisko Brook and slide area near Zuberec point out on mesopelagial conditions. The scales of the *Clupea sardinites* were found in all succession studied. On the other hand, the remnants of the skeletons of *Trachinus minutus* were identified in the studied section near Zuberec. The fossils fish remnants represented by the Eocene fish species *Clupea sardinites*, *Serranus bunensis* derived from locality brook in Blatná Valley - Zásكالie indicate littoral shallow water conditions prevailing near the coast. Oligo-

cene fishes *Lepidopus glarisianus*, *Alosa* sp. are typical for open deep-water conditions. On the base of these data it is possible to presuppose deepening of the sedimentary environment during the Oligocene.

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