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OLIGOCENE ALEPOCEPHALOID FISHES FROM THE POLISH CARPATHIANS

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Carpathichthys polonicus gen. et sp. n., alepocephaloid fish from the Menilite Beds (Carpathian flysch) is described. It represents the first fossil occurrence of this deep-sea group. This new form is superficially similar to the Recent genus *Rouleina*, but differs from it in osteological features.
K e y w o r d s: Teleostei, taxonomy, Oligocene, Polish Carpathians.

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INTRODUCTION

The present paper is based on several specimens of alepocephaloids found in the years 1963—1977 in the Oligocene Menilite Beds of the Carpathian flysch. All the fishes were collected in the upper part of the upper bathypelagic horizon of the Menilite Beds (Jerzmańska 1968). The Alepocephalidae described below occur in zones IPM 5—6 according to the latest biostratigraphic subdivision of the Menilite Beds (Kotlarczyk and Jerzamńska 1976). The majority of the specimens were found in the following sites (Skole Unit): Huta Brzuska, Siemowica and on the Krępak hill at the village Korzeniec. The lithostratigraphic profiles of these localities will be published later. One specimen only is derived from the Subsilesian Unit. The site is situated in the village Przysietnica (Jerzmańska 1968).

True fossil Alepocephalidae were hitherto unknown. Although Daniltshenko (1960) included the new genus and species *Palaeotroctes strictus*, from the Oligocene of the Caucasus, in this family, according to Arambourg (1967) this form belongs to the Gonostomatidae. Having studied the description and photograph in Daniltshenko's paper, I believe that Arambourg's opinion is correct. So the present material constitutes the first occurrence of fossil Alepocephalidae.

The Alepocephalidae, together with the Bathyprionidae and Searsiidae (both without fossil record), constitute the superfamily Alepocephaloidea (Greenwood and Rosen 1971). All living alepocephaloids are mesopelagic and bathypelagic or benthic fishes (Grey 1956, Krefft 1973). Their relationships are dubious. Originally they were connected with the Clupeoidei (Berg 1958, Gosline 1960), but subsequently Gosline (1969) suggested a relationship with the Osmeroidei. New data concerning the structure of the gill arches, the caudal fin skeleton and other characteristics allowed Greenwood and Rosen (1971) to introduce a new hypothesis, that the Alepocephaloidea are most closely related to the Argentinoidei. These authors assume that the reduction in ossification of the skeleton and the backward migration of the dorsal fin in alepocephaloid phylogeny were related to invasion of abyssal waters. The Oligocene *Carpathichthys* n. gen., showing both of these features (pp. 5 and 10) and occurring among other deep-water fishes (Kotlarczyk and Jerzmańska 1976), doubtless represents one of the stages of this invasion. The Alepocephalidae appeared in the Carpathian basin rather late, since they occur only in the upper part of the Menilite Beds. They are absent in the relatively well-known earlier sediments in the lower part of the Menilite Beds which contain an assemblage of deep-water fishes (zone IPM 1), and they are not found among the shallow-water forms (zone IPM 2). It could therefore be assumed that the morphological and ecological evolution of the Alepocephalidae must have taken place earlier and in another basin.

For finding the fossil alepocephalids I owe thanks to Dr. W. Szymczyk and Ms E. Świdnicka, who greatly helped me in my field work, and to my husband, Prof. J. Jerzmański, for his persistence in searching for these rare fishes. I thank Mr. Z. Staniewski, M. Sc. for making the photographs.

All specimens described here are housed in the Zoological Institute of Wrocław University (abbreviated as ZPALWr.).

SYSTEMATIC PART

Division **Teleostei** (*sensu* Nelson, 1969)
Superorder **Protacanthopterygii** Greenwood *et al.*, 1966
Order **Salmoniformes** (*sensu* Greenwood *et al.*, 1966)
Suborder **Argentinoidei** (*sensu* Greenwood and Rosen, 1971)
Superfamily **Alepocephaloidea** Greenwood and Rosen, 1971
Family **Alepocephalidae** Richardson, 1856

Genus *Carpathichthys* gen. n.

Type species: *Carpathichthys polonicus* sp. n.

Derivation of the name: found in the Carpathians.

Diagnosis. — Long head with short posterior part of neurocranium; maxilla forms the greater part of upper jaw; mandible shallow; jaws with small, uniform teeth arranged in single rows; opercular bones thin with smooth margins; preoper-

culum and interoperculum large; operculum long, shallow and triangular; ceratohyal imperforate with narrow midportion; pelvics inserted slightly behind midpoint of body; dorsal and anal fins, posteriorly placed, subequal and opposite; about 41 vertebrae, 20 caudal; majority of head bones, cleithrum and vertebral centra of adult forms with numerous low ridges and furrows; scales absent; pectoral and caudal fin without produced ray.

Remarks. — Among over 20 living genera of the family Alepocephalidae (Norman 1930, Parr 1951, 1952, Nielsen 1972, Ivamato *et al* 1976, Amaoka and Abe 1977) the Recent genus *Rouleina* Jordan displays the highest degree of resemblance to *Carpathichthys*. The latter agrees with *Rouleina*: in the position of the pelvic, dorsal and anal fins; in number of dorsal and anal rays; and in absence of scales. However, *Carpathichthys* differs from the known species of *Rouleina*:

1) in having a slender mandible resembling that of *Bathylaco* Goode and Bean (Nielsen and Larsen 1968, fig. 3; pl. 15: 1), while in *Rouleina* the lower jaw is deeper (Alcock 1892: 359; pl. 17: 3) and similar in shape to that of *Alepocephalus rostratus* Risso (Gosline 1969, fig. 2);

2) in having a longer maxilla, extending beyond the posterior margin of the orbit;

3) in having more rays in the pectoral fin — in *Rouleina* there are only 7 (Parr 1951, Grey 1959);

4) in the smaller number of vertebrae; in *Rouleina attrita* (Vaillant) there are 48 vertebrae (Fowler 1936).

A typical feature of *Carpathichtys* is the numerous low ridges and furrows around the margins of some dermal bones (parasphenoid, ectopterygoid, mesopterygoid, preoperculum, interoperculum, supramaxilla, cleithrum) and some cartilage bones (hyomandibular, ceratohyal, centra of vertebrae). These ridges and furrows are visible on both the medial and lateral surface of these bones. It seems that they probably indicate the stages of growth of the dermal and cartilage bones in *Carpathichthys*. Among living alepocephaloids, so far as they are known, such ornament is absent. However, according to Gegenbaur (1878) and Gosline (1969) in *Alepocephalus rostratus* the cartilage bones of the skull show concentric markings, which can be regarded as growth rings. Lack of data on the osteology of other living species of Alepocephalidae does not allow us to eliminate the occurrence of these ridges and furrows.

Comparison of the axial skeleton of *Carpathichthys polonicus* with those of Recent Alepocephalidae can be based only on Gosline's paper (1969) concerning *Alepocephalus rostratus*. Such a comparison shows some similarities in the morphology of the neural arches in the abdominal region. In *Carpathichtys polonicus* paired plate-like bones occur above the abdominal centra. They are unfused to the centra in all the abdominal vertebrae except the last one. These plate-like bones serve as the base for two long, fine projections. According to Gosline's interpretation of similar ossifications in the Recent *Alepocephalus rostratus* it seems probable that each such ossification represents a neural spine and an epineural bone. It should be emphasized, that in the caudal region of *Carpathichtys polonicus* one can also see traces of these plate-like bones on several centra, while in *Alepocephalus rostratus*, according to Gosline (1969), the bones seem to be fused completely into the centra.

The poorly ossified skeleton can be regarded as a specialization of *Carpathichthys polonicus*. This specialization manifests itself both in thin bones and in their feeble sutures. That is the reason for frequent finds of isolated skull bones. The dislocation of vertebrae (fig. 1) in complete specimens is probably caused by feebly fused centra.

The operculum of *Carpathichthys polonicus* has a reduced dorsal part which also points to an early specialization of the family and agrees with the reduction of ossification in the evolution of the Alepocephalidae assumed by Greenwood and Rosen (1971).

Carpathichtys polonicus sp.n.
(pls 15 and 16; figs 1—6)

Holotype: ZPALWr A/2004; pl. 15 and 16; figs 1, 5b, 6.

Type horizon: Oligocene, zone IPM 5 of the Menilite Beds.

Type locality: the Krępak hill, near the village Korzeniec, the Carpathians, Poland.

Derivation of the name: *polonicus* — found in Poland.

Diagnosis. — As for the genus, only species.

Formulae: Vert. 41—42 (22—21+20); D-20; A-17—18; P-13; V-7.

Material. — 2 complete (ZPALWr A/2004—2005), 5 almost complete (ZPALWr A/2006—2010) and 20 incomplete specimens (ZPALWr A/2011—2014; 2017—2024; 2041—2048).

Dimensions: ZPALWr A/2004	mm	Percentages of	
		Standard Length	Head Length
Standard length	68.0	—	—
Head length	24.0	35.3	—
Predorsal length	45.0	66.1	—
Preanal length	46.5	68.7	—
Prepelvic length	38.5	56.7	—
Depth caudal peduncle	6.5	—	18.3
Upper jaw length	13.0	—	54.1
Lower jaw length	15.5	—	64.1

Description. — Small, slender fishes with delicate skeleton. Large head whose length fits 2,8 times in standard length. The bones of the skull were not heavily fused, since they are often found disarticulated. Standard length of the largest complete specimen is 68 mm. From the fragments of other skeletons I assume that the length of the remaining specimens ranges from 30 to 100 mm.

The neurocranium is short, as the greater part of the head length is occupied by the well-developed gill region. The dermal bones of the skull roof were probably poorly ossified, since they are not preserved in any specimen. Only the parasphenoid, being better ossified, is preserved among the isolated head bones. It is a long, straight bone, broadest posteriorly, narrowest in the middle and again broader anteriorly. In the middle of the dorsal surface there is a distinct ridge, with a corresponding groove on the ventral surface. On the lateral parts of the parasphenoid there are low ridges and furrows running almost parallel to the bone margins (fig. 2*a*).

Splanchnocranium. The mouth is large and oblique, the jaws extending back beyond the posterior margin of the orbit. The maxilla is slightly curved. The posterior part of the maxilla is broad and weakly ornamented. A well developed ridge runs close to the ventral margin (fig. 2*b*). There is a single, oval supramaxilla with a slender anterior process. The broad part of the supramaxilla is ornamented with concentric low ridges. The premaxilla is a narrow bone. Its length constitutes no more than about 1/3 of the length of the upper jaw. The mandible is slender anteriorly and slightly deeper posteriorly. The toothed margin of the dentary is long. The lateral face of the mandible shows a long ridge with a corresponding groove on the medial face. This must mark the course of the mandibular sensory canal,

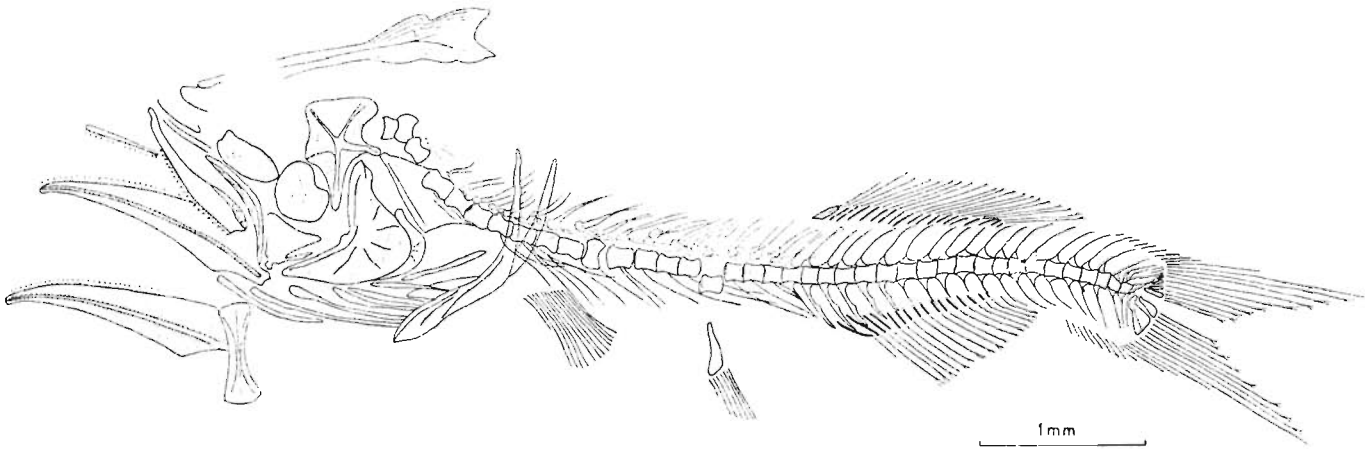

Fig. 1. *Carpathichthys polonicus* gen. et sp.n.: reconstruction based on ZPALWr A/2004 and 2011, Menilite Beds, zone IPM 5, Krępak and Huta Brzuska. Scale bar = 1 cm.

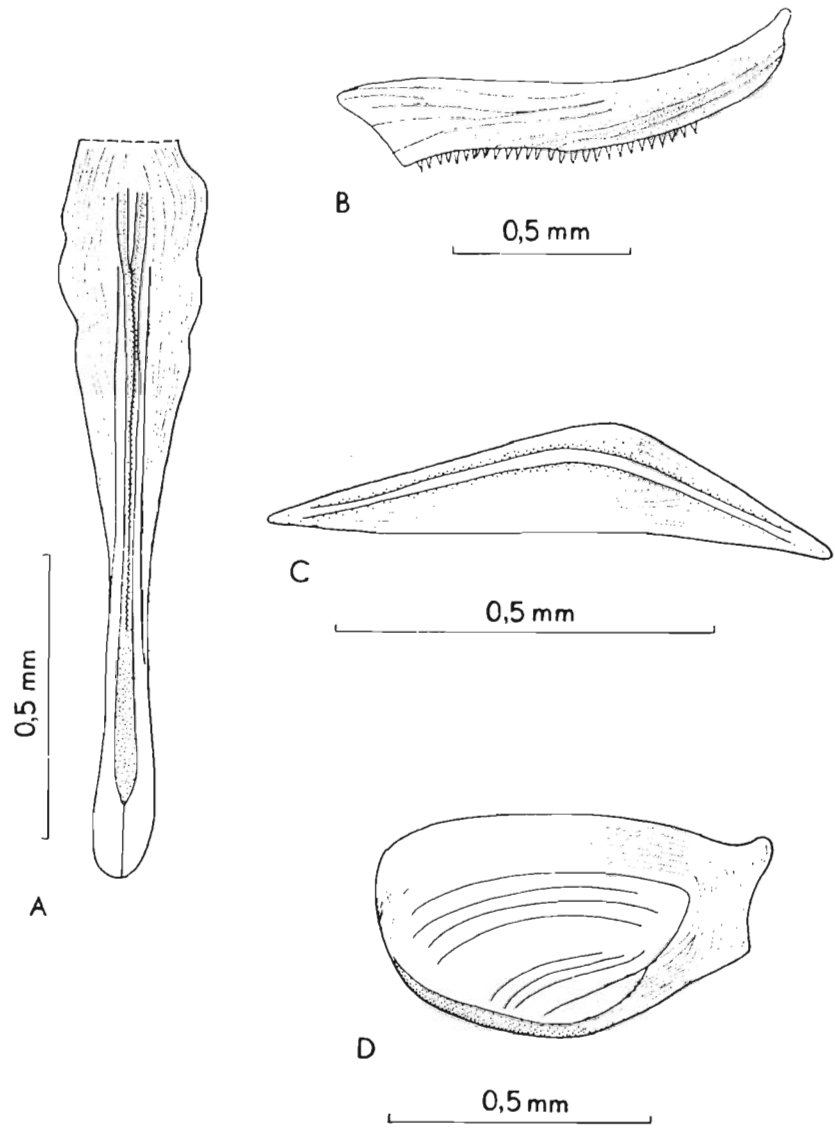

Fig. 2. *Carpathichthys polonicus* gen. et sp.n.: *A* ZPALWr A/2022, parasphenoid, Siemowica; *B* ZPALWr A/2022, left maxilla in medial view, Siemowica; *C* ZPALWr A/2013, right ectopterygoid in medial view, Krępak; *D* ZPALWr A/2022, left mesopterygoid in medial view, Siemowica; Menilite Beds, zone IPM 5. Scale bars = 0.5 cm.

which appears to be open in the greater part of its length. The dentition of the upper jaw and of the dentary consists of a single row of small conical teeth.

The ectopterygoid is broadest in the middle part. There is a smooth ridge on the medial surface of the ectopterygoid, with a corresponding groove on the lateral surface (fig. 2*c*). The remainder of the bone is ornamented with fine furrows and ridges. Similar almost concentric furrows and ridges can be seen on the surface of the oval mesopterygoid (fig. 2*d*). The metapterygoid is roundish in shape with several radial thickenings (fig. 1). The rest of the surface is smooth. Its margin neighbouring the hyomandibular is concave.

The hyomandibular (fig. 3*a*) is large and well ossified and is frequently preserved among the isolated bones of the skull. Four stout thickenings meeting at the center can be seen on the lateral and medial sides of the bone. The remaining thinner part of the bone has two kinds of furrows and ridges. In the first kind they are fine and run parallel to the margins of the bone, in the other they are less regular and coarsed. The head of the hyomandibular is single and slightly convex. The relatively long opercular process lies almost in the middle part of the bone. The anterior edge of the hyomandibular is slightly arched with two small depressions.

The large, thin opercular bones extend far beyond the neurocranium (fig. 1). The long, almost triangular operculum (fig. 3*b*) is a very thin bone with a gently striated posterior part. Only its anterior edge and the horizontal flange running posteriorly on the medial surface from the opercular facet ae more heavily ossified.

The large preoperculum has smooth edges, is more heavily ossified anteriorly and has irregularly placed longitudinal thickenings on the posterior part (fig. 4*a*,*b*). The remaining part of the bone is very thin. The bone surface shows fine furrows and ridges which are almost parallel to the margins and thicker in the lower part of the bone. The number and arrangement of these ridges and furrows vary from one specimen to another. The narrower, dorsal part of the preoperculum is always oblique to the lower part of the bone.

The interoperculum (fig. 4*c*) is a thin, large bone with concave anterior and arched posterior edges and a highly furrowed surface. More ossified parts are seen as radial or irregular thickenings running from the middle of the bone, and as a broad, arched ridge parallel to the anterior edge of the bone. Fig. 4*d* shows the natural position of the bone, partially covered by the preoperculum.

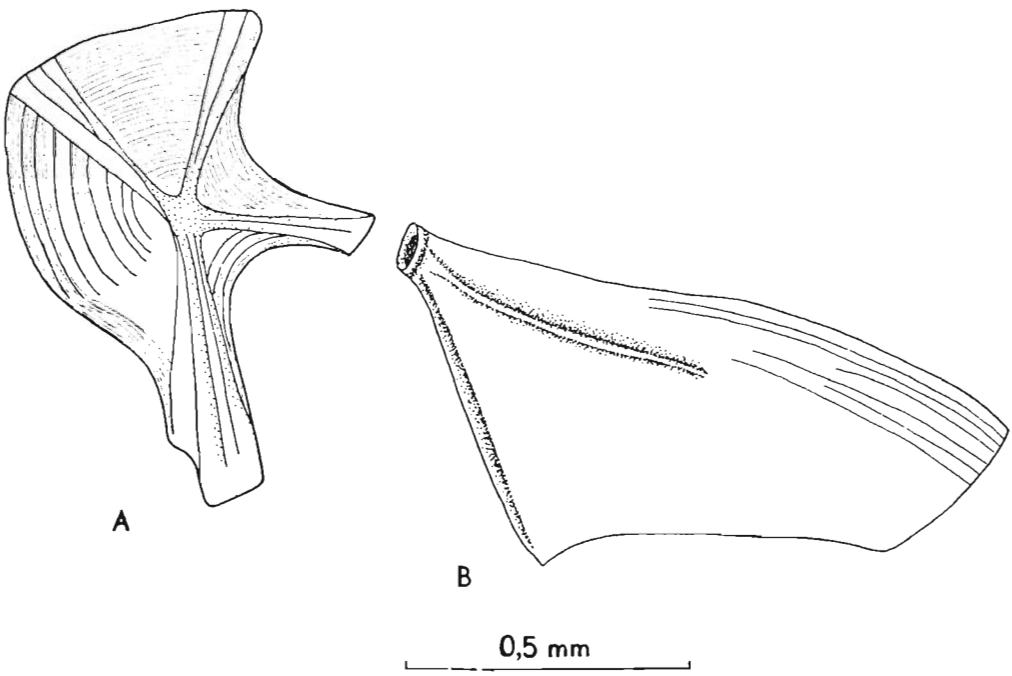

Fig. 3. *Carpathichthys polonicus* gen. et sp.n.: *A* ZPALWr A/2041, right hyomandibular in medial view, Krępak; *B* right operculum in medial view — based on ZPALWr A/2041 and 2011; Menilite Beds, zone IPM 5, Krępak and Huta Brzuska. Scale bar = 0.5 cm.

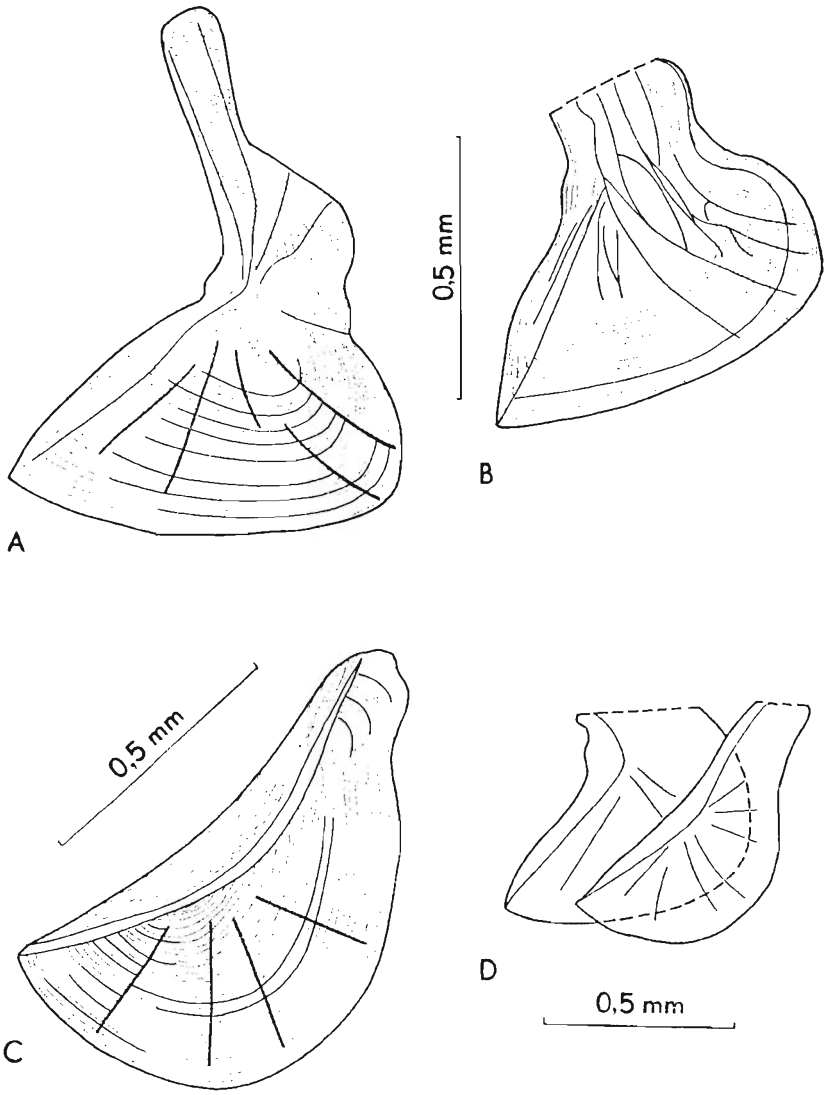

Fig. 4. *Carpathichthys polonicus* gen. et sp.n.: *A* ZPALWr A/2041, right preoperculum in medial view, Krępak; *B* ZPALWr A/2022, lower part of the right preoperculum in medial view, Siemowica; *C* ZPALWr A/2042, left interoperculum in lateral view, Siemowica; *D* restoration of right preoperculum and interoperculum in medial view based on ZPALWr A/2044, Krępak; Menilite Beds, zone IPM 5. Scale bars = 0.5 cm.

The suboperculum is not preserved among the isolated skull bones and it is impossible to reconstruct its shape. The posterior margins of the opercular bones show a certain variability in size and contour.

The imperforate ceratohyal resembles an hour-glass in shape, and has longitudinal flanges and transverse, fine furrows and ridges on the anterior and posterior end (fig. 5*a*). Only seven branchiostegal rays are visible (fig. 1).

Among the bones of the pectoral girdle only the cleithrum has low ridges and furrows on the surface (fig. 1). The supracleithrum and post-temporal are poorly

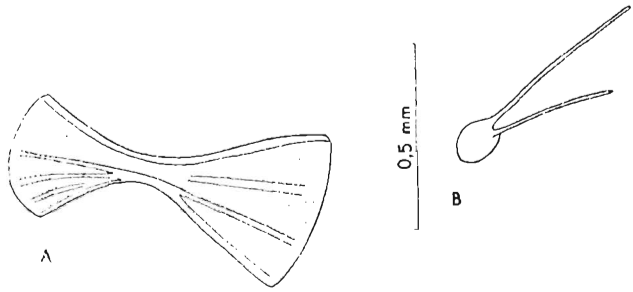

Fig. 5. *Carpathichthys polonicus* gen. et sp.n.: *A* ZPALWr A/2044, left ceratohyal in lateral view; *B* ZPALWr A/2004, plate- like bone with neural spine and epineural; Menilite Beds, zone IPM 5, Krępak. Scale bar = 0.5 cm.

preserved and smooth. The pectoral fin is placed near the ventral margin of the body. It contains 13 delicate rays, none of which is produced or elongated.

The pelvic fin is inserted a little beyond the middle of the standard length, below the 4th or 5th abdominal vertebra counted from the posterior end. It contains 7 rays, the first of which is unbranched.

Vertebral column. There are 20 caudal vertebrae and 21—22 abdominals. All the centra are ossified. In adolescent specimens they are smooth and short, but in adults the centra are longer with furrows on the anterior and posterior part (fig. 1). Paired plate-like bones, which I consider to be neural arches, occur above the abdominal vertebrae. Each plate-like bone bears a posterodorsally projecting neural spine and a slender epineural bone (figs 1, 5*b*). In the last abdominal vertebra the neural arches are fused with the centrum, and with each other, though the single neural spine is still bifurcated dorsally; epineurals are lacking. There are 13 pairs of ribs. In the caudal region the neural arches are fused with the centra and the neural spines are single, except the first two which are bifurcated at the tip. Epineurals are absent in all caudal vertebrae. The first five haemal arches are slightly broadened in the middle (fig. 1).

The specimens are so preserved that a complete reconstruction of the caudal skeleton is impossible. Fig. 6 is merely an interpretation based on two specimens. The last neural spine seems to be more poorly developed than the preceding one.

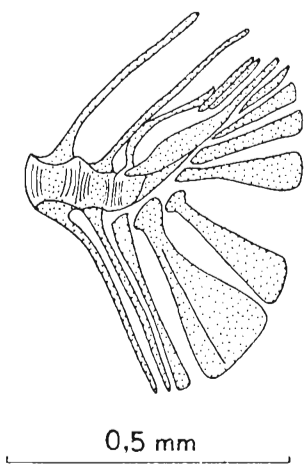

Fig. 6. *Carpathichthys polonicus* gen. et sp.n.: restoration of caudal fin skelton based on ZPALWr A/2004 and 2011, Menilite Beds, zone IPM 5, Krępak and Huta Brzuska. Scale bar = 0.5 cm.

It is impossible to state how many uroneurals there were in *Carpathichthys*. One can see two epurals and six hypurals, including two lower and four upper ones.

The dorsal fin originates behind the middle of the standard length. It contains 20 rays and originates above the 18th and ends above the 10th caudal vertebra (counted from the end). The first ray is unbranched. The remaining rays are segmented distally and branched. All the rays of the dorsal fin are supported by slender pterygiophores.

The anal fin contains 17—18 rays and is slightly shorter than the dorsal fin. The first short ray is unbranched and the remainder are segmented distally and branched. The second ray is the longest. The anal fin begins not far behind the origin of the dorsal fin.

The forked caudal fin is rather short since its length amounts to about 15% of the standard length. The upper lobe contains 10 principal rays (9 of them branched) and about 10 shorter procurrent ones. There are 9 principal rays (8 of them branched) in the lower lobe and 12 shorter procurrent rays.

Scales are not preserved in any specimen. It seems that the body was naked. Light organs are absent.

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ANNA JERZMAŃSKA

OLIGOCEŃSKIE RYBY KOŚCISTE RODZINY ALEPOCEPHALIDAE Z POLSKICH KARPAT FLISZOWYCH

Streszczenie

Przedstawiono opis nowego rodzaju i gatunku ryby *Carpathichthys polonicus*, rodzina Alepocephalidae, z górnej części górnego poziomu batypelagicznego warstw menilitowych (Jerzmańska 1968), zona IPM 5—6 (Kotlarczyk, Jerzmańska 1976). Współcześni przedstawiciele Alepocephalidae należą do form mezo- i batypelagicznych lub bentonicznych (Grey 1956, Krefft 1973). W stanie kopalnym rodzina ta była dotychczas nieznana. Ich budowa jak i występowanie w profilu warstw menilitowych pozwala przypuszczać, iż ewolucja tej rodziny musiała odbywać się już wcześniej w innym basenie morskim. Wśród ponad 20 współczesnych rodzajów Alepo-

cephalidae największe podobieństwo do opisanej formy karpackiej wykazuje rodzaj *Rouleina* Jordan. Dotyczy ono położenia płetw brzusznych, płetwy grzbiętowej i odbytowej oraz braku łusek. Równocześnie *Carpathichthys* różni się od rodzaju *Rouleina* budową szczęk, większą liczbą promieni w płetwach piersiowych i mniejszą liczbą kręgów.

Praca została wykonana w ramach problemu MR. II/3.

EXPLANATION OF THE PLATES 15 and 16

Plate 15

Carpathichthys polonicus gen. et sp. n., Krępak hill, Oligocene: holotype, ZPAL Wr A/2004, right side, ×2.

Plate 16

Carpathichthys polonicus gen. et sp. n., Krępak hill, Oligocene: anterior portion of holotype, ZPAL Wr A/2004, left side, ×4.