A new deep-sea hatchetfish (Teleostei: Stomiiformes: Sternoptychidae) from the Eocene of Ilam, Zagros Basin, Iran

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ABSTRACT - The deep-sea hatchetfish clade includes some of the most bizarre stomiiforms, which are characterized by a deep and strongly compressed body, with vertically flattened silvery sides. This peculiar group of mesopelagic fishes consists of three extant and three extinct genera that appeared in the record in the Middle Eocene. A new genus and species of deep-sea hatchetfish, Sternoptyx discoidalis n. gen. et sp., is described from the Middle to Late Eocene deposits of the Pabdeh Formation exposed a few kilometres east of the city of Ilam, Zagros Basin, Iran. The new deep-sea hatchetfish taxon from Ilam is based on a partially complete specimen in part and counterpart characterized by a remarkably discoid physiognomy and a unique combination of features, including: 28 (13+15) vertebrae; eight pairs of pleural ribs; two posteriormost pleural ribs shortened not reaching the ventral margin of the abdominal keel; six supraneurals; dorsal blade absent; dorsal fin contains 18 rays; first dorsal-fin pterygiophore very large and protruding externally beyond the dorsal profile of the body; possession of two preanal spines; anal-fin origin opposite to dorsal-fin origin; posttemporal and supracleithrum not fused; posttemporal spine absent; body naked. The comparative osteological analysis suggests that Sternoptyx n. gen. appears to be intermediate between the basal genus Polyipnus and the more derived deep-sea hatchetfish genera Argyrophelebus, Discosteron, Horbatshia, Polyipnoides, and Sternoptyx.

KEY WORDS - Stomiiformes, Sternoptychidae, deep-sea hatchetfish, Eosternoptyx discoidalis n. gen. et sp., Eocene, Ilam, Zagros Basin.

INTRODUCTION

The existence of exceptionally well-preserved teleost skeletal remains from the Pabdeh Formation cropping out in the territory surrounding the city of Ilam was reported for the first time by Priem (1908), who described a small fossil assemblage based on material discovered by Roland de Mecquenem around 1904 in the course of his geological exploration of Iran. In agreement with the hypothesis formulated by de Mecquenem (1908) based on stratigraphic data, Priem (1908) suggested that the fish assemblage was Cretaceous in age. Towards the end of 1938 and at the beginning of 1939, Camille Arambourg visited the locality discovered more than 30 years earlier by Roland de Mecquenem and carried out extensive excavations that resulted in the accumulation of a vast collection of articulated skeletons of teleost fishes, many of which were described in great detail in his monograph devoted to this fauna published about 30 years later (Arambourg, 1967). Arambourg (1967) documented the existence of slightly fewer than 30 taxa from Ilam, including species belonging to groups today occurring in the oceanic realm, for example berycids, bythitids, bregmacerotids, gephyrids, gonostomatids, lophotids, nomeids, phosichthyids, and sternoptychids. Based on Arambourg’s (1967) study of the fish fauna at Ilam, the family Sternoptychidae is exclusively represented by the species Maurolicus morgani Arambourg, 1967. A few years after the publication of the monographic study by Arambourg (1967), Haghipour & Brants (1971) published a short report on a few fishes collected from the Pabdeh Formation in another site in the surroundings of Ilam and included a few biostratigraphic data allowing a more precise age assignment. More recently, Jafarian et al. (1999) provided a short overview of the fish assemblage of Ilam.

The goal of this paper is to describe another sternoptychid from the Ilam, representing the first deep-bodied member of this family, commonly known as deep-sea hatchetfishes, recognized from this locality.

The deep-sea hatchetfishes are among the most bizarre members of the order Stomiiformes being
characterized by a deep and strongly compressed body, with vertically flattened silvery sides used to reflect the incident light and appear invisible at all angles of view. These mesopelagic fishes primarily feed on amphipods, copepods, euphausiids and ostracods and usually occur at depths below 200 meters, exhibiting a diurnal vertical migration toward the surface (e.g., Hopkins & Baird, 1985). The group of deep-sea hatchetfishes includes three extant genera, Argyropleucus, Polyipnus and Sternopteryx, plus three fossil genera - Polyipnoides from the Middle Eocene of Georgia, Horbatshia from the Oligocene of the Carpathians, and Discosternon from the Middle Miocene of Italy (Prokofiev, 2005; Carnevale, 2008; Colombero et al., 2013) - forming a well-defined and cohesive clade also known as (subfamily) Sternoptychinae.

A detailed morphoanatomical analysis of the single available specimen of deep-sea hatchetfish from Ilam revealed that it represents a new genus of the Sternoptychinae, thereby constituting the seventh genus of the subfamily and one of the earliest members of this group.

STRATIGRAPHIC NOTES

The Pabdeh Formation originated in the northwestern and southwestern parts of the Zagros Basin between the late Paleocene and the early Oligocene and consists of thin to thick-bedded limestone intercalated with gray shales with abundant planktonic microfauna (e.g., James & Wynd, 1965; Sampò, 1969). Overall, the Pabdeh Formation accumulated under oxygen-depleted conditions in the deeper parts of intrashelf basins formed in a foreland suite (see, e.g., Ala et al., 1980; Murris, 1980). In a recent study, Mohseni et al. (2013) - forming a well-defined and cohesive clade also known as (subfamily) Sternoptychinae.

The age of the ichthyolithiferous layers of the Pabdeh Formation exposed in the surroundings of Ilam was erroneously assigned to the Rupelian by Arambourg (1967) based on the presence of certain taxa as Bregmaceros filamentosus (Priem, 1908) and Palaeorhynchus, taxa which, at that time, were known exclusively from the Oligocene of the Rhine Basin, Switzerland, the Carpathians and North Caucasus; both these taxa have been subsequently documented in Eocene deposits of Europe (e.g., Bannikov, 2010). Haghipour & Brants (1971) proposed a Middle to Late Eocene age based on the presence of planktonic foraminifers belonging to the genus Hantkenina in the fish-bearing layers (see Coxall et al., 2003). A recent analysis of the foraminiferan content of strata placed about 300 meters above the fish-bearing layers revealed the presence of several benthic forms that seem to indicate a Middle to Late Eocene age, including Bolivinoides draco (Marsson, 1878), Elphidium sp., Laevidentalina communs (d’Orbigny, 1826), Lagena sp., Marginulina wetherelli Jones, 1854, Nodosaria spp., Operculina sp., Stilostomella sp., Tritaxia aspera (Cushman, 1926), and Uvigerina spicostata Cushman & Jarvis, 1929.

MATERIALS AND METHODS

The specimen described herein was collected in 2011 during summer field activities east of the city of Ilam (33°37’36’’N, 46°26’24’’E), western Iran (Fig. 1). It is currently housed in the paleontological collection of the Museum of the Department of Geology, University of Isfahan (IUV). The fossil was examined using a Leica M80 stereomicroscope with attached camera lucida drawing arm. Measurements were taken with a dial caliper, to the nearest 0.1 mm. The specimen required matrix removal before examination in order to allow observation of its anatomical structure in as much detail as possible; this was achieved using entomological mounting needles. Comparative data were derived from the literature, mainly Baird (1971), Weitzman (1974), Harold (1993, 1994), Carnevale (2003, 2007, 2008), and Prokofiev (2005).

Abbreviations

AB, abdominal photophores; AN, anal photophores; bsp, basisphenoid; cl, cleithrum; cor, coracoid; ecp, ectopterygoid; enp, endopterygoid; epi, epicoxial; f, frontal; h, hyomandibula; io, infraorbital bone; IUV, Museum of the Department of Geology, University of Isfahan, Isfahan, Iran; le, lateral ethmoid; MGPA, Museo Geo-Paleontologico dell’Alto Aventino, Palena (CH), Italy; mtp, metapterygoid; op, opercle; pa, parietal; pal, palatine; PAN, preanal photophores; pas, parasphenoid; pfr, pectoral-fin rays; PIN, Borisyak Paleontological Institute, Russian Academy of Sciences, Moscow, Russia; pop, preopercle; pro, prootic; pto, pterotic; pts, pterosphenoid; ptt, posttemporal; q, quadrate; rad, pectoral-fin radials; SAB, supra-abdominal photophores; SC, subcaudal photophores; sca, scapula; scl, supracleithrum; soc, supraccipital; spn, first supraneural; spo, sphenotic; USNM, National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA; sym, symplectic; vo, vomer.
SYSTEMATICS

Subdivision Teleostei sensu Patterson & Rosen, 1977
Order Stomiiformes sensu Harold & Weitzman, 1996
Infraorder Gonostomata sensu Harold, 1998
Family Sternoptychidae Duméril, 1806

Genus Eosternoptyx n. gen.

Diagnosis - A deep-sea hatchetfish with discoid body; body depth 79.3% of standard length; caudal peduncle length 13.2% of standard length; 28 (13+15) vertebrae; eight pairs of pleural ribs; two posteriormost pleural ribs shortened not reaching the ventral margin of the abdominal keel; six supraneurals; dorsal blade absent; 18 dorsal-fin rays; first dorsal-fin pterygiophore very large and protruding externally beyond the dorsal profile of the body; two preanal spines; anal-fin origin opposite to dorsal-fin origin; posttemporal and supracleithrum not fused; posttemporal spine absent; body naked.

Derivation of name - From the Greek Eos (dawn or sunrise); and sternoptyx, from the Greek words sternon (chest) and ptyx (plate), referring to the remarkably deep and compressed body shape typical of the deep-sea hatchetfishes; hence a ‘deep-sea hatchetfish from the Eocene’.

Eosternoptyx discoidalis n. sp.
(Figs 2-4)

Diagnosis - As for the genus, only species.

Holotype - IUV IL/S1, a partially complete articulated skeleton in part and counterpart (Fig. 2).

Locality and age - East of Ilam, Ilam Region, western Iran; Middle to early Late Eocene.

Derivation of name - The species name refers to the almost discoid outline of the body.

Description - The holotype and only known specimen of Eosternoptyx discoidalis n. gen. et sp. consists of a relatively well-preserved partially complete articulated skeleton in part and counterpart lacking the jaws, hyoid apparatus, part of the gill arches, and median and pelvic fin rays (Fig. 2).

The specimen is relatively small, its standard length measuring 29.5 mm. Other measurements as percentage of standard length (SL): body depth 79.3%; head length 33.5%; head height 74.9%; orbit diameter 22.7%; caudal peduncle length 13.2%; caudal peduncle depth 15.6%; dorsal-fin length 42.7%; anal-fin length 26.1%; predorsal length 60.3%; preanal length 82.7%; prepectoral length 47.1%; prepelvic length 58.9%.

The body is nearly discoid in outline, extremely deep and markedly compressed (Fig. 2). Like in the Miocene Discosteron (see Carnevale, 2008), the cephalic-abdominal portion of the body is rounded and hypertrophied and the body trunk is deep and considerably shortened. The abdominal keel is contained about three times in SL. The head is deep and antero-posteriorly compressed. The orbit is large. Part of the large eyeball is preserved as a thin organic film. The interorbital region was possibly relatively wide in origin. The caudal peduncle is short and deep.

The neurocranium is remarkably deep posteriorly and nearly triangular in outline (Fig. 2). The braincase is rather large. The ethmoid region is inadequately preserved in the single available specimen. The only partially recognizable elements of the ethmoid region are the large and columnar lateral ethmoid and the vomer; scattered conical vomerine teeth are also recognizable. The frontals are by far the largest bones of the skull roof. Each frontal bears a prominent longitudinal ridge characterized by a regularly crenulated margin. The posteroventral sector of the frontals is partially covered by sparse irregular pits, exhibiting a cancellous structure similar to that characteristic of certain species of the genus Argyropelecus and Sternoptyx (see Weitzman, 1974; Carnevale, 2003). The parietal is rather large and bears well-developed mid longitudinal and lateral ridges. The broad lateral and posterior extension of the parietal possibly resulted in the absence of a posttemporal fossa. The small supraoccipital has a pointed distal end. What appears to be the epioccipital has a greatly concave posterior margin and a nearly smooth outer surface. Exoccipital, basisoccipital and intercalary are not accessible in the specimen. There is no evidence of the original presence of the otic bullae. The parasphenoid is bent at right angle; the horizontal arm constitutes most of the basicranium and is nearly straight while the vertical arm gradually expands dorsally. The basiphenoid is tubular and roughly parallel to the vertical arm of the parasphenoid. Prootic and pterosphenoid are rather large; the ventral margin of these bones define the central and posterior portions of the dorsal border of the orbit. Both the sphenotic and pterotic are of moderate size and appear to be nearly quadrangular in outline.

Fragmentary remains of relatively large and laminar bone(s) underlying the horizontal arm of the parasphenoid can be interpreted as element(s) of the infraorbital series. There is no evidence of the supraorbital (Fig. 3).

Both the upper and lower jaws are not preserved in the available specimen (Figs 2-3).

The structure of the suspensorium is, in large part, relatively well exposed (Fig. 2). Overall, the suspensorium is remarkably deep and the quadrate-mandibular joint was apparently situated roughly under the midregion of the orbit. The spineless hyomandibula is slender and strongly elongate, reaching about four fifths of the neurocranial length; the articular head of the hyomandibula is flat and obliquely oriented and appears to be articulated with the pterotic; the opercular process emerges along the posterior border of the hyomandibula within the upper one sixth of its length. The symplectic is short and stout, characterized by a weakly club-shaped distal termination. The quadrate is rather large and appears to be roughly triangular in outline; the dorsal sector of the anterior border of the quadrate contacts the gently arched and laminar ectopterygoid. Both the large endopterygoid and the metapterygoid are incomplete; endopterygoid teeth are absent. The palatine, which is partially recognizable in counterpart, articulates posteriorly with the ectopterygoid and endopterygoid. Scattered palatine teeth appear to be present.
The opercular series is only partially preserved (Fig. 3). The exposed bones of the series are vertically elongate. Of the preopercle, only the elongate dorsal limb is clearly recognizable; the dorsal limb of the preopercle encloses a laterosensory canal for most of its length; the posterior border of the dorsal limb of this bone is smooth. The opercle is subquadrangular in outline, with a gently curved upper border and an irregular ventral border; this bone is strengthened by a vertical longitudinal ridge originating at the level of the opercular-hyomandibular...
Fig. 3 - *Eosternoptyx discoidalis* n. gen. et sp. from the Eocene of Ilam. Reconstruction of the skull, right lateral view. See text for abbreviations.
The architecture of the gill arches is difficult to interpret due to the extensive lateral compression that modified the original configuration of these complex structures so that the mutual relationships between the bones cannot be properly recognized. Nevertheless, hypobranchials, ceratobranchials, epibranchials and pharyngobranchials can be recognized evidently displaced from their original position. Elongate gill rakers bearing small denticles and possibly belonging to the hypobranchial or ceratobranchial of the first branchial arch are also partially exposed. The third and fourth pharyngobranchials are irregular in shape and bear strong conical teeth with recurved tips. Overall, the morphology of the individual bones of the gill arches of *Eosternoptyx discoidalis* appears to be similar to those of *Polypterus asteroides* figured by Weitzman (1974).

The vertebral column is compact and sigmoid with the abdominal portion bent in a remarkably kyphotic curve (Fig. 2). The vertebral column consists of 28 vertebrae. The vertebral centra are anteroposteriorly compressed, higher than long and laterally ornamented with shallow fossae and ridges. According to Weitzman (1974), the abdominal vertebrae of sternoptychids include those elements that do not bear a long, single haemal spine and/or are not directly associated with the anal-fin pterygiophores, with the anterior haemal spine that is invariably associated with the anterior anal-fin pterygiophore. Based on these considerations, *Eosternoptyx* has 13 abdominal and 15 caudal vertebrae. All the neural and haemal arches appear to be fused with their respective centra. The anterior six neural spines remain unfused medially, completely separated from each other up to their distal tips. The neural arches of the anterior nine vertebrae are anteroposteriorly expanded. The neural spines of the abdominal and caudal vertebrae are elongate and robust; the neural spines of the vertebrae 11 to 23 are very robust and vertically oriented. The haemal spines of the anterior caudal vertebrae are expanded, as well as the haemal arches of the three posterior abdominal vertebrae. The haemal spine of the 18th vertebra is less developed that of the preceding and successive elements, resulting in the origin of a moderately developed anal-fin hiatus (see Harold, 1994); the vertebrae 23 to 25 are notably shortened in order to accommodate the enlarged subcaudal photophore mass. The third through eighth vertebrae bear thick pleural ribs that extend ventrally to the ventral profile of the body; the two posterior elongate pleural ribs are associated with the pelvic girdle. The ninth and tenth vertebrae support small pleural ribs. The pleural ribs insert on the parapophyses and their bases are notably expanded anteroposteriorly. Epineural bones are present on the bases of the neural arches of the second through ninth vertebrae.

The caudal is scarcely preserved and difficult to interpret (Fig. 2c). The first preural centrum is fused with the ural centra. The first and second hypurals are fused together into a single autogenous plate; the third, fourth and fifth hypurals are mostly preserved as compression only and appear to be co-ossified into an autogenous plate; a small autogenous sixth hypural was possibly present in origin. The parhypural is a cylindrical and rather elongate bone; it appears to be co-ossified with the fused first and second hypurals only at its base. What appears to be the proximal portion of an unattached neural can be recognized. The neural spine of the second preural centrum is flattened and anteroposteriorly expanded, while the haemal spine seems to be autogenous. The caudal fin is not recognizable in the single available specimen.

The long-based dorsal fin is exclusively represented by its endoskeletal portion (Fig. 2). The fin is preceded by six laterally flattened and distally expanded supraneurals, the anterior inserting in the first interneural space; all the supraneurals are similar to each other and not especially modified into a dorsal blade. There are 18 proximal-middle dorsal-fin pterygiophores, some of which are poorly preserved and mostly represented as impression only; the distal pterygiophores of the dorsal fin are not preserved. The first dorsal-fin pterygiophore originates in the seventh interneural space; it is the largest element of the series and protrudes from the continuous dorsal profile of the body due to a spatulate process arising from the main axis of bone. The second dorsal-fin pterygiophore also inserts in the seventh interneural space and resembles the first element of the pterygiophore series. Overall, the dorsal-fin pterygiophore series includes a variety of morphologies. Considering that the first dorsal-fin pterygiophore of extant deep-sea hatchefishes supports two rays and that the last one bears no rays (see Weitzman, 1974), it is reasonable to hypothesize that the dorsal fin of *Eosternoptyx* contained 18 rays in origin.

The anal-fin rays are not preserved (Fig. 2). Of the anal fin only the peculiar 12 pterygiophores are recognizable. There is not a definite ratio between dorsal-fin pterygiophores and rays in extant deep-sea hatchefishes and for this reason it is not possible to provide a reasonable hypothesis about the original number of anal-fin rays in *Eosternoptyx*. All the anal-fin pterygiophores are in some ways anteroposteriorly expanded, characterized by a central nearly cylindrical axis that supports anterior and posterior bony laminae of different morphology and size; the anterior and posterior borders of these bones are parallel and closely associated to each other for most of their length. The two anterior anal-fin pterygiophores are greatly elongate and bear an external spine (preanal spines in the sense of Schultz, 1961) that project beyond the ventral profile of the body. The anal-fin hiatus is primarily developed between the sixth and seventh anal-fin pterygiophores; the proximal shaft of the fifth and eighth anal-fin pterygiophores are also slightly modified to accommodate the deep structures of anal photophores. The shaft of the last anal-fin pterygiophore is opposite to that of the dorsal fin, both lying in the interneural space between the vertebrae 21 and 22.

The pectoral girdle is very high due to the discoid morphology of the body (Figs 2-3). The outer surface of some of the bones of the pectoral girdle, including the posttemporal, supracleithrum and cleithrum is densely ornamented. The posttemporal is a robust L-shaped bone with irregular dorsal border that is completely separate from the supracleithrum but articulates with it. The supracleithrum is very large, elongate and blade like; it broadly overlaps the upper limb of the cleithrum. The cleithrum is roughly sigmoid in shape and has a long and slender upper limb and a relatively short anterodorsal limb; the ventral border of the anterodorsal limb of the
cleithrum is characterized by a regularly serrated posterior sector and ends anteriorly with a ventrally directed stout spine (preabdominal spine in the sense of Schultz, 1961). Coracoid and scapula are poorly preserved. Two short cylindrical pectoral-fin radials can be recognized. Of the pectoral fin, remains of seven rays are clearly exposed in the fossil.

The pelvic girdle is dorsally oriented as in other deep-sea hatchetfishes (Fig. 2c). The relatively short pubic process is preserved mostly as impression. A ventrally directed iliac spine is stout and well developed, protruding beyond the ventral profile of the body. What appears to be a second iliac spine is preserved as impression only. The ischial process is posterodorsally oriented. The pubic process is closely associated with the pleural ribs of the seventh and eighth vertebrae. Ischial and pubic processes are separated by an angle of about 45°. There is a stout and pointed anterodorsally directed process emerging along the anterior margin of the basipterygium, which possibly is homologous of the anterior blade-like process characteristic of the genus *Argyropelecus* (see Harold, 1993). Pelvic-fin rays are not preserved.

There are no traces of the original squamation, including the specialized and thick scales associated to photophores typical of *Argyropelecus, Horbatshia, Polyipnoides* and *Polyipnus* (see Weitzman, 1974; Prokofiev, 2005), thereby suggesting that the body was probably naked (Fig. 2). The absence of the stiff bony scales in the abdominal keel suggests a condition similar to that characteristic of *Argyropelecus* with a membranous keel constituted by strong connective tissue.

A thin organic film reveals the outlines of at least seven photophores of the abdominal cluster situated along the ventral margin of the abdominal keel, the four posterior partially separated from each other by the distal portions of the pre-pelvic pleural ribs (Fig. 4). The supra-abdominal cluster seems to be represented by two small photophores vertically aligned in the lower third of the space between the fourth and fifth pleural ribs (Fig. 4). Of the preanal cluster, three photophores are partially recognizable, while the anal and subcaudal clusters are exclusively represented by a black globular film developed in the anal-fin hiatus and under the 10th to 12th caudal vertebrae, respectively (Fig. 4).

**DISCUSSION**

The morphological analysis of the specimen documented herein has revealed a variety of features that unquestionably support its recognition as a new genus and species of deep-sea hatchetfish. That of the deep-sea hatchetfishes is a derived group of the stomiiform family Sternoptychidae. According to Weitzman (1974), the Sternoptychidae includes ten extant genera (*Araiophos, Argyripnus, Argyropelecus, Danaphos, Maurolicus, Polyipnus, Sonoda, Sternoptyx, Thorophos, Valenciennellus*) sharing several synapomorphies, including: the presence of type Alpha photophores and their occurrence in glandular clusters, possession of three branchiostegal rays articulated with the posterior ceratohyal, parietals separated by the supraoccipital, and absence of basihyal and endopterygoid teeth. In a more recent phylogenetic analysis of the stomiiform fishes, Harold & Weitzman (1996) recognized more than 20 characters that corroborated the monophyly of the family; however, Harold & Weitzman (1996) also pointed out that only two of the more than 20 features that define the Sternoptychidae are unique and unreversed (parietals separated by the supraoccipital, and photophore arranged in clusters as a result of their development by budding; see also Ahlstrom et al., 1984). As documented above, *Eosternoptyx* exhibits some of the diagnostic characters of the Sternoptychidae, including: absence of endopterygoid teeth, hypurals 1+2 and 3+4+5 (apparently) fused, and parhypural fused to the lower hypural plate.

Within the Sternoptychidae, the deep-sea hatchetfishes form a well-defined monophyletic clade, the Sternoptychinae (e.g., Baird, 1971; Weitzman, 1974), currently diagnosed by more than 30 synapomorphies (Harold, 1993; Harold & Weitzman, 1996). The assignment of *Eosternoptyx* to the Sternoptychinae...
is supported by a number of features (see Harold & Weitzman, 1996), including: body depth measuring about 80% of SL, abdominal keel present, possession of prominent frontal crest, parietal crest present, sphenotic of moderate size, symplectic with club-shaped distal termination, opercle elongate and subrectangular in outline, hyomandibula greatly elongate, possession of expanded neural and haemal spines, pleural ribs enlarged, anal-fin hiatus present, posttemporal strongly ossified and well-developed, neural spine of the second preural centrum flat and broad, basipterygium vertically developed and directly supported by pleural ribs, and possession of iliac spine.

Eosternoptyx is characterized by a unique combination of features that clearly indicate that it represents a new genus of the deep-sea hatchetfish clade. As pointed out above, the sternoptychine clade (Fig. 5) consists of three extant (Argyropelecus, Polyipnus, Sternoptyx) and three
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so-called dorsal blade (secondarily lost in Discosternon). As discussed above, both Polyipnus and Eosternoptyx are characterized by six unmodified supraneurals and by an enlarged anterior dorsal-fin pterygiophore that emerges from the dorsal profile of the body. Unfortunately, because of the incompleteness of the single available specimen documented herein, it is not possible to properly define the phylogenetic position of Eosternoptyx within the sternoptychine clade. Additional well-preserved material is certainly necessary to conclusively infer its phylogenetic affinities. Moreover, a detailed morphological analysis of Horbatshia and Polyipnoides would be also desirable to perform a comprehensive phylogenetic study of fossil and extant deep-sea hatchefishes.

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