The First Soleid Flatfish (Pleuronectiformes, Soleidae) from the Miocene of the Northern Caucasus

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The First Soleid Flatfish (Pleuronectiformes, Soleidae) from the Miocene of the Northern Caucasus

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Received May 11, 2000

Abstract—A new soleid flatfish, *Buglossidium apsheronskiense* sp. nov. (Pleuronectiformes), from the Upper Maikopian (Lower Miocene) of the Northern Caucasus (Apsheronsk District) is described. This is the first finding of the Soleidae in the Miocene of the Caucasus. The new species is distinguished from the Recent Mediterranean *B. luteum* (Risso) by a greater number of rays in the pectoral fins, a smaller number of supracranial pterygiophores of the dorsal fin, smaller scales, and a greater number of vertebrae. The finds of the Pleuronectiformes from the Miocene of southwestern Russia and adjacent areas of Azerbaijan and Ukraine are reviewed, and the taxonomic positions of certain taxa are revised.

INTRODUCTION

The Pleuronectiformes are only rarely found as fossils, since bony fish skeletons are usually preserved under special (generally anoxic) conditions at the sea floor. Such conditions impede the existence of benthic organisms, including adult flatfishes. Therefore, the majority of flatfish remains are otoliths. In the case where localities contain flatfish skeletons, the latter are scarce and usually belong to juveniles, most of which retained a pelagic mode of life.

Several flatfish species were described from the Miocene of southwestern Russia and adjacent areas of Azerbaijan and Ukraine (Smirnov, 1936; Bogatshov, 1955; Dzhafarova, 1966, 1976; Switchenska, 1980, 1981). Their skeletons were usually at most 3 cm long. Only *Solea ambrosiana* Bogatshov was 68 mm long (Bogatshov, 1955).

Chanet (1997) performed a cladistic reappraisal of the fossil flatfishes record and corroborated or disproved the initial assignment of the taxa to the order Pleuronectiformes and to certain flatfish families. Many species proved to be dubious Pleuronectiformes and Pleuronectoidei incertae sedis. Chanet assigned *Hippoglossoides macroptera* Smirnov and *Protopsetta parvula* Smirnov from the Lower Miocene of Northern Ossetia (Smirnov, 1936) to the dubious Pleuronectiformes. Switchenska (1980) referred the first of these species to *Arnoglossus* (Bothidae) and the second to *Platichthys* (Pleuronectidae). Chanet did not revise the other flatfish species from the Miocene of southwestern Russia and adjacent areas of Azerbaijan and Ukraine, although the original identification of the majority of these forms was also questionable.

The description of *Solea ambrosiana* from the Lower Sarmatian of the Amvrosievka locality (southeastern Ukraine) was very brief (Bogatshov, 1955); the holotype was not chosen nor figured, and its location

was not indicated. Switchenska (1980) referred this species to the soleid genus *Monochirus*. However, the indication that "eyes are on the left side" (Bogatshov, 1955, p. 571) contradicts the assignment of this form to the Soleidae, because, in this family, the eyes are on the right side. I propose to refer to *Solea ambrosiana* as nomen dubium until new finds from Amvrosievka are available.

Only one out of three flatfish species described by Dzhafarova (1966, 1976) from Azerbaijan undoubtedly belongs to the Pleuronectiformes. Late Miocene *Pleuronectes svitschenskajae* Dzhafarova, 1976 was referred to the genus *Platichthys* (Switchenska, 1980); this determination was apparently correct. The other two species, *Hippoglossoides bogatshevi* and *Protopsetta daniltshenkoi*, were described from the Lower Miocene of the Apsheron Peninsula (Dzhafarova, 1966). Subsequently, the first was assigned to *Arnoglossus* and the second was assigned to *Platichthys* (Switchenska, 1980). Although much is uncertain in the original description of the species and the figures are of a poor quality, the erroneous identification of the material is evident. In actual fact, both fishes probably belong to the order Perciformes. Judging from the initial description and figure (Dzhafarova, 1966, fig. 1), the specimen referred to as *Hippoglossoides bogatshevi* is probably closely related (or even conspecific) to the perciform *Pinichthys fractus* (Stromateidae) described from the same locality (Bannikov, 1985). Regarding the specimen described as *Protopsetta daniltshenkoi*, the presence of three spiny rays in the anal fin, indicated by Dzhafarova (1966, p. 75), obviously contradicts the assignment of this species to the Pleuronectiformes.

Three species of the genus *Arnoglossus* were described by Switchenska (1981) to be from the Lower and Middle Miocene of the northern Caucasus and Azerbaijan. Using the photos of the holotype from *Fos-*

Fig. 1. *Buglossidium apsheronskiense* sp. nov., holotype PIN, no. 1413/813, ×1.6.

silien Atlas Fische (Frickhinger, 1991), Chanet (1997) assigned one of them, i.e., Early Miocene *A. distinctus* Switchenska from the northern Caucasus, to the dubious Pleuronectiformes. However, this species (as with *A. sumgaiticus* Switchenska from the Chokrakian Horizon of the Apsheron Peninsula) possesses a set of intermuscular bones characteristic of the Bothidae, in particular, the upper and lower myorhabdoi. The holotype of the third species, *A. ovalis* Switchenska from the Karaganian Horizon of the Apsheron Peninsula, is poorly preserved; therefore, only some upper myorhabdoi are distinguishable, whereas the presence of other intermuscular bones can only be inferred.

In 1995, I found a double-faced imprint of a complete skeleton of a soleid fish in the Upper Maikopian deposits of the Krasnodar Region. This is the first find of the Soleidae in the Miocene of the Caucasus. An extraordinary point was the fact that the skeleton belonged to an adult fish. The standard body length (SL) (measured to the ending of the hypurals) was 79 mm. It is well known that the sea floor of the Early Miocene Eastern Paratethys was contaminated by hydrogen sulfide, as in the modern Black Sea, although the sulfureous zone was located much lower. Therefore, it is difficult to explain the presence of a typical benthic fish in that region, even if this is considered to be an accidental find.

In the fossil fish described below, the ethmoid projects anteroventrally and forms an obtuse process. This is an apomorphic feature of the Soleidae (Chapleau and Keast, 1988). Out of the apomorphies characteristic of the Soleinae + Cynoglossidae (Chapleau and Keast, 1988; Chapleau, 1993), the Miocene soleid fish under consideration shows a long anterior process of the first pterygiophore of the dorsal fin and a proximal fusion between the hypurals 1–4 and the terminal centrum. This fish can be assigned to the solein genus *Buglossidium* based on the following characters: the structure of the supracranial part of the dorsal fin is of the A type (Chapleau, 1989), a well-pronounced

supratemporal branch of the lateral line canal is absent, and the bases of the dorsal and anal fins are positioned close to the caudal fin. The latter character suggests the presence of a membrane between these fins. *Buglossidium* currently occurs in the northeastern Atlantic and Mediterranean regions. Fossil material on the genus has not previously been found, except for otoliths of the Recent species *B. luteum* (Risso) from the Pliocene of Belgium (Gaemers and Schwarzhans, 1973).

Below is a description of a new species belonging to the genus *Buglossidium*.

SYSTEMATIC PALEONTOLOGY

Family Soleidae Bonaparte, 1832

Subfamily Soleinae Bonaparte, 1832

Genus *Buglossidium* Chabanaud, 1930

Buglossidium apsheronskiense Bannikov, sp. nov.

E t y m o l o g y. From the town of Apsheronsk.

H o l o t y p e. PIN (Paleontological Institute of the Russian Academy of Sciences), no. 1413/813, double-faced imprint of a complete skeleton; Krasnodar Region, Apsheronsk District, left wall of a gully on the left bank of the Pshekha River, 1.5 km southwest of the Cossack village of Shirvanskaya; Lower Miocene, Upper Maikopian, Sakaraulian Horizon.

D e s c r i p t i o n . (Figs. 1 and 2). The body is oblong, elongated oval, and clearly compressed laterally. The ratio between the SL and maximum body depth is 3.3 to 3.4. The head is small, approximately 5.45 times shorter than the SL. It is evident that the eyes were on the right side. In the holotype, bone substance is carbonized and mostly lost; therefore, the bone structure is examined on the basis of imprints alone.

The neurocranium is clearly asymmetrical, low in the orbital region, and increasing in height toward the occiput. The ethmoid projects anteroventrally and forms an obtuse process. The parasphenoid forms the
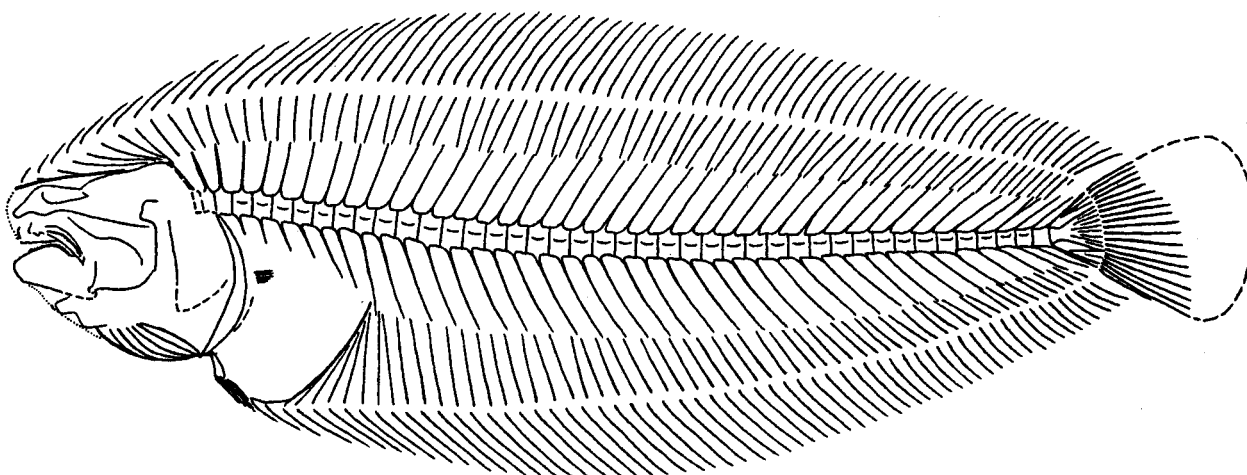
Fig. 2. *Buglossidium apsheronskiense* sp. nov., reconstructed skeleton, blind side, based on the holotype PIN, no. 1413/813.

ventral edge of the neurocranium. The premaxillae on the eyed and blind sides differ from each other in shape. In the first case, the premaxilla is almost straight and probably lacks teeth. On the opposite side, the bone is C-shaped and bears numerous small teeth. The maxillae are narrow and extended. The lower jaw is deep. The oral edge of the dentary is convex and possesses numerous small teeth. The quadrate is subtriangular and has a well-pronounced articular condyle. The ectopterygoid and entopterygoid are incompletely preserved in the holotype. The hyomandibular axis is almost vertically oriented. The urohyal and other bones of the hyoid apparatus are poorly preserved in the holotype. Seven narrow and curved branchiostegal rays are present. The preopercle moderately curves at the anterior edge. Apparently, the bones of the gill cover were extremely thin; their limits are difficult to discern in the holotype.

The cleithrum is relatively large and moderately curved (C-shaped). The scapula and coracoid are indiscernible. The postcleithrum is absent. The pelvic bones are small, wedge-shaped, attached to the lower part of the cleithrum, and ventrodorsally directed.

The axial skeleton consists of 43 (or 44) vertebrae, including nine abdominal and 34 caudal vertebrae. The vertebral column is almost straight and only slightly dorsally concaves. The vertebral centra are short in the anterior part and almost square in the posterior part of the vertebral column. The vertebrae possess longitudinal lateral crests. It is uncertain whether or not transverse apophyses were developed. Six posterior abdominal vertebrae have large and narrow parapophyses (or hemapophyses) inclined posteroventrally. They undoubtedly contain the haemal arches. In a series of vertebrae, the parapophyses gradually increase in length posteriorly. In the first vertebra, the centrum is strongly shortened; the neural spine is inclined anteriorly, adjoins the occiput, and does not project above the latter. Since the Soleidae lack the first neural spine (Hensley and Ahl-

strom, 1984), it can be proposed that the vertebra interpreted as the first is, in actual fact, the second, whereas the first vertebra (lacking the neural spine) is indistinguishable in the holotype. The vertebral spines are narrow and almost straight; the neural spines of the second and third vertebrae are anteriorly inclined and are somewhat broader than those of succeeding vertebrae. The neural spine of the fourth vertebra is vertical with reference to the body axis, and the spines of succeeding vertebrae are posterodorsally inclined; the inclination gradually increases caudally. The neural spine of the fifth posteriormost vertebra bifurcates in the holotype. The haemal spines of the caudal vertebrae are inclined posteroventrally; they are equal to or slightly longer than the corresponding neural spines. The pleural ribs and intermuscular bones are absent.

The caudal endoskeleton is formed by the penultimate (second preural, pu2) and terminal (composed of the first preural and two ural centra fused with each other, pu1 + u1 + u2) vertebrae. The spines of pu2 are developed to a greater extent than those of preceding vertebrae and are clearly fused with the vertebral centrum. The hypurals 1–4 are fused proximally with the centrum of the terminal vertebra to form a fan-shaped plate; distally, there are longitudinal slits between the hypurals and inside each hypural. Two extended and anteriorly tapering plates are located between the hypurals and the pu2 neural spine. The upper plate is the epural, and the lower plate is hypural 5. An extended triangular parhypural possessing a longitudinal slit in the distal section is located between the hypural plate and the pu2 haemal spine. This bone is isolated from the centrum of the terminal vertebra. The uroneural is absent.

The dorsal fin extends along the entire upper edge of the body and consists of 76 simple unbranching rays. The shortest rays are located anteriorly; the longest rays are in the middle. The structure of the supracranial part of the dorsal fin is of the A type (Chapleau, 1989):

(1) the first dorsal-fin pterygiophore (erisme after Chabanaud, 1930) is thickened and extends anteriorly from the otic region, parallel to the skull; (2) the anterior process of the first pterygiophore overhangs the ethmoid; (3) two anterior rays of the dorsal fin are directly attached to the erisme; and (4) proximally, the second dorsal-fin pterygiophore is attached to the erisme; pterygiophores 3–6, to the dorsal surface of skull; and pterygiophore 7, to the first neural spine. Thus, seven dorsal-fin pterygiophores are supracranial pterygiophores. The lower endings of the anterior pterygiophores of the dorsal fin are inclined posteriorly. The pterygiophores located above the posterior part of the abdominal region of the vertebral column are subvertical. Caudal to this region, the proximal endings of the pterygiophores are inclined anteriorly. The distal ending of each neural spine usually contacts with two (rarely one) dorsal-fin pterygiophores. The posteriormost dorsal-fin pterygiophore is located anterior to the neural spine of the last but four vertebra. The dorsal fin does not merge into the caudal fin; however, they are close to each other and were probably connected by a membrane.

The anal fin originates under the pectoral fin and extends along the ventral edge of the body. It consists of 63 simple unbranching rays; the anterior ray is shortest, and the longest rays are in the middle. The first pterygiophore of the anal fin is stout, long, and curved in the lower part; it adjoins the anterior side of the lower part of the haemal spine of the first caudal vertebra and restricts the abdominal cavity posteroventrally. The first anal-fin pterygiophore bears the first two rays of the fin; the second and third anal-fin pterygiophores adjoin the posteroventral part of the first pterygiophore. Four succeeding pterygiophores are located anterior to the haemal spine of the first caudal vertebra and approach each other proximally. The anal-fin pterygiophores almost do not enter the interhaemal spaces and adjoin dorsally the distal endings of the haemal spines of the caudal vertebrae. Each interhaemal space (except for two vacant posterior spaces) usually corresponds to two anal-fin pterygiophores (rarely one). Pterygiophores 7 and 8 of the anal fin are subvertical. Caudally, the proximal endings of the pterygiophores become inclined anteriorly and gradually decrease in length. The anal fin does not merge into the caudal fin; however, they are close to each other and were probably connected by a membrane.

The pectoral fins are narrow and probably short (only the imprints of the ray bases are preserved in the holotype). The pectoral fins on the eyed and blind sides contain six and five rays, respectively.

The pelvic fins are located anterior to the pectoral fins; each contains about five narrow rays. The distal endings of the latter extend beyond the anterior edge of the anal fin.

The caudal fin consists of 20 rays. The majority of the distal endings of the rays are not preserved in the holotype. Therefore, the number of branching rays in the caudal fin is uncertain.

The scales are small ctenoid and cover the body, head, and the bases of the unpaired fins. The lateral line canal is indiscernible in the holotype. Apparently, the straight part of the lateral line overlaps the vertebral column and becomes indistinguishable against the background of the latter; a clear supratemporal ramus is actually absent. There are at least 88–90 transverse rows of scales between the head and the base of the caudal fin.

M e a s u r e m e n t s. SL of the holotype is 79 mm.

Other measurements, % of SL:

Head length, 18;

Maximum body depth, 30;

Minimum body depth, 11;

Length of the longest ray of the dorsal fin, 9;

Length of the longest ray of the anal fin, 10;

Length of the dorsal fin base, 96;

Length of the anal fin base, 77;

Length of the lower jaw, 6.

C o m p a r i s o n. The new species is distinguished from the only Recent member of *Buglossidium*, *B. luteum* (Risso) by a larger number of rays in the pectoral fins (in *B. luteum*, the right and left fins contain 3–5 and 3 rays, respectively); a smaller number of supracranial pterygiophores in the dorsal fin; smaller scales (in *B. luteum*, the lateral line canal contains 55–70 scales); and a larger number of vertebrae (43 or 44 in contrast to 36–38 in *B. luteum*).

R e m a r k s. Chanet (1997) indicated that *Eobuglossus eocenicus* (Woodward) and *Turahbuglossus cuvillieri* Chabanaud, the earliest reliable Soleidae, were found in the Middle Eocene of Egypt. Soleids have not yet been recorded in the Oligocene. In the Miocene, the following three soleid species were established with certainty: *Solea kirchbergana* (von Meyer) from the Burdigalian of Germany and Switzerland and *S. cuneiformis* (de Bosniaski) and *Microchirus abropteryx* (Sauvage) from the Messinian of the Mediterranean Region. Thus, the finding of *Buglossidium apsheronskiense* sp. nov. enlarges the list of Miocene soleids. The new species essentially differs from the contemporary *Solea kirchbergana* [this species was recently revised by Chanet (1996)] by a more elongated body; a larger number of vertebrae and rays in the dorsal, anal, and caudal fins; and by seven (instead of six) supracranial dorsal pterygiophores.

The Recent *Buglossidium* species, *B. luteum*, occurs in the northeastern Atlantic and Mediterranean regions. Thus, *B. apsheronskiense* sp. nov. is a Mediterranean element of the Late Maikopian Fish Fauna from the Caucasus.

M a t e r i a l. Holotype.

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