New Data on the osteology of actinopterygian fish Sphaerolepis kounoviensis

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Abstract. A well preserved parasphenoid referred to the actinopterygian fish *Sphaerolepis kounoviensis* is described from the highway cut near Nýřany (Mšec Member; Stephanian B; Plzeň Basin). Accompanying fauna and flora is mentioned. Morphology of the bone, comparison with selected genera and position of *Sphaerolepis kounoviensis* on the chondrostean-holostean boundary are discussed.

Abstrakt. v práci je popsán izolovaný parasfenoid patřící paprskoploutvé rybě *Sphaerolepis kounoviensis*, který byl nalezen spolu s další faunou a flórou v mšeckých vrstvách plzeňské pánve. Je popsána morfologie parasfenoidu a jsou diskutovány vztahy k ostatním rodům jakož i postavení druhu *Sphaerolepis kounoviensis* na rozhraní mezi Chondrostei a Holostei.

Key word Upper Carboniferous, Bohemia, Actinopterygii, osteology

Introduction

The Carboniferous strata of the Plzeň Basin were exposed near the town of Nýřany during the construction of the highway Plzeň – Rozvadov. Upper Carboniferous vertebrate fauna was collected by dr. Zbyněk Šimůnek (Czech Geological Survey, Prague) during the geological documentation of the construction site. The Jelenice, Mšec and Hředle Members were represented (in the west –east direction) in an approximately 0.5 km long cut. A find of one bone, a well preserved actinopterygian parasphenoid, gave rise to this paper. The bone is deposited in the collections of the Museum of Eastern Bohemia in Hradec Králové under No. P 1/2000.

Locality: Nýřany, Plzeň - Rozvadov highway (D5) cut, about 200 m north of the elevation point 354 on the Šibeniční vrch Hill (the name and number of the map at scale 1:25000 is Nýřany 11-444).

Lithostratigraphy: Mšec Member

Sediment: grey mudstone to clayey siltstone

Biostratigraphy: *Watsonichthys* subzone (for details see Zajíc in print)

Accompanying fauna:

- actinopterygians *Sphaerolepis kounoviensis* Frič, 1875 (parasphenoid and scales), *Spinarichthys dispersus* (Fritsch, 1895) (scales), *Watsonichthys* sp. (scales), unidentified scales and segments of lepidotrichia
- coprolites

Accompanying flora (Z. Šimůnek, personal communication):

- horsetails of species *Calamites cistii*
- ferns *Nemejcopteris feminaeformis, Pecopteris polymorpha*
- seed ferns of species *Sphenopteris* cf. *mathetii*
- cordaites *Cordaites* cf. *principalis, Poacordaites* sp.

Description

A complete parasphenoid in ventral view is preserved (figs. 1 a, b, 2e). It is singular at first sight with conspicuously prolonged stem of parasphenoid and one pair of lateral processes.

Corpus parasphenoidis is 18 mm long. The bucco-hypophysial foramen (bh) is situated approximately in the middle of the total length of the stem and at the same time passes through the centre of ossification. The bucco-hypophysial foramen divides the corpus parasphenoidis into anterior and posterior parts. The anterior part is 7.5 mm long, anteriorly narrower, bluntly pointed and partly divided into three lobes. A shallow paired groove is visible anteriorly from the bucco-hypophysial foramen. Posterior part of the stem is considerably more enlarged than the anterior one. This part is 10.5 mm long and broadest (6 mm) is immediately behind the lateral processus. Posteriorly it is narrower and its caudal end is sharply pointed. Surface of the posterior part of the stem is furrowed with fine grooves radially diverging from the bucco-hypophysial foramen. The dentition is not developed on parasphenoid.

A pair of processus ascendens posterior (pap) projects approximately in the middle of the length of the stem. The axis of processus ascendens posterior meets the medial axis of corpus parasphenoidis at an angle of 70°. The processus is well developed, relatively narrow, distally lobate. A distinct groove on the processus runs from bucco-hypophysial foramen distally. We consider it to be a spiracular groove (spig). The internal carotid arteries are believed to have passed through the notch (aci) in the angle between lateral edge of the caudal part of the stem and laterocaudal margin of the processus ascendens posterior.

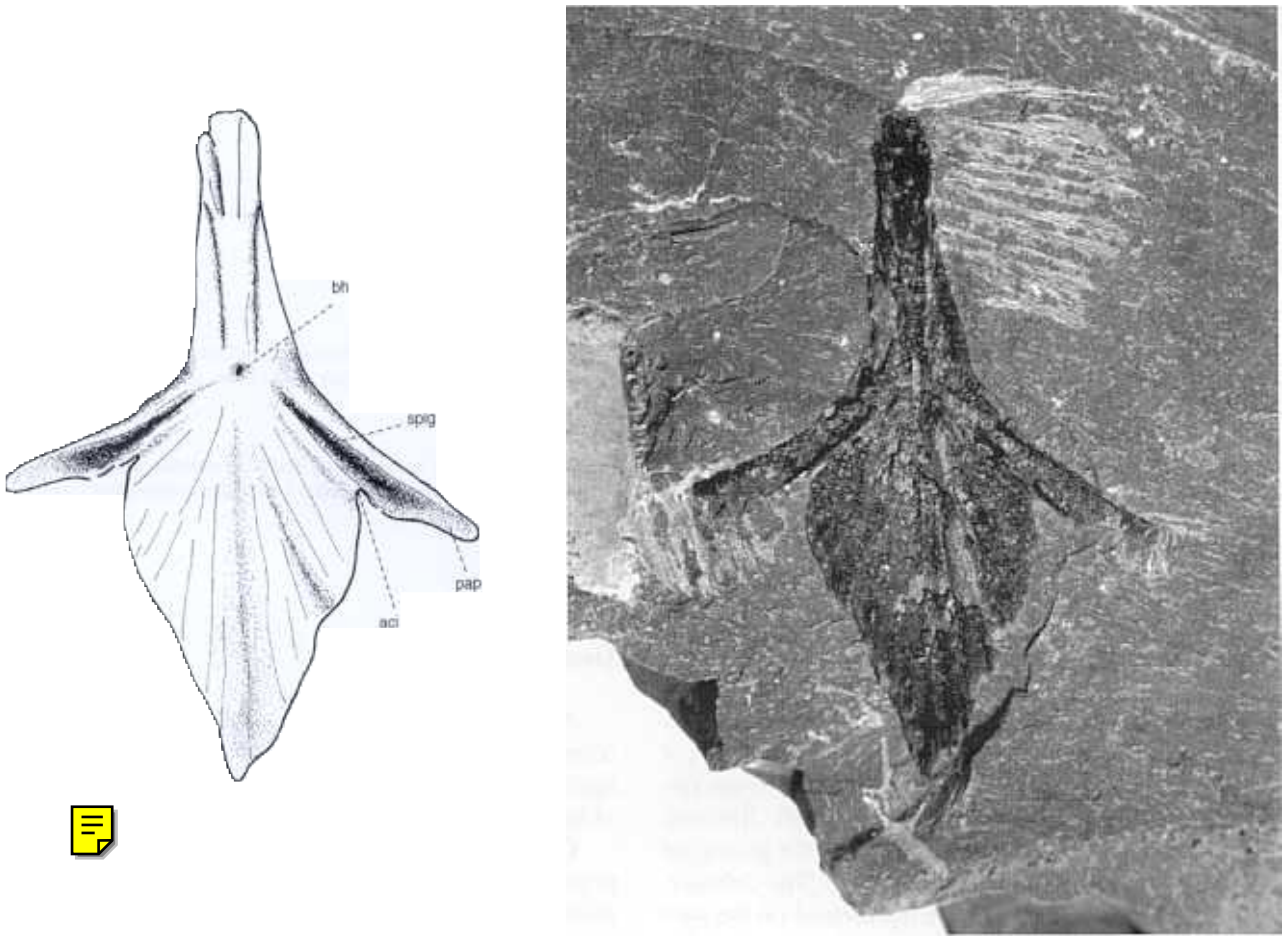

Fig. 1. *Sphaerolepis kounoviensis* Frič, 1875. Drawing (A) and photo (B) of the parasphenoid No. P 1/2000. Aci – notch for arteria carotis interna, bh – bucco-hypophysial canal, pap – processus ascendens posterior, spig – spiracular groove. Ventral view, x10.3.

Discussion

Only a few records exist of parasphenoids described from actinopterygian fishes from the Permo-Carboniferous basins of Bohemia and Moravia. Well known is the parasphenoid of *Sphaerolepis kounoviensis* from the Carboniferous. It was described by Štamberg (1985, 1991) on the type material and is characterized especially by the caudally prolonged stem. Partly known is also the parasphenoid of Carboniferous species *Sceletophorus bisserialis*. Corpus parasphenoidis of this parasphenoid is not posteriorly prolonged and terminates immediately behind the processus ascendens posterior (Štamberg 1983). A number of parasphenoids are known from the Lower Permian of the Krkonoše Piedmont Basin and Boskovice Furrow. Relatively well preserved parasphenoids were collected thanks to the attention to isolated bones and fragments of fish. The whole parasphenoid of *Paramblypterus rohani* was described (Štamberg 1975) from the Veselá Horizon of the Krkonoše Piedmont Basin. The stem is anteriorly well developed, but terminated immediately behind the lateral process caudally. Several other parasphenoids were figured by Štamberg (1982) from the Kalná Horizon of the Krkonoše Piedmont Basin. Their shape is similar to that of *Paramblypterus rohani*. Small differences in the proportions of some parts of bones and in the angle between the axis of the stem and processus ascendens posterior exist only. It is, however, not quite obvious, whether these are real differences in the shape of bones or mere products of changes in the course of fossilization.

The above described parasphenoid from Nýřany undoubtedly agrees with that described by Štamberg (1985, 1991) on *Sphaerolepis kounoviensis* Frič, 1875 from the Kounov Member. The agreement of those bones is sustained by the shape of parasphenoid, shape of processus ascendens posterior and mainly by the exceptionally posteriorly prolonged stem.

The shape of parasphenoid went through changes in the evolution of the Chondrostei. The stems of parasphenoid of early palaeoniscids from the Devonian (*Moythomasia durgaringa, Mimia toombsi* – Fig. 2a) are not prolonged posteriorly, and the processus ascendens is short (Gardiner 1984). The palaeoniscids from the Carboniferous and Permian, such as *Kansasiella eatoni* (Fig. 2B, Poplin 1984), *Kentuckia deani* (Rayner 1951), *Palaeoniscus freislebeni, Pygopterus nielseni* (Fig. 2d, Aldinger 1937), *Paramblypterus comblei* (Fig. 2c, Heyler 1969) and others also lack a backwards prolonged stem.

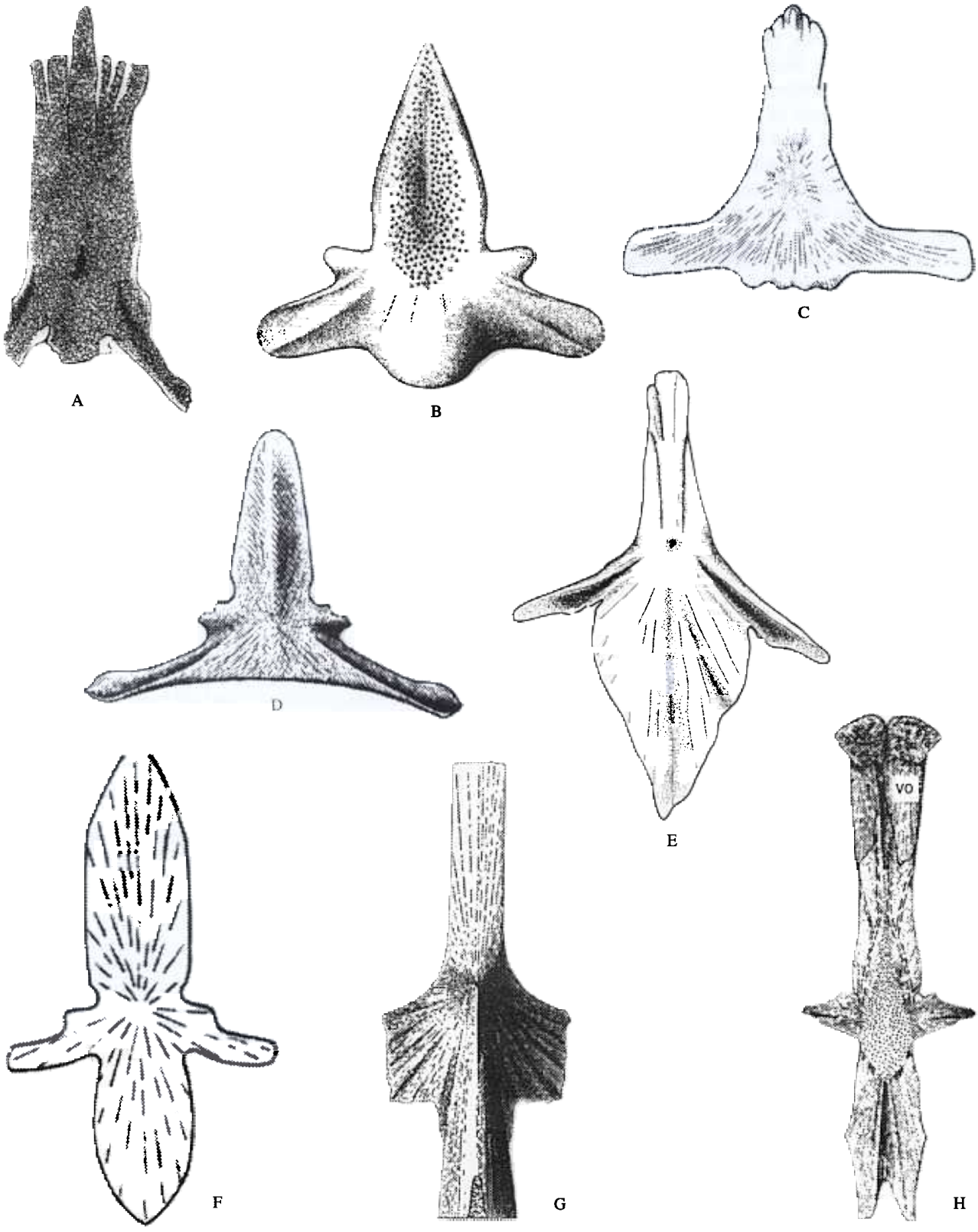

Fig. 2. Parasphenoids of different actinopterygians. A – *Mimia toombsi* (after Gardiner 1984), B – *Kansasiella eatoni* (after Poplin 1974), C – *Paramblypterus comblei* (after Heyler 1969), D – *Pygopterus nielseni* (after Aldinger 1937), E – *Sphaerolepis kounoviensis* (orig.), F – *Broughia* (after Stensiö 1932), G – *Birgeria groenlandica* (after Nielsen 1949), H – *Amia calva* (after Jarvik 1980).

Parasphenoids with prolonged caudal part of the stem are known only from more advanced Triassic palaeonisicids such as *Birgeria mougeoti* (Fig. 2G, Nielsen 1949) or from Triassic holosteans, such as *Broughia* (Fig. 2F, Sten-

siö 1932) and others including the living species of *Amia calva* (Fig. 2H, Jarvik 1980). The shape of the parasphenoid of *Broughia, Birgeria mougeoti, Amia calva* and *Sphaerolepis kounoviensis* (Fig. 2E-H) is very close. Besides the prolongation of the posterior stem a shift probably occurred of the canal for aorta carotis interna from the corpus parasphenoidis to the notch in angle between the posterior part of the stem and processus ascendens posterior. As regards for *Sphaerolepis kounoviensis* we can consider changes of internal carotids in comparison with other fishes only in the missing neurocranium.

From the above mentioned short review, it is obvious that the evolution within Chondrostei and from Chondrostei to Holostei involves the extending of the stem posteriorly. This trend is realized by incorporation of one or more caudally placed small bones (Jarvik 1954, 1980) or by growing of the bone posteriorly (Nielsen 1949).

Carboniferous palaeoniscid *Sphaerolepis kounoviensis* has several advanced features. The main features include the nearly vertical suspensorium, small number of branchiostegal rays, well-developed cycloidal scales and shape of the caudal fin. The parasphenoid with posteriorly extended stem is a holostean type of parasphenoid. Comparing the chondrostean and holostean features, we may conclude that *Sphaerolepis kounoviensis* lies on the chondrostean – holostean boundary. Although typical primitive palaeoniscoids are known from the Permian and even from the Lower Triassic, the development of advanced palaeoniscoids into the holosteans occurred already in the Upper Carboniferous.

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