

SBORNÍK NÁRODNÍHO MUZEA V PRAZE

ACTA MUSEI NATIONALIS PRAGAE

B XLVII (1991), No. 1—4

REDAKTOR: JIŘÍ ČEJKA

STANISLAV ŠTAMBERG

Regional Museum of Eastern Bohemia at Hradec Králové

ACTINOPTERYGIANS OF THE CENTRAL BOHEMIAN CARBONIFEROUS BASINS

INTRODUCTION

The following work reviews the actinopterygian fishes found in the Central Bohemian Carboniferous Basins. The revision is based on the types and referred specimens of Prof. Antonín Frič on previously unstudied material from the collections of the Paleontological Department of the National Museum at Prague and the Regional Museum of West Bohemia at Plzeň, and on new material from boreholes in the collection of the Geological Survey in Prague.

A revision of the Carboniferous fishes of the Central Bohemian Basins is necessary for several reasons. Firstly, it is now clear that the original descriptions by A. Frič no longer correspond to our knowledge of the anatomy of these Carboniferous fishes and that some structures were misinterpreted. Secondly, a precise classification of the intact fish specimens originally described by A. Frič is a prerequisite for the determination of the many osteological fragments and scales of fishes found during more recent geological exploration of Permocarboniferous coalfields.

The completion of this revision will form the basis of objective comparisons with other material from similar basins and facies. It gives us the possibility of understanding aspects of the evolution of some of these groups of fishes, and, at the same time, it is a contribution to the resolution of the stratigraphy of the Permocarboniferous basins.

I am pleased to thank everyone who has helped me in this work. I would particularly like to thank Prof. Dr Zdeněk Špinar for his interest and his frequent advice and valuable comments. This work would not have been possible without the amicable help of the entire staff of the Paleontological Department of the National Museum at Prague, in particular Dr M. Maňourová, Dr V. Turek, CSc., Dr R. Prokop, CSc., and others. I also wish to thank Dr J. Zajíc (Geological Survey, Prague) for the loan of specimens from the boreholes. I am obliged to Dr A. A. Selezneva (Paleontological Institute of Academy of Science of the USSR, Moscow), to Dr C. Poplin (Musée National d'Histoire Naturelle, Paris) for frequent discussion and much advice and to Dr A. Milner (Birkbeck College, University of London) for correction of the english translation of the first half of the text and for many valuable suggestions.

TERMINOLOGY

This paper summarizes results of the revision of actinopterygian fishes from the Carboniferous sediments of the Central Bohemian basins. The term "Central Bohemian basins" is used here in the sense of HAVLENA and PEŠEK (1975), as a designation for all covered and exposed areas of the Central Bohemian upper Palaeozoic. The Central Bohemian Carboniferous basins are geographically divided into following: the Plzeň Basin, the Manětín Basin, the Radnice Basin, the Žihle Basin, the Rakovník Basin, the Kladno Basin, the Roudnice Basin and the Mšec Basin. The stratigraphical correlation of the Central Bohemian Basins is given in text. table 1.

The system used for the description of this fish material is essentially that used by GARDINER (1967). The terminology used by LEHMAN (1966) is applied in the descriptions together with detailed anatomical terms used by NIELSEN (1942, 1949) and GARDINER (1963, 1967, 1984). New terms used in this work are explained in the following paragraphs. The aim has been to describe the species to a uniform standard and the descriptions are divided into following parts:

1. Neurocranium
 - a) Endoskeleton of the neurocranium
 - b) Exoskeleton of the neurocranium — skull roof, rostrum, dermal bones of the ventral part of the neurocranium, cheek bones
2. Viscerocranium — endoskeleton and exoskeleton of the palatomaxillary apparatus, lower jaw, hyoid arch and gill arches
3. Shoulder girdle
4. Trunk — vertebral column, fins and squamation

In the interests of precision, the dimensions of the fishes and of individual bones are given in mm, exact scale counts are given and the size of the fins is indicated by the number of lepidotrichia.

The descriptions of bones are based on measurable values, namely length, width and height. The length of a bone is its rocaudal dimension. The term "width" is used for the mediolateral dimension of the bones of the dorsal and ventral part of the head, namely the bones of the skull roof, the rostral region, the posttemporal, the gular bones and also the clavicle. The "height" of a bone is its dorsoventral dimension, and this term is used for bones on the lateral surface of the head. Similar terms are used for the squamation.

"The inclination of the suspensorium" is a term widely used in the description of fishes. Terms such as "suspensorium oblique", "suspensorium moderately oblique" or "suspensorium almost vertical" are often used but are imprecise. The changes in the inclination of the suspensorium (os hyomandibulare) have an immediate effect on the shape and orientation of the preopercular which covers the hyomandibular. Because of this relationship, the terms "angle of obliqueness of the preopercular" and "angle of the bend of the preopercular" are used in this work.

The angle of obliqueness of the preopercular is the angle between the dorsocaudal margin of the preopercular and the horizontal plane. The angle of the bend of the preopercular is the angle between the caudal margin of the narrow ventral part of the preopercular and the dorsocaudal margin of the broader dorsal part of the preopercular. The method of measurement of these angles is illustrated in fig. 1.

The angle of obliqueness of the opercular is also used for the same reasons. It is the angle subtended by the axis of the opercular (situated in the direction of dorsoventral elongation of the bone) against the horizontal plane (fig. 1). It should be noted that the definition of the angle of obliqueness of the opercular used in this work differs from that used by KAZANCEVA-SELEZNEVA (1981).

The text. tables in the following text contain the dimensions of the bodies and fins of the fishes and the scale counts. The methods of measurement are demonstrated in fig. 2 In the text. tables, the numbered columns 1—9 refer to the following data.

1. Scale count

The number in the numerator is the number of scale rows dividing the supracleithrum from the anterior base of the dorsal fin. The first number in the denominator is the number of scale rows between the supracleithrum and the anterior part of the pelvic fin base; the second one is the number of scale rows between the supracleithrum and the anal fin base; the third one is the number of scale rows between the supracleithrum and the caudal fin base. The final number represents the total number of scale rows from the supracleithrum to the point at which the lobe of the caudal fin ascends (i.e. where the scales change their direction). The number of scale rows was determined, as far as possible, by counting the number of scales along the lateral sensory canal.

Text. tab. 1. Lithostratigraphical division of the Central Bohemian Basins (after V. HAVLENA, J. PEŠEK 1980) with occurrence of actinopterygians.

Age		Lithostratigraphical unit		Main Horizons	Occurrence of fishes	
Carboniferous	Per- mian	Lower Autunian	Líně Formation		— Klobuky Horizon — Zdětín Horizon	Sphaerolepis kounoviensis Spinrichthys dispersus
			Hiatus			
	Stephanian	C	Slaný Formation	Kamenný Most Member	— Kounov Coal Seams	Progyrolepis speciosus Zaborichthys fragmentalis Acrolepis gigas Sphaerolepis kounoviensis Spinrichthys dispersus
				Kounov Member		
				Ledce Member		
				Hředle Member		
				Mšec Member		
				Jelenice Member		
	A	Týnec Formation		— Tatiná Horizon — Plachtín Horizon — Nevěň Coal Seams	Sceletophorus biserialis Sceletophorus verrucosus Pyritocephalus sculptus	
		Westphalian	D	Nýřany Member		— Nýřany Coal Seams — Mirošov Horizon
	Kladno Formation			— Lubná Coal Seams — Radnice Coal Seams — Plzeň Coal Seams		
	Hiatus					
	C		Radnice Member			
	B					

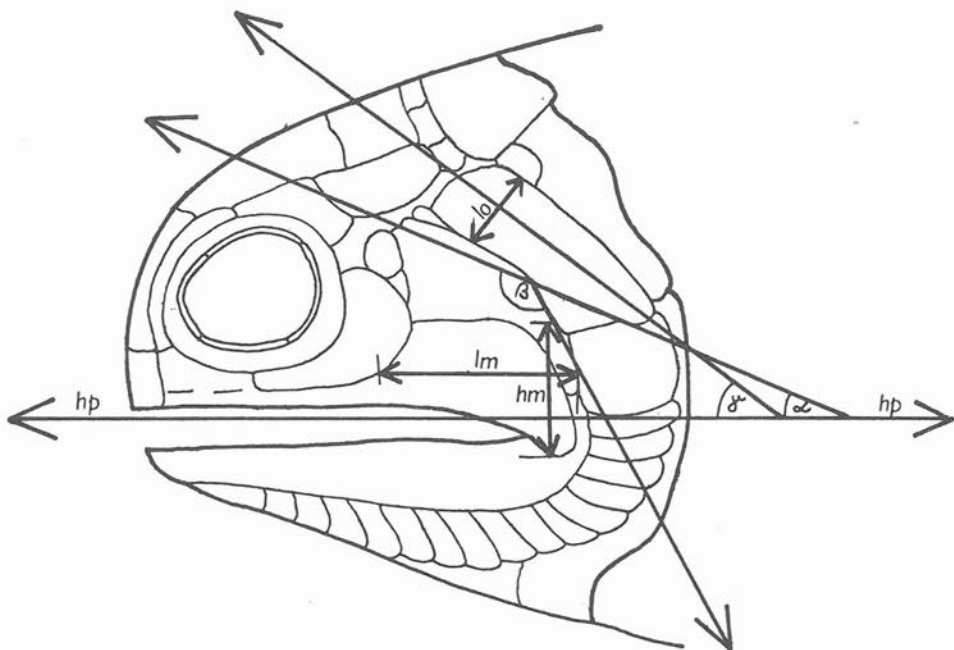


Fig. 1. Schematic demonstration methods of measurement.

α — the angle of obliqueness of the preopercular.

β — the angle of the bend of the preopercular.

γ — the angle of obliqueness of the opercular.

hm — height of the maxillary plate; hp — horizontal plane; lm — length of the maxillary plate; lo — length of the opercular.

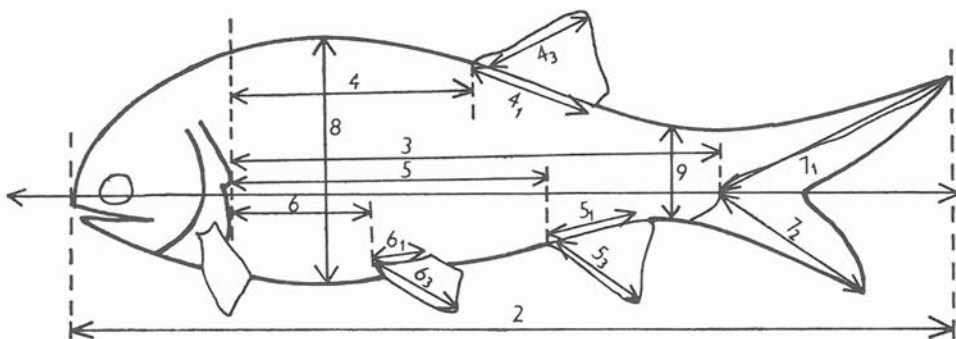


Fig. 2. The methods of measurements, the results of which are recorded on text. tables in text. Explanations of measurements are given in pages 26—29.

2. Total length of the body.

This was measured in the body axis from the rostral tip to the caudal end of the dorsal lobe of the tail.

3. Length of the trunk.

This was measured in the body axis from the caudal margin of the supracleithrum to the angle included by the dorsal and ventral lobes of the caudal fin.

4. The distance from the caudal margin of the supracleithrum to the oral margin of the dorsal fin base.

4.1 - The length of the dorsal fin base measured at the level of the basal segments.

4.2 - The number of dorsal fin lepidotrichia.

4.3 - The length of the longest lepidotrichia of the dorsal fin.

5. The distance from the caudal margin of the supracleithrum to the oral margin of the anal fin base.

5.1 - The length of the anal fin base.

5.2 - The number of anal fin lepidotrichia.

5.3 - The length of the longest lepidotrichium of the anal fin.

6. The distance from the caudal margin of the supracleithrum to the oral margin of the pelvic fin base.

6.1 - The length of the pelvic fin base.

6.2 - The number of pelvic fin lepidotrichia.

6.3 - The length of the longest lepidotrichium of the pelvic fin.

7.1 - The length of the dorsal lobe of the caudal fin.

7.2 - The length of the ventral lobe of the caudal fin.

8. The greatest height of the body.

9. The height of the caudal peduncle.

All measurements are given in mm. The presence of a question mark with the number of scales or lepidotrichia indicates that that number is an approximate estimate, because of the imperfect state of preservation of some specimens.

Systematic section

Subclass: *Actinopterygii*

Order: *Palaeonisciformes* HAY, 1929

Family: *Cosmoptychiidae* GARDINER, 1963

Diagnosis (after GARDINER 1963, emended): Body fusiform. Dorsal fin shifted orally. Dorsal and anal fins triangular. Caudal fin deeply cleft with unequal lobes. Pectoral fin with bases of principal rays unjointed. Anal fin with long base. All fins with numerous small fulcra. Lepidotrichia distally bifurcated. Skull rounded anteriorly and without well-developed rostrum. Suspensorium oblique and orbit large. Antorbital bearing teeth. Opercular much larger than subopercular. Dermohyal and epipreopercular present. Branchiostegal rays numerous, suborbital bones present. Dentition consisting of a series of a few large laniary teeth flanked laterally by series of smaller, more numerous teeth. Scales rhomboidal, with pronounced striae.

Type genus: *Cosmoptychius* TRAQUAIR, 1877

Remarks: The family *Cosmoptychiidae* was erected by GARDINER (1963) to include the Carboniferous genera *Cosmoptychius* TRAQUAIR, 1877 and *Watsonichthys* ALDINGER, 1937. These two genera had previously been included in the family *Acrolepididae* by ALDINGER (1937). The family *Cosmo-*

ptychiidae was diagnosed by GARDINER (1963) particularly by the presence of accessory bones situated anterior to the opercular and by the shape of the long-based pelvic fin.

Included genera: *Cosmoptychius* TRAQUAIR, 1877; *Watsonichthys* ALDINGER, 1937; *Grassator* KAZANCEVA, 1968.

Stratigraphical range: Lower Carboniferous — Upper Carboniferous.

Geographical distribution: Great Britain, Bohemia, USSR, South Africa.

Watsonichthys ALDINGER, 1937

1937 *Watsonichthys*, nov. gen.; H. ALDINGER, *Permische Ganoidfische*, p. 254—257.

1963 *Watsonichthys* ALDINGER, 1937; B. G. GARDINER, *Certain Palaeoniscoid Fishes*, p. 260.

1964 *Watsonichthys* ALDINGER, 1937; L. S. BERG, A. A. KAZANCEVA, D. V. OBRUTSCHEV, *Osnovy paleontologii*, p. 347.

1966 *Watsonichthys* ALDINGER; J. P. LEHMAN, *Traité de Paléontologie*, p. 83.

1976 *Watsonichthys* ALDINGER, 1937; D. HEYLER, *Sur le genre Amblypterus*, p. 27—30.

Type species: *Watsonichthys pectinatus* (TRAQUAIR, 1877).

Locustypicus: Gilmerton, Scotland.

Stratum typicum: Lower Carboniferous.

Diagnosis (after GARDINER 1963, emended): Body fusiform, some species reaching almost one metre in length. Pectoral fin long with principal lepidotrichia unjointed in proximal third of their length. Dorsal fin arising opposite anal fin or shifted forward of level of anal fin. Caudal fin deeply cleft and unequally lobed. All fins with numerous small fulcra anteriorly. Lepidotrichia bifurcated distally. Rostral region of head not conspicuously convex orally. Two pairs of extrascapular bones present. Maxilla with orocaudally elongated maxillary plate. Lower jaw strong. Dentition comprising two types of teeth. Suborbital bones present. Suspensorium very oblique. Opercular of oval shape, 2—3 times higher than the subopercular and narrowing ventrally. Branchiostegal rays numerous. Accessory bones, namely the dermohyal, epipraeopercular and prospectively the antopercular, present orally from the opercular. Rhomboidal scales with peg and socket articulation and with sculpture formed by mounds of enamel. Caudal margin of scales either serrate or straight.

Remarks: ALDINGER (1937) described the genus *Watsonichthys* on the basis of the type species *Elonichthys pectinatus* (TRAQUAIR, 1877). GARDINER (1962) added a further species, *W. lotzi* (GUERICH, 1923) from the Dwyka Series of South Africa. HEYLER (1976) considered *W. pectinatus* to be a synonym of *W. eupterygius* (AGASSIZ, 1833—1843) originally described by AGASSIZ as *Amblypterus eupterygius*. A detailed discussion of the interrelationships of the species of the genus *Watsonichthys* follows the concluding paragraph of the description of *W. sphaerosideritarum*.

Included species: *Watsonichthys pectinatus* (TRAQUAIR, 1877); *Watsonichthys eupterygius* (AGASSIZ, 1833—1843); *Watsonichthys lotzi* (GUERICH, 1923); *Watsonichthys krejci* (FRITSCH, 1895); *Watsonichthys sphaerosideritarum* (FRITSCH, 1895).

Occurrence and distribution: Lower Carboniferous — Upper Carboniferous; Great Britain, Bohemia, South Africa.

Watsonichthys krejčí (FRITSCH, 1895)

(figs. 3—5, pls. I—III)

1895 *Acrolepis Krejčí*, Fr.; A. FRITSCH, Fauna der Gaskohle, Band 3, p. 115—116, pl. 128, figs. 1—8.

1905 *Acrolepis Krejčí* Fr.; F. BAYER, Katalog, p. 24.

1985 *Acrolepis krejčí* FRITSCH, 1895; J. ZAJÍC, S. ŠTAMBERG, Summary of the Permocar-boniferous, p. 71.

H o l o t y p e (by original designation): Specimen figured by FRITSCH (1895) on Pl. 128, figs 1—8, deposited in the National Museum, Prague as M 1208 (both counterparts) and M 890 (galvanic cast). The holotype is refigured in this work (fig. 5, and pls. I—III).

L o c u s t y p i c u s: Malesice, distr. Plzeň - north, Czech Rep.

S t r a t u m t y p i c u m: Mšec member, Stephanian B, Upper Carboniferous.

M a t e r i a l: Holotype specimen only.

D i a g n o s i s: Body fusiform reaching a total length of 130 mm. Lepidotrichia of pectoral fin long, reaching to oral margin of pelvic fin base. Anal fin with long base, about 1.5 times the length of the oral margin of anal fin. Anal fin composed of approximately 50 lepidotrichia. Base of dorsal fin partly opposite the space between pelvic and anal fins and partly opposite to the oral region of anal fin. Oral margin of dorsal fin shorter or same length as oral margin of anal fin. First branchiostegal ray ventral to the subopercular is high, the rest being narrow. Ventral margin of supracleithrum reaching up to half the height of subopercular. Scales stout, sculpture formed by conspicuous ridges. Scales with

straight caudal margin. Scale count $\frac{25}{10 \quad 20 \quad 40} ?$

D e s c r i p t i o n: The holotype is relatively well preserved, missing only the caudal fin and the oral part of the head.

HEAD

Skull roof

The bones of the skull roof are indistinctly preserved. The sculpture on the frontal is formed by tubercles and short pits, mostly orocaudally arranged. The rostral region of the head is not conspicuously convex orally.

Palatomaxillary apparatus

O s m a x i l l a r e (fig. 5, pl. I, fig. 2). The maxilla is 22 mm long with a well developed oblong maxillary plate, 12 mm long. The maxillary plate bears a process in its caudoventral region. The height of the plate, including this process, is 8 mm. The maxilla is conspicuously sculptured on its lateral surface by orocaudally arranged tubercles and short ridges. There are conspicuous ridges on the ventral part of the lateral face of the maxilla. The maxillary dentition is formed by two distinct series of teeth. The outer marginal series comprises numerous minute pointed teeth of 1 mm length, while the inner series is formed by a few larger stout pointed teeth. There is no sculpture on the tooth surfaces.

Of the dermal bones on the medial side of the palatoquadrate only the impression of the ectopterygoid is preserved. The ectopterygoid is orocaudally elongated but its oral margin does not reach the level of the oral margin of the maxillary plate.

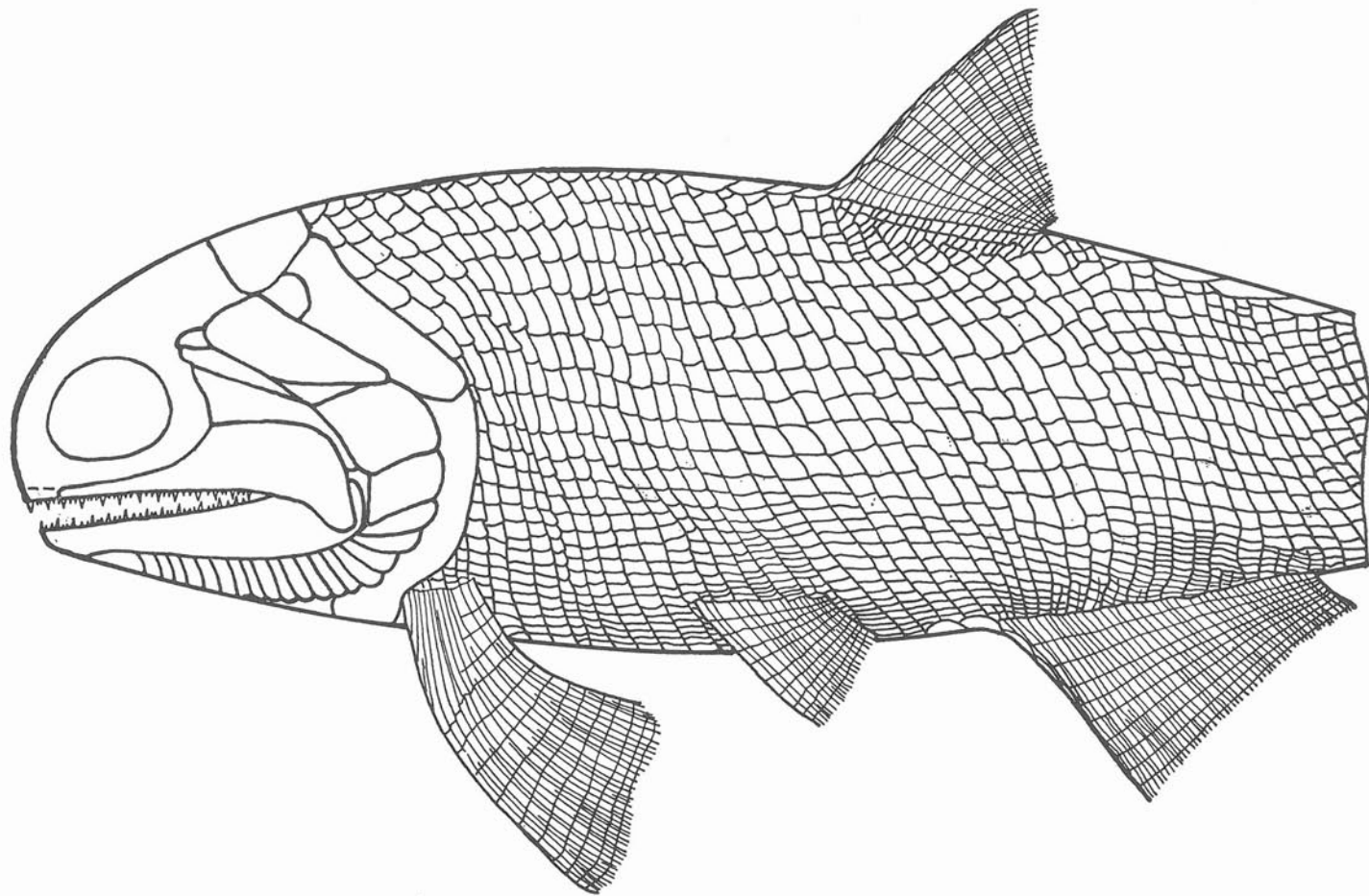


Fig. 3. *Watsonichthys krejci* (FRITSCH, 1895). Reconstruction of whole fish. Drawn after holotype M 1208, $\times 2.0$

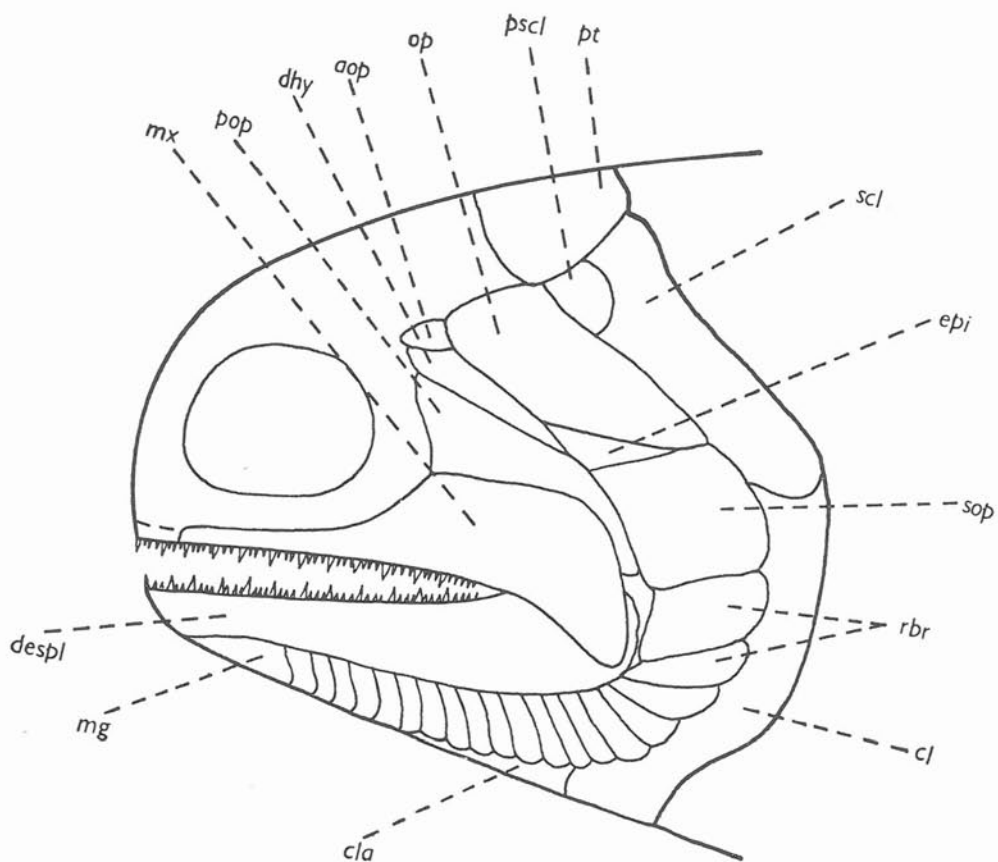


Fig. 4. *Watsonichthys krejci* (FRITSCH, 1895). Reconstruction of head in lateral view. Drawn after holotype M 1208, $\times 2.7$

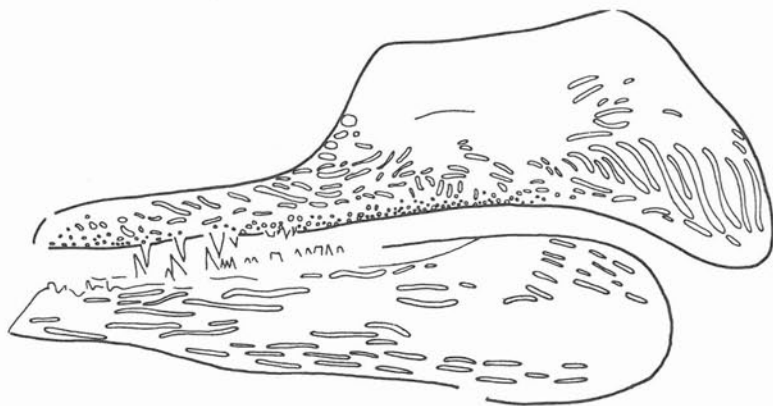


Fig. 5. *Watsonichthys krejci* (FRITSCH, 1895). Maxilla and lower jaw in lateral view. M 890, $\times 4.5$

Lower jaw (fig. 5, pl. I, fig. 2).

The lower jaw is 20 mm long, well-developed and apparently strong. Its maximum height is 5.5 mm at the caudal end, and it is narrower orally. The sculpture on the lateral side is formed by conspicuous ridges arranged in orocaudal rows. The dentition mirrors the dentition of the maxillary.

Os hyomandibulare (pl. I, fig. 2, pl. II, fig. 1).

The hyomandibular is only partly preserved. The bone is very oblique orally. The hyomandibular is bent orally at the level of the dividing line between the opercular and the subopercular. Its ventral region is narrow and the dorsal region is broader.

Os praeperculare (pl. I, fig. 2, pl. II, fig. 1).

The preopercular is only partly preserved. It consists of a narrow ventral part and a broader dorsal region which is orally inclined. The angle of the inclination of the preopercular is 25 degrees, and the angle of the bend of the preopercular is 145 degrees. The oral margin of the dorsal part of the bone is at the same level as the oral margin of the maxillary plate. The preopercular is bent orally in the same manner as the hyomandibular, at the level of the dividing line between the dorsal part of the opercular and subopercular. Accessory bones are present between the dorsal part of the preopercular and the opercular. They are the dermohyal, the antopercular and the epipreopercular. Poor preservation has precluded the recognition of dermal sculpture or sensory canals.

Os dermohyale (pl. I, fig. 2).

The dermohyal is a relatively small triangular bone, considerably dorsoventrally elongated. It is 10.5 mm high and, dorsally, 2 mm long. It is situated between the oral part of the opercular and the dorsocaudal part of the preopercular. The dorsal part of the dermohyal borders the small antopercular.

Gill arch

Only some parts of the gill arch endoskeleton are present. In the dorsal region of the gill arch are several small stick-like fragments of bone. They are dorsoventrally elongated and 7 mm high, and I consider them to be the remains of the epibranchials (pl. I, fig. 2, pl. II, fig. 1).

Remains of the ventral region of the endoskeleton are also preserved and appear to represent the ceratobranchial bones.

The dermal cover of the gill arches comprises the following dermal bones: os operculare, os suboperculare, radii branchiostegales, os gulare laterale and a single os gulare mediale. As well as these bones, there are also some accessory bones present namely: os epipraeperculare and os antoperculare.

Os operculare (pl. I, fig. 2, pl. II, fig. 1).

The opercular is of oval shape and dorsoventrally elongated. It is 12 mm high and 5.5 mm long at the dorsal end. It is narrower ventrally, and because of this there is a space oroventral to it which is occupied by an anamnestic ossification — the os epipraeperculare. The antopercular and the dermohyal are situated beside the epipreopercular orally from the opercular. The caudal margin of the opercular overlaps the presupracleithrum and the supracleithrum. The opercular is very oblique orally and its angle of inclination is 30 degrees. The sculpture on the lateral face of the bone is formed only by fine, concentrically arranged striae.

O s s u b o p e r c u l a r e (pl. II, fig. 1).

The subopercular is poorly preserved. It is square in shape and is 6 mm in height and length. Orally from it is the ventral part of the preopercular, while its caudal margin overlaps the oral region of the supracleithrum.

R a d i i b r a n c h i o s t e g a l e s

There were probably a large number of branchiostegal rays present but in the preserved material only those that are ventral to the subopercular can be seen.

The first ray is overlapped by the subopercular and is relatively large in comparison with the others. It is 2.5 mm high and 4.5 mm long. The second ray is only 1.5 mm high and the height of the others does not exceed 1 mm. They are very narrow. Five branchiostegal rays are preserved ventral to the subopercular. They overlap one another in dorsoventral direction. The branchiostegal rays in the oroventral region of the gill arch are preserved fragmentarily. It appears from the preserved fragments that there were approximately twenty branchiostegal rays in all.

O s g u l a r e l a t e r a l e

The lateral gular is 4 mm long and 2 mm wide. It is situated caudally to the median gular. The sculpture is formed by ridges situated parallel to the lateral margin of the bone.

O s g u l a r e m e d i a l e

This bone is triangular in shape. Its sculpture is formed by ridges situated orocaudally. Two short pit lines are present in the medial region of the ventral face of the bone and these connect with one another.

O s a n t o p e r c u l a r e (pl. II, fig. 1).

The antopercular is a small oval bone, 2 mm high and 2.5 mm long. The sculpture resembles that of the opercular.

O s e p i p r a e o p e r c u l a r e (pl. II, fig. 1).

The epipreopercular is a small supplemental bone of triangular shape, 2.5 mm in length and 2 mm high. It borders the opercular, the subopercular and the preopercular.

S h o u l d e r g i r d l e

The shoulder girdle consists of the following paired dermal bones: *os posttemporale*, *os supracleithrum*, *os praesupracleithrum*, *os cleithrum* and *os clavicularae*.

O s p o s t t e m p o r a l e

This bone is indistinctly preserved on the dorsal part of the head.

O s s u p r a c l e i t h r u m (pl. I, fig. 2, pl. II, fig. 1)

The supracleithrum is oval in shape and is dorsoventrally elongated, being 8 mm high and 5 mm long. The ventral margin of the supracleithrum reaches up to a level halfway up the height of the subopercular. The sculpture on the lateral face of the bone is formed by conspicuous ridges. In the dorsal part of the bone these are arranged in orocaudal rows, but in the ventral part, the rows are parallel with the oral and caudal margins of the bone. The lateral line sensory canal passes through the dorsal third of this bone.

O s p r a e s u p r a c l e i t h r u m (pl. II, fig. 1)

This is a small oval bone 3 mm long and 3 mm high. It is situated caudally from the opercular and partly overlaps the orodorsal region of the supracleithrum. Its dermal sculpture is formed by conspicuous short ridges situated in orocaudal rows.

O s c l e i t h r u m

Only a fragment of this bone is preserved.

O s c l a v i c u l a r e (pl. I, fig. 2)

The clavicle is situated orally from the ventral region of the cleithrum. Only the long ventral part of the clavicle is preserved and is 13 mm in length. The caudal part of the clavicle is at the level of the caudal margin of the maxillary.

TRUNK

Paired fins

P e c t o r a l f i n (pl. I, fig. 1, pl. III, fig. 1)

The pectoral fin is conspicuously long and contains approximately 17 lepidotrichia. The longest lepidotrichia are 26 mm long and are articulated and distally dichotomously branching. Only 6—7 orally placed lepidotrichia are not articulated in the proximal third of their length. Numerous small fulcra are present on the oral margin of the fin.

P e l v i c f i n (pl. I, fig. 1, pl. III, fig. 1)

The pelvic fin is approximately equidistant between the pectoral and anal fins. It is composed of articulate lepidotrichia. The oral margin of the fin base is situated behind the tenth scale row.

Unpaired fins

A n a l f i n (pl. I, fig. 1, pl. III, fig. 2)

The anal fin is very well preserved and characterized by its long base and numerous lepidotrichia. It is composed of 50 articulated and dichotomously branching lepidotrichia. The oral margin of the fin is protected by fringing fulcral scales.

D o r s a l f i n (pl. I, fig. 1)

The base of the dorsal fin is situated partly above the space between the pelvic and anal fins and partly above the base of the anal fin. The oral margin of the fin base begins behind the twenty-fifth scale row. The dorsal fin base is half the length of the anal fin base. All lepidotrichia are articulated. There are four ridge scales orally from the dorsal fin.

S q u a m a t i o n

The trunk is covered by stout, rhomboidal scales. The scales on the flank of the fish are of rhomboidal shape but near the ventral edge of the trunk, they are orocaudally elongated. The dimensions of representative scales along the lateral sensory canal is: in the tenth row, 2 mm high and 1.5 mm long (pl. II, fig. 2); in the twentieth row (near the oral margin of the anal fin), 0.7 mm high and 1.5 mm long. The scale count is $\frac{25}{10 \ 20 \ 40} ?$

The scales are of medium size and overlap each other only slightly. All scales are ornamented with the ridges arranged parallel with the ventral and dorsal margins of the scales. Over the centre of the scale, ridges are arranged diagonally.

The ridges are connected in the caudal part of each scale. The caudal margin of the scale is not denticulate. The ridge scales situated orally from the dorsal fin are ornamented with orocaudally arranged ridges. The lateral sensory canal is clearly visible from the supracleithrum to the level of the anal fin.

No.	1	2	3	4	4 ₁	4 ₂	4 ₃	5	5 ₁	5 ₂	5 ₃	6	6 ₁	6 ₂	6 ₃	7 ₁	7 ₂	8	9
M 1208	10	20	40?	34	12		15?	40	27	50	19	24			14?			36	19

Text. tab. 2. *Watsonichthys krejci* (FRITSCH, 1895). Dimensions of the body. Explanations see on p. 26—29.

Remarks and relationships: The interrelationships of the species of the genus *Watsonichthys* are discussed following the description of *W. sphaerosideritarum*.

Watsonichthys sphaerosideritarum (FRITSCH, 1895).
(figs. 6—11, pl. 4)

1895 *Acrolepis sphaerosideritarum*, Fr.; A. FRITSCH, Fauna der Gaskohle, Band 3, p. 116—117 pl. 127, figs. 1—7.

1905 *Acrolepis sphaerosideritarum* Fr.; F. BAYER, Katalog, p. 24.

1985 *Acrolepis sphaerosideritarum* FRITSCH, 1895; J. ZAJIC, S. ŠTAMBERG, Summary of the Permocarboneous, p. 71.

Holotype (by original designation): Specimen figured by FRITSCH (1895) on pl. 127, figs. 1—7, deposited in the National Museum, Prague as M 888 (positive) and M 889 (negative). The holotype is refigured in this work (figs. 6, 7 and Pl. IV).

Locustypicus: Žilov, distr. Plzeň — north, Czech Rep.

Stratum typicum: Mšec member, Stephanian B, Upper Carboniferous.

Material: Holotype and another well-preserved specimen YA 135 b, together with five specimens showing fragments of heads and scales.

Diagnosis: Body fusiform reaching a total length of 100 mm. Lepidotrichia of pectoral fin long, reaching to caudal margin of pelvic fin base. Pelvic fin composed of approximately 30 lepidotrichia. Anal fin base about the same length as oral margin of anal fin. Dorsal fin base entirely opposite anal fin base. Oral margin of dorsal fin is 25% longer than oral margin of anal fin. First branchiostegal ray ventral to the subopercular is high, the rest being narrow. Ventral margin of supracleithrum not reaching subopercular. Scales stout, sculpture formed by conspicuous ridges. Scales with denticulated caudal margin. Large ridge scales extending from head to anterior base of dorsal fin. Scale count
26—27

6—8 18—20 41—42 46.

DESCRIPTION

THE HEAD

Skull roof (figs. 7, 6)

The skull roof is composed of the following paired bones: os parietale, os frontale, os dermopteroticum, os dermosphenoticum. Caudally it is separated from the dermal bones of the shoulder girdle by the row of extrascapular bones.

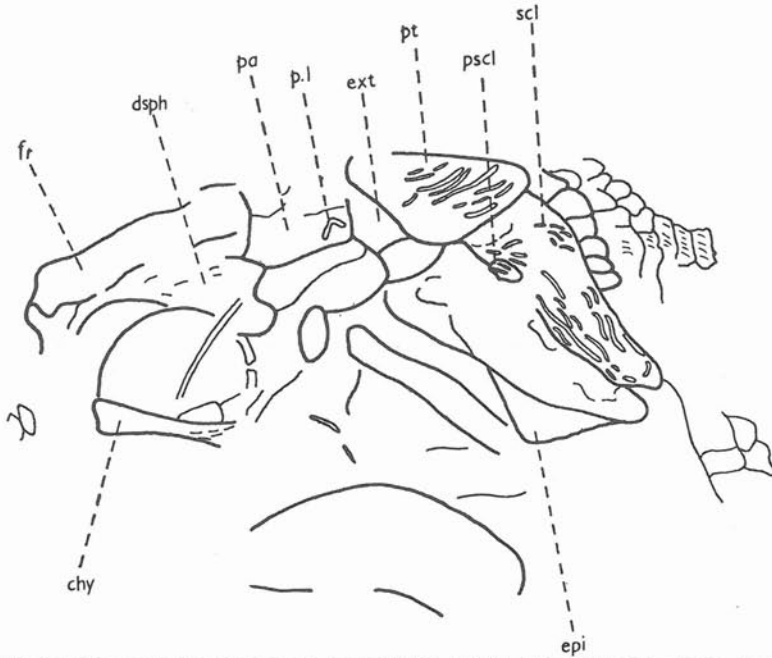


Fig. 6. *Watsonichthys sphaerosideritarum* (FRITSCH, 1895). Dermal bones of the skull roof, gill arches and pectoral girdle in dorsoventral view. M 888, \times 3.5

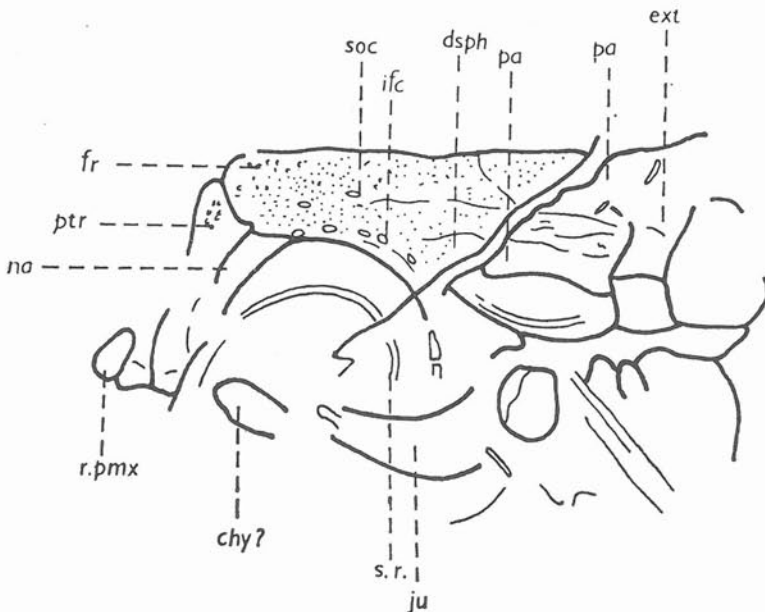


Fig. 7. *Watsonichthys sphaerosideritarum* (FRITSCH, 1895). Skull roof, rostral part of the head and orbit in dorsolateral view. M 889, \times 4.0

Extrascapular bones

These bones are situated caudally from the parietal and dermopterotic. Two or three pairs of extrascapular bones are present. Because of their poor preservation, no trace of the sensory canal could be found.

O s p a r i e t a l e

The parietal is square in shape and is two-fifths of the length of the frontal. The dermopterotic borders it laterally. The dorsal surface of the parietal is ornamented with tubercles and at the caudolateral end of the bone, short grooves represent traces of the sensory lines.

O s f r o n t a l e

The frontal is considerably orocaudally elongated, its length being three times its width. The frontal is orally in contact with the postrostral and nasal, and laterally with the dermopterotic and dermosphenotic. The sculpture on the dorsal face of the bone is formed by numerous tubercles, partly arranged in orocaudal rows. The remains of the supraorbital sensory canal are preserved in the oral region of the bone.

O s d e r m o p t e r o t i c u m

This bone is of oblong shape and also orocaudally elongated. Its caudal margin extends to the extrascapular bones and its oral margin contacts the dermosphenotic. The infraorbital sensory canal passes along the lateral margin of the bone and continues on the dermosphenotic.

O s d e r m o s p h e n o t i c u m

This bone is triangular in shape with the caudal margin contacting the dermopterotic, the oral margin contacting the nasal, and the lateral edge forming the orbit margin. The sculpture on the dorsal face of the bone is formed by irregularly arranged tubercles (fig. 7). Parts of the sensory canal are present. The infraorbital canal continues from the dermopterotic on to this bone, turning ventrally in the oral region and passing along the dorsocaudal margin of the orbit. Indistinct traces of the infraorbital canal suggest that it continues orally to the nasal (fig. 7).

R o s t r a l (fig. 7)

The rostral region of the head is poorly preserved as in other material. I judge from the visible remains that the rostral region is made up of a single postrostral, paired nasals and paired rostromaxillaries. The oral region of the head is blunt and the rostrum is not conspicuously convex orally. Only a fragment of the rostromaxillary is present and is sculptured with irregularly arranged tubercles.

P a l a t o m a x i l l a r y a p p a r a t u s a n d d e r m a l b o n e s o f t h e c h e e k

The palatomaxillary apparatus includes the following visible ossifications: os maxillare, os praeoperculare and os dermohyale. Other bones are not preserved. Two of the circumorbital series of dermal cheek bones have also been identified namely: os jugale and os suborbitale.

O s m a x i l l a r e

The upper jaw is very indistinct but its fragments do show very well, the broad oblong maxillary plate, orocaudally elongated. The maxillary plate bears a lobular process in its ventrocaudal region. The dentition is not preserved.

O s p r a e o p e r c u l a r e (fig. 6)

The preopercular is composed of broad and orally inclined dorsal region and a narrow ventral region. The preopercular is inclined orally at an angle of 20 to 25 degrees. The angle of the bend of the preopercular is 140 degrees. The oral margin of the dorsal part of the preopercular is at the level of the oral margin of the maxillary plate. The dermohyal and antopercular lie caudal to the dorsal broadened part of the preopercular. The next supplemental bone, the os epipraeoperculare lies caudally from the bend of the preopercular. Consequently the supplemental dermohyal and epipreopercular ossifications entirely separate the preopercular and opercular.

O s d e r m o h y a l e

The dermohyal is triangular and dorsoventrally elongate. It is 6 mm high and ventrally is in contact with the preopercular.

O s j u g a l e (fig. 7)

The jugal (also known as the os infraorbitale inferior) is crescent-shaped. It is situated orally from the maxillary plate and the preopercular. The oral margin of the bone is arched and forms the ventrocaudal margin of the orbit. Neither sculpture nor traces of the sensory canals are preserved.

O s s u b o r b i t a l e (fig. 6, 7)

In the holotype, there is an indistinct fragment of this oval bone situated between the caudal margin of the orbit and the oral margin of the preopercular.

The orbit is of medium size and bordered orally by the nasal. The nasal extends up to half of the dorsal margin of the orbit. Dorsally the orbit is bordered by the dermosphenotic and ventrocaudally by the jugal. The remains of the ring of oblong sclerotic ossicles is present (fig. 7).

T h e g i l l a r c h

The dermal cover of the gill arches comprises the os operculare, os suboperculare, radii branchiostegales, ossa gularia, os antoperculare and os epipraeoperculare.

O s o p e r c u l a r e (figs. 6, 7)

The opercular is oval and is twice as high as it is long. It is longer dorsally and narrower ventrally, the later feature providing space for the supplemental bone — the epipreopercular. The opercular is substantially inclined orally. The angle of inclination of the opercular is 35 degrees. The opercular partly covers the oral margin of the presupracleithrum and the supracleithrum.

O s s u b o p e r c u l a r e

This bone is approximately square in shape, and is half the height of the opercular. The ventral margin of the supracleithrum reaches the level of the boundary between the opercular and subopercular.

O s a n t o p e r c u l a r e

The antopercular is very obscure. It is a small bone situated between the dermohyal and the oral margin of the opercular.

O s e p i p r a e o p e r c u l a r e (fig. 6)

The epipreopercular is a triangular bone bordering the opercular, subopercular and preopercular. The dorsal margin of this bone reaches the dermohyal.

Radii branchiostegales

The branchiostegal rays are indistinctly preserved. The fragments suggest that there was a great number of narrow branchiostegal rays.

The shoulder girdle

The following dermal bones are present in the shoulder girdle: os posttemporale, os supracleithrum, os praesupracleithrum, os cleithrum and os claviculare.

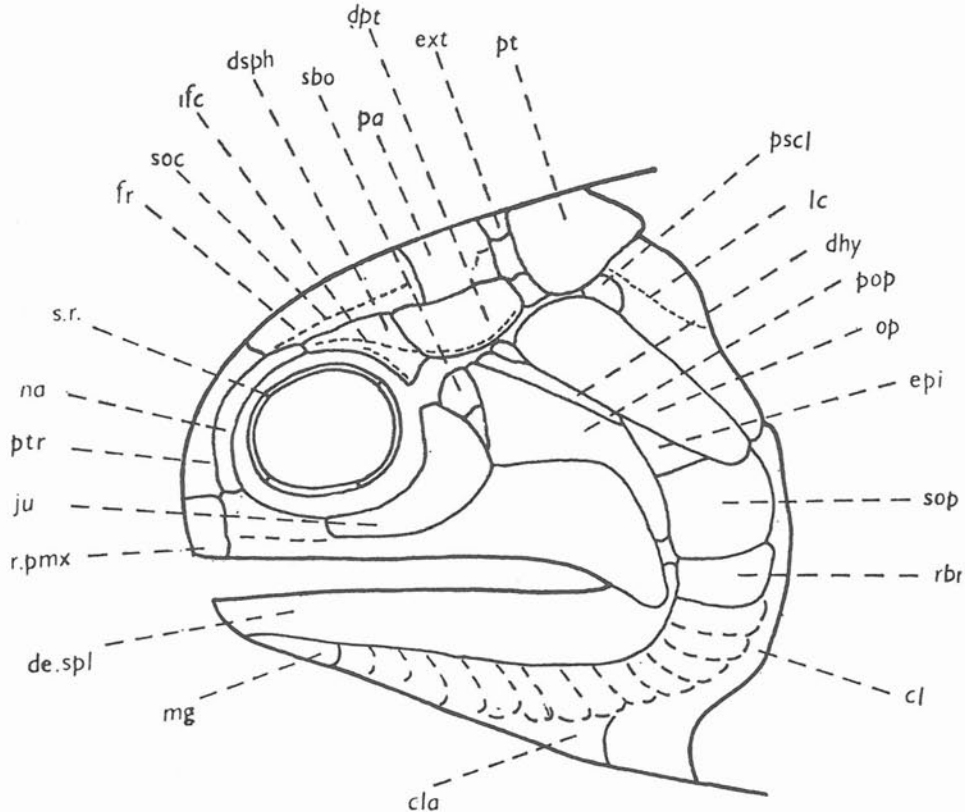


Fig. 8. *Watsonichthys sphaerosideritarum* (FRITSCH, 1895). Reconstruction of head in lateral view, $\times 3.2$

Os posttemporale (fig. 6)

The posttemporal is situated caudally from the extrascapular bones. Its lateral margin covers the presupracleithrum and the supracleithrum. The dorsal face of the bone is sculptured by ridges arranged in an orocaudal direction.

Os supracleithrum (fig. 6)

The supracleithrum is a dorsoventrally elongated oval bone. Orally from its dorsal region lies the presupracleithrum. The ventral part of the supracleithrum does not reach the level of the dividing line between the opercular and subopercular. The sculpture on the lateral face of the bone is formed by conspicuous ridges arranged in a dorsoventral direction. The sculpture dorsal to the lateral

sensory canal is formed by irregularly arranged ridges and tubercles. The lateral sensory canal passes through the dorsal region from the caudal margin of the bone obliquely to the dorsal margin.

O s c l e i t h r u m

The cleithrum is dorsoventrally elongate with an arch-like orally directed bend in the ventral region. The oral margin of the cleithrum is covered by the subopercular and the branchiostegal rays. The clavicle lies orally from the cleithrum.

O s c l a v i c u l a r e (fig. 10)

The clavicle forms the oroventral part of the dermal skeleton of the shoulder girdle. It connects to the ventral part of the cleithrum. The oral edge of the clavicle reaches up to the level of the caudal margin of the orbit.

O s p r a e s u p r a c l e i t h r u m (fig. 6)

The presupracleithrum is a small bone situated orally from the dorsal part of the supracleithrum. Its sculpture is a ridge pattern similar to that on the supracleithrum.

T R U N K

The shape of the trunk is illustrated in fig. 9 and its dimensions are given in text. tab. 3.

No.	1	2	3	4	4 ₁	4 ₂	4 ₃	5	5 ₁	5 ₂	5 ₃	6	6 ₁	6 ₂	6 ₃	7 ₁	7 ₂	8	9
M 889	$\frac{27}{8\ 18\ 42}$ 46	120	63	30	13	—	20	30	17	—	15?	18	6	—	11	—	—	32	12
YA 135	$\frac{26}{6\ 20\ 41}$?	100?	47	24	12	—	17	29	12	—	15?	—	6	—	9	—	—	22	6

Text. tab. 3. *Watsonichthys sphaerosideritarum* (FRITSCH, 1895). Dimensions of the body. Explanations see on p. 26—29.

P a i r e d f i n s

P e c t o r a l f i n (pl. IV)

The pectoral fin is conspicuously long, the longest lepidotrichia in the holotype being 25 mm long. The lepidotrichia are articulated and distally dichotomously branching. Only the proximal third of the oral lepidotrichia is not articulate. If the pectoral fin could be stretched caudally, it would extend beyond the caudal margin of the base of the pelvic fin. Numerous small fringing fulcra are present.

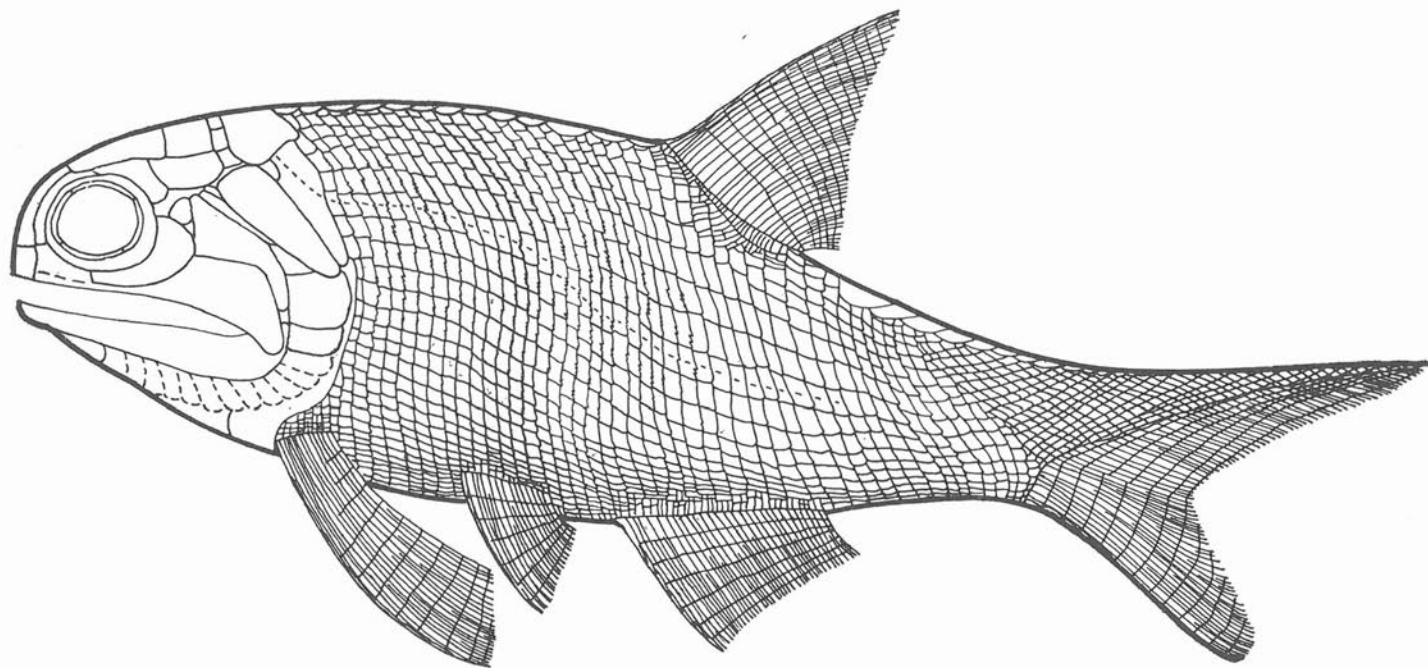
P e l v i c f i n

The pelvic fin is approximately equidistant between the pectoral and anal fins, or may be nearer the pectoral fin. The oral margin of the pelvic fin base begins at the eight scale row. The fin is composed of about 15 articulated lepidotrichia.

M e d i a n f i n s

A n a l f i n

The anal fin is smaller than the dorsal fin and lies opposite to it. The oral



margin of the anal fin base begins at scale rows 18—20. The fin consists of 27—30 articulated lepidotrichia.

Dorsal fin

The dorsal fin is triangular and consists of articulated lepidotrichia. It begins above scale rows 26—27. There are fringing fulcra on the leading edge and orally from the fin lie a row of large ridge scales.

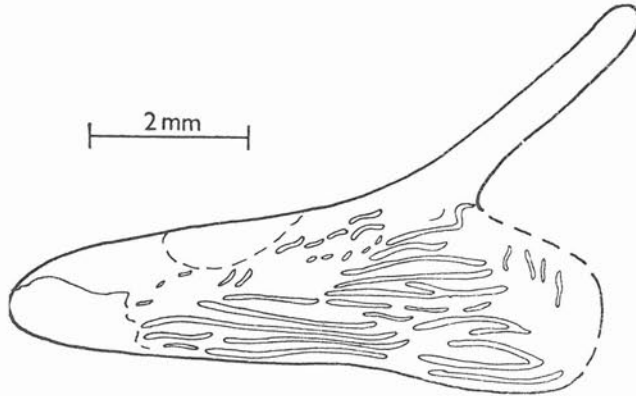


Fig. 10. *Watsonichthys sphaerosideritarum* (FRITSCH, 1895). Clavicle in ventrolateral view. YA 1350.

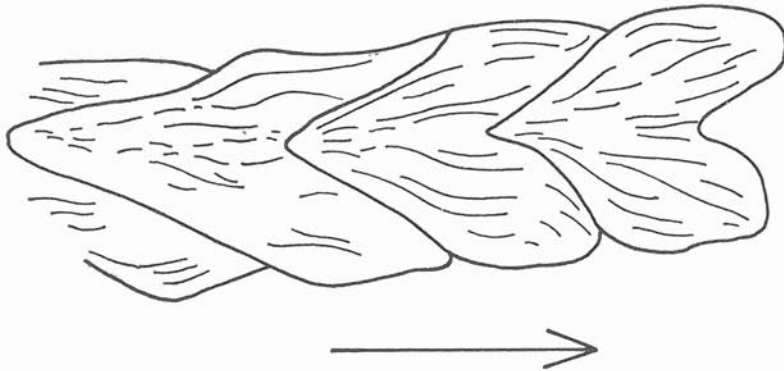


Fig. 11. *Watsonichthys sphaerosideritarum* (FRITSCH, 1895). Large ridge scales protect the dorsal side of the caudal peduncle. Arrow indicates the directio cranialis. M 889, $\times 8.0$

Caudal fin

The caudal fin is deeply cleft with well developed dorsal and ventral lobes. The lepidotrichia are branched and jointed. There are ridge scales along the dorsal margin of the fin and caudal peduncle, and fulcral scales along the ventral margin of the fin.

Squamation

The trunk is covered by rhomboidal scales which are ornamented with oro-caudally arranged ridges. On the lateral face of each scale are 5—7 ridges arranged in parallel and rarely linked. The ridges terminate caudally in small

teeth. In the holotype, representative scales along the lateral sensory canal have the following dimensions: in row 10: height 2 mm, length 1.3 mm
in row 25: height 0.8 mm, length 1.3 mm.

The scale count is $\frac{26-27}{6-8 \quad 18-20 \quad 41-42}$ 46?

The dorsal margin of the trunk between the posttemporal and the dorsal fin is protected by 18—19 ridge scales. Similar ridge scales are present caudal to the dorsal fin on the peduncle of the caudal fin.

Occurrence in Czechoslovakia: Žilov (Kladno and Rakovnick Basins), Netovice (Borehole Nt-1).

Geographical distribution: Czech Rep.

Stratigraphical range: Mšec member, Stephanian B, Upper Carboniferous.

Remarks and relationships: Two species of the genus *Watsonichthys* are now known from the Carboniferous basins of Central Bohemia, namely *W. krejci* and *W. sphaerosideritarum*. They are very similar but have been clearly differentiated in this study. The basic differences are as follows:

1. In *W. krejci*, the longest lepidotrichia of the pectoral fin reach the level of the oral margin of the pelvic fin base. In *W. sphaerosideritarum*, the same lepidotrichia reach the caudal margin of the pelvic fin base.
2. In *W. krejci*, the anal fin is composed of 50 lepidotrichia and its base is 1.5 times longer than the length of its oral margin. In *W. sphaerosideritarum*, the anal fin is composed of approximately 30 lepidotrichia and the base is approximately the same length as the oral margin.
3. In *W. krejci*, the dorsal fin base lies partly above the space between the pelvic and anal fin, and partly above the anal fin. In *W. sphaerosideritarum*, the base of the dorsal fin lies entirely above the base of the anal fin.
4. In *W. krejci*, the scales are not denticulated on their caudal margin. In *W. sphaerosideritarum*, the scales are denticulated on their caudal margin.
5. In *W. krejci*, the ventral margin of the supracleithrum extends to the level of half of the height of the subopercular. In *W. sphaerosideritarum*, the ventral margin of the supracleithrum does not reach the subopercular.

Comparison of *W. krejci* and *W. sphaerosideritarum* with the description of the type species *W. pectinatus* given by TRAQUAIR (1877—1914), ALDINGER (1937) and GARDINER (1963) reveals that the Bohemian basin species share some distinct features not found in the type species:

- a) *W. krejci* and *W. sphaerosideritarum* share the possession of a conspicuously long pectoral fin, and a long anal fin base.
- b) *W. krejci* and *W. sphaerosideritarum* do not possess the long base to the pelvic fin, as described in *W. pectinatus*.
- c) In *W. krejci* and *W. sphaerosideritarum*, the branchiostegal ray ventral to the subopercular is twice as high as the other branchiostegal rays. This size discrepancy does not occur in *W. pectinatus*.
- d) *W. krejci* and *W. sphaerosideritarum* possess a presupracleithrum which is absent in *W. pectinatus*.

As a result of this work, the genus *Watsonichthys* is considered to include the species *W. pectinatus* (TRAQUAIR, 1877), *W. krejci* (FRITSCH, 1895), *W. sphaerosideritarum* (FRITSCH, 1895), *W. lotzi* (GUERICH, 1923) and *W. eupterygius* (AGASSIZ, 1833—1843). In contradistinction to HEYLER (1976), I consider *W. eupterygius* to be distinct from *W. pectinatus* and closer to the two Bohemian species. Several features of the body and fins support this argument. The pelvic fin does not have a long base, but the anal fin does have a long base and the pectoral fin is elongate. Unfortunately, it is not possible to make comparison of the bones of the head as they are poorly preserved in *W. eupterygius*.

Family: *Pygopteridae* ALDINGER, 1937

Diagnosis: (after ALDINGER 1937, emended): Body fusiform. Pectoral fin with bases of principal rays unjointed. Pelvic fin very small. Anal fin with long base. Caudal fin deeply cleft and unequally lobated. Lepidotrichia distally bifurcated. Endocranium only partly ossified. Parietal bones short. One pair of extrascapular bones present. Parasphenoid short with processus ascendens posterior and processus ascendens anterior. Skull with well-developed rostrum. Postrostral large and wide. Maxilla with well-developed orocaudally elongated maxillary plate. Dentition consisting of a series of a few large laniary teeth flanked laterally by a series of smaller, more numerous teeth. Suspensorium very oblique. Subopercular longer than opercular. Branchiostegal rays numerous. Accessory bones present between dorsal parts of opercular and preopercular. Sculpture on dermal bones of the head well-developed. Scales small, in oral part of the trunk oblong, dorsoventrally elongated, usually sculptured with ridges. The scales in caudal part of the trunk rhomboidal, smooth. Ridge scales developed orally from the dorsal fin and on the dorsal side of the caudal fin.

Type genus: *Pygopterus* AGASSIZ, 1833—1843

Included genera: *Pygopterus* AGASSIZ, 1833—1843; *Nematoptychius* TRAQUAIR, 1875; *Progyrolepis* FRITSCH, 1895; *Itararichthys* BELTAN, 1977; *Zaborichthys* n. g.

Stratigraphical range: Lower Carboniferous — Triassic.

Geographical distribution: Europe, South America.

Progyrolepis FRITSCH, 1895

1895 *Progyrolepis*, Fr.; A. FRITSCH, Fauna der Gaskohle, Band 3, p. 118.

Type species: *Progyrolepis speciosus* (FRIČ, 1875).

Locus typicus: Kounov, distr. Rakovník, Czech Rep.

Stratum typicum: Kounov member, Stephanian B, Upper Carboniferous, Kladno and Rakovník Basins.

Diagnosis: Fish approximately 60 cm in length. Lepidotrichia of pectoral fin unjointed in their proximal part, distally articulated and dichotomously branched. Endocranium ossified. Frontal 2.5 times longer than the wide, sculpture formed by conspicuous tubercles. Rostral region of head conspicuously convex orally, comprising large single postrostral, paired nasal and rostro-

premaxillar. Rostro-premaxillar with teeth. Medial side of palatoquadratum formed by entopterygoid, ectopterygoid, dermometapterygoid and small dermopalatines. Maxilla with long and low maxillary plate, the length-height ratio of maxillary plate is 1.6; the ratio of the length of the maxillary plate to the length of the oral narrow maxillary part is 0.9. Sculpture on maxilla formed by tubercles and ridges. Lower jaw very stout. Dentition comprising two types of teeth in two rows. Preopercular conspicuously bent and inclined orally. The angle of obliqueness of the preopercular is 27 degrees, angle of bend of preopercular is 137 degrees. Orbit small, placed orally. Opercular of oval shape, three times as high as long. The angle of obliqueness of the opercular is 30 degrees. Subopercular of square shape. One anamnestic bone, the epipreopercular, present. Numerous branchiostegal rays. Rhomboidal scales small and stout, with peg and socket articulation. Sculpture on scales formed by several ridges. Caudal margin of scales not serrated.

Remarks and relations: According to the results of this work, the genus *Progyrolepis* includes the type species *Progyrolepis speciosus* only. DUNCLE (1946) described *Progyrolepis tricessimalaris* from the Lower Permian of Texas. I consider this species to be distinct from the genus *Progyrolepis*, namely the maxilla and preopercular differ in shape. Remaining bones are not comparable.

Progyrolepis speciosus (FRIČ, 1875)

(figs. 12—23, pls. V—IX)

- 1875 *Gyrolepis speciosus* Fr.; A. FRIČ, Über die Fauna, p. 77.
1877 *Gyrolepis speciosus* Fr.; A. FRIČ, Zur Fauna der Gaskohle, p. 46.
1879 *Gyrolepis speciosus* Fr.; A. FRIČ, Neue Übersicht, p. 191.
1883 *Gyrolepis speciosus* Fr.; A. FRITSCH, Fauna der Gaskohle, Band 1, p. 31.
1891 *Élonichthys speciosus*; A. S. WOODWARD, Catalogue of the Fossil Fishes, p. 501.
1895 *Progyrolepis speciosus*, Fr.; A. FRITSCH, Fauna der Gaskohle, Band 3, p. 118—120, fig. 308, pl. 131, figs. 1—15, pl. 132, figs. 1—7.
1905 *Progyrolepis speciosus* Fr.; F. BAYER, Katalog, p. 42.
1945 *Progyrolepis speciosus*, A. S. ROMER, Late Carboniferous, p. 422—423.
1946 *Progyrolepis speciosus* FRITSCH; A. DUNCLE, A new palaeoniscoid fish, p. 402—403.
1964 *Progyrolepis speciosus* Fr.; BERG, KAZANCEVA, OBRUTSCHEV, Osnovy paleontologii, p. 341.
1985 *Progyrolepis speciosus* (FRIČ, 1875); J. ZAJÍČ, S. ŠTAMBERG, Summary of the Permian-carboniferous, p. 72.

Lectotype (designated herein): Specimen figured by FRITSCH (1895) on pl. 131, fig. 12, deposited in the National Museum, Prague as M 1217 (positive) and M 881 (negative). The lectotype is refigured in this work on figs. 12, 14 and pls. V, VI — fig. 1, VII.

Paralectotypes: Specimens figured by FRITSCH (1895) on fig. 308, pls. 131, 132, deposited in the National Museum, Prague as M 1204 (cast only — fig. 308), M 1216 (pl. 131, figs. 1—9), M 886 (cast only — pl. 131, fig. 10), M 823 (pl. 131, fig. 14), M 2070 and M 2071 (positive and negative, pl. 132, fig. 1), M 884 (pl. 132, figs. 2—7).

Locus typicus: Kounov, distr. Rakovník, Czech Rep.

Stratum typicum: Kounov member, Stephanian B, Upper Carboniferous, Kladno—Rakovník basin.

Material: Together with lectotype and paralectotypes additional other five fragments of specimens were used. Material is deposited in the National Museum, Prague.

Diagnosis: Same as for genus.

DESCRIPTION

Samples provide the most complete information about some dermal bones of the head, part of endocranium and scales. Pectoral fin is poorly preserved. Shape of the body and position of fins are not known.



Fig. 12. *Progyrolepis speciosus* (FRİČ, 1875). Otical part of the neurocranium in dorsal view M 1217, $\times 3.5$
c.p.ot — caudal processus of otical part; fb — fossa Bridgei; font — fontanella, m — mould in place of semicircular canal.

HEAD

Endoskeleton of the neurocranium (fig. 12).

Endoskeleton of the neurocranium is preserved on lectotype M 1217. It is probably preserved whole, but we can study only its caudal part because the remaining part is covered with dermal bones of the skull roof. The dorsal part of regio oticalis is distinguished. The round foramen lying medially I consider to be fontanelle anterior. This fontanelle is not prolonged in oral direction, as it is on *Kansasiella eatoni* (see POPLIN 1974). In our sample there is only a deep furrow orally from the fontanelle anterior. Laterocaudally from the fontanelle anterior lies mould in the place of semicircular canal which is laterally bordered by deep narrow cut with two foramens or deep pits in its caudal part. Two small foramens also lie in oral part of this cut. This cut probably corresponds with the formation described as a Fossa Bridgei anterior and posterior. Other small foramens on dorsal side of the endocranium are difficult to determine.

Skull roof and rostral part.

Dermal bones of the skull roof and rostral part of the head are conserved on lectotype M 1217 and isolate bones are on M 2070 and M 2071.

O s f r o n t a l e. Only the frontal of the bones of the skull roof is present. It is orocaudally elongated, its length being two-fifth times its width. The post-rostral and nasal border the frontal orally. Sculpture on the dorsal face of bone is formed by tubercles.

R o s t r a l

The rostral part is conspicuously convex orally. It is made up of a single postrostral, paired nasals and rostromaxillaries.

O s p o s t r o s t r a l e (fig. 14). The postrostral is approximately of square shape, broadened orally. The width of the bone in its oral part on M 1217 is 18 mm and caudally is narrower. The length of the same bone is 16 mm. The sculpture is formed by conspicuous tubercles.

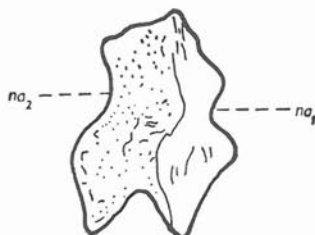


Fig. 13. *Progyrolepis speciosus* (FRİČ, 1875). Nasal in orodorsal view. M 2070, $\times 2.0$

O s n a s a l e (fig. 13). The nasal is partly preserved on M 1217, M 1204 and M 2070. It is orocaudally elongated, 15 mm long; in its oral part lateral margin forms large shallow notch for anterior nostril. The oral part of the nasal is narrow, caudally broadening. Caudal margin is concave. The sculpture is made by short ridges parallel with the caudal and lateral margins of the bone, which pass into tubercles anteriorly.

O s r o s t r o - p r a e m a x i l l a r e. The rostromaxillary lies orally to the postrostral. The right and left rostromaxillaries are in connection medially. This bone on M 2070 measures 16 mm in lateromedial direction and 7 mm in dorsoventral direction. The ventral margin is provided by teeth arranged in two rows. The outer marginal series comprises numerous minute sharp pointed teeth, while the inner series is formed of a few larger stout pointed teeth. The remains of the infraorbital sensory canal are preserved along the ventral margin of the bone.

D e r m a l b o n e s s u r r o u n d i n g t h e o r b i t

The bones surrounding the orbit between the orbit and the preopercular are poorly preserved. As samples M 1217 and M 881 show, the orbit is small, bounded ventrally by infraorbital bones, which partly cover orodorsal margin of the palatomaxillary apparatus. Isolate infraorbital bone on M 2070 is partly curved and sculptured by short ridges and tubercles. Oroventrally orbit is bordered by the antorbital which is sculptured with tubercles; the teeth are not developed.

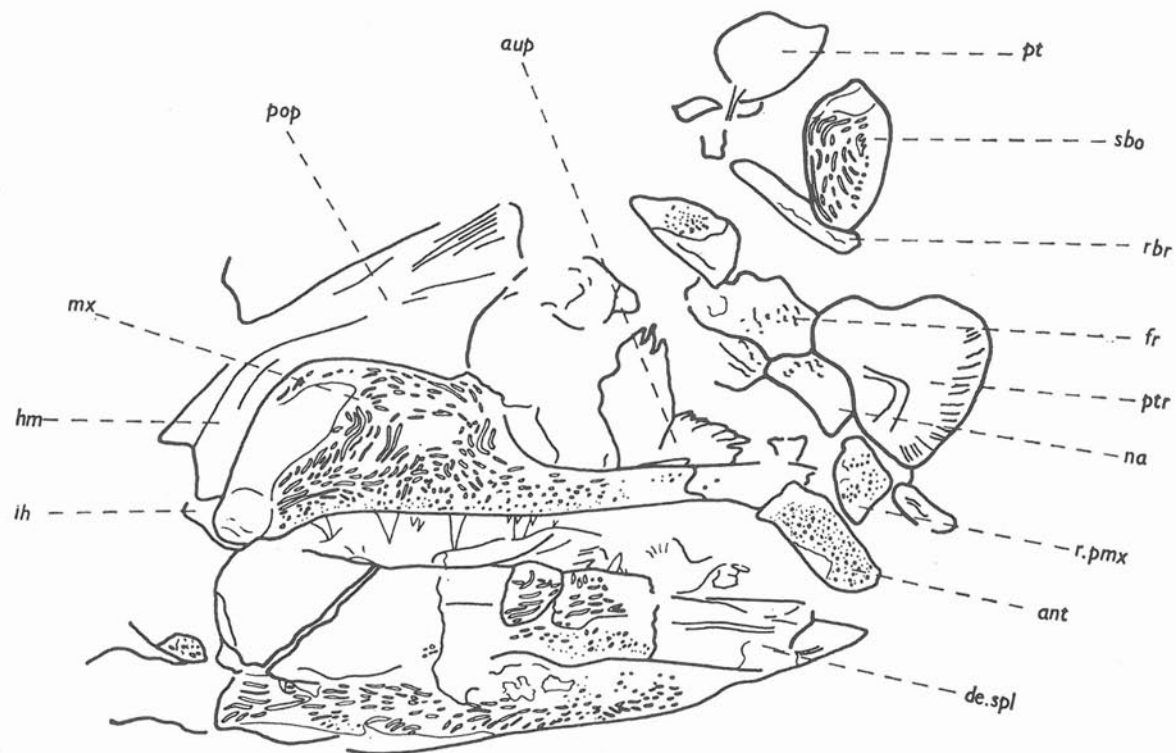


Fig. 14. *Progyrolepis speciosus* (FRIČ, 1875). Bones of palatomaxillary apparatus, lower jaw and rostral region. M 1217, $\times 1.0$

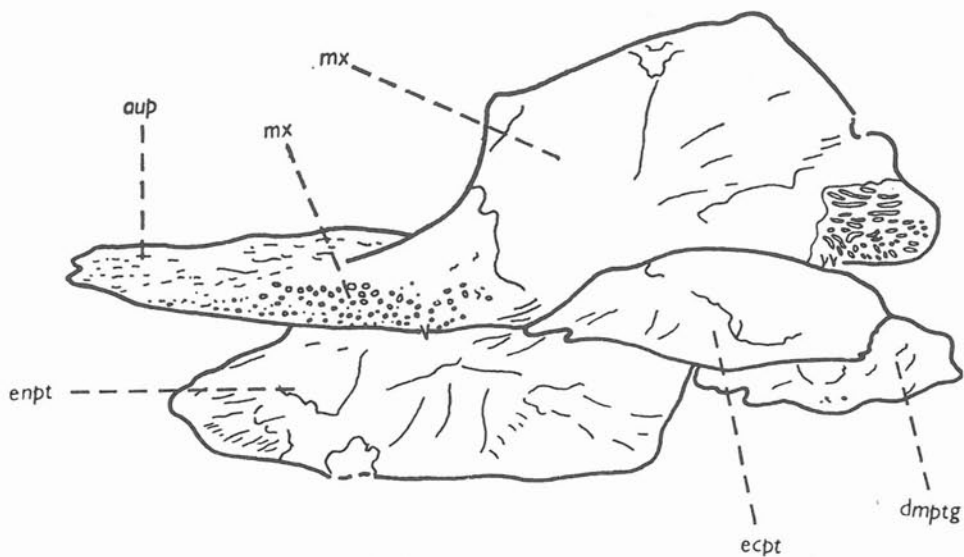


Fig. 15. *Progyrolepis speciosus* (FRIČ, 1875). Dermal bones of the palatomaxillary apparatus. M 2070, $\times 2.0$

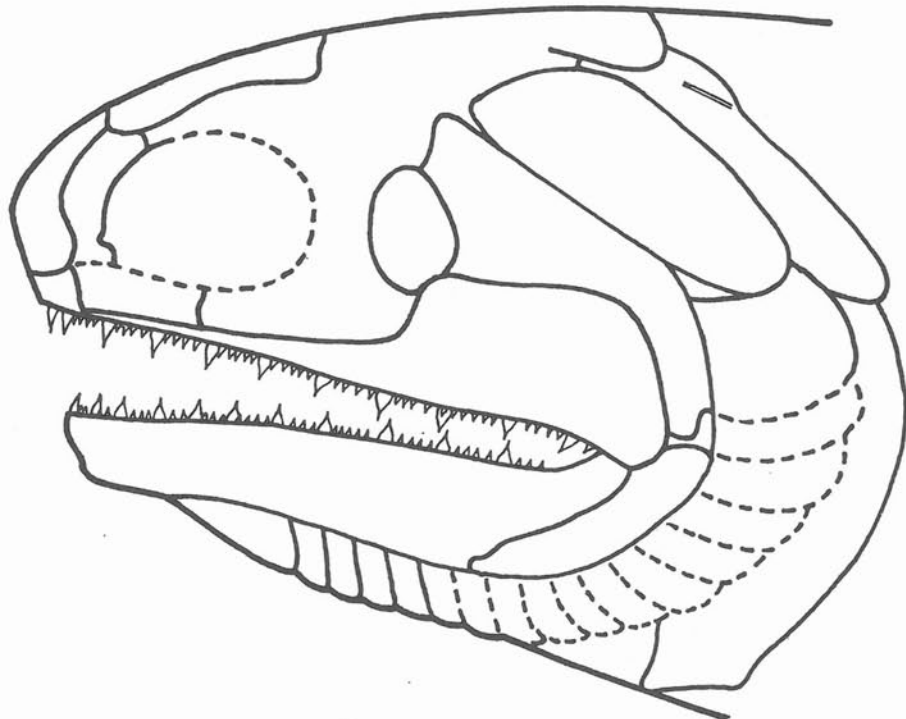


Fig. 16. *Progyrolepis speciosus* (FRIČ, 1875). Reconstruction of head in lateral view, $\times 1.5$

Two oval suborbital bones lie anteriorly to the preopercular and they are preserved on M 1217 and M 2072. The sculpture on their lateral surface is formed by conspicuous ridges running parallel with caudal margin of the bone, apart from the oral part of the bone, which was covered in natural position with the jugal.

Palatomaxillary apparatus

Endoskeleton

Os palatoquadratum (fig. 14). Orocaudally elongated bone with narrow oral pars autopalatina, without any processes. Pars autopalatina form with the oral part of maxilla the compact unit as on M 823 (fig. 19). On the boundary line of coalescent there are rests of sensory canal.

Exoskeleton

Os palatoquadratum is medially and laterally covered with dermal bones. Medially lies *os entopterygoideum*, *os ectopterygoideum*, *os dermometapterygoideum* and several small dermopalatines. The lateral cover of the palatoquadratum consists of maxilla and partly of preopercular.

Os entopterygoideum (figs. 15, 19). The entopterygoid is the largest dermal bone on medial side of palatoquadratum. On M 2070 it is 38 mm long and 11 mm high. It lies orally, its oral margin is frayed and it does not extend to the oral margin of the palatoquadratum. Caudal part of the entopterygoid extends to the level of half length of the maxillary plate. The centre of ossification lies near the ventral margin of the bone.



Fig. 17. *Progyrolepis speciosus* (FRIČ, 1875). Lower jaw in lateral view. M 884, $\times 1.4$

Os ectopterygoideum (figs. 15, 19). The ectopterygoid is on M 2070 28 mm long and 10 mm high. Oral margin of the bone extends to the level of the oral margin of the maxillary plate.

Os dermometapterygoideum (figs. 15, 19). The dermometapterygoideum is on M 2070 20 mm long. Orally is bounded by entopterygoid and ventrally by ectopterygoid.

Os dermopalatinum (figs. 15, 19). Four dermopalatines 5–7 mm long are preserved on sample M 823 ventrally from the entopterygoid.

Os maxillare (figs. 14, 15, 19, 20). Maxilla is well preserved on several specimens. It consists of narrow oral part and broadened caudal maxillary plate. The shape of maxillary plate is very characteristic; it is low and bears a process in its caudoventral region. Ratio of the length of maxillary plate to its height is 1.6; ratio of the length of the maxillary plate to the narrow oral part of the maxilla is 0.9. Length of the upper jaws on specimens oscillates from 62 mm to 64 mm and height of the maxillary plate from 19 to 20 mm.

Sculpture on the lateral side of the maxilla is formed by tubercles and ridges. The ventral margin of the maxilla is sculptured with tubercles which pass into short and lastly to long ridges (fig. 14). Oral narrow part of maxilla is sculptured only along its ventral margin, while the dorsal part is without sculpture and has been covered with infraorbitals and antorbital.

Fine remainders of the sensory lines are on the boundary between the narrow oral part of the maxilla and maxillary plate. Two rows of teeth cover stronger ventral border of the jaw. The outer marginal series comprises numerous pointed teeth, while the inner series consists of a few larger stout pointed teeth. The detailed description of the teeth will be presented further.

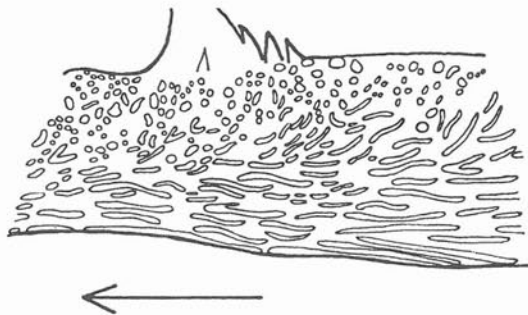


Fig. 18. *Progyrolepis speciosus* (FRIČ, 1875). Sculpture on lower jaw in lateral view. Arrow indicates the directio cranialis. M 714, $\times 3.5$

Lower jaw (figs. 14, 17, 18, 20).

The lower jaw is preserved on several samples. It is well developed, strong, lateral side is formed by dentalosplenic and angular. Length of the lower jaws on samples ranges from 56 mm to 72 mm and height in their caudal parts from 12 to 14 mm.

O s d e n t a l o s p l e n i a l e, by far the largest dermal bone on the lateral side of the lower jaw. Caudally it bears a processus which is presumed to joint with the palatoquadrate. The sculpture along the ventral margin of the dentalosplenic is formed by long ridges parallel with its ventral margin, which are shorten dorsally. Near to the dorsal margin of the bone the sculpture consists of tubercles (fig. 18).

O s a n g u l a r e. The angular covering the lateral surface of the lower jaw is restricted to caudal part of the lower jaw and is poorly preserved.

Ventromedial side of the lower jaw is covered with a narrow strip of dentalosplenic which is sculptured by ridges. Dorsally, on medial side of the lower jaw is poorly preserved *os praearticulare*.

The teeth on the lower jaw are similar as on the maxilla. It is possible to describe the teeth in detail on the basis of samples M 1217 and M 884.

Medial row bears large teeth 3—5 mm long. Orally lying teeth are 3 mm long, in caudal direction are teeth longer (5 mm), and two last are again shorter. The teeth have a wide base (2 mm) and they are sharp pointed distally. Lower jaw bears from 11 to 12 large teeth. Lateral row consists of small teeth about 1.2 mm long. There are more numerous than the first ones. There are 4 or 5 small teeth

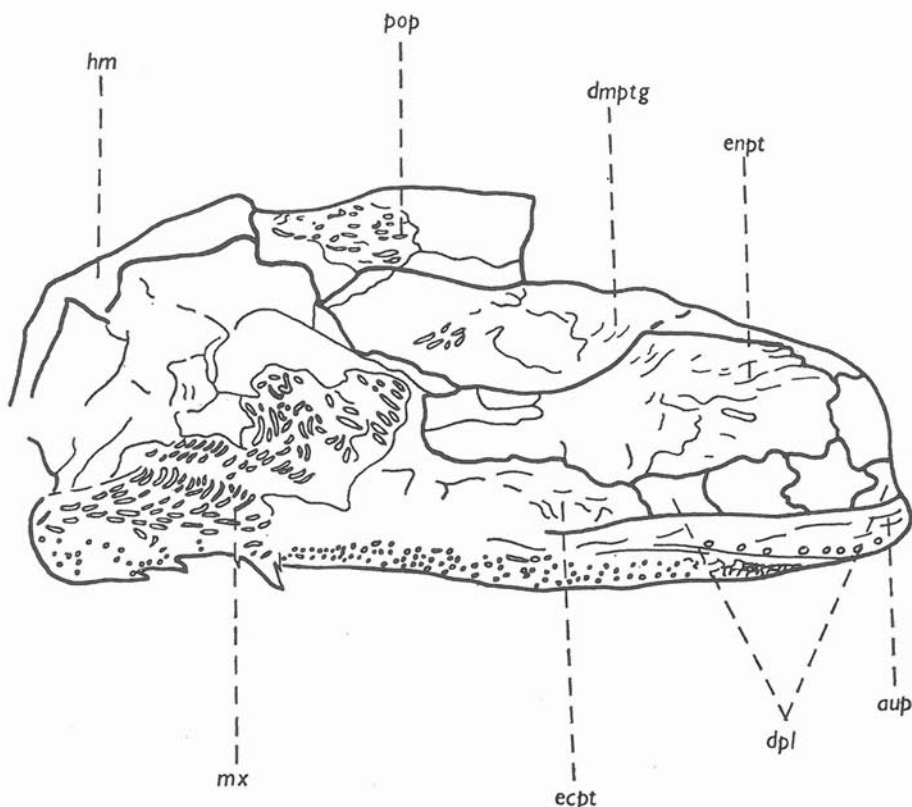


Fig. 19. *Progyrolepis speciosus* (FRİČ, 1875). Dermal bones of the palatamaxillary apparatus. M 823, $\times 2.0$

in the space between the two large teeth in inner row. In the lateral row there are also teeth not exceeding 0.5 mm in length.

Hyoid arch

Of the endoskeletal bones building the hyoid arch there are partly preserved the hyomandibular, interhyal, ceratohyal and the preopercular covers the endoskeletal bones laterally.

O s h y o m a n d i b u l a r e (figs. 14, 19). The hyomandibular is bow-like dent bone making the dorsal part of the endoskeleton of the hyoid arch. On sample M 1217 its dorsal part is orally inclined at the same angle as the preopercular. Processus opercularis is not developed. Ventral margin is bordered with a short strong bone, which we can consider as the interhyal.

O s i n t e r h y a l e (fig. 14). The interhyal on M 1217 is short, very strong, not well preserved. It mediates connection between the hyomandibula, ceratohyal and jaws.

O s c e r a t o h y a l e (fig. 21). The ceratohyal forms ventral part of the endoskeleton of the hyoid arch. This bone is partly preserved, orocaudally

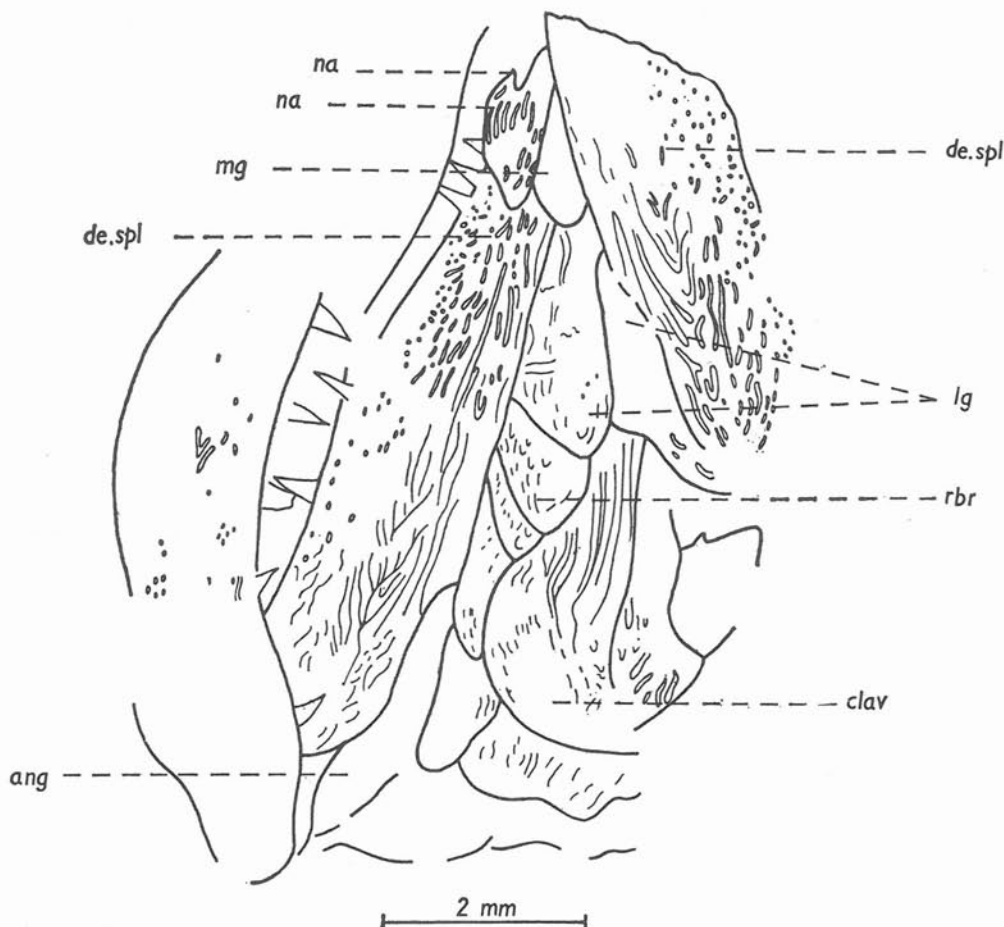


Fig. 20. *Progyrolepis speciosus* (FRIČ, 1875). Dermal bones of the gill arches and clavicle in ventral view. M 1204.

elongated. Approximately at mid-length it is narrow, broadening distally and orally. Oral margin of the bone is convex. Over the whole bone runs a groove, which I regard as the groove with the hyoid artery (NIELSEN 1942) on *Pteronisculus aldingeri*.

O s p r a e o p e r c u l a r e (figs. 14, 19). The preopercular is partly preserved on M 1217. It is acutely bent anteriorly, orally expanded and ventrocaudally narrow. The angle of the obliqueness of the preopercular is 27 degrees, the angle of the bend of the preopercular is 137 degrees.

Gill arch

The endoskeleton of the gill arch of *Progyrolepis speciosus* is entirely obscure. The dermal cover of the gill arch consists of paired opercular, subopercular, epipreopercular, branchiostegal rays, gular lateral and single gular medial.

Os operculare (fig. 16). The opercular is known on samples M 881, M 2070, M 2071. It is dorsoventrally elongated, three times as high as long, ventrally narrow. The ventral margin of the bone partly overlaps the subopercular and epipreopercular. The angle of obliqueness of the opercular is 30 degrees. The sculpture consists of ridges and tubercles arranged parallel with the elongation of the bone.

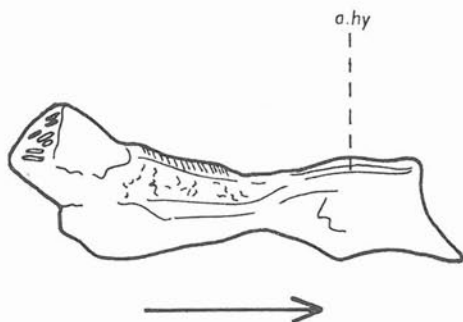


Fig. 21. *Progyrolepis speciosus* (FRIČ, 1875). Ceratohyal in lateral view. Arrow indicates the directio cranialis. M 2070, $\times 2.0$

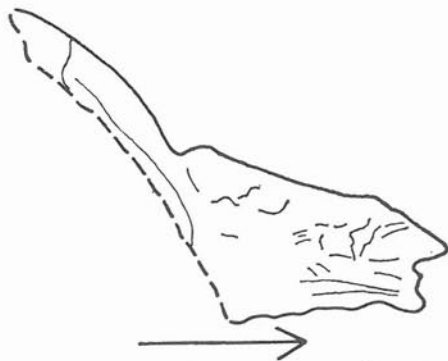


Fig. 22. *Progyrolepis speciosus* (FRIČ, 1875). Clavicle in dorsal view. Arrow indicates the directio cranialis, M 2070, $\times 1.4$

Os epipraeoperculare. The epipreopercular is preserved on M 881; it is triangular, dorsoventral dimension is 6 mm and orocaudal dimension 3.5 mm. Bone is surrounded by the opercular, subopercular and preopercular. Other anamnestic bones have not been found.

Os suboperculare. The subopercular on samples M 881 and M 2070 has square shape with concave dorsal and oral margins. Orally it is in contact with the ventrocaudal part of the preopercular. Caudal margin of the subopercular is convex. The sculpture consists of ridges and tubercles.

Radii branchiostegales (fig. 16). It is possible to presume from several very narrow branchiostegal rays that they have been very numerous.

Os gulare laterale (fig. 20). The paired gular is narrow in its oral part, caudally expanded, lying orally from the branchiostegal rays. The gular lateral is known on sample M 1204. Ventral side of the bone is provided with fine ridges and tubercles. The rests of sensory canals are preserved in the central part of the bone and they also form groove on oral part of the bone.

Os gulare mediale (fig. 20). The gular medial is poorly preserved on M 1204.

Pectoral girdle

The following dermal bones form the pectoral girdle: *os posttemporale*, *os supracleithrum*, *os cleithrum* and *os claviculare*.

Os posttemporale. The posttemporal is of oval shape, mediolaterally elongated, sculptured with the conspicuous ridges running parallel with the caudal and oral margins of the bone.

Os cleithrum. The cleithrum is dorsoventrally elongated, sculptured by conspicuous ridges placed dorsoventrally.

O s c l a v i c u l a r e (figs. 20, 22). The clavicle is preserved on M 1204 and M 2070. It consists of the short and broad oroventral part and narrow dorsal part. On sample M 2070 clavicle is preserved in dorsal view. The oroventral part is 22 mm long and 15 mm wide. From the form of clavicle the wide shape of head may be inferred.

P e c t o r a l f i n

The pectoral fin is partly preserved on M 1216 and M 2070. It is composed of numerous lepidotrichia not articulated in proximal third; distally they are articulated and dichotomously branching.

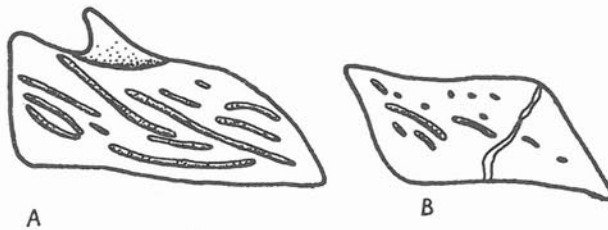


Fig. 23. *Progyrolepis speciosus* (FRIČ, 1875). M 1216, $\times 6.0$

A — scale from between the pectoral and pelvic fins in lateral view.
B — scale from the part caudally from the pelvic fin in lateral view.

S q u a m a t i o n

Scales on the trunk are stout, very small, conspicuously sculptured. The preserved scales have a rhombic shape, orocaudally elongated, twice as long as high. The peg and socket articulation is developed on the scales from oral part of the trunk. The sculpture consists of ridges arranged diagonally across the lateral side of scales. Caudal margin of scales is not denticulated.

Zaborichthys n. g.

D e r i v a t i o n o m i n i s: After locality Záboř (distr. Plzeň-North), Czech Rep., with the occurrence of typical species *Zaborichthys fragmentalis*.

T y p e s p e c i e s: *Zaborichthys fragmentalis* n. sp.

L o c u s t y p i c u s: Záboř, distr. Plzeň-North, Czech Rep.

S t r a t u m t y p i c u m: Kounov member, Stephanian B, Upper Carboniferous, Kladno and Rakovník Basin.

D i a g n o s i s: Head with rostral part conspicuously convex orally. Frontal in its oral part broader than in caudal, four times long as wide. Postrostral large, wide. Maxilla with very low and long maxillary plate, its length/width ratio 2.3. Dentition on jaws comprising two types of teeth in two rows. Preopercular very oblique, the angle of obliqueness is 30 degrees, the angle of its bend is 145 degrees. Orodorsal part of the preopercular short, not reaching up to oral margin of maxillary plate. Lower jaw strong. Opercular of oval shape, three times as high as long, ventrally narrow. Epipreopercular probably present. Subopercular of square shape, lower orally by one third than caudal part. Subopercular one and half times lower but one and half times longer than the opercular. Clavicle short and wide. Dermal bones sculptured mostly with tuber-

cles and rare ridges. Rhombic scales small, stout, sculptured with diagonally arranged ridges. Caudal margin of scales denticulated.

Remarks and relations: Only type species *Z. fragmentalis* is known. The interrelationships with other closely related genera is discussed in the concluding paragraph of the description of *Z. fragmentalis*.

Zaborichthys fragmentalis n. sp.

(Figs. 24–27, pls. X–XI)

Derivatio nominis: After poorly conserved holotype; fragmentum, í = fragment.

Holotype: Specimen figured in this work on figs. 24, 25, 27 and pls. X–XI, deposited in the National Museum, Prague as M 2065 and M 2066 (positive and negative).

Locus typicus: Zábřeh, distr. Plzeň-North, Czech Rep.

Stratum typicum: Kounov member, Stephanian B, Upper Carboniferous, Kladno and Rakovník Basin.

Material: Holotype and another isolate lower jaw as YA 1355.

Diagnosis: Same as for genus.

DESCRIPTION

Only holotype and isolate lower jaw have been used for the study. The bones and scales on holotype are dissociated and fragmentarily preserved.

Skull roof

Os frontale (fig. 24). Right and left frontals in dorsal view are preserved. The frontal is orocaudally elongated, nearly four times as long as wide (19 mm long and 5 mm wide), in oral part wider than in caudal. Oral margin is medially slanting and it has been in contact with the postrostral. The sculpture is formed exclusively by tubercles, several short ridges are on the caudal part of the bone only. The ossification centre lies in the narrowest part of the bone. Sensory lines have not been observed.

Os parietale, **os dermopteroticum** and **os dermosphenoticum** are conserved very obscurely and their detailed description is not possible.

Rostral

Os postrostrale (fig. 24). This bone is partly preserved, is 10 mm wide and 5.5 mm long; caudal margin is concave (part is broken off), oral margin is convex. The sculpture consists exclusive of tubercles irregularly placed on the whole dorsal side of the bone.

Os nasale. This bone is poorly preserved.

Palatomaxillary apparatus

Os palatoquadratum (fig. 24). Pars metapterygoidea is relatively well preserved and pars quadrata indistinctly.

Pars metapterygoidea makes on its orodorsal margin a distinct notch for the articulation with the basipterygoid process. The processes which are described from *Pteronisculus magnus* (NIELSEN 1942) are missing. The presence of a notch

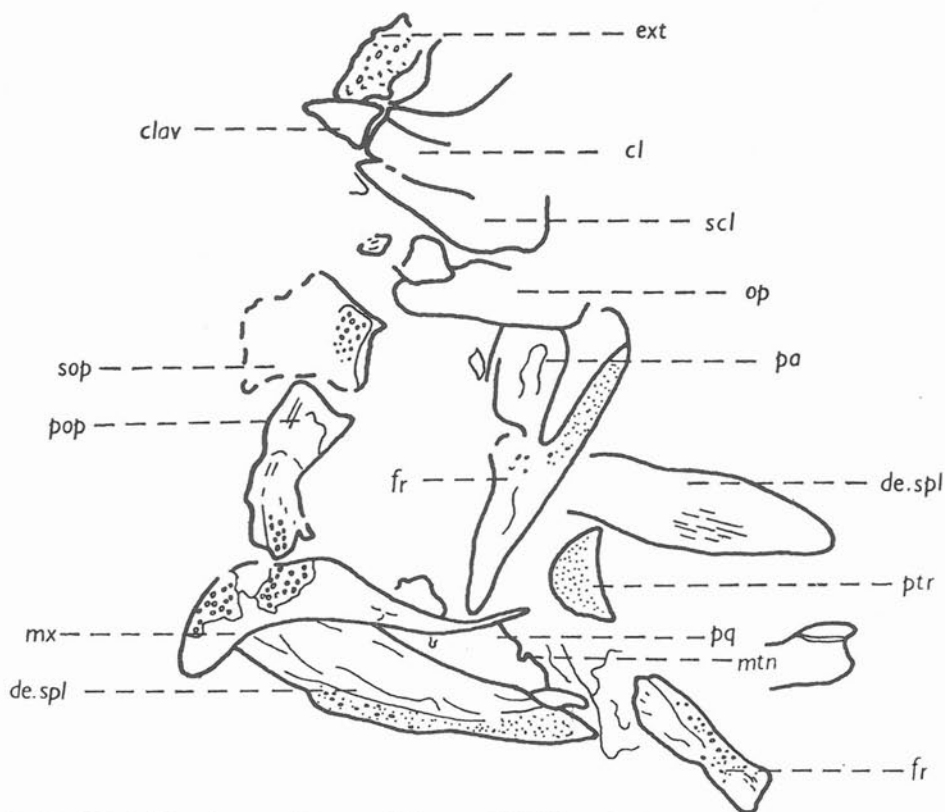


Fig. 24. *Zaborichthys fragmentalis* n. sp. Holotype, M 2066, $\times 1.2$

for articulation of pars metapterygoidea with the basiptyergoid process only, demonstrates progressive changes in articulation between the palatoquadrate and endocranium. This articulation is mediated in Devonian paleoniscoids *Myothomasia durgaringa*, *Mimia toombsi* and in Carboniferous genus *Kentuckia* by a hole in the dorsal part of pars metapterygoidea (GARDINER 1973, 1984; GARDINER, BARTRAM 1977; RAYNER 1951). On *Zaborichthys* this hole is reduced to notch, which loosened the articulation and allowed freer motion of the palatoquadrate.

O s m a x i l l a r e (fig. 24). The upper jaw is well preserved on the holotype. Orally the maxilla is slender broadening caudally into long and low maxillary plate. The maxilla is 37 mm long, maxillary plate is 21 mm long, ventrocaudally bears a process. The height of the plate, including the process is 9 mm, without the process 7 mm. The shape of the maxillary plate is considered to be very characteristic, especially the length/height ratio of the plate (2.3). Maxilla is medially smooth, along the ventral margin stretches horizontal longitudinal lamina (lamina horizontalis). At the boundary between oral slender part and maxillary plate four foramina occur, one of them is larger than the others;

they probably contained nerves leading to the sensory line on the lateral side of the maxilla.

The sculpture on lateral side of the bone is preserved in dorsocaudal part. It consists of tubercles and short ridges. On sample YA 1355 the sculpture on lateral side of the bone is formed by short ridges and the dentition consists of two types of teeth in two rows. The outer marginal row comprises numerous minute teeth, while the inner row is formed of a few larger stout teeth.

Lower jaw (fig. 24).

The lower jaw on holotype is 44 mm long, in caudal part it is 10 mm high and apparently strong. Laterally it is formed by the dentalosplenic which is sculptured by irregularly arranged tubercles on the whole lateral side except the oral part of the dentalosplenic, where it is sculptured with ridges. In medial view of lower jaw orocaudally elongated prearticular is seen in its caudal part.

Hyoid arch

Of the bones of the hyoid arch only the preopercular is preserved.

Os praeperculare (fig. 24). The preopercular shows the medial face and part impression of lateral surface is observable. Bone is bent orally and consists of broadened oral part and narrow ventral part. The angle of the bend of the preopercular is 145 degrees and it may be presumed that the angle of obliqueness of the preopercular was 30 degrees. Oral margin of broadened oral part is moderately concave. The preopercular rims the maxillary plate dorsally and caudally. It is rather small relative to the maxillary plate, so that it has not been in contact with the whole dorsal and caudal margins of the maxillary plate.

Bone is medially smooth. Well preserved sensory canal lies in oral part of the bone and pass ventrocaudally to the ventral margin of the preopercular. The sculpture on the lateral face consists of irregularly placed tubercles. The ventral narrow part of the preopercular is caudally probably bordered with the subopercular and dorsocaudally with the opercular. With regard to the narrow ventral part of the opercular it is possible to presume the presence of triangular epipreopercular between the opercular, subopercular and preopercular.

Gill arch

Os operculare (fig. 24). The opercular is considered to be the dorsoventrally elongated bone on the holotype close to the subopercular. The height of the bone is 21 mm, maximum length in dorsal part is 7 mm, ventrally it is narrow (3.5 mm). Its ventral margin covers the subopercular. The presence of the epipreopercular is presupposed. With regard to the shape of the maxillary plate and preopercular, the inclination of the opercular about 35—40 degrees may be presumed. The sculpture on the bone lateral face is formed by ridges passing dorsoventrally.

Os suboperculare (figs. 24, 25). The right and left suboperculars of approximately square shape are preserved. Height of the bone is 14 mm and length 11 mm. Dorsal margin is concave, orodorsally the bone protrudes into a small process. Caudal margin is convex. The bone is orally one third lower than in its caudal part.

The whole lateral face of the bone is sculptured with numerous tubercles except the smooth processus and a strip along the dorsal side of the bone which

was covered with opercular and probably epipreopercular. Along the oral margin of the subopercular several short ridges are developed (fig. 25).

Pectoral girdle

Of the bones of pectoral girdle the supracleithrum, cleithrum and clavicle are preserved.

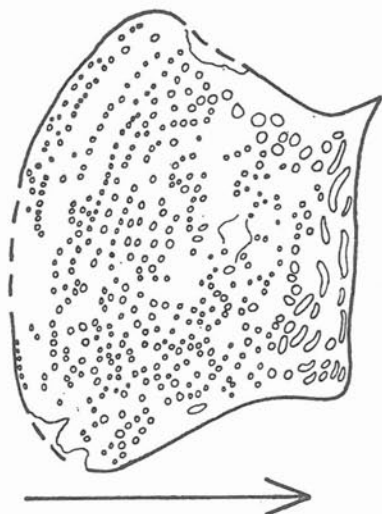


Fig. 25. *Zaborichthys fragmentalis* n. sp. Subopercular in lateral view. Arrow indicates the direction cranialis. M 2065, $\times 4.1$

O s s u p r a c l e i t h r u m (fig. 24). It is a dorsoventrally elongated bone, with the sensory canal on medial side in dorsal third of the bone.

O s c l e i t h r u m (fig. 24). The bone is sculptured with conspicuous ridges arranged dorsoventrally.

O s c l a v i c u l a r e (fig. 24). The clavicle lies orally from the cleithrum. Oroventrally it is triangular, short and wide. Length/wide ratio of oroventral part of the bone is 1.6.

S q u a m a t i o n

The scales covering the trunk are of rhombic shape, small and stout. They are not well preserved. Peg and socket articulation developed, the sculpture on the lateral face consists of ridges which posteriorly terminate in sharp points.

F i n s

The fins were orally probably protected with fulcral scales. The oral part of the pectoral fin consists of lepidotrichia, which are not articulated in their proximal part.

R e m a r k s a n d r e l a t i o n s: The species *Zaborichthys fragmentalis* is similar to *Progyrolepis*, but it differs in several features, which I consider to be significant:

1. The shape of the maxilla.

The maxillary plate of *Zaborichthys fragmentalis* apparently low, with length/height ratio 2.3; ventrocaudally well developed process on maxillary plate.

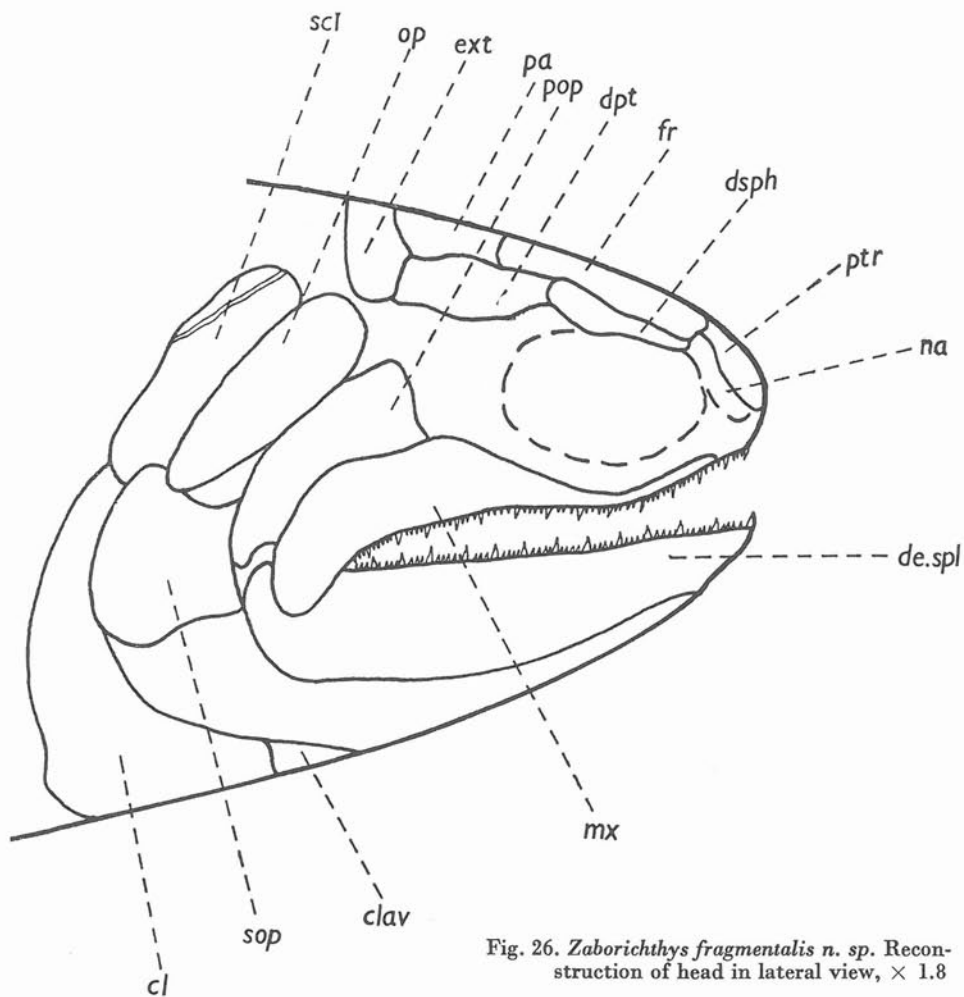


Fig. 26. *Zaborichthys fragmentalis* n. sp. Reconstruction of head in lateral view, $\times 1.8$

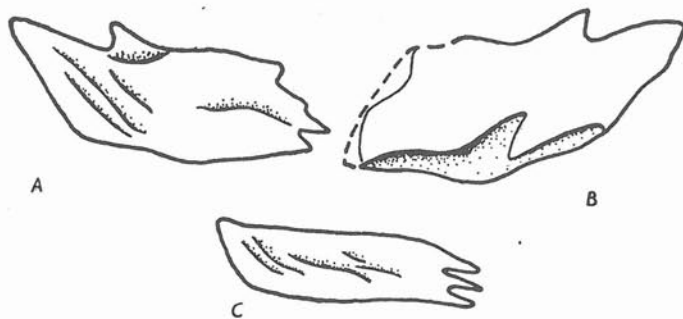


Fig. 27. *Zaborichthys fragmentalis* n. sp. M 2065, $\times 6.0$

A — scale in lateral view; B — scale in medial view; C — scale from ventral part of the trunk in lateral view.

The maxillary plate of *Progyrolepis speciosus* well developed, but not so low as at *Z. fragmentalis*. Length/height ratio of the maxillary plate is 1.6.

2. Shape of the preopercular.

The preopercular of *Z. fragmentalis* is orally bent at an angle of 145 degrees, oral part of the preopercular is short relative to the maxillary plate and it does not extend to the level of its oral margin.

The angle of bend of the preopercular of *P. speciosus* is 137 degrees, oral part of it is broadened and long so that it extends to the level of the oral margin of the maxillary plate.

3. Shape of the subopercular.

The shape of the subopercular of *Z. fragmentalis* very characteristic, orally one third lower than in the caudal part.

4. The sculpture of the bones of *Z. fragmentalis* (frontal, dentalosplenial, subopercular, preopercular, partly maxilla) formed predominantly by conspicuous tubercles. The ridges are developed in a low degree and some form the sculpture on the opercular, cleithrum and supracleithrum.

The sculpture on the bones of *P. speciosus* consists predominantly of ridges.

5. Scales.

Caudal margin of scales of *Z. fragmentalis* pectinated. Caudal margin of scales of *P. speciosus* straight, not pectinated.

Family: *Acrolepididae* ALDINGER, 1937

Diagnosis (after ALDINGER 1937, emended): Body fusiform, some species reaching almost two metres in length. Proximal lepidotrichia of pectoral fin not articulated. Pelvic fin small. Caudal fin deeply cleft, unequally lobed, advanced species with equal lobes. Endocranium of ancient species partly or totally ossified. Number of extrascapular bones oscillates. Parietal of square shape, small, frontal either narrow, long, or in oral part wider than in its caudal part. Parasphenoid short with teeth on its ventral side. Dentition on jaws consists of stout teeth in two rows, in advanced species the number of teeth is reduced. Ancient species with suspensorium very oblique, later vertical. Besides the dermohyal also several antopercular bones may be present. Opercular narrower than subopercular. Sculpture well developed on the dermal bones of the skull roof. Sculpture on the dermal bones of gill arch formed by tubercles and short ridges. The trunk provided with stout scales, usually with sculpture formed by conspicuous ridges. Caudal margin of scales either straight or denticulated.

Type genus: *Acrolepis* AGASSIZ, 1833—1843

Remarks: The family *Acrolepididae* was erected by ALDINGER (1937) to include initially numerous genera, which ALDINGER (1937) divided into groups A, B, C. With regard to the fact that it was a really heterogeneous complex, some of these genera were later classified in others families. Two of them, *Acrolepididae* and *Cosmoptychiidae*, are mentioned in this paper.

Included genera: *Acrolepis* AGASSIZ, 1833—1843; *Acropholis* ALDINGER, 1937; *Acrorhabdus* STENSIO, 1921; *Hyllingea* ALDINGER, 1935; *Plegmolepis* ALDINGER, 1937; *Reticulolepis* ALDINGER, 1937; *Mesonichthys* GARDINER, 1963; *Gondwanichthys* BELTAN, 1977; *Carbonilepis* BELTAN, 1977; *Avamia* KAZANCEVA-SELEZNEVA, 1980.

Stratigraphical range: Lower Carboniferous — Upper Triassic.

Geographical distribution: Europe, USSR, North and South America.

Acrolepis AGASSIZ, 1833—1843

1833—1843 *Acrolepis* Agas.; L. AGASSIZ, Recherches sur les Poissons, p. 79—80.

1891 *Acrolepis*, Agassiz; partim, A. S. WOODWARD, Catalogue, p. 501.

1937 *Acrolepis*, Agassiz; H. ALDINGER, Permische Ganoidfische, p. 257—265.

1938 *Acrolepis*, Agassiz; MOY THOMAS, B. DYNE, On the Actinopterygian, p. 464.

Type species: *Acrolepis sedgwicki* AGASSIZ, 1833—1834.

Locus typicus: Great Britain.

Stratum typicum: Upper Permian.

Diagnosis: Body fusiform reaching almost one metre in length. Pelvic fin small, dorsal and anal fins of triangular shape and approximately of the same dimensions. Caudal fin deeply cleft and unequally lobed. All fins protected with small fulcral scales. Lepidotrichia articulated except those on proximal part of the pectoral fin. Endocranium probably only partly ossified. One pair of extrascapular bones, small postparietal bones present. Parietal of square shape, frontal of oblong shape, three times longer than the parietal, orally broader than in its caudal part. Dermopterotic orocaudally elongated with caudal process. Dermosphenotic orally from the dermopterotic. Conspicuous sculpture on all dermal bones of the skull roof. Rostral part of the head blunt, postrostral wide. Suborbital bones present. Maxilla with well developed maxillary plate. Ratio of the length of the maxillary plate to the length of narrow oral part of maxilla is 1. Length/height ratio of the maxillary plate is 1.1. Lower jaw strong. Dentition consists of two types of teeth in two series. The inner series is formed of a few larger teeth, while the outer comprises numerous minute teeth. The angle of the obliqueness of preopercular is about 35 degrees, bone is apparently bent orally. Anamnestic bones between opercular and preopercular. Opercular relatively small, narrower than subopercular. Angle of the obliqueness of the opercular about 40 degrees. Branchiostegal rays numerous. Scales stout, minute, widely overlapping. Sculpture on scales and dermal bones conspicuous, forming by anastomosing ridges. Ridge scales on dorsal margin of caudal fin and caudal peduncle, sometimes also orally from dorsal fin. Lateral sensory line on trunk

scales not well distinct. Scale count of type species $\frac{48}{23 \ 42 \ 64} \ 71$.

Remarks and relations: The deficient description of the type species *Acrolepis sedgwicki* is the main obstruction to the classification of the species of genus *Acrolepis*. Type species *A. sedgwicki* was described by L. AGASSIZ (1833 to 1843, p. 80—81) only on the basis of the part of trunk and caudal fin. Reconstruction of the head of type species is known from the manuscript of WESTOLL (1934), which was taken over by ALDINGER (1937). Indistinct determination of the genus has been the cause of classification of 23 species with the genus *Acrolepis*. They are discussed in detail by ALDINGER (1937). In determining the diagnosis of genus *Acrolepis* in this paper the works of AGASSIZ (1833 to 1843), TRAQUIR (1877—1914 and ALDINGER (1937) are used. However,

I consider a new revision of the type species *A. sedgwicki* and whole family *Acrolepididae* to be necessary.

Stratigraphical range: Lower Carboniferous — Upper Permian.

Geographical distribution: Europe, USSR, USA.

Acrolepis gigas (FRİČ, 1877)

(figs. 28—30, pls. XII—XV)

1877 *Amblypterus gigas* Fr.; A. FRİČ, Zur Fauna der Gaskohle, p. 50.

1877—1914 *Acrolepis gigas*; R. H. TRAQUAIR, The Ganoid Fishes, p. 109.

1883 *Amblypterus gigas* Fr.; A. FRİTSCH, Fauna der Gaskohle, Band I, p. 30.

1891 *Elonichthys (?) gigas* (FRİTSCH); A. S. WOODWARD, Catalogue of the Fossil Fishes, p. 494.

1895 *Acrolepis gigas*, Fr.; A. FRİTSCH, Fauna der Gaskohle, Band 3, p. 117—118, pl. 129—130.

1905 *Acrolepis gigas* Fr.; F. BAYER, Katalog, p. 24.

1937 *Acrolepis gigas* FRİTSCH; H. ALDINGER, Permiſche Ganoidfische, p. 259.

1985 *Acrolepis gigas* (FRİTSCH, 1877); J. ZAJÍC, S. ŠTAMBERG, Summary of the Permo-carboniferous, p. 71.

Lectotype (here designated): Specimen figured by A. FRİTSCH (1895, pls. 129, 130, fig. 1) deposited in the National Museum, Prague as M 125 and refigured here on pls. XII, XIII.

Locus typicus: Žilov, distr. Plzeň-North, Czech Rep.

Stratum typicum: Mšec Member, Stephanian B, Upper Carboniferous, Plzeň basin.

Material: Holotype and isolated scales only.

Diagnosis: Body fusiform, reaching a total length of 1250 mm. Base of dorsal fin opposite to the base of pelvic fin. Caudal peduncle long. Branchiostegal rays about 30, considerably overlapping one another. Height of subopercular half the height of opercular. Angle of obliqueness of the preopercular is 25 degrees, angle of obliqueness of opercular is 30 degrees. Scales with sculpture formed by diagonally arranged ridges. Scales are considerably overlapping one

another, caudal margin not denticulated. Scale count $\frac{55}{32 \ 60 \ 87} 95 ?$

DESCRIPTION

The description is based on the lectotype, which shows well preserved trunk with the pelvic and dorsal fins; partly preserved are anal fin and ventral lobe of the caudal. The pectoral fin is missing. On the head it is possible to study dermal bones of the gill arch and dermal bones of the pectoral girdle.

HEAD

Skull roof

Only obscure fragments of the dermal bones with the sculpture formed by tubercles are preserved.

Rostral

The rostral part of the head is not conspicuously convex orally. A fragment of the square-shaped postrostral with the sculpture formed by conspicuous tubercles is present. Indistinct fragment of the bone lying oroventrally is considered to be the rostro-premaxilla.

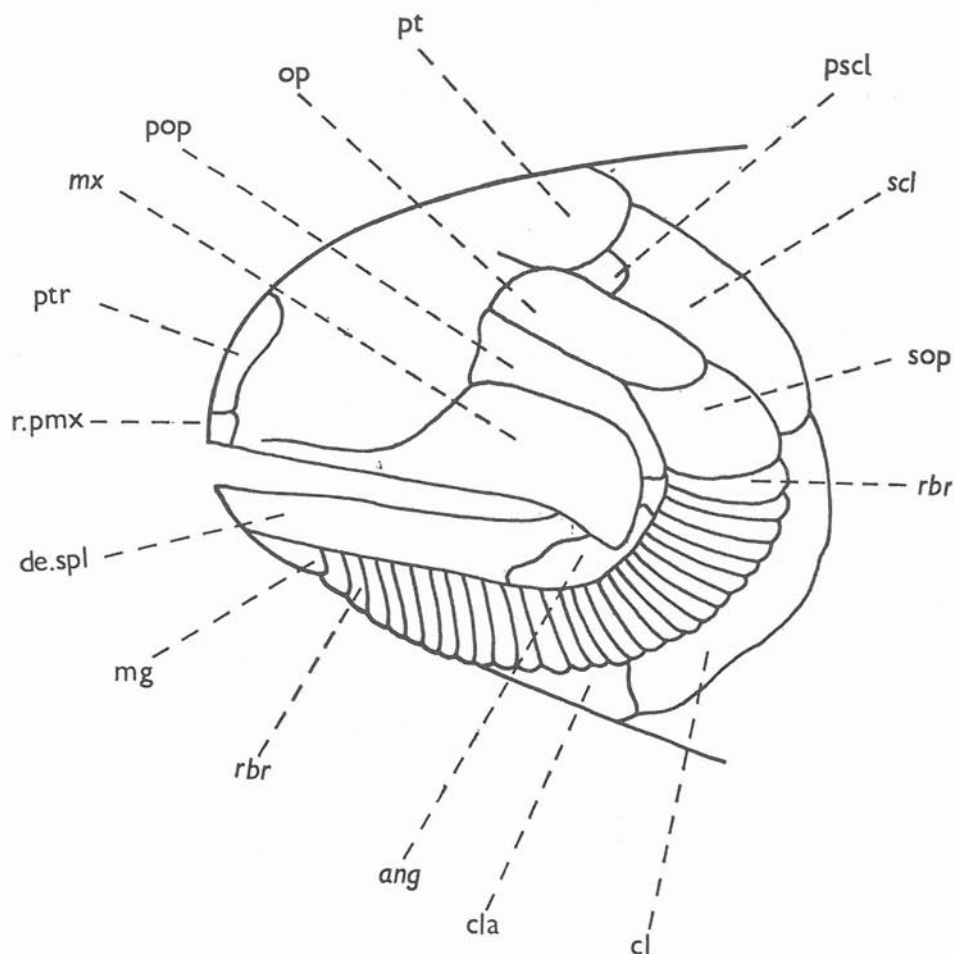


Fig. 28. *Acrolepis gigas* (FRİČ, 1877). Reconstruction of head in lateral view. Drawn after lectotype M 125, $\times 0.4$

Palatomaxillary apparatus

Part of the palatoquadratum is preserved with the broad caudal part. The maxilla is missing but from the shape of palatoquadratum a maxilla with broad, rocaudally elongated maxillary plate may be presumed.

Lower jaw

The lower jaw is strong, caudally formed by the angular. Dentition on jaws is not preserved.

Os praeoperculare. The preopercular is partly preserved. It is orally bent, the angle of the bend is 140 degrees, the angle of obliqueness is 25 degrees, therefore the suspensorium is very oblique. The preopercular is dorsocaudally bordered by the opercular and it is not clear if the dermohyal is

present. Caudally the preopercular is also bordered by the subopercular and by the first branchiostegal ray.

Gill arch

The dermal bones of the gill arch are relatively well preserved and give an idea of the construction of this part of head. The dermal part of the gill arch consists of the opercular, subopercular, branchiostegal rays, gular lateral and also unpaired medial gular was probably present.

O s o p e r c u l a r e (pl. XIII). The opercular is of oblong shape, dorsoventrally elongated. It is 30 mm long and 65 mm high. The angle of obliqueness of the opercular is 30 degrees. Orally lies the preopercular, anamnetic bones are not developed. The presence of the dermohyal is uncertain.

The sculpture on opercular is formed by conspicuous tubercles and short ridges, mostly parallel with the dorsoventral prolongation of the bone.

O s s u b o p e r c u l a r e (pl. XIII). The height of subopercular is one half of the opercular height but on the contrary it is longer. The height of the subopercular is 30 mm and its length 35 mm. Subopercular is dorsally concave, orally is bordered by the ventral part of preopercular. The sculpture on the subopercular is formed by conspicuous tubercles.

R a d i i b r a n c h i o s t e g a l e s (pl. XIII). The branchiostegal rays are narrow and numerous. The branchiostegal ray lying ventrally from the subopercular is 10 mm high and 45 mm long, the ninth (take account from the subopercular) is 4 mm high and 40 mm long. The one lying caudally from the gular lateral is 9 mm high and 40 mm long. They overlap one another by one half. They are overlapping both in dorsoventral direction from the subopercular and in orocaudal direction from the gular lateral. Uncovered part is sculptured by tubercles, overlapped part of the lateral face is smooth. According to preserved remains, about thirty branchiostegal rays could be developed.

O s g u l a r e l a t e r a l e (pl. XIII). Part of the bone is preserved with the sculpture formed by tubercles.

Pectoral girdle

O s p o s t t e m p o r a l e (pl. XIII). The posttemporal is of oval shape, lateromedially elongated (63 mm). Sculpture consists of ridges.

O s s u p r a c l e i t h r u m (pl. XIII). The supracleithrum is oval, dorsoventrally elongated. The height is approximately 130 mm, length 40 mm. Its ventral margin reaches up to the level of the boundary between subopercular and first branchiostegal ray. The sculpture is formed by conspicuous and numerous ridges.

O s p r a e s u p r a c l e i t h r u m (pl. XIII). Presupracleithrum is indistinctly preserved orally from the dorsal part of the supracleithrum. Height of the bone is 17 mm and length 10 mm. The sculpture is formed by tubercles.

O s c l e i t h r u m. It is indistinctly preserved.

O s c l a v i c u l a r e (pl. XIII). The clavicle is relatively short, length of its ventral part is 70 mm. Connection of the cleithrum with clavicle is approximately at the level of bend of the preopercular. Orally, clavicle reaches up to the level of the oral margin of the preopercular.

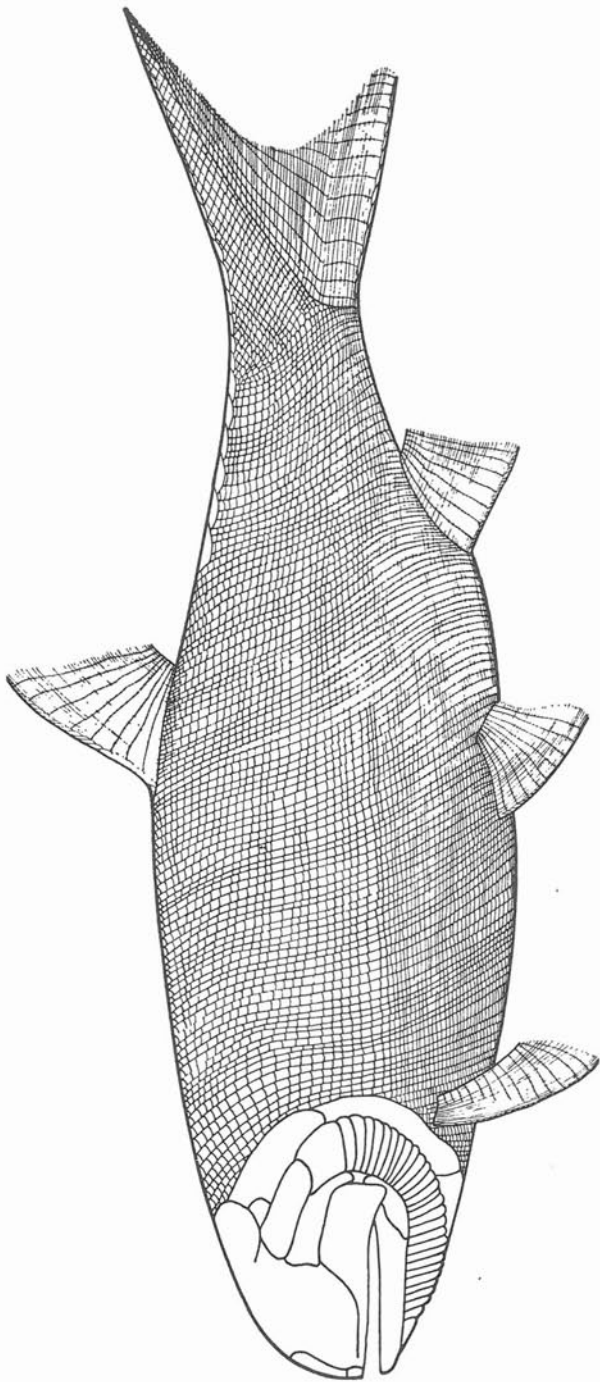


Fig. 29. *Acrolepis gigas* (FRIČ, 1877). Reconstruction of whole fish, $\times 0.15$

TRUNK

The trunk is fusiform, elongated, dorsally not conspicuously convex. The dimensions are on text. table 4.

No.	1	2	3	4	4 ₁	4 ₂	4 ₃	5	5 ₁	5 ₂	5 ₃	6	6 ₁	6 ₂	6 ₃	7 ₁	7 ₂	8	9
M 125	$\frac{55}{32\ 60\ 87?}$	95?	1250?	715	320	110	—	150	515	—	—	270	75	38?	130	—	—	330	170?

Text. tab. 4. *Acrolepis gigas* (FRİČ, 1877). Dimensions of the body. Explanations see one p. 26–29.

Paired fins

Pectoral fin is not preserved.

Pelvic fin (pl. XII). The pelvic fin consists approximately of 38 articulated lepidotrichia and is placed at the mid-length of the fish. Fin is orally protected by fulcral scales. Dimensions of the fin are in text. tab. 4.

Unpaired fins

Dorsal fin (pl. XII). The dorsal fin is moved orally. The dorsal fin is unusually located because its oral margin begins nearly opposite the beginning

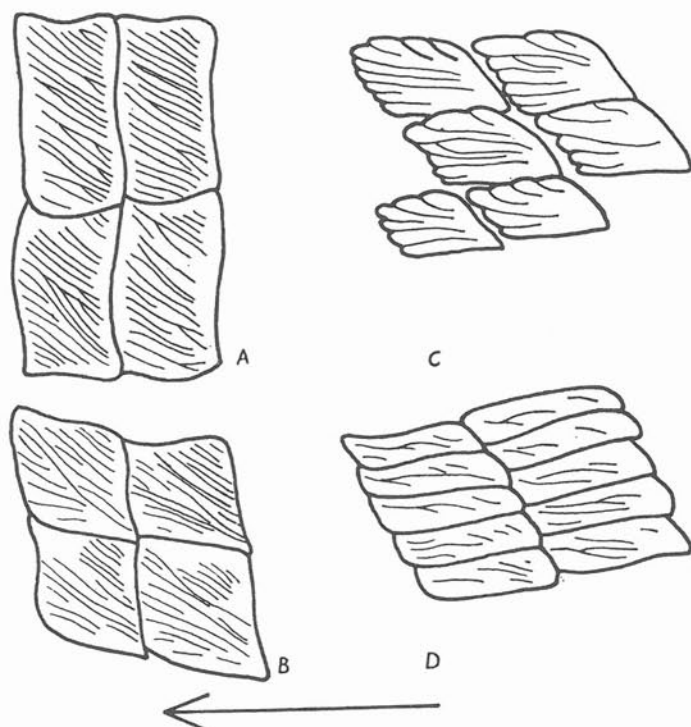


Fig. 30. *Acrolepis gigas* (FRİČ, 1877). M 125, $\times 2.4$

Arrow indicates directio cranialis. Lateral view.

A — scales from rows 12 and 13; B — scales from rows 34 and 35; C — scales from rows 80–82 (from caudal peduncle); D — scales from rows 48–49 on ventral part of the trunk.

of the pelvic fin. It has a triangular shape and consists of numerous articulated lepidotrichia. The fulcral scales are indistinct.

Caudal fin (pl. XII). Only the ventral lobe of anal fin is preserved and is formed by articulated lepidotrichia. The caudal peduncle is relatively long.

S q u a m a t i o n

The trunk is covered with stout scales sculptured by diagonally arranged ridges. The peg and socket articulation is developed. Caudal margin of scales is straight. The shape of scales is changing in accord with their position on trunk (fig. 30). Scales are relatively small and overlapping one another by one third. Scales of the twelfth row on the flank are oblong (fig. 30A), 11 mm high and 6 mm long; in the thirty-fifth row there are rhombic scales 8 mm high and 7 mm long (fig. 30B). In the eighty row, on the peduncle caudal are rhombic scales 5 mm long and 4 mm high. On the ventral part of the trunk, orally from the pelvic fin are oblong scales, 9 mm long and 2 mm high (fig. 30D). The scale count

$$\begin{array}{r} 55 \\ 32 \quad 60 \quad 87? \end{array} 95?$$

Stratigraphical range: Stephanian B, Upper Carboniferous.

Geographical distribution: Czech Rep.

Occurrence in Czechoslovakia: Žilov, Kounov (Kladno and Rakovnik Basins, Plzeň Basin).

Remarks and relations: Three species of the genus *Acrolepis* were initially described by A. FRITSCH (1895) from the Central Bohemian Carboniferous basins: *A. gigas*, *A. krejci* and *A. sphaerosideritarum*. After the revision of these three species it is evident that only the species *A. gigas* belongs to the genus *Acrolepis*, whereas the remaining two are classified as *Watsonichthys krejci* and *Watsonichthys sphaerosideritarum*. The species *Acrolepis gigas* is exceptional not only by its dimensions, it is the largest Permocarboneous fish in Czechoslovakia, but it has also characteristic anatomical features. It is distinguished by the following features: numerous branchiostegal rays, the scale count, movement of the dorsal fin orally, long peduncle caudal, oblique suspensorium, conspicuous sculpture on dermal bones and scales.

Family: *Trissolepididae* FRITSCH, 1895

Diagnosis: Fusiform body of moderate size, reaching a total length of 15 cm. Paired and unpaired fins formed by a few articulated lepidotrichia, uncommonly dichotomically bifurcated. Lepidotrichia of pectoral fin articulated also in their proximal part. Head short, without conspicuously convex oral part. Maxilla with maxillary plate short and high. Dentition consists of teeth of one type. Suspensorium nearly vertical. Opercular large, a few branchiostegal rays. Presupracleithrum present. Scales of medium size, thin, rhombic or cycloidal.

Type genus: *Sphaerolepis* FRIČ, 1877.

Remarks: The family *Trissolepididae* was erected by FRITSCH (1895) on the basis of genus *Trissolepis*, for which its original name *Sphaerolepis* is now used. The family includes now two genera: *Sphaerolepis* and *Sceletophorus*. Both are placed in this family with regard to the relatively universal structure

of the dermal cover of palatamaxillary apparatus, pectoral girdle and to the tendency towards the decrease of the number of branchiostegal rays.

Included genera: *Sphaerolepis* FRIČ, 1877; *Sceltophorus* FRITSCH, 1895.

Stratigraphical range: Westphalian D - Stephanian C.

Geographical distribution: Czech Rep.

Sphaerolepis FRIČ, 1877

1875 (*Nov. gen.*) *Kounoviensis*; A. FRIČ, Über die Fauna, p. 76.

1877 *Sphaerolepis* (n. g.); A. FRIČ, Zur Fauna der Gaskohle, p. 46.

1895 *Trissolepis*, Fr.: A. FRITSCH, Fauna der Gaskohle, Band 3, p. 76.

1967 *Sphaerolepis* FRIČ 1877; B. G. GARDINER, Further notes, p. 164.

Type species: *Sphaerolepis kounoviensis* FRIČ, 1875

Locus typicus: Kounov, distr. Rakovník, Czech Rep.

Stratum typicum: Kounov Member, Stephanian B, Upper Carboniferous, Kladno and Rakovník basins.

Diagnosis: Body fusiform reaching a total length of 15 cm. Paired fins small, pectoral fin composed of 11—12 lepidotrichia, pelvic fin of 14—16 lepidotrichia; dorsal fin with short base consists of 15—19 lepidotrichia and is placed opposite the space between the pelvic and anal fins. Anal fin consists of 19 lepidotrichia, caudal fin not deeply cleft, with long and slender dorsal lobe. Lepidotrichia of all fins articulated, uncommonly dichotomously bifurcated. Fulcral scales are missing. Head orally bluntly terminated, not conspicuously convex. Paired extrascapular lateral and simple extrascapular medial present. Parietal of square shape, frontal by one third longer than the parietal. Dermosphenotic of triangular shape, small. Postrostral of square shape. Parasphenoid with one pair of processus ascendens posterior, caudally elongated body of parasphenoid. Body of parasphenoid lying caudally from the bucco-hypophysial foramen is of the same length as the orally lying part. Vomers and dermal bones on medial face of palatoquadratum with well developed teeth. Suborbital bones present. Maxillary plate short and high, the length: height ratio is 0.8—1.1. The ratio of the maxillary plate length to the oral narrow part of maxilla is 0.5—0.7. Lower jaw strong, moderately curved orally. Dentition formed of numerous, relatively stout teeth of one type. Preopercular not conspicuously bent orally. Angle of obliqueness of the preopercular is 65—70 degrees. Anamnestic bones are not developed. Opercular large, moderately dorsoventrally elongated. Angle of obliqueness of the opercular is 80 degrees. Subopercular is not developed, no more than five branchiostegal rays. Scales covering the trunk are of cycloidal shape except those on the dorsal lobe of caudal fin. Scales thin, sculpture formed by concentrically arranged lines terminated caudally in small sharp pointed tubercles. Scales overlap one another by two thirds. Scales on the dorsal lobe of the caudal fin and partly on caudal peduncle are rhombic. Scale count

of type species $\frac{18}{6 \ 16 \ 29} 32$.

Remarks: FRIČ (1875) shortly described in his work a new find of fish with the species name „*kounoviensis*“, without the name of genus. Only in his next work (FRIČ 1877) he erected the new genus *Sphaerolepis*. Later (FRITSCH

1895) he gave a more detailed description of the fish with figures and erected for this fish new name *Trissolepis* and the new family *Trissolepididae*. With regard to priority the name *Sphaerolepis* is to be kept.

Stratigraphical range: Stephanian B — Stephanian C.

Geographical distribution: Czech Rep.

Sphaerolepis kounoviensis FRİČ, 1875
(figs. 31—48, pls. XVI—XVIII)

- 1875 (*Nov. gen.*) *Kounoviensis*; A. FRİČ, Über die Fauna, p. 76.
1877 *Sphaerolepis* (n.g.) *Kounoviensis*; A. FRİČ, Zur Fauna der Gaskohle, p. 46.
1883 *Sphaerolepis Kounoviensis* Fr.; A. FRİTSCH, Fauna der Gashohle, Band I, p. 31.
1877—1914 *Nov. gen. (Kounoviensis)*; R. H. TRAQUAIR, The Ganoid Fishes, p. 106.
1877—1914 *Sphaerolepis*; R. H. TRAQUAIR, The Ganoid Fishes, p. 106.
1877—1914 *Trissolepis*; R. H. TRAQUAIR, The Ganoid Fishes, p. 107.
1879 *Sphaerolepis Kounoviensis* Fr.; A. FRİČ, Neue Übersicht, p. 191.
1879 *Sphaerolepis Kounoviensis* FRİČ; J. KUŠTA, Der Brandschiefer, p. 320.
1880 *Trissolepis (sphaerolepis) Kounoviensis* FRİČ; J. KUŠTA, O geologických poměrech, p. 161.
1891 *Sphaerolepis kounoviensis*; A. S. WOODWARD, Catalogue, p. 523.
1895 *Trissolepis Kounoviensis* Fr.; A. FRİTSCH, Fauna der Gaskohle, Band 3, p. 76—80, figs. 277, 278, pls. 109—112.
1905 *Trissolepis Kounoviensis* FR.; F. BAYER, Katalog, p. 49.
1912 *Trissolepis Kounoviensis* FR.; A. FRİČ, Studie v oboru, p. 44.
1944 *Trissolepis kounoviensis* FRİTSCH; T. S. WESTOLL, The Haplolepididae, p. 65—66.
1964 *Sphaerolepis kounoviensis* FR.; L. S. BERG, A. A. KAZANCEVA, D. V. OBRUTSCHEV, Osnovy paleontologii, p. 355.
1966 *Sphaerolepis* FRİTSCH; J. P. LEHMAN, Traité de Paléontologie, p. 193.
1967 *Sphaerolepis kounoviensis* FRİČ; B. G. GARDINER, Further notes, p. 164—168, figs. 16 to 18.
1971 *Sphaerolepis*; J. A. MOY-THOMAS, R. S. MILES, Palaeozoic Fishes, p. 92.
1985 *Sphaerolepis kounoviensis* FRİČ, 1875; J. ZAJÍC, S. ŠTAMBERG, Summary of the Permian-carboniferous, p. 71.
1986 *Sphaerolepis kounoviensis* FRİTSCH, 1877; S. ŠTAMBERG, Poissons permocarbonifères, p. 101—103.

Lectotype (designated herein): Specimen figured by FRİTSCH (1895) on pl. 110, fig. 1, deposited in National Museum, Prague as M 1198 and M 1197 (galvanic cast). Here refigured on figs. 31, 46, 47 and pls. XVI, fig. 2, XVIII.

Paralectotypes: Specimens figured by FRİTSCH (1895) on figs. 227, 278 and on pl. 109, figs. 1—4, 6, 7, pl. 110, figs. 2—5, pl. 111, figs. 1—5 and on pl. 112, fig. 1. They are deposited in National Museum, Prague as M 1263, M 1220, M 816, M 836, M 825, M 835, M 819, M 822, M 1199.

Locus typicus: Kounov, distr. Rakovnick, Czech Rep.

Stratum typicum: Kounov Member, Stephanian B, Upper Carboniferous, Kladno and Rakovnick Basins.

Material: Lectotype, paralectotypes and others 32 specimens from the collection of National Museum, Prague and number of scales from the collection of Geological Survey, Prague.

Diagnosis: As for genus.

DESCRIPTION

HEAD

Skull roof (fig. 31, pl. XVI, fig. 2).

The skull roof is formed by parietal, frontal, dermosphenotic and dermopterotic. Caudally it is bordered by a narrow strip of extrascapular bones.

Extrascapular bones. They form a narrow strip caudally from the parietal and dermopterotic, representing the connection between the dermal bones of the skull roof and dermal bones of pectoral girdle. They consist from a single extrascapular medial and paired extrascapular lateral.

Extrascapular medial is bordered orally by parietal, laterally by extrascapular lateral and caudally by posttemporal. Sensory canal is well developed on all extrascapular bones and is formed of pits arranged in mediolateral direction.

Os parietale (fig. 31). Pair bone of square shape with its oral margin curved, bordered by frontal, laterally by dermopterotic. The parietal on lectotype is 3.5 mm long and 4 mm wide. Rests of sensory canal, i.e. medial and caudal pit lines, lie on the caudal part of the dorsal surface. Orally from these pit lines, the supraorbital canal runs to the frontal.

Os frontale (fig. 31). The frontal is the largest bone on skull roof; it is bordered by parietal, dermopterotic, dermosphenotic, nasal and postrostral. Interfrontal suture is curved. The frontal is orocaudally elongated, approximately only by one third longer than the parietal. On lectotype it is 5 mm long and 4 mm wide. Sensory supraorbital canal is well preserved on dorsal surface of the bone. Sculpture is formed, as on other bones of the skull roof, by ridges irregularly arranged.

Os dermopteroticum (fig. 31). This orocaudally elongated bone

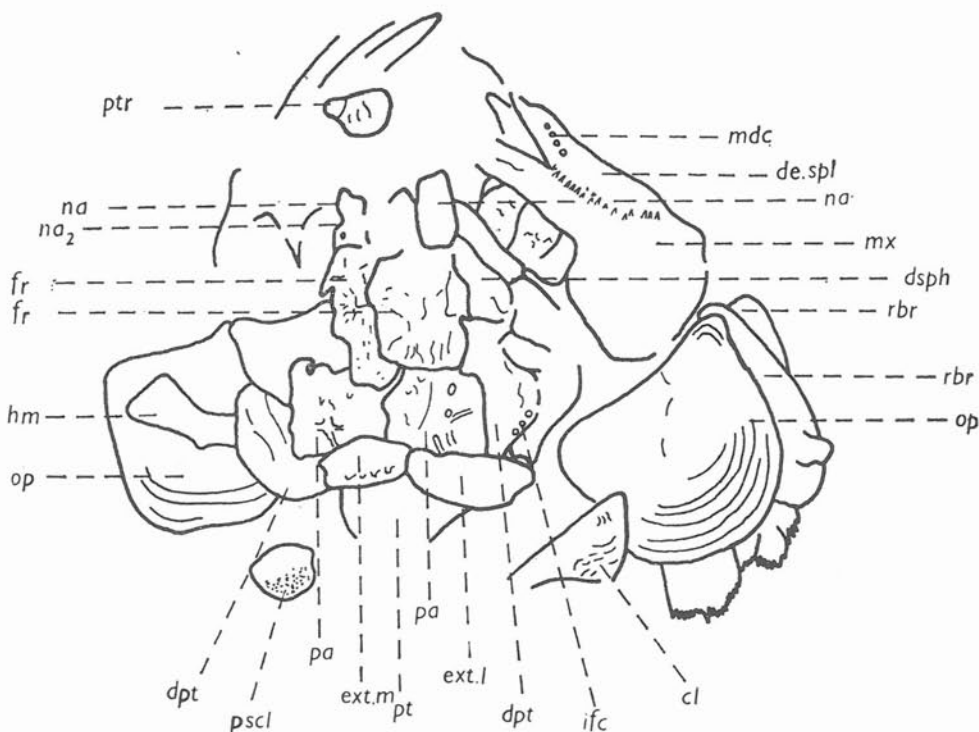


Fig. 31. *Sphaerolepis kounoviensis* FRIČ, 1875. Dermal bones on lectotype. Drawn after cast M 1197, $\times 3.5$

forms lateral part of the skull roof. On lectotype it is 5.5 mm long and 2.2 mm wide. Its caudal margin reaches up to the extrascapular lateral and its oral margin to the level of one third of the length of the frontal. Orally it is bordered by dermosphenotic and oral part of its lateral margin forms the border of the orbit. The rests of sensory infraorbital canal are distinct along the lateral margin of the bone.

O s d e r m o s p h e n o t i c u m (fig. 31). Small bone distinguishable only on samples M 1198 and M 1164. It probably forms the dorsal margin of the orbit.

FRITSCH (1895) described and figured on pl. 112, fig. 2 a pair opening in the skull roof, namely between parietal, frontal and dermopterotic. GARDINER (1967) records the same opening in his description and figs. 16 and 17. On the basis of the study of all specimens, I presume that this opening has not been developed. In the part where Fritsch and Gardiner observed the opening, an outstanding parasphenoid is preserved and makes the observation of this part of the skull roof difficult. I presume that the structure observed formerly was produced by a parasphenoid.

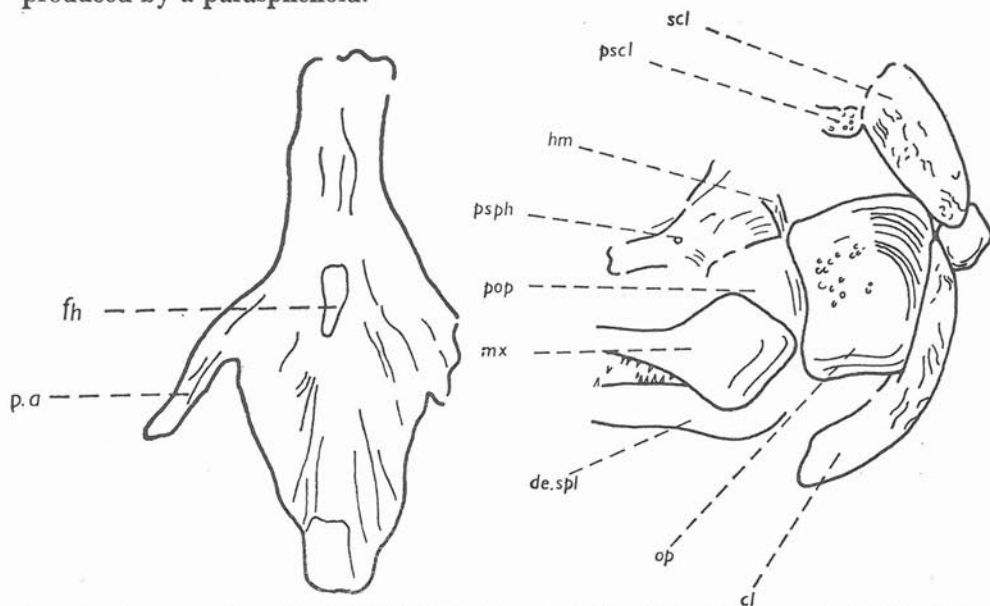


Fig. 32. *Sphaerolepis kounoviensis* FRICĀ, 1875. Parasphenoid in dorsal view. M 1456, $\times 7.0$

Fig. 33. *Sphaerolepis kounoviensis* FRICĀ, 1875. Dermal bones of palatamaxillary apparatus. gill arches and pectoral girdle. M 825, $\times 3.0$

R o s t r a l (fig. 31).

Rostral region of the head is poorly preserved. It is made up of a single post-rostral, paired nasal and probably medial rostro-premaxillar.

O s p o s t r o s t r a l e (fig. 31). Postrostral is partly preserved on M 1198. It is 2 mm wide and 1.8 long. On specimen M 816 (fig. 43) it is 5.5 mm wide and 4.5 mm long. The sculpture is formed by conspicuous tubercles. Sensory canal has not been developed.

No.	parietal		frontal		dermo- pterotic		vomer		maxilla		opercular		medial gular		supra- cleithrum		praesupra- cleithrum		para- sphenoid		
	l.	w.	l.	w.	l.	w.	l.	w.	l.	h.c.	l.	h.	l.	w.	l.	h.	l.	h.	l.	w.	
M 1455										3,0											
M 1456																				11,5	7,0
M 1463							1,5	2,5	8,5	3,0	4,5	5,5	3,0	2,5							
M 1464	3,0	2,5	4,0	2,5	4,0	1,3					4,0	4,5					2,3	2,0			
M 1458							1,5	2,0							2,2	6,5				8,0	
M 1460							1,6	2,0	10,5	4,0										9,0	
M 1459											5,0	5,5									
M 1462										7,5	3,0	3,0	3,5								
M 822					2,0	1,5					2,5	3,5	4,0	3,0	1,8						
M 824											3,5	5,0	5,5								
M 1198	3,5	4,0	5,0	4,0	5,5	2,2			12,0	6,0	8,0	9,0			4,0	11,0	2,5	2,0			

Text. tab. 5. *Sphaerolepis kounoviensis* FRICĚ, 1875. Dimensions of some dermal bones in mm.
l — length of bone; w — width of bone; h — height of bone; — h.c. — height of maxillary plate.

O s n a s a l e (fig. 31). This bone is on M 1198 2.5 mm long and 1 mm wide and caudally is bordered by the frontal and dermosphenotic. Its lateral margin borders the orbit. Small posterior nasal opening lies on the lateral margin of the nasal.

O s r o s t r o - p r a e m a x i l l a r e (fig. 34). In this case I presume a single bone lying orally from the postrostral (M 1455, M 1220, M 1263). On sample M 1263 it is 1.7 mm wide (in lateromedial direction), ventrally is provided stout teeth as on the jaws. These teeth cover the whole ventral margin of the bone, but minute, sharp pointed irregularly arranged teeth are also present. The rests of the sensory canal are formed by fine pits arranged lateromedially.

D e r m a l b o n e s o f t h e v e n t r a l s i d e o f n e u r o c r a n i u m

Ventral side of the neurocranium is covered with single parasphenoid and paired vomer.

O s p a r a s p h e n o i d e u m (fig. 32). Parasphenoid is known on several specimens. Its length ranges from 9 to 11 mm. Parasphenoid consists of the corpus parasphenoidis and processus ascendens posterior. The processus ascendens posterior is narrow, trending in laterocaudal direction. It makes an angle of 41–64 degrees with the corpus parasphenoidis. Corpus parasphenoidis is oro-caudally elongated, particularly in its caudal part beyond the bucco-hypophysial opening, which is approximately in the middle of corpus parasphenoidis. The length of the oral part of corpus parasphenoidis (measured from the bucco-hypophysial opening to the oral margin of corpus parasphenoidis) is as long as or shorter than the caudal part of parasphenoid (measured from the bucco-hypophysial opening to the caudal margin of the corpus parasphenoidis).

This bone is of a very similar in shape as the bone in the genus *Birgeria*, but it differs from that in *Sceletophorus* and most of other palaeoniscoid fishes. Ventral surface of the bone is without teeth although on the vomer and palatinal bones are teeth well developed. The oral part of the corpus parasphenoidis probably overlapped the medial part of the vomer.

O s v o m e r i s (fig. 35). Paired vomer is approximately of square shape and is placed along the oral part of the parasphenoid. It is from 2 to 3 mm long and 1.5–2 mm wide. Ventral face of the vomer is protected by teeth except the medial part, which was overlapped by corpus parasphenoidis. Teeth are similar to those on the jaws. Along the lateral margin of the vomer they are smaller increasing in medial direction.

P a l a t o m a x i l l a r y a p p a r a t u s

It is possible to study the maxilla and remains of several dermal bones covering the palatoquadrate. Remains of dermal bones covering the palatoquadrate ventrally are on samples M 1220 and M 1460. All those remains are protected by well developed teeth of the same type as on the vomer and jaws.

O s m a x i l l a r e (figs. 31, 35, 38). The upper jaw has well developed maxillary plate of square shape. The length/height ratio of the plate fluctuates from 0.83 to 1.1 and ratio of the plate length to the length of the oral part of maxilla from 0.54 to 0.71. Ventrally, the jaw is protected with well developed, sharp pointed teeth reaching a length of 0.5 mm. Teeth are set directly on the jaw and they are not arranged in one row, but cover the whole ventral margin of the upper jaw (fig. 34). Besides these stout teeth there are minute sharp pointed

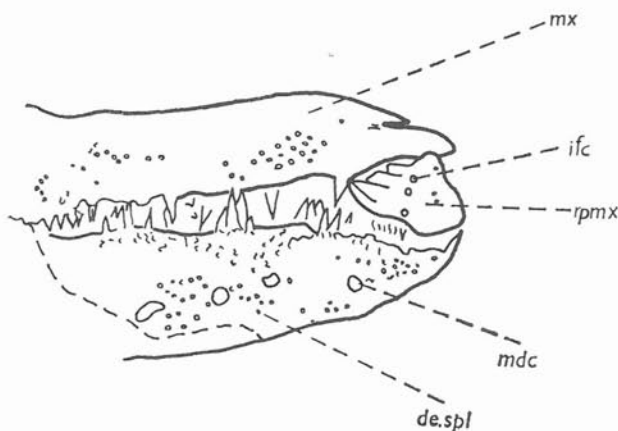


Fig. 34. *Sphaerolepis kounoviensis* FRIČ, 1875. Oral part of the maxilla, lower jaw and rostromaxillary. M 1263, $\times 6.4$

teeth irregularly placed. This dentition is quite different from that of *Watsonichthys* and *Progyrolepis*.

Lower jaw (figs. 31, 34, 35, 38). The lower jaw is well developed; its dorsal margin is in oral part curved ventrally. The whole margin is protected by numerous smooth, sharp pointed teeth which are 0.5 mm long, the same as on the upper jaw. The dentalosplenic forms lateral, ventral and partly also medial parts of the lower jaw. On its lateral face it bears distinct rests of the

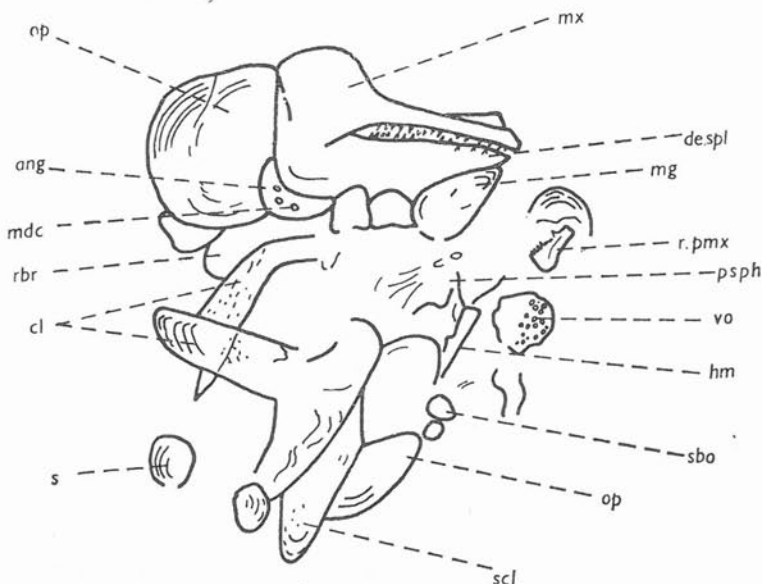


Fig. 35. *Sphaerolepis kounoviensis* FRIČ, 1875. Dermal bones of opercular apparatus, palatamaxillary apparatus and pectoral girdle. M 1463, $\times 3.0$

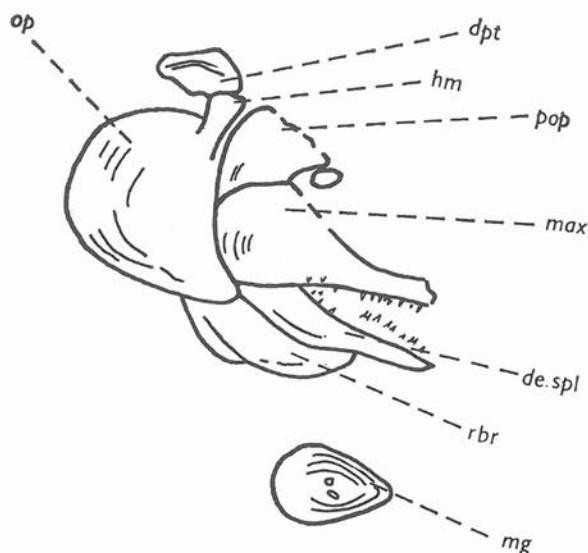


Fig. 36. *Sphaerolepis kounoviensis* FRİÇ, 1875. Dermal bones of palatomaxillary apparatus and opercular apparatus. M 822, $\times 5.2$

mandibular sensory canal (fig. 34) formed deep pits. Caudally, the lateral side of the lower jaw is formed of the angular. On the medial side of the lower jaw lies ventrally the dentalosplenic and dorsally to it is the rest of Meckel's cartilage. On sample M 1199 fragments of the prearticular are dorsally from Meckel's cartilage.

Hyoid arch

The hyomandibular and dermal bone — the preopercular, are preserved of the hyoid arch.

Os hyomandibulare (figs. 31, 35, 39). The hyomandibular is preserved on samples M 1220, M 822, M 1198 and others. It is dorsoventrally elongated, on sample M 1458 5 mm high. Hyomandibular is not conspicuously bent orally, but only moderately curved at about 150 degrees (fig. 39); dorsally and ventrally broadened; medially, at the place of bend it is narrowest. Processus opercularis is formed by a small process immediately dorsally from the narrowest part of the hyomandibular. The shape of this bone is similar to that on *Karaunguria kleimani*. KAZANCEVA-SELEZNEVA (1981) divided hyomandibular bones on the basis of their shape into three groups and compared the shape of them with the presence or absence of accessory bones. On the basis of her study (1981) the anamnestic bones would be developed in our case, but they have not been developed in the species *Sphaerolepis kounoviensis*.

Os praeperculare (figs. 33, 36). The preopercular is rarely and obscurely preserved. On sample M 825 the preopercular is probably in natural position also with the surrounding bones. Preopercular inclines moderately, the angle of obliqueness is 65—70 degrees, dorsally it is broadened, orally probably bordered by two suborbital bones. Ventrally it is narrow and separates the

maxillary plate from the opercular. The whole caudal margin of the preopercular contacts the opercular. Nor dermohyal, nor antopercular bones have been developed. The preopercular sensory canal runs along the caudal margin of the preopercular.

Dermal bones surrounding the orbit (figs. 31, 35, 36).

The shape of the orbit and surrounding bones could not be studied on the material, except obscure remains of infraorbitals on M 1198 and two oval suborbitals between the preopercular and orbit (M 822, M 1463). It is possible to presume that the dermopterotic and dermosphenotic form the dorsal margin of the orbit, the nasal forms its oral margin and infraorbital bones form ventral and caudal margin of the orbit.

Gill arch (figs. 31, 33, 35, 36, 40).

Very indistinct remains of the endoskeleton of the gill arch are on sample M 1220 but detailed description is impossible. The dermal skeleton of the gill arch consists of the opercular, branchiostegal rays and gular medial.

Opercular (figs. 31, 33, 35, 36, 40). The opercular is a large bone 3.5 to 9 mm high and 3.0 to 9 mm long. It is only moderately dorsoventrally elongated, with rounded edges. Its height/length ratio is 1.1—1.2. The angle of obliqueness of the opercular is 80 degrees. Fine growing lines concentrically arranged are on the lateral face of the bone. Opercular is bordered orally by the preopercular. Ventral margin of the bone reaches approximately up to the mid-

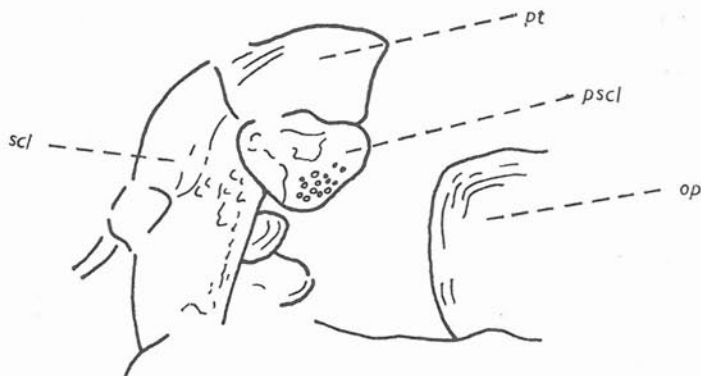


Fig. 37. *Sphaerolepis kounoviensis* FRIČ, 1875. Dermal bones of pectoral girdle and opercular in lateral view. M 1464, $\times 7.3$

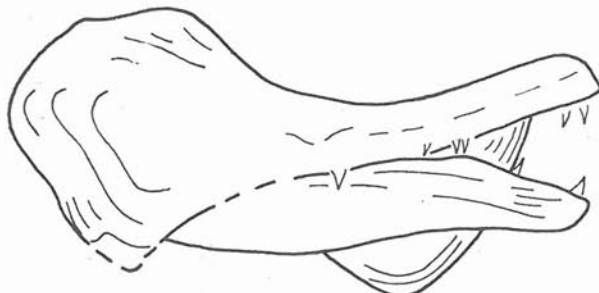


Fig. 38. *Sphaerolepis kounoviensis* FRIČ, 1875. Maxilla, lower jaw and medial gular. M 1460, $\times 7.5$

height of the maxillary plate. The subopercular has never been found on our material and the arrangement of bones indicates that the subopercular was missing and that the opercular ventrally overlaps the first branchiostegal ray. Dorsally from the opercular lies the presupracleithrum and the extracapular lateral. Location of the opercular and absence of the subopercular distinguish *Sphaerolepis kounoviensis* from other Chondrosteans.

Radii branchiostegales (figs. 31, 35). The branchiostegal rays are preserved on M 1463 and M 1198. Their number is not evident but from the preserve rests I infer the presence of not more than five branchiostegal rays.



Fig. 39. *Sphaerolepis kounoviensis* FRIČ, 1875. Os hyomandibulare with processus opercularis. Lateral view. M 1220, $\times 10.5$



Fig. 40. *Sphaerolepis kounoviensis* FRIČ, 1875. Opercular in lateral view. M 1459, $\times 6.0$

Os gulare mediale (figs. 35, 38). The gular medial is well preserved on several specimens. It is approximately of oval shape, orally pointed, caudally broadened. Ventral side of the bone is sculptured by fine growing lines concentrically arranged, the rests of the sensory lines are placed in the middle of the ventral side.

Pectoral girdle (figs. 33, 35, 37, 41—43).

The dermal cover of the pectoral girdle comprises the posttemporal, supraclithrum, presupracleithrum, cleithrum and clavicle. The clavicle, however is, poorly preserved.

Os posttemporale (figs. 31, 41). Paired posttemporal is of oblong shape, mediolaterally elongated and situated caudally from the extracapular bones. Dorsal side of the bone is sculptured by ridges concentrically arranged. The posttemporal on M 816 is 6 mm wide and 3 mm long and it belongs to a large specimen. Caudal part of its dorsal side is sculptured by conspicuous tubercles.

Os praesupracleithrum (figs. 31, 33, 37). The presupracleithrum is of oval shape, bordered by the supraclithrum, posttemporal and opercular. Dimensions of the bone are shown on text. tab. 5. Lateral surface is partly sculptured and part of the surface, which was covered with posttemporal, is smooth. Sensory lines are not developed.

Os supraclithrum (figs. 33, 35, 37). The supraclithrum is dorsoventrally elongated, about 11 mm high and 4 mm long. On dorsal margin it bears a process which is covered with the posttemporal. Lateral sensory canal



Fig. 41. *Sphaerolepis kounoviensis* FRIČ, 1875. Posttemporal in dorsal view. Conspicuous sculpture is developed on caudal part of dorsal surface. M 816, $\times 13.0$

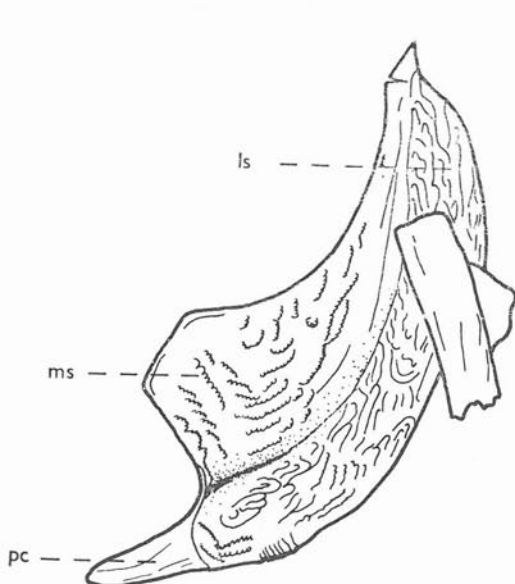


Fig. 42. *Sphaerolepis kounoviensis* FRIČ, 1875. Cleithrum in lateral view. M 816, $\times 6.0$

ls — lateral surface; ms — oromedial surface; pc — unsculptured process which is in connection with clavicle.



Fig. 43. *Sphaerolepis kounoviensis* FRIČ, 1875. Cleithrum in medial view and postrostral in oral view. M 816, $\times 6.0$

is situated on the dorsal part of lateral surface and it runs diagonally. The sculpture on lateral side of the bone is formed on dorsal part by tubercles which ventrally pass into short ridges dorsoventrally arranged. The oral margin of the bone is overlapped by the opercular and ventral margin overlaps the cleithrum.

O s cleithrum (figs. 33, 35, 42, 43). The cleithrum lies ventrally from the supracleithrum and is arch-like curved. Through the centre of the bone runs dorsoventrally conspicuous edge visible both from medial and lateral view. This edge divides the bone into the medial part which is covered by branchiostegal rays and into the uncovered lateral part (fig. 42). Medial part forming a compo-

ment of the gill cavity is oroventrally conspicuously broadened. It indicates a spacious gill cavity and broad skull. The lateral uncovered face of the cleithrum is sculptured by conspicuous ridges. The oroventral part of the bone bears distinct unsculptured process (fig. 42). Also the whole oral board of the cleithrum is of similar type as on other palaeoniscoid fishes, but the shape of the oral margin of cleithrum is quite different.

There are only not well preserved remains of six radials composing endoskeleton of the pectoral girdle. The radials have a stick form, the longest of them is 3 mm long.

TRUNK

Specimens used for the study had a total length from 50 mm to 78 mm. Some fragments of skeletons (M 1198, M 816, YA 1357, YA 1358), however, show that *Sphaerolepis kounoviensis* might have reached a total length of 10 or 15 cm. Body is fusiform, highest immediately in front of the pelvic fin. Dimensions of the trunk are on text. table 6.

No.	1	2	3	4	4 ₁	4 ₂	4 ₃	5	5 ₁	5 ₂	5 ₃	6	6 ₁	6 ₂	6 ₃	7 ₁	7 ₂	8	9
M 819	$\frac{14}{6 \ 14 \ 27}$	33	50?		6	17												13	5
M 822	$\frac{15}{- \ 14 \ 29}$	32	55	24	9			15	7	19	7	5	4	15	5	24		11	
M 1464			70	36	17														
M 824					17							10						18	
M 1455	$\frac{18}{6 \ 16 \ 29}$	32	78	38	16			20				8					26		7

Text. tab. 6. *Sphaerolepis kounoviensis* FRIČ, 1875. Dimensions of the trunk. Explanations see on p. 26–29.

A x i a l s k e l e t o n

Remains of the axial skeleton with the endoskeleton of dorsal fin are found on M 1461. Between the head and first axonost of the dorsal fin are 12 supraneurals. Supraneurals are of stick shape, 1 mm long in oral part, their length rises in caudal direction and those in part of the dorsal fin base are 2 mm long.

In part of the dorsal fin base a row of axonosts of the dorsal fin is developed. They have a stick form, proximally and distally broadened. There are five axonosts and every of them joins with the one supraneural and is oriented accordingly with it. The first axonost lying orally is 2.5 mm long. To the distal part of every axonost there is one baseost joined. They have also a stick form. Arrangement of the axonosts, baseosts and supraneurals is similar to that of *Sceltophorus biserialis*, where they are described in detail (ŠTAMBERG 1983).

P a i r e d f i n s

Pectoral fin. The longest lepidotrichia of the pectoral fin on specimen M 819 are 8 mm long and they do not reach up to the oral margin of the pelvic fin. The fin is composed of about 11–12 articulated and distally bifurcated

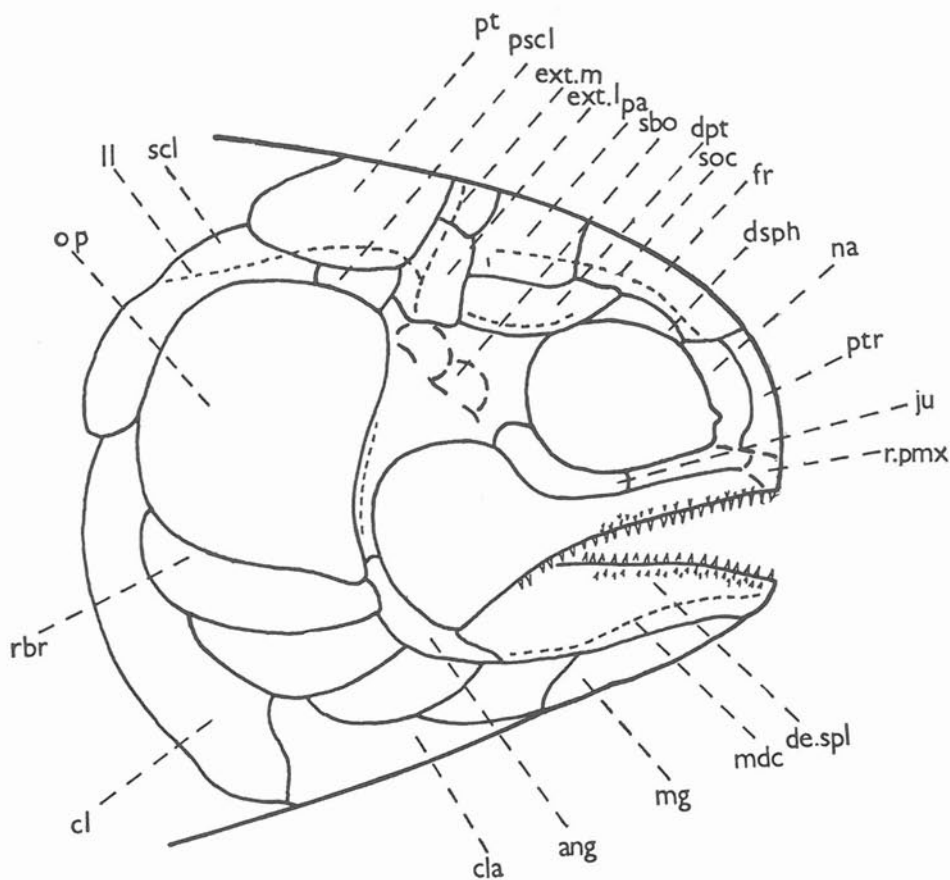


Fig. 44. *Sphaerolepis kounoviensis* FRIČ, 1875. Reconstruction of head in lateral view, $\times 3.5$

lepidotrichia. Oral margin is protected by 4 or 6 ridge scales, typical fulcral scales are absent.

Pelvic fin. The pelvic fin is approximately equidistant between the pectoral and anal fins. The oral margin of the pelvic fin base begins at the sixth scale row. The fin of specimen M 822 is composed of fifteen articulated lepidotrichia. Bifurcating of lepidotrichia in their distal part is obscure.

Unpaired fins

Anal fin. The anal fin is immediately in front of the caudal fin. It is composed of 19 articulated lepidotrichia, distally not dichotomically bifurcated. The lepidotrichia are separated from one another in their distal part. The fulcral scales are absent. The base of anal fin is about one third longer than the base of the dorsal fin.

Dorsal fin. The dorsal fin is perpendicular to the space between the pelvic and anal fins. It is composed of 15–19 articulated lepidotrichia, some of them

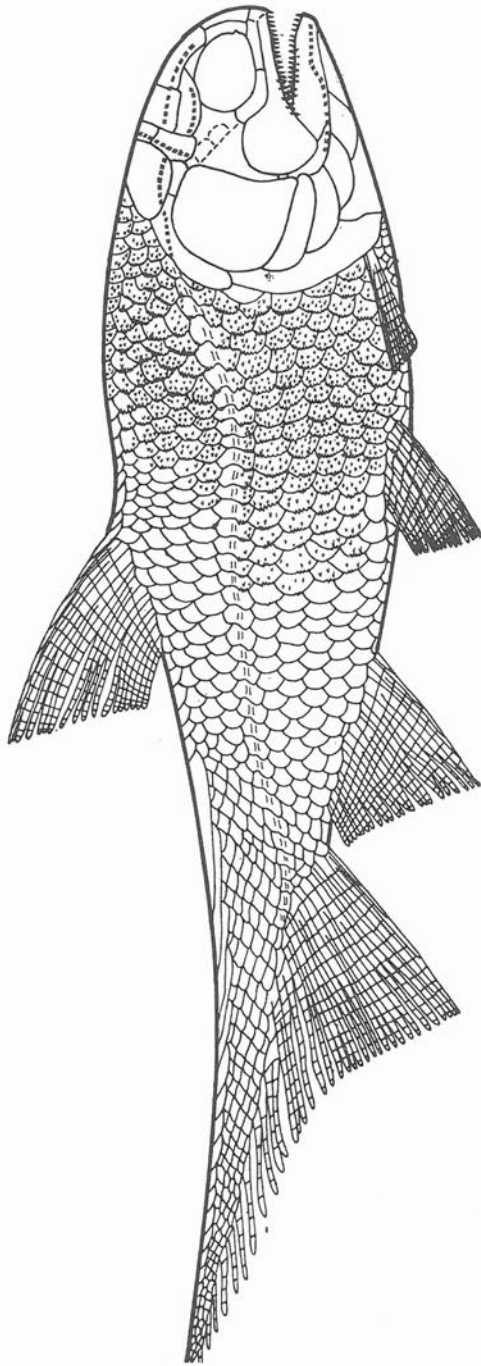


Fig. 45. *Sphaerolepis kounoviensis* FRIČ, 1875. Reconstruction of whole fish, $\times 1.5$

are dichotomically bifurcated. Orally from the dorsal fin base lie three ridge scales. Fulcral scales are absent.

Caudal fin. Caudal fin is heterocercal, but not deeply cleft. Dorsal lobe is slender, long, composed at least of about 25 lepidotrichia, which are on distal part of dorsal lobe separated from one another along their whole length. Ventral lobe is composed of about 19 articulated lepidotrichia. Dorsal margin of caudal fin is protected by ridge scales.

Squamation

The trunk is covered with thin scales of cycloidal shape. Rhombic, typical scales of palaeoniscoid fishes are developed only on the dorsal lobe of caudal fin and on a part of caudal peduncle. The contrast between these two types of squamation is obvious on fig. 48. The scale count is known on three specimens

only. The best preserved specimen M 1455 has scale count $\frac{18}{6 \ 16 \ 29} 32$.

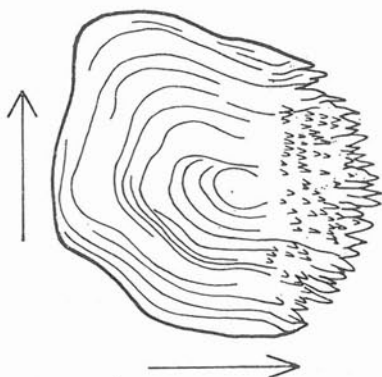


Fig. 46. *Sphaerolepis kounoviensis* FRICĀ, 1875. Anterior flank scale in lateral view. Uncovered surface sculptured with sharp pointed tubercles. Arrow indicates directio dorsalis and directio caudalis. M 1197, $\times 12.2$

The scales on younger specimens are sculptured only by fine concentrically arranged growing lines (M 817, fig. 48).

The scales of older specimens (M 1198 and others) are on their outer surface sculptured by conspicuous, concentrically arranged growing lines projecting caudally into sharp pointed tubercles. Mutual overlapping of the scales is sizeable (figs. 46, 47). Orally lying scales overlap at least by one third the scales lying caudally. The free surface of scale is covered with numerous, sharp pointed tubercles, so that the surface of the body was very rough, like of the recent *Perca fluviatilis*.

The scales bearing lateral sensory canal are well obvious along the lateral side of the trunk from the caudal margin of supracleithrum as far as the dichotomization of the caudal fin (fig. 48). At the site of dichotomization the sensory canal bend to the dorsal lobe of caudal fin and is still observable on three or five scales.

Size of cycloidal scales varies in accord with the length of the specimen and with their location on the trunk. On specimen M 1197 the height of scales in the eighth row on lateral side is 3.5 mm and length also 3.5 mm. On specimen

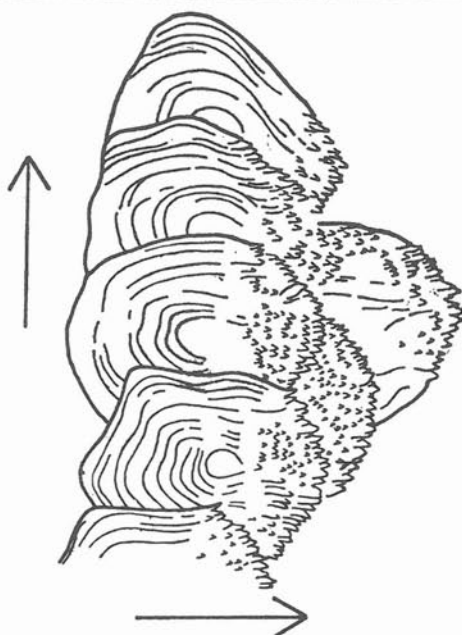


Fig. 47. *Sphaerolepis kounoviensis* FRIČ, 1875. Anterior flank scales in lateral view. Arrows indicates directio dorsalis and directio caudalis. M 1197, $\times 12.2$

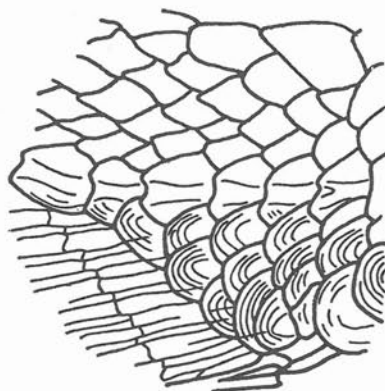


Fig. 48. *Sphaerolepis kounoviensis* FRIČ, 1875. Scales at the beginning of the caudal fin. The contrast between cycloidal and rhombic scales. Scales with lateral sensory canal form the the dividing line. M 819, $\times 11.0$

M 819 which is approximately 50 mm long, the same scales are 2 mm high and 1.7 mm long. Scales of rhombic shape are on dorsal part of the caudal peduncle and on the dorsal lobe of caudal fin are not sculptured.

Stratigraphical range: Stephanian B — Stephanian C.

Geographical distribution: Czech Rep.

Occurrence: Kounov, Zábřeh (Kounov Member, Stephanian C)

Boreholes: Strachaly (Zdětín Horizon, Stephanian C),
 Dolní Bousov (Zdětín Horizon, Stephanian C;
 Měsíc Member, Stephanian B)
 Liběchov (Líně Member, Stephanian C;
 Měsíc Member, Stephanian B)
 Martiněves (Zdětín Horizon, Stephanian C),
 Semčice (Zdětín Horizon, Stephanian C),
 Syřenov (Krkonoše Piedmont Basin, Ploužnice Horizon, Stephanian C).

Remarks and relations: *Sphaerolepis kounoviensis* distinguishes markedly from other Permocarboneferous Chondrosteans. Even when the present study has shown that the foramen on the skull roof is not developed, as A. FRITSCH (1895) and B. G. GARDINER (1967) presupposed, there are many features distinguishing this fish from other chondrosteian fishes.

Sphaerolepis kounoviensis is characterized by thin cycloidal scales covering the whole trunk except the dorsal part of caudal peduncle and dorsal lobe of caudal fin, where rhombic scales are present. The cycloidal scales are sculptured by sharp pointed tubercles. Very important features are the nearly vertical suspensorium and small inclination of the dermal bones attached to the hyomandibular, i.e. the preopercular, and the small inclination of the opercular. Singular is the presence of one large opercular only and the lack of the subopercular. We can also observe a tendency to the reduction of the number of branchiostegal rays and of lepidotrichia.

Sphaerolepis kounoviensis is very similar in the scale type to *Cryphiolepis striatus* (TRAQUAIR, 1881) from the Lower Carboniferous of Scotland. This species has the same squamation, but according to the description and reconstruction (TRAQUAIR 1881, 1877—1914) it differs from *Sphaerolepis kounoviensis* by the more oblique suspensorium, the shape of maxillary plate, the shape and structure of the fins and the presence of fulcral scales.

I do not assign to the genus *Sphaerolepis* the small plates of bones and teeth which were described from Permocarboneferous sediments of Illinois and Texas (USA) by several authors (CASE 1900, OLSON 1967, ORWIG 1978 and others). These small plates (15—20 mm long) were initially described as *Peplorhina arctata* COPE, 1877; later CASE (1900) classed these plates in the genus *Sphaerolepis*. The last report on these small fragments is by ORWIG (1978) who classifies them as *Sphaerolepis cf. arctata* (COPE). I assume from the figures of these fragments that there is no reason for allocating these fragments to the genus *Sphaerolepis*, because their preservation is very poor and they may be fragments of vomers or of dermal bones of the medial side of the palatoquadrate of various fishes.

Sceletophorus FRITSCH, 1895

- 1895 *Sceletophorus* FR.; A. FRITSCH, Fauna der Gaskohle, Band 3, p. 88—92.
 1895 *Phanerosteon* TRAQUAIR; A. FRITSCH, Fauna der Gaskohle, Band 3, p. 92—93.
 1895 *Amblypterus* AGASSIZ; A. FRITSCH, partim, Fauna der Gaskohle, Band 3, p. 96—99.
 1936 *Gymnoniscus n. g.*; L. S. BERG, Teleopterina n. g., p. 345.
 1966 *Gymnoniscus* BERG; J. P. LEHMAN, Traité, p. 78, 89.
 1967 *Sceletophorus* FRIC; B. G. GARDINER, Further notes, p. 168—172.
 1983 *Sceletophorus* FRITSCH, 1895; S. ŠTAMBERG, Revision of the genus *Sceletophorus*, p. 43—44.

Diagnosis (ŠTAMBERG 1983): Body of fusiform shape, total length 14 cm. Pelvic fins placed closer to pectoral fins than to anal fin. Dorsal fin of approximately the same size as the anal fin but with a shorter base. There are 17–20 lepidotrichia in dorsal fin and 18–22 in anal fin. Lepidotrichia of all fins articulated and distally once or twice dichotomized. Dorsal fin invariably arises in front of anal fin. In dorsal and anal fins there are twice as many lepidotrichia as radialis. Fulcral scales developed on oral side of all fins. Frontals only by 1/3 longer than or of the same length as parietals. Dermopterotic and dermosphenotic present. A narrow strip of extrascapular bones caudally from parietal. Rostral part of the head not conspicuously convex orally. Parasphenoid well ossified even in young specimens. One pair of caudolaterally directed processus ascendens posterior developed. Orbit large, lying well forward. From the dorsal side limited by the dermosphenotic and partly by the dermopterotic. Maxilla with a large maxillary plate, whose length/height ratio equals 1. The upper and lower jaws bear robust, smooth, sharp-pointed teeth of identical size. Lower jaw strong. The preopercular is not conspicuously curved orally; it is inclined at an angle of 60–70 degrees. There is no evidence of another bone between the preopercular and the opercular. The opercular by 1/3 to 1/2 higher than long and 1/3 higher than the subopercular. No more than six branchiostegal rays. Opercular inclined at angle 60–70 degrees. Paired gular lateral and single gular medial present. The posttemporal oval, larger than the parietal. Presupracleithrum present, cleithrum considerably elongated dorsoventrally. Its narrowed dorsal end reaches up to the row of scales bearing the lateral sensory canal. Lateral sensory canal very conspicuous. Scales very delicately sculptured only in the oral part of the trunk. The articulation peg and socket type. Scale

count of type species $\frac{21}{6 \ 18 \ 30} = 35$

Type species: *Sceletophorus biserialis* FRITSCH, 1895

Locus typicus: Třemošná, Distr. Plzeň, Czech Rep.

Stratum typicum: Nýřany Member, Westphalian D, Upper Carboniferous.

Remarks: The species *Phanerosteon pauper* FRITSCH, 1895, which I regard as a young specimen of *Sceletophorus biserialis*, is placed here in the genus *Sceletophorus*, as done already by WESTOLL (1944) and GARDINER (1967). I also class *Amblypterus verrucosus* FRITSCH, 1895 in the genus *Sceletophorus* as a separate species *Sceletophorus verrucosus* (FRITSCH, 1895).

Included species: *Sceletophorus biserialis* FRITSCH, 1895; *Sceletophorus verrucosus* (FRITSCH, 1895).

Stratigraphical range: Westphalian D.

Geographical distribution: Czech Rep.

Sceletophorus biserialis FRITSCH, 1895
(figs. 49–51, pls. XIX–XX)

1895 *Sceletophorus biserialis*, FR.; A. FRITSCH, Fauna der Gaskohle, Band 3, p. 88–92, figs. 281–286, pls. 116, 117, fig. 3.

1895 *Phanerosteon pauper*, FR.; A. FRITSCH, Fauna der Gaskohle, Band 3, p. 92–94, fig. 287. pl. 117, figs. 1–4.

- 1895 *Amblypterus verrucosus*, FR.; A. FRITSCH, partim, Fauna der Gaskohle, Band 3, fig. 290.
 1902 *Sceltophorus biserialis* FR.; C. PURKYNĚ, Nýřanská a Radnická sloj, p. 16.
 1902 *Phanerosteon pauper* FR.; C. PURKYNĚ, ibid., p. 16.
 1905 *Phanerosteon pauper* FR.; F. BAYER, Katalog, p. 40.
 1905 *Sceltophorus biserialis* FR.; F. BAYER, Katalog, p. 46.
 1912 *Sceltophorus biserialis* FR.; FRIČ, Studie, p. 44.
 1912 *Phanerosteon pauper* FR.; A. FRIČ, Studie, p. 44.
 1877—1914 *Phanerosteon pauper*; R. H. TRAQUAIR, The Ganoid Fishes, p. 168.
 1936 *Gymnoniscus pauper*; L. S. BERG, Teleopterina n. g., p. 345.
 1944 *Sceltophorus biserialis* FRITSCH; S. T. WESTOLL, The Haplolepidae, p. 65.
 1944 *Phanerosteon pauper* FRITSCH; S. T. WESTOLL, The Haplolepidae, p. 66.
 1964 *Sceltophorus biserialis* FR.; L. S. BERG, A. A. KAZANCEVA, D. V. OBRUTSCHEV, Osnovy paleontologii, p. 355.
 1966 *Gymnoniscus pauper* (FRITSCH); J. P. LEHMAN, Traité de Paléontologie, p. 78, 79.
 1967 *Sceltophorus biserialis* FRIČ; B. G. GARDINER, Further notes, p. 169—172, figs. 19—21.
 1967 *Sceltophorus biserialis* FRIČ 1894; S. M. ANDREWS at all., Pisces, p. 650.
 1983 *Sceltophorus biserialis* FRITSCH, 1895; S. ŠTAMBERG, Revision, p. 44—61, figs. 1—10.
 1986 *Sceltophorus biserialis* FRITSCH, 1895; S. ŠTAMBERG, Poissons Permocarbonifères, p. 100—101, fig. 3.
 1985 *Sceltophorus biserialis* FRITSCH, 1895; J. ZAJÍC, S. ŠTAMBERG, Summary of the Permocarboniferous, p. 71.

Lectotype (ŠTAMBERG 1983): Specimen figured by A. FRITSCH (1895) on pl. 116, fig. 1, deposited in the National Museum, Prague as No. M 1202.

Paralectotypes: Specimens figured by A. FRITSCH (1895) on pl. 116, fig. 3, pl. 117, fig. 5 and text-figs. 284, 285; deposited in the National Museum, Prague as Nos. M 887, M 893, M 1264.

Type locality: Třemošná, distr. Plzeň.

Stratum typicum: Nýřany Member, Westphalian D, Upper Carboniferous.

Material: In addition to types, further 50 specimens were used for study.

Diagnosis (ŠTAMBERG 1983): Body slender, fusiform, attaining a length of 10 cm. Segments of lepidotrichia always longer than wide. The longest lepidotrichia of the anal fin composed of 14—18 segments. The longest lepidotrichia of the ventral lobe of caudal fin have maximum 20 segments.

Detailed revision of the species *Sceltophorus biserialis* is given in previous paper of the author (ŠTAMBERG 1983).

Sceltophorus verrucosus (FRITSCH, 1895)
(pl. XXI)

- 1895 *Amblypterus verrucosus*, FR.; A. FRITSCH, Fauna der Gaskohle, Band 3, p. 96—99, fig. 289 pl. 120.
 1902 *Amblypterus verrucosus* FR.; C. PURKYNĚ, Nýřanská a Radnická sloj, p. 17.
 1905 *Amblypterus verrucosus* FR.; F. BAYER, Katalog, p. 25.
 1912 *Amblypterus verrucosus* FR.; A. FRIČ, Studie, p. 44.
 1983 *Sceltophorus verrucosus* (FRITSCH, 1895); S. ŠTAMBERG, Revision of the genus *Sceltophorus*, p. 61—65, figs. 11—14.
 1985 *Sceltophorus verrucosus* (FRITSCH, 1895); J. ZAJÍC, S. ŠTAMBERG, Summary of the Permocarbonifères, p. 71.
 1986 *Sceltophorus verrucosus*; S. ŠTAMBERG, Poissons Permocarbonifères, p. 101.

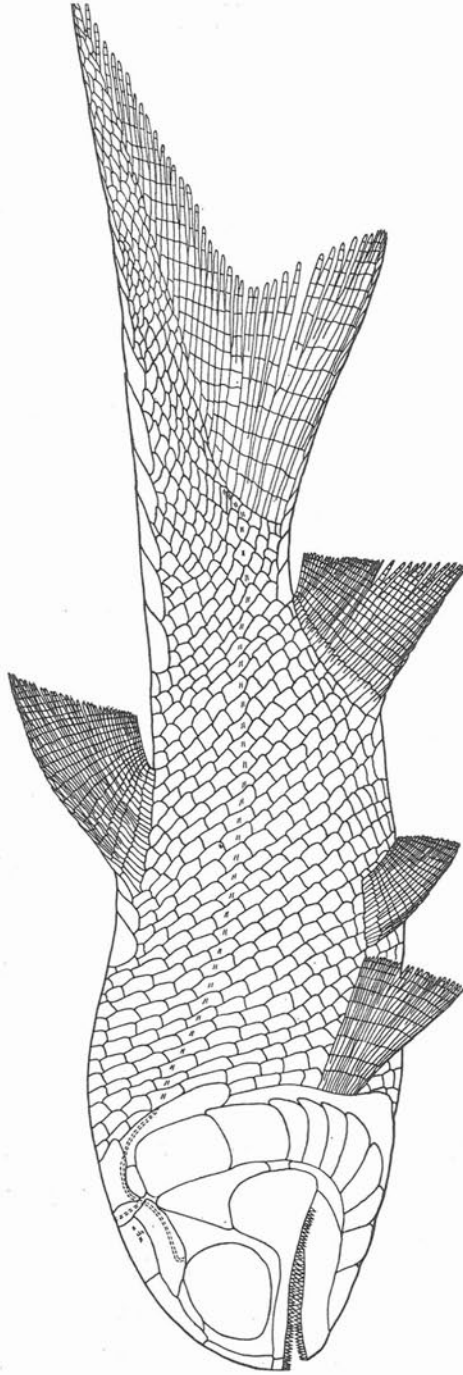


Fig. 49. *Sceltophorus biserialis* FRITSCH, 1895. Reconstruction of whole fish, $\times 2.5$

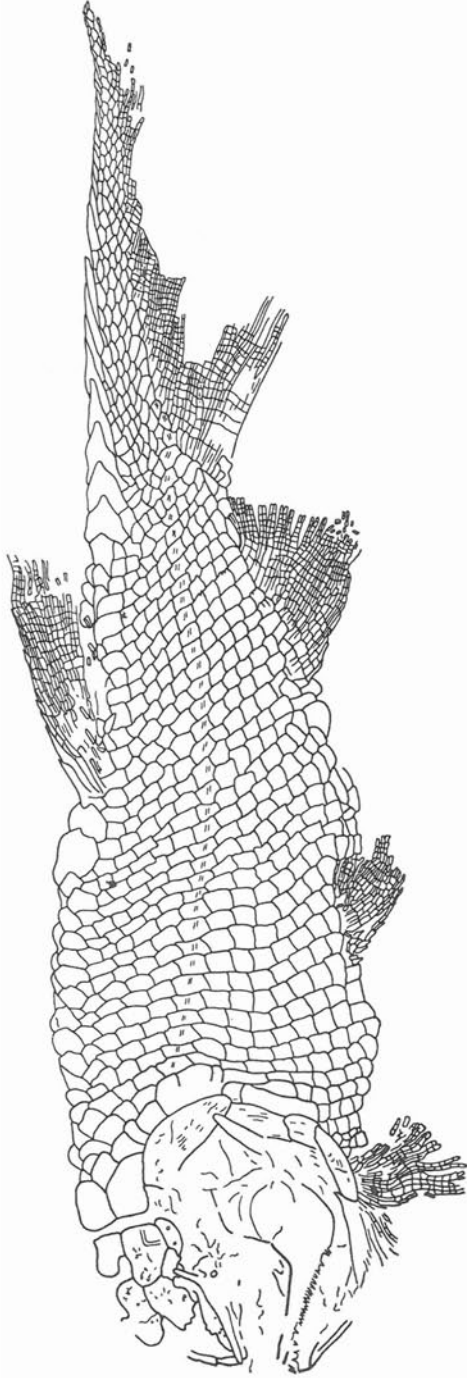


Fig. 50. *Scelatothorus biserialis* FRITSCH, 1895. Specimen M 1262, $\times 2.0$

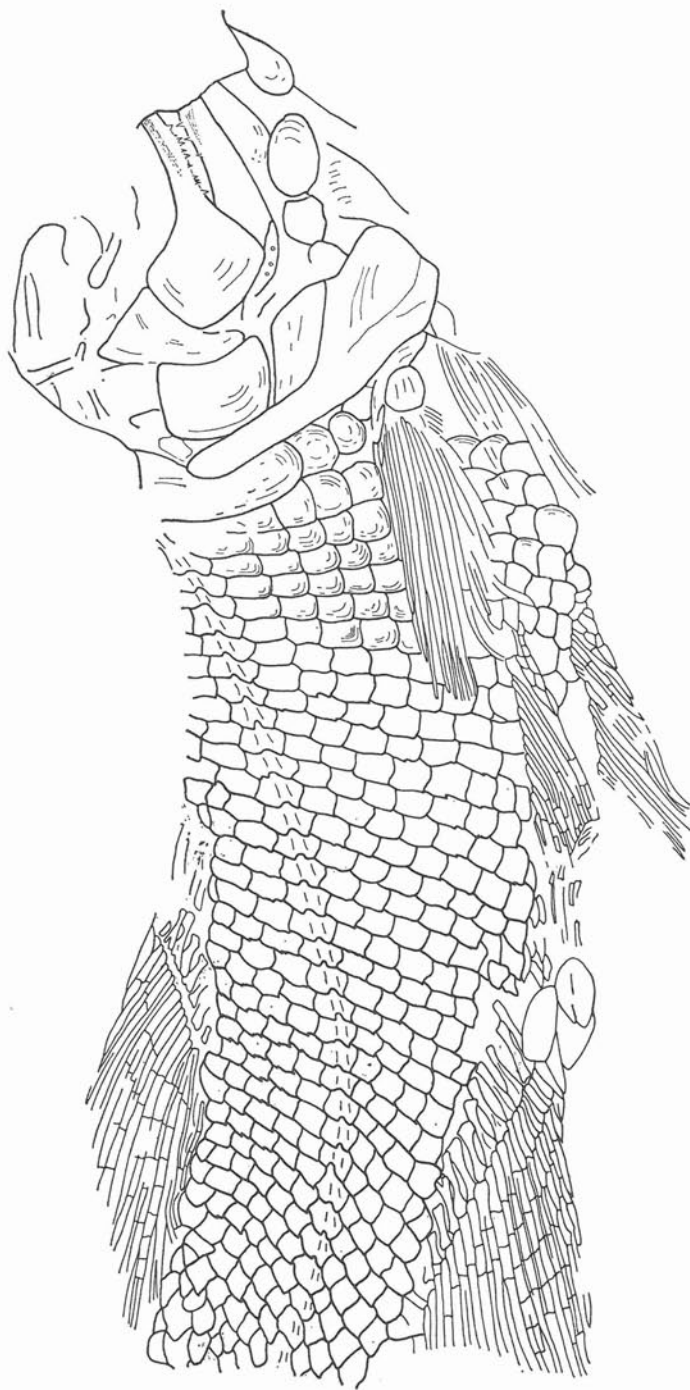


Fig. 51. *Sceloporphorus biserialis* FRITSCH, 1895. Specimen M 1264, \times 5.9

Lectotype (ŠTAMBERG 1983): Specimen figured by FRITSCH (1895) on fig. 289 and pl. 120, deposited in the National Museum, Prague as M 1205 and here is refigured on pl. XXI.

Locus typicus: Třemošná, District Plzeň-North, Czech Rep.

Stratum typicum: Nýřany Member, Westphalian D, Upper Carboniferous.

Material: In addition to lectotype, other 10 specimens from the coll. of the National Museum, Prague and 2 specimens from the coll. of the Regional Museum of West Bohemia, Plzeň were employed for study.

Diagnosis (ŠTAMBERG 1983): Total length of the body 14 cm. Oral part of trunk dorsally convex. Segments of lepidotrichia usually wider than long. The longest lepidotrichia of the anal fin composed of 30 or more segments, the longest lepidotrichia of the ventral lobe of caudal fin of 30—42 segments.

Detailed revision of the species *Sceletophorus verrucosus* is given in previous paper of the author (ŠTAMBERG 1983).

As results from the descriptions of two species of genus *Sceletophorus*, this genus is distinguished, among others, by these features:

1. Suspensorium moderately inclined; angle of obliqueness of the preopercular is 60—70 degrees.
2. Preopercular not conspicuously bent orally.
3. Anamnestic bones are not developed.
4. Presupracleithrum present.
5. Small number of branchiostegal rays.
6. The number of radialia of anal and dorsal fins is half that of lepidotrichia.

7. The scale count of type species $\frac{21}{6 \ 18 \ 30} 35$

Order: *Aeduelliformes* HEYLER, 1969

Family: *Aeduellidae* ROMER, 1945

Diagnosis: See HEYLER (1969).

Type genus: *Aeduella* WESTOLL, 1937.

Included genera: *Aeduella* WESTOLL, 1937; *Westollia* WHITE, MOY THOMAS, 1940; *Bourbonnella* HEYLER, 1969; *Decazella* HEYLER, 1969; *Spinarichthys* ŠTAMBERG, 1986.

Stratigraphical range: Upper Carboniferous — Lower Permian.

Geographical range: France, Czech Rep., Great Britain, USA.

Spinarichthys ŠTAMBERG, 1986

1986 *Spinarichthys* gen. nov.; ŠTAMBERG, Fish *Spinarichthys dispersus*, p. 155—156.

Type species: *Spinarichthys dispersus* (FRITSCH, 1895).

Locus typicus: Kounov, District Rakovník, Czech Rep.

Stratum typicum: Kounov Member, Stephanian B, Upper Carboniferous, Kladno and Rakovnik Basin.

Diagnosis (ŠTAMBERG 1986): Small fishes not exceeding 8–10 cm in total length of the body. Rostral part of the head rounded, not convex orally. Os maxillare with small triangular maxillary plate. Lower jaw strong. The lower and upper jaws bear a row of very small teeth joined to short tubules. The preopercular not curved orally, situated in vertical position. The opercular of oblong shape, dorsoventrally elongated, making an angle of 45 degrees with the horizontal plane. The subopercular dorsoventrally elongated, of the same height as the opercular. No more than three branchiostegal rays, paired lateral gular and unpaired median gular. The clavicle present. Caudal margin of the scales strongly pectinated. Scales possess a conspicuous peg and socket articulation.

Included species: Type species only.

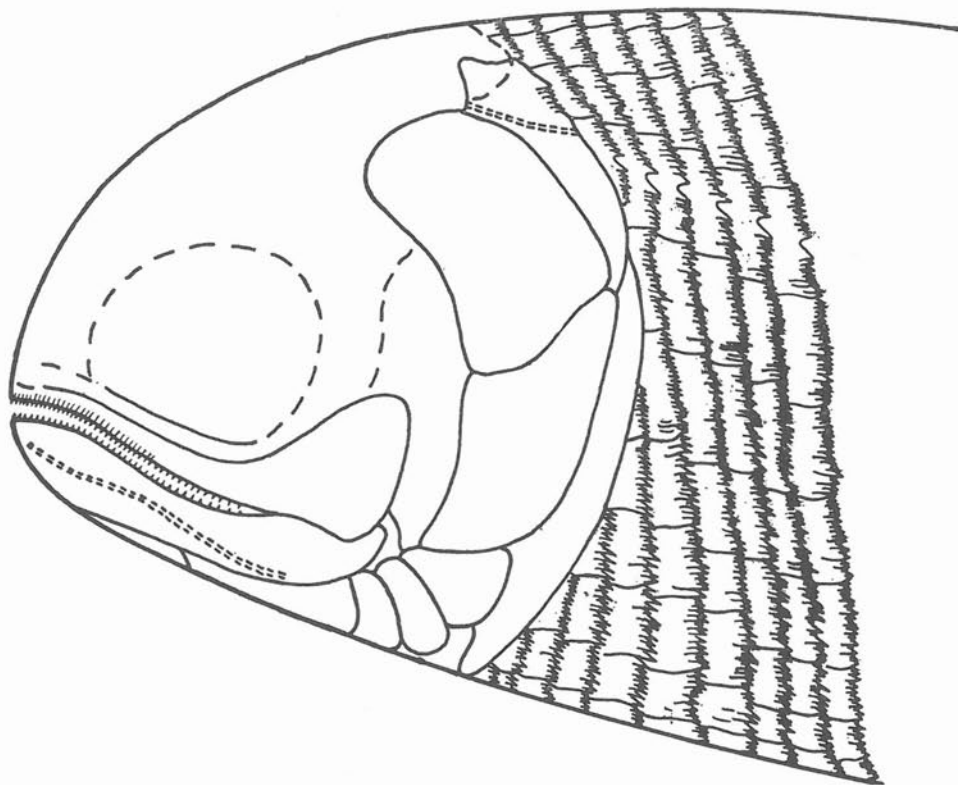


Fig. 52. *Spinarichthys dispersus* (FRITSCH, 1895). Reconstruction of head and oral part of the trunk, without the pectoral fin, $\times 5.5$

Spinarichthys dispersus (FRITSCH, 1895)

(fig. 52, pls. XXII—XXIII)

- 1895 *Acentrophorus dispersus* FR.; A. FRITSCH, Fauna der Gaskohle, Band 3, p. 81—83, fig. 279, pls. 113, 114.
1905 *Acentrophorus dispersus* FR.; F. BAYER, Katalog, p. 23.
1945 "*Acentrophorus*" *dispersus*; A. S. ROMER, Late Carboniferous, p. 442.
1985 "*Acentrophorus*" *dispersus* FRITSCH, 1895; J. ZAJÍC, S. ŠTAMBERG, Summary of the Permocarboneous, p. 76.
1986 *Spinarichthys dispersus* (FRITSCH, 1895); S. ŠTAMBERG, Fish *Spinarichthys dispersus*, p. 156—165.

H o l o t y p e: Specimen figured by A. FRITSCH on pl. 113, figs. 2, 3, 4 and on pl. 114, fig. 1, deposited in the National Museum, Prague as No. M 814 and cast No. 1200.

L o c u s t y p i c u s: Kounov, Distr. Rakovník, Czech Rep.

S t r a t u m t y p i c u m: Kounov Member, Stephanian B, Upper Carboniferous, Kladno and Rakovník Basin.

D i a g n o s i s: The same as for genus.

Detailed description is given in the previous paper of the author (ŠTAMBERG 1986).

Order: *Haplolepidiformes* ANDREWS et al., 1967

Family: *Haplolepididae* WESTOLL, 1944

Genus: *Pyritocephalus* FRITSCH, 1895

- 1895 *Pyritocephalus*, FR.; A. FRITSCH, Fauna der Gaskohle, Band 3, p. 86.
1936 *Teleopterina* n. g.; L. S. BERG, *Teleopterina* n. g. p. 345.
1944 *Pyritocephalus* FRITSCH; S. T. WESTOLL, The Haplolepididae, p. 42—43.
1978 *Pyritocephalus* FRITSCH, 1895; S. ŠTAMBERG, New data, p. 275.
1986 *Pyritocephalus* FRITSCH, 1895; S. ŠTAMBERG, Poissons Permocarboneous, p. 100.

T y p e s p e c i e s: *Pyritocephalus sculptus* (FRITSCH, 1883).

L o c u s t y p i c u s: Nýřany, Distr. Plzeň, Czech Rep.

S t r a t u m t y p i c u m: Westphalian D, Nýřany Member, Upper Carboniferous, Plzeň Basin.

D i a g n o s i s: Slender fish not exceeding 70 mm of the total length. Pectoral fin consists of 10—15 lepidotrichia, pelvic fin small with short base consists of 6—9 lepidotrichia. Dorsal and anal fins approximately of the same size, dorsal fin consists of 7—9 lepidotrichia, anal fin of 8—12 lepidotrichia. Caudal fin not deeply cleft. Fulcral scales present on the oral margin of the fins, but not reaching their distal parts. Lepidotrichia segmented, distally only exceptionally bifurcated, near the distal tip. Lepidotrichia of all fins are distally separated from each other. The paired dermal bones of the skull roof (parietal, frontal, dermopterotic) coalesce into one unite, often without visible sutures, and constitute a characteristic formation. Os dermosphenoticum and one pair of small extrascapular bones present. A large paired fenestration in the skull roof is surrounded by frontals, parietals, dermopterotics and dermosphenotics. Bones of the skull

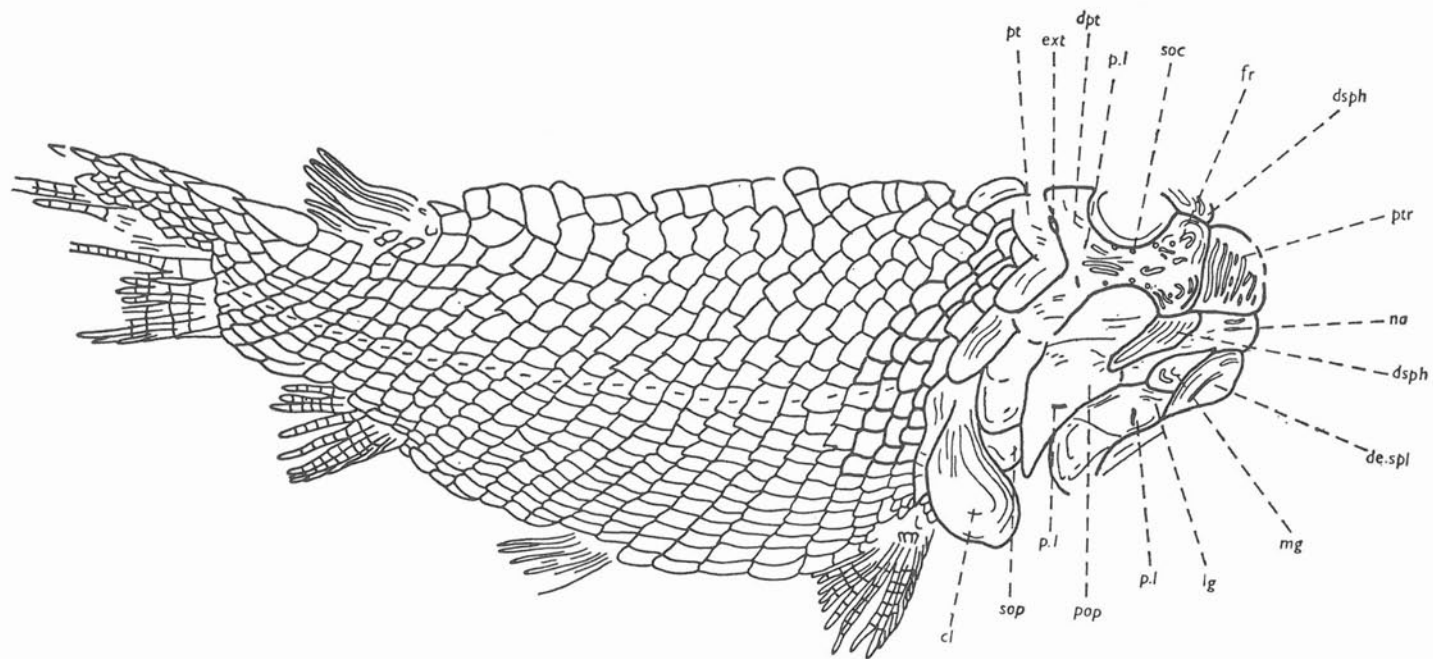


Fig. 53. *Pyritocephalus sculptus* (FRITSCH, 1883). Specimen M 2075, $\times 3.0$

roof are sculptured with conspicuous ridges. Rostral part of the head not conspicuously convex, composed of paired rostro-premaxillar and nasal, unpaired postrostral. Sometimes the second small postrostral is developed orally. Very large orbit surrounded by dermosphenotic, nasal, rostro-premaxillar and narrow infraorbital bones. From two to four small suborbitals in front of the preopercular. Maxilla with well developed maxillary plate, the length/height ratio of the maxillary plate is 1.2, and ratio of the plate length to the length of the oral part of maxilla is 0.8. The teeth not developed. Lower jaw strong. The preopercular not oblique, it inclined orally at angle 65 degrees. Small triangular antopercular present. Os operculare dorsoventrally elongated, 2.5 higher than the subopercular. Opercular inclined orally at angle 67 degrees. The subopercular small of triangular shape. Branchiostegal rays not developed, series of one median and two pairs of gulars between the jaws present. The scales smooth, rhombic, not pectinated on their caudal margin. The scale count

21—24	25—28.
6—8 14—17 23—25	

Remarks: WESTOLL (1944) described and ranged to the genus *Pyritocephalus* species *P. lineatus*, *P. gracilis*, *P. comptus* and *P. rudis*. As the results of the study of type species *Pyritocephalus sculptus* shown (ŠTAMBERG 1978, 1986) there are not differences between *P. sculptus* and *P. gracilis*, *P. comptus* and *P. lineatus*. For that reason I consider species *P. gracilis*, *P. comptus* and *P. lineatus* for the species *P. sculptus*, but additional study of the types of *P. lineatus*, *P. gracilis*, *P. comptus* and *P. rudis* and other material is necessary.

Included species: *Pyritocephalus sculptus* (FRITSCH, 1883); *Pyritocephalus lineatus* (NEWBERRY, 1856); *Pyritocephalus gracilis* (NEWBERRY, WORTHEN, 1870); *Pyritocephalus comptus* WESTOLL, 1944; *Pyritocephalus rudis* WESTOLL, 1944.

Stratigraphical range: Upper Carboniferous.

Geographical distribution: USA, Great Britain, CSFR.

Pyritocephalus sculptus (FRITSCH, 1883)
(fig. 53, pl. XXIV)

- 1883 *Palaeoniscus sculptus*, FR.; A. FRITSCH, Fauna der Gaskohle, Band 1, p. 30.
 1895 *Pyritocephalus sculptus*, FR.; A. FRITSCH, Fauna der Gaskohle, Band 3, p. 86—87, fig. 280, pl. 115.
 1944 *Pyritocephalus sculptus* FRITSCH; S. T. WESTOLL, The Haplolepidae, p. 43—50, figs. 23—27.
 1978 *Pyritocephalus sculptus* FRITSCH, 1895; S. ŠTAMBERG, New data, p. 276—287, pls. LX—LXIII, figs. 1—6.
 1985 *Pyritocephalus sculptus* (FRITSCH, 1895); J. ZAJÍC, S. ŠTAMBERG, Summary of the Permocarboniferous, p. 76.
 1986 *Pyritocephalus sculptus* (FRITSCH, 1883); S. ŠTAMBERG, Poissons Permocarboniferes, p. 100, figs. 1 a—e, 2.

Lectotype (ŠTAMBERG 1978): Specimen figured by FRITSCH (1895) on pl. 115, fig. 4, deposited in the National Museum, Prague, No. M 1201.

Locus typicus: Nýřany, Distr. Plzeň, Czech Rep.

Stratum typicum: Nýřany Member, Westphalian D, Upper Carboniferous, Plzeň Basin.

Diagnosis: The same as for genus.

Detailed description of species *Pyritocephalus sculptus* is presented in the paper by WESTOLL (1944) and in the previous papers of the author (ŠTAMBERG 1978, 1986).

STANISLAV ŠTAMBERG

AKTINOPTERYGII STŘEDOČESKÝCH KARBONSKÝCH PÁNVI

V předložené práci je věnována pozornost nálezům paprskoploutvých ryb z karbonu středoevropských pánví. Ke studiu byl využit především typový materiál Prof. Antonína Friče a dále novější, dosud nezpracované sběry uložené v Národním muzeu v Praze. Podkladem pro tuto revizní studii byla též kolekce ryb ze sbírek Západočeského muzea v Plzni a četné fragmentální zbytky z vrtů prováděných Ústředním ústavem geologickým v Praze v poslední době. Na základě revize celého souboru materiálu jsou podány základní anatomické rysy deseti druhů, a to: *Watsonichthys sphaerosideritarum* (FRITSCH, 1895), *Watsonichthys krejci* (FRITSCH, 1895), *Progyrolepis speciosus* (FRÍČ, 1875), *Zaborichthys fragmentalis n. sp.*, *Acrolepis gigas* (FRÍČ, 1877), *Sphaerolepis kounoviensis* FRÍČ, 1875, *Sceletophorus biserialis* FRITSCH, 1895, *Sceletophorus verrucosus* (FRITSCH, 1895), *Spinarichthys dispersus* (FRITSCH, 1895), *Pyritocephalus sculptus* (FRITSCH, 1883). Kromě detailního popisu fosilií jsou též diskutovány vztahy popisovaných druhů k rybám z jiných obdobných oblastí.

USED ABBREVIATIONS

Specimen numbers are prefixed as follows:

- M — National Museum, Prague
- YA — Geological Survey, Prague

Lettering used in text figures and plates:

- a.hy — groove for afferent hyoidean artery
- ang — os angulare
- ant — os antorbitale
- aop — os antoperculare
- aup — pars autopalatina
- ax — axonost
- bo — baseost
- bv — basiventral
- chy — ceratohyal
- cl — cleithrum
- cla — clavicle
- d — dentale
- despl — dentalosplenic
- dhy — dermohyal
- dmptg — dermometapterygoid
- dpl — dermopalatine
- dpt — dermopterotic
- dsph — dermosphenotic
- ebr — epibranchial
- ecpt — ectopterygoid
- enpt — entopterygoid
- ep — epibranchial
- epi — epipreopercular
- ext — extrascapular
- ext.l — extrascapular lateral
- ext.m. — extrascapular medial
- fh — bucco-hypophysial canal
- fr — frontal
- gul — gular lateral
- gum — gular medial
- gup — gular posterior
- hm — hyomandibular
- ifc — infraorbital canal
- ih — interhyal
- io — infraorbital
- ju — jugal
- lc — lateral sensory canal
- ls — lateral side
- lg — gular lateral
- ll — lateral sensory canal
- mdc — mandibular canal
- meck — Meckelian cartilage
- mg — gular medial
- ms — medial side
- mtn — notch on the metapterygoid
- mx — maxilla
- na — nasal
- na₁ — anterior nasal opening
- na₂ — posterior nasal opening
- op — opercular

pa	— parietal
p.a	— processus ascendens posterior
pc	— processus on the cleithrum
pcl	— postcleithrum
pl	— pit line
pop	— preopercular
popc	— preopercular sensory canal
post	— postrostral
pq	— palatoquadrate
pr.asc	— processus ascendens posterior
pr.po	— processus postorbitalis
ps	— parasphenoid
pscl	— presupracleithrum
psph	— parasphenoid
pt	— posttemporal
ptr	— postrostral
quj	— quadratojugal
rbr	— branchiostegal ray
ros	— second postrostral
r.pmx	— rostro-premaxillar
s	— scale
sbo	— suborbital
scl	— supracleithrum
sn	— supraneural
so	— suborbital
soc	— suborbital sensory canal
sop	— subopercular
s.r.	— sclerotical ring
vo	— vomer

LITERATURE

- AGASSIZ, L. (1833—1843): Recherches sur les poissons fossiles, 2. Neuchatel.
- ALDINGER, H. (1937): Permische Ganoidfische aus Ostgrönland. Meddr. Gronl. ,102, (3), 1—392. Kobenhavn.
- ANDREWS et al. (1967): The Fossil Record, Pisces, 26, 637—683. Geological Soc. of London. London.
- BAYER, F. (1905): Katalog českých fosilních obratlovců. Čes. Akad. Vědy, Slovesn. Umění, 1—102. Praha.
- BERG, L. S. (1936): Teleopterina n. g., a highly organised Acanthopterygian from the Carboniferous of North America. Dokl. Akad. Nauk SSSR, 4, (7), 345—347. Moskva.
- BERG, L. S., KAZANCEVA, A. A., OBRUTSCHEV, D. V. (1964): Nadotřjad Palaeonisci, 336—370; in: OBRUTSCHEV, D. V. (1964): Osnovy paleontologii, Bezčeljustnye, Ryby. — Moskva.
- CASE, E. C. (1900): The vertebrates from the Permian bone-bed of Vermilion county, Illinois. Journ. of Geology, 8, 698—729. Chicago.
- COPE, E. D. (1872): Systematic relations of the fishes, Proc. Amer. Assoc. Adv. Sci. New York.
- DUNKLE, D. H. (1946): A new Palaeoniscoid Fish from the Lower Permian of Texas. Journ. Washington Acad. Sci., 36, 12. Washington.
- FRÍČ, A. (1875): Über die Fauna der Gaskohle der Pilsner und Rakonitzer Beckens. Sitz.-Ber. kön. böhm. Gessel. Prag, Praha.
- FRÍČ, A. (1877): Zur Fauna der Gaskohle von Zaboř bei Schlan, Kroučová bei Řeňč und Třemošná bei Pilsen, sowie über die Sphaerosideritkugeln von Žilov. Sitz.-Ber. kön. böhm. Gesell. der Wissensch. Prag, 45—52. Praha.
- FRÍČ, A. (1879): Neue Übersicht der in der Gaskohle und der Kalksteinen der Permformation in Böhmen vorgefundenen Thierreste. Sitz.-Ber. kön. böhm. Gesell. der Wissensch. Prag, Praha.
- FRITSCH, A. (1883—1901): Fauna der Gaskohle und der Kalksteine der Permformation Böhmens, 1—4. Praha.
- FRÍČ, A. (1912): Studie v oboru českého útvaru permského. Archiv přírodověd. Výzk. Čech, 15, (2), 1—47. Praha.
- GARDINER, B. G. (1962): Namaichthys schroederi Gürich and other palaeozoic fishes from South Africa. Palaeontology (London), 5, (1), 9—21. London.
- GARDINER, B. G. (1963): Certain Palaeoniscoid fishes and evolution of the snout in actinopterygians. Bull. Brit. Mus. natur. Hist., Ser. Geol., 8, (6), 255—325. London.
- GARDINER, B. G. (1967): Further notes on palaeoniscoid fishes with classification of the Chondrostei. Bull. Brit. Mus. natur. Hist., Ser. Geol., 14, (5), 143—206. London.
- GARDINER, B. G. (1984): The relationships of the palaeoniscoid fishes, a review based on new specimens of Mimia and Moythomasia from the Upper Devonian of Western Australia. Bull. Brit. Mus. natur. Hist., Ser. Geol., 37, (4), 173—428. London.
- GARDINER, B. G., BARTRAM, A. W. H. (1977): The homologies of ventral cranial fissures in osteichthyans. In: Problems in Vertebrate Evolution (Eds. S. M. ANDREWS et al.). Linn. Soc. Symp., vol. 4, 227—245. London.
- HAVLENA, V., PEŠEK, J. (1975): Litostratigrafické členění středočeského karbonu. Západočes. Muz., Odd. Přír., 11, 1—82. Plzeň.
- HAVLENA, V., PEŠEK, J. (1980): Stratigrafie, paleogeografie a základní strukturální členění limnického permokarbonu Čech a Moravy. Sbor. Západočes. Muz., Odd. Přír., 34, 1—144. Plzeň.
- HEYLER, D. (1976): Sur le genre Amblypterus Agassiz (Actinoptérygien du Permien inférieur). Bull. Soc. Hist. Nat. d'Autun, 78, 17—37. Autun.
- KAZANCEVA, A. A.—SELEZNEVA (1981): Pozdněpaleozoiskie paleoniski vostočnovno Kazachstana. Trudy Paleont. Inst. (Akad. Nauk SSSR Moskva), 180, 1—140. Moskva.
- KUŠTA, J. (1879): Der Brandschiefer von Herrendorf bei Rakonitz. Verhandl. der k.k. geol. Reichsanst. Wien.
- KUŠTA, J. (1880): O geologických poměrech pánve rakovnické. Sitz.-Ber. kön. böhm. Gessel. der Wissensch. Prag, 161—186. Praha.
- LEHMAN, J. P. (1966): Actinopterygii. I.: Piveteau J.: Traité de Paléontologie, 4, vol. 3, 1—242. Masson. Paris.
- MILNER, A. R. (1980): The tetrapod Assamblage from Nýřany, Czechoslovakia. In: A. L. Panchen (ed.): Terrestrial Environment and the Origin of Land Vertebrates. Academic Press, 439 to 496. London.

- MOY-THOMAS, J. A., DYNE, B. (1938): The Actinopterygian Fishes from the Lower Carboniferous of Glencartholm, Eskdale, Dumfriesshire. *Trans. Roy. Soc.*, **59**, (17), 437—480. Edinburgh.
- MOY-THOMAS, J. A., MILES, R. S. (1971): *Palaeozoic Fishes*, 2nd ed. Chapman and Hall. London.
- NIELSEN, E. (1942): Studies on Triassic fishes from East Greenland. 1. *Glaucolepis* and *Boreosomus*. *Meddr. Gronl.*, (Palaeozoologica Groenlandica, 1), **138**, 1—403. Kobenhavn.
- NIELSEN, E. (1949): Studies on Triassic fishes from East Greenland. 2. *Australosomus* and *Birgeria*. *Meddr. Gronl.* (Palaeozoologica Groenlandica, 3), **146**, 1—309. Kobenhavn.
- OLSON, E. C. (1967): Early Permian vertebrates of Oklahoma. *Okla. geol. surv. Circ.*, **74**, 1—111. Norman.
- ORVIG, T. (1978): Microstructure and Growth of the dermal Skeleton in Fossil Actinopterygian Fishes: *Nephrotus* and *Colobodus*, with Remarks on the Dentition of Other Forms. *Zool. Scripta*, **7**, 297—326. Stockholm.
- POPLIN, C. (1974): Étude de quelques Paléoniscidés Pennsylvaniens du Kansas. *Cah. Paléont.*, 1—151. Paris.
- PURKYNĚ, C. (1902): Nýřanská a radnická sloj u Třemošné. *Rozpr. Čes. Akad. Věd, Tř. 2. math. přírodn.*, **11**, 8. Praha.
- RAYNER, D. H. (1951): On the cranial structure of an early palaeoniscid, *Kentuckia*, gen. nov. *Trans. Roy. Soc. Edinb.*, **62**, 53—83. Edinburgh.
- ROMER, A. S. (1945): The late carboniferous vertebrate fauna of Kounova (Bohemia) compared with that of the Texas Redbeds. *Amer. Journ. of Sciences*, **243**, (8), 417—442. New Haven.
- STENSIÖ, E. A. (1921): Triassic Fishes from Spitzbergen. Adolf Holzhausen Edit. Wien.
- ŠTAMBERG, S. (1978): New data on *Pyritocephalus sculptus* (Pisces) from the Carboniferous of the Plzeň basin. *Paleontol. konference "77"* — Univ. Karlova, 275—288. Praha.
- ŠTAMBERG, S. (1983): Revision of the genus *Scletophorus* (Actinopterygii) from the Carboniferous of the Plzeň basin. *Acta mus. Reginahradecensis S. A*, **18**, 43—74. Hradec Králové.
- ŠTAMBERG, S. (1986): Poissons Permocarboneux de Tchécoslovaquie. *Bull. Soc. Hist. Nat. Autun*, 99—113. Autun.
- ŠTAMBERG, S. (1986): Fish *Spinarichthys dispersus* (Actinopterygii) from the Carboniferous of Bohemia. *Acta Univ. Carolinae, Geol.*, **2**, 155—169. Praha.
- TRAQUAIR, R. H. (1877—1914): *The Ganoid Fishes of the British Carboniferous Formations. I. Palaeoniscidae*. Palaeontographical Soc. London.
- TRAQUAIR, R. H. (1881): Notice of New Fish Remains from the Blackband Ironstone of Borough Lee, near Edinburgh. *Geol. Mag.*, **2**, (8), 34—37. London.
- WESTOLL, T. S. (1934): The Permian Palaeoniscid Fishes of Northumberland and Durham. *Dissert. (Manuscript)*. Durham.
- WESTOLL, T. S. (1937): On a remarkable Fish from the Lower Permian of Autun, France. *Ann. Mag. natur. Hist.*, **10**, 19. London.
- WESTOLL, T. S. (1944): The Haplolepididae, a new family of Late Carboniferous Fishes. *Bull. Amer. Mus. natur. Hist.*, **83**, 1—121. New York.
- WOODWARD, A. S. (1891): *Catalogue of the Fossil Fishes in the British Museum (Natural History)* London. Part 2. *Brit. Mus. (Nat. Hist.)*. London.
- ZAJÍC, J., ŠTAMBERG, S. (1985): Summary of the Permocarboneous freshwater fauna of the limnic basins of Bohemia and Moravia. — *Acta Mus. Reginahradecensis S. A*, **20**, 61 to 82. Hradec Králové.

PLATE I.

Watsonichthys krejci (FRITSCH, 1895)Fig. 1. Holotype, M 1208, \times 1.3.Fig. 2. Head with the proximal part of pectoral fin. M 1208, \times 2.0.

PLATE II.

Watsonichthys krejci (FRITSCH, 1895)Fig. 1. Dermal cover of the gill arches and pectoral girdle. Whitened, M 1208, \times 4.5.Fig. 2. Anterior flank scales in lateral view. Whitened, M 1208, \times 4.5.

PLATE III.

Watsonichthys krejci (FRITSCH, 1895)Fig. 1. Pectoral and pelvic fins. Whitened, M 1208, \times 3.0.Fig. 2. Anal fin. Whitened, M 1208, \times 4.5.

PLATE IV.

Watsonichthys sphaerosideritarum (FRITSCH, 1895). Holotype, M 889, \times 1.3.

PLATE V.

Progyrolepis speciosus (FRIČ, 1875). Dermal bones of the skull roof, palatomaxillary apparatus, lower jaw. Lectotype, M 1217, \times 1.5. Compare with fig. 14 in text.

Fig. 1. Non whitened.

Fig. 2. Whitened.

PLATE VI.

Progyrolepis speciosus (FRIČ, 1875).Fig. 1. Skull roof, nasal, postrostral and oral part of palatoquadrate. Whitened, M 1217, \times 4.2.Fig. 2. Oral part of the lower jaw. Lateral view. M 884, \times 3.1.

PLATE VII.

Progyrolepis speciosus (FRIČ, 1875).Fig. 1. Dermal bones of the palatomaxillary apparatus and hyomandibular. Compare with fig. 19 in text. Lateral view. Whitened, M 823, \times 1.7.Fig. 2. Os suborbitale. Oral part of lateral surface of the bone is without the sculpture. Lateral view. Whitened, M 1217, \times 5.0.Fig. 3. Teeth on lower jaw. Lateral view. M 884, \times 6.0.

PLATE VIII.

Progyrolepis speciosus (FRIČ, 1875).Fig. 1. Maxilla with teeth and part of the palatoquadrate. Lateral view. Whitened, M 1217, \times 5.0.Fig. 2. Sculpture on lateral surface of dentalosplenic. Whitened, M 1217, \times 6.0.

PLATE IX.

Progyrolepis speciosus (FRIČ, 1875).Fig. 1. Lower jaw with the teeth. Lateral view. Whitened, M 2074, \times 4.5.Fig. 2. Detail of the sculpture on the lower jaw. Whitened, M 2074, \times 8.0.

PLATE X.

Zaborichthys fragmentalis n. sp. Holotype, M 2066.Fig. 1. Dermal bones of head. Compare with text. fig. 24, \times 1.8.Fig. 2. Supracleithrum in medial view, frontal in dorsal view, \times 3.1.

PLATE XI.

Zaborichthys fragmentalis n. sp. Whitened, M 2065.Fig. 1. Opercular in lateral view, \times 5.2.Fig. 2. Subopercular in lateral view, \times 5.2.Fig. 3. Scales with peg and socket articulation, \times 8.0.

PLATE XII.

Acrolepis gigas (FRIČ, 1877). Lectotype, M 125, \times 0.2.

PLATE XIII.

Acrolepis gigas (FRIČ, 1877). Head and oral part of the trunk. Lectotype, M 125, \times 0.7.

PLATE XIV.

Acrolepis gigas (FRIČ, 1877).

Fig. 1. Scales in medial view with peg and socket articulation. Whitened, M 1211, \times 4.3.

Fig. 2. Ridge scale in dorsal view. Whitened, M 1209, \times 4.8.

Fig. 3. Sculpture on flank scales. Lateral view. Whitened, M 1211, \times 4.8.

PLATE XV.

Acrolepis gigas (FRIČ, 1877). Scales in lateral view. Whitened, M 125, \times 3.0.

Fig. 1. Scales from rows 12 and 13.

Fig. 2. Scales from rows 34 and 35.

Fig. 3. Scales from rows 80—82 (from caudal peduncle).

Fig. 4. Scales from rows 48—49 on ventral part of the trunk.

PLATE XVI.

Sphaerolepis kounoviensis FRIČ, 1875.

Fig. 1. Teeth on lower jaw. Lateral view. M 1199, \times 15.

Fig. 2. Dermal bones of skull roof. Cast of the lectotype. Whitened, M 1197, \times 10.

PLATE XVII.

Sphaerolepis kounoviensis FRIČ, 1875.

Fig. 1. Opercular apparatus, palatamaxillary apparatus, hyoid arch and pectoral girdle. Whitened, M 822, \times 7.0.

Fig. 2. Cleithrum in medial view and postrostral in oral view. Whitened, M 816, \times 5.5.

Fig. 3. Cleithrum in lateral view. Whitened, M 816, \times 5.5.

PLATE XVIII.

Sphaerolepis kounoviensis FRIČ, 1875. Maxilla and lower jaw in lateral view. Whitened.

Fig. 1. Cast of the lectotype. M 197, \times 8.0.

Fig. 2. Lectotype M 1198, \times 8.0.

PLATE XIX.

Sceletophorus biserialis FRITSCH, 1895.

Fig. 1. M 1265. In etylalcohol, \times 2.6.

Fig. 2. M 1264. In etylalcohol, \times 3.8.

PLATE XX.

Sceletophorus biserialis FRITSCH, 1895.

Fig. 1. M 1202. Whitened, \times 2.5.

Fig. 2. M 1262. Whitened, \times 1.8.

PLATE XXI.

Sceletophorus verrucosus (FRITSCH, 1895).

Lectotype, M 1205. In etylalcohol, \times 1.2.

PLATE XXII.

Spinarichthys dispersus (FRITSCH, 1895).

Fig. 1. Holotype. Whitened, M 814, \times 5.0.

Fig. 2. Anterior flank scale with lateral sensory canal. Lateral view. In etylalcohol, M 2068, \times 6.0.

Fig. 3. Scale in medial view. In etylalcohol, M 2067, \times 9.0.

PLATE XXIII.

Spinarichthys dispersus (FRITSCH, 1895).

Fig. 1. Upper and lower jaws with teeth. Whitened, M 2066, \times 7.5.

Fig. 2. Part of head and trunk. Cast of the holotype. Whitened, M 1200, \times 5.0.

PLATE XXIV.

Pyritocephalus sculptus (FRITSCH, 1883).

Fig. 1. Skull roof and opercular. Whitened, M 2076, \times 5.0.

Fig. 2. Dermal bones of head. Whitened, M 2077, \times 4.2.

All photographs by the author.

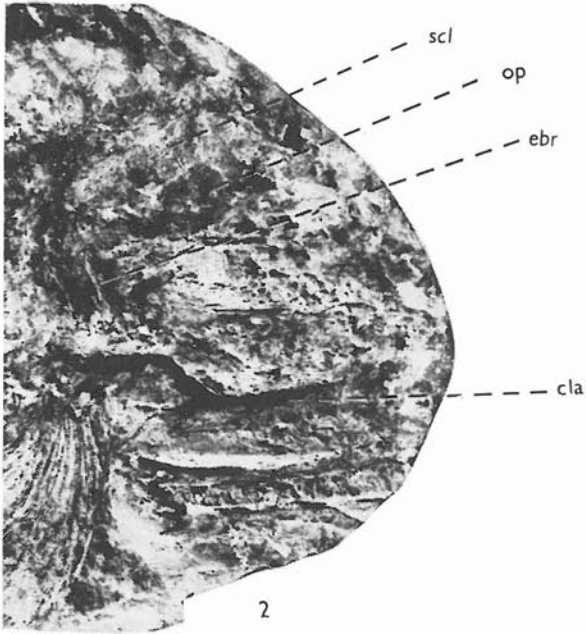
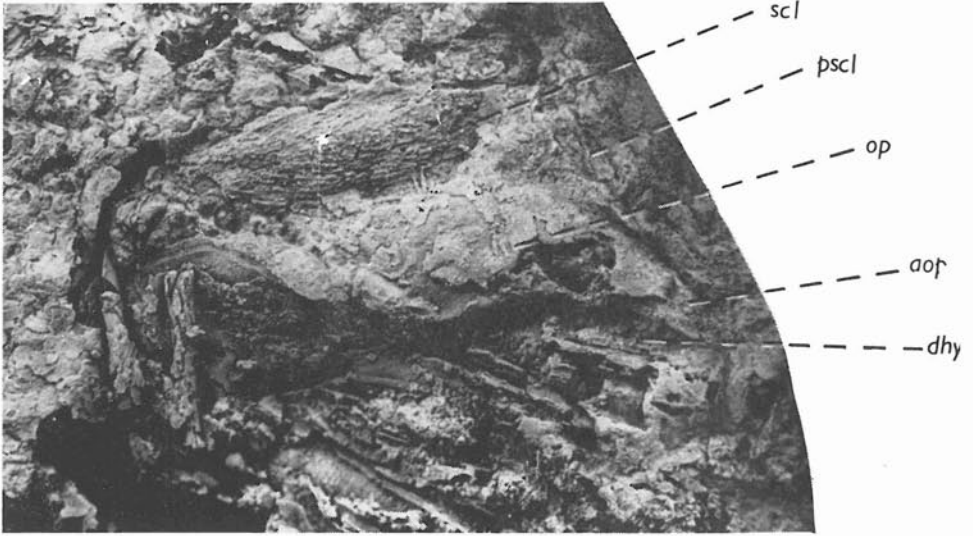


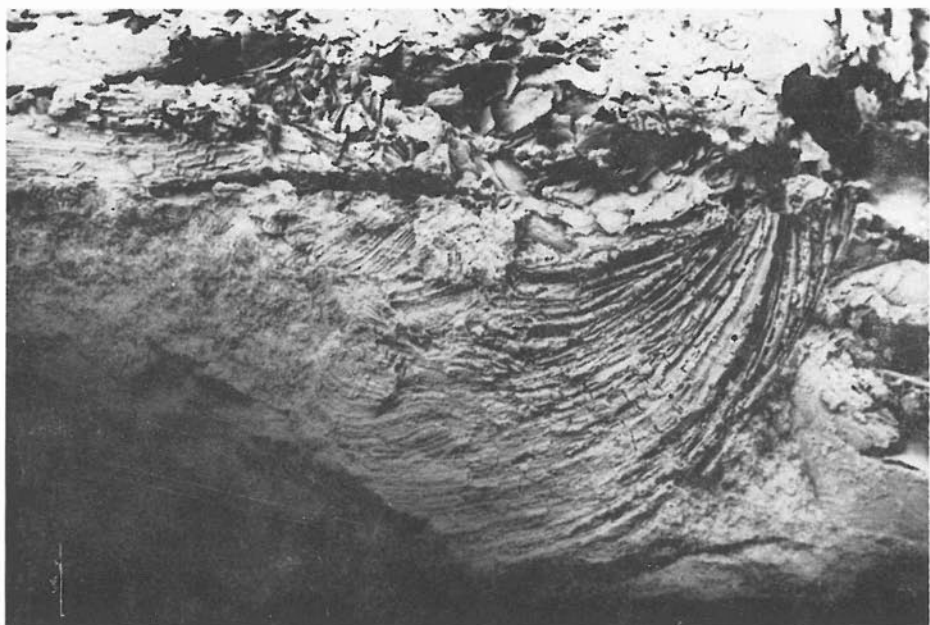
Plate I



1
2



Plate II



1
2

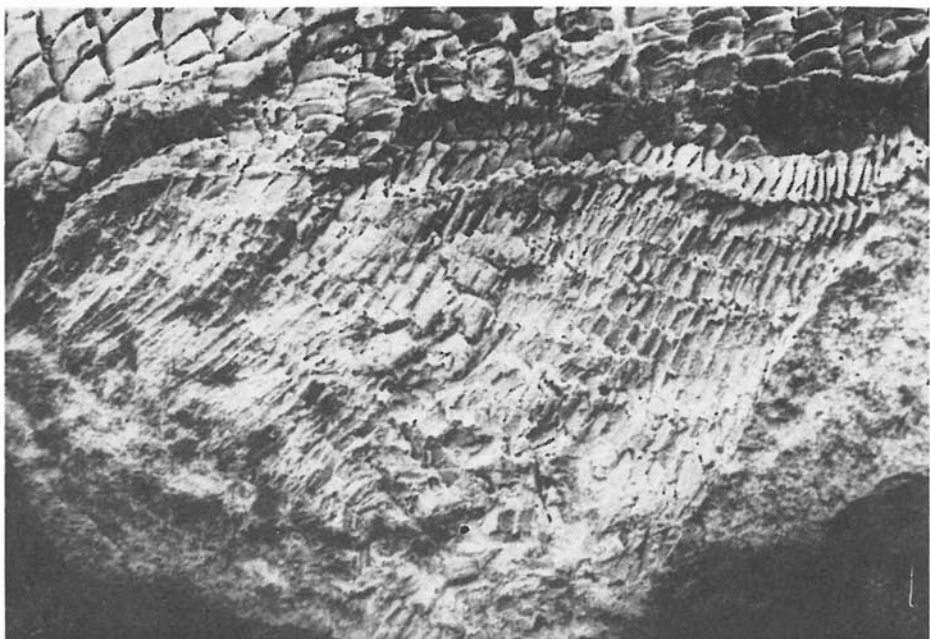


Plate III



Plate IV



1
2

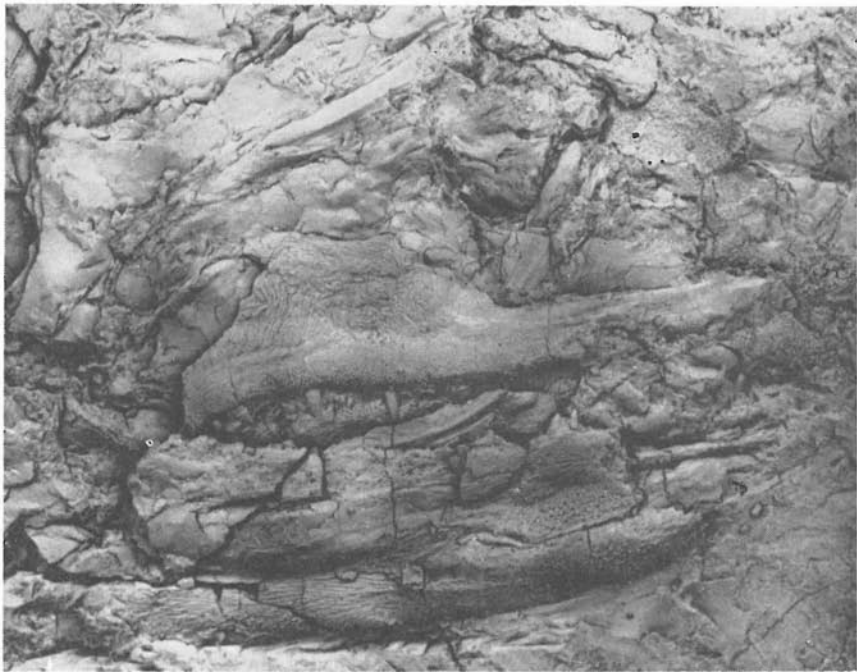
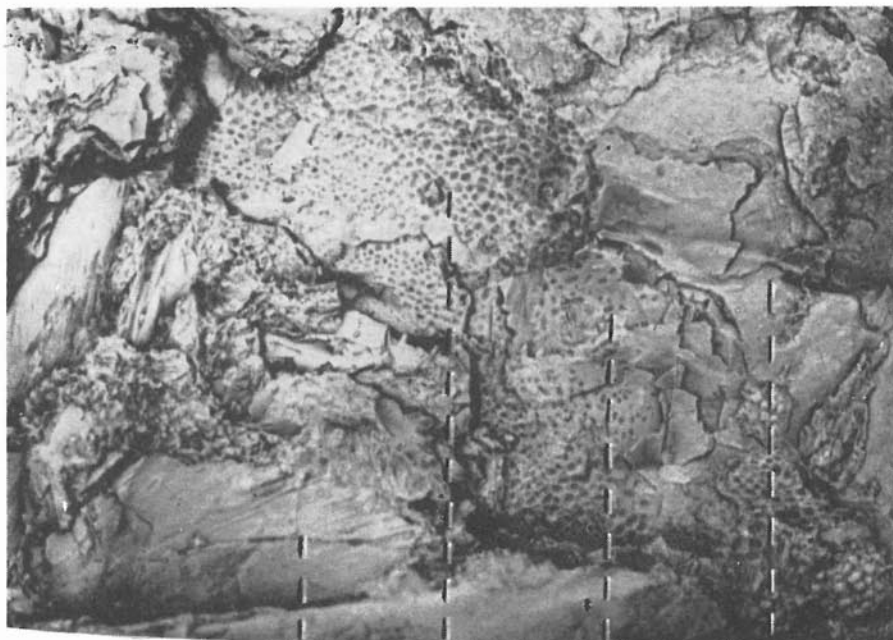


Plate V



1

pq

fr

na

ptr

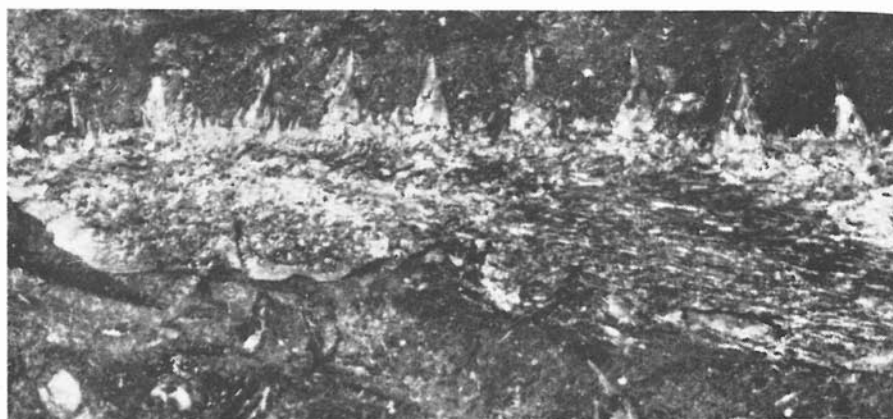


Plate VI

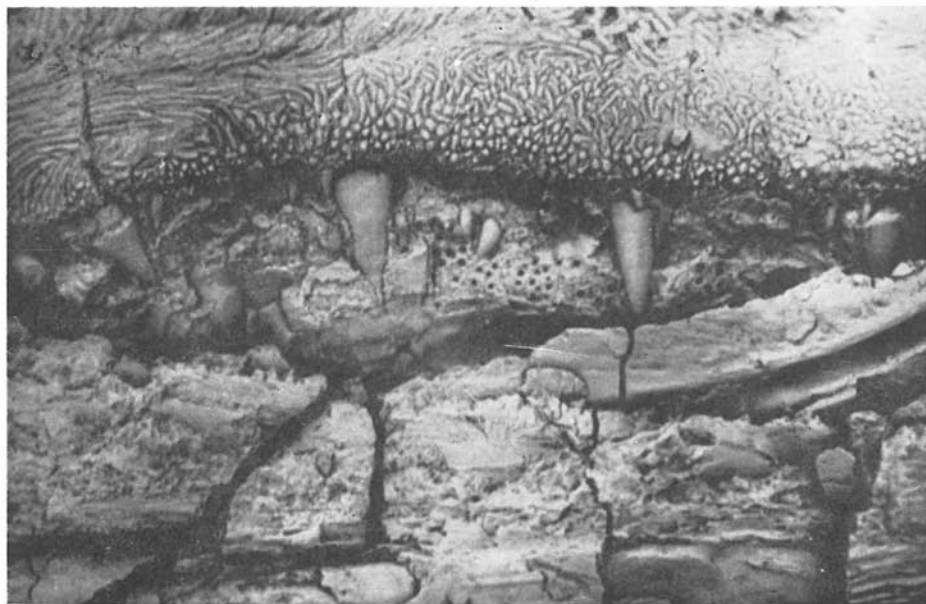


1



2 3

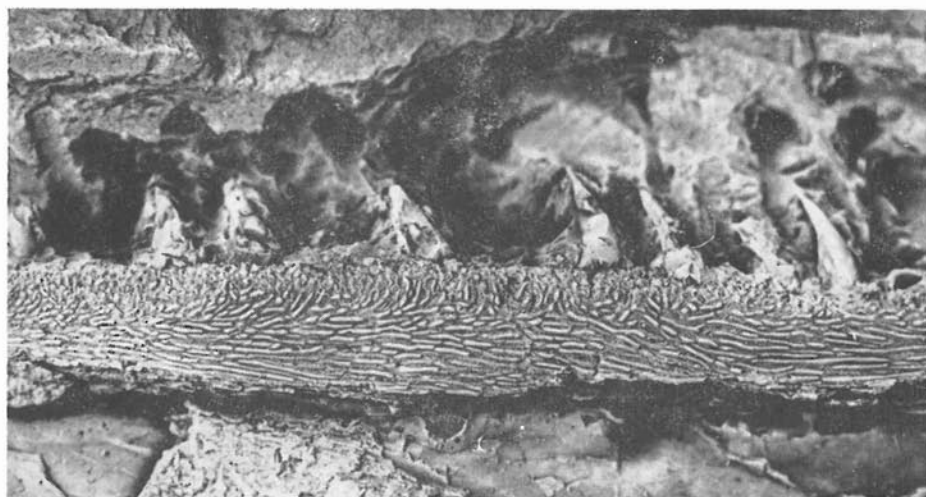




1
2

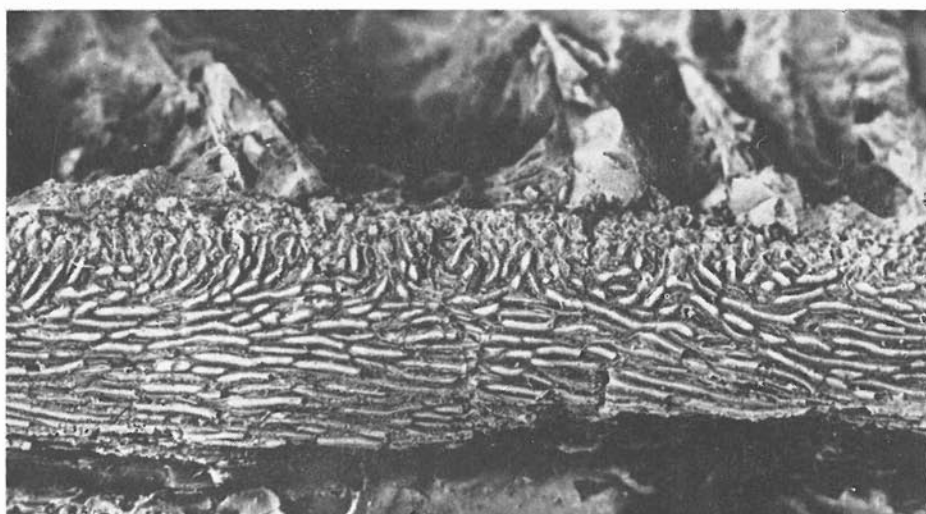


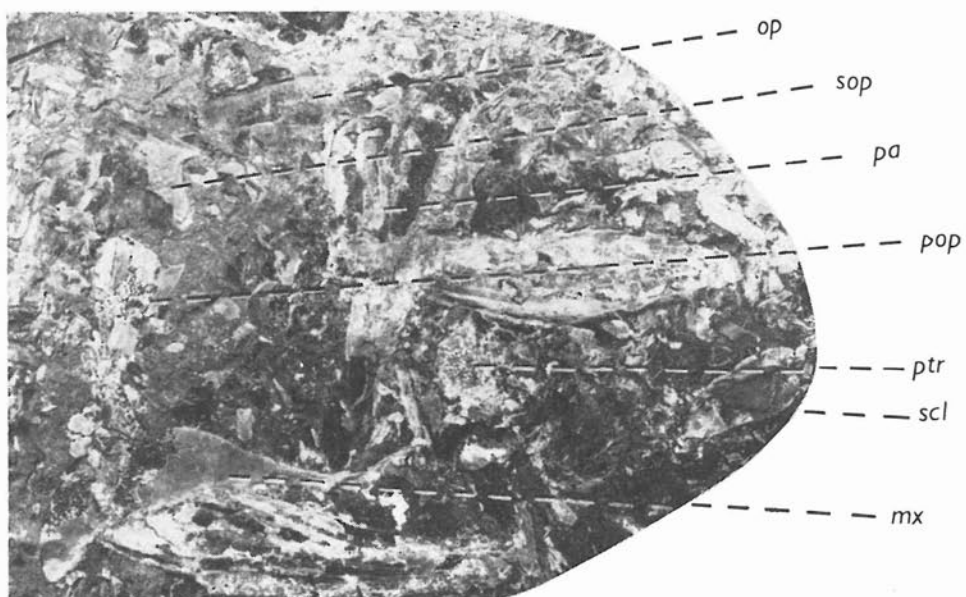
Plate VIII



1

2





1

2

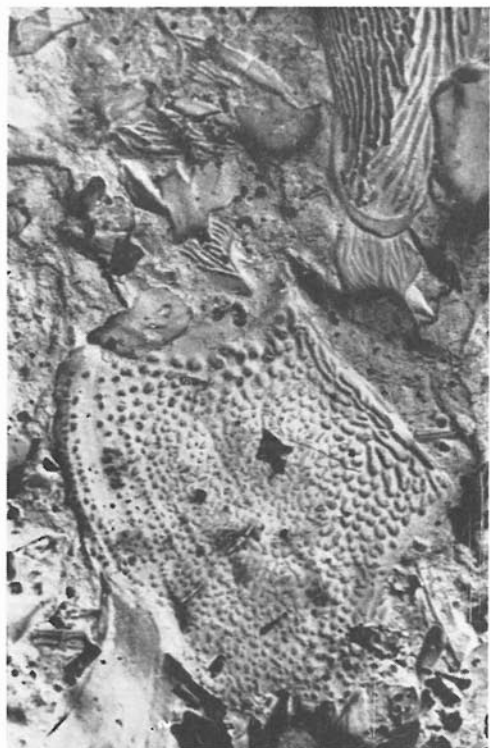


scl

fr



1



2



3



Plate XII

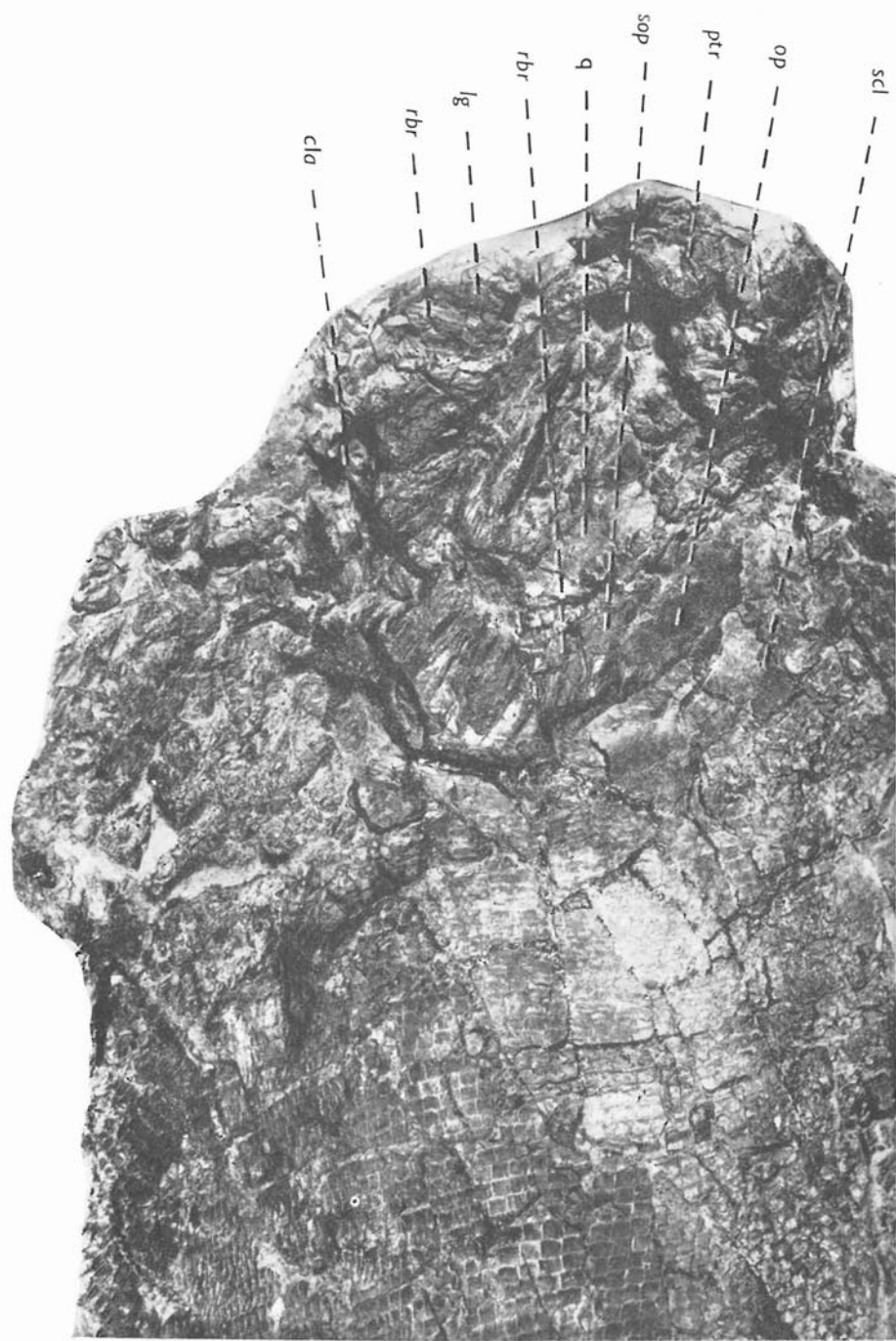


Plate XIII



1
3



2

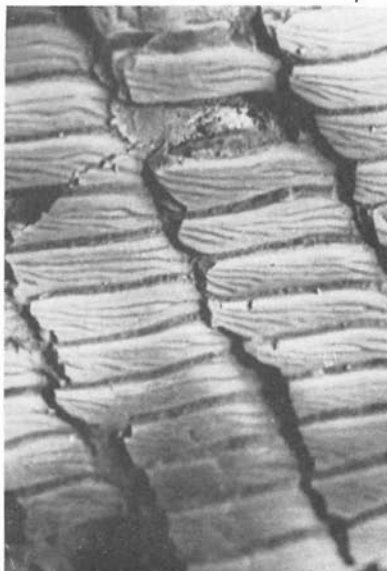
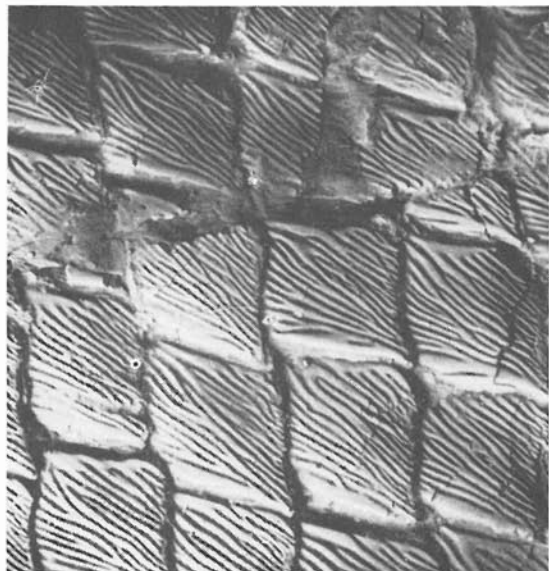




1
2



3
4



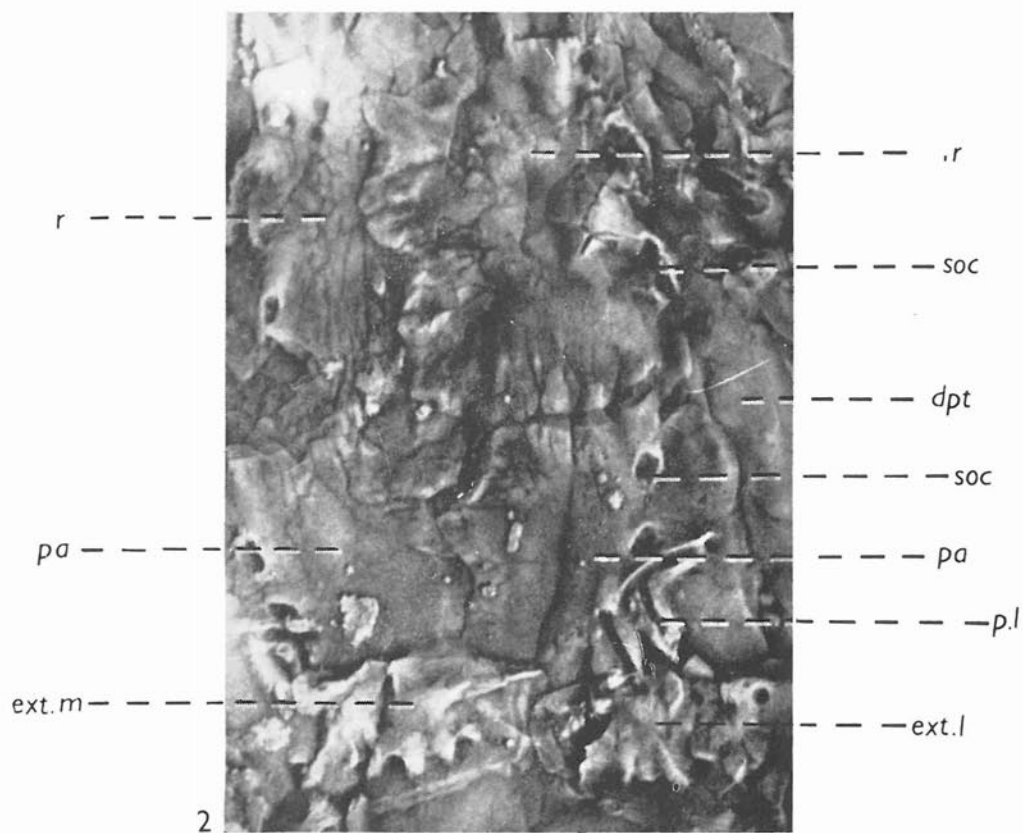


Plate XVI

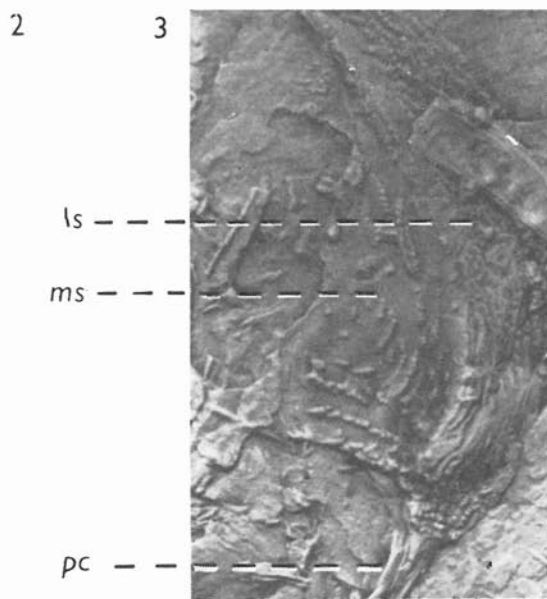
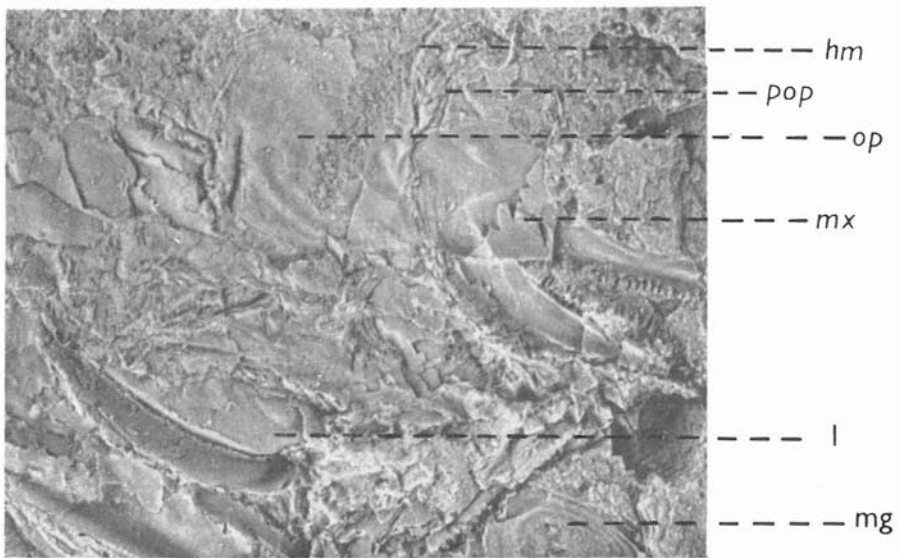
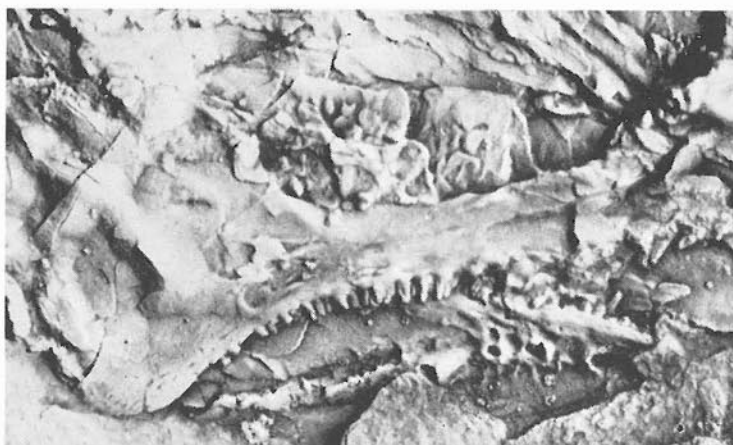


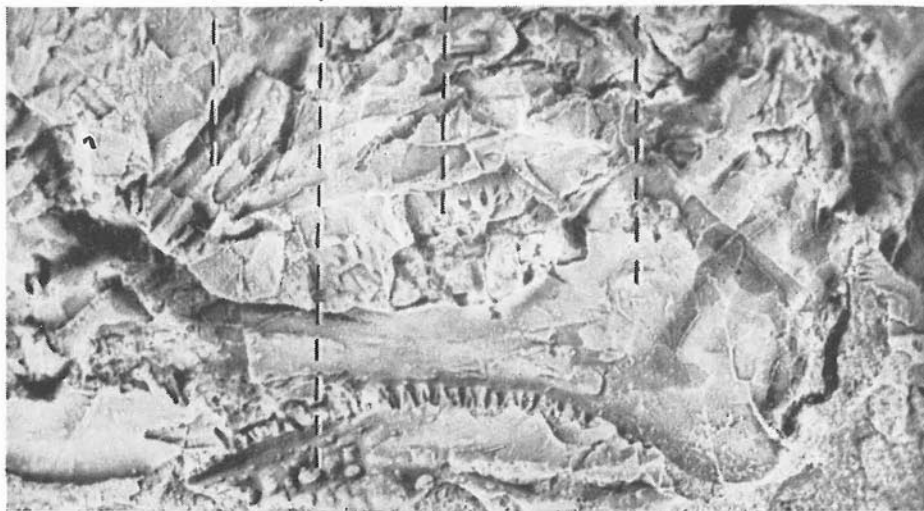
Plate XVII

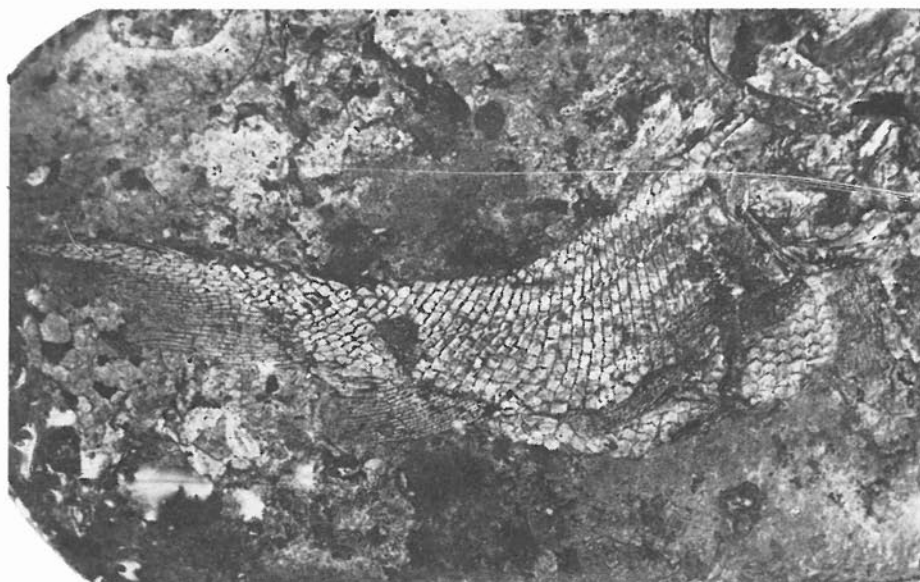


1

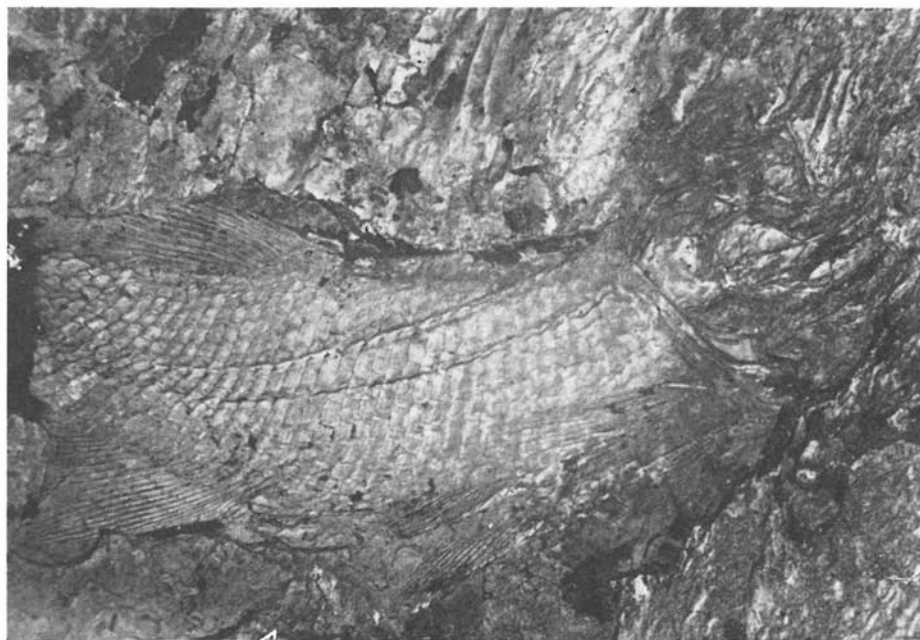
psph
ju
mdc
mx

2





1



2

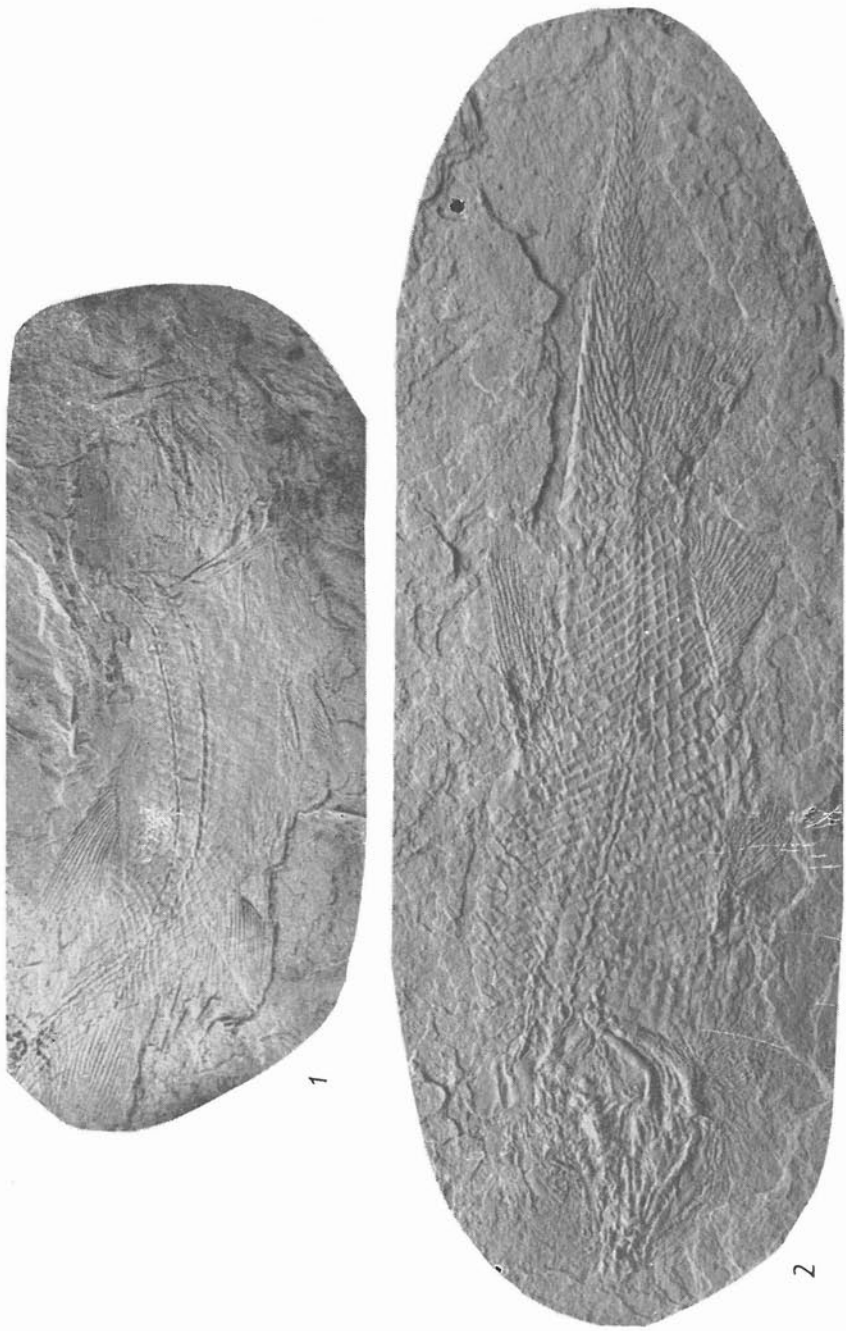


Plate XX



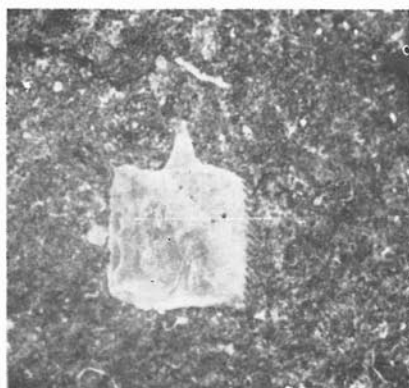
Plate XXI



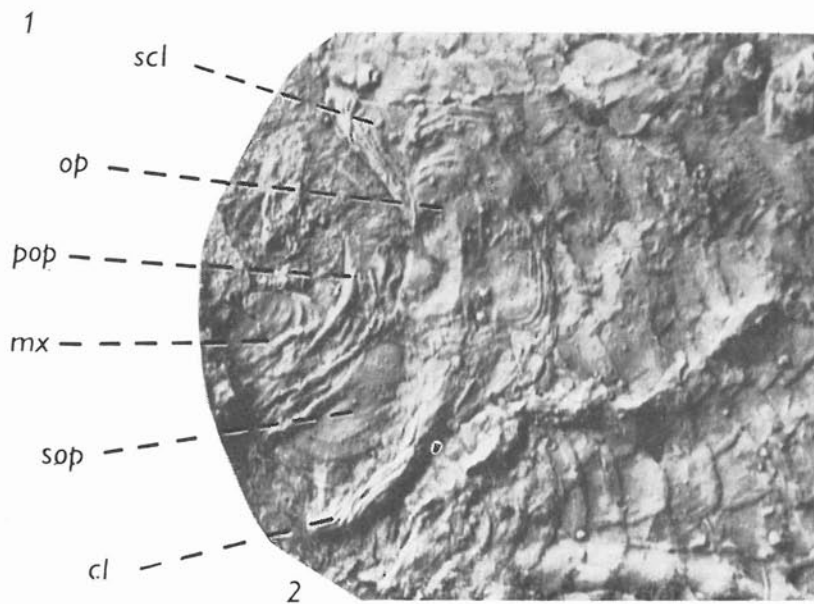
1

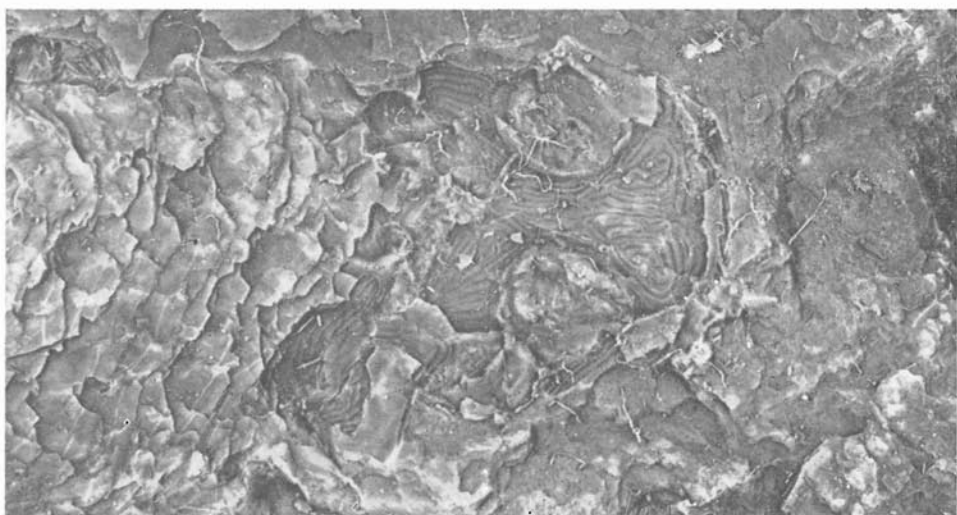


2

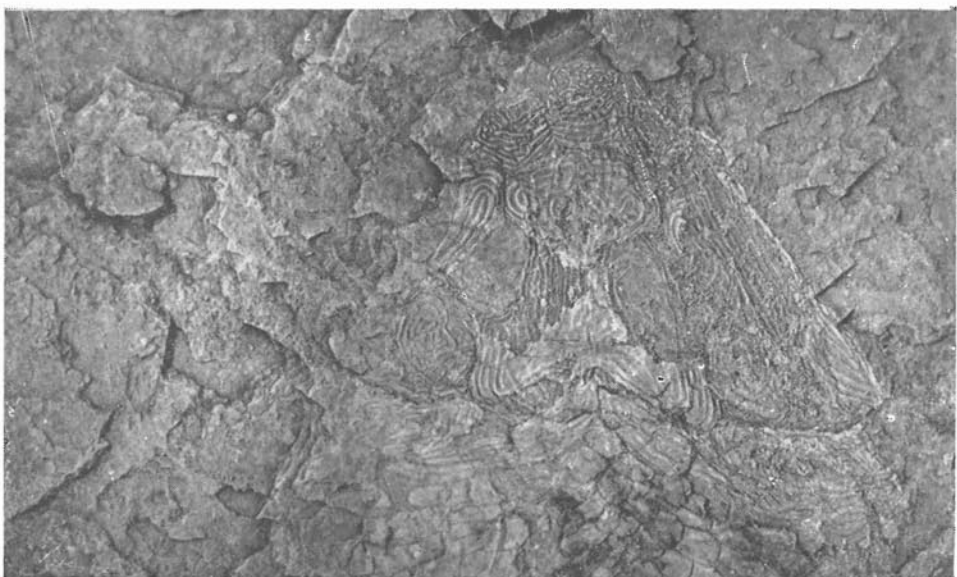


3





1



2