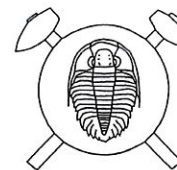


## New discoveries of palaeoniscoid fishes and other fauna and flora from the northern region of Boskovice Furrow, Czech Republic



Nové nálezy paleoniskoidních ryb a další fauny a flóry ze severní části Boskovické brázdy (Czech summary)

(3 text-figs., 4 plates)

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The Upper Carboniferous and Permian sediments have been object of interests to paleontologists for more than a hundred years. Much attention has been paid to the study of discosauriscid amphibians. Article summarizes new discoveries of palaeoniscoid fishes and other fauna and flora from the northern region of Boskovice Furrow. The finds on new localities and new methods of their preparation make possible the study of anatomy of palaeoniscoids in detail, also the historical data about palaeoniscoids are revised. Anatomy of the upper and lower jaws, dentition on the jaws formed by tubular teeth and well developed supraorbitale anterior are the main features typical for the genus *Paramblypterus* Sauvage, 1888.

**Key words:** fauna, palaeoniscoids, *Paramblypterus*, flora, Lower Permian, Boskovice Furrow, Czech Republic

### Introduction

The Boskovice Furrow is the name first introduced in 1902 by E. Tietze for the narrow depression running south-north from Moravský Krumlov through Rosice, Boskovice, Letovice as far as Žamberk. Later, Havlena (1960) named the northern part of this strip between Křenov and Žamberk as the Orlice Basin. The name Boskovice Furrow in the more restricted sense of Havlena (1960) for the narrow depression between Moravský Krumlov and Moravská Třebová filled by Upper Carboniferous and Permian sediments is also used in this paper.

The Upper Carboniferous and Permian sediments have been the object of interest to palaeontologists for more than a hundred years and much attention has been paid, both to the flora, and to the amphibians. The first amphibians were found by Prof. A. Makowsky in 1872 in shales near the village of Malá Lhota and he later described this find as *Archegosaurus austriacus* (Makowsky 1876). These amphibians were later studied mainly by Fritsch (1883), Augusta (1936) and many others and they were assigned to the family *Discosauriscidae*. The most comprehensive study of discosauriscids from the Boskovice Furrow was made by Špinar (1952). They have become the subject of further attention in recent years, thanks to the discovery of new localities and to improved methods of preparation of their skeletons. Studies by J. Klembara (Klembara 1992, 1993, 1995, Klembara - Janiga 1993, Klembara - Mezsároš 1992) have introduced significant new information about their anatomy, taxonomy and palaeoecology.

Other groups of vertebrates, except of palaeoniscoids, from the northern part of Boskovice Furrow are represented by collections of xenacanthids. These were studied by Zidek (1966) and assigned to *Xenacanthus decheni* (Goldfuss, 1847).

### Localities

New material has been collected in the northern region of the Furrow from 1987 onwards. The excavation for a water pipe in the village of Drválovice was the stimulus for me to excavate a more extensive exposure. A quantity of well-preserved palaeoniscoid fishes, discosauriscids and plants were collected. The plant and animal fossils were found mainly in a layer of grey bituminous limestone and an overlying greyish-black or greyish-brown bituminous shale. They were collected in subsequent years from localities north and south of the village of Kochov. The northernmost locality with palaeoniscoids and discosauriscids between the villages of Kochov and Novičí shows the following stratigraphical section (Table 1).

Table 1. Stratigraphical section of the northernmost paleontological locality between the villages Kochov and Novičí

Layer	Thickness	Description
1	60 cm	Reddish-brown strongly micaceous sandstone.
2	40 cm	Conglomerate at the base of the layer, towards to overlying stratum changes into yellowish-brown coarse-grained sandstone. Wet rock is yellowish-green.
3	38 cm	Greyish-black pelocarbonate bituminous shale with undetermined plant pulp. Upper part is greyish-green fine grained and more crumble.
4	1-3 cm	The ochraceous-yellow marly clay with sandy admixture.
5	13 cm	Calcareous laminated shale of greyish-black colour. Splits readily into thin plates with abundant carbonised fishes and plants.
6	0.3 cm	Ochraceous marly clay (as the layer no. 4).
7	15 cm	Calcareous laminated shale of greyish-black colour with abundant fish fossilized by calcium phosphate and plants.
8	1-1.5 cm	Ochraceous-yellow marly clay with sandy admixture.
9	3.5 cm	Greyish-black or light brown calcareous laminated shale splitting readily into thin plates with abundant fish remains.
10	1 cm	Ochraceous-yellow marly clay.
11	0.5 cm	Light-brown laminated shale with fish.
12	0.5 cm	Ochraceous-yellow marly clay.
13	32 cm	Grey bituminous laminated limestone. The most important layer for occurrence of discosauriscids. Palaeoniscoids also present, but not so abundant.



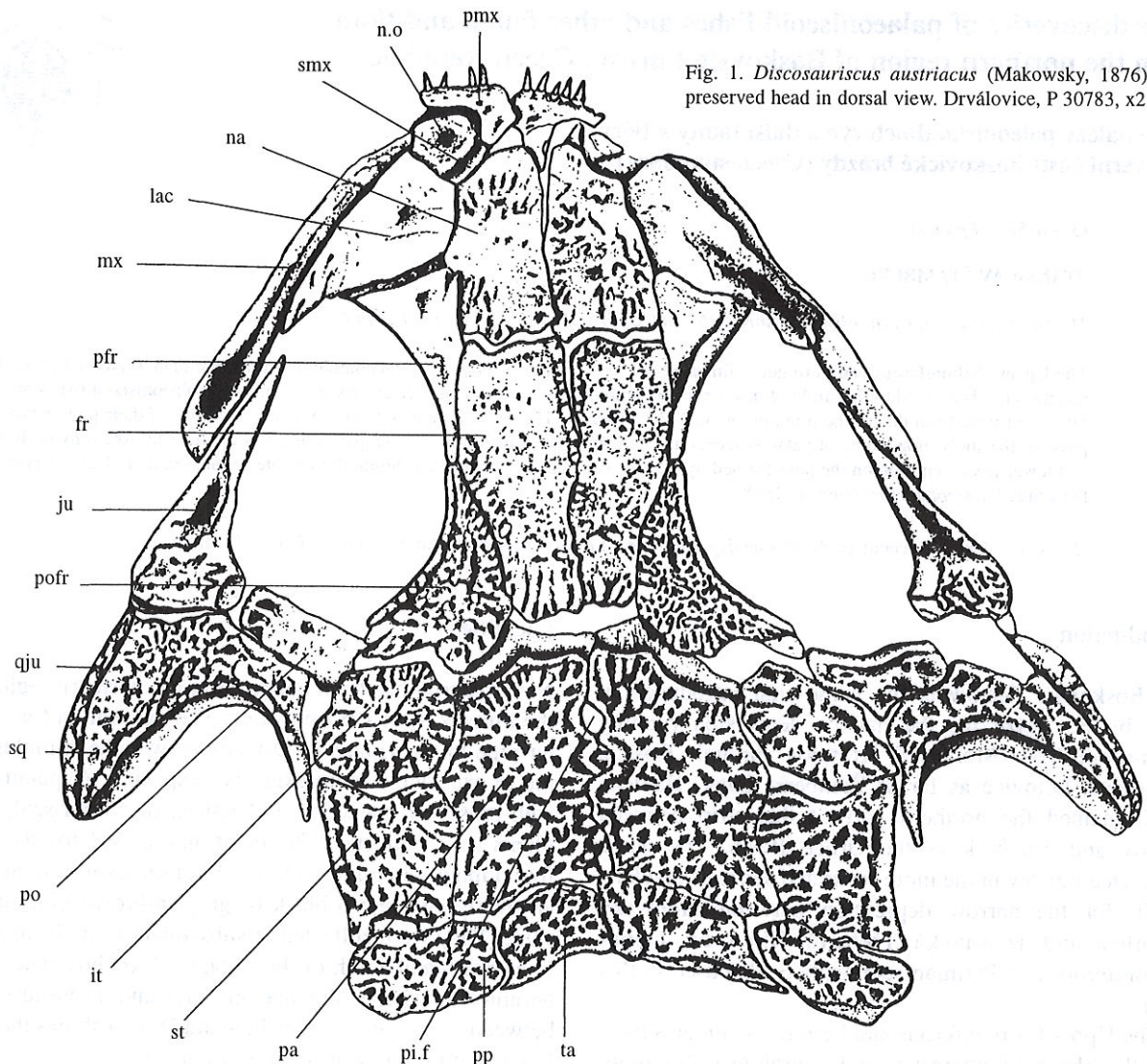


Fig. 1. *Discosauriscus austriacus* (Makowsky, 1876). Well preserved head in dorsal view. Drvalovice, P 30783, x2.3

Used abbreviations:

ang - angular  
cl - cleithrum  
dhy - dermohyal  
dpt - dermopterotic  
dsph - dermosphenotic  
dspl - dentalosphenial  
ectp - ectopterygoid  
ethm - ethmoidal region  
entpt - entopterygoid

ext. l - extrascapular lateral

fr - frontal  
gu. l - gular lateral  
gu. m - gular medial  
it - intertemporal  
inf - infraorbital  
ju - jugal  
lac - lacrimal  
mx - maxillary

na - nasal

n.o - nasal opening  
op - opercular  
pa - parietal  
pfr - prefrontal  
pi. f - pineal foramen  
pmx - premaxillary  
pofr - postfrontal

pop - preopercular

pp - postparietal  
psp - parasphenoid  
pt - posttemporal  
ptr - postrostral  
qj - quadratojugal  
qju - quadratojugal  
r.br - branchiostegal ray  
sbo - suborbital

scl - supracleithrum

smx - septomaxillary  
so.ant - supraorbital anterior  
so. c - supraorbital canal  
sop - subopercular  
spi - spiracular  
sq - squamosal  
st - supratemporal  
ta - tabular

- 14 3 cm Fine grained claystone without fossils.  
15 1-2 cm Laminated grey claystone. Its lower part fills the spaces among nodules of nodular subjacent limestone. Fossils have not been found.  
16 15 cm Grey nodular limestone without fossils.  
17 Greyish-yellow sandstone.

The stratigraphical section at all localities in the vicinity of Drvalovice and Kochov is uniform and is very similar to the section described previously by Havlena and Špinar (1956) in the vicinity of Bačov. The marker bed of the grey bituminous limestone (layer no. 13 on Tab. 1) and

the overlying calcareous laminated shale referred to as "fish beds" (layers no. 7-12 on Tab. 1) have stable development over a relatively large area at localities more than six kilometres apart.

### Fauna and flora

As well as the actinopterygian fishes, which will be discussed later, the following fauna and flora have been found at localities in the vicinity of Kochov and Drvalovice:



Fauna: Conchostraca

Insects (fragments of the wings)

*Xenacanthus* sp. (spines, fragments of skeletons)

*Discosauriscus austriacus* (Makowsky, 1876) and other species of amphibians which are studied by J. Klembara (Comenius University, Bratislava)

Coprolites

Flora:

*Callipteridium gigas*

"*Callipteris*" cf. *woldřichi*

*Pecopteris* cf. *cyathea*

*Pecopteris* sp.

*Pecopteris* cf. *arborescens*

*Supaia* sp.

*Annularia* cf. *mucronata*

*Annularia stellata*

*Autunia conferta*

*Aphlebia* sp.

*Asterophyllites* sp.

*Dichophyllum flabellifera*

*Cordaites* cf. *principalis*

*Walchia pinniformis*

*Carpentieria marrocana*

*Taeniopteris* sp.

*Taeniopteris* cf. *jejunata*

*Palaeonisciformes*

Palaeoniscoid fishes are relatively very abundant in the Lower Permian deposits of the Boskovice Furrow. The first specimens were collected by A. Rzehak in 1875-1880 between the villages of Neslovice and Padochov in the southern region of the Furrow. He described these fishes (Rzehak 1881) under the new species names *Palaeoniscus moravicus* n. sp., *P. katholitzkianus* n. sp., *P. promtus* n. sp. and *P. sp.* (aff. *angustus* A.). The spelling *Palaeoniscus* instead of *Palaeoniscus* was a lapsus calami. He also erected the new genus and species *Anaglyphus insignis* n. gen., n. sp. from Malá Lhota. However no description, figures or reference to the material was published, the only short remark referring to the new genus and species *Anaglyphus insignis* mentioning strongly ornamented scales, undivided lepidotrichia in the pectoral fin, and stout teeth. Rzehak stated that he would describe these Moravian fishes in "Paläontologische Beiträgen", but this publication never appeared. I have tried, without success, to locate the

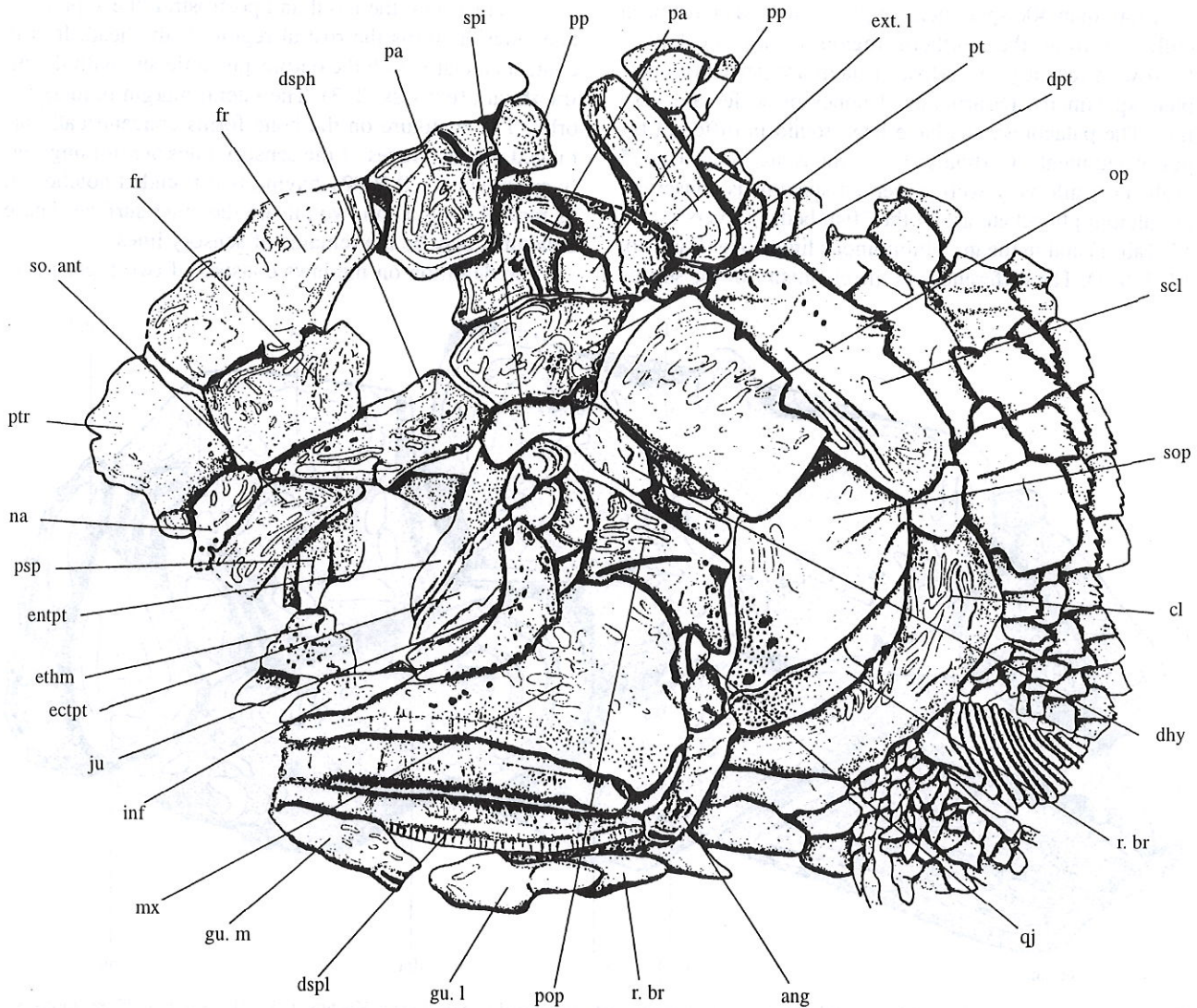


Fig. 2. *Paramblypterus* sp. Dermal bones of the head. Kochov, P 50019, x3.3. For abbreviations, see list on page 112.



specimens which were the basis for Rzehak's study. That material is not present either in the collection of the Masaryk University in Brno, or in the collection of the Museum in Brno. Because the description of the new species was not published and the original material cannot be located, it is necessary to consider these names as nomina nuda.

The same list of species was published in a second paper (Makowsky, Rzehak 1884) with only small modification. *Anaglyphus insignis* is mentioned with the same comment as in the previous paper (Rzehak 1881), and again without any description or figures, the species *Palaeoniscus moravicus*, *P. moravicus* var. *katholitzkyanus* and *P. promptus* were reported.

Palaeoniscoid fishes were frequently collected in the later years, either in the course of geological mapping, or during collection of discosauriscids. Various publications report these records. Sometimes they are assigned to the genera *Amblypterus* or *Palaeoniscus* (Augusta 1931, 1946, 1947, Augusta - Pokorný 1951), but without any more detailed study.

More than 400 specimens of palaeoniscoids have been collected from the northern region of the Boskovice Furrow in recent years. Most of them are partial or complete specimens. Disarticulated bones or scales are very rare. The palaeoniscoids have been found in different types of sediments. Carbonised specimens are in layer no. 5 (Tab. 1), while very well preserved specimens conserved as calcium phosphate are in the "fish beds" (layers no. 7-12, Tab. 1) and in the grey bituminous limestone (layer no. 13, Tab. 1). The differences in the chemistry of the source

rock and the skeletons permitted the preparation of fossils utilizing dilute acetic acid. This method, as used by Špinar (1952, 1958) for the preparation of skeletons of discosauriscids and in recent years improved by Klembara and Mezsároš (1992) for the same purpose, has also given good results in the preparation of palaeoniscoids from the limestone. To date, more than 100 well prepared fragments or whole skeletons of palaeoniscoids are being studied. This material includes small juvenile palaeoniscoids, not more than 3.5 cm in total length, with no developed squamation, up to specimens of about 22 cm total length with well ossified scales and bones. On all skeletons which are sufficiently well preserved, it is possible to distinguish two main features typical for the genus *Paramblypterus* Sauvage, 1888:

1. Well developed supraorbitale anterior.
2. Dentition on the lower and upper jaws formed by tubular teeth.

These two features, very exceptional among palaeoniscoids, have been studied in great detail on our material, thanks to well prepared specimens.

Together with the nasal and postrostral, the supraorbitale anterior forms the rostral region of the head. It is in contact caudally with the dermosphenotic and with the infraorbital (Text-figs. 2, 3). The lateral margin borders the orbit. The sculpture on the bone forms concentrically arranged ridges. Traces of the sensory lines are missing, only specimen no. P 50021 having two rounded notches on its medial margin and two pits on the outer surface. These structures may be the remains of sensory lines.

The dentition on the jaws consists of two types of te-

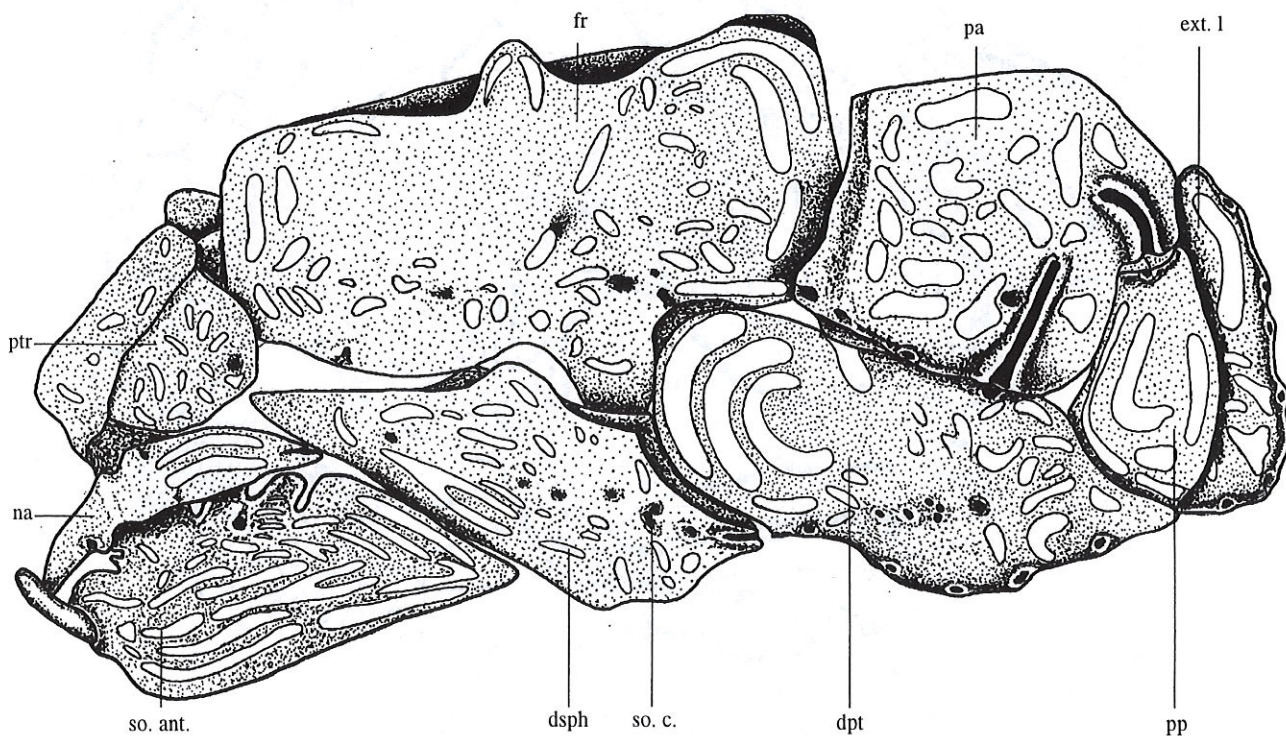


Fig. 3. *Paramblypterus* sp. Dermal bones of the skull roof and rostral part of the head in dorsal view. Kočov, P 50021, x8.0. For abbreviations, see list on page 112.



eth and is well preserved on a number of specimens. The prearticular and dermopalatines bear 0.3-0.4 mm long bluntly pointed teeth. They are firmly joined to the bone. The second type are tubular teeth (Blot and Heyler 1963, Blot 1966, Heyler 1969, Štamberg 1982) consisting of 1.5 mm long tube-like structures (tubules) which are found in specimens of about 15 cm total length. On the tops of the tubules are attached very small, slender, often moderately curved, sharp pointed crowns which are about 0.2 mm long. The location of the tubular teeth on the jaws is also very conspicuous. It may be described briefly, as seen on the lower jaw no. P 50019. The dentalosplenic forms on the lateral side of the lower jaw space and is bordered dorsally by the prearticular and other coronoid bones. This space is filled up by the tubules attached to the inner face of the dentalosplenic. The tubules grow dorsally up to the level of the coronoids and on the outer end of the tubules are attached the crowns. These teeth fill up the space between the lateral margin of the coronoids and the dorsal region of the very thin lateral wall of the dentalosplenic.

The lower jaw shows several exceptional osteological features. One of them is the construction of its caudal region which forms a large dorsocaudal process. This process is composed of a caudal ossification of the Meckelian cartilage and two dermal bones, namely the angular and supraangular (Text-fig. 2).

As well as the two important features shared by the palaeoniscoids of the northern region of the Boskovice Furrow which permit their assignment to the genus *Paramblypterus*, there are several differences within the material collected. It is possible to distinguish three different body-shapes, and different shapes of the maxillary, the opercular bones and the bones of the skull roof. At present it is uncertain whether these differences have some taxonomical value or they are a by-product of deformation in the course of fossilization. Study of this three-dimensional material is generating new information about the anatomy of palaeoniscoids including the endocranial structures. The results of these studies will be consecutively published in the next few years.

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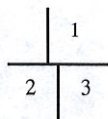
## Nové nálezy paleoniskoidních ryb a další fauny a flóry ze severní části Boskovické brázdy

Sedimenty svrchního karbonu a permu Boskovické brázdy jsou objektem studia paleontologů již více než sto let. V popředí zájmu byli vždy především diskosauriscidní obojživelníci. V článku jsou shrnuty nové nálezy fauny a flóry v severní části Boskovické brázdy z posledních několika let a zároveň jsou revidovány historické údaje o paleoniskoidních rybách. Nálezy na nových lokalitách a nové metody preparace umožňují detailní poznání paleoniskoidů z Boskovické brázdy. Stavba svrchní a spodní čelisti, ozubení na čelistech tvořené tubulárními zuby a přítomnost kosti superorbitale anterior jsou hlavními znaky, které řadí paleoniskoidy Boskovické brázdy do rodu *Paramblypterus* Sauvage, 1888.



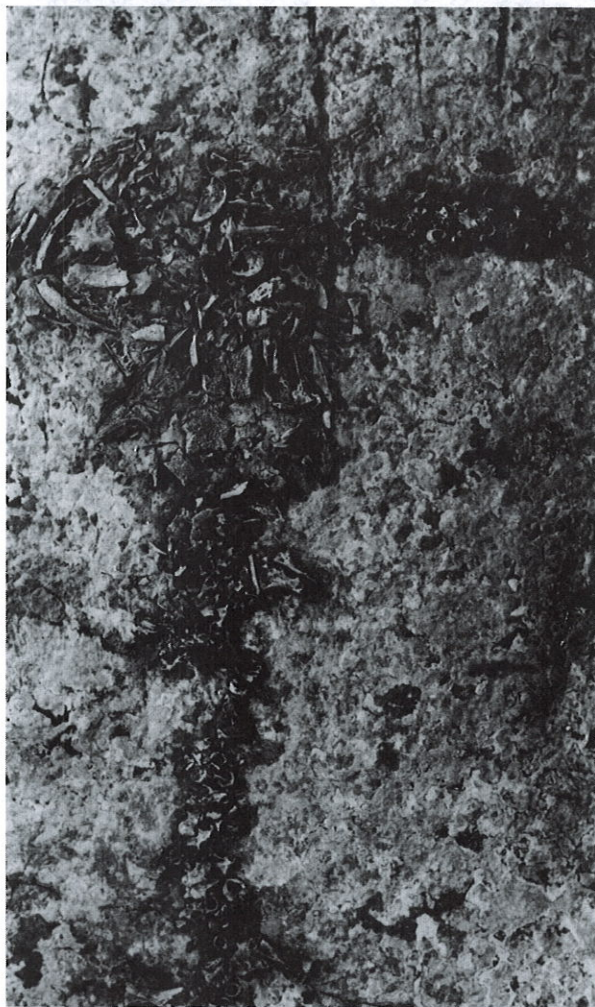
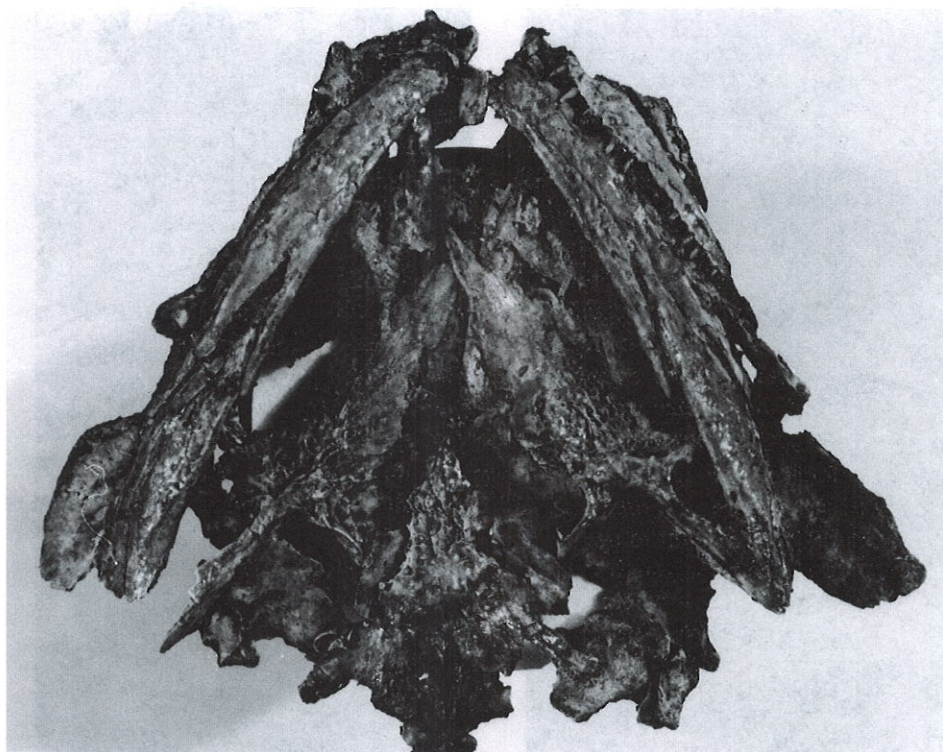
Material is deposited in the Regional Museum of Eastern Bohemia at Hradec Králové.

*Photos by the author.*

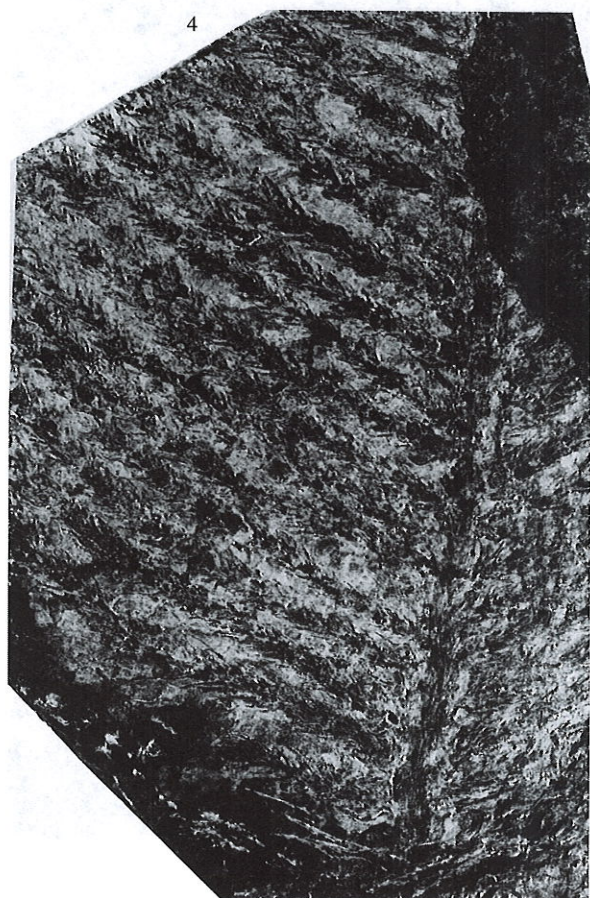
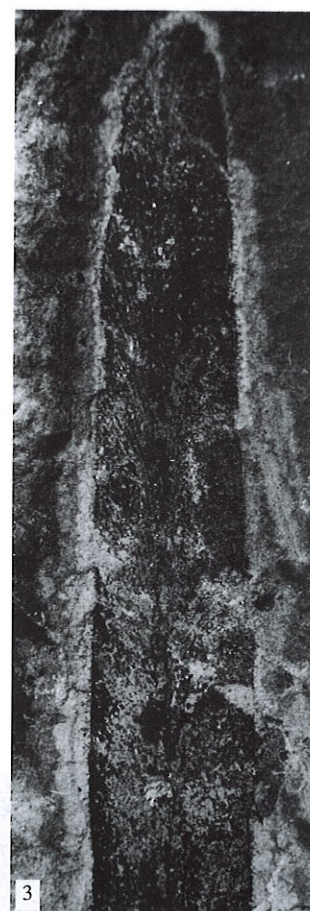
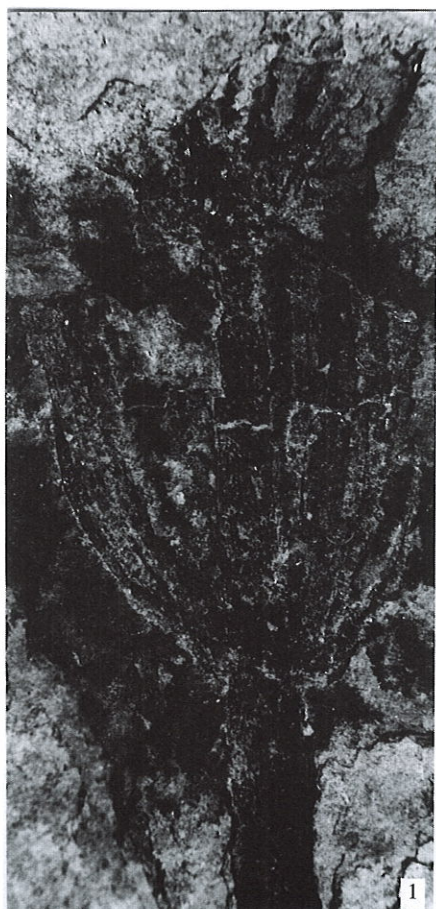


*Discosauriscus austriacus*  
(Makowsky, 1876).

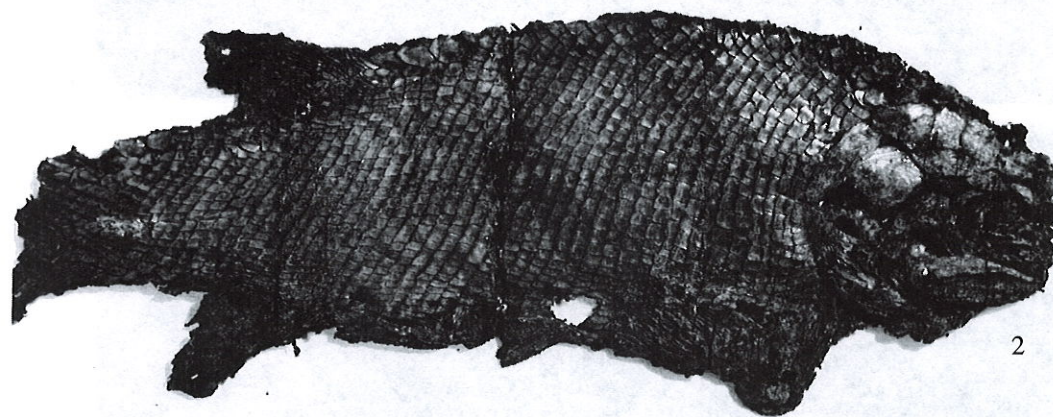
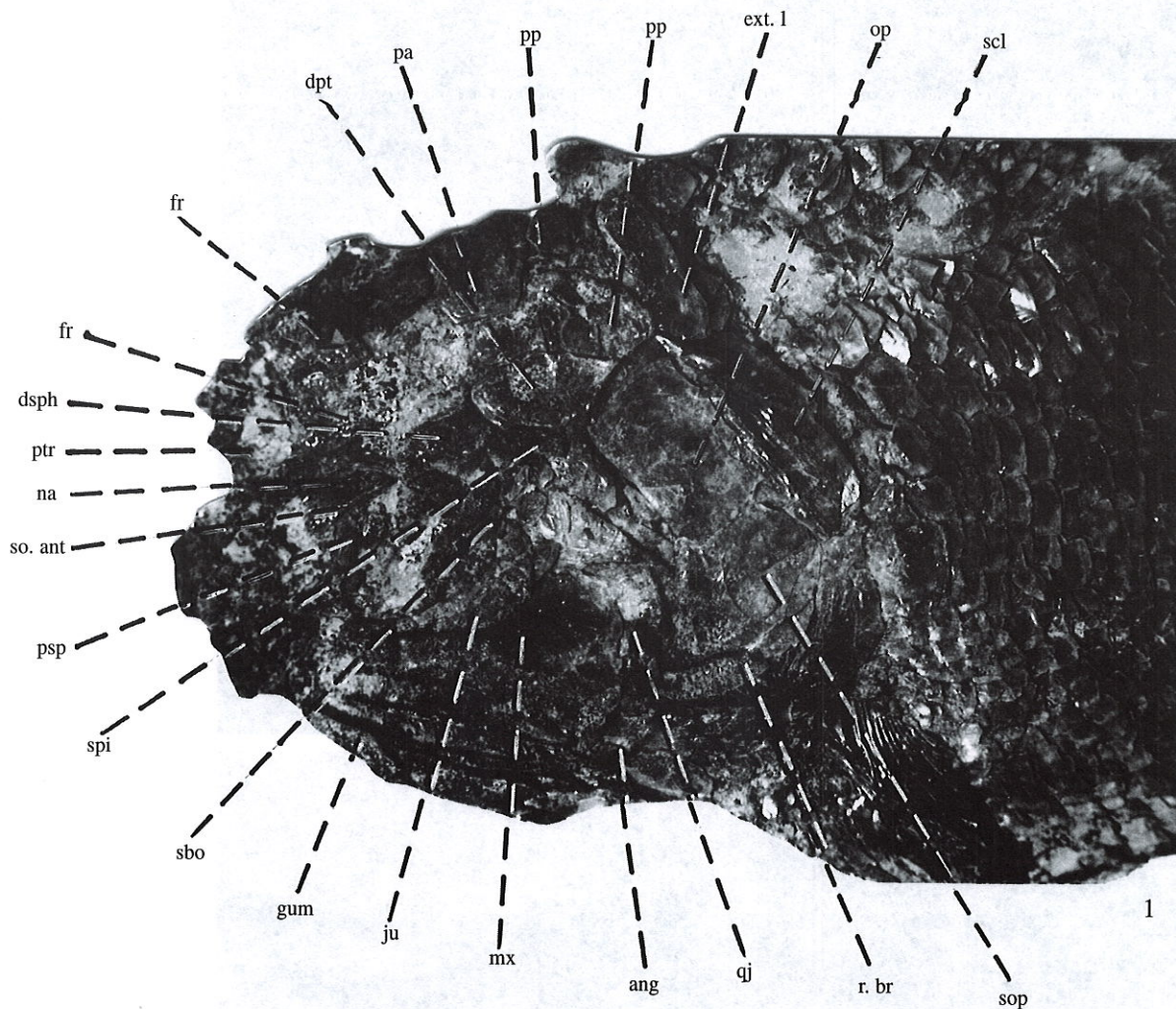
1. Skull in ventral view prepared with dilute acetic acid. Kochov, P 50039, x2.1.
2. Two specimens on one plate of the limestone. Kochov, P 50040, x0.7.
3. Skull in dorsal view. Drvátovice, P 30783, x1.3.











← Plate II

1. *Asterophyllites* sp. Kochov, P 50046.
2. *Annularia stellata* Scholtheim. DrvÁlovice, P 50041.
3. *Taeniopteris* sp. DrvÁlovice, P 50051.
4. *Walchia* sp. DrvÁlovice, P 50048.
5. *Autunia conferta* (Sternberg). Kochov, P 50044.

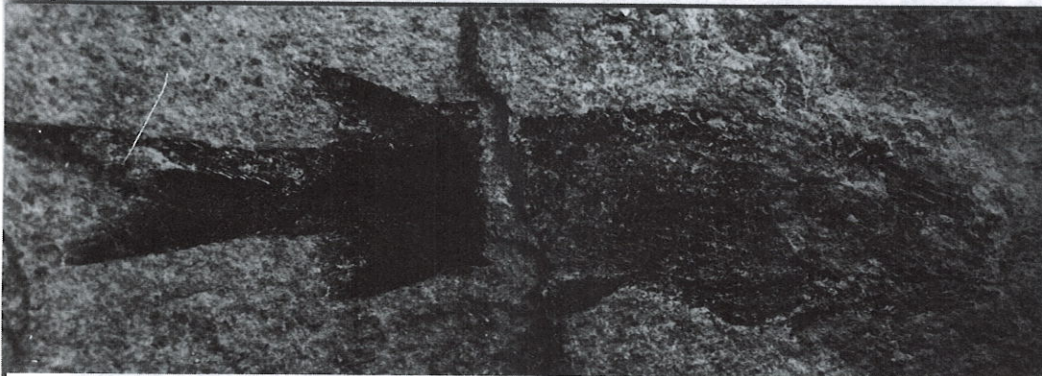
↑ Plate III

1. *Paramblypterus* sp. Head and oral part of the body. Kochov, P 50019, x2.7.. For abbreviations, see list on page 112.
2. *Paramblypterus* sp. Nearly whole specimen. DrvÁlovice, P 50024, x1.2.

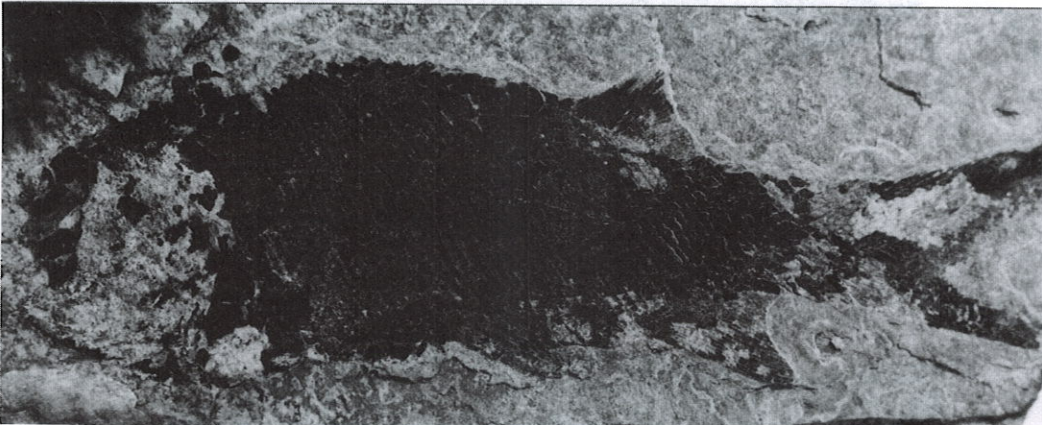




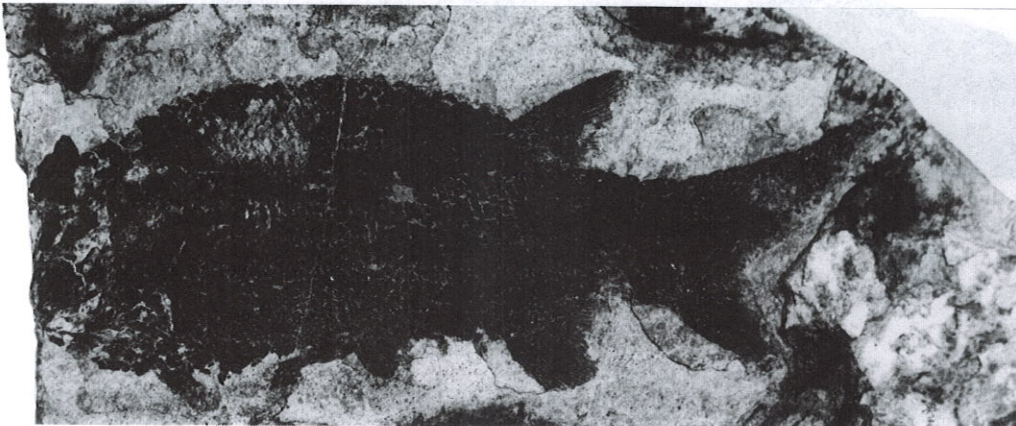
1



2



3



4

Palaeoniscoids of the different age and body-shapes.

1. Slender young specimen 53 mm in total length. Kochov, P 30777.
2. Slender specimen 120 mm in total length. Drválovice, P 10770.
3. Specimen of fusiform shape of the body 114 mm in total length. Kochov, P 30771.
4. Thick-set specimen 125 mm in total length. Kochov, P 10961.