

## LEPIDOLOGICAL REVIEW ON THE FISH FAUNA OF THE KUČLÍN LOCALITY (UPPER EOCENE, CZECH REPUBLIC)

TOMÁŠ PŘIKRYL

Institute of Geology, Academy of Sciences of the Czech Republic, v.v.i., Rozvojová 269, CZ-165 00 Prague 6, Czech Republic;  
Charles University in Prague, Faculty of Science, Institute of Geology and Palaeontology, Albertov 6, CZ-128 43 Prague 2,  
Czech Republic; e-mail: prikryl@gli.cas.cz



Příkryl, T. (2011): Lepidological review on the fish fauna of the Kučlín locality (Upper Eocene, Czech Republic). – Acta. Mus. Nat. Pragae, Ser. B, Hist. Nat., 67(3–4): 149–156, Praha. ISSN 0036-5343.

Abstract. The review of the four different types of the scales at the Kučlín locality is presented. Each type represents one species, i.e. *Cyclurus macrocephalus*, *Thaumaturus furcatus*, *Properca prisca*, and *Morone* sp. Detail description and systematic position of each type is briefly discussed.

■ Fossil fish fauna, Osteichthyes, scales, morphology, Paleogene, Upper Eocene, Czech Republic

Received October 31, 2011

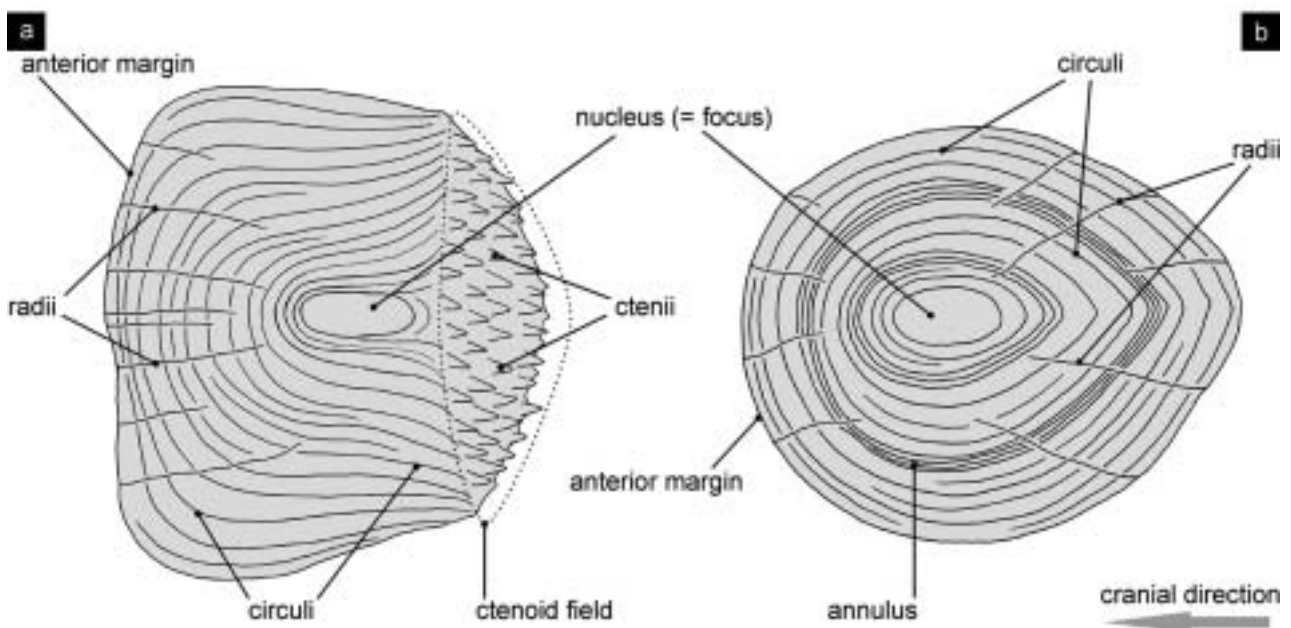
Issued November 2011

### Introduction

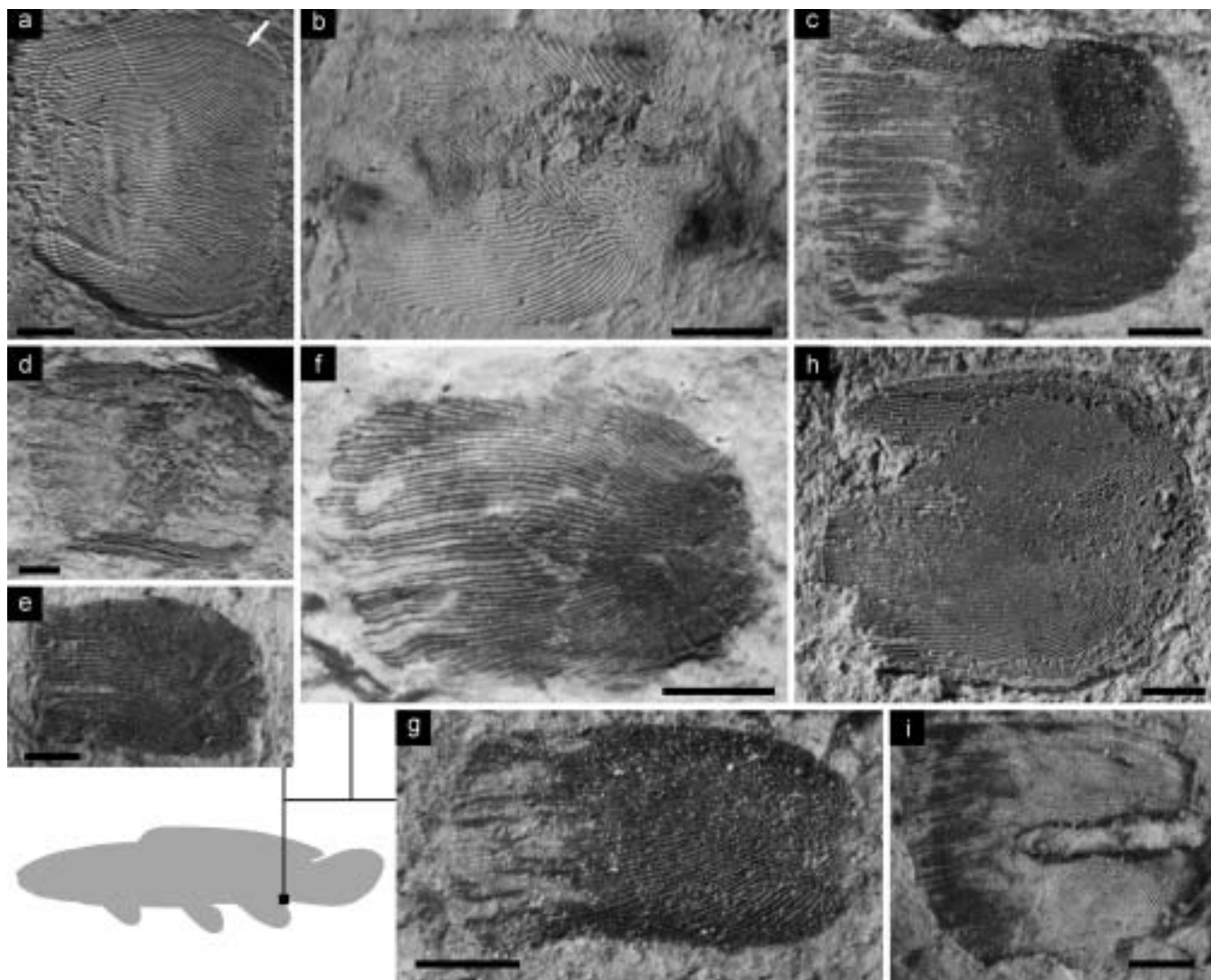
The fish fauna of the Kučlín fossil site (1.5 km SE from Bílina) is known since the first half of the 19<sup>th</sup> century (Reuss, 1844). The findings are represented by isolated bones, more or less complete skeletons (or their parts) and also by isolated scales. Scales are the most numerous findings and represent quantitatively usable data for statistical studies, especially in layers with limited record of articulated fossils.

The fish taxa are represented by four different types (see below), but interestingly, no cyprinid fishes were found there, although they are regularly found at other localities in the České středohoří Mts. (for review see e.g. Obrhelová, 1979). This cyprinid absence suggests an Eocene age for the locality, which was also confirmed by radiometric dating ( $38.3 \pm 0.9$  Ma, i.e. Upper Eocene; Bellon et al., 1998).

The informational value of isolated fish scales in sediment is usually underestimated, which is frequently caused



Text-fig. 1. Main morphological features of scales (nomenclature according to Lagler 1947). a – ctenoid scale; b – cycloid scale.



**Text-fig. 2.** *Cyclurus macrocephalus*, scales. a-i – isolated scales: a – specimen IGP 2011/14; b – specimen IGP 2011/22, scale 2; c – specimen IGP 2011/18, scale 2; d – specimen NMP Pc 2868; e – specimen IGP 2011/17; f – specimen NMP Pc 2867; g – specimen IGP 2011/18, scale 3; h – specimen IGP 2011/16; i – specimen IGP 2011/18, scale 1. e-g – scales from the postanal area of the body; i – scale from the lateral line. Head should be in the left. Scale bars represent 1 mm.

by the problems with classification of isolated scales. The main goal of this contribution is to describe, briefly discuss and conclude information on scale morphology of the fish taxa at the Kučlín locality.

### Material and methods

The specimens are preserved as imprints or as true fossils at the surface of the diatomaceous sediment. The scales were left unprepared and were photographed on the binocular microscope Olympus SZX 12 with CCD camera adapter Olympus DP 72 (National Museum) and binocular microscope Leica MZ6 with camera Canon EOS 1000D (Geological institute of AS).

Specimens from the collections of the National Museum (NMP) and Institute of geology and paleontology of Charles University in Prague (IGP) were used for this study (see appendix for full list).

The specimen of the recent species *Morone labrax* LINNAEUS, 1758 is deposited in the comparative collection of the author.

The nomenclature of the morphological features of the scale followed Lagler (1947) – Text-fig. 1.

The synonymy of the species was not included.

### Systematic part and description

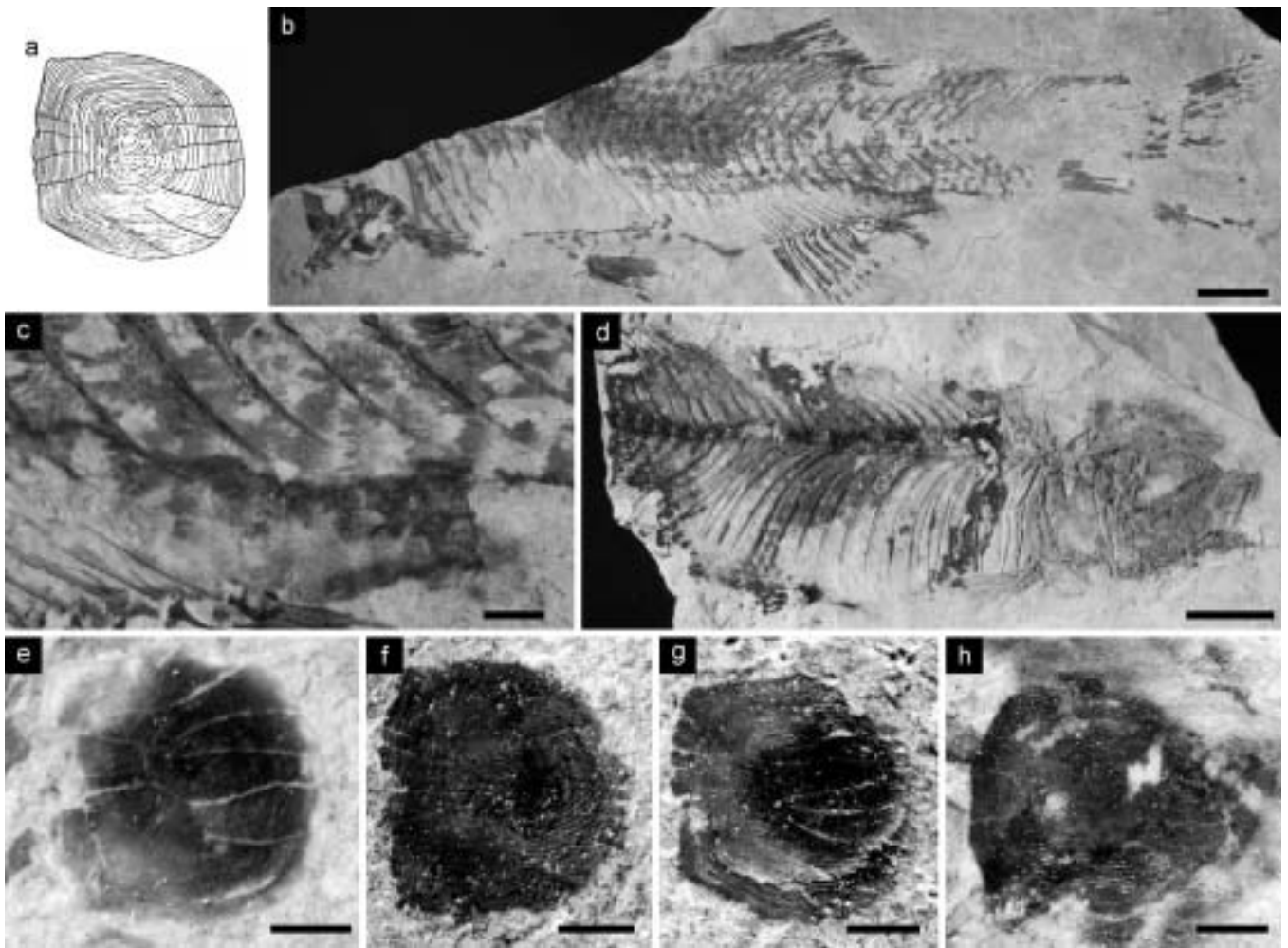
#### Amiiformes

#### Amiidae BONAPARTE, 1838

#### *Cyclurus* AGASSIZ, 1844

#### *Cyclurus macrocephalus* REUSS, 1844

**Description:** *Cyclurus* scales (Text-fig. 2) are typical elasmoid ones, “amioid type” sensu Schultze (1966).



**Text-fig. 3.** *Thaumaturus furcatus*, scales. a – reconstruction according to Obrhelová (1975); b – specimen NMP Pc 164, scales in situ; c – detail of the postanal part of the specimen NMP Pc 164 with the preserved scale covering. d – specimen NMP Pc 191, scales in situ; e – h isolated scales: e – NMP Pc 185; f – NMP Pc 239, scale 1; g – NMP Pc 239, scale 2; h – NMP Pc 241. Head should be in the left (excluding d). Scale bars represent 5 mm (b, d) 1 mm (c) and 0.5 mm (e-h).

The general shape is oblong to oval, with a more roundish posterior edge. The circuli are arranged in parallel rows. The concentric, diffuse or “untidy” arrangement is typical for the nucleus area. The nucleus is shifted to the posterior part of the scale. Annuli are visible in some specimens (see arrow at the Text-fig. 2a). Variability of the scales is shown in Text-fig. 2. Scales from the postanal lateral part of the body are especially well distinguishable for their elongated shape and fuzzy anterior edge (Text-figs 2e-g). The lateral line scales have a well developed canal for the sensory line (Text-fig. 2i).

Scales preserved in situ at the surface of the body are relatively common (e.g. Laube, 1901: taf. 1, fig. 2).

**R e m a r k s :** The scale of this species was figured by Grande et Bemis (1998: page 309, fig. 201). The same authors also noted the presence of eight scale rows above the lateral line, and seven below it.

The scales are very similar to the recent species *Amia calva* LINNAEUS, 1766. The detail description with large discussion on the morphology and development of the scales in the *A. calva* was published by Grande et Bemis (1998), with summarization of previous works by other authors.

The presence of the amiid fish *Cyclurus macrocephalus* in the Kučlín was recognized by Reuss (1844) and later was discussed by von Meyer (1848, 1851). Laube (1901) placed the species in the genera *Amia* and definitive taxonomical identification to the genus *Cyclurus* has been provided by Gaudant (1987). Additional osteological information was published by Gaudant (2008).

The remains of the species (including scales) were also recognized at the Roudníky (Gaudant in Bellon et al. 1998; Příklad, personal observation) and Kostomlaty (Obrhelová et Obrhel, 1987; Böhme, 2007) localities in the České středohoří Mts.

### Esociformes

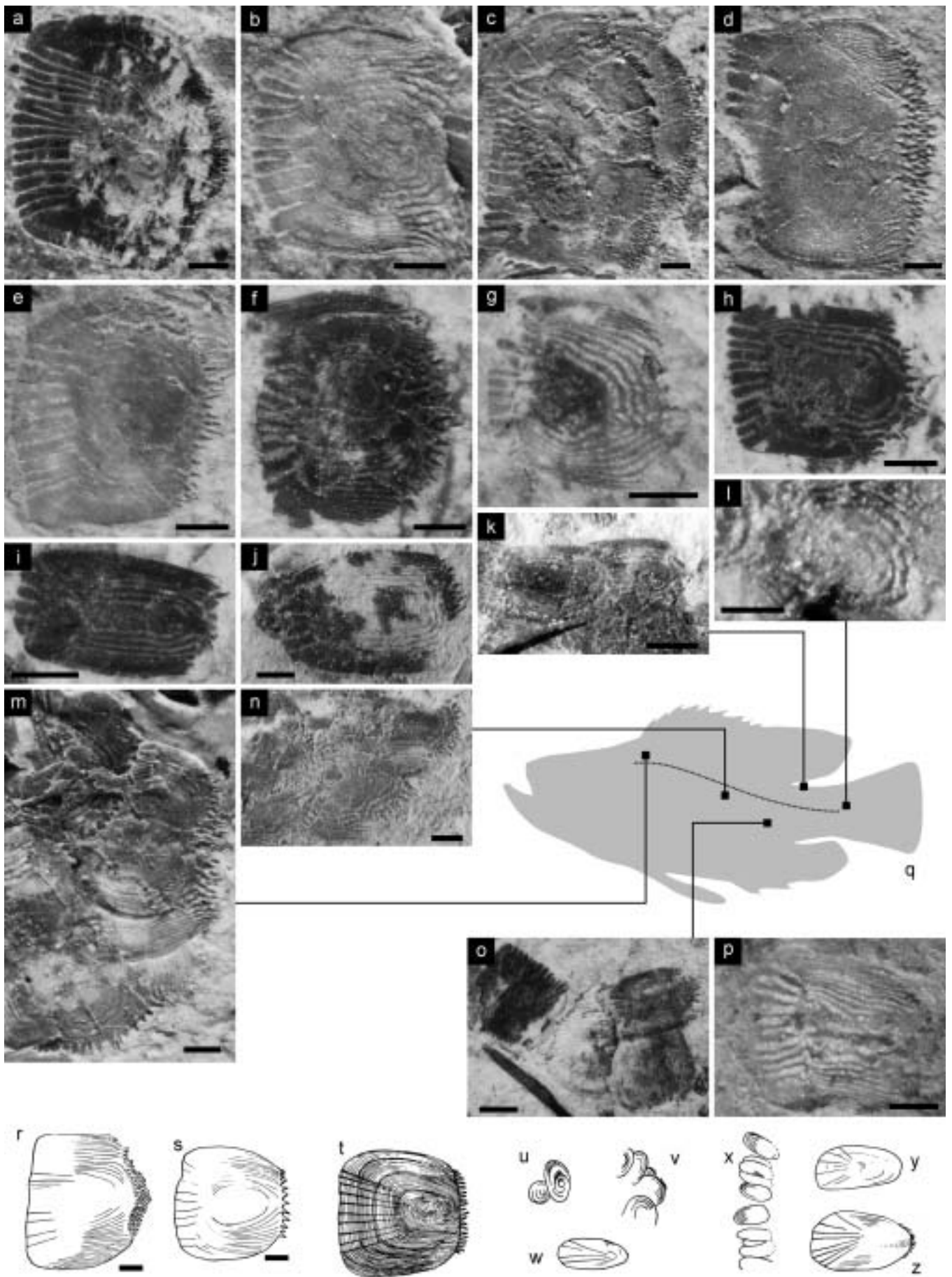
#### Thaumathuridae VOIGT, 1935

#### *Thaumaturus* REUSS, 1844

#### *Thaumaturus furcatus* REUSS, 1844

**Description:** The scales of this species are cycloid (Text-fig. 3). They are extremely thin and often are





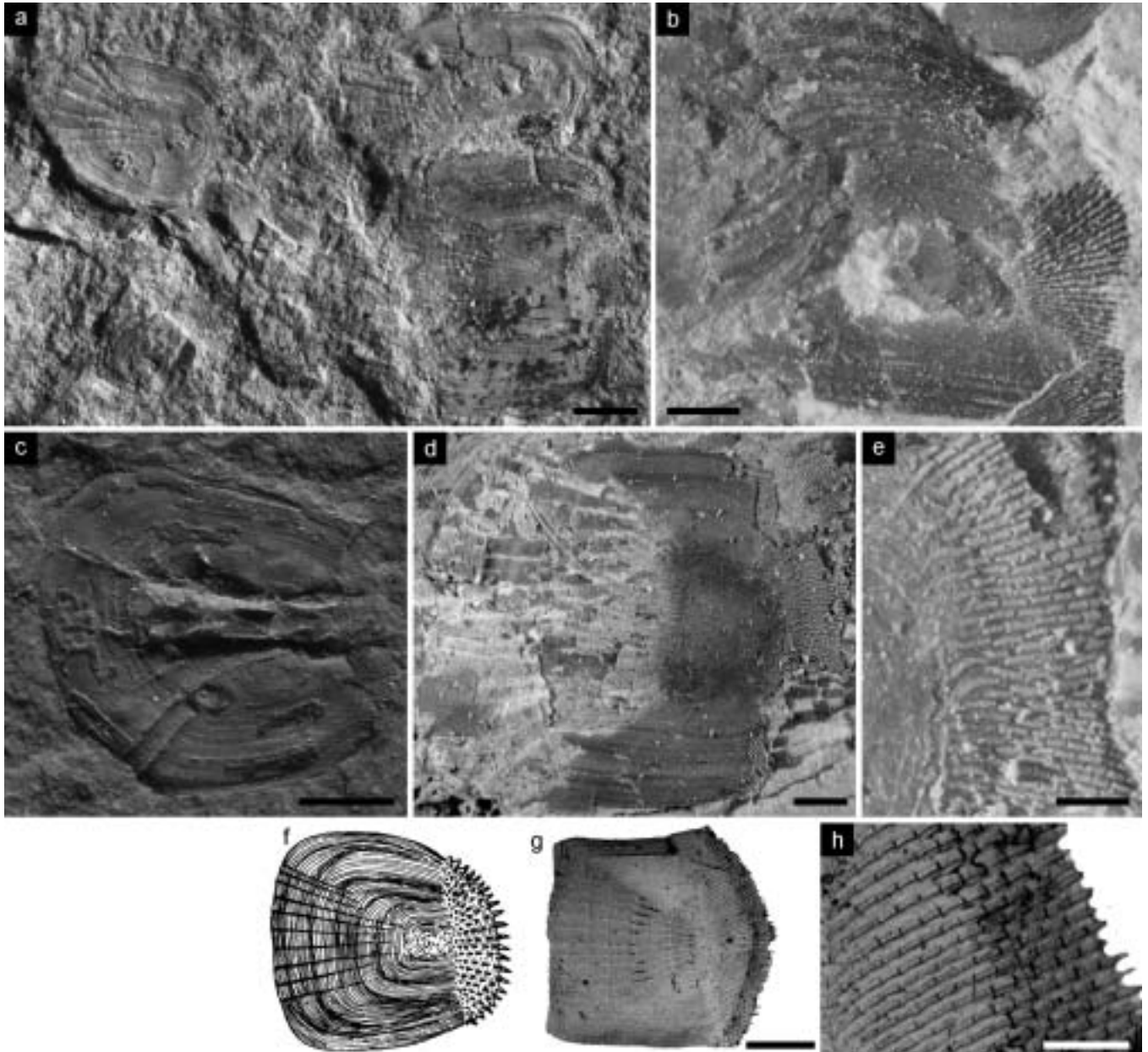
preserved as just “pigmented shadows”, without detailed morphology (Text-fig. 3c). The shape of individual scales is subsquarish, with more roundish posterior edge. The nucleus is situated more or less in the middle portion of the scale. The circuli are very fine (see Text-fig. 3f) and often they are not visible separately at all. At the posterior side, the dorsal and ventral part of the circuli merges together in an acute angle. Annuli were not recognized. The radii are developed in higher number in the posterior edge. The articulated scales at the surface of the body are often preserved (Gau-

dant et Meunier, 2004: fig. 13; Text-figs 3b-d).

**R e m a r k s :** The description of the scales is the same as was provided by Obrhelová (1975). The lateral line runs along the vertebral column (Obrhelová, 1975).

Laube (1900: fig. 5) figured articulated scales of the species with notches on their posterior edges, which can suggest presence of the ctenii. This confusion was caused by radii.

The systematic position of *Thaumathurus furcatus* has not been fixed. The species was traditionally considered as



**Text-fig. 5.** a-f – *Morone* sp. scales. a – specimen NMP Pc 2850, group of scales; b – specimen NMP Pc 2854; c – specimen NMP Pc 2850, lateral line scale; d – specimen NMP Pc 2855; e – detail of the previous fig.; f – reconstruction, originally classified by Obrhelová (1971) as *Bilinia uraschista*, with typical moronid like arrangement of the ctenii. g-h – *Morone labrax*, recent. Scale and detail of its ctenoid field. Head should be in the left. Scale bars represent 2 mm (a, g), 1 mm (b-d), 0.5 mm (e, h).

◀ **Text-fig. 4.** *Properca prisca*, scales. a – specimen IGP 2011/6b, scale 1; b – specimen IGP 2011/6b, scale 2, c – specimen IGP 2011/6b, scale 3; d – specimen IGP 2011/4a; e – specimen IGP 2011/7; f – specimen IGP 2011/1; g – specimen IGP 2011/8, scale 1; h – specimen IGP 2011/8, scale 3; i – specimen IGP 2011/8, scale 2; j – specimen IGP 2011/5a, scale 1; k – specimen IGP 2011/2a; l – specimen IGP 2011/3a; m – specimen IGP 2011/6b, group of scales; n – specimen IGP 2011/5a, group of scales; o – specimen IGP 2011/8, group of scales; p – specimen IGP 2011/7, lateral line scale; q – reconstruction of the running of the lateral line according to the NMP Pc 68; r-s – reconstruction of the scales according to Obrhelová (1976); t-z – reconstruction of the scales according to Obrhelová (1971). Head should be in the left. Scale bars represent 0.5 mm.



salmoniform (e.g. Laube, 1901; Obrhelová, 1975), or osteoglossid (Gaudant, 1981). More recently Gaudant et Meunier (2004) presented a connection of the thaumatourids to esociforms, mainly on the basis of paleohistological characteristics.

*Thaumatourus* fossils are known from the Kostomlaty, Řisuty and Leská localities in the České středohoří Mts. area (Obrhelová, 1979).

## Perciformes

### Percichthyidae *sensu* JOHNSON, 1984

#### *Properca* SAUVAGE, 1880

#### *Properca prisca* (AGASSIZ, 1834)

**Description:** This species has scales of two types: cycloid and ctenoid ones (Text-fig. 4). The major part of the body is covered by the ctenoid scales. The nucleus is antero-posteriorly elongated and is placed in the midline of the scale. Fine circuli are developed around the nucleus and are sectioned by radii in the cranial part of the scale. Radii are present in relative high number (up to 13). At the caudal part of the scale, there is a developed ctenoid field. Ctenii are arranged in one or several rows. If more than one row is developed, ctenii from the vicinal rows alternate. Younger scales have fewer ctenii rows. The ctenii are short, tapered and sharp.

Cycloid scales are developed at the extremities of the fish body (e.g. in the caudal peduncle, or at the dorsal edge of body – see Text-figs 4k, l). Variability of the scales is shown in the Text-fig. 4. Variability dependent on the place of origin is shown in the Text-figs 4k-o.

Lateral line scales have large and elongated openings for the sensory canal in the middle part of nucleus (Text-fig. 4p). Reconstruction of the position of the lateral line is showed in the Text-fig. 4q (based on the specimen NMP Pc 68).

**Remarks:** The description of the scales is generally the same as was described by Obrhelová (1971, 1976), who also included specimen no. NMP Pc 2869 (Obrhelová, 1971: taf. IV, fig. 6) to the morphotype. The same specimen was obviously used as a pattern for the reconstruction in fig. 7c (Obrhelová, 1971: page 383). Micklich (1990) showed affinity of this specimen rather to the moronids (see below).

The species was traditionally classified as a percid (Laube, 1901). Obrhelová (1971) erected new genus *Bilinia* and supposed its relations to serranid, but revision of the original material suggests its affinity to the percichthyid fishes (Micklich, 1988). Gaudant (2000) synonymized the *B. uraschista* with species *Properca prisca*.

The fossil of *Properca* was already described (without preserved scaly covering) from the Kundračice locality in the České středohoří Mts. area (as *B. bispinella* by Obrhelová, 1976).

## Perciformes

### Moronidae *sensu* JOHNSON, 1984

#### *Morone* MITCHILL, 1814

#### *Morone* sp.

**Description:** The species have typical large, sub-squarish ctenoid scales (Text-fig. 5). At the posterior part of the scale, there is developed a triangular ctenoid field. The nucleus is relatively large and is situated in the middle or posterior part of the scale. The ctenii are well developed, and are arranged fan-like in several rows. Ctenii from the vicinal rows create columns (see detail in the Text-fig. 5e). Separate ctenii are long and blunt. In the anterior part of the scale, there are developed numerous radii (up to 15). In the middle part of the lateral line scale, a large canal is developed (Text-fig. 5c).

**Remarks:** The scales of this type are clearly distinguishable and different from all previous taxa, and they are generally similar to the recent representatives of the family Moronidae (see Text-figs 5g, h).

Although, we lack information about running of the lateral line scale or scale formula, the detail scale morphology was described in several publications.

Micklich (1990) published his interpretation of the specimen NMP Pc 2869 (Kuč. 80), which was originally classified as *B. uraschista* by Obrhelová (1971: fig. 7c; taf. IV, fig. 6). Other information, based also on the lepidological analysis and new material, was provided by Micklich et Böhme (1997), and all conclusions suggest pertinence of these fossils to the moronids. New discoveries of almost complete specimens with preserved scales were studied by Příklad (2008), and he also classified the remains to the genus *Morone*.

## Discussion

The correct identification of the isolated scales is conditioned by detailed knowledge of osteology and morphology of complete and articulated specimens, because just such information can help us avoid parataxonomy. The fish fauna of the Kučlín locality is described and known enough for such an approach. Furthermore, the results of such research are also applicable (with methodological limitations) at other localities of similar age where articulated skeletal remains are missing.

## Conclusion

The contribution summarizes information about fish scales at the Kučlín locality from published literature and combined them with data obtained by studies of fossil specimens. A description of morphology, taxonomic position and brief discussion for each taxa were provided.

## Acknowledgements

I am grateful to B. Ekrt (National Museum in Prague) for access to the collection under his care. I am very grate-

ful to both reviewers (J. Gaudant and B. Ekrt) for their constructive and useful suggestions which improved the quality of the manuscript. The research was financially supported by the following grants AVOZ30130516 and MSM 002 1620855.

## References

- Bellon, H., Bůžek, C., Gaudant, J., Kvaček, Z., Walther, H. (1998): The České Středohoří magmatic complex in Northern Bohemia <sup>40</sup>K-<sup>40</sup>Ar ages for volcanism and biostratigraphy of the Cenozoic freshwater formations. – *Newsletters on Stratigraphy*, 36(2/3): 77–103.
- Böhme, M. (2007): Revision of the cyprinids from the Early Oligocene of the České Středohoří Mountains, and the phylogenetic relationships of *Protothymallus* Laube 1901 (Teleostei, Cyprinidae, Gobioninae). – *Acta Musei Nationalis Pragae, series B – Historia Naturalis*, 63(2-4): 175–194.
- Gaudant, J. (1981): Contribution de la paléoichthyologie continentale à la reconstitution des paléoenvironnements cénozoïques d'Europe occidentale: Approche systématique, paléoécologique, paléogéographique et paléoclimatologique. – *Doctoral thesis, Université Pierre et Marie Curie, Paris*, 368 pp.
- Gaudant, J. (1987): Mise au point sur certains poissons Amiidae du Cénozoïque européen: le genre *Cyclurus* Agassiz (= *Kindleia* Jordan). – *Paläontologische Zeitschrift*, 61(3/4): 321–330.
- Gaudant, J. (2000): New observations on some Percoid fishes (Teleostei) from European Cenozoic fresh and brackish waters. – *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen*, 217(2): 199–244.
- Gaudant, J. (2008): Complements to the anatomical knowledge of *Cyclurus macrocephalus* Reuss (Pisces, Actinopterygii) from the Eocene of Kučlín, Bohemia, Czech Republic. – *Acta Musei Nationalis Pragae, Series B - Historia Naturalis*, 64(1): 3–7.
- Gaudant, J., Meunier, F.J. (2004): Un test pour déterminer la position systématique du genre *Thaumaturus* Reuss, 1844 (poisson téléostéen): l'approche paléohistologique. – *Courier Forschungsinstitut Senckenberg*, 252: 79–93.
- Grande, L., Bemis, W.E. (1998): A comprehensive phylogenetic study of amiid fishes (Amiidae) based on comparative skeletal anatomy. An empirical search for interconnected patterns of natural history. – *Society of Vertebrate Paleontology Memoir*, 4: 1–681.
- Lagler, K.F. (1947): *Lepidological Studies 1. Scale Characters of the Families of Great Lakes Fishes*. – *Transactions of the American Microscopical Society*, 66(2): 149–171.
- Laube, G.C. (1900): Salmoniden aus der böhmischen Braunkohlenformation. – *Sitzungsberichte des deutschen naturwissenschaftlich-medizinischen Vereines für Böhmen „Lotos“*, 1: 1–6.
- Laube, G.C. (1901): Synopsis der Wirbelthierfauna der Böhm. Braunkohlenformation und Beschreibung neuer, oder bisher unvollständig bekannter Arten. – *Abhandlungen des deutschen naturwissenschaftlich-medizinischen Vereines für Böhmen „Lotos“*, 2(4): 107–182.
- Meyer, von H. (1848): Die fossilen Fische aus den tertiären Süsswassergebilden in Böhmen. – *Neues Jahrbuch Mineralogie, Geognosie, Geologie und Petrefakten-Kunde*, 1848: 424–433.
- Meyer, von H. (1851): Beschreibung der fossilen Decapoden, Fische, Batrachier und Säugetiere aus den tertiären Süßwassergebilden des nördlichen Böhmens. – *Palaeontographica*, 2: 43–73.
- Micklich, N., Böhme, M. (1997): Wolfsbarsch-Funde (Perciformes, Moronidae) aus den Süßwasser-Diatomiten von Kučlín (Böhmen) nebst Anmerkungen zur taxonomischen Stellung von *Perca* „*lepidota*“ aus den Süßwasser-Kalken von Öhningen (Baden). – *Paläontologische Zeitschrift*, 71(1/2): 117–128.
- Micklich, N. (1988): Ergänzungen zur Morphologie und Systematik der Gattung *Bilinia* Obrhelova 1971 (Pisces, Percoidei). – *Paläontologische Zeitschrift*, 62(3/4): 297–317.
- Micklich, N. (1990): Ein neuer Percoide (Pisces, Perciformes) aus den tertiären Süßwasser-Diatomiten von Kučlín in Böhmen. – *Senckenbergiana lethaea*, 70(1/3): 199–208.
- Obrhelová, N. (1971): Über einen Serranid (Pisces) aus dem nordböhmischen Süßwassertertiär. – *Časopis pro mineralogii a geologii*, 16(4): 371–387.
- Obrhelová, N. (1975): Osteologischer Bau von *Thaumaturus furcatus* Reuss, 1844 (Pisces) aus dem nordböhmischen Süßwassertertiär (Kučlín bei Bílina). – *Časopis pro mineralogii a geologii*, 20(3): 273–290.
- Obrhelová, N. (1976): Eine neue Percoiden-Art (Pisces) aus dem nordböhmischen Süßwassertertiär. Bemerkungen zur Gattung *Bilinia* Obrhelova, 1971. – *Časopis pro mineralogii a geologii*, 21(3): 233–256.
- Obrhelová, N. (1979): Süßwasser-Ichthyofauna im Tertiär der ČSSR. – *Časopis pro mineralogii a geologii*, 24(2): 135–145.
- Obrhelová, N., Obrhel, J. (1987): Paläoichthyologie und Paläoökologie des kontinentalen Tertiärs und Quartärs in der ČSSR. – *Zeitschrift für geologische Wissenschaften*, 15(6): 709–731.
- Příkryl, T. (2008): Sea bass fish *Morone* sp. (Teleostei) from North Bohemian Paleogene (Tertiary, Czech Republic). – *Bulletin of Geosciences*, 83(1): 117–122.
- Reuss, A.E. (1844): Die Kreidegebilde des westlichen Böhmens, ein monographischer Versuch. Nebst Bemerkungen über die Braunkohlenlagen jenseits der Elbe und eine Übersicht der fossilen Fischreste Böhmens. – *C. W. Medau, Prag*, 303 pp.
- Scultze, H.-P. (1966): Morphologische Untersuchungen an Schuppen mesozoischer Actinopterygier (Übergang von Ganoid- zu Rundschuppen). – *Neues Jahrbuch für Geologie und Paläontologie Abhandlungen*, 126: 232–314.

## Appendix

### List of the studied specimens.

IGP:

*Cyclurus macrocephalus*, 2011/14, 2011/16, 2011/17, 2011/18, 2011/22.

*Properca prisca*, 2011/1, 2011/2a, 2011/3a, 2011/4a, 2011/5a, 2011/6b, 2011/7, 2011/8.

NMP:

*Cyclurus macrocephalus*, Pc 2867, Pc 2868.

*Thaumaturus furcatus*, Pc 164, Pc 185, Pc 191, Pc 239, Pc 241.

*Properca prisca*, Pc 68, Pc 2869.

*Morone* sp., Pc 2850, Pc 2854, Pc 2855.