

**Checklist of the fossil fish otoliths in the  
Department of Palaeontology and Geology, Hungarian Natural History Museum**

by  
Mariann BOSNAKOFF

**Abstract** — This paper presents otoliths housed in the Department of Palaeontology and Geology of Hungarian Natural History Museum, Budapest. In addition to the synonym lists, it includes information on each species' palaeogeographical and stratigraphical range. The collection consists of 54 taxa from the Middle Eocene to the Late Miocene sediments of the Tethys, the Paratethys and the Lake Pannon. The total number of specimens is 472. With the exception of a few specimens, until now the otoliths were unidentified. This work provides previously unpublished otolith records from the small basins of the North Hungarian Mountains.

**Key words** — fish otoliths, Hungarian Natural History Museum, Eocene, Oligocene, Miocene

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### Introduction

This paper provides a checklist and illustrations of fossil fish otoliths represented in the collection of the Department of Palaeontology and Geology. The material was collected in the past hundred years from various localities of the sedimentary basins of the Alp–Carpathian region. There are more than 50 different species in the collection from the Middle Eocene to Late Miocene. Excluding some macrourid and gadid otoliths, until now the material was unidentified. Most of the presented specimens are saccular otoliths, exceptions are marked.

Fish otoliths are common fossils in Cenozoic marine, brackish and lacustrine sediments. They consist of calcium carbonate, primarily aragonite. Otoliths also contain 0.2 to 10% organic matter as a fibrous protein. During the fossilization aragonite has recrystallized into calcite and became more compact and abrasion-resistant. Therefore, otoliths are more frequent in the sandy-clayey deposits and more useful for paleontological studies than the other parts of the fish skeleton. In general, fish otoliths size vary between 0.5 mm and 15 mm or more and their shape is species specific.

### Localities

The studied material was collected from 26 different localities of the Vienna Basin, the Pannonian Basin and the Transylvanian Basin (Figure 1).

**Vienna Basin:** Baden-Sooss and Bad Vöslau are located in the Southern Vienna Basin (Lower Austria). Baden-Sooss is the type section of regional stage Badenian for the Central Paratethys (RÖGL et al. 2008). Claypit of the old brickyard at Walbersdorf (in Hungarian: Borbolya, Burgenland, Austria) is near to the Austrian–Hungarian border.

**Little Hungarian Plain:** Badenian beds exposed on the Szélmalom Hill, while Late Miocene sediments were cultivated in Lenk brickyard at Sopron. The Late Miocene mollusc faunas of this region were extensively studied and described by many workers for more than a hundred years (STRAUSZ 1942; VITÁLIS 1951).

**Transdanubian Range:** The invertebrate faunas (i.e. gastropods, foraminifers, ostracods etc.) of Lutetian (Eocene) deposits near Gánt (Vértes Mts) are well investigated by numerous authors (SZÓTS 1953; MONOSTORI 1977).

Budapest–Kiscell is the locality after which the Oligocene Kiscell Clay is named, the most common rock type of

Buda (BÁLDI 1986). The microfauna of the Kiscell Clay was first described by HANTKEN (1875), partly from this locality.

**North Hungarian Mountains:** There are several well-known localities located in small basins developed in the environment of the Inner Carpathian Volcanic Arc, filled with mainly marine sediments deposited during the Oligocene and the Miocene. Szob is one of the most famous localities of the mollusc-rich faunas in the Börzsöny Mts (DULAI 1996), other otolith-bearing localities are Szokolya and Hont. The diverse otolith fauna of Szob was described by the present author (BOSNAKOFF 2001, 2006). The collection contains otoliths from various localities of the Cserhát and Mátra Mts (HÁMOR 1985). Borsodbóta is known about its rich Badenian mollusc fauna, solitary corals and bryozoans (DULAI et al. 2010). Only one specimen from Ostoros represents the Egerian otoliths elaborated by NOLF & BRZOBOHATÝ (1994).

**Transylvanian Basin:** Among the less known Romanian localities (Bodogaia, in Hungarian: Alsóboldogfalva, in German: Unter-Mariendorf, Harghita county; Răchitova, in Hungarian: Reketefalva, Hunedoara county; Livezile, in Hungarian: Úrháza, in German: Lasslenkirch, Alba county)

Coșteiu de Sus (in Hungarian: Kostej, Timiș county) is the most intensively investigated Miocene site. Its otolith fauna was studied by WEILER (1950) and RADO (1965).

Data of the identified species compiled in Table 1, while the comparison of the two most diversified fauna (Szob and Coșteiu de Sus) is given in Table 2.

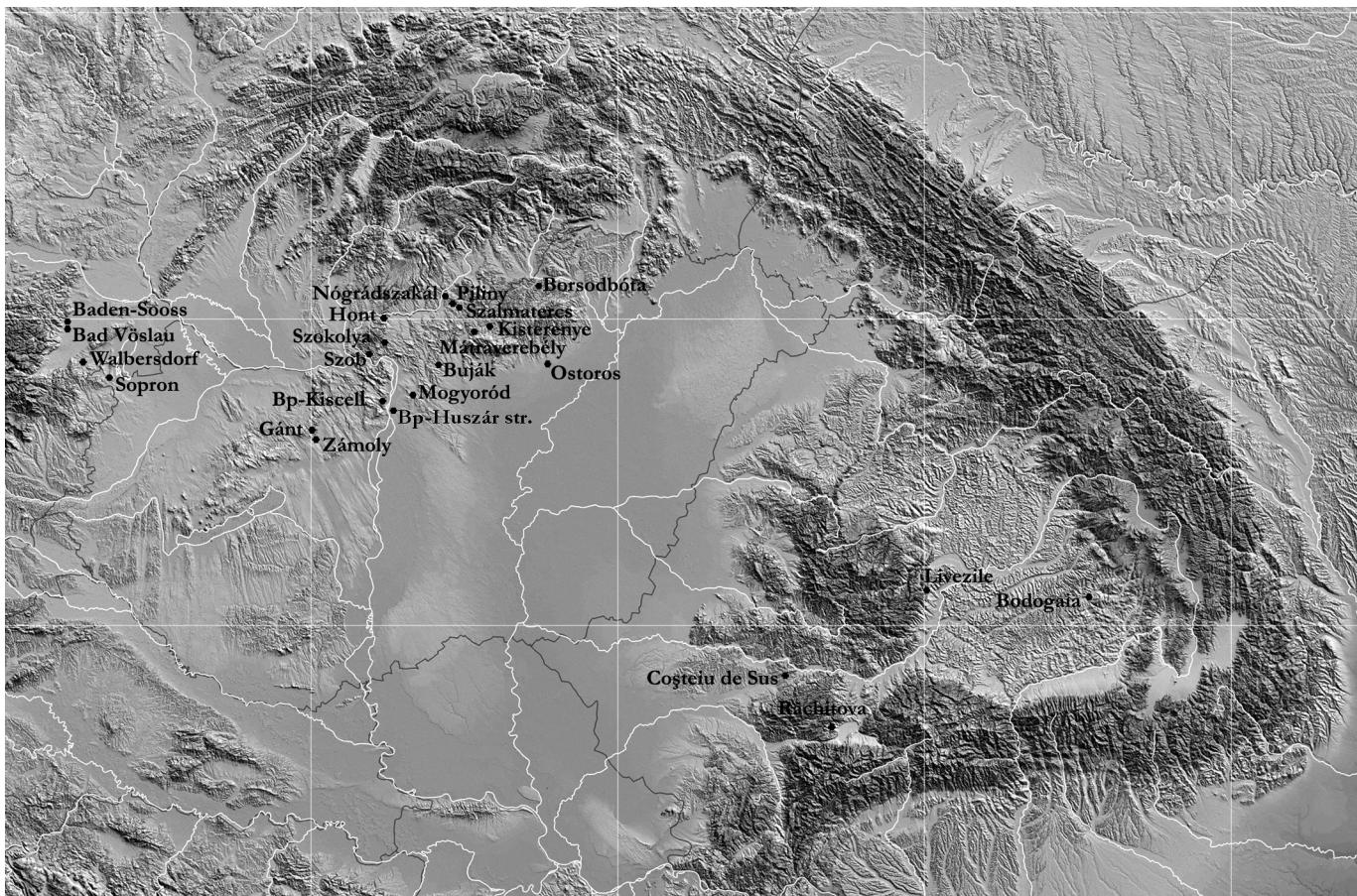


Figure 1 — Map showing the studied localities in the Carpathian region. — Source: [http://geophysics.elte.hu/atlas/geodin\\_atlas.htm](http://geophysics.elte.hu/atlas/geodin_atlas.htm).

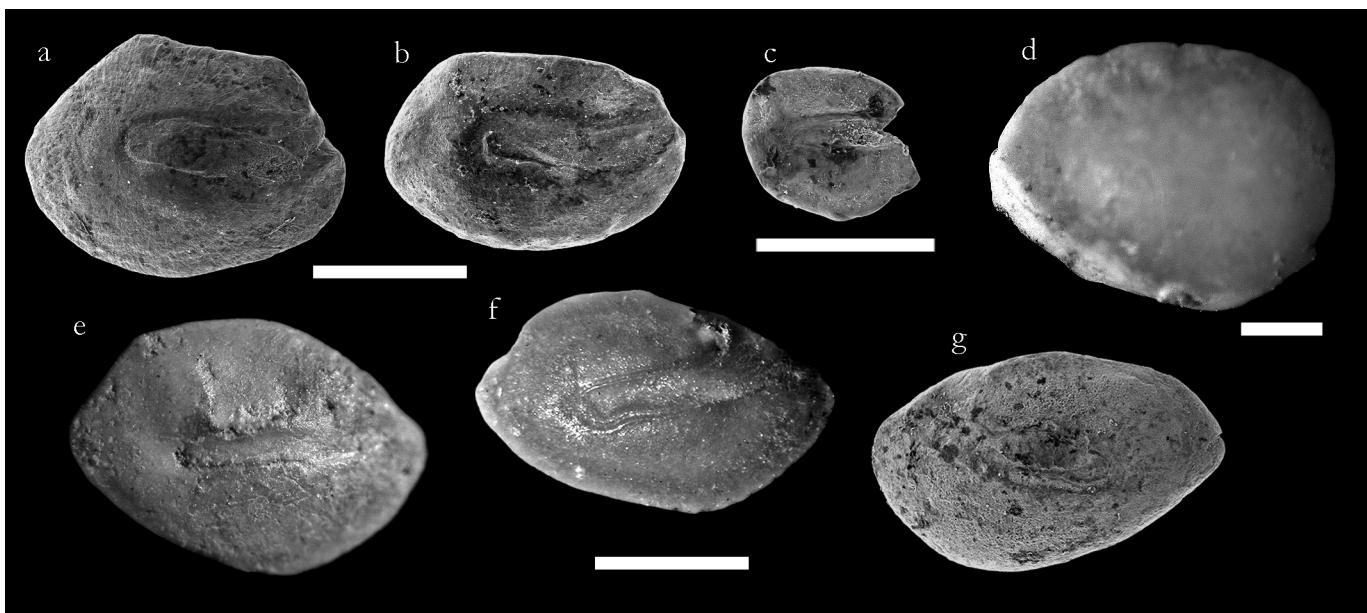


Figure 2 — a: *Panturichthys subglaber* (SCHUBERT, 1906) — Coșteiu de Sus (no Inv. №); b: *Panturichthys subglaber* (SCHUBERT, 1906) — Szob (V.63.733.17); c: *Argentina?* sp. — Coșteiu de Sus, (no Inv. №); d: *Arius* sp. — Coșteiu de Sus (M.60.7523); e: *Rhechias nagymarosi* NOLF & BRZOBHATÝ, 1994 — Budapest-Kiscell (M.59.4786); f: *Rhynchoconger pantanellii* (BASSOLI & SCHUBERT, 1906) — Coșteiu de Sus (no Inv. №); g: *Rhynchoconger pantanellii* (BASSOLI & SCHUBERT, 1906) — Coșteiu de Sus (M.60.7523.3). Each scale bars represent 1 mm.

## Systematics

Order Anguilliformes REGAN, 1909

Suborder Albuloidei JORDAN, 1923

Superfamily Albuloidea BLEEKER, 1859

Family Pterothriidae GILL, 1893

Genus *Pterothrissus* HILGENDORF, 1877

### *Pterothrissus cf. umbonatus* (KOKEN, 1884)

1884: *Otolithus* (inc. sed.) *umbonatus* n. sp. — KOKEN, p. 557, pl. XII, fig. 12.

1884: *Otolithus* (inc. sed.) *minor* n. sp. — KOKEN, p. 558, pl. XII, fig. 14.

1888: *Otolithus* (inc. sed.) aff. *umbonato* KOKEN — KOKEN, p. 294, pl. XVII, fig. 12.

1891: *Otolithus* (inc. sed.) *umbonatus* KOKEN — KOKEN, p. 134.

1891: *Otolithus* (inc. sed.) *lunaburgensis* n. sp. — KOKEN, p. 137, textfig. 26.

1942: *Otolithus* (inc. sed.) *umbonatus* KOKEN — WEILER, p. 110, pl. 11, fig. 11.

1942: *Otolithus* (inc. sed.) *minor* KOKEN — WEILER, p. 114, pl. 5, figs 38, 42, pl. 11, figs 5, 9, 10.

1977: *Pterothrissus umbonatus* (KOKEN, 1884) — NOLF, p. 14.

1979: *Pterothrissus minor* (KOKEN, 1884) — ŚMIGIELSKA, p. 299, textfig. 2, pl. I, figs 1–3.

1979: *Pterothrissus* sp. — STEURBAUT, p. 53, pl. 1, figs 1–2.

1981: *Pterothrissus umbonatus* (KOKEN, 1884) — NOLF, p. 139.

1983: *Pterothrissus umbonatus* (KOKEN, 1884) — NOLF & STEURBAUT, p. 148, pl. I, figs 1–2.

1988: *Pterothrissus umbonatus* (KOKEN, 1884) — NOLF, p. 33, pl. I, fig. 3.

1994: *Pterothrissus umbonatus* (KOKEN, 1884) — NOLF & BRZOBONATÝ, p. 230, pl. 1, fig. 1, pl. 7, fig. 1.

2002: *Pterothrissus umbonatus* (KOKEN, 1884) — NOLF & BRZOBONATÝ, pl. 1, figs 4–6.

**Material** — 1 poorly preserved otolith from Ostoros (Hungary), Late Oligocene (M.63.7182).

**Distribution** — This species is known from the

Middle Eocene to the Upper Miocene from various deposits of the Paratethys, the North Sea Basin and the Mediterranean area.

Suborder Anguilloidei REGAN, 1909

Superfamily Anguilloidea RAFINESQUE, 1810

Family Heterenchelyidae REGAN, 1912

Genus *Panturichthys* PELLEGRIN, 1913

### *Panturichthys subglaber* (SCHUBERT, 1906)

(Figure 2: a, b)

1906: *Otolithus* (*Solea*) *subglaber* n. sp. — SCHUBERT, p. 672, pl. XX, figs 19–26.

1980: *Panturichthys subglaber* (SCHUBERT, 1906) — NOLF & CAPPETTA, p. 4, pl. 1, figs 1–2.

1980: *Panturichthys subglaber* (SCHUBERT, 1906) — NOLF & MARTINELL, p. 210, pl. 1, figs 3–6.

1981: *Panturichthys subglaber* (SCHUBERT, 1906) — NOLF, p. 168, pl. 1, figs 3–6.

1989: *Panturichthys subglaber* (SCHUBERT, 1906) — NOLF & CAPPETTA, p. 213, pl. 1, fig. 8.

1994: *Panturichthys subglaber* (SCHUBERT, 1906) — BRZOBONATÝ, p. 70, pl. 1, figs 1–3.

? 2005: *Panturichthys subglaber* (SCHUBERT, 1906) — HOEDEMAKERS & BATLLORI, pl. 1, figs 1–5.

**Material** — 1 otolith from Coșteiu de Sus (Romania), Badenian (no inventory number), 1 otolith from Szob (Hungary), Badenian (V.63.733.9), 1 otolith from Nőgrádszakál, Bertece stream, (Hungary), Middle Miocene (M.61.8346.3).

**Distribution** — This species is known from the Middle Miocene of the Paratethys and from the Middle Miocene to the Middle Pliocene of the Mediterranean realm.

Family Congridae KAUP, 1856

Genus *Rhechias* JORDAN, 1921

### *Rhechias nagymarosi* NOLF & BRZOBONATÝ, 1994

(Figure 2: e)

1994: *Rhechias nagymarosi* n. sp. — NOLF & BRZOBONATÝ, p. 230, pl. 1, figs 3–6.

2002: *Rhechias nagymarosi* NOLF & BRZOBONATÝ, 1994 — NOLF & BRZOBONATÝ, p. 268, pl. 2, figs 1–4.

**Material** — 1 otolith from Budapest–Kiscell (Hungary), Late Oligocene (M.59.4786).

**Table 1 — Complete list of the identified species.**

**Distribution** — Holotype was described from the Kiscell Clay at Noszvaj (North Hungarian Mts.).

Family	Species	Distribution			
		Middle Eocene	Late Oligocene	Middle Miocene	Late Miocene
Pterothriidae	<i>Pterothrissus cf. umbonatus</i>		Ostoros		
Heterenchelyidae	<i>Panturichthys subglaber</i>			Coșteiu de Sus, Nógrádszakál, Szob	
Congridae	<i>Rhynchoconger pantanellii</i>			Coșteiu de Sus	
	<i>Rhechias nagymarosi</i>		Budapest–Kiscell		
Ariidae	<i>Arius</i> sp.			Coșteiu de Sus	
Argentinidae	<i>Argentina</i> ? sp.			Coșteiu de Sus	
Myctophidae	<i>Diaphus cf. acutirostrum</i>			Hont, Mogyoród	
	<i>Diaphus debilis</i>			Szob, Sopron, Mogyoród	
	<i>Diaphus cf. regani</i>			Szob, Coșteiu de Sus, Ráchitova	
	<i>Diaphus taanungi</i>			Sopron, Szob, Szokolya, Coșteiu de Sus, Ráchitova	
	<i>Diaphus cf. taanungi</i>			Hont, Nógrádszakál	
	<i>Diaphus</i> sp. 1			Coșteiu de Sus	
	<i>Diaphus</i> sp. 2			Szob	
	<i>Symbolophorus meridionalis</i>			Coșteiu de Sus	
Moridae	<i>Physiculus aff. huloti</i>			Coșteiu de Sus	
Bregmacerotidae	<i>Bregmaceros</i> sp.			Nógrádszakál	
Gadidae	<i>Gadiculus argenteus</i>			Szob, Coșteiu de Sus	
	<i>Merluccius merluccius</i>			Walbersdorf	
	<i>Micromesistius cognatus</i>			Szob	
	<i>Phycis tenuis</i>			Walbersdorf, Coșteiu de Sus, Szob	
	<i>Trisopterus sculptus</i>			Walbersdorf, Baden-Sooss, Vöslau, Szob	
	Gadidae indet.				Bodogaia
Macrouridae	<i>Coelorhynchus arthaberi</i>			Piliny, Szupatak	
	<i>Coelorhynchus coelorhynchus</i>			Walbersdorf, Szalmatercs	
	<i>Trachyrhynchus trachyrhynchus</i>			Walbersdorf, Vöslau, Sopron	
Carapidae	<i>Echiodon nuntius</i>			Szob	
Ophidiidae	<i>Glyptophidium major</i>			Walbersdorf	
Atherinidae	“genus Atherinidarum” sp.			Coșteiu de Sus	
Trachichthyidae	<i>Hoplostethus praemediterraneus</i>			Kisterenyé	
Myripristinae	“genus Myripristinarum” sp.			Coșteiu de Sus	
Serranidae	<i>Serranus integer</i>	Zámoly		Szob	
	Serranidae indet.			Szob	
Apogonidae	<i>Apogon</i> sp. 1	Zámoly			
	<i>Apogon</i> sp. 2			Coșteiu de Sus	
Acropomatidae	<i>Acropoma nobilis</i>			Borsodbóta, Kostej, Zámoly	
Carangidae	<i>Trachurus</i> sp.			Szob	
Pomadasytidae	<i>Brachydeuterus latior</i>			Buják, Coșteiu de Sus	
Sparidae	<i>Dentex gregarius</i>	Zámoly		Szob, Nógrádszakál, Coșteiu de Sus	
	Sparidae indet.	Gánt		Budapest, Coșteiu de Sus	
Sciaenidae	“genus aff. <i>Umbrina</i> ” <i>kokeni</i>				Sopron
	<i>Umbrina subcirrhosa</i>				Sopron
Cepolidae	<i>Cepola rubescens</i>			Szob, Coșteiu de Sus	
Percoidei inc. sed.	“genus Percoideorum” aff. <i>tietzei</i>	Zámoly		Szob	
Gobiidae	<i>Deltenostenus telleri</i>			Szob	
	<i>Gobius aff. francofurtanus</i>			Szob	
	<i>Gobius aff. niger</i>			Coșteiu de Sus	
	<i>Gobius practiosus</i>			Mátraverebély, Szob, Coșteiu de Sus	
	<i>Lesueurigobius vicinalis</i>			Nógrádszakál, Szob, Szokolya, Buják, Coșteiu de Sus	
	Gobiidae indet.			Livezile	
	Otolith sp. indet. 1, 2, 3, 4			Szob, Nógrádszakál, Coșteiu de Sus	

**Table 2 — Comparison of the two most diversified fauna from Szob and Coșteiu de Sus.** — The species list is based both on the collection and papers (WEILER 1950; RADO 1965; BOSNAKOFF 2001, 2006). These Badenian marine shallow-water fish faunas with gobiid dominance are characteristic of the Central Paratethys, more or less in the same taxonomic composition.

Family	Species	Szob	Coșteiu de Sus
Heterenchelyidae	<i>Panturichthys subglaber</i> (SCHUBERT, 1906)	+	+
Congridae	<i>Rhynchoconger pantanellii</i> (BASSOLI & SCHUBERT, 1906)	+	+
Clupeidae	<i>Spratelloides</i> ? sp.	+	
Ariidae	<i>Arius</i> sp.		+
Argentinidae	<i>Argentina</i> ? sp.		+
Sternopychidae	<i>Maurolicus muelleri</i> (GMELIN, 1789)	+	
Myctophidae	<i>Diaphus acutirostrum</i> (HOLEC, 1975)		+
	<i>Diaphus</i> cf. <i>regani</i> TAANING, 1932	+	+
	<i>Diaphus debilis</i> (KOKEN, 1891)	+	
	<i>Diaphus</i> sp. 1		+
	<i>Diaphus</i> sp. 2	+	
	<i>Diaphus taanungi</i> NORMAN, 1930	+	+
	<i>Symbolophorus meridionalis</i> STEURBAUT, 1979		+
Moridae	<i>Physiculus</i> aff. <i>buloti</i> POLL, 1953	+	+
Gadidae	<i>Gadiculus argenteus</i> GUICHENOT, 1850	+	+
	<i>Micromesistius cognatus</i> (KOKEN, 1891)	+	
	<i>Phycis tenuis</i> (KOKEN, 1891)	+	+
	<i>Trisopterus sculptus</i> (KOKEN, 1891)	+	
Carapidae	<i>Echiodon nuntius</i> (KOKEN, 1891)	+	
Atherinidae	“genus <i>Atherinidarum</i> ” sp.		+
Holocentridae	“genus <i>Myripristinarum</i> ” sp.		+
Caproidae	Caproidae sp. indet.	+	
Serranidae	<i>Serranus integer</i> (SCHUBERT, 1906)	+	
Apogonidae	<i>Apogon</i> sp. 2		+
Acropomatidae	<i>Acropoma nobilis</i> (KOKEN, 1891)		+
Carangidae	<i>Trachurus</i> sp.	+	
Pomadasytidae	<i>Brachydeuterus latior</i> (KOKEN, 1891)		+
Sparidae	<i>Dentex gregarius</i> (KOKEN, 1891)	+	+
Cepolidae	<i>Cepola rubescens</i> LINNAEUS, 1758	+	+
Percoidei inc. sed.	“genus <i>Percoideorum</i> ” aff. <i>tietzei</i> (SCHUBERT, 1906)	+	
Gobiidae	<i>Deltenostens telleri</i> (SCHUBERT, 1906)	+	+
	<i>Gobius</i> aff. <i>francofurtanus</i> (KOKEN, 1891)	+	
	<i>Gobius</i> aff. <i>niger</i> LINNAEUS, 1758	+	+
	<i>Gobius praetiosus</i> PROCHÁZKA, 1893	+	+
	<i>Lesueuriogobius vicinalis</i> (KOKEN, 1891)	+	+
Bothidae	<i>Arnoglossus</i> sp.	+	

Genus *Rhynchoconger* JORDAN & HUBBS, 1925

***Rhynchoconger pantanellii* (BASSOLI & SCHUBERT, 1906)**  
(Figure 2: f, g)

- 1906: *Otolithus (Ophidium) Pantanellii* n. sp. — BASSOLI, p. 43, pl. I, figs 41–42.  
 1906: *Otolithus (Ophidium) appendiculatus* n. sp. — BASSOLI, p. 43, pl. I, figs 37–38.  
 1906: *Otolithus (Brotulidarium) pantanellii* (BASSOLI & SCHUBERT, 1906) — SCHUBERT, p. 668, pl. XIX, figs 31–34.  
 1950: *Congermuraena pantanellii* (BASSOLI, 1906) — WEILER, p. 235, pl. 5, fig. 30.  
 1952a: *Otolithus (Congridarum) pantanellii* (BASSOLI & SCHUBERT) — WEINFURTER, p. 156, pl. 1, fig. 9.  
 1970: *Uroconger pantanellii* (BASSOLI, 1906) — ROBBA, p. 116, pl. 9, fig. 9.  
 1970: *Uroconger* sp. — ROBBA, p. 117, pl. 10, fig. 1.  
 1975: *Otolithus (Congridarum) pantanellii* (BASSOLI, 1906) — HOLEC, p. 259, pl. I, fig. 6.  
 1979: *Gnathophis pantanellii* (BASSOLI, 1906) — STEURBAUT, p. 54, pl. 1, fig. 14.  
 1981: *Gnathophis pantanellii* (BASSOLI & SCHUBERT, 1906) — NOLF, p. 140.  
 1983: *Hildebrandia pantanellii* (BASSOLI & SCHUBERT, 1906) — NOLF & STEURBAUT, p. 149, pl. 1, figs 4–9.  
 1985: *Hildebrandia pantanellii* (BASSOLI & SCHUBERT, 1906) — NOLF, p. 43, fig. 37E.  
 1989: *Hildebrandia pantanellii* (BASSOLI, 1906) — NOLF & CAPPETTA, pl. 2, figs 1–4.  
 1994: *Rhynchoconger* sp. — BRZOBOHATÝ, pl. 1, fig. 5.  
 1994: *Rhynchoconger pantanellii* (BASSOLI & SCHUBERT, 1906) — NOLF & BRZOBOHATÝ, p. 231, pl. 7, figs 2–3.  
 2002: *Rhynchoconger pantanellii* (BASSOLI & SCHUBERT, 1906) — NOLF & BRZOBOHATÝ, pl. 1, fig. 12.  
 2005: *Rhynchoconger pantanellii* (BASSOLI & SCHUBERT, 1906) — HOEDEMAKERS & BATLLORI, pl. 2, figs 4–7.  
 2009: *Rhynchoconger pantanellii* (BASSOLI & SCHUBERT, 1906) — NOLF & BRZOBOHATÝ, p. 334, pl. I, fig. 4.

**Material** — 2 otoliths from Coșteiu de Sus (Romania), Badenian (M.60.7523.3) and 1 otolith without inventory number.

**Distribution** — *Rhynchoconger pantanellii* is widely

found in the Middle Miocene and the Pliocene deposits of the Paratethys and the Mediterranean region, and it was also recognised in the Upper Oligocene sediments in southern France and Hungary.

Order Siluriformes CUVIER, 1817

Family Ariidae GÜNTHER, 1864

Genus *Arius* CUVIER & VALENCIENNES, 1840

*Arius* sp.

(Figure 2: d)

? 1994: *Arius* sp. — BRZOBONATÝ, p. 69, pl. I, fig. 8.

**Material** — 1 utricular otolith from Coșteiu de Sus (Romania), Badenian (M.60.7523).

**Distribution** — Ariid species are known from various Oligocene and Miocene deposits of the Paratethys.

Order Salmoniformes BLEEKER, 1859

Suborder Argentinoidea BONAPARTE, 1832

Family Argentinidae BONAPARTE, 1832

Genus *Argentina* LINNAEUS, 1758

*Argentina* ? sp.

(Figure 2: c)

**Material** — 1 specimen without inventory number.

**Distribution** — Coșteiu de Sus (Romania), Badenian.

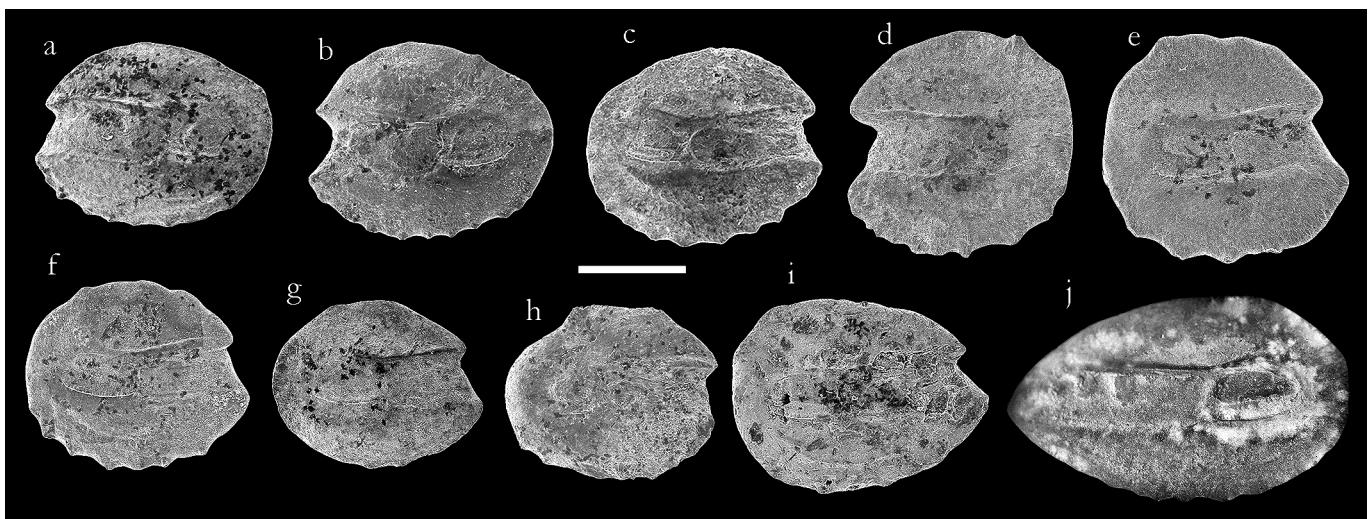


Figure 3 — a, b: *Diaphus* cf. *regani* TAANING, 1932 — Coșteiu de Sus (no Inv. №); c: *Diaphus* cf. *regani* TAANING, 1932 — Szob (V.63.733.4); d: *Diaphus debilis* (KOKEN, 1891) — Szob (V.63.733.4); e: *Diaphus debilis* (KOKEN, 1891) — Sopron (no Inv. №); f: *Diaphus taanungi* NORMAN, 1930 — Coșteiu de Sus (no Inv. №); g: *Diaphus* sp. 1 — Coșteiu de Sus (M.60.7512); h: *Diaphus* sp. 2 — Szob (V.63.733.4); i: *Diaphus* cf. *acutirostrum* (HOLEC, 1975) — Hont (V.62.425); j: *Symbolophorus meridionalis* STEURBAUT, 1979 — Coșteiu de Sus (no Inv. №). (The scale bar represents 1 mm.)

Order Myctophiformes REGAN, 1911

Family Myctophidae GILL, 1893

Genus *Diaphus* EIGENMANN, 1890

*Diaphus* cf. *acutirostrum* (HOLEC, 1975)

(Figure 3: i)

? 1975: *Ot. (Myctophidarum) acutirostrum* n. sp. — HOLEC, p. 258, pl. 1, fig. 5.

? 1975: *Myctophum mediterraneum* (KOKEN, 1891) — HOLEC, p. 255, pl. I, fig. 2.

? 1975: *Myctophum splendidum* (PROCHÁZKA, 1893) — HOLEC, p. 256, pl. I, fig. 4.

? 2000: *Diaphus acutirostrum* (HOLEC, 1975) — BRZOBONATÝ & NOLF, p. 187, pl. 3, figs 1–6.

**Material** — 3 otoliths from Mogyoród (M.61.6534), 2 specimens from Hont (V.62.425).

**Distribution** — Both localities explore Middle Miocene strata of North Hungary.

***Diaphus debilis* (KOKEN, 1891)**  
(Figure 3: d, e)

- ? 1891: *Ot. (Berycidarum) debilis* n. sp. — KOKEN, p. 122, pl. VI, fig. 3.
- ? 1891: *Ot. (Berycidarum) austriacus* n. sp. — KOKEN, p. 122, textfig. 14.
- 1905: *Ot. (Berycidarum) austriacus* KOKEN — SCHUBERT, p. 630, pl. XVII, figs 1–7.
- 1905: *Ot. (Berycidarum) kokeni* KOKEN — SCHUBERT, p. 631, pl. XVII, figs 8–11.
- 1942: *Scopelus debilis* (KOKEN, 1891) — WEILER, p. 21, pl. 1, figs 31, 33, 36, 37, non figs 30, 32, 34, 35.
- 1950: *Scopelus debilis* (KOKEN, 1891) — WEILER, p. 211, pl. 1, fig. 2, pl. 9, figs 66–67.
- ? 1952a: *Scopelus debilis austriacus* (KOKEN) — WEINFURTER, p. 151, pl. I, figs 2–3.
- 1965: *Scopelus debilis* (KOKEN) — RADO, p. 60, pl. I, figs 4, 6.
- 1966: *Myctophum debile* (KOKEN) — ŚMIGIELSKA, p. 229, pl. XII, figs 6, 8, pl. XIII, fig. 1.
- 1970: *Myctophum debile* (KOKEN, 1891) — ROBBA, p. 104, pl. 8, figs 1–2.
- 1971: *Myctophum debile* (KOKEN, 1891) — GAEMERS, p. 241, pl. I, fig. 2, pl. IV, fig. 3.
- 1973: *Myctophum debile* (KOKEN, 1891) — HOLEC, p. 394, pl. I, figs 1, 4, 5, 6, 7.
- 1977: *Diaphus debilis* (KOKEN, 1891) — NOLF, p. 18, pl. II, figs 11–18.
- 1979: *Diaphus debilis* (KOKEN, 1891) — STEURBAUT, p. 62, pl. 3, figs 9–16.
- 1981: *Diaphus debilis* (KOKEN, 1891) — NOLF, p. 137.
- 1994: *Diaphus debilis* (KOKEN, 1891) — BRZOBONATÝ, pl. 2, figs 5–8.
- 2000: *Diaphus debilis* (KOKEN, 1891) — BRZOBONATÝ & NOLF, p. 189, pl. 2, figs 13–18.
- 2007: *Diaphus debilis* (KOKEN, 1891) — CHALUPOVÁ & LEDVÁK, p. 50, pl. 1, fig. 5.

**Material** — 3 otoliths from Sopron, Szélmalom Hill (Hungary) Badenian (no inv. №); 1 otolith from Mogyoród (Hungary) Middle Miocene (M.61.6534); 8 specimens from Szob (Hungary) Badenian (V.63.733.4).

**Distribution** — This species was widespread in the North Sea Basin during the Miocene, and also occurs in the Lower to Middle Miocene sediments of the Paratethys.

***Diaphus cf. regani* TAANING, 1932**  
(Figure 3: a, b, c)

- ? 1980: *Diaphus* sp. II — NOLF & MARTINELL, p. 211, pl. 3, figs 13–15.
- ? 1998: *Diaphus regani* TAANING, 1932 — NOLF & AGUILERA, p. 239, pl. 5, figs 7–12.
- ? 2000: *Diaphus regani* TAANING, 1932 — BRZOBONATÝ & NOLF, p. 192, pl. 3, figs 15–20.
- ? 2009: *Diaphus regani* TAANING, 1932 — NOLF & BRZOBONATÝ, pl. 2, figs 7–9.

**Material** — 1 otolith from Szob (Hungary), Badenian (V.63.733.4), 3 otoliths from Coșteiu de Sus (Romania), Badenian (without inventory number), 1 otolith from Răchitova (Romania), Middle Miocene (without inventory number).

**Distribution** — *Diaphus regani* is a member of the present day fauna but known also from the Lower Miocene of Northern Italy and the Pliocene of the wider Mediterranean region.

***Diaphus taanungi* NORMAN, 1930**  
(Figure 3: f)

- 1950: *Scopelus debilis* (KOKEN, 1891) — WEILER, p. 211, pl. 1, fig. 2, non pl. 9, figs 66–67.
- 1978: *Diaphus austriacus* (KOKEN) — BRZOBONATÝ, pl. 1, fig. 10.
- 1979: *Diaphus debilis* (KOKEN, 1891) — STEURBAUT, p. 62, pl. 3, figs 9–10.
- 1994: *Diaphus debilis* (KOKEN, 1891) — BRZOBONATÝ, pl. 2, figs 5, 8, non figs 6–7.
- 2000: *Diaphus taanungi* NORMAN, 1930 — BRZOBONATÝ & NOLF, p. 193, pl. 2, figs 7–12.
- 2001: *Diaphus* sp. 1 — BOSNAKOFF, p. 211, fig. 24.
- 2001: *Diaphus* sp. 2 — BOSNAKOFF, p. 211, fig. 25.
- 2006: *Diaphus taanungi* NORMAN, 1930 — BOSNAKOFF, p. 21, pl. II, figs 1–4.

**Material** — 2 otoliths from Sopron, Szélmalom Hill (Hungary) Badenian (no Inv. №); 1 otolith from Szokolya (Hungary) Badenian (V.63.731); 13 otoliths from Coșteiu de Sus (Romania) Badenian (M.60.7512, M.60.7523.2 and 5 specimens without inventory number); 6 otoliths from Răchitova (Romania) Middle Miocene (no Inv. №); 1 *Diaphus*

cf. *taanungi* otolith from Hont (V.62.425); 1 eroded specimen from Nógrádszakál (Hungary) Badenian (M.61.8346.2).

**Distribution** — This species is known from the Karpatian to the Upper Badenian sediments of the Paratethys.

***Diaphus* sp. 1**  
(Figure 3: g)

**Material** — 1 otolith (M.60.7512).

**Distribution** — Coșteiu de Sus, Romania, Badenian.

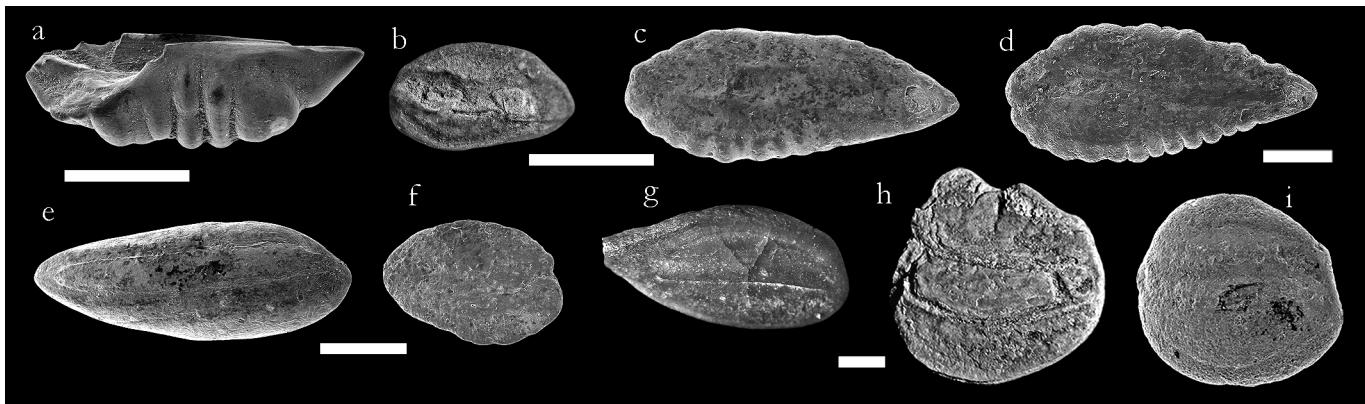
*Diaphus* sp. 2

(Figure 3: h)

**Material** — 1 otolith (V.63.733.4).**Distribution** — Szob (Hungary) Badenian.*Diaphus* spp. indet.**Material** — 4 otoliths (M.60.7522.1).**Distribution** — Coșteiu de Sus (Romania) Badenian.Genus *Symbolophorus* BOLIN in WISNER & BOLIN, 1959*Symbolophorus meridionalis* STEURBAUT, 1979

(Figure 3: j)

- 1891: *Otolithus (Berycidarum) mediterraneus* n. sp. — KOKEN, p. 122, textfig. 15.  
 1905: *Otolithus (Berycidarum) mediterraneus* KOKEN — SCHUBERT, p. 632, pl. XVII, figs 19, 20.  
 1905: *Otolithus (Berycidarum) splendidus* PROCHÁZKA — SCHUBERT, p. 633, pl. XVII, fig. 17.  
 1979: *Symbolophorus meridionalis* n. sp. — STEURBAUT, p. 60, pl. 3, figs 1–6, pl. 12, fig. 5.  
 1981: *Symbolophorus meridionalis* STEURBAUT, 1979 — NOLF, p. 138.  
 1985: *Symbolophorus meridionalis* STEURBAUT, 1979 — NOLF, p. 56, fig. 47E.  
 1996: *Symbolophorus meridionalis* STEURBAUT, 1979 — BRZOBOHATÝ & NOLF, pl. 8, figs 9–15.  
 2002: *Symbolophorus meridionalis* STEURBAUT, 1979 — NOLF & BRZOBOHATÝ, pl. 5, fig. 11.  
 2007: *Symbolophorus meridionalis* STEURBAUT, 1979 — CHALUPOVÁ & LEDVÁK, p. 48, pl. 1, fig. 2.

**Material** — 1 otolith from Coșteiu de Sus (Romania), Badenian (no inventory number).**Distribution** — This species is known also in the deposits of Aquitaine Basin and the Paratethys from the Late Oligocene to Early Miocene times.

**Figure 4** — a: *Physiculus* aff. *huloti* POLL, 1953 — Coșteiu de Sus (no Inv. №); b: *Gadiculus argenteus* GUICHENOT, 1850 — Coșteiu de Sus (no Inv. №); c: *Micromesistius cognatus* (KOKEN, 1891) — Szob (V.63.733.2); d: *Trisopterus sculptus* (KOKEN, 1891) — Szob (V.63.733.3); e: *Phycis tenuis* (KOKEN, 1891) — Coșteiu de Sus (no Inv. №); f: *Gadiculus argenteus* GUICHENOT, 1850 — Szob (V.63.733.5); g: *Echiodon nuntius* (KOKEN, 1891) — Szob (V.63.733.7); h: *Glyptophidium major* (SCHUBERT, 1905) — Walbersdorf (V.63.714); i: “genus *Atherinidarum*” sp. — Coșteiu de Sus (no Inv. №). (Each scale bars represent 1 mm.)

Order Gadiformes GOODRICH, 1909

Suborder Gadoidei GOODRICH, 1909

Family Moridae GOODE &amp; BEAN, 1896

Genus *Physiculus* KAUP, 1855*Physiculus* aff. *huloti* POLL, 1953

(Figure 4: a)

- 1979: *Physiculus fitchi* n. sp. — ŚMIGIELSKA, p. 307, textfig. 10, pl. 3, figs 1–2.  
 1979: *Physiculus* aff. *huloti* POLL, 1953 — STEURBAUT, p. 63, pl. 6, figs 3–5.  
 1980: *Physiculus* aff. *huloti* POLL, 1953 — NOLF & MARTINELL, pl. 3, figs 16, 17.  
 1983: *Physiculus* aff. *huloti* POLL, 1953 — NOLF & STEURBAUT, p. 162, pl. 3, fig. 17.  
 2001: *Physiculus* sp. — BOSNAKOFF, p. 208, fig. 20.  
 2006: *Physiculus* sp. — BOSNAKOFF, p. 22, pl. III, fig. 1.

**Material** — 1 otolith from Coșteiu de Sus (Romania), Badenian (no inventory number).

**Distribution** — *Physiculus* aff. *buloti* POLL., 1953 was found in the Middle Miocene deposits of the Paratethys.

Family Bregmacerotidae GILL, 1872

Genus *Bregmaceros* THOMPSON, 1840

***Bregmaceros* sp.**

**Material** — 1 otolith (M.61.8346.2).

**Distribution** — Nógrádszakál, Bertece stream (Hungary), Badenian.

Family Gadidae RAFINESQUE, 1810

Genus *Gadiculus* GUICHENOT, 1850

***Gadiculus argenteus* GUICHENOT, 1850**  
(Figure 4: b, f)

- 1905: *Otolithus (Macrurus) ellipticus* n. sp. — SCHUBERT, p. 622, pl. XVI, figs 31–33.  
 1905: *Otolithus (Macrurus) excisus* n. sp. — SCHUBERT, p. 623.  
 1906: *Otolithus (Macrurus) ellipticus* SCHUBERT — BASSOLI, p. 39, pl. I, figs 17–18.  
 1942: *Macrurus ellipticus* SCHUBERT — WEILER, p. 96, pl. 5, figs 39, 41, 45–48, 50, 51.  
 1950: *Macrurus ellipticus* SCHUBERT, 1905 — WEILER, p. 242, pl. 5, figs 32, 34, 35.  
 1966: *Macrurus ellipticus* SCHUBERT — ŚMIGIELSKA, p. 244, pl. XV, figs 5–7.  
 1970: *Glyptorhynchus communis* (PROCHÁZKA, 1893) — ROBBA, p. 123, pl. 11, fig. 5.  
 1971: *Macrurus communis* (PROCHÁZKA, 1894) — GAEMERS, p. 245, pl. I, fig. 12, pl. IV, fig. 4.  
 1973: *Macrurus communis* (PROCHÁZKA, 1893) — HOLEC, p. 402, pl. III, figs 4–9.  
 1976: *Gadiculus ellipticus* (SCHUBERT, 1905) — GAEMERS, p. 513, pl. V, fig. 6, pl. VII, figs 3, 4.  
 1977: *Gadiculus argenteus* GUICHENOT, 1850 — NOLF, pl. IV, figs 1–6.  
 1978: *Gadiculus communis* (PROCHÁZKA) — BRZOBOHATÝ, p. 164, pl. 1, fig. 5.  
 1978: *Gadiculus ellipticus* (SCHUBERT) — BRZOBOHATÝ, p. 164, pl. 1, fig. 7.  
 1978: *Gadiculus argenteus* GUICHENOT, 1850 — NOLF, p. 522, pl. 1, figs 5–8.  
 1979: *Gadiculus argenteus* GUICHENOT, 1850 — STEURBAUT, p. 64, pl. 5, figs 12–16.  
 1981: *Gadiculus argenteus* GUICHENOT, 1850 — NOLF, p. 151.  
 1983: *Gadiculus argenteus* GUICHENOT, 1850 — NOLF & STEURBAUT, p. 164, pl. 3, fig. 36.  
 1989: *Gadiculus argenteus* GUICHENOT, 1850 — NOLF & CAPPETTA, pl. 11, figs 4–6.  
 1994: *Gadiculus argenteus* GUICHENOT, 1850 — BRZOBOHATÝ, pl. 3, fig. 6.  
 2006: *Gadiculus ellipticus* (SCHUBERT, 1905) — BOSNAKOFF, p. 23, pl. IV, figs 1–2.

**Material** — 2 otoliths from Szob (Hungary), Badenian (V.63.733.5), 4 otoliths (M.60.7551) and 1 without inventory number from Coșteiu de Sus (Romania),

Badenian are available.

**Distribution** — This Recent species is known also from the Oligocene to Pleistocene of Europe.

Genus *Merluccius* RAFINESQUE, 1810

***Merluccius merluccius* (LINNEAUS, 1758)**

- 1884: *Otolithus (Merluccii) esculentus* n. sp. — KOKEN, p. 529, pl. IX, fig. 1.  
 1906: *Otolithus (Merluccius) preesculentus* n. sp. — BASSOLI, p. 39, pl. 1, figs 7, 9, 10.  
 1906: *Otolithus (Merluccius) praesculentus* BASS. et SCHUB. — SCHUBERT, p. 657, pl. XIX, fig. 29.  
 1942: *Merluccius vulgaris* FLEMING — WEILER, p. 87, pl. 11, figs 1–4, 6, 7.  
 1970: *Paleogadus emarginatus* (KOKEN, 1884) — ROBBA, p. 122, pl. 11, fig. 4.  
 1971: *Merluccius vulgaris* FLEMING, 1828 — GAEMERS, p. 245, pl. II, fig. 1, pl. V, fig. 4.  
 1973: *Merluccius vulgaris* FLEMING — ŚMIGIELSKA, p. 7, pl. I, fig. 2.  
 1973: *Paleogadus emarginatus* (KOKEN, 1884) — HOLEC, p. 400, pl. III, figs 2–3.  
 1977: *Merluccius merluccius* (LINNEAUS, 1758) — NOLF, p. 21, pl. III, figs 1–3.  
 1978: *Paleogadus emarginatus* (KOKEN, 1884) — BRZOBOHATÝ, pl. 1, fig. 3.  
 1979: *Merluccius merluccius* (LINNEAUS, 1758) — ŚMIGIELSKA, p. 308, textfig. 11, pl. 2, fig. 8.  
 1989: *Merluccius merluccius* (LINNEAUS, 1758) — NOLF & CAPPETTA, pl. 11, fig. 9.  
 1994: *Merluccius* aff. *merluccius* (LINNEAUS, 1758) — BRZOBOHATÝ, pl. 3, fig. 2.

**Material** — 1 otolith from Walbersdorf, Prost brick-yard (Austria) Badenian (V.63.716).

**Distribution** — It occurs also in further Miocene deposits of the Paratethys.

Genus *Micromesistius* GILL, 1863

***Micromesistius cognatus* (KOKEN, 1891)**  
(Figure 4: c)

- 1891: *Otolithus (Merlangus) cognatus* n. sp. — KOKEN, p. 89, pl. V, fig. 1, non pl. III, fig. 5.  
 1906: *Otolithus (Gadus) elegans* KOKEN — SCHUBERT, p. 660, pl. XIX, figs 21–26, pl. XX, figs 16–18.  
 1942: *Merlangus cognatus* (KOKEN) — WEILER, p. 79, pl. 9, figs 7, 8.  
 1971: *Merlangius cognatus* (KOKEN, 1891) — GAEMERS, p. 244, pl. I, fig. 9, pl. II, fig. 3, pl. V, fig. 5, pl. VI, fig. 1.  
 1976: *Merlangiogadus cognatus* (KOKEN, 1891) — GAEMERS, p. 511, pl. V, figs 1, 2.  
 1977: *Micromesistius cognatus* (KOKEN, 1891) — NOLF, p. 25, pl. IV, figs 17–22.  
 1980: *Micromesistius poutassou* (RISSO, 1826) — NOLF & MARTINELL, p. 211, pl. 3, figs 22–27.  
 1994: *Micromesistius* sp. — BRZOOBOHATÝ, pl. 3, figs 3–5.

**Material** — 2 otoliths from Szob (Hungary) Badenian (V.63.733.2).

**Distribution** — It is known from the Oligocene of Germany, the Miocene of the Paratethys and the North Sea.

Genus *Phycis* ARTEDI, 1792

***Phycis tenuis* (KOKEN, 1891)**  
(Figure 4: e)

- 1891: *Otolithus (Gadus) tenuis* n. sp. — KOKEN, p. 92, pl. IV, fig. 3.  
 1906: *Otolithus (Phycis) tenuis* KOKEN — BASSOLI, p. 38, pl. I, figs 3–4.  
 1928: *Phycis tenuis* KOKEN — CHAINE & DUVERGIER, p. 191, pl. VI, figs 1–6.  
 1950: *Phycis tenuis* (KOKEN, 1891) — WEILER, p. 240, pl. 5, figs 31, 33.  
 1966: *Phycis tenuis* (KOKEN, 1891) — ŚMIGIELSKA, p. 238, pl. XIV, fig. 4.  
 1978: *Urophycis tenuis* (KOKEN, 1891) — BRZOOBOHATÝ, pl. 1, fig. 4.  
 1979: *Urophycis tenuis* (KOKEN, 1891) — ŚMIGIELSKA, p. 309, pl. 3, figs 3–5.  
 1983: *Phycis tenuis* (KOKEN, 1891) — NOLF & STEURBAUT, p. 165, pl. 6, fig. 22.  
 1989: *Phycis tenuis* (KOKEN, 1891) — NOLF & CAPETTA, p. 219, pl. 11, figs 13, 14.

**Material** — 3 otoliths from Coșteiu de Sus (Romania), Badenian (M.60.7585, M.60.7602) and 3 without inventory number from Coșteiu de Sus, 2 otoliths from Walbersdorf (Austria), Badenian (V.63.718), 2 otoliths from Szob

(Hungary), Badenian (V.63.733.11).

**Distribution** — This species was described from the Oligocene of Germany, it occurs also in Miocene deposits of the Paratethys.

Genus *Trisopterus* RAFINESQUE, 1814

***Trisopterus sculptus* (KOKEN, 1891)**  
(Figure 4: d)

- 1884: *Otolithus (Gadidarum) elegans* n. sp. — KOKEN, p. 542, pl. XI, figs 2–4.  
 1891: *Otolithus (Gadus) elegans* KOKEN, 1884 — KOKEN, p. 93, pl. IV, fig. 2.  
 1891: *Otolithus (Merlangus) cognatus* n. sp. — KOKEN, p. 89, pl. III, fig. 5, non pl. V, fig. 1.  
 1906: *Otolithus (Gadus) elegans* var. *sculpta* KOKEN — BASSOLI, p. 38, pl. I, figs 5–6.  
 1906: *Otolithus (Gadus) elegans* KOKEN — SCHUBERT, p. 660, pl. XIX, figs 13–18.  
 1928: *Gadus* (?) Friedbergi n. sp. — CHAINE & DUVERGIER, p. 197, pl. VI, figs 16–27.  
 1942: *Gadus friedbergi* CHAINE et DUVERGIER — WEILER, p. 75, pl. 6, figs 10, 12–14.  
 1966: *Gadus friedbergi* CHAINE et DUVERGIER — ŚMIGIELSKA, p. 239, pl. XIV, figs 7–8.  
 1966: *Gadus schuberti* n. sp. — ŚMIGIELSKA, p. 240, pl. XV, figs 1–2.  
 1966: *Gadus elegans sculptus* KOKEN — ŚMIGIELSKA, p. 241, pl. XV, fig. 3.  
 1971: *Trisopterus friedbergi* (CHAINE et DUVERGIER, 1928) nov. comb. — GAEMERS, p. 242, pl. I, figs 5, 6, pl. V, fig. 2, pl. VI, fig. 3.  
 1973: *Trisopterus friedbergi* (CHAINE et DUVERGIER, 1928) — HOLEC, p. 396, pl. I, figs 8–10.  
 1976: *Colliolus friedbergi* (CHAINE et DUVERGIER, 1928) — GAEMERS, p. 516.  
 1976: *Colliolus jobannetiae* n. sp. — GAEMERS, p. 515, pl. VI, figs 9, 10.  
 1977: *Trisopterus sculptus* (KOKEN, 1891) — NOLF, p. 30, pl. VI, figs 19–25.  
 1978: *Colliolus friedbergi* (CHAINE et DUVERGIER, 1928) — BRZOOBOHATÝ, pl. 1, fig. 2.  
 1981: *Trisopterus sculptus* (KOKEN, 1891) — NOLF, p. 146.  
 1985: *Trisopterus sculptus* (KOKEN, 1891) — NOLF, p. 62, fig. 49K.  
 1994: *Trisopterus elegans* (KOKEN, 1884) — BRZOOBOHATÝ, pl. 3, figs 8–10.  
 2001: *Trisopterus sculptus* (KOKEN, 1891) — BOSNAKOFF, p. 206, fig. 18.  
 2006: *Trisopterus sculptus* (KOKEN, 1891) — BOSNAKOFF, p. 24, pl. IV, figs 3–5.

**Material** — 4 otoliths from Walbersdorf (Austria) Badenian (M.91.70, V.63.710), 5 otoliths from Baden-Sooss (Austria) Badenian (M.61.6991), 1 otolith from Vöslau (Austria) Badenian (V.62.269), 11 otoliths from

Szob (Hungary) Badenian (V.63.733.3).

**Distribution** — This species is well known from the Miocene sediments of the North Sea Basin and the Paratethys.

**Gadidae sp. indet.**

- ? 1954: *Otolithus (Gadidarum) ponticum* n. sp. — WEINFURTER, p. 39, pl. 6, figs 47–48.  
 ?v 2010: “genus *Gadidarum*” *ponticum* WEINFURTER, 1954 — JOVANOVIĆ et al., p. 73, pl. II, fig. 5.

**Material** — 1 otolith from Bodogaia, Akasztó Hill (Romania), Upper Miocene (V.63.2009).

**Remarks** — A poorly preserved specimen, one can only guess that belongs to WEINFURTER’s species.

**Distribution** — Similar poorly preserved gadid otoliths known from other Upper Miocene beds at Vösendorf (Vienna Basin, Austria), Doba (Hungary) and Oresač (Serbia).

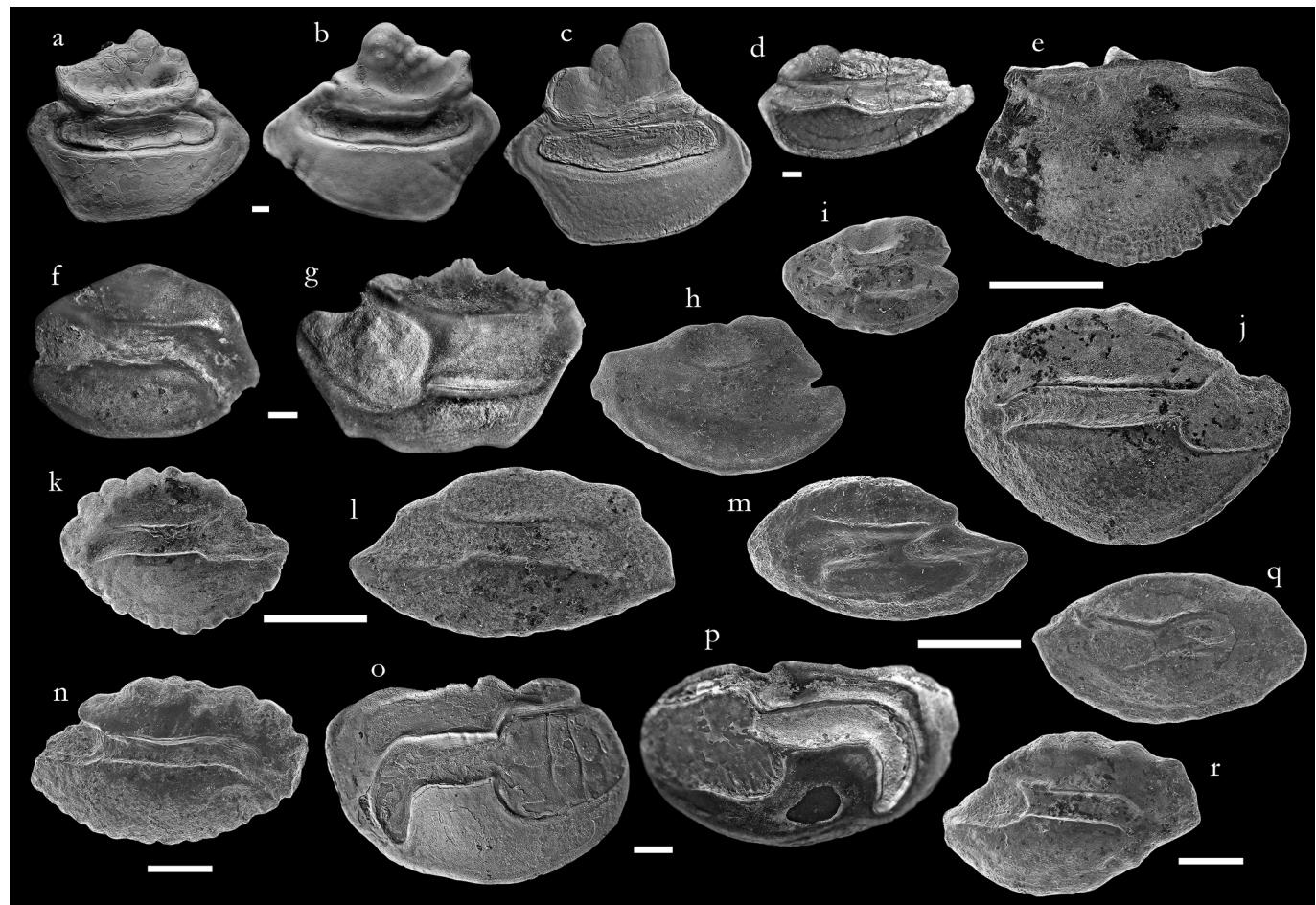


Figure 5 — a: *Trachyrhynchus trachyrhynchus* (RISSO, 1810) — Walbersdorf (no Inv. №); b: *Trachyrhynchus trachyrhynchus* (RISSO, 1810) — Vöslau (V.62.271); c: *Trachyrhynchus trachyrhynchus* (RISSO, 1810) — Walbersdorf (V.63.722.2); d: *Coelorhynchus coelorhynchus* (RISSO, 1810) — Szalmatercs (M.61.8167); e: “genus *Myripristinarum*” sp. — Coșteiu de Sus (no Inv. №); f: Otolith indet. 4. — Coșteiu de Sus (M.60.7567); g: *Hoplostethus praemediterraneus* SCHUBERT, 1905 — Kisterenyé (M.61.9024); h: *Apogon* sp. 1 — Zámoly (M.62.544); i: *Apogon* sp. 2 — Coșteiu de Sus, (M.60.7523.4); j: *Brachydeuterus latior* (SCHUBERT, 1906) — Coșteiu de Sus (no Inv. №); k: Sparidae indet. — Budapest, Huszár street (V.63.751); l: *Serranus integer* (SCHUBERT, 1906) — Zámoly (M.62.544.2); m: *Serranus integer* (SCHUBERT, 1906) — Szob (V.63.733.14); n: *Trachurus* sp. — Szob (V.63.733.15); o: “genus aff. *Umbrina*” *kokeni* (SCHUBERT, 1902) — Sopron, Lenk brickyard (M.57.1081.1); p: *Umbrina subcircularis* SCHUBERT, 1902 — Sopron, Lenk brickyard (M.57.1081.2); q: *Cepola rubescens* LINNAEUS, 1766 — Szob, (V.63.733.10); r: “genus *Percoideorum*” aff. *tietzei* (SCHUBERT, 1906) — Szob, (V.63.733.16). (Each scale bars represent 1 mm.)

Suborder Macrouroidei GARMAN, 1899

Family Macrouridae JORDAN & EVERMANN, 1898

Genus *Trachyrhynchus* GIORNA, 1809

***Trachyrhynchus trachyrhynchus* (RISSO, 1810)**  
 (Figure 5: a–c)

- 1891: *Otolithus (Macrurus) praecursor* n. sp. — KOKEN, p. 96, textfigs 6, 7.  
 1905: *Otolithus (Hymenocephalus?) austriacus* n. sp. — SCHUBERT, p. 625, pl. XVI, fig. 29.  
 1905: *Otolithus (Macrurus) angustus* n. sp. — SCHUBERT, p. 619, pl. XVI, figs 20, 21.  
 1905: *Otolithus (Hymenocephalus?) austriacus* n. sp. — SCHUBERT, p. 625, pl. XVI, fig. 29.

- 1905: *Otolithus (Macrurus) crassus* n. sp. — SCHUBERT, p. 619, pl. XVI, figs 23–25, 30.  
 1905: *Otolithus (Macrurus) elongatus* n. sp. — SCHUBERT, p. 617, pl. XVI, fig. 22.  
 1905: *Otolithus (Macrurus) gracilis* n. sp. — SCHUBERT, p. 616, pl. XVI, figs 9–13.  
 1905: *Otolithus (Macrurus) praetachyrhynchus* n. sp. — SCHUBERT, p. 615, pl. XVI, figs 1–8.  
 1905: *Otolithus (Macrurus) rotundatus* n. sp. — SCHUBERT, p. 620, pl. XVI, figs 26–28.  
 1905: *Otolithus (Macrurus) trolli* n. sp. — SCHUBERT, p. 617, pl. XVI, figs 14–19.  
 1906: *Otolithus (Macrurus) gracilis* SCHUBERT, 1905 — BASSOLI, p. 42, pl. 1, figs 19, 20, 23, 24.  
 1906: *Otolithus (Macrurus) trolli* SCHUBERT, 1905 — BASSOLI, p. 42, pl. 1, figs 34–35.  
 1970: *Macrurus gracilis* SCHUBERT, 1905 — ROBBA, p. 126, pl. 12, fig. 4.  
 1970: *Macrurus trolli* SCHUBERT, 1905 — ROBBA, p. 128, pl. 13, fig. 1.  
 1977: *Trachyrhynchus trachyrhynchus* (RISSO, 1810) — NOLF, p. 37.  
 1978: *Macrurus gracilis* SCHUBERT, 1905 — HOLEC, p. 163, pl. XVII, fig. 2.  
 1981: *Trachyrhynchus trachyrhynchus* (RISSO, 1810) — NOLF, p. 149–153.  
 1983: *Trachyrhynchus trachyrhynchus* (RISSO, 1810) — NOLF & STEURBAUT, p. 172, pl. 5, figs 12–24.  
 1989: *Trachyrhynchus trachyrhynchus* (RISSO, 1810) — NOLF & CAPPETTA, pl. 12, fig. 8.

**Material** — 28 otoliths from Walbersdorf (Austria) Badenian (M.91.72, M.62.4894, V.63.706, V.63.709, V.63.711, V.63.712, V.63.715, V.63.717, V.63.719, V.63.722), and 57 otoliths without inventory numbers. 8 otoliths from

Vöslau (Austria) Badenian (V.62.271) and 3 otoliths from Sopron (Hungary) Badenian (M.62.4930).

**Distribution** — This extant species occurs also in the Paratethyan and Mediterranean Miocene and Pliocene.

#### Genus *Coelorinchus* GIORNA, 1805

##### *Coelorinchus arthaberi* (SCHUBERT, 1905)

- 1905: *Otolithus (Macrurus) arthaberi* n. sp. — SCHUBERT, p. 621, pl. XVI, fig. 38, non textfig. 1.  
 1906: *Otolithus (Macrurus) arthaberoides* BASSOLI — BASSOLI, p. 41, pl. I, fig. 26.  
 1966: *Macrurus arthaberi* SCHUBERT — ŚMIGIELSKA, p. 249, pl. XVI, figs 11–12.  
 1981: *Coelorhynchus coelorhynchus* (RISSO, 1810) — NOLF, p. 151.  
 1983: *Coelorinchus arthaberi* (SCHUBERT, 1905) — NOLF & STEURBAUT, p. 168, pl. 5, figs 1–4.  
 1985: *Coelorinchus arthaberi* (SCHUBERT, 1905) — NOLF, p. 62, fig. 50F.  
 2000a: *Coelorinchus arthaberi* (SCHUBERT, 1905) — NOLF & GIRONE, pl. 2, figs 18–20.

**Material** — 2 otoliths (M.61.8164 and M.61.9099) from different localities.

**Distribution** — Piliny, Vár Hill (M.61.8164) and Szupatak (Hungary) Middle Miocene.

##### *Coelorinchus coelorinchus* (RISSO, 1810)

(Figure 5: d)

- 1905: *Otolithus (Macrurus) toulai* n. sp. — SCHUBERT, p. 620, pl. XVI, fig. 37.  
 1906: *Otolithus (Macrurus) toulai* SCHUBERT — BASSOLI, p. 41, pl. I, figs 13–14.  
 1942: *Macrurus toulai* SCHUBERT — WEILER, p. 93, pl. 3, figs 1–8.  
 1970: *Glyptorhynchus toulai* (SCHUBERT, 1905) — ROBBA, p. 123, pl. 11, fig. 6.  
 1977: *Coelorhynchus coelorhynchus* (RISSO, 1810) — NOLF, p. 37, pl. XI, figs 1–8.  
 1978: *Coelorinchus toulai* (SCHUBERT) — BRZOBHATÝ, pl. 1, fig. 11.  
 1978: *Coelorinchus toulai* (SCHUBERT, 1905) — HOLEC, p. 161, pl. XXVI, fig. 2.  
 1979: *Coelorhynchus coelorhynchus* (RISSO, 1810) — ŚMIGIELSKA, p. 311, textfig. 12, pl. 3, fig. 6.  
 1981: *Coelorhynchus coelorhynchus* (RISSO, 1810) — NOLF, p. 151–153.  
 1983: *Coelorinchus coelorinchus* (RISSO, 1810) — NOLF & STEURBAUT, p. 168, pl. 4, fig. 23.  
 1989: *Coelorinchus coelorinchus* (RISSO, 1810) — NOLF & CAPPETTA, p. 219, pl. 12, figs 1–4.  
 1994: *Coelorinchus coelorinchus* (RISSO, 1810) — NOLF & BRZOBHATÝ, p. 234, pl. 5, figs 1–5.  
 2000a: *Coelorinchus coelorinchus* (RISSO, 1810) — NOLF & GIRONE, p. 180, pl. 2, figs 13–17.

**Material** — 1 otolith from Szalmatercs (Hungary) Middle Miocene (M.61.8167), and 2 otoliths from Walbersdorf (Austria) Middle Miocene (V.63.713, V.63.722).

**Distribution** — Otoliths of *C. coelorhynchus* are known

from the Late Oligocene in the Paratethys (Kiscell Clay Formation, Hungary and Aquitaine Basin, France), from the Early to Middle Miocene of the North Sea Basin and from the Late Miocene and Pliocene of the Mediterranean region.

#### Order Ophidiiformes BERG, 1937

##### Suborder Ophidioidei BERG, 1937

###### Family Carapidae JORDAN & FOWLER, 1902

###### Genus *Echiodon* RAFINESQUE, 1810

##### *Echiodon nuntius* (KOKEN, 1891)

(Figure 4: g)

- 1891: *Ot. (Fierasfer) nuntius* n. sp. — KOKEN, p. 99, pl. VI, fig. 2.  
 1942: *Fierasfer nuntius* KOKEN — WEILER, p. 109, pl. 5, figs 13–19.

- 1952a: *Fierasfer nuntius* KOKEN — WEINFURTER, p. 157, pl. 1, fig. 10.  
 1973: *Carapus nuntius* (KOKEN) — ŚMIGIELSKA, p. 21, pl. III, fig. 7.  
 1977: *Carapus nuntius* (KOKEN, 1891) — NOLF, p. 36.  
 1979: *Carapus nuntius* (KOKEN, 1891) — ŚMIGIELSKA, p. 326, textfig. 30, pl. 6, fig. 9.  
 1985: *Echiodon nuntius* (KOKEN, 1891) — NOLF, p. 64.  
 2006: *Carapus nuntius* (KOKEN, 1891) — BOSNAKOFF, p. 25, pl. V, figs 1–2.

**Material** — 1 otolith from Szob (Hungary) Badenian (V.63.733.7).

**Distribution** — This species is known from the Oligocene of Germany and the Middle Miocene of the Paratethys.

Family Ophidiidae RAFINESQUE, 1810

***Glyptophidium major* (SCHUBERT, 1905)**  
 (Figure 4: h)

- v 1905: *Otolithus (Bercidaram) major* n. sp. — SCHUBERT, p. 637, pl. XVI, figs 42–46.  
 1906: *Otolithus (Bercidaram?) major* SCHUBERT — SCHUBERT, p. 635.  
 1966: *Ophidion major* (SCHUBERT) — ŚMIGIELSKA, p. 259, pl. XVIII, fig. 7.  
 1978: *Otolithus (Ophidiidaram) major* SCHUBERT, 1905 — HOLEC, p. 160, pl. XXVI, fig. 1.  
 1981: *Glyptophidium major* (SCHUBERT, 1905) — NOLF, p. 138.

**Material** — 1 otolith from Walbersdorf (Austria) Badenian (V.63.714).

**Distribution** — This species is known from Badenian deposits of the Central Paratethys.

Order Atheriniformes ROSEN, 1964

Suborder Atherinoidei ROSEN, 1964  
 Family Atherinidae RISSO, 1826

**“genus Atherinidarum” sp.**  
 (Figure 4: i)

**Material** — 1 otolith (no inventory number).

**Distribution** — Coșteiu de Sus (Romania) Middle Miocene.

Order Beryciformes REGAN, 1909

Suborder Berycoidei REGAN, 1909  
 Family Trachichthyidae BLEEKER, 1859

***Hoplostethus praemediterraneus* SCHUBERT, 1905**  
 (Figure 5: g)

- 1905: *Ot. (Hoplostethus) praemediterraneus* n. sp. — SCHUBERT, p. 628, pl. XVI, figs 39–40.  
 1906: *Ot. (Hoplostethus) praemediterraneus* — BASSOII, p. 48, pl. II, fig. 10.  
 1966: *Hoplostethus praemediterraneus* SCHUBERT, 1905 — ŚMIGIELSKA, p. 251, pl. 17, fig. 1.  
 1970: *Hoplostethus praemediterraneus* SCHUBERT, 1905 — ROBBA, p. 135, pl. 14, figs 2–3.

**Material** — 1 otolith from Kisterenyé (Hungary) Middle Miocene (M.61.9024).

**Distribution** — This species is known from Badenian deposits of the Paratethys.

Family Holocentridae RICHARDSON, 1864

Subfamily Myripristinae NELSON, 1955

**“genus Myripristinarum” sp.**  
 (Figure 5: e)

**Material** — 1 otolith (without inventory number).

**Distribution** — Coșteiu de Sus (Romania), Badenian.

Order Perciformes BLEEKER, 1859

Suborder Percoidei BLEEKER, 1859  
 Family Serranidae SWAINSON, 1839

***Serranus integer* (SCHUBERT, 1906)**

(Figure 5: l, m)

- 1906: *Otolithus (Centropristis) integer* n. sp. — SCHUBERT, p. 626, pl. IV, fig. 6.  
 1942: *Centropristis integer* SCHUBERT — WEILER, p. 32, pl. 1, figs 54–56.  
 1965: *Centropristis integer* SCHUBERT — RADO, p. 60, pl. II, fig. 8.  
 1973: *Centropristis integer* SCHUBERT — ŚMIGIELSKA, p. 10, pl. I, figs 7–8.  
 1981: *Serranus integer* (SCHUBERT, 1906) — NOLF, p. 141.  
 1998: *Serranus integer* (SCHUBERT, 1906) — REICHENBACHER, p. 329, pl. 3, fig. 22.  
 2009: *Serranus integer* (SCHUBERT, 1906) — NOLF & BRZOBHATÝ, p. 334, pl. 4, fig. 7.

**Material** — 1 otolith from Zámoly, vineyard near Gánt (Hungary), Middle Eocene (M.62.544.2), 1 otolith from Szob (Hungary) Badenian (V.63.733.14).

**Distribution** — This species is known from Middle Eocene sediments of the Tethys, and Badenian deposits of the Paratethys.

#### **Serranidae indet.**

**Material** — 2 otoliths (V.63.733.9).

**Distribution** — Occurred at Szob (Hungary), Badenian.

Family Apogonidae JORDAN & GILBERT, 1882

#### ***Apogon* sp. 1** (Figure 5: h)

**Material** — 9 otoliths (M.62.544).

**Distribution** — Zámoly, vineyards near Gánt (Hungary), Middle Eocene.

#### ***Apogon* sp. 2** (Figure 5: i)

**Material** — 4 otoliths under M.60.7523.4 and 7 ones without inventory number.

**Distribution** — Coșteiu de Sus (Romania), Badenian.

Family Acropomatidae GILL, 1891

#### ***Acropoma nobilis* (KOKEN, 1891)**

- 1891: *Otolithus (Dentex) nobilis* n. sp. — KOKEN, p. 124, pl. VIII, fig. 8.  
 1906: *Otolithus (Dentex) nobilis* KOKEN — SCHUBERT, p. 626.  
 1906: *Otolithus (Dentex) nobilis* KOKEN — BASSOLI, p. 51, pl. II, fig. 32.  
 1942: *Dentex nobilis miocenica* n. sp. — WEILER, p. 41, pl. 4, figs 18, 19, 39, 40, 42, 43, 52, pl. 7, figs 2, 8, 9.  
 1950: *Dentex nobilis miocenica* WEILER, 1942 — WEILER, p. 225, pl. 3, fig. 14.  
 1977: *Dentex (? Cheimerius) nobilis* KOKEN, 1891 — NOLF, p. 53, pl. XV, figs 21–22.  
 1977: *Acropoma nobilis* (KOKEN, 1891) — NOLF, p. 118, pl. XVIII, figs 3–4.  
 1978: *Dentex nobilis* KOKEN, 1891 — HOLEC, p. 165, pl. XXVIII, figs 4–5.

**Material** — 1 otolith from Zámoly, vineyards Middle Eocene (M.62.544.3) and 1 otolith (no inventory №) from Middle Miocene of Borsodbóta (Hungary) and 1 specimen from Coșteiu de Sus (Romania) Badenian (M.60.7523.11).

**Distribution** — It was found in Middle Eocene strata of the Tethys, Oligocene and Miocene deposits of the North Sea Basin, and Miocene sediments of the Paratethys.

Family Carangidae RAFINESQUE, 1815

Genus *Trachurus* RAFINESQUE, 1810

#### ***Trachurus* sp.** (Figure 5: n)

**Material** — 1 otolith (V.63.733.15).

**Distribution** — Found in Szob (Hungary) Badenian.

Family Pomadasytidae REGAN, 1913

Genus *Brachydeuterus* GILL, 1862

#### ***Brachydeuterus latior* (SCHUBERT, 1906)**

## (Figure 5: j)

- 1906: *Otolithus (Dentex) latior* n. sp. — SCHUBERT, p. 627, pl. XVIII, figs 7–9.  
 1912: *Otolithus (Dentex) nobilis* KOKEN — SCHUBERT, p. 114, textfig. 7.  
 1928: *Otolithus (Dentex) latior* SCHUBERT — CHAINE & DUVERGIER, p. 202, pl. VI, figs 7–9.  
 1950: *Dentex latior* SCHUBERT, 1906 — WEILER, p. 226, pl. 3, figs 15–17.  
 1966: *Dentex latior* SCHUBERT — ŚMIGIELSKA, p. 254, pl. XVII, figs 4–5.  
 1973: *Dentex latior* SCHUBERT, 1906 — HOLEC, p. 406, pl. V, figs 1–3.  
 1973: *Dentex latior* SCHUBERT — ŚMIGIELSKA, p. 16, pl. II, figs 7–8.  
 1978: *Dentex latior* SCHUBERT — BRZOOBOHATÝ, pl. 1, fig. 13.  
 1979: *Dentex latior* SCHUBERT, 1906 — ŚMIGIELSKA, p. 319, pl. 6, figs 1–2.  
 1979: *Brachydeuterus latior* (SCHUBERT, 1906) — NOLF & STEURBAUT, p. 8, pl. 2, figs 16–23.  
 1980: *Brachydeuterus latior* (SCHUBERT, 1906) — NOLF & CAPPETTA, p. 10, pl. 2, figs 9, 10.  
 1981: *Brachydeuterus latior* (SCHUBERT, 1906) — NOLF, p. 144.  
 1983: *Brachydeuterus latior* (SCHUBERT, 1906) — NOLF & STEURBAUT, p. 181, pl. 6, fig. 19.  
 1994: *Brachydeuterus latior* (SCHUBERT, 1906) — BRZOOBOHATÝ, pl. 5, fig. 12.  
 1998: *Brachydeuterus latior* (SCHUBERT, 1906) — REICHENBACHER, p. 329, pl. 2, figs 6–7, pl. 3, fig. 21.  
 1999: *Brachydeuterus latior* (SCHUBERT, 1906) — REICHENBACHER & CAPPETTA, p. 19, pl. 2, fig. 17.

**Material** — 1 otolith from Buják (Hungary), Middle Miocene (V.62.1325); 1 otolith (M.60.7523.10) and 3 ones without inventory numbers are from Coșteiu de Sus (Romania), Badenian.

**Distribution** — It occurs in the Upper Oligocene of Germany, Middle Miocene of Hungary, Austria, Romania, Italy and Poland. During the Early and Middle Miocene widely distributed in the Mediterranean and the Paratethys.

## Family Sparidae BONAPARTE, 1832

Genus *Dentex* CUVIER, 1815*Dentex gregarius* (KOKEN, 1891)

- 1891: *Otolithus (Sparidarum) gregarius* n. sp. — KOKEN, p. 128, textfigs 18–20, pl. VII, figs 7, 8.  
 1906: *Otolithus (Pagellus) gregarius* KOKEN — BASSOLI, p. 52, pl. II, fig. 35.  
 1906: *Otolithus (Pagellus?) gregarius* KOKEN — SCHUBERT, p. 630, pl. XVIII, figs 23–29, 36?  
 1942: *Pagellus gregarius* (KOKEN) — WEILER, p. 44.  
 1950: *Pagellus gregarius* (KOKEN, 1891) — WEILER, p. 228, pl. 3, fig. 18, pl. 4, figs 20, 21.  
 ? 1966: *Pagellus gregarius* (KOKEN, 1891) — ŚMIGIELSKA, p. 255, pl. XVII, fig. 6.  
 1971: *Dentex gregarius* (KOKEN, 1891) — GAEMERS, p. 246, pl. II, fig. 8, pl. III, fig. 3, pl. VII, fig. 2.  
 1977: *Dentex (Polysteganus) gregarius* (KOKEN, 1891) — NOLF, p. 54, pl. XV, figs 18–20.  
 1978: *Dentex gregarius* (KOKEN, 1891) — BRZOOBOHATÝ, pl. 1, fig. 6.  
 1979: *Dentex gregarius* (KOKEN, 1891) — ŚMIGIELSKA, p. 319, textfig. 22, pl. 6, figs 3, 4.  
 1979: *Dentex (Polysteganus) aff. gregarius* (KOKEN, 1891) — STEURBAUT, p. 72, pl. 9, figs 5–7.  
 1981: *Dentex (Polysteganus) gregarius* (KOKEN, 1891) — NOLF, p. 156.  
 1999: *Dentex gregarius* (KOKEN, 1891) — REICHENBACHER & CAPPETTA, p. 23, pl. 5, fig. 1.

**Material** — 4 otoliths from Zámoly vineyards, Middle Eocene (M.62.544.3); 3 otoliths (M.61.8346) from Nógrádszakál (Hungary), Badenian; 6 otoliths (V.63.733.1) from Szob (Hungary) Badenian, and 1 otolith (M.60.7523.1) from

Coșteiu de Sus Badenian (Romania).

**Distribution** — Found in Tethyan Middle Eocene deposits and in Upper Oligocene to Middle Miocene sediments of the Paratethys.

## Sparidae indet. sp.

## (Figure 5: k)

**Material** — 1 otolith from Gánt, Lutetian (M.62.543) and 1 (V.63.751) from Budapest, Huszár street (Hungary) Middle Miocene, and 1 (M.60.7522.2) + 4 otoliths without

inventory numbers from Coșteiu de Sus (Romania) Badenian.

**Distribution** — Found in Tethyan Middle Eocene and Paratethyan Miocene of the Carpathian region.

## Family Sciaenidae CUVIER, 1829

Genus *Umbrina* CUVIER, 1816“genus aff. *Umbrina*” *kokeni* (SCHUBERT, 1902)  
(Figure 5: o)

- ? 1902: *Otolithus (Sciaenidarum) kokeni* n. sp. — SCHUBERT, p. 305, pl. X, figs 18 a, b.  
 1902: *Otolithus (Sciaena) aff. speciosus* KOKEN — SCHUBERT, p. 307, pl. X, fig. 10.  
 1902: *Otolithus (Sciaena?) telleri* n. sp. — SCHUBERT, p. 307, pl. X, fig. 16.  
 1902: *Otolithus (Sciaenidarum) aff. claybornensis* KOKEN — SCHUBERT, p. 310, textfig. 2, pl. X, fig. 13.  
 1902: *Otolithus (Sciaenidarum) levii* n. sp. — SCHUBERT, p. 306, pl. X, fig. 9.  
 1906: *Otolithus (Sciaena?) telleri* SCHUBERT — SCHUBERT, p. 637.

- 1906: *Otolithus (Sciaena?) kokeni* SCHUBERT — SCHUBERT, p. 638.  
 1981: “genus aff. *Umbrina*” *kokeni* (SCHUBERT, 1902) — NOLF, p. 164, pl. 3, figs 8–9.  
 1992: “genus aff. *Umbrina*” *kokeni* (SCHUBERT, 1902) — BRZOBOHATÝ, p. 3, pl. 1, fig. 8.  
 1993: *Trevalencia kokeni* (SCHUBERT, 1902) — SCHWARZHANS, p. 98, figs 171–177.  
 2008: *Trevalencia kokeni* (SCHUBERT, 1902) — BOSNAKOFF, p. 224, pl. II, figs 1, 2, 4, 7, 8, 10, 11, pl. III, figs 1–8.  
 2010: *Trevalencia kokeni* (SCHUBERT, 1902) — JOVANOVIĆ et al., p. 73, pl. II, figs 1–2.

**Material** — 2 otoliths (M.57.1081.1) from Sopron, Lenk brickyard (Hungary) Upper Miocene.

**Distribution** — This species is known from the Late Miocene of the Pannonian basin system.

***Umbrina subcirrhosa* SCHUBERT, 1902**

(Figure 5: p)

- 1902: *Otolithus (Umbrina) subcirrhosus* n. sp. — SCHUBERT, p. 304, pl. X, fig. 3.  
 ? 1902: *Otolithus (Sciaenidarum) subsimilis* n. sp. — SCHUBERT, p. 309, pl. X, fig. 12.  
 ? 1902: *Otolithus (Sciaenidarum)* aff. *claybornensis* KOKEN — SCHUBERT, p. 310, pl. X, fig. 13, non Textfig. 2.  
 1906: *Otolithus (Umbrina) subcirrhosus* SCHUBERT — SCHUBERT, p. 636.  
 1906: *Otolithus (Sciaenidarum) subsimilis* SCHUBERT — SCHUBERT, p. 638.  
 1981: *Umbrina cirrhosa* (LINNAEUS, 1758) — NOLF, p. 171.  
 1989: *Umbrina* sp. — NOLF & CAPPETTA, pl. XVI, fig. 7.  
 1993: *Umbrina subcirrhosa* SCHUBERT, 1902 — SCHWARZHANS, p. 71, figs 103–107.  
 2008: *Umbrina subcirrhosa* SCHUBERT, 1902 — BOSNAKOFF, p. 223, pl. I, fig. 5, pl. II, figs 3, 5, 6, 9, non 1, 2, 7, 8, 10, 11.

**Material** — 1 otolith (M.57.1081.2) from Sopron, Lenk brickyard (Hungary) Upper Miocene.

**Distribution** — This species is known from the Late Miocene of the Pannonian basin system.

Family Cepolidae BONAPARTE, 1832

Genus *Cepola* LINNAEUS, 1766

***Cepola rubescens* LINNAEUS, 1766**

(Figure 5: q)

- 1891: *Cepola rubescens* LINNAEUS — KOKEN, pl. XVII, fig. 4.  
 1977: *Cepola rubescens* LINNAEUS, 1766 — NOLF, p. 56, pl. XVI, figs 10–11.  
 1978: *Cepola rubescens* LINNAEUS, 1766 — NOLF, p. 529, pl. 5, fig. 12.  
 1979: *Cepola rubescens* LINNAEUS, 1766 — ŚMIGIELSKA, p. 322, textfig. 25, pl. 6, figs 5–7.  
 1984: *Cepola macrophtalma* (LINNAEUS, 1758) — RADWAŃSKA, p. 311, pl. 5, figs 1–4.  
 1989: *Cepola rubescens* LINNAEUS, 1766 — NOLF & CAPPETTA, pl. 16, fig. 4.  
 1999: *Cepola rubescens* LINNAEUS, 1766 — REICHENBACHER & CAPPETTA, p. 28, pl. 2, fig. 12.  
 2004: *Cepola rubescens* LINNAEUS, 1766 — NOLF & BRZOBOHATÝ, pl. 10, fig. 12.  
 2005: *Cepola rubescens* LINNAEUS, 1766 — HOEDEMAKERS & BATILLORI, pl. 7, figs 6–9.  
 2009: *Cepola rubescens* LINNAEUS, 1766 — NOLF & BRZOBOHATÝ, p. 334, pl. 6, fig. 3.

**Material** — 1 otolith (V.63.733.10) from Szob (Hungary) Badenian, and 1 (M.60.7523.6) from Coșteiu de Sus (Romania) Badenian.

**Distribution** — This species widely distributed during the Oligocene and Miocene in the Paratethys, the North Sea Basin, the Aquitaine Basin and the Mediterranean region.

Percoidei incertae sedis

**“genus Percoideorum” aff. *tietzei* (SCHUBERT, 1906)**

(Figure 5: r)

- ? 1906: *Otolithus (Cantharus?) Tietzei* n. sp. — SCHUBERT, p. 632, pl. IV, figs 13–18.  
 ? 1978: *Spondylisoma tietzei* (SCHUBERT) — BRZOBOHATÝ, p. 165, pl. 1, fig. 14.  
 ? 1981: “genus Percoideorum” *tietzei* (SCHUBERT, 1906) — NOLF, p. 141, pl. 2, fig. 22.  
 1994: “genus Percoideorum” aff. *tietzei* (SCHUBERT, 1906) — BRZOBOHATÝ, pl. 6, figs 7–8.

**Material** — 1 otolith from Szob (Hungary), Badenian (V.63.733.16), and 1 specimen (M.62.544.4) probably belongs to this species from Zámoly (Hungary), Early Eocene.

**Distribution** — This species is known with certainty from the Middle Miocene of the Paratethys; the Zámoly specimen indicate also possible Early Eocene occurrence.

Suborder Gobioidei JORDAN & EVERMANN, 1896

Family Gobiidae BONAPARTE, 1832

Genus *Deltenosteus* GILL, 1864

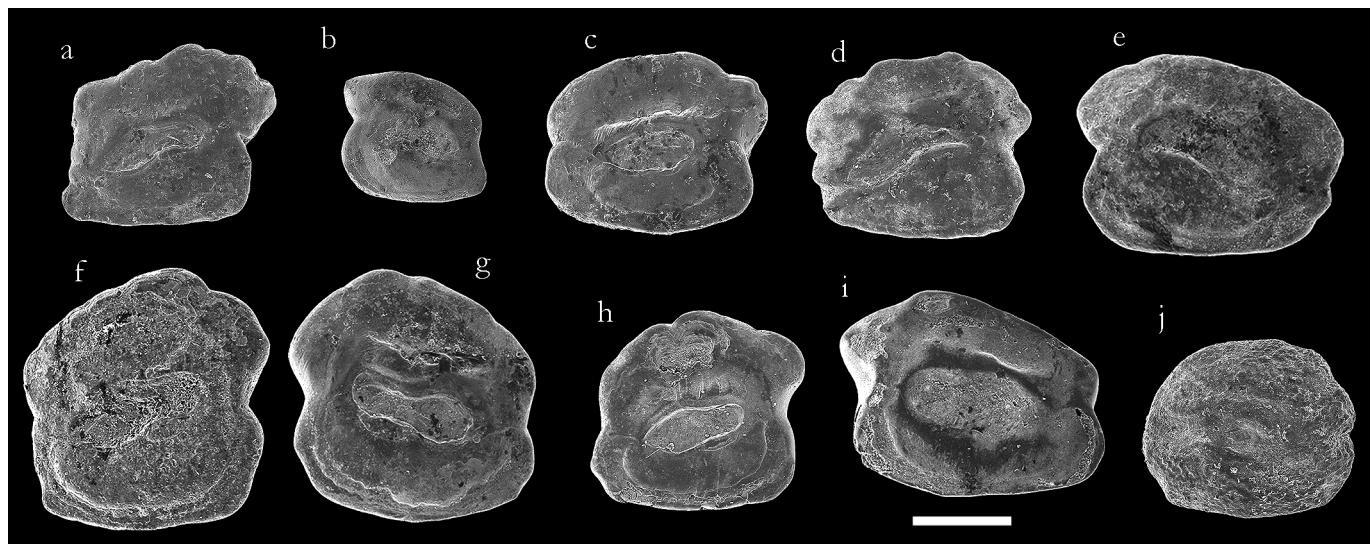
***Deltenosteus telleri* (SCHUBERT, 1906)**

(Figure 6: d, e)

- 1906: *Otolithus (Gobius) telleri* n. sp. — SCHUBERT, p. 648, pl. XX, figs 27, 28.  
 1952a: *Gobius telleri* SCHUBERT — WEINFURTER, p. 162, pl. 2, fig. 5.  
 1965: *Gobius telleri* SCHUBERT — RADO, p. 62, pl. IV, fig. 13.  
 1966: *Gobius telleri* SCHUBERT — ŚMIGIELSKA, p. 263, pl. XIX, fig. 1.  
 1973: *Gobius telleri* SCHUBERT — ŚMIGIELSKA, p. 26, pl. V, figs 1–3.  
 1981: “genus Gobiidarum” *telleri* SCHUBERT, 1906 — NOLF, p. 147.  
 1994: *Deltenosteus telleri* (SCHUBERT, 1906) — BRZOOBOHATÝ, p. 73, pl. 7, figs 14–18.  
 1998: *Deltenosteus telleri* (SCHUBERT, 1906) — REICHENBACHER, p. 331, pl. 3, fig. 11.  
 2001: *Gobius* sp. 2 — BOSNAKOFF, p. 203, fig. 12, non fig. 7.  
 2001: *Gobius* sp. 3 — BOSNAKOFF, p. 205, fig. 13.  
 2006: *Deltenosteus telleri* (SCHUBERT, 1906) — BOSNAKOFF, p. 26, pl. VI, figs 1–3.  
 2007: *Deltenosteus telleri* (SCHUBERT, 1906) — BRZOOBOHATÝ et al., pl. 8, figs 2–5.

**Material** — 14 otoliths from Szob (Hungary) Badenian (V.63.733.6).

**Distribution** — Distributed in the Paratethys during the Miocene.



**Figure 6** — a: *Gobius* aff. *francofurtanus* (KOKEN, 1891) — Szob (V.63.733.8); b: *Gobius pretiosus* PROCHÁZKA, 1893 — Coșteiu de Sus (no Inv. №); c: *Gobius* aff. *niger* LINNÆUS, 1758 ? — Nógrádszakál (M.61.8346.1); d, e: *Deltenosteus telleri* (SCHUBERT, 1906) — Szob (V.63.733.6); f: *Lesueurigobius vicinalis* (KOKEN, 1891) — Buják (V.62.1325); g: *Lesueurigobius vicinalis* (KOKEN, 1891) — Coșteiu de Sus (no inv. №); h: *Lesueurigobius vicinalis* (KOKEN, 1891) ? — Coșteiu de Sus (M.60.7522); i: *Gobius* aff. *niger* LINNÆUS, 1758 — Coșteiu de Sus (M.60.7523.8); j: Otolith sp. indet. 2 — Szob (V.63.733.13). (Scale bar represent 1 mm.)

Genus *Gobius* LINNÆUS, 1758

***Gobius* aff. *francofurtanus* (KOKEN, 1891)**  
 (Figure 6: a)

**Material** — 1 otolith from Szob (Hungary) Badenian (V.63.733.8).

from the Lower Miocene of Germany and occurs also in the Middle Miocene of the Central Paratethys.

**Distribution** — *Gobius francofurtanus* has been described

***Gobius* aff. *niger* LINNÆUS, 1758**  
 (Figure 6: c?, i)

- 1952b: *Gobius* aff. *pretiosus* PROCHÁZKA — WEINFURTER, p. 145, pl. 1, fig. 7.  
 2000b: *Gobius niger* LINNÆUS, 1758 — NOLF & GIRONE, pl. 2, fig. 13.

**Material** — 1 otolith (M.61.8346.1) from Nógrádszakál (Hungary) Badenian, 2 otoliths (V.63.733.8) from Szob (Hungary) Badenian, and 3 otoliths from Coșteiu de Sus

(Romania) Badenian (M.60.7523.8, M.60.7625).

**Distribution** — This form has been found only in the Carpathian region.

***Gobius pretiosus* PROCHÁZKA, 1893**  
 (Figure 6: b)

- 1906: *Otolithus (Gobius) pretiosus* PROCHÁZKA — SCHUBERT, p. 645, pl. XX, figs 29–31.  
 1942: *Gobius pretiosus* PROCHÁZKA — WEILER, p. 57, pl. 2, fig. 50.  
 1950: *Gobius pretiosus* PROCHÁZKA, 1893 — WEILER, p. 231, pl. 4, figs 25, 27, non pl. 8, fig. 62.  
 1952a: *Gobius pretiosus* PROCHÁZKA — WEINFURTER, p. 162, pl. 2, fig. 4.  
 1965: *Gobius pretiosus* PROCHÁZKA — RADO, p. 62, pl. IV, fig. 16.  
 1966: *Gobius multipinnatus* (H. v. MEYER) — ŚMIGIELSKA, p. 262, pl. XVIII, figs 12, 13, non figs 14–16.  
 ? 1973: *Gobius praetiosus* PROCHÁZKA — ŚMIGIELSKA, p. 23, pl. IV, figs 4, 5, non 3, 6, 7.  
 1978: *Ot. (Gobiidarum) pretiosus* (PROCHÁZKA, 1893) — HOLEC, p. 168, pl. XXIX, figs 5–6.

**Material** — 2 otoliths from Mátraverebély (Hungary), Middle Miocene (M.62.3212) and 8 otoliths from Coșteiu de Sus (Romania), Badenian, without inventory numbers.

Genus *Lesueurigobius* WHITLEY, 1950

***Lesueurigobius vicinalis* (KOKEN, 1891)**  
 (Figure 6: f, g, h?)

- 1891: *Otolithus (Gobius) vicinalis* n. sp. — KOKEN, p. 133, Textfig. 21.  
 1906: *Otolithus (Gobius) vicinalis* KOKEN — SCHUBERT, p. 644, pl. XX, fig. 32.  
 1950: *Gobius vicinalis* KOKEN, 1891 — WEILER, p. 232, pl. 4, figs 24, 26, pl. 8, fig. 63.  
 1952a: *Gobius vicinalis* KOKEN — WEINFURTER, p. 161, pl. 2, figs 2–3.  
 1965: *Gobius vicinalis* KOKEN — RADO, p. 63, pl. IV, figs 18, 20.  
 1965: *Gobius vicinalis* KOKEN — PANĀ, p. 6, pl. 1, figs 37–40.  
 1966: *Gobius vicinalis* KOKEN — ŚMIGIELSKA, p. 260, pl. XVIII, figs 8–11.  
 1970: *Gobius vicinalis* KOKEN, 1891 — ROBBA, p. 150, pl. 16, fig. 7.  
 1973: *Gobius vicinalis* KOKEN, 1891 — HOLEC, p. 410, pl. VI, figs 4–8.  
 1973: *Gobius vicinalis* KOKEN — ŚMIGIELSKA, p. 22, pl. III, figs 8–14, pl. IV, figs 1–2.  
 1994: *Gobius* sp. — BRZOBOHATÝ, pl. 7, figs 5–7.  
 1994: *Gobius* sp. — BRZOBOHATÝ, pl. 7, figs 8–10.  
 1994: *Gobius* sp. — BRZOBOHATÝ, pl. 7, figs 11–13.  
 1998: *Lesueurigobius vicinalis* (KOKEN, 1891) — REICHENBACHER, p. 332, pl. 3, figs 14–17.  
 1999: *Lesueurigobius vicinalis* (KOKEN, 1891) — REICHENBACHER & CAPETTA, p. 31, pl. 3, figs 1–5.  
 2001: *Gobius vicinalis* KOKEN, 1891 — BOSNAKOFF, p. 202, fig. 8.  
 2006: *Lesueurigobius vicinalis* (KOKEN, 1891) — BOSNAKOFF, p. 28, pl. VI, figs 4–5.

**Material** — 8 otoliths (M.61.8346.1) from Nógrádszakál, Badenian, 1 (V.62.1325) from Buják Badenian, 118 (V.63.733) specimens from Szob Badenian, 1 from Szokolya Badenian (V.63.731), all in Hungary; 5 registered otoliths (M.60.7522, M.60.7523.5) and 20 without

**Distribution** — This species was described from various Miocene deposits of the Paratethys.

inventory numbers from Coșteiu de Sus (Romania) Badenian.

**Distribution** — This species occurs in the Lower and Middle Miocene deposits of the Paratethys, the north-eastern Atlantic and the Mediterranean regions.

**Gobiidae indet.**

**Material** — 1 otolith (M.60.9450) from Livezile (Romania), Middle Miocene.

**Remarks** — Gobiid otolith, not identifiable on lower taxonomic levels.

**Otolith indet. (5 species)**  
 (indet. 2: Figure 6: j; indet 4: Figure 5: f)

**Material** — **Indet. 1:** 1 specimen (V.63.733.12) from Szob (Hungary) Badenian; **indet. 2:** 1 otolith (V.63.733.13) from Szob (Hungary) Badenian; **indet. 3:** 1 otolith (M.61.8346.2) from Nógrádszakál (Hungary) Badenian; **indet. 4:** 1 otolith (M.60.7567) from Coșteiu de Sus (Romania) Badenian; **indet. 5:** 5 otoliths (M.60.7523.7, M.60.7551) from Coșteiu de Sus (Romania) Badenian.

\* \* \*

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#### Author's address:

Mariann BOSNAKOFF  
 Department of Palaeontology and Geology  
 Hungarian Natural History Museum  
 POB 137  
 1431 Budapest, Hungary  
 e-mail: bosnakoff@yahoo.com