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The Middle Miocene Fish Fauna (excl. otolithes) from Mühlbach am Manhartsberg and Grund near Hollabrunn, Lower Austria

by Ortwin SCHULTZ[1]

(With 5 text figures)

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Summary

The sites Mühlbach am Manhartsberg and Grund has yielded relatively little material. The samples from Mühlbach am Manhartsberg yielded 4 Chondrichthyes taxa as well as 6 marine and 1 freshwater-Osteichthyes taxa. 15 Chondrichthyes and 5 Osteichthyes taxa were documented from the Grund site. The marine material from both sites points to neritic conditions. In particular *Acanthurus,* but also *Sphyrna, Rhinoptera* as well as *Aetobatus* indicate tropical to subtropical waters. All remaining genera inhabit tropical to temperate waters.

Keywords: Central Paratethys, Gaindorf Formation, Grund Formation, Middle Miocene, Badenian, fish teeth.

Zusammenfassung

Von den Fundkomplexen Mühlbach am Manhartsberg und Grund liegen jeweils nur relativ kleine Mengen an Belegen vor. Die Proben aus Mühlbach am Manhartsberg erbrachten 4 Chondrichthyes-, 1 Süßwasser- und 6 marine Osteichthyes-Taxa. Aus dem Raum Grund können 15 Chondrichthyes- und 5 Osteichthyes-Taxa nachgewiesen werden. Die marinen Belege beider Fundgebiete indizieren neritische Verhältnisse. Insbesondere *Acanthurus,* aber auch *Sphyrna, Rhinoptera* sowie *Aetobatus,* sind Anzeiger für tropische bis subtropische Gewässer. Alle anderen Gattungen kommen in tropischen bis temperierten Gewässern vor.

Schlüsselwörter: Zentrale Paratethys, Gaindorf-Formation, Grund-Formation, Badenium, Mittel Miozän, Fischzähne.

Introduction

Two sediment samples of the Gaindorf Formation at Mühlbach am Manhartsberg, Lower Austria (Fig. 1) yielded fish remains. The individual taxa are primarily documented by isolated teeth or tooth plates and a few tail spines. The otolith faunas are treated in a separate contribution (REICHENBACHER, in prep.).

For comparative purposes, the fish fauna from Grund near Hollabrunn (Fig. 1), which is of the same age, was also analysed. Tab. 1 demonstrates that only small faunas with relatively few specimens are present. Nonetheless, a total of 24 taxa were found in the Lower Lagenidae Zone (Early Middle Miocene) in Lower Austria: 8 sharks/Squalomorphii, 7 rays/Batomorphii, 8 marine bony fishes/Osteichthyes as well as 1 freshwater bony fish/Osteichthyes.

[1] Dr. Ortwin SCHULTZ, Naturhistorisches Museum Wien, Geologisch-Paläontologische Abteilung, Postfach 417, A-1014 Wien, Austria / Österreich. – e-mail: ortwin.schultz@nhm-wien.ac.at

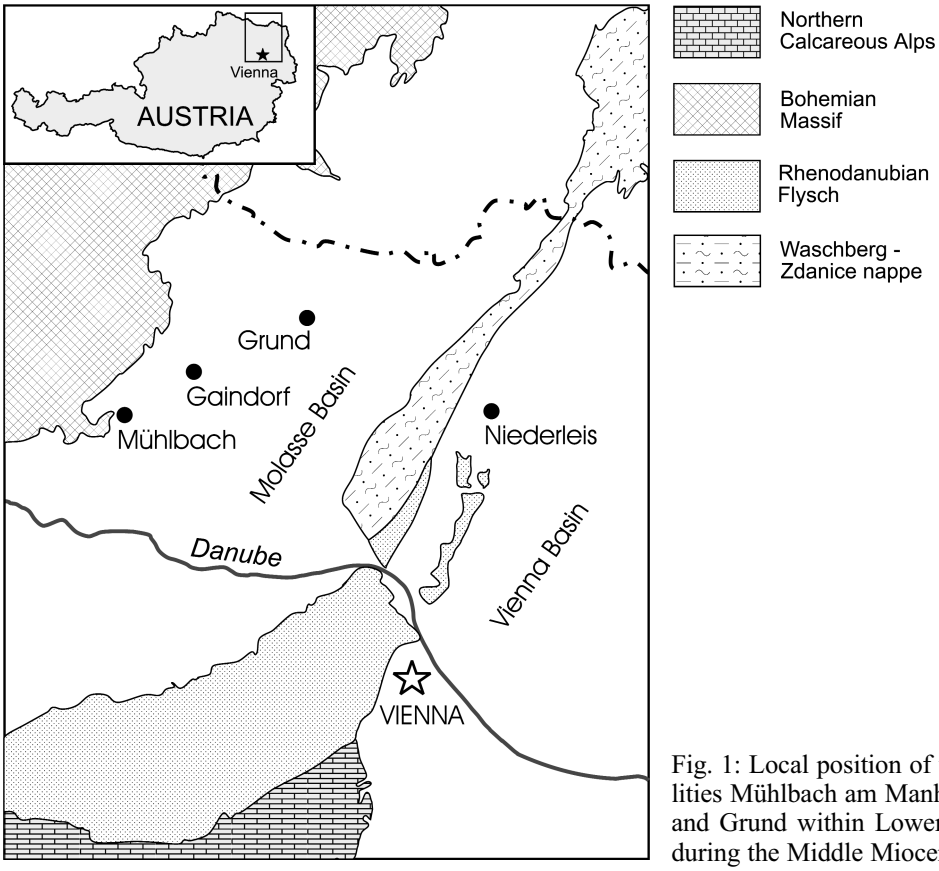

Fig. 1: Local position of the localities Mühlbach am Manhartsberg and Grund within Lower Austria during the Middle Miocene.

The fish faunas were not expected to provide evidence about their stratigraphic position. The study of the foraminifera faunas (RÖGL & SPEZZAFERRI 2003), of the calcareous nannoplankton (CORIC 2003) as well as of the rodent fauna (DAXNER-HÖCK 2003), however, demonstrated their position in Zone M5b/Mt5b or NN5, or in the higher MN5 or the higher Lower Lagenid Zone, Lower Badenian, Middle Miocene. The geological situation of the Gaindorf Formation at Mühlbach am Manhartsberg is documented by ROETZEL 2003.

All the material treated here is stored in the Geolog.-Paläontolog. Abteilung of the Naturhistorische Museum in Vienna: NHMWien: 2002z0067/0001-0010, 2002z0123/0001-0009, 2002z0124/0001-0010, 2002z0125/0001-0003, 2002z0126/0001-0009, 2002z0127/0001-0014, along with old material.

Faunal content

The determination of all marine material presented no greater difficulties[2]. The determination of *Sphyrna*, however, remains uncertain because only a somewhat eroded tooth is available.

[2] determinations are based largely on the following literature: CAPPETTA 1970 and 1987, PROBST 1877, REINECKE et al. 2001, SCHULTZ 1971, 1978 and 1998

Tab. 1: The fish fauna of the Gaindorf and the Grund Formation in Lower Austria[3]

	Mühlbach am Manhartsberg		Grund 1999				Vicinity of Grund
	Mü 1	Mü 2	GRU-B1-1	GRU-B1-3	GRU-F-11	NHM Wien	NHM Wien
Marine fishes							
Squalomorphii indet.[4]					2		
Notorynchus primigenius						2	
Carcharias acutissimus			1		9	21+3?	8[5]
Carcharias cuspidatus						9	1[6]
C. acutissimus or *C. cuspidatus*					2		
Scyliorhinus distans	1	1			1		
Carcharhinus priscus	1	2		1?	1+2?	11	1[7]
Galeocerdo aduncus						2	1[8]
Sphyrna ? sp.				1			
Batomorphii							
Dasyatis cf. *rugosa*		3		1	1		
Dasyatis sp.		1		1		2	
Myliobatis sp.						1	
Rhinoptera sp.						1	
Myliobatis/Rhinoptera sp.				1	2	5	
Aetobatus arcuatus				1		2	
Myliobatidae/Dasyatidae[9] (Fig. 2)			1		2		1[10]
Osteichthyes							
Diplodus incisivus		1		2			
Sparus umbonatus					6	10	1[11]
Pagrus cinctus					1	1+?1	1[12]
Sparidae indet.[13]	4	15		13	4	6	1[14]
? Labridae indet.		1					
Acanthurus haueri (Fig. 3)	1						
Sphyraena sp. (Fig. 4)	2				1		
Trichiurus miocaenicus (Fig. 5)		1					
Freshwater fishes							
Palaeoleuciscus sp.	18						

[3] Arrangement according to ESCHMEYER 1990

[4] vertebra

[5] from Guntersdorf 5 teeth, from Immendorf, Gaindorf and from Niederleis 1 tooth each

[6, 7] from Windpassing

[8, 11] from Gaindorf

[9] tail spine

[10] from Guntersdorf 1 fragment

[12] from Mailberg

[13] with different tooth-types: small, round, dome-shaped tooth plates, or conical teeth, or elongate-conical teeth with curved tips = ? pharyngeal teeth

[14] from Guntersdorf

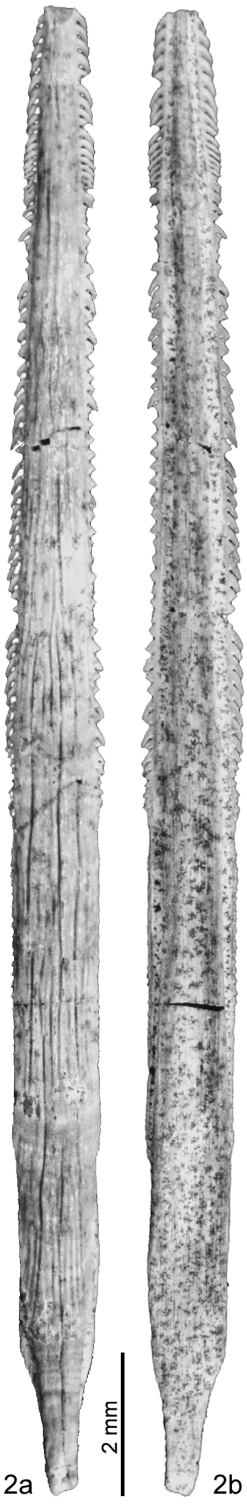

Fig. 2: **Myliobatidae** or **Dasyatidae**, tail spine, Grund (GRU-F-11); Badenian, Lower Lagenid Zone. – NHMWien 2002z0127/0008. – a: upper surface, b: lower surface.

The determination of the freshwater material relied on the excellent overview of morphotypes of the pharyngeal teeth ("Schlundzähne der Cyprinen" by HECKEL 1843: Plate 1), because only few publications have dealt with such fossil cyprinid teeth. In this connection the following authors deserve mention: RUTTE 1962, RUTTE & BECKER-PLATEN 1980, OBRHELOVA 1969, 1971 and 1990, RUTTE & VAN DE WEERD 1980, SYTCHEVSKAYA 1989, GAUDANT 1989-1997 as well as BÖHME 1993.

Four of the 18 isolated teeth from the Cyprinidae pharyngeal apparatus from Mühlbach am Manhartsberg (sample Mü 1), can be determined more precisely. The denticulation or grooves of the masticatory surface (compare RUTTE 1962: 177, Fig. 3) are represented by forms of the type "hooked teeth with masticatory surface" ("Hakenzähne mit Kauflächen"), or the "Drück- und Greifzähne" along with those of the type "hooked teeth without masticatory surface" ("Hakenzähne ohne Kauflächen") or so-called "Fangzähne" (HECKEL 1843): these are *Phoxinellus alepidotus* HECKEL, 1843*, "Leucos Basak"* – now *Rutilus basak* (HECKEL, 1843) – *, "Bliccopsis Buggenhagii"* – now recognized as a hybrid of *Abramis brama* x *Rutilus rutilus*– and *Blicca argyroleuca* – now *Abramis bjoerkna* (LINNAEUS, 1758)– as well as "*Squalius Dobula* BPT." and *Scardinius erythrophthalmus*[15]. A more detailed comparison based on the rich collection of pharyngeal apparatuses at the NHMWien[16], which contains the specimens of HECKEL 1843, yielded a good correspondence for the four of the pharyngeal teeth with main row teeth (see RUTTE 1962: 177, Fig. 3) of "*Squalius Dobula"* – now *Leuciscus leuciscus* (LINNAEUS, 1758)–, "*Squ. Berag* HECKEL" – now *Leuciscus*

[15] updated according to ESCHMEYER 2002

[16] comparisons were done with the following forms: *Abramis ballerus* (L.)*, A. brama* (L.), *A. sapa* (PALLAS)*, A. vetula* HECKEL*, Alburnoides bipunctatus* (BLOCH), *Alburnus iblis* HECKEL, *Aspius aspius* (L.), *Barbus barbus* (L.), *Blicca bjoerkna* (L.), *Bliccopsis abramorutilus* HECKEL*, Cyprinion macrostomus* HECKEL, *Gobio vulgaris* CUVIER, *Leuciscus cephalus orientalis* NORDM.*, L. idus* (L.), *L. meidingeri* HECKEL, *L. pausingeri* HECKEL, *Leucos basak* HECKEL, *Pelecus cultratus* (L.), *Phoxinus laevis* AGASSIZ, *Rhodeus amarus* AGASSIZ, *Rutilus frisii* (NORDM.), *R. rutilus* (L.), *R. rutilus* (L.) x *Abramis brama* (L.), *Scardinius erythrophthalmus* BPT.*, S. scardofa* BPT., *Squalius argenteus* SELYS*, Squ. balteatus* HECKEL*, Squ. berag* HECKEL*, Squ. cavedanus* BPT.*, Squ. cephalus* L., *Squ. compressus* HECKEL*, Squ. dobula* BPT.*, Squ. lepidus* HECKEL*, Squ. microlepis* HECKEL*, Squ. turskyi* HECKEL*, Squ. tyberinus* BPT.*, Squ. delineatus* HECKEL, *Telestes savignyi* BPT., *Tinca tinca* (L.), *Vimba vimba* L.

cephalus (LINNAEUS, 1758)–, "*Squ. Spurius* HECKEL" – now *Leuciscus spurius* (HECKEL, 1843)– and *"Squ. Turskyi* HECKEL" – now *Leuciscus turskyi* (HECKEL, 1843). If the four available pharyngeal teeth, with their particularly characteristic denticulation, were from Recent material, then they would be determined as *Leuciscus* sp. (Leuciscinae) (compare also OBRHELOVA 1971: 593, Fig. 42/A-L).

Three additional, isolated pharyngeal teeth can be attributed to the pharyngeal apparatus of *Leuciscus* of the taxa just listed: 1st and 2nd tooth of the upper row (compare RUTTE 1962: 177, Fig. 3). The remaining 11 isolated smaller pharyngeal teeth lack distinctive features, but an attribution to *Leuciscus* is likely.

The genus *Leuciscus* is represented in the Miocene by *Palaeoleuciscus* OBRHELOVA, 1969 (compare OBRHELOVA 1969, 1971 and 1990, GAUDANT 1989-1995, as well as BÖHME 1993). A comparison with the pharyngeal teeth of this genus, for example of *Palaeoleuciscus chartaceus* (LAUBE) (compare GAUDANT 1993: Fig. 6 or NHMWien 1971/1405/10), confirms the strong morphological correspondence, so that all the pharyngeal teeth from Mühlbach can be attributed to *Palaeoleuciscus* sp.

Evaluation of the biogeographical and ecological conditions[17]

Although only a small number of fish findings are available (see Table 1 and 2) they do provide some general ecological information on the early marine Badenian of the Molasse Zone.

Tab. 2: Biogeographical and ecological data of fishes based on Recent distributions

Genera	tropical / subtropical	temperate	cold	littoral / neritic	pelagic	bathyal	benthonic	Fresh-water
Notorynchus	(+)	+		+			+	
Carcharias (2 taxa)	+	+		+	+			
Scyliorhinus	+	+		+		+	+	
Carcharhinus	+	(+)		+	+			
Galeocerdo	+	+		+	+			
Sphyrna	+	(+)		+				
Dasyatis (2 taxa)	+	+		+			+	
Myliobatis	+	+		+			+	
Aetobatus	+			+			+	
Rhinoptera	+			+			+	
Palaeoleuciscus		+						+
Diplodus	+	+		+				
Sparus	+	+		+				
Pagrus	+	+		+				
Acanthurus (Fig. 3)	+			+				
Sphyraena (Fig. 4)	+	(+)		+	+			
Trichiurus (Fig. 5)	+			+	+	+		

[17] compiled largely from COMPAGNO 1984 & 1999, DECKERT 1974 and SMITH & HEEMSTRA 1986

tropical - subtropical (4):	*Aetobatus, Rhinoptera; Acanthurus* (Fig. 3), *Trichiurus* (Fig. 5)
tropical - temperate (14):	*Notorynchus, Carcharias* (2 taxa), *Scyliorhinus, Carcharhinus, Galeocerdo, Sphyrna, Dasyatis* (2 taxa), *Myliobatis; Diplodus, Sparus, Pagrus, Sphyraena* (Fig. 4)
littoral - neritic (16):	*Notorynchus, Carcharias* (2 taxa), *Scyliorhinus, Carcharhinus; Sphyrna, Dasyatis* (2 taxa), *Myliobatis, Rhinoptera, Aetobatus; Diplodus, Sparus, Pagrus, Acanthurus* (Fig. 3), *Trichiurus* (Fig. 5)
littoral - pelagic (6):	*Carcharias* (2 taxa), *Carcharhinus*, *Galeocerdo; Sphyraena* (Fig. 4), *Trichiurus* (Fig. 5)
littoral - bathyal (2):	*Scyliorhinus, Trichiurus* (Fig. 5)
benthonic (7):	*Notorynchus, Scyliorhinus, Dasyatis* (2 taxa), *Myliobatis, Rhinoptera, Aetobatus*
Freshwater (1):	*Palaeoleuciscus*

Results

The fish fauna of Mühlbach am Manhartsberg consist of 11 taxa, of which 10 are exclusively marine and only one represents a freshwater form. The habitat of the marine taxa can be classified as neritic. The Recent genus *Trichiurus* (Fig. 5) is known from the continental shelf down to 350 m, but also advances into shallow coastal waters and harbors (PARIN 1986: 980; SMITH & HEEMSTRA 1986: 829); it has been documented also from shallow waters of the Badenian, for example from Gainfarn (SCHULTZ 1978: 213). This underlines that definitive bathymetric conclusions cannot be drawn based on a single tooth.

The *Acanthurus* find (Fig. 3) is remarkable. This genus is a superb indicator for tropical to subtropical marine waters. Also *Aetobatus, Rhinoptera* and *Trichiurus* are inhabitants of such waters. The remaining taxa inhabit tropical to temperate waters.

Palaeoleuciscus has been described from lacustrine depositional environments (OBRHELOVA 1971: 553), whereas the Recent genus *Leuciscus* can be found both in rivers and in lakes.

The fish fauna of the Grund Formation in and around Grund must be classified as poor, even though the site has been sampled for over 150 years. The total yield is only 8 shark/Squalomorphii-, 7 ray/Batomorphii- and 5 bony fish/Osteichthyes-taxa. The high contribution of benthonic taxa is conspicuous. These small-sized sharks as well as the rays and the Osteichthyes-taxa indicate a shallow sea for the Grund Formation in the vicinity of Grund. In particular the genus *Notorynchus* – in contrast to *Hexanchus*[18]– is a Recent inhabitant of shallow waters; it is also known from Miocene shallow-water localities of the Paratethys, e.g. from the Eggenburgian (Kühnring), Ottnangian (Höch, Rainbach, Prambachkirchen, Plesching) and the Badenian (Wien-Kalksburg, Gaaden, Devinska Nova Ves) (SCHULTZ 1971, SCHULTZ in BRZOBOHATY & SCHULTZ 1971 and 1973).

[18] depending on species, known from shallow water to 1875 m or from 90 m - 600 m depth (compare COMPAGNO 1984: 20 und 21.

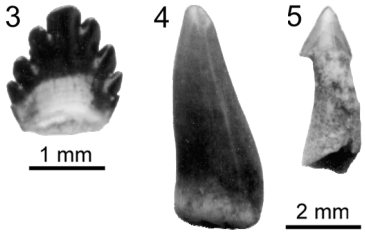

Fig. 3: ***Acanthurus haueri* (v.MEYER, 1842),** Mühlbach am Manhartsberg (Mü 2); Badenian, Lower Lagenid Zone. – NHMWien 2002z0123/0006.

Fig. 4: ***Sphyraena* sp.,** Grund (GRU-F-11); Badenian, Lower Lagenid Zone. – NHMWien 2002z0127/0014.

Fig. 5: ***Trichiurus miocaenicus* (DELFORTRIE, 1876),** Mühlbach am Manhartsberg (Mü 2); Badenian, Lower Lagenid Zone. – NHMWien 2002z0124/0010.

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