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Contents

Late Oligocene gastropods and bivalves from the Lower and Upper Austrian Molasse Basin

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Abstract: For the first time, the Late Oligocene (Late Kiscellian – Early Egerian) nearshore mollusc fauna of the Lower and Upper Austrian Molasse Basin is described systematically. 73 taxa are documented (32 Gastropoda, 41 Bivalvia; 1 new species is introduced: *Astarte hoelzli* nov. sp.)

The investigated material derives mainly from the Pielach, Linz, Melk, and Ebelsberg Formations from the vicinities of Linz and Melk. Despite the generally poor preservation and the fact that most shells were collected in short-lived and little documented outcrops, the fauna allows paleoecological interpretations. Thus the various associations document littoral and shallow to moderately deep sublittoral environments. The composition of the fauna displays high similarities with those of Bavaria and Hungary and furnishes evidence for a strong influence from the Proto-Atlantic-Boreal Region, whilst typical elements from the Western Tethys are very rare.

Zusammenfassung: Erstmals wird die küstennahe früholigozäne (Spätes Kiscellium – Frühes Egerium) Molluskenfauna aus der nieder- und oberösterreichischen Molassezone ausführlich dargestellt. 73 Taxa wurden dokumentiert (32 Gastropoda, 41 Bivalvia). *Astarte hoelzli* nov. sp. wird als neue Art beschrieben.

Das Material stammt überwiegend aus der Umgebung von Linz und Melk und repräsentiert die Fauna der Pielach, Linz, Melk und Ebelsberg-Formation. Die relativ schlechte und selektive Erhaltung und die Tatsache, dass die meisten Funde aus temporären und wenig dokumentierten Aufschlüssen stammen erschweren die Bearbeitung und Interpretation. Trotzdem zeigt die Fauna gute Übereinstimmung mit den wesentlich besser erhaltenen Gastropodenfaunen Ungarns und Bayerns und beweist darüber hinaus einen starken faunistischen Einfluß aus der Proto-atlantisch-borealen Region während typische Elemente der westlichen Tethys kaum auftreten.

Keywords: Gastropoda, Bivalvia, Paratethys, Oligocene, Egerian, Palecology

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1. INTRODUCTION

1.1. Historical setting

Detailed geological investigations in the study area began during the last decades of the 19th century. In the Lower Austrian part of the studied area, Czjzek (1853) and Wolf (1858) were the first who gave a rough description of the lithology without focusing on the molluscan fauna. At the same time, Fitzinger (1842) and Ehrlich (1852, 1855) initiated geological and paleontological studies in the Upper Austrian part. With the increasing importance of local exploitation of small coal-seams in the Pielach Formation, the studies focused on stratigraphic problems. These efforts resulted in papers by Posepny (1865) and Fuchs (1868) which included the first reliable lists of molluscs – at that time the best markers for stratigraphical correlations. Additionally, Hauer (1861) published first data on the chemistry of the coal from Viehdorf. During the next phase of investigations by Suess (1891), Commenda (1900), and Abel (1903), new data on the paleontology and geology of the vicinities of Linz and Melk emerged, including initial information on the mollusc fauna of Plesching. First descriptions and illustrations of some molluscs from the Kiscellian part of the Pielach Formation from Starzing at Neulengbach were published by Vetters (1922).

The new era was initiated by the geological studies of Grill (1933, 1935) and Ellison (1936, 1942), which both give detailed lists of the mollusc fauna. Further data were supplied by Sieber (1953) who published several extensive lists of molluscs mainly deriving from drilling holes. Our knowledge on the geology and tectonics here rapidly increased from the 1960s on due to the investigations by the OMV but also due to the geological mappings by the Geological Survey. The Oligocene Upper Austrian mollusc fauna was newly studied by Steininger (1966, 1969, 1975), who attempted to integrate the fauna into the newly established Paratethys stages. It was also Steininger, who provided preliminary lists of the mollusc fauna from the Melk Formation in the sedimentological paper by Roetzel (1983). No new data on the mollusc fauna of the northern Paratethys coast from Lower and Upper Austria were added since then.

Further remarks on the history of geological investigations in the studied area are given in Steininger (1975) and Roetzel (1983).

1.2. Study area and geological setting

The studied mollusc fauna derives from siliciclastic sediments, which represent the nearshore facies of the northern coast of the Oligocene Paratethys in Lower and Upper Austria. A predominating fault system of conjugate NW-SE and NE-SW trending faults in the southern part of the Massif caused a triangular crystalline peninsula which extended south to Amstetten and separated the area into a western and eastern part. Tectonically this Amstetten fault block is limited by the Steyr fault in the west and the Diendorf fault in the east (Wagner, 1998). At that time the Bohemian Massif formed a fissured shoreline with the Weizenkirchen, Eferding, Linz, and Gallneukirchen bays in the west and the Krems and Melk embayments in the east.

In the eastern, Lower Austrian, part, the sedimentation most probably started during the Upper Kiscellian stage with limnic clay and silt of the Pielach Formation. During a transgressive phase the limnic conditions were replaced by brackish to marine environments coinciding with the formation of small paralic coal seams. In the Egerian, the transgression resulted in first intercalations of the pelitic Pielach Formation with the sandy Melk Formation, indicating a fully marine coastal situation (Roetzel, 1983).

After a short-lived regressive phase, postulated by Roetzel (1983), the following transgression started again with the deposition of the pelitic Pielach Formation, yielding lagoonal, estuarine conditions. In respect to the fissured crystalline shoreline, resulting in embayments, lagoons and small islands, a small-scale lithofacies pattern is documented in the interfingering and overlaying Melk Formation. The deposition of these fully marine near-shore sediments gradually replaced the brackish pelites of the Pielach Formation during the Early Egerian. The progressive transgression resulted in the deposition of off-shore pelites of the Ebelsberg Formation of the Lower Egerian which intercalate during that time with the sands of the Melk Formation.

In the western, Upper Austrian part the development generally corresponds to that of Lower Austria. Again, the paralic Pielach Formation fills the crystalline relief. Kaolin deposits often form the base of the Pielach Formation, which bears scattered coal seams (Fuchs & Thiele, 1987). The thickness and extension of the Pielach Formation decrease towards the west and especially in the Linz Bay and in the Gallneukirchen Bay, the sandy

Linz Formation often transgrades directly on the crystalline with basal conglomerates (GRILL, 1934; STEININGER, 1975). Finally, the transgrading Linz Formation reflects the establishment of marine, sublittoral, near-shore environments in the Linz area during the late Early Egerian. Deposition of coarse sand of the Linz Formation is influenced by the relief along faults which caused rather steep coasts along the Upper Austrian part of the Amstetten Fault block (WAGNER, 1998). Similarly as in the Lower Austrian part, the sandy coastal facies interfingers with the pelitic Ebelsberg Formation towards the shelf.

The separation of the western Linz Formation from the eastern Melk Formation seems to be an artefact; according to ROETZEL & KRENMAYR (pers. comm.) these formations will be united in the Linz–Melk Formation.

Detailed descriptions of the geodynamics, sedimentology, tectonics and facies development in the investigated part of the Molasse Basin are given by WAGNER (1996a, b, 1998) and ROETZEL (1983). Various geological, tectonical and facies-distribution maps concerning parts of the investigation area are published in ELLISON (1936, 1940), SCHADLER in HOFMANN (1944), SCHAFFER & GRILL (1951), GRILL (1958), FUCHS (1964, 1972, 1980), BRAUMÜLLER (1961), SCHADLER (1964), KAPOUNEK et al. (1965), SCHERMANN (1966), STEINIGER (1975), ROETZEL (1983), and WAGNER (1996a, b, 1998). Additionally, the Oligocene formations are mapped on sheets 34, 35, 36, 37, and 38 of the ÖK 1:50.000 (Geological maps of Austria, Geological Survey Vienna).

1.3. Dating of investigated sections

The biostratigraphic dating of the **Linz Formation** at the section Plesching is based on the occurrence of *Miogypsina (Miogypsinoides) formosensis* YABE & HANZAWA (RÖGL & STEININGER, 1969). According to BALDI et al. (1999), this index fossil characterizes the late calcareous Nannoplankton biozone NP 25 and the late planktic Foraminifera biozone P 22. It allows a dating of the section into the latest Oligocene, specifically into the late Early Egerian (Fig. 1). As pointed out above, the Upper Austrian Linz Formation largely corresponds to the Lower Austrian **Melk Formation** (section Melk/Wachberg).

The **Ebelsberg Formation** (section Krustetten/Tiefenfucha), because it interfingers with and transgrades both the Linz and the Melk Formation, yielded the stratigraphically youngest mollusc fauna. Following HOCHULI in ROETZEL (1983) the section can be dated into the late Pollen Biozone Ng. Z. I., which can be correlated with the calcareous Nannoplankton biozone NP 25 and the planktic Foraminifera biozone P 22. Hence the fauna of Krustetten/Tiefenfucha can be dated into the Middle to late Late Oligocene, i.e., into the Early Egerian (Fig. 1). According to BALDI et al. (1999) the base of the Egerian stage corresponds exactly with the bases of these biozones (P 22, NP 25).

The **Pielach Formation** (sections Melk, Melk/Tunnel, Zelking, Neuwinden, Kendl), according to its stratigraphic position at the base of the marine transgression, includes the oldest sediments in the sequence. The dating is mainly based on the palynological studies by P. HOCHULI, published in ROETZEL (1983). According to his results the mollusc-bearing beds of the sections Neuwinden and Zelking can be dated to the lower Pollen Biozone Ng. Z. I., ranging from the Late Kiscellian to the Early Egerian. The Early Egerian age can be inferred for the upper part of the Pielach Formation, based on its interfingering with the Melk and Linz Formations.

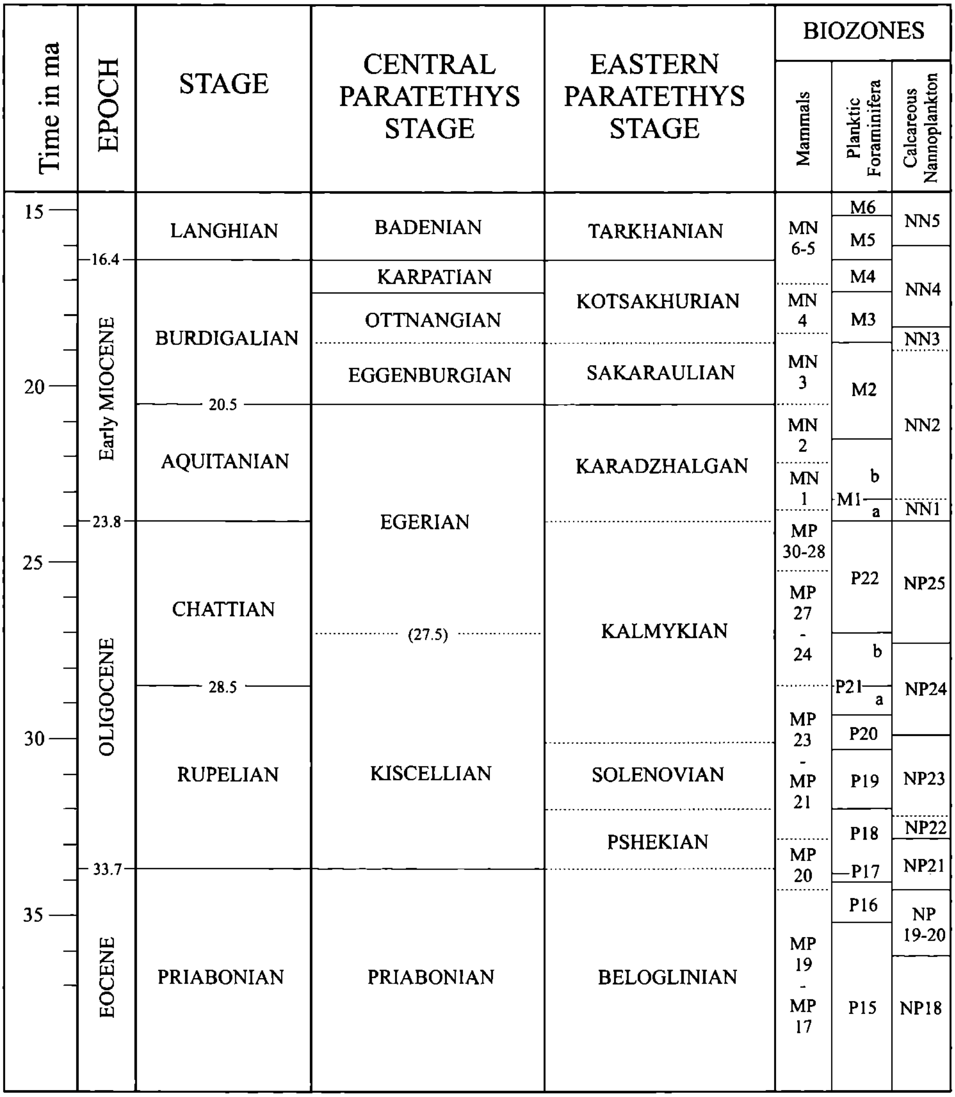

Fig. 1: Eocene to Miocene correlation of Paratethys stages to the standard time scale according to Rögl (1998).

2. MATERIAL

The main problem in studying the Oligocene mollusc fauna of the Austrian Molasse Basin is the poor and selective preservation. Generally, the aragonitic shells are heavily dissolved in the sandy Linz and Melk Formations. The shells are usually preserved as thin calcareous coverings. In contrast, the pelitic Pielach Formation bears a shelly fauna which displays all details of sculpturing but has often suffered strong deformation. Further sources for those molluscs are limited because hardly any contemporaneous mollusc-bearing outcrops exist beside the stream-bed outcrop at Kendl. Therefore the material was recruited from the collections of the Institute of Paleontology Vienna, the Geological Survey Vienna and the Museum of Natural History Vienna. The fauna of the Linz Formation derives nearly exclusively from collections carried out by F. STEININGER and F. RÖGL in the 1960s and 1970s. The best fauna of the Pielach Formation was collected in late 1990s during a tunnelling project at Melk. This material is also stored at the three above-mentioned institutions but is qualitatively enlarged by the private collection of J. MAYER. Further material from the Pielach Formation was gathered by F. STEININGER and F. RÖGL during the construction of a hydroplant at Neuwinden/Melk and at a quartz-sand pit at Zelking. None of the mollusc-bearing units of these localities is still accessible. The only section which still gives an impression of the fossiliferous Pielach Formation is a small stream-bed outcrop along the Erlauf River at Kendl. See Fig. 2 for the study area.

3. RESULTS

The investigated sections (Fig. 2) yielded a total mollusc fauna of 73 taxa, composed of 32 gastropod species and 41 bivalve species (Tab. 1). Ecologically, the fauna consists of two main groups. One is represented by the fauna of the Pielach Formation, which is characterised by a high amount of lagoonal and/or brackish-estuarine species. In contrast, the Upper Austrian Linz Formation predominately bears species from fully marine environments of the littoral to moderately deep sublittoral.

In the following, the studied sections are briefly characterized. A short lithological description enlarged by the most important data from the literature is given for each section. Finally, the total mollusc fauna is summarized and a palecological interpretation is presented.

1. Section: Plesching (Upper Austria) – Linz Formation
(Position: 48° 19' 30" N; 14° 20' 38" E)

SUESS (1891) was one of the first to give a short description of logs in the Linz Formation and to identify some of the typical molluscs from Plesching. Due to the bad preservation and the generally underrated stratigraphic value of the mollusc fauna, no really new data on the gastropod fauna of the Linz Formation found their way into the literature until STEININGER (1969). The latest revision of the fauna from Plesching was published again by STEININGER (1975) and BALDI & STEININGER (1975). In that year, STEININGER proposed the section "Austernbank" at Plesching as the faciostratotype for the Egerian Linz Sand in volume 5 of the Chronostratigraphy and Neostratotype series.

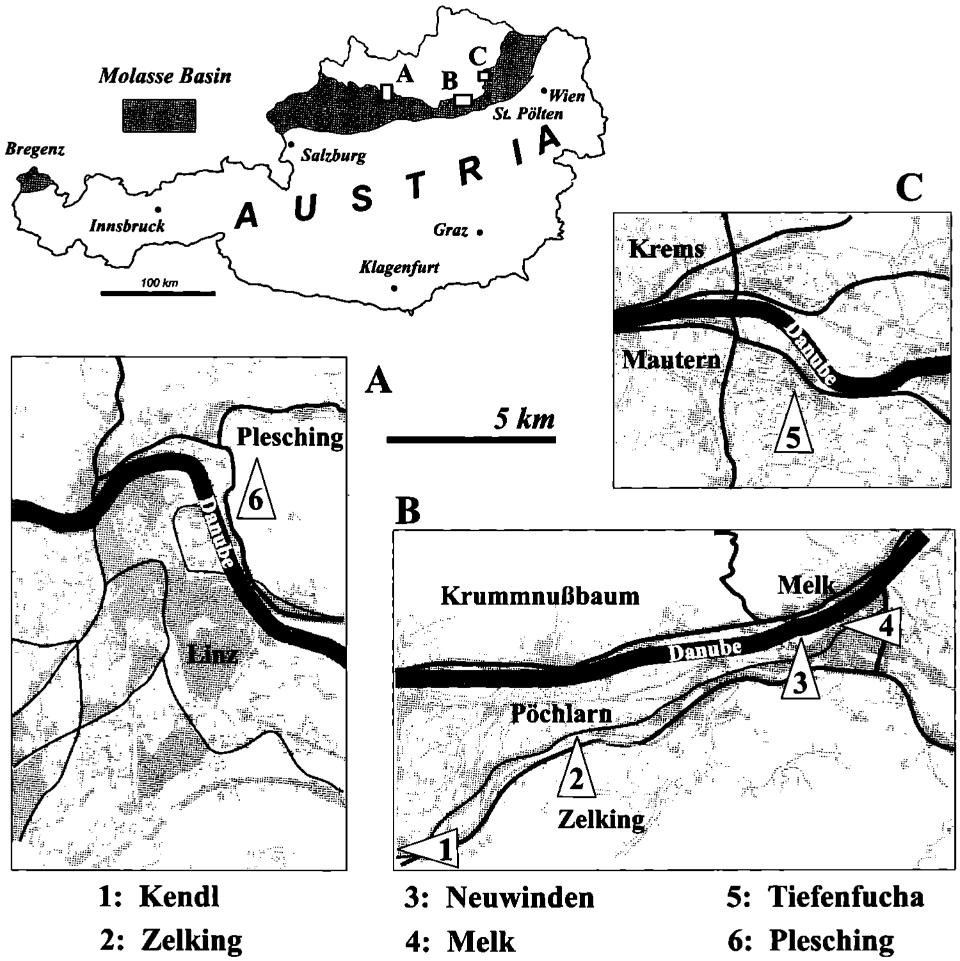

Fig. 2: Geographic setting of the investigated sections.

a. Gastropoda	ME	KE	NE	ZE	PL	TI
Neritina picta (Fèrussac, 1825)	+	+		+		
Theodoxus crenulatus (Klein, 1853)				+		
Emarginula sp.					+	
Jujubinus aff. *multicingulatus* (Sandberger, 1960)	+				+	
Calliostoma hegeduesi Baldi, 1973					+	
Angaria cf. *scobina* (Brongniart, 1823)					+	
Turritella (Haustator) venus d'Orbigny, 1852	+	+	+	+	+	+
Granulolabium plicatum (Bruguière, 1792)	+	+	+	+		
Tympanotonos margaritaceus (Brocchi, 1814)	+	+	+	+		
Melanopsis impressa Krauss, 1852	+			+		
Hydrobia sp.	+					
Xenophora transiens Sacco, 1896					+	?
Calyptraea chinensis (Linne, 1758)	+					
Drepanocheilus speciosus (Schlotheim, 1820)	+				+	+
Cypraea sp.					+	
Euspira helicina (Brocchi, 1814)	+				?	
Natica tigrina (Defrance, 1825)	?		+		?	
Galeodea megacephala (Philippi, 1843)					+	
Ficus concinnus (Beyrich, 1854)					+	
Ficus cf. *conditus* (Brongniart, 1823)					+	
Boreotrophon capito/deshayesi (Philippi, 1843/Nyst, 1836)					+	
Ocenebra bistriata (Gümbel, 1861)	+					
Melongena semseyiana (Erdös, 1900)	+					
Melongena incornuta (Hölzl, 1962)	+					
Euthriofusus cf. *szontaghi* Noszky, 1936	+					
Fasciolaria? plexa (Wolff, 1897)					+	+
Bullia hungarica (Gabor, 1936)	+	+				
Conus sp.					+	
Stenodrillia obeliscus (Desmoulins, 1842)	+					
Orthosurcula regularis (Koninck, 1837)					+	
Ringicula auriculata paulucciae Morlet, 1878	+					
Scaphander sp.					+	

Tab. 1: Taxonomic content and distribution of studied Gastropoda (a) and Bivalvia (b). Abbreviations: TI – Tiefenfucha; ME – Melk/Tunnel; KE – Kendl; NE – Neuwinden; ZE – Zelking; PL – Plesching.

b. Bivalvia	ME	KE	NE	ZE	PL	TI
Nuculana (Saccella) mayeri (GÜMBEL, 1861)						+
Mytilus (Crenomytilus) aquitanicus (MAYER-EYMAR, 1858)	+	+		+		
Brachidontes taurinensis (MICHELOTTI, 1847)					+	
Anadara diluvii (LAMARCK, 1805)	+					
Glycymeris latiradiata (SANDBERGER in GÜMBEL, 1861)			+		+	+
Isognomon (Hippochaeta) maxillatus (LAMARCK, 1801)		+			+	
Atrina cf. *pectinata* (LINNÉ, 1767)					+	
Crassostrea fimbriata (GRATELOUP, 1855)	+					
Pycnodonte gigantica callifera (LAMARCK, 1819)					+	
Palliolum incomparabile (RISSO, 1826)					+	
Costellamussiopecten? cf. *northamptoni* (MICHELOTTI, 1839)						+
Anomia ephippium LINNÉ, 1758	+	+	+		+	
Myrtea spinifera (MONTAGU, 1803)						+
Lucinoma barrandei (MAYER, 1871)					+	
Saxolucina heberti (DESHAYES, 1857)			+			
Lucinella divaricata rotundoparva (SACCO, 1901)			+			
Diplodonta rotundata (MONTAGU, 1803)	+	+			+	
Astarte henckeliusiana NYST, 1836						+
Astarte hoelzli nov. sp.					+	
Cyclocardia orbicularis (SOWERBY, 1825)						+
Cardita cf. *elongata* BRONN, 1831					+	
Eucrassatella carcarensis (MICHELOTTI, 1847)					+	
Corbula (Caryocorbula) carinata (DUJARDIN, 1837)	+					
Corbula (Varicorbula) gibba (OLIVI, 1792)						+
Acanthocardia bojorum (WOLFF, 1897)	+			+		
Lutraria (Lutraria) sanna (BASTEROT, 1825)			+			
Peronidia nysti (DESHAYES, 1860)						+
Peronidia postera (BEYRICH IN KOENEN, 1867)		+				
Macoma (Psammacoma) elliptica (BROCCHI, 1814)						+
Gari protracta (MAYER-EYMAR, 1893)	+					
Mytilopsis basteroti (DESHAYES, 1836)	+					
Arctica rotundata (BRAUN in AGASSIZ, 1845)					+	+
Glossus subtransversus (D'ORBIGNY, 1852)					+	
Polymesoda subarata sowerbii (BASTEROT, 1825)	+			+		
Cordiopsis incrassata (NYST, 1836)	+	+	+		+	+
Macrocallista beyrichi (SEMPER, 1861)	+				+	+
Pholadomya puschi GOLDFUSS, 1837					+	
Panopea menardi DESHAYES, 1828					+	
Thracia ventricosa (PHILIPPI, 1843)		+			+	+
Cuspidaria cf. *cuspidata* (OLIVI, 1792)					+	
Clavagella (Stirpulina) oblita MICHELOTTI, 1861					+	

Tab. 1: continued.

Radwanska & Radwanski (1989) were the latest authors to refer to the section Plesching when describing a new brachiopod from the Linz Formation. Drawings of the now inaccessible section with brief lithological descriptions are presented in Steininger (1969) and Radwanska & Radwanski (1989).

The Oligocene part of the pit attains a thickness of approximately 6–8 meters. Coarse sand directly overlays the crystalline bedrock. In the basal part of the log the name-giving oysterbed of up to 50 cm thickness is developed. Upsection follows mollusc-bearing sand with thin intercalations of sandstone. One of these sandstone layers is of special interest for dating the section, since the ophiomorpha-type bioturbations in this bed contain numerous specimens of the latest Oligocene foraminifer *Miogypsina (Miogypsinoides) formosensis.*

Palecology: Coral rubble and elasmobranch teeth in the basal sand layer reflect an immediately fully marine transgression. A well-agitated nearshore environment in the shallow sublittoral, close to the shoreline, can be expected for the oysterbed and the associated brachiopod fauna (Radwanska & Radwanski, 1989).

Deepening-upward is documented in the overlaying part with abundant ophiomorpha-type bioturbations followed by the common occurrence of in situ valves of *Pholadomya puschi.* This genus, only scarcely present in the shallow sublittoral Egerian communities,

Gastropods		**Bivalves**	
Emarginula sp.	r	*Brachidontes taurinensis*	f
Jujubinus aff. *multicingulatus*	f	*Glycymeris latiradiata*	f
Calliostoma cf. *hegeduesi*	f	*Isognomon (Hippochaeta) maxillatus*	r
Angaria cf. *scobina*	r	*Atrina* cf. *pectinata*	r
Turritella (Haustator) venus	a	*Pycnodonte gigantica callifera*	a
Xenophora cf. *transiens*	a	*Palliolum incomparabile*	a
Drepanocheilus (Arrhoges) speciosus	f	*Anomia ephippium*	f
Euspira helicina	f	*Lucinoma barrandei*	f
Cypraea sp.	r	*Diplodonta rotundata*	f
Galeodea megacephala	a	*Astarte hoelzli*	f
Ficus concinnus	a	*Cardita* cf. *elongata*	r
Ficus cf. *conditus*	r	*Eucrassatella carcarensis*	r
Boreotrophon? capito vel *deshayesi*	r	*Arctica rotundata*	a
Fasciolaria? plexa	r	*Glossus subtransversus*	f
Orthosurcula regularis	r	*Cordiopsis incrassata*	f
Conus sp.	r	*Macrocallista beyrichi*	f
Scaphander sp.	r	*Pholadomya puschi*	a
		Panopea menardi	f
		Thracia ventricosa	f
		Cuspidaria cf. *cuspidata*	r
		Clavagella (Stirpulina) oblita	a

r – rare
f – frequent
a – very abundant

typically inhabited the medium-depth sublittoral at that time (Baldi, 1973).
The mollusc fauna of the top beds corresponds largely to the Hungarian Late Oligocene *Pitar beyrichi* and *Glycymeris latiradiata* communities defined by Baldi (1973). These are characterised by stenohaline species adapted to sandy bottoms in fully marine shallow to moderately deep sublittoral environments. Moreover, the abundance of *Ficus concinna* and *Galeodea megacephala* and the occurrence of *Calliostoma* cf. *hegeduesi* and solitary corals are strongly reminiscent of Baldi's *Flabellipecten-Odontocyathus* community, which is indicative for the moderately deep sublittoral.

Unfortunately, the old collections from the sandpit Plesching cannot be correlated with distinct assemblages. Therefore only this very rough palecological interpretation is possible. Generally, the section represents the Early Egerian transgression starting with transgressive nearshore sands and gradually passing into somewhat deeper coastal environments.

2. Section: Kendl (Lower Austria) – Pielach Formation

(Position: 48° 09′ 14″ N; 15° 10′ 26″ E)

The small stream bed outcrop along the Erlauf rivulet close to the village Kendl exhibits a short section of the Pielach Formation. The log starts with about 1 m blueish to brown clay and silt with rootled beds. A rich mollusc fauna appears at the top of the overlying silty/sandy part of about 2 m thickness; it consists mainly of *Tympanotonos margaritaceus, Granulolabium plicatum, Mytilus (C.) aquitanicus, Neritina picta,* and *Cordiopsis incrassata.* Up to 1 m silty sand follows, which bears predominantly *Turritella venus* in enormous numbers, accompanied by *Glycymeris latiradiata, Isognomon maxillatus* and *Cordiopsis incrassata.*

Palecology: The basal part of the section lacks any macro-fossils but is probably related to fluvial-estuarine facies, as indicated by rootled beds and coal-lenses. Upsection, a rich potamidid-mytilid association indicates first marine influence. Littoral environments are favoured by these animals. In respect to Baldi's paleo-community analyses the association in the basal part of section Kendl corresponds to the *Tympanotonus-Pirenella* and the *Mytilus aquitanicus* communities (Baldi, 1973), which indicate lagoonal, brackish conditions. Mesohaline or even polyhaline salinities are probable for the fauna from Kendl, since species such as *Anomia ephippium* and *Cordiopsis incrassata* would avoid oligohaline environments.
The fauna of the overlying beds reflects an increase in salinity and a gradual shift from the littoral to the sublittoral. Intertidal species such as the potamidids decrease in numbers, whilst turritellids and venerids start to predominate the composition. This nearshore community exhibits a large percentage of infaunal suspension feeders; epifaunal species become rare. Salinity requirements range from polyhaline to normal marine for most of the species. Nonetheless, minor salinity fluctuations would have been tolerated by all the species.
Especially *Turritella venus*, which is an ubiquitous gastropod in the entire investigation area, seems to have flourished in nearshore habitats and was clearly adapted to slightly lowered salinities. These interpretations are confirmed by observations of Allmon (1988) and Allmon et al. (1992) that some recent turritellid species are well adapted to estuarine environments and may also thrive in tidal flats.

Gastropods		**Bivalves**	
Neritina picta	a	*Mytilus (Crenomytilus) aquitanicus*	f
Turritella (Haustator) venus	a	*Isognomon (Hippochaeta) maxillatus*	f
Granulolabium plicatum	f	*Anomia ephippium*	f
Tympanotonos margaritaceus morphotype: *calcaratus*	a	*Diplodonta rotundata*	a
Tympanotonos margaritaceus	a	*Peronidia postera*	r
Euspira helicina	r	*Cordiopsis incrassata*	a
Bullia hungarica	r	*Thracia ventricosa*	r

r – rare
f – frequent
a – very abundant

3. Section: Zelking (Lower Austria) – Pielach Formation
(Position: 48° 10' 48" N; 15° 15' 03" E)

The sediment petrography of the sandpit Zelking was extensively studied by Roetzel (1983). According to him the now inaccessible basal part of the outcrop exhibits Late Kiscellian to early Early Egerian, limnic pelites of the Pielach Formation overlying the crystalline basement. Sedimentation of the pelites continues into the Early Egerian, when paralic coals and a rich mollusc fauna indicate first marine influence which climaxes in the overlying coastal sand of the Melk Formation.

The mollusc fauna from Zelking derives from the dark brown to black clays. Most shells are deformed but are accumulated in distinct coquinas. Among the bivalves, *Mytilus* (*C.*) *aquitanicus* and *Polymesoda subarata sowerbii* predominate the assemblage, whilst neritimorphs and potamidids represent nearly the total gastropod fauna besides scattered shells of *Melanopsis impressa*.

Palecology: The composition clearly indicates lagoonal conditions. Thousands of herbivorous, euryhaline gastropods flourished on the muddy bottom of the shallow embay-

Gastropods		**Bivalves**	
Neritina picta	a	*Mytilus (Crenomytilus) aquitanicus*	f
Theodoxus crenulatus	f	*Acanthocardia bojorum*	r
Turritella (Haustator) venus	r	*Polymesoda subarata sowerbii*	a
Granulolabium plicatum	f	*Teredo* sp. indet.	r
Tympanotonos margaritaceus morphotype: *calcaratus*	f		
Melanopsis impressa	a		

r – rare
f – frequent
a – very abundant

ment. Besides the corbiculids, the occurrence of fluvial-estuarine species such as *Theodoxus crenulatus* and *Melanopsis impressa* document major fluvial influx. Suboptimal conditions – probably caused by the high input of organic debris, low salinities and/or poor oxygenation – may be the reason for the small size of the otherwise abundant *Mytilus (C.) aquitanicus.*

Following the considerations of BALDI (1973) for the Egerian mollusc faunas of Hungary, the fauna of Zelking corresponds to his *Polymesoda-Tympanotonus*-community, being best developed in shallow lagoons and estuaries. Salinity optima of the dominant taxa are generally thought to range from 3 to 10‰.

The environmental interpretation also fits well to the paleogeographic position of the section. During the first marine ingression in the Early Egerian the section was situated far in the Melk Bay which was protected at that time in southern and western direction by prominent crystalline swells (see also geological map in ROETZEL, 1983).

4. Sections: Melk/Tunnel (Position: 48° 13′ 00″ N; 15° 21′ 51″ E) and Neuwinden/Hydroplant (Position: 48° 13′ 19″ N; 15° 18′ 18″ E) (Lower Austria) – Pielach Formation

Both sections are close to Melk and represent short-lived outcrops during a tunneling and a hydroplant project. Rich and well-preserved mollusc faunas derived from these excavations allow an extraordinary insight into the small-scale facies patterns in Melk Bay. These patterns are reflected by several paleocommunities which exhibit rapid vertical and lateral changes in composition, whilst the pelitic sediment typically displays a rather homogeneous character. Additionally, these patterns document local oscillations of sea level and fluctuating freshwater influx, instead of one simple regression-transgression cycle.

During the tunneling at the section Melk/Tunnel, the complete Oligocene sequence from basement via Pielach Formation to Melk Formation was exposed. The log started with several meters of greenish to gray-blue pelites of the Pielach Formation, overlying the crystalline relief. Upsection the pelites are intercalated by thin layers of sand, representing the gradual shift into the overlying Melk Formation. Due to a characteristic rootled bed and a discrete layer of large concretions in the top of the tunnel-log, the overlying part of the section Melk/Tunnel can be correlated with the corresponding succession at the section Melk/Wachberg in ROETZEL (1983, p. 160–165, layers 2–9).

From the excavated material of the Pielach Formation several typical mollusc assemblages could be determined.

The most abundant assemblage consists of *Acanthocardia bojorum* and *Anadara diluvii* along with *Crassostrea fimbriata, Mytilus* (*C.*) *aquitanicus, Polymesoda subarata sowerbii, Euspira helicina,* and *Calyptraea chinensis.*

Additionally, layers with nearly monospecific mass-occurrences of *Hydrobia* sp., *Tympanotonos margaritaceus, Turritella venus, Mytilus* (*C.*) *aquitanicus,* or *Crassostrea fimbriata* appear.

The section Melk/Tunnel is correlated with the nearby section Neuwinden, where the Pielach Formation is mainly represented by silty fine sand. The gastropod fauna is roughly similar to that of Melk/Tunnel, whilst the bivalve association lacks the estuarine forms (*Mytilopsis basteroti* and *Polymesoda subarata sowerbii*) and oyster beds. Moreover, the documented faunas are usually more diverse without producing monospecific associations. The prevailing taxa are glycymerids and venerids besides *Saxolucina heberthi* and *Divaricella divaricata.*

Palecology: All the various paleo-communities of the two sections are bound to protected environments of lagoons and estuaries. A flattish shoreline with extended mudflats

Melk/Tunnel			
Gastropods		**Bivalves**	
Neritina picta	f	*Mytilus (Crenomytilus) aquitanicus*	a
Turritella (Haustator) venus	a	*Anadara diluvii*	a
Granulolabium plicatum	a	*Crassostrea fimbriata*	a
Tympanotonos margaritaceus	a	*Anomia ephippium*	a
Melanopsis impressa	f	*Diplodonta rotundata*	r
Hydrobia sp.	a	*Corbula (Caryocorbula) carinata*	r
Euspira helicina	a	*Acanthocardia bojorum*	f
Calyptraea chinensis	a	*Gari protracta*	r
Drepanocheilus (Arrhoges) speciosus	r	*Mytilopsis basteroti*	a
Bullia hungarica	r	*Polymesoda subarata sowerbii*	f
Ocenebra (Ocinebina) bistriata	r	*Cordiopsis incrassata*	f
Melongena semseyiana	r	*Macrocallista beyrichi*	r
Melongena incornuta	r		
Stenodrillia obeliscus	r		
Ringicula (Ringiculella) auriculata paulucciae	r		

r – rare
f – frequent
a – very abundant

Neuwinden/Hydroplant			
Gastropods		**Bivalves**	
Turritella (Haustator) venus	a	*Mytilus (Crenomytilus) aquitanicus*	f
Granulolabium plicatum	f	*Glycymeris latiradiata*	a
Tympanotonos margaritaceus morphotype: *calcaratus*	a	*Anomia ephippium*	f
Euspira helicina	r	*Saxolucina heberti*	a
Calyptraea chinensis	r	*Lucinella divaricata*	f
Natica tigrina	r	Cardiidae gen. et sp. indet.	a
Bullia hungarica	r	*Lutraria (Lutraria) sanna*	f
		Cordiopsis incrassata	a

r – rare
f – frequent
a – very abundant

bordering a shallow, well-protected lagoon favoured large populations of hydrobiids and potamidids. In these environements patches of *Mytilus* (*C.*) *aquitanicus* or *Crassostrea fimbriata* developed. Similar to many modern ocenebrids, the carnivorous *Ocenebra bistriata* was probably associated with these oysterbeds. Similarly, *Calyptraea chinensis* settled the secondary hardsubstrate of the mytilid-oyster biostromes. Partly exposed intertidal mudflats may be documented by the nearly monospecific *Hydrobia* sp. beds. Similar modern hydrobiid assemblages are known from the intertidal of the northern European coasts, where some species may appear in enormous masses of up to 7000 specimens per 0.1 m^2 (QUEDENS, 1997).

Towards the lagoon the muddy bottom was inhabited by a diverse infaunal bivalve fauna, on which the large-sized melongenids fed. Very calm conditions are reflected by the often articulated valves of *Anadara diluvii.*

5. Section: Melk/Wachberg (Lower Austria) – Melk Formation

The fauna derives from a sandpit at Melk, which was the focus of the sedimentological studies by ROETZEL (1983). It was collected within a layer of yellowish sand with abundant concretions (= layer 9 in ROETZEL, 1983). ROETZEL interprets the concretions based on the amount of carbonate, resulting from the dissolution of coquinas, which now are preserved only patchily as hardly identifiable, limonitic casts and moulds. The sand was deposited in coastal environments and is related to the swash and breaker zones.
All molluscs are only preserved as casts or moulds, and the specific identification is therefore often very difficult.

Palecology: Despite the poor preservation and the small number of taxa, the fauna reflects littoral to shallow sublittoral conditions. Typical shoreline dwellers such as the potamidids and mytilids are mixed with sublittoral elements such as *Arctica rotundata* or *Euthriofusus* cf. *szontaghi*, indicating the formation of the coquinas by wave agitation.

Gastropods		**Bivalves**	
Jujubinus aff. *multicingulatus*	f	*Mytilus* (*C.*) *haidingeri*	r
Granulolabium plicatum	f	*Glycymeris latiradiata*	r
Tympanotonos margaritaceus	f	*Crassostrea fimbriata*	r
Euspira cf. *helicina*	r	*Habecardium tenuisulcatum*	r
Euthriofusus cf. *szontaghi*	r	*Arctica rotundata*	f
		Macrocallista beyrichi	r

r – rare
f – frequent
a – very abundant
bivalves according to STEININGER in ROETZEL (1983) (taxonomically revised)

6. Section: Krustetten/Tiefenfucha (Lower Austria) – Ebelsberg Formation

(Position: 48° 22′ 01″ N; 15° 39′ 38″ E)

The outcrop was associated with a small rivulet in NW of Krustetten in Lower Austria during the 1970–80s. Unfortunately the realignment of the rivulet in the 1990s destroyed the outcrop and no fossils can be collected now. The greyish and dark-blue pelitic sediment bears scattered concretions of several dm diameter which contained most of the molluscs. Aragonitic shells are usually strongly dissolved and leaned. Fully preserved shells deriving from the less cemented pelites are rather rare. Generally, bivalves such as *Thracia ventricosa, Arctica rotundata, Cyclocardia orbicularis,* and *Cordiopsis incrassata* predominate the assemblage, whilst gastropods contribute only in small numbers to the mollusc fauna, both with regard to species and specimens.

Palecology: The poor gastropod fauna is not very significant for palecological considerations. Xenophorids are sand and mud bottom dwellers which range from the shallow sublittoral down to more than 1400 m depth in all tropical and subtropical modern seas (Kreipl & Alf, 1999). Similarly, modern turritellids display a broad range of bathymetric requirements, being reported from intertidal environments down to the upper bathyal (Nesbitt, 1995; Rützen-Kositzkau, 1999). The palecological requirements of *Drepanocheilus speciosus* have been studied in detail by Baldi (1973), who considers the animal to have lived mainly in the shallow to moderately deep sublittoral.

Gastropods		**Bivalves**	
Turritella (Haustator) venus	r	*Nuculana (Saccella) biali*	r
Drepanocheilus (Arrhoges) speciosus	r	*Glycymeris latiradiata*	r
Xenophora cf. *transiens*	r	*Costellamussiopecten?* cf. *northamptoni*	f
Fasciolaria? plexa	r	*Myrtea spinifera*	a
		Astarte henckeliusiana	f
		Cyclocardia orbicularis	a
		Corbula (Varicorbula) gibba	a
		Peronidia nysti	r
		Macoma (Psammacoma) elliptica	r
		Arctica rotundata	f
		Cordiopsis incrassata	f
		Macrocallista beyrichi	r
		Thracia ventricosa	a

r – rare
f – frequent
a – very abundant

4. DISCUSSION

4.1. The impact of geodynamics on the mollusc faunas

Despite the geographic closeness of the Upper and Lower Austrian sections there are strong differences in the faunistic inventory. The east-west shifts in the composition of mollusc faunas are most obvious if attention is focused on the two typical oyster-assemblages of the investigation area.

In the Upper Austrian part *Pycnodonte gigantica callifera* predominates the oyster-beds and forms thick coquinas in the outcrop Plesching (the so-called "Austernbank"). This oyster is accompanied by a characteristic brachiopd assemblage consisting of *Terebratula* cf. *grandis* and *Discinisca steiningeri* (Radwanska & Radwanski, 1989). The oyster-brachiopod paleocommunity favoured well-agitated, sandy environments in the littoral down to a few meters water depth under fully marine conditions.

In contrast, in the eastern part of the investigation area the mollusc fauna inhabited extended mud flats and protected lagoons which suffered repeated salinity decreases. Thus the stenohaline *Pycnodonte gigantica callifera* is completely missing, which seems in all respects to be primary due to the very high fossilisation potential of oystershells. However, oysters are well established in this area but are represented exclusively by the ubiquitous *Crassostrea fimbriata*. Typically the species is associated with potamidids, such as *Tympanotonos margaritaceus* and in smaller numbers by *Granulolabium plicatum*. As determined by Baldi (1973) and Barthelt (1989), nearly identical paleocommunities from the Egerian of Hungary and Bavaria are interpreted as facies indices for lagoonal to littoral environments indicating oligo/mesohaline salinities. These oyster-dominated assemblages often pass into mytilid-potamidid assemblages mainly composed of *Mytilus (C.) aquitanicus, Tympanotonos margaritaceus, Polymesoda subarata sowerbii*, and *Cordiopsis incrassata*. Additionally, *Granulolabium plicatum, Neritina picta, Theodoxus crenulatus*, and *Melanopsis impressa* co-occur in variable abundance. Some of these assemblages indicate even lower salinities and higher fluvial-estuarine influx. This is most pronounced in assemblages with abundant *Theodoxus crenulatus* and *Melanopsis impressa*, both of which probably represent estuarine or even freshwater species.

These faunistic differences between the mollusc faunas of Lower and Upper Austria along the Egerian coast are mainly due to tectonic predisposition (Harzhauser, 2000b). The NW-SE trending fault system limiting the Amstetten Fault block in the west caused steep and abrupt coastlines excluding extensive coastal flats. The formation of embayments along this coast, such as the Weizenkirchen, Eferding, Linz, and Gallneukirchen bays, was also associated with the predominating fault system, resulting in open embayments which lacked protecting swells. In contrast, the strongly fissured eastern coastline displays an irregular relief with numerous highs and lows. Especially in the vicinity of Melk and Pöchlarn and less pronounced in the area of Krems, the embayments were protected by submarine highs and small crystalline islands resulting in a broad fringe of lagoons and mudflats. The faunas of Zelking and Melk/Tunnel are good examples of such lagoonal associations.

4.2. Paleobiogeographic implications

The presented mollusc fauna can be divided into at least four groups from the biogeographers' point of view. The most important part, demonstrating the Paratethyan identity of the fauna, consists of endemic taxa unknown from other biogeographic units. Among the gastropods *Ocenebra bistriata, Bullia hungarica*, and *Fasciolaria? plexa* are typical representatives of this endemic species group. In addition, within the studied samples, *Xenophora* cf. *transiens, Calliostoma* cf. *hegeduesi*, the *Melongena incornuta-semseyiana* species group and the bivalves *Acanthocardia bojorum, Astarte hoelzli*, and *Lucinoma barrandei* are characteristic for the Central Paratethys.

The second large group represents species which display strong affinities to northern European bioprovinces. Among them *Drepanocheilus speciosus, Galeodea megacephala, Ficus concinna, Stenodrilla obeliscus, Orthosurcula regularis*, the *Boreotrophon deshayesi*-group, *Glycymeris latiradiata, Peronidia nysti, Cyclocardia orbicularis, Pycnodonte gigantica callifera*, and *Saxolucina heberti* are immigrants from the North Sea Basin where they are documented even in the Early Oligocene. Similarly, *Nuculana mayeri* is a heritage of the northern immigration, since it seems to evolve from the Rupelian *Nuculana westendorpii.*

This strong "northern" aspect stands in contrast to the rather poor influence of the "southern", adjacent bioprovince – the Western Tethys Region. If the cosmopolitan species are omitted, only *Crassatella carcarensis, Costellamussiopecten? northamptoni* and *Angaria* cf. *scobina* remain, pointing to a Western Tethyan origin. A surprising taxon of this group is represented by *Angaria* cf. *scobina.* During the Oligocene several *Angaria* species flourished in the coral reefs along the northern coast of the Western Tethys from Italy via Greece to Iran (HARZHAUSER, 2000a). At that time the genus managed to enter the Paratethys as far north as Romania (MOISESCU, 1972) but was rare in the north-western part of the early Central Paratethys. Additionally, *Ficus* cf. *conditus* and *Natica tigrina* seem to be of Western Tethyan origin.

A smaller part of the fauna, mainly representing ecologically tolerant species, consists of wide-spread European species such as *Granulolabium plicatum, Tympanotonos margaritaceus, Neritina picta, Euspira helicina*, and *Calyptraea chinensis.* These are long-lived facies indices rather than biogeographic markers. Among the bivalves this "cosmopolitan" group is represented by *Panopea menardi, Pholadomya puschi, Cordiopsis incrassata, Anomia ephippium*, and *Diplodonta rotundata.*

Hence, the Late Oligocene mollusc fauna of the Austrian Molasse Basin confirms the "northern" immigration as proposed by SENES (1958) and BALDI (1973).

5. CONCLUSION

Despite the faunistic differences of the Lower and Upper Austrian Oligocene mollusc faunas, which are due to different coastal morphology, the total species inventory coincides well with the Late Oligocene faunas of Bavaria and Hungary. It is not surprising that the brackish, lagoonal assemblages of Lower Austria display highest affinities with those of Bavaria, where similar conditions prevailed (see BARTHELT, 1989). These similarities are highest concerning species such as *Melongena incornuta* or *Ocenebra bistriata,* which are unknown from the synchronous assemblages of Hungary. On the other hand the fully marine fauna of Upper Austria consists nearly exclusively of species that are well documented by BALDI (1973) from the Hungarian Late Oligocene. Thus the presented fauna turns out to be an excellent transition between these two classical Oligocene Central Paratethys sedimentation areas.

6. SYSTEMATIC PART

Classis Gastropoda Cuvier, 1797

Subclassis Neritimorpha Golikov & Starbogatov, 1975

Superfamilia Neritoidea Rafinesque, 1815
Familia Neritidae Rafinesque, 1815
Genus *Neritina* Lamarck, 1815

Neritina picta (Férussac, 1825)

1856 *Neritina picta* Férussac – Hörnes, p. 535, pl. 47, fig. 14.
1896 *Nerita picta* var. *taurinensis* – Sacco, p. 51, pl. 5, fig. 52.
1912 *Nerita picta* Férussac – Schaffer, p. 170, pl. 54, fig. 33.
1952 *Clithon (Vittocilthon) pictus pictus* Férussac – Papp, p. 161, pl. 1, fig. 1, 2, 5–8, 25–28.
1954 *Clithon (Vittoclithon) pictus pictus* Férussac – Papp, p. 21, pl. 5, fig. 1, 2, 3.
1958 *Clithon pictus pictus* Férussac – Senes, p. 129.
1966 *Clithon pictus* Férussac – Strausz, p. 58, pl. 49, fig. 13–17.
1971 *Clithon (Vittoclithon) pictus pictus* Férussac – Steininger, p. 368, pl. 2, fig. 9, 10, pl. 3, fig. 3, 4.
1973 *Theodoxus (Vittoclithon) pictus* Férussac – Baldi, p. 243, pl. 24, fig. 1, 2, 7.
1979 *Clithon (Vittoclithon) pictus pictus* (Férussac) – Jurisic-Polsak, p. 14, pl. 1, fig. 1, 2.
1989 *Theodoxus (Vittoclithon) pictus* Férussac – Barthelt, p. 35, pl. 12, fig. 7.

Investigation area
1882 *Neritina picta* Férussac – Toula, p. 198.
1903 *Neritina picta* Férussac – Abel, p. 134.
1905 *Neritina picta* Férussac – Abel, p. 356.
1943 *Neritina* – Schaffer, p. 519
1951 *Neritina picta* Férussac – Schaffer & Grill, p. 700

Description: Small sized, spherical shell; spire hardly emerges from the body whorl, which almost completely covers the proceeding ones. Within the samples, strongly convex specimens prevail, whilst those with slightly concave flanks are rare. The shells bear their maximum width in the anterior third, where the convex base meets the flank. The aperture is wide, with a more or less dentate columellar lip, which is sunken into the aperture. Usually, the color ornament is preserved, displaying various kinds of patterns. The most common pattern consists of two bands of wide-spaced, V-shaped, blunt, axial lines; one situated close to the posterior suture and the second one coinciding with the transition from flank to base. Between these bands numerous close-spaced, axial lines produce, a dense somewhat irregular pattern. diameter: 5 mm, height: 4 mm.
Material: Numerous well-preserved, coloured specimens, from Kendl, Viehdorf, Melk and Zelking.
Lithostratigraphy: Pielach Formation.

Remarks: The generic identification of this species as *Neritina* is problematic. Based on protoconch features it will be necessary to errect a new genus (see Harzhauser & Kowalke (in press) for detailed discussion).
In respect to the vast variability of this species, concerning color ornament, it seems questionable whether the Oligocene *Neritina buekkensis* (Telegdi-Roth, 1914) and *Neritina pilisensis* (Baldi, 1973) represent valid species.

Distribution: The *Neritina picta*-group is a very abundant species during the Oligocene and Miocene in all European provinces.

Genus *Theodoxus* MONTFORT, 1810

Theodoxus crenulatus (KLEIN, 1853)

1870–75	*Neritina crenulata* KLEIN – SANDBERGER, p. 571, pl. 28, fig. 13.
1856	*Neritina Grateloupana* FÉRUSSAC – HÖRNES, p. 533, pl. 47, fig. 13a–c.
1929	*Theodoxus (Calverita) crenulatus crenulatus* (KLEIN) – WENZ, p. 2941, (cum syn.)
1954	*Theodoxus (Th.) crenulatus crenulatus* (KLEIN) – PAPP, p. 22, pl. 5, fig. 4, 5.
1973	*Theodoxus (Theodoxus) crenulatus* (KLEIN) – BALDI, p. 246, pl. 25, fig. 3–8.

Remarks: This fluvial-estuarine species is documented only by few shells from Zelking. Despite the bad preservation, even fragments can be distinguished from the predominating and somewhat similar *Neritina picta* (FÉRUSSAC, 1825.) by its dense, speckled, brownish color ornament. Rather complete specimens display depressed spherical shells which lack the distinct convexity between base and flank as observed in *Neritina picta*. In addition, *Neritina picta* is usually smaller than *Theodoxus crenulatus*. Unfortunately, no apertures are preserved.

A comprehensive description with remarks on relationships with similar species is given in BALDI (1973) and HARZHAUSER (in press).

Distribution: *Theodoxus crenulatus* (KLEIN) appears in the Central Paratethys during the Late Oligocene. According to BALDI (1973) it is also known from the North Sea Basin in the Oligocene. In the Early Miocene it reaches the French Atlantic coast. It is one of the few gastropod species which managed to survive the water-chemistry crisis of the Sarmatian and displays its bloom in the Paratethys at that time.

Subclassis Archaeogastropoda THIELE, 1925

Ordo Vetigastropoda SALVINI-PLAWEN & HASZPRUNAR, 1987
Superfamilia Fissurelloidea FLEMING, 1822
Familia Fissurellidae FLEMING, 1822
Subfamilia Emarginulinae GRAY, 1834
Genus *Emarginula* LAMARCK, 1801

Emarginula sp.

Investigation area

1969	*Emarginula* sp. – STEININGER, p. 42.
1969	*Emarginula* sp. – RÖGL & STEININGER, p. 48.
1975	*Emarginula* sp. – STEININGER, p. 218.

Description: Small-sized, elongated patelliform shells. The shell is rather high conical with convex flanks and bears its apex at the beginning of the posterior shell-third. The sculpture is strongly abraded. Only one specimen shows some remnants of strong radial ribs, which are crossed by weaker growth lines. Diameter: 12 mm, height: 4.5 mm.

Material: 3 specimens form Plesching.

Lithostratigraphy: Linz Formation

Remarks: *Emarginula kitteli* DREGER, 1892 from the Kiscellian of Bad Häring in Tirol, illustrated in LÖFFLER (1999), differs in its more depressed shape and the denser radial ribbing. Numerous representatives of the genus are described from the Oligocene of the Mainz Basin and the North Sea Basin (see GÜRS, 1995, KUSTER-WENDENBURG, 1972, JANSSEN, 1978a, 1978b), whilst little data exists on Paratethyan and Western Tethyan species. Among these "northern" species, *Emarginula fasciata* (KOENEN, 1867) displays some resemblance with the specimens from Plesching.

Superfamilia Trochoidea RAFINESQUE, 1815
Familia Trochidae RAFINESQUE, 1815
Genus *Jujubinus* MONTEROSATO, 1884

Jujubinus aff. *multicingulatus* (SANDBERGER, 1860)
Pl. 1, Fig. 1

? 1966 *Jujubinus multicingulatus praestrigosus* n. subsp. – BALDI, p. 87, pl. 6, fig. 3.
? 1973 *Jujubinus multicingulatus praestrigosus* BALDI – BALDI, p. 240, pl. 23, fig. 7.
? 1973 *Jujubinus multicingulatus* (SANDBERGER) – KUSTER-WENDENBURG, p. 19, pl. 1, fig. 9.
? 1995 *Jujubinus multicingulatus* (SANDBERGER) – GÜRS, p. 37, pl. 5, fig. 1.

Investigation area
1975 *Jujubinus multicingulatus* ssp. – STEININGER, p. 219.
1983 *Trochus* sp. – STEININGER in ROETZEL, p. 164.

Description: Small-sized conical shells with an apical angle ranging between 70° and 75°. The 5–6 whorls are hardly convex, separated by narrow sutures. The body whorl bears about 7 spiral ribs, with one slightly weaker secondary rib between two primary ones. About 10 similar spiral ribs cover the flattish, feebly convex base, which passes through a marked angulation into the flank. Due to the covering by sediment, the umbilical features are rather obscure. Dense-spaced, prosocline growthlines cross the spiral ornamentation. Height: 7 mm, diameter 7 mm.
Material: 2 shells from Plesching and 4 specimens from Melk.
Lithostratigraphy: Linz Formation, Melk Formation.

Remarks: The similar *Jujubinus multicingulatus* (SANDBERGER, 1960) was reported from the Egerian of the Central Paratethys by BALDI (1973) as the subspecies *Jujubinus multicingulatus praestrigosus*. This type is clearly not identical with the Austrian form, since it develops rather convex whorls and bears a well-rounded peribasal angulation. For the same reason BALDI's Hungarian form seems to differ from the type species on a higher taxonomic level than the subspecies level. The poor preservation of the shells, however, which all lack any reliable information on apertural and umbilical features, allows no clear specific identification. Nonetheless, the specimens from the Linz Formation were identified by STEININGER (1975) as *Jujubinus multicingulatus* ssp. A comparison with specimens of *Jujubinus multicingulatus* from the Rupelian of Alzey at Weinheim revealed similarities concerning sculpture, but on the other hand most specimens of *Jujubinus multicingulatus* are slenderer and lack the slightly steplike profile of the Austrian shells.
Distribution: *Jujubinus multicingulatus* (SANDBERGER, 1860) is described from the Rupelian of the Mainz Basin. Its occurrence in the Paratethys is doubtful.

Genus *Calliostoma* Swainson, 1840
Subgenus *Ampullotrochus* Monterosato, 1890

Calliostoma (Ampullotrochus) cf. *hegeduesi* Baldi, 1973
Pl. 1, Fig. 3

? 1973 *Calliostoma (Ampullotrochus) elegantulum hegeduesi* nov. ssp. – Baldi, p. 239, pl. 23, fig, 4–5.

Investigation area
1975 *Calliostoma (A.) elegantulum* ssp. – Steininger, p. 219.
1975 *Calliostoma elegantulum* Philippi ssp. – Baldi & Steininger, p. 344, pl. 8, fig. 8.

Description: Conical to slightly coeloconoid shell with flattend whorls and narrow sutures. The flanks of the whorls bear a row of spirally elongated nodes, which causes an indistinct swollen zone close to the adapical suture. A second, stronger swelling at the anterior suture is caused by two close spiral rows of distinct nodes. Due to these sutural swellings, the whorl seems to be slightly concave. Additionally, another weak spiral row of nodes is developed in the middle of the whorl. The body whorl is much broader and thus the outline of the shell becomes coeloconoid within its youngest part. A sharp, prominent angulation separates the flank from the flat base, which is sculptured by more than 13 spiral ribs. Diameter of fragment: 31 mm.
Material: 2 casts from Plesching.
Lithostratigraphy: Linz Formation.

Remarks: The comparison of the well-preserved Hungarian specimen, illustrated in Baldi (1973) together with the conspecific but poorly preserved specimens from Plesching with *Calliostoma elegantulum* (Philippi, 1843) illustrated in Speyer (1870), reveals distinct differences in sculpturing and size. This necessitates separating the Paratethyan form from the German type at the species level.
Distribution: The species is only known from the Egerian of Hungary and Austria.

Familia Turbinidae Rafinesque, 1815
Genus *Angaria* Bolten in Röding, 1798

Angaria cf. *scobina* (Brongniart, 1823)
Pl. 1, Fig. 2

1823 *Delphinula scobina* – Brongniart, p.57, pl. 2, fig. 7.
1840 *Delphinula scobina* Brongniart – Grateloup, pl. 12, fig. 12–14.
1861 *Turbo scobinus* d'Orbigny – Michelotti, p. 93.
1870 *Delphinula scobina* Brongniart – Fuchs, p. 161.
1885 *Delphinula Scobina* Brongiart – Teller, p. 196.
1896 *Delphinula scobina* Brongniart var. – Sacco, 21, p. 51, pl. 4, fig. 62.
1972 *Angaria (Angaria) scobina* (Brongniart) – Moisescu, p. 69, pl. 36, fig. 8.
1973 *Angaria "scobina"* (Brongniart) – Turco, p. 15, pl. 1, fig, 1, 2.
1973 *Angaria calcar* (Lamarck) – Turco, p. 15, pl. 1, fig. 3, 4.
1974 *Angaria (Angaria) scobina* (Brongniart) – Moisescu & Meszaros, p. 23.
1993 *Angaria scobina* (Brongniart) – Brogiato, p. 243.

Description: Depressed, trochoid shell with strongly step-like profile and rapidly increasing whorls. A distinct angulation separates the hardly convex flank from the also rather flat

sutural ramp. The sculpturing is largely destroyed, but as far as can be judged from the remaining parts of the shell, the flanks bear spiral ribs, and the angulation carries wide-spaced nodes. Spiral ribs are also visible on the sutural ramp of the last preserved whorl, which might also bear some radial rugae. diameter: 34 mm, height: 16 mm.
Material: One specimen from Plesching.
Lithostratigraphy: Linz Formation.

Remarks: The identification of this rare but interesting form is obscured by the bad preservation. No resembling species has been described up to now from the Oligocene and Miocene of the Molasse Basin. The comparison with *Angaria scobina* from the Eocene and Oligocene of Northern Italy and France and from the Late Rupelian and Early Chattian of Greece and Iran revealed high resemblance with the discussed specimen concerning shape, outline, and sculpture. *Angaria lima* (LAMARCK, 1805), which is described from the Oligocene of Rumania (MOISESCU, 1974) and from the Eocene of France (COSSMANN & PISSARRO, 1910–13) is also very similar but lacks the strong nodes at the angulation, which are still visible even on the specimen from Plesching.
The species is common in the Oligocene of the Mediterranean basins and becomes abundant in coral-bearing facies. Thus the scarceness of *Angaria* in the Paratethys can be explained easily by the absence of the required environments. The geographically closest occurrence of *Angaria scobina* is mentioned by TELLER (1885) from the Oligocene of Slovenia and by BALDI (1986) from the Early Oligocene of Hungary.

Distribution: Following TURCO (1973), who unites *Angaria calcar* (LAMARCK, 1805) with BRONGNIART's *Angaria scobina*, its range would be Eocene to Oligocene. *Angaria scobina* is a widespread species in the Oligocene Western Tethys. It occurs in France, Northern Italy, Greece, and the Central Iran. In the Paratethys it is a very rare species and is known only from Rumania, Hungary, Slovenia and now probably also from Austria.

Subclassis Caenogastropoda COX, 1959

Order Cerithiimorpha GALIKOV & STAROBOGATOV, 1975
Superfamilia Cerithioidea FERRUSAC, 1819
Familia Turritellidae LOVÉN, 1847
Genus *Turritella* LAMARCK, 1799
Subgenus *Haustator* MONTFORT, 1810

Turritella (Haustator) venus (d'ORBIGNY, 1852)

1897 *Turritella Sandbergeri* MAYER-EYMAR – WOLFF, p. 266, pl. 25, fig. 24.
1914 *Turritella Sandbergeri* MAYER – TELEGDI-ROTH, p. 35, pl. 4, fig. 21–24.
1921 *Turritella venus* d'ORBIGNY – COSSMANN & PEYROT, 73, p. 31, pl. 2, fig. 31, 32.
1925 *Turritella (Haustator) venus* d'ORBIGNY – PEYROT, p. 31, pl. 2, fig. 31–32.
1952 *Turritella venus* d'ORBIGNY – ANIC, p. 37, pl. 9, fig. 10, 11.
1958 *Turritella venus* d'ORBIGNY – SENES, p. 130, pl. 212, fig. 263–268.
1962 *Turritella venus* d'ORBIGNY – HÖLZL, p. 139, pl. 8, fig. 11,12.
1963 *Turritella venus* d'ORBIGNY – BALDI, p. 84, pl. 5, fig. 1–3.
1973 *Turritella (Haustator) venus* d'ORBIGNY – BALDI, p. 249, pl. 28, fig. 1, 2.
1975 *Turritella (Haustator) venus* d'ORBIGNY – BALDI & STEININGER, p. 249, pl. 28, fig. 1, 2.

Investigation area
1853 *Turritella acutangula* BROCCHI – CZJZEK, p. 275.

1868 *Turritella* sp. cf. *turris* BASEROT – FUCHS, p. 217.
1891 *Turritella* sp. (cf. *turris*) – SUESS, p. 412.
1933 *Turritella* cf. *Geinitzi* SPEYER – GRILL, p. 1.
1943 *Turritella* cf. *geinitzi* SPEYER – SCHAFFER, p. 517.
1953 *Turritella* sp. – SIEBER, p. 373.
1953 *Turritella* cf. *geinitzi* SPEYER – SIEBER, p. 373.
1969 *Turritella (H.) venus* d'ORBIGNY – STEININGER, p. 42, pl. 5, fig. 1a–c.
1969 *Turritella venus* d'ORBIGNY – RÖGL & STEININGER, p. 48.
1975 *Turritella (H.) venus venus* d'ORBIGNY – STEININGER, p. 218.
1983 *Turritella* sp. – STEININGER in ROETZEL, p. 141.
1983 *Turritella venus* – STEININGER in ROETZEL, p. 164.

Description: Medium-sized shells with convex whorls and deep sutures. The maximum diameter of the whorls is in the adapertural third. The early teleoconch-whorls bear two primary ribs which are soon accompanied by a third one. Between these three primary ribs, one or two secondary spiral-threads are intercalated, which grow as strong as the primary ribs within a few whorls. Furthermore a third generation of spiral-threads appears between some secondary and primary ribs, again attaining almost the same strength as the preceeding. Max. diameter: 16 mm.
Detailed descriptions of this widespread species are given in SENES (1958) and BALDI (1973).
Material: Numerous specimens from Kendl, Neuwinden, Tiefenfucha, Melk, Zelking, Pielach, Gallneukirchen and Plesching.

Remarks: *Turritella (Haustator) venus* (d'ORBIGNY) is one of the most abundant gastropods in some layers at Neuwinden and Kendl. Within the large populations several shells develop secondary ribs which are less prominent than the primary ones, thus strongly reminiscent of *Turritella (Haustator) venus margarethae* GAÁL 1937/38.
Distribution: *Turritella (Haustator) venus* (d'ORBIGNY) is ubiquitous in the Oligocene of the Western and Central Paratethys (BALDI, 1973). In the Mediterranean area the species is recorded from the Oligocene of Italy (see BALDI, 1973). In the Early Miocene the species vanishes from the Paratethys but is still represented in Greece (HARZHAUSER, 2000a) and also reaches the Atlantic coast (COSSMANN & PEYROT, 1921).
Its occurrence in the Early Miocene of Marokko (LECOINTRE, 1952) is obscure, since the author gives neither a description nor an illustration of his specimens.

Familia Potamididae ADAMS & ADAMS, 1854
Genus *Granulolabium* COSSMANN, 1889

Granulolabium plicatum (BRUGUIÈRE, 1792)
Pl. 1, Fig. 7

1823 *Cerithium plicatum* BRUGUIÈRE – BRONGNIART, p. 71, pl. 6, fig. 12.
1856 *Cerithium plicatum* BRUGUIÈRE – HÖRNES, p. 400, pl. 42, fig. 6.
1863 *Cerithium plicatum* BRUGUIÈRE div. var. – SANDBERGER, p. 96, pl. 8, fig. 6, pl. 9, fig. 1–7.
1895 *Granulolabium plicatum* (BRUGUIÈRE) div. var. – SACCO, p. 58, pl. 3, fig. 45–47.
1896 *Potamides papillatus* SANDBERGER – PENECKE, p. 54, pl. 3, fig. 1–3.
1912 *Cerithium plicatum* BRUGUIÈRE div. var. – SCHAFFER, p. 151, pl. 51, fig. 36–40.
1925 *Pirenella plicata* (BRUGUIÈRE) – COSSMANN & PEYROT, p.267, pl. 5, fig. 99–101, pl. 6, fig. 42–44.
1965 *Pirenella plicata plicata* (BRUGUIÈRE) – HÖLZL, p. 261, pl. 3, fig. 10.

1972 *Pirenella plicata* (Bruguière) – Moisescu, p.89, pl. 29, fig. 20a, b.
1973 *Pirenella plicata* (Bruguière) – Baldi, p. 259, pl. 29, fig. 3.
1986 *Pirenella plicata* (Bruguière) – Gitton, et.al. p. 8, pl. 2, fig. 10, 11.
1986 *Granulolabium plicatum* (Bruguière) – Lozouet, p. 8, fig. 2 a–d, 4 f.

Investigation area
1853 *Cerithium pictum* Brocchi – Czjzek, p. 275.
1853 *Cerithium lignitarum* Eichwald – Czjzek, p. 282.
1868 *Cerithium plicatum* Bruguière var. *intermedium* Sandberger – Fuchs, p. 217.
1868 *Cerithium plicatum* Bruguière var. *multinodosum* Sandberger – Fuchs, p. 217.
1868 *Cerithium plicatum* Bruguière var. *Sabotti* Nyst. – Fuchs, p. 217.
1868 *Cerithium plicatum* Bruguière var. *enodosum* Sandberger – Fuchs, p. 217.
1868 *Cerithium plicatum* Bruguière var. *pustulatum* Sandberger – Fuchs, p. 217.
1868 *Cerithium elegans* Desh.ayes– Fuchs, p. 217.
1882 *Cerithium plicatum* Bruguière – Toula, p. 198.
1891 *C. plicatum* – Suess, p. 412.
1903 *Cerithium plicatum* Bruguière – Abel, p. 134.
1905 *Cerithium plicatum* Brocchi – Abel, p. 356.
1942 *Cerithium plicatum* Bruguière – Ellison, p. 38.
1943 *Cer. (Granulolabium) plicatum* Bruguière – Schaffer, p. 519
1951 *Cerithium plicatum* Bruguière – Schaffer & Grill, p. 700
1953 *Potamides plicatus* (Bruguiuère) – Sieber, p. 373.
1964 *C. plicatum* Brocchi – Fuchs, S. 284
1983 *Cerithium plicatum papillatum* – Steininger in Roetzel, p. 164.
1983 *Pirenella plicata* ssp. – Steininger in Roetzel, p. 169.

Description: A medium-sized, slender, turriculate shell with flat whorls, incised sutures and an apical angle between 16° and 19°. The whorls carry four spiral ribs of equal strength and a fifth rather weak one which is often covered by the following whorl. Ribs usually bear 14 to 16 pearl-like nodes, slightly elongated parallel to the spiral ribs. Additionally, these nodes are often arranged in loose or distinct axial costae. The furrows between them are deeper than the intervals between the spiral ribs, but they are always incised by the spiral furrows. A sixth and seventh spiral thread with a large number of small knots are covered by younger whorls. Height: 24 mm, diameter: 6 mm.
Material: Numerous specimens from Kendl, Pielach, Neuwinden, Zelking, Sitzental, Loosdorf, Viehdorf, and Melk.

Remarks: In the literature the species *Granulolabium plicatum* (Bruguière) is divided into several subspecies because of its variable ornamentation. Nonetheless, most of these morphs seem to represent ecophenotypes rather than biological subspecies. In the investigation area, too, *Granulolabium plicatum* develops at least two morphotypes.
The most frequent one occurs in large populations at Zelking, Neuwinden and Pielach and corresponds more or less to Sandberger's *Granulolabium plicatum papillatum* (Sandberger, 1863). The second type, though widespread, can be found in considerably smaller numbers typically at Kendl and Melk/Tunnel. This type differs in its smaller size and the slightly more delicate ornamentation. Since the common *Tympanotonos margaritaceus* (Brocchi, 1814) is usually also represented by smaller and less ornamented shells at the section Melk/Tunnel, these dwarf potamidids may be a result of unfavourable ecological conditions.
Similarly, Lozouet (1986), as a result of his statistical analysis, concludes that a splitting of *Granulolabium plicatum* in subspecies is untenable.

Distribution: Widespread in the Oligocene and Early Miocene of the Boreal, the Paratethys, the Mediterranean and the Atlantic bioprovinces.

Genus *Tympanotonos* Schumacher, 1817

Tympanotonos margaritaceus (Brocchi, 1814)

Pl. 1, Fig. 4–6

1814 *Murex margaritaceus* – Brocchi, p. 447, pl. 9, fig. 24.
1856 *Cerithium margaritaceum* Brocchi – Hörnes, p. 404, pl. 42, fig. 9.
1863 *Cerithium margaritaceum* Brochhi var. *calcaratum* Grateloup – Sandberger, p. 106, pl. 8, fig. 2.
1888 *Potamides promargaritaceus* Sacco div. var. – Sacco, p. 13, pl. 6, fig. 1–23
1888 *Potamides margaritaceus* Brocchi var. – Sacco, p.21, pl. 7, fig. 30, 31.
1895 *Tympanotomus calcaratus promargaritaceus* – Sacco, 17, p. 47, pl. 3, fig. 14.
1897 *Potamides margaritaceus* (Brocchi) – Wolff, p. 270, pl. 25, fig. 18–21.
1910 *Potamides (T.) margaritaceus* (Brocchi) div. var. – Vignal, p. 168, pl. 8, fig. 25–29.
1912 *Cerithium margaritaceum* Brocchi – Schaffer, p. 154, pl. 52, fig. 1, 2.
1921 *Tympanotonus margaritaceus* (Brocchi) div. var. – Cossmann & Peyrot, p. 248, pl. 6, fig. 60, 64, 67, pl. 7, fig. 1, 2, 6, 7.
1952 *Tympanotonus margaritaceus* (Brocchi) – Anic, p. 40, pl. 10, fig. 10–12.
1966 *Potamides (Tymp.) margaritaceus* Brocchi – Strausz, p. 163, fig. 68.
1973 *Tympanotonus margaritaceus* (Brocchi) – Baldi, p. 260, pl. 29, fig. 1, 2.
1983 *Mesohalina m. margaritacea margaritacea* (Brocchi) – Wittibschlager, p. 58, pl. 1, fig. 1.
1983 *Mesohalina m. margaritacea nondorfensis* (Sacco) – Wittibschlager, p. 59, pl. 1, fig. 2.
1983 *Mesohalina m. margaritacea calcarata* (Grateloup) – Wittibschlager, p. 60, pl. 1, fig. 3a, b.
1989 *Tympanotonus margaritaceus* (Brocchi) – Barthelt, p. 39, pl. 12, fig. 1.
1995 *Mesohalina m. margaritacea* (Brocchi) – Kadolsky, p. 15, pl. 2, fig. 18.
1996 *Tympanotonos (T.) margaritaceus* (Brocchi) – Taner, p. 69, pl. 2, fig. 3, 3a.
1996 *Tympanotonos (T.) margaritaceus* (Brocchi) – Taner, p. 69, pl. 2, fig. 5, 5a.
1998 *Mesohalina ("Tympanotonus") margaritacea nondorfensis* Sacco – Schultz, p. 54, pl. 20, fig. 16a, 16b.

Investigation area
1882 *Cerithium margaritaceum* Brocchi – Toula, p.198.
1856 *Cerithium margaritaceum* Brocchi – Posepný, p. 164.
1868 *Cerithium margaritaceum* Brocchi – Fuchs, p. 217.
1868 *Cerithium lamarckii* Deshayes – Fuchs, p. 217.
1891 *Cerithium margaritaceum* Brocchi – Suess, p. 412.
1903 *Cerithium margaritaceum* Brocchi– Abel, p. 134.
1905 *Potamides margaritaceus* Brocchi – Abel, p. 356.
1936 *Cerithium margaritaceum* Brocchi – Ellison, p. 140.
1942 *Cerithium margaritaceum* Brocchi – Ellison, p. 38.
1943 *Cerithium (Tympanotomus) margaritaceum* Brocchi – Schaffer, p. 517, 519.
1951 *Cerithium (Tympanotomus) margaritaceum* Brocchi – Schaffer & Grill, p. 700
1953 *Tympanotonus margaritaceus* Brocchi – Sieber, p. 373.
1964 *Cerithium margaritaceum* Brocchi – Fuchs, S. 284
1983 *Tympanotonus margaritaceus margaritaceus* – Steininger in Roetzel, p. 164.
1983 *Tympanotonus margaritaceus calcaratus* – Steininger in Roetzel, p. 164, 169.

Description: A high conical, stocky shell with flat whorls and insignificant sutures, causing a rather straight outline of the spire. Only the body whorl and the latest two spire-whorls are somewhat stepped because of the strong and prominent row of pearl-like to slightly spiny granules at the posterior suture. Two weaker spiral strings of granules run anterior to the sutural one. While on early whorls the strings are equally spaced with granules of same strength, on later whorls the interspace anterior to the adapical string becomes markedly wider than that between the following two, and a secondary spiral string of small nodes is intercalated. Similarly, a distinctly less prominent spiral string of nodes runs at the anterior suture. On the body whorl the granules of the strongest, adapical string often become feebly elongated perpendicular to the axis, whereas the abapical strings bear opisthocline elongated granules.

The wing-like aperture consists of callous lips, forming the broad, short siphonal and adapical channels. A sharp fold is developed slightly anterior to the median line of the columella; towards the columellar-lip this fold becomes a broad swelling with a strong main fold in the middle and a very weak anterior secondary one.

Former apertures are sometimes preserved as narrow crests of the body whorl and the penultimate one.

Additionally, a comprehensive description of the species based on a statistical analyses of Oligocene populations is given in WITTIBSCHLAGER (1983).

Material: One of the most common gastropods at the Lower Austrian sections. The species is known from Kendl, Neuwinden, Sitzenthal, Melk, Viehdorf, Petzenkirchen, Pielach, and Zelking.

Remarks: In her description of "*Mesohalina margaritacea calcarata* (GRATELOUP, 1840)", WITTIBSCHLAGER (1983) emphasizes the close relationship between " *Mesohalina margaritacea calcarata*" and "*Mesohalina margaritacea margaritacea*". Since she examined selected specimens with typical representatives of each taxon, she treated the types as distinct subspecies. Own observations, however, furnished evidence, that *calcaratus*-types may exist synchronously and sympatrically with the less ornamented *margaritaceus*-types. This fact was observed by the present author at the Aquitanian section Kalochion in the Mesohellenic Trough, where both types co-occur (HARZHAUSER, 2000a). Additionally, within the investigation area this can be stated at least for the section Kendl. On the other hand, *calcaratus*-types predominate at Neuwinden nearly exclusively, whilst the close section Melk/Tunnel revealed mainly *margaritaceus*-types. This fully corresponds to observations of Recent populations of the potamidid *Tympanotonos fuscatus* (LINNÉ) at the Cameroonian coast (BANDEL & KOWALKE, 1999). According to BANDEL & KOWALKE (1999) the animal develops two morphotypes. The "*fuscatus*-morph" develops spines and a coarse granulation, whilst *the* "*radula*-morph" is characterised by its weaker sculpturing. Because of the equivalent radula of both types and because of rare transitional morphs (PLAZIAT, 1977), both varieties are treated as belonging to the same species by most modern authors. Nevertheless – as usually seen in the morphotypes of *Tympanotonos margaritaceus* – the varieties of *Tympanotonos fuscatus* have been observed to form pure populations at a distinct locality. Co-occurrence as well as transitional types are the exception.

Therefore, corresponding to *Tympanotonos fuscatus* as described by BANDEL & KOWALKE (1999), the various types of *Tympanotonos margaritaceus* should be treated as belonging to one species, which develops morphological varieties but no biological subspecies.

The validity of the genus *Mesohalina* was criticised by LOZOUET (1986), whereas KADOLSKY (1995) suggests that WITTIBSCHLAGER's genus is justified, based on the distinct development of early spiral-ribs. Recently, a detailed study of the protoconch and the early teleoconch in HARZHAUSER & KOWALKE (in press) proved that the species is a *Tympanotonos* s.s.

Distribution: The species is wide-spread in the Oligocene of Europe (Baldi, 1973) and vanishes during the Early Miocene when it occurs in the Paratethys, the Mediterranean and the Atlantic provinces.

Familia Melanopsidae Adams, H. & A., 1854
Genus *Melanopsis* Férussac, 1807

Melanopsis impressa Krauss, 1852 s.l.
Pl. 1, Fig. 9

1856 *Melanopsis impressa* Krauss – Hörnes, p. 596, pl. 49, fig. 10.
1917/18 *Melanopsis (Lyrcaea) impressa* Krauss – Cossmann & Peyrot, 70, p. 490, pl. 16, fig. 88, 89.
1966 *Melanopsis impressa* Krauss – Strausz, p. 126, pl. 40, fig. 7-11.
1969 *Melanopsis (Lyrcaea) impressa impressa* Krauss – Tejkal & al., p. 197, pl. 9B, fig. 10-11.
1971 *Melanopsis impressa impressa* Krauss – Steininger, p. 377, pl. 3, fig. 9.
1973 *Melanopsis impressa hantkeni* Hofmann – Baldi, p. 258, pl. 27, fig. 1-3.
1975 *Melanopsis impressa hantkeni* Hofmann – Baldi & Steininger, p. 344, pl. 3, fig. 5.
1989 *Melanopsis aquensis* Grateloup – Barthelt, p. 38, pl. 12, fig. 4.
1989 *Melanopsis hantkeni* Hofmann – Barthelt, p. 38, pl. 12, fig. 5.
1996 *Melanopsis impressa hantkeni* Hofmann – Taner, p. 69, pl. 2, fig. 2, 2a.
1998 *Melanopsis impressa impressa* Krauss – Schultz, p. 54, pl. 20, fig. 14.

Investigation area
1853 *Melanopsis Martyniana* Férussac – Czjzek, p. 275.
1868 *Melanopsis callosa* Braun – Fuchs, p. 217.
1905 *Melanopsis Hantkeni* Brocchi – Abel, p. 356.
1905 *Melanopsis aquensis* Grateloup – Abel, p. 356.
1943 *Melanopsis* – Schaffer, p. 519
1951 *Melanopsis* – Schaffer & Grill, p. 700
1983 *Melanopsis* sp. – Steininger in Roetzel, p. 169.

Description: A spindle-shaped shell with acute apical-angle, flat spire-whorls, and indistinct sutures. The body whorl bears a slight angulation separating the feebly concave sutural-ramp from the convex base. The height to diameter ratio varies notably within one population, producing elongated fusiform types as well as depressed stocky shells. Similarly, the strength of the angulation fluctuates, resulting in rather ovoidal forms to strongly shouldered types. The aperture is oval, oblique with a narrow, short siphonal canal and strongly callous inner lip which covers the base partly. Height: 20 mm, diameter: 12 mm.
Material: 16 specimens from Zelking, St. Pölten, Melk, and Pielach.
Lithostratigraphy: Pielach Formation

Remarks: In respect to the morphological variabilty of the *impressa*-group and regarding the usually sympatric occurrences of many so-called species and subspecies related to *Melanopsis impressa*, it seems questionable whether the Paratethyan shells referred to *Melanopsis aquensis* (Grateloup, 1838) , *Melanopsis callosa* Braun in Sandberger, 1863, and *Melanopsis hantkeni* Hofmann, 1870 represent valid species. Herein, the authors consider especially *Melanopsis hantkeni* to represent rather one morphotype of the highly variable *Melanopsis impressa*, which has priority over Hofmann's *hantkeni*.
Minor differences in shell-morphology are of little taxonomic significance but correspond rather to environmental influence. In this sense Steininger et al. (1971), too, rejected any subspecific splitting of the species.

Distribution: The species occurs in various subspecies in the Oligocene of the Paratethys (BALDI, 1973; WOLFF, 1897) as well as in Oligocene deposits of Greece (PENECKE, 1896), during the Early and Middle Miocene it is a common shell in the Paratethys and the Mediterranean area, and extends into the Late Miocene in the Paratethys and into the Late Pliocene in the Mediterranean (RUST, 1997).

Superfamila Rissooidea GRAY, *1847*
Familia Hydrobiidae TROSCHEL, 1857
Genus *Hydrobia* HARTMANN, 1821

Hydrobia sp.

? 1897 *Hydrobia ventrosa* MONTAGU – WOLFF, p. 289.
? 1973 *Hydrobia ventrosa* (MONTAGU) – BALDI, p. 249, pl. 26, fig. 6.
? 1983 *Hydrobia ventrosa* (MONTAGU) – BARTHELT, p. 36, pl. 12, fig. 6.

Investigation area
1905 *Hydrobia ventrosa* MONT. – ABEL, p. 356.

Material: numerous fragmentary shells from Melk.
Lithostratigraphy: Pielach Formation.

Remarks: The shells of hydrobiids appear in enormous, nearly monospecific masses within some clayey beds at Melk. Traditionally, these shells, which are also common in Egerian deposits of Hungary and Bavaria, are identified as *Hydrobia ventrosa* (MONTAGU, 1803), a Recent European species. This designation seems to be rather vague, because the shells are usually badly preserved as fragments or at least strongly deformed. However, the poor preservation of the Austrian material hinders any identification on the species level.

Superfamilia Xenophoroidea TROSCHEL, 1852
Familia Xenophoridae PHILIPPI, 1853
Genus *Xenophora* FISCHER, 1780

Xenophora cf. *transiens* SACCO, 1896

1856 *Xenophora cumulans* (BRONGNIART) – HÖRNES, p. 443, pl. 44, fig. 13.
1896 *Xenophora cumulans* BRONGNIART var. *transiens* – SACCO, p.23.
1912 *Xenophora cumulans* var. *transiens* SACCO – SCHAFFER, p. 170, pl. 54, fig. 34, 35.
1958 *Xenophora cumulans* var. *transiens* SACCO – HÖLZL, p. 203, pl. 16, fig. 14.
1963 *Xenophora cumulans transiens* SACCO – STEININGER, p. 52,53, pl. 10, fig. 2a, b.
1971 *Xenophora cumulans transiens* SACCO – STEININGER, p. 389, pl. 8, fig. 6, 7.

Investigation area
1969 *Xenophora deshayesi* (MICHELOTTI) – RÖGL & STEININGER, p. 48.
1975 *Xenophora deshayesi* (MICHELOTTI) – STEININGER, p. 218.
? 1983 *Xenophora* sp. – STEININGER in ROETZEL, p. 141.

Description: Broad, slightly cyrtoconoid shells with obtuse apical angle ranging from 85° to 91°. Specimens with few agglutinations develop flattend or weakly convex whorls. Most casts from Plesching, however, display deep grooves at the sutures of the adult whorls, resulting from large pebbles of up to 15 mm in diameter. On early whorls the agglutinated pebbles are distinctly smaller. Therefore the outline of the casts becomes somewhat stepped towards the aperture. Due to the large agglutinations the shell surface of these specimens is very wavy. The base is flattish and is bordered by a narrow peripheral flange. Its inner lip forms a delicate callus.

apical angle (approx.)	height	diameter
85°	15 mm	34 mm
91°	26 mm	43 mm
90°	14 mm	23 mm

Material: 7 fragmentary casts from Plesching.
Lithostratigraphy: Linz Formation, Ebelsberg Formation ?

Remarks: The species can be distinguished from other Oligocene xenophorids by its cyrtoconoid spire and the obtuse apical angle, which results in a rather depressed shell outline. The typical Miocene *Xenophora deshayesi* (Michelotti, 1847), which appears during the Late Oligocene, can be distinguished by its low apical angle and by the coalescing and never stepped whorls. Ten representatives of this species from the Early Miocene of France and the Middle Miocene of Austria revealed an average apical angle of 77° and a mean diameter/height ratio of 1.76. Similarly, *Xenophora scrutaria* (Phiippi, 1843) from the Rupelian of Weinheim displayed a rather low apical angle of 82° and a diameter/height ratio of 1.45 (n=12). Additionally, the latter species is usually distinctly smaller than *X. transiens* and *X. deshayesi.* Poor preservation, however, allows no distinct determination of any cast from Plesching. Especially the apical angles are often obscured by heavy deformation.

According to Sacco (1896) the Early Miocene shells from Austria are not identical with the Eocene species and thus he introduced the subspecies *Xenophora cumulans transiens*, referring to the illustration in Hörnes (1856, pl. 44, fig. 13). As far as can be judged from the illustrations in Brongniart (1823) and Cossmann & Pissarro (1910), *Xenophora cumulans* (Brongniart, 1823) differs markedly by its spiral ornamentation of the base, whilst *Xenophora transiens* lacks this feature (compare basal view of *X. transiens* in Steininger, 1963). Since modern workers such as Ponder (1983) and Kreipl & Alf (1999) stress the importance of the basal sculpturing of xenophorids, it seems justified to separate also *Xenophora cumulans* and *Xenophora transiens* at the species level.

Distribution: *Xenophora transiens* is described from the Early Miocene of Austria and Bavaria. Due to the insufficient descriptions, the identification of many Mediterranean and Paratethyan Oligocene xenophorids, assigned to *Xenophora cumulans* (e.g., Fuchs, 1870; Moisescu, 1972; Moisescu & Meszaros, 1974) is unclear. These specimens might partly represent *Xenophora transiens* as well.

Superfamilia Calyptraeoidea LAMARCK, 1809
Familia Calyptraeidae LAMARCK, 1809
Genus *Calyptraea* LAMARCK, 1799

Calyptraea chinensis (LINNÉ, 1758)
Pl. 1, Fig. 12

1856 *Calyptraea Chinensis* LINNÉ – HÖRNES, p. 632, pl. 50, fig. 17, 18.
1870 *Calyptraea (Infundibulum) chinensis* (LINNÉ) – SPEYER, p. 192, pl. 21, fig. 5.
1896 *Calyptraea chinensis* LINNÉ div. var. – SACCO, p. 29, pl. 4, fig. 6.
1897 *Calyptraea sinensis* LINNÉ – WOLFF, p. 264, pl. 25, fig. 8.
1912 *Calyptraea Chinensis* (LINNÉ) – SCHAFFER, p. 168, pl. 54, fig. 20, 21.
1964 *Calyptraea chinensis* (LINNÉ) – ANDERSON, p. 223, pl. 18, fig. 145.
1966 *Calyptraea chinensis* (LINNÉ) – STRAUSZ, p. 209, pl. 77, fig. 1, 2.
1973 *Calyptraea chinensis* (LINNÉ) – BALDI, p. 264, pl. 31, fig. 1, 2.
1978a *Calyptraea (Calyptraea) chinensis* (LINNÉ) – JANSSEN, p. 83.
1978b *Calyptraea (Calyptraea) chinensis* (LINNÉ) – JANSSEN, p. 189.
1984 *Calyptraea (Calyptraea) chinensis* (LINNÉ) – JANSSEN, p. 187, pl. 8, fig. 1, pl. 52, fig. 7.
1994 *Calyptraea chinensis* (LINNÉ) – BANDEL & RIEDEL, p. 337.
1995 *Calyptraea (Calyptraea) chinensis* (LINNÉ) – BALUK, p. 174, pl. 3, fig. 3–5.

Investigation area
1936 *Calyptraea sinensis* (LINNÉ) – ELLISON, p. 140.
1942 *Calyptrea sinensis* LINNÉ – ELLISON, p. 38.
1953 *Calyptraea chinensis* (LINNÉ) – SIEBER, p. 373.

Description: Concentric, depressed conical shells with subcentral apex. The protoconch consists of little more than one whorl, which passes into a smooth, convex juvenile shell. The convexity of the whorl soon decreases and the adult shell becomes rather flattish towards the periphery. Its shell surface is usually smooth, but develops some growth lines, and may also carry small scales or tiny pearls on the late parts of the shell. Diameter: 13–17 mm.
Material: 8 shells from Melk/Tunnel and from Neuwinden.
Lithostratigraphy: Pielach Formation.

Remarks: *Calyptraea chinensis* is treated as a direct descendent of the Rupelian *Calyptraea striatella* (NYST, 1845) by JANSSEN (1978b) and BANDEL & RIEDEL (1994). The separation of *Calyptraea chinensis* from the ancestor-species based only on the outer shell features is very difficult. According to JANSSEN (1978b), *Calyptraea striatella* has a larger apex, a protruding protoconch and somewhat inflated whorls. However, the comparison with *Calyptraea chinensis* from the Miocene of the Vienna Basin revealed high variability concerning the convexity and the height of the apex. Therefore at least the latter features mentioned by JANSSEN seem to be of little value. Generally, typical representatives of *Calyptraea chinensis* develop smooth shells which bear only growth lines. This stands in contrast to the described specimens, which exhibit several tiny scales or pearls along the growth lines, thus being strongly reminiscent of the sculpture of the Early Oligocene *Calyptraea striatella* as illustrated in NYST (1845), KUSTER-WENDENBURG (1973) and MÜLLER (1983). On the other hand, several specimens of *Calyptraea chinensis* from the Miocene of the Paratethys (BALUK, 1995) and the North Sea (JANSSEN, 1984), but also Recent representatives (POPPE & GOTO, 1991), exhibit an equivalent sculpturing. Detailed investigations of the *striatella/chinensis* group might reveal a single chronospecies.

Distribution: The species appears in the Chattian in the North Sea Basin and in the Egerian in the Paratethys, and settled all European bioprovinces during the Miocene. *Calyptraea chinensis* is common in the modern Mediterranean-Atlantic Region but is mentioned even from the Miocene of the western Indo-Pacific by VREDENBURG (1928).

Superfamilia Stromboidea RAFINESQUE, 1815
Familia Aporrhaidae MÖRCH, 1852
Genus *Drepanocheilus* MEEK, 1864
Subgenus *Arrhoges* GABB, 1868

Drepanocheilus (Arrhoges) speciosus (SCHLOTHEIM, 1820)

1973 *Drepanocheilus speciosus* (SCHLOTHEIM) – BALDI, p. 268, pl. 30, fig. 3, 4, pl. 31, fig. 3, 4, (cum syn.)
1983 *Arrhoges (Arrhoges) speciosus* (SCHLOTHEIM) – MÜLLER, p. 43, pl. 2, fig. 3–6.
1986 *Aporrhais speciosa* SCHLOTHEIM – GITTON & al., pl. 2, fig. 31a.
1997 *Drepanocheilus (Arrhoges) margerini* (KONINCK) – GRÜNDEL, p. 5, pl. 1, fig. 3–5.
1998a *Drepanocheilus (Arrhoges) speciosus* (SCHLOTHEIM) – WELLE, p. 150 (cum syn.)

Investigation area
1953 *Arrhoges speciosa* (SCHLOTHEIM)? – SIEBER, p. 373.
1969 *Drepanocheilus speciosus megapolitana* (BEYRICH) – STEININGER, p. 42, pl. 5, fig. 4.
1969 *Drepanocheilus speciosus megapolitana* (BEYRICH) – RÖGL & STEININGER, p. 48.
1975 *Drepanocheilus speciosus* (SCHLOTHEIM) – STEININGER, p. 218.
1983 *Drepanocheilus speciosus* ssp. – STEININGER in ROETZEL, p. 141.

Description: The casts and moulds correspond to the descriptions given by BALDI (1973). Only one mould from Melk/Tunnel shows the digitation, whilst all other specimens are very fragmentary. This specimen bears a very long posterior digit (c in STRAUSZ, 1966) and a narrow wing, thus being strongly reminiscent of the morphotype usually identified as *Drepanocheilus (Arrhoges) speciosus digitata* (TELEGDI-ROTH, 1914).

Material: 2 casts from Plesching and Krustetten and 1 mould from Melk. Further specimens are recorded from Eisenhub/Braunau and Loosdorf.
Lithostratigraphy: Linz Formation, Melk Formation, Pielach Formation, Ebelsberg Formation.

Remarks: The species is quite variable concerning shell-size, digitation and ornamentation, resulting in several descriptions of morphotypes, such as *Drepanocheilus (Arrhoges) speciosus margerini* (KONINCK, 1837), *Drepanocheilus (Arrhoges) speciosus megapolitana* (BEYRICH, 1854), *Drepanocheilus (Arrhoges) speciosus unisinatus* (SANDBERGER, 1863), *Drepanocheilus (Arrhoges) speciosus digitatus* (TELEGDI-ROTH, 1914), and *Drepanocheilus (Arrhoges) speciosus serus* (STEININGER, 1963). The status as a biological subspecies seems to be rather vague for most of these forms.
Distribution: The species has an extraordinarily wide distribution during the Oligocene, when it is recorded from the North Sea Basin, the Mainz Basin, the Paris Basin, and the Molasse Basin. In the Paratethys it extends into the Early Miocene and is recorded from Austria and Bavaria.

Superfamilia Cypraeoidea Rafinesque, 1815
Familia Cypraeidae Rafinesque, 1815
Genus *Cypraea* Linné, 1758

Cypraea? sp.

? 1973 *Zonaria globosa* (Duj.) – Baldi, p. 279, pl. 34, fig. 4, 6.

Investigation area
1969 *Cypraea* sp. – Steininger, p. 42.
1969 *Cypraea* sp – Rögl & Steininger, p. 48.
1975 *Zonaria* sp. (? *Z. globosa*) – Steininger, p. 218.

Material: Two casts from Plesching, diameter: 14 mm, height: 21 mm.
Lithostratigraphy: Linz Formation.

Remarks: The fragmentary preservation of the casts allows no specific identification. Generally, cypraeids are rare in the Oligocene Paratethys. Baldi (1973) mentions only *Zonaria globosa* (Dujardin, 1837) and *Zonaria subexcisa* (Braun, 1850) from the Hungarian Egerian. One of the fragments fits well to Baldi's illustration (pl. 34, fig. 4) of "*Zonaria globosa* (forma *subglobosa*)" regarding the broad aperture and the stout shell and is probably identical with that taxon.
Distribution: The probably identical *Zonaria globosa* is known from the Late Oligocene of the Paratethys (Baldi, 1973) and becoms common during the Early Miocene in the Mediterranean and the Atlantic (Cossmann & Peyrot, 1922).

Superfamilia Naticoidea Forbes, 1838
Familia Naticidae Forbes, 1838
Subfamilia Polinicinae Gray, 1847
Genus *Euspira* Agassiz, 1839

Euspira helicina (Brocchi, 1814)
Pl. 1, Fig. 8

1856 *Natica helicina* Brocchi – Hörnes, p. 525, pl. 47, fig. 6,7.
1914 *Natica helicina* Brocchi – Telegdi-Roth, p. 31.
1962 *Polynices (Lunatia) catena achatensis* (Recluz) – Hölzl, p. 154, pl. 8, fig. 22, 23.
1963 *Lunatia catena helicina* Brocchi – Steininger, p. 50, pl. 10, fig. 8.
1966 *Natica (Lunatta) catena helicina* Brocchi – Strausz, p. 228, fig. 108, pl. 48, fig. 13–16, pl. 49, fig. 1–8.
1969 *Polinices (Euspira) helicinus helicinus* (Brocchi) – Janssen, p. 163, pl. 4, fig. 17–21, pl. 5, fig. 1–3, (cum syn.)
1971 *Lunatia catena helicina* Brocchi – Steininger et al., p. 394, pl. 7, fig. 6,7.
1973 *Polinices (Lunatia) catena helicina* (Brocchi) – Baldi, p. 273, pl. 33, fig. 1.
1998 *Lunatia catena helicina* (Brocchi) – Schultz, p. 58, pl. 22, fig. 11.

Investigation area
1969 *Polinices (Lunatia) catena achatensis* De Kokninck – Seininger, p. 42, pl. 5, fig. 3.
1969 *Polinices catena achatensis* (De Kokninck) – Rögl & Steininger, p. 48.
1975 *Polinices (Lunatia) catena* ssp. – Steininger, p. 218.

Description: A comprehensive description and discussion of the *Euspira helicina*-group is given by Janssen (1969). The specimens from Melk/Tunnel display a remarkable variability of spire height and encompass elongated shells with high spire as well as

nearly spherical shells. In contrast, the population is very homogeneous concerning shell size and umbilical features. The latter are characterised by a deep and open umbilicus, narrowed by a weak funiculus which terminates in a distinct callus. The callus usually develops a faint embayment along the base of the penultimate whorl. Typically the whorls bear a very shallow concavity close to the posterior suture. Height: 7 mm, diameter: 8 mm.
Material: Several shells from Melk/Tunnel and Kendl; some naticids from Plesching and Neuwinden are probably also identical with that species.
Lithostratigraphy: Linz Formation, Pielach Formation.

Remarks: The shells fully correspond to those from the Middle Miocene of the Vienna Basin in the collection of the NHMW and are clearly conspecific. As one of the most common naticids in the Paratethys the animal is found in nearshore environments where it tolerated fluctuating salinities, as well as in deeper-water environments. Within the investigation area the species is very abundant in the vicinity of Melk and is probably also represented at Plesching and at Neuwinden, but a distinct identification of these specimens is hindered by the poor preservation.
Distribution: According to Janssen (1969) the *Euspira helicina*-species group is a widespread naticid during the Oligocene and Miocene of Europe. In the Central Paratethys the species group appears during the Oligocene and is the only naticid that managed to pass the Badenian/Sarmatian boundary, which is a further hint to the high ecological tolerance of the species.

Subfamilia Naticinae Forbes, 1838
Gattung *Natica* Scopoli, 1777

Natica tigrina (Defrance, 1825)
Pl. 1, Fig. 10

1856 *Natica millepunctata* Lamarck – Hörnes, p. 518, pl. 47, fig. 1, 2.
1912 *Natica millepunctata* Lamarck – Schaffer, p. 165, pl. 54, fig. 5–7.
1952 *Natica tigrina* Defrance – Glibert, p. 255, pl. 2, fig. 3.
1958 *Natica millepunctata* Lamarck. – Hölzl, p. 210, pl. 19, hig. 4, 4a.
1966 *Natica millepunctata* Lamarck – Strausz, p. 225, pl. 48, fig. 5–12.
1973 *Natica millepunctata tigrina* Defrance – Baldi, p. 275, pl. 33, fig. 6 (cum syn.).
1995 *Natica tigrina* Röding – Baluk, p. 194, pl. 15, fig. 10–14.

Description: A deformed specimen consisting of four whorls with a low spire. The whorls are convex but become slightly flattish close to the posterior suture. Although the body whorl is partly damaged, the base and umbilicus are well preserved. The inner lip is straight and borders a deep, uncovered umbilcus which is partly filled by a flat funiculus. Diameter: 24 mm.
Material: 1 shell from Neuwinden.

Remarks: The species is very rare at the investigated sections. Nonetheless, several unidentifiable casts of naticids from Plesching and Melk resemble *Natica tigrina* in size and outline. A comprehensive discussion of the synonymy of the species is given by Baluk (1995) and a discussion of the morphology of the *Natica tigrina*-species group is given by Janssen (1969).

Distribution: The species appears in the Central Paratethys in the Oligocene (Austria, Hungary) and extends into the Badenian. *Natica tigrina* is a widespread species in the Miocene of all European bioprovinces.

Superfamilia Cassoidea LATREILLE, 1825
Familia Cassidae LATREILLE, 1825
Genus *Galeodea* LINCK, 1807 (syn. *Cassidaria* LAMARCK, 1810)

Galeodea megacephala (PHILIPPI, 1843)
Pl. 1, Fig. 11

1843 *Pyrula megacephala* n. sp. – PHILIPPI, p. 26, pl. 4, fig. 18.
1854 *Cassidaria Buchii* BOLL – BEYRICH, p. 484, pl. 12, fig. 2, 3.
1897 *Cassidaria Buchii* BOLL – WOLFF, p. 273, pl. 26, fig. 8.
1914 *Cassidaria nodosa* (SOLANDER) var. *Buchii* BOLL – TELEGDI-ROTH, p. 29, pl. 3, fig. 3.
1937 *Cassidaria nodosa* SOLANDER var. *Buchii* BOLL – VENZO, p. 38, pl. 2, fig. 22–23.
1952 *Cassidaria nodosa* (SOLANDER) – GÖRGES, p. 84.
1958 *Cassidaria nodosa nodosa* (SOLANDER) – SENES, p. 150.
1958 *Cassidaria nodosa* (SOLANDER) var. *Buchii* BOLL – SENES, p. 150.
1962 *Phalium nodosum* SOLANDER – HÖLZL, p. 158, pl. 9, fig. 5.
1963 *Cassidaria nodosa* SOLANDER – BALDI, p. 89, pl. 6, fig. 4.
1973 *Cassidaria nodosa* (SOLANDER) – BALDI, p. 281, pl. 35, fig. 1–2.
1975 *Cassidaria nodosa* SOLANDER – BALDI & STEININGER, p. 345, pl. 4, fig. 1–2.
1978b *Cassidaria megacephala* (PHILIPPI) – JANSSEN, p. 198, pl. 14, fig. 87.

Investigation area
1896 *Cassidaria* sp. – SUESS, p. 415.
1903 *Cassidaria* spec. – SUESS in ABEL, p. 133.
1969 *Cassidaria nodosa* (SOLANDER) – STEININGER, p. 42, pl. 5, fig. 5.
1969 *Cassidaria nodosa* (SOLANDER) – RÖGL & STEININGER, p. 48.
1975 *Cassidaria nodosa* (SOLANDER) – STEININGER, p. 218.
1975 *Cassidaria nodosa* (SOLANDER) – STEININGER, p. 220, pl. 4, fig. 1, 2.

Description: Inflated, globular shell with short spire and long, deflected siphonal canal. The body whorl carries 4 rows of marked nodes. The spines which probably protruded from these nodes are missing due to the preservation as internal mould. The most prominent row is close to the adapical suture, whilst the following three rows are slightly less pronounced. Weak spiral threads run between these rows. max. diameter: 34 mm.
Material: Numerous casts and fragments from Plesching.
Lithostratigraphy: Linz Formation.

Remarks: The form is clearly conspecific with the shell from the Hungarian Egerian described by BALDI (1973) as *Cassidaria nodosa* (SOLANDER in BRANDER, 1766). This identification was criticised by JANSSEN (1978b), who assigns the Late Oligocene representatives with four to five rows of nodes to *Galeodea megacephala* (PHILIPPI, 1843). The similar *Galeodea depressa* BUCH, 1831 has to be treated as a distinctly separate species based on its characteristic sculpture. Weaker, but more numerous nodes and a stronger spiral ornamentation clearly distinguish *Galeodea depressa* from *G. megacephala.* This point of view is also supported by the observation of BALDI (1973) that the species from the Hungarian Oligocene lack any morphological transitions. According to the data presented by GÜRS (1995), the Late Oligocene *Galeodea depressa* and *Galeodea mega-*

cephala might represent sister species, deriving from the ancestral *Galeodea nodosa*, which is restricted to the interval from the Middle Eocene up to the Rupelian (JANSSEN, 1978b; GÜRS, 1995; LÖFFLER, 1999).

Whilst both Late Oligocene species are recorded from the Hungarian Egerian (TELEGDI-ROTH, 1914; BALDI, 1973), in Austria only *Galeodea megacephala* is known from the sublittoral sands of Plesching. A considerable number of casts which most probably also represent the species document a large population of this echinovorous gastropod at the Upper Austrian coast.

Distribution: The first occurrence of *Galeodea megacephala* is reported by GÜRS (1995) from the Rupelian of the North Sea Basin, where the species becomes most abundant during the Chattian. In the Central Paratethys *Galeodea megacephala* appears in the Egerian of Hungary and Austria. From the adjacent Western Tethys Region it is recorded from the Chattian of Northern Italy by VENZO (1937). In all bioprovinces the species is clearly restricted to the Oligocene.

Superfamilia Ficoidea Meek, 1864

Familia Ficidae MEEK, 1864

Genus *Ficus* BOLTEN IN RÖDING, 1798

Ficus concinnus (BEYRICH, 1854)

Pl. 1, Fig. 13

1854 *Pyrula concinna* – BEYRICH, p. 775, pl. 18, fig. 7, 8.
1854 *Pyrula simplex* – BEYRICH, p. 777, pl. 15, fig. 3.
1860 *Pyrula imbricata* – SANDBERGER, pl. 17, fig. 8.
1863 *Pyrula concinna* BEYRICH – SPEYER, p. 184, pl. 33, fig. 15a–c.
1863 *Pyrula simplex* BEYRICH – SPEYER, p. 187, pl. 33, fig. 16, 17.
1896 *Pyrula concinna* BEYRICH – KISSLING, p. 36, pl. 3, fig. 14.
1897 *Ficula concinna* BEYRICH – WOLFF, p. 274, pl. 26, fig. 11.
1962 *Pirula concinna* BEYRICH – HÖLZL, p. 162, pl. 9, fig. 9.
1973 *Ficus concinnus* (BEYRICH) – BALDI, p. 283, pl. 36, fig. 4–5.
1973 *Ficus (Ficus) concinnus* (BEYRICH) – KUSTER-WENDENBURG, p. 97.
1978a *Ficus concinnus* (BEYRICH) – JANSSEN, p. 94.
1978b *Ficus concinnus* (BEYRICH) – JANSSEN, p. 200, pl. 14, fig. 90.
1983 *Ficus (Ficus) concinnus* (BEYRICH) – MÜLLER, p. 45, pl. 2, fig. 16.
1983 *Ficus concinnus* (BEYRICH) – GÜRS, p. 69, pl. 5, fig. 109.
1995 *Ficus concinnus* (BEYRICH) – GÜRS, p. 92, pl. 15, fig. 8.
1997 *Ficus concinnus* (BEYRICH) – GRÜNDEL, p. 5.
1998b *Ficus concinna* (BEYRICH) – WELLE , p. 152.
1999 *Ficus concinna* (BEYRICH) – DUCKHEIM & al., p. 40.

Investigation area
1936 *Pyrula concinna* (BEYRICH) – ELLISON, p. 140.
1942 *Pyrula concinna* BEYRICH – ELLISON, p. 38.
1953 *Ficus concinnus* (BEYRICH) – SIEBER, p. 373.
1975 *Ficus concinna* BEYRICH – STEININGER, p. 218.

Description: Small- to medium-sized, pear-shaped shells with small but emerging spire. The body whorl is inflated, rounded, and bears its maximum diameter approximately in its middle. No sutural ramp or shelf is developed. The sculpture is usually abraded in most specimens from Plesching. Only few shells still exhibit an ornament of densly spaced

spiral ribs which are crossed by slightly weaker axial ribs, producing a cancellate pattern. Secondary spiral ribs are missing. Max. diameter: 22 mm.
Material: Numerous casts from Plesching.
Lithostratigraphy: Linz Formation, Melk Formation, Pielach Formation.

Remarks: Shape and ornament allow a certain identification of the casts. Especially the typical spire and the well-rounded adapical part of the body whorl distinguish them from shells of *Ficus conditus* (BRONGNIART, 1823). Additionally, none of the specimens bears any secondary spiral ribs, which would be characteristic for *Ficus conditus*. GÜRS (1995) treats *Ficus simplex* (BEYRICH, 1854) and *Ficus imbricata* (SANDBERGER, 1860) as synonyms of *F. concinnus*.
Distribution: An ubiquitous Oligocene species in the North Sea Basin, the Mainz Basin and in the Western and Central Paratethys.

Ficus cf. *conditus* (BRONGNIART, 1823)

1823 *Pyrula condita* – BRONGNIART, p. 75, pl. 6, fig. 4.
1856 *Pyrula condita* BRONGNIART – HÖRNES, p. 270, pl. 28, fig. 4–6.
1914 *Pyrula condita* BRONGNIART – TELEGDI-ROTH, p. 29, pl. 4, fig. 9.
1922 *Pirula condita* BRONGNIART – COSSMANN & PEYROT, p. 333, pl. 10, fig. 46.
1962 *Pirula condita* BRONGNIART – HÖLZL, p. 162, pl. 9, fig. 10.
1966 *Pirula condita* BRONGNIART – STRAUSZ, p. 254, pl. 57, fig. 4–6.
1973 *Ficus conditus* (BRONGNIART) – BALDI, p. 284, pl. 36, fig. 1, 2.
1984 *Ficus (Ficus) condita* (BRONGNIART) – JANSSEN, p. 211, pl. 59, fig. 1.
1995 *Ficus (Ficus) condita* (BRONGNIART) – BALUK, p. 204, pl. 17, fig. 7–9.
1998 *Ficus (Ficus) condita* BRONGNIART – SCHULTZ, p. 62, pl. 24, fig. 7.

Investigation area
1969 *Ficus* cf. *condita* (BRONGNIART) – STEININGER, p. 42.
1969 *Ficus* cf. *condita* (BRONGNIART) – RÖGL & STEININGER, p. 48.
1975 *Ficus condita* (BRONGNIART) – STEININGER, p. 218.

Remarks: One fragment of a medium-sized *Ficus* from Plesching differs in its ornamentation from the predominating *Ficus concinnus* (BEYRICH, 1854) by its wider spiral ribbing and the less strict, slightly wavy axial ribbing. Weak secondary spiral ribs might be present but the preservation is too poor for any detailed description.
Distribution: *Ficus conditus* appears in the Late Oligocene in the Western Tethys Region and in the Western and Central Paratethys and becomes ubiquitous during the Miocene in all European bioprovinces.

Section Stenoglossa BOUVIER, 1887
Superfamilia Muricoidea RAFINESQUE, 1815
Familia Muricidae DA COSTA, 1776
Genus *Boreotrophon* FISCHER, 1884

Boreotrophon (s. lat.) *capito* (PHILIPPI, 1843) vel *Boreotrophon deshayesi* (NYST, 1836)

1973 *Hexaplex (Muricantha) deshayesi* (NYST) – BALDI, p. 287, pl. 38, fig. 1, 2, cum syn.
1999 *Eopaziella capito* (PHILIPPI) – DUCKHEIM & al, p. 40, cum syn.
1999 *Eopaziella deshayesi* (NYST) – DUCKHEIM & al. p. 41, cum syn.

Investigation area
1969 *Hexaplex* sp. – STEININGER, p. 42.
1969 *Hexaplex* sp. – RÖGL & STEININGER, p. 48.
1975 *Hexaplex* cf. *deshayesi* (NYST) – STEININGER, p. 218.

Description: Only a body whorl is preserved. The characteristic features for the identification of the fragment are the narrow, sharp and wide-spaced axial ribs and the angulation of the whorl which separates a flat sutural ramp from the rather flat flank of the strongly contracting base. Diameter: 14.5 mm.
Material: 1 fragment of the body whorl.
Lithostratigraphy: Linz Formation.

Remarks: GÜRS (1995) erected the genus *Eopaziella* for the two very similar species *Eopaziella capito* and *Eopaziella deshayesi*. However, the new taxon has to be treated as numen nudum, since it was only described in an unpublished thesis. The two species have been variously identified as *Hexaplex, Murex, Trophon, Aspella,* and *Boreotrophon* on the generic level. Even the specific separation of the taxa has been controversial for decades as well. SCHAFFER (1912), TELEGDI-ROTH (1914), NOSZKY (1936), and GÖRGES (1952) interpreted the differences as subspecific, whilst KOENEN (1867) and BALDI (1973) united both taxa in *deshayesi*. Recently, GÜRS (1995) and DUCKHEIM et al. (1999) emphasized that a clear separation of the species can only be based on the analysis of the protoconchs.
Distribution: The species-group is widespread during the Oligocene from the North Sea Basin and Mainz Basin to the Paratethys where it is known from Bavaria, Austria, Hungary, and Slovakia. In the Paratethys *Boreotrophon capito/deshayesi* extends into the Early Miocene of Austria and Bavaria (HÖRNES, 1856; SCHAFFER, 1912; HÖLZL, 1958).

Genus *Ocenebra* LEACH in GRAY, 1847
Subgenus *Ocinebrina* JOUSSEAUME, 1880

Ocenebra (Ocinebrina) bistriata (GÜMBEL, 1861)
Pl. 2, Fig. 7, 8

1861 *Fusus (?) bistriatus* nov. spec. aff. *F. abbreviatus* LK. – GÜMBEL, p. 94.
1897 *Murex bistriatus* GÜMBEL – WOLFF, p. 279, pl. 27, fig. 3.
1957 *Ocinebrina bistriata* (GÜMBEL) – HÖLZL, p. 74.
1989 *Ocinebrina bistriata* (GÜMBEL) – BARTHELT, p. 41.

Description: A fusiform shell with high, somewhat gradate spire. Spire whorls are convex without a distinct shouldering, whilst the body whorl develops a narrow sutural ramp. A characteristic muricid spiral-ornamentation covers the entire shell surface without producing spines. The body whorls carry about 10 broad and rounded varices which become narrow-spaced and prominent towards the apex. Aperture partly destroyed; outer lip is missing. The convex body whorl contracts rapidly into the short base, which terminates in a short, deflected siphonal canal. Height: 23 mm, diameter: 14 mm.
Material: 1 shell and several fragments from Melk/Tunnel.
Lithostratigraphy: Pielach Formation.

Remarks: The (sub)generic determination follows HÖLZL (1957), as the fragmentary preservation of the Austrian material allows no critical investigation concerning the superspecific rank of the taxon.

Surprisingly, the species is unknown from the diverse Hungarian Oligocene gastropod fauna. *Chicoreus (Foveomurex) trigonalis* (Gábor, 1936) differs by its lower number of wide-spaced varices. Additionally, its spire whorls are more depressed. Similarly, the Hungarian *Ocinebrina trivaricosa* (Baldi in Baldi et al., 1964) develops fewer varices and bears three very prominent main varices on the body whorl. Finally, *Hadriana egerensis* (Gábor, 1936) develops a charactersitic sutural ramp and displays a coalescing spire.

According to Hölzl (1957) and Barthelt (1989) this rare species is restricted to brackish environments.

Distribution: The species is only known from the Egerian of Melk and Bavaria.

Superfamilia Buccinoidea Rafinesque, 1815
Familia Melongenidae Gill, 1867
Genus *Melongena* Schumacher, 1817

Melongena semseyiana (Erdös, 1900)
Pl. 2, Fig. 3

1900 *Pyrula Semseyiana* – Erdös, p. 262.
1906 *Melongena Deschmanni* nov. form. – Hoernes, p. 1521, pl. 1, fig. 1.
1912 *Melongena (Myristica) Rotkyana* nov. spec. – Knett, p. 83, pl. 9, fig. a–c.
1916 *Melongena Semseyiana* Erdös – Bukowski, p. 9–10, in text.
1952 *Melongena lainei* (Basterot) – Anic, p. 43, pl. 11, fig. 5, 6.
1964 *Galeodes semseyiana* (Erdös) – Baldi, p. 174, pl. 2, fig. 10.
1973 *Galeodes semseyiana* (Erdös) – Baldi, p. 295, pl. 40, fig. 1, 2, pl. 51, fig. 8.
1999 *Melongena semseyiana* (Erdös) – Mikuz, p. 30, pl. 1–4.

Description: Small sized, juvenile fusiform shell consisting of the body whorl and a spire fragment. The spirewhorl is high and produces a strongly stepped outline; its flanks are straight or even somewhat projecting and pass into a flat sutural shelf or ramp via a sharp shoulder. This angulation is sculptured by 8 prominent spines. The very low-angled sutural ramp carries 4 to 5 blunt spiral cords, separated by deep furrows. The base is covered by numerous spiral cords and bears a row of spines in its anterior third.
Height: 53 mm, diameter: 34 mm.
Material: 1 shell from Melk/Tunnel.
Lithostratigraphy: Pielach Formation.

Remarks: The high morphological variability of many melongenids (as documented by Fujimoto, 1999, for *Semifusus sazanami* or by Dollfus, 1888, and Strausz, 1966, for *Melongena cornuta*) makes a clear identification as distinct biological species extremely difficult for many fossil "species" in the literature. However, the single, juvenile shell corresponds well to the representatives of *Melongena semseyiana* as illustrated in Baldi (1973) and Mikuz (1999). A slight difference is the sutural shelf, which differs – although very low-angled – from the flat sutural shelf of typical representatives of *Melongena semseyiana*. Concerning this feature, the Austrian type is closer to the Croatian shells in Anic (1952), which in addition also lack the extremely strong spines of Baldi's shells. Both the Austrian and the Croatian specimens very closely resemble the Early Miocene *Melongena lainei* (Basterot, 1825). A reliable difference is the less stepped spire outline of *Melongena lainei*, due to the higher spire whorls of *Melongena semseyiana*. But the more important feature seems to be the distinctly higher body whorl of *Melongena semseyiana* in contrast to the rapidly contracting and short last whorl of *Melongena lainei*. From the authors' point of view the various Oligocene melongenids of the Paratethys which are referred to as *Melongena lainei* in the literature (e.g., in BARTHELT, 1989 and WOLFF, 1897) probably represent this morph of *Melongena semseyiana*. In contrast, specimens with strongly coalescing spire, such as "*Melongena Noszky*" in GAAL (1937/38) or "*Galeodes lainei lainei*" in SENES (1958), belong to the *Melongena basilica* (BELLARDI) -group.

Distribution: *Melongena semseyiana* (ERDÖS) is known from the Egerian of the Paratethys and was found in Austria, Hungary, Slovenia and Croatia. In addition, the species is probably also represented in Bavaria and by a strongly sculptured type in the Early Chattian of the Mesohellenic Trough in Greece (HARZHAUSER, 2000a).

Melongena incornuta (HÖLZL, 1962)
Pl. 2, Fig. 1, 2

1962 *Galeodes incornutus* nov. sp. – HÖLZL, p. 173, pl. 10, fig. 1, 1a.
? 1992 *Melongena* sp. – HAGN et al., p. 158, pl. 40.

Investigation area
1882 ?*Pyrula cornuta* AG.ASSIZ – TOULA, p. 198.
1903 ?*Pyrula cornuta* AG.ASSIZ – ABEL, p. 134.

Description: Medium-sized, stocky-fusiform shells of up to 7 whorls. Early spire whorls are rather high and produce a stepped outline. The spire is tall and narrow, whilst the body whorl expands considerably. The flanks of the spire whorls are straight. The shells lack prominent spines but develop only reduced, broad nodes along the shoulder. Fully grown specimens develop a rounded shoulder, resulting in a pyriform outline.
One specimen shows an arched siphonal fasciole, which hardly rises from the shell.
Besides the spines, the ornamentation of the morphotype corresponds fully to that of the co-occurring *Melongena semseyiana*.

height:		diameter:	
	92 mm		62 mm
	83 mm		55 mm
	64 mm		44 mm

Material: 3 shells from Melk/Tunnel (Pielach Formation); in addition, TOULA (1882) mentioned melongenids also from Viehdorf.
Lithostratigraphy: Pielach Formation.

Remarks: HÖLZL (1962) based his *Galeodes incornutus* on the absence of spines, which he thought to be a feature sufficient enough to separate his form from the sculptured *Melongena lainei* (BASTEROT, 1825) In fact, the shells differ from *Melongena lainei* in the same way as *Melongena semseyiana* (ERDÖS, 1900) because of the high spire whorls and because of the higher and convex body whorl. On the other hand, the separation of *Melongena incornuta* from *Melongena semseyiana* is based at first sight on the absence of the spines as well. As documented by the rather weak sculpturing of the Croatian specimens of *Melongena semseyiana* in ANIC (1952), however, the spines of this species display considerably variations in strength. Therefore, *Melongena incornuta* might also represent a morphotype of *Melongena semseyiana* with strongly reduced sculpture. Due to the poor information on the variability of the rarely reported *Melongena semseyiana*, the two taxa are still treated as different species herein.

Distribution: The species is only known from the Late Oligocene of Bavaria and Austria.

Familia Fasciolariidae Gray, 1853
Subfamilia Fasciolariinae Gray, 1853
Genus *Euthriofusus* Cossmann, 1901

Euthriofusus cf. *szontaghi* Noszky, 1936

1936 *Euthriofusus szontaghi* nov. sp. – Noszky, p. 70, pl. 5, fig. 2.
1936 *Euthriofusus szontaghi* nov. sp var. *alternans* – Noszky, p. 70, pl. 5, fig. 4.
1973 *Euthriofusus szontaghi* Noszky – Baldi, p. 299, pl. 42, fig. 3.

Description: Two casts consisting of three spire whorls and the strongly convex body whorl. The last whorl is broad, well rounded without a distinct shoulder. The base contracts abruptly in the narrow siphonal canal. Even the cast still displays strong axial ribs, which are approximately as wide as the spaces between them. Height: 15 mm, diameter: 9 mm.
Material: 2 casts from Melk.
Lithostratigraphy: Melk Formation.

Remarks: Due to the very poor preservation the specific identity of the casts remains doubtful. Additionally, the casts are considerably smaller than the Hungarian representatives of *Euthriofusus szontaghi*. Nonetheless, the apical-angle and the broad body whorl allow a clear distinction from morphologically similar taxa such as *Aquilofusus loczy* (Noszky, 1936).
Distribution: *Euthriofusus szontaghi* is only known from the Hungarian Egerian.

Genus *Fasciolaria* Lamarck, 1799

Fasciolaria? plexa (Wolff, 1897)
Pl. 2, Fig. 6

1897 *Fusus (Fasciolaria?) plexus* – Wolff, p. 282, pl. 26, fig. 9.
1897 *Fasciolaria (Fusus?) plexa* – Wolff, pl. 27, fig. 4.
1914 *Fasciolaria plexa* Wolff – Telegdi-Roth, p. 15, pl. 1, fig. 13–15.
1936 *Fasciolaria plexa* (Wolff) – Noszky, p. 70.
1952 *Fasciolaria (Pleuroploca) plexa* (Wolff) – Hagn & Hölzl, p. 46.
1958 *Fasciolaria (Pleuroploca) plexa* (Wolff) – Hölzl, p. 248, pl. 21, fig. 4.
1963 *Fasciolaria* ex aff. *plexa* (Wolff) – Baldi, p. 92, pl. 6, fig. 12.
1973 *Fasciolaria plexa* (Wolff) – Baldi, p. 301, pl. 42, fig. 8.
1975 *Fasciolaria plexa* (Wolff) – Baldi & Steininger, p. 108.

Material: 1 deformed cast from Tiefenfucha (Ebelsberg Formation), height: 24 mm, diameter: 15 mm and 1 cast from Plesching (Linz Formation), diameter: 27 mm.

Remarks: In contrast to the statement of Wolff (1897), who emphasized similarities of sculpturing of his species with that of the Middle Miocene *Fasciolaria pyrulaeformis* Hoernes & Auinger, 1890, the comparison with the holotype of the younger form revealed marked differences in node arrangement. Nonetheless, the bad preservation of the Oligocene specimen from Tiefenfucha allows no revision of the traditional generic classification within the fasciolarids.

Distribution: The species seems to be restricted to the Egerian and the Eggenburgian of the Central and Western Paratethys.

Familia Nassariidae Iredale, 1916
Genus *Bullia* Gray, 1833

Bullia hungarica (Gábor, 1936)
Pl. 2, Fig. 4

1936 *Cominella hungarica* n. sp. – Gábor, p. 3, pl. 1, fig. 4.
1936 *Cominella hungarica* Gábor. var. *simplex* nov. var. – Noszky, p. 104.
1973 *Bullia hungarica* (Gábor) – Baldi, p. 297, pl. 39, fig. 4–6.
1975 *Bullia hungarica* (Gábor) – Baldi & Steininger, p. 345, pl. 3, fig. 3, pl. 10, fig. 5–6.

Description: A medium-sized *Bullia* having 6 convex whorls, which bear their maximum diameter in their anterior third. The blunt axial ribs are narrow-spaced and are crossed by finer but distinct spiral ribs. Close to the posterior suture some shells develop a very weak concavity or flat, narrow sutural ramp. Usually the axial ribs become weaker within this area and rarely may even be disconnected. Height: 14 mm, diameter: 9 mm (slightly deformed).
Material: Several shells from Melk and Kendl.
Lithostratigraphy: Pielach Formation.

Remarks: As pointed out by Baldi (1973), the discrimination between *Bullia hungarica* and *Bullia flurli* (Gümbel, 1861) is problematical. Both taxa are described as rather variable (Wolff, 1897, Baldi, 1973). Especially the strength and density of the axial ribbing and the development of a more or less distinct sutural ramp are documented as very mutable features. Therefore it is rather likely that *Bullia hungarica* will turn out to be a junior synonym of *Bullia flurli* (Gümbel, 1861).
Among the Austrian representatives the typical concave sutural ramp is hardly recognisable. A similar type was described by Noszky (1936) as *Cominella hungarica simplex.* Later this splitting was rejected by Baldi (1973), who identifies even shells with fully convex whorls as *Bullia hungarica* (see Baldi, pl. 39, fig. 6 and Baldi & Steininger, pl. 10, fig. 6.).

Superfamilia Volutoidea Rafinesque, 1815
Familia Volutidae Rafinesque, 1815
Genus *Volutilithes* Swainson, 1829

Volutilithes cf. *permulticostata* Telegdi-Roth, 1914

1914 *Volutilithes permulticoststa* n. sp. – Telegdi-Roth, p. 26, pl. 4, fig. 3–5.
1973 *Volutilithes permulticostata* Telegdi-Roth – Baldi, p. 305, pl. 43, fig. 6–7.
1975 *Volutilithes permulticostata* Telegdi-Roth – Baldi & Steininger, p. 346, pl. 7, fig. 2–3.

Investigation area
1903 *Voluta* – Abel, p. 117.
1922 *Voluta (Volutilithes) calva* Sowerby – Vetters, p. 118, fig. 1a–c.
1953 *Voluta (Volutilithes) calva* Sowerby – Sieber, p. 373.

Material: 1 very fragmentary shell from Starzing at Neulengbach, stored at the Geological Survey Vienna Inv. Nr. 1922/01/1. Additionally, the species is mentioned by Sieber (1953) from Loosdorf at Melk.
Lithostratigraphy: Pielach Formation.

Remarks: VETTERS (1922) described the specimen as *Voluta (Volutilithes) calva* SOWERBY and published three idealised illustrations. Unfortunately, the marly sediment in which the specimen is preserved dried out and fell into pieces. Therefore, it is impossible to add any further details to the description given by VETTERS. Moreover, only one of the specimens illustrated in VETTERS (1922) is still preserved, whilst the second one is missing. As far as can be judged from the poorly preserved specimen, a close relationship to the Egerian, Hungarian *Volutilithes permulticoststa* can be stated. The related *Volutilithes multicostata* BELLARDI, 1890 as well as *Athleta stromboides* (DREGER, 1892) differ by their typical sculpture (compare illustrations in BALDI, 1973, and LÖFFLER, 1999). *Volutilithes calva* (SOWERBY), which VETTERS (1922) refers to, can clearly be excluded as a candidate for the Austrian specimen. On the one hand, *Volutilithes calva* is described from the English Eocene, thus representing an element from a quite different biogeographic region. The Eocene shell as illustrated in EDWARDS & WOOD (1877) differs in its coalescing spire, which lacks the step-like profile of *Volutilithes permulticostata.* Furthermore, the shoulder of the Oligocene species is more rounded and less acute than that of *Volutilithes calva.*

Distribution: *Volutilithes permulticoststa* is known from the Egerian of Hungary and was probably restricted to the Central Paratethys.

Genus *Athleta* CONRAD, 1853

Athleta? sp.

Investigation area

1922 *Fusimoro* conf. *carcariensis* MICHELOTTI – VETTERS, p. 120, fig. 2a–c.

1953 *Fusimoro* cf. *carcariensis* MICHELOTTI – SIEBER, p. 373

Description: Small-sized, depressed fusiform shell with short spire and large, somewhat inflated body whorl. The spire whorls bear a row of small granules close to the anterior suture; the body whorl displays a spiral row of indistinct nodes along the shoulder, which separates the gently contracting, convex base from a narrow, slightly concave sutural ramp. No further sculpture is visible except for some faint growth lines. Height: 18 mm, diameter: 12 mm.

Material: 1 shell from Starzing at Neulengbach, stored at the Geological Survey Vienna Inv. Nr. 1922/1/3. Additionally, the species is mentioned by SIEBER (1953) from Loosdorf at Melk.

Lithostratigraphy: Pielach Formation.

Remarks: Due to the poor preservation no reliable identification of the shell is possible. Nevertheless, it seems likely that the specimen represents a juvenile stage of an *Athleta*, similar to the shell illustrated by WOLFF (1897, pl. 27, fig. 14.). In the Oligocene of the Paratethys the genus *Athleta* is documented by the species *Athleta ficulina* (LAMARCK, 1811) (syn. *Athleta rarispina* LAMARCK, 1811) from the Egerian of Bavaria and Hungary and by *Athleta stromboides* (DREGER, 1892) from the Kiscellian of Tyrol. The latter seems to differ by its higher spire whorls, whilst young individuals of *Athleta ficulina* from the collection of the NHMW correspond better to the discussed fragment.

VETTERS (1922) introduced this specimen as "*Fusimoro* conf. *carcariensis* MICHT." referring to the Italian *Fusimoro carcarensis* (MICHELOTTI, 1861), which was described by

SACCO (1897) from the Rupelian of Carcare and Dego. This designation is quite unintelligible since the Austrian shell bears nothing in common with the Italian species. *Fusimoro carcarensis* differs clearly in its higher apex and in its rapidly contracting base. It bears much more nodes on the shoulder of the last whorl and develops a very characteristic spiral and axial ornament which results in distinct nodes at the intersectionpoints. In contrast, the Austrian shell has a stout apex, few and indistinct nodes on the shoulder and a rather inflated body whorl, which bears no additional sculpturing. The spiral threads and nodes mentioned by VETTERS (1922) are only simulated by the partly eroded shell surface.

Superfamilia Conoidea RAFINESQUE, 1815
Familia Conidae RAFINESQUE, 1815
Genus *Conus* LINNÉ, 1758

Conus sp.

Investigation area
1969 *Conus* sp. – STEININGER, p. 42.
1969 *Conus* sp. – RÖGL & STEININGER, p. 48.
1975 *Conus* sp. – STEININGER, p. 218.

Material: 1 cast from Plesching.
Lithostratigraphy: Linz Formation.

Remarks: Conids are very rare throughout the Oligocene in the Paratethys. Similarly, the diversity of this group is low in the entire Western Tethys Region compared with its bloom in the Miocene. Of course, the very poor preservation of the cast allows no identification on the species level. However, the general outline of the cast corresponds neither to the Bavarian species described by WOLFF (1897) as *Conus* sp. nor to the species from Hungary which BALDI (1973) described as *Conus dujardini egerensis*. Therefore the small-sized, stout specimen from Plesching indicates a new conid species for the Western and Central Paratethys Region.

Familia Turridae SWAINSON, 1840
Subfamilia Clavinae POWELL, 1942
Genus *Stenodrillia* KOROBKOV, 1955

Stenodrillia obeliscus (DESMOULINS, 1842)
Pl. 2, Fig. 5

1897 *Pleurotoma obeliscus* DESMOULINS – WOLFF, p. 286, pl. 28, fig. 1–2.
1931 *Drillia obeliscus* DESMOULINS – COSSMANN & PEYROT, p. 94, pl. 7, fig. 59, 61.
1952 *Clavus obeliscus* DESMOULINS – GÖRGES, p. 102, pl. 3, fig. 76.
1973 *Clavus (Brachytoma) obeliscus* (DESMOULINS) – BALDI, p. 323, pl. 48, fig. 4–5.
1975 *Clavus obeliscus* DESMOULINS – BALDI & STEININGER, p. 346, pl. 6, fig. 6.
1979 *Stenodrillia obeliscus* (DESMOULINS) – JANSSEN, p. 313.
1998a *Inquisitor obeliscus* (DESMOULINS) – WELLE, p. 48.

Description: Slender, fusiform shells with a characteristic rimlike swelling close to the adapical suture. Anteriorly to that swelling the flanks bear slightly oblique, rounded axial ribs. The ribs are less distinct on the body whorl and vanish towards the base. No spiral

sculpture is visible except for the rim and several very delicate furrows on the canal. Height: 15 mm, diameter: 5.5 mm.
Material: 2 shells from Melk/Tunnel.
Lithostratigraphy: Pielach Formation.

Remarks: The Middle Miocene to Pliocene *Stenodrillia bellardii* (Desmoulins, 1842) stands close to *obeliscus* but differs by its more convex whorls. Nonetheless, Strausz (1966) emphasises the relationship between both species and carefully suggests *Stenodrillia allionii* to be only a variation of *Stenodrillia obeliscus*. The shells from the Middle Miocene of the Vienna Basin referred to *Stenodrillia obeliscus* by Hörnes (1856) represent a *Stenodrillia bellardii* (cf. Strausz, 1966).
Distribution: The species is common in the Oligocene of the North Sea Basin and is known from the Egerian of Hungary and Austria in the Central Paratethys. From the Early and ?Middle Miocene it is described from the French Atlantic coast and own observations proved its occurrence in the early Burdigalian of the Mesohellenic Trough in Greece.

Subfamilia Turriculinae Powell, 1942

Genus *Orthosurcula* Casey, 1904

Orthosurcula regularis (Koninck, 1837)

1896 *Pleurotoma regularis* Koninck – Kissling, p. 34, pl. 3, fig. 7.
1897 *Pleurotoma regularis* Koninck – Wolff, p. 286, pl. 27, fig. 17–19.
1914 *Surcula regularis* Koninck – Telegdi-Roth, p. 21, pl. 1, fig. 24, 25, pl. 3, fig. 10–13.
1937 *Surcula regularis* Koninck – Venzo, p. 25, pl. 2, fig. 3.
1952 *Surcula regularis* Koninck – Anic, p. 44, pl. 11, fig. 12.
1962 *Turricula regularis* (Koninck) – Hölzl, p. 192, pl. 10, fig. 9.
? 1965 *Clavatula* cf. *regularis* Koninck – Ondrejickova & Senes, p. 180.
1973 *Turricula regularis* (Koninck) – Baldi, p. 318, pl. 47, fig. 1–5, 8.
1973 *Turricula (Turricula) belgica* (Münster) – Kuster-Wendenburg, p. 129.
1975 *Turricula regularis* (Koninck) – Baldi & Steininger, p. 346, pl. 2, fig. 9, pl. 7, fig. 6.
1978a *Turricula regularis* (Koninck) – Janssen, p. 118.
1979 *Orthosurcula regularis* (Koninck) – Janssen, p. 312.
1995 *Orthosurcula regularis* (Koninck) – Gürs, p. 127, pl. 23, fig. 1, pl. 62, fig. 4.
1997 *Orthosurcula regularis* (De Koninck) – Gründel, p. 25, pl. 5, fig. 13–15.

Description: The mould consists of parts of the spire, the body whorl and the imprint of the long and narrow siphonal canal. The spire whorls of the fusiform shell are flat, separated by insignificant sutures. In contrast, the body whorl is slightly inflated, bearing a rounded angulation and a slightly concave sutural ramp. The last whorl is convex below the shoulder and contracts rapidly into the narrow canal. Plaster casts of the specimen show a smooth shell surface, lacking any axial sculpture. Height: 41 mm, diameter: 18 mm.
Material: 1 mould from Plesching.
Lithostratigraphy: Linz Formation.

Remarks: This common and widespread species displays a considerable variability of shape and sculpturing. Smooth-shelled morphotypes predominate among the Paratethyan representatives of *Orthosurcula regularis*, although shells with marked axial ribs are mentioned as well. The high variability is reflected in older literature by numerous

superfluous "species" which are usually considered as synonyms by modern workers. A good summary of synonyms is given by Gürs (1995).
Distribution: The species is common during the Oligocene of the North Sea and the Mainz Basin. Equally, it is widespread in the entire Central and Western Paratethys and is described from Switzerland, Bavaria, Hungary, the Slowak Republic, and Croatia. The "boreal" *Orthosurcula regularis* is even mentioned from Northern Italy by Venzo (1937), but seems to be generally absent in the Oligocene of the Western Tethys.

Subclassis Heterostropha Fischer, 1885

Supraordo Euthyneura Spengel, 1850
Ordo Cephalaspida Fischer, 1883
Superfamilia Ringiculoidea Philippi, 1853
Familia Ringiculidae Philippi, 1853
Genus *Ringicula* Deshayes, 1838
Subgenus *Ringiculella* Sacco, 1892

Ringicula (Ringiculella) auriculata paulucciae Morlet, 1878
Pl. 2, Fig. 9

1954 *Ringicula (Ringiculella) auriculata paulucciae* Morlet – Berger, p. 115, pl. 7, fig. 3–18.
1963 *Ringicula auriculata paulucciae* Morlet – Steininger, p. 56, pl. 12, fig. 15.
1973 *Ringicula auriculata paulucciae* Morlet – Baldi, p. 333, pl. 50, fig. 3.
1975 *Ringicula auriculata paulucciae* Morlet – Baldi & Steininger, p. 346, pl. 2, fig. 10.

Material: 2 shells from Melk; diameter: 2.7 mm.
Lithostratigraphy: Pielach Formation.

Remarks: The shells correspond well to the chiefly Neogene *Ringicula auriculata paulucciae* Morlet but differ slightly in the less dense spiral furrows. From the authors' point of view the latter feature does not justify a separation of the discussed specimens from the *R. auriculata*-group. Following Berger (1954) the Neogene Paratethyan ringiculids are usually divided into two distinct species. From these the heavily sculptured *Ringicula costata* (Eichwald, 1830) is restricted to the Neogene, whilst the second, represented by the *Ringicula auriculata*-goup appears already in the Oligocene. This group is split into at least 7 forms, which are variously treated as species, subspecies or variations. Most modern authors tend to treat some of the "subspecies", such as *Ringicula buccinea* (Brocchi, 1814) as valid species. The Oligocene and Early Miocene representatives of *Ringicula auriculata* (Ménard, 1811) are usually described as *Ringicula auriculata paulucciae*, which generally seems to be the ancestor of the group. Here this tradition is adopted uncritically, although its rank as subspecies is not reliably proved.
The broad inductura of this species allows a clear separation from the Oligocene *Ringicula striata* Philippi, 1843 as illustrated in Moths et al. (1997). *Ringicula semperi* Koch, 1862 which is also an Oligocene species from the North Sea Basin and from the Mainz Basin, differs in the smaller inductura and in the less prominent posterior columellar fold.
Distribution: The species is known from the Egerian of Austria and Hungary and extends into the Paratethys up to the Badenian. During the Early Miocene it was an ubiquitous European species. Further quotations of Miocene and Pliocene occurrences of the taxon from the Mediterranean, Atlantic and the North Sea have to be revised carefully due to the very different species-concepts of the various authors.

Superfamilia Philinoidae GRAY, 1850
Familia Cylichnidae ADAMS & ADAMS, 1854
Genus *Scaphander* MONTFORT, 1810

Scaphander sp.

Investigation area
1969 *Scaphander* sp. – STEININGER, p. 42.
1969 *Scaphander* sp. – RÖGL & STEININGER, p. 48.
1975 *Scaphander* sp. – STEININGER, p. 218.

Material: 1 cast from Plesching, diameter: >5 mm.
Lithostratigraphy: Linz Formation.

Remarks: A single cast from Plesching can be doubtlessly asigned to the genus *Scaphander*. This genus has a very low diversity and is rarely mentioned from the Paratethyan Oligocene. Traditionally these remnants are interpreted as members of the *Scaphander lignarius* (LINNÉ, 1766) -group, which is ubiquitous in all European bioprovinces during the entire Neogene. Unfortunately, the specimen was destroyed during preparation and thus no species identification is posssible.

Classis Bivalvia LINNE, 1758

The supra-generic bivalve classification is taken from SKELTON & BENTON (1993). Decriptive nomenclature follows MOORE (1969), except for Pectinidae which is based mainly on WALLER (1991).

Subclassis Palaeotaxodonta KOROBKOV, 1954

Ordo Nuculoida DALL, 1889
Familia Nuculanidae ADAMS, H. & A., 1858
Genus *Nuculana* LINK, 1807
Subgenus *Saccella* WOODRING, 1925

Nuculana (*Saccella*) *mayeri* (GÜMBEL, 1861)
Pl. 3, Fig. 1

1861 *Leda Mayeri* – GÜMBEL, p. 786.
1958 *Leda* (*Ledina*) *mayeri* GÜMBEL – HÖLZL, p. 786, pl. 1, Fig. 7, 7a.

Description: Shell small, rostrate, longer than high, moderately convex, with convexity axis oriented postero-anteriorly, anterior portion regularly oval, about as long as posterior portion, posterior portion pointed, with centrally positioned most posterior point, with straightened posterodorsal margin and shortened, oblique, slightly concave anteroventral margin. Posterior diagonal ridge (rostrum) concave, adjoining the slightly concave escutcheon, which is elongated up to the most posterior shell point, shell portion ventral to ridge very weakly depressed, lunula narrow and elongated, umbo incurved dorsally, slightly opisthogyrate. Shell exterior sculpture fine, umbonally produced by regular commarginal grooves, changing gradually distally into prominent, irregular, commarginal lirae. Height: 8.7 mm, length: 16.7 mm, convexity: 2.8 mm.
Material: 1 rather well-preserved left valve from Tiefenfucha.

Remarks: The specimen from Tiefenfucha is closely related to *Nuculana westendorpii* (NYST in NYST & WESTENDORP, 1839), differing from it by a shorter rostrum (posterior shell part), prominently prolonged anterior shell part and larger size. In contrast, those characters best fit to the endemic Eggenburgian species of Lower Bavaria *N. mayeri*. According to HÖLZL (1962) *N. mayeri* is most certainly a direct descendent of *Nuculana westendorpii*. *N. westendorpii* is a typical species of the Oligocene to Miocene of the Proto Boreal NE Atlantic (ANDERSON, 1959), being present in the Rupelian of the Mainz Basin (GÜRS, 1995) and throughout the Oligocene of Upper Bavaria (HÖLZL, 1962). The occurrence of *N. mayeri* in the uppermost Oligocene sediments of Tiefenfucha, belonging to the closest adjacent sedimentation area of Upper Bavaria, fit HÖLZL's idea. Moreover, *Leda gracilis* DESHAYES described by WOLFF (1897) from the same stratigraphic level of Upper Bavaria already attains the typical large size and elongated anterior shell portion of *N. mayeri*. (Note that ANDERSON (1959) reunited *N. gracilis* with *N. westendorpii*.)

Leda subfragilis HÖRNES (1875) from the Ottnangian of Upper Austria has a similar shell outline but distinctly finer and weaker concentric sculpture and smaller size. *Leda (Ledina) guembeli* HÖLZL (1958) from the Late Eggenburgian to Early Ottnangian of Upper Bavaria has, in contrast, apparently more prominent concentric sculpture. Miocene *Ledina fragilis deltoidea* (RISSO, 1826) of SACCO (1898) from Italy and *Leda* (*Lembulus*) *biali* COSMANN & PEYROT (1912) from the Aquitaine have identical concentric sculpture, but smaller size and shell outline corresponding better to *Nuculana westendorpii*. STUDENCKA (1986), however, reunited them with *N. fragilis*.

The Late Oligocene (SENES, 1958) to Recent *Nuculana (S.) fragilis* differs by its narrower shape, much coarser concentric lirae and presence of the anterior diagonal ridge (COSMANN & PEYROT, 1913; MILISIC, 1991). Also the Late Oligocene *Nuculana anticeplicata* TELEGDI-ROTH differs by having of the anterior diagonal ridge (BALDI, 1973).

STUDENCKA (1986) determined a great intraspecific variability in shell shape and ornamentation in *Nuculana fragilis* based on more than 1000 investigated specimens from the Middle Miocene of Rybnica in S Poland. She stated that also the anterior diagonal ledge is variably absent or present within the sample. This implies that both *Nuculana biali* and *Nuculana deltoidea* as well as possibly also the North Sea Basin forms like *Nuculana westendorpii* (=*N. gracilis*) could be simple morphs of one and the same species. This would also hold true for the Paratethyan forms like the one identified here as *Nuculana mayeri*, followed by *N. subfragilis,* and numerous others described by NEVESSKAJA et al. (1993). Such a revision, however, would go beyond the frame of the present study.

Distribution: Restricted to the Early Egerian of Lower Austria (the present study) and Eggenburgian of Upper Bavaria (HÖLZL, 1958).

Subclassis Isofilibranchia Iredale, 1939

Ordo Mytiloida Férussac, 1822
Familia Mytilidae Rafinesque, 1815
Genus *Mytilus* Linné, 1758
Subgenus *Crenomytilus* Soot-Ryen, 1955

Mytilus (*Crenomytilus*) *aquitanicus* (Mayer-Eymar, 1858)
Pl. 3, Fig. 2

1870 *Mytilus haidingeri* Hörn. – Hörnes, p. 356, pl. 46, fig. 1–3.
1897 *Mytilus aquitanicus* Mayer-Eymar – Wolff, p. 232, pl. 21, fig. 23, 29.
1914 *Mytilus aquitanicus* Mayer-Eymar – Cossmann & Peyrot, p. 8, pl. 11, fig. 13–14.
1952 *Mytilus aquitanicus* Mayer-Eymar – Anic, p. 30, pl. 5, fig. 4–5, pl. 6, fig. 1.
1971 *Mytilus* (*Mytilus*) *haidingeri* Hörnes – Steininger et al., p. 416, pl. 16, fig. 1.
1972 *Mytilus* (*Mytilus*) *aquitanicus* Mayer-Eymar – Moisescu, p. 416, pl. 7, fig. 7a–b.
1973 *Mytilus aquitanicus* Mayer-Eymar – Baldi, p. 173, pl. 4, fig. 7.
1975 *Mytilus aquitanicus* Mayer-Eymar – Baldi & Steininger, p. 219, pl. 1, fig. 4.
1998 *Mytilus aquitanicus* Mayer-Eymar – Schultz, p. 32, pl. 8, fig. 5.
1998 *Mytilus* (*Mytilus*) *haidingeri* Hörnes – Schultz, p. 80, pl. 33, fig. 2–3.
1998 *Mytilus* (*Crenomytilus*) *haidingeri* Hörnes – Studencka et al., p. 294.

Description: Shell large, mytiliform, dorsoventrally elongated, pointed dorsally, ventral and posterior margins convex, anterior margin concave, moderately convex, point of maximum convexity shifted strongly anteriorly resulting in a steep anterior marginal region, posterior marginal region concave, umbonal and central region strongly swollen, ventral marginal region flattened. Pits, 0.2 mm apart, sculpture the proximal portion of the interior ventral margin. Well-preserved shell surface portions shiny, radially wavy striated. Shell structure is dominated by nacreous aragonite that disintegrates through weathering and peels into thin shiny sheets. Height: 99 mm, length: 42 mm, convexity: 14 mm.

Material: Badly preserved, incomplete and deformed specimens are available from Melk/ Tunnel, Kendl, Neuwinden, and Zelking.

Remarks: The main difference between *Mytilus aquitanicus* and *Mytilus haidingeri*, as pointed out by Cossmann & Peyrot (1914), is the narrower and more strongly dorsally pointed valve outline in the former. In the Central Paratethys the Egerian large mytilids were formerly always identified as *M. aquitanicus*, the Eggenburgian to Karpatian ones as *M. haidingeri*. According to the morphological variation observed by the present authors in specimens from Melk, but also in those from the Eggenburgian of Lower Austria (e.g. Mold – Maria Dreieichen, Maigen), they certainly belong to the same species. The shell outlines with variably angular umbonal angle are likely represented in both Oligocene and Miocene populations.

There are several other, possibly synonymous names, but, as already discussed by Schaffer (1910, p. 48–50) these are taxonomically badly defined. The Armenian Early Miocene *Mytilus aramaeus* Abich (1857) and also *Mytilus michelinianus* Matheron, 1842, a characteristically large Early Miocene *Mytilus* of SE France, are known only as steinkerns. Schaffer (1910) doubted the certainty of mytilid species identification based on steinkerns and in consequence rejected those names. Not all authors accepted Schaffer's revisions. In fact, Mongin (1952, p. 118), beside using the designation *Mytilus* *michelinianus*, also argued for a differentiation of that species from *Mytilus aquitanicus* based on its more centrally positioned axis of maximal convexity. Note that Sacco (1898) formerly considered those names as synonyms.

Mytilus scaphoides of Bronn (1831, p. 113) is a large mytilid from the Pliocene of Italy, documented through illustrations by Sacco (1898). The latter author considered it as closely related to *Mytilus aquitanicus* but still of independent taxonomic status. Mongin (1952) doubted that opinion and considered them as synonyms. Indeed, the specimens illustrated by Sacco (1898) can hardly be differentiated from *M. aquitanicus*. If their reinvestigation, which goes beyond the frame of the present study, confirms the synonymy, then the designation *Mytilus scaphoides* would have priority.

The Early Miocene *Mytilus rissoi* Hörnes (1870) from the Torino Hills in NW Italy is possibly also a synonym of *M. aquitanicus*. This was already expected by Hörnes (1870), but Sacco (1898) considered this species to be independent as well. The illustrated material (Sacco, 1898) seems too fragmentarily preserved for any more certain identification.

Distribution: Late Oligocene to Middle Miocene – Aquitanian to Serravallian of NW France (Cossman & Peyrot, 1915), Egerian of Bavaria (Wolff, 1897; Hölzl, 1958), Austria (Steininger, 1969; present study), Hungary (Telegdi-Roth, 1914; Noszky, 1936; Baldi, 1973), Croatia (Anic, 1952) and Rumania (Moisescu, 1972), Eggenburgian and Karpatian of Austria (Hörnes, 1870; Schaffer, 1910; Steininger et al., 1971; Schultz, 1998) and Early Badenian of Hungary (Studencka et al., 1998).

Genus *Brachidontes* Swainson, 1840

Brachidontes taurinensis (Michelotti, 1847)

Pl. 3, Fig. 3–7

1847 *Mytilus taurinensis* – Michelotti, p. 94, pl. 4, fig. 2.
1862 *Modiola Nystii* Kickx – Sandberger, pl. 31, fig. 2. [*non* Kickx in Nyst, 1836]
1863 *Modiola Nystii* Kickx – Sandberger, p. 363. [*non* Kickx in Nyst, 1836]
1893 *Modiola (Brachyodontes) retifera* – Koenen, p. 1057, pl. 69, fig. 15.
1898 *Modiola (Brachyodontes) taurinensis* (Bonelli) – Sacco, p. 41, pl. 12, fig. 1–4.
1900 *Modiola (Brachyodontes) taurinensis* (Bonelli) – Rovereto, p. 73, pl. 4, fig. 12.
1943 *Brachidontes retifera* (Koenen) – Albrecht & Valk, p. 115, pl. 10, fig. 353.
1973 *Brachidontes cf. granulifera* (Koenen) – Neuffer, p. 24, pl. 3, fig. 3a–b. [*non* Koen.]
1973 *Musculus (Musculus) nystii* (Kickx.) – Neuffer, p. 25. [*non* Kickx in Nyst, 1836]
1974 *Brachidontes retiferus* (Koenen) – Merklin, p. 62, pl. 10, fig. 10.
1995 *Septifer retifera* (Koenen) – Gürs, p. 211, pl. 38, fig. 6.
1999 *Brachidontes* ? sp. – Löffler, p. 95, pl. 21, fig. 2.

Description: Shell medium-sized, mytiliform, umbones subterminal, prosogyrate, anterior shell-margin reduced, narrowly rounded, dorsal margin straightened and forming an obtuse angle with the posterodorsal margin, which is straightened, oblique, paralleling the dorsal margin; posteroventral margin broadly convex. Shell in central dorso-ventral cross section highly inflated with steep, straightened ventral and centrally convex – marginally concave dorsal shell portion; point of maximum inflation positioned about centrally, shell flattens posteriorly. Sculpture consisting of numerous (>100), generally fine but distally partly coarsening radial ribs, inarticulately wavy bended, partly bifurcating. Rib-interspaces bear distinctly finer commarginal lirae. Ligament suture short, adductor muscle septum not present. Height: 40 mm, length: 13 mm, convexity: 7 mm. Material: 17 moderately preserved specimens from Plesching;

Remarks: Austrian Middle Miocene *Mytilus taurinensis* of HÖRNES (1870), which differs from the Italian type by coarsely crenulated radial ribs, was renamed firstly by ROVERETO (1898) to *Mytilus pedemontanus*, then by SACCO (1898) to *Modiola (Brachidontes) taurinensis parvogranosa*. SIEBER (1955) used the name of SACCO (1898). Despite that, STUDENCKA et al. (1998) followed the identification of HÖRNES (1870). The latter authors classified it, however, into the genus *Gregariella* MONTEROSATO, 1883, which cannot be accepted in the present study. *Gregariella* lacks, in contrast to *Brachidontes*, radial sculpture on the median shell part (MOORE, 1969). ROVERETO (1900) neglected the affiliation of HÖRNES' specimens with *Brachidontes* and classified them into *Hormomya* MÖRCH, 1853.

Brachidontes retifera from the Early Rupelian of Lattorf in N Germany (KOENEN, 1893) and from the Late Rupelian of Weinheim (GÜRS, 1995) is considered in the present study as synonymous with *Brachidontes taurinensis*. *Brachidontes retifera* is also rather large sized, showing well corresponding outline and sculpture pattern. In contrast to its Mediterranean and Paratethys occurrence, at the end of the Rupelian this species disappears from the North Sea and Mainz Basins.

Specimens from Plesching can be classified as *Brachidontes* based on the radial, partly bifurcating sculpture covering the whole exterior surface, strongly reduced but still present anterior shell margin and absent septum beneath the umbo. Closely similar *Septifer* has absent anterior shell margin, giving the umbonal shell region a typical, sharply trigonal shape (MOORE, 1969).

Brachidontes ? sp. of LÖFFLER (1999) from the Early Rupelian of W Austria is, according to identical shell habitus and sculpture pattern synonymous with *B. taurinensis*. Closely related *Brachidontes biali* (COSSMANN & PEYROT, 1914) from the Early Miocene of SW France, with length of 9 mm, differs from *B. taurinensis* by its distinctly smaller size.

Distribution: Early Rupelian of NW Germany (KOENEN, 1893), Holland (ALBRECHT & VALK, 1943); Early Kiscellian Biozone NP22 (= Early Rupelian) of W Austria (LÖFFLER, 1999); Pshekium (= Early Rupelian) of SW Kazakhstan (MERKLIN, 1974); Late Rupelian of Mainz Basin in W Germany (SANDBERGER, 1862/63; NEUFFER, 1973; GÜRS, 1995); Late Rupelian to Early Chattian of NW Italy (ROVERETO, 1900); Egerian (= Late Chattian) of N Austria (the present study); Burdigalian to Serravallian of NW Italy (MICHELOTTI, 1847; SACCO, 1898).

Subclassis Pteriomorphia BEURLEN, 1944

Ordo Arcoida STOLICZKA, 1871
Familia Arcidae LAMARCK, 1809
Genus Anadara GRAY, 1847

Anadara diluvii (LAMARCK, 1805)
Pl. 3, Fig. 8–10

1805 *Arca diluvii* – LAMARCK, p. 219.
1870 *Arca diluvii* LAMARCK – HÖRNES, p. 333, pl. 44, fig. 3–4.
1898 *Arca (Anadara) diluvii* LAMARCK – SACCO, p. 20, pl. 4, fig. 7–12.
1898 *Arca (Anadara) diluvi pertransversa* – SACCO, p. 23, pl. 4, fig. 19–21.

1912 *Arca diluvii* LAMARCK – COSSMANN & PEYROT, p. 269, pl. 8, fig. 3–6; pl. 10, fig. 53.
1925 *Arca diluvii* LAMARCK – KAUTSKY, p. 15, pl. 1, fig. 7.
1936 *Arca (Anadara) diluvii* LAMARCK – FRIEDBERG, p. 166, pl. 27, fig. 23–25, pl. 28, fig. 1–3,.
1942 *Arca (Arca) diluvii* LAMARCK et var. div. – IJSPEERT, p. 37, pl. 2, fig. 1–6.
1942 *Arca diluvii* LAMARCK – HEERING, p. 22, pl. 3,fig. 24–27; pl. 4, fig. 1–4.
1945 *Arca diluvii* LAMARCK – GLIBERT, p. 35, pl. 1, fig. 12.
1952 *Arca diluvii* LAMARCK – ANIC, p. 29, pl. 5, fig. 2–3.
1955 *Arca diluvii* LAMARCK – ACCORDI, p. 48, pl. 4, fig. 5.
1958 *Arca diluvii diluvii* LAMARCK – SENES, p. 34, pl. 1, fig. 13.
1959 *Anadara diluvii* (LAMARCK) – ANDERSON, p. 81, pl. 13, fig. 6.
1962 *Anadara diluvii* (LAMARCK)– HÖLZL, p. 46, pl. 1, fig. 11.
1963 *Anadara diluvii pertransversa* (SACCO) – TAVANI & TONGIORGI, p. 9, pl. 3, fig. 2, 4–8.
1964 *Arca diluvii* (LAMARCK) – RAILEANU & NEGULESCU, p. 166, pl. 1, fig. 1–5.
1967 *Anadara (Anadara) diluvii* (LAMARCK) – TEJKAL et al., p. 156, pl. 1B, fig. 17–19.
1973 *Anadara diluvii* (LAMARCK) – BALDI, p. 166, pl. 3, fig. 1–2.
1974 *Anadara (Anadara) diluvii* (LAMARCK) – MALATESTA, p. 21, pl. 1, fig. 17a–b.
1986 *Anadara (Anadara) diluvii* (LAMARCK) – STUDENCKA, p. 22, pl. 2, fig. 5a–b.
1991 *Anadara diluvii* (LAMARCK) – MILISIC, p. 27.
1993 *Anadara diluvii* (LAMARCK) – POPPE & GOTO, p. 41, pl. 2, fig. 10 [*nec* 11] .
1998 *Anadara (Anadara) diluvii* (LAMARCK) – SCHULTZ, p. 78, pl. 32, fig. 5.

Description: Shell moderate to small in size, longer than high, posteriorly elongated, strongly centrally convex. Outline subtrapezoidal with narrowly convex posterior, anterior and dorsal margins, concave postero- and antero-dorsal margins and broadly convex dorsal outline portion. Umbo broadly inflated, strongly dorsally incurved, opisthogyrate. Shell exterior with 25–27 radial, quadrangular, narrow, regular ribs, which are only slightly broader than interspaces. Rib tops with fine transversal bars. Interior distal margin crenulated. Height: 22.0 mm, length: 30.5 mm, convexity: 12.9 mm.
Material: 3 well-preserved specimens from the Melk/Tunnel.

Remarks: In the Chattian of the North Sea Basin *Anadara speyeri*, a species closely related to *Anadra diluvii* is typical. Elsewhere, *A. speyeri* is reported only from the Egerian of the Central Paratethys by BALDI (1973) and by SENES (1958), and from the Sakaraulian of the Eastern Paratethys by NEVESSKAJA et al. (1993), co-occurring with *A. diluvii*. The differentiation between *A. speyeri* and *A. diluvii*, is principally based on rib numbers and rib shapes. In literature however no uniform morphologic definition is provided for *A. diluvii* and the same is true also for *A. speyeri*. Therefore their differentiation, based on these data is not possible to present author. A detailed material comparison and revision would extend the frame of the present study. The identification of *A. diluvii* at Melk is based on comparison with other described occurrences from the Egerian of the Central Paratethys and with Recent Mediterranean specimens. In continuation the literature record is compiled and commented.
The type specimens of *Anadara diluvii*, collected by CUVIER in the Piacenzian of Piacentino, are deposited in the LAMARCK collection in Paris (SACCO, 1898). Specimens of that age and from that region illustrated by SACCO (1898) closely resemble those from Melk, except for the higher rib number. LAMARCK (1805), but also SACCO (1898), failed to define that number, but according to GÖRGES (1952) it ranges between 30 and 38. Nevertheless, the fact that the Recent *Anadara diluvii* from the Mediterranean Sea also has on average 26 ribs – varying between 24 and 28 (MILISIC, 1991) or 25 and 28 (POPPE &

Goto, 1993) – confirms our identification. Among Egerian specimens, *A. diluvii* of Baldi (1973) has 29 ribs, those of Hölzl (1962) 27–30 ribs, whereas Anic (1952) and Senes (1958) failed to define this feature.

Note that Görges (1952) as well as Nevesskaja et al. (1993) use the reduced ribs number (26–29) to distinguish *A. speyeri* (Semper) from *A. diluvii*. However, Hölzl (1962) and Baldi (1973) pointed out the sulcate rib tops in *A. speyeri* as the most important distinguishing feature. *Anadara speyeri* of Senes (1958), abundantly present in the Egerian of Kovacov, do not display sulcate rib tops, and is possibly an erroneous identification of *A. diluvii*.

The Central Paratethys Egerian *A. diluvii* is the stratigraphically oldest record of this species. Related Eocene *A. granulosa* (Deshayes) of Cossmann & Pissaro (1904–06) from the Paris Basin (?= *Anadara eogassanensis* (Sacco, 1897) from Piemont) has distinctly finer and more numerous ribs. A related Rupelian taxon is *Anadara sulcicostata* (Nyst) of Koenen (1893), having sulcate rib tops. The Central Paratethys *A. diluvii* immediately becomes very successful, yielding a frequent, widely distributed Late Oligocene record from Upper Bavaria (Hölzl, 1962), across Austria, to Hungary (Baldi, 1973), Croatia (Anic, 1952), and Slovakia (Senes, 1958). In other European regions this species was absent or uncertainly present at that time. In the Lusitanian Region its Oligocene record is restricted to a note by Cossmann & Peyrot (1912) on its presence in St-Etienne-d'Orthe / Peyrère (Aquitanian basin). The age of this locality, originally erroneously given as Helvetian, is Middle to Late Chattian according to Roger & Demarcq (1974) and Bekaert et al. (1992). In the Chattian of the North Sea Basin as already mentioned a closely related species *Anadara speyeri* is typical.

Other Late Oligocene, *Anadara diluvii* related taxa are recorded only in the Paratethys. Their taxonomic status is under discussion and needs modern verification through reexamination of the type material. *Arca guembeli* Mayer.-Eymar (1868), *Arca intercedens* Wolff (1897) and *A. trauntalensis* Hölzl in Hagn & Hölzl (1952) are described from the Late Oligocene of the Upper Bavaria. *Anadara intercedens* differs from *Anadara diluvii* by its more inflated profile and the shape of the ligament area (higher, more numerous lamellae displaying more obtuse angle). *Anadara trauntalensis* differs from *A. intercedens* by lamellae of the ligament area being orthogonal and not diagonal to hinge axis. Ijspeert (1942) stated that morphology of *A. intercedens* corresponds to those of *A. diluvii pertransversa* and proposed their reunion. *A. guembeli* is according to Wolff (1897) more similar to *A. speyeri* than to *A. diluvii*, differing from it by somewhat more densely spaced ribs, and less dorsally projecting umbo.

Senes (1958) even distinguished 8 taxa morphologicaly similar to *Anadara diluvii* in the Kovacov beds of Slovakia. Three of them (*A. d. diluvii* Lamarck, *A. d. latecostata* Ijspeert and *A. d. pertransversa* Sacco) have been later reunited by Studencka (1986) with *A. diluvii*. (Popov in Nevesskaja et al. (1993), however, recognized *A. diluvii latecostata* of Senes as a new species (*A. sakaraulensis*) occurring also in the Early Miocene of the Eastern Paratethys). The others, except for already discussed *A. speyeri*, are taxa formerly unrecorded from the Oligocene. In the view of present authors the two illustrated taxa (*Anadara turonensis longiformis* nov. ssp. and *A. burdigalina* Mayer) among them cannot be distinguished from *A. diluvii*.

Distribution: Late Oligocene to Middle Miocene of the Western and Central Paratethys; Late Oligocene? (Cossmann & Peyrot, 1912), Miocene to Recent of the Lusitanian

Region; Late Oligocene? (*A. speyeri*), Miocene of the Boreal NE Atlantic Region (ANDERSON, 1959); Early Miocene to Middle Miocene of the Eastern Paratethys (NEVESSKAJA et al., 1993).

Familia Glycymerididae NEWTON, 1922

Genus *Glycymeris* DA COSTA, 1787

Glycymeris latiradiata (SANDBERGER in GÜMBEL, 1861)

Pl. 4, Fig. 1–3

1861 *Pectunculus latiradiatus* – SANDBERGER in GÜMBEL, p. 742.
1897 *Pectunculus latiradiatus* SANDBERGER – WOLFF, p. 239, pl. 21, fig. 21–22.
1899 *Pectunculus obovatus* (LAMARCK) – BÖCKH, p. 20, pl. 5, fig. 5. [*non* LAMARCK]
1899 *Pectunculus Philippi* (DESHAYES) – BÖCKH, p. 20, pl. 5, fig. 2. [*non* DESHAYES]
1958 *Glycymeris* aff. *latiradiatus* (SANDBERGER) – HÖLZL, p. 53, pl. 2, fig. 4, 4a.
1958 *Glycymeris* ex.gr. *obovatus* (LAMARCK) var?. – SENES, p. 42, pl. 3–8.
1962 *Glycymeris latiradiata* (SANDBERGER) s.str. – BALDI, p. 101, pl. 3, fig. 8, pl. 6, fig. 4–6.
1962 *Glycymeris latiradiata obovatoides* – BALDI, p. 103, pl. 1, fig. 2, pl. 4, fig. 1–6, pl. 5, fig. 1–5, pl. 8, fig. 6.
1962 *Glycymeris latiradiata subfichteli* – BALDI, p. 106, pl. 1, fig. 3, pl. 5, fig. 6, pl. 6, fig. 1–3, 7.
1969 *Glycymeris latiradiata* (SANDBERGER) – STEININGER, p. 42, pl. 4, fig. 4.
1973 *Glycymeris latiradiata* (SANDBERGER) et div. subsp. – BALDI, p. 169, pl. 1, fig. 7–8.

Description: Shell small to medium sized, thick-shelled, orbicular, subequilateral, very slightly elongated posteroventrally; dorsal margin narrowly convex, followed by straightened to slightly convex postero- and anterodorsal margins, the rest of the outline circular, except for the straightened, posteriorly dipping posterior margin; umbo inflated, positioned centrally, pointed, slightly incurvated dorsally, projecting by 2% of height over the area. Shell exterior with commarginal grooves and rugae that gradually coarsen and slightly undulating and irregular, dense radial crevasses of the interior shell structure commonly project to the shell surface as weak striae or depressions. Massive hinge apparatus with subhorizontal, medium-sized cardinal area, with maximally 6 well-differentiated diverging chevrons, taxodont hinge displays laterally 6–7 elongated, prominent, subhorizontally positioned, slightly interiorly dipping teeth. Interior distal shell margin coarsely crenulated. Height: 50 mm, length: 51 mm, convexity: 13.5 mm.

Material: 5 moderately preserved articulated specimens from Neuwinden and 5 badly preserved ones from Plesching.

Remarks: BALDI (1962) created 2 new subspecies of *Glycymeris latiradiata* s.s. based on morphological affinities to Rupelian *Glycymeris planicostalis* (LAMARCK, 1819) (*G. l. obovatoides*) or to Eggenburgian *Glycymeris fichteli* (DESHAYES, 1852) (*G. l. subfichteli*). These subspecies however occur together with *G. latiradiata* s.s. throughout Egerian and Early Eggenburgian and therefore should be better considered as simple morphotypes of *G. latiradiata*. *Glycymeris obovata* (LAMARCK 1819) described by BALDI (1962) is an erroneous identification of *Glycymeris planicostalis* (JANSSEN, 1979; GÜRS, 1995). *G. obovata* is restricted to the Chattian of the North Sea Basin.

Distribution: Egerian to Early Eggenburgian of Western and Central Paratethys (BALDI, 1962).

Ordo Pterioida Newell, 1965
Familia Isognomonidae Woodring, 1925
Genus *Isognomon* Lightfoot, 1786
Subgenus *Hippochaeta* Sangiovanni in Philippi, 1844

Isognomon (*Hippochaeta*) *maxillatus* (Lamarck, 1801)
Pl. 4, Fig. 4–6

1801 *Perna maxillata* – Lamarck, p. 134.
1835 *Perna maxillata* Lamarck – Goldfuss, p. 100 , pl. 108, fig. 3a–c.
1861 *Perna sandbergeri* – Deshayes, p. 56.
1862 *Perna sandbergeri* Deshayes – Sandberger, pl. 31, fig. 4.
1863 *Perna sandbergeri* Deshayes– Sandberger, p. 367 [part., ad *I. heberthi*].
1870 *Perna soldani* Deshayes – Hörnes, p. 378, pl. 43, pl. 44, fig. 1.
1898 *Perna maxillata* Lamarck et var. div. – Sacco, p. 26, pl. 7, fig. 1–6.
1937 *Perna maxillata* Lamarck – Venzo, p. 144, pl. 9, fig. 12–13.
1938 *Pedalion* (*Hippochaeta*) *heberti sandbergeri* (Deshayes) – Zilch, p. 366, fig. 1A, pl. 1, fig. 7–8.
1954 *Perna maxillata soldanii* Deshayes – Csepreghy Meznerics, p. 68, pl. 17, fig. 2.
1958 *Pedalion maxillatum* (?) *soldanii* (Deshayes) – Senes, p. 48, pl. 13, fig. 148–153, pl. 14, fig. 154–156.
1973 *Isognomon* (*Hippochaeta*) *maxillata sandbergeri* (Deshayes) – Neuffer, p. 28, pl. 12, fig. 1.
1995 *Hippochaeta sandbergeri* (Deshayes) – Gürs, p. 217, pl. 39, fig. 1, pl. 40, fig. 1, 2.
1998 *Isognomon* (*Isognomon*) *maxillatum soldanii* (Deshayes) – Schultz, p. 82, pl. 34, fig. 1.

Description: Shell thick, large with length exceeding 80 mm, maximal preserved ligament area height 18 mm, length 58 mm, ligament platforms vertically arranged, wider than grooves between them, grooves shallow convex in Plesching specimens, deep convex in Kendl ones, platform tops shallowly concave; umbo situated terminally, posteriorly pointed, posterior margin thickened, depressed, sculptured by commarginal lamellae, interior with a row of rounded muscle scar pits paralleling the posterior shell wall.

Material: Fragments of the hinge region, 3 from Kendl and 3 from Plesching.

Remarks: As stated by Schaffer (1910) there is no difference between Rupelian Mainz Basin *I. sandbergeri* (Deshayes) illustrated by Sandberger (1862) and Badenian Vienna Basin *I. soldanii* (Deshayes) of Hörnes (1870). Furthermore, following Sacco (1898), Nevesskaja et al. (1993) and Studencka et al. (1998) the European names are also here reunited with the North American Miocene *I. maxillatus* (Sacco, 1898).

The present determination is uncertain due to fragmentary preservation. The ligament area of our specimens differs somewhat from typical *Isognomon maxillatus* (e.g., form *sandbergeri* or form *soldani* of Hörnes, 1870) due to broadened grooves between ligament platforms. By being always narrower than platforms, they allow, at least, a clear distinction from *Isognomon rollei* and *Isognomon heberthi* (Schaffer, 1910). The latter species are characterised by having broader grooves than platforms between them.

Additionally some minor differences of ligament area were observed between specimens from Kendl and those from Plesching The number of platforms in one centimeter of hinge length is in Kendl specimens 2.1, 2.5 and 2.9; in Plesching ones 2.9, 3.0 and 4.1 (in one 7 cm small hinge fragment). The fragments from Kendl have also distinctly deeper grooves and appear to be thicker shelled.

All those differences probably still reflect an intraspecific variation due to distinct environmental conditions.
Distribution: Oligocene to Pliocene.
Late Rupelian of the Mainz Basin (Neuffer, 1973), Chattian of N Germany (Zilch, 1938), Rupelian? of NE Italy (Accordi, 1955), Chattian of NE Italy (Venzo, 1937), Early Egerian of NE Austria (the present study) and Slovakia (Senes, 1958), Badenian of Austria (Schultz, 1998) and Hungary (Csepreghy Mesznericz, 1954), questionably in the Sakaraulian of Georgia (Nevesskaja et al., 1993), Early Miocene to Pliocene of NW Italy (Sacco, 1898) and Early to Middle Miocene of SE France (Mongin, 1952), Pliocene of Marocco (Lecointre,1952); Miocene of Virginia (USA) (Sacco, 1898).

Familia Pinnidae Leach, 1819
Genus *Atrina* Gray, 1842

Atrina cf. *pectinata* (Linné, 1767)
Pl. 5, Fig. 1

1767 *Pinna pectinata* – Linné, p. 264.
1920 *Pinna pectinata* Linné. – Dollfus & Dautzenberg, p. 396, pl. 33, fig. 34.
1959 *Pinna (Atrina) pectinata* Linné – Anderson, p. 95, pl. 14, fig. 5a,b.
1998 *Pinna pectinata brocchii* (d'Orbigny) – Schultz, p. 80, pl. 33, fig. 4.

Description: Shell broadly trigonal, pointed anteriorly, umbo placed terminally, ligament line straightened. Shell thin, prismatic layer distinctly thicker than inner nacreous shell layer. Posterodorsally, outer shell surface undulated by 8 narrow, rounded, undulating radial ribs as broad as interspaces, roughly paralleling the anteroventral margin. Height: 123 mm, length: 88 mm.
Material: 1 badly preserved left valve and 2 fragments from Plesching.
Remarks: Anderson (1959), following Glibert (1945), doubted the justifiability of numerous subspecies names of *A. pectinata* existing in the literature. He pointed out that forms designated by those names never characterize the whole populations, but represent rather extremes of an intraspecific morphological variation. *A. pectinata brocchi* d'Orbigny of Hörnes (1870), Friedberg (1934/36), Heering (1950) and Korobkov (1951) is considered by Anderson (1959) and Nevesskaja et al. (1993) as a synonym of *A. pectinata*.
The Recent *Atrina pectinata* is restricted to the Indo-Pacific (Oliver, 1992, Poppe & Gotto, 1993). The only Mediterranean to NE Atlantic *Atrina* – *A. fragilis* (Pennant, 1777) – is morphologically highly similar to and indeed reunited by some authors with *Atrina pectinata* (Riedl, 1983). Still its ecological requirements apparently differ from the Recent and fossil *Atrina pectinata*, which is a shallow-water bivalve (Oliver, 1992). According to Milisic (1991) *Atrina fragilis* of the Adriatic Sea is restricted to depths between 75 and 130 m. In other Mediterranean regions and NE Atlantic it ranges between 150 and 600 m (Poppe & Gotto, 1993). *Atrina fragilis* is unknown as a fossil.
Distribution: Miocene to Pleistocene of the Lusitanian Region (Malatesta, 1974); Late Oligocene to Miocene of the North Sea Basin (Anderson, 1959); Egerian? (the present study), Eggenburgian to Badenian of Central and Western Paratethys (Steininger et al., 1971, Schultz, 1998); Pshekian? (Popov et al., 1993), Sakaraulian to Konkian of Eastern Paratethys (Nevesskaja et al., 1993); Recent Indo-Pacific (Oliver, 1992).

Ordo Ostreoida Férussac, 1822 (emend. Waller, 1978)
Familia Ostreidae Wilkes, 1810
Genus Crassostrea Wilkes, 1810

Crassostrea fimbriata (Grateloup in Raulin & Delbos, 1855)
Pl. 5, Fig. 2–3

1855 *Ostrea fimbriata* – Grateloup in Raulin & Delbos, p. 1158.
1859 *Ostrea fimbrioides* – Rolle, p. 204, pl. 2, fig. 1–3.
1870 *Ostrea fimbriata* Grateloup – Reuss in Hörnes, p. 450, pl. 74, fig. 1–5.
1897 *Ostrea cyathula carcarensis* – Sacco, p. 11, pl. 3, fig. 30.
1897 *Ostrea* cf. *Cosmanni oligoplicata* – Sacco, p. 11, pl. 3, fig. 31–35.
1909 *Ostrea fimbriata* Grateloup – Cossmann & Peyrot, p. 179, pl. 19, fig. 19–21, pl. 20, fig. 14–15.
1910 *Ostrea fimbriata* Grateloup – Schaffer, p. 16, pl. 6, fig. 6–8.
1958 *Ostrea* cf. *fimbriata fimbriata* Grateloup – Senes, p. 56, pl. 9, fig. 111–112.
1971 *Ostrea fimbriata* Grateloup – Steininger et al., p. 433.

Description: Shell medium to large sized, higher than long, more or less bent posteriorly, convexity moderate, left valve slightly more convex than the right one; right valve with numerous, regularly arranged, narrow, densely spaced radial ribs of similar wideness throughout ontogeny, being somewhat wider centrally than laterally, slowly multiplying distally through bifurcation; about 60 such ribs weakly undulating the commissure in one 65 mm high specimen; prominent, well-differentiated single growth lamellae, subparalleling the shell surface characterize the concentric exterior sculpture; left valve exterior with irregular, more or less projecting comarginal growth lamellae, organized in part to narrow commarginal depressions, inactivated catachomata forming an irregular radial undulation of the exterior surface next to the ligamental area. Right interior more strongly concave than the left one, anteriorly developing a cavity; ligamental area higher than long, slightly bent posteriorly, right resilifer deeply concave, broader than the bourrelets, left ligamental area concave with flattened resilifer and bourrelets, adductor scar medium-sized, drop-like, pointed posterodorsally, positioned posteriorly. Height: 64 mm, length: 56 mm, convexity: 13 mm.
Material: 4 well preserved specimens from Melk/Tunnel.

Remarks: As emphasised by Cossmann & Peyrot (1909), *Crassostrea cyathula* (Lamarck) with the type occurrence in the Rupelian of the Paris Basin, among other minor differences, has less numerous ribs. Therefore *Crassostrea cyathula* as described by Baldi (1973), closely resembles specimens from Melk, is possibly also a *Crassostrea fimbriata*. Distribution: Egerian to Badenian in the Paratethys (Senes, 1958; Steininger et al., 1971); Late Rupelian to Chattian in Liguria (Sacco, 1897); Aquitanian of the Aquitanian Basin (type occurrence according to Cossmann & Peyrot, 1909); Early Miocene of the Rhone Basin (Mongin, 1952). Additional report on *Crassostrea fimbriata* is from the Oligocene to Early Miocene of the Mesohellenic Basin (Penecke, 1897).

Familia Gryphaeidae Vialov, 1936

Genus *Pycnodonte* Fischer, 1835

Pycnodonte gigantica callifera (Lamarck, 1819)

Pl. 5, Fig. 4–6; Pl. 6, Fig. 1

1863 *Ostrea callifera* Lamarck – Sandberger, p. 377, pl. 34, fig. 6, pl. 35, fig. 1.
1884 *Ostrea callifera* Lamarck – Speyer & Koenen, pl. 23, fig. 9–10, pl. 24, fig. 11, pl. 25, fig. 2–4, pl. 26, fig. 1.
1893 *Ostrea callifera* Lamarck – Koenen, p. 1008, pl. 63, fig. 1–2.
1897 *Ostrea callifera* Lamarck – Wolff, p. 231, pl. 20, fig. 2–3.
1943 *Ostrea callifera* Lamarck – Albrecht & Valk, p. 121, pl. 24, fig. 951–952.
1952 *Ostrea callifera* Lamarck – Görges, p. 28.
1959 *Ostrea callifera* Lamarck – Vanova, p. 162, pl. 23, fig. 29–30.
1962 *Ostrea callifera* Lamarck – Hölzl, p. 59.
1963 *Ostrea gigantica callifera* Lamarck – Baldi, p. 75, pl. 1, fig. 11–12, pl. 2, fig. 1.
1969 *Ostrea (Gigantostrea) callifera* Lamarck – Steininger, p. 42.
1973 *Ostrea (Gigantostrea) gigantea callifera* Lamarck – Baldi, p. 184, pl. 8, fig. 1–2, 4–5.
1975 *Ostrea (G.) gigantea callifera* Lamarck – Steininger, p. 219.
1995 *Pycnodonte callifera* (Lamarck) – Gürs, p. 232.

Description: Adult shell large, mostly rounded in outline, but also irregular, posteroanteriorly or dorsoventrally elongated. Left valve more highly convex than the right valve, in young specimens much deeper concave interiorly than in the adult ones. Left exterior surface with mostly strongly irregular radial ribs, in two small, more regularly developed valves 14 ribs present; right exterior surface irregularly undulated, in smaller valves, thick, irregularly projecting, concentric laminae present. Exterior surface sculptured additionally with antimarginal striation. Interior with large, rounded to oval adductor scar; chomata paralleling roughly the interior valve margins, with the distance from the very margin varying between 0 and 13 mm. Height: 103.5 mm, length: 105 mm, convexity: 20 mm.
Material: 34 specimens from Plesching.

Remarks: Most of the sample (30 specimens) is made up of a size class from 8 to 37 mm shell length. Only 4 valves are larger, with lengths exceeding 68 mm. Among large specimens there is only one left valve and it displays different morphology than the small ones, being distinctly less concave interiorly, having also a shallower cavity beneath the ligamental area. Its small counterparts are prominently, deeply convex. In contrast the small right valves correspond well with the large ones. Because no left valves are available in transitional size classes between small and large specimens, their specific relation is somewhat uncertain. Nevertheless the correspondence of right valves, and typical antimarginal striation in small and in large right valves maintain the identification. As pointed out by Baldi (1973) this oyster stands very close to *Pycnodonte gigantica* Solander in Brander (1766), being on average, however, distinctly smaller. For example the Bulgarian Late Eocene to Oligocene *Pycnodonte gigantica* of Karagiuleva (1964) reaches heights up to 290 mm. According to Baldi the Mediterranean *Pycnodonte gigantica* and the N European Boreal *Pycnodonte callifera* are related on the subspecies level. The Western to Central Paratethyan occurrence represents a transitional form with larger specimens hardly distinguishable from *P. g. gigantica*. The Plesching occurrence upholds Baldi's conclusion.

The more regularly ribbed, small right valves, as also the small left valves, resemble those from Eger illustrated by Telegdi-Roth (1914) and identified as *Ostrea cyathula* Lamarck, whereas in adult ones any similarity is absent. The taxonomic significance of that observation cannot be evaluated without a direct comparison with original material of Telegdi-Roth.

Distribution: Rupelian of the Paris Basin (type occurrence); Rupelian to Chattian of the North Sea Basin (Görges, 1952); Rupelian to Chattian of the Mainz Basin (Gürs, 1995); Kiscellian to Chattian of the Paratethys (Baldi, 1973).

Familia Pectinidae Wilkes, 1810

Genus *Palliolum* Monterosato, 1884

Palliolum incomparabile (Risso, 1826)

Pl. 6, Fig. 2–4

1826 *Pecten incomparabilis* – Risso, p. 302, pl. 11, fig. 154.
1826 *Pecten vitreus* – Risso, p. 303, pl. 11, fig. 156.
1884 *Pecten hertlei* – Bittner , p. 518, pl. 10, fig. 19.
1897 *Chlamys* (*Pallolium*) *incomparabilis* (Risso) – Sacco, p. 45.
1899 *Pecten textus* Philippi – Boeckh, p. 13, pl. 2, fig. 16. [*non* Philippi]
1907 *Chlamys* (*Pallolium*) *incomparabilis* (Risso)– Cerulli-Irelli, p. 97, pl. 6, fig. 9.
1914 *Chlamys* (*Camptonectes*) *textus* Philippi – Telegdi-Roth, p. 66, pl. 6, fig. 9. [*non* Philippi]
1939 *Chlamys incomparabilis* (Risso) – Roger, p. 204, pl. 20, fig. 7a–b, pl. 21, fig. 2a–b.
1959 *Chlamys decussata* (Münster) – vanova, p. 157, pl. 20, fig. 10–12. [*non* Münster in Goldfuss]
1960 *Chlamys (Camponectes) hertlei* (Bittner) – Csepreghy-Meznerics, p. 37, pl. 34, fig. 5–6.
1960 *Chlamys (Camponectes) texta* Philipi – Csepreghy-Meznerics, p. 37. [non Phil.]
1962 *Chlamys (Camponectes) incomparabilis* (Risso) – Hölzl, p. 58, pl. 2, fig. 3.
1963 *Chlamys incomparabilis* (Risso) – Steininger, p. 17, pl. 2, fig. 2–3.
1963 *Chlamys incomparabilis* (Risso) – Baldi, p. 73, pl. 1, fig. 5–8.
1969 *Chlamys incomparabilis* (Risso) – Steininger, p. 43.
1969 *Chlamys* cf. *decussata* (Münster) – Steininger, p. 42, pl. 3, fig. 2 [*non* Münster in Goldfuss].
1973 *Chlamys incomparabilis* (Risso) – Baldi, p. 183, pl. 7, fig. 2.
1975 *Chlamys incomparabilis* (Risso) – Baldi & Steininger, p. 219, pl. 8, fig. 1–2.
1975 *Chlamys decussata* (Münster) – Baldi & Steininger, p. 219, pl. 8, fig. 4–5 [*non* Münster in Goldfuss].

Description: Shell small, chlamydoid, biconvex, inequilateral with disc slightly elongated posteroventrally and anterior ears distinctly larger than the posterior ones, right anterior ear pointed anteriorly with prominent byssal notch. Disc somewhat higher than long with height not exceeding 23 mm, disc outline orbicular in the ventral portion, pointed in its dorsal part with disc flanks straightened; disc convexity rather low, disc flanks moderately high, broadly sigmoidal in cross section; ears rather large with length exceeding 55% of the disc length and ear height exceeding 23% of disc height. Disc exterior radial sculpture highly variable, being present in form of radial folds or absent, initiation of radial folds random, in few specimens already umbonally, folds weak to prominent, narrow or broad, separated by narrower or distinctly wider interspaces; narrow, densely spaced ones bearing rows of microscopic scales on tops; folds, if multiplied then through intercalation, folds number varies in larger specimens between 26 and 43. Concentric sculpture absent, except for some growth constrictions, although the differently coloured commarginal bands appear. Microsculpture represented by prominent *Camptonectes*-type antimarginal striation. Ears with free margins dipping steeply posteriorly, anterior ears ornamented by fine, scaly, densely spaced radial ribs, 7 to 10 in number, multiplying through intercalation, two dorsal ones coarser than others, in right valve forming a dorsal crista; posterior ears smooth or, in some specimens, single, fine, scaly ribs can also appear. Byssal fasciole depressed, flattened, sculptured by commarginal lirae, separated from the ctenolium by a rib-like flexure, ear/disc contact gaping distally, showing inactive ctenolium; active ctenolium present. Disc interior smooth to simply radially folded. Hinge with dorsal and resilial teeth similarly prominent, both narrow and strongly laterally elongated; dorsal teeth do not reach the origin of shell growth. Height: 20.3 mm, length: 18.2 mm, convexity: 3 mm.

Material: more than 50 specimens from Plesching.

Remarks: *Palliolum incomparabile*, the type species of *Palliolum*, is commonly represented in the Recent Mediterranean and adjacent Atlantic region (Wagner, 1991). Although mainly restricted to Pliocene – Recent (Roger, 1939), additionally its presence in the Late Oligocene to Early Miocene of the Paratethys is well documented (Hölzl, 1962; Steininger et al., 1971; Baldi, 1973; Popov et al. 1993). Yet, the Middle to Late Miocene stratigraphic gap apparently complicated the interpretation of species level affiliation between the Recent and the Oligo/Miocene occurrences. Nevertheless based on their identical morphology this interpretation is well supported.

The sample from Plesching differs however distinctly from other Paratethyan occurrences. It includes completely smooth specimens co-occurring with radially folded ones, and continuous morphologic transitions. The Recent ones, but also all other previously recorded Paratethyan *Palliolum incomparabile*, are always smooth. Whereas the smooth shells from Plesching cannot be distinguished from *P. incomparabile*, the folded ones, resemble species, such as the Recent *Palliolum striatum* (Müller, 1776), the German Oligocene *Palliolum pictum* (Goldfuss 1833), *Palliolum venosum* (Speyer 1864) and *Palliolum decussatum* (Münster 1833) or the Paratethyan *Palliolum hertlei* (Bittner 1884).

Palliolum striatum highly resembles *Palliolum incomparabile* except for radial folds, which number varies from 4 very weak marginal ones to 72 (Wagner, 1991). Its stratigraphically oldest record is from the Pleistocene of Italy and therefore its affiliation with Plesching specimens would be highly speculative.

Palliolum venosum from the Rupelian of the Mainz Basin (Neuffer, 1973; Gürs, 1995) is closely related to the Plesching species, showing similar variation of the exterior disc surface sculpture, but differing by the presence of posterior ear riblets – absent both in Plesching and in Fels am Wagram (Steininger, 1963) specimens – and by exterior disc folds, that are densely spaced and more numerous (Neuffer, 1973).

Palliolum pictum (= *P. weinheimense*) from the Rupelian of the Mainz Basin (Neuffer, 1973) has weaker *Camptonectes* microstriation. The folds are generally distinctly stronger than in Plesching specimens, although the smooth specimens, or those with fine, scally ribs are, highly similar.

The Chattian North Sea Basin *P. decussatum* – according to Anderson (1958) a probable descendant of *Palliolum pictum* – shows similar variation in sculpture as the Plesching species. It displays clearly *Camptonectes* microstriation, as pointed out by Anderson (1958), and therefore the only apparent difference from the Plesching species remains the presence of riblets on posterior ears.

The only synchronous closely related form from the Paratethys is *Palliolum hertlei*, formerly described from the Egerian of N Slovenia and N Hungary (illustrated in Csepreghy-Mesznerics, 1960) and Karadzhalgian of the Precaucasian (Popov et al., 1993). It resembles closely the strongly radially folded shells from Plesching.

Based on its continuous stratigraphic and geographic occurrence as well as morphology, we assume, that the Late Oligocene to Early Miocene Paratethyan representatives of *Palliolum* are conspecific. The predominantly smooth species includes more or less radially folded morphotypes during the Egerian/Karadzhalgian – usually described as *Palliolum hertlei*. In the Eggenburgian/Sakaraulian exclusively smooth morphs remain, which cannot be distinguished from *Palliolum incomparabile*. The ancestor of that species immigrated possibly from the adjacent Boreal NW Atlantic Region that is indeed characterized by several related species throughout the Oligocene. Based on taxonomic results of previous workers this species is also in the present study identified with *P. incomparabile,* although in its more primitive stage it still develops radial disc ornamentation.

Distribution: Egerian to Eggenburgian of the Central and Western Paratethys; Early Kalmykian?, Karadzhalgian to Sakaraulian of Eastern Paratethys (Popov et. al., 1993); Pliocene to Recent of the Lusitanian Region (Roger, 1939).

Genus uncertain

Costellamussiopecten? cf. *northamptoni* (Michelotti, 1839)

Pl. 6, Fig. 5–6

1839 *Pecten northamptoni* – Michelotti, p. 8
1897 *Chlamys (Aequipecten) northamptoni* (Michelotti) div. subsp. – Sacco, p. 16, pl. 4, fig. 1–16
1903 *Pecten northamptoni* (Michelotti) – Oppenheim, p. 153, pl. 9, fig. 4
1937 *Chlamys (Aequipecten) northamptoni laevitransiens* (Sacco) – Venzo, p. 159, pl. 11, fig. 14
1938 *Chlamys (Aequipecten) northamptoni laevitransiens* (Sacco) – Venzo, p. 199, pl. 10, fig. 1–3
1938 *Chlamys (Aequipecten) northamptoni oblita* (Michelotti) – Venzo, p. 200, pl. 10, fig. 4
1939 *Chlamys northamptoni* (Michelotti) – Roger, p. 48, pl. 2, fig. 11, pl. 7, fig. 1, 1a, 2, 8, 8a, 9
1955 *Chlamys northamptoni* (Michelotti) – Accordi, p. 55, pl. 5, fig. 1
1955 *Chlamys northamptoni* var. *laevitransiens* Sacco – Accordi, p. 55, pl. 5, fig. 2 and 4.
1959 *Chlamys (Aequipecten) northamptoni* (Michelotti) – Ctyroky, p. 91, pl. 9, fig. 1, 3, pl. 11, fig. 1, pl. 18, fig. 1–3, text-fig. 5, 6
1960 *Chlamys northamptoni* (Michelotti) – Csepreghy-Meznerics, p. 30, pl. 20 (part.), fig. 4–5.
1962 *Chlamys northamptoni* (Michelotti) – Boni & Sacchi-Vialli, p. 93, pl. 14, fig. 10, pl. 17, fig. 1–2, 4, 6–9
1969 *Chlamys (Aequipecten) northamptoni* (Michelotti) – Ctyroky, p. 35, fig. 7, 10, pl. 9, fig. 1–6, pl. 10, fig. 1–4, pl. 11, fig. 1–6, pl. 12, fig. 1–5
1973 *Chlamys (Aequipecten) northamptoni* (Michelotti) – Baldi, p. 180, pl. 6, fig. 3
1986 *Chlamys northamptoni* (Michelotti) – Baglioni Mavros et al., p. 145, pl. 1, fig. 24, 25, 27, 28, 29

Description: Moderate to large in size, low to moderately biconvex. Exterior with 17 moderately prominent ribs, being dorsally sub-trigonal to rounded, distally in cross section sub-trapezoidal; with interspaces flat-bottomed, as wide as ribs. Secondary sculpture, contributed by weak, mainly scaly riblets, occurring at least laterally on ribs and in interspaces. Their appearance varies. Scaly riblets can already initiate in the dorsal disc region, gradually becoming prominent distally, with two riblets marking the rib-top boundaries following one central riblet on rib-top and 2–3 riblets in interspaces. Rib-tops of the central disc region can, in contrast, remain smooth with riblets on rib flanks present or absent, developed distally at about 20 mm of height. Also left and right valve of the same shell can differ in secondary sculpture, with well-differentiated scaly riblets in one valve being absent in other one. Disc exterior shiny, with extremely fine growth lines and with very fine *Camptonectes*-type antimarginal microstriation. Shell thin in dorsoventral cross section myostracum layer about two times broader than inner calcite layer; outer calcite layer extremely thin. Height (reconstructed): 71 mm, length and convexity undeterminable.

Material: 3 badly preserved specimens (2 articulated shells, 1 single left valve) from Tiefenfucha.

Remarks: Badly preserved outline, missing ears and unexposed interior characters make identification uncertain.

The Oligocene *C. northamptoni* is thus far documented from the Egerian of Hungary by Csepreghy-Meznerics (1960) and Baldi (1973) and from the Chattian of NE Italy by Venzo (1937, 1938) and Baglioni Mavros et al. (1986). Citation of its infrequent appearance in the Oligocene of Liguria by Sacco (1897) is not secured through a figure. Note that *C. northamptoni* of Csepreghy-Meznerics (1960) is a partial misidentification (specimens on pl. 20, fig. 1–3) of *Chlamys darnoensis* Csepreghy-Meznerics, 1960. Those specimens apparently have fewer ribs.

C. northamptoni due to its right hinge with three tooth pairs is not related to *Aequipecten* s.s. (sensu Waller, 1991). Indeed, except for its aequipectinoid shape, all other characters such as hinge, scaly sculpture on disc and ears, *Camptonectes* microsculpture and prominent internal ribs carinae point to its affiliation with *Costellamussiopecten* Bongrain et al. (1994).

Distribution: Late Oligocene to Early Miocene of Mediterranean and Central Paratethys (e.g., Sacco, 1897; Roger, 1939; Ctyroky, 1959; Baldi, 1973; Baglioni Mavros et al., 1986), ?Middle Miocene of Mediterranean (Comaschi, 1972)

Familia Anomiidae Rafinesque, 1815

Genus *Anomia* Linné, 1758

Anomia ephippium Linné, 1758

Pl. 6, Fig. 7

1866	*Anomia Goldfussi* Deshayes – Speyer, p. 49, pl. 3, fig. 7–9.
1884	*Anomia Goldfussi* Deshayes – Speyer & Koenen, pl. 23, fig. 7–8, pl. 24, fig. 6–10.
1897	*Anomia costata* Brocchi– Wolff, p. 231, pl. 20, fig. 9–10.
1897	*Anomia ephippium* Linné et var. div. – Sacco, p. 31, pl. 10.
1899	*Anomia ephippium* costata Brocchi – Böckh, p. 15, pl. 2, fig. 5, pl. 3, fig. 4.
1910	*Anomia ephippium* Linné et var. div. – Schaffer, p. 22, pl. 12, fig. 1–14.
1934–36	*Anomia ephippium rugolosostriata* Bronn – Friedberg, p. 257; fig. 27, pl. 49, fig. 2–5.
1952	*Anomia goldfussi* Deshayes – Görges, p. 27.
1958	*Anomia ephippium* Linné et var. div. – Senes, p. 51, pl. 11, fig. 130–133.
1958	*Anomia ephippium* Linné et var. div. – Hölzl, p. 62, pl. 4, fig. 5.
1959	*Anomia ephippium* Linné – Anderson, p. 103, pl. 14, fig. 11.
1964	*Anomia ephippium* Linné – Anderson, p. 145, pl. 2, fig. 28.
1971	*Anomia ephippium* Linné – Steininger et al., p. 428, pl. 28, fig. 1.
1973	*Anomia ephippium* Linné – Baldi, p. 185, pl. 5, fig. 1.

Description: Shell small sized, except for specimens from Melk/Tunnel, which also include medium-sized specimens, although maximal height does not exceed 50 mm, outline irregular, mainly suborbicular, preferable lateral growth directions are highly variable according to commarginal lines, yet the elongation of the posterior shell is characteristic. Shell convexity completely irregular in cross section, in right valves varying from being low to high. Valve exterior surface undulated throughout ontogeny by very fine, irregular, wavy, antimarginal striae and folds; coarse irregular, wavy folds, varying in number and prominence can occurre in later growth stages. Shell structure is dominantly foliate, the single folia are nacreous, in dorsal region white macroscopically homogeneous median layer intercalates. Height: 27.8 mm, length: 26.8 mm, convexity: 11 mm.
Material: 3 specimens from Melk/Tunnel, 5 from Kendl, 6 from Neuwinden and 15 from Plesching.

Remarks: According to ANDERSON (1959), *A. ephippium* cannot be distinguished from the Late Oligocene *A. goldfussi* DESHAYES. *A. costata* BROCCHI of WOLFF (1897) and BÖCKH (1899), as well as numerous forms described by SACCO (1897), SCHAFFER (1910), SENES (1958), and HÖLZL (1958) are placed by BALDI (1973) into synonymy of *A. ephippium*. Based on the extraordinary variability of this species (ANDERSON, 1959), this interpretation is followed in the present study. The studied Austrian specimens correspond morphologicaly at best to form *rugolosostriata* BRONN of SACCO (1897). *A. ephipium rugolosostriata* of FRIEDBERG (1934–36) is reunited by ANDERSON (1959) with *A. ephipium*.
Distribution: Rupelian to Recent of the North Sea Basin (ANDERSON, 1959); Kiscellian to Badenian of the Western and Central Paratethys (BALDI, 1973); Sakaraulian?, Karaganian to Konkian of the Eastern Paratethys (NEVESSKAJA et al., 1993); Aquitanian to Recent of the Lusitanian Region (SACCO, 1897; POPPE & GOTO, 1993).

Subclassis Lucinata POJETA, 1978

Ordo Lucinoida DALL, 1889
Familia Lucinidae FLEMING, 1828
Genus *Myrtea* TURTON, 1822

Myrtea spinifera (MONTAGU, 1803)
Pl. 6, Fig. 8–10

1803 *Venus spinifera* – MONTAGU, p. 577, pl. 17, fig. 1.
1870 *Lucina spinifera* (MONTAGU) – HÖRNES, p. 236, pl. 33, fig. 8.
1901 *Lucina (Myrtea) spinifera* div. subsp. – SACCO, p. 93–95, pl. 21, fig. 8–23.
1901 *Lucina (Myrtea) taurina* div. subsp. – SACCO, p. 95, pl. 21, fig. 24–30.
1901 *Lucina (Myrtea) extinta* (MICHTELOTTI) (an *M. spinifera* var.) – SACCO, p. 95, pl. 21, p. 37–39.
1908 *Lucina (Myrtea) spinifera* (MONTAGU)– DOLLFUS & DAUTZENBERG, p. 245, pl. 16, fig. 18–27.
1912 *Myrtea spinifera* (MONTAGU) div. subsp. – COSSMANN & PEYROT, p. 671–674, pl. 28, fig. 16–19 and 23–29.
1934 *Myrtea spinifera* (MONTAGU) – FRIEDBERG, pl. 120, pl. 20, fig. 10–11.
1960 *Lucina (Myrtea) spinifera* (MONTAGU) – KOJUMDIGIEVA in KOJUMDIGIEVA & STRACHIMIROV, p. 30, pl. pl. 9, fig. 12 and 13.

Description: Shell small, with length (<11 mm) slightly exceeding height, weakly to moderately biconvex; variable in shape, suborbicular to subquadrate; posterior margin

more or less dorsoventrally straightened, anterodorsal margin concave, other margins convex, prosogyrate. Escutcheon ridge following dorsally a shallow and narrow radial depression; escutcheon extremely narrow, dipping steeply interiorly; ligamental nymph elongate and prominent, ligamental suture deep, lunula deep, elongate and narrow. Exterior with widely distanced, well projecting, concave commarginal lamellae intercalated by growth lines; developing scaly projections at intersections with escutcheon ridge. Umbonally, commarginal lamellae closely spaced, with a maximum of 7 lamellae present in the first mm of growth; in adult shell absent or present, moderately wide to widely spaced (0.5–2 mm), variable in number, restricted to dorsal exterior region or reaching the mature shell margin. Right hinge with one short and prominent cardinal tooth centrally and single narrow, elongate lateral tooth posteriorly and anteriorly; left hinge with two prominent cardinal teeth centrally and single, weak, elongate lateral teeth posteriorly and anteriorly. Height: 8.1 mm, length: 8.9 mm, convexity: 1.5 mm.
Material: 31 moderately preserved specimens (1 articulated shell, 11 left and 19 right single valves) from Tiefenfucha.

Remarks: This is the oldest evidence of this common Miocene to Recent species. Up to now it was unknown from sediments older than Early Miocene. Its presence in the Oligocene of the Subcarpathian foredeep, asserted by S. Popov (Moscow) (pers. comm., 2000), is thus far unpublished.
This highly variable species can be easily identified according to the scaly escutcheon ridge. Subspecies introduced by Sacco (1901) and Cossmann & Peyrot (1912), based on differences in size, sculpture and outline, are most likely not valid. Among the investigated specimens, a similar variation pattern is present. *Myrtea taurina* (Bonelli), characterized by reduced, and *M. extinta* (Michelötti) with widely spaced commarginal lamellae in the adult shell are for the same reason most certainly synonymous with *M. spinifera* (Sacco, 1901; Venzo, 1933).
Today it inhabits sand, mud and gravel bottoms between 7 and 250 m (Poppe & Goto, 1993). According to Milisic (1991) it prefers sandy bottoms of the littoral zone.
Distribution: Late Oligocene to Middle Miocene of Paratethys (the present study; Hörnes, 1870, Studencka et al., 1998); Early to Middle Miocene of Central Paratethys and Miocene to Recent of Mediterranean to NE Atlantic (Sacco, 1901; Cossmann & Peyrot, 1909–14; Dollfus & Dautzenberg, 1902; Poppe & Goto, 1993; Milisic, 1991).

Genus *Lucinoma* Dall, 1901

Lucinoma barrandei (Mayer, 1871)
Pl. 7, Fig. 1–4

1871 *Lucina barrandei* – Mayer, p. 340, pl. 10, fig. 1.
1958 *Lucinoma barrandei* (Mayer) – Hölzl, p. 75, pl. 6, fig. 4.
1958 *Lucinoma barrandei taurinorum* (Sacco) – Hölzl, p. 75, pl. 6, fig. 5, 5a.
1963 *Lucinoma barrandei* (Mayer) – Steininger, p. 25, pl. 1, fig. 2a,b.
1971 *Lucinoma barrandei* (Mayer) – Steininger et al., p. 436, pl. 36, fig. 5, 7.
1975 *Lucinoma barrandei* ssp. – Baldi & Steininger, p. 219, pl. 11, fig. 8.
1998 *Lucinoma barrandei* (Mayer) – Schultz, p. 96, pl. 42, fig. 8a,b.

Description: Shell of medium size with maximal length of 55 mm, orbicular to oval, slightly postero-anteriorly elongated, moderately biconvex; umbo strongly prosogyrate, placed variably above posterior to anterior shell portion; lunulae deeply excavated, with outer edge only slightly concave, escutcheon closed, dorsal margin straight or concavely projecting dorsally from umbo, anterior and posterior margins rounded to slightly obtusely angled, slightly dorsally bent postero-dorsal ridge is followed by flattened to slightly concave postero-dorsal shell region; anterior adductor muscle scar is large, long and narrow, straightened, dipping steeply posteriorly, on its anterior end bent dorsally; posterior adductor muscle scar smaller, quadrangularly suboval, located beneath the postero-dorsal interior shell margin; interior marginal area outside the integripalliate pallial line with inarticulate concentric ridges. Outer surface proximally smooth, distally more or less rough, with irregular, slightly projecting, commarginal lirae. Ligament suture is slightly dorsally bent, extraordinarily deep, concave, broadening and deepening, in direct contact with the internal shell cavity. Nymph concave, forming the ventral wall of the ligamental suture. Posterior hinge plate concave, variably wide (broad to narrow). Cardinal teeth dipping posteriorly, tooth 4 narrow, slightly elongated, tooth 2a massive, trigonal, with two lamellae developed on its posterior and anterior edges, groove receiving the 3b tooth deep, trigonal, groove receiving the 3a narrow, inarticulate; lateral teeth AI and AII feebly laminar. Height: 32 mm, length: 34 mm, convexity: 7 mm. Material: 19 moderately to well-preserved specimens (predominantly articulated shells) from Plesching.

Remarks: Hölzl (1958) illustrated and described two subspecies – *L. b. barrandei* and *L. b. taurinum* – from the Eggenburgian of Kaltenbachgraben in Bavaria, which differ by the shell-outline, in particular through shape of the lunula. Because they always occur together, their taxonomic separation is considered in the present study as doubtful; they more likely represent a morphological variation within the same population. Kaltenbachgraben is the type locality of *L. barrandei*, which is according to Hölzl (1958) unknown from other Bavarian localities. Specimens from Plesching coincide well with the specimens illustrated by Hölzl (1958). Especially apparent is the similarity of the extremely massively developed hinges.

The Mediterranean Early Miocene occurrence documented by Sacco (1901, p. 83, pl. 19, fig. 6–9) seems to be an erroneous identification. There is an apparent difference to Bavarian specimens in the shape of the hinge region (Sacco, 1901, fig. 6b). The Paratethyan specimens are characterized by a very prominent ligament pit that is deep, broad and long, making the hinge region extremely broad. In contrast, the specimen illustrated by Sacco (1901) has a narrow hinge region with underrepresented ligament pit.

One of the specimens from Plesching is already illustrated by Baldi & Steininger (1975) and identified as *L. barrandei* ssp. No indication for a subspecies status of the Plesching population was traced in the present investigation. The specimen illustrated by the latter authors is dorsoventrally elongated with prolonged anterior portion. Among the present material such shapes are present together with rounded ones. Similar elongated shape also characterizes specimens from Fels am Wagram illustrated by Steininger (1963) and Steininger et al. (1971). These coincide well in all details with Plesching valves, including the form of the hinge region. The latter authors claimed minor differences of Austrian specimens from the typical *L. barrandei* of Bavaria in outline and in hinge apparatus. Those differences were, however, interpreted as environmental adaptations.

The generic definition of Moore (1969) does not fit exactly to *L. barrandei*; namely, the commarginal lirae are not regular and do not have intercalated finer lines, the lunule is

sunken and the anterior scar is short. On the other hand, the described dentition is identical to those in Plesching specimens.
Distribution: Egerian of Plesching (BALDI & STEININGER, 1975; present study), Early Eggenburgian of Fels am Wagram in Lower Austria (STEININGER, 1963; STEININGER et al., 1971; SCHULTZ, 1998), Eggenburgian of Kaltenbachgraben in Bavaria (HÖLZL, 1958).

Genus *Saxolucina* STEWART, 1930

Saxolucina heberti (DESHAYES, 1857)

Pl. 7, Fig. 5–6

1857 *Lucina Heberti* DESHAYES – DESHAYES, pl. 42, fig. 4–6.
1858 *Lucina Heberti* DESHAYES – DESHAYES, p. 647.
1861 *Lucina Heberti* DESHAYES – SANDBERGER, pl. 27, fig. 3, 3a,b.
1863 *Lucina Heberti* DESHAYES – SANDBERGER, p. 327.
1973 *Saxolucina(Saxolucina) heberti* (DESHAYES) – NEUFFER, p. 52, pl. 10, fig. 11a,b, 12a,b.
1993 *Pterolucina heberti* (DESHAYES) – POPOV et al., p. 95, pl. 5, fig. 12.
1995 *Saxolucina heberti* (DESHAYES) – GÜRS, p. 237, pl. 63, fig. 4.

Description: Shell small, about as high as long, low convex; outline suborbicular to subquadrangular with straightened posterior and concave antero-umbonal portions; posterior diagonal ridge prominent, adjoining the depressed, wing-like, distally pointed posterodorsal area; anterior diagonal ridge more or less prominent adjoining the depressed, wing-like, distally pointed anteroventral area, being smaller than the posterodorsal one. Umbo inflated, prosogyrate; lunule depressed, pointed posteriorly, slightly anterodorsally elongated, escutcheon narrow. Shell exterior sculptured by fine, somewhat wavy, irregularly projecting commarginal lirae; relatively dense growth constrictions present. Hinge region with broad, depressed, posteriorly elongated ligamental groove, adjoined to sharp, elongated nymph; posterior right cardinal tooth 3b short, oblique, subparalleling the nymph; posterior left cardinal tooth 5 shorter and steeper than 3b; anterior cardinals reduced or not preserved; right laterals AI and AIII short, subhorizontal and weak. Height: 20 mm, length: 21.8 mm, convexity: 5 mm.
Material: 21 moderately preserved, mainly articulated shells from Neuwinden.

Remarks: This is the first Chattian record of this species formerly thought to be restricted to the Rupelian.
Distribution: Rupelian of the Paris Basin (type occurrence), Mainz Basin (GÜRS, 1995) and Georgia (POPOV et al., 1993).

Genus *Lucinella* DI MONTEROSATO, 1883

Lucinella divaricata rotundoparva (SACCO, 1901)

Pl. 7, Fig. 7

1901 *Divaricella divaricata rotundoparva* – SACCO, p. 99, pl. 29, fig. 14–15.
1910 *Divaricella divaricata rotundoparva* SACCO – SCHAFFER, p. 102, pl. 46, fig. 11–14.
1911 *Divaricella divaricata rotundoparva* SACCO – COSSMANN & PEYROT, p. 713, pl. 28, fig. 75–78.
1971 *Divalinga divaricata rotundoparva* (SACCO) – STEININGER et al., p. 435, pl. 36, fig. 3.

Description: Shell very small with height not exceeding 11 mm, highly convex, about as high as long or slightly longer, suborbicular in outline, slightly inequilateral, with prosogyrate umbonal part, with elongated, slightly pointed posteroventral region, straightened posterior margin and wing-like, distally pointed anterodorsal region; posterior diagonal ridge more or less prominent, posterodorsal area more or less depressed, wing-like and pointed distally. Umbo highly inflated, lunule deeply depressed, rounded, pointed posteriorly, escutcheon narrow, posteriorly elongated. Exterior layer mostly destroyed and absent, exposing of internal, fine radial ribbing representing the inner shell layer structure; if preserved, exterior sculpture made up of fine divaricating ribs and fine, irregular commarginal lirae. Height: 6 mm, length: 6.2 mm, convexity: 1.2 mm. Material: more than 15 badly preserved specimens from Neuwinden.

Remarks: *Divalinga ornata* (AGASSIZ) can be easily distinguished by its more regularly circular outline and larger average size. SACCO (1901) differentiated his subspecies as being somewhat larger, more ovate and smoother than the Recent species. STUDENCKA et al. (1998) reunited the fossil with the Recent subspecies, yet without providing reasons for that decision. The specimens of Recent *L. divaricata* (LINNE) from the Adriatic Sea of MILISIC (1991) differ by displaying prominent radial ribbing of the exterior shell surface; the specimens of POPPE & GOTO (1993) are, in contrast, identical to fossil ones.
Distribution: Late Miocene to Pliocene of NW Italy (SACCO, 1901), Middle Miocene of the Aquitanian Basin (COSSMANN & PEYROT, 1911), Egerian to Badenian of Western and Central Paratethys (SCHAFFER, 1910; STEININGER et al., 1971; STUDENCKA et al., 1998; present study)

Familia Ungulinidae ADAMS & ADAMS, 1857

Genus *Diplodonta* BRONN, 1831

Diplodonta rotundata (MONTAGU, 1803)

Pl. 7, Fig. 8

1803 *Tellina rotundata* – MONTAGU, p. 71, pl. 2, fig. 3.
1870 *Diplodonta rotundata* (MONTAGU) – HÖRNES, p. 216, pl. 32, fig. 3.
1901 *Diplodonta rotundata* (MONTAGU) et var . div. – SACCO, p. 62, p. 15, fig. 12–18.
1910 *Diplodonta rotundata* (MONTAGU) – SCHAFFER, p. 102, pl. 46, fig. 15–17.
1911 *Diplodonta rotundata* (MONTAGU) – COSSMANN & PEYROT, p. 241, pl. 26, fig. 26–31.
1945 *Taras rotundatus* (MONTAGU) – GLIBERT, p. 150, pl. 10, fig. 2.
1954 *Diplodonta rotundata* (MONTAGU) – CSEPREGHY-MEZNERICS, p. 83, pl. 11, fig. 13, 20.
1958 *Diplodonta rotundata rotundata* (MONTAGU) – SENES, p. 69, pl. 15, fig. 183.
1962 *Taras rotundatus* (MONTAGU) – HÖLZL, p. 72, pl. 4, fig. 1.
1964 *Taras rotundatus* (MONTAGU) – RAILENAU & NEGULESCU, p. 169, pl. 8, fig. 5.
1964 *Taras rotundatus* (MONTAGU) – ANDERSON, p. 160, pl. 5, fig. 47.
1969 *Taras rotundatus* (MONTAGU) – STEININGER, p. 42.
1971 *Taras rotundatus* (MONTAGU) – STEININGER et al., p. 438.
1973 *Taras rotundatus* (MONTAGU) – BALDI, p. 198, pl. 14, fig. 7–8.
1975 *Taras rotundatus* (MONTAGU) – STEININGER, p. 219.

Description: Shell small, about as high as long or longer, moderately inflated, suborbicular with straightened dorsal and concave antero-umbonal margin, subequilateral through weak posteroventral elongation; umbo moderately inflated, strongly prosogyrate; lunule rounded, strongly depressed; escutcheon narrow, posteriorly elongated. Shell exterior surface with irregular commarginal lirae, disturbed by growth constrictions. Hinge plate narrow, exposing two short but prominent cardinals radiating away from umbo; ligamental groove narrow. Height: 14.2 mm, length: 16 mm, convexity: 3.2 mm. Material: 1 specimen from Melk/Tunnel, 10 from Kendl and 8 from Plesching.

Remarks: BALDI (1973) pointed out that the only difference between Oligocene Aquitanian Basin *T. parilis* COSSMANN, 1921 and *D. rotundata* is the smaller size of the former and advocated their synonymy. Their reunion would imply an already Late Rupalian to Early Oligocene presence of *D. rotundata* in the Atlantic Region. This revision need however verification based on the reexamination of the French material.
Distribution: Late Rupelian to Early Chattian of Liguria (SACCO, 1901), Early Miocene to Recent of the Lusitanian Region (SENES, 1958); Miocene to Pliocene of the North Sea Basin (KAUTSKY, 1925; ANDERSON, 1964; MALATESTA, 1974) Egerian to Badenian of the Central and Western Paratethys (SENES, 1959; SCHAFFER, 1910; STUDENCKA et al., 1998); Konkian of the Eastern Paratethys (STUDENCKA et al., 1998).

Subclassis Heteroconchia HERTWIG, 1895

Ordo Veneroida ADAMS & ADAMS, 1856
Familia Astartidae D'ORBIGNY, 1844
Genus *Astarte* SOWERBY, 1816

Astarte henckeliusiana NYST, 1836
Pl. 8, Fig. 1–3

1836 *Astarte henckeliusiana* – NYST, p. 145, pl. 1, fig. 12.
1868 *Astarte Henckeliusiana* NYST – KOENEN, p. 250, pl. 29, fig. 7a–k.
1893 *Astarte Henckeli* NYST – KOENEN, p. 1214, pl. 83, fig. 12–14.
1995 *Astarte Henckeliusiana* NYST – GÜRS, p. 247, pl. 45, fig. 6–7.

Description: Small (<12 mm), moderately biconvex, length about equal to or slightly exceeding height, trigonally suboval in outline, weakly prosogyrate, umbonally pointed, umbonal angle 107°–120, anterodorsal margin slightly concave to straight, posterodorsal margin straight to slightly convex, other margins convex. Exterior with dense, concentric sculpture; umbonally up to height of 3 mm, regular, slightly projecting concentric lamellae appear, with a density of 7–9 lamellae per 1 mm, in later growth stage lamellae become irregular, commonly disturbed by growth constrictions. Escutcheon and lunula weakly differentiated, straightened and elongate. Right hinge with one massive, centrally positioned cardinal tooth and one elongate, sharp, anterior lateral tooth; left hinge with massive, prominent posterior cardinal tooth, weaker anterior cardinal tooth and elongate, sharp posterior lateral tooth. Margin crenulation not observed. Height: 8.9 mm, length: 8.9 mm, convexity: 3.0 mm.
Material: 29 moderately preserved specimens (1 articulated shells, 15 left and 13 right single valves) from Tiefenfucha (grayish, micaceous finesand).

Remarks: According to GÜRS (1995), *A. henckeliusiana* is restricted to the Rupelian of Northern Germany, Mainz Basin and Belgium. It differs from other members of its genus by typically densely arranged, fine concentric sculpture. *A. henckeliusiana* of HÖLZL (1962) from the Chattian of S Germany shows broadly developed concentric ridges in the umbonal region and does not correspond with the typical morphology of *A. henckeliusiana*. It is a possible misidentification of *A. kickxi* of the same author (HÖLZL, 1962).

A. u. ustjurtensis ILYNA and *A. u. mangyschlakensis* nov. sp. described by MERKLIN (1974) from the Rupelian of SW Kazakhstan are closely related to *A. henckeliusiana*. Beside generally corresponding shape and sculpture, most conspicuous correspondence is due to typical dense commarginal lamellae sculpturing the umbonal region (2 and 5 lamellae per 1 mm). The revision based on original material is needed. Recently POPOV et al. (1993) still referred *A. usturtensis* as a distinct species.

Specimens from Tiefenfucha differ from Rupelian *A. henckeliusiana* of N Germany (e.g., KOENEN, 1893) by an even more dense concentric sculpture in the umbonal region and a more weakly differentiated lunula. Nevertheless, due to coincidence of all other characters, their synonymy is postulated in the present study. With the exception of HÖLZL (1962), this is the only record of this species in the Egerian of the Central Paratethys

Distribution: Rupelian of Northern Germany, Mainz Basin and Belgium (GÜRS, 1995) and Egerian of Central Paratethys (the present study).

Astarte hoelzli nov. sp.

Pl. 8, Fig. 4–6

1952 *Astarte* (*Macroastarte*) n. subgen. n. sp. – HAGN & HÖLZL, p. 43
1969 *Astarte* nov. spec. – STEININGER, p. 42.
1975 *Astarte* (nov. sp.) – STEININGER, p. 219.
1998 *Astarte* nov. spec. – SCHULTZ, p. 34, pl. 9, fig. 10.

Holotypus: articulated specimen on pl. 8, fig. 4

Depository: Collection of the NHM Vienna – Coll. No. 2001z0031/0001.

Locus typicus: Sandpit Plesching near Linz.

Stratum typicum: Medium sand of the Linz Formation with *Miogypsina formosensis* (Early Egerian, latest Oligocene)

Derivatio nominis: In honour of Dr. Otto Hölzl, a german miner, autodidact, earth scientist, and discoverer of this species.

Diagnosis: A very large, subtrapezoidal *Astarte*, with shell strongly posteriorly elongated, inflated prosogyrate umbo and prominent posterodorsal diagonal ridge.

Differential diagnosis: It differs from closely related Rupelian North Sea Basin *A. dilatata* PHILIPPI, 1846 by its distinctly larger size and more elongated outline.

Description: Medium-sized, subquadrate to suboval shell, with length exceeding height, strongly posteriorly elongated, with umbo positioned in the anterior fifth of the shell length, umbonal region convex, posterior shell outline broadly oval but somewhat straightened posteriorly, ventrally convex anterior shell outline prominently concave in its anteriodorsal portion; convexity moderate, posterior diagonal ridge more or less prominent, running from umbo to the posteroventral shell margin; umbo inflated, prosogyrate; lunule and escutcheon deeply depressed, separated from the rest of the exterior shell by a prominent ledge-like flexure, with inner walls steep and somewhat concave, escutcheon shallower than lunule, lunule oval in outline, slightly anterodorsally elongated, escutcheon strongly anterodorsally elongated, stretching along the whole posterodorsal margin; commarginal ribs prominent, anterorly fairly regular, distally rather irregular, loosely spaced except in the umbonal region. Commissure finely crenulated, integripalliate, anisomyarian with almost two times larger posterior adductor scar, anterior scar depressed, posterior one slightly convex, shell interior deeply concave, divided by a diagonal flexure into larger posterodorsal and smaller anteroventral portion, umbonal cavity rather deep. Hinge with prominent, trigonal cardinals, radiating from umbo into posteroventral direction: on right valve 5b and 3a thin and sharp, 3b strong, wide and massive, on left valve 2 and 4b both prominent, rather massive and similarly wide; nymph rather massive, elongated posteriorly, posterior laterals elongated, on left valve PII and PIV prominent, on right valve PI reduced, PIII more or less prominent, anterior laterals shortened, on right valve AI and AIII as well as AII of the left valve prominent, on left valve ventrally to AII an additional, badly preserved lateral tooth seems to be present. Resulting hinge formula after Boyd & Newell in Moore (1969) is typical for *Astarte*:

```
RV    1 0 (1) -n 1 0 1 0 1-----1 0 1
LV 1 0 1-----n 0 1 0 1 0-(1) 0 1
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Dimensions of the holotype: height: 39.9 mm, length: 49.9 mm, convexity: 11.2 mm.
Material: 8 fairly well preserved specimens from Plesching.

Remarks: The presence of a new *Astarte* species in Plesching was already indicated by Steininger (1969, 1975). Schultz's (1998) illustration shows the holotype. The specimens from Plesching are identical with specimens from the Hölzl Collection at the Institute for Paleontology, Univ. Vienna, labelled as "*Astarte* nov. Subgenus nov.sp / Chatt-Aquitan "Thalberg-Schichten", Thalberggraben b. Traunstein / Obb." Although Hagn & Hölzl (1952) indicated the presence of that taxon in the Egerian Thalberg Formation of the Thalberggraben (Upper Bavaria) as *Astarte* (*Macroastarte*) nov. subgen. nov. sp., it remained taxonomically undefined to date.

A. hoelzli is morphologically closely related to *A. dilatata* Philippi, 1846. *A. dilatata* is, according to Gürs (1995), a earliest Rupelian index fossil in the Mainz and North Sea Basins, being unknown from other geographic regions. Up to now it was taken for the last member of an old (at least from the Paleocene) group of *Astarte tenera* Morris. Now *A. hoelzli* assumes this position.

Gürs (1995) doubted the generic affiliation of *A. dilatata* to *Astarte*, but failed to argument it. He also doubted its classification with the *Carinastarte* Hinsch (1952) inferred by latter author and followed by Neuffer (1973) and based on presence of the postero-dorsal edge. Gürs claimed, without providing more detailed arguments, that *Carinastarte* is restricted to one Late Miocene lineage initiated by *Astarte gracilis convexior*, being phylogenetically unrelated to *A. dilatata*. The same author, finaly concluded that the generic status of the *A. tenera* Group should be based on a comprehensive taxonomic revision of the whole Astartidae family. An independent subgeneric status for *A. hoelzeli* is indicated also by Hagn & Hölzl (1952) with the name *Macroastarte* (nomen nudum). S. Popov (Russian Acad. Sci., Moscow, pers. comm., 2000), after inspecting the Plesching material, doubted the generic affiliation of Plesching and Thalberg specimens to *Astarte*. The present authors, in respect to Moore (1969), are unable to extract any distinguishing feature on the generic or subgeneric level than distinctly larger size. Therefore, following Steininger (1975) and Schultz (1998) it will remain classified into *Astarte* in the present study.

Distribution: Egerian of Upper Bavaria and Upper Austria.

Familia Carditidae Fleming, 1828
Genus *Cyclocardia* Conrad, 1867

Cyclocardia orbicularis (Sowerby, 1825)
Pl. 8, Fig. 7–10

1825	*Venericardia orbicularis* – Sowerby, p. 507, pl. 490, fig. 4, 5.
1834–40	*Cardita tuberculata* – Münster in Goldfuss, p. 188, pl. 134, fig. 3.
1845	*Cardita Omaliana* – Nyst, p. 212, pl. 16, fig. 6.
1861–63	*Cardita Omaliana* Nyst – Sandberger, p. 338, pl. 24, fig. 7.
1907	*Venericardia tuberculata* (Münster) – Ravn, p. 266, pl. 1, fig. 19.
1944	*Cardita orbicularis* (Sowerby) – Heering, p. 25, pl. 6, fig. 1–8.
1945	*Cardita (Cyclocardita) orbicularis* (Sowerby) – Glibert, p. 123, pl. 4, fig. 14a–d.
1950	*Cardita (V.) orbicularis* (Sowerby) – Heering, p. 23.
1952	*Cardita (Pteromeris) orbicularis* (Sowerby) – Görges, p. 35.
1959	*Cardita (Cyclocardita) orbicularis* (Sowerby) – Anderson, p. 116, pl. 15, fig. 9a–d.
1962	*Cardita (Cyclocardita) orbicularis tuberculata* (Münster) – Hölzl, p. 66, pl. 2, fig. 9.
1973	*Cyclocardita (Cyclocardita) orbicularis tuberculata* (Münster) – Neuffer, p. 56, pl. 7, fig. 4–5.
1998	*Cardita (Cyclocardita) orbicularis* (Sowerby) – Schultz, p. 34, pl. 9, fig. 8.

Description: Shell small (max. height 16 mm, the most common height about 10 mm), suborbicular in outline, posteroventrally elongated, prosogyrate with origin of growth shifted strongly anteriorly, umbonal portion projecting over the hinge line, dorsal margin narrow convex, posterodorsal margin straightened to slightly convex, anterodorsal margin slightly concave, other margins convex, shell moderately biconvex with maximum convexity located in the dorsal shell third. Exterior sculptured by 20–22 ribs, about 3 times broader than interspaces, ornamented by subquadrangular nodes, up to 9 nodes within initial 2 mm of height, later on about 5 nodes per 1 mm present. Nodes well differentiated in the dorsal shell, about as high as long; in ventral shell they become commarginally elongated, somewhat indistinct, interfering with irregular, finely projecting growth lines. Interior margin crenulated. Height: 9.2 mm, length: 9.5 mm, convexity: 3.1 mm.
Material: 18 moderately preserved specimens (10 left and 8 right single valves) from Tiefenfucha.

Remarks: The specimens from Tiefenfucha, characterized by rows of densely spaced tubercles on rib tops which amalgamate and become less prominent distally, are most closely affiliated with Neuffer's (1973) Rupelian specimens from the Mainz Basin identified as *Cyclocardia (C.) orbicularis tuberculata*. *C. tuberculata*, as widely accepted in the literature (Görges, 1952, Anderson, 1959), is not a subspecies but a simple morphotype of *C. orbicularis*. Based on inspection of the original material, Neuffer (1973) found his specimen to be synonymous with *Cardita omaliana* of Sandberger (1863), with *C. orbicularis* of Görges (1952) and Anderson (1959) and with *C. orbicularis tuberculata* of Hölzl (1962). He stated, as also later advocated by Janssen (1979), that *C. omaliana* from the Mainz Basin is not related with the type of Nyst (1845).
Cyclocardita (Cyclocardita) orbicularis depressa (Koenen) as described by Neuffer (1973) and Hölzl (1962), characterized by 20–23 ribs, are also similar to specimens from Tiefenfucha.
Middle Miocene *C. scalaris* (Sowerby) of Studencka (1986) resembles *C. orbicularis* from Tiefenfucha, yet has a more trigonal outline, more regularly ordinated tubercles on rib

tops and a more massive hinge apparatus. *C. scalaris* originates in the Early Miocene (Glibert, 1945). *C. scalaris* of Wolff (1897) from the Early Egerian of Upper Bavaria is possibly affiliated with *C. orbicularis*, a revision should be however verified on original specimens. Its rib number is identical to those of the specimens from Tiefenfucha.
Distribution: Oligocene to Miocene of North Sea Basin (Anderson, 1959); Egerian of Western Paratethys (the present study); Beloglinian to Sakaraulian of the Eastern Paratethys (Popov et al., 1993).

Genus *Cardita* Bruguière, 1792

Cardita cf. *elongata* Bronn, 1831

Pl. 8, Fig. 11

1870	*Cardita elongata* Bronn – Hörnes, p. 276, pl. 36, fig. 9.
1899	*Cardita rufescens elongata* Bronn – Sacco, p. 6, pl. 1, fig. 10–11.
1907	*Cardita elongata* Bronn – Cerulli-Irelli, p. 132, pl. 12, fig. 15–16.
1909	*Cardita calyculata* Linné – Dollfus & Dautzenburg, p. 284 (*pars.*), pl. 20, fig. 10–15. [non Linné]
1911–12	*Cardita elongata* Bronn – Cossmann & Peyrot, p. 32, pl. 2, fig. 7–8, 13–14.
1934–36	*Cardita* cf. *elongata* Bronn – Friedberg, p. 89, pl. 16, fig. 1–3.
1956	*Beguina (Mytilicardia) elongata* (Bronn) – Sieber, p. 198, pl. 3, fig. 3.

Description: Shell small, modioliform with length distinctly exceeding height; strongly diagonally inflated with depressed, wing-like, distally pointed posterodorsal and anteroventral areas, umbo strongly prosogyrate, terminally positioned; radial ribs convex, differentiated into 6 weaker, suborthogonal, anteroventral ribs, and 6 prominent, diagonal ribs; rib interspaces somewhat narrower than ribs; rib surfaces bear massive transversal scaly bars. Height: 25 mm, length: 31.6 mm, convexity: 9 mm.
Material: 6 badly preserved specimens from Plesching.

Remarks: Sieber (1956) also considered *Cardita* cf. *elongata* of Friedberg (1934–36) as a synonym of *C. elongata*. In contrast Nevesskaja et al. (1993) placed it into synonymy of *Carditamera auingeri* (Hörnes, 1870). Should the identification from Plesching become confirmed through better preserved-specimens, this will be the stratigraphically oldest record of *C. elongata*. Another possible Late Oligocene *C. elongata* is *Cardita crassa* Lamarck of Venzo (1937, 1938). According to illustrated specimens from the Chattian of NE Italy, it is characterized by two main, massive diagonal ribs, a feature defined by Sieber (1956) as the best *C. elongata* distinguishing feature from *C. crassa*. The Recent occurrence of *C. elongata* in the Eastern Mediterranean, noted by Sieber (1956), was not confirmed by Poppe & Goto (1993). This is possibly a reference to a closely related form, *Cardita calyculata* Linné, which in the literature is commonly confused with *C. elongata* (Malatesta, 1974). A detailed reinvestigation of their affinity is needed.
Distribution: Badenian of Central Paratethys (Hörnes, 1870; Friedberg, 1934–36; Sieber, 1956; Studencka et al., 1998); Aquitanian to Serravallian of the Aquitanian Basin (Cossmann & Peyrot, 1911–12); Middle Miocene of the Loire Basin (Dollfus & Dautzenburg, 1911); Early Miocene to Pliocene of Italy (Sacco, 1899; Cerulli-Irelli, 1907)

Familia Crassatellidae Férussac, 1822
Genus *Eucrassatella* Iredale, 1924

Eucrassatella carcarensis (Michelotti, 1847)
Pl. 8, Fig. 12

1861 *Crassatella carcarensis* Michelotti – Michelotti, p. 66, pl. 7, fig. 13.
1897 *Crassatella* sp. – Penecke, p. 52, pl. 2, fig. 11.
1899 *Crassatella carcarensis* Michelotti – Sacco, p. 28, pl. 6, fig. 39–40, pl. 7, fig. 1–2.
1910 *Crassatella carcarensis* Michelotti – Kranz, p. 215, pl. 4, fig. 3, pl. 6, fig. 13–14.
1910 *Crassatella carcarensis* Michelotti – Kranz, p. 215, pl. 4, fig. 3, pl. 6, fig. 13–14.
1911 *Crassatella carcarensis* Michelotti – Boussac, p. 201, pl. 12, fig. 21–23.
1937 *Crassatella carcarensis* Michelotti – Venzo, p. 118, pl. 7, fig. 47–48, pl. 8, fig. 1.
1958 *Crassatella carcarensis* Michelotti – Senes, p. 63, pl. 14, fig. 157–165, pl. 15, fig. 168–169.

Description: Moderately inflated shell, small in size, with length exceeding height, inequilateral, distinctly posteriorly elongated, broadly subtrigonal in outline, with broadly convex ventral margin; umbo weakly inflated, orthogyrate, pointed dorsally; posterior diagonal ridge present (enhanced by a plastic deformation in specimen on pl. 8, fig. 12); shell exterior sculptured by slightly undulated, loosely spaced, projecting commarginal lirae, in ventral area, lirae become irregularly stacked, between those lirae finer growth lines can be intercalated. Height: 21.5 mm, length: 30.2 mm, convexity: 6.2 mm.
Material: 1 moderately preserved, articulated specimen from Plesching,

Remarks: Shape variation is high in this species, as apparent from the numerous subspecies names present in the literature (Sacco, 1899; Venzo, 1937). The paleogeographic and stratigraphic distribution of these subspecies, however, makes their subspecific status questionable. Penecke (1897) claimed that affiliation of his *Crassatella* sp. to *C. carcarensis* is uncertain because of its smaller size relative to the Italian type. The Plesching specimen is even smaller than specimen of Penecke, but its outline, convexity and sculptural characters underpin the identification.
Distribution: late Rupelian to Chattian of Liguria (Sacco, 1899) and NE Italy (Kranz, 1910; Venzo, 1937), Oligocene of SE France (Boussac, 1911) and Greece (Penecke, 1897), early Egerian of Slovakia (Senes, 1958) and Austria (the present study).

Familia Corbulidae Lamarck, 1818
Genus *Corbula* Bruguière, 1797
Subgenus *Caryocorbula* Gardner, 1926

Corbula (*Caryocorbula*) *carinata* (Dujardin, 1837)
Pl. 9, Fig. 1

1870 *Corbula carinata* (Dujardin) – Hörnes, p. 36, pl. 3, fig. 8.
1897 *Corbula carinata* (Dujardin) – Wolff, p. 259, pl. 22, fig. 11–12.
1901 *Corbula carinata* (Dujardin) – Sacco, p. 36, pl. 9, fig. 13.
1902 *Corbula carinata* (Dujardin) – Dollfus & Dautzenberg, p. 80, pl. 2, fig. 1–14.
1909 *Corbula carinata* (Dujardin) *hoernesi* – Benoist in Cossmann & Peyrot, p. 95, pl. 2, fig. 61–65.
1914 *Corbula carinata* (Dujardin) – Telegdi-Roth, p. 50.
1952 *Corbula carinata* (Dujardin) – Anic, p. 20, pl. 1, fig. 2.
1958 *Aloidis carinata* (Dujardin) – Erünal-Erentöz, p. 193, pl. 26, fig. 4–6.

1962 *Corbula carinata* (DUJARDIN) – HÖLZL, p. 121, pl. 7, fig. 14.
1973 *Corbula carinata* (DUJARDIN) – BALDI, p. 234, pl. 22, fig. 7.
1993 *Corbula (Caryocorbula) carinata* (DUJARDIN) – NEVESSKAJA et al., p. 331, pl. 77, fig. 7, 9–12.

Description: Shell thick, strongly inflated, small (maximal length 17 mm), suboval to subquadrate with length exceeding height; anterior outline portion oval, anteroventrally pointed, posterior outline portion angular, posteriorly and posterodorsally pointed; posterodorsal area depressed, wing-like, pointed in distal direction, adjoined in both valves to a very prominent posterior diagonal ridge; umbo highly inflated, prosogyrate. Shell exterior sculptured by coarse, trigonal, commarginal ribs, becoming distinctly finer only in posterodorsal area and in lunular depression; ribs, intercalated by fine growth lines, display radial microstriation; posterodorsal areas with median, channel-like, radial depression. Height: 9 mm, length: 13 mm, convexity: 3.9 mm.
Material: 3 fairly well preserved specimens from Melk/Tunnel.

Remarks: The record of *C. carinata* (DUJARDIN) in the Eurpean Boreal Region by HEERING (1950) is doubted by ANDERSON (1959). The latter author considered it as probable form of *C. basteroti* HÖRNES. SACCO (1901) defined numerous subspecies of *C. carinata*, based mainly on sculpture prominence. The only Oligocene form among them – *C. carinata oligolaevis* – differs from Melk specimens by being apparently weaker sculptured.
Distribution: Egerian (WOLFF, 1897; HÖLZL, 1962; ANIC, 1952; BALDI, 1973) and Badenian (HÖRNES, 1870; NEVESSKAJA et al., 1993; STUDENCKA et al., 1998) of Central Paratethys; Aquitanian to Serravallian ("Helvetien") of Aquitanian Basin (COSSMANN & PEYROT, 1909); Middle Miocene of Loire Basin (type occurrence, DOLLFUS & DAUTZENBERG, 1902), Aquitanian and Burdigalian of SE France (MONGIN, 1952); Middle to Late Miocene ("Helvetien" to "Tortonien") of S Turkey (ERÜNAL-ERENTÖZ, 1958); subspecies of SACCO except for the Oligocene are mainly from Burdigalian to Langhian ("Elveziano") and Tortonian of NW Italy.

Subgenus *Varicorbula* GRANT & GALE, 1931

Corbula (Varicorbula) gibba (OLIVI, 1792)
Pl. 9, Fig. 2

1860 *Corbula subpisum* ORBIGNY – DESHAYES, p. 216, pl. 12, fig. 21–28.
1863 *Corbula subpisiformis* – SANDBERGER, p. 288, pl. 22, fig. 14.
1870 *Corbula gibba* (OLIVI) – HÖRNES, p. 34, pl. 3, fig. 7.
1884 *Corbula gibba* (OLIVI) – SPEYER & KOENEN, pl. 2, fig. 4–7.
1901 *Corbula gibba* (OLIVI) et var. div. – SACCO, p. 34, pl. 9, fig. 1–11.
1902 *Corbula (Agina)gibba* (OLIVI) – DOLLFUS & DAUTZENBERG, p. 82, pl. 3, fig. 43–46.
1909 *Corbula gibba* (OLIVI) – COSSMANN & PEYROT, p. 176, pl. 2, fig. 2, pl. 5, fig. 22.
1909 *Corbula gibba* (OLIVI) – CERULLI-IRELLI, p. 164, pl. 26, fig. 13–19.
1914 *Corbula gibba* (OLIVI) – TELEGDI-ROTH, p. 50.
1921 *Corbula subpisum* ORBIGNY – COSSMANN, p. 25, pl. 1, fig. 81–82.
1934 *Corbula gibba* (OLIVI) – FRIEDBERG, p. 16, pl. 2, fig. 9–20.
1943 *Aloidis (Varicorbula) gibba* (OLIVI) – ALBRECH & VALK, p. 138, pl. 15, fig. 457–462.
1944 *Aloidis (Aloidis) gibba* (OLIVI) – HEERING, p. 45, pl. 6, fig. 16–17, pl. 7, fig. 22–28, pl. 10, fig. 9–15.
1945 *Aloidis (Varicorbula) gibba* (OLIVI) – GLIBERT, p. 215, pl. 3, fig. 10a–c.
1950 *Aloidis (Aloidis) gibba* (OLIVI) – HEERING, p. 45, pl. 5, fig. 101–102, 109.

1952 *Aloidis (Varicorbula) gibba* (Olivi) – Görges, p. 55.
1958 *Aloidis gibba* (Olivi) – Senes, p. 119.
1958 *Aloidis gibba* (Olivi) – Hölzl, p. 163.
1958 *Varicorbula gibba* (Olivi) – Sorgenfrei, p. 129, pl. 23, fig. 69.
1959 *Varicorbula gibba* (Olivi) – Anderson, p. 154, pl. 18, fig. 6.
1962 *Varicorbula gibba* (Olivi) – Hölzl, p. 122.
1963 *Varicorbula gibba* (Olivi) – Baldi, p. 83, pl. 4, fig. 15.
1964 *Corbula gibba* (Olivi) – Anderson, p. 187.
1964 *Corbula gibba* (Olivi) – Raileanu & Negulescu, p. 173, pl. 12, fig. 7.
1971 *Corbula (Varicorbula) gibba* (Olivi) – Steininger et al., p. 467.
1973 *Corbula gibba* (Olivi) – Baldi, p. 233, pl. 21, fig. 7.
1986 *Corbula (Varicorbula) gibba* (Olivi) – Studencka, p. 103, pl. 16, fig. 13–15, pl. 18, fig. 2, 3, 6, 8, 10.

Description: Shell thick, higher than long, inequivalve with right valve larger and more strongly inflated; outline subtrapezoidal with broadly convex ventral, narrowly convex dorsal, and slightly concave postero- and anterodorsal margins; umbo prosogyrate, highly inflated, incurved dorsally; left valve moderately, right valve highly inflated, convexity disturbed by prominent, irregular growth constrictions. Shell exterior surface sculptured by proximally fine, distally gradually coarser, irregular commarginal lamellae. Height: 8.1 mm, length: 8.1 mm, convexity: 3.5 mm.
Material: About 50 disarticulated, moderately preserved specimens from Tiefenfucha.

Remarks: Gürs (1995) advocated the separation of *C. subpisum* d'Orbigny (= *C. subpisiformis* Sandberger) from *C. gibba* based on its consistently smaller size and stronger radial ribbing. This contradicts, however, numerous former studies (Anderson, 1959) and is therefore not followed in the present study.
Distribution: Late Rupelian to Recent of the European Boreal Region (Anderson, 1959); Egerian to Badenian of Central and Western Paratethys (Baldi, 1973; Studencka et al., 1998), Early Oligocene to Middle Miocene of Eastern Paratethys (Nevesskaja et al., 1993), Recent of the Black Sea (Poppe & Goto, 1993); Early Miocene to Recent of Mediterranean and Lusitanian Atlantic (Sacco, 1901; Malatesta, 1974; Poppe & Goto, 1993); questionable reference is Late Eocene of the Paris Basin (Malatesta, 1974; Studencka, 1986; Nevesskaja et al., 1993).

Familia Cardiidae Lamarck, 1809

Genus *Acanthocardia* Gray, 1851

Acanthocardia bojorum (Wolff, 1897)

Pl. 9, Fig. 3–4

1897 *Cardium bojorum* – Wolff, p. 248, pl. 21, fig. 38
1899 *Cardium bojorum* Wolff – Böckh, p. 22, pl. 5, fig. 2
1973 *Cardium (Acanthocardium) bojorum* Wolff – Baldi, p. 208, pl. 16, fig. 2

Description: Shell small, moderately convex, suborbicular with length exceeding height. Exterior with 19 trigonal ribs which bear single fine riblets and transversal scales on crests. Scales with concave side turned dorsally; scale distances are about 0.5 mm for the most of the shell growth, in the very distal, mature shell portion they become more densely spaced. Rib interspaces flat-bottomed to V-shaped with fine mediate striae

developed. The flat-bottomed interspaces attain maximally 30% of the width of adjacent ribs. Fine growth lines present on ribs and interspaces, bent to concave bows on rib flanks, in part slightly projecting above the shiny valve surface. Height: 34 mm, length: 39 mm, convexity: 11 mm.
Material: 1 moderately preserved specimen from Zelking, 2 moderately to badly preserved specimens (1 right valve PVC-cast and one dorsal valve exterior) from Melk/Tunnel.

Remarks: Three Austrian specimens have a smaller rib number than the one noted by BALDI (1973) for his Hungarian specimens (22), but the identical sculpture with fine, characteristically densely spaced scales on sharply trigonal rib tops confirm their affiliation. Its Hungarian occurrence was originally detected by BÖCKH (1899) through a direct material comparison with the Bavarian specimens of WOLFF (1897). The holotype is a single right valve from Thalberggraben in E Bavaria illustrated by WOLFF (1897, pl. 21, fig. 38).
Cardium bojorum of SENES (1958) is, according to the available illustrations, a misidentification. Its ribs are not trigonal but flatly rounded, and the scales are apparently wider.
Distribution: Egerian of Western (Bavaria) and Central Paratethys (Austria, Hungary).

Familia Mactridae LAMARCK, 1809
Genus *Lutraria* LAMARCK, 1799
Subgenus *Lutraria* LAMARCK, 1799

Lutraria (Lutraria) sanna BASTEROT, 1825
Pl. 9, Fig. 5

1825 *Lutraria sanna* – BASTEROT, p. 94, pl. 7, fig. 13a–b.
1870 *Lutraria sanna* BASTEROT – HÖRNES, p. 56, pl. 5, fig. 5a–c.
1870 *Lutraria latissima* DESHAYES – HÖRNES, p. 57, pl. 6, fig. 1a–b. [*non* DESHAYES]
1901 *Psamobia oblonga mioparva* – SACCO, p. 31 (pars.), pl. 8, fig. 5.
1909 *Lutraria sanna* BASTEROT – COSMANN & PEYROT, p. 196, pl. 7, fig. 6–12.
1937 *Lutraria sanna* BASTEROT – VENZO, p. 77, pl. 4, fig. 16.
1958 *Lutraria latissima* DESHAYES – SENES, p. 103, pl. 18, fig. 244. [*non* DESHAYES]
1958 *Lutraria* cf. *sanna sanna* BASTEROT – SENES, p. 104, pl. 18, fig. 239.
1958 *Lutraria soror* MAYER-EYMAR – SENES, p. 105, pl. 18, fig. 245. [non MAYER.-EYMAR]
1963 *Lutraria* (*Lutraria*) *sanna* BASTEROT – STEININGER, p. 33, pl. 10, fig. 1.
1999 *Lutraria sanna* BASTEROT – PFISTER & WEGMÜLLER, p. 409, pl. 8, fig. 1–8, pl. 9, fig. 1–2, pl. 10, fig. 1–5, pl. 11, fig. 1–3. [*cum syn.*]

Description: Shell thin, low convex, posteriorly gaping, medium sized with length distinctly exceeding height, inequilateral, strongly posteriorly elongated; outline subelliptical, principally oval, but anterodorsally obliquely truncated; umbonal region more or less dorsally pointed, umbo slightly incurved, weakly prosogyrate; shell exterior sculptured by weak, irregularly undulated commarginal lirae. Height: 34.5 mm, length: ~57 mm, convexity: 4.5 mm.
Material: 3 specimens from Neuwinden.

Remarks: The variation pattern of *Lutraria sanna* is described in detail by PFISTER & WEGMÜLLER (1999). The same authors considered in the different species from the Late Oligocene of Kovacov in Slovakia (SENES, 1959) as being erroneous identifications of *L. sanna*. In contrast, the revision of the Italian Oligocene *Lutraria declivis* MICHELOTTI

(1861, p. 57, pl. 6, fig. 1) cannot be followed in the present study because already Sacco (1901) classified it into the genus *Panopea*. Senes (1958) reunited specimen on plate 8, figure 5 designated by Sacco (1901) as *Psammobia oblonga mioparva* with *L. sanna*.
Distribution: Early Egerian (Senes, 1958; the present study), Eggenburgian – Ottnangian (Steininger, 1963; Steininger et al. 1971; Hölzl, 1958) of Central and Western Paratethys, Burdigalian ("OMM") of Switzerland Molasse (Pfister & Wegmüller, 1999); Aquitanian to Burdigalian of Aquitanian Basin (Cossmann & Peyrot, 1909), Middle Miocene of Loire Basin (Dollfus & Dautzenberg, 1909); Tortonian? of Portugal (Dollfus et al., 1903–04); Chattian (Venzo, 1937) and Miocene (Sacco, 1901; Oppenheim, 1903; Stefanini, 1916) of N Italy.

Familia Tellinidae de Blainville, 1814
Genus *Peronidia* Dall, 1900

Peronidia nysti (Deshayes, 1857)
Pl. 9, Fig. 6

1857	*Tellina Nystii* Deshayes – Deshayes, p. 336, pl. 25, fig. 5, 6.
1861–3	*Tellina Nystii* Deshayes– Sandberger, p. 294, pl. 23, fig. 6.
1884	*Tellina Nysti* Deshayes – Speyer & Koenen, pl. 4, fig. 15.
1897	*Tellina Nystii* Deshayes – Wolff, p. 254, pl. 23, fig. 11–12.
1944	*Tellina nysti* Deshayes – Heering, p. 40, pl. 4, fig. 16–18.
1952	*Angulus (Peronidia) nysti* (Deshayes) – Görges, p. 51.
1952	*Tellina nysti* Deshayes – Anic, p. 21, pl. 1, fig. 10.
1957	*Angulus* (*Homala*) *nysti nysti* (Deshayes) – Glibert, p. 43, pl. 4, fig. 1.
1958	*Angulus (Peronidia) nysti* (Deshayes) – Hölzl, p. 151, pl. 15, fig. 2.
1958	*Angulus (Peronidia) nysti pseudofalax* – Hölzl, p. 153, pl. 15, fig. 3.
1958	*Angulus (Peronidia) nysti* (Deshayes) – Senes, p. 111, pl. 17, fig. 219.
1958	*Angulus (Peronidia) nysti regularis* – Senes, p. 111, pl. 17, fig. 217.
1962	*Angulus (Peronidia) Nysti* (Deshayes) – Hölzl, p. 111, pl. 6, fig. 15–18.
1963	*Angulus (Peronidia) nysti subfallax* – Baldi, p. 82, pl. 4, fig. 9–12.
1971	*Angulus (Peronidia) nysti pseudofalax* Hölzl – Steininger et al., p. 453, pl. 46, fig. 2.
1973	*Angulus (Peronidia) nysti* Deshayes – Baldi, p. 225, pl. 21, fig. 1–2, 4.
1995	*Peronidia nysti* (Deshayes) – Gürs, p. 256, pl. 48, fig. 8.

Description: Shell small, low convex, with length exceeding height, suboval, inequilateral, slightly elongated anteriorly, rounded anteriorly, pointed posteriorly and dorsally; umbonal region broadly trigonal, umbo weakly inflated, slightly opisthogyrate; posterior, diagonal ridge weak, posterodorsal area narrow, weakly depressed, pointed wing-like distally, posterior shell area bent slightly rightwards; exterior surface sculptured by fine, microscopically projecting commarginal lirae. Height: 36 mm, length: 22 mm, convexity: 3 mm.
Material: 1 right valve from Tiefenfucha.

Remarks: This species is characterized by a strongly variable shell outline, resulting in the designation of several subspecies in the Oligocene and in the Early Miocene of the Paratethys. Baldi (1973) reunited those subspecies, and this is followed also in the present study. *P. fallax* (Lehman), a Miocene North Sea Basin successor of *P. nysti* differs likely only by smaller size and less symmetrical outline.
Distribution: Late Rupelian of the Paris Basin (type occurrence; Deshayes, 1857; Gürs, 1995) and Mainz Basin (Sandberger, 1961/63; Gürs, 1995), Chattian of the North Sea

Basin (GÖRGES, 1952; HEERING, 1944; GLIBERT, 1957); Egerian and Eggenburgian of Central and Western Paratethys (WOLFF, 1897; ANIC, 1952; HÖLZL, 1958, 1962; STEININGER et al., 1971; BALDI, 1973; SENES, 1958).

Peronidia postera (BEYRICH IN KOENEN, 1868)
Pl. 9, Fig. 7

1868 *Tellina postera* – BEYRICH in KOENEN, p. 259.
1884 *Tellina postera* BEYRICH – SPEYER & KOENEN, pl. 31, fig. 8.
1925 *Tellina postera* BEYRICH. – KAUTSKY, p. 43, pl. 4, fig. 14.
1945 *Angulus posterus* (BEYRICH) – GLIBERT, p. 205, pl. 12, fig. 8.
1952 *Moerella postera* (BEYRICH) – GÖRGES, p. 51, pl. 1, fig. 25–27.
1958 *Angulus posterus* (BEYRICH) – SENES, p. 113.
1962 *Angulus posterus* (BEYRICH) – HÖLZL, p. 109, pl. 6, fig. 21–22.
1973 *Angulus (Peronidia) posterus* (BEYRICH) – BALDI, p. 226, pl. 21, fig. 3.

Description: Shell small, low convex, suboval to subtrigonal, with height exceeding length, pointed dorsally and posteroventrally, strongly inequilateral, anteriorly elongated, ventral and anterodorsal margin straightened, parallel, bounded through convex anterior margin, posterior margin narrowly convex, shifted ventrally, posteroventral margin straightened, oblique, dorsal region broadly convex, with umbo pointed dorsally; exterior surface sculptured by commarginal lirae. Height: 14 mm, length: 25 mm, convexity: 2.2 mm.
Material: One badly preserved right valve from Kendl.

Remarks: In contrast to *P. nysti* it is compressed, strongly anteriorly elongated, and characterized by steeper and longer posterodorsal margin.
Distribution: Early Egerian of Bavaria (HÖLZL, 1962), Austria (the present work), Slovakia (SENES, 1958), and Hungary (BALDI, 1973); late Early Oligocene ("Mittel Oligozän"; KOENEN, 1884), Late Oligocene (SPEYER & KOENEN, 1884; GÖRGES, 1952), and Miocene (KAUTSKY, 1925; GLIBERT, 1945) of the North Sea Basin.

Genus *Macoma* LEACH, 1819
Subgenus *Psammacoma* DALL, 1900

Macoma (Psammacoma) elliptica (BROCCHI, 1814)
Pl. 9, Fig. 8

1814 *Tellina elliptica* – BROCCHI, p. 513, pl. 12, fig. 7.
1875 *Tellina ottnangensis* – HÖRNES, p. 370, pl. 13, fig. 1–4.
1901 *Macomopsis elliptica* (BROCCHI) – SACCO, p. 107, pl. 22, fig. 36–40.
1904 *Tellina (Macoma) elliptica* (BROCCHI) – DOLLFUS & DAUTZENBERG, p. 145, pl. 10, fig. 12–13 [*pars.*, *non* fig 10, 11]
1910 *Macoma elliptica* (BROCCHI.) – COSSMANN & PEYROT, p. 281, pl. 9, fig. 33–35.
1945 *Macoma elliptica* (BROCCHI)– GLIBERT, p. 204, pl. 12, fig. 7.
1950 *Macoma elliptica* (BROCCHI)– HEERING, p. 40, pl. 8, fig. 189–190.
1964 *Macoma elliptica* (BROCCHI)– ANDERSON, p. 174, pl. 8, fig. 62.
1973 *Macoma elliptica* (BROCCHI)– BALDI, p. 223, pl. 20, fig. 5–6, 8.

Description: Shell thin and small, flatly convex, subelliptical and inequilateral with oval, strongly elongated anterior portion and obliquely truncated, posteroventrally pointing

posterior portion; umbo weakly inflated, prosogyrate, slightly dorsally pointing; posterior diagonal ridge subparalleling the posterodorsal margin, posterodorsal area very narrow, convex, dipping steeply outwards, diagonal ridge adjoining central shell portion marked by a shallow but well-differentiated, gradually broadening depression in right valve; shell exterior surface with very fine commarginal lirae and common commarginal constrictions. Height: 10.8 mm, length: 15 mm, convexity: 2 mm.
Material: 1 moderately preserved right valve from Tiefenfucha.

Remarks: ANDERSON (1964) investigating the specimens described by DOLLFUS & DAUTZENBERG (1904) rejected the affiliation of the right valve illustrated on pl. 10, fig. 10 and 11 with *M. elliptica*. He classified it into genus *Moerella* but failed to argument it.
Distribution: Egerian (BALDI, 1973; the present study) to Badenian (STUDENCKA et al., 1998) of the Central Paratethys; Miocene of Mediterranean (SACCO, 1901), Lusitanian Atlantic (COSSMANN & PEYROT, 1910; DOLLFUS & DAUTZENBERG, 1904) and North Sea Basin (GLIBERT, 1945; HEERING, 1950; ANDERSON, 1964); notations on its presence in the Late Rupelian to Chattian of Liguria (SACCO, 1901) and Hungary (BALDI, 1973) are additionally available.

Familia Psammobiidae FLEMING, 1828
Genus *Gari* SCHUMACHER, 1817

Gari protracta (MAYER-EYMAR, 1893)
Pl. 9, Fig. 9

1897 *Psammobia protracta* MAYER-EYMAR – WOLFF, p. 254, pl. 23, fig. 3–5.
1901 *Psammobia protracta* MAYER-EYMAR – SACCO, p. 11, pl. 2, fig. 7.
1952 *Psammobia aquitanica* MAYER-EYMAR – ANIC, p. 22, pl. 1, fig. 5–7. [non MAYER, 1858]
1958 *Psammobia protracta* MAYER-EYMAR – SENES, p. 106, pl. 18, fig. 240–243.
1973 *Gari protracta* (MAYER-EYMAR) – BALDI, p. 221, pl. 20, fig. 1, 4.

Description: Shell thin, subelliptical to subquadrangular, anterior outline portion principally oval but with truncated anterior margin, posterodorsal margin slightly concave adjacent to the umbonal region, posterior outline portion subquadrangular, pointed posteroventrally and posterodorsally, posterior margin straightened, dipping steeply behind; posterior diagonal ridge prominent, adjoining the broad, trigonal, slightly flattened posterodorsal area; umbo less inflated, opisthogyrate; shell exterior shiny, sculptured by irregular, fine to fairly coarse, weakly projecting commarginal lirae. Height: 9.8 mm, length: 20 mm, convexity: 1.2 mm.
Material: 1 moderately preserved left valve from Melk/Tunnel.

Remarks: It is an ancestor of the Early Miocene *G. labordei* (BASTEROT) differing from it exclusively by its distinctly smaller adult size. As pointed out by BALDI (1973) *G. aquitanica* is stronger posteriorly elongated than *G. protracta*.
Distribution: Late Rupelian to Chattian of Liguria (SACCO, 1901); early Egerian of Central and Western Paratethys (WOLFF, 1897; ANIC, 1952; SENES, 1958; BALDI, 1973)

Familia Dreissenidae Gray, 1840
Genus *Mytilopsis* Conrad, 1858

Mytilopsis basteroti (Deshayes, 1836)
Pl. 9, Fig. 10

1863 *Tichogonia brardii* (Brongniart) – Sandberger, p. 357, pl. 29, fig. 7.
1870 *Congeria Basteroti* (Deshayes) – Hörnes, p. 370, pl. 49, fig. 5–6.
1897 *Dreissensia Basteroti* (Deshayes) – Wolff, p. 234, pl. 20, fig. 11–12.
1912 *Congeria Basteroti* (Deshayes) – Cossmann & Peyrot, p. 41, pl. 11, fig. 24–26, pl. 13, fig. 14.
1950 *Congeria basteroti* (Deshayes) – Csepreghy-Meznerics, p. 357, pl. 29, fig. 7.
1952 *Congeria basteroti* (Deshayes) – Anic, p. 76, pl. 5, fig. 5–6.
1958 *Congeria basteroti* (Deshayes) – Senes, p. 30, pl. 5, fig. 6.
1972 *Congeria basteroti* (Deshayes) – Moisescu, p. 40, pl. 15, fig. 9–11.
1973 *Congeria basteroti* (Deshayes) – Baldi, p. 197.
1990 *Mytilopsis basteroti* (Deshayes) – Nuttall, p. 724, pl. 5, fig. 8–10.

Description: Shell thin, small to very small, mytiliform, compressed, strongly elongated posteroventrally, pointed anteriorly, narrowly rounded anteroventrally, highly inflated in the central region with steep anteroventral marginal region and steep to slightly flattened posterodorsal region; umbo positioned terminally, umbonal region incurved anteroventrally, lunular region large, oval, elongated, flattened, delimited by a narrow depression; surface shiny, sculptured by fine, irregular commarginal lirae, disturbed by growth constricions; in many specimens original colour pattern preserved, made up of parallel dark brown bands being commarginal in the ventral and central exterior surface region, divaricating in the dorsal region, central band portions gradually obscuring distally.
Height: 6.5 mm, length: 14.8 mm, convexity: 3 mm.
Material: numerous well- to badly preserved specimens from Melk/Tunnel.

Remarks: Nuttall (1990) provided a detailed systematic revision of Dreissenidae. He redefined *Congeria* Partsch 1835 as a short-lived Late Miocene offshoot of *Mytilopsis*, characterized by large, heavy and often quadrate species, restricted paleogeographically to Central Paratethys. Based on its typical mytiliform shape, paleogeographic and stratigraphic distribution, Nuttall (1990) placed the present species into the long-lived (Eocene to Recent), cosmopolitan genus *Mytilopsis*.
Distribution: Aquitanian to Burdigalian of the Aquitanian Basin (Cossmann & Peyrot, 1912); Early Miocene of SE Turkey (Stchépinsky, 1946); Chattian of the Mainz Basin (Sandberger, 1863); Egerian to Badenian (Wolff, 1897, Anic, 1952; Baldi, 1973, Senes, 1958; Tejkal et al. 1967; Studencka et al., 1998) of the Central and Western Paratethys; Late Solenovian of the Eastern Paratethys (Popov et al., 1993).

Familia Arcticidae Newton, 1891
Genus *Arctica* Schumacher, 1817

Arctica rotundata (Braun in Agassiz, 1845)
Pl. 9, Fig. 11

1861–63 *Cyprina rotundata* (Braun) – Sandberger, p. 313, pl. 25, fig. 1.
1884 *Cyprina rotundata* (Braun) – Speyer & Koenen, pl. 9, fig. 2–4, pl. 10, fig. 1–8, pl. 11, fig. 1–5, pl. 12, fig. 1–4.
1897 *Cyprina rotundata* (Braun) – Wolff, p. 251, pl. 23, fig. 1, 6.

1899 *Cyprina rotundata* (Braun) – Böckh, p. 24, pl. 8, fig. 1.
1914 *Cyprina rotundata* (Braun) – Telegdi-Roth, p. 55.
1936 *Cyprina rotundata* (Braun) – Noszky, p. 88.
1937 *Cyprina rotundata* (Braun) – Venzo, p. 98, pl. 6, fig. 14–17.
1943 *Cyprina rotundata* (Braun) – Albrecht & Valk, p. 127, pl. 13.
1952 *Cyprina rotundata* (Braun) – Görges, p. 38.
1952 *Cyprina rotundata* (Braun) – Anic, p. 25, pl. 3, fig. 4–5.
1957 *Cyprina rotundata* (Braun) – Glibert, p. 31, pl. 6, fig. 18.
1958 *Cyprina rotundata* (Braun) – Senes, p. 67.
1962 *Cyprina islandica rotundata* (Braun) – Hölzl, p. 68, pl. 3, fig. 1–2.
1963 *Cyprina islandica rotundata* (Braun) – Baldi, p. 78, pl. 2, fig. 12 , pl. 3, fig. 5.
1969 *Cyprina islandica rotundata* (Braun) – Steininger, p. 42, pl. 3, fig. 3.
1973 *Cyprina islandica rotundata* (Braun) – Baldi, p. 196, pl. 10, fig. 1–2.
1975 *Cyprina islandica rotundata* (Braun) – Baldi & Steininger, p. 219, pl. 2, fig. 1, 2.
1993 *Arctica rotundata* (Braun) – Nevesskaja et al., p. 140, pl. 30, fig. 30, 31; pl. 31, fig. 1–3.
1995 *Arctica rotundata* (Braun) – Gürs, p. 262, pl. 49, fig. 1–3.

Description: Shells thick, large to extremely large, moderately inflated, suboval with prosogyrate, rounded umbonal region and concave anterodorsal region, posterior margin slightly truncated. Height: 62.5 mm, length: 68 mm, convexity: 14 mm.
Material: 4 specimens from Plesching and 5 from Tiefenfucha, preservation moderate.

Remarks: According to Baldi (1973) *A. rotundata* is a cosmopolitan European Oligocene species. Yet, Nevesskaja et al. (1993) recently reinvestigated *A. girondica* (Cossmann & Peyrot, 1912) of Haratishvili (1952) from the Sakaraulian of Georgia and inferred its affiliation with *A. rotundata*. Thereafter also Gürs (1995) claimed the presence of the latter species in the North Sea Basin Early Miocene. Unfortunatly he did not provide any closer information on this quotation. Apparently the taxonomy of European *Arctica* is still incompletely understood. Gürs (1995), following Glibert (1945), pointed out that *A. rotundata* differs importantly from Pliocene to Recent *A. islandica* (Linné) by thicker valve and different outline and hinge characters. In consequence to that observation he advocated their taxonomic separation on the species level. Nevesskaja et al. (1993) viewed *A. rotundata* likely as a distinct species. In contrast, Anderson (1959), considering the high variability of hinge morphology in Recent *Arctica* population, inferred that *A. rotundata*, *A. girondica* and *A. islandica* are subspecies or even morphotypes of one and the same species. A revision should bring more light into this discussion.
Distribution: Late Rupelian of the Mainz Basin (type occurrence; Gürs, 1995); Late Rupelian to Chattian of the North Sea Basin (Anderson, 1959); Egerian of the Central and Western Paratethys (Hölzl, 1962; Baldi, 1973); Oligocene (Merklin, 1974) to Early Miocene (Nevesskaja et al., 1993) of the Eastern Paratethys; Chattian of NE Italy (Venzo, 1937); occurrence in the Rupelian of the Paris Basin is additionally noted by Gürs (1995).

Familia Glossidae Gray, 1847
Genus *Glossus* Poli, 1795

Glossus subtransversus (d'Orbigny, 1852)
Pl. 10, Fig. 1–2

1863 *Isocardia subtransversa* (d'Orbigny) – Sandberger, p. 316, pl. 25, fig. 3.
1870 *Isocardia subtransversa* (d'Orbigny) – Hörnes, p. 166, pl. 20, fig. 3.

1884 *Isocardia subtransversa* (d'Orbigny) – Speyer & Koenen, pl. 6, fig. 7–12, pl. 7, fig. 1–3.
1900 *Isocardia* cf. *subtransversa abbreviata* – Sacco, p. 4, pl. 1, fig. 6.
1914 *Isocardia subtransversa* (d'Orbigny) – Telegdi-Roth, p. 56.
1936 *Isocardia subtransversa* (d'Orbigny) – Noszky, p. 89.
1937 *Isocardia subtransversa* (d'Orbigny) – Venzo, p. 6, pl. 6, fig. 20–26.
1952 *Isocardia subtransversa* (d'Orbigny) – Görges, p. 37.
1957 *Isocardia subtransversa* (d'Orbigny) – Glibert, p. 31, pl. 6, fig. 11.
1958 *Isocardia subtransversa* (d'Orbigny) – Hölzl, p. 69, pl. 5, fig. 1.
1962 *Isocardia subtransversa* (d'Orbigny) – Hölzl, p. 70, pl. 2, fig. 12–13.
1963 *Isocardia subtransversa abbreviata* Sacco – Baldi, p. 78, pl. 3, fig. 6–7.
1969 *Isocardia subtransversa* (d'Orbigny) – Steininger, p. 42, pl. 4, fig. 3.
1973 *Isocardia subtransversa abbreviata* Sacco – Baldi, p. 196, pl. 9, fig. 4.
1975 *Isocardia subtransversa* (d'Orbigny) – Steininger, p. 219.
1995 *Glossus subtransversus* (d'Orbigny) – Görs, p. 265, pl. 46, fig. 7, pl. 50, fig. 4, 5..

Description: Shell medium in size, highly convex, distinctly inequilateral, with gyrate, anteriorly pointed umbonal region, shifted into very anterior shell portion; about as high as long or longer, outline suborbicular to subquadrate with dorsal and anterior margin convex, anterodorsal margin concave, posterodorsal margin straightened in angular contact with the equally straightened, steeply posteriorly dipping posterior margin, ventral margin broadly convex; posterior, diagonal ridge prominent, adjoining broad, elongated, slightly depressed and wing-like posterodorsal area; lunular region deeply depressed; umbonal region highly inflated. Height: 44.5 mm, length: 46 mm, convexity: 8.3 mm. Material: 10 badly preserved specimens, mainly steinkerns from Plesching.

Remarks: This cosmopolitan Oligocene species become diminished toward the end of the Oligocene. Still the Early Eggenburgian beds of the Central Paratethys bear not only the last known *G. subtransversus* s.s., but moreover even three closely related forms: *G. s. major* (Hölzl), *G. werneri* (Hörnes) and *G. miotransversus* (Schaffer). Their separation from *G. subtransversus*, based on differences in hinge morphology is advocated by Steininger et al. (1971). Distribution: Late Rupelian to Early Chattian of Liguria (Sacco, 1900), Chattian of NE Italy (Venzo, 1937); Late Rupelian of the Mainz Basin (Görs, 1995), Rupelian (Nyst, 1836; Görs, 1996) and Chattian (Görges, 1952) of the North Sea Basin; Rupelian of the Paris Basin (Mayer, 1891); Egerian (Baldi, 1973, Hölzl, 1962) and Eggenburgian (Hölzl, 1958) of the Central and Western Paratethys.

Familia Corbiculidae Gray, 1847

Genus *Polymesoda* Rafinesque, 1828

Polymesoda subarata sowerbii (Basterot, 1825)

Pl. 10, Fig. 3

1897 *Cyrena semistriata* Deshayes – Wolff, p. 249, pl. 22, fig. 17–23.
1899 *Cyrena semistriata* Deshayes – Böckh, p. 25, pl. 7, fig. 4; pl. 8, fig. 2.
1900 *Cyrena sirena* Brongn. et var div. – Sacco, p. 61, pl. 14, fig. 12–24.
1910 *Cyrena Brongniarti* Basteroti – Cossmann & Peyrot, p. 449, pl. 19, fig. 32–34.
1943 *Cyrena semistriata* Deshayes – Albrecht & Valk, p. 126, pl. 11, fig. 398–400.
1952 *Cyrena semistriata* Deshayes – Anic, p. 25, pl. 2, fig. 7–8, pl. 3, fig. 1–3.
1957 *Polymesoda brongniarti* (Basteroti) et var. div. – Hölzl, p. 20–24, pl. 2, fig. 8, pl. 3, fig. 1–5, pl. 4, fig. 1–5.

1957 *Polymesoda convexa* (BRONGNIART) et var. div. – HÖLZL, p. 10–20, pl. 1, fig. 10, pl. 2, fig. 1–7, pl. 4, fig. 6.
1962 *Polymesoda convexa* (BRONGNIART) – HÖLZL, p. 68.
1973 *Polymesoda convexa* (BRONGNIART) – BALDI, p. 193, pl. 9, fig. 1–2, pl. 51, fig. 11.
1973 *Polymesoda convexa* brogniarti (BASTEROT) – BALDI, p. 195, pl. 9, fig. 3, 5.
1995 *Polymesoda subarata sowerbii* (BASTEROT) – KADOLSKY, p. 30, pl. 4, fig. 34–37.

Description: Shells moderately thick, moderately inflated, small to medium in size, subtrapezoidal with narrowly convex dorsal region, slightly concave to obliquely straightened antero- and posteroventral margins, anterior and posterior margins narrowly, ventral margin broadly convex; inequilateral, elongated posteriorly; umbo prosogyrate, highly inflated, incurved dorsally, strongly projecting over the hinge line; dorsal shell region arched, ventral region flattened, antero- and posterodorsal shell regions highly orthogonally raised umbonally, lowering and flattening laterally, concave in cross section; exterior surface sculptured centrally by gradually coarsening, slightly projecting commarginal lamellae, that become thinner and finer in the postero- and anterodorsal marginal area. Height: 18 mm, length: 22 mm, convexity: 4.5 mm.
Material: 3 specimens from Melk/Tunnel, 10 from Zelking, preservation fairly well to moderate.

Remarks: A detailed taxonomic revision of the present species is carried out by KADOLSKY (1975; 1995). He verified the priority of the name *Venulites subaratus* SCHLOTHEIM 1820 instead of the formerly used name "*Cytherea*?" *convexa* BRONGNIART in CUVIER & BRONGNIART, 1822. Furthermore he substituted the name *Cyrena Brogniartii* BASTEROT 1825 with the next available name *Cyrena Sowerbii* BASTEROT 1825. The former name was originally defined as the substitution for the name "*Mactra*?" *sirena* BRONGNIART 1823, designating an unrelated species from the Eocene of NE Italy.
Polymesoda subarata and *Polymesoda sowerbii* are defined by KADOLSKY (1995), following GLIBERT & VAN DE POEL (1966), as chrono-subspecies of a single species. Thus, *Polymesoda subarata sowerbii* represents a subspecies restricted to Chattian – Burdigalian. *P. subarata convexa* is restricted to latest Oligocene – earliest Oligocene.
Distribution: Chattian of the Mainz Basin (KADOLSKY, 1995) and of the North Sea Basin (ALBRECHT & VALK, 1943); Chattian of Liguria (SACCO, 1900); Aquitanian to Burdigalian of the Aquitanian Basin (COSSMANN & PEYROT, 1910); Kalmykian – ?Karadzhalgian (POPOV et al., 1993) of the Eastern Paratethys; Egerian to Eggenburgian of the Central and Western Paratethys (HÖLZL, 1957; BALDI, 1973).

Familia Veneridae RAFINESQUE, 1815
Genus *Cordiopsis* COSSMANN, 1910

Cordiopsis incrassata (NYST, 1836)
Pl. 10, Fig. 4

1817 *Venus incrassata* – SOWERBY, pl. 155, fig. 1–2.
1836 *Cyprina incrassata* – NYST, p. 147, pl. 2, fig. 16.
1863 *Cytherea incrassata* (SOWERBY) et var. div. – SANDBERGER, p. 300, pl. 23, fig. 11, pl. 24, fig. 1–3.
1870 *Cytherea incrassata transilvanica* – HOFMANN, p. 22, pl. 3, fig. 2.
1884 *Cytherea incrassata* (SOWERBY) et var. div. – SPEYER & KOENEN, pl. 5, fig. 14–18, pl. 6, fig. 1–3.
1894 *Cytherea incrassata* (SOWERBY) – KOENEN, p. 1259, pl. 86, fig. 12–13, pl. 87, fig. 1–3.

1897 *Cytherea incrassata* (Sowerby) – Wolff, p. 252, pl. 23, fig. 13–14.
1899 *Cytherea incrassata* (Sowerby) – Böckh, p. 26, pl. 7, fig. 3.
1900 *Amiantis* cf. *incrassata* (Sowerby) et var. div. – Sacco, p. 21, pl. 4, fig. 31–33.
1900 *Meretrix* (*Amiantis*) *incrassata* (Sowerby) – Rovereto, p. 100, pl. 7, fig. 5.
1910 *Meretrix* cf. *incrassata* (Sowerby) – Cossmann & Peyrot, p. 393, pl. 17, fig. 5–7, pl. 18, fig. 14–16, 30.
1910 *Cytherea incrassata* (Sowerby) – Kranz, p. 219, fig. 2.
1914 *Meretrix incrassata* Sowerby – Telegdi-Roth, p. 53, pl. 5, fig. 10–11.
1936 *Meretrix incrassata* (Sowerby) – Noszky, p. 89.
1937 *Meretrix incrassata* (Sowerby) – Venzo, p. 92, pl. 5, fig. 21.
1939 *Cytherea incrassata* (Sowerby) et var. div. – Noszky, p. 69.
1943 *Pitaria incrassata* (Sowerby) – Albrecht & Valk, p. 133, pl. 14, fig. 443–445.
1952 *Pitaria incrassata suborbicularis* (Goldfuss) – Görges, p. 44.
1955 *Meretrix incrassata* (Sowerby) – Accordi, p. 43.
1957 *Cytherea incrassata* (Sowerby) – Glibert, p. 38, pl. 3, fig. 13.
1958 *Pitaria incrassata* (Sowerby) – Hölzl, p. 107, pl. 10, fig. 1.
1958 *Pitaria incrassata* (Sowerby) et var. div. – Senes, p. 85–86, pl. 16, fig. 201–202, 205–206.
1959 *Pitar polytropa* et var. div. – Anderson, p. 135, pl. 17, fig. 1.
1959 *Pitar incrassata incrassata* (Sowerby) – Vanova, p. 167, pl. 23, fig. 34.
1962 *Pitar polytropa* Anderson – Hölzl, p. 95, pl. 5, fig. 2–3.
1962 *Pitar polytropa suborbicularis* (Goldfuss) – Hölzl, p. 95, pl. 5, fig. 5.
1962 *Pitar polytropa praesuborbicularis* – Hölzl, p. 96, pl. 5, fig. 4.
1963 *Pitar polytropa* Anderson – Baldi, p. 81, pl. 3, fig. 9–11.
1971 *Pitar* (*Cordiopsis*) *incrassata* (Sowerby) – Steininger et al., p. 464, pl. 40, fig. 2, pl. 44A, fig. 2–5, pl. 44B, fig. 3–4.
1973 *Pitar* (*Cordiopsis*) *polytropa* Anderson – Baldi, p. 213, pl. 17, fig. 1–2.
1974 *Cordiopsis westendorpi* (Nyst) et div. subsp. – Merklin, p. 111–112, pl. 35, fig. 10–15, pl. 36, fig. 1–7. [*non* Nyst]
1993 *Cordiopsis westendorpi* (Nyst) et div. subsp. – Popov et al., p. 113–114. [*non* Nyst]
1973 *Cordiopsis polytropa* (Anderson) – Baldi, p. 213, pl. 17, fig. 1–2.
1995 *Cordiopsis incrassata* (Nyst) – Gürs, p. 272, pl. 51, fig. 4.

Description: Shell small, highly arched, more or less longer than high with strongly prosogyrate, highly inflated umbo, suborbicular to subelliptical, postero- and anterodorsal margin straightened, anterior margin more or less narrowly convex in elongated forms; escutcheon and lunule not differentiated, single lunular regions broad, slightly depressed, overwhelmed in their posterior portions by umbones; shell exterior sculptured by somewhat irregularly undulated, slightly projecting commarginal lirae. Height: 21.5 mm, length: 26.5 mm, convexity: 6.7 mm.
Material: 3 specimens from Melk, 8 from Kendl, 17 from Neuwinden, 2 from Plesching and 9 from Tiefenfucha.

Remarks: Anderson (1959) stated that the name *Venus incrassata* Sowerby 1817 with type occurrence in the Late Eocene of England is invalid through primary homonymy with *Venus incrassata* Brocchi 1814. In consequence he substituted Sowerby's name with the new name *C. polytropa*, argumenting that the usage of any name not based on Sowerby's type specimen would threaten the stability of nomenclature. Yet Gürs (1995) showed that Anderson's name, being valid for Sowerby's form, is still a junior synonym to a number of older, according to ICZN available names. He pointed out that among those names *Cyprina incrassata* Nyst 1836 from the Late Rupelian of Belgium has priority, because *Cyprina westendorpii* Nyst 1836 from the same publication is indeed an *Arctica* and not a *Cordiopsis* as erroneously thought by some former authors (e.g., Merklin, 1974).

Görs (1995) rejected any subspecies differentiation of *C. incrassata* and defined its stratigraphic range with Bartonian to Aquitanian. Yet respective to its frequent, well documented occurrence in the Eggenburgian of the Central Paratethys (Steininger et al., 1971) the upper boundary of that range must be corrected to Burdigalian. Additionally the presence of *C. incrassata* was stated by present authors also in the Late Burdigalian of S Turkey. Still this occurrence represents a highly variable population including forms hardly distinct from *C. islandicoides* (Brocchi). *C. islandicoides* apparently a direct successor of *C. incrassata* become increasingly frequent with the Middle Miocene in Mediterranean and in Central Paratethyan Region (Studencka et al., 1998). Morphologicaly it differs from *C. incrassata*, according to authors preliminary investigation, by being thinner and having a less massively developed hinge.

Distribution: Late Eocene (Bartonian; Sowerby, 1817) to Early Miocene (Anderson, 1959) of the North Sea Basin (Görs, 1995); Kiscellian (Noszky, 1939), Egerian (Baldi, 1973; Hölzl, 1962) and Eggenburgian (Hölzl, 1958; Steininger et al., 1971) of the Western and Central Paratethys; Late Eocene to Karadzhalgian of the Eastern Paratethys (Popov et al., 1993); Late Rupelian? (Cossmann, 1921), Aquitanian (Cossmann & Peyrot, 1910) of the Lusitanian Atlantic Region; Late Rupelian to Early Chattian (Roveretto, 1900; Sacco, 1900) and Late Chattian (Venzo, 1937; Accordi, 1955) of the Mediterranean Region.

Genus *Macrocallista* Meek, 1876

Macrocallista beyrichi (Semper, 1861)

Pl. 10, Fig. 5

1884 *Cytherea beyrichi* Semper – Speyer & Koenen, pl. 5, fig. 3–11.
1897 *Cytherea beyrichi* Semper – Wolff, p. 253, pl. 23, fig. 9.
1897 *Cytherea erycina* (Linné) – Wolff, p. 252, pl. 23, fig. 7. [*non* Linné]
1897 *Cytherea subarata* Sandb. – Wolff, p. 251, pl. 23, fig. 8. [*non* Sandb.]
1899 *Cytherea beyrichi* Semper – Böckh, p. 26, pl. 7, fig. 2.
1944 *Pitaria (Paradione) beyrichi* (Semper) – Heering, p. 34, pl. 4, fig. 1–4.
1952 *Pitaria beyrichi* (Semper) – Görges, p. 46.
1952 *Meretrix erycinoides* (Lamarck) – Anic, p. 24, pl. 2, fig. 6.
1957 *Pitaria dubia* – Hölzl, p. 64, pl. 7, fig. 4.
1957 *Callista beyrichi* (Semper) – Glibert, p. 41, pl. 3, fig. 15.
1958 *Pitaria beyrichi postera* – Hölzl, p. 115, pl. 11, fig. 7.
1958 *Pitaria beyrichi rotundata* – Hölzl, p. 116, pl. 11, fig. 8.
1958 *Pitaria beyrichi* (Semper) – Senes, p. 88, pl. 16, fig. 192–193.
1962 *Pitaria beyrichi* (Semper) – Hölzl, p. 90, pl. 5, fig. 6–8.
1963 *Pitar beyrichi* (Semper) – Baldi, p. 80, pl. 4, fig. 1–4.
1969 *Pitar* cf. *beyrichi* (Semper) – Steininger, p. 42.
1973 *Pitar (Paradione) beyrichi* (Semper) – Baldi, p. 214, pl. 17, fig. 3.
1975 *Pitar (Paradione) beyrichi* (Semper) – Steininger, p. 219.

Description: Shell small, with length exceeding height, suboval, with broadly convex anterior and narrower convex posterior margin, inequilateral, elongated posteriorly, with strongly prosogyrate, pointed umbonal region and weakly concave lunular region, other margins convex; umbo slightly incurved, highly inflated, shell low to moderately inflated, escutcheon and lunule deeply depressed, lunule posteriorly overwhelmed by umbo; shell exterior sculptured by regularly distanced, fairly wide, flattened commarginal ribs, separated by distinctly narrower commarginal depressions. Height: 19.5 mm, length: 24.3 mm, convexity: 4 mm. Material: moderately to badly preserved specimens from Melk/Tunnel (1x), Plesching (2x) and Tiefenfucha (1x).

Remarks: The nomenclature is stressed in detail by Baldi (1973). As pointed out by Hölzl (1958) *M. beyrichi* is ancestor of the Early Miocene *M. lillacinoides* (Schaffer, 1910) which differs by apparently larger size and much longer lateral tooth AI. The left valve on pl. 10, fig. 5 of the present study, is illustrated due to its good preservation. It represents a somewhat antero-posteriorly compacted morphotype.
Distribution: Pshekian to Kalmykian, ?Karadzhalgian and ?Sakaraulian of the Eastern Paratethys (Popov et al., 1993); Egerian (Anic, 1952; Senes, 1958; Hölzl, 1962; Baldi, 1973) and Eggenburgian (Hölzl, 1958) of the Western and Central Paratethys; Chattian of the North Sea Basin (type occurrence; Görges, 1952).

Subclassis Anomalodesmata Dall, 1889

Ordo Pholadomyoida Newell, 1965
Familia Pholadomyidae Gray, 1847
Genus *Pholadomya* G.B. Sowerby, 1823

Pholadomya puschi Goldfuss, 1837
Pl. 10, Fig. 6; Pl. 11, Fig. 1

1884 *Pholadomya Puschi* Goldfuss – Speyer & Koenen, pl. 4, fig. 2.
1897 *Pholadomya Puschi* Goldfuss – Wolff, p. 257, pl. 24, fig. 4–6.
1901 *Pholadomya Puschi* Goldfuss et var. div. – Sacco, p. 141, pl. 23, fig. 1–8.
1921 *Pholadomya Puschi* Goldfuss – Cossmann, p. 17, pl. 1, fig. 24–28.
1955 *Pholadomya puschi virgula* Micht. – Accordi, p. 37, pl. 3, fig. 3.
1957 *Pholadomya Puschi* Goldfuss – Senes, p. 7, pl. 1, fig. 4–7, pl. 2, fig. 8–12.
1958 *Pholadomya puschi* Goldfuss – Senes, p. 124, pl. 19, fig. 249–245. pl. 20, fig. 254–262.
1962 *Pholadomya puschi* Goldfuss – Hölzl, p. 7, 125, pl. 125, fig. 9–10.
1963 *Pholadomya puschi* Goldfuss – Baldi, p. 83, pl. 4, fig. 13.
1969 *Pholadomya puschi* Goldfuss – Steininger, p. 43, pl. 4, fig. 5
1969 *Pholadomya alpina rostrata* Schaffer – Steininger, p. 43, pl. 4, fig. 5.
1973 *Pholadomya puschi* Goldfuss – Baldi, p. 235, pl. 22, fig. 5–6.
1975 *Pholadomya alpina* Matheron – Steininger, p. 220, pl. 9, fig. 6.

Description: Shell large sized, with maximal length 114 mm, equivalve (but commonly deformed), oblong to subtrigonal, strongly inequilateral with anterior part more or less reduced and posterior part more or less strongly elongated, strongly inflated, umbones inflated, twisted dorsally inward, gaping at posterior end, shell thin and nacreous (mostly dissolved). Sculpture consisting of 13–20 radial ribs of roughly similar prominence, ornamenting the central shell portion, only slightly broadening distally, being densely or loosely spaced, weak commarginal rugae ornamenting the whole surface, at intersections with ribs weak tubercles developed. Height: 53 mm, length: 61 mm, convexity: 16.5 mm.; height: 67 mm, length: 123 mm, convexity: 24.5 mm
Material: 30 deformed, mostly fragmented steinkerns of articulated individuals from Plesching.

Remarks: The specimen-rich Plesching sample includes individuals in continous shape transition between two characteristic morphotypes. The small, shortened and umbonally pointed morphotype (pl. 10, fig. 6) corresponds to *P. puschi*, the larger, posteriorly elongated and umbonally flattened one (pl. 11, fig. 1) is identical with *P. alpina* MATHERON, particularly with its form *rostrata* SCHAFFER. Whereas *P. puschi* represents a characteristic Oligocene species (BALDI, 1973), *P. alpina* does not occure before the Early Miocene (NEVESSKAJA et al., 1993). Particularly *P. alpina rostrata* is a form restricted to Eggenburgian (STEININGER et al., 1971).

Hence the Plesching record documents the presence of typical Miocene *Pholadomya* morphology already in the Late Oligocene. A more detailed, morphometric investigation of *P. puschi* and *P. alpina* could verify their taxonomic reunion. The material from the MAYER-EYMAR Collection housed in the Museum of Natural History in Basel (Switzerland) should be included into this research. The numerous specimens from the classical Oligocene locality Carcare of Liguria (ROVERETO, 1900) deposited therein display a variation affiliated with the one from Plesching.

The stratigraphic range and paleobiogeographic distribution of *P. puschi* was recherched in detailed by SENES (1958).

Distribution: Chattian of the North Sea Basin (type occurrence; GÖRGES, 1952); latest Eocene to earliest Oligocene of the Eastern Paratethys (POPOV et al. 1993); Late Eocene to Kiscellian? (SENES, 1958), Egerian (SENES, 1958; HÖLZL, 1962; BALDI, 1973), Eggenburgian to Ottnangian (HÖLZL, 1958) of the Central and Western Paratethys; Late Rupelian to Chattian (SACCO, 1901; VENZO, 1937), Aquitanian? (OPPENHEIM, 1903; ACCORDI, 1955) of the Mediterranean Region.

Familia Thraciidae STOLICKZKA, 1870

Genus *Thracia* LEACH, 1824

Thracia ventricosa (PHILIPPI, 1843)

Pl. 11, Fig. 3

1870 *Thracia ventricosa* PHILIPPI – HÖRNES, p. 48, pl. 3, fig. 15.
1901 *Thracia* cf. *Speyeri* KOENEN – SACCO, p. 138, pl. 27, fig. 29.
1925 *Thracia ventricosa* PHILIPPI – KAUTSKY, p. 49, pl. 5, fig. 5.
1936 *Thracia* cf. *Speyeri* KOENEN – NOSZKY, p. 91.
1936 *Thracia convexa* WOOD – NOSZKY, p. 91.
1939 *Thracia convexa oligantiqua* – NOSZKY, p. 80.
1945 *Thracia ventricosa* PHILIPPI – GLIBERT, p. 219, pl. 3, fig. 7.
1952 *Thracia speyeri* KOENEN – GÖRGES, p. 59.
1957 *Thracia ventricosa* PHILIPPI – GLIBERT, p. 47, pl. 4, fig. 3.
1958 *Thracia ventricosa* PHILIPPI – HÖLZL, p. 170, pl. 16, fig. 7.
1958 *Thracia speyeri* KOENEN – SENES, p. 125, pl. 17, fig. 220–221.
1959 *Thracia ventricosa* PHILIPPI – ANDERSON, p. 158, pl. 18, fig. 9.
1962 *Thracia speyeri* KOENEN – HÖLZL, p. 129, pl. 8, fig. 2–3.
1969 *Thracia ventricosa* PHILIPPI. – STEININGER, p. 43, pl. 4, fig. 1.
1973 *Thracia ventricosa* PHILIPPI – BALDI, p. 237, pl. 22, fig. 4.
1975 *Thracia ventricosa* PHILIPPI – BALDI & STEININGER, p. 202, pl. 115, fig. 4.
1986 *Thracia* (*Thracia*) *ventricosa* PHILIPPI – STUDENCKA, p. 109, pl. 16, fig. 5; pl. 18, fig. 5.

Description: Shell thin, small to medium in size, being more or less elongated but with length always exceeding height, outline quadrangularly to trigonally suboval with trun-

cated posterior margin and broadly convex anterior margin; umbonal region inflated, pointed dorsally, broadly trigonal to rounded; posterior diagonal ridge prominent, adjoining wing-like depressed, trigonal, posterodorsally pointed posterodorsal area; exterior surface sculptured by somewhat irregularly undulated commarginal rings and fine growth lines. Height: 32.5 mm, length: 50 mm, convexity: 6.5 mm.
Material: 1 specimen from Kendl, 11 from Plesching and 30 from Tiefenfucha, preservation moderate, plastic deformation is common.

Remarks: The variation of anteroposterior elongation produce partly unusual elongated forms. Yet these are well distinguishable from the Recent *P. pubescens* PULTENEY. having always typically oblique anterior and posterior margins, being trigonal and stronger inflated anteriorly.
Its affiliation with the Recent *T. convexa* is highly probable. Indeed, the shorter, trigonal Austrian Oligocene forms do not importantly differ from the Recent specimen of *T. convexa* illustrated by POPPE & GOTO (1993). Yet, the present identification follows former studies which do not recognize the presence of *T. convexa* in the Paratethys (e.g., BALDI, 1973; STUDENCKA, 1986; POPOV et al., 1993; NEVESSKAJA et al., 1993; STUDENCKA et al. 1998). A reinvestigation would go beyond the scope of the present study.
Distribution: Egerian (HÖLZL, 1962; BALDI, 1973) to Badenian (STUDENCKA, 1986) of the of the Central and Western Parartethys; Late Eocene to Chokrakian of the Eastern Paratethys (POPOV et al., 1993; NEVESSKAJA et al., 1993); Miocene of the North Sea Basin (GLIBERT, 1957); Oligocene to Late Pliocene of the Mediterranean (HÖRNES, 1870; SACCO, 1901; VENZO, 1937; STUDENCKA, 1986)

Familia Cuspidariidae DALL, 1886
Genus *Cuspidaria* NARDO, 1840

Cuspidaria cf. *cuspidata* (OLIVI, 1792)
Pl. 11, Fig. 4

1814 *Tellina cuspidata* OLIVI – BROCCHI, p. 515.
1870 *Neaera cuspidate* (OLIVI) – HÖRNES, p. 42, pl. 5, fig. 1–2.
1901 *Tellina cuspidata* OLIVI – SACCO, p. 123, pl. 26, fig. 31–34, pl. 24, fig. 31–34.
1952 *Cuspidaria cuspidata* (OLIVI) – HAGN & HÖLZL, p. 44.
1958 *Cuspidaria cuspidata* (OLIVI) – HÖLZL, p. 171, pl. 16, fig. 8.
1959 *Cuspidaria (Cuspidaria) cuspidata* (OLIVI) – ANDERSON, p. 160, pl. 18, fig. 10.
1969 *Cuspidaria* cf. *cuspidata* (OLIVI) – STEININGER, p. 43.
1973 *Tellina cuspidata* OLIVI – BALDI, p. 239.
1975 *Cuspidaria cuspidata* (OLIVI) – STEININGER, p. 220.

Description: Shell highly inflated, subtrigonal, dorsally pointed, anteriorly obliquely straightened, ventrally broadly convex, posteriorly elongated to a narrow, in cross section rounded rostrum, with length attaining about one third of the whole shell length; umbo opisthogyrate, highly inflated, anterodorsal marginal area highly raised. Height: 9.6 mm, length: 17.3 mm, convexity: 4 mm.
Material: 1 badly preserved left valve from Plesching.

Remarks: *C. clava* (BEYRICH) from the Oligocene of the North Sea Basin, Mainz Basin and Central and Western Paratethys differs from *C. cuspidata* by a shorter and broader rostrum. It is regarded by ANDERSON (1959) and BALDI (1973) as a direct ancestor of C.

cuspidata. The specimen from the latest Oligocene of Plesching is stratigraphically the oldest *C. cuspidata* record, underpinning well that inference.
Distribution: Initiated in the latest Oligocene of Central Paratethys (the present study), present in the Early Miocene to Recent of the North Sea Basin (ANDERSON, 1959) and Lusitanian Region (SACCO, 1901; POPPE & GOTO, 1993)

Familia Clavagellidae D'ORBIGNY, 1843
Genus *Clavagella* LAMARCK, 1818
Subgenus *Stirpulina* STOLICZKA, 1870

Clavagella (Stirpulina) oblita MICHELOTTI, 1861
Pl. 11, Fig. 5–6

1861 *Clavagella oblita* – MICHELOTTI, p. 53, pl. 5, fig. 8–9.
1900 *Clavagella oblita* MICHELOTTI – ROVERETO, p. 127, pl. 7, fig. 23.
1901 *Clavagella (Stirpulina) oblita* MICHELOTTI – SACCO, p. 147, pl. 14, fig. 47–49.
1969 *Clavagella oblita* MICHELOTTI – STEININGER, p. 220, pl. 1, fig. 3.
1973 Clavagella *(Stirpulina) oblita* MICHELOTTI. – BALDI, p. 238, pl. 23, fig. 1.
1975 *Clavagella oblita* MICHELOTTI – STEININGER, p. 220.
1975 *Clavagella oblita* MICHELOTTI – BALDI & STEININGER, p. 344, pl. 1, fig. 3.

Description: The right valve, except for the umbonal region, embedded in a thin calcareous tube, the left valve free, the tube at least 4 times longer than shell, but never complete, tube anterior end with terminal root-like corona made up of irregularly arranged tubuli, tube exterior surface can bear irregularly arranged concentric rings, narrow radial depressions can occur as well. Valves irregularly suborbicuar with inflated, about centrally positioned, dorsally pointing umbones, exterior surface smooth or undulated by irregular growth constrictions. Maximum preserved tube length 80 mm
Material: Numerous, rather badly preserved specimens available from Plesching.

Remarks: As already noted by BALDI (1973) the N Italian Oligocene *C. (S.) oblita* seems to differ only by its smaller size from the N Italian Pliocene *C. (S.) bacillum* BROCCHI documented by SACCO (1901). According to the latter author, *C. (S.) bacillum* is a senior synonym of *C. (S.) bacillaris* DESHAYES, a name introduced by HÖRNES (1807) for a clavagellid species occurring in the Austrian Middle Miocene. VADASZ (1906) revised the identification of HÖRNES, replacing it with the new name *Aspergillum miocaenicus*. *Aspergillum* LAMARCK, 1818 is, according to MOORE (1969), an objective junior synonym of *Penicillus* BRUGUIERE, 1789, differing from *Clavagella (Stirpulina)* by the anterior disc rimmed by single row of distinct simple tubules. Such a structure is missing in specimens illustrated by HÖRNES (1870) and VADASZ (1906). *Brechites* (= *Penicillus* of MOORE, 1969) *miocaenicus* from the Early Miocene of Austria, illustrated by STEININGER et al. (1971), can hardly be differentiated from specimens found in Plesching. A revision is apparently needed.
Distribution: Late Rupelian to Chattian of Liguria (SACCO, 1901), Early Egerian of Austria and Hungary (Baldi, 1973; the present study).

Ordo Myoida Stoliczka, 1870
Familia Hiatellidae Gray, 1824
Genus *Panopea* Ménard de la Groye, 1807

Panopea menardi Deshayes, 1828
Pl. 11, Fig. 2

1863 *Panopaea Heberti* Bosquet – Sandberger, p. 279, pl. 21, fig. 8.
1870 *Panopaea Menardi* Deshayes – Hörnes, p. 29, pl. 2, fig. 1–3.
1884 *Panopaea heberti* Bosquet – Speyer & Koenen, pl. 1, fig. 9–12, pl. 2, fig. 1–3.
1897 *Panopaea Meynardi* Deshayes– Wolff, p. 256, pl. 24, fig. 1–3.
1899 *Panopaea heberti* Bosquet– Böckh, p. 28, pl. 8, fig. 3–4.
1900 *Glycymeris Menardi* (Deshayes) – Rovereto, p. 116.
1901 *Glycymeris Menardi* (Deshayes) – Sacco, p. 43, pl. 12, fig. 4.
1901 *Glycymeris oligofaujasi acutangula* – Sacco, p. 44, pl. 12, fig. 10.
1901 *Glycymeris oligofaujasi proxima* – Sacco, p. 44, pl. 12, fig. 9.
1901 *Glycymeris* cfr. *intermedia declivis* (Micht.) – Sacco, p. 45, pl. 10, fig. 5–7.
1902 *Glycymeris menardi* (Deshayes) – Dollfus & Dautzenberg, p. 74, pl. 2, fig. 19–20.
1903 *Panopaea declivis* Michelotti – Oppenheim, p. 187.
1909 *Glycymeris Menardi* (Deshayes) – Cossmann & Peyrot, p. 195, pl. 3, fig. 40–41.
1910 *Glycymeris Menardi* (Deshayes) – Schaffer, p. 96, pl. 45, fig. 4, pl. 46, fig. 1–2.
1934 *Glycymeris menardi Rudolphii* – Friedberg, p. 24, pl. 3, fig. 15–16, pl. 4, fig. 1–2.
1937 *Glycymeris menardi* (Deshayes) – Venzo, p. 74, pl. 4, fig. 12–13.
1943 *Panopaea* cf. *Meynardi* Deshayes– Albrecht & Valk, p. 136, pl. 14, fig. 454.
1944 *Panopea heberti* Bosquet – Heering, p. 42, pl. 3, fig. 17–18.
1945 *Panopea menardi* Deshayes – Glibert, p. 211, pl. 12, fig. 9.
1952 *Panopea meynardi* Deshayes – Görges, p. 54.
1952 *Glycymeris heberti* (Bosquet) – Anic, p. 21, pl. 1, fig. 3–4.
1957 *Panopea menardi* Deshayes – Glibert, p. 45, pl. 4, fig. 6.
1958 *Panopea menardi* Deshayes – Hölzl, p. 160.
1958 *Panopea meynardi meynardi* Deshayes – Senes, p. 116, pl. 17, fig. 228–229, pl. 18, fig. 233–237.
1959 *Panopea meynardi* Deshayes– Anderson, p. 150, pl. 18, fig. 3.
1962 *Panopea meynardi* Deshayes – Hölzl, p. 117, pl. 7, fig. 7–8.
1963 *Panopea menardi* Deshayes – Steininger, p. 34, pl. 6, fig. 2.
1963 *Panopea menardi* Deshayes – Baldi, p. 83, pl. 4, fig. 14.
1964 *Panopea meynardi* Deshayes – Anderson, p. 187.
1969 *Panopea menardi* Deshayes – Steininger, p. 42.
1971 *Panopea menardi* Deshayes – Steininger et al., p. 468, pl. 48, fig. 2.
1973 *Panopea menardi* Deshayes – Baldi, p. 230, pl. 21, fig. 6.
1975 *Panopea menardi* Deshayes – Steininger, p. 219.
1986 *Panopea* (*Panopea*) *menardi* Deshayes – Studencka, p. 105, pl. 17, fig. 7; pl. 18, fig. 4, 7 and 9.
1995 *Panopea menardi* Deshayes – Gürs, p. 280.

Description: Shell large, higher than long but variously compressed; inequilateral, strongly elongated posteriorly, subquadrangular to subelliptical with concave posterodorsal margin and straightened ventral margin; moderately inflated, highly arched in the dorsal region, gradually flattening toward the ventral region; umbonal region dorsally pointed, broadly trigonal or rounded; widely gaping posteriorly; exterior surface sculptured by broad, irregular commarginal rings. Height: 64 mm, length: >90 mm, convexity: 21 mm. Material: several moderately preserved, deformed steinkerns from Plesching.

Remarks: *Panopea menardi* is one of the most common European Oligocene to Miocene bivalves. Many synonymous names available in the literature are result of its highly variable morphology, wide geographic distribution and a long stratigraphic range. Studencka (1986) provided an overview of its complicated nomenclature history. Despite to former revisions, Görs (1995) again considered Oligocene Boreal *Panopea angusta* Nyst (= *P. heberti* Bosquet in Deshayes) as a distinct species, however without any more detailed explanation. Reunion of Oligocene North Italian species and subspecies of Sacco (1901) with *P. menardi* goes back to Venzo (1937).

Distribution: Rupelian (Nyst, 1836), Chattian (Görges, 1952) and Miocene (Glibert, 1943) of the North Sea Basin; Rupelian of the Paris and Mainz Basin (Görs, 1995); Late Rupelian to Early Chattian (Rovereto, 1900; Sacco, 1901); Late Chattian (Venzo, 1937), Aquitanian to Tortonian (Sacco, 1901; Oppenheim, 1903, Accordi, 1955) of the Mediterranean Region; Burdigalian to Serravallian ("Helvetien") of the Lusitanian Atlantic Region (Dollfus & Dautzenberg, 1902; Cossmann & Peyrot, 1909); Late Kalmykian?, Karadzhalgian, Sakaraulian?, and Tarhanian of the Eastern Paratethys (Popov et al., 1993; Nevesskaja et al., 1993); Egerian (Anic, 1952; Senes, 1958; Hölzl, 1962; Baldi, 1973) to Badenian (Hörnes, 1870; Studencka et al., 1998) of the Central and Western Paratethys.

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Plate 1

Fig. 1: *Jujubinus* aff. *multicingulatus* (SANDBERGER, 1960), Melk – 4x

Fig. 2: *Angaria* cf. *scobina* (BRONGNIART, 1823), Plesching – 1×

Fig. 3: *Calliostoma (Ampullotrochus)* cf. *hegeduesi* BALDI, 1973, Plesching – 1×

Fig. 4: *Tympanotonos margaritaceus* (BROCCHI, 1814), Kendl – 1×

Fig. 5: *Tympanotonos margaritaceus* (BROCCHI, 1814), Kendl – 1×

Fig. 6: *Tympanotonos margaritaceus* (GRATELOUP, 1840), "*calcaratus*-morph" Neuwinden – 1×

Fig. 7: *Granulolabium plicatum* (BRUGUIÈRE, 1792), Zelking – 1×

Fig. 8: *Euspira helicina* (BROCCHI, 1814), Melk/Tunnel – 4×

Fig. 9: *Melanopsis impressa* KRAUSS, 1852 s.l., Zelking – 2×

Fig. 10: *Natica tigrina* (DEFRANCE, 1825), Neuwinden – 1×

Fig. 11: *Galeodea megacephala* (PHILIPPI, 1843), Plesching – 2×

Fig. 12: *Calyptraea chinensis* (LINNE, 1758), Melk/Tunnel – 3×

Fig. 13: *Ficus concinnus* (BEYRICH, 1854), Plesching – 3×

Plate 1


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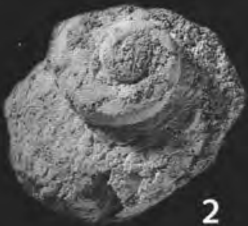
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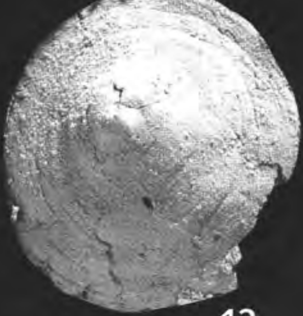
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Plate 2

Fig. 1: *Melongena incornuta* (Hölzl, 1962), Melk/Tunnel – 1×

Fig. 2: *Melongena incornuta* (Hölzl, 1962), Melk/Tunnel – 1×

Fig. 3: *Melongena semseyiana* (Erdős, 1900), Melk/Tunnel – 1×

Fig. 4: *Bullia hungarica* (Gabor, 1936), Melk/Tunnel – 3×

Fig. 5: *Stenodrillia obeliscus* (Desmoulins, 1842), Melk/Tunnel – 3×

Fig. 6: *Fasciolaria? plexa* (Wolff, 1897), Tiefenfucha – 2×

Fig. 7: *Ocenebra (Ocinebrina) bistriata* (Gümbel, 1861), Melk/Tunnel – 2×

Fig. 8: *Ocenebra (Ocinebrina) bistriata* (Gümbel, 1861), Melk/Tunnel – 2×

Fig. 9: *Ringicula (Ringiculella) auriculata paulucciae* Morlet, 1878, Melk/Tunnel – 10×


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Plate 3

Fig. 1: *Nuculana (Saccella) mayeri* (GÜMBEL, 1861), Tiefenfucha – 2.2×

Fig. 2: *Mytilus (Crenomytilus) aquitanicus* (MAYER-EYMAR, 1858), Kendl – 1.3×

Fig. 3: *Brachidontes taurinensis* (MICHELOTTI, 1847), Plesching – 1×

Fig. 4: *Brachidontes taurinensis* (MICHELOTTI, 1847), Plesching – 1×

Fig. 5: *Brachidontes taurinensis* (MICHELOTTI, 1847), Plesching – 1×

Fig. 6: *Brachidontes taurinensis* (MICHELOTTI, 1847), Plesching – 1×

Fig. 7: *Brachidontes taurinensis* (MICHELOTTI, 1847), Plesching – 1×

Fig. 8: *Anadara diluvii* (LAMARCK, 1805), Melk/Tunnel – 1.3×

Fig. 9: *Anadara diluvii* (LAMARCK, 1805), Melk/Tunnel – 1.4×

Fig. 10: *Anadara diluvii* (LAMARCK, 1805), Melk/Tunnel – 1.1×

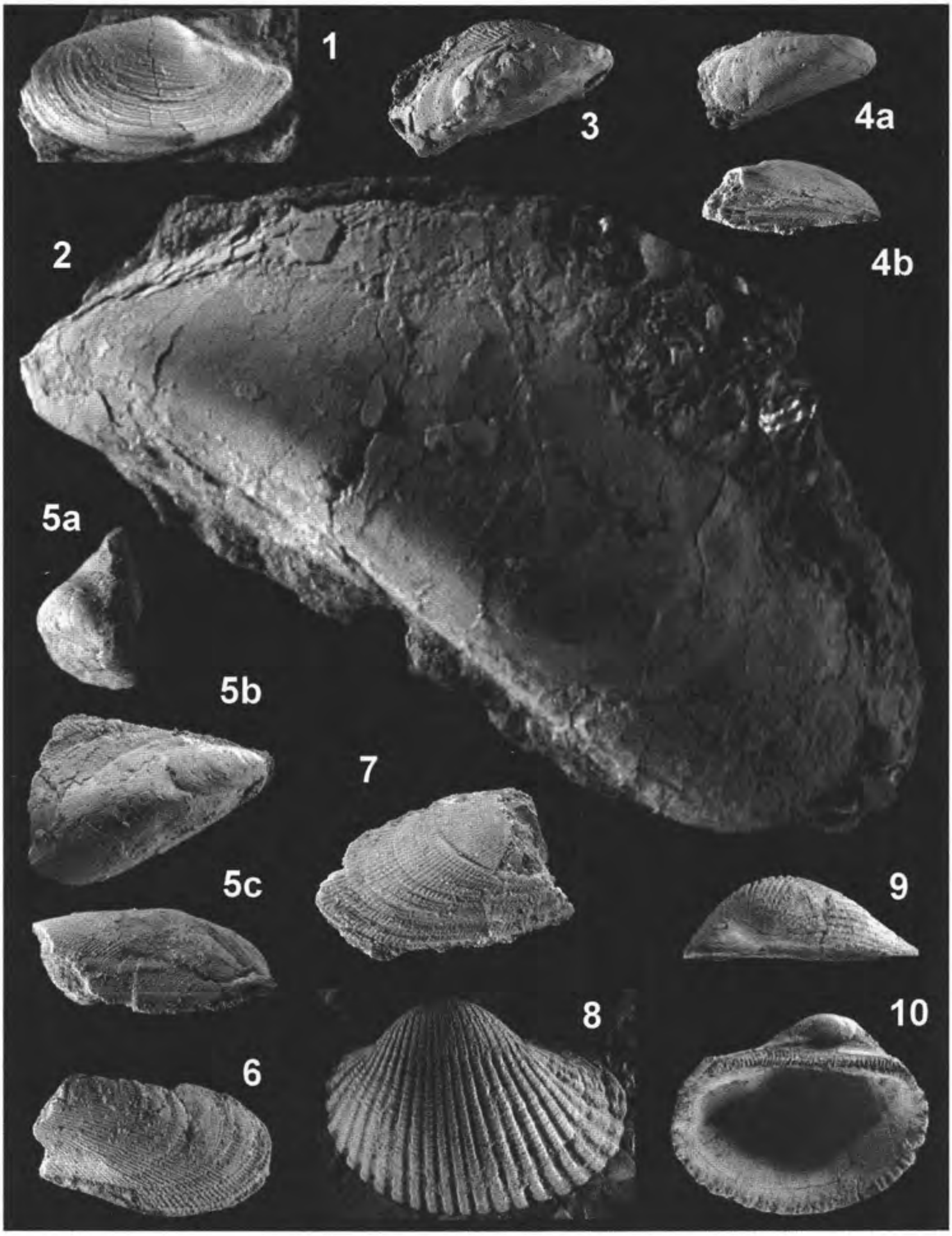
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Plate 4

Fig. 1: *Glycymeris latiradiata* (SANDBERGER in GÜMBEL, 1861), Neuwinden – 1×

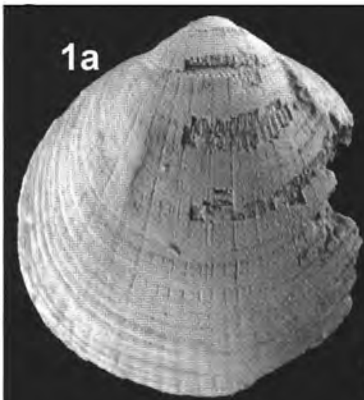
Fig. 2: *Glycymeris latiradiata* (SANDBERGER in GÜMBEL, 1861), Neuwinden – 1×

Fig. 3: *Glycymeris latiradiata* (SANDBERGER in GÜMBEL, 1861), Neuwinden – 1×

Fig. 4: *Isognomon (Hippochaeta) maxillatus* (LAMARCK, 1801), Kendl – 1×

Fig. 5: *Isognomon (Hippochaeta) maxillatus* (LAMARCK, 1801), Kendl – 0.9×

Fig. 6: *Isognomon (Hippochaeta) maxillatus* (LAMARCK, 1801), Kendl – 1×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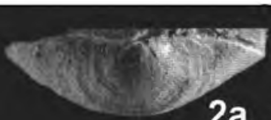
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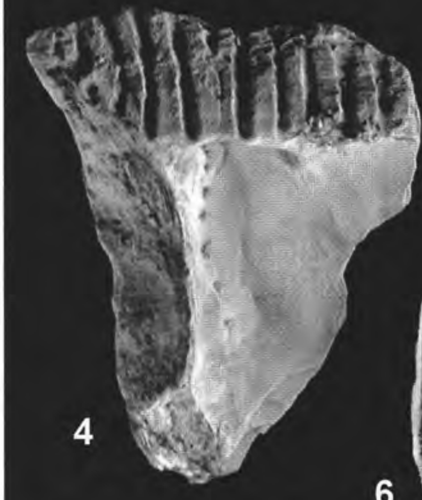
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Plate 5

Fig. 1: *Atrina* cf. *pectinata* (Linné, 1767), Plesching – 4x

Fig. 2: *Crassostrea fimbriata* (Grateloup in Raulin & Delbos, 1855), Melk/Tunnel – 0.9×

Fig. 3: *Crassostrea fimbriata* (Grateloup in Raulin & Delbos, 1855), Melk/Tunnel – 0.9×

Fig. 4: *Pycnodonte gigantica callifera* (Lamarck, 1819), Plesching – 1.3×

Fig. 5: *Pycnodonte gigantica callifera* (Lamarck, 1819), Plesching – 1.4×

Fig. 6: *Pycnodonte gigantica callifera* (Lamarck, 1819), Plesching – 1.3×

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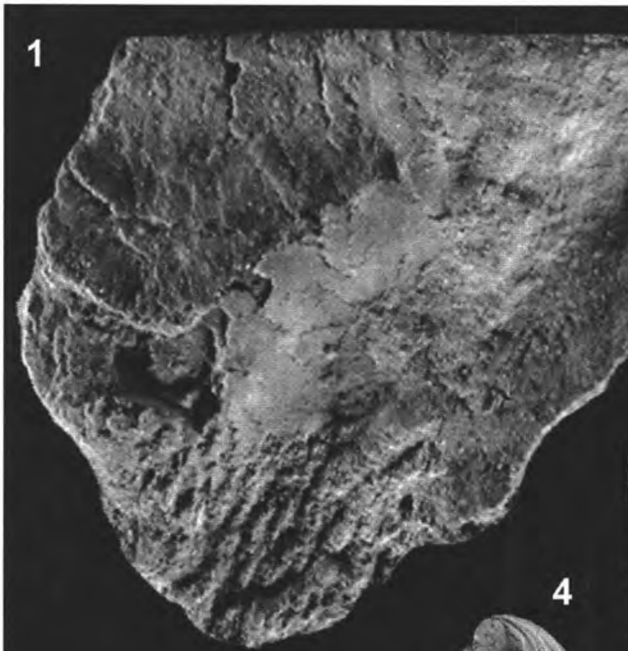

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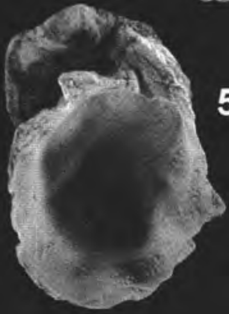

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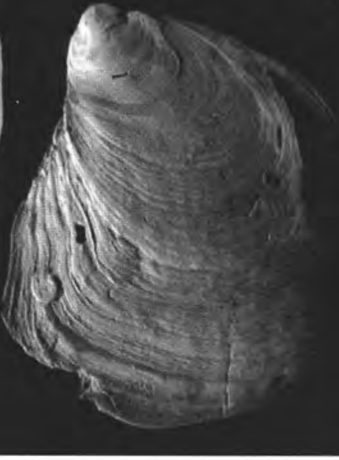

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Plate 6

Fig. 1: *Pycnodonte gigantica callifera* (LAMARCK, 1819), Plesching – 0.8×

Fig. 2: *Palliolum incomparabile* (RISSO, 1826), Pleching – 1.5×

Fig. 3: *Palliolum incomparabile* (RISSO, 1826), Pleching – 1.6×

Fig. 4: *Palliolum incomparabile* (RISSO, 1826), Pleching – 1.7×

Fig. 5: *Costellamussiopecten*? cf. *northamptoni* (MICHELOTTI, 1839), Tiefenfucha – 1×

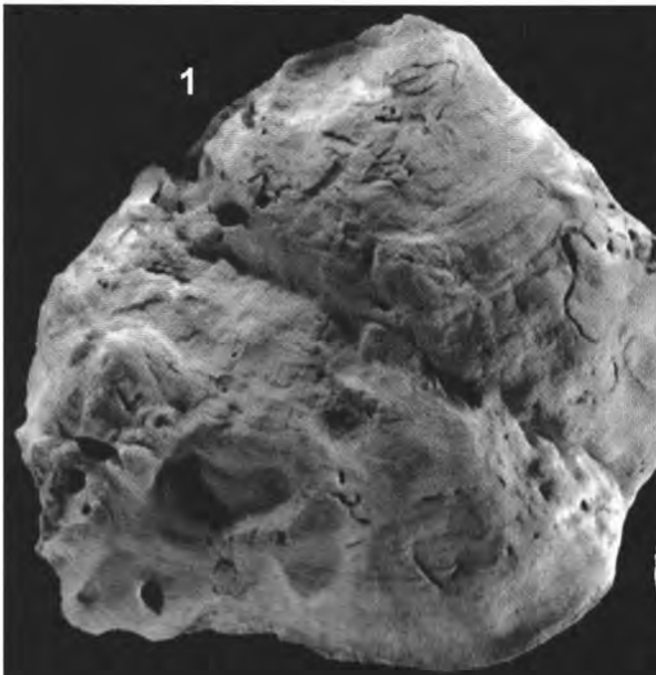
Fig. 6: *Costellamussiopecten*? cf. *northamptoni* (MICHELOTTI, 1839), Tiefenfucha – 1.3×

Fig. 7: *Anomia ephippium* LINNÉ, 1758, Melk/Tunnel – 1.4×

Fig. 8: *Myrtea spinifera* (MONTAGU, 1803), Tiefenfucha – 2.5×

Fig. 9: *Myrtea spinifera* (MONTAGU, 1803), Tiefenfucha – 2.6×

Fig. 10: *Myrtea spinifera* (MONTAGU, 1803), Tiefenfucha – 2.4×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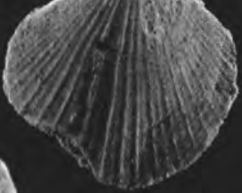
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Plate 7

Fig. 1: *Lucinoma barrandei* (Mayer, 1871), Plesching – 1×

Fig. 2: *Lucinoma barrandei* (Mayer, 1871), Plesching – 1×

Fig. 3: *Lucinoma barrandei* (Mayer, 1871), Plesching – 1×

Fig. 4: *Lucinoma barrandei* (Mayer, 1871), Plesching – 1×

Fig. 5: *Saxolucina heberti* (Deshayes, 1857), Neuwinden – 1.6×

Fig. 6: *Saxolucina heberti* (Deshayes, 1857), Neuwinden – 1.6×

Fig. 7: *Lucinella divaricata rotundoparva* (Sacco, 1901), Neuwinden – 3.9×

Fig. 8: *Diplodonta rotundata* (Montagu, 1803), Plesching – 2.3×

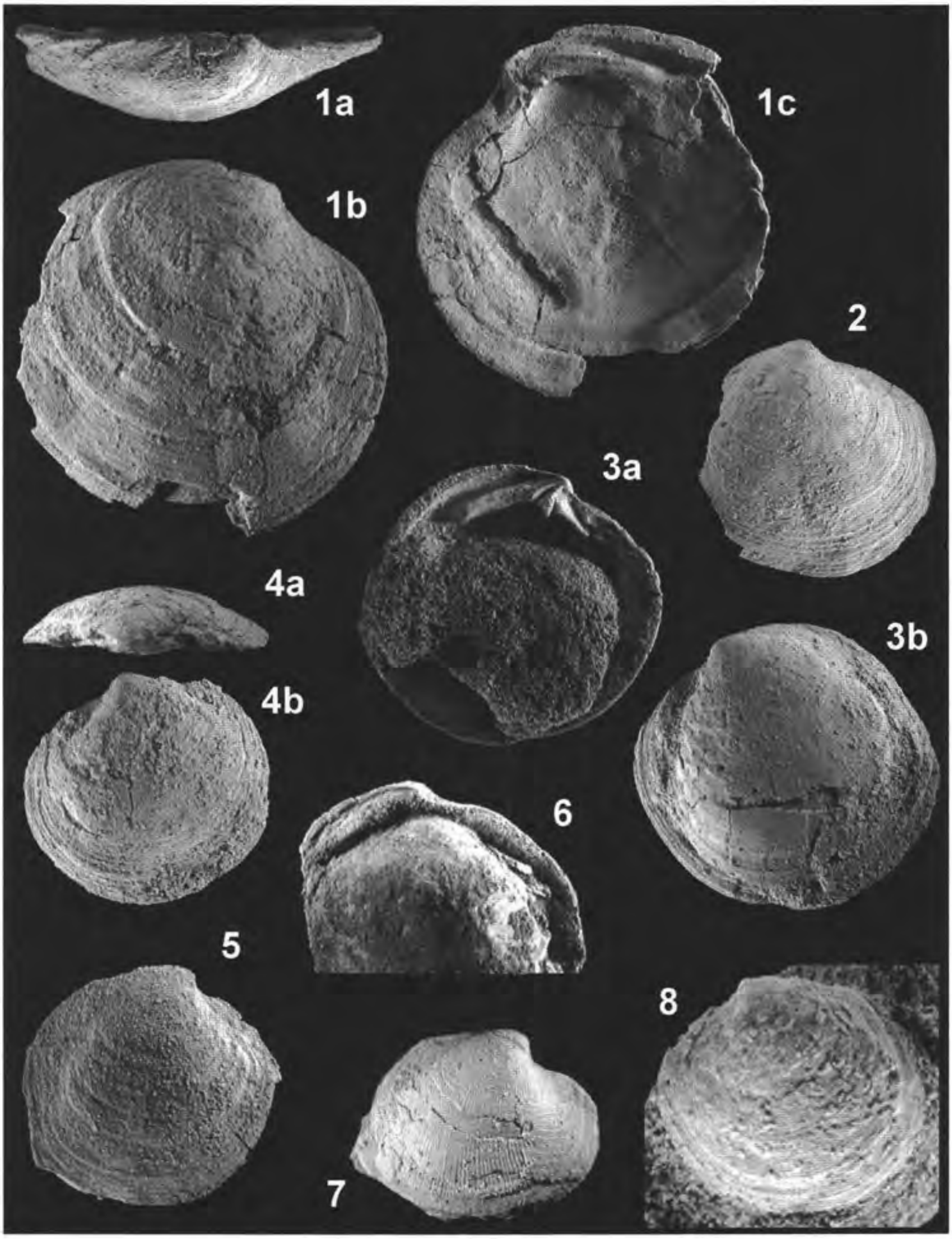
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Plate 8

Fig. 1: *Astarte henckeliusiana* Nyst, 1836, Tiefenfucha – 3.9×

Fig. 2: *Astarte henckeliusiana* Nyst, 1836, Tiefenfucha – 3.2×

Fig. 3: *Astarte henckeliusiana* Nyst, 1836, Tiefenfucha – 3.5×

Fig. 4: *Astarte hoelzli* nov. sp., Plesching – 1×

Fig. 5: *Astarte hoelzli* nov. sp., Plesching – 1×

Fig. 6: *Astarte hoelzli* nov. sp., Plesching – 1×

Fig. 7: *Cyclocardia orbicularis* (Sowerby, 1825), Tiefenfucha – 2.4×

Fig. 8: *Cyclocardia orbicularis* (Sowerby, 1825), Tiefenfucha – 2.4×

Fig. 9: *Cyclocardia orbicularis* (Sowerby, 1825), Tiefenfucha – 2.3×

Fig. 10: *Cyclocardia orbicularis* (Sowerby, 1825), Tiefenfucha – 2.3×

Fig. 11: *Cardita* cf. *elongata* Bronn, 1831, Plesching – 1.3×

Fig. 12: *Eucrassatella carcarensis* (Michelotti, 1847), Plesching – 1.3×

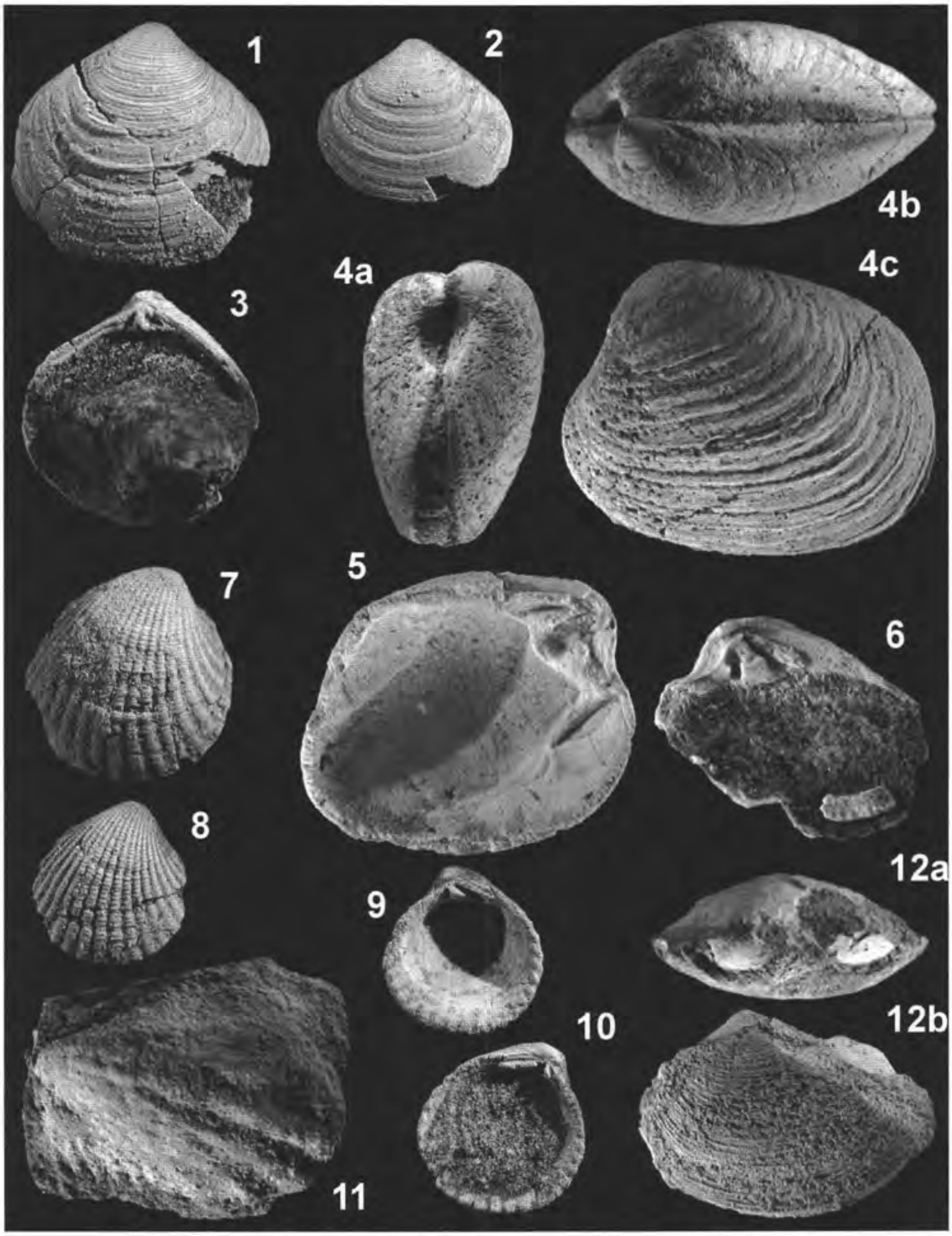
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Plate 9

Fig. 1: *Corbula (Caryocorbula) carinata* (Dujardin, 1837), Melk/Tunnel – 2.4×
Fig. 2: *Corbula (Varicorbula) gibba* (Olivi, 1792), Tiefenfucha – 2.5×
Fig. 3: *Acanthocardia bojorum* (Mayer in Wolff, 1897), Melk/Tunnel – 1×
Fig. 4: *Acanthocardia bojorum* (Mayer in Wolff, 1897), Melk/Tunnel – 1×
Fig. 5: *Lutraria (Lutraria) sanna* Basterot, 1825, Neuwinden – 1.1×
Fig. 6: *Peronidia nysti* (Deshayes, 1860), Tiefenfucha – 1.3×
Fig. 7: *Peronidia postera* (Beyrich in Koenen, 1867), Kendl – 1.3×
Fig. 8: *Macoma (Psammacoma) elliptica* (Brocchi, 1814), Tiefenfucha – 1.8×
Fig. 9: *Gari protracta* (Mayer-Eymar, 1893), Melk/Tunnel – 1.8×
Fig. 10: *Mytilopsis basteroti* (Deshayes in Lamarck, 1836), Melk/Tunnel – 1.9×
Fig. 11: *Arctica rotundata* (Braun in Agassiz, 1845), Tiefenfucha – 1×

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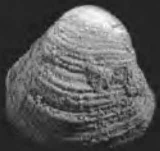

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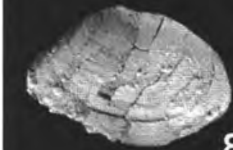

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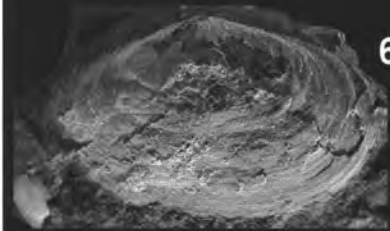

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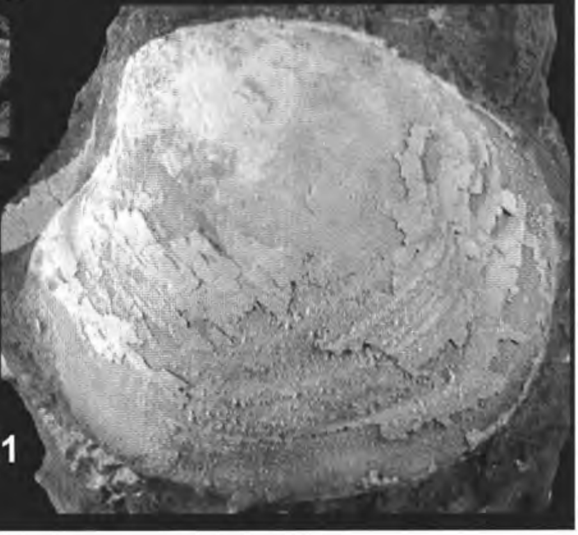

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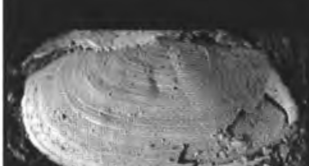

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Plate 10

Fig. 1: *Glossus subtransversus* (d'Orbigny, 1852), Plesching – 1×

Fig. 2: *Glossus subtransversus* (d'Orbigny, 1852), Plesching – 1.1×

Fig. 3: *Polymesoda subarata sowerbii* (Basterot, 1825), Melk/Tunnel – 1.4×

Fig. 4: *Cordiopsis incrassata* (Nyst, 1836), Neuwinden – 1.4×

Fig. 5: *Macrocallista beyrichi* (Semper, 1861), Tiefenfucha – 1.5×

Fig. 6: *Pholadomya puschi* Goldfuss, 1837, Plesching – 1.9×

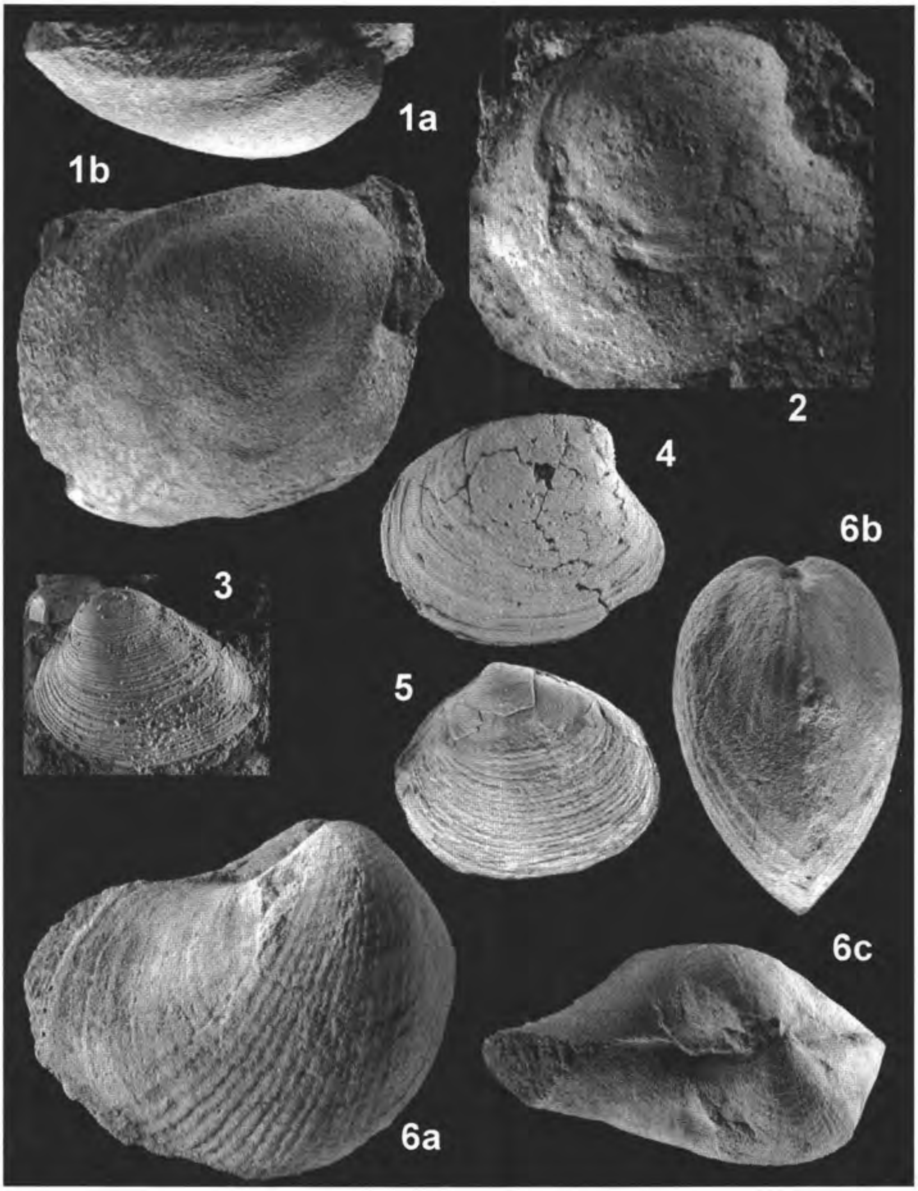
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Plate 11

Fig. 1: *Pholadomya puschi* Goldfuss, 1837, Plesching – 0.8×

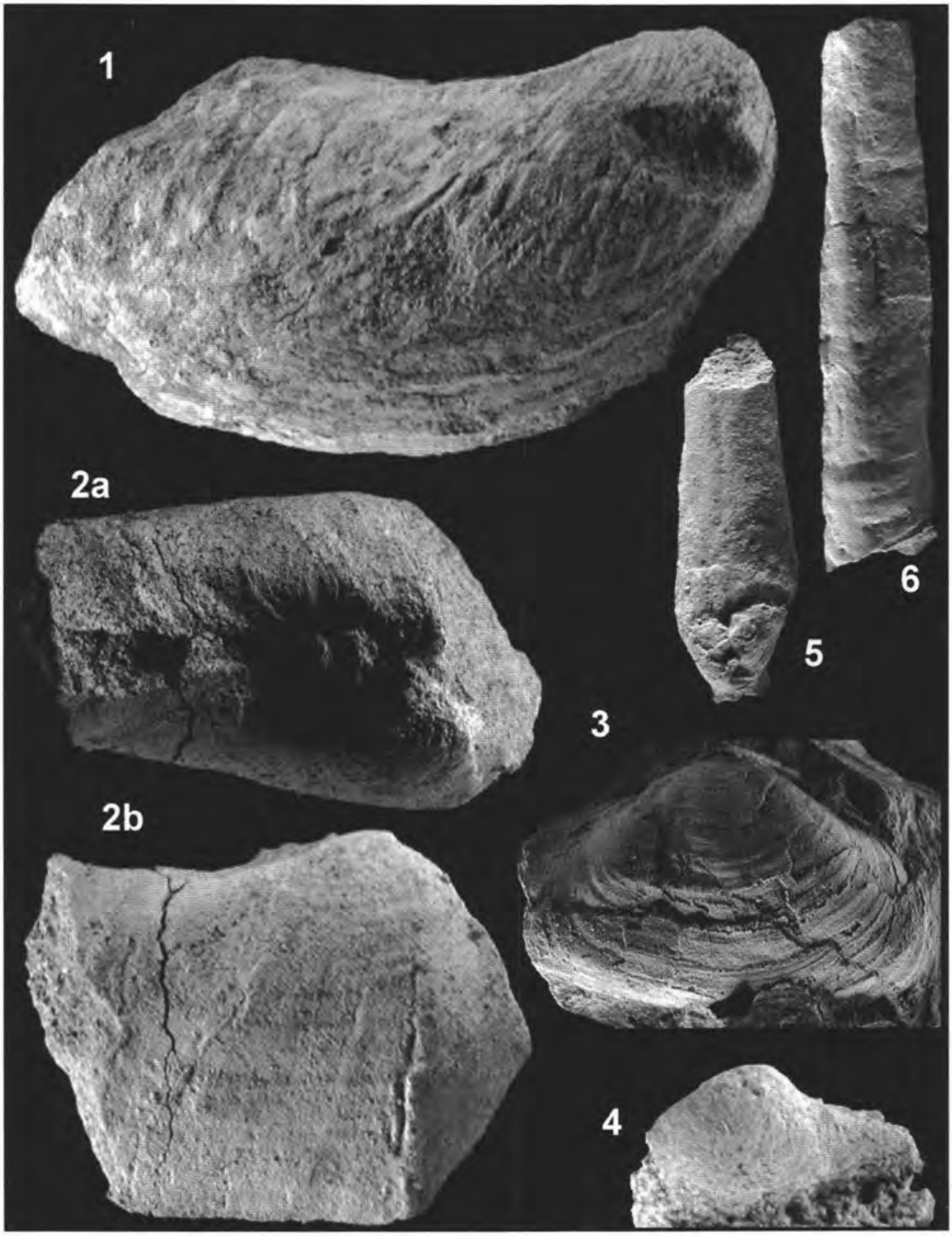
Fig. 2: *Panopea menardi* Deshayes, 1828, Plesching – 0.8×

Fig. 3: *Thracia ventricosa* (Philippi, 1843), Tiefenfucha – 1×

Fig. 4: *Cuspidaria* cf. *cuspidata* (Olivi, 1792), Plesching – 2.2×

Fig. 5: *Clavagella* (*Stirpulina*) *oblita* Michelotti, Plesching – 1×

Fig. 6: *Clavagella* (*Stirpulina*) *oblita* Michelotti, Plesching – 1×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