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The Cenomanian Gastropoda of the Kassenberg quarry in Mülheim (Germany, Late Cretaceous)

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with 8 figures

Kurzfassung: Aus dem Cenoman des Steinbruchs Kassenberg bei Mülheim a. d. Ruhr werden 46 Gastropoden-Arten beschrieben, zwölf davon neu. Sie werden 33 bekannten und zwei neuen Gattungen zugeordnet. *Deikella* n. gen. wird für drei *Turbo*-artige Spezies eingeführt, die im Gegensatz zum rezenten *Turbo* kräftige Axialrippen aufweisen. *Frydatinus* n. gen. wird für eine offen gewundene Archaeogastropode mit runder Mündung und dornenartigen Fortsätzen an der Außenseite eingeführt. Es wird eine neue Art von *Delpeya* eingeführt und diskutiert, dass sich diese Gattung von der jurassischen Gattung *Nummocalcar* ableitet. Die hohe Zahl an Pleurotomarien in dieser Fauna zeigt, dass diese Tiere im Cenoman noch im Bereich von Felsküsten gelebt haben, im Gegensatz zu heute, wo sie auf Hartgründe im Tiefwasser beschränkt sind. Die neuen Arten sind: *Bathrotomaria harasewychi*, *Deikella spinicostata*, *Deikella ruhrensis*, *Deikella? muelheimensis*, *Trochus rauenorum*, *Margarella* (*Promargarita*) *spiraloides*, *Margarella* (*Promargarita*) *trochoides*, *Semisolarium boehmi*, *Onkospira perrilliatae*, *Delpeya hilperti*, *Neritopsis kasei* und *Otostoma kassenbergensis*.

Schlüsselwörter: Gastropoda, Kreide, Cenoman, Deutschland, Taxonomie, Felsküste

Abstract: Forty-six gastropod species are described from the Cenomanian of the Kassenberg quarry in Mülheim a. d. Ruhr, Germany, twelve of them are new. They are assigned to 33 known genera and two new genera. *Deikella* n. gen. is introduced for three *Turbo*-like species which have strong axial ribs in contrast to the smooth Recent *Turbo*. *Frydatinus* n. gen. is introduced for a loosely coiled archaeogastropod with a round aperture and spine-like extensions on its outer side. A new species of *Delpeya* is introduced, and it is suggested that this genus derived from the Jurassic *Nummocalcar*. The high number of pleurotomariids indicates that these gastropods still lived on rocky shores during the Cenomanian, in contrast to modern times, where they are restricted to hardgrounds in deep-water. The new species are: *Bathrotomaria harasewychi*, *Deikella spinicostata*, *Deikella ruhrensis*, *Deikella? muelheimensis*, *Trochus rauenorum*, *Margarella* (*Promargarita*) *spiraloides*, *Margarella* (*Promargarita*) *trochoides*, *Semisolarium boehmi*, *Onkospira perrilliatae*, *Delpeya hilperti*, *Neritopsis kasei*, and *Otostoma kassenbergensis*.

Keywords: Gastropoda, Cretaceous, Cenomanian, Germany, taxonomy, rocky shore

Introduction

Fossils from Mülheim a d. Ruhr, Germany, were first described by the school teacher DEIKE (1876, 1878) from several small quarries on the southern edge of Mülheim. Scientific work improved greatly since about 1910 when the Kassenberg quarry was opened (Fig. 1;

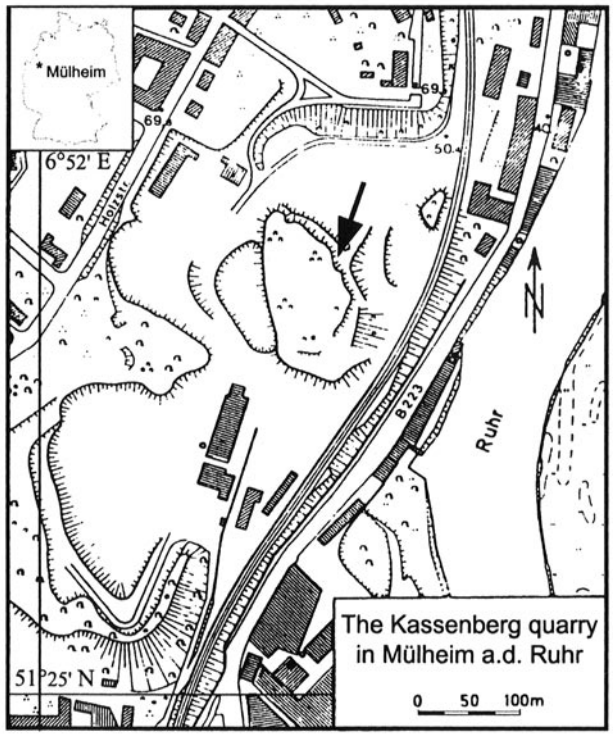

Fig. 1. The Kassenberg quarry at Mühlheim, Germany.

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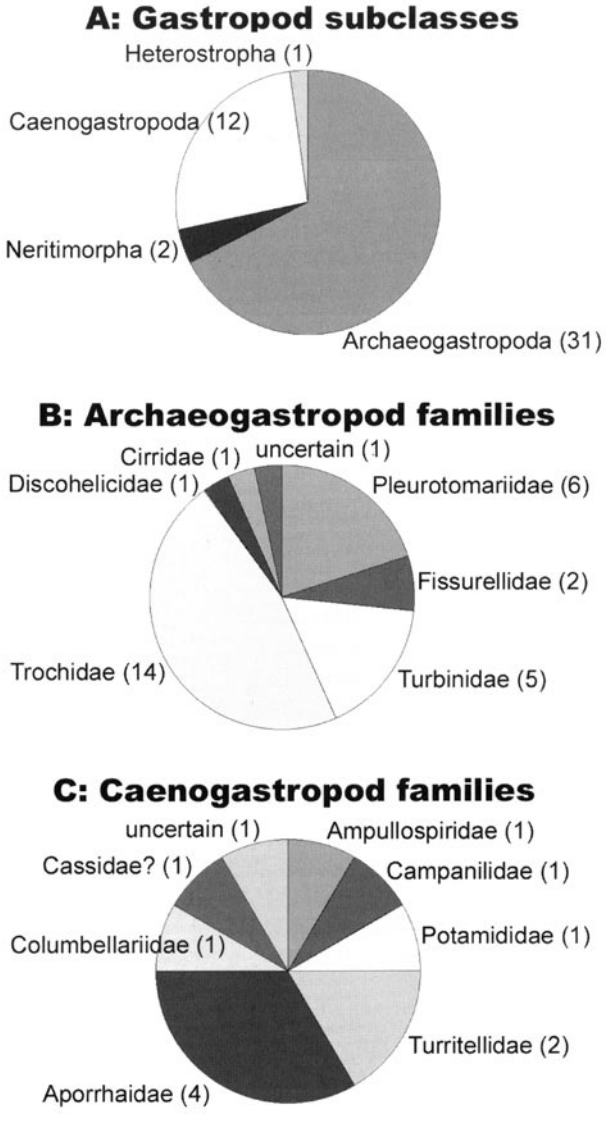


Fig. 2. Species diversity of the Gastropoda from the Kassenberg quarry. – **A**: Number of species among the gastropod subclasses. – **B**: Number of species among the archaeogastropod families. – **C**: Number of species among the caenogastropod families.

SCHEER & STOTTROP 1995). A first analysis of the sediments and its fauna was published by KAHRS (1927). He also published a faunal list provided by JOHANNES BÖHM, which included 77 gastropod species, nine of them new. These species, however, have neither been described nor figured and thus their names are not valid. Apart from the gastropods, the Kassenberg fauna contains bryozoans (VOIGT 1974, 1989), cephalopods (HANCOCK et al. 1972; WIEDMANN & SCHNEIDER 1979; KAPLAN et al. 1998), corals (FRIEG 1982; LÖSER 1994), crinoids (SIEVERTS 1931; SCHNEIDER 1987, 1988), and sponges (RAUFF 1933; HILLMER & SENOWBARI-DARYAN 1986).

The fossils were extracted from a hard, yellow to red limestone, which was deposited in cavities of the Carboniferous sandstone along a rocky shore during the Cenomanian (KAHRS 1927). The Cenomanian age of these cavity-fillings was recently confirmed by KAPLAN et al. (1998), based on a study of their ammonite fauna.

Systematic descriptions

Type locality and **type strata** for all new taxa described herein are the Cenomanian of the Kassenberg quarry in Mülheim a.d. Ruhr, Germany. All material is deposited in the Ruhr Museum in Essen, Germany. The numbers of the figured specimens are marked by two asterisks (**). Most of the material was collected by KARL-HEINZ HILPERT, a small part is from old collections of the Ruhr Museum.

Class Gastropoda CUVIER, 1797
Subclass Archaeogastropoda THIELE, 1925
Order Vetigastropoda SALVINI-PLAWEN, 1980
Family Pleurotomariidae SWAINSON, 1840

Genus *Bathrotomaria* COX, 1956

Type species: *Trochus reticulatus* SOWERBY, by original designation, Upper Jurassic (COX 1956).

Bathrotomaria velata (GOLDFUSS, 1844)
Figs. 3A–C

* 1844 *Pleurotomaria velata* GOLDFUSS: 76, figs. 3–4.
1960 *Bathrotomaria velata* GOLDFUSS. – COX: 405, pl. 54 figs. 3–4.

Material: Five specimens: A836/1, A1232, **A1331/4, A3244, A3269.

Description: The trochiform shell consists of at least five convex whorls with deep sutures. The whorls have a peripheral angulation with the slit about mid-whorl below the peripheral angulation and a basal keel. Its sculpture consists of fine spiral lines and fine axial growth lines which slope away from the aperture above the slit and are sinuous below. The base is convex, sculptured by spiral lines and fine, sinuous growth lines, and has a broadly conical umbilicus. The figured shell is 34 mm wide and 22 mm high.

Discussion: Closely allied or perhaps even the same species might be *Bathrotomaria elegans* (d'ORBIGNY, 1842: pl. 190, figs. 1–4) from the "Neocomian" of France. In the latter case, d'ORBIGNY's name would have priority. However, d'ORBIGNY's species appears to have a slightly wider basal keel, and it is older than the specimens described here.

Bathrotomaria dixoni COX, 1960
Figs. 3D–F

* 1960 *Bathrotomaria dixoni* COX: 404, pl. 55 figs. 1a–c, 2.

Material: 24 specimens: A796/2, **A836/2, A837/2, A1146/6, A1261, A1287/3, A1287/7, A1331/1, A1332/4, A3180, A3190, A3196, A3202, A3230, A3233, A3278, A3279/1, A3279/2, A3280, A3281, A3389, A3390/1, A3390/2, A3390/39.

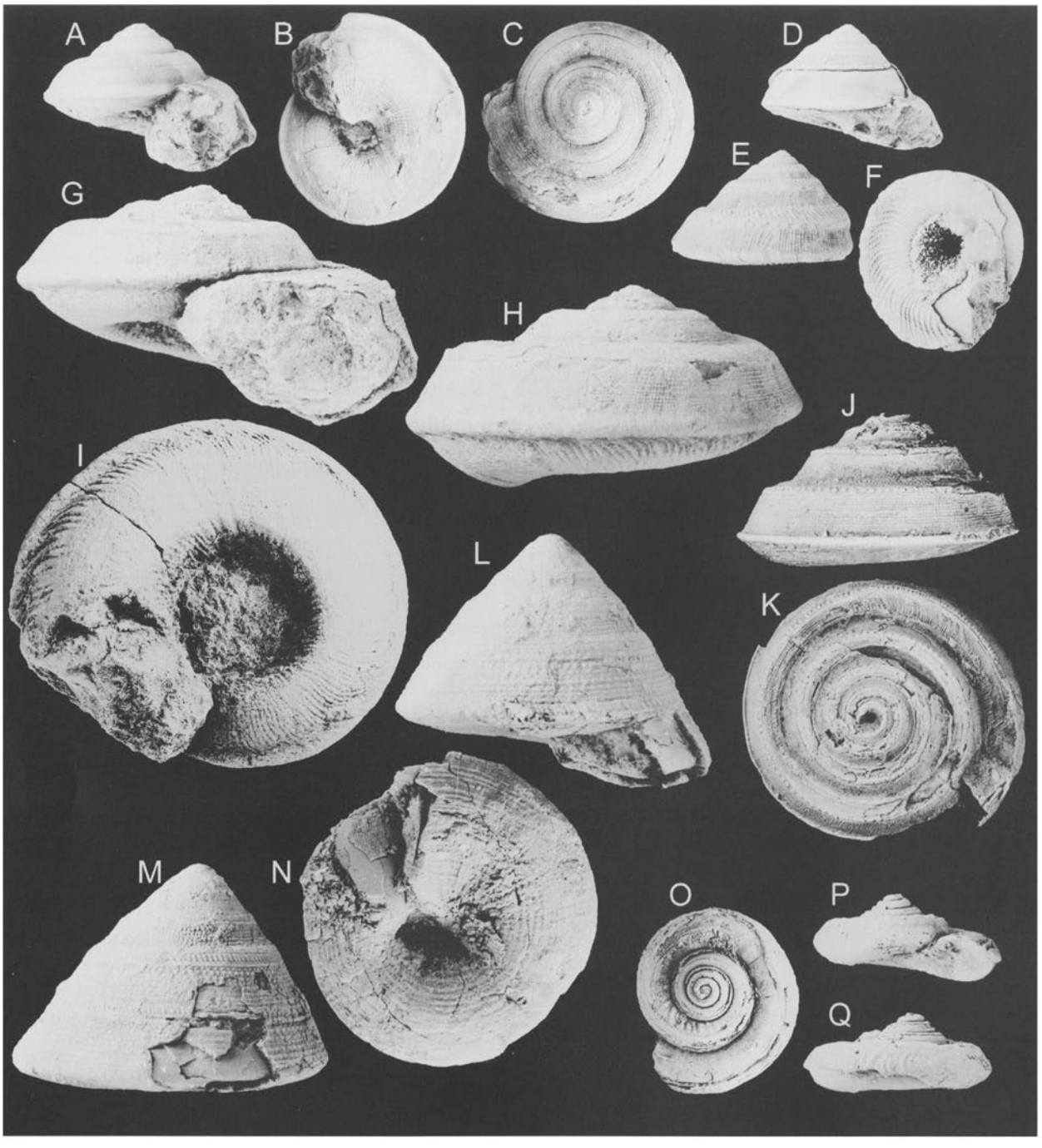


Fig. 3. Cenomanian Gastropoda from the Kassenberg quarry. – **A–C**: *Bathrotomaria velata* (GOLDFUSS, 1844), A1331/4. – **D–F**: *Bathrotomaria dixoni* COX, 1960, A836/2. – **G–I**: *Bathrotomaria harasewychi* n. sp., holotype, A71. – **J–K**: *Bathrotomaria* sp., A3176. – **L–N**: *Conotomaria percevali* COX, 1960, A3174. – **O–Q**: *Pleurotomaria* sp., A1292/1. – All figures natural size.

Description: The trochiform shell consists of the protoconch and seven whorls of the teleoconch; the slit starts after the first half volution of the teleoconch and is situated in the upper half of the whorls. The whorls have an angular shoulder sculptured by oblique ribs above the slit; below the slit, the whorls are straight-sided to concave and are sculptured by fine, sinuous wrinkles. The basal ridge is prominent and rounded; the base is more-or-less flat, sculptured by strongly prosocline to sinuous ribs and fine spiral lines, and the umbilicus is wide and conical. The figured specimen is 29 mm wide and 19 mm high.

Discussion: COX (1960) described this species from Cenomanian chalks and limestones of southern England. It is similar to *B. velata* (GOLDFUSS, 1844) regarding general shape and sculpture. It differs from *B. velata* in its flat base, the stronger ribs above the slit, the strong, sinuous ribs on the base, and the position of the slit. Although there is some variability within *B. dixoni* regard-

ing the apical angle and the shape of the base, no transition into *B. velata* has been observed within the available material.

Bathrotomaria harasewychi n. sp.
Figs. 3G–I

Holotype: A71, illustrated in Figs. 3G–I.
Derivatio nominis: Named after M.G. HARASEWYCH, Washington, who is working on extant pleurotomariids.
Material: Three specimens: **A71, A3175, A3371.

Diagnosis: The low conical shell has an angular whorl profile, with the apical side almost horizontal. The peripheral angulation is rounded with the slit just below. The outer side is straight; the basal margin is keeled and rounded. The base is convex, and the umbilicus occupies one third of the diameter of the base.

Description: The low conical shell consists of at least four angular whorls. The whorls profile is almost horizontal apically. The periphery is marked by a strong but rounded angulation with the selenizone just below it; the whorl sides are straight; the basal margin is marked by a strong and rounded ridge; the base is convex, and the umbilical margin is rounded. Sculpture consists of oblique growth lines and spiral lines above the slit, and beaded spiral cords with fine, sinuous growth lies below. The base is sculptured by fine sinuous ribs and spiral lines, and the wide umbilicus occupies one third of the base. The largest specimen is 28 mm high and 64 mm wide.

Discussion: This species differs from *Bathrotomaria velata* in its more angular whorls, its lower spire, and its proportionally wider umbilicus. *B. dixoni* also has a higher spire and a narrower umbilicus than *B. harasewychi* n. sp., and has even less angulated whorls. *Bathrotomaria* sp. described below has a higher spire than *B. harasewychi* n. sp. and a sharper basal margin.

Bathrotomaria sp.
Figs. 3J–K

Material: One specimen: **A3176.

Description: The large, conical shell consists of at least five strongly shouldered whorls. Above the periphery, the whorls are sculptured by strongly transverse lines crossed by spiral lines; the slit is situated at the peripheral angulation, below it are fine, sinuous growth lines and fine spiral lirae. The basal keel is smooth and sharp; the base is convex and sculptured by sinuous growth lines and numerous spiral lines. The umbilicus is wide and deep. The figured shell is 30 mm high and 45 mm wide.

Genus *Conotomaria* COX, 1959

Type species: *Pleurotomaria mailleana* d'ORBIGNY, 1843, Cenomanian, France, by original designation (COX 1959a).

Conotomaria percevali COX, 1960
Figs. 3L–N

* 1960 *Conotomaria percevali* COX: 411, pl. 57 figs. 2a–b.

Material: Five specimens: A837/1, A1240/2, A1240/3, **A3174, A3314.

Description: The large, conical shell has rather straight sides and consists of at least eight whorls. The slit is very narrow and is situated just below a narrow subsutural band of fine axial riblets. Below the slit are about eight beaded spiral cords of different strength, crossed by sinuous growth lines. The basal ridge is rounded; the base is only slightly convex, and sculptured by numerous beaded spiral cords and fine, sinuous growth lines. The umbilicus is wide but only one whorl deep. The figured shell is 50.5 mm wide and 38 mm high.

Genus *Pleurotomaria* DEFRANCE, 1826

Type species: *Trochus anglicus* SOWERBY, Liassic, Europe.

Discussion: *Pleurotomaria* applies here in the widest sense to include three specimens which do not fit into any of the known genera but are too poorly preserved to serve as type species of a new genus.

Pleurotomaria sp.
Figs. 3O–Q

Material: Three specimens **A1292/1, A1292/3, A3271.

Description: The shell shows a change from high-conical coiling in the first whorls to very low conical coiling in the last two whorls. The broad slit is situated at the whorl's shoulder. On the low-conical whorls, the upper sides of the whorls show strong, slightly oblique tubercles; below the slit are opisthocline growth lines and ribs, and fine spiral lines. The base is convex, has a broad and deep umbilicus, and is sculptured by spiral lines and slightly sinuous growth lines. The figured shell is 30 mm wide and 12 mm high; the largest specimen is 37 mm wide and 11 mm wide.

Family Fissurellidae FLEMING, 1822

Genus *Emarginula* LAMARCK, 1801

Type species: *Patella fissura* LINNAEUS, 1758, Recent, North Sea (WENZ 1938–44: 175, fig. 276).

Emarginula? sp. 1
Figs. 4A–B

Material: One specimen: **A3320.

Description: The high, oval limpet is sculptured with numerous fine radial ribs and fine lamellae between them. The ribs are separated by interspaces of about equal size. The shell has an elliptical base and is 10 mm high, 17 mm long, and 12 mm wide.

Discussion: The two species described here as *Emarginula* are too poorly preserved to be determined to spe-

cies level. *Emarginula*? sp. 1 differs from the one described below in having smaller interspaces between the radial ribs, and it has a conical apex, whereas the apex of *Emarginula*? sp. 2 is slightly coiled.

Emarginula? sp. 2
Figs. 4C–D

Material: One specimen: **A3357.

Description: The high, oval limpet has a slightly coiled shell. Sculpture consists of radial ribs separated by interspaces which are about one and a half times the size of the ribs, fine lamellae are between the ribs. The shell is 12 mm high, 12 mm wide, and approximately 20 mm long.

Family Turbinidae RAFINESQUE, 1815
Subfamily Angariinae THIELE, 1921

Genus *Angaria* RÖDING, 1798

Type species: *Turbo delphinus* LINNAEUS, 1758, Recent, Indopacific (WENZ 1938–44: fig. 742).

Angaria coronata (ROEMER, 1841)
Figs. 4E–F

* 1841 *Delphinula coronata* ROEMER: pl. 12 fig. 2.

Material: 22 specimens: A335/3, A832/1, **A832/2, A832/3, A832/4, A1335/2, A1335/3, A3162/1, A3162/2, A3179, **A3186, A3191, A3203, A3206, A3209, A3212, A3213, A3254, A3264, A3353, A3376/1, A3376/2.

Description: The turbiniform shell consists of about six volutions. The whorls have a broad subsutural ramp, a peripheral keel with strong, spiny tubercles, and a rounded-angular basal edge. Sculpture consists of coarsely noded spirals. The aperture has a prosocline inclination of about 30°. The figured specimen A832/2 is 25 mm high; A 3186 is 30 mm high.

Discussion: A very similar extant species is *Angaria tyria* (REEVE) from northern Australia (see WELLS & BRYCE 1988: fig. 59), which differs in its slightly lower spire and in its sharper umbilical margin. The extant type species differs in developing enormous spines on its periphery. ROMAN & MAZERAN (1913: pl. 5 figs. 2–3) figured two similar shells from the Turonian of the Uchaux Basin in France: *A. renauxiana* (d'ORBIGNY, 1842) and *A. pelossei* (ROMAN & MAZERAN, 1913). *A. renauxiana* lacks the peripheral spines that are present in *A. coronata*. *A. pelossei* has fewer but stronger peripheral spines than *A. coronata*, and only two spiral cords below the periphery, rather than the four in *A. coronata*.

Shells of *Angaria*, *Astraea* and *Turbo* are often convergent in shape, and similar shells can be traced back into the Triassic (WENZ 1938–44; YIN & YOCHELSON 1983; HICKMAN & MCLEAN 1990; BANDEL 1993; KIEL & BANDEL 2002b). The convergence makes it rather impossible to assign these shells to modern genera, and our treatment should be seen only as tentative.

Subfamily Turbininae RAFINESQUE, 1815

Genus *Deikella* n. gen.

Type species: *Deikella spinicostata* n. sp., Cenomanian, Mülheim, Germany, described below.
Derivatio nominis: Named in honour of H. DEIKE, who first described fossils from the area in Mülheim where the Kassenberg quarry is located today.

Diagnosis: *Turbo*-like shells with strong axial ribs on the whorl's periphery, deep sutures, and an open or closed umbilicus.

Discussion: This new genus presumably belongs to the Turbininae due to its *Turbo*-like shape. It differs from all extant subgenera of *Turbo* in its strong axial ribs on the whorl's periphery; *Turbo* s.str. is smooth, and its subgenera have predominantly spiral ornament. The Jurassic to Miocene *Barbotella* COSSMANN, 1916 has axial ribs, but these are located subsuturally, disintegrate below the periphery, and do not develop spines (see KIEL & BANDEL 2002b).

Deikella spinicostata n. sp.
Figs. 4G–H

Holotype: A1411/4, illustrated in Figs. 4G–H.
Derivatio nominis: Named for the spiny ribs (costae) on the whorl's periphery.
Material: Six specimens: A890/3, A1313/20, A1314/1, **A1411/4, A3178, A3295/1.

Diagnosis: The high-spired turbiniform shell has deep sutures and a row of strong axial ribs at the whorl's periphery, which are very strongly developed on the last whorl; the aperture is only weakly inclined.

Description: The high spired turbiniform shell is ornamented by strong axial ribs that are very prominent on the last whorl. The small subsutural ramp shows beaded spirals of differing strength, and the strong axial ribs are also covered with spirals. The basal edge is well rounded, and the base has a small umbilicus. The aperture is round and has a prosocline inclination of about 45°. The holotype is 27 mm high and 18 mm wide.

Deikella ruhrensis n. sp.
Figs. 4I–J

Holotype: 1358/1, illustrated in Figs. 4I–J.
Derivatio nominis: Named after the Ruhr river, which passes near the Kassenberg quarry.

Material: 17 specimens: A878, A1236/2, A1236/1, A1313/24, **A1358/1, A3160, A3166, A3200, A3224, A3226, A3243, A3250, A3251, A3381, A3285, A3286, A3288, A3291, A3298, A3388.

Diagnosis: The turbiniform shell has deep sutures and is sculptured by a fine carina. A row of blunt tubercles marks the whorls periphery. There is a small umbilicus, and the aperture has a prosocline inclination of 22°.

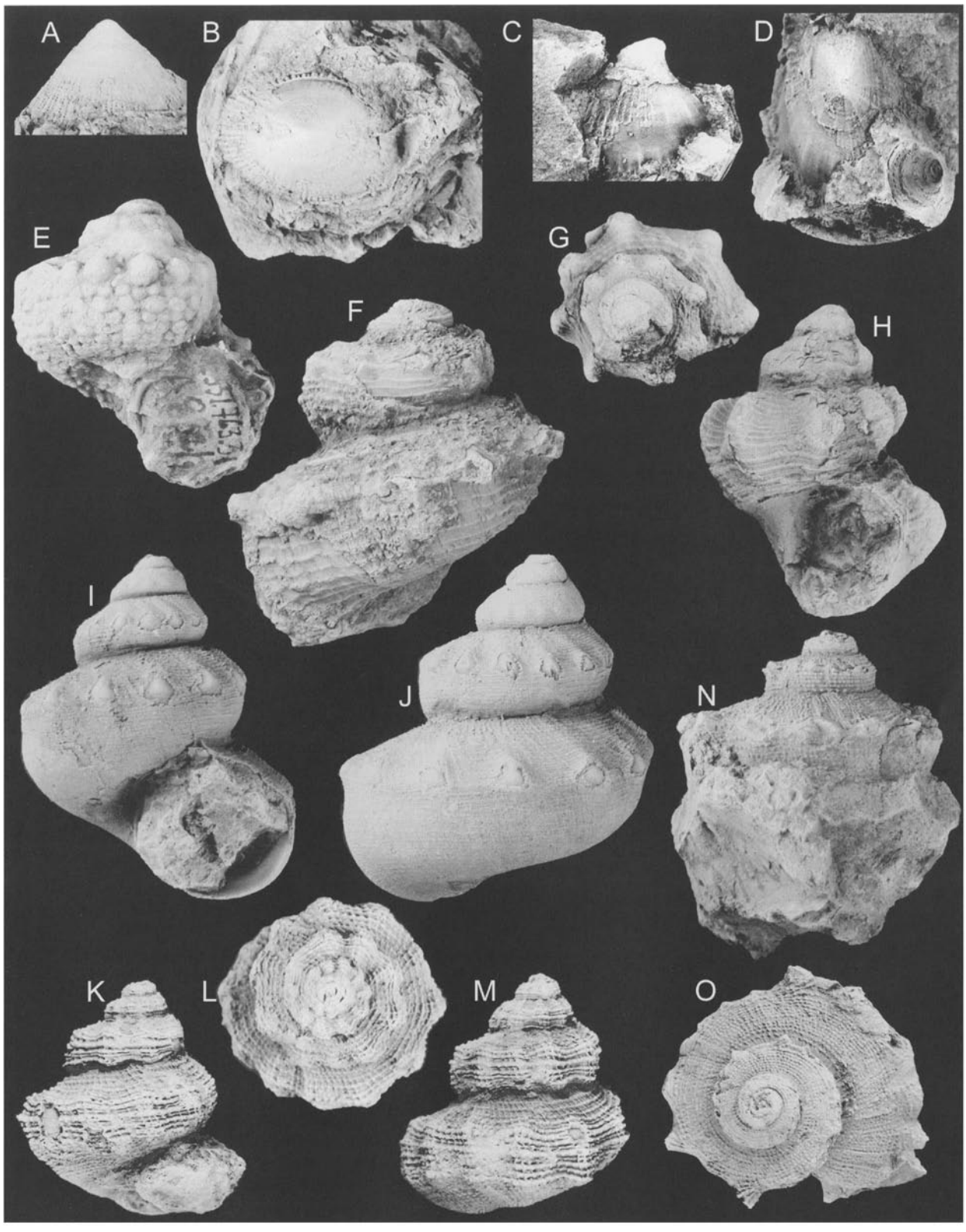


Fig. 4. Cenomanian Gastropoda from the Kassenberg quarry. – **A–B**: *Emarginula*? sp. 1, A3320. – **C–D**: *Emarginula*? sp. 2, A3357. – **E–F**: *Angaria coronata* (ROEMER, 1841); **E**. apertural view on an incrusted specimen, A832/2; **F**. backside of specimen showing the loosely coiled last whorl, A3186. – **G–H**: *Deikella spinicostata* n. sp., holotype, A1411/4. – **I–J**: *Deikella ruhrensis* n. sp., holotype, A1358/1. – **K–M**: *Deikella*? *muelheimensis* n. sp., holotype, A3183. – **N–O**: *Marmostoma* sp., A1401. – All figures twice natural size.

Description: The turbiniform shell has convex, slightly angular whorls with deep sutures. Sculpture consists of a fine cancellate pattern formed by spirals and transverse growth lines, and of blunt tubercles which form a ridge on the periphery. The basal slope and base are well rounded, show only faint spiral sculpture, and there is a

small umbilicus. The aperture is amost circular and has a prosocline inclination of 22°. The holotype is 30 mm high and 23 mm wide.

Discussion: This species resembles *Trochus boehmi* MÜLLER, 1898 from the Late Cretaceous of northern Germany. *Trochus boehmi* has a similar general shell shape, but its ribs are not as spiny as those of *Deikella ruhrensis* (see MÜLLER 1898: 97, pl. 12 fig. 6).

Deikella? muelheimensis n. sp.
Figs. 4K–M

Holotype: A3183, illustrated in Figs. 4K–M.
Derivatio nominis: Named after the city of Mülheim, Germany, where the Kassenberg quarry is located.
Material: One specimen: **A3183.

Diagnosis: The shell has low whorls, a sculpture of broad, straight to slightly oblique, axial ribs, and fine spirals that are stronger on the whorl's periphery and finer towards the sutures. The surface is covered by fine collabral growth increments. The aperture is roundish to lenticular, inclined by about 45°.

Description: The turbinid shell is of moderate height and has convex whorls. Its sculpture consists of strong axial ribs, which are a little oblique, and a fine, cancellate pattern of spiral lirae and growth lines. On later whorls, the apical ends of the ribs form a peripheral ridge and a basal ridge, giving the whorl an angular appearance. The base has a small umbilicus and the same fine cancellate pattern as the whorl sides. The aperture has a prosocline inclination of about 45°; the shell is 20 mm high and wide.

Discussion: A similar species from the Late Cretaceous of the Austrian Gosau is *Turbo haidingeri* REUSS, 1854. This species does not have the deep sutures of *Deikella? muelheimensis* n. sp., and its base is not as rounded (see REUSS 1854: pl. 29 figs. 2a–b). Also somewhat similar is *Turbo reticulatus* PHILLIPS from the Early Cretaceous of Germany (see WOLLEMANN 1900: 154, pl. 7 figs. 9a–d), but it has two well developed keels and only fine axial ribbing on the last whorl, deeper sutures, and a lower spire.

A similar sculpture can be found on some Late Cretaceous neogastropods (see SOHL 1964). However, we place this species within *Deikella* due to its strongly inclined and roundish aperture, although this treatment is not entirely satifactory due to the lack of protoconch and shell structure data.

Genus *Marmorostoma* SWAINSON, 1829

Type species: *Turbo crysostomus* LINNAEUS, 1758, Recent, Indopacific (WENZ 1938–44: 348, fig. 822).

Marmorostoma sp.
Figs. 4N–O

Material: One specimen: **A 1401.

Description: The turbiniform shell consists of at least four whorls. The whorls have a step-like profile with a broad subsutural ramp, a spiny keel at the angulation, and are straight below the angulation. There are about 15 spines on the last whorl. Sculpture consists of a fine cancellate pattern of oblique growth lines and spiral lirae above the periphery; fine beaded spirals dominate below the periphery. The aperture and base are unknown. The shell is 25 mm high and 23 mm wide.

Family Trochidae RAFINESQUE, 1815
Subfamily Margaritinae STOLICZKA, 1868

Genus *Margarites* GRAY, 1847

Type species: *Helix margarita* MONTAGU (= *Turbo helicina* FABRICIUS), Recent, eastern Atlantic (WENZ 1938–44: 269, fig. 557).

Margarites sp.
Figs. 5A–B

Material: Two specimens: **A3333/37, A3333/43.

Description: The sturdy conical shell consists of about five little convex volutions, sculptured with numerous (about 15 on the penultimate whorl) fine, equally sized spirals with equally sized interspaces. The basal margin is rounded-angular, and the base shows fine spiral lines. The figured shell is 8 mm high and 7.5 mm wide.

Discussion: Since neither of our two specimens has the aperture well preserved, this *Margarites* is here described in open nomenclature only. *Margarites* (*Valvatella*) *pupillus* (GOULD) is an extant species of similar shell-shape (see HICKMAN & MCLEAN 1990: fig. 48D).

Genus *Semisolarium* COSSMANN, 1916

Type species: *Solarium moniliferum* MICHELIN, Early Cretaceous, Saint Florentin, Dép. Yonne, France, by original designation (COSSMANN 1916: 155, pl. 6 figs. 28–29).

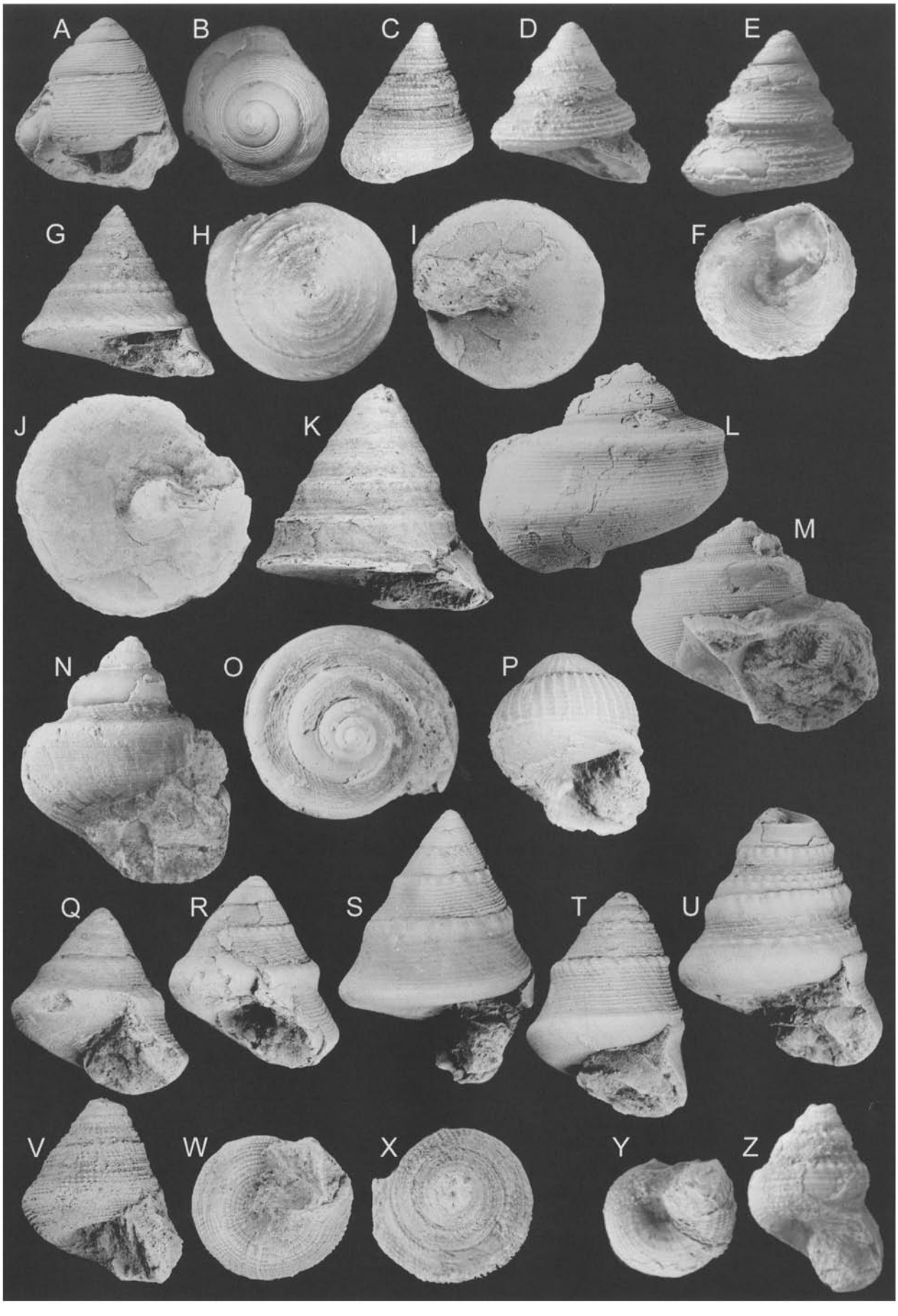
Discussion: KASE (1984) extensively discussed history and relationships of *Semisolarium* and concluded to place it within the Margaritinae due to its similarities to *Atira* STEWARD, 1927. This treatment is followed here.

Semisolarium boehmi n. sp.
Figs. 6A–C

Holotype: A1329/3, illustrated in Figs. 6A-C.
Derivatio nominis: Named in honour of JOHANNES BÖHM, who investigated the Kassenberg Material early in the last century.
Material: Two specimens: **A1329/3, A1339.

Diagnosis: This *Semisolarium* has a low apical angle of about 110°, 24 subsutural ribs on the last whorl, a strong basal keel, and a well-rounded base.

Description: The low-trochiform shell consists of five or more whorls. These are more or less convex and are sculptured by a subsutural band of axial ribs (24 of them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on the last whorl), several finely crenulated spiral lines below, and a basal keel. The base is rounded and sculptured by fine spiral lines, and the umbilicus takes about one third of the width of the base. The aperture is quadrangular with rounded corners. The figured specimen is 12 mm high, 20 mm wide, and has an apical angle of about 110°.

Discussion: This species can be distinguished from the type species *S. moniliferum* by its lower apical angle, and its strong basal keel; the basal margin of *S. moniliferum* is rounded. *Semisolarium incrassatum* (NAGAO) from the Aptian/Albian of Japan (KASE 1984: 58, pl. 5 figs. 3–6, 9) also has a higher spire than *Semisolarium boehmi* n. sp.; the subsutural ribs are smaller, and the spiral lines are stronger than in *Semisolarium boehmi* n. sp.

Subfamily Trochinae RAFINESQUE, 1815
Tribe Trochini RAFINESQUE, 1815

Genus *Trochus* LINNAEUS, 1758

Type species: *Trochus maculatus* LINNAEUS, 1758, Recent, Indopacific.

Trochus sarthinus d'ORBIGNY, 1842
Fig. 5C

* 1842 *Trochus sarthinus* d'ORBIGNY: 189, pl. 117 figs. 6–8.

Material: Two specimens: **A897/16, A1284/14.

Description: The elongate conical shell has seven straight-sided to slightly convex whorls and a sculpture of five strong, beaded spirals with numerous fine beaded spirals between them. These are crossed by transverse growth lines. The basal margin is well rounded, and the base has fine beaded spirals and a narrow umbilicus. The aperture has a prosocline inclination of about 20°. The figured shell is 15 mm high and 10 mm wide.

Discussion: A similar beaded spiral ornament occurs on *Ilerdus pyrenaeus* KIEL & BANDEL, 2001 from the Campanian of Torallola, Spain, but the basal margin of *Trochus sarthinus* is rounded in contrast to the sharp basal margin of *Ilerdus pyrenaeus*. The first whorl of *T. sarthinus* is unknown, thus the species cannot undoubtedly be assigned to the eucyclid *Ilerdus*.

Trochus rauenorum n. sp.
Figs. 5D–F

Holotype: A1308/74, illustrated in Figs. 5D–F.
Derivatio nominis: Named after the RAUEN family which opened the Kassenberg quarry in 1910.
Material: One specimen: **A1308/74.

Diagnosis: The conical shell has convex whorls with deep sutures, is sculptured by six to seven beaded spirals, has a flat base with fine spiral lines, and has a basal denticle on the columella.

Description: The trochiform shell consists of at least five whorls. The whorls are almost straight-sided, subsuturally somewhat constricted, sculptured by six to seven beaded spirals, have a sharp but rounded basal margin, and a suture marked by a nodular spiral cord. The base is flat, has 16 fine spirals, collabral growth lines, and a small, conical umbilicus. The aperture has a basal denticle on the columella and a prosocline inclination of 45°; the peristome is interrupted at its parietal side. The shell is 15 mm wide and high.

Discussion: A species that is similar in shape was described as *Calliostoma sohli* by CALZADA (1989: 6, pl. 2 figs. 2a–d). That species differs in having straight sides and in having eleven spirals per whorl, instead of six to seven as in *Trochus rauenorum* n. sp.

Genus *Tectus* MONTFORT, 1810

Type species: *Trochus mauritianus* GMELIN, Recent, Indian Ocean (WENZ 1938–44: 308, fig. 687).

Tectus cf. *guerangeri* (d'ORBIGNY, 1842)
Figs. 5G–I

cf.* 1842 *Trochus guerangeri* d'ORBIGNY: 188, pl. 177 figs. 4–5.

Material: Two specimens: A903/5, **A1193/1.

Description: The trochiform shell consists of seven concave whorls which are sculptured by two strong, nodular spiral cords and fine spiral lirae. The two spiral cords are situated at the upper and lower sutures, and the growth lines are strongly prosocline. The basal margin is sharp, and the base is flat and smooth. The aperture has a prosocline inclination of about 50°, is rhomboid in shape, and bears a strong plait on the columella. The figured shell is 14 mm high, 16 mm wide, and has an apical angle of almost 70°.

Fig. 5. Cenomanian Gastropoda from the Kassenberg quarry. – **A–B**: *Margarites* sp., A3333/37, figures four times natural size. – **C**: *Trochus sarthinus* d'ORBIGNY, 1842, A897/16. – **D–F**: *Trochus rauenorum* n. sp., holotype, A1308/74. – **G–I**: *Tectus* cf. *guerangeri* (d'ORBIGNY, 1842), A1193/1. – **J–K**: *Tectus* sp., aff. *T. vulgatus* (REUSS, 1854), A1237/2. – **L–M**: *Margarella (Promargarita) spiraloides* n. sp., holotype, A1177/4. – **N–O**: *Margarella (Promargarita) trochoides* n. sp., holotype, A1177/2. – **P**: *Monodonta marcaisi* (d'ORBIGNY, 1842), A1285/4. – **Q–U**: *Thalotia scrubiculata* (REUSS, 1846), five specimens showing intraspecific variability, all figures three times natural size; **Q**. A1308/80; **R**. 1308/5; **S**. A903/25; **T**. A1308/42; **U**. 1235/3. – **V–X**: *Calliostoma*? sp., A1308/70. – **Y–Z**: *Solariella* sp., A897/5, two and a half times natural size. – Figures twice natural size except where noted.

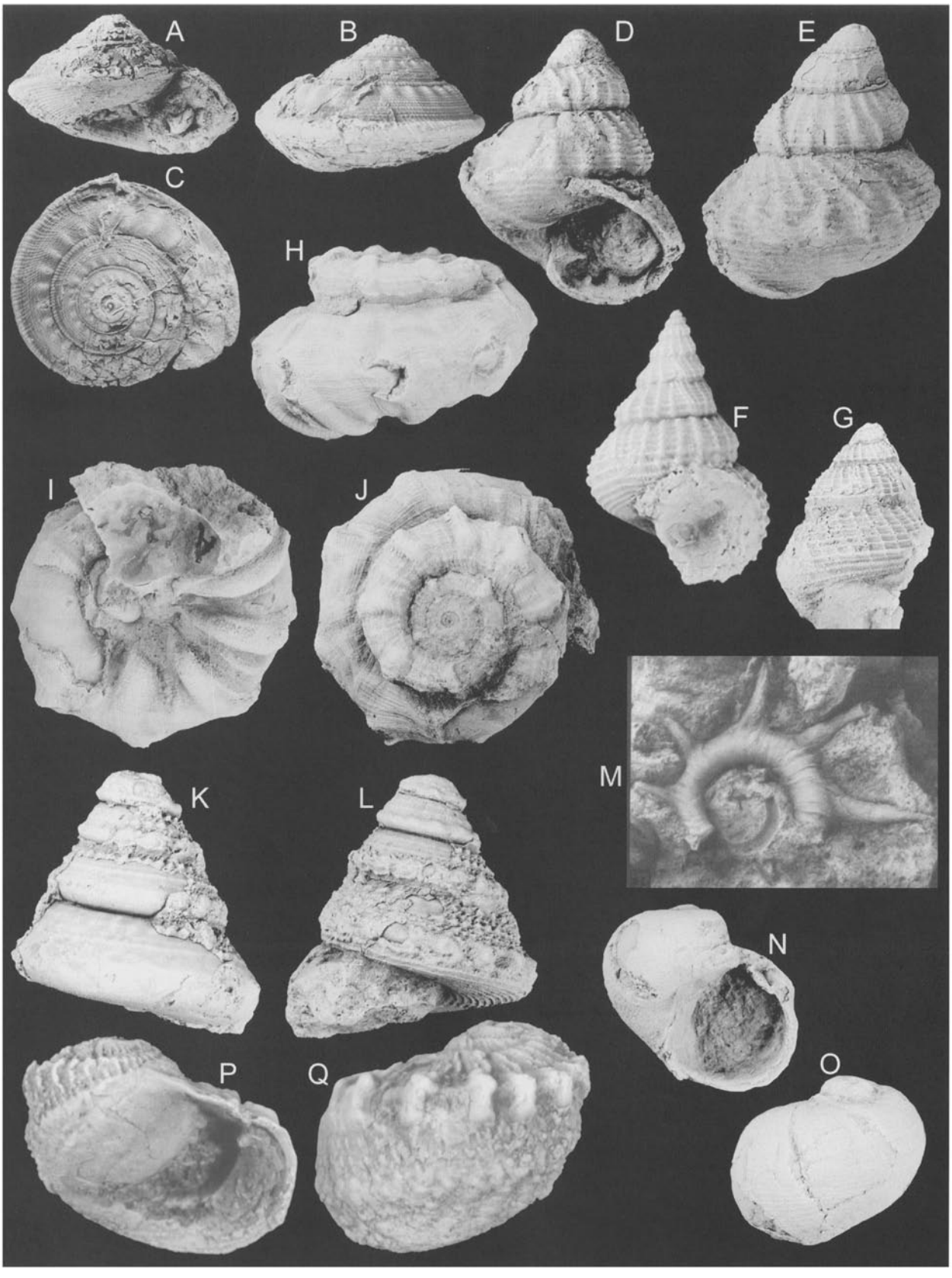


Fig. 6. Cenomanian Gastropoda from the Kassenberg quarry. – **A–C**: *Semisolarium boehmi* n. sp., holotype, A1329/3. – **D–F**: *Onkospira perrilliatae* n. sp.; **D–E**. adult specimen, holotype, A1313/26; **F**. juvenile specimen, A898/4, four times natural size. – **G**: *Chilodonta*? sp., A887/41. – **H–J**: *Delpeya hilperti* n. sp., holotype, A1358/3. – **K–L**: *Hamusina kahrsi* BANDEL, 1993, A1231/1. – **M**: *Frydatinus scheeri* (BANDEL & FRÝDA, 1998), A1271, one and a half time natural size. – **N–O**: *Neritopsis hayamii* n. sp., holotype, A3375/2. – **P–Q**: *Otostoma kassenbergensis* n. sp., holotype, A74/5. – All figures twice natural size except when indicated.

Discussion: The figure provided by d'ORBIGNY (1842: 188, pl. 177 figs. 4–5) shows a specimen with a slightly higher spire and a base which is not as flat as in the specimens available to us. *Tectus carinatus* (QUINTERO & REVILLA, 1966) from the Campanian of Torallola, Spain, is similar but differs in having a spirally sculptured base and a higher spire (see KIEL & BANDEL 2001b, pl. 3 figs. 1, 4). The drawing of a specimen of *T. bundei* d'ARCHIAC in WEINZETTL (1910: pl. 2 fig. 3) shows a similar nodular basal keel. That specimen is from the Cenomanian of Korycany, Czech Republic, and thus of the same age as the species described here.

Tectus sp., aff. *T. vulgatus* (REUSS, 1854)
Figs. 5J–K

aff.* 1854 *Trochus vulgatus* REUSS, pl. 29 fig. 1.

Material: 17 specimens: A897/1, A897/6, A903/5, A903/9, A903/25, **A1237/2, A1284/16, A3333/6, A3333/36, A3335/10, A3336/3, A3346/2, A3346/8, A3346/14, A3395/05, A3395/17.

Description: The conical shell has low, slightly concave whorls. These are sculptured with four beaded spiral cords and one rather smooth ridge on the lower suture. The fourth beaded cord is somewhat stronger than the upper three. The basal edge is sharp, and the base is flat and smooth. The trapezoid aperture shows a strong basal plate, and there is no umbilicus. The largest shell is 22 mm wide and 19 mm high.

Discussion: The specimen figured by REUSS (1854) as *Tectus vulgatus* (REUSS 1854: pl. 29 fig. 1) differs slightly in having a lower apical angle. The Campanian *Tectus revillai* (BATALLER) from northern Spain (see KIEL & BANDEL 2001b) differs in growing to larger size, having concave whorl sides, and having only three beaded spirals per whorl, in contrast to the straight sides and four spirals of *T.* sp., aff. *T. vulgatus*. *Tectus sohli* (CALZADA, 1989) from the Aptian of Spain differs in having a slightly convex, umbilicate base, in its more rounded basal margin, and in its more numerous (eight to ten) spiral lines.

Tribe Gibbulini STOLICZKA, 1868

Genus *Margarella* THIELE, 1893
in TROSCHEL & THIELE, 1856–93
Subgenus *Margarella* (*Promargarita*) STREBEL, 1908

Type species: *M.* (*P.*) *tropidophoroides* STREBEL, 1908, Recent, South Georgia, by monotypy (WENZ 1938–44: 271, fig. 564).

Discussion: A genus with similarly angulated whorls was introduced as *Casanovina* CALZADA, 1989, based on *Casanovina forcali* CALZADA, 1989 from the Early Cretaceous of Spain. This species possesses a columellar denticle which was included in the diagnosis of *Casanovina* (CALZADA 1989: 5, pl. 3 figs. 5a–d). The two species described below lack such a columellar denticle and are therefore not assigned to *Casanovina*, but to *M.* (*Promargarita*), although the latter genus is currently known only from its Recent type species (WENZ 1938–44).

Margarella (*Promargarita*) *spiraloides* n. sp.
Figs. 5L–M

Holotype: A1177/4, illustrated in Figs. 5L–M.
Derivatio nominis: Named according to its well developed spiral sculpture.
Material: Ten specimens: A1177/1, A1177/3, **A1177/4, A1188/2, A1320, A1334, A3157/2, A3231, A3333/45, A3347.

Diagnosis: This low-spired *M.* (*Promargarella*) has a round aperture, is sculptured by fine, beaded spiral cords, and its whorls are constricted below the peripheral keel. In the adult shell the umbilicus is covered by callus.

Description: The low-spired turbiniform shell has convex early whorls. The latter develop a broad ramp and a strong peripheral keel. The outer side of the whorl is slightly constricted below this keel; the basal edge is well rounded. The shell is covered with fine, beaded spiral cords which are connected by even finer axial lamellae. The umbilicus is covered with callus, and the round aperture has a prosocline inclination of about 45°. The holotype is 23 mm wide and 20 mm high.

Discussion: The two new species described here differ from the type species in having the umbilicus covered by callus in case of *M.* (*P.*) *spiraloides* n. sp., and in having a more prominent spire in case of *M.* (*P.*) *trochoides* n. sp. The two species differ from each other in the lower spire and the more rapidly expanding whorls of *M.* (*P.*) *spiraloides* compared to *M.* (*P.*) *trochoides*.

Margarella (*Promargarita*) *trochoides* n. sp.
Figs. 5N–O

Holotype: A1177/2, illustrated in Figs. 5N–O.
Derivatio nominis: Named according to its trochoid spire.
Material: Three specimens: **A1177/2, A3185, A3207.

Diagnosis: This *M.* (*Promargarita*) has a moderately high spire and strong growth lines; its aperture has a prosocline inclination of about 22°.

Description: The turbiniform shell consists of at least five whorls which are convex and well rounded at first, the last two whorls develop a strong peripheral keel and are angular. They are sculptured by about 15 fine spiral lirae above the periphery and collabral growth lines below the periphery. The base is rounded and has a narrow umbilical slit. The round aperture has a prosocline inclination of about 22°. The holotype is 22 mm high and 20 mm wide; the largest shell is 28 mm high and 26 mm high.

Genus *Monodonta* LAMARCK, 1801

Type species: *Trochus labio* LINNAEUS, 1758, Recent, Indopacific (WENZ 1938–44, fig. 654).

Monodonta marcaisi (d'ORBIGNY, 1842)
Fig. 5P

* 1842 *Trochus marçaisi* d'ORBIGNY: 190, pl. 186 fig. 19.

Material: Eleven specimens: A897/13, A1281/3, A1281/4, A1285/1, A1285/2, A1285/3, **A1285/4, A3333/28, A3335/06, A3346/22, A3351.

Description: The turbiniform shell consists of at least four convex volutions, which are sculptured by fine, straight axial ribs and very fine spiral lirae. The base is well-rounded, and the basal margin is marked by a change in ornamentation from axially dominated on the whorl's flank to spirally dominated, with fine, oblique growth lines, on the base. The umbilical slit is small, the aperture has a prosocline inclination of about 45°, and there is a strong fold on the inner lip. The shells are up to 16 mm wide and high.

Discussion: This species shows a cancellate sculpture that is similar to that of the Chilodontini (see below), but the single strong fold in the aperture indicates that this species belongs to *Monodonta*. *Monodonta bartonensis* STANTON, 1947 (STANTON 1947: 58, pl. 49 fig. 35) from the Edwards Limestone in Texas (middle Albian according to AKERS & AKERS 1997) has a similar shape but has nodular spirals instead of the cancellate sculpture of *M. marcaisi*.

Tribe Cantharidini COTTON, 1959

Genus *Thalotia* GRAY, 1847

Type species: *Monodonta conica* GRAY, Recent, Australia (WENZ 1938–44: 305, fig. 676).

Thalotia scrubiculata (REUSS, 1846)
Figs. 5Q–U

* 1846 *Trochus scrubiculatus* REUSS, pl. 10 fig. 14.

Material: 110 specimens: A75/1, A840/4, A887/8, A887/14, A887/51, A887/58, A897/3, A897/8, A897/11, A897/18, A903/7, **A903/25, A903/28, A1233/1, A1233/3, A1235/2, **A1235/3, A1237/3, A1285/1, **A1308/5, A1308/24, **A1308/42, A1308/45, A1308/61, A1308/62, A1308/75, **A1308/80, A3156, A3165, A3208, A3210, A3221, A3260, A3283, A3295/2, A3301, A3308, A3317, A3319, A3321, A3333/1, A3333/2, A3333/4, A3333/5, A3333/7, A3333/9, A3333/10, A3333/16, A3333/19, A3333/22, A3333/23, A3333/25, A3333/26, A3333/27, A3333/29, A3333/30, A3333/31, A3333/35, A3333/38, A3333/41, A3333/42, A3333/44, A3333/46, A3333/47, A3333/48, A3333/49, A3333/50, A3333/51, A3333/53, A334/7, A3334/11, A3335/3, A3335/7, A3346/3, A3346/6, A3346/10, A3346/11, A3346/12, A3346/15, A3346/16, A3346/17, A3346/18, A3346/19, A3346/24, A3346/25, A3346/26, A3346/27, A3346/28, A3346/29, A3346/30, A3346/32, A3346/33, A3346/34, A3346/35, A3346/36, A3346/37, A3346/40, A3356, A3363, A3377/1, A3391/2, A3395/1, A3395/2, A3395/16, A3395/22, A3395/32, A3395/40, A3395/42, A3395/43, A3395/48, A3395/54.

Description: The conical shell has concave whorls and shows allometric growth with the apical angle becoming steeper on later whorls. The sculpture consists of a subsutural band of blunt tubercles and about nine to ten fine beaded spirals below. The basal margin is sharp but rounded; the base has no umbilicus and shows spiral lines; the columella has a thickened base, and the aperture has a prosocline inclination of 45°. The largest figured specimen is 16 mm high and 12 mm wide.

Discussion: REUSS (1846) published only a drawing of *Turbo scrubiculatus*. The specimen on this drawing resembles our specimens in having a subsutural band of blunt tubercles, similar beaded spirals below, and similar prosocline growth lines. It differs from our specimens in having convex whorls, whereas those of our specimens are concave. Although our material shows a high variability, and REUSS' material is only poorly documented, our assignment should be treated cautiously.

Subfamily Calliostomatinae THIELE, 1924

Genus *Calliostoma* SWAINSON, 1840

Type species: *Trochus conulus* LINNAEUS, 1758, Recent, Mediterranean (WENZ 1938–44, fig. 598).

Calliostoma? sp.
Figs. 5V–X

Material: One specimen: **A1308/70.

Description: The trochiform shell consists of at least five slightly concave whorls. It is sculptured by a reticulate pattern formed by numerous fine spiral and axial ribs which are spiny at their intersections, and a fine grid of spiral lirae and slightly oblique growth lines. The basal margin and base are strongly convex and rounded; the base is covered by the same sculpture as the whorl's flanks, and there is a wide and deep umbilicus. The growth lines have a prosocline inclination of about 25°; the figured shell is 17 mm high, 15 mm wide, and has an apical angle of about 50°.

Discussion: This specimen is similar to the Recent *Calliostoma annulatum* (LIGHTFOOT, see HICKMANN & MCLEAN 1990: fig. 68B), however, our placement remains preliminary because HICKMANN & MCLEAN (1990) pointed out that a honeycomb pattern on the protoconch is diagnostic for Calliostomatinae. The protoconch of our specimen is not preserved.

Subfamily Solariellinae POWELL, 1951

Genus *Solariella* WOOD, 1842

Type species: *Solariella maculata* WOOD, 1842, Pliocene, Suffolk, England (WENZ 1938: fig. 579).

Solariella sp.
Figs. 5Y–Z

Material: One specimen: **A897/5.

Description: The conical shell consists of at least four whorls with an angulation at the periphery. The whorls have a tuberculate, subsutural cord, and are slightly concave between suture and the tuberculate peripheral keel. On the early whorls a second tuberculate keel lies near the whorl's base; later whorls are evenly convex below the periphery and sculptured by beaded spirals. The base is convex and has a narrow but deep umbilicus. The aperture has a prosocline inclination of about 25°; the shell is 15 mm high, 11 mm wide, and has an apical angle of about 45°.

Subfamily Eucyclinae KOKEN, 1897
Tribe Chilodontini WENZ, 1938

Genus *Onkospira* ZITTEL, 1873

Type species: *Turbo ranellata* QUENSTEDT, Jurassic, Germany.

Onkospira perrilliatae n. sp.
Figs. 6D–F

Holotype: A1313/26, illustrated in Figs. 6D–E.
Paratype: A898/4, illustrated in Fig. 6F
Derivatio nominis: Named after MARÍA DEL CARMEN PERRILLIAT, Mexico City, who is working on Cretaceous molluscs.
Material: Five specimens: **A898/4, A1252, **A1313/26, A1403/1, A3375.

Diagnosis: This *Onkospira* has whorls that are angulated in their lower third and possess axial ribs that become highly oblique on the last whorl. Adult shells have up to three oblique varices. The aperture has a thickened outer margin, an interrupted peristome, two basal denticles, and one strong, almost horizontal columellar fold. The base is sculptured by spirals and has a small umbilicus.

Description: The coeloconid shell is made of six or more convex to angular volutions. Its sculpture consists of straight to prosocline ribs crossed by finer spiral cords, and the intersections are knobbly. Below the periphery spirals are the only ornament. The aperture's outer margin is reinforced, and remnants of such thickenings form up to three varices on the spire. The aperture has one strong columellar fold and two small basal denticles. A small umbilicus is on the spirally sculptured base. The largest shell is 28 mm high and 22 mm wide.

Discussion: Although the Jurassic type species has axial varices, those of *Onkospira perrilliatae* n. sp. are highly oblique.

Genus *Chilodonta* ÉTALLON, 1859

Type species: *Chilodonta clathrata* ÉTALLON, 1859, Late Jurassic, France (WENZ 1938–44: fig. 651).

Chilodonta? sp.
Fig. 6G

Material: One specimen: **A887/41.

Description: The trochiform shell has six little convex volutions. Sculpture consists of slightly oblique axial ribs crossed by spiral cords; the junctions are spiny. There are some finer spiral lines in between the strong ones, and they are connected by fine transverse lamellae. The aperture is unknown. The shell is 18 mm high and 15.5 mm wide.

Discussion: This specimen has a cancellate sculpture that is typical for species of *Chilodonta* (see KIEL & BANDEL 2001b, pl. 2 figs. 3–8). But an unquestionable determination is impossible without knowing the aperture.

Family Discohelicidae? SCHRÖDER, 1995

Genus *Delpeya* COLLIGNON, 1949

Type species: *Delpeya cottreaui* COLLIGNON, 1949, Albian, Mahajanga Basin, Madagascar, by original designation and monotypy (COLLIGNON 1949: pl. 5 figs. 10–12).

Delpeya hilperti n. sp.
Figs. 6H–J

Holotype: A1358/3, illustrated in Figs. 6H–J.
Paratypes: A1212/2, A1411/2.
Derivatio nominis: Named for KARL-HEINZ HILPERT, Datteln, Germany, who collected much of the studied material.
Material: Three specimens: A1212/2, **A1358/3, A1411/2.

Diagnosis: A *Delpeya* in which the change from planispiral to trochispiral coiling takes place with the onset of the last whorl. The shell is sculptured with eight oblique rings encircling the penultimate whorl and with nine encircling the last whorl.

Description: The shell consists of about six round whorls of which the first five are planispirally coiled; only the last one turns into trochiform coiling. The whorls are sculptured with slightly oblique rings around the whole whorl, which are most strongly developed on the base. These rings possess semitubular spines on the periphery, there are eight such rings on the penultimate whorl and nine on the last. Fine axial and spiral lines cover the entire shell. The umbilicus is wide, and the aperture is round. The holotype is 18 mm high and 25 mm in diameter.

Discussion: This new species differs from the type in having rings encircling the whorls, whereas *D. cottreaui* has no rings but only spines. A third species that most probably belongs to this genus is *Delphinula dupiniana* d'ORBIGNY, 1842 from the Hauterivian of Marolle, Aube, France (d'ORBIGNY 1842: pl. 182 figs. 1–4), but that species has low-conical early whorls in contrast to the planispiral ones of *Delpeya hilperti* n. sp. described here. Additionally, *D. dupiniana* has broad ribs on the outer side of the whorls, but lacks spines. *Delpeya* thus ranges from the Hauterivian to the Cenomanian.

D. dupiniana is the oldest species of *Delpeya* known to date and shares several features like the beaded spiral sculpture, and the shape of the spines, and the umbilicus with *Solarium polygonium* d'ARCHIAC, type species of *Nummocalcar* COSSMANN, 1896. It thus seems likely that *Delpeya* was derived from *Nummocalcar* during the Early Cretaceous. *Nummocalcar* was placed within the Discohelicidae by SCHRÖDER (1995) due to its almost planispiral coiling. Since we consider *Delpeya* to be related to *Nummocalcar*, *Delpeya* is here tentatively placed among the Discohelicidae. However, because neither protoconch morphology nor the shell structure of *Delpeya* are known, the position of *Delpeya* among the Archaeogastropoda remains uncertain.

Family Cirridae COSSMANN, 1916

Genus *Hamusina* GEMMELLARO, 1878

Type species: *Turbo bertheloti* d'ORBIGNY, Upper Liassic, France.

Hamusina kahrsi BANDEL, 1993
Figs. 6K–L

* 1993 *Hamusina kahrsi* BANDEL: 59, pl. 6 figs. 1–11.

Material: 50 specimens: A840/1, A840/2, A1191/1, A1191/2, **A1231/1, A1231/2, A1315/1, A1315/2, A1315/4, A1315/5, A1315/6, A1315/7, A1315/9, A1315/10, A1315/11, A1328/1, A1336/1, A1336/2, A1336/6, A1336/7, A1338/8, A1357/1, A1412/1, A1412/2, A1412/3, A3164, A3177, A3194, A3211, A3215, A3220, A3228, A3239/1, A3240, A3241, A3249, A3294/1, A3311, A3316, A3333/14, A3334/4, A3334/19, A3336/8, A3336/9, A3362/2, A3364, A3365, A3366/3, A3377/2, A3395/25.

Description: The shell consists of about nine, sinistrally-coiled whorls, is higher than wide, and has an apical angle of about 40°. The whorls have a flattened to slightly concave or convex upper flank, a tuberculate peripheral keel, a convex base, and deep sutures. The sculpture consists of two beaded spiral cords on the early whorls, which increase to about five on the last whorl. The base is covered by fine spiral lines only, and there is a small umbilicus. The aperture is rounded rectangular. The figured shell is 23 mm high and 24 mm wide.

Discussion: This species has deeper sutures and a more rectangular aperture than the Jurassic type species.

Archaeogastropod incertae sedis

Genus *Frydatinus* n. gen.

Type species: *Phanerotinus? scheeri* BANDEL & FRÝDA, 1998, Cenomanian, Kassenberg quarry, Mülheim, Germany, described below.

Derivatio nominis: Named after JIŘÍ FRÝDA, Prague, who worked with this species, and the postfix of *Phanerotinus*, a Palaeozoic genus which has some features in common with the new genus.

Diagnosis: The openly coiled shell is round in cross-section, shows concentric and somewhat oblique growth lines, and has long spines on its outer side that point slightly forward.

Discussion: BANDEL & FRÝDA (1998) assigned the type species of this new genus tentatively to *Phanerotinus*, a Devonian to Carboniferous genus, and noted that its systematic position is still quite open. *Phanerotinus* occasionally has triangular extensions on the outer side of its whorls, and some species agglutinate particles to the shell (WENZ 1938–44: 196). The new genus introduced here differs from *Phanerotinus* in having spine-like extensions.

Frydatinus scheeri (BANDEL & FRÝDA, 1998)
Fig. 6M

1995 undescribed archaeogastropod SCHEER & STOTTROP: 129, pl. 3 fig. 2.

* 1998 „*Phanerotinus*" *scheeri* BANDEL & FRÝDA: 115, pl. 3 figs. 31–32.

Material: One specimen: **A1271.

Description: Little more than half a volution is preserved, from which extents another half whorl of external mould. It is planispiral and openly coiled, has an almost round cross-section, and has slightly sinuous growth lines. There are five long spines extending from the whorl's periphery in about the same plane as the planispiral shell and pointing slightly forwards. The largest spine is about as long as the diameter of the preserved whorl. The shells largest diameter (without spines) is 18 mm; the whorls widest cross-section measures 4 mm.

Discussion: The relationships of this species to shells from the Triassic and even the Palaeozoic have been discussed by BANDEL & FRÝDA (1998). Its systematic position is left open since neither protoconch morphology nor shell structure are known, and additionally no relatives are known except for the Palaeozoic *Phanerotinus*.

Subclass Neritimorpha GOLIKOV & STAROBOGATOV, 1975

Family Neritopsidae GRAY, 1847

Genus *Neritopsis* GRATELOUP, 1832

Type species: *Nerita radula* LINNAEUS, 1758, Recent, Indo-Pacific.

Neritopsis kasei n. sp.
Figs. 6N–O

Holotype: A3375/2, illustrated in Figs. 6N-O.

Derivatio nominis: Named after our colleague TOMOKI KASE, Tokyo, for his fine work on extant and fossil Neritimorpha.

Material: Two specimens: A3217, **A3375/2.

Diagnosis: This *Neritopsis* has an elevated spire, two whorls, numerous fine spiral lines, a concave inner lip,

and an umbilical slit that is covered by a callus-pad extending from the inner lip.

Description: The adult shell consists of two whorls with numerous fine spiral lines that are crossed by faint, oblique growth lines. The callous inner lip is concave, has a rectangular embayment in its centre, and a callus-pad extending from its upper part covers the umbilical slit in the base. The figured shell is 17 mm wide and 18 mm high.

Discussion: *Neritopsis tanchatensis* KASE, 1984 from the Aptian/Albian of Japan (KASE 1984: 82, pl. 8 figs. 2–5, 7–8) has a lower spire, and its spiral ornament is more strongly developed. *Neritopsis costulata* GEINITZ, 1875 is similar in shape but has fewer spirals with wider interspaces between them (GEINITZ 1875: 247, pl. 54 figs. 24–25).

Family Neritidae RAFINESQUE, 1815

Genus *Otostoma* d'ARCHIAC, 1859

Type species: *Nerita rugosa* HOENIGHAUS, 1830, Late Cretaceous, Europe, by subsequent designation (DOUVILLÉ 1904).

Discussion: SQUIRES & SAUL (1993) extensively discussed the nomenclatural history of *Otostoma*'s type species, and BANDEL & KIEL (2003) discussed the validity of subgeneric divisions of *Otostoma*. They considered *Corsania* VIDAL, 1917 a synonym of *Otostoma*; *Damesia* HOLZAPFEL, 1888 was identified as an allogastropod by DOCKERY (1993).

Otostoma kassenbergensis n. sp.
Figs. 6P–Q

Holotype: A074/5, illustrated in Figs. 6P–Q.
Derivatio nominis: Named after the Kassenberg quarry, the type locality of this species.
Material: 21 specimens: A74/1, A74/2, A74/3, **A74/5, A891/6, A891/7, A891/8, A891/10, A1192, A1244/1, 2, A1291/2, A3214, A3248, A3327, A3368, A3370, A3384, A3385, A3387, A3394, A3398.

Diagnosis: The early whorls are rounded to slightly angulated; later whorls develop a strongly tuberculated keel at the periphery and a minor keel near the base. The aperture is strongly prosoclinally oblique, D-shaped, and the inner lip bears six subequal denticles. There is an apical denticle on the inner side of the outer lip.

Description: The apically flattened shell has rapidly enlarging whorls of which two and a half form the teleoconch. The first whorl of the teleoconch has rounded margins and is covered by a dense pattern of collabral ribs which may be bifurcated. In the second whorl the shell changes shape by developing a peripheral edge, a nodular ridge on the basal margin, and an ornament of stronger and more widely spaced axial ribs. The last whorl carries about ten nodular ribs which dominate the apical side. On the flanks, which are weakly convex to weakly concave, there are eight to nine spiral rows of tubercules which are transected by growth lines forming a strong sinus near the columella. The nodular ridge on the basal margin disappears on the last quarter volution. The aperture is strongly prosoclinally oblique and D-shaped, and the columellar edge of the inner lip is a little convex and bears six almost equally strong denticles. The inner lip callus covers almost the whole base, and the interior of the outer lip is smooth except for a denticle on its apical side. The holotype is 24 mm wide and 21 mm high; the largest shell is 28 mm wide and 24 mm high.

Discussion: A similar denticle in the interior of the outer lip can be seen in *Otostoma japonica* (NAGAO) from the Aptian/Albian of Japan (see KASE 1984: pl. 9 figs. 1–10). This species has a smaller callus on the inner lip than *O. kassenbergensis* n. sp. and also seems to be more variable in its sculpture. A neritid from the Albian of Punta China in north-western Mexico was identified as *O. (Lyosoma) japonica* by ALLISON (1955) and subsequently assigned to a new species named *Corsania allisoni* by SAUL & SQUIRES (1997: 140, figs. 22–24). Since we are able to demonstrate that *Otostoma* and *Corsania* are synonyms (BANDEL & KIEL 2003), we consider the Mexican species to represent an *Otostoma*. It differs from *O. japonica* in having spiral ribs below the periphery (SAUL & SQUIRES 1997) and from *O. kassenbergensis* n. sp. in having finer spiral sculpture on the last whorl, in having a higher spire and a slower increase in the whorls diameter, and in having finer spiral sculpture. From the Albian/Cenomanian of Austria, KOLLMANN (1982) described different growth stages of *Otostoma pustulata* (THOMAS & PERON, 1889–90). Early stages show axial ribs above the periphery which change into a coarsely tuberculated peripheral ridge in the late adult stage (KOLLMANN 1982: 35, pl. 5 figs. 53–62). Below the periphery the shell of *O. pustulata* is more or less smooth, which distinguishes it from *O. kassenbergensis* n. sp. GEINITZ (1850: pl. 15 figs. 27–28) and WEINZETTL (1910: pl. 3 figs. 1–6) provided drawings of *Otostoma nodosa* (GEINITZ, 1850). They show a species which is rounded and axially ribbed in the early growth stages, and has a strongly nodular peripheral ridge in the adult stage. The adult stage is somewhat similar to those of *O. kassenbergensis* n. sp. but seems to lack the spiral cords below the periphery. The two species of *Otostoma* described by BANDEL & KIEL (2003) from the Campanian of northern Spain differ from *O. kassenbergensis* n. sp. in lacking the denticle on the inner side of the outer lip.

Subclass Caenogastropoda COX, 1959
Order Architaenioglossa HALLER, 1892
Family Ampullospiridae COX, 1930

Genus *Tylostoma* SHARPE, 1849

Type species: *Tylostoma globosum* SHARPE, 1849, Turonian, Portugal, by subsequent designation (WENZ 1939–44).

Tylostoma? sp.
Figs. 7F–G

Material: Twelve specimens: A3156, A3166, **A3173, A3182, A3201, A3205, A3222, A3246, A3247, A3282, A3303, A3329.

Description: The egg-shaped shell consists of numerous convex, smooth whorls with incised sutures and fine, axial growth lines. The inner lip is callused. The figured shell is 24.5 mm high and 16 mm wide; the largest shell is 50 mm high and 36 mm wide.

Discussion: Such shells have traditionally been placed in the Naticoidea, but KASE (1990) and KASE & ISHAKAWA (2003) showed that the sole living species of this group is a herbivourous gastropod with affinities to the Architaenioglossa. KOWALKE & BANDEL (1996) documented the protoconch of a species that they assigned to the naticiform genus *Pseudamaura* FISCHER, 1884, and pointed out that it is different from that of the Naticidae. The species concerned here has an adult shell similar to that of the ampullospirid *Tylostoma*. However, this placement is only tentative, because neither the protoconch of *Tylostoma*'s type species is known, nor that of our species from the Kassenberg quarry.

Order and family uncertain

Genus *Cimolithium* COSSMANN, 1906

Type species: *Cerithium belgicum* d'ARCHIAC, 1846, Cenomanian, Belgium, by original designation (COSSMANN 1906: 57, pl. 14 figs. 2–3).

Discussion: *Cimolithium* was placed within the Metacerithiinae by COSSMANN (1906) and WENZ (1938–44), and DELPEY (1941) considered the type species *C. belgicum* as a possible early member of the Campanilidae DOUVILLÉ, 1904. NÜTZEL (1998) noted similarities in adult shell characters between *Cimolithium* and the Triassic *Protorcula* KITTL, 1894, and referred to the work of ABBASS (1973), who described a *Cimolithium* with opisthocyrt ribs on the larval shell. Based on this description, NÜTZEL (1998) interpreted ABBASS' (1973) species as member of the Protorculidae BANDEL, 1991. KIEL et al. (2000) showed that the protoconch of *Metacerithium* COSSMANN, 1906 is similar to that of *Campanile* FISCHER, 1884, and pointed out that the Metacerithiinae represent an polyphyletic group composed of campaniloids, cerithioids, and mathildoids. The protoconch of *Cimolithium*'s type species has not yet been described, and thus the taxonomic position of the genus remains uncertain.

Cimolithium cf. *belgicum* d'ARCHIAC, 1846
Figs. 7A–B

Material: Nine specimens: A866/3, A887/25, A887/43, A887/63, A887/83, A1190/1, **A1222, A1288, A3310.

Description: The turriculate shell consists of at least ten concave to straight-sided volutions. They are sculptured by two strongly tuberculated keels (24 tubercles on the last whorl), one below the suture, the other on the basal edge. This latter keel is usually covered by the succeeding whorl. There are prosyncline growth lines on the whorl's flank and numerous fine spiral lirae. The base is covered by sinuous growth lines only. The figured shell is 55 mm high, 21 mm wide, and has an apical angle of about 25°.

Order Cerithiimorpha GOLIKOV & STAROBOGATOV, 1975
Family Campanilidae DOUVILLÉ, 1904

Genus *Metacerithium* COSSMANN, 1906

Type species: *Cerithium trimonile* MICHELIN, Albian, France, by original designation (COSSMANN 1906: 54, pl. 6 figs. 29–31).

Metacerithium? sp.
Fig. 7C

Material: Six specimens: A1338/1, A1338/2, **A3225, A3236, A3306/2, A3366/2.

Description: The large, turriculate shell consists of at least six straight-sided whorls with incised sutures. The whorls are sculptured by two tuberculate ridges, one at the upper suture, the other at the lower suture, and fine spiral lirae between them. The tubercles of the upper and lower ridge correspond only sometimes. The aperture is rhomboid; the columella bears one plate, and the base is rounded and smooth. The figured shell is 64 mm high.

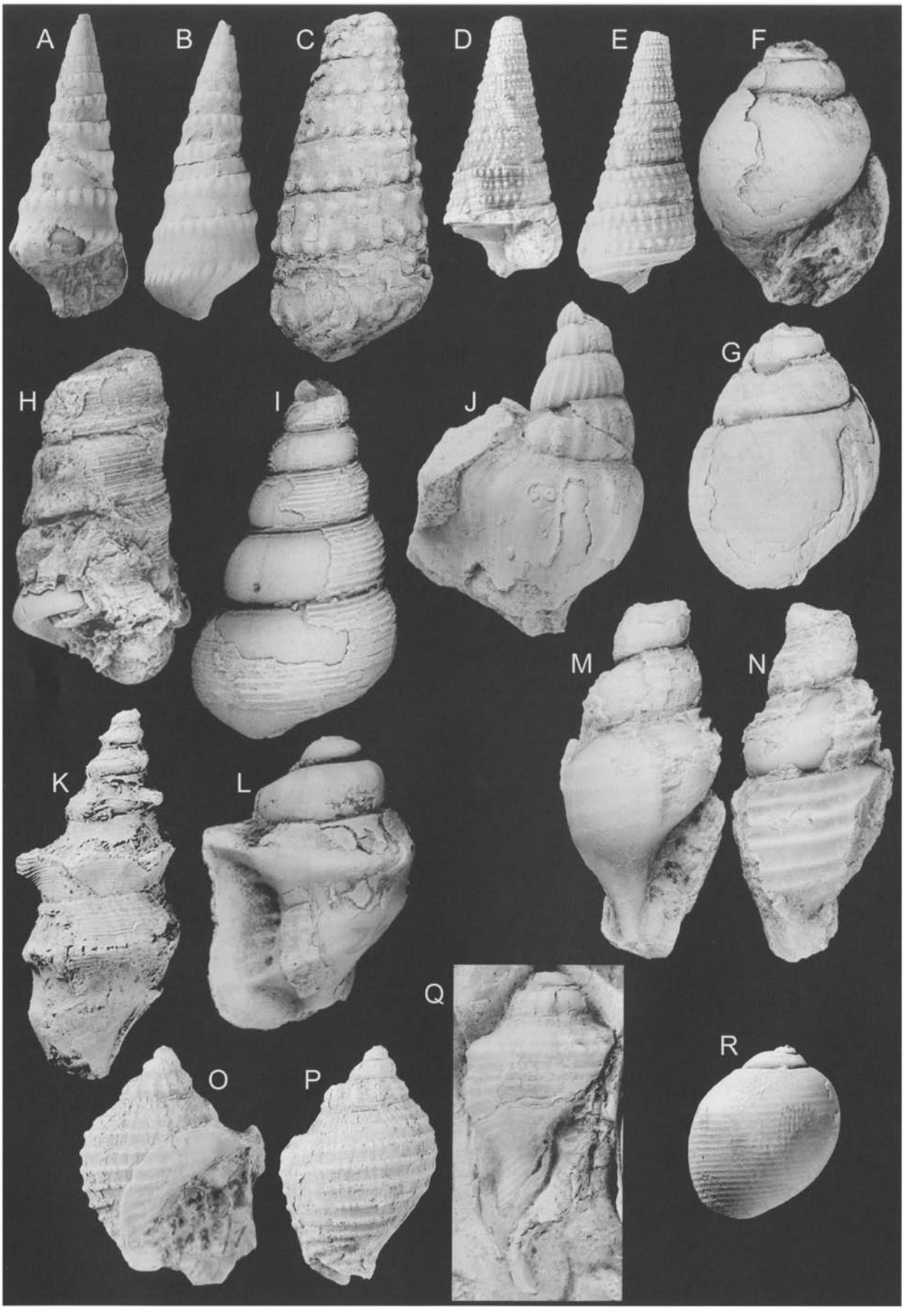
Discussion: Our specimens are too poorly preserved for a certain determination so we assign them only tentatively to *Metacerithium*.

Family Potamididae H. & A. ADAMS, 1854

Genus *Tympanotonos* SCHUMACHER, 1817
Subgenus *Tympanotonos* (*Exechocirsus*) COSSMANN, 1906

Type species: *Cerithium cingillatus* ZEKELI, 1852, Turonian, Gosau Formation, Austria, by original designation (COSSMANN 1906: 121).

Fig. 7. Cenomanian Gastropoda from the Kassenberg quarry. – **A–B**: *Cimolithium belgicum* d'ARCHIAC, 1846, A1222, natural size. – **C**: *Metacerithium*? sp., A3225. – **D–E**: *Tympanotonos* (*Exechocirsus*) *cingillatus* ZEKELI, 1852, A898/5, four times natural size. – **F–G**: *Tylostoma* sp., A3173. – **H**: *Haustator* cf. *bauga* d'ORBIGNY, 1842, A887/64. – **I**: *Mesalia* cf. *multilineata* MÜLLER, 1847, A3235. – **J**: *Latiala*? cf. *lobata* WADE, 1926, A811/18. – **K**: *Aporrhais*? cf. *pugens* WOLLEMANN, 1908, A1210. – **L**: *Tessarolax*? sp., A3169. – **M–N**: *Anchura*? sp., A3326. – **O–P**: *Columbellaria* cf. *tuberculosa* (BINKHORST, 1861), A1187/1. – **Q**: *Galeodea*? (*Taieria*)? sp., A1278. – **R**: *Avellana* sp., A1262. – All figures twice natural size except when indicated.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Tympanotonos (Exechocirsus) cingillatus ZEKELI, 1852
Figs. 7D–E

* 1852 *Cerithium cingillatus* ZEKELI: 98, pl. 18 fig. 6.

Material: Three specimens: **A898/2, **A898/5, A3335/1.

Description: The small, turriculate shell consists of at least eight straight-sided whorls. They are sculptured with three spiral rows of spiny tubercles and five fine, beaded spiral lirae, above, below and between the stronger spiral rows. The growth lines are slightly prosocline. The base shows numerous fine spiral lirae; the aperture is roundish, and the columella is smooth. The figured shell is 12 mm high and 5 mm wide.

Family Turritellidae LOVÉN, 1847

Genus *Haustator* de MONTFORT, 1810

Type species: *T. (Haustator) callicus* de MONTFORT, 1810, Eocene, France, by original designation (WENZ 1938–44: 653, fig. 1860).

Haustator cf. *bauga* d'ORBIGNY, 1842
Fig. 7H

cf.* 1842 *Turritella bauga* d'ORBIGNY: pl. 153 fig. 3.

Material: Six specimens: A887/34, A887/45, A887/52, A887/59, **A887/64, A1409/1.

Description: The turriculate shell consists of numerous concave whorls which are sculptured by about 17 beaded spiral lines of differing strength. The growth lines are strongly prosocline on the whorl sides, and weakly prosocline on the base (Fig. 8). The basal edge is sharp and the base is sculptured by about 13 fine spiral lines. The figured shell is 31 mm high and 16 mm wide.

Discussion: The figure provided by d'ORBIGNY (1842: pl. 153 fig. 3) shows a specimen with slightly convex whorls, those of our specimens are rather concave. However, sculpture and the shape of the growth lines agree well with d'ORBIGNY's (1842) figure. The growth lines also agree well with those described by MARWICK (1957) for the genus *Haustator*.

Genus *Mesalia* GRAY, 1842

Type species: *Cerithium mesal* ADAMSON, Recent, African west coast (WENZ 1938–44: 650, fig. 1851).

Mesalia cf. *multilineata* MÜLLER, 1847
Fig. 7I

cf.* 1898 *Turritella multilineata* J. MÜLLER. – G. MÜLLER: 97, pl. 13 figs. 4–5.

Material: Two specimens: **A3235, A3304.

Description: The conical-turriculate shell consists of at least five convex volutions. It is sculptured with ten about equally strong spiral cords and a few weak spiral lines in between. The figured shell is 33 mm high, 18 mm wide, and has an apical angle of about 30°.

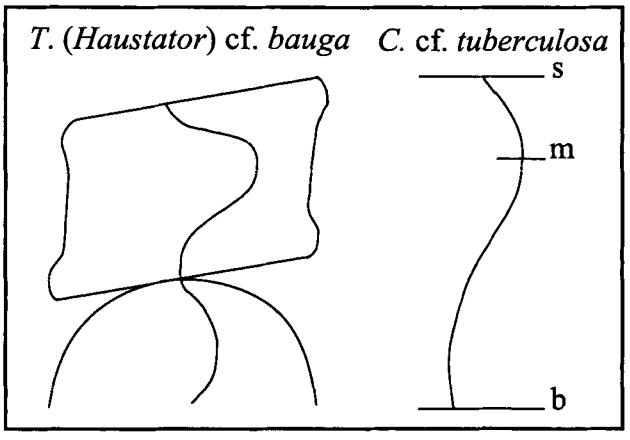

Fig. 8. Growth lines of *Haustator* cf. *bauga* and *Columbellaria* cf. *tuberculosa*. – b = basal slope, transition from whorl's periphery into the siphonal column, m = maximal width of whorl; s = suture.

Discussion: The specimens figured by MÜLLER (1898) show a slightly lower apical angle (i.e. the spire is more slender).

Order Alata LAMARCK (STOLICZKA, 1868)
Family Aporrhaidae MÖRCH, 1852

Genus *Latiala* SOHL, 1960

Type species: *Anchura lobata* WADE, 1926, Maastrichtian, Ripley Formation, Tennessee, USA, by original designation (SOHL 1960: 101, pl. 11 figs. 9, 13–15).

Latiala? cf. *lobata* WADE, 1926
Fig. 7J

cf.* 1926 *Latiala lobata* WADE: 150, pl. 52 figs. 11–12.
2002a *Latiala*? cf. *lobata* WADE. – KIEL & BANDEL: 85, fig. 1G

Material: One specimen: **A811/18.

Description: The high-spired shell has a body whorl and spire of equal height. The whorls of the spire are sculptured by about 30 axial ribs and fine spiral lirae; the latter are most strongly developed near the sutures. There are only two strong ribs on the body whorl and growth lines which continue onto the wing. The shell is 31 mm high and 24 mm wide.

Discussion: The upper and outer parts of the wing are the diagnostic features to distinguish *Latiala* and *Perissoptera* TATE, 1865 (KIEL & BANDEL 2002a). Since these parts are broken off in the investigated specimen, it is only tentatively assigned to *Latiala*.

Genus *Aporrhais* DACOSTA, 1778

Type species: *Strombus pespelicani* LINNAEUS, 1758, Recent, Mediterranean (WENZ 1938–44: 915, fig. 2689).

Aporrhais? cf. *pugens* WOLLEMANN, 1908
Fig. 7K

cf.* 1908 *Fasciolaria* (?) *pugens* WOLLEMANN: 181, pl. 13 fig. 13.

Material: One specimen: **A1210.

Description: The high-spired, elongate shell consists of at least six whorls. The aperture and spire are about equally high. The whorls are convex, have a strong, central keel with about six spines per whorl, and are covered by fine spiral lirae. There is a second keel low on the last whorl. The aperture is long and narrow; the inner lip is lightly callused, and ends anteriorly in a long canal. The shell is 34 mm high and 15 mm wide.

Discussion: WOLLEMANN (1908) described two specimens of *Fasciolaria* (?) *pugens* from the Albian of Algermissen, northern Germany. He noted that the aperture of his specimens was broken away and thus no satisfactory placement was possible. Based upon its general shape he assigned it tentatively to *Fasciolaria* LAMARCK, 1799. But the shell of *Fasciolaria* is more or less smooth and does not have any spines or keels. From the Hauterivian of Yonne, France, PERON (1900) described two aporrhaids of similar shape: *Aporrhais cotteaui* PERON, 1900 and *Aporrhais foudriatensis* PERON, 1900. Both have a spiny central keel and a second one on the last whorl. Also similar are *Rostellaria dupiniana* d'ORBIGNY, 1842 from the "Neocomian" of France (d'ORBIGNY 1842: 281, pl. 206 figs. 1–3), and perhaps *Mayeria milleri* COLLIGNON, 1951, a steinkern from the "Crétacé supérieur d'Antonibe" of Madagascar (COLLIGNON 1951: 117–118, pl. 18 fig. 10) which has similarly keeled whorls but seems to lack the spines.

Some aporrhaids like *Dicroloma* or *Spinigera* d'ORBIGNY, 1850 have a similar shape but do not develop regular spines on the spire. *Spinigera* has only two spines per whorl, one every 180° (WENZ 1938–44: 925, fig. 2709), and these spines are connected to varices, which is not the case in *Aporrhais*? cf. *pugens*. A proper classification of this fossil must await better preserved material.

Aporrhais? sp.
Fig. 7L

Material: Four poorly preserved specimens: **A3169, A3184, A3218, A3328.

Description: The shell has a low to elevated spire made of about four whorls. The whorls are angular, have a spiny, peripheral keel, and are sculptured by numerous beaded spiral lines of different strength. The basal keel is smooth and is covered by the succeeding whorl; it becomes visible only on the last whorl. The inner lip has a thin callus cover, and the wing is unknown. The figured specimen is 27 mm high and 19 mm high.

Discussion: These specimens are too poorly preserved for a more precise treatment.

Genus *Anchura* CONRAD, 1860

Type species: *Anchura abrupta* CONRAD, 1860, Maastrichtian, Ripley Formation, Mississippi, United States, by monotypy (SOHL 1960, pl. 12 figs. 1, 4–9, 12).

Anchura? cf. *dubius* BRIART & CORNET, 1868
Figs. 7M–N

cf.* 1868 *Fusus dubius* BRIART & CORNET: 24, pl. 3 figs. 3–4.
cf. 1939 *Fusus*? *dubius* BRIART & CORNET. – MARLIÈRE: 136, pl. 7 fig. 14

Material: One specimen: **A3326.

Description: The slender fusiform shell has convex whorls which are sculptured by six beaded spiral cords and fine, granulated spiral lines in between. The aperture is narrow and ends anteriorly in a long siphonal canal. The figured shell is 44 mm high and 19 mm wide.

Discussion: The identity and taxonomic position of this poorly preserved specimen are unclear. BRIART & CORNET (1868) assigned a very similar species to *Fusus*, probably due to its fusiform shell, but MARLIÈRE (1939) had some doubt about this treatment. No Late Cretaceous neogastropod with such distinct spiral cords on the spire as present in the figured specimen is known to us. Similar spirals can sometimes be found on members of *Anchura* (ELDER & SAUL 1996; KIEL & BANDEL 2002a). STEPHENSON (1952: 179, pl. 40 fig. 13) figured a specimen with similar spirals from the Woodbine Cenomanian of Texas, which he tentatively assigned to *Anchura*. Another similar species from the Albian/Cenomanian of Texas is *Falsifusus*? *blancensis* STANTON, 1947 (STANTON 1947: 108, pl. 55 figs. 27, 29; AKERS & AKERS 1997: 204, fig. 209).

Family Columbellinidae FISCHER, 1884

Genus *Columbellaria* ROLLE, 1861

Type species: *Cassis corallina* QUENSTEDT, upper Jurassic, Nattheim, Würthemberg, Germany (WENZ 1938–44, fig. 2712).

Columbellaria cf. *tuberculosa* (BINKHORST, 1861)
Figs. 7O–P

cf.* 1861 *Pyrula tuberculosa* BINKHORST: 8, pl. 3 figs. 5a–b.
cf. 1897 *Columbellaria tuberculosa* BINKHORST. – KAUNHOWEN: 79, pl. 9 figs. 7–8.

Material: Six specimens: A898/3, **A1187/1, A1280/1, A1287/1, A3247, A3284, A3396.

Description: The small, egg-shaped shell consists of five volutions. The spire is ornamented with 16 axial ribs per volution which are crossed by two spiral cords and additionally many fine spiral lirae. This ornament turns into about eight tuberculate spiral cords crisscrossed by fine axial and spiral lirae. The inner lip is denticulate, broad but thin, so that the ornament shines through. The aperture ends posteriorly in a canal, the

growth lines are sinuous (Fig. 8). The shell is 22 mm high, 16 mm wide, and has an apical angle of about 75°.

Discussion: This species is assigned to *Columbellaria tuberculosa* with some reservations, since the species described by KAUNHOWEN (1897: 79, pl. 9 figs. 7–8) has a shorter spire, but he mentioned that higher spires sometimes occur. Also the number of cords on the spire differs from two to four with four being the most common number in KAUNHOWEN's 54 examined specimens. The Japanese *Columbellaria brevisiphonata* has a more slender body whorl (see KASE 1984: 146, pl. 23 fig. 13).

Order Neomesogastropoda? BANDEL, 1991
Family Cassidae? LATREILLE, 1825

Genus *Galeodea*? LINK, 1807
Subgenus *Galeodea* (*Taieria*)? FINLAY & MARWICK, 1937

Type species: *Taieria allani* FINLAY & MARWICK, 1937, Wangaloan (Danian), New Zealand, by original designation (FINLAY & MARWICK 1937: 67, pl. 9 figs. 17, 19–20).

Galeodea (*Taieria*)? sp.
Fig. 7Q

Material: One specimen: **A1278.

Description: The fusiform shell has a short spire and a high aperture. The penultimate whorl is convex and has a peripheral keel made of tubercles crossed by two fine spiral lines. The last whorl has a broad, concave subsutural ramp with slightly oblique growth lines and fine spiral lirae; below the two crenulated peripheral keels the whorl is a little rounded and slopes gently into the long siphonal canal. The last whorl and the siphonal canal are sculptured by beaded spiral cords and fine spiral lirae. The aperture is long and narrow; its inner lip is callused, and the columella is twisted. The shell is 41 mm high and 19 mm wide.

Discussion: This specimen shows some similarities to the Late Cretaceous to Paleocene cassoid *Galeodea* (*Taieria*) (see FINLAY & MARWICK 1937; KIEL & BANDEL, in press) such as its fusiform shape, the peripheral ridge, and the spiral ornament. But also the Aporrhaidae develop fusiform shells and an appropriate placement of this species must await better preserved material.

Subclass Heterostropha FISCHER, 1885
Order Opisthobranchia MILNE-EDWARDS, 1848
Family Ringiculidae FISCHER, 1883

Genus *Avellana* d'ORBIGNY, 1843

Type species: *Cassis avellana* BROGNIART, Cenomanian, France (WENZ & ZILCH 1959–60: 21, fig. 59).

Discussion: Based on a species which KOLLMANN (1976) considered to be intermediate between *Avellana* and *Oligoptychia*, he proposed to synonymise the two genera. KASE (1984) stated that discrimination between *Eriptychia* and *Avellana* is difficult. KIEL & BANDEL (2001a) noted that the double-toothed basal columellar plate of *Eriptychia* might distinguish it from *Avellana* and treated *Eriptychia* as a subgenus of *Avellana*.

Avellana sp.
Fig. 7R

Material: One specimen: **A1262.

Description: The globular shell consists of three whorls sculptured by numerous fine spirals with axial lamellae in between. The shell is 16 mm high and 15 mm wide.

Discussion: This specimen is assigned to *Avellana*, but a more precise classification is impossible without knowing the aperture and its columellar folds.

Discussion and conclusions

Of the 46 recognized species, four can not be assigned to known genera. *Frydatinus* n. gen. is introduced for one species that resembles late Palaeozoic or early Mesozoic archaeogastropods rather than those known from the Cretaceous, but differs from these by several distinct features. Its relationships and systematic position within the Gastropoda remain unclear. The three *Turbo*-like species present in the Kassenberg fauna differ from extant *Turbo* LINNAEUS, 1758 and its subgenera by having strong axial ribs or spines in the whorl's centre. For these species *Deikella* n. gen. is introduced.

The majority of the described species (68 %) belong to the Archaeogastropoda (Fig. 2). This number is quite high compared to other Cenomanian gastropod faunas (SOHL 1987: fig. 4). The most obvious reason for this high number is that archaeogastropods usually are rocky shore inhabitants (BANDEL & WEDLER 1987; HICKMAN & MCLEAN 1990) and thus were abundant in the rocky shore of the Cenomanian Kassenberg quarry.

Another conspicuous feature in the composition of the Kassenberg fauna is the high number of pleurotomariids, which make 13.6 % of the total number of species (Fig. 2). Today pleurotomariids are absent from rocky shores and live mainly on hard substrate at depths of 100–1000 m (HICKMAN 1998; HARASEWYCH 2002). The Kassenberg fauna thus shows that in the Cenomanian they were still present at rocky shores. KANNO (1961) stated that the bathymetric range of the pleurotomariids shifted from shallow to deep water from Mesozoic to Recent, and HICKMAN (1976) suggested that this was due to elimination of the shallow-water forms rather than forcing into deeper water. The absence of predatory caenogastropods (the cassid is not yet certain) from the Kassenberg fauna might provide some evidence that the rise of these predatory gastropods might – at least partly

– have been responsible for the shift in the bathymetric range of pleurotomariids.

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