

Notes on the systematics, morphology and biostratigraphy of fossil holoplanktonic Mollusca, 14¹. A new species of *Vaginella* (Gastropoda, Euthecosomata, Cavoliniidae) from the Late Oligocene of the North Sea Basin and its bearing on Chattian biostratigraphy

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A new pteropod species, *Vaginella basitruncata*, is erected on the basis of material from the Late Oligocene (Chattian A) 'Kasseler Meeressand' in Hessen (Germany). It is the oldest representative of this genus known from the North Sea Basin, and is characterised by shedding of the larval shell, a straight ventral apertural margin and by the absence of a preapertural constriction and apertural folds.

Some notes on the biostratigraphical implication of pteropod distributions during the Late Oligocene within the North Sea Basin are added, and it is concluded on this evidence that the 'Kasseler Meeressand' is coeval with the basal portion of the Grafenberg Sands in the Lower Rhine area (Germany). A subdivision of pteropod zone 16 into three subzones covering the Eochattian appears to be feasible. The so-called 'Sternberger Gestein' is of middle and late Eochattian age (Chattian A/B, pteropod subzones 16b-c).

Key words: Gastropoda, Euthecosomata, *Vaginella*, systematics, biostratigraphy, new species, Oligocene, Chattian, North Sea Basin.

INTRODUCTION

Among pteropods (Gastropoda, Euthecosomata: holoplanktonic molluscs known since the Late Paleocene), the genus *Vaginella* Daudin, 1800 (type species: *V. depressa* Daudin, 1800; Early Miocene) demonstrates a surprisingly rapid development. The earliest representative (just a single, specifically unassigned specimen) is known from Oligocene (Rupelian) sediments in SW France. During the Late Oligocene (Chattian) several species occurred, but it was during the Early and Middle Miocene that the genus reached full development, only to go extinct suddenly around the boundary between Middle and Late Miocene (Serravallian-Tortonian), meaning that the complete 'rise and fall' of the genus lasted a mere 20-25 Ma. From this interval, numerous occurrences have been described as species of *Vaginella*, several of which are currently assigned to other genera (e.g., *Edithinella* Janssen, 1995, or *Ireneia* Janssen, 1995). Yet other species are insufficiently known to be certain of their generic placement. Species of *Vaginella* occur worldwide: SW France (Aquitaine), Mediterranean, Paratethys, North Sea, Caribbean, Japan, southern Australia and New Zealand. For additional notes on the genus *Vaginella* and on other species that might belong there, reference is made to Janssen (1995: 133).

1) For no. 13 in this series see *Cainozoic Research*, 2 (1-2): 163.

Abbreviations, for collections: RGM, Nationaal Natuurhistorisch Museum *Naturalis*, Palaeontology Department, Leiden (The Netherlands), formerly Rijksmuseum van Geologie en Mineralogie; SMF, Senckenberg Museum, Frankfurt am Main, Germany. For shell characters: D, diameter (dorso-ventral diameter); DS, diameter of septum (measured in ventral view); H, height; W, width.

VAGINELLA IN THE NORTH SEA BASIN

From the North Sea Basin, Janssen & King (1988) listed seven *Vaginella* species, occurring in their pteropod zones 16 to 19 (Late Oligocene to Middle Miocene):

Name in Janssen & King, 1988	pteropod zone	revised name (this paper)
<i>Vaginella austriaca</i>	18-19	<i>Vaginella austriaca</i> Kittl, 1886
<i>Vaginella</i> sp. vel <i>Clio</i> sp. nov.	18	<i>Vaginella austriaca</i> Kittl, 1886
<i>Vaginella</i> aff. <i>lapugyensis</i>	18	<i>Vaginella lapugyensis</i> Kittl, 1886
<i>Vaginella depressa</i>	17	<i>Vaginella depressa</i> Daudin, 1800
<i>Vaginella chattica</i>	top 16	<i>Vaginella chattica</i> R. Janssen, 1979
' <i>Vaginella</i> ' <i>tenuistriata</i>	16	<i>Ireneia tenuistriata</i> (Semper, 1861)
<i>Vaginella</i> sp.	base 16	<i>Vaginella basitruncata</i> spec. nov.

Table 1. North Sea Basin species of '*Vaginella*'.

The so-called '*Vaginella* sp. vel *Clio* sp. nov.' was recognised as the juvenile, pre-metamorphosis stage of *Vaginella austriaca* (compare Janssen, 1984: figs 8 and 10). '*Vaginella*' *tenuistriata* subsequently became the type species of the genus *Ireneia* Janssen, 1995, characterised by the lack of lateral carinae, the presence of longitudinal micro-ornament and a differently shaped aperture (Janssen, 1995: 48, pl. 4, fig. 3a-c). *Ireneia* is considered to belong to the Cuvierinidae.

The oldest vaginellid, an undescribed species, in the North Sea Basin was recognised by Janssen & King (1988); this was already referred to and illustrated by Görge (1952: 118, pl. 3, fig. 10), but incorrectly identified as *Vaginella lanceolata* (Boll, 1846). The latter name is an older (but preoccupied) synonym of *V. chattica* R. Janssen, 1979.

In his monograph of German Chattian molluscs, R. Janssen (1979b: 351) did not distinguish the new species from '*Vaginella*' *tenuistriata*, although he did note the presence of lateral carinae and the absence of micro-ornament in part of his material. Interestingly, the new species differs in various respects from other species of the genus.

SYSTEMATIC PART

Vaginella basitruncata spec. nov. (figs 1a-c, 2a-d)

Vaginella depressa Daudin; Semper, 1861: 274 (pars, non Daudin; only the two specimens from 'Cassel').

Vaginella lanceolata (Boll 1846); Görge, 1952: 118, pl. 3 fig. 101 (non Boll).

Vaginella tenuistriata Semper, 1861; R. Janssen, 1979b: 351 (pars, non Semper; specimens from Niederkaufungen and Ahnetal only).

Holotype. – RGM 515.284 (fig. 1a-c), leg. M. van den Bosch, June 1973. Measurements, see Table 2.

Locus typicus. – Ahnetal (Germany, Hessen), Brandkopf outcrop at co-ordinates r 26.400 h 88.980, topographical map sheet 4622.

Stratum typicum. – 'Kasseler Meeressand, Schill 2/3'; Oligocene, Chattian A.

Derivatio nominis. – from L. - *basis* (noun), base, and L. - *truncare* (verb), to truncate: after the truncated basal part of the shell, caused by shedding of the larval shell.

Diagnosis. – Species of *Vaginella* with a straight ventral apertural margin and a much higher, semicircular dorsal apertural margin. Preapertural constriction and apertural folds absent. Larval shell shed, the opening closed by an oblique, rather flat septum.

Description. – The shell is elongated triangular, dorso-ventrally flattened towards the proximal aperture, especially ventrally. The apical part of the shell produces an angle of approximately 35° in ventral view, and 25° in lateral view. Towards the aperture, the sides become near parallel, but lack the preapertural constriction which is seen in many other species of *Vaginella*. The greatest width is situated at the aperture. The ventral side is clearly more convex (lateral view) than the dorsal side, with its maximum convexity at half height.

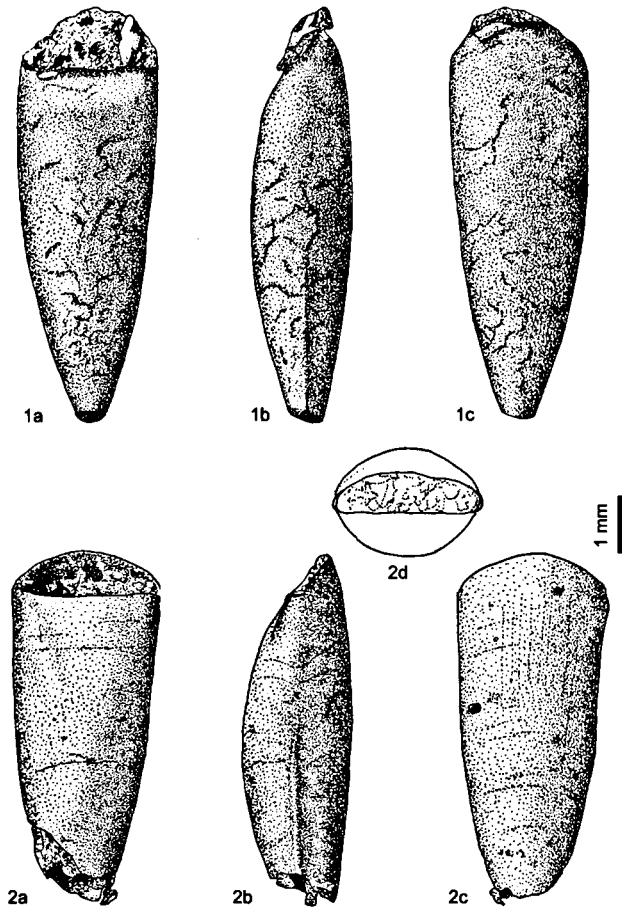
The larval shell is shed, and a septum closes the apical part of the shell. The septum is slightly convex to almost flat and is situated a bit obliquely, higher on the ventral side of the shell.

The ventral apertural margin is straight, sometimes slightly reinforced (bent outwards). The dorsal margin is semicircular, considerably higher than the ventral one, and consequently the aperture is very oblique, and narrow in adapical view (Fig. 2d). Apertural folds, as seen in many other species of *Vaginella*, are absent. Weak growth lines are only observable in specimens in shell preservation. They are curved adaperturally on the dorsal side, and almost straight on the ventral side. In some specimens in shell preservation a weak and irregular longitudinal striation is seen, especially so on the dorsal side. Lateral carinae, typical of the genus *Vaginella*, are present in the apical half of the shell. The larval shell with protoconch is not yet known.

Measurements:

sample	H	W	D	DS
RGM 515.284 (holotype)	7.20	2.40	1.84	0.64
RGM 515.574	7.44+	2.56	1.92	0.72
	6.80+	2.48	1.76	0.72
	6.32+	2.48	1.84	-
SMF 251355	6.16+	2.64	1.84	-
SMF 251358	6.08+	2.16	1.84	0.64
SMF 251661	6.32+	2.64	1.60	-
SMF 251356	6.64	2.24	1.68	0.64
	6.08+	2.24	1.52	
	6.00+	2.48	1.68	0.64
	5.84+	2.08	1.44	0.48
	6.40+	2.32	1.76	0.80
	5.92+	2.16	1.60	0.48
	4.88+	2.00	1.76	-
mean values	6.29+ (n=14)	2.35 (n=14)	1.72 (n=14)	0.64 (n=9)

Table 2. Measurements of *Vaginella basitruncata* spec. nov. (in specimens marked + the aperture is incomplete)



Figs 1-2. *Vaginella basitruncata* spec. nov., holotype and paratype. 1, holotype, RGM 515.284; 2, paratype, SMF 251355. a = ventral, b = lateral, c = dorsal, d = apertural view.

Paratypes: All specimens are from the 'Kasseler Meeressand', Oligocene, Eochattian (Chattian A).

From the type locality (RGM 515.574/3), leg. M. van den Bosch, June 1973.

Ahnetal near Kassel (Germany, Hessen), (SMF 251356/13; SMF 251357/10; SMF 251358/4; SMF 251661/1); all J. G6rges Collection.

Ahnetal (Germany, Hessen), Brandkopf outcrop, 'Schurf' (SMF 327957/50; SMF 327958/16; SMF 327959/3); 'Schurf, Schicht 9' (SMF 327960/1; SMF 327961/1); all leg. T. Schellmann.

Ahnetal (Germany, Hessen), Brandkopf outcrop, 'Schurf, Schicht 3' (SMF 327962/1?), leg. R. Janssen, 10 June 1973; 'Schurf, Schicht 6' (SMF 327963/1), leg. R. Janssen, 1972-1973; 'Schurf, Schicht 9' (SMF 327964/1), leg. R. Janssen, 10 June 1973.

Niederkaufungen, Gelber Berg (SMF 251355/1), specimen illustrated in G6rges, 1952, pl. 3 fig. 101; here fig. 2a-d); J. G6rges Collection; 'Hangfu6 a. S-Seite' (SMF 327965/1), leg. R. Janssen, 1973-1976.

Discussion: The present species, the earliest member of *Vaginella* in the North Sea Basin, differs in several respects from later vaginellids. Larval shell shedding, in particular, is remarkable, since such is known only from few other species in the genus, e.g. *V. chipolana* Dall (1893: 431, pl. 23 figs 4-5) and *V. floridana* Collins, 1934 (compare Collins, 1934: 214, 216, pl. 13 figs 16-19, 22-23), both from the Early Miocene of Florida, USA. Also conspicuous is the straight ventral apertural margin; in other vaginellids both dorsal and ventral apertural margins are curved, usually the dorsal one protruding beyond the ventral.

BIOSTRATIGRAPHY

Within the North Sea Basin the Late Oligocene Chattian Stage usually is either subdivided into substages A, B and C, or into the Eochattian and Neochattian (Eochattian = Chattian A and B, Neochattian = Chattian C). Underlying criteria for these subdivisions are of a palaeontological nature. Especially the development of species of the bivalve family Pectinidae has been applied in this respect (Anderson, 1958; revised in R. Janssen, 1979b). The 'Kasseler Meeressand', from which the new species originates, is of unequivocal 'Chattian A' age (Anderson, 1961; Welle, 1993: 385).

For the so-called 'Sternberger Gestein', referring to reworked fossiliferous sandstone boulders found in fluvio-glacial deposits of Mecklenburg and Schleswig-Holstein (Germany), in particular, different age interpretations are found in the literature. R. Janssen (1979a: 11) suggested 'Chattian A, ?B'. Gaemers (1988: 373), in contrast, based on fish otoliths, interpreted the 'Sternberger Gestein' as 'Late Oligocene, Neochattian (late part)'. Welle (1993: 386), however, again accepted a 'vermutlich Chatt A und B' age. To obtain a more reliable age assignment of the 'Sternberger Gestein', the fossil contents of separate boulders should be analysed and compared. Most boulders, however, yield the pectinid *Palliolum decussatum* (von Münster, 1833), which is restricted to (the later part of ?) Chattian A (R. Janssen, 1979a: fig. 1).

Eight pteropod species are known from the Sternberg boulders (Table 4), of which at least *Heliconoides hospes*, *Ireneia tenuistriata* and *Vaginella chattica* have been recorded from a single boulder (from Segrahner Berg, RGM collections, leg. K. Eichbaum, don. F. Weinbrecht).

The Chattian Grafenberg Sand Member, in Nordrhein-Westfalen (Germany), has yielded quite a number of pteropods in material recovered from boreholes or mine shaft excavations (RGM collections), most of which remain unpublished to this date.

The most important section of the Grafenberg Sands is the Sophia Jacoba 8 mine shaft (Erkelenz, Nordrhein-Westfalen, sunk 1985-1988). Welle (1993) analysed a complete series of samples from this shaft, but found just a single pteropod species in the Late Oligocene portion, *Vaginella chattica*. A set of samples from this section is also available in the RGM collections, but remains to be studied. A parallel section from the K-3 borehole, sunk earlier than the actual shaft construction, was analysed by Mr A.C. Janse, Brielle (RGM collection) and has yielded several more pteropod species. The Grafenberg Sands occur in this section between approximately 402 and 165 m below surface. Welle (1993: 43, 408) doubted the value of Pectinidae in this section for a subdivision of the Chattian, but did record *Palliolum decussatum* from between 339.5 and 205 m below surface, considering it to be a later development of *P. aquaetranquillae* (Hubach, 1952), which was found in this section between 367.5 and 339.5 m. Both species are also known from the 'Kasseler Meeressand' (R. Janssen, 1979a: 54). Ranges

of pteropod species recorded from the Sophia Jacoba 8 (K-3 borehole) section are given in Table 3.

depth in m below surface																						
400	390	380	370	360	350	340	330	320	310	300	290	280	270	260	250	240	230	220	210	200	190	180
Eochattian (A)							Eochattian (B)						Neochattian (C)									
<i>Heliconoides hospes</i>																						
.....+++++																						
<i>Limacina valvatina</i>																						
.....+++++																						
<i>Ireneia tenuistriata</i>																						
.....+++++																						
<i>Styliola subula</i>																						
.....+++++																						
<i>Vaginella chattica</i>																						
.....+++++																						

Table 3. Pteropod distribution in the Grafenberg Sands of the Erkelenz - Sophia Jacoba 8 (K-3) borehole section.

The basal 50 m and the uppermost 70 m of this section did not yield any pteropod. In the interval 250-350 m, five pteropod species occur. In the upper portion, the absence of pteropods is presumably caused by decalcification of the sediment, but the basal part contains excellently preserved molluscan faunas, and the absence of pteropods is difficult to explain.

The co-occurrence of *Heliconoides hospes*, *Ireneia tenuistriata* and *Vaginella chattica*, as seen in one of the Sternberg boulders (see above), is found in the Sophia Jacoba section exclusively in the Chatt B part. *Spoelia torquayensis* was not found in the Sophia Jacoba section, but is known from another Grafenberg Sands locality (Rheinberg, RGM collections).

Classic assemblages known from the Kassel area ('Kasseler Meeressand') are supposed to have originated in a rather isolated basin (Anderson, 1961: 131, map 1), whereas both 'Sternberger Gestein' and Grafenberg Sands represent more open marine settings. In terms of holoplanktonic organisms, such as pteropods, one might expect that open sea assemblages contain more species than those from sheltered or coastal areas, where only the most frequent open-sea species can be expected. Table 4 lists pteropod species on record from these three lithological units.

Six out of eight species known from the 'Sternberger Gestein' are also recorded from the Grafenberg Sands, and in closely comparable frequencies. Just two very rare species from the Sternberg boulders are still unknown from the Grafenberg Sands.

None of these eight species, however, is known from the 'Kasseler Meeressand', in which *Vaginella basitruncata* sp. n. is the sole pteropod, collected in the Ahnetal outcrop from three different levels ('Schicht 3, 6, 9'), which according to R. Janssen (in litt., 2005) covers some 7 m of sediment. This species is absent from both other lithological units.

Some of these eight species also occur in younger (Miocene) deposits (*Limacina valvatina*, *Styliola subula*, *Spoelia torquayensis*), and a single (*Heliconoides hospes*) is found in pre-Chattian strata. On this basis, I assume the Kasseler Meeressand to be coeval with the lowermost part of the Grafenberg Sands, thus representing the oldest Chattian in the North Sea Basin.

species	Kasseler Meeressand	Sternberger Gestein	Grafenberg Sand Member
<i>Heliconoides hospes</i> (Rolle, 1862)	-	c	c
<i>Limacina valvatina</i> (Reuss, 1867)	-	r	r
<i>Limacina</i> spec. nov. ?	-	rr	-
<i>Styliola subula</i> (Quoy & Gaimard, 1827)	-	r	r
<i>Ireneia tenuistriata</i> (Semper, 1861)	-	cc	c
<i>Spoelia torquayensis</i> A.W. Janssen, 1995	-	rr	rr
<i>Vaginella basitruncata</i> spec. nov.	c	-	-
<i>Vaginella chattica</i> R. Janssen, 1979	-	c	c
<i>Vaginella tricuspidata</i> Zorn & Janssen, 1993	-	rr	-

Table 4. Occurrence of pteropod species in three lithological units of Late Oligocene (Chattian) age; rr - very rare, r - rare, c - common, cc - very common.

Data presented above also allow to subdivide pteropod zone 16 into three sub-zones, viz. 16a, 16b and 16c, characterised by the FODs (first occurrence datums) of *Vaginella basitruncata*, *Ireneia tenuistriata* and *Vaginella chattica*, respectively. Subzones 16a-c together cover the Eochattian. The Neochattian has so far yielded barely any pteropods. The only species known with certainty to continue into the basal part of the Neochattian is *Vaginella chattica*. Most probably, *V. chattica* is the precursor of *Vaginella depressa* Daudin, 1800, which is restricted to the Early Miocene (Burdigalian, pteropod zone 17).

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