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Biodiversity and palaeoecology of the Maastrichtian marine molluscs from the Paris Basin (France)

Didier MERLE

Muséum national d'Histoire naturelle, Département Origines & Évolution,
Centre de Recherche en Paléontologie Paris (CR2P –MNHN, CNRS, Sorbonne Université),
Case postale 38, 57 rue Cuvier, F-75231 Paris cedex 05, France.
Email: didier.merle@mnhn.fr

Abstract. Since the first half of the 19th century, the limestones of Vertus Mont Aimé (Marne) and Bois d'Esmans (Seine-et-Marne) have been confused with the Danian pisolitic limestone and their malacological content has been the subject of partial lists. For the first time, the complete description of the malacofauna of these limestones is provided. Its study is based on recent samples (fieldtrips in 2014 and 2017) and a new examination of material collected by the previous authors. As a result, 57 taxa were recognised, including 31 formally identified species; nine species are in open nomenclature and the other taxa identified at the higher ranks. Among these, 14 species of gastropods, including a new genus and 5 species of bivalves, are newly described: ?*Calliostoma monswavinarensis* sp. nov., *Sparnollonia bicarinata* gen. et sp. nov., ?*Tectus acmantensis* sp. nov., ?*Tectus fraterculus* sp. nov., ?*Tectus senarmonti* sp. nov., ?*Clypeostoma vertusensis* sp. nov., *Calliomphalus* (*Planolateralus*) *montenati* sp. nov., *Rhinoclavis parvisulcatus* sp. nov., ?*Vicinocerithium heberti* sp. nov., *Granulolabium cretaceum* sp. nov., *Haustator bergierensis* sp. nov., *Sveltella binkhorsti* sp. nov., *Fusinus bouchardae* sp. nov., ?*Pseudopisania cretacea* sp. nov., *Nucula bauti* sp. nov., *Arca* (s. str.) *submontensis* sp. nov., *Plicatula pacaudi* sp. nov., *Bathytormus sparnacensis* sp. nov. and *Chama loubryi* sp. nov. This fauna was previously unknown from the Paris Basin or even from Northwestern Europe. With the exception of endemic taxa which are dominant, it shares significantly more species with the Maastrichtian of Limburg (28% of the assemblage) than with the Danian of the Paris Basin (9% of the assemblage). This allows it to be attributed to the Maastrichtian age, in accordance with other palaeontological data on ostracods, chondrichthyans, large benthic Foraminifera and mosasaurs discovered recently. The assemblages at Vertus and Mont Aimé indicate palaeoenvironments deposited under shallow waters (with some brackish elements), probably close to the coastline. Therefore, this study highlights the distinctive character of the faunal content of the limestones of Vertus Mont Aimé and Bois d'Esmans, which constitute a unique Maastrichtian formation in the Paris Basin and which can be called the Vertus-Mont Aimé-Esmans Formation.

Keywords. Maastrichtian, molluscs, new species, biodiversity, palaeoenvironments.

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Introduction

Between the top of the upper Campanian white flint chalk and the Thanetian marine sands or the Ypresian sands and clays found in the north of the Île-de-France region, several marine limestone formations are known from very small and discontinuous outcrops, exceptionally spared from erosion. Their marine fauna is poorly preserved, and this has led to much controversy in the scientific community over the age of these formations (Montenat 2018a, 2018b), which were sometimes placed in the terminal Cretaceous and sometimes in the basal Tertiary. This is the case for the limited outcrop of sandy limestone once quarried in small quarries at Mont Aimé (Bergères-lès-Vertus, Marne), Grand Mont (Vertus, Marne) and Bois d'Esmans (Esmans, Seine-et-Marne), the malacological material from which is the subject of this study. This malacological fauna has gone unnoticed despite two and a half centuries of palaeontological studies of the Paris Basin, with the exception of two recent preliminary lists with few photographs (Merle & Pacaud 2018a; Merle 2023). The aim of the paper is therefore to provide an exhaustive study of the malacological content in refining the initial identifications and in describing the newly identified species. This approach will provide a more accurate picture of palaeobioversity of these localities and its biostratigraphic and palaeoenvironmental implications. It should help document a critical moment in palaeobiodiversity, the Maastrichtian, in an area where it has never been clearly identified, the Paris Basin.

Geographical location

Quarry of Mont Aimé – The former Mont Aimé quarry is located in the municipality of Bergères-lès-Vertus (Marne), Fig. 1. It is clearly located on the 1 : 50 000 geological map, sheet Vertus XXVII 1–4 (Mégnien *et al.* 1977).

Vertus ravine (Grand Mont) – The outcrop is located northwest of the town of the municipality Vertus (Marne), Fig. 1. It is clearly located on the 1 : 50 000 geological map, sheet Vertus XXVII 1–4 (Mégnien *et al.* 1977). Samples were taken at the following geographical coordinates: 48°54′44.64″ N, 3°59′38.71″ E.

Vertus (Faloise) – In the ancient collections, there is material with labels indicating the locatility of Vertus with the mention Faloise or Falloise, or Falaise (= cliff). The name of this locality refers to old quarries where Maastrichtian limestone, known as Pierre de Faloise, was mined for construction purposes. It is clearly located on the 1 : 50 000 geological map, sheet Vertus XXVII 1–4 (Mégnien *et al.* 1977).

Bois d'Esmans – The former Bois d'Esmans quarry is located in the municipality of Esmans (Seine-et-Marne), Fig. 1. It is clearly located on the 1 : 50 000 geological map, sheet Montereau-Fault-Yonne XXV 7 (Neau *et al.* 1989).

Geological context and sections

The limestones of Vertus-Mont Aimé

Viquesnel (1838) distinguished the limestones of Vertus and Mont Aimé and showed that they lie on top of white chalk now attributed to the Campanian (Bignot 1987). Hébert (1848, see Fig. 2A) placed them in the 'Pisolithic' group, between white chalk and plastic clays and Sparnacian sands (= Ypresian). The Mont Aimé section at Bergères-lès-Vertus (Figs 3A, 4A) begins with white chalk, containing rare flint and *Belemnitella mucronata* (Schlotheim, 1813) and *Magas pumilus* Sowerby, 1816 from the Upper Campanian, zone C6j (Bignot 1987). Above the chalk and in discordant superposition, 4 m of marly-sandy laminites can be found, alternating between white sand and grey marl that becomes red when it dries. These beds yielded bones from crocodiles, turtles, fishes (see Lapparent *et al.* 2018: fig. 164), and invertebrates (echinoderms, bryozoans, ostracods and foraminifera). Above, 1 m of laminites alternate with a lower shell limestone containing rare chalk pebbles and numerous black horn flints with a thick white patina. At the base of these banks, burrows parallel to the stratification can be observed. These

laminites yielded fish skeletons of *Prolates heberti* (Sauvage, 1883) and *Oropycnodus ponsorti* (Heckel, 1854) in anatomical connection (see Lapparent *et al.* 2018: fig. 161). Above, over a thickness of 10 m, are beds of hard, white or yellowish sandstone limestone with an oblique stratification and joints of white clayey sand. On top, 3 to 4 m of a yellow or red sandy limestone, karstified, with concentrations of shells imprints (bed 6 of Chavan 1948). The most abundant shells are the carditids *Baluchicardia hebertiana* (d'Orbigny, 1850). It is in these bed with carditid imprints, which had collapsed onto the quarry floor, that the studied material was collected in December 2014 and July 2017. The Vertus (Grand Mont) section (Figs 3B, 4B) also begins at the base with approximately 2 m of visible Campanian chalk. Above this and in discordant superposition, 0.60 m of a yellowish, slightly sandy and glauconitic clayey marl, finely bedded, rich in clayey layers, containing flint nodules, small chalk pebbles, numerous invertebrates remain and shark teeth. Above, a hardened whitish limestone layer of 0.30 m thick. It is rich in flint and chalk pebbles, foraminifera, *Laffitteina mengaudi* (Astre, 1923), and crystallised shells or rare shell imprints. It is in this bed that several teeth of Mosasauridae Gervais, 1853 of the genus *Prognathodon*

Fig. 1. Geographical location of the three Maastrichtian localities (Vertus, Bergères-lès-Vertus and Esmans).

Dollo, 1889 were discovered (Lapparent *et al.* 2018: fig. 165). Above, a 2 m thick bed of a biocalcarenite containing numerous fragments of disarticulated invertebrates (pectinids and echinoderms), fish remains and *L. mengaudi*. This bed is referred to as the lower bed of Vertus by Chavan (1948 = bed 2 à *Lima*) and includes a few mollusc imprints and many pectinids (but not *Lima*!). After a gap of approximately 2 m, there is a bed of hardened sandy limestone rich in mollusc imprints, visible over a thickness of 1 m. It is in this upper bed that most of the material was collected in July 2017. Chavan (1948) was unaware of the upper sandy limestone.

The sandy limestone of Bois d'Esmans

This sandy limestone was once quarried in small quarries. It was first briefly mentioned by C. d'Orbigny (1837), who classified these beds as Lutetian 'Calcaire grossier'. Sénarmont (1844) succinctly described the sandy limestone of the Bois d'Esmans, which was then being quarried, specifying its thickness of approximately 4 m and providing interesting observations on its relationship with the adjacent beds, the Campanian chalk and the Sparnacian (= Ypresian) clays. Hébert (1848) provides a more detailed description (Fig. 2B): "these are horizontal beds of white, compact, homogeneous limestone". The limestone of the Bois d'Esmans remains accessible in a small excavation exposing it to a thickness of approximately 1 to 2 m (Fig. 4D).

Age of the Vertus-Mont Aimé and Bois d'Esmans beds

1838 to 1997: a period of fluctuation

The age attribution of the sandy limestones of Vertus-Mont Aimé (Marne) and Bois d'Esmans (Seine-et-Marne) has varied according to the authors who have successively attributed them to the Tertiary (Viquesnel 1838; Hébert 1848 based on geology and molluscs), the Montian (Marie 1945 based on benthic foraminifera), the Thanetian (Margerie *et al.* 1966; Guillevin 1977 based on benthic foraminifera), the Maastrichtian (Margerie 1967, 1968 based on ostracods), but above all to the Danian

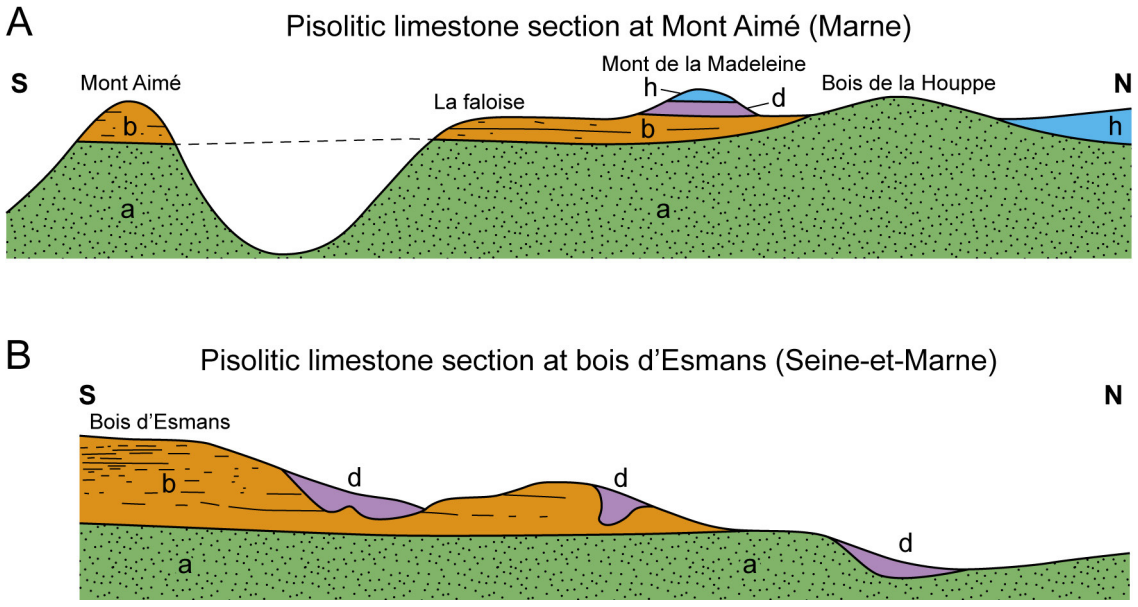

Fig. 2. Geological context of the sections of Mont Aimé (A) and Bois d'Esmans (B) after Hébert (1848), original figures coloured. Legends: a = chalk; b = 'Pisolithic' = Maastrichtian beds; d = sands and sandstone from Argile plastique (Ypresian); h = millstone from Brie (Rupelian). The two sections are not to the same scale. The thickness of the Maastrichtian (b) is 9 to 10 m at Bois d'Esmans and 25 m at Mont Aimé.

(d'Orbigny 1850; Chavan 1948 based on molluscs; Megnien & Wyns 1980; Bignot 1987, 1993; Bignot *et al.* 1997 based on small benthic foraminifera). The latest hypothesis, based on the study of small benthic Foraminifera, led Bignot (1987, 1993) and Bignot *et al.* (1997) to conclude that the Vertus-Mont Aimé sandy limestones were deposited during the lower Danian although containing many redeposited Maastrichtian elements. For a more detailed discussion of this period see also Montenat (2018b).

2018 *Stratotype Danian* volume: new data supporting a Maastrichtian age

In the *Danian Stratotype* volume (Montenat & Merle 2018), the age of the Vertus-Mont Aimé and Bois d'Esmans localities was revised, combining new field data and new samples with historical data.

First, the hypothesis of lower Danian deposits reworking Maastrichtian material was tested and the results are as follows. The lower beds of Mont Aimé have yielded various vertebrates, including delicate fish skeletons in anatomical connection that cannot have been transported or redeposited (Priem 1898;

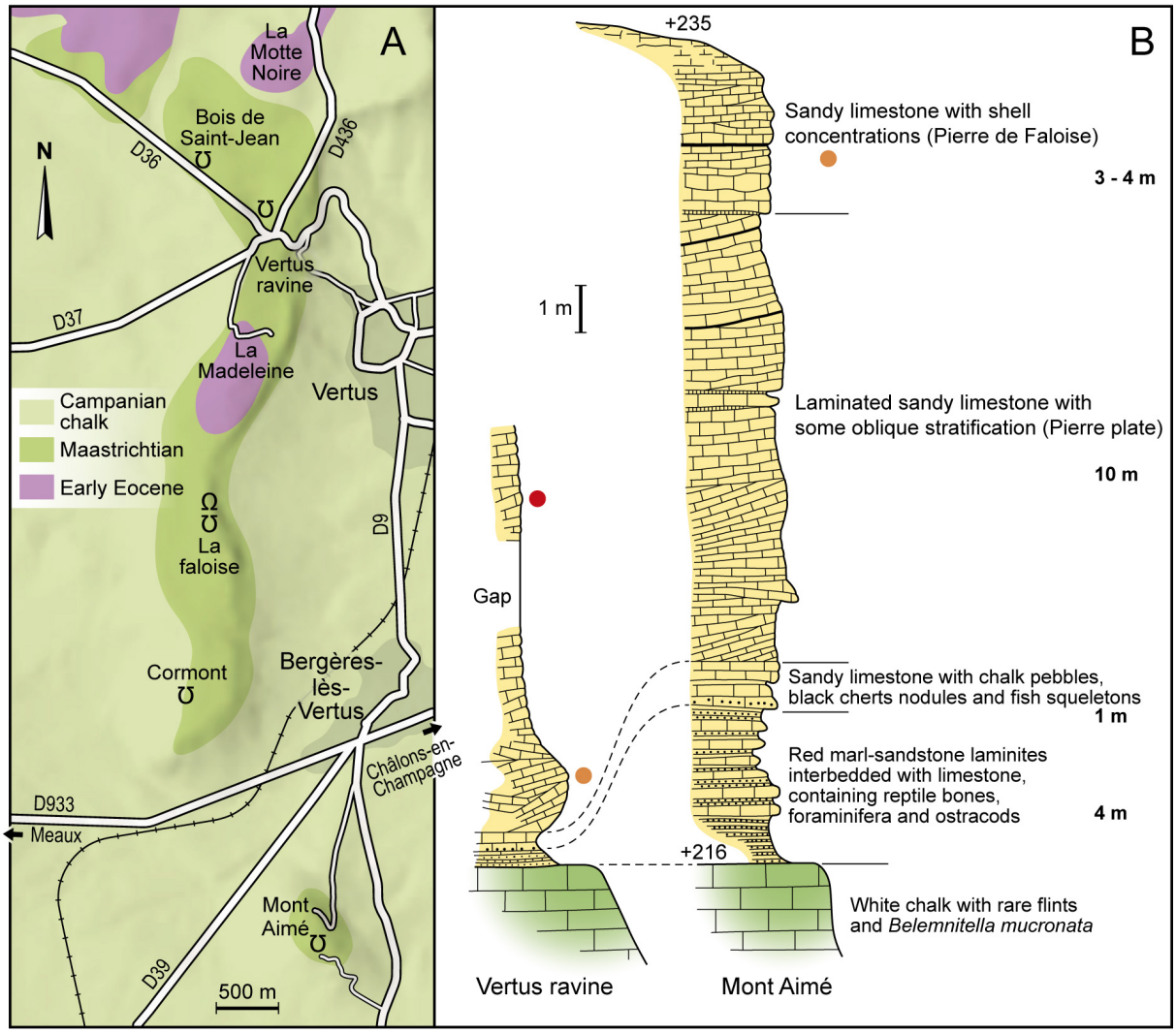

Fig. 3. Geographic location and sections of Maastrichtian outcrops at Vertus (Grand Mont, Vertus ravine) and Bergères-lès-Vertus (Mont Aimé), Marne. **A**. Geographic locations. **B**. Sections based on the original figures of Bignot (1987) colourised. The red circles correspond to the place of the samples. At Vertus (Grand Mont) lower circle = basal biocalcarenite with pectinids, upper circle = sandy limestone of Vertus and at Bergères-lès-Vertus (Mont Aimé), red circle = sandy limestone with shell concentrations.

Lapparent *et al.* 2018: fig. 161). At Mont Aimé and Vertus (Grand Mont), imprints of shells collected in the sandy limestone at the top of the both sections (Fig. 3B) show that many shells were broken, but they were rarely eroded or biocorroded. The bivalves are usually disarticulated. The assemblage therefore consists of shells that were transported only during a short period and indicates a calm depositional environment, conducive to a rapid post-mortem burial of the organisms. Furthermore, the hypothesis of redeposited Maastrichtian material in a hypothical lower Danian deposit was only formulated for the local context of the Vertus-Mont Aimé (Marne) sections, but did not take into account the analogous geological and palaeontological context of the Bois d'Esmans (Seine-et-Marne), located around 120 km away to the south west. In addition, the microfacies observed at Bois d'Esmans are very similar to those of the 'Pierre plate' at Mont Aimé, and all differ from those of the Danian in the Paris Basin (Montenat 2018b: fig. 150).

Second, recently acquired biostratigraphic data should take into account when determining the age of the three localities. Guernet & Villier (2017) and Guernet (2018) revised the ostracod fauna of Mont Aimé and concluded that "Danian ostracods species of Mons and of the Paris basin are totally absent. These ostracods are not reworked: even the most fragile valves are not broken and no size- or shape-related

Fig. 4. Photographs of the studied sections. **A**. The Mont Aimé section at Bergères-lès-Vertus (Marne). **B**. The Grand Mont section in the Vertus ravine (exhibiting the basal biocalcarenite with pectinids). **C**. The former Faloise quarry in the Vertus Massif at Vertus. **D**. The Bois d'Esmans outcrop at Esmans (Seine-et-Marne). Credits: A–C = Christian Montenat; D = Elise Auberger.

sorting has been observed. Also, the characteristic large benthic foraminifer *Laffitteina mengaudi* (Astre, 1923), only known in the upper Cretaceous, is not reworked. Thus, the early Danian age assumed until now cannot be accepted" (Guernet & Villier 2017: 248). For the vertebrates, the discovery in 2014 of two mosasaur teeth of *Prognathodon* at the base of Vertus (Grand Mont ravine) was an important find that clearly indicates a Cretaceous age (Lapparent *et al.* 2018: fig. 165). Moreover, Dutheil (2018) identified 15 species of elasmobranchs at the base of the sections of Vertus (Grand Mont) and Mont Aimé. Most of these species are strictly Cretaceous, and only four survived the K/Pg crisis. Six of them are known to have a strictly Maastrichtian stratigraphic range. The preliminary list of 41 species compiled by Merle & Pacaud (2018a: table 2) highlights above all the originality of the malacofauna for the Paris Basin, but with 12 species whose stratigraphic range does not extend beyond the Maastrichtian.

Finally, the fact that, in the Paris Basin, the Maastrichtian stage has not been recognised anywhere other than in Normandy (Megnien & Wyns 1980), as well as the hypothesis of a reworking of Maastrichtian fossils in hypothetical Danian beds, have worked against the acceptance of a Maastrichtian age for the beds of Vertus-Mont Aimé and Bois d'Esmans. However, the absence of arguments in favour of redeposited fossils in these beds, combined with the discovery of new biostratigraphic markers, leads us to the rejection of a Danian age for these beds and to the recognition of a Maastrichtian age.

Geological comparisons with European sites near the K/Pg boundary

Given that the hypothesis a lower Danian fauna possibly containing redeposited Maastrichtian material has already been proposed for the Mont Aimé locality (Bignot 1987 followed by some other authors), it is necessary herein to compare it with European localities (Poland, The Netherlands and Denmark) where the K/Pg boundary is well attested and Maastrichtian fossils redeposited in the Danian are well established.

Poland

Machalsky & Duda (2024) studied a richly fossiliferous Cretaceous–Paleogene (Maastrichtian–Danian) boundary interval exposed in the northern part of the Middle Vistula River section. The sections of Bochotnica & Nasilów and Edelman Fossil Park clearly expose both the Maastrichtian and the overlying Danian. At the boundary between the Maastrichtian and the Danian, the authors identified a zone of pseudobreccia containing a characteristic assemblage of upper Maastrichtian fossils, which had been exposed underground by burrowing animals as part of an ichnotaphonomic process previously unknown. No breccia or pseudo-breccia has been observed at Mont Aimé or Vertus, nor has a Maastrichtian-Danian boundary been identified. Moreover, the great thickness of the fossiliferous beds at Mont Aimé also rules out a deposit formed by condensation.

The Netherlands

In South Limburg (The Netherlands), two sections clearly expose both the typical Maastrichtian and the overlying Danian (Vellekoop *et al.* 2019: fig. 1). The K/Pg boundary represents a submarine condensation level. The irregular surface and palaeorelief, with knolls and depressions, is inferred to be the result of bioerosion and current activity in relatively shallow waters (<40 m) (Roep & Smit 1996). The upper part of the lowest Danian unit, of two metres thick, is rich in autochthonous macrofossils, including gastropods, bivalves, cephalopods and echinids (Jagt *et al.* 1996, 2013). Most of the baculitid ammonites are preserved with their apertures intact, indicating that they were buried without undergoing significant reworking or transport, which would otherwise have destroyed their delicate shells (Landman *et al.* 2014). Consequently, the ammonites from this unit are considered to be the oldest surviving specimens from the Danian. As is the case in Poland, the sedimentary context differs greatly from that of the Paris Basin, and even the presence of redeposited Maastrichtian fossils in the Danian is not easy to demonstrate. The depositional environment inferred from the Dutch assemblages (>40 m) is also deeper than in the Marne localities, where it is thought not to have exceeded 20 m (Merle 2023).

Denmark

In western Denmark, the Cretaceous–Paleogene boundary is marked by a marly bed a few centimetres thick, rich in terrigenous material. In eastern Denmark, an equivalent bed, the Fiskeler Member (fish clay) of the Rødvig Formation, is found in the small depressions formed between the biogenic mounds of the Upper Cretaceous. The Fiskeler Member, 10 cm thick, is rich in fossilised remains of fish and shelled animals that have been redeposited (Surlyk *et al.* 2006). The Fiskeler Member of eastern Denmark is succeeded by an up to just over one metre thick micritic limestone bed, the lower Danian Cerithium Limestone Member of the Rødvig Formation (Hansen 2019). The Cerithium Limestone Member basically comprises the fills of a series of small troughs between the crests of the underlying biogenic mounds of the Højerup Member (Surlyk *et al.* 2006). In the lower part, shelled fossils are common, although most are preserved as moulds due to dissolution of aragonitic shells (Hansen 2019). The member is furthermore strongly burrowed by *Thalassinoides* Ehrenberg, 1944, the burrows of which are filled with coarse bryozoan-rich material from the succeeding Stevns Klint Formation. Therefore, the sedimentary context also differs from that of the Paris Basin. The presence of redeposited Maastrichtian fossils in the Danian is demonstrated, but in a thin bed. The depositional environment inferred from the Danish assemblages is also deeper than in the Marne area. A likely estimate is 100 to 250 metres during the deposition of the larger part of the Maastrichtian chalk and perhaps shallower during parts of the Danian (Håkansson *et al*. 1975; Surlyk 1997; Hart *et al*. 2005).

These three well-documented examples, in which Maastrichtian fossils have been found redeposited in sediments from the lower Danian, reveal sedimentary contexts that are very different from that described in the Paris Basin at Bergères-lès-Vertus (Mont Aimé), Vertus and at Bois d'Esmans. Indeed, in all cases, the redeposited fossils are found in thin beds located at the Maastrichtian-Danian boundary, and the Danian is always clearly attested. This type of deposit contrasts sharply with that of the Paris Basin, where the Maastrichtian beds are very thick and show no evidence of a contact with Danian beds.

History of the malacological research

As far as knowledge of the palaeontological content of the Vertus-Mont Aimé and Bois d'Esmans localities is concerned, molluscs are the poor cousins. Like the Danian of the Paris Basin, the aragonite shells have been dissolved leaving only external imprints, which makes them difficult to identify. Hébert (1848) reported a nautilid from the Bois d'Esmans, emphasising the resemblance to a species from Maastricht (The Netherlands) figured by Faujas de Saint-Fond (1799). Hébert (1848) also mentioned a campanilid at Vertus, which he identified with doubt as *Cerithium giganteum* Lamarck, 1804 from the Lutetian of the Paris Basin. As for the rest of the fauna, Hébert (1848) confined himself to saying that the shells encountered were indeterminable. Two years later, d'Orbigny (1850) described several new species by including specimens from these three localities in their Danian type material (*Cerithium carolinum* [Mont Aimé], *Cerithium uniplicatum* [Vertus], *Cardita hebertiana* [Vertus], *Corbis multilamellosa* [Vertus], *Corbis sublamellosa* [Vertus] and *Nautilus hebertinus* [Montereau = Bois d'Esmans]. For the Bois d'Esmans, Combes (1908) cited 17 species, identified as being of Cretaceous age (e.g., *Janira quadricostata* Sowerby, 1814 [= *Neithea regularis* (Schlotheim, 1813)] and *Lima tecta* Goldfuss, 1835) or of Danian age (e.g., *Cerithium carolinum*, *Corbis multilamellosa* and *C. sublamellosa*). Later Chavan (1948) reviewed some of the malacological research carried out on material of these localities. With regard to Mont Aimé and Vertus, he first noted that it is difficult to indicate the precise origin of the cited specimens by the previous authors, as the two localities are generally confused. For Mont Aimé, however, Chavan (1948) mentioned a bed (bed 6) of sandy limestone with carditid imprints to the top of the quarry corresponding herein to the sandy limestone with shell concentrations (= SLSC, Fig. 3B). He reported *Arca montensis* Cossmann, 1908, *Corbis sublamellosa* d'Orbigny, 1850, *Hipponix ornatissimus* d'Orbigny, 1850, *Turritella* cf. *supracretacea* d'Orbigny, 1850, *Cerithium* sp. nov., *Venericardia roedeli* Ravn, 1939 and *Surcula* cf. *hauniensis* von Koenen, 1885. These identifications of species present at Vigny (France), Mons (Belgium) or Faxe (Denmark) suggested a Danian age. From Vertus, he reported,

on the basis of the Hébert collection housed at the Sorbonne (now collection of Palaeontology of the Université Pierre & Marie Curie = UPMC), another assemblage containing *Pycnodonte semiplana* J. Sowerby, 1825, *Neithea regularis* (von Schlotheim, 1813), *Lima tecta* Goldfuss, 1835, *Chlamys cicatrisata* (Goldfuss, 1833) and *Chlamys dentata* (Nilsson, 1827). According to Chavan (1948), this assemblage comes from a bed lower than the carditid bed and contains taxa shared with the Maastrichtian. It corresponds to the basal biocalcarenite with pectinids (BBWP) of Vertus (Grand Mont) in which we collected few imprints of shells (Fig. 3B). From the basal beds of Mont Aimé, Bignot (1987) noted the presence of inoceram prisms, a group of exclusively Cretaceous bivalves. As no shell illustrations were given in the aforementioned works, the stratigraphic information obtained from molluscs appeared contradictory. This was the state of the art when the writing of the book *Stratotype Danien* (Montenat & Merle 2018) began with the recurring problem of the stratigraphic dating of this mollusc fauna. It was in this context that a preliminary list of taxa from the three localities was given (Merle & Pacaud 2018a: figs 155–159), based on the results of the fieldwork carried in December 2014 at Mont Aimé and Vertus, as well as a review of the ancient collections of the Sorbonne Université (= UPMC) and the Muséum national d'Histoire naturelle (MNHN). This list included 41 species (23 bivalves, 17 gastropods, 1 nautilid), but most of the species mentioned were left in open nomenclature, because the material was still insufficient to give a precise identification or because it was an unknown species. For the first time, several characteristic molluscs were illustrated (Merle & Pacaud 2018a). This work represented an important step forward in the understanding of this Maastrichtian fauna, but it remained incomplete as it did not provide formal descriptions of the taxa discovered. Moreover, it did not include the new data from a second fieldwork carried in July 2017. The first preliminary list was updated by Merle (2023), but without figures or descriptions.

Abbreviations

Shell measurements

APL = antero-posterior length (bivalves)
D = diameter
DWH = dorso-ventral height (nautilids)
DVL = dorso-ventral length (bivalves)
H = height
L = length
UD = umbilical diameter (nautilids).
W = width
WH = whorl height (nautilids)

Other shell abbreviations

EF = external face
IF = internal face
LV = left valve
RV = right valve

Repository and collections

IRSNB = Institut royal des Sciences naturelles de Belgique, Bruxelles, Belgium
MMM coll. = Collection of Maastrichtian Mollucs from the Marne area (fieldtrips of 2014 and 2017), Muséum national d'Histoire naturelle, Paris (paleontology collection)
MNHN.F. = Muséum national d'Histoire naturelle, Paris (collection de Paléontologie), France
MNHN.GG. = Muséum national d'Histoire naturelle, Paris (collection de Géologie), France
NHMUK = Natural History Museum, London, United Kingdom
NHMM = Natural History Museum, Maastricht, The Netherlands
UPMC.PAL = Université Pierre & Marie Curie, collection de Paléontologie de Sorbonne Université (SU), Paris, France

Material and methods

Most of the studied material comes from two fieldtrips to the Mont Aimé at Bergères-lès-Vertus and the Grand Mont ravine at Vertus in the Marne Department. The first fieldtrip was carried out in December 2014 during two days by Christian Montenat (UniLasalle Beauvais), Grégoire Métais (MNHN), Didier Dutheil (MNHN), Michael Dion and Didier Merle, and the second fieldtrip in July 2017 during eight days by Jean-Paul Baut and Didier Merle. The material is deposited at the Muséum national d'Histoire naturelle, Paris (invertebrate palaeontology collection) under the name Maastrichtian Molluscs from Marne (acronym MMM). In addition, the ancient collections at the Muséum national d'Histoire naturelle (palaeontology and geology collections) and the Sorbonne Université (palaeontology collection of UMPC) have been reexamined. Two field trips carried out at the Bois d'Esmans in 2016 enabled us to locate the Maastrichtian beds, but they proved to be very poor in fossils.

Methods

Shell preparation

In the studied localities, the aragonite mollusc shells were dissolved during diagenesis. They always appear in the form of external shell imprints. As a result, they are not immediately easy to identify. In the field, the sampling method consists of breaking up the limestone blocks with a hammer and collecting the imprints. This step is followed by laboratory work, which involves drying and cleaning the blocks. After this step, the imprints are moulded with silicone elastomer in order to obtain casts. These casts reproduce the original shape of the shells with great fidelity. Therefore, almost all material studied herein corresponds to silicone elastomer casts of imprints. They are then compared with data from the literature in order to identify the species encountered. This method is an old one, since it was used by d'Orbigny (1850) for his palaeontological study of the Danian, but also in more recent works (e.g., Pacaud *et al.* 2000; Saint Martin *et al.* 2007; Pacaud & Ledon 2010; Chaix & Saint Martin 2018; Merle & Pacaud 2018a, 2018b; Pacaud 2018a).

Shell terminology of the spiral sculpture

The protoconch and the first whorl of the teleoconch of the gastropods studied are generally not preserved, and therefore the criterion of homology based on ontogenetic correspondence cannot be fully applied to the spiral cords (see Merle 2005 for the definition of homology criteria). Consequently, the cords will not be qualified as primary, minor or tertiary. Instead, the criterion of topological correspondence will be used, based on the cords observed on the smallest teleoconch whorls. This approach allows for a more rigorous descriptive and comparative framework, than imprecise descriptions that inevitably lead to confusion (overestimation of variability, false homoplasy, etc.). The cords will therefore be qualified as major, minor or threads.

The description of new species and comparisons adopt the terminology suggested by Marshall (1995) and Vilvens (2001) for the Vetigastropoda Salvini-Plawen, 1980, by Allmon (1996) for the Turritellidae Lovén, 1847 and by Harzhauser & Landau (2026) for the Cerithiidae J. Fleming, 1822, subfamily Bittiinae Cossmann, 1906.

Major cords: M1…M8: M1 is the most adapical cord.

Minor cords: m1… m4. Usually, these minor cords are inserted at equal distances between two major cords.

Palaeoecology

To establish the ecological characteristics of the molluscs (bivalves and gastropods) found in the Maastrichtian of the Paris Basin, particularly their substrate relationships and feeding types, the working method of Lauridsen & Schnetler (2014) on the Danian of Faxe (Denmark) is used. Their identification is

based on the actualist method and follows the categories defined according to the classification of Todd (2000). They are broken down as follows for trophic categories: CB: browsing carnivores; CP: predatory carnivores; DC: chemosymbiotic deposit feeders and for modes of locomotion: DS: surface deposit feeders; DU: subsurface deposit feeder; EF: fixed epibionts; EM: mobile epibionts; EN: endobionts; HM: herbivores on fine-grained substrates; HO: herbivores omnivores; HR: herbivores on rock, rubble or coral substrates; SU: suspension feeders. This approach will allow assess separately the life habits of bivalves and gastropods and to consider those which are known or which can be reliably inferred through functional morphology, or taxonomic uniformitarism in the case of anatomically unknown present day or extinct taxa. Thanks to this approach, it is possible to deduce several associated environmental parameters, such as the nature of the substrate or the types of food available.

Results

Systematic palaeontology

The taxa presented in this section follow the systematic classification given in the MolluscaBase website (https://www.molluscabase.org).

Class Gastropoda Cuvier, 1795
Sublclass Vetigastropoda Salvini-Plawen, 1980
Order Lepetellida Moskalev, 1971
Superfamily Fissurelloidea J. Fleming, 1822
Family Fissurellidae J. Fleming, 1822
Subfamily Fissurellinae J. Fleming, 1822

Genus ***Diodora*** J.E. Gray, 1821

Type species

Patella apertura Montagu, 1803 by monotypy, junior synonym of *Diodora graeca* (Linnaeus, 1758). Present day, Western Europe.

Stratigraphic range of the genus

Late Cretaceous (Knight *et al.* 1960) to present day.

Diodora sp.
Fig. 5A–D

Diodora sp. – Merle & Pacaud 2018a: 169–170, fig. 155a–b. — Merle 2023: 25.

Material examined (3 specs)

FRANCE – **Marne** • 1 spec., internal imprint; Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; MMM coll.; figured in Merle & Pacaud (2018a: fig. 155a) and herein Fig. 5A; MNHN.F.A66743 • 1 spec., internal mold; same data as for preceding; Ch. d'Orbigny coll., ex n°GG. Gg2005/6003; figured in Merle & Pacaud (2018a: fig. 155b) and herein Fig. 5B–C; MNHN.F.C02614 • 1 spec., part of an external imprint; same data as for preceding; MMM coll.; Fig. 5D; MNHN.F.C02608.

Measurements

MNHN.F.A66743, L: 34 mm; W: 25 mm. MNHN.F.C02614, L: 16 mm; W: 13 mm. MNHN.F.C02608, L (incomplete): 11 mm.

Description

Conical and moderately elevated limpet shell. Outline rounded at anterior and posterior edges, almost straight at mid point. Anal aperture approximately located at mid part of shell length, elongated, 1.8 mm long and rounded in both extremes. On internal imprint, crenulations made by axial ribs more marked on anterior part. On external imprint, delicate major ribs with three or four minor ribs intercalated in between. Surface weakly squamose.

Remarks

Sohl (1992) described two species of *Diodora* from the Late Cretaceous carbonate-platform deposits of the Caribbean: *D. decussata* Sohl, 1992 and *D. hazeli* Sohl, 1992. *Diodora* sp. from the Paris Basin differs from *D. decussata* by having coarser radial ribs, and from *D. hazeli* by lacking prominent radial ribs. In the North European Maastrichtian, no specimens of *Diodora* have been identified. The studied material can be compared to Danian *Diodora* described from the Paris Basin in France (see Pacaud 2004) and the Mons limestone in Belgium (see Glibert 1973). Among them, *Diodora* sp. is reminiscent of *Diodora corneti* (Rutot in Cossmann, 1919) in its moderately elevated shells, its elongated posterior aperture, its shape rounded in both extremes and its delicate major ribs with three or four minor ribs intercalated in between. However, *Diodora* sp. differs from *D. corneti* by having a narrower and less rounded posterior edge and a longer and wider anterior edge (see holotype IRSNB n°3023 in Glibert 1973: pl. 1 fig. 7).

Order Trochida authority not given see MolluscaBase

Taxonomic comment

Most of the species of Trochoidea Rafinesque, 1815 and Seguenzoidea A.E. Verrill, 1884 described in this study are new species, but usually do not have a preserved aperture and their protoconchs are not visible. Generic assignments have had to be made on the basis of comparisons of shape and sculpture, which are not the best diagnostic characters. For this reason, these assignments are considered provisional and are preceded by a question mark until more material becomes available to confirm or refute them.

Superfamily Trochoidea Rafinesque, 1815

Trochoidea indet.
Fig. 5E

?*Jujubinus* sp. – Merle & Pacaud 2018a: 169–170, fig. 155g. — Merle 2023: 25.

Material examined

FRANCE – **Marne** • 1 spec.; Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; figured in Merle & Pacaud (2018a: fig. 155g) and herein Fig. 5E; MNHN.F.A66745.

Measurements

H (incomplete apex): 4.2 mm; D: 4 mm.

Description

Two preserved whorls (penultimate and last whorls). Shell of small size; conical shape with fairly flat whorls. Suture shallow. Extreme abapical part of last whorl near base slightly convex. Penultimate whorl smooth (sculpture not preserved). Last whorl with three major cords more prominent at base.

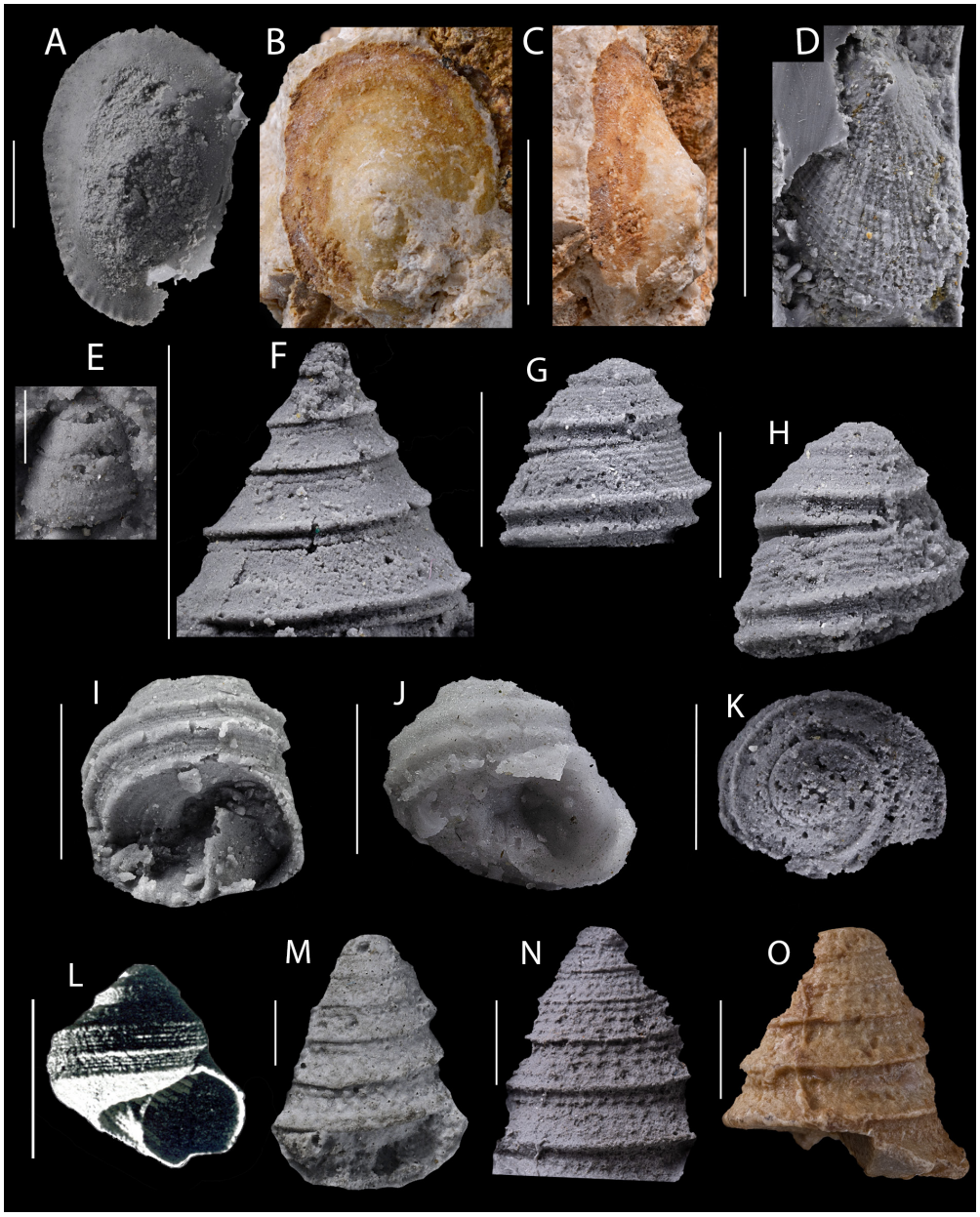

Fig. 5. Vetigastropoda Salvini-Plawen, 1980 from the Maastrichtian of the Paris Basin. **A–D**. *Diodora* sp. **A**. MNHN.F.A66743, MA, apical view of the imprint. **B**. MNHN.F.C02614, MA, apical view of the internal mould. **C**. Same specimen in lateral view. **D**. MNHN.F.C02608, MA, apical view. — **E**. Trochoidea indet. MNHN.F.A66745, MA, lateral view. — **F**. ?*Calliostoma monswavinarensis* sp. nov., holotype MNHN.F.C02609, MA, lateral view. — **G–K**. *Sparnollonia bicarinata* gen. et sp. nov. **G**. Holotype MNHN.F. C02610, VGM, lateral view. **H**. Paratype MNHN.F.C02616, VGM, lateral view. **I**. Paratype MNHN.F.C02612, VGM, apertural view. **J**. Paratype MNHN.F.C02618, VGM, apertural view. **K**. Paratype MNHN.F.C02621, VGM, apical view. — **L**. *Afrollonia nigeriensis* Adegoke, 1977 for comparison, holotype UIMG 189, Ewekoro (Nigeria), Danian, apertural view. — **M–O**. ?*Tectus acmantensis* sp. nov. **M**. Holotype MNHN.F.A66744, BE, lateral view. **N**. Paratype UPMC.PAL.2017.0.15.1a, BE, lateral view. **O**. Paratype UPMC.PAL.2017.0.15.1b, BE, lateral view. Localities: BE = Esmans (Bois d'Esmans); MA = Bergères-lès-Vertus (Mont Aimé); VGM = Vertus (Grand Mont). Scale bars: A–C, F = 10 mm; D, M–O = 5 mm; E = 2 mm**;** G–L = 3 mm; Credits: A–B, M, O = P. Loubry (MNHN/CNRS), C–K, N = L. Cazes (MNHN/CNRS).

Remarks

With its conical shape with fairly flat whorls, the fragment of shell is more reminiscent of members of *Jujubinus*, than species of *Tectus* Montfort, 1810 (Montfort 1810: 186), *Calliomphalus* Cossmann, 1888 (Cossmann 1888: 52) or *Agathodonta* Cossmann, 1918 (Cossmann 1918: 193) described in the present paper. Nevertheless, this fragment does not allow to give a reliable generic assigment.

Family Calliostomatidae Thiele, 1924
Subfamily Calliostomatinae Thiele, 1924

Genus ***Calliostoma*** Swainson, 1840

Type species

Trochus conulus Linnaeus, 1758 by subsequent designation (Herrmannsen 1846: 154). Present day, NE Atlantic and Mediterranean.

Stratigraphic range of the genus

Late Cretaceous (*Calliostoma* s. lat.) according to Knight *et al.* (1960) to present day.

?*Calliostoma monswavinarensis* sp. nov.
urn:lsid:zoobank.org:act:B6DCCF53-A6C0-4494-BEFF-A7EEB4202E66
Figs 5F, 6A–B

Etymology

From the ancient name of the locality Mont Aimé ('Mons Wavinarum' in the 7th century).

Type locality

Bergères-lès-Vertus (Mont Aimé), Marne, France.

Type horizon

Sandy limestone with shell concentrations of Mont Aimé, Maastrichtian.

Type material

Holotype

FRANCE – **Marne** • Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; MMM coll.; MNHN.F.C02609.

Measurements

H (incomplete apex): 7 mm, D: 7.5 mm.

Description

Medium-sized shell. Conical and pyramidal spire. Spiral angle 54°. Four teleoconch whorls preserved, nearly concave and enlarged at base. Suture shallow. From first to last whorl, two major cords M1 and M2 (Fig. 6A–B). M1 prominent, smooth, at base of whorl, making a keel and delineating the periphery (Fig. 6A–B). M2 close set the anterior suture and weaker than M1 (Fig. 6A–B). Aperture not preserved.

Comparisons

?*Calliostoma monswavinarensis* sp. nov. is reminiscent of *Trochus lineatus* Binkhorst, 1861 from the Maastrichtian of The Netherlands (see Binkhorst 1861: pl. 5a1 fig. 9a–b) in its prominent M1 delineating the periphery. However, ?*C. monswavinarensis* has fewer threads adapically and displays a

narrower shape. ?*C. monswavinarensis* also resembles *Tectus carinodentatus* (Briart & Cornet, 1887) from the Danian of Mons in having a prominent M1 forming a keel delineating the periphery, but it differs by lacking crenulations on M1, fewer threads adapically and a narrower shape. ?*Calliostoma monswavinarensis* and *Tectus gabrielis* (d'Orbigny, 1850) from the Danian of the Paris Basin have a prominent M1, but ?*C. monswavinarensis* differs by having fewer threads adapically and by having a prominent M2. The generic attribution of ?*C. monswavinarensis* is difficult to give. It cannot be easily attributed to *Tectus* Montfort, 1810, whose sculpture is more developed, particularly the peripheral cord, which bears numerous crenulations. The type species of *Calliostoma*, *Calliostoma conulus* (Linnaeus, 1758), present day, Mediterranean Sea, has a prominent cord delineating the periphery, but its early whorls bear four beaded cords. Moreover, species of *Calliostoma* are usually more ornamented than ?*C. monswavinarensis*. A narrow shape, a strong peripherical cord at the base of whorls is also found in *Jujubinus* Monterosato, 1884, but as in *Calliostoma*, the species of *Jujubinus* have numerous other cords. In the absence of apertural characters, it is difficult to choose between *Calliostoma*, *Tectus* or *Jujubinus*. This is why *Calliostoma* is provisionally proposed with a question mark for this new species.

Stratigraphic range

Maastrichtian: Marne, France.

Family Colloniidae Cossmann, 1917
Subfamily Colloniinae Cossmann, 1917

Genus ***Sparnollonia*** gen. nov.
urn:lsid:zoobank.org:act:0F0B6F64-CADB-43C6-8111-F0CAA38FDAAF

Type species

Sparnollonia bicarinata gen et sp. nov., by present designation.

Included species

Sparnollonia bicarinata gen et sp. nov., Paris Basin, France, Maastrichtian.

Etymology

Name based from the 'Sparnacus' (old name of Epernay, France) and 'Collonia' using the letters 'sparn-' as prefix and '-ollonia' as suffix. Genus female.

Diagnosis

Shell small with low spire. Whorls bicarinate. Spiral sculpture with three prominent major cords (M1–M3), M1: peripheric cord. Several threads between M1 and adapical suture and between M3 and umbilicus. Outer lip thin, slightly prosocline. Columella with a weak tubercle. Ombilicus very narrow. Columellar lip slightly adherent.

Sparnollonia bicarinata gen. et sp. nov.
urn:lsid:zoobank.org:act:B681154D-2AA0-45FD-A107-09FC558C3F8B
Figs 5G–K, 6C–D

?*Afrollonia* sp. – Merle & Pacaud 2018a: 169–170, fig. 155i–j. — Merle 2023: 25.

Etymology

From '*bicarinatus*' (Latin adjective) referring to the double carina formed by the major cords M1 and M2.

Type locality

Vertus (Grand Mont), Marne, France.

Type horizon

Sandy limestone of Vertus, Maastrichtian.

Type material

Holotype

FRANCE – **Marne** • Vertus (Grand Mont); sandy limestone; MMM coll.; Figs 5G, 6D; MNHN.F.C02610.

Paratypes (13 specs)

FRANCE – **Marne** • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02611 • 1 spec.; same data as for holotype; MMM coll.; Figs 5I, 6C; MNHN.F.C02612 • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02613 • 1 spec.; same data as for holotype; MMM coll.; Fig. 5H; MNHN.F.C02616 • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02617 • 1 spec., same data as for holotype; MMM coll.; Fig. 5J; MNHN.F.C02618 • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02619 • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02620 • 1 spec., same data as for holotype; MMM coll.; Fig. 5K; MNHN.F.C02621 • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02622 • 1 spec.; Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; MMM coll.; figured in Merle & Pacaud (2018a: fig. 155I); MNHN.F.A66746 • 1 spec.; same data as for preceding; Ch. d'Orbigny coll. (ex n°GG.gg2005/5999); figured in Merle & Pacaud (2018a: fig. 155j); MNHN.F.C02615 • 1 spec.; same data as for preceding; MMM coll.; MNHN.F.C02623.

Other examined material (5 specs)

FRANCE – **Marne** • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02624 • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02626 • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02625 • 1 spec.; Bergères-les Vertus (Mont Aimé), sandy limestone with shell concentrations; MMM coll.; MNHN.F.C02627 • 1 spec.; same data as for preceding; MMM coll.; MNHN.F.C02628.

Measurements

Holotype MNHN.F.C02610, H: 4.1 mm, D: 4.4 mm. Paratype MNHN.F.A66746, H: 4.6 mm, D: 4.7 mm. Paratype MNHN.F.C02615, H: 3.8 mm, D: 3.7 mm. Paratype MNHN.F.C02611, H: 4.2 mm, D: 4.8 mm. Paratype MNHN.F.C02612, H: 4.5 mm, D: 4.6 mm. Paratype MNHN.F.C02613, H 2.9 mm, D: 3.8 mm. Paratype MNHN.F.C02616, H: 4.2 mm, D: 4.2 mm. Paratype MNHN.F.C02617, H: 4.1 mm, D: incomplete. Paratype MNHN.F.C02618, H: incomplete, D: 4.9 mm. Paratype MNHN.F.C02620, H: incomplete, D: 3.9 mm. Paratype MNHN.F.C02621, H: incomplete, D: 4.6 mm. Paratype MNHN.F.C02622, H: 4.5 mm, D: 4.1 mm. Paratype MNHN.F.C02623, H 4.0 mm, D: 3.9 mm.

Description

Shell small, with low spire. Spiral angle 45°. Four teleoconch whorls; first and second whorls flat, third and fourth whorls conical, bicarinate. Suture shallow on three first whorls and moderately deep on last whorl. Spiral sculpture on first one not preserved. On second whorl, M1 smooth and prominent delineating the periphery. On third whorl, four to seven threads between adapical suture and M1; M1 and M2 smooth, prominent. Between M1 and M2, occasionnally one to three threads. Last whorl five to eight threads between adapical suture and M1; M1 and M2 prominent (Fig. 6C–D). Between M1 and M2, occasionnally one to three threads. On base M3 smooth, prominent yet slightly smaller than M2 and four weaker cords abapically. Base flat delineated by M3 (Fig. 6C–D). Aperture rounded. Outer lip thin, slightly prosocline. Columella with a weak tubercle. Columellar lip slightly adherent. Ombilicus very narrow.

Comparisons

This species was first attributed by Merle & Pacaud (2018a) to ?*Afrollonia* Adegoke, 1977 (type species: *Turbo nigeriensis* Adegoke, 1977 by original designation; Danian, Nigeria, see Fig. 5L), because of shell similarities (shell shape and sculpture) with *Afrollonia vilcassina* Pacaud, 2017 from the Danian of the Paris Basin. *Afrollonia vilcassina* differs in having more numerous threads between adapical suture and M1, by M1 and M2 being less prominent (Fig. 6E–F) and by having small axial ribs on first teleoconch whorls (see Pacaud 2017: pl. 2 fig. 1). Pacaud (2017: 187) stated that the base is deeply umbilicate and did not indicate a tubercle on the columella. In addition, the type species of *Afrollonia* differs from *Sparnollonia bicarinata* gen et sp. nov. in having a deep and moderate umbilicus, with a semilunar exterior outline and umbilical rim coarsely noded. Other Nigerian species of *Afrollonia* share these apertural characters which are frequently found in species of Margaritinae. The aperture of *Sparnollonia bicarinata*, is more reminiscent of that of the Collininae *Otomphalus dumasi* Cossmann, 1902 (Bartonian, Western France) in having a narrow umbilicus lacking a semilunar exterior outline. Moreover, its shell bears a low shape and two prominent M1–M2 as in *S. bicarinata*. Nevertheless, *S. bicarinata* differs from *O. dumasi* by having an M3, by lacking a columellar tubercle and by lacking a strong cord surrounding the umbilicus. *Sparnollonia bicarinata* and *Otomphalus kleinoichingensis* Traub, 1979 from the Thanetian (Oichinger Schichten) of Kleinoichinger Graben in Austria share M3, but M1–M2 are more prominent and wider apart in *S. bicarinata*. *Cirsochilus* Cossmann, 1888 (type species *Delphinula striata* Lamarck, 1804, accepted as *Cirsochilus varius* (Defrance, 1818), by original designation; Lutetian, Paris Basin) resembles *S. bicarinata* in its shape and its sculpture, but *S. bicarinata* differs in lacking

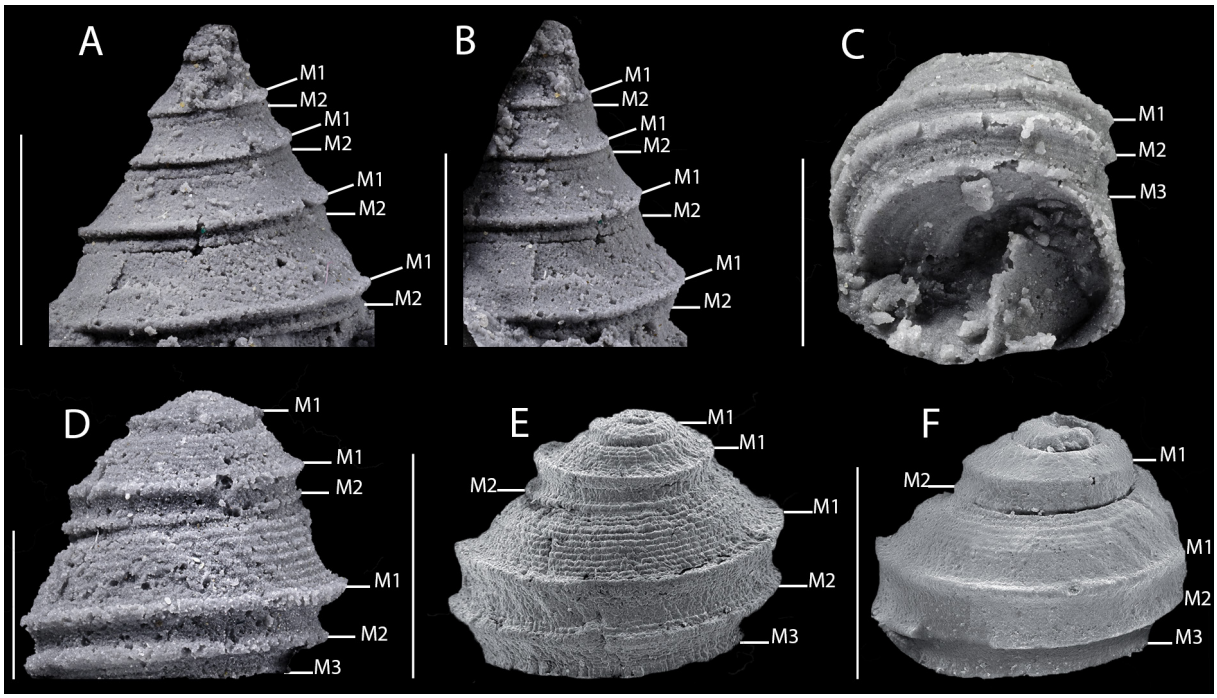

Fig. 6. Analysis of the spiral cords of the Vetigastropoda Salvini-Plawen, 1980 from the Maastrichtian of the Paris Basin. **A–B**. ?*Calliostoma monswavinarensis* sp. nov. **A**. Holotype MNHN.F.C02609, MA, lateral view. **B**. Same specimen in profil view. — **C–D**. *Sparnollonia bicarinata* gen et sp. nov. **C**. Paratype MNHN.F.C02612, VGM, apertural view. **D**. Holotype MNHN.F.C02610, Vertus (Grand Mont), lateral view. — **E–F**. *Afrollonia vilcassina* Pacaud, 2017 for comparison. **E**. Holotype MNHN.F.R62758, Vigny (Bois des Roches), Val d'Oise, Paris Basin, Danian, lateral view. **F**. Paratype MNHN.F.R63259, same locality. Localities: MA = Bergères-lès-Vertus (Mont Aimé); VGM = Vertus (Grand Mont). Scale bars = 3 mm. Credits = L. Cazes (MNHN/CNRS).

a thickened outer lip and in having a tubercle on the columellar lip. *Homalopoma* P.P. Carpenter, 1864 (type species *Turbo sanguineus* Linnaeus, 1758 by monotypy; present day, Mediterranean Sea) has a more rounded shape, displays more numerous spiral cords, but some species bear a columellar tubercle as in *S. bicarinata*. Finally, *Sparnollonia bicarinata* cannot be classified without problems in apparently similar genera of Colloninae and for this reason we propose a new genus.

Stratigraphic range

Maastrichtian: Marne, France.

Family Tegulidae Kuroda, Habe & Oyama, 1971

Genus ***Tectus*** Montfort, 1810

Type species

Tectus pagodalis Montfort, 1810, junior synonym of *Trochus mauritianus* Gmelin, 1791, type by original designation. Present day, Indian Ocean.

Stratigraphic range of the genus

Late Cretaceous (Knight *et al.* 1960) to present day.

Comments

The sculpture of fossil *Tectus* is quite variable. However, many species display at the base of the whorls a prominent peripheral cord (P4), often beaded, whilst the upper cords (P1–P3) are less developed. A study of numerous species of *Tectus* from the Lutetian of Normandy (Gain *et al.* 2019) shows that the P1 to P4 cords are frequently present. The three species described below also have flattened whorls, a flat base and bear the same cords (herein M1–M4, most likely corresponding to P1–P4). Due to these similarities, and pending observations of their aperture, they are provisionally assigned to *Tectus*.

?*Tectus acmantensis* sp. nov.
urn:lsid:zoobank.org:act:20C5E291-1686-4758-B6D7-81D2DFFD2472
Figs 5M–O, 7A–C

Tectus montissanctipetri – Merle & Pacaud 2018a: 169–170, fig. 155e–f. — Merle 2023: 25 (non *Trochus montissanctipetri* Binkhorst, 1861).

Etymology

From the ancient name of the locality Esmans (‘Acmantum’, 9th century).

Type locality

Esmans (Bois d’Esmans), Seine-et-Marne, France.

Type horizon

Sandy limestone of Esmans, Maastrichtian.

Type material

Holotype

FRANCE – **Seine-et-Marne** • Esmans (Bois d’Esmans); sandy limestone of Esmans; MNHN coll.; figured in Merle & Pacaud (2018a: fig. 155f) and herein Figs 5M, 7A; MNHN.F.A66744.

Paratypes (2 specs)
FRANCE – **Seine-et-Marne** • 1 spec.; same data as for holotype; Hébert coll.; Figs 5N, 7B; UPMC.PAL.2017.0.15.1a • 1 spec., historical imprint; same locality as for holotype; Hébert coll.; figured in Merle & Pacaud (2018a: fig. 155e) and herein Figs 5O, 7C; UPMC.PAL.2017.0.15.1b.

Measurements

Holotype MNHN.F.A66744, H (incomplete apex): 19 mm, D: 14 mm. Paratype UPMC.PAL.2017.0.15.1a, H (incomplete apex): 19 mm, D: 14 mm. Paratype UPMC.PAL.2017.0.15.1b, H (incomplete apex): 18 mm, D: 16 mm.

Description

Medium-sized shell. Conical and pyramidal spire. Spiral angle between 40° and 46°. Six teleoconch whorls preserved, nearly concave, enlarged and very angulose at base. Suture incised, moderately deep. On paratype UPMC.PAL.2017.0.15.1bis, spiral sculpture of first preserved whorl consisting of three equally-sized cords (M1 to M3); fourth cord (M4) making periphery at base of whorl, prominent and protruding. Second to sixth whorls: first cord (M1) close set to adapical suture; M2 and M3 at the centre of whorl; M4 close set to anterior suture. M1 strongly beaded, M2 to M4 less beaded (Fig. 7A–C). On cords, between 12 and 16 fairly rounded, closely spaced beads and more prominent adapically. Base flat, apparently smooth. Aperture not preserved.

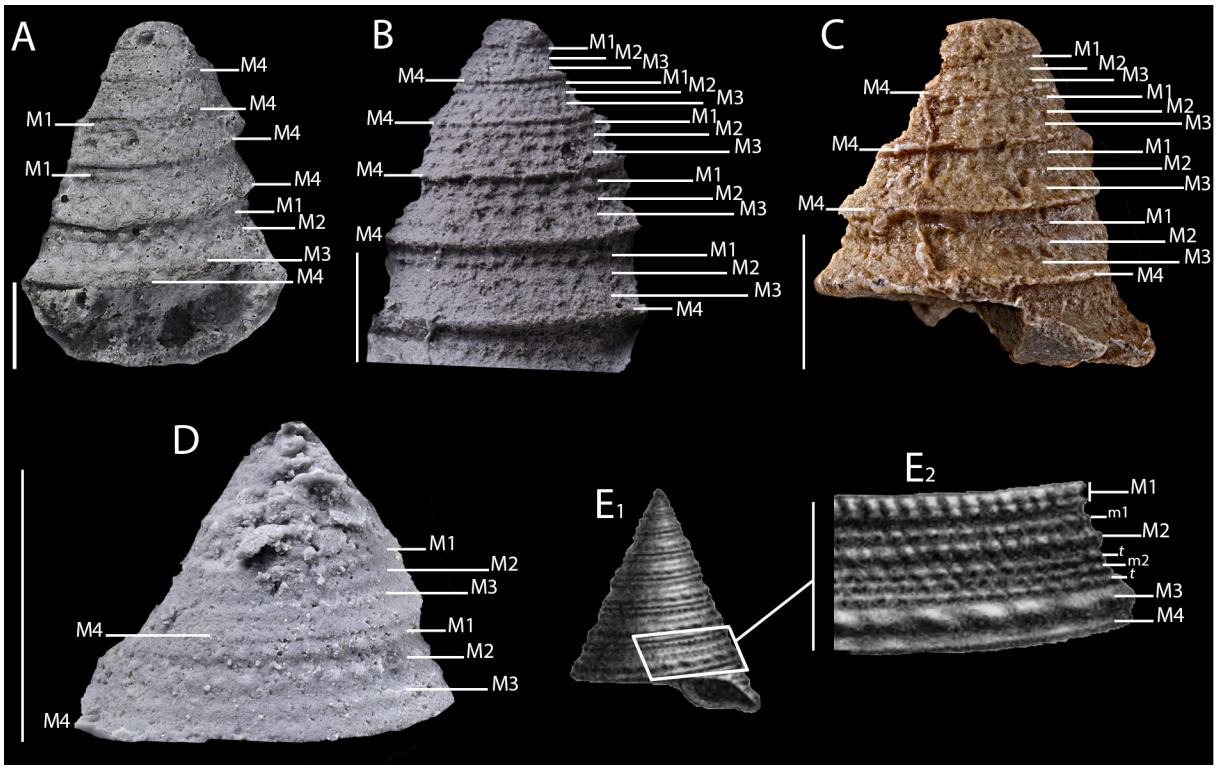

Fig. 7. Analysis of the spiral cords of the Vetigastropoda Salvini-Plawen, 1980 from the Maastrichtian of the Paris Basin. **A–C**. ?*Tectus acmantensis* sp. nov. **A**. Holotype MNHN.F.FA66744, BE, lateral view. **B**. Paratype UPMC.PAL 2017.15.1a, BE, lateral view. **C**. Paratype UPMC.PAL 2017.15.1b, BE, lateral view. — **D**. ?*Tectus fraterculus* sp. nov., holotype MNHN.F.C02629, VGM, lateral view. — **E**. ?*Tectus montissanctipetri* (Binkhorst, 1861) from Maastricht (The Netherlands) for comparison. $\mathbf{E}_1$. Original figure of Binkhorst (1861: pl. 5a1 fig. 10a apertural view. $\mathbf{E}_2$. Detailed figure of Binkhorst (1861: pl. 5a1 10c) of the spiral sculpture. Localities : BE = Esmans (bois d'Esmans); VGM = Vertus (Grand Mont). Scale bars = 5 mm. Credits: B, D = L. Cazes (MNHN/CNRS); A, C = P. Loubry (MNHN/CNRS).

Comparisons

These three specimens of ?*Tectus acmantensis* sp. nov. were first attributed to ?*Tectus montissanctipetri* (Binkhorst, 1861) from the Maastrichtian of Limburg, because of a prominent peripheral cord (M1) at the base of the whorls and finer cords adapically. However, a more detailed comparison with the figure by Binkhorst (1861: pl. 5a1 fig. 10b–c and Fig. 7E herein) shows that the specimens from the Paris Basin bear narrower whorls, major cords (M1 to M3) with coarser beads and a protruding M4 that clearly delineates the periphery by forming an acute angle at the base of the whorls (Fig. 7A–C). Moreover, ?*T. montissanctipetri* differs in having m1 and m2, threads between M2 and M3, a prominent M3 delineating the periphery and a smaller M4 close set the anterior suture. From the figure of Binkhorst (1861: pl. 3 fig. 6a–b), ?*Tectus detritus* (Binkhorst, 1861) resembles ?*T. acmantensis* in having M1–M3 above the peripheric cord M4. However, M2 is more prominent than M1 and M3 in ?*T detritus*, whereas they are subequal in ?*T. acmantensis*. In addition, ?*T. detritus* differs in having a strongly beaded M4, a smooth M6 and an M5 close set the anterior suture.

Stratigraphic range

Maastrichtian: Seine-et-Marne, France.

?Tectus fraterculus sp. nov.
urn:lsid:zoobank.org:act:E0991DA6-AFD4-4EA4-91B6-AF0857E93343
Figs 7D, 8A–D

Etymology

From the Latin (‘*frater*’ meaning ‘brother’) and the suffix (‘*culus*’) to recall ?*T. acmantensis* sp. nov. from the Maastrichtian of Bois d’Esmans (Seine-et-Marne) with which it shares several similarities.

Type locality

Vertus (Grand Mont), Marne, France.

Type horizon

Sandy limestone of Vertus, Maastrichtian.

Type material

Holotype

FRANCE – **Marne** • Vertus (Grand Mont); sandy limestone; MMM coll.; Figs 7D, 8A; MNHN.F.C02629.

Paratype

FRANCE – **Marne** • 1 spec.; same data as for holotype; MMM coll.; Fig. 8B–D; MNHN.F.C02630.

Measurements

Holotype: MNHN.F.C02629, H (incomplete apex): 9 mm, D: 9 mm. Paratype MNHN.F. C02630, H (incomplete apex): 5.5 mm, D: 7.5 mm.

Description

Small sized shell. Conical spire. Spiral angle 46°. Two teleoconch whorls preserved, almost straight, enlarged at base. Suture shallow. On holotype, spiral sculpture consisting of four cords (M1 to M4); M1 beaded, prominent and close set the suture; M2 beaded, weaker than M1; M3 weaker than M2 and M4 and with weak beads; M4 more prominent that M3, almost smooth and making periphery at base of whorl (Fig. 7D). On last whorl of holotype, 17–18 fairly rounded and closely spaced beads, on M1 and M2. Base flat, apparently smooth. Aperture not preserved.

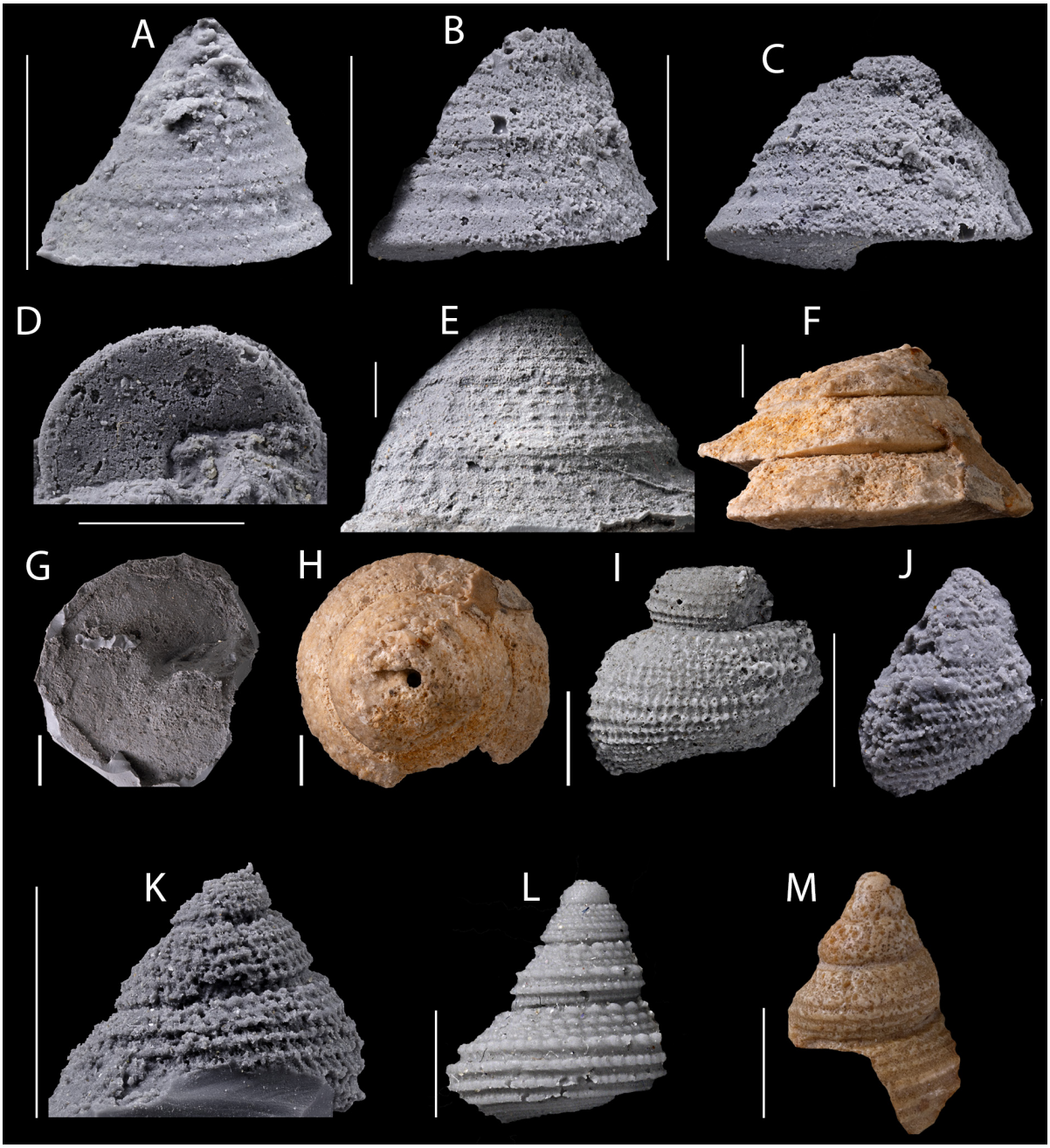

Fig. 8. Vetigastropoda Salvini-Plawen, 1980 from the Maastrichtian of the Paris Basin. **A–D**. ?*Tectus fraterculus* sp. nov. **A**. Holotype MNHN.F.C02629, VGM, lateral view. **B–C**. Paratype MNHN.F.C02630, VGM, two lateral viewes. **D**. Same specimen, basal view — **E–H**. ?*Tectus senarmonti* sp. nov., holotype SU.PAL.2017.0.2.404, BE. **E**. Lateral view of the imprint. **F**. Lateral view of the internal mould. **G**. Basal view of the imprint. **H**. Apical view of the internal mould. — **I**. ?*Agathodonta granosecincta* (Binkhorst, 1861) comb. nov. MNHN.F.R63293, MA, lateral view. — **J–K**. ?*Clypeostoma vertusensis* sp. nov. **J**. Paratype MNHN.F.C02632, VGM, lateral view. **K**. Holotype MNHN.F.C02631, VGM, lateral view. — **L–M**. *Calliomphalus* (*Planolateralus*) *montenati* sp. nov. **L**. Holotype MNHN.F.C02633, MA, lateral view. **M**. Paratype UPMC.PAL.2017.0.14.1, VF, lateral view. Localities: BE = Esmans (Bois d'Esmans); MA = Bergères-lès-Vertus (Mont Aimé); VF: Vertus (Faloise); VGM = Vertus (Grand Mont). Scale bars: A–K, M = 5 mm; L = 3 mm. Credits A–H, J–K = Lilian Cazes (MNHN/CNRS), I, L–M = P. Loubry (MNHN/CNRS).

Comparisons

?*Tectus fraterculus* sp. nov. is reminiscent of ?*T. acmantensis* sp. nov. in its spiral sculpture of fourth major cords (M1 to M4). However, its size is smaller (H: 9 mm instead of 18–19 mm), its apical angle larger (46° instead of 40°) and its suture shallower. Moreover, there are some differences in the spiral sculpture: M4 is not protuding as it is in ?*T. acmantensis*, the beads are more prominent on M1 and M2 and more numerous and larger (17–18 instead of 12–16 in ?*T. acmantensis*). ?*Tectus fraterculus* resembles ?*T. montissanctipetri*, but differs in lacking m1 and m2, threads present between M2 and M3. It bears a weaker M3 delineating the periphery and a prominent M4 close set the anterior suture (see Fig. 7E2).

Stratigraphic range

Maastrichtian: Marne, France.

?Tectus senarmonti sp. nov.
urn:lsid:zoobank.org:act:BB8F18D5-54BA-43D0-8FFB-D559E184AB05
Figs 8E–H, 9A

Etymology

Dedicated to Alexandre-Antoine Hureau, baron de Sénarmont who briefly described the sandy limestone of Bois d'Esmans.

Type locality

Esmans (Bois d'Esmans), Seine-et-Marne, France. The label of the sample indicates Montereau as the locality, but it is most likely the locality of Bois d'Esmans at Esmans.

Type horizon

Sandy limestone of Esmans, Maastrichtian.

Type material

Holotype

FRANCE – **Seine-et-Marne** • Esmans (Bois d'Esmans); sandy limestone; Munier-Chalmas coll.; SU. PAL.2017.0.2.404.

Measurements

SU.PAL.2017.0.2.404: H (incomplete base): 16 mm, probably 20 mm; D: 34 mm.

Description

Large-sized shell. Conical and pyramidal spire, with large base. Spiral angle 56°. Three teleoconch whorls preserved, nearly concave and enlarged at periphery. Periphery rather thick, slightly rounded. Suture shallow. Spiral sculpture consisting of five equally-sized spiral cords (M1 to M5) from the adapical suture of whorl until adapical top of periphery; periphery with two or three cords (M6–M7 or M6–M8) close set the abapical suture. M1–M5 delicately beaded, M6 to M8 less beaded (Fig. 9A). Between 16 and 20 small and spirally elongate beads on cords. Base flat, apparently smooth. Aperture not preserved.

Comparisons

?*Tectus senarmonti* sp. nov. has a much wider shape and a lower spire than ?*Tectus acmantentis* sp. nov. It cannot be considered a gerontological specimen of ?*T. acmantensis*, because it has a very different

spiral sculpture. First, ?*T. senarmonti* bears delicately beaded M1–M5, whereas ?*T. acmantensis* bears only three strongly beaded major cords (M1–M3), and second, ?*T. senarmonti* has two-three cords (M6–M8) making a rounded periphery whereas ?*T. acmantensis* has a prominent M4 making a very angulose periphery at the base of the whorl.

Stratigraphic range

Maastrichtian: Seine-et-Marne, France.

Order Seguenziida Haszprunar, 1986
Superfamily Seguenzioidea A.E. Verrill, 1884
Family Chilodontidae Wenz, 1938

Genus ***Agathodonta*** Cossmann, 1918

Agnathodonta Wenz, 1938: 298, error of spelling for *Agathodonta* Cossmann (1918).

Type species

Trochus dentigerus d'Orbigny, 1842 by original designation. Early Cretaceous (Hauterivian), Aube, France.

Stratigraphic range of the genus

Late Cretaceous (Hauterivian) according to d'Orbigny (1842) to ?Maastrichtian (this paper).

?Agathodonta granosecincta (Binkhorst, 1861) comb. nov.
Figs 8I, 9B

Turbo granose-cinctus Binkhorst, 1861: 46, pl. 5a1 fig. 6a–b.

Danilia strombecki – Merle & Pacaud 2018a: 169–170, fig. 155h. — Merle 2023: 25 (non *Turbo strombecki* Binkhorst, 1861).

Type material (not examined)

Problably lost (John Jagt pers. com.).

Type locality

Maastricht or Fauquemont, cf. Binkhorst (1861: iv), The Netherlands; Meerssen Member, Maastrichtian.

Material examined

FRANCE – **Marne** • 1 spec.; Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; MMM coll.; figured in Merle & Pacaud (2018a: fig. 155h) and herein Figs 8I, 9B; MNHN.F.R63293.

Measurements

H (incomplete apex): 13 mm, D: 12 mm.

Description

Medium-sized shell. Penultimate and last whorls preserved. Convex whorls delineated by a moderately deep incised suture. Base convex. Sculpture of spiral cords crossed by axial riblets, cords ornamented with small and rounded beads. On penultimate whorl, five major cords (M1–M5); two weak cords

adapically (M1–M2), two prominent cords in centre of whorl (M3–M4) and a weaker cord close set abapical suture (M5), see Fig. 9B. Cords ornamented with around 20 beads. On last whorl, most adapical cord prominent (M1), three weaker cords abapically (m1+M2+m2), three prominent cords in the centre of whorl (M3–M5) and around five weaker cords until base (M6–M10), see Fig. 9B. All spiral cords ornamented with around 30 small and rounded beads. Axial riblets almost orthocline and connected to the beads. Aperture not preserved.

Remarks

This specimen from the Paris Basin was previously attributed to *Turbo strombecki* Binkhorst, 1861 from the Maastrichtian of Limburg (The Netherlands) by Merle & Pacaud (2018a). The beaded spiral sculpture is quite similar, but the holotype of *Turbo strombecki* has less convex whorls, a higher spire, and according to Binkhorst's illustration (Binkhorst 1861: pl. 5a fig. 6b) its sculpture lacks minor cords in the adapical part of the whorls. The specimen from the Paris Basin is more strongly reminiscent of *Turbo granosecinctus* Binkhorst, 1861 (Binkhorst 1861: pl. 5a1 fig. 6a–b), from the Maastrichtian of Limburg (The Netherlands), in its very rounded whorls, its incised suture, its sculpture of spiral cords crossed by axial riblets, its cords ornamented with small and rounded beads and its prominent M1 (see Fig. 9B–C). Moreover, it displays minor (m1, m2 and m3) in the apical part of the whorl, as observed in the specimen from Maastricht. It therefore seems more appropriate to attribute it to *T. granosecinctus*. Merle & Pacaud (2018a) included *T. strombecki* in the genus *Danilia* Brusina, 1865 (type species: *Olivia otaviana* Cantraine, 1835 by monotypy). However, species of *Danilia* display less rounded whorls and coarser beaded spiral cords. As stated by Herbert (2012: 399), strongly convex whorls and spiral cords finely and regularly beaded are found in the type species *Agathodonta*, *A. dentigera* (d'Orbigny, 1842), from the Hauterivian of France, and not in the other genera of Chilodontidae. This sculpture is also shared with *T. granosecinctus*. The type species of *Agathodonta* only differs by having varices on spire whorls and prosocline riblets. Therefore, *T. granosecinctus* is provisionally assigned to ?*Agathodonta* pending a validation by the examination of the aperture.

Stratigraphic range

Maastrichtian: Marne, France; Limburg, The Netherlands.

Genus ***Clypeostoma*** Herbert, 2012

Type species

Turcica salpinx Barnard, 1964 by origninal designation. Present day: South Africa.

Stratigraphic range of the genus

Present day, South Africa (fossil range unknown).

?Clypeostoma vertusensis sp. nov.
urn:lsid:zoobank.org:act:4007445E-2C73-4388-971C-E0B4CECFD5A9
Figs 8J–K, 9D

Etymology

From Vertus (Marne), the name of the type locality.

Type locality

Vertus (Grand Mont), Marne, France.

Type horizon

Sandy limestone of Vertus, Maastrichtian.

Type material

Holotype

FRANCE – **Marne** • Vertus (Grand Mont); sandy limestone; MMM coll.; Figs 8K, 9D; MNHN.F.C02631.

Paratype

FRANCE – **Marne** • 1 spec.; same data as for holotype; MMM coll.; Fig. 8J; MNHN.F.C02632.

Measurements

Holotype, H (incomplete base): 8 mm, D: 7.1 mm. Paratype, H: 6.1 mm; D: 5 mm.

Description

Medium-sized shell. Conical spire, base large. Spiral angle between 62° (paratype) and 67° (holotype). Three preserved teleoconch whorls, slightly convex and almost straight. Periphery not thickned at base of whorls. Suture deep and canaliculate. Base convex. Spiral cords well developed and crossed by prosocline axial riblets. Cords ornamented with beads small and slightly pointy at their top. Space between cords deep. On spire whorls, five subegal major cords (M1–M5) and one minor cord (m1) between M1 and M2 (Fig. 9D). M5 delineating the periphery. Cords ornamented with around twenty beads. On last whorl, 13 cords from suture to base. Cords ornamented with around 25 small beads. Aperture not preserved.

Comparisons

The sculpture of ?*Clypeostoma vertusensis* sp. nov. is reminiscent of that of ?*A. granosecincta* comb. nov. in its cords of small beads crossed by axial riblets. However, ?*C. vertusensis* differs from ?*A. granosecincta* by having a conical spire with a weakly convex whorl, less numerous minor spiral cords (only m1 instead of m2–m3) and prosocline axial riblets (see Figs 8I–K, 9B–D).?*Clypeostoma vertusensis* is distinguished from *Turbo rimosus* Binkhorst, 1861 (Binkhorst 1861: pl. 5a1 fig. 5a–b) from the Maastrichtian of The Netherlands in having a narrower shape, coarser spiral ridges and prosocline axial riblets. Conical whorls with a canaliculate suture and spiral cords which, where they intersect prosoclinic riblets, form rows of small beads that are slightly pointed at their tips, a featured shared with ?*C. vertusensis* and members of *Clypeostoma* (Herbert 2012). However, it is difficult to be certain of this identification due to the lack of apertural characters and thus this genus assigment is provisionally proposed.

Stratigraphic range

Maastrichtian: Marne, France.

Family Calliotropidae Hickman & J.H. McLean, 1990

Genus ***Calliomphalus*** Cossmann, 1888

Type species

Turbo squamulosus Lamarck, 1804 by original designation. Middle Eocene (Lutetian), Paris Basin, France.

Subgenus ***Planolateralus*** Sohl, 1961

Type species

Calliomphalus argenteus Wade, 1926, by original designation, Late Cretaceous (Maastrichtian), Ripley Formation, Mississippi (USA).

Stratigraphic range of the subgenus

Late Cretaceous (Maastrichtian) of Mississippi (USA) according to Wade (1926) to Paleocene (Danian) of Paris Basin according to Merle & Pacaud (2018b).

Calliomphalus* (*Planolateralus*) *montenati sp. nov.
urn:lsid:zoobank.org:act:07EC388F-C859-4D33-9EBA-FC2A5CC87B47
Figs 8L–M, 9E–F

Calliomphalus sp. – Merle & Pacaud 2018a: 169–170, fig. 155c–d. — Merle 2023: 25.

Etymology

Dedicated to the French geologist Christian Montenat, who worked on the Maastrichtian of the Paris Basin.

Type locality

Bergères-lès-Vertus (Mont Aimé), Marne, France.

Type horizon

Sandy limestone with shell concentrations, Maastrichtian.

Type material

Holotype

FRANCE – **Marne** • Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; Ch. d'Orbigny coll., ex n° GG.gg2007/16527; figured in Merle & Pacaud (2018a: fig. 155d) and herein Figs 8L, 9E; MNHN.F.C02633.

Paratype

FRANCE – **Marne** • 1 spec., historical cast of the imprint; Vertus (Faloise); Hébert coll.; figured in Merle & Pacaud (2018a: fig. 155c) and herein Figs 8M, 9F; UPMC.PAL.2017.0.14.1.

Measurements

Holotype, H 8.2 mm, D: 6.2 mm. Paratype UPMC.PAL.2017.0.14.1, H: 12.5 mm, D: 9 mm.

Description

Medium-sized shell with conical shape. Five teleoconch whorls becoming increasingly convex with growth. Last whorl 40% of total height. Suture slightly incised. Spiral cords ornamented with rounded beads. Based on preseverd part of holotype (Fig. 9E): first spire whorl, with poorly visible beads; second whorl: three beaded (M1 to M3) cords (between 10 and 13 small beads per cord) and abapically two larger beaded (M4–M5) cords (15–16 beads per cord). Second whorl (penultimate): three (M1–M3) beaded cords (between 9 and 12 small beads per cord), abapically two (M4–M5) larger cords (between 11 and 16 beads per cord) and one smaller cord (M6) close set to the suture; M4 larger than the others and delineating the periphery. Last whorls: three (M1–M3) small beaded cords (between 11 and 16 beads per cord), M1 slightly larger that M1–M2 and abapically four (M4–M7) larger beaded cords (between 15 and 25 beads per cord); M4 larger than the other major cord and delineating the periphery. Seventh cord (M7) delineating the base. Aperture not preserved.

Comparisons

A conical shape with weakly convex whorls, an incised suture, several (three to five) adapical cords of small beads and cords of more prominent beads placed abapically are typical of *Calliomphalus*

(*Planolateralus*). The type species, *Calliomphaus* (*Planolateralus*) *argenteus*, displays five cords of small beads adapically whereas *C.* (*P.*) *montenati* sp. nov. bears three and has two prominent cords of beads or hollow spines delineating the periphery. Moreover, its spire is lower, particularly in specimens from the Mexcala Formation, Mexico (Perrilliat *et al.* 2000). *Calliomphalus* (*Planolateralus*) *montenati* displays a lower spire and less elevated whorls than *C.* (*P.*) *cypliensis* Vincent, 1930, from the Danian of Ciply (Belgium). Its spire in *C.* (*P.*) *montenati* bears seven beaded cords instead of only four in *C.* (*P.*) *cypliensis*. In addition, the beads of *C.* (*P.*) *cypliensis* are arranged in oblique series, whereas they are not in *C.* (*P.*) *montenati*. *Calliomphalus* (*Planolateralus*) *gravesii* (d'Orbigny, 1850), from the Danian of the Paris Basin, differs in having cords of more or less subequal beads that increase in size towards the base of the whorls (see Pacaud 2018a: fig. 225b–f). Finally, *Calliomphalus* (*Planolateralus*) *montenati* is easily distinguished from *C.* (*P.*) *firketi* from the Danian of the Mons Basin (Briart & Cornet 1887) by stronger cords (see Glibert 1973: fig. 22).

Stratigraphic range

Maastrichtian: Marne, France.

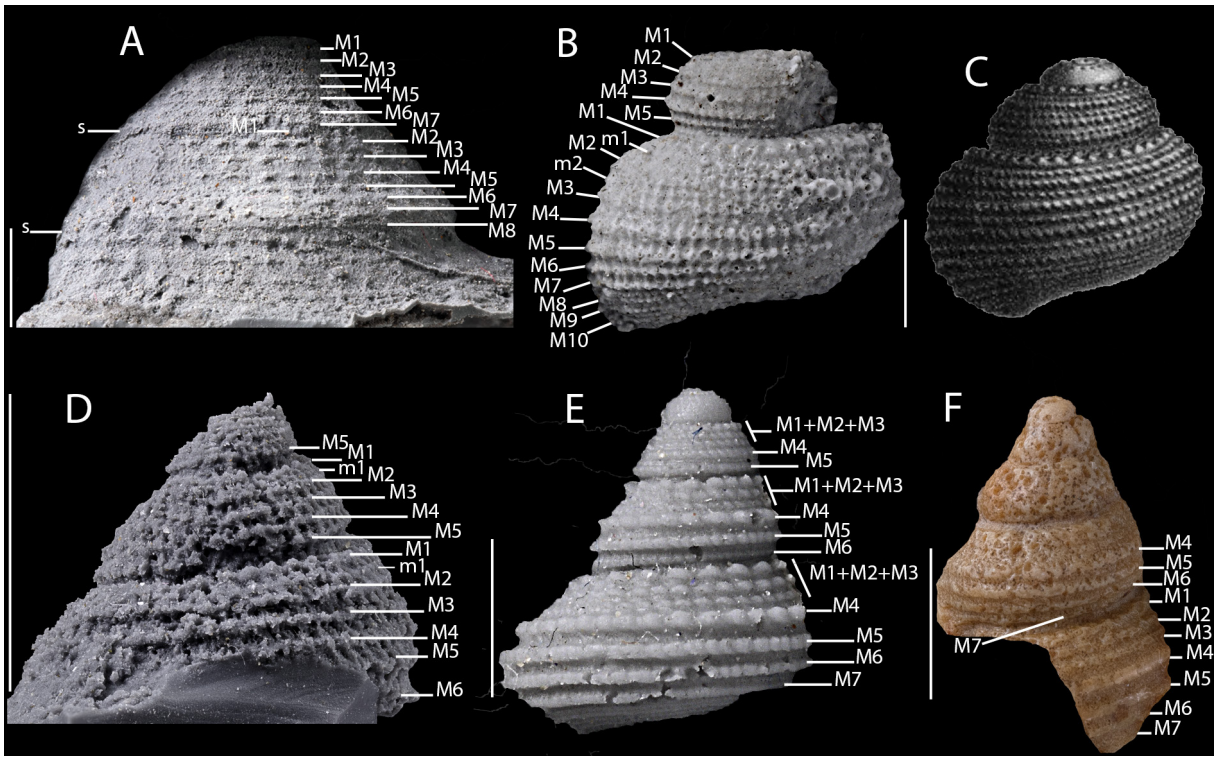

Fig. 9. Analysis of the spiral cords of the Vetigastropoda Salvini-Plawen, 1980 from the Maastrichtian of the Paris Basin. **A**. ?*Tectus senarmonti* sp. nov., holotype UPMC.PAL, BE, lateral view. — **B–C**. ?*Agathodonta granosecincta* (Binkhorst, 1861) comb. nov. **B**. MNHN.F.R63293, MA, lateral view. **C**. Holotype, original figure of Binkhorst (1861: pl. 5a1 fig. 6a–b) for comparison. — **D**. ?*Clypeostoma vertusensis* sp. nov., holotype MNHN.F.C02631, VGM, lateral view. — **E–F**. *Calliomphalus* (*Planolateralus*) *montenati* sp. nov. **E**. Holotype MNHN.F.C02633, MA, lateral view. **F**. Paratype UPMC.PAL.2017.0.14.1, VF, lateral view. Localities: BE = Esmans (Bois d'Esmans); MA = Bergères-lès-Vertus (Mont Aimé); VF = Vertus (Faloise); VGM = Vertus (Grand Mont). Scale bars: A–B, D, F = 5 mm; E = 3 mm. Credits: A, D = L. Cazes (MNHN/CNRS); B–C, E–F = P. Loubry (MNHN/CNRS).

Subclass Caenogastropoda L.R. Cox, 1960
Order Caenogastropoda incertae sedis temporary name
Superfamily Cerithioidea J. Fleming, 1822
Family Cerithiidae J. Fleming, 1822
Subfamily Cerithiinae J. Fleming, 1822

Genus ***Rhinoclavis*** Swainson, 1840

Type species

Murex vertagus Linnaeus, 1767 by subsequent designation (Herrmannsen 1848). Present day, Indo-Pacific.

Stratigraphic range of the genus

Late Cretaceous (Maastrichtian) of Maastricht (see below) and Paris Basin (this work) to present day in tropical waters.

Rhinoclavis parvisulcatus sp. nov.
urn:lsid:zoobank.org:act:9FB955B3-9A14-4DC4-A3E7-0E3D646491D2
Figs 10A–C, 11A–F

Rhinoclavis (*Semivertagus*) sp. – Merle & Pacaud 2018a: 169, 171, fig. 156d–e. — Merle 2023: 25.

Etymology

From the latin adjectives '*parvus*' (meaning 'small') and '*sulcatus*' (meaning 'grooved') to refer the small spiral groove of the species.

Type locality

Bergères-lès-Vertus (Mont Aimé), Marne, France.

Type horizon

Sandy limestone with shell concentrations, Maastrichtian.

Type material

Holotype
FRANCE – **Marne** • Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; MMM coll.; Figs 10C, 11A; MNHN.F.C02634.

Paratypes (9 specs)
FRANCE – **Marne** • 1 spec.; same data as for holotype; MMM coll.; Fig. 11D; MNHN.F.C02635 • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02636 • 1 spec.; same data as for holotype; MMM coll.; Figs 10B, 11B; MNHN.F.C02637 • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02638 • 1 spec.; same data as for holotype; MMM coll.; figured in Merle & Pacaud (2018a: fig. 156d); MNHN.F.A66752 • 1 spec.; same data as for holotype; MMM coll.; figured in Merle & Pacaud (2018a: fig. 156e1–e2b) and herein Fig. 11E–F; MNHN.F.A66753 • 1 spec.; same data as for holotype; MMM coll.; figured in Merle & Pacaud (2018a: fig. 156d); MNHN.F.C02639 • 1 spec.; Vertus (Grand Mont); sandy limestone; MMM coll.; Figs 10A, 11C; MNHN.F. C02639 • 1 spec.; same data as for preceding; MMM coll.; MNHN.F.C02640.

Measurements

Holotype: H (base incomplete), 11.2 mm, D: 4.6 mm. Paratype MNHN.F. C02635, H (base incomplete): 10.3 mm, D: 4.5 mm. Paratype MNHN.F.C02636, H (base incomplete): 9 mm, D: 3.5 mm. Paratype MNHN.F.C02637: H (base incomplete), 6.8 mm, D: 3.2 mm. Paratype MNHN.F.C02638, H: 10.7 mm, D: 3.6 mm. Paratype MNHN.F.A66753, H: 14.4 mm, D: 5.7 mm. Paratype MNHN.F.C02639, H: 10.6 mm, D: 4.1 mm. Paratype MNHN.F.C02640, H (base incomplete): 8 mm, D: 3.1 mm.

Description

Shell medium in size, fairly pupate with convex apex. Around height-nine moderately convex whorls. Apical angle between 32° and 44°. Suture linear, shallow. Height of last whorl: approximately of 37% of shell length (based on paratype MNHN.F.C02638). No axial sculpture. Spire whorls notched by one moderately small spiral groove located halfway up apical part of whorls (about 45% of the height of whorl starting from adapical suture). On last whorl, spiral groove located in adapical third of whorl. On spire and in adapical part of whorl located between spiral groove and adapical suture, spiral sculpture varying from flat threads to three very flat cords. On spire and in abapical part of whorl located between spiral groove and abapical suture, surface of four small shallow grooves. On last whorl, similar spiral sculpture in part located between spiral groove and the adapical suture; from spiral groove to base of whorl, sculpture varying from flat threads to six flat cords. *Rhinoclavis*-type aperture with smooth and well detached columellar lip.

Comparisons

Rhinoclavis parvisulcatus sp. nov. has a variable spiral sculpture ranging from flat threads to small flat spiral ridges (Fig. 10A–C). However, it is clearly characterised by a spiral groove located approximately

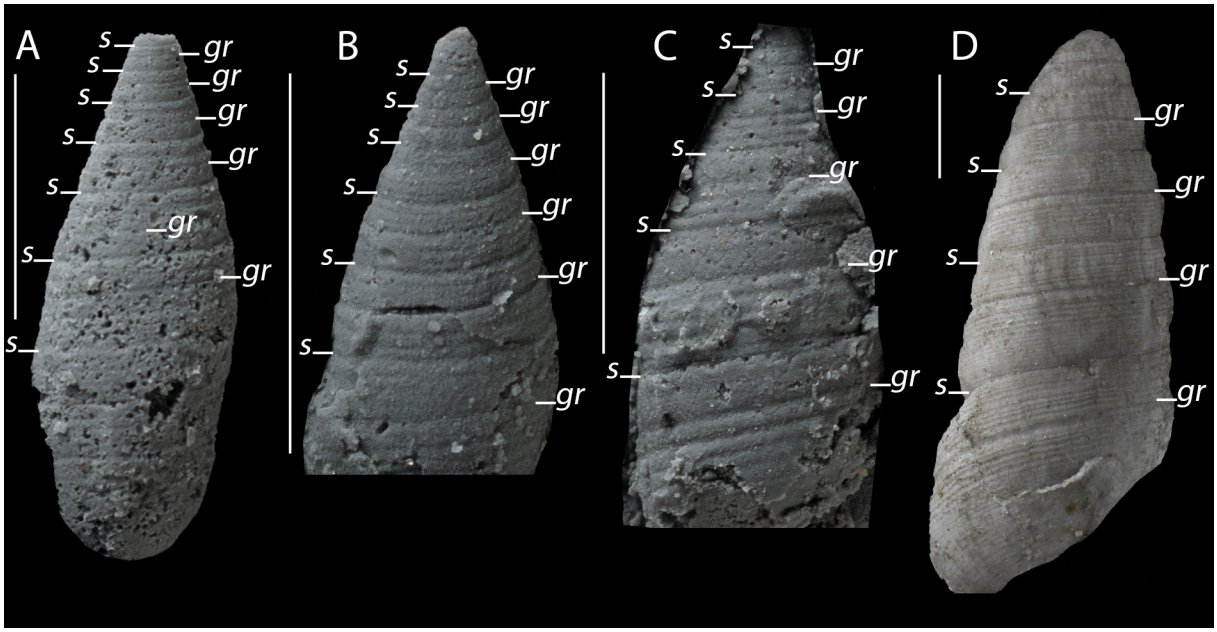

Fig. 10. Analysis of the spiral cords of *Rhinoclavis parvisulcatus* sp. nov. from the Maastrichtian of the Paris Basin. **A**. Paratype MNHN.F.C02639, VGM. **B**. Paratype MNHN.F.C02637, MA. **C**. Holotype MNHN.F.C02634, MA. — **D**. *Rhinoclavis urania* (d'Orbigny, 1850) from the Danian of the Paris Basin for comparison, syntype MNHN.F.A46112, Montainville (Pont de Falaise), Yvelines. Abbreviations: gr = groove; *s* = suture. Localities: MA = Bergères-lès-Vertus (Mont Aimé); VGM = Vertus (Grand Mont). Scale bars = 5 mm. Credits = P. Loubry (MNHN/CNRS).

halfway around the shell. This sculpture and the shape of its aperture are found in *R. unisulcatus* (Lamarck, 1804) from the Eocene of the Paris Basin. The first specimens of *R. parvisulcatus* illustrated by Merle & Pacaud (2018a: fig. 156d–e) as *Rhinoclavis* sp. bear spiral threads, but additionnal specimens demonstrate that the species can be more ornamented with small flat cords (Fig. 10B–C). Among Paleocene species, *R.* (*S.*) *parvisulcatus* is comparable to *R. urania* d'Orbigny (1850) from the Danian of the Paris and Mons basins (Glibert 1973). *Rhinoclavis parvisulcatus* differs from *R. urania* in having a wider shape, a shallower spiral groove and a coarser spiral sculpture (see the syntypes of *R.* (*S.*) *urania* illustrated by Pacaud (2018a: 249, fig. 196g–h and herein Fig. 10D). In the Danian of Mons, Glibert (1973) cited four other species: *R. gibbosus* (Briart & Cornet, 1873), *R. abnormis* (Briart & Cornet, 1873), *R. elisae* (Briart & Cornet, 1873) and *R. edmondi* (Briart & Cornet, 1873). These four species display a shorter shape than *R. parvisulcatus* and, except *R. gibbosus*, a spiral groove is not clearly visible. The genus is still not reported in the Late Cretaceous, but Kaunhowen (1898: 48, pl. 4 fig. 4aa) described *Turritella egregia* Kaunhowen, 1898 from the *Bryozoen-Schichten* of Maastricht. The shape of the illustrated specimen bears a convex apex, a spiral sculpture with flat threads and whorls bearing a spiral groove which are typical characters of *Rhinoclavis* and not those of Turritellidae. Kaunhowen (1898: 48) mentioned clearly this groove in his description: "Die Nähte sind und können leicht mit einer Furche verwechselt werden, welche von jedem Umgange hinten einen Gürtel abtrennt, dessen Höhe ungefähr ein Dritttheil bis die Hälfte von der einer jeden Windung ausmacht" ["The sutures are and can easily be confused with a groove that separates a belt from each whorl at the back, the height of which is approximately one-third to one-half of that of each whorl"]. *Rhinoclavis egregius* comb. nov. differs from *R. parvisulcatus* by having a weaker sculpture of flat threads and by a slenderer shape. It is the first record of the genus *Rhinoclavis* in the Maastrichtian.

Stratigraphic range

Maastrichtian: Marne, France.

Cerithiidae subfamily incertae sedis

Genus ***Pseudoaluco*** B.L. Clark, 1946

Type species

Cerithium jussieui Mayer-Eymar, 1876 by original designation. Middle Eocene (Lutetian), Paris Basin, France.

Stratigraphic range of the genus

Maastrichtian (this paper) to Middle Eocene.

***Pseudoaluco* sp.**
Figs 11G–12A

Pseudoaluco sp. – Merle & Pacaud 2018a: 171, fig. 156f. — Merle 2023: 25.

Material examined

FRANCE – **Marne** • 1 spec.; Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; MMM coll.; figured in Merle & Pacaud (2018a: fig. 156f); MNHN.F.A66755.

Measurements

H (two last whorls preserved): 11 mm, D: 7 mm.

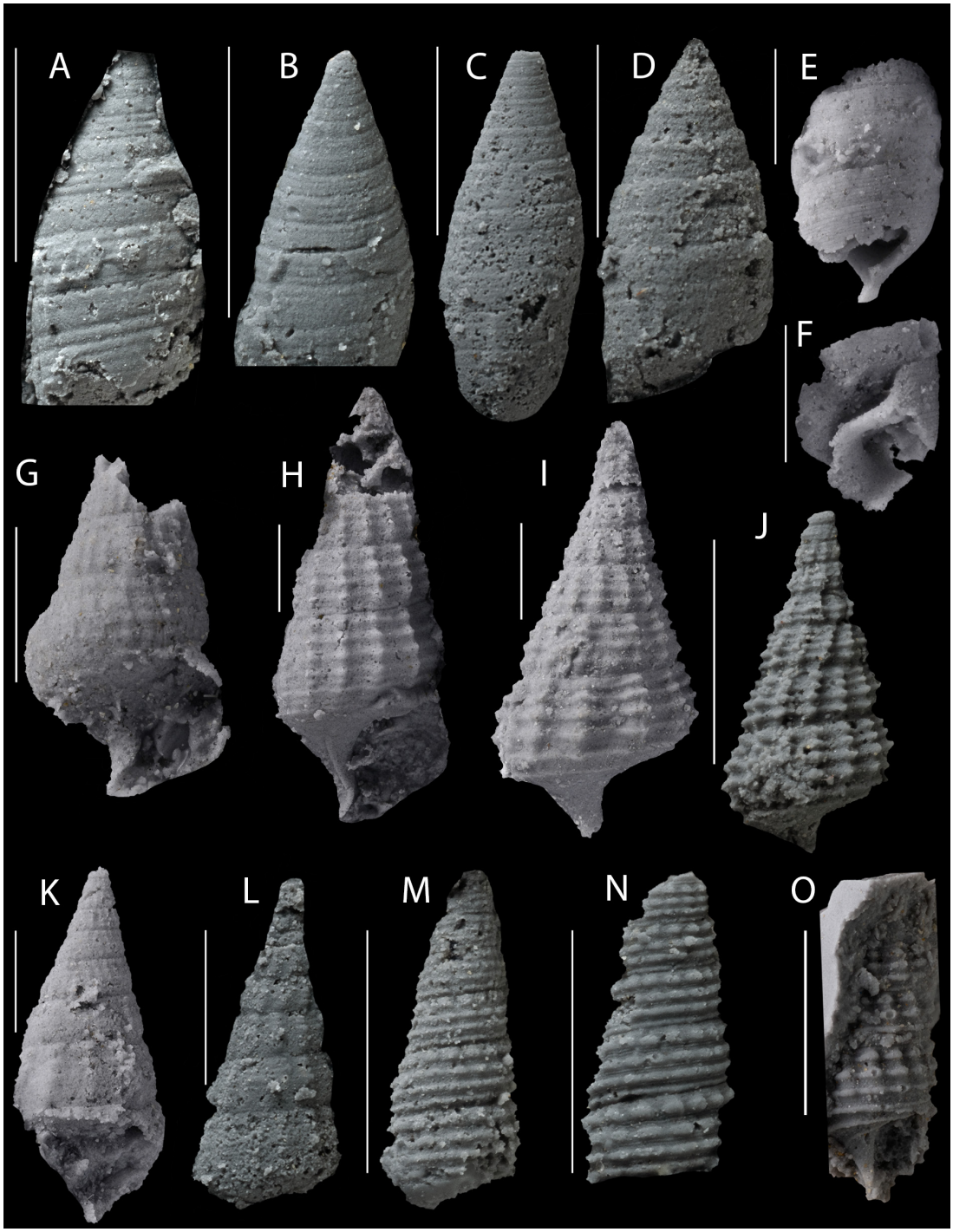

Fig. 11. Cerithioidea J. Fleming, 1822 from the Maastrichtian of the Paris Basin. **A–F**. *Rhinoclavis parvisulcatus* sp. nov. **A**. Holotype MNHN.F.C02634, MA. **B**. Paratype MNHN.F.C02637, MA. **C**. Paratype MNHN.F.C02639, VGM. **D**. Paratype MNHN.F.C02635, MA. **E–F**. Paratype MNHN.F.A66753, MA. — **G**. *Pseudoaluco* sp., MNHN.F.A66755, MA. — **H–J**. *?Vicinocerithium heberti* n. sp. **H**. Paratype MNHN.F.A66749, MA. **I**. Holotype MNHN.F.A66750, MA. **J**. Paratype MNHN.F.C02641, MA. — **K–L**. ?*Vicinocerithium* sp. **K**. MNHN.F.A66751, MA. **L**. MNHN.F.C02651, VGM. — **M–O**. *Granulolabium cretaceum* sp. nov. **M**. Paratype MNHN.FC02652, VGM. **N**. Paratype MNHN.F.C02653, VGM. **O**. Holotype MNHN.F.C02654, MA. Localities: MA = Bergères-lès-Vertus (Mont Aimé); VGM = Vertus (Grand Mont). Scale bars = 5 mm. Credits = P. Loubry (MNHN/CNRS).

Description

Fragment of shell corresponding to two preserved teleoconch whorls in ventral face: penultimate and last whorls. Penultimate whorl slightly convex; last whorl slightly impressed beneath suture with convex base. Suture linear, shallow. Axial sculpture consisting of 10–12 low and slightly opisthocyrt riblets.

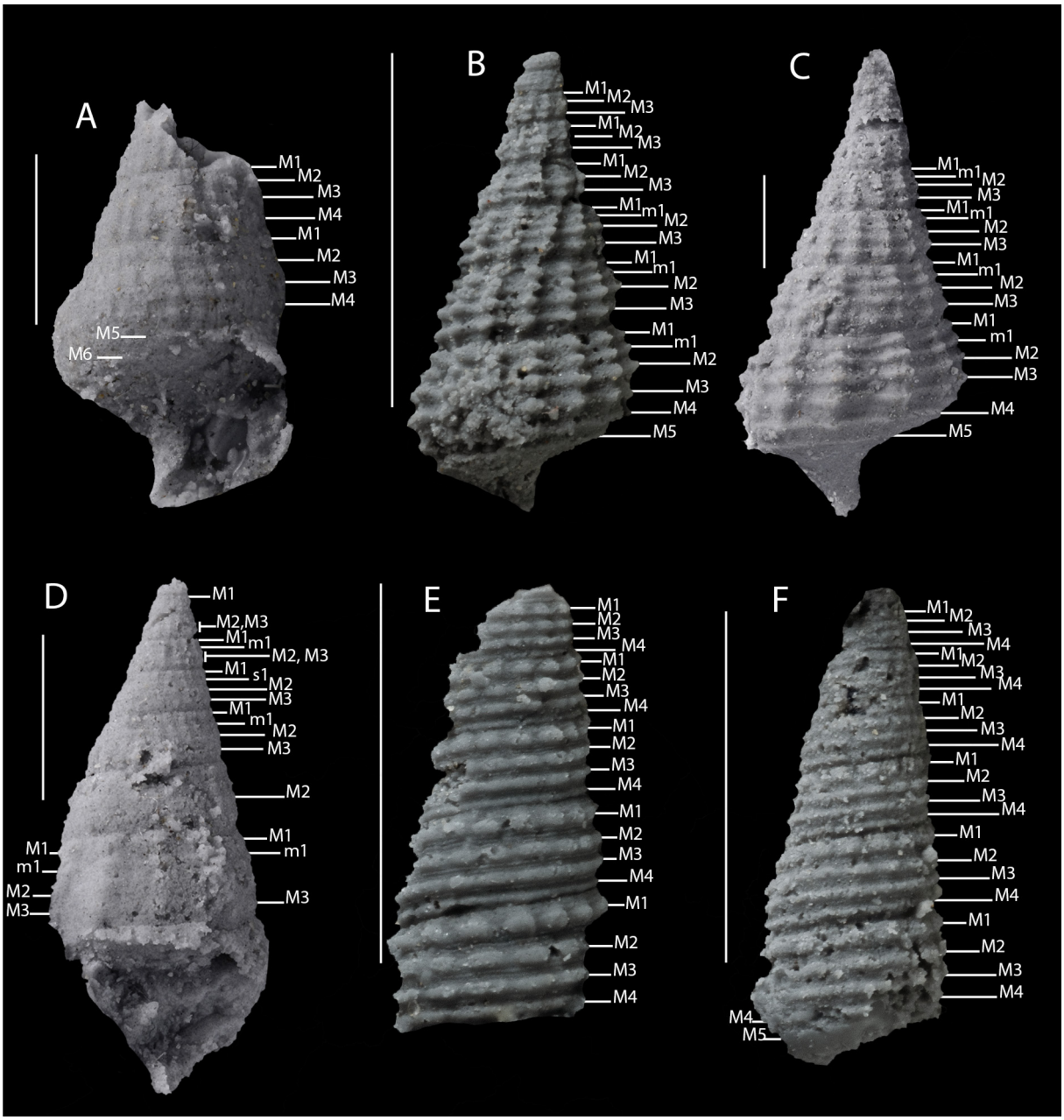

Fig. 12. Analysis of the spiral cords of *Pseudoaluco* B.L. Clark, 1946, ?*Vicinocerithium* E. Wood, 1910 and *Granulolabium* Cossmann, 1889 from the Maastrichtian of the Paris Basin. **A**. *Pseudoaluco* sp., MNHN.F.A66755, MA. — **B–C**. ?*Vicinoceritium heberti* sp. nov. **B**. Paratype MNHN.F.C02641, MA. **C**. Holotype MNHN.F.A66750, MA. — **D**. ?*Vicinocerithium* sp., MNHN.F.A66751, MA. — **E–F**. *Granulolabium cretaceum* sp. nov. **E**. Paratype MNHN.F.C02653, VGM. **F**. Paratype MNHN.F.C02652, VGM. Localities: MA = Bergères-lès-Vertus (Mont Aimé); VGM = Vertus (Grand Mont). Scale bars = 5 mm. Credits = P. Loubry (MNHN/CNRS).

On penultimate whorl, a prominent rib and on last whorl another prominent rib in abapertural side of shell. On penultimate whorl, four subequal beaded major cords (M1–M4); on last whorl, four subequal beaded major cords from suture to centre of whorl and abapically several weaker and poorly visible cords (Fig. 12A). Aperture ovate. Columella twisted. Columellar lip not visible. Siphonal canal medium, reflexed to left of shell axis. Posterior canal indistinct. Outer lip thin.

Remarks

In agreement with Merle & Pacaud (2018a), this shell fragment is more related to *Pseudoaluco* than to other genera of Cerithioidea. It is comparable to *P. carolinum* (d'Orbigny, 1850) from the Danian of the Paris Basin. However, *P. carolinum* differs by having more cords (M1–M5, m1, m2–m3), more prominent ribs and by lacking beaded cords except on M1. *Pseudolacuco dejaeri* (Briart & Cornet, 1873), from the Danian of Mons (Belgium), figured by Glibert (1973: pl. 6 fig. 10, spec. IRSNB n° 5356), displays a detached columellar lip and a posterior canal, lacking in *Pseudoaluco* sp. However, *Pseudoaluco* sp. is probably juvenile, which may explain why these characters are not yet present. The sculpture of *Pseudoaluco* sp. also resembles that of the Maastricht specimen of *Cerithium pseudoclathratum* d'Orbigny, 1850, illustrated by Kauenhowen (1897: pl. 11 fig. 12). However, in that illustration, the prominent ribs on the penultimate and last whorl of *Pseudoaluco* sp. are not visible and Kaunhowen (1898: 65) makes no mention of them in his description. An examination of the materiel of Kaunhowen would be necessary to explore this comparison in greater depth.

Stratigraphic range

Maastrichtian: Marne, France.

Family Batillariidae Thiele, 1929
Genus ***Vicinocerithium*** E. Wood, 1910

Type species

Vicinocerithium parallelum E. Wood, 1910 (junior synonym of *Cerithium bouei* Deshayes, 1833) by original designation. Middle Eocene (Bartonian), Paris Basin, France.

Stratigraphic range of the genus

?Late Cretaceous (Maastrichtian) of Paris Basin (this paper) to Middle Eocene.

?Vicinocerithium heberti sp. nov.
urn:lsid:zoobank.org:act:D4BC61B9-13DB-4244-9B89-2B7BE551CE97
Figs 11H–J, 12B–C

Cerithium carolinum d'Orbigny, 1850: 129, n° 19, pars, only the syntype of Mont Aimé.

?*Cerithium carolinum* – Combes 1908: 14 (non *Cerithium carolinum* d'Orbigny, 1850).
Vicinocerithium sp. 1 – Merle & Pacaud 2018a: 169–171 fig. 155k–m, 156a–b. — Merle 2023: 25.

Etymology

Dedicated to Edmond Hébert, French geologist of the 19th century who collected Maastrichtian material from this species in the Paris Basin.

Type locality

Bergères-lès-Vertus (Mont Aimé), Marne, France.

Type horizon

Sandy limestone with shell concentrations, Maastrichtian.

Type material

Holotype

FRANCE – **Marne** • Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; MMM coll.; figured in Merle & Pacaud (2018a: fig. 156b) and herein Figs 11I ,12C; MNHN.F.A66750.

Paratypes (5 specs)

FRANCE – **Marne** • 1 spec.; same data as for holotype; MMM coll.; figured in Merle & Pacaud (2018a: fig. 155k); MNHN.F.A66747 • 1 spec.; same data as for holotype; MMM coll.; figured in Merle & Pacaud (2018a: fig. 155m); MNHN.F.A66748 • 1 spec.; same data as for holotype; MMM coll.; figured in Merle & Pacaud (2018a: fig. 156a) and herein Fig. 11H; MNHN.F.A66749 • 1 spec.; same data as for holotype; MMM coll.; Figs 11J, 12B; MNHN.F.C02641 • 1 spec., historical cast of the imprint; Vertus (Faloise); Hébert coll.; figured in Merle & Pacaud (2018a: fig. 155l); UPMC.PAL.2017.0.16.1.

Other examined material (9 specs)

FRANCE – **Marne** • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02642 • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02643 • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02644 • 1 spec.; Vertus (Grand Mont); sandy limestone; MMM coll.; MNHN.F.C02645 • 1 spec.; same data as for preceding; MMM coll.; MNHN.F.C02646 • 1 spec.; same data as for preceding; MMM coll.; MNHN.F.C0264 • 2 specs; same data as for preceding; MMM coll.; MNHN.F.C02647 • 1 spec.; same data as for preceding; MMM coll.; MNHN.F.C02648. Many fragments of this species are not listed in the Examined material.

Measurements

Holotype, H: 23 mm, D: 11 mm. Other material broken.

Description

Shell medium in size, elongate and turreted. Protoconch unknown. Around eleven slightly convex whorls. Apical angle 34°. Suture shallow. Height of last whorl: 39% of shell length (based on holotype). Axial sculpture consisting of moderately strong and rather straight ribs. 10–12 ribs on spire and 13–14 ribs on last whorl. On first five whorls, three major cords (M1–M3) thicker in abapical direction. On later whorls three major cords (M1–M3) and a minor cord (m1). Last whorl with five major cords (M1–M5), one minor cord m1 and occasionally m4 and m5 (Fig. 7B–C). Abapical M4–M5 weaker than the adapical major cords. Major cords swelling on axial ribs and forming acute beads at intersection between axial and spiral sculptures. Aperture ovate. Outer lip not preserved. Columellar lip smooth, detached.

Comparisons

d'Orbigny (1850) described *Cerithium carolinum* from the Danian by introducing material from Bergères-lès-Vertus (Mont Aimé), Meudon (Hauts-de-Seine, Danian) and Montainville (Yvelines, Danian) in the type series. Comparison of specimens from Mont Aimé with those from the two cited Danian localities shows that these are two different species (Pacaud 2018a; Merle & Pacaud 2018a, 2018b). In order to stabilise the nomenclature, a lectotype was designated from a Danian specimen of *C. carolinum* from Montainville (Pacaud 2018a: 240, 195e). Furthermore, the sculptural features *C. carolinum* are those of *Pseudoaluco* and therefore *C. carolinum* is attributed to this genus. ?*Vicinocerithium heberti* sp. nov. bears similarities with *Cirsocerithium* Cossmann, 1906 (type species: *Cerithium subspinosum* Leymerie, 1842 by original designation; Albian, Paris Basin). Compared to *C. subspinosum*, ?*V. heberti* has a more elongate spire, a less rounded aperture and lacks a prominent, spiny spiral cord. *Cirsocerithium collignoni* Kiel, 2006 from the Albian of Madagascar displays a more comparable sculpture lacking a prominent, spiny spiral cord, but it bears a shorter spire and a more rounded aperture than in ?*V. heberti*. *Cirsocerithium crassilabris* (von Koenen, 1885) from the Danian

of Copenhagen also differs from ?*V. heberti* by having a shorter spire and a more rounded aperture. The sculpture of ?*Vicinocerithium heberti* is more reminiscent of that of *Cerithium inopinatum* Deshayes, 1864 (Deshayes 1864: pl. 82 fig. 32) reported and illustrated from the Danian of Mons by Glibert (1973: 43, pl. 5 fig. 12). Moreover, both species share a turreted shape, moderately strong and rather straight axial ribs as well as a detached columellar lip. ?*Vicinocerithium heberti* differs clearly by having four (M1–M4 and m1) instead of only three major cords on spire (M1–M3) in ?*V. inopinatum*, and by having more axial ribs, 10–12 ribs on spire and 13–14 ribs on last whorl, 7–8 on spire instead of 12 on last whorl in ?*V. inopinatum*. Glibert (1973) attributed ?*V. inopinatum* to *Vicinocerithium*, but the type species of the genus *Vicinocerithium parallelum* E. Wood, 1910 and many members of the genus differ by having a prominent spiny cord located in the adapical part of the whorls. However, several Eocene species of the genus, as *V. turbinoides* (Deshayes, 1864) from the Ypresian of the Paris Basin, are less spiny. Finally, ?*V. heberti* has an atypical sculpture for *Vicinocerithium*, but its shape is more similar to that of this genus than to that of *Cirsocerithium*. For this reason, we assign ?*V. heberti* to *Vicinocerithium*, whilst indicating uncertainty by the use of a question mark.

Stratigraphic range

Maastrichtian: Marne and ?Seine-et-Marne, France. This species is one the most common from the Maastrichtian of the Paris Basin. It is found from the base of the section of Vertus (Grand Mont) to the top of section of Bergères-lès-Vertus (Mont Aimé). Combes (1908) reported *Cerithium carolinum* from the Bois d'Esmans (Seine-et-Marne), but it could be ?*Vicinocerithium heberti* sp. nov.

?*Vicinocerithium* sp.
Figs 11K–L, 12D

Vicinocerithium sp. 2 – Merle & Pacaud 2018a: 169, fig. 156c. — Merle 2023: 25.

Material examined (3 specs)

FRANCE – **Marne** • 1 spec.; Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; MMM coll.; figured in Merle & Pacaud (2018a: fig. 156c) and herein Figs 11K, 12D; MNHN.F.A6675 • 1 spec.; same data as for preceding; MMM coll.; MNHN.F.C02650 • 1 spec.; Vertus (Grand Mont); sandy limestone; MMM coll.; Fig. 11L; MNHN.F.C02651.

Measurements

MNHN.F.A6675, H: 15.7 mm, D: 7 mm. Paratype MNHN.F.C02651, H: 10 mm, D: 4.3 mm. MNHN.F.C02650, H (three last whorls only): 12 mm, D: 8.3 mm.

Description

Shell medium in size, elongate and turreted. Around nine moderately convex whorls. Apical angle 32° (based on holotype). Suture moderately shallow. Height of last whorl: 36% of shell length (based on holotype). Axial sculpture consisting of low ribs becoming slightly stronger on penultimate and last whorls. Number of ribs increasing from 12 to 25 from second to antepenultimate whorl and falling to 16 ribs on penultimate whorl. On two first teleoconch whorls, three major cords (M1–M3), on third whorl appearance of minor cord m1 and on other spire whorls M1, m1, M2 and M3 (Fig. 12D). Cords weak forming spiral rows of small rounded beads. Aperture not preserved.

Remarks

?*Vicinocerithium* sp. is reminiscent of *Pseudoaluco* sp. in its low and slightly curved ribs and its four subequal beaded major cords. However, ?*Vicinocerithium* sp. lacks varical nodes observed in *Pseudoaluco* sp. In addition, the last whorls of ?*Vicinocerithium* sp. bear stronger varices recalling more those of ?*V. heberti* sp. nov. ?*Vicinocerithium* sp. differs from ?*V. heberti* in having weaker and more

numerous axial ribs (12 to 25 on spire and 16 on penultimate whorl instead of 10–12 on spire and 13–14 on last whorl in ?*V. heberti*) and weaker and more rounded beads on cords.

Genus ***Granulolabium*** Cossmann, 1889

Type species

Granulolabium plicatum Bruguière, 1792 by original designation. Early Oligocene (Rupelian), Paris Basin, France.

Stratigraphic range of the genus

Late Cretaceous of Paris Basin (this work) to Serravallian of Paratethys (Harzhauser *et al.* 2023).

Granulolabium cretaceum sp. nov.
urn:lsid:zoobank.org:act:9EBABB04-A051-4CD6-B984-64808CD34F44
Figs 11M–O, 12E–F

Granulolabium sp. – Merle 2023: 25.

Etymology

'Cretaceum': name given to recall the Cretaceous range of the species.

Type locality

Bergères-lès-Vertus (Mont Aimé), Marne, France.

Type horizon

Sandy limestone with shell concentrations, Mont Aimé, Maastrichtian.

Type material

Holotype
FRANCE – **Marne** • Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; MMM coll.; Fig. 11O; MNHN.F.C02654.

Paratypes (2 specs)
FRANCE – **Marne** • 1 spec.; Vertus (Grand Mont); sandy limestone; MMM coll.; Figs 11M, 12F; MNHN.F.C02652 • 1 spec.; same data as for preceding; MMM coll.; Figs 11N, 12E; MNHN.F.C02653.

Measurements

Holotype, H: (incomplete apex): 7 mm, D: 3.9 mm. Paratype MNHN.F.C02652, H (incomplete apex): 6.8 mm, D: 2.4 mm. Paratype MNHN.F.C02653, H (incomplete apex): 7 mm, D: 3 mm.

Description

Shell small in size, slender and turreted. Protoconch unknown. Around nine nearly straight-sided whorls. Apical angle 25° (based on paratype MNHN.F.C02652). Suture shallow, weakly incised. Height of last whorl: 31% of shell length (on paratype MNHN.F.C02652). Axial sculpture not varicose, with no defined ribs. Four major cords (M1–M4) on spire. M1 and M2 more prominent, ornamented with subquadratic beads. M3 linaear poorly beaded. M4 smooth, smaller than other adapical major cords. M4 and abapical suture close set. In holotype, M5 and M6 present (Fig. 12E–F). Small threads between most prominent cords M1, M3 and M4. Aperture subquadrangular. Columellar lip adherent. Siphonal canal short.

Comparisons

These narrow shells, regular, not varicose and bearing major cords decorated of subquadratic beads, are typical of the genus *Granulolabium*. According to Lozouet (1986), *Granulobium montense* (Briart & Cornet, 1873) from the Danian of Mons is the oldest record of the genus. Briart & Cornet (1873) described two other species: *Cerithium ovalituberosum* and *Cerithium sexlinum* from the same beds. However, *Granulobium montense* displays a large variability discussed by Glibert (1973: 35) and Kowalke (2002). As first reviser, Glibert (1973) considered *Cerithium ovalituberosum* and *Cerithium sexlinum* to be junior subjective synonyms of *Cerithium montense*. Kowalke (2002) admitted, as Glibert (1973), that there is only one species of *Granulolabium* in the Danian of Mons, but did not took into account the nomenclature act of Glibert (1973) and used erroneously the binome *Granulolabium ovalituberosum*. Although *G. montense* displays a large shell variability, Glibert (1973: 35) noted that "la sculpture spirale comporte sur chaque tour quatre cordons spiraux principaux munis de nodosités longitudinales de grosseur variable [= M1 to M4]. ... Un cinquième cordon [= M5], un peu plus faible et lisse, longe la suture antérieure". [English translation: "The spiral structure comprises, on each whorl, four main spiral cords with longitudinal nodules of varying sizes [= P1 to P4]. ... A fifth cord [= P5], slightly thinner and smooth, extends along the anterior suture"]. *Granulolabium cretaceum* sp. nov. differs from *G. montense* by having only four major M1 to M4 on the spire. In addition, M4 is close to the abapical suture in *G. cretaceum*, whereas M5 is close to abapical suture in *G. montense*. The occurrence of *Granulolabium* in the Maastrichtian is the oldest occurrence of the genus and indicates that it was already present in the Late Cretaceous.

Stratigraphic range

Maastrichtian: Marne, France.

Family Turritellidae Lovén, 1847
Subfamily Turritellinae Lovén, 1847

Genus ***Haustator*** Montfort, 1810

Type species

Haustator gallicus Montfort, 1810 (junior synonym of *Turritella imbricataria* Lamarck, 1804) by original designation. Middle Eocene (Lutetian), Paris Basin, France.

Stratigraphic range of the genus

Early Cretaceous (Valanginian) of Poland (Bandel 1993; Schröder 1995) to Early Miocene of South West India (Harzhauser 2014)

Haustator bergierensis sp. nov.
urn:lsid:zoobank.org:act:04B7CC19-0E2B-4A52-984A-00BD4EFBBBE1
Figs 13A–D, 14A–E

Haustator sp. – Merle & Pacaud 2018a: 169, fig. 156g. — Merle 2023: 25.

Etymology

From 'bergier' the ancient name of the type locality Bergères-lès-Vertus.

Type locality

Bergères-lès-Vertus (Mont Aimé), Marne, France.

Type horizon

Sandy limestone with shell concentrations, Mont Aimé, Maastrichtian.

Type material

Holotype

FRANCE – **Marne** • Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; MMM coll.; Figs 13A, 14A; MNHN.F.C02655.

Paratypes (5 specs)

FRANCE – **Marne** • 1 spec.; same data as for holotype; MMM coll.; figured in Merle & Pacaud (2018a: fig. 156g); MNHN.F.A66756 • 1 spec.; same data as for holotype; MMM coll.; Figs 13B, 14B; MNHN.F.C02656 • 1 spec.; same data as for holotype; MMM coll.; Figs 13C, 14C; MNHN.F.C02657 • 1 spec.; same data as for holotype; MMM coll.; Figs 13D, 14D; MNHN.F.C02658 • 1 spec.; same data as for holotype; MMM coll.; Fig. 14E; MNHN.F.C02659.

Other examined material (11 specs)

FRANCE – **Marne** • 1 spec.; same data as for holotype; MMM coll.; MNNH.F.C02660 • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02661 • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02662 • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02663 • 1 spec.; same data as for holotype; MMM coll.; MNHN.F. C02664 • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02665 • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02666 • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02667 • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02668 • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02669 • 1 spec.; same data as for holotype; MMM coll.; MNHN.F.C02670. Many fragments are not listed in the examined material.

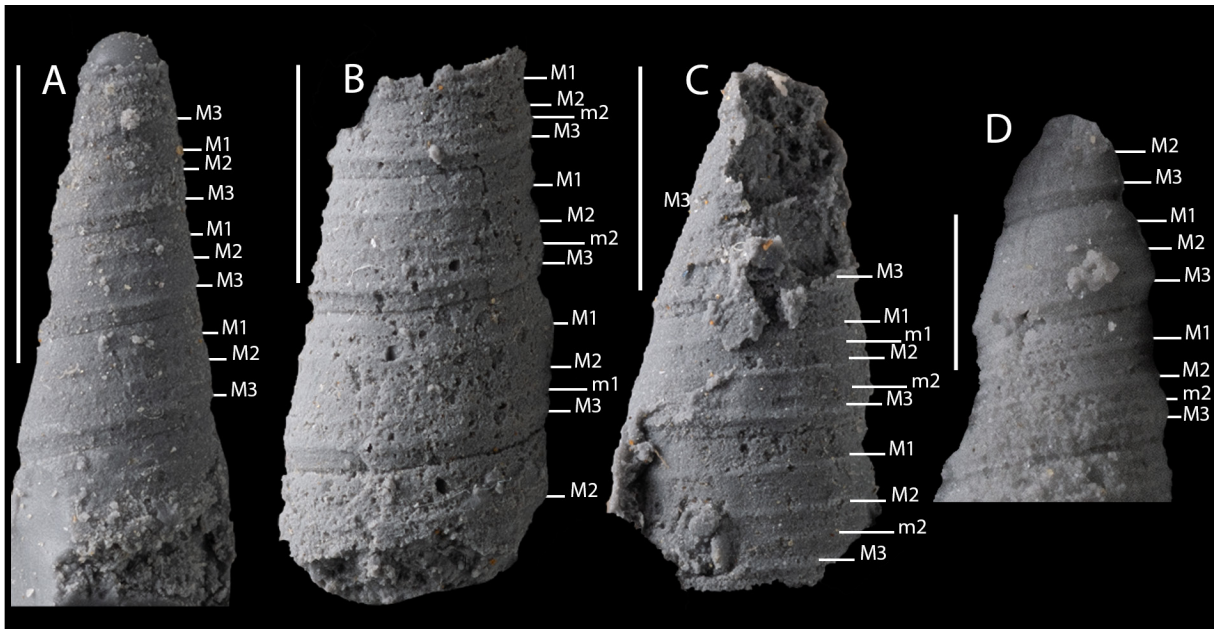

Fig. 13. Analysis of the spiral cords of *Haustator bergierensis* sp. nov. from the Maastrichtian of the Paris Basin. **A**. Holotype MNHN.F.C02655, MA. **B–D**. Paratypes. **B**. MNHN.F.C02656, MA. **C**. MNHN.F.C02657, MA. **D**. MNHN.F. C02658, MA. Locality: MA = Bergères-lès-Vertus (Mont Aimé). Scale bars: A–C = 5 mm; D = 2 mm. Credits = P. Loubry (MNHN/CNRS).

Measurements

Holotype, H (six whorls, apex and base incomplete): 10 mm, D: 4 mm. Paratype MNHN.F.C02656, H (four whorls, apex and base incomplete): 12 mm, D: 6 mm. Paratype MNHN.F.C02657, H (five whorls, apex and base incomplete): 12 mm, D: 5.5 mm. Paratype MNHN.F. C02658, H (eight whorls, apex subcomplete): 11.3 mm, D: 4 mm. Paratype MNHN.F. C02659, H (around 13 whorls, base incomplete): 10.5 mm, D: 3.5 mm. Paratype MNHN.F.A667560, H (two whorls, apex and base incomplete): 12 mm, D: 7 mm.

Description

Shell medium in size, slender, comprising up to 20 teleoconch whorls when complete. Protoconch not preserved. Whorl profile shifting from frustate to campanulate during ontogeny (terminology adopted from Allmon 1996). Spiral angle between 15° (juvenile, based on paratype MNHN.F.C02659) and 21° (adulte, based on holotype). On first ten teleoconch whorls M3 close set to abapical suture and becoming prominent during ontogeny. On later whorls, M1 (most adapical cord) and M2 (central) more or less weak, M1 being weaker than M2. Minor cords m1 and m2 present; m1 occasional (see Fig. 13B–C). Sutural ramp indistinct, flat. Suture moderately incised. Sinuses not preserved. Aperture subquadrate. Base flat.

Comparisons

Haustator bergierensis sp. nov. is reminiscent of three turritellid species from the Aachener Formation (Santonian of Germany) in its slender shape, its frustate to campanulate profile and in its three major cords (M1–M3): 1°) '*Turritella*' *omaliusi* Müller, 1851 (Müller 1851: 31, pl. 4 fig. 12a–b) a junior synonym of *Nodosella alternans* (F.A. Roemer, 1841), 2°) '*Turritella humbolti*' Müller, 1851 (Müller, 1851: 32, pl. 4 fig. 17) and 3°) '*Turritella*' *acutissima* Müller, 1849 (Müller, 1849; 31, pl. 4 fig. 19a–b). The major cord M3 appears late in the ontogeny in *H. bergieriensis*, whereas it appears on the early teleoconch whorl in '*T.*' *omaliusi*. Moreover, only M1 is prominent in *H. bergieriensis*, whereas M1 and M3 are prominent in '*T.*' *omaliusi* (M2 being smaller). '*Turritella*' *omaliusi* is recorded in the Maastrichtian of Maastricht (Binkhorst 1861: pl. 1 fig. 6). '*Turritella*' *humboldti* differs in having M1 to M3 appearing later in the ontogeny than in *H. bergierensis* and M4 is not close set to the abapical suture on the last whorls. The major cords M1 to M3 of '*T.*' *acutissima* appear earlier in the ontogeny than in *H. bergierensis*. The suture is always shallow in *H. bergierensis*, whereas that of '*T.*' *acutissima* is deep and delineates the teleoconch whorls. In addition, M3 is clearly more prominent in *H. bergieriensis*, whereas M1 to M3 have a more or less similar relief in '*T.*' *acutissima*. The shape of the whorls of *Haustator plana* (Binkhorst, 1861) from the Maastrichtian of Maastricht is reminiscent of that of *Haustator bergierensis*, but the latter is clearly distinguishable by its coarser spiral cords and a significantly shallower suture. The cords of *Haustator plana* are extremely fine and cannot be identified (see the text and the figure of Binkhorst 1861: 30, pl. 1 fig. 5). This is not the case with specimens of *Haustator bergierensis*, in which the M1–M3 cords are easily identifiable. The Cenozoic *Haustator nysti* (Briart & Cornet, 1873) from the Danian from Mons (Belgium) shares with *H. bergierensis* a prominent M3 and weaker M1 and M2. However, this species differs from *H. bergierensis* in having a more prominent M3 appearing on the early teleoconch whorls and in having teleoconch whorls bearing an imbricate shape.

Stratigraphic range

Maastrichtian: Marne, France.

Haustator sp.
Fig. 14F

Material examined

FRANCE – **Marne** • 1 spec.; Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; MMM coll.; MNHN.F.C02671.

Measurements

H (four whorls, apex and base incomplete): 7 mm, D: 2.5 mm.

Description

Shell slender. Whorl profile subquadrate (terminology adopted from Allmon 1996). No spiral sculpture. No sutural ramp. Suture very shallow. Sinuses not preserved.

Remarks

This fragment of turritellid differs from *H. bergierensis* sp. nov. by having a subquadrate profile and in lacking a spiral sculpture. Chavan (1948) cited from the Mont Aimé *Turritella* cf. *supracretacea*, a species originally described from the Danian of Meudon. Unfortunately, Chavan did not illustrate any specimens. The two syntypes illustrated by Pacaud (2018a: fig. 193a–b) as *Haustator supracretacea* bear a weak sculpture as in *Haustator* sp.

Superfamily Campaniloidea Douvillé, 1904
Family Campanilidae Douvillé, 1904

Genus ***Campanile*** P. Fischer, 1884

Type species

Cerithium leve Quoy & Gaimard, 1834 (non Perry, 1810 = *Campanile symbolicum* Iredale, 1917) by subsequent designation (Crosse 1888). Present day, Western Australia.

Stratigraphic range of the genus

Late Cretaceous (Maastrichtian) of Mexico (Kiel *et al.* 2000) to present day (Australia).

Subgenus *Campanile* (s. str.)

***Campanile* (*Campanile*)** sp.
Fig. 14G

Campanile sp. – Merle & Pacaud 2018a : 169, fig. 156h.

Material examined

FRANCE – **Marne** • 1 spec.; Bergères-lès-Vertus (Mont Aimé); unknown bed; MNHN coll., ex n°GG. gg2007/16527; figured in Merle & Pacaud (2018a: fig. 156h); MNHN.F.C02672.

Measurements

H (incomplete): 82 mm; D: 47 mm.

Description

Shell large and turreted. Internal mould displaying four spire whorls. Inside of whorls convex with two grooves corresponding to two columellar folds.

Comments

Hébert (1848: 394) reported a *Campanile* from Vertus (probably from Faloise), which he identified, albeit with some doubt, as *Campanile giganteum* (Lamarck, 1804) from the Lutetian of Paris Basin. Later, d'Orbigny (1850) reported in the type material of the Danian *Campanile unisulcatum* (d'Orbigny, 1850), a specimen coming from Vertus. However, this specimen has not been retrieved in his collection. In the

collections of the MNHN, we found only a Maastrichtian specimen of *Campanile* from the locality of Bergères-lès-Vertus (Mont Aimé). However, it is an internal mould and it does not allow an identification at species level (see Fig 14G). Therefore it is not possible to validate this identification. Binkhorst

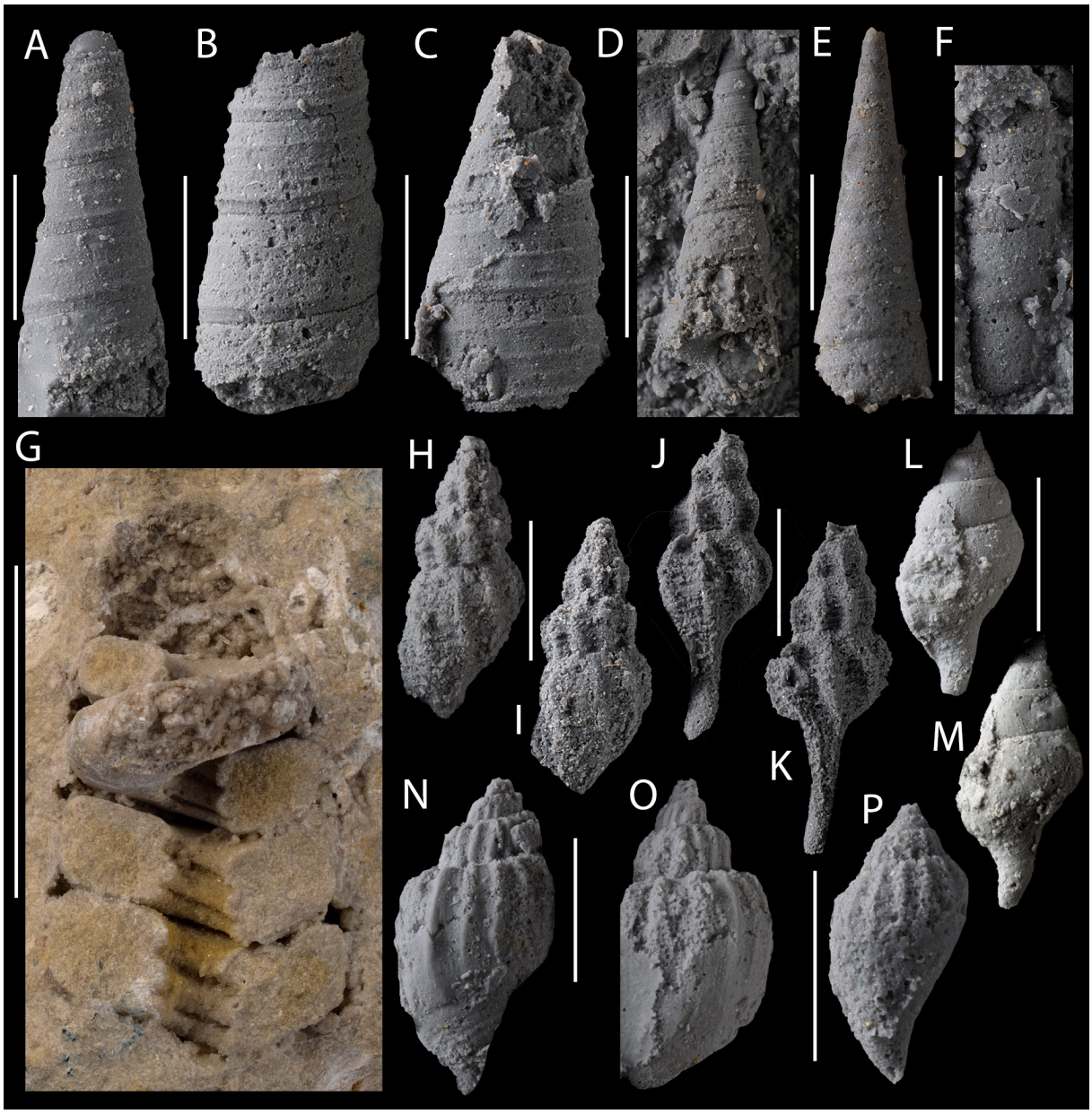

Fig. 14. Caenogastropoda L.R. Cox, 1960 and Neogastropoda Wenz, 1938 from the Maastrichtian of the Paris Basin. **A–E**. *Haustator bergierensis* sp. nov. **A**. Holotype MNHN.F.C02655, MA. **B**. Paratype MNHN.F. C02656, MA. **C**. Paratype MNHN.F.C02657, MA. **D**. Paratype MNHN.F.C02658, MA. **E**. Paratype MNHN.F.C02659, MA. — **F**. *Haustator* sp., MNHN.F.C02671, MA. — **G**. *Campanile* (s. str.) sp., MNHN.F.C02672, MA. — **H–I**. *Sveltella binkhorsti* sp. nov. **H**. Holotype MNHN.F.C02675, VGM. **I**. Paratype MNHN.F.C02676, VGM. — **J–K**. *Fusinus bouchardae* sp. nov., holotype MNHN.F.C02677, VGM. — **L–M**. ?*Pseudopisania cretacea* sp. nov., holotype MNHN.F.C02684, VGM. — **N–O**. *Popenoeum ambiguum* (Binkhorst, 1861), MNHN.F.C02685, VGM. — **P**. *Volutomorpha* sp., MNHN.F.C02682, MA. Localities: MA = Bergères-lès-Vertus (Mont Aimé); VGM = Vertus (Grand Mont). Scale bars: A–F, H–P = 5 mm; G = 50 mm. Credits = P. Loubry (MNHN/CNRS).

(1861: pl. 6 fig. 1c) illustrated an internal mold of *Campanile* (s. str.) *maximum* (Binkhorst, 1861) from Maastricht, but it differs by having three grooves instead of two in the *Campanile* from Bergères-lès-Vertus (Mont Aimé).

Stratigraphic range

Combes (1908: 14–15) cited *Cerithium uniplicatum* d'Orbigny, 1850 which is now attributed to the genus *Campanile* (see Merle & Pacaud 2018b). This identification of Combes (1908: 15) confirms unequivocally the presence of the genus *Campanile* at the Bois d'Esmans: "… la présence de moules internes de gros cérites, analogues à ceux du *Cerithium giganteum* lutétien ...". English translation ["… the presence of internal moulds of large cerites, similar to those of the Lutetian *Cerithium giganteum*…"].

Order Neogastropoda Wenz, 1938
Superfamily Cancellaroidea Forbes & Hanley, 1851
Family Cancellariidae Forbes & Hanley, 1851
Subfamily Admetinae Troschel, 1865

Genus ***Sveltella*** Cossmann, 1889

Type species

Cancellaria quantula Deshayes, 1864 by original designation (junior synonym of *Cancellaria biplicata* Lamarck, 1803). Middle Eocene (Lutetian), Paris basin, France.

Stratigraphic range of the genus

Late Cretaceous (Maastrichtian) of Paris Basin (this work) to Late Oligocene (Chattian) of Aquitaine Basin (Lozouet 1999).

Sveltella binkhorsti sp. nov.
urn:lsid:zoobank.org:act:F58C53D6-A0DF-47B1-9343-9A2A808E84FC
Fig. 14H–I

Caveola sp. – Merle 2023: 25.

Etymology

Dedicated to the palaeontologist Jan Theodor Binkhorst van den Binkhorst who described the molluscs fauna from the Maastrichtian of Limburg.

Type locality

Vertus (Grand Mont), Marne, France.

Type horizon

Sandy limestone of Vertus, Maastrichtian.

Type material

Holotype
FRANCE – **Marne** • Vertus (Grand Mont), sandy limestone; MMM coll.; Fig. 14H; MNHN.F.C02675.

Paratype
FRANCE – **Marne** • 1 spec.; same data as for holotype; MMM coll.; Fig. 14I; MNHN.F.C02676.

Measurements

Holotype MNHN.F.C02675, H: 9.5 mm, D: 4.7 mm. Paratype MNHN.F.C02676, H: 9 mm, D: 4 mm.

Description

Shell slender, subfusiform small in size. Protoconch missing. Spiral angle 32°. Five spire whorls. Two early whorls poorly preserved. Antepenultimate and penultimate whorls high, subcarinate, slightly constricted adapically. Narrow subsutural ramp. Suture distinct, moderately deep. Last whorl moderately subcarinate, equals 53% of total shell height. Siphonal canal short. On antepenultimate and penultimate whorls four–five strong, varicose ribs in dorsal view (= one half whorl) tending to fade near sutural ramp. Five thin spiral cords covering delicately the ribs and more prominent between them. On last whorl, five lower ribs. Nine–ten thin spiral cords of equal size undulating across the ribs. Siphnal canal short.

Comparisons

The shell shape of *Sveltella binkhorsti* sp. nov. is reminiscent of that of *Caveola producta* Stephenson, 1941 from the Maastrichtian of Texas (USA), type species of *Caveola* Stephenson, 1941 (by original designation) and attributed to the family Mataxidae Bandel & Dockery, 2012 and to the superfamily Tonnoidea Suter, 1913. Nevertheless, the sculpture of *S. binkhorsti* differs from that of *Caveola* in having higher and less numerous ribs (5–6 instead of 9–11 on spire and 5 instead of 15–16) crossed by weaker spiral cords. *Sveltella* has a similar shape and its sculpture resembles more that of *S. binkhorsti*. *Sveltella loevstroemi* Schnetler & Petit, 2010 from the Danian of Nuusuaq (Greenland) and *S. binkhorsti* share 5–6 varicose ribs on the spire and undulating cords on the ribs. Furthermore, in both species, the ribs become less strong on the last whorl. *Sveltella binkhorsti* is distinguished from *S. loevstroemi* by having a slightly higher spire whorls, fewer ribs (6–7 on spire and 8 on last whorls) and weaker cords. *Sveltella binkhorsti* differs from *Sveltella tobiasseni* Schnetler & Petit, 2010 from the Danian of Nuusuaq by having less coarse spiral cords and more rounded whorls. The shape of *S. quantula* from the Lutetian of the Paris Basin is also quite similar to that of *S. binkhorsti*. Howewer, *S. binkhorsti* displays higher and less convex whorls and its spiral sculpture consists of coarser and fewer cords.

Stratigraphic range

Maastrichtian: Marne, France.

Superfamily Buccinoidea Rafinesque, 1815
Family Fasciolariidae Gray, 1853
Subfamily Fusinae Wrigley, 1927

Genus ***Fusinus*** Rafinesque, 1815

Type species

Murex colus Linnaeus, 1758 by typification of replaced name. Present day, Indian Ocean and Indo-West-Pacific.

Stratigraphic range of the genus

?Late Cretaceous (Campanian) of The Netherlands (this work) to present day, warm seas.

Fusinus bouchardae sp. nov.
urn:lsid:zoobank.org:act:157C1A91-01D9-4B04-9FF4-25A5B8AA0940
Fig. 14J–K

Dolicholatirus sp. – Merle 2023: 25.

Etymology

Dedicated to Blanche Bouchard for her help on the computerisation of the mollusc collection of Vertus (Grand Mont) and Bergères-lès-Vertus (Mont Aimé).

Type locality

Vertus (Grand Mont), Marne, France.

Type horizon

Sandy limestone of Vertus, Maastrichtian.

Type material

Holotype

FRANCE – **Marne** • Vertus (Grand Mont), sandy limestone; MMM coll.; MNHN.F.C02677.

Measurements

Holotype, H (three last whorls observed): 12.7 mm, D: 5 mm.

Description

Shell medium in size, fusiform, rather elongated, measuring approximately 15 mm. Spire whorls convex, slightly constricted adapically by a narrow subsutural band. Spiral angle around 41°. Suture distinct, but not canaliculate. On antepenultimate and penultimate whorls four varicose and rounded ribs in dorsal view (= one half whorl) tending to be more prominent abapically. Seven to eight thin spiral cords of equal size, covering delicately the ribs and more prominent between the ribs. Last whorl elongate. Siphonal canal moderately long occupying 53% of length of last whorl. Five varicose ribs in dorsal view (= one half whorl) tending to fade near siphonal canal. Eleven thin spiral cords of equal size on convex part of whorl. On siphonal canal, cords more distinct on adapical part.

Comparisons

Fusinus bouchardae sp. nov. is reminiscent of "*Fusus*" *gracilis* (J. Böhm, 1885), not *Fusus gracilis* Da Costa, 1778 or "*Fusus*" *scala* Holzapfel, 1888 from the Campanian Grünsand of Vaals (The Netherlands) in its fusiform shape, its varicose ribs crossed by thin spiral cords of equal size and in its whorls slightly constricted adapically (see Holzapfel 1888: 103, pl. 11 figs 1–2). However, "*Fusus*" *gracilis* has more (6–7 for one half whorl) and close-set axial ribs and "*Fusus*" *scala* displays flatter ribs than those of *Fusinus bouchardae*. There is no similar shell in the works of Binkhorst (1861) and Holzapfel (1888) on the Late Cretaceous mollusc fauna of Limburg. The shape and form of *Fusinus schnetleri* Hansen, 2019 from the lower Danian of Denmark closely resemble those of *F. bouchardae*, but the latter differs in having more elongated whorls and a less pronounced subsutural band. From the point of view of genus assignment, Merle (2023) previously attributed this species to *Dolicholatirus* Bellardi, 1884 (family Dolicholatiridae Kantor, Fedosov, Kosyan, Puillandre, Sorokin, Kano, R. Clark & Bouchet, 2021). However *Fusinus bouchardae*. differs from members of *Dolicholatirus* (type species: *Fusus bronnii* Michelotti, 1847 by subsequent designation Cossmann (1901); Late Miocene, Italy) in having a shorter shape and finer spiral cords. The shape and the sculpture of "*Fusus*" *gracilis*, "*Fusus*" *scala*, *Fusinus schnetleri* and *Fusinus bouchardae* bear a closer resemblance to those of the species of *Fusinus*. For this reason, it seems more appropriate to provisionally assign *F. bouchardae* to *Fusinus*. This assignment is provisional and requires further verification using new material to determine whether the columella of this species is smooth, as is the case with species of *Fusinus.*

Stratigraphic range

Maastrichtian: Marne, France.

Family Columbellidae Swainson, 1840

Genus ***Pseudopisania*** Cossmann, 1897

Type species

Mitrella (*Pseudopisania*) *plateaui* (Cossmann, 1889) by original designation. Early Eocene (Ypresian), Paris Basin, France.

Stratigraphic range of the genus

Late Cretaceous (Maastrichtian) of Paris Basin (this work) to Early Eocene (Europe).

?Pseudopisania cretacea sp. nov.
urn:lsid:zoobank.org:act:53A885F1-9D43-4918-919A-3C97EC9FF8DB
Fig. 14L–M

Etymology

From '*cretaceous*', name given to recall the Cretaceous range of the species.

Type locality

Vertus (Grand Mont), Marne, France.

Type horizon

Sandy limestone of Vertus, Maastrichtian.

Type material

Holotype

FRANCE – **Marne** • Vertus (Grand Mont), sandy limestone; MMM coll.; MNHN.F.C02684.

Measurements

H: 10 mm, D: 4 mm.

Description

Shell medium in size, fusiform, elongate. Protoconch missing. Spiral angle 35°. Six spire whorls, slightly rounded. Last whorl of 50% of total shell height. Suture linear, slightly impressed. No axial sculpture. On penultimate whorl, one weak thread below suture. On last whorl, two weak threads below suture and several weak basal cords on siphonal canal. Outer lip thickened by terminal varix. Siphonal canal moderately long (in dorsal face) of 36% of height of last whorl and slightly recurved.

Comparisons

The fusiform shape of *Pseudopisania cretacea* sp. nov., its slightly rounded whorls with a moderately long siphonal canal, spiral threads below the suture and on the siphonal canal recall some mitrids such as *Mitra subglabra* (Ravn, 1933) from the Danian of Denmark (Ravn 1933: 65 and figured specimen in Lauridsen & Schnetler 2014: 97, fig. 153), or columbellids such as *Pseudopisania plateaui* (Cossmann, 1889) from the Thanetian of the Paris Basin (Cossmann 1889: 142 and figured specimen in Cossmann & Pissarro 1911: pl. 37 fig. 179-18). The outer lip thickened by a terminal varix of *P. cretacea* lacks in Mitridae, but is common in Columbellidae. Among the Columbellidae, *P. cretacea* resembles *P. plateaui* which only differs in having more pronounced threads on the last whorl. The assignment of *P. cretacea* to *Pseudopisania* is, however, provisional and requires examination of the aperture to validate it.

Stratigraphic range

Maastrichtian: Marne, France.

Superfamily Olivoidea Latreille, 1825
Family Pseudolividae de Gregorio, 1880

Genus ***Popenoeum*** Squires, 1989

Type species

Popenoeum maritimum Squires, Zinsmeister & Paredes-Mejia, 1989 by original designation. Paleocene (Danian), southern California, USA.

Stratigraphic range of the genus

Late Cretaceous (Maastrichtian) of North Africa, Madagascar and northern Europe to Early Eocene (see Pacaud 1998).

Popenoeum ambiguum (Binkhorst, 1861)
Fig. 14N–O

Pyrula ambigua Binkhorst, 1861: 6, pl. 1 fig. 9.

Pseudoliva ambigua – Kaunhowen 1898: 78, pl. 7 figs 3–4. — Pervinquière 1912: 64, pl. 5 figs 1–2a–c.
Sulcobuccinum ambiguum – Vermeij 1998: 81.
Popenoeum ambiguum – Pacaud 1998: 3, figs 1–9b, 12. — Merle & Pacaud 2018a: 169, fig. 156h; 2018b: 322, fig. 230g–h. — Merle 2023: 25.

For a detailed synonymic list, see Pacaud (1998: 3).

Type material (not examined)

Two syntypes (see Binkhorst 1861: 6).

Type locality

Maastricht or Fauquemont, cf. Binkhorst (1861: iv), The Netherlands; Meerssen Member, Maastrichtian.

Material examined (4 specs)

FRANCE – **Marne** • 1 spec., external part of an outer lip showing the pseudolivid spiral groove; Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; MMM coll.; figured specimen of Merle & Pacaud (2018a: fig. 156i); MNHN.F.A66757 • 1 spec., spire only; Vertus (Grand Mont); sandy limestone; MMM coll.; MNHN.F.C02686 • 1 spec., subcomplete; same data as for preceding; MMM coll.; Fig. 14N–O; MNHN.F.C02685 • 1 spec., juv.; same data as for preceding; MMM coll.; MNHN.F.C02687.

Measurements

MNHN.F.C02685, H: 11 mm, D: 6 mm.

Description

Shell medium in size and globose. Protoconch missing. Spiral angle 54°. Four spire whorls, rather high, moderately convex and separated by a canaliculate suture. Last whorl large, convex, of 73% of total shell height. On antepenultimate and penultimate whorls, 8–9 distinct and flexuous axial ribs (in dorsal view =

one half whorl) reaching adapical suture, without bearing spines on shoulder. On last whorl, eight ribs (in dorsal view = one half whorl) reaching dorsal groove and disappearing abapically. Spiral sculpture lacking on spire and on last whorl consisting of around ten small threads extended from dorsal groove to base. Dorsal pseudolivid groove shallow. Outer lip not thickened. an canal short.

Comparisons

Merle & Pacaud (2018a) identified this species from a fragment of an outer lip bearing a pseudolivid shallow dorsal groove found at Bergères-lès-Vertus (Mont Aimé) in 2014. The 2017 fieldtrip led to the discovery of three new specimens, one of which was fairly complete: MNHN.F.C02685 (Fig. 14N–O). It is reminiscent of the specimen from Maastricht illustrated by Kaunhowen (1898: pl. 7 figs 3–4) in having rather high spire whorls, flexuous axial ribs reaching the adapical suture, without bearing spines on the shoulder, and in having a poorly developed spiral sculpture. According to Pacaud (1998), *P. ambiguum* has a wide geographic range and is also present in the Danian.

Stratigraphic range

Maastrichtian: France (Marne), The Netherlands, North Africa and Madagascar to Danian–Ypresian: Europe, Western and Eastern Tethys, West Africa and Caribbean, for details see Pacaud (1998).

Superfamily Volutoidea Rafinesque, 1815
Family Volutidae Rafinesque, 1815
Subfamily Volutidae Rafinesque, 1815 incertae sedis

Genus ***Volutomorpha*** Gabb, 1877

Type species

Volutilithes conradi Gabb, 1860 by original designation. Late Cretaceous, New Jersey, USA.

Stratigraphic range of the genus

Late Cretaceous (Turonian) of Egypt (El Qot 2006) to Maastrichtian (North America, West Africa, Europe, Tethys…).

Volutomorpha sp.
Fig. 14P

Volutocorbis sp. – Merle 2023: 25.

Material examined

FRANCE – **Marne** • 1 spec.; Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; MMM coll.; MNHN.F.C02682.

Measurements

H: 7 mm, D: 3.5 mm.

Description

Shell small, biconic. Protoconch not preserved. Four teleoconch whorls including last whorl. Last whorl of 79% of total length. Apical angle 66°. Spire moderately high. Spire whorls slightly convex; last whorl elongate, slightly convex in its adapical part. On two first whorls no sculpture, on penultimate and last whorls six–seven low and orthocline axial ribs (in dorsal view = one half whorl). On last whorl, several small cords from suture to first adapical part of last whorl. Siphonal canal slightly elongate.

Remarks

This small shell corresponds to a juvenile individual and is reminiscent of *Volutocorbis* Dall, 1890 or *Volutomorpha* in its shape and sculpture. The early sculpture of Paleocene/Early Eocene *Volutocorbis* (see Merle *et al.* 2014) is, however, stronger than in this specimen from the Paris Basin. Young specimens of *Volutomorpha*, a genus present in the Late Cretaceous, are more similar in having a poorly developed early sculpture.

Incertae sedis

Caenogastropoda indet. 1 (?ampullinid shape)
Fig. 15A

Ampullinidae indet. – Merle & Pacaud 2018a: 166. — Merle 2023: 25.

Material examined

FRANCE – **Marne** • 1 spec.; Vertus (Grand Mont), sandy limestone; MMM coll.; MNHN.F.C02673.

Measurements

H (incomplete): 12 mm, D (incomplete): 12 mm.

Description

Fragment of shell bearing three teleoconch whorls and internal part of last whorl. Whorls subcarinate to slightly convex. Surface apparently smooth. Basal internal part making an inverse cone with slightly concave sides.

Remarks

Although this fragment is significantly altered, it resembles a fragment of the spire of an Ampullinidae Cossmann, 1919 or maybe a Naticidae Guilding, 1834.

Caenogastropoda indet. 2 (?calyptraeid shape)
Fig. 15B

Calyptraea sp. – Merle 2023: 25.

Material examined

FRANCE – **Marne** • 1 spec.; Vertus (Grand Mont), sandy limestone; MMM coll.; MNHN.F.C02674.

Measurements

D: 14.8 mm.

Description

Fragment of external part of last whorl; spire broken. Hat shell shape. Last whorl convex, moderately high. Suture line between penultimate whorl and last whorl linear. Outline of base subcircular. Shell surface smooth, but with a few small tips more or less spirally aligned.

Remarks

This fragment of the last whorl is reminiscent of the calyptraeids in its hat shell shape, its subcircular outline and its moderately high last whorl. Its shell surface with small lines more or less spirally aligned is found in the genus *Sigapatella* R.P. Lesson, 1831, particularly in *Sigapatella aperta* (Solander in

Brander, 1766) from the middle Eocene (Bartonian) of the Paris Basin, see Cossman & Pissarro (1911: pl. 12 fig. 73.1). The oldest member of the genus is *Sigapatella montensis* (Cossmann, 1919), see Pacaud (2018a: 29). Cossmann (1919: 70) stated "…il est orné de rugosités irrégulières, plus où moins alignées sur des lignes d'accroissement trè obliques" [English translation: "…it is decorated with irregular roughnesses, more or less aligned with very oblique growth lines"], as it is in ?*Sigapatella* sp. According to Marshall (2003), "Bandel & Riedel (1994) interpreted *Sigapatella* as a synonym of *Calyptraea* Lamarck, 1799, but *S. novaezelandiae* and other species discussed herein differ from *C. chinensis* in that the septum edge is broadly and evenly concave instead of sigmoidal". As the septum is not preserved in the collected fragment, it is not possible to determine with certainty whether it corresponds to *Sigapatella*.

Caenogastropoda indet. 3 (?volutid shape)
Fig. 15C

Aporrhaidae indet. – Merle & Pacaud 2018a: 169, 171, fig. 156j. – Merle 2023: 25.

Material examined

FRANCE – **Marne** • 1 spec.; Bergères-lès-Vertus (Mont Aimé), sandy limestone with shell concentrations; MMM coll.; figured specimen of Merle & Pacaud (2018a, fig. 156j); MNHN.F.A66758.

Measurements

H (spire missing): 7 mm, D (outer lip missing): 4 mm.

Description

Fragment of penultimate and last whorls in ventral side. Penultimate whorl convex and smooth. Last whorl conical, elongate with carina located in adapical quarter of whorl. Surface smooth. Suture linear. Inner lip slightly erect, making moderatery deep groove from adapical part of whorl to base.

Remarks

This fragment of shell is slightly reminiscent of a volutid in the conical and elongate shape of its last whorl, its carina and its inner lip. However, it is impossible to specify which genus it might belong to.

Caenogastropoda indet. 4 (?volutid/cancellariid shape)
Fig. 15D

Material examined

FRANCE – **Marne** • 1 spec.; Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; MMM coll.; MNHN.F.C02683.

Measurements

H (apex and base incomplete), 4.7 mm, D: 4 mm.

Description

Two whorls preserved. Penultimate whorl moderately convex. On penultimate whorl, six low and orthocline ribs (in dorsal view = one half whorl) crossed by six subequal cords, tending to be nodulose when crossing the ribs. On last whorl, eight ribs (in dorsal view = one half whorl) crosssed by eight cords nodulose at intersection with ribs. In adapical part of whorl, subsutural cord clearly distinct from shoulder cord. Shoulder cord slightly spiny delineating small carina.

Remarks

This fragment of a small shell displays a stronger sculpture than *Volutomorpha* sp. It resembles *Volutomorpha corrugata* (Binkhorst, 1861) in having a shoulder cord delineaeting a small carina (see Binkhorst 1861: pl. 5 fig. 1a–b), but it has more numerous ribs. Its cancellate sculpture also recalls that of cancellariids.

Caenogastropoda indet. 5 (?turrid/aporrhaid shape)
Fig. 15E

Turridae indet. – Merle 2023: 25.

Material examined

FRANCE – **Marne** • 1 spec.; Vertus (Grand Mont), sandy limestone; MMM coll.; MNHN.F.C02678.

Measurements

H (base missing): 14 mm, D: 8 mm.

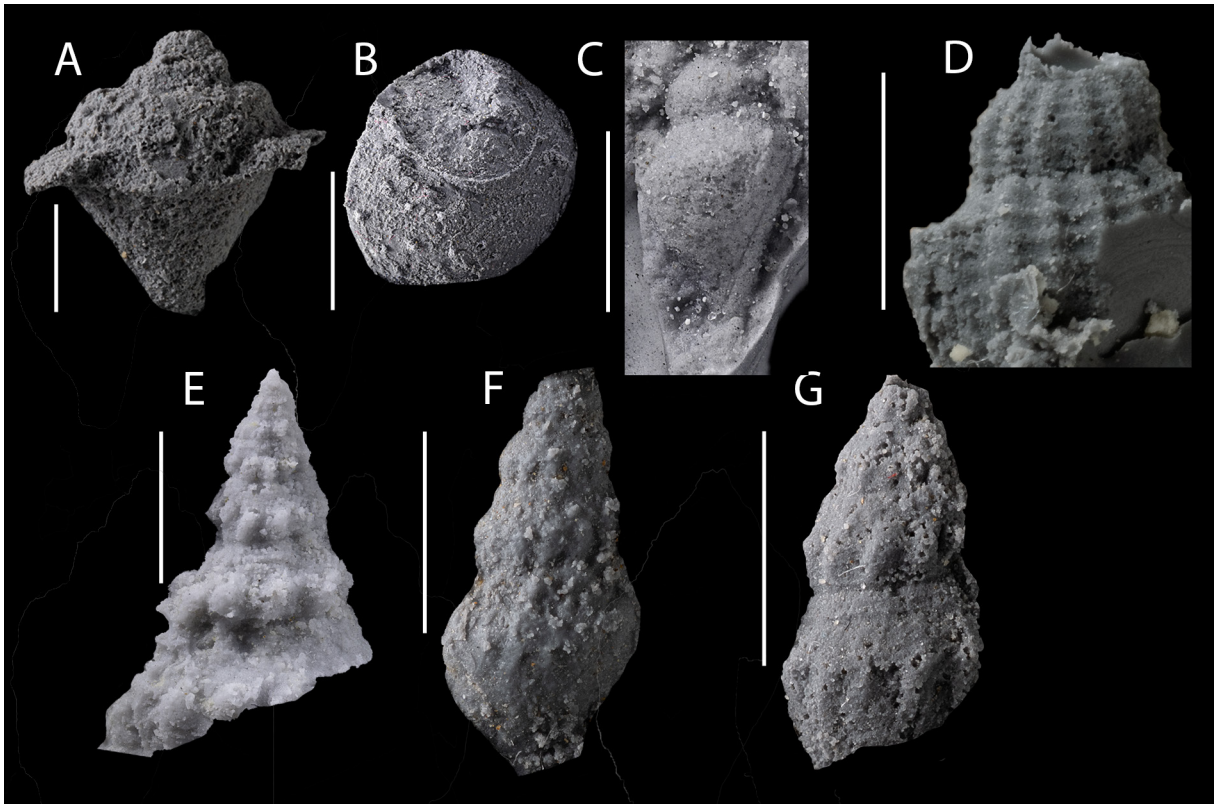

Fig. 15. Caenogastropoda L.R. Cox, 1960 indet. from the Maastrichtian of the Paris Basin. **A**. Caenogastropoda indet. 1 (?ampullinid shape), MNHN.F.C02673, VGM. — **B**. Caenogastropoda indet. 2 (?calyptraeid shape), MNHN.F.C02674, VGM. — **C**. Caenogastropoda indet. 3 (?volutid shape), MNHN.F.A66758, MA. — **D**. Caenogastropoda indet. 4 (?volutid/cancellariid shape), MNHN.F.C02683, MA. — **E**. Caenogastropoda indet. 5 (?turrid/aporrhaid shape), MNHN.F.C02678, VGM. — **F**. Caenogastropoda indet. 6 (?turrid/aporrhaid shape), MNHN.F.C02679, MA. — **G**. Caenogastropoda indet. 7 (?turrid/aporrhaid shape), MNHN.F.C02680, VGM. Localities: MA = Bergères-lès-Vertus (Mont Aimé); VGM = Vertus (Grand Mont). Scale bars = 5 mm. Credits = P. Loubry (MNHN/CNRS).

Description

Shell medium in size, fusiform, rather elongated. Seven rather angular whorls. Spiral angle of 39°. Suture deep and linear. Four to five (in dorsal view = one half whorl) varicose protruding ribs, marking the periphery of whorls. On spire, subsutural ramp extending to middle of whorl with one or two small threads.

Remarks

The sculpture of varicose protruding ribs, marking the periphery of the whorls, is found in some Turridae or Aporrhaidae J.E. Gray, 1850.

Caenogastropoda indet. 6 (?turrid/aporrhaid shape)
Fig. 15F

Material examined

FRANCE – **Marne** • 1 spec.; Bergères-lès-Vertus (Mont Aimé), sandy limestone with shell concentrations; MMM coll.; MNHN.F.C02679.

Measurements

H (incomplete apex and siphonal canal broken): 10 mm, D: 4.9 mm.

Description

Shell medium in size, fusiform, moderately elongated. Five subcarinate whorls preserved. On spire, subsutural ramp extending to middle of whorl. Spiral angle of 33°. Suture shallow and linear. Five–six ribs on spire and eight on last whorl (in dorsal view = one half whorl). Ribs low, slightly nodulose on periphery; abapically to periphery, small pleurotomoid sinus and prosocyrt outline until base; adapically to periphery, ribs connected to a subsutural spiral row of small nodules, well visible on last whorl. Convex part of whorl and base of whorl lacking spiral sculpture.

Remarks

This shell called Caenogastropoda indet. 6 differs from that of Caenogastropoda indet. 5 in having a shorter shape, lower ribs, a subsutural row of small nodules and in lacking a spiral sculpture.

Caenogastropoda indet. 7 (?turrid/aporrhaid shape)
Fig. 15G

Material examined (2 specs)

FRANCE – **Marne** • 1 spec.; Vertus (Grand Mont), sandy limestone; MMM coll.; MNHN.F.C02680 • 1 spec.; Bergères-lès-Vertus (Mont Aimé); sandy limestone with carditid imprints; MMM coll.; MNHN.F.C02681.

Measurements

MNHN.F.C02680, H (apex and base incomplete): 9 mm, D: 6 mm. MNHN.F.C02681, H (apex and base incomplete): 11.1 mm, D: 5.9 mm.

Description

Shell small, fusiform, moderately elongated. Four subcarinate whorls preserved including part of last whorl. On spire, subsutural ramp extending to middle part of whorl. Spiral angle of 37°. Suture shallow and linear. Five-six ribs on spire and six on last whorl (in dorsal view = one half whorl). Ribs low,

slightly nodulose on periphery; abapically to periphery, ribs with prosocyrt outline until base; adapically to periphery, ribs connected to suture by oblique striae, well visible on last whorl. Spiral sculpture with delicate threads of subsutural ramp and convex part of whorl.

Remarks

These two other specimens resemble Caenogastropoda indet. 6, but differ in having a spiral sculpture of delicate threads on their whorls and in lacking a subsutural row of small nodules. Their characters likely correspond to another species.

Class Bivalvia Linnaeus, 1758
Infraclass Protobranchia Pelseneer, 1889
Order Nuculida Dall, 1889
Superfamily Nuculoidea Gray, 1824
Family Nuculidae Gray, 1824

Genus ***Nucula*** Lamarck, 1799

Type species

Arca nucleus Linnaeus, 1758 type by monotypy. Present day, North east Atlantic, Mediterranean and West Africa.

Stratigraphic range of the genus

Late Cretaceous to present day, cosmopolite (Cox *et al.* 1969).

Nucula bauti sp. nov.
urn:lsid:zoobank.org:act:CBFA3580-162E-47E4-AEF5-C015E2A55BA0
Fig. 16A–D

Nucula sp. – Merle 2023: 25.

Etymology

Dedicated to Jean-Paul Baut who actively participated in the fieltrip in July 2017.

Type locality

Vertus (Grand Mont), Marne, France.

Type horizon

Sandy limestone of Vertus, Maastrichtian.

Type material

Holotype
FRANCE – **Marne** • RV, IF; Vertus (Grand Mont), sandy limestone; MMM coll.; Fig. 16A; MNHN.F.C02688.

Paratypes (4 specs)
FRANCE – **Marne** • 1 spec., LV, IF; same data as for holotype; MMM coll.; Fig. 16B; MNHN.F.C02689 • 1 spec., EF in anatomical connection and RV visible; same data as for holotype; MMM coll.; Fig. 16C; MNHN.F.C02701 • 1 spec., EF in anatomical connection and RV visible; same data as for holotype; MMM coll.; Fig. 16D; MNHN.F.C02702 • 1 spec., internal mould; same data as for holotype; MMM coll.; MNHN.F.C02703.

Measurements

Holotype, DVL: 5.8 mm; APL: 8 mm. MNHN.F.C02701, DVL, 6 mm; APL: 7 mm. Paratype MNHN.F.C02702, DVL: 7.8 mm; APL: 10.2 mm.

Description

Subequilateral shell, anterior area rather elongate. Dorsal margin moderately curved, slightly convex; anterior margin rounded. Ventral margin wide and convex; postero-ventral margin angular and dorsal margin almost straight, slightly concave near beak. Fine crenulations on ventral edge. Posterior muscle scar ovoid; anterior scar not visible. Pallial line apparently without sinus. Posterior hinge plate short bearing nine strong teeth with rectangular cross-section projecting vertically from hinge. Anterior hinge plate slightly convex with 15–18 teeth arranged similarly to those of anterior part of hinge. Chondrophore elongated situated in line with anterior hinge teeth.

Comparisons

In *Nucula bauti* sp. nov., an elongated chondrophore situated in line with the anterior hinge teeth is reminiscent of that of the Liassic species *Nucula subovalis* Goldfuss, 1837 (Goldfuss 1837: pl. 25 fig. 19). *Nucula subovalis* seems differ by having more teeth (24–25) on the anterior hinge plate and on the posterior hinge plate (11). *Nucula bauti* displays a less rounded shape and more teeth than the Danish Maastrichtian species *Nucula* (*Nucula*) aff. *truncata* Nilsson, 1827 presented by Heinberg (1989: fig. 1). *Nucula truncata* is also known in the Maastrichtian of Poland (Abdel Gawad 1986: pl. 25 figs 1–2), but the figured specimens are two poorly preserved internal moulds and don't allow a reliable comparison. *Nucula montensis* Cossmann, 1908, from the Danian of Mons (Belgium), resembles *Nucula bauti* in its elongate chondrophore and in the number of teeth (8–9) on the posterior hinge. However, *N. bauti* differs by having fewer teeth (more than 15–18 instead of 25) on the anterior hinge which are less close set near the umbo, by a ventral margin more rounded and by a less angular postero-ventral margin (see Glibert & van de Poel 1973: pl. 1 fig. 1). Despite the limited number of specimens available, the characters of *N. bauti* differ sufficiently from stratigraphically close species for it to be considered new.

Stratigraphic range

Maastrichtian: Marne, France.

Subclass Autobranchia Grobben, 1894
Infraclass Pteriomorphia Beurlen, 1944
Order Arcida Stoliczka, 1871
Superfamily Arcoidea Lamarck, 1809
Family Arcidae Lamarck, 1809

Genus ***Arca*** Linnaeus, 1758

Type species

Arca noae Linnaeus, 1758 by subsequent designation Opinion 189 (ICZN 1945). Present day, North east Atlantic (North Sea to Portugal), Mediterranean and West Africa until Angola.

Subgenus ***Arca*** Linnaeus, 1758

Note

MolluscaBase recognises several subgenera within the genus *Arca*. See MolluscaBase - Arca Linnaeus, 1758

Stratigraphic range of the subgenus

Late Cretaceous to present day, cosmopolitan in warm seas (Cox *et al.* 1969).

Arca* (s. str.) *submontensis sp. nov.
urn:lsid:zoobank.org:act:AEEFF7B0-A754-43A3-A785-004236B69C19
Fig. 16E–H

Arca (*s.s.*) sp. – Merle & Pacaud 2018a: 172, fig. 157a. — Merle 2023: 25.

?*Arca montensis* – Chavan 1948: 566 (non *Arca montensis* Cossmann, 1908).

Etymology

Name formed by the Latin prefix '*sub*' ('under') and '*montensis*' to show the affinities with *Arca montensis* Cossmann, 1908 from the Danian of Mons.

Type locality

Bergères-lès-Vertus (Mont Aimé), Marne, France.

Type horizon

Sandy limestone with shell concentrations, Maastrichtian.

Type material

Holotype
FRANCE – **Marne** • RV, EF; Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; MMM coll.; Fig. 16E–F; MNHN.F.C02690.

Paratypes (2 specs)
FRANCE – **Marne** • 1 spec., RV, IF; same data as for holotype; MMM coll.; figured in Merle & Pacaud (2018a: fig. 157a) and herein Fig. 16G; MNHN.F.A66760 • 1 spec., LV, EF; Vertus (Grand Mont); sandy limestone; Fig. 16H; MNHN.F.C02691.

Measurements

Holotype, DVL: 5.5 mm; APL: 13.5 mm. Paratype MNHN.F.C02691, DVL: 7 mm, APL: 16.5 mm.

Description

Shell medium in size, convex, angular dorsally and inaequilateral. Anterior margin curved and smoothly passing into ventral margin, but meets straight hinge line at a nearly 90º angle. Ventral margin curved near anterior margin, slightly concave in central part and slightly convex near posterior margin. Posterior margin angular, almost perpendicular to hinge and delineated by transverse ridge starting from umbo flexure. Beaks high, inclined anteriorly. Shell surface covered with around 50 fine riblets on antero-ventral margin, 5–6 finer riblets crossed by small growth lamellae on posterior ridge and 14–15 riblets on posterior margin. Riblets giving cancellate sculpture in combination with commarginal lines. Ligamental area wide, assymmetrical and low triangular in shape. Teeth small in middle part, but clearly elongate at posterior margin.

Comparisons

From the bed with shell concentrations of Mont Aimé, Chavan (1948) cited, but without figure, *Arca montensis* Cossmann, 1908, a species known from the Montian of Mons. Merle & Pacaud (2018a) presented from the same bed one valve in internal face, which was difficult to identify and called it *Arca* (s. str.) sp. New field research conducted in 2017 led to the discovery of other, better-preserved specimens, allowing for more accurate descriptions and precise comparisons with other species of *Arca*. *Arca* (s. str.) *submontensis* sp. nov. clearly differs from *Arca* (s. str.) *ernae* Heinberg, 1978, from Danish

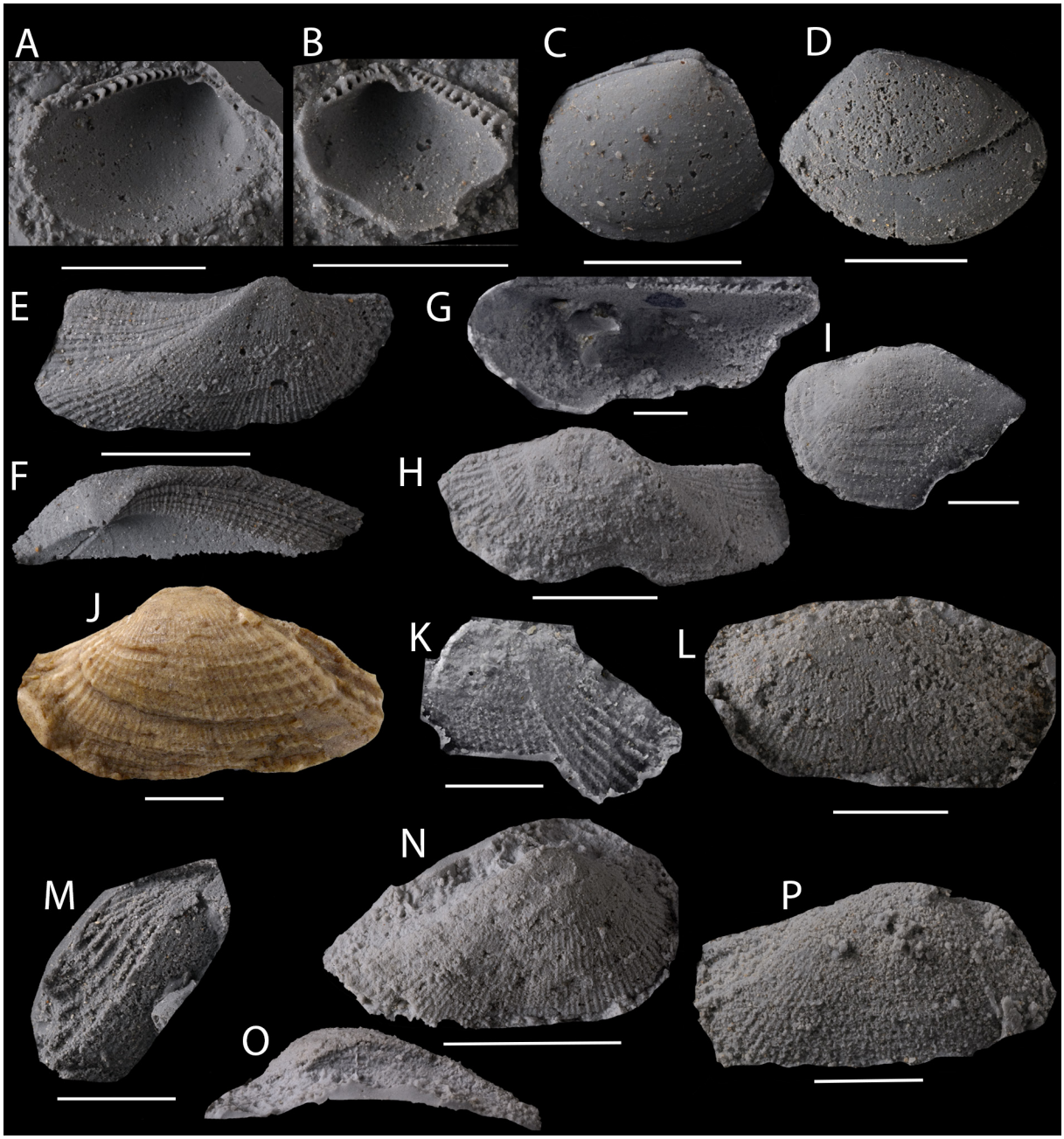

Fig. 16. Bivalvia Linnaeus, 1758 (Nuculoidea Gray, 1824 and Arcoidea Lamarck, 1809) from the Maastrichtian of the Paris Basin. **A–D**. *Nucula bauti* sp. nov. **A**. Holotype MNHN.F.C02688 (RV, IF), VGM. **B**. Paratype MNHN.F.C02689 (LV, IF), VGM. **C**. Paratype MNHN.F.C02701 (LV, EF), VGM. **D**. MNHN.F.C02702 (RV, EF), VGM. — **E–H**. *Arca* (s. str.) *submontensis* sp. nov. **E–F**. Holotype MNHN.F.C02690 (RV, EF), MA. **G**. Paratype MNHN.F.A66760 (RV, IF), MA. **H**. Paratype MNHN.F.C02691 (LV, EF), VGM. — **I**. *Barbatia* sp., MNHN.F.A66762 (LV, EF), MA. — **J–P**. *Cucullaearca supracretacea* (d'Orbigny, 1850). **J**. MNHN.F.C02692 (LV, EF), VF. **K**. MNHN.F.A66761 (fragment of LF, EF), MA. **L**. MNHN.F.C02693 (LV, EF), MA. **M**. MNHN.F.C02694 (fragment of RV, EF), VGM. **N–O**. MNHN.F.C02695 (RV, EF), VGM. **P**. MNHN.F.C02697 (RV, EF), VGM. Localities: MA = Bergères-lès-Vertus (Mont Aimé); VF = Vertus (Faloise); VGM = Vertus (Grand Mont). Scale bars = 5 mm. Credits = P. Loubry (MNHN/CNRS).

Maastrichtian in having a larger size, a lower ligamentary area, a less prominent posterior ridge and weaker ribs.

The external morphology of *Barbatia hennigi* Heinberg, 1978 sensu Abdel Gawad (1986: pl. 26 fig. 4) from the Maastrichtian of Poland is somewhat reminiscent of that of *A.* (s. str.) *submontensis* sp. nov., but the hinge of the type specimen of *B. heninigi* from the Danish Maastrichtian is not straight like that of *Arca* and is very similar to that of a *Barbatia* E. Gray, 1842. The shape, the size and the riblets of *Arca* (s. str.) *montensis* Cossmann, 1908 from the Danian recall more *Arca* (s. str.) *submontensis* and these two species seem closely related. The antero-ventral margin of *A.* (s. str.) *montensis* bears around 50–60 riblets in specimens from the Danian of Mons (see Glibert & van de Poel 1973: pl. 1 fig. 5) and from the Danian of the Paris Basin (see Pacaud 2018a: fig. 231f) as it does in *Arca* (s. str.) *submontensis*. The posterior margin is also very similar with around 15 riblets in the Danian from the Paris Basin and 10–11 in the Danian from Mons Basin. However, a space with 5–6 finer riblets crossed by small growth lamellae on posterior ridge is missing in *A.* (s. str.) *montensis*. In addition, the anterior margin is oblique in *A.* (s. str.) *submontensis*, whereas it is almost perpendicular to the line of the hinge in *A.* (s. str.) *montensis*. In addition, the posterior margin is is almost perpendicular to the line of the hinge in *A.* (s. str.) *submontensis* whereas it is slightly oblique in *A.* (s. str.) *montensis*.

Stratigraphic range

Maastrichtian: Marne, France.

Genus ***Barbatia*** E. Gray, 1842

Type species

Arca barbata Linnaeus, 1758 by subsequent designation (Gray 1847). Present day, Northeastern Atlantic (Portugal to Morocco) and Mediterranean Sea.

Stratigraphic range of the genus

Triassic, Jurassic to present day, cosmopolite (Cox *et al.* 1969).

Barbatia sp.
Fig. 16I

Barbatia sp. – Merle & Pacaud 2018a: 172, fig. 157d. — Merle 2023: 25.

Material examined

FRANCE – **Marne** • 1 spec., LV, EF; Bergères-lès-Vertus (Mont Aimé); MMM coll.; figured in Merle & Pacaud (2018a: fig. 157d); MNHN.F.A66762.

Measurements

DVL: 15 mm; APL (posterior magin broken): 23.5 mm.

Description

Shell medium in size large, low and with convex outline. Anterior margin rounded and smoothly passing into ventral margin. Ventral margin rounded near anterior margin. Posterior margin not visible. Shell surface covered with around 10 weak riblets on anterior margin and 30 on ventral margin. Near posterior margin no visible riblets. Riblets crossed by commarginal lines and more weaker on dorsal area than on ventral area.

Remarks

No new specimens of this arcid have been collected since the paper of Merle & Pacaud (2018a). Among the Maastrichtian arcids from Marne, *Barbatia* sp. cannot be confused with *Arca* (s. str.) *submontensis* sp. nov. which displays more prominent riblets and a very angular posterior margin (Fig. 16C–F). It is also easily distinguished from *Cucullearca supracretacea* (d'Orbigny, 1850), which bears stronger ribs (Fig. 16H–N) and a posterior carina. *Barbatia* sp. differs from *B. forchammeri* (Lundgren, 1888) from the Maastrichtian of Stevns Klint (Denmark) by having weaker ribs (see Heinberg 1978: 107, fig. 3). Compared to *Barbatia gravesi* (d'Orbigny, 1850) from the Danian of the Paris Basin (see the syntype in Pacaud 2018a: fig. 199e), *Barbatia* sp. has higher ribs that are significantly fewer, crossed by lamellar concentric ribs. *Barbatia* sp. has ribs that are significantly less numerous than in *Barbatia dejeari* Glibert & van de Poel (1973) from the Danian of Mons. *Barbatia rutoti* Cossmann, 1908 from the same locality resembles more *Barbatia* sp. in having riblets that are weaker on the dorsal area than on the ventral area.

Genus ***Cucullaearca*** Conrad, 1865

Type species

Byssoarca lima Conrad, 1847, accepted as *Cucullaearca cuculloides* (Conrad, 1833), by subsequent designation (Stoliczka 1871). Late Eocene (Priabonian) to Early Oligocene (Rupelian), Mississippi (USA).

Stratigraphic range of the genus

Late Cretaceous to present day, cosmopolite in warm seas (Cox *et al.* 1969; El Qot 2006).

Cucullaearca supracretacea (d'Orbigny, 1850)
Fig. 16J–P

Arca supracretacea d'Orbigny, 1850: 131, n°38.

Cucullaearca supracretacea – Pacaud *et al.* 2000: 872, fig. 2.12. — Merle & Pacaud 2018a: 172, fig. 157b–c; 2018b: 320, fig. 231j–m. — Pacaud 2018a: 253, 256, fig. 199a–b. — Merle 2023: 25.

Type material

Syntypes

FRANCE – **Yvelines** • 1 spec., VG, EF; Montainville (Pont de Falaise); Danian; A. d'Orbigny coll.; figured in Pacaud (2018a: 256, fig. 199a); MNHN.F.R63244. – **Val d'Oise** • 1 spec., VG, EF; Vigny; Danian; A. d'Orbigny coll.; figured in Pacaud (2018a: 256, fig. 199b); MNHN.F.A53498.

Type locality

Montainville (Pont de Falaise), Danian coral bed; Yvelines, France.

Other material (7 specs)

FRANCE – **Marne** • 1 spec., historical cast, LV, EF; Vertus (Faloise); Ch. d'Orbigny coll., ex n°GG. gg2005/6523; figured in Merle & Pacaud (2018a: fig. 157b) and herein Fig 16J; MNHN.F.C02692 • 1 spec., fragment of RV, EF; Vertus (Grand Mont); sandy limestone; MMM coll.; Fig. 16M; MNHN.F.C02694 • 1 spec., RV, EF; same data as for preceding; MMM coll.; Fig. 16N-O; MNHN.F.C02695 • 1 spec., LV, EF; same data as for preceding; MMM coll.; Fig. 16P; MNHN.F.C02696 • 1 spec., LV, EF; Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; MMM coll.; figured in Merle & Pacaud (2018a: fig. 157c) and herein Fig. 16K; MNHN.F.A66761 • 1 spec., LV, EF; same data as for preceding; MMM coll.; Fig. 16L; MNHN.F.C02693 • 1 spec., LV, EV; same data as for preceding; MMM coll.; MNHN.F.C02697.

Measurements

MNHN.F.C02692 (LV), DVL: 21 mm; APL: 12 mm. MNHN.F.C02693 (LV), DVL: 18 mm; APL: 9.5 mm. MNHN.F.C02695 (RV), DVL: 14 mm; APL: 7.5 mm. MNHN.F.C02697 (RV), APL: 25 mm, DVL: 15.2 mm. Other specimens incomplete.

Description

Shell medium in size, subtriangular and inaequilateral. Anterior margin curved delineated by a small ridge and smoothly passing into ventral margin. Ventral margin curved near anterior margin, and rather straight until posterior margin. Posterior margin angular, oblique to hinge and delineated by transverse ridge starting from the umbo flexure. Beaks high, inclined anteriorly. Shell surface covered with around 7–8 riblets on anterior margin, around 30–40 on ventral margin and 6–8 on posterior margin. Riblets more prominent on posterior and anterior margins than on ventral margin and giving cancellate sculpture in combination with commarginal lines. Ligamental area wide, assymmetrical and low in shape.

Remarks

Merle & Pacaud (2018a) presented two specimens and attributed them to *Cucullaearca supracretacea* from the Danian of the Paris Basin. New specimens collected in 2017 have enabled its description to be completed. The radial sculpture of the Maastrichtian specimens is very similar to that of the Danian specimens (particularly specimen MNHN.F.A53498 figured by Pacaud (2018a: fig. 199b)) and displays the same pattern with riblets more prominent, fewer on posterior and anterior margins than on ventral margin and a prominent transverse ridge starting from the umbo flexure. These similarities, based on more significant material, validate the specific attribution made by Merle & Pacaud (2018a).

Stratigraphic range

Maastrichtian to Danian, Paris Basin, France.

Order Limida Moore, 1952
Superfamily Limoidea Rafinesque, 1815
Family Limidae Rafinesque, 1815

Genus ***Ctenoides*** Mörch, 1853

Type species

Ostrea scabra Born, 1778 by subsequent designation (Stoliczka 1871). Present day, North Carolina (USA), Florida (USA), Caribbean and Venezuela to North Brazil.

Stratigraphic range of the genus

Late Jurassic to present day, cosomopolitan (Cox *et al.* 1969).

Ctenoides vogeli Dhondt, 1983
Fig. 17A–C

Inoceramus nobilis Münster in Goldfuss, 1835: 117, pl. 113 fig. 3 (non *Inoceramus nobilis* Münster in Goldfuss 1835: 109, pl. 109 fig. 4).
?*Ctenoides vogeli* Dhondt, 1983: 3, pl. 1 figs 1, 4 (new name for *Inoceramus nobilis* Münster in Goldfuss 1835: pl. 113, fig. 3).

Lima nobilis – Bosquet 1860: 384. — Vogel 1895: fig. 12.
Acesta tecta – Merle & Pacaud 2018a: 174, fig. 158c–d. — Merle 2023: 25 (non *Lima tecta* Goldfuss, 1835).

Non *Lima tecta* – Munier-Chalmas 1897: 83.
Non *Lima texta* – Combes 1908: 14. Error of spelling for *Lima tecta* Goldfuss, 1835.

Type material (not examined)

As the type material of *Inoceramus nobilis* was destroyed during the 1939–45 war, Dhondt (1983: 3) designated a neotype n° ST13550 (Naturalis, Leiden) using a specimen illustrated by Vogel (1895: 183, fig. 12). In addition, Dhondt (1983) stated that Goldfuss (1835) considered two different species under the binome *Inoceramus nobilis*, one from the German Liassic of Falkenhagen (Goldfuss 1835: 109, pl. 9 fig. 4) and the other from the Maastrichtian of Sint Pietersberg (Goldfuss 1835: 117, pl. 113 fig. 3). Dhondt (1983) designated clearly a neotype for *Inoceramus nobilis* from the Maastrichtian, species for which she gave a new name *Ctenoides vogeli*. Therefore, this neotype should rather be considered the holotype of *Ctenoides vogeli* in order to fully meet with the recommandation 73A (designation of holotype) of the ICZN (1999).

Type locality

Sint Pietersberg near Maastricht, Limburg, The Netherlands.

Type horizon

"*E creta tophina*" ("Tuffkreide"), Late Maastrichtian.

Material examined (4 specs)

FRANCE – **Marne** • 1 spec., RV, IF; Vertus (probably Faloise); MNHN coll.; figured in Merle & Pacaud (2018a: fig. 158c) and herein Fig. 17B; MNHN.F.A66773 • 1 spec., IF, RV; same data as for preceding; Hébert coll.; Fig. 17C; SU.PAL.2017.0.13.290 • 1 spec., IF, LV; Vertus (Faloise); Hébert coll.; SU.PAL.2017.0.13.291 • 1 spec., EF, **?**RV; same data as for preceding; Hébert coll.; figured in Merle & Pacaud (2018a: fig. 158d) and herein Fig.17A; UPMC.PAL.2017.0.18.

Measurements

MNHN.F.A66773, DVL: 77 mm, APL: 56 mm. UPMC.PAL.2017.0.18, DVL: 62 mm, APL: 48 mm. Other specimens incomplete.

Description

Moderately large shell, slightly opisthocline, large compressed and biauricular. Umbonal angle 64–70°. Lamellar concentric sculpture more developed at end of growth. Around 25 concentric lamellae more or less aequally spaced. No radial sculpture. Auriculae and hinge poorly preserved. No prismatic shell structure.

Remarks

Munier-Chalmas (1897) and Combes (1908) also identified this species, as *Lima tecta* Goldfuss, 1835 at the Bois d'Esmans. Merle & Pacaud (2018a) used this name following the label given by Hébert in the UPMC collection. According to Dhondt (1983), *Ctenoides vogeli* has many similarities (particularly concentric lamellae) to Cretaceous limids generally classified as *Ctenoides*, such as *Lima tecta* Goldfuss, 1835. However, *Ctenoides tecta* displays numerous and delicate radial ribs, whereas *Ctenoides vogeli* is devoid of radial ribs and bears only concentric lamellae (see Dhondt 1983: pl. 1). As the studied specimens have only concentric lamellae and are fairly identical to *Ctenoides vogeli* regarding the other characters of the shell, their attribution to this species rather than to ?*C. tecta* is more justified.

Stratigraphic range

Maastrichtian: Marne, France; Limburg, The Netherlands.

Order Mytilida A. Férussac, 1822
Superfamily Mytiloidea Rafinesque, 1815
Family Mytilidae Rafinesque, 1815
Subfamily Septiferinae Scarlato & Starobogatov, 1979

Genus ***Septifer*** Récluz, 1848

Type species

Mytilus bilocularis Linnaeus, 1758 by subsequent designation Stoliczka (1871: 366). Present day, Indo-Pacific from East and South Africa to Japan, Australia, New Caledonia and eastern Polynesia.

Stratigraphic range of the genus

Triassic to preseent day, tropical and subtropical seas (Cox *et al.* 1969).

?*Septifer* sp.
Fig. 17D

Material examined

FRANCE – **Marne** • 1 spec., RV, internal mould; Vertus (Grand Mont); basal biocalcarenite with pectinids; MMM coll.; MNHN.F.C02698.

Measurements

APL: 11 mm, DVL: 4.8 mm.

Description

Triangular mytiliform shell medium in size. Ventral margin rather straight, slightly twisted passing into anterior margin. Posterior margin moderaterly rounded, making a weak angle passing into dorsal margin. Dorsal margin straight. Umbonal angle 46°. Radial sculpture bearing 20 continuous ribs.

Remarks

This ornate shell resembles species of *Septifer*, but radial ribs have been invented so many times in Mytilidae and also in Modiolidae G. Termier & H. Termier, 1950. Therefore, more material is needed to validate this initial identification.

Family Mytilidae incertae sedis

Genus ***Lecompteus*** Van de Poel, 1959

Type species

Mytilus ornatus Münster, 1837 by original designation. Late Cretaceous (Maastrichtian), Northern Europe.

Stratigraphic range of the genus

Jurassic to Late Cretaceous (Maastrichtian), India, Europe (Cox *et al.* 1969).

Lecompteus ornatus (Münster in Goldfuss, 1837)
Fig. 17E–F

Mytilus ornatus Münster in Goldfuss, 1837: 171, pl. 129 fig. 8.

Modiola radiatula – Vogel 1895: 30, pl. 2 fig. 6–8 (non *Mytilus* (*Brachiodontes*) *radiatulus* Stoliczka, 1871).
Lecompteus ornatus – van de Poel 1959: 13.
Lecompteus aff. *radiatulus* – Jagt, van Rijsselt & van Rijsselt 2014: 192, fig. 4. — Merle & Pacaud 2018a: 172, fig. 157f–g.

Type material (not examined)

Not found, one specimen illustrated in Goldfuss (1837: pl. 129 fig. 8).

Type locality

Haldem (Germany)

Type horizon

Upper Campanian of Haldem subformation.

Material examined (2 specs)

FRANCE – **Marne** • 1 spec., RV, EF; Vertus (Faloise); MNHN coll.; figured in Merle & Pacaud (2018a: 172, fig. 157f) and herein Fig. 17E; MNHN.F.A66764 • 1 spec., LV, EF; same data as for preceding; MNHN coll.; figured in Merle & Pacaud (2018a: 172, fig. 157g) and herein Fig. 17F; MNHN.F.A66765.

Measurements

MNHN.F.A66764, APL (anterior area not preserved): 32 mm, DVL: 19.5 mm. MNHN.F.A66765, APL: 30.5 mm, DVL: 13.5 mm.

Description

Middle sized shell of mytiliform shape, slightly twisted anteriorly. Umbonal angle 19°. Inverse V-shaped ribs across entire shell. Around 20 ribs more prominent in dorsal area of shell. Internal face unknown.

Remarks

This mytiliform shell is reminiscent of *Lecompteus ornatus* from the upper Campanian of Westphalia in its typical inverse V-shaped ribs covering the entire shell. In addition, Vogel (1895) illustrated a comparable shell from the Maastrichtian of Sint Pietersberg (Limburg) that he identified as *Modiola radiatula* Stoliczka, 1871, originally described from the Late Cretaceous of India. More recently, Jagt *et al.* (2014: figs 3a, 4) illustrated well two well-preserved specimens from the Heidelberg Cement Group quarry (Maastrichtian, Meerssen Member) as *Lecompteus* aff. *radiatulus*. These shells, particularly the one in Figure 4, are so similar to those from Marne that there is no hesitation in considering them conspecific. *Lecompteus radiatula* (Stoliczka, 1871) comes from the Campanian-Maastrichtian of India (Ariyalur group [= Arrialoor group in Stoliczka], see Arkaprava *et al.* 2023). The figures given by Stoliczka (1871: pl. 23 figs 4, 6–7) illustrate shells that are very comparable to the European shells and it is difficult to know whether they belong to one or two different species. However, if they belong to the same species, *Mytilus ornatus* is senior and has the priority over *Mytilus* (*Brachiodontes*) *radiatulus* (Stoliczka, 1871). For this reason, the name *Lecompteus ornatus* is preferred to *Lecompteus radiatulus* for the European shells.

Stratigraphic range

Campanian: North Rhine-Westphalia, Germany. Maastrichtian: Limburg, The Netherlands; Marne, France.

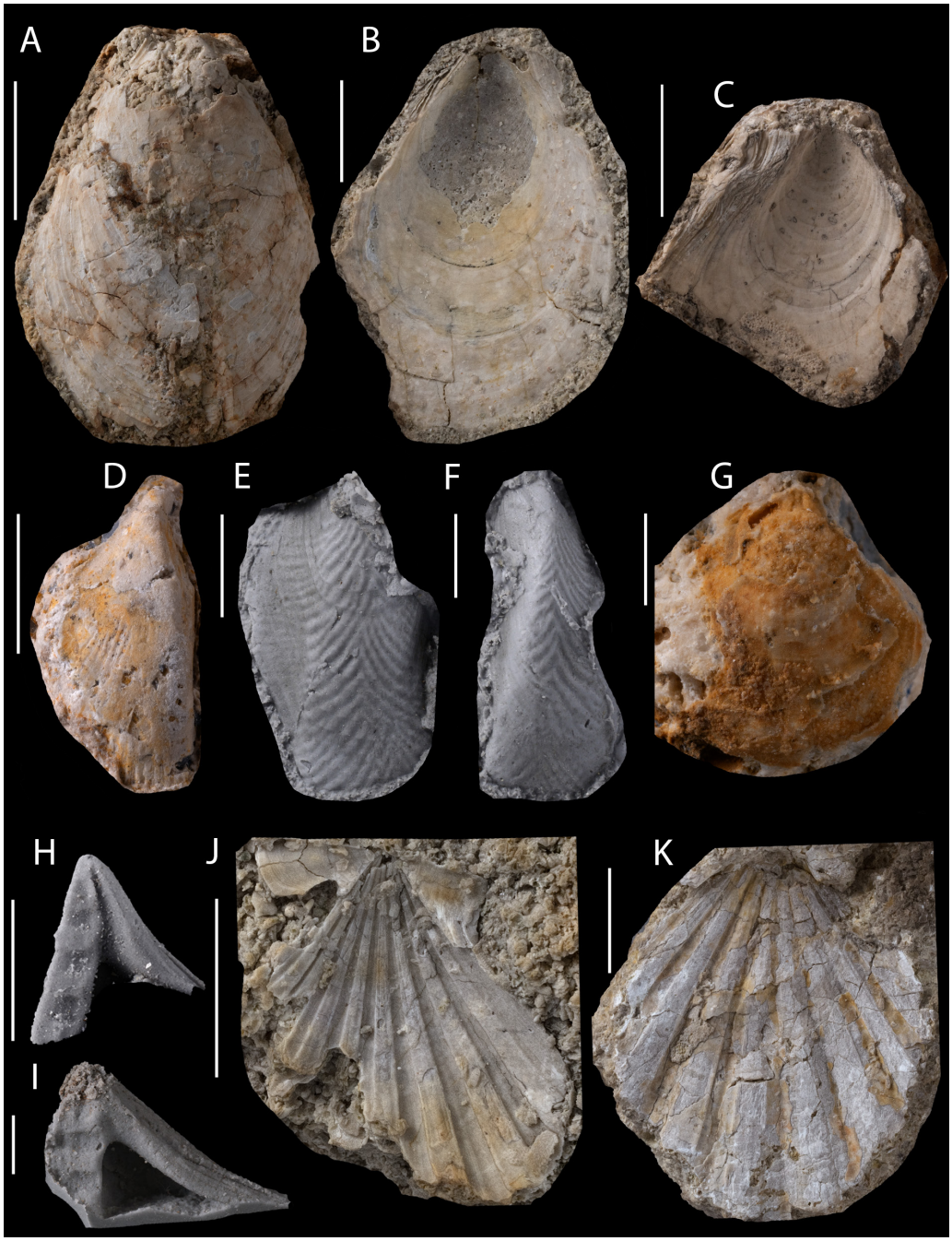

Fig. 17. Bivalvia Linnaeus, 1758 (Limoidea Rafinesque, 1815, Mytiloidea Rafinesque, 1815, Ostreoidea Rafinesque, 1815, Pterioidea Gray, 1847 and Pectinoidea Rafinesque, 1815) from the Maastrichtian of the Paris Basin. **A–C**. *Ctenoides vogeli* Dhont, 1983. **A**. UPMC.PAL.2017.0.18 (EF, ?RV), VF. **B**. MNHN.F.A66773 (IF, RV), ?VF. **C**. SU.PAL.2017.0.13.290 (IF, RV), VF. — **D**. ?*Septifer* sp., MNHN.F.C02698 (RV, internal mould), VGM. — **E–F**. *Lecompteus ornatus* (Münster in Goldfuss, 1837). **E**. MNHN.F.A66764 (RV, EF), VF. **F**. MNHN.F.A66765 (LV, EF). — **G**. ?Ostreoidea indet., MNHN.F.C02699 (LV, EF), MA. — **H–I**. *Isognomon* sp. **H**. MNHN.F.A66763 (LV, IF), MA. **I**. MNHN.F.C02700 (LV, IF), MA. — **J–K**. *Lyropecten ternatus* (Münster in Goldfuss, 1833). **J**. MNHN.F.A66768 (RV, IF), VF. **K**. MNHN.F.A66769 (RV, IF), VF. Localities: MA = Bergères-lès-Vertus (Mont Aimé); VF = Vertus (Faloise); VGM = Vertus (Grand Mont). Scale bars: A–C = 20 mm; D, H–I = 5 mm; E–G, J–K = 10 mm. Credits = P. Loubry (MNHN/CNRS).

Order Ostreida A. Férussac, 1822
Superfamily Ostreoidea Rafinesque, 1815

?Ostreoidea indet.
Fig. 17G

Ostreoidea indet. – Merle 2023: 25.

Material examined

FRANCE – **Marne** • 1 spec., LV, EF; Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; MMM coll.; MNHN.F.C02699.

Measurements

H: 21 mm; D: 21.5 mm.

Description

Shell partially epigenised. Convex shell with triangular outline dorsally and rounded ventrally. Dorso-posterior area straight slightly concave, dorsal-anterior straight slightly convex. Five fairly spaced concentric lamellae bearing several weak irregular radial folds.

Remarks

This shell cannot be confused with specimens of *Chama* Linnaeus, 1758 which are present in the same beds but display denser concentric lamellae and lack radial folds. In addition, the aragonite shells of *Chama* are usually dissolved and only calcite shells are preserved in being more or less epigenised. Its concentric lamellae also resemble those of a specimen of *Amphidonte obliquata* (Pulteney, 1813) from the Cenomanian of Algeria (see Benyoucef *et al.* 2022: fig. 6a2), a species belonging to the family Gryphaeidae Vialov, 1936. Chavan (1948) reported another species of oyster, *Pycnodonte semiplana* (now attributed to the genus *Hyotissa* Stenzel, 1971), from Vertus on the basis of the material housed in Hébert's collection. However, *Hyotissa semiplana* bears stronger radial ribs. Moreover, the material of Hébert's collection is poorly preserved and it is difficult to validate this identification. While these shells cannot be identified at family rank, they are reminiscent of those of Ostreoidea.

Superfamily Pterioidea Gray, 1847
Family Isognomonidae Woodring, 1925

Genus ***Isognomon*** Lightfoot, 1786

Type species

Ostrea perna Linnaeus, 1767. Present day, Indo-West Pacific.

Stratigraphic range of the genus

Late Triassic to present day, cosmopolite (Cox *et al.* 1969).

Isognomon sp.
Fig. 17H–I

Isognomon sp. – Merle & Pacaud 2018a: 172, fig. 157e. — Merle 2023: 25.

Material examined (2 specs)

FRANCE – **Marne** • 1 spec., LV, IF; Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; MMM coll.; figured in Merle & Pacaud (2018a: 172, fig. 157E) and herein Fig. 17H; MNHN.F.A66763 • 1 spec., LV, IF; same data as for preceding; MMM coll.; Fig. 17I; MNHN.F.C02700.

Measurements

MNHN.F.A66763, H (hinge fragment): 7 mm. MNHN.F.C02700, H (hinge fragment): 10 mm.

Description

Umbo acute. Hinge incomplete. Ligamental area bearing two (MNHN.F.C02700) to four (MNHN.F.A66763) ligamental grooves. Grooves rectangular, moderately deep. External part of umbo smooth.

Remarks

The material is too fragmentary to allow identification at the species level, but the hinge is typical of *Isognomon*. This genus is present in the European Mesozoic (see Goldfuss 1833: 104, pl. 107) as well as in the northwestern European Danian (France and Belgium) with *Isognomon inaequicrenatus* (Cossmann, 1908).

Order Pectinida Gray, 1854
Superfamily Pectinoidea Rafinesque, 1815
Family Pectinidae Rafinesque, 1815
Subfamily Pectininae Rafinesque, 1815
Tribe Decatopectinini T.R. Waller, 1986

Genus ***Lyropecten*** Conrad, 1862

Type species

Pallium estrellatum Conrad, 1856 by subsequent designation (Dall 1898). Pliocene, California (USA).

Stratigraphic range of the genus

Early Cretaceous, Europe (Dhondt 1972) to present day.

Lyropecten ternatus (Münster in Goldfuss, 1833)
Fig. 17J–K

Pecten ternatus Münster in Goldfuss, 1833: 52, pl. 9, fig. 13.
Pecten cicatrisatus Münster in Goldfuss, 1833: 56, pl. 93 fig. 6a–b (junior subjective synonym).

Lyropecten (*Aequipecten* ?) *ternatus* – Dhondt 1972: 42, pl. II fig. 3a–b, pl. III fig. la–d.
Lyropecten ternatus – Niebuhr, Schneider & Wilmsen 2014: 121, fig. 8b, d, g–h.
Chlamys (*Lyropecten*) *cicatrisata* – Merle & Pacaud 2018a: 169, 173, fig. 157k–l.

For a complete synonymic list see Dhondt (1972: 42) and https://www.molluscabase.org/aphia.php?p=taxdetails&id=1667106

Type material (not examined)

Holotype or syntype, Bayerische Staatssammlung für Paläontologie und Geologie according to Dhondt (1972: 48).

Type locality

Schandau (Saxony).

Type horizon

Quader sandstein of Schandau (?Turonian), Germany.

Material examined (5 specs)

FRANCE – **Marne** • 1 spec., RV, IF; Vertus (Faloise); MNHN coll.; figured in Merle & Pacaud (2018a: 173, fig. 157k) and herein Fig. 17J; MNHN.F.A66768 • 1 spec., RV, IF; same data as for preceding; MNHN coll.; figured in Merle & Pacaud (2018a: 173, fig. 157l) and herein Fig. 17K; MNHN.F.A66769 • 3 specs (internal valves, 2 specs incomplete, 1 spec. subcomplete); same locality; Hébert coll.; SU.PAL.2017.0.13.292.1 to SU.PAL.2017.0.13.292.3.

Measurements

MNHN.F.A66768, H (anterior part incomplete): 32 mm, D: 28.5 mm. MNHN.F.A66769, H: 39 mm, D: 35 mm. UPMC.PAL, H: 30 mm, D: 31 mm.

Description

Right valve (internal face), shell rather wide. Umbonal angle 72°. 7–8 broad ribs with plane spaces between ribs. Auricles unequal and small. Anterior auricle: winglike and elongated; posterior auricle: triangular; acute to right angled. Byssal sinus deep.

Remarks

Merle & Pacaud (2018a) identified these specimens from Vertus as *Chlamys* (*Lyropecten*) *cicatrisata* (Goldfuss, 1833), a species originally described from Maastrichtian of Sint Pietersberg (Limburg). Although they consist solely of shells showing their internal faces, their shape and their 7–8 ribs are fairly typical of *Pecten cicatrisatus*. Following Dhondt (1972) and Niebuhr *et al.* (2014), *Pecten cicatrisatus* is considered to be a junior subjective synonym of *Pecten ternatus*.

Stratigraphic range

This species has a large European stratigraphic range from the Cenomanian to the Maastrichtian (Dhondt 1972). In the Maastrichtian, it has been recorded in Belgium, The Netherlands, Bulgaria and France (Manche), see Dhondt (1972). The Paris Basin is added.

Subfamily Pectininae incertae sedis

Genus ***Lyriochlamys*** Sobetski, 1977

Type species

Pecten fissicosta Etheridge, 1881 by original designation. Late Cretaceous (Cenomanian), Great Britain.

Stratigraphic range of the genus

Late Triassic (Rhetian) to Late Cretaceous (Maastrichtian according Waller & Marincovich 1992).

Lyriochlamys faujasii (Defrance, 1826)
Fig. 18A–D

Pecten faujasii Defrance, 1826: 265.

Chlamys faujasii – Dhondt 1973a: 6, pl. 1 fig. 2a–e
Lyriochlamys faujasii – Waller & Marincovich 1992: 223.
Chlamys dentata – Merle & Pacaud 2018a: 169, fig. 157i–j (non *Pecten dentatus* S. Nilsson, 1827: 20).

For a complete synonymic list see Dhondt (1973a: 6–8).

Type material (not examined)

The type material is based on Faujas's collection but this material is apparently lost (Dhondt 1973a: 8). However, Dhondt (1973a) stated that: "… it is not necessary to select a neotype: the figure in Faujas and the numerous topotypes leave no doubt as to the content of the species".

Type locality

Sint Pietersberg (Limburg), Maastrichtian.

Material examined (10 specs)

FRANCE – **Marne** • 1 spec., LV, IF; Vertus (Faloise); MNHN coll.; figured in Merle & Pacaud (2018a: 173, fig. 157i) and herein Fig. 18A; MNHN.F.A66766 • 1 spec., LV, IF; same data as for preceding; Hébert coll.; Fig. 18B; SU.PAL.2017.0.13.293 • 1 spec., EF, subcomplete RV, same data as for preceding; Hébert coll.; Fig. 18D; SU.PAL.2017.0.13.294 • 1 spec., EF, subcomplete LV, same data as for preceding; Hébert coll.; SU.PAL.2017.0.13.295 • 3 specs, EF incomplete; same data as for preceding; Hébert coll.; SU.PAL.2017.0.13.296.1 to SU.PAL.2017.0.13.296.3 • 1 spec., LV, EF; same data as for preceding; MNHN coll.; figured in Merle & Pacaud (2018a: 173, fig. 157j) and herein Fig. 18C; MNHN.F.A66767 • 1 spec., IF juv., incomplete; Vertus (Grand Mont); basal biocalcarenite with pectinids; MMM coll.; MNHN.F.C02704 • 1 spec., IF incomplete; same data as for preceding; MMM coll.; MNHN.F.C02705.

Measurements

MNHN.F.A66766, DVL: 41 mm, APL: 32.5 mm. MNHN.F.A66767, DVL: 34.2 mm, APL: 27.8.5 mm. SU.PAL.2017.0.13.293, DVL: 38 mm, APL: 31.5 mm. U.PAL.2017.0.13.294, DVL: 43 mm, APL: 33 mm. SU.PAL.2017.0.13.295 (LV), DVL: 31 mm, APL: 26 mm.

Description

Middle sized shell. Valves elongated, prosocline and flattened. Left valve with undivided 37–41 ribs, bipartite on extremities of anterior and posterior areas of ventral margin. Right valves with 40 ribs. Ribs most undivided, but irregularly bipartite near center of ventral margin. Close set scales on ribs, denser near dorsal area. Anterior auricle triangular acute-angled. Posterior auricle not seen, probably smaller.

Remarks

These shells were initially identified as *Pecten dentatus* S. Nilsson, 1827 by Hébert (in collection) and by Chavan (1948). Dhondt (1973a) reviewed the Pectinidae of this group and concluded that the differences between *Lyriochlamys dentata* (S. Nilsson, 1827) and *L. faujasii* are subtle. However, she mentioned that *L. dentata* differs from *L. faujasii* in having a higher radial rib number and more developed spines rather than scales. The specimens from Marne have between 37 and 41 ribs, which is more in line with the variation seen in *L. dentata*. On the other hand, the specimens from Marne have more scales than spines, as in *L. faujasii*. According to Dhondt (1973a), *L. dentata* became extinct in the Campanian, whereas *L. faujasii* persisted in the upper Maastrichtian. It therefore seems preferable to use provisionally the binome *L. faujasii* for the Paris Basin material.

Stratigraphic range

This species has a large European stratigraphic range from the Turonian to the Maastrichtian (Dhondt 1973a). In the Maastrichtian, it has been recorded in Belgium and The Netherlands, see Dhondt (1973a). The Paris Basin is added.

Family Neitheidae Sobetski, 1960

Genus ***Neithea*** Drouët, 1825

Type species

Pecten aequicostatus Lamarck, 1819 by subsequent designation (Dhondt 1973b: 7). Early Cretaceous (Albian) to Late Cretaceous (Turonian), Western Europe.

Stratigraphic range of the genus

Early Cretaceous to Late Cretaceous, cosmopolite (Cox *et al.* 1969).

Neithea regularis (Schlotheim, 1813)
Fig. 18E–F

Pectinites regularis Schlotheim, 1813: 112 (refers to an illustration in Faujas de Saint-Fond 1799: pl. 23 fig. 2).

Pecten (*Neithea*) *regularis* – Pervinquière 1912: 138.
Neithea regularis – Torriani 1942: 88, pl. 6 fig. 1 a–b. — Dhondt 1973b: 20, pl 1 fig. 3, pl. 2 fig. 1 a–d. — Merle & Pacaud 2018a: 169, fig. 157h.

For a detailed synonymic list, see Dhondt (1973b: 20–22).

Type material (not examined)

Syntype represented by Faujas de Saint-Fond (1799: pl. 23 fig. 2), see Dhondt (1973b). The material was originally deposited at the Muséum national d'Histoire naturelle, Paris, but is probably lost.

Type locality

Sint Pietersberg (Limburg), Maastrichtian.

Material examined (2 specs)

FRANCE – **Seine-et-Marne** • 1 spec., partial internal mould of a RV; Esmans (Bois d'Esmans); Hébert coll.; figured in Merle & Pacaud (2018a: 169, fig. 157h) and herein Fig. 18E; UPMC.PAL 2017.0.17 • 1 spec., LV, IF; same data as for preceding; Hébert coll.; Fig. 18F; SU.PAL.2017.0.13.297.

Measurements

UPMC.PAL2017.0.17, DVL: 57 mm; APL: 45 mm. SU.PAL.2017.0.13.297, DVL (umbonal part incomplete): 28 mm, APL: 34 mm.

Description

Right valve convex, equilateral. Umbonal angle 80°. Trace of around 20 distinct low ribs, probably more (25–30). Parts of preserved shell showing smooth ribs. Left valve flattened with 26 ribs. Ribs narrow. Intercalary ribs undistinguishable.

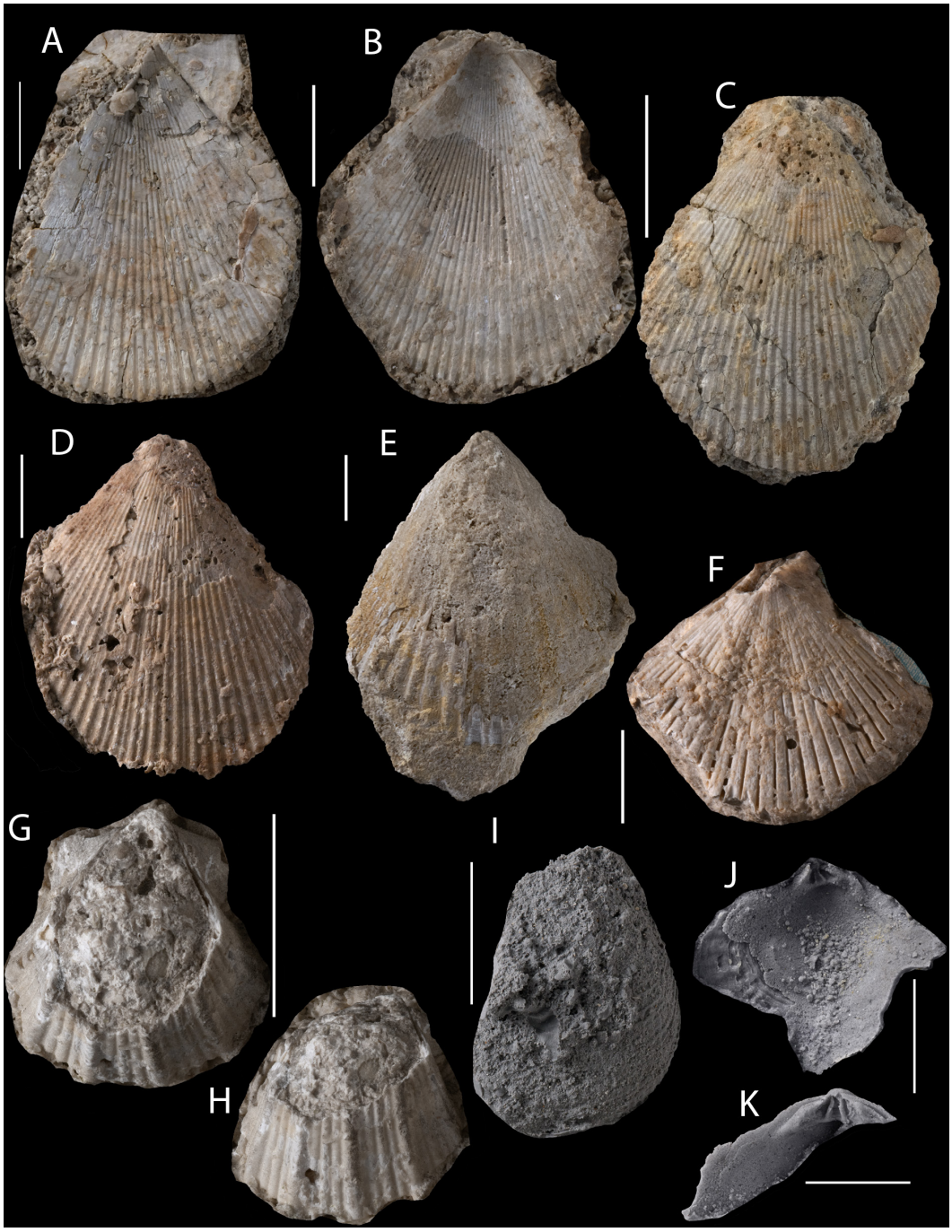

Fig. 18. Bivalvia Linnaeus, 1758 (Pectinoidea Rafinesque, 1815 and Plicatuloidea Gray, 1854) from the Maastrichtian of the Paris Basin. **A–D**. *Lyriochlamys faujasii* (Defrance, 1826). **A**. MNHN.F.A66766 (LV, IF), VF. **B**. SU.PAL.2017.0.13.293 (LV, IF), VF. **C**. MNHN.F.A66767 (LV, EF), VF. **D**. SU.PAL.2017.0.13.294 (RV, IF), VF. — **E–F**. *Neithea regularis* (Schlotheim, 1813). **E**. UPMC.PAL2017.0.17 (partial internal mold of RV, Hébert coll.), BE. **F**. SU.PAL.2017.0.13.297 (LV, IF), BE. — **G–H**. *Neithea quinquecostata* (J. Sowerby, 1814). **G**. SU.PAL.2017.0.13.298 (RV, EF), specimen in dorsal view, VF. **H**. same specimen in commissural view. — **I**. ?Spondylidae indet., MNHN.F.C02706 (EF), MA. — **J–K**. *Plicatula pacaudi* sp. nov. **J**. Paratype MNHN.F.A66771 (LV, IF), MA. **K**. Paratype MNHN.F.A66772 (hinge, LV), MA. Localities: MA = Bergères-lès-Vertus (Mont Aimé); VF = Vertus (Faloise). Scale bars = 10 mm. Credits = P. Loubry (MNHN/CNRS).

Remarks

Although it is not very well preserved, this pectinid convex valve is reminiscent of *Neithea regularis* in its shape, and its low and smooth ribs (see Dhondt 1973b). Moreover, the number and the shape of the ribs of the left valve are similar to specimens from Sint Pietersberg (Limburg) described by Dhondt (1973b).

Stratigraphic range

This species has a wide European stratigraphic range, from the Cenomanian to the Maastrichtian (Dhondt 1973b). In the Maastrichtian, it has been recorded in Belgium, The Netherlands, Bulgaria and France (Calcaire à *Baculites*, Manche), see Dhondt (1973b). The Maastrichtian of the Paris Paris is a new record for this species.

Neithea quinquecostata (J. Sowerby, 1814)
Fig. 18G–H

Pecten quinquecostatus J. Sowerby, 1814: 122, pl. 56 figs 4–8.

Janira quinquecostata – d'Orbigny 1847: pl. 444 figs 1–5.
Vola quinquecostata –Stoliczka 1871: 437, pl. 31 figs 1–6, pl. 37 figs 4–9.
Neithea quinquecostata – Bayle 1878: pl. 122 figs 2–3. — Dhondt 1973b: 29, pl. 2 fig. 2 a–c. — Merle & Pacaud 2018a: 167.

For a detailed synonymic list, see Dhondt (1973b: 29–32).

Type material (not examined)

Lectotype NHMUK n°43324 designated by Dhondt (1973b: 32).

Type locality

Chute (England), Greensand bed (lower Cenomanian).

Material examined

FRANCE – **Marne** • 1 spec., RV, EF; Vertus (Faloise); coll. Hébert; SU.PAL.2017.0.13.298.

Measurements

SU.PAL.2017.0.13.298, DVL: 18.5 mm, APL: 16.5 mm.

Description

Right valve. Convex valve, equilateral. Umbonal angle 72°. Six prominent ribs. Between a pair of prominent ribs, 3-4 intercalary ribs. Auricles triangular, slightly ornamented with fine riblets.

Remarks

Although the top of this right valve is damaged, its sculpture consisting of six ribs and 3–4 intercostal spaces is reminiscent of *Neithea quinquecostata* known from the Maastrichtian of Maastricht. *Neithea striatocostata* (Goldfuss, 1833) differs by less regular intercalary ribs (usually two). In addition, the ribs of *N. striatocostata* are always radially striated and this never occurs in *N. quinquecostata*.

Stratigraphic range

This species has a large European stratigraphic range from the Barremian to the Maastrichtian (Dhondt 1973b). In the Maastrichtian, it has been recorded in Belgium, The Netherlands and Bulgaria, see Dhondt (1973b). The Maastrichtian of the Paris is a new record.

Family Spondylidae J.E. Gray, 1826

?Spondylidae indet.
Fig. 18I

Spondylidae indet. – Merle 2023: 25.

Material examined

FRANCE – **Marne** • 1 spec., EF incomplete; Bergères-lès-Vertus (Mont Aimé), sandy limestone with shell concentrations; MMM coll.; MNHN.F.C02706.

Measurements

DVL (incomplete): 27 mm.

Description

Fragment of a convex shell (?cemented valve). Outline elongate dorso-ventrally with convex ventral margin. Surface with dense concentric lamellae (around 15 observed) crossed by delicate radial ribs between concentric lamellae.

Remarks

The shape and sculpture of this fragment are reminiscent of shells of Spondylidae. It does not appear to be a shell of *Plicatula* Lamarck, 1801, which is found in the same beds. The shells of *Plicatula* from Marne (see below) are flatter and bear a stronger radial sculpture.

Superfamily Plicatuloidea Gray, 1854
Family Plicatulidae Gray, 1854

Genus ***Plicatula*** Lamarck, 1801

Type species

Spondylus plicatus Linnaeus, 1764 by subsequent designation (F.C. Schmidt 1818). Present day, Red Sea, eastern Africa, Chagos Islands, Japan, China, Philippines, Indonesia and Australia.

Stratigraphic range of the genus

Middle Triassic (Ladinian) to present day, subtropical and tropical seas (Cox *et al.* 1969)

Plicatula pacaudi sp. nov.
urn:lsid:zoobank.org:act:BC5BECCA-0400-4833-A675-D631B3902036
Fig. 18J–K, 19A–D

Plicatula sp. – Merle & Pacaud 2018a: 174, fig. 158a–b. — Merle 2023: 25.

Etymology

Species dedicated to Jean-Michel Pacaud for his malacological work on Cenozoic molluscs.

Type locality

Bergères-lès-Vertus (Mont Aimé), Marne, France.

Type horizon

Sandy limestone with shell concentrations, Maastrichtian.

Material examined

Holotype

FRANCE – **Marne** • RV, EF; Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; MMM coll.; Fig. 19A a1–Ba1; MNHN.F.C02707.

Paratypes (12 specs)

FRANCE – **Marne** • 1 spec., RV, EF; same data as for holotype; MMM coll.; Fig. 19Aa2–Ba2; MNHN.F.C03009 • 1 spec., RV, EF; same data as for holotype; MMM coll.; Fig. 19Aa3; MNHN.F.C02987 • 1 spec., RV, EF; same data as for holotype; MMM coll.; Fig. 19A4; MNHN.F.C02988 • 1 spec., RV, IF, incomplete; same data as for holotype; MMM coll.; figured in Merle & Pacaud (2018a: 174, 158a) and herein Fig. 18J; MNHN.F.A66771 • 1 spec., RV, IF, incomplete; same data as for holotype; MMM coll.; figured in Merle & Pacaud (2018a: 174, fig. 158b) and herein Fig. 18K; MNHN.F.A66772 • 1 spec., ?LV, EF; same data as for holotype; MMM coll.; figured in Merle & Pacaud (2018a: 172, 157m); MNHN.F.A66770 • 1 spec., RV, EF; same data as for holotype; MMM coll.; Fig. 19C; MNHN.F.C02989 • 1 spec., RV, IF; same data as for holotype; MMM coll.; Fig. 19D; MNHN.F.C02990 • 1 spec., RV, EF; same data as for holotype; MMM coll.; MNHN.F.C02991 • 1 spec., RV, IF; same data as for holotype; MMM coll.; MNHN.F.C02992 • 1 spec., RV, EF; same data as for holotype; MMM coll.; MNHN.F.C02993 • 1 spec., RV, EF; same data as for holotype; MMM coll.; MNHN.F.C02994.

Measurements

Holotype MNHN.F.C02707, DVL: 18 mm, APL: 15 mm. Paratype MNHN.F.C03010, DVL: 20 mm, APL: 15 mm. Paratype MNHN.F.C02987, DVL: 17 mm, APL: 19.8 mm. Paratype MNHN.F.C02988, DLV: 20 mm, APL: 20 mm. Paratype MNHN.F.A66770, DVL: 19.7 mm, APL: 15.8 mm. Paratype MNHN.F.C02989, DVL: 20.2 mm, APL: 18 mm. Paratype MNHN.F.C02990, DVL: 20 mm, APL: 19.5 mm. Paratype MNHN.F.C02991, DVL: 18.8 mm, APL: 16.5 mm. Paratype MNHN.F.C02992, DVL: 14.5 mm, APL: 16.7 mm.

Description

Valves of medium size (DVL 20 mm), curved, ostreiform, moderately inaequilateral. Right valve convex, area of attachment in dorsal posterior beak region not visible. Numerous (between 45–55), very closely spaced, fine radial ribs with some intercalated in early growth stage; left valve flat, sculptured by numerous (around 50), closely spaced very fine radial ribs. At end of growth, radial ribs slightly tubular with numerous scales. Hinge well developed, cardinal area small with two teeth, lateral teeth larger, clearly diverging from the cardinal teeth.

Comparisons

Plicatula pacaudi sp. nov. can be easily distinguished from *P. megaera* (d'Orbigny 1850) from the Danian of the Paris Basin (see Merle & Pacaud: 2018b: fig. 232f–g) in having significantly thinner and more numerous radial ribs. *Plicatula megaera* resembles *P. cossmanni* Cossmann, 1887 from the Ypresian and *P. parisiensis* Deshayes, 1858 from the Lutetian (both from the Paris Basin) in its few ribs, its hinge strongly developed, its cardinal area very small with two reduced cardinal teeth and its lateral teeth larger, clearly parallel to the cardinal teeth. This type of hinge is similar to that of the type species of the genus (*P. plicata*), but differs from that of *P. pacaudi*, whose cardinal teeth are less reduced and whose lateral teeth are not parallel to the cardinal teeth, but divergent. A radial sculpture composed of numerous ribs more similar to that of *P. pacaudi* is found mainly in Cretaceous species such as *P. gurgitis* Pictet & Roux, 1852 from the Albian of Folkestone (see Woods 1901: pl. 25 figs 13–21), *P. batnensis*

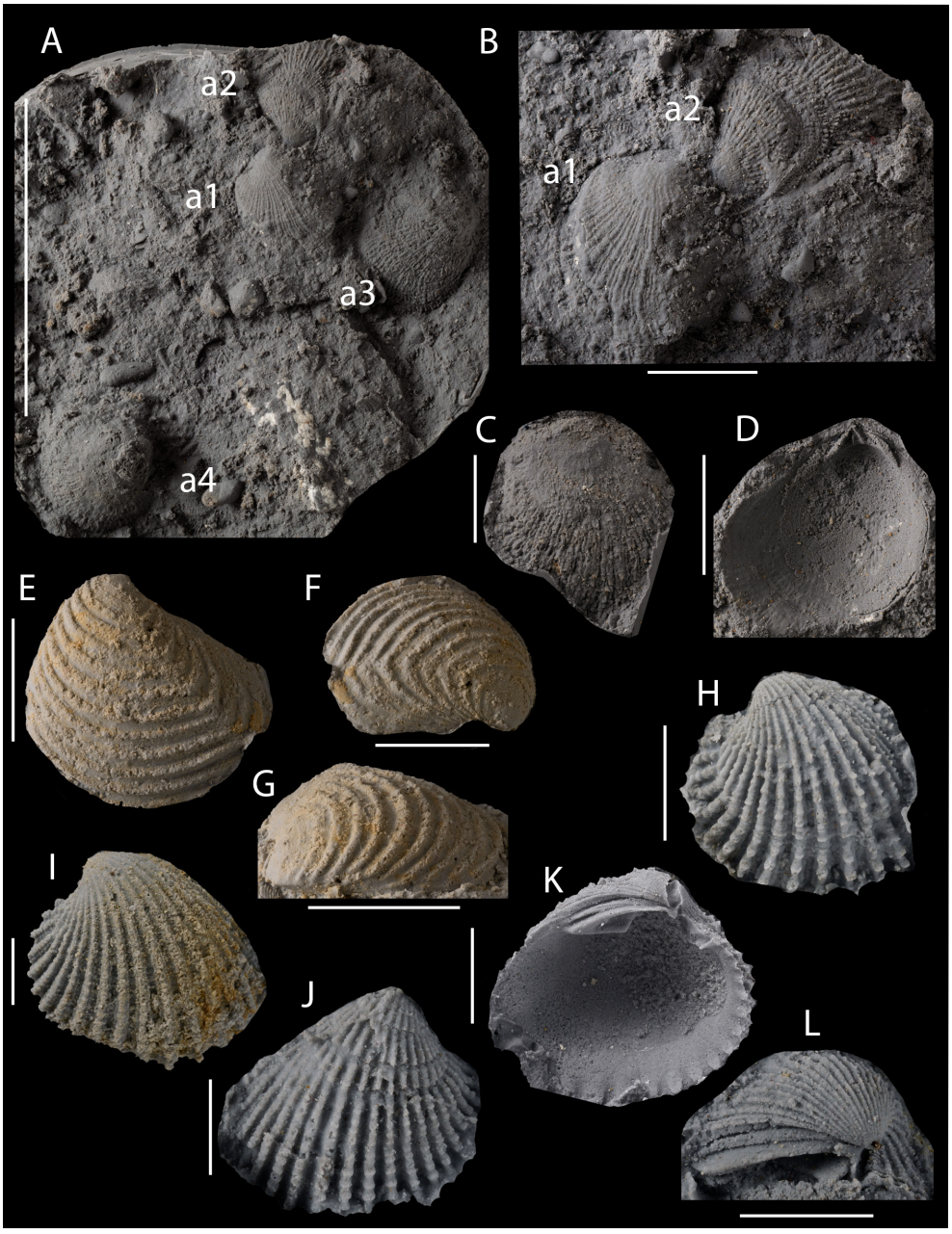

Fig. 19. Bivalvia Linnaeus, 1758 (Plicatuloidea Gray, 1854, Myophorelloidea T. Kobayashi, 1954 and Carditoidea A. Férussac, 1822) from the Maastrichtian of the Paris Basin. **A–D**. *Plicatula pacaudi* sp. nov. **A**. Sample of three specimens, holotype MNHN.F.C02707 (a1, RV, EF), paratype MNHN.F.C03009 (a2, RV, EF), paratype MNHN.F.C02987 (a3, RV, EF), paratype MNHN.F.C02988 (a4, RV, EF), MA. **B**. Holotype MNHN.F.C02707 (a1) and paratype MNHN.F.C03010 (a2), detailed view. **C**. Paratype MNHN.F.C02989 (RV, EF), MA. **D**. Paratype MNHN.F.C02990 (RV, IF), MA. — **E–G**. *Wolfgangella* cf. *neilpearti* Jagt, M.R. Cooper & Jagt-Yazykova, 2022. **E**. MNHN.F.C03010 (LV, EF), VGM. **F**. Same specimen in dorso-posterior view. **G**. Same specimen in anterior view. — **H–L**. *Baluchicardia hebertiana* (d'Orbigny, 1850). **H**. Lectotype MNHN.F.R63240 (LV, EF), Vertus. **I**. MNHN.F.A57133 (LV, EF), MA. **J**. Paralectotype MNHN.F.A57275 (RV, EF), Vertus. **K**. MNHN.F.A66778 (LV, IF), MA. **L**. MNHN.F.A57132 (LV, IF), MA, not Vertus as indicated in Pacaud & Merle (2016: 47). Localities: MA = Bergères-lès-Vertus (Mont Aimé); VGM = Vertus (Grand Mont). Scale bars: A = 50 mm; B–I, K–L = 10 mm; J = 5 mm. Credit = P. Loubry (MNHN/CNRS).

Coquand, 1880 from the upper Cenomanian of southern Algeria (see Benyoucef *et al.* 2022: fig. 10c–g), *P. hirsuta* Coquand, 1880 from the upper Cenomanian of southern Algeria (see Pervinquière 1912: pl. 10 fig. 12) and *P. ventilabrum* Coquand, 1880 from the Coniacian of Tunisia (see Pervinquière 1912: pl.10 fig. 7). *Plicatula simiensis* Squires & Saul, 1998 from the upper Paleocene of California also displays numerous (around 70) and fairly fine ribs and its shell outline also resembles that of *P. pacaudi*. These species, whose sculpture resembles that of *P. pacaudi*, have been illustrated without figure of their hinge, and therefore it is not known whether it is similar to that typical of *P. plicata* or *P. pacaudi*

Stratigraphic range

Maastrichtian: Marne, France.

Infraclass Heteroconchia J.E. Gray, 1854
Subterclass Paleoheterodonta Newell, 1965
Order Trigoniida Dall, 1889
Superfamily Myophorelloidea T. Kobayashi, 1954
Family Rutitrigoniidae van Hoepen, 1929
Subfamily Rutitrigoniinae van Hoepen, 1929

Genus ***Wolfgangella*** Jagt, M.R. Cooper & Jagt-Yazykova, 2022

Type species

Wolfgangella neilpearti Jagt, M.R. Cooper & Jagt-Yazykova, 2022 by original designation. Late Cretaceous (Maastrichtian), The Netherlands.

Stratigraphic range of the genus

Late Cretaceous (Maastrichtian), The Netherlands (Jagt *et al.* 2022) and Paris Basin (this work).

Wolfgangella* cf. *neilpearti Jagt, M.R. Cooper & Jagt-Yazykova, 2022
Fig. 19E–G

Type material of *Wolfgangella neilpearti*

Holotype (not examined)
THE NETHERLANDS – **Southern Limburg** • LV, EF; Sint-Pietersberg area; Meerssen Member (see Jagt *et al.* 2022: 21 for the type locality); NHMM 00381a.

Paratype (not examined)
THE NETHERLANDS – **Southern Limburg** • 1 spec., fragment of LV, EF and its internal mould; same data as for holotype; NHMM JJ 13544a/b.

Material examined

FRANCE – **Marne** • 1 spec., LV, EF, Vertus (Grand Mont); basal biocalacarenite with pectinids; MMM coll.; MNHN.F.C03010.

Measurements

DVL: 20 mm; APL: 22 mm.

Description

Shell medium in size, trapezoidal, almost as long as high (DVL/APL = 0.90) and moderately inflated. Small, anteriorly positioned umbo. Convex anterior margin passing evenly into convex ventral margin.

Posterior margin obliquely truncate, posterodorsal margin almost straight. Escutcheon carina lacking; escutcheon area discriminated by slight inflexion in commarginal ribs. On flank, 14–15 strong, non-tuberculate, commarginal ribs about as wide as interspaces. Marginal carina not prominent, but forming a line marked by strong angulosity of ribs when passing on dorso-posterior margin. Ribs tighter on dorso-posterior margin than on ventral margin.

Remarks

This shell from Vertus has an outline and a shape with strong commarginal ribs that are very similar to those of the holotype of *Wolfgangella neilpearti* from the upper Maastrichtian of Maastricht, but it bears fewer ribs (14–15 ribs for DVL = 20 mm instead of 20 ribs for DVL = 14 mm). Therefore, this shell is identified as *W.* cf. *neilpearti* due to these differences. *Wolgangella ignota* Jagt *et al.*, 2022 is another species from the upper Maastrichtian of Maastricht, but it differs from *W. neilpearti* and *W.* cf. *neilpearti* by having its smaller size (DVL = 10 mm) and by having beaded costellae on the escutcheon. Compared to *W.* cf. *neilpearti*, *W. ignota* displays 12–15 ribs, but its DVL = 10 mm instead of 20 mm.

Stratigraphic range

Maastrichtian: ?Limburg, The Netherlands; Marne, France.

Subterclass Archiheterodonta Giribet, 2007
Order Carditida Dall, 1889
Superfamily Carditoidea A. Férussac, 1822
Family Carditidae A. Férussac, 1822
Subfamily Venericardiinae Chavan, 1969

Genus ***Baluchicardia*** Rutsch & Schenk, 1940

Type species

Cardita beaumonti d'Archiac & Haime, 1854 by original designation. Paleocene (Danian), Pakistan.

Stratigraphic range of the genus

Late Cretaceous to Paleocene, India, Africa and North America (Cox *et al.* 1969).

Baluchicardia hebertiana (d'Orbigny, 1850)
Fig. 19H–L

Cardita hebertiana d'Orbigny, 1850: 130, n°32 (partim).

Cardium porulosum – Ch. d'Orbigny 1836: 284 (non Solander in Brander, 1766).
?*Venericardia roedeli* – Chavan 1948: 567 (non Ravn, 1939: 31).
Glyptoactis (*Baluchicardia*) *hebertiana* – Pacaud & Merle 2016: pl. 1 figs 1–9. — Merle & Pacaud 2018a: 165, 176, fig. 159a–d. — Pacaud 2018b: 251. — Merle 2023: 24, fig. 2a–b.

For a complete synonymic list, see Pacaud & Merle (2016: 44).

Type locality

Vertus (Marne), France.

Type horizon

Sandy limestone of Vertus, Maastrichtian.

Type material

Lectotype

FRANCE – **Marne** • LV, EF; Vertus; A. d'Orbigny coll.; designated by Pacaud & Merle (2016: 44, 46, pl. 1 fig. 2) and herein Fig. 19H; MMM coll.; MNHN.F.R63240.

Paralectotypes (5 specs)

FRANCE – **Marne** • 1 spec., LV, EF; Vertus; sandy limestone; MMM coll.; figured in Pacaud & Merle (2016: 46, pl. 1 fig. 3; MNHN.F.R63241 • 1 spec., RV, EF; same data as for preceding; MMM coll.; figured in Pacaud & Merle (2016: 46, pl. 1 fig. 4); MNHN.F.A46194 • 1 spec., LV, EF; same data as for preceding; MMM coll.; figured in Pacaud & Merle (2016: 46, pl. 1 fig. 5); MNHN.F.A46195 • 1 spec., LV, EF; same data as for preceding; MMM coll.; figured in Pacaud & Merle (2016: 46, pl. 1 fig. 1a–b); MNHN.F.A46243 • 1 spec., RV, EF juvenile; same data as for preceding; MMM coll.; figured in Pacaud & Merle (2016: 46, pl. 1 fig. 6) and herein Fig. 19J; MNHN.F.A57275. All paralectotypes from A. d'Orbigny coll.

Other examined material (5 specs)

FRANCE – **Marne** • 1 spec., LV, EF; Vertus (Grand Mont), sandy limestone; MMM coll.; figured in Pacaud & Merle (2016: 46, pl. 1 fig. 9); MNHN.F.A57131 • 1 spec., LV, IF; same data as for preceding; MMM coll.; figured in Pacaud & Merle (2016: 46, pl. 1 fig. 8) and herein Fig. 19L; MNHN.F.A57132 • 1 spec., LV, EF; same data as for preceding; MMM coll.; figured in Pacaud & Merle (2016: 46, pl. 1 fig. 7) and herein Fig. 19I; MNHN.F.A57133 • 1 spec., LV, IF; Bergères-lès-Vertus (Mont Aimé), sandy limestone with shell concentrations; MMM coll.; figured in Merle & Pacaud (2018a: 176, fig. 159d) and herein Fig. 19K; MNHN.F.A66778 • 1 spec., LV, EF; same data as for preceding; MMM coll.; figured in Merle (2023: 24, fig. 2a–b); MNHN.F.A77757. Many imprints have not been molded and are not counted here.

Measurements

Lectotype, DVL: around 19 mm, APL: around 21 mm. Paralectotype MNHN.F.R63241, DVL: around 23 mm, APL: around. 25 mm. Paralectotype MNHN.F.A46194, DVL: around 26 mm, APL: around 28 mm. Paralectotype MNHN.F.A46195, DVL: around 14 mm, APL: around 15 mm. Paralectotype MNHN.F.A46243, DVL: 26 mm, APL: 28 mm. Paralectotype MNHN.F.A57275, DVL: around 11 mm, APL: around 14 mm. Measurements from Pacaud & Merle (2016: 44-45).

Description

Original description (d'Orbigny 1850: 130): "Espèce quadrangulaire, renflée, ornée d'environ 26 grosses côtes rayonnantes, saillantes, carénées, pourvues dessus d'une série de tubercules, et latéralement d'une saillie longitudinale". [English translation: "Quadrangular species, bulging, with approximately 26 large, protruding, keeled ribs, featuring a series of tubercles on top and a longitudinal protrusion on the sides".]

Descriptive complement: 20–27 ribs separated by deep interspaces. Ribs tripartite in larger specimens. Inner margin strongly crenulated (around 20 subtriangular crenulations).

Remarks

d'Orbigny (1850) described *Cardita hebertiana* based on type material from Vertus and two Danian localities, Le Port-Marly (Yvelines) and Meudon (Hauts-de-Seine). Pacaud & Merle (2016) showed that the type material included four different species. However, the diagnosis given by d'Orbigny (1850) corresponds perfectly to the specimens from Vertus, and a lectotype (MNHN.F.R63240) from this locality was thus designated. The Danian specimens represented the following species: *Venericor duponti* (Cossmann, 1908) from Meudon, *Venericardia elisabethae* Pacaud & Merle, 2016 and *Paraglans*

lydiae Pacaud & Merle, 2016 from Port Marly. Chavan (1948) reported *Venericardia roedeli* Ravn, 1939 from the sandy limestone with shell concentrations of Mont Aimé, a species present in the Danian of Copenhagen (Denmark). This species is easily distinguished from *Baluchicardia hebertiana* by its much more rounded outline and its flatter, almost smooth ribs. Chavan (1948) apparently did not know the work of d'Orbigny (1850) and did not compare *V. roedeli* with *B. hebertiana*. As Chavan refers to the sandy limestone with shell concentration and carditid imprints of Mont Aimé where *B. hebertiana* is one of the most common species and the only Carditidae collected in this bed, it is very likely that what he identified as *V. roedeli* is in fact *B. hebertiana*. *Baluchicardia hebertiana* is a mollusc characteristic of the Maastrichtian of Marne. It occurs from the lower beds at the base of the Vertus section (Grand Mont) to the upper beds of the Mont Aimé section.

Stratigraphic range

Maastrichtian: Marne, France.

Superfamily Crassatelloidea A. Férussac, 1822
Family Crassatellidae A. Férussac, 1822
Subfamily Crassatellinae A. Férussac, 1822

Genus ***Bathytormus*** R.B. Stewart, 1930

Type species

Crassatella protexta Conrad, 1832 by original designation. Middle Eocene (Bartonian), Alabama (USA).

Stratigraphic range of the genus

Late Cretaceous to present day, subtropical and tropical seas (Cox *et al.* 1969).

Bathytormus sparnacensis sp. nov.
urn:lsid:zoobank.org:act:BD7CB6BB-0A7C-47E9-8F11-9D27FB4A89DA
Fig. 20A–D

Bathytormus sp. – Merle & Pacaud 2018a: 175, fig. 158e–h. — Merle 2023: 25.

Etymology

From Épernay (Latin name: '*Sparnacum*'), the city near the type locality.

Type locality

Bergères-lès-Vertus (Mont Aimé), Marne, France.

Type horizon

Sandy limestone with shell concentrations.

Type material

Holotype

FRANCE – **Marne** • RV, EF; Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; MMM coll.; figured in Merle & Pacaud (2018a: 175, fig. 158e) and herein Fig. 20A; MNHN.F.A66774.

Paratypes (3 specs)
FRANCE – **Marne** • 1 spec., LV, EF; same data as for holotype; MMM coll.; figured in Merle & Pacaud (2018a: 175, fig. 158h) and herein Fig. 20C; MNHN.F.A66777 • 1 spec., RV, EF; same data as for holotype; MMM coll.; figured in Merle & Pacaud (2018a: 175, fig. 158f) and herein Fig. 20D; MNHN.F.A66775 • 1 spec., LV, EF; same data as for holotype; MMM coll.; figured in Merle & Pacaud (2018a: 175, fig. 158g) and herein Fig. 20B; MNHN.F.A66776.

Measurements

Holotype, DVL: 12 mm, APL: 14.7 mm. Paratype MNHN.F.A66777, DVL: 22 mm, APL: 33.5 mm. Paratype MNHN.F.A66775, APL: around 18 mm, DVL: incomplete. Paratype MNHN.F.A66776, APL: 22 mm, DVL: 34 mm.

Description

Middle sized shell, moderately elongate posteriorly and not inflated. Antero-dorsal margin concave and postero-dorsal margin slightly straight; anterior and ventral margins rounded, posterior margin almost straight making large angle at transition with postero-dorsal margin and angulose when joining ventral margin. Posterior ridge weakly angulate near umbo, becoming smooth and connected to angulosity of ventral margin. On posterior ridge, seven undulating commarginal ribs in umbonal region and around ten more widely spaced and lamellose major commarginal ribs in the postero-ventral margin. On antero-ventral margin, around 20 undulating and small commarginal ribs corresponding to intercalated ribs between major ribs. Around two intercalated ribs between two major ribs.

Remarks

Bathytormus sparnacensis sp. nov. is comparable to *B. pisolithicus* (d'Orbigny, 1850) in its shape and in the organisation of its commarginal sculpture displaying intercalated ribs between major ribs on antero-ventral margin. However, the ribs of *B. sparnacensis* are more widely spaced and less numerous (around 17 on postero-ventral margin and 27 on antero-ventral margin instead of respectively 36 and 50 in *B. pisolithicus*). This sculptural difference had already been mentioned by Merle & Pacaud (2018a: 165) who compared *B. sparnacensis* with the syntype of *B. pisolithicus* (MNHN.F.A53495) from the Danian of Meudon (Pacaud 2018a). Combes (1908) identified *Crassatella pisolithica* d'Orbigny, 1850 (= *B. pisolithicus*) from the Bois d'Esmans locality. Nevertheless, without material or description it is difficult to know which species this is, but it could be *B. sparnacensis*.

Stratigraphic range

Maastrichtian: Marne, France.

Superclass Euheterodonta Giribet & Distel, 2003

Euheterodonta indet. (tellinoid shape).
Fig. 20E

?Tellinoidea indet. – Merle 2023: 25.

Material examined

FRANCE – **Marne** • 1 spec., internal mould, RV; Vertus (Grand Mont), sandy limestone; MMM coll.; MNHN.F.C02995.

Measurements

DVL: 5 mm, APL (incomplete): 10 mm.

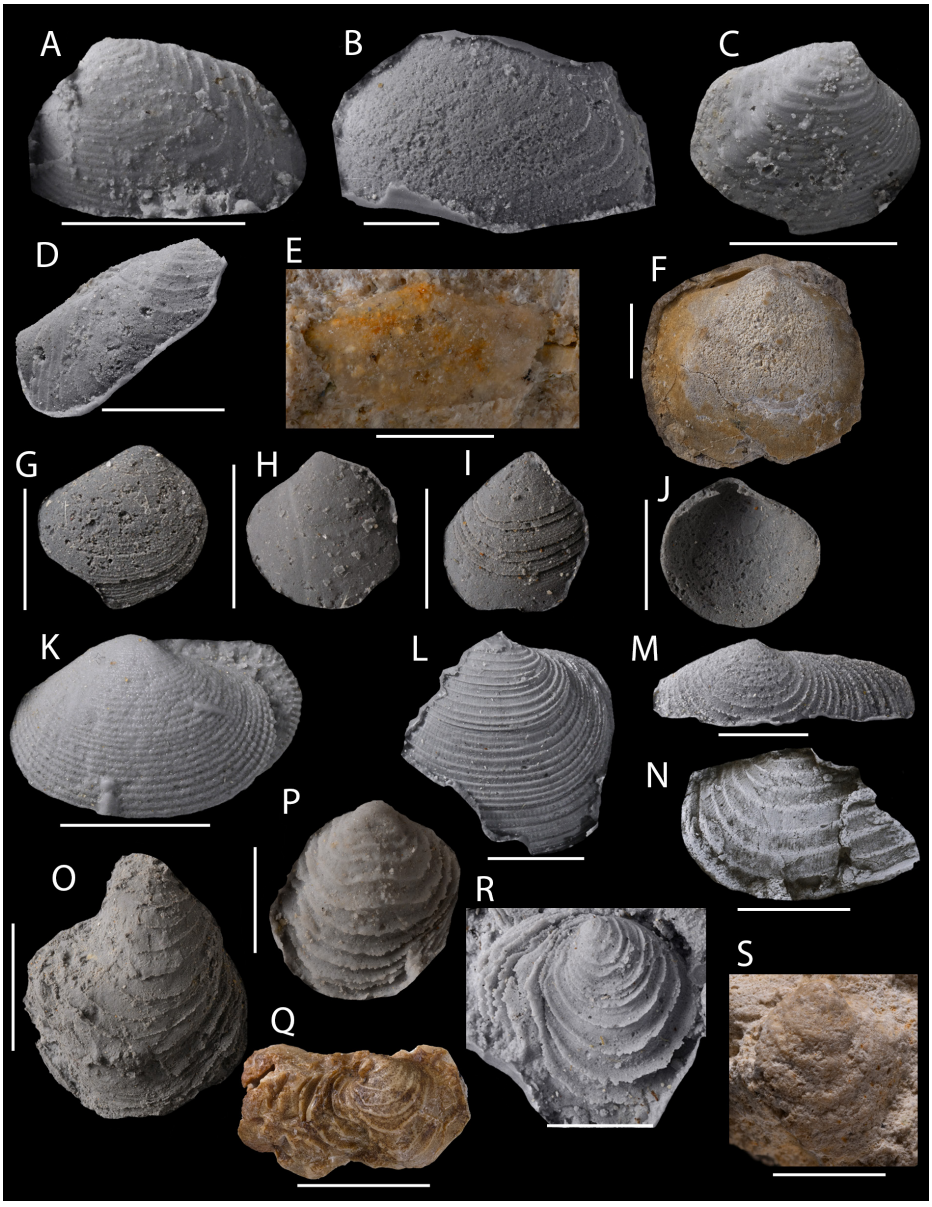

Fig. 20. Bivalvia Linnaeus, 1758 (Carditoidea Fleming, 1828, Euheterodonta Giribet & Distel, 2003 indet., Chamoidea Lamarck, 1809 and Bivalvia indet.) from the Maastrichtian of the Paris Basin. **A–D**. *Bathytormus sparnacensis* sp. nov. **A**. Holotype MNHN.F.A66774 (RV, EF), MA. **B**. Paratype MNHN.F.A66776 (RV, EF), MA. **C**. Paratype MNHN.F.A66777 (LV, EF), MA. **D**. MNHN.F.A66775 (LV, EF), MA. — **E**. Euheterodonta indet. (tellinoid shape), MNHN.F.C02995 (RV), VGM. — **F**. Euheterodonta indet. (*Recticardo* shape), MNHN.F.A66784 (LV), VGM. — **G–J**. Euheterodonta indet. (lucinoid shape), **G**. MNHN.F.C02996 (LV, EF), VGM. **H**. MNHN.F.C02997 (LV, EF), VGM. **I**. MNHN.F.C02998 (RV, EF), MA. **J**. MNHN.F.C02999 (LV, IF), VGM. — **K**. *Fimbria multilamellosa* (d'Orbigny, 1850), MNHN.F.C03002 (RV, EF), Vertus. — **L–M**. *Fimbria* sp. 1. **L**. MNHN.F.A66780 (?RV, EF), MA. **M**. MNHN.F.A66779 (RV, EF), MA. — **N**. *Fimbria* sp. 2, MNHN.F.R63680 (?RV, EF), Vertus. — **O–R**. *Chama loubryi* sp. nov. **O**. MNHN.F.C03003 (LV, EF), MA. **P**. MNHN.F.C03004 (RV, EF), VGM. **Q**. UPMC.PAL.2017.0.19 (LV, EF), VF. **R**. MNHN.F.A66785, MA. — **S**. Bivalvia indet., MNHN.F.C03005, VGM. Localities: MA = Bergères-lès-Vertus (Mont Aimé); VF = Vertus (Faloise); VGM = Vertus (Grand Mont). Scale bars: A–D, F = 10 mm; E, G–S = 5 mm. Credits = P. Loubry (MNHN/CNRS).

Description

Shell, small and flat. Elongated and inequilateral outline with APL twice as large as DVL. Antero-dorsal margin straight. Dorso-posterior margin almost straight, but slightly concave near beak. Ventral margin moderately curved. Anterior and posterior margins incomplete.

Remarks

This small, flat, elongated shell with an inequilateral outline is somewhat similar to those of Tellinoidea Blainville, 1814 (Psammobiidae J. Fleming, 1828 or Tellinidae Blainville, 1814). Its shape is also reminiscent of *Nuculana* Link, 1807, but the anterior area is shorter in this genus. The material is not sufficiently well preserved to allow for a more precise taxonomic attribution.

Euheterodonta indet. (?*Recticardo* shape)
Fig. 20F

Recticardo sp. – Merle & Pacaud 2018a: 176, fig. 159k.

Material examined

FRANCE – **Marne** • 1 spec., LV, internal mould; Vertus (Grand Mont), sandy limestone; MMM coll.; figured in Merle & Pacaud (2018a: 176, fig. 159k) and herein Fig. 20; MNHN.F.A66784.

Measurements

DVL: 32.8 mm, APL: 34 mm.

Description

Internal moulds showing right sides. Flattened shell, moderately large, subquadrangular. Dorso-posterior margin slightly convex, oblique. Posterior margin convex perpendicular to dorso-ventral axis. Ventral margin rounded. Anterior margin rather straight dorsally, rounded ventrally. Antero-dorsal margin slightly concave.

Remarks

It is difficult to identify this internal mould of Lucinidae J. Fleming, 1828 precisely, but its flat, moderaltely subquadrangular shape is slightly reminiscent of *Recticardo* Cossmann, 1908, a genus found in the Late Cretaceous of Europe (Cox *et al.* 1969) and in the Danian of the Paris and Mons basins (Cossmann 1908; Pacaud 2018a). However, this mould has a rather central almost rectigyrate, blunt umbo, which does not fit *Recticardo* very well.

Euheterodonta indet. (?lucinoid shape)
Fig. 20G–J

Material examined (6 specs)

FRANCE – **Marne** • 1 spec., LV, EF; Vertus (Grand Mont), sandy limestone; MMM coll.; Fig. 20G; MNHN.F.C02996 • 1 spec., LV, EF; same data as for preceding; MMM coll.; Fig. 20H; MNHN.F.C02997 • 1 spec., RV, EF, Bergères-lès-Vertus (Mont Aimé), sandy limestone with shell concentrations; MMM coll.; Fig. 20I; MNHN.F.C02998 • 1 spec., LV, IF; Vertus (Grand Mont), sandy limestone; MMM coll.; Fig. 20J; MNHN.F.C02999 • 1 spec., RV, IF; same data as for preceding; MMM coll.; MNHN.F.C03000 • 1 spec., LV, EF; same data as for preceding; MMM coll.; MNHN.F.C03001.

Measurements

MNHN.F.C02996, DVL: 6.8 mm, APL: 7.5 mm. MNHN.F.C02997, DVL: 5 mm, APL: 5.1 mm. MNHN.F.C02998, DVL: 6.2 mm, APL: 6 mm. MNHN.F.C02999, DVL: 7.5 mm, APL: 8.2 mm. MNHN.F.C03000, DVL: 7.2 mm, APL: 7 mm. MNHN.F.C03001, DVL: 7 mm, APL: 9 mm.

Description

Small and subcircular shell with lucinid shape. Postero-dorsal margin curved, posterior, ventral and dorsal margins rounded. Antero-dorsal margin slightly concave near the beak. Irregular commarginal growth ridges. No radial ribs. Hinge missing but apparently weak.

Remarks

These small bivalves display a lucinoid shape with more or less inflated valves, but it is not certain that they belong to the same species. The specimen MNHN.F.C02996 (Fig. 20G) has an anteriorly shifted, blunt umbo. In the specimen MNHN.F.C02997 (Fig. 20H), the umbo is central and rather pointed. The specimen MNHN.F.C02999 (Fig. 20J) is a more inflated shell than the others. Additional shells are therefore necessary to understand this complex of small bivalves.

Subfamily Fimbriinae Nicol, 1950

Genus ***Fimbria*** Megerle von Mühlfeld, 1811

Type species

Fimbria magna Megerle von Mühlfeld, 1811 accepted as *Fimbria fimbriata* (Linnaeus, 1758) by monotypy. Present day, Indo-Pacific.

Stratigraphic range of the genus

Middle Jurassic (Bathonian) to present day, tropical seas (Cox *et al.* 1969).

Fimbria multilamellosa (d'Orbigny, 1850)
Fig. 20K

Corbis multilamellosa d'Orbigny, 1850: 131, n° 34.

Lucina contorta – C. d'Orbigny 1836: 284 (non Defrance, 1823).
?*Corbis* (*Fimbria*) *multilamellosa* – Combes 1908: 14.
Corbis multilamellosa – Chavan 1948: 566–567, 569. — Pacaud & Merle 2002: 595, fig. 1.1a–b.
Fimbria multilamellosa – Pacaud 2018a: 252, fig. 198d–f; 2018b: 51. — Merle & Pacaud 2018a: 176, fig. 159f. — Merle 2023: 25.

For a detailed synonymic list, see Pacaud (2018b: 51).

Type locality

Meudon, Hauts-de-Seine, France.

Type horizon

Pisolitic limestone of Meudon, Danian.

Type material

Lectotype

FRANCE – **Hauts-de-Seine** • RV, EF; Meudon; Danian; A. d'Orbigny coll.; designated by Pacaud (2018a: 253, 256, fig. 198f); MNHN.F.R63237.

Paralectotypes (2 specs)

FRANCE – **Hauts-de-Seine** • 1 spec., LV, EF; same data as for lectotype; A. d'Orbigny coll.; figured in Pacaud (2018a: 156, fig. 198d; MNHN.F.R63246. – **Yvelines** • 1 spec., LV, EF; Le Port-Marly; Danian; A. d'Orbigny coll.; MNHN.F.R63253.

Other material examined

FRANCE – **Marne** • 1 spec., RV, EF; Vertus; probably sandy limestone of Vertus; Ch. d'Orbigny coll., ex n°GG.gg2005/5961; figured in Merle & Pacaud (2018a: 176, fig. 159e) and herein Fig. 20K; MNHN.F.C03002.

Measurements

MNHN.F.C03002, DVL: 13 mm; APL: 18.5 mm.

Description

Original description (A. d'Orbigny 1850: 131): "Grande espèce ovale, voisine du *C. pectunculus*, mais beaucoup moins bombée, à côtes concentriques très rapprochées, à côtes rayonnantes à peine visibles". [English translation: "Large oval species, similar to *C. pectunculus*, but much less rounded, with very closely spaced concentric ribs and barely visible radial ribs".]

Description of the Maastrichtian material: small shell (juvenile), transversely elliptical, subequilateral. Posterior margin shorter than anterior margin. Around 40 low, lamellose commarginal ribs. Radial ribs slightly pronounced. Intersections between marginal and radial ribs forming small scales, more distinct on anterior margin than posterior margin.

Remarks

d'Orbigny (1850) described this species based on two syntypes from the Danian of the Paris Basin (Meudon and Le Port Marly) and one syntype from Vertus (MNHN.F.R63253). Pacaud (2018a: 253, 256, fig. 198f) designated the syntype from Meudon (MNHN.F.R63237) as the lectotype. According to Merle & Pacaud (2018a), the Vertus paralectotype has more widely spaced commarginal ribs. It does not correspond to *Fimbria multilamellosa*, but to *Fimbria* sp. 1, a species discussed below. However, another specimen from Vertus (MNHN.F.C03002), found in the geology collection of the Muséum, bears close similarities to the Danian specimens. In particular, the tightly packed commarginal lamellae at the beginning of growth are completely identical. Because of these strong similarities, this specimen is thus identified herein as *Fimbria multilamellosa*. Combes (1908: 14) cited two species of *Fimbria* from the Bois d'Esmans, *Fimbria multilamellosa* and *F. sublamellosa* (d'Orbigny, 1850), but in the absence of material, these identifications cannot be confirmed. Squires & Godaert (1994) described *Linearia* (*Linearia*) *louellasaulae* Squires & Godaert, 1994, a Tellinidae from the Lower Eocene of the Crescent Black Hills Formation, Southwestern Washington (USA), whose sculpture is somewhat reminiscent of that of *Fimbria multilamellosa*. However, the radial ribs are much more pronounced and the American species is taller in shape.

Stratigraphic range

Maastrichtian to Danian, Paris Basin, France.

Fimbria sp. 1
Fig. 20L–M

Fimbria sp. 1 – Merle & Pacaud 2018a: 177, fig. 159f–g. — Merle 2023: 25.

Material examined (3 specs)

FRANCE – **Marne** • 1 spec., RV, EF, fragment; Bergères-lès-Vertus (Mont Aimé); sandy limestone with shell concentrations; MMM coll.; figured in Merle & Pacaud (2018a: 177, fig. 159f) and herein Fig. 20M; MNHN.F.A66779 • 1 spec., ?RV, EF; same data as for preceding; MMM coll.; figured in Merle & Pacaud (2018a: 177, fig. 159g) and herein Fig. 20L; MNHN.F.A66780 • 1 spec., ex syntype of *Corbis sublamellosa* d'Orbigny, 1850; Vertus; A. d'Orbigny coll.; MNHN.F.R63253.

Measurements

MNHN.F.A66780, DVL: 23.3 mm, APL (posterior area missing): 23 mm. Other material incomplete.

Description

Middle sized shell. Anterior and ventral margins rounded. Dorso-posterior margin almost straight. Around 34–35 commarginal lamellose ribs, slightly wrinkled in anterior region when crossing radial riblets. Commarginal ribs fairly spaced near the umbo, becoming closer together at end of growth. Commarginal sculpture crossed by numerous radial riblets.

Remarks

Fimbria sublamellosa is cited from Vertus (d'Orbigny 1850), Mont Aimé (Chavan 1948: 566) and Bois d'Esmans (Combes 1908: 14). d'Orbigny (1850) clearly stated that it differs from *F. multilamellosa* in having fewer commarginal ridges. The type material of *F. sublamellosa* included a Danian specimens from Le Port Marly and two specimens from Vertus. To stabilise the nomenclature of *F. sublamellosa*, Pacaud (2018a: 253, fig. 198g) designated the Danian specimen (MNHN.F.A46124) from Le Port Marly as the lectotype. The lamellose commarginal ribs of the Maastrichtian specimens are much more widely spaced throughout their growth than those of the typical Danian *F. sublamellosa*. These specimens from Vertus are named herein as *Fimbria* sp. 2 (see Fig. 20N). Like the lectotype of *F. sublamellosa*, *Fimbria* sp. 1 has spaced commarginal lamellae, but in the lectotype of *F. sublamellosa* they remain spaced at the end of growth, whereas in *Fimbria* sp. 1 they become closer together. The lectotype of *F. sublamellosa* has 22 ribs across the entire shell, while the two specimens of *Fimbria* sp. 1 have between 30 and 34 ribs. This difference in ontogeny suggests that *Fimbria* sp. 1 is a different species from *F. sublamellosa*. However, more specimens would be needed to better understand the sculptural variability of *F. sublamellosa*, *Fimbria* sp. 1 and *Fimbria* sp. 2 and clearly define these three species, which are distinguished by subtle differences. The citations of *F. sublamellosa* by Combes (1908) at Bois d'Esmans and by Chavan (1948) at Mont Aimé undoubtedly correspond to a species different from *F. multilamellosa*, but without figure or description, it is impossible to specify whether it is *Fimbria* sp. 1 or *Fimbria* sp. 2.

Fimbria sp. 2
Fig. 20N

Fimbria sp. 2 – Merle & Pacaud 2018a: 176, fig. 159j.

Material examined (2 specs)

FRANCE – **Marne** • 2 specs, ex syntypes of *Corbis sublamellosa* d'Orbigny, 1850, historical cast including 1 spec. ?RV, EF; Vertus; A. d'Orbigny coll.; figured in Merle & Pacaud (2018a: 176, fig. 159j) and herein Fig. 20N; MNHN.F.R63680.

Measurements

MNHN.R63680 (figured specimen), DVL: 15 mm, APL: 24 mm. Other specimen incomplete.

Description

Middle sized shell, flattened. Anterior and ventral margins rounded. Around ten commarginal lamellose ribs. Commarginal ribs regularly spaced from umbo to ventral margin. Commarginal sculpture crossed by numerous radial riblets.

Remarks

As seen above *Fimbria* sp. 2 differs from *Fimbria* sp. 1 in that it has fewer marginal ribs (20 instead of 30–35 in *Fimbria* sp. 1) which are significantly more widely spaced. The poor state of preservation of the specimens calls for caution in generic attribution, but the numerous small radial riblets are typical of *Fimbria*.

Order Venerida Gray, 1854
Superfamily Chamoidea Lamarck, 1809
Family Chamidae Lamarck, 1809

Genus ***Chama*** Linnaeus,1758

Type species

Chama lazarus Linnaeus, 1758 by subsequent designation Children (1823) and Opinion 484 (ICZN 1957). Present day, Indo-Pacific.

Stratigraphic range of the genus

Late Cretaceous (Coniacian) from Austria (Kennedy *et al.* 1970) to present day, subtropical and tropical seas.

Chama loubryi sp. nov.
urn:lsid:zoobank.org:act:04AA310B-337C-4B12-90B9-399B562FD406
Fig. 20O–R

Chama sp. – Merle & Pacaud 2018a: 176, fig. 159l–m. — Merle 2023: 25.

Etymology

Dedicated to Philippe Loubry for his important photographical work on the Maastrichtian shells of the Paris Basin.

Type material

Holotype
FRANCE – **Marne** • LV, EF; Bergères-lès-Vertus; sandy limestone with shell concentrations; MMM coll.; MNHN.F.C03003 (Fig. 20O).

Paratypes (5 specs)
FRANCE – **Marne** • 1 spec., LV, EF; same data as for holotype; MMM coll.; figured in Merle & Pacaud (2018a: 176, fig. 159m) and herein Fig. 20R; MNHN.F.A66785 • 1 spec., LV, EF incomplete, historical cast; Vertus (Faloise); Hébert coll.; figured in Merle & Pacaud (2018a: 176, fig. 159l) and herein Fig. 20Q; UPMC.PAL.2017.0.19 • 1 spec., RV, EF; Vertus (Grand Mont); sandy limestone; MMM coll.; Fig. 20P; MNHN.F.C03004 • 1 spec., LV, EF; same data as for preceding; MMM coll.;

MNHN.F.C03006 • 1 spec. (LV, IF), Vertus (Grand Mont); basal biocalcarenite with pectinids; MMM coll.; MNHN.F.C03007.

Measurements

Holotype MNHN.F.C03003, DVL: 23 mm, APL: 18.8 mm. Paratype MNHN.F.A66785, DVL: 17.8 mm, APL: 18.2 mm. Paratype MNHN.F.C03004, DVL: 13.2 mm, APL: 12.2 mm. Paratype MNHN.F.C03006, DVL: 10.9 mm, APL: 9 mm.

Description

Middle sized shell, solid. Outline rounded to slightly elongated dorso-ventrally. Valves moderately to strongly convex and inequilateral. Umbo prosogyrate. Postero-dorsal, posterior and ventral margins rounded; antero-dorsal margin slightly concave or expanded by accretion of commarginal lamellae (see Fig. 20Q–R). Between 15–20 commarginal lamellae. Lamellae low, not spiny, tending to be tighter at end of growth.

Comparisons

Chama loubryi sp. nov. resembles *Chama ciplyensis* Vincent, 1930, from the Danian of the Paris Basin and Belgium, in its fairly smooth lamellar commarginal ribs, which are more widely spaced at the beginning than at the end of the growth. *Chama loubryi* differs from *C. ciplyensis* by lacking developed spiny lamellae at the end of its growth (see Vincent 1930: pl. 5, fig. 17a and Merle & Pacaud 2018b: fig. 233c–d). It has less flat valves and is smaller in size (15 mm in *C. loubryi* versus 18–23 mm in larger specimens of *C. cypliensis*). *Chama loubryi* is smaller (DVL: 11 mm) *Chama ancestralis* Cossmann, 1908 from the Danian of the Mons Basin and doesn't display a high hollow valve shaped like a cornucopia, as seen in *C. ancestralis*.

Stratigraphic range

Maastrichtian: Marne, France.

Incertae sedis

Bivalvia indet.
Fig. 20S

Inceramidae indet. – Merle 2023: 25.

Material examined

FRANCE – **Marne** • 1 spec., LV, internal mould; Vertus (Grand Mont); basal biocalcarenite with pectinids; MMM coll.; MNHN.F.C03005.

Measurements

DVL: 13 mm; APL: 20 mm

Description

Shell small and subcircular. Antero-dorsal margin slightly concave. Anterior margin curved, slightly convex passing to rounded and narrower ventral margin. Posterior margin rounded and dorso-posterior margin almost straight. Six strong and thick commarginal folds.

Remarks

It is difficult to identify this internal mould, but its shape and sculpture with pronounced commarginal folds are reminiscent of inoceramid shells. Since inoceramids generally have folds rather than ribs, an internal mould should preserve this sculpture. The early stage of growth of the internal mould of *Inoceramus* aff. *bererensis* Sornay, 1975 from the Campanian of Austria illustrated by Tröger *et al.* (1999: pl. 1 fig. 1) displays similar strong commarginal folds.

Class Cephalopoda Cuvier, 1795
Subclass Nautiloida Agassiz, 1847
Order Nautilida Agassiz, 1847

Nautilida indet.
Fig. 21A–F

Nautilus hebertinus d'Orbigny, 1850: 127, no 3[4] pars, only the syntype of Montereau.

Material examined (2 specs)

FRANCE – **Marne** • 1 spec.; Bergères-lès-Vertus (Mont Aimé); base of the section (1 m above the top of the Campanian chalk; Gilles Fronteau leg; Fig. 21A–D; MNHN.F.C03008. – **Seine-et-Marne** • 1 spec., fragments of an internal mould, ex syntype of *Nautilus hebertinus* d'Orbigny, 1850; Montereau (probably Bois d'Esmans); A. d'Orbigny coll.; Fig. 21E–F; MNHN.F.B46110.

Measurements

MNHN.F.C03008, D: 83 mm, W: 67 mm, WH: 47 mm, DWH: 25 mm, UD: 4 mm.

Description

Small internal mould slightly deformed, probably juvenile specimen. Shape slightly depressed (W/WE = 1.42), involute (umbilicus generally about 5% of shell diameter). Umbilicus very small. Flanks slightly convex, converging towards rounded venter; venter rather wide. Peristome rounded, ventrally enlarged. Sinuous suture towards umbilicus.

Remarks

The nautilid from Bois d'Esmans is known only from a very fragmentary specimen (Fig. 21E–F) that was part of the type material for *Nautilus hebertinus* by Orbigny A., 1850, a species from the Danian of the Paris Basin (Montainville and Vigny). It was the occurrence of this species that prompted Chavan (1948) to recognise the Danian at Bois d'Esmans. The specimen collected at Bergères-lès-Vertus is better preserved, but does not allow for precise identification as it is a young specimen with poorly visible sutures (Stijn Goolaerts, written communication).

Composition of the assemblage

The list obtained from the detailed study of the mollusc assemblage at the Vertus (Grand Mont and Faloise), Bergères-lès-Vertus (Mont Aimé) and Esmans (Bois d'Esmans) sites includes 57 taxa (Table 1). It provides a much clearer picture of the assemblage than those presented in Merle & Pacaud (2018a) and Merle (2023), which included only 24 and 41 taxa, respectively. For gastropods, 30 taxa were recognised. Sixteen species were identified, 14 of which are new (?*Calliostoma monswavinarensis* sp. nov., *Sparnollonia bicarinata* gen et sp. nov., ?*Tectus acmantensis* sp. nov., ?*T. fraterculus* sp. nov., ?*T. senarmonti* sp. nov., ?*Clypeostoma vertusensis* sp. nov., *Calliomphalus* (*Planolateralus*) *montenati* sp. nov., *Rhinoclavis parvisulcatus* sp. nov., ?*Vicinocerithium heberti* sp. nov., *Granulolabium cretaceum* sp. nov., *Haustator bergierensis* sp. nov., *Sveltella binkhorsti* sp. nov., *Fusinus bouchardae*

sp. nov. and ?*Pseudopisania cretacea* sp. nov.), eight are left in open nomenclature due to a lack of material, and five taxa are identified at the higher ranks. For bivalves, 26 taxa were recognised. Fifteen species were identified, including five new ones (*Nucula bauti* sp. nov., *Arca* (s. str.) *submontensis* sp. nov., *Plicatula pacaudi* sp. nov., *Bathytormus sparnacensis* sp. nov. and *Chama loubryi* sp. nov.), five were left in open nomenclature and six taxa were identified at the family level or higher ranks. For cephalopods there is one unidentified Nautilida. The fauna thus appears to be quite diversified. The

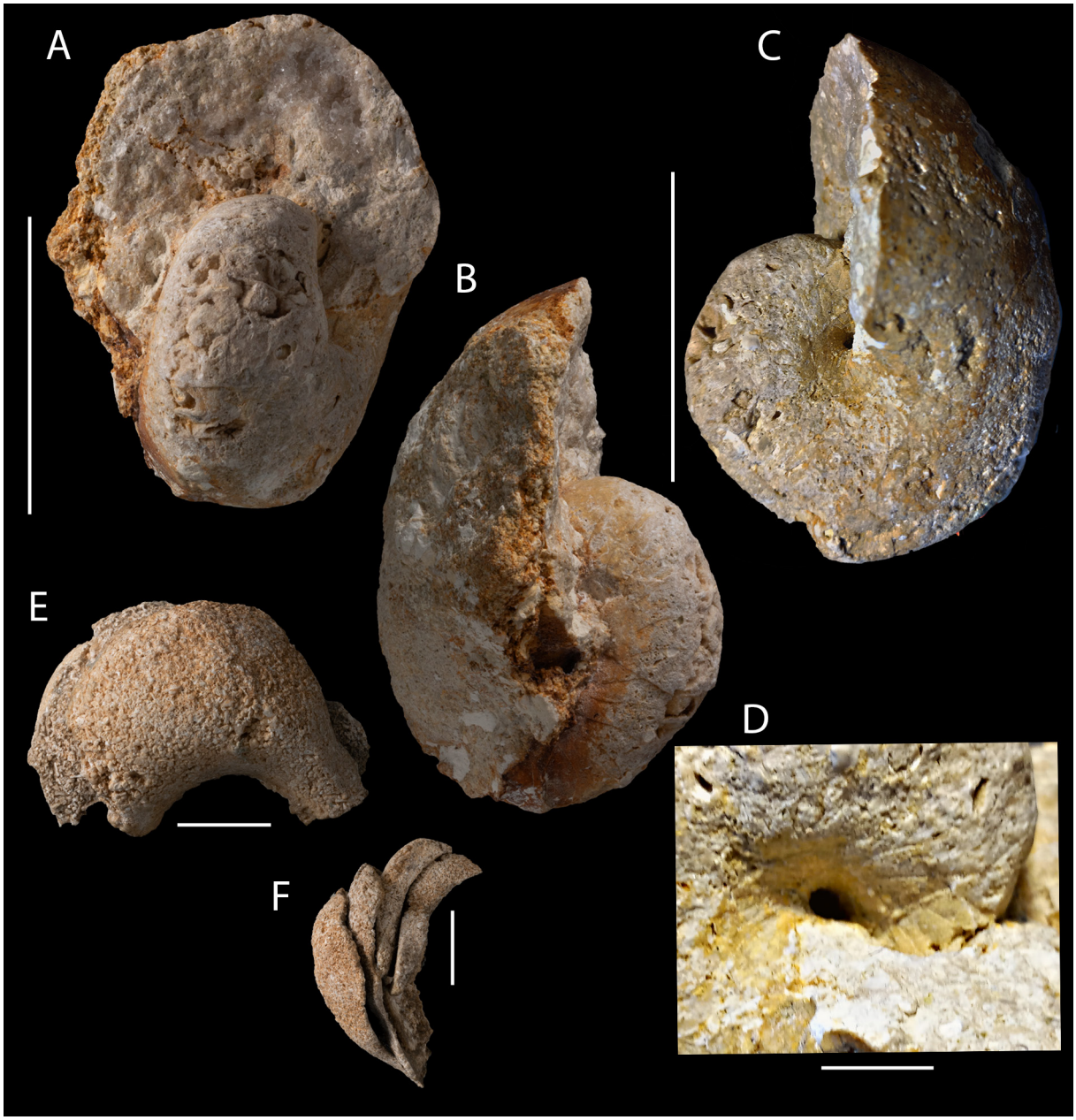

Fig. 21. Cephalopoda Cuvier, 1795 of the Maastrichtian of the Paris Basin. **A–D**. Nautiloidea indet. **A**. MNHN.F.C03008 (leg. Fronteau), apertural view; MA. **B–C**. Same specimen in lateral viewes. **D**. Same specimen, detailed view of the umbilicus. — **E–F**. Ex syntype of *Nautilus hebertinus* d'Orbigny, 1850, MNHN.F.B46110 (unindentifiable fragments), BE. Material: internal moulds. Localities: BE = Esmans (Bois d'Esmans); MA = Bergères-lès-Vertus (Mont Aimé). Scale bars: A–C = 50 mm; D–F = 10 mm. Credits: A–B, E–F = P. Loubry (MNHN/CNRS); C–D = D. Merle.

analysis of size distribution (Fig. 22A) shows that taxa measuring between 1 and 10 mm (the average size of the taxa is taken as a reference) represent only 27% of the assemblage for gastropods and 4% for bivalves. For the present day, small forms can represent more than 50% of the extant species (Bouchet *et al.* 2002) and they likely represent a high part of the post-Palaeozoic mollusc diversity (Cherns & Wright 2011). These low values for the number of small species from the Maastrichtian of the Paris Basin, together with the sedimentary context (sandy limestone), clearly indicate a bias in the record of the palaeobiodiversity due to the lithification of the studied beds. The analysis the lithification bias in the Lutetian beds of Grignon (Sanders *et al.* 2015) reveals that nearly 80% of the species richness is not recorded in the lithified facies, and that loss can reach 100% for species smaller than 2 mm. Consequently, the fauna studied could originally have been much richer and this lithification bias cannot be compensated by simply adjusting the sample size. Given the limited amount of field research conducted so far, it is highly likely that future field trips will be able to supplement this study.

Discussion

Biostratigraphic significance (Table 1)

The discussion on the biostratigraphic significance of the fauna is based on the detailed study of three beds at Vertus (Grand Mont) and Bergères-lès-Vertus (Mont Aimé), see Fig. 3B: 1°) at Vertus, the basal biocalcarenite with pectinids (BBWP); 2°) the upper sandy limestone with mollusc imprints (USL); 3°) at Mont Aimé, the sandy limestone with shell concentrations (SLSC).

1°) Basal biocalcarenite with pectinids of Vertus (Grand Mont, BBWP): only eight species have been recorded. *Lyriochlamys faujasii* is the most abundant species. However, imprints of ?*Vicinocerithium heberti* sp. nov., *Cucullaearca supracretacea*, ?*Septifer* sp., *Wolfgangella* cf. *neilpearti*, *Baluchicardia hebertiana*, *Chama loubryi* sp. nov. and Bivalvia indet. (?Inoceramidae) also been found. *Lyriochlamys faujasii*, ?*Septifer* sp. and *Wolfgangella* cf. *neilpearti* and Bivalvia indet. (?Inoceramidae) seems restricted to this basal bed, but ?*Vicinocerithium heberti* sp. nov., *Cucullaearca supracretacea*, *Baluchicardia hebertiana* and *Chama loubryi* sp. nov. also occur in the upper beds of Vertus (Grand Mont) and Mont Aimé.

2°) The upper sandy limestones of Vertus (USL) and Mont Aimé (SLSC): it is difficult to determine whether the sandy limestone of Vertus and the sandy limestone with carditid imprints of Mont Aimé are strictly synchronous (see sections, Fig. 3), but both are found above the basal biocalcarenite with pectinids (BBWP) and vertebrate remains (teeth of fish and mosasaures) at Vertus and above the basal bed with crocodile bones and actinopterygian fishes skeletons at Mont Aimé (see Fig. 3B). In addition, they show a similar lithological facies. The Vertus (Grant Mont, USL) assemblage contains 24 taxa and the Mont Aimé assemblage (SLSC) contains 33 taxa. They share 12 taxa, representing 50% and 36% of the common elements, respectively. The four species *?Vicinocerithium heberti* sp. nov., *Cucullaearca supracretacea*, *Glyptoactis*, *Baluchicardia hebertiana*, *Chama loubryi* sp. nov., already recorded in the basal bed of Vertus, are present in both upper beds. Moreover, ?*Vicinocerithium heberti* and *G.* (*B.*) *hebertiana* are abundant in the upper beds. These two species should be regarded as characteristic species of the Maastrichtian formation of Vertus-Mont Aimé. The other shared taxa are: *Sparnollonia bicarinata* gen et sp. nov., *Rhinoclavis parvisulcatus* sp. nov., ?*Vicinocerithium* sp., *Granulolabium cretaceum* sp. nov., *Popenoeum ambiguum* and *Arca* (s. str.) *submontensis* sp. nov. The high number of shared taxa clearly demonstrates the palaeoecological similarity between the two assemblages.

3°) Comparison with Vertus (Faloise) and Bois d'Esmans: the material collected at Vertus (Faloise) by the previous authors (Hébert, Munier-Chalmas, Charles and Alcide d'Orbigny) contains *Lyriochlamys faujasii* which is present in the basal biocalcarenite with pectinids of Vertus (Grand Mont, BBWP) and *Calliomphalus* (*Planolateralus*) *montenati* sp. nov., ?*Vicinocerithium heberti* sp. nov., *Cucullaearca*

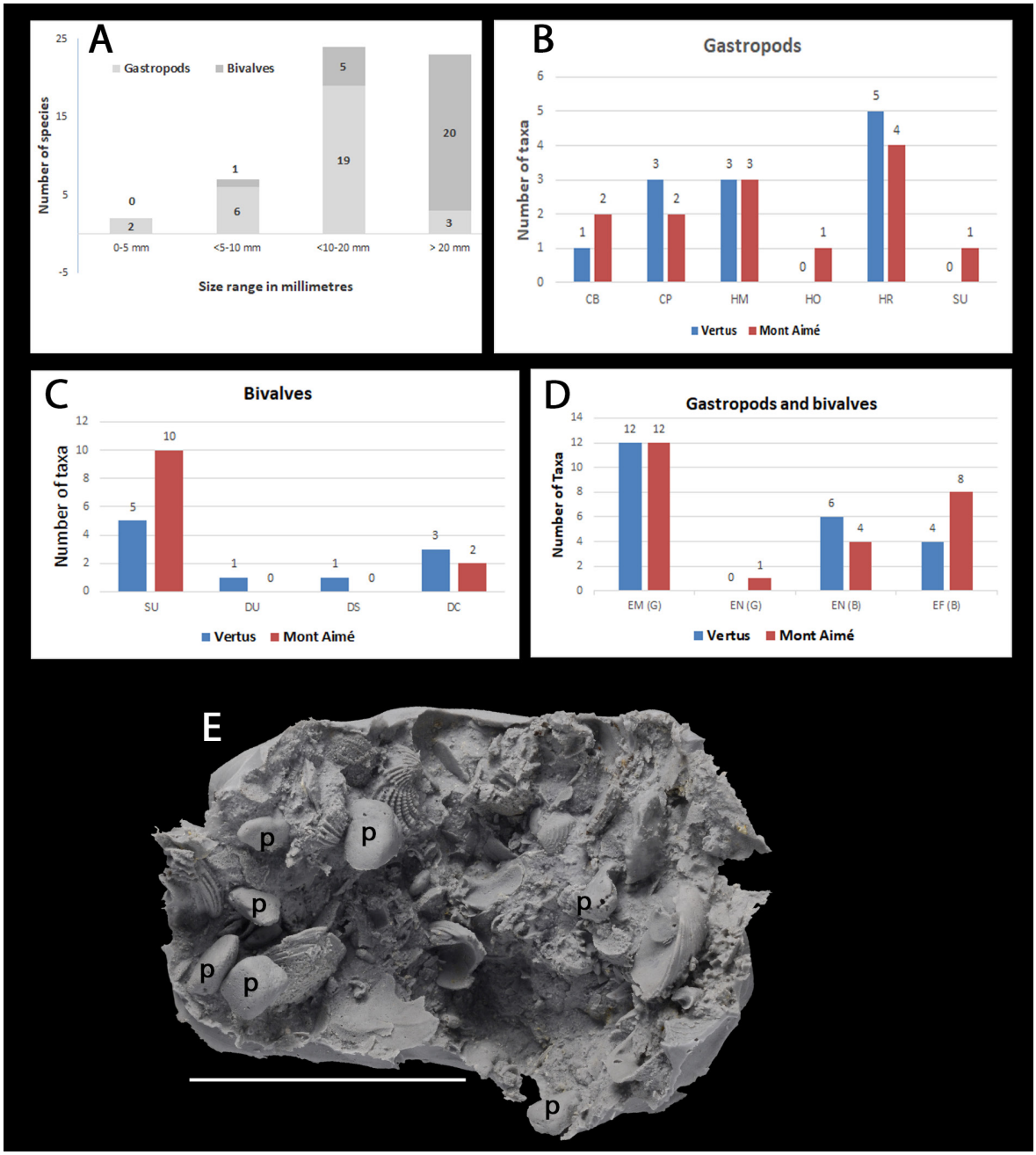

Fig. 22. Palaeoecological data. **A**. Histogram showing the size range in millimetres for the gastropods and the bivalves of the lithified facies of Vertus (Grand Mont and Faloise), Bergères-lès-Vertus (Mont Aimé) and Bois d'Esmans, Maastrichtian, Paris Basin, France. **B–C**. Histograms showing the distribution of taxa by feeding for the gastropods (B) and bivalves (C) in the upper beds of Vertus (Grand Mont) and Mont Aimé. **D**. Histogram showing the distribution of taxa mobility types for the same localities. **E**. Silicone elastomer cast from the sandy limestone with shell concentrations of Mont Aimé showing bivalve shells (mainly *Glyptoactis*) mixed with carbonate pebbles (p). Abbreviations: CB = browsing carnivores; CP = predatory carnivores; DC = chemosymbiotic deposit feeders; DS = surface deposit feeders; DU = subsurface deposit feeder; EF = fixed epibionts; EM = mobile epibionts; EN = endobionts; HM = herbivores on fine-grained substrates; HR = herbivores on rock, rubble or coral substrates; HO = herbivorous omnivores; SU = suspension feeders. Scale bar = 50 mm. Credit = P. Loubry (MNHN/CNRS).

Table 1 (continued on next three pages). List of all taxa from the Maastrichtian localities studied in the Paris Basin. Abbreviations: BBWP = basal biocalcarenite with pectinids; SLSC = sandy limestone with shell concentrations; USL= upper sandy limestone.

SPECIES	Vertus (Faloise)	Vertus (Grand Mont) BBWP	Vertus (Grand Mont) USL	Bergères-les-Vertus (Mont Aimé) SLSC	Shared taxa between USL and SLSC	Bois d'Esmans (Seine-et-Marne)	TOTAL Paris Basin	Maastrichtian of Belgium and Netherlands	Danian of Paris Basin
GASTROPODA	–	–	–	–	–	–	–	–	–
Diodora sp.	–	–	–	1	–	–	1	–	–
Trochoidea indet.	–	–	–	1	–	–	1	–	–
?*Calliostoma monswavinarensis* sp. nov.	–	–	–	1	–	–	1	–	–
Sparnollonia bicarinata gen. et sp. nov.	–	–	1	1	1	–	1	–	–
?*Tectus acmantensis* sp. nov.	–	–	–	–	–	1	1	–	–
?*Tectus fraterculus* sp. nov.	–	–	1	–	–	–	1	–	–
?*Tectus senarmonti* sp. nov.	–	–	–	–	–	1	1	–	–
?*Agathodonta granosecincta* (Binkhorst, 1861)	–	–	–	1	–	–	1	1	–
?*Clypeostoma vertusensis* sp. nov.	–	–	1	–	–	–	1	–	–
Calliomphalus (*Planolateralus*) *montenati* sp. nov.	1	–	–	1	–	–	1	–	–
Rhinoclavis (*Semivertagus*) *parvisulcatus* sp. nov.	–	–	1	1	1	–	1	–	–
Pseudoaluco sp.	–	–	–	1	–	–	1	–	–
?*Vicinocerithium heberti* sp. nov.	1	1	1	1	1	?1	1	–	–
?*Vicinocerithium* sp..	–	–	1	1	1	–	1	–	–
Granulolabium cretaceum sp. nov.	–	–	1	1	1	–	1	–	–
Haustator bergierensis sp. nov.	–	–	–	1	–	–	1	–	–
Haustator sp.	–	–	–	1	–	–	1	–	–

Table 1 (continued). List of all taxa from the Maastrichtian localities studied in the Paris Basin. Abbreviations: BBWP = basal biocalcarenite with pectinids; SLSC = sandy limestone with shell concentrations; USL= upper sandy limestone.

SPECIES	Vertus (Faloise)	Vertus (Grand Mont) BBWP	Vertus (Grand Mont) USL	Bergères-les-Vertus (Mont Aimé) SLSC	Shared taxa between USL and SLSC	Bois d'Esmans (Seine-et-Marne)	TOTAL Paris Basin	Maastrichtian of Belgium and Netherlands	Danian of Paris Basin
Campanile sp.	1	–	–	1	–	1	1	–	–
Sveltella binkhorsti sp. nov.	–	–	1	–	–	–	1	–	–
Fusinus bouchardae sp. nov.	–	–	1	–	–	–	1	–	–
?*Pseudopisania cretacea* sp. nov.	–	–	1	–	–	–	1	–	–
Popenoeum ambiguum (Binkhorst, 1861)	–	–	1	1	1	–	1	1	1
Volutomorpha sp.	–	–	–	1	–	–	1	–	–
Caenogastropoda indet. 2 (?calyptraeid shape)	–	–	1	–	–	–	1	–	–
Caenogastropoda indet. 3 (?volutid shape)	–	–	–	1	–	–	1	–	–
Caenogastropoda indet. 4 (?volutid/cancellariid)	–	–	–	1	–	–	–	–	–
Caenogastropoda indet. 5 (?turrid/aporrhaid)	–	–	1	–	–	–	–	–	–
Caenogastropoda indet. 6 (?turrid/aporrhaid)	–	–	–	1	–	–	–	–	–
Caenogastropoda indet. 7 (?turrid/aporrhaid)	–	–	1	1	1	–	1	–	–
BIVALVIA	–	–	–	–	–	–	–	–	–
Nucula bauti sp. nov.	–	–	1	–	–	–	1	–	–
Arca (s. str.) *submontensis* sp. nov.	–	–	1	1	1	–	1	–	–
Barbatia sp.	–	–	–	1	–	–	1	–	–
Cucullaearca supracretacea (d'Orbigny, 1850)	1	1	1	1	1	–	1	–	–
Ctenoides vogeli Dhont, 1983	1	–	–		–	1	1	–	–

Table 1 (continued). List of all taxa from the Maastrichtian localities studied in the Paris Basin. Abbreviations: BBWP = basal biocalcarenite with pectinids; SLSC = sandy limestone with shell concentrations; USL= upper sandy limestone.

SPECIES	Vertus (Faloise)	Vertus (Grand Mont) BBWP	Vertus (Grand Mont) USL	Bergères-les-Vertus (Mont Aimé) SLSC	Shared taxa between USL and SLSC	Bois d'Esmans (Seine-et-Marne)	TOTAL Paris Basin	Maastrichtian of Belgium and Netherlands	Danian of Paris Basin
?Ostreoidea indet.	1	–	–	1	–	–	1	–	–
Isognomon sp.	–	–	–	1	–	–	1	–	–
Lyropecten ternatus (Münster, 1833)	1	–	–	–	–	–	1	1	–
Lyriochlamys faujasii– (Defrance, 1825)	1	1	–	–	–	–	1	1	–
Neithea regularis (Schlotheim, 1813)	–	–	–	–	–	1	1	1	–
Neithea quinquecostata (J. Sowerby, 1814)	1	–	–	–	–	–	1	1	–
?Spondylidae indet.	–	–	–	1	–	–	1	–	–
Plicatula pacaudi sp. nov.	–	–	–	1	–	–	1	–	–
Wolfgangella cf. *neilpearti* Jagt, M.R. Cooper & Jagt-Yazykova, 2022	–	1	–	–	–	–	1	1	–
Baluchicardia hebertiana (d'Orbigny, 1850)	–	1	1	1	1	–	1	–	–
Bathytormus sparnacensis sp. nov.	–	–	–	1	–	–	1	–	–
Euheterodonta indet. (tellinoid shape).	–	–	1	–	–	–	1	–	–
Euheterodonta indet. (*Recticardo* shape)	–	–	1	–	–	–	1	–	–
Euheterodonta indet. (lucinoid shape).	–	–	1	1	1	–	1	–	1
Fimbria multilamellosa (d'Orbigny, 1850)	–	–	1	–	–	?1	1	–	–
Fimbria sp. 1	1	–	–	1	–	?1	1	–	–

Table 1 (continued). List of all taxa from the Maastrichtian localities studied in the Paris Basin. Abbreviations: BBWP = basal biocalcarenite with pectinids, SLSC = sandy limestone with shell concentrations; USL: upper sandy limestone.

SPECIES	Vertus (Faloise)	Vertus (Grand Mont) BBWP	Vertus (Grand Mont) USL	Bergères-les-Vertus (Mont Aimé) SLSC	Shared taxa between USL and SLSC	Bois d'Esmans (Seine-et-Marne)	TOTAL Paris Basin	Maastrichtian of Belgium and Netherlands	Danian of Paris Basin
Fimbria sp. 2	1	–	–	–	–	–	1	–	–
Chama loubryi sp. nov.	1	1	1	1	1	–	1	–	–
Bivalvia indet. (?Inoceramidae)	–	1	–	–	–	–	1	–	–
–	–	–	–	–	–	–	–	–	–
CEPHLALOPODA	–	–	–	–	–	–	–	–	–
Nautilida indet.	–	–	–	1	–	1	1	–	–
TOTAL	13	8	24	33	12	6	57	8	2

supracretacea and *Chama loubryi* sp. nov. which are present in the upper beds of Vertus (Grand Mont, USL) and Mont Aimé (SLSC). It is possible that previous authors may have collected specimens from both a pectinid-rich basal bed and the upper bed at Vertus (Faloise). Among the few taxa formally identified at Bois d'Esmans, only *Ctenoides vogeli* and *Campanile* sp. are shared with the Vertus-Mont Aimé assemblages. However, according to the faunal list of Combes (1908: 14–15), several other species could be shared with the Vertus-Mont Aimé assemblage: *Corbis* (*Fimbria*) *multilamellosa*, *Corbis* (*Fimbria*) *sublamellosa* (probably *Fimbria* sp. 1) and *Cerithium carolinum* (probably ?*Vicinicerithium heberti* sp. nov.).

4°) Affinities with the European Danian and Maastrichtian faunas: among 31 identified species, 20 species are only known in the Vertus/Mont Aimé/Esmans fauna that represent 64.5% of endemic elements. This mollusc fauna is therefore completely distinct from that of the Danian of the Paris Basin, with which it shares only three species (9.6% of the assemblage): *Fimbria multilamellosa*, *Cucullaearca supracretacea* and *Popenoeum ambiguum*. However, it shares nine species with the Maastrichtian of Limburg (29% of the assemblage): *Ctenoides vogeli*, *Lecompteus ornatus*, *Lyropecten ternatus*, *Lyriochlamys faujasii*, *Neithea regularis*, *N. quinquecostata*, *Wolfgangella* cf. *neilpearti*, *Agathodonta granosecincta* comb. nov. and *Popenoeum ambiguum*.

In conclusion to this biostratigraphic analysis, three points are established: 1°) in the Marne (Vertus and Mont Aimé), characteristic taxa are present from the base to the top of the series and, as a result, the assemblage observed does not correspond to a condensed series. 2°) The composition of the assemblage from Seine-et-Marne (Bois d'Esmans) cannot be separated from that of the Marne. 3°) Although fairly endemic, the fauna shows significantly greater affinities with the European Maastrichtian than with the Danian. Therefore, it is dated to the Maastrichtian. This age is consistent with that obtained from ostracods (Guernet 2018), selachians (Dutheil 2018), the presence of mosasaurs (de Lapparent *et al.* 2018) and the large benthic Foraminifera, *Laffitteina mengaudi* (Astre 1923: 360).

Palaeoenvironmental significance

The detailed results of the study of the ecological characteristics of the molluscs (bivalves and gastropods) are based on the method of Todd (2000) and Lauridsen & Schnetler (2014) and are provided in Appendix 1. As for the biostratigraphic analysis, the discussion focuses on the basal biocalcarenite with pectinids from Vertus (Grand Mont, BBWP), the upper sandy limestone from Vertus (Grand Mont, USL) and the sandy limestone with shell concentrations from Bergères-lès-Vertus (Mont Aimé, SLSC), see Fig. 2 for the stratigraphic location.

1°) Basal biocalcarenite with pectinids from Vertus (Grand Mont, BBWP): only eight mollusc taxa have been identified. This bed mainly contains numerous disarticulated shells of Pectinidae (*Lyriochlamys faujasii*). This sessile bivalve is accompanied by other sessile and stenohaline bivalves belonging to the genera *Cucullaearca*, ?*Septifer*, *Wolfgangella* and *Chama*. The large number of disarticulated bivalves suggests a turbulent marine environment. More rarely, ?*Vicinocerithium heberti* sp. nov. and *Baluchicardia hebertiana* have been found. Both species are abundant in the upper beds from Vertus (Grand Mont) and Bergères-lès-Vertus (Mont Aimé).

2°) The upper sandy limestones from Vertus (Grand Mont, USL) and Bergères-lès-Vertus (Mont Aimé, SLSC) (Fig. 22B–C): herbivore gastropods are the dominant taxa, accounting for 67% and 62% of the assemblage, respectively. Within this category, herbivores on rock, rubble or coral substrates dominate. After herbivores, carnivorous taxa are the most abundant (33% at Vertus and 30% at Mont Aimé). The suspension feeders are in the minority, representing only 8% of the assemblage of taxa at Mont Aimé. Among bivalves, suspension feeders are the most abundant taxa, with a clear dominance at Mont Aimé (83% of the assemblage versus 50% at Vertus). Deposit feeders remain in the minority. With regard

to their relationships with the substrate (Fig. 22D) and their mobility, gastropod taxa are exclusively represented by mobile forms at both sites. However, bivalve taxa represented by sessile forms are more abundant at Mont Aimé and conversely, endobiont taxa are more at Vertus. On the other hand, when making casts of shell imprints, a large number of dissolved carbonate pebbles were revealed, mixed in with the shells (Fig. 22E). These pebbles may have formed a substrate allowing sessile forms to attach themselves. The abundance of herbivores in both localities also indicates the presence of sea grass in the infralittoral zone. Bivalves anatomically connected and the absence of eroded shells also indicate a low hydrodynamic regime. Furthermore, ?*Vicinocerithium* and *Granulolabium*, two genera that tolerate salinity variations, also suggest polyhaline waters of lagoon-type. Finally, the assemblages at Vertus and Mont Aimé reveal palaeoenvironments deposited under shallow waters probably close to the coastline (see palaeogeographic map in Merle & Montenat 2024: 58). These upper limestones contrast with the biocalcarenite with pectinids (BBWP) at the base of Vertus (Grand Mont) and suggest a calmer environment.

Conclusion

The limestones of Vertus, Mont Aimé (Marne) and Bois d'Esmans (Seine-et-Marne) have long been confused with the Danian pisolitic limestone, because their malacological content has not been properly identified. This study, based on recent samples and a new examination of material collected by the previous authors, provides the first complete description of the malacofauna of these limestones. 57 taxa were recognised, including 31 formally identified species. Among them, 14 species of gastropods and 5 species of bivalves are newly described. Given that this fauna is affected by a strong lithification bias, it appears to be quite diversified. It is completely unknown from the Paris Basin. With the exception of endemic taxa which are dominant, it shares significantly more species with the Maastrichtian of Limburg (28% of the assemblage) than with the Danian of the Paris Basin (9% of the assemblage). This allows its attribution to the Maastrichtian age (probably upper Maastrichtian), in accordance with other palaeontological data on ostracods, chondrichthyans, large benthic Foraminifera and mosasaurs discovered recently. The palaeoecological analysis also reveals that the assemblages at Vertus and Mont Aimé indicate palaeoenvironments deposited under shallow waters probably close to the coastline. Its coastal malacofauna with some brackish elements is also unique in Western Europe. Therefore, this study highlights the distinctive character of the faunal content of the limestones of Vertus Mont Aimé and Bois d'Esmans, which constitute an unique Maastrichtian formation in the Paris Basin and which can be called the Vertus-Mont Aimé-Esmans Formation. In spite of the progress made by the present study, further work is needed to gain a better understanding of it. Additional fieldtrips, particularly in the Vertus biocalcarenite of Grant Mont (BBWP), could complete the faunal list. It might seem surprising that after three centuries of geological surface research in the Paris Basin, it is still possible to identify a stage such as the Maastrichtian, but this basin is extremely complex and re-examining it using new approaches could continue to enrich its knowledge.

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References

Abdel Gawad G.I. 1986. Maastrichtian non cephalopod mollusks (Gastropoda, Scaphopoda and Bivalvia) of the Middle Vistula Valley, Central Poland. *Acta Geologica Polonica* 36 (1–3): 69–224.

Adegoke O.S. 1977. Stratigraphy and paleontology of the Ewekoro Formation (Paleogene) of southwestern Nigeria. *Bulletins of American Paleontology* 71 (295): 1–379.
Available from https://www.biodiversitylibrary.org/page/10696713 [accessed 2 Dec. 2025].

Allmon W. 1996. Systematics and evolution of Cenozoic American Turritellidae (Mollusca: Gastropoda) I: Paleocene and Eocene Coastal Plain species related to "*Turritella mortoni* Conrad" and "*Turritella humerosa* Conrad". *Paleontographica Americana* 59: 1–128.
Available from https://www.biodiversitylibrary.org/page/28068322 [accessed 2 Dec. 2025].

Arkaprava M., Shubhabrata P., Arghya P., Debarati C., Ranita S., Rudranil B., Sundaresan P. 2023. Body size evolution of the Late Cretaceous bivalves from Ariyalur, southern India. *Cretaceous Research* 149: 105570. https://doi.org/10.1016/j.cretres.2023.105570

Astre G. 1923. Étude paléontologique des *Nummulites* du Crétacé supérieur de Cézan-Lavardens (Gers). *Bulletin de la Société géologique de France, série 4* 23: 360–368.
Available from https://www.biodiversitylibrary.org/page/31475647 [accessed 2 Dec. 2025].

Bandel K. 1993. Caenogastropoda during Mesozoic times. *Scripta Geologica* special issue 2: 7−56.

Bandel K. & Dockery D.T. 2012. Protoconch characters of Late Cretaceous Latrogastropoda (Neogastropoda and Neomesogastropoda) as an aid in the reconstruction of the phylogeny of the Neogastropoda. *Freiberger Forschungshefte Ser. C* 542 (20): 93–128.

Bandel K. & Riedel F. 1994. The late Cretaceous gastropod fauna from Ajka (Bakony Mountains, Hungary): a revision. *Annalen des Naturhistorischen Museums in Wien*, *Serie A* 96: 1–65.

Bayle E., 1878. *Explication de la Carte géologique de la France, Vol. 4, part 1. Fossiles principaux des Terrains de la France, vol. II*. Imprimerie nationale, Paris.

Bellardi L. 1884. *I molluschi dei terreni terziarii del Piemonte e della Liguria. Parte IV (Fasciolaridae e Turbinellidae)*. Ermanno Loescher, Torino.
Available from https://www.biodiversitylibrary.org/page/12589474 [accessed 2 Dec. 2025].

Benyoucef M., Ghenim A.-F., Ferré B., Ayoub-Hannaa W., Kočí T., Adaci M., Guendouz M.-L., Zaoui Z., Bendella M. & Bensalah M. 2022. Taxonomy, palaeoecology and palaeobiogeography of upper Cenomanian (Upper Cretaceous) oysters and plicatulids from southern Algeria. *Historical Biology* 34 (7): 1274–1304. https://doi.org/10.1080/08912963.2021.1974018

Bignot G. 1987. Les paléoenvironnements et les paléogéographies du bassin de Paris au Danien, d'après les foraminifères du Mont-Aimé (Marne, France). *Revue de Micropaléontologie* 30 (3): 150–176.

Bignot G. 1993. Le Danien basal à *Laffitteina* de Vertus-Mont Aimé. *Revue de Micropaléontologie* 36 (suppl.): 62–66.

Bignot G., Quesnel F. & Bourdillon C. 1997. Le Crétacé terminal et le Paléocène basal de l'Europe nord-occidentale. *Géologie de la France* 3: 21–27.

Binkhorst J.T. Binkhorst van den 1861. *Monographie des Gastéropodes et des Céphalopodes de la craie supérieure du Limbourg, suive d'une description de quelques espèces de crustacés du même dépôt crétacé, avec dix-huit planches dessinées et lithographiées par C. Hohe, de Bonn.* C. Muquardt, Brussels & F. Müller, Maastricht. Available from https://www.biodiversitylibrary.org/page/61964180 [accessed 2 Dec. 2025].

Böhm J. 1885. Der Grünsand von Aachen und seine Molluskenfauna. *Verhandlungen des Naturhistorischen Vereines der preussischen Rheinlande und Westphalens* 42 (5): 1–152. Available from https://www.biodiversitylibrary.org/page/60250939 [accessed 2 Dec. 2025].

Bosquet J. 1860. Fossiele Fauna en Flora van het Krijt in Limburg. *In*: Staring W.C.H. (ed.) *Natuurlijke Historie van Nederland. — De Bodem van Nederland Vol. 2 (Bivalvia)*: 376–388. Kruze, Haarlem.

Bouchet P., Lozouet P., Maestrati P. & Heros V. 2002. Assessing the magnitude of species richness in tropical marine environments: exceptionally high numbers of molluscs at a New Caledonia site. *Biological Journal of the Linnean Society* 75: 421–436. https://doi.org/10.1046/j.1095-8312.2002.00052.x

Boury E. (de) 1899. Révision des Pleurotomes éocènes du Bassin de Paris. *La Feuille des Jeunes Naturalistes, série 3* 29 (339): 33–46. Available from https://www.biodiversitylibrary.org/page/44462756 [accessed 2 Dec. 2025].

Brander G. 1766. *Fossilia hantoniensia collecta, et in musaeo britannico deposita*. Solander, London. https://doi.org/10.5962/bhl.title.146466

Briart A. & Cornet F.L. 1873. Description des fossiles du calcaire grossier de Mons. Seconde partie. Gastéropodes. Ordre I. Prosobranches. Section B. Syphonostomes (première partie). *Mémoires couronnés et Mémoires des savants étrangers, publiés par l'Académie royale des Sciences, des Lettres et des Beaux-arts de Belgique* 37: 1–94. Available from https://www.biodiversitylibrary.org/page/5795466 [accessed 2 Dec. 2025].

Briart A. & Cornet F.L. 1887. Description des fossiles du Calcaire grossier de Mons. Gastéropodes. 4e partie. *Mémoires de l'Académie royale des Sciences, des Lettres et des Beaux-Arts de Belgique* 47: 1–128.

Brusina S.1865. Conchiglie dalmate inedite. *Verhandlungen der Kaiserlich-königlichen Zoologisch-botanischen Gesellschaft in Wien* 15: 3–42.
Available from https://www.biodiversitylibrary.org/page/16400444 [accessed 2 Dec. 2025].

Cantraine F.J. 1835. Diagnoses ou descriptions succinctes de quelques espèces nouvelles de mollusques. *Bulletins de l'Académie royale des Sciences et Belles-Lettres de Bruxelles* 2 (11): 380–401. Available from https://www.biodiversitylibrary.org/page/2880681 [accessed 2 Dec. 2025].

Carpenter P.P. 1864. Supplementary report on the present state of our knowledge with regard to the Mollusca of the West Coast of North America. *Reports of the British Association for the Advancement of Science* (1863) 33: 517–686. Available from https://www.biodiversitylibrary.org/page/29370651 [accessed 2 Dec. 2025].

Chaix C. & Saint Martin J.-P 2018. L'inventaire du contenu paléontologie – Anthozoaires. *In*: Montenat C. & Merle D. (eds) *Stratotype Danien* (Patrimoine géologique 9): 278–290. Publications scientifiques du Muséum national d'Histoire naturelle, Paris.

Chavan A. 1948. L'âge des principaux gisements de calcaire pisolithique. *Bulletin de la Société géologique de France, série 5* 18: 565–574.

Cherns L. & Wright V.P. 2011. Skeletal mineralogy and biodiversity of marine invertebrates: size matters more than seawater chemistry. *Geological Society, London, Special Publications* 358: 9–17. https://doi.org/10.1144/SM358.2

Children J.G. 1823. Lamarck's genera of shells. *The Quarterly Journal of Science, Literature, and the Arts* 14 (28): 298–322 (Jan. 1823), 15 (29): 23–52 (April 1823), 15 (30): 216–258 (July 1823), 16 (31): 49–79 (Oct. 1823). Available from https://www.biodiversitylibrary.org/page/14497099 [accessed 2 Dec. 2025].

Combes P. 1908. *Géologie de la Région parisienne*. Institut encyclopédique, Paris.

Coquand H. 1880. Études supplémentaires sur la paléontologie algérienne: faisant suite à la description géologique et paléontologique de la région sud de la province de Constantine. *Bulletin de l'Académie Hippone* 15: 1–449.

Cossmann M. 1887. Catalogue illustré des coquilles fossiles de l'Éocène des environs de Paris. *Annales de la Société royale malacologique de Belgique* 22: 3–214.
Available from https://www.biodiversitylibrary.org/page/41213509 [accessed 2 Dec. 2025].

Cossmann M. 1888. Catalogue illustré des coquilles fossiles de l'Éocène des environs de Paris. *Annales de la Société royale malacologique de Belgique* 23: 3–328.
Available from https://www.biodiversitylibrary.org/page/5609412 [accessed 2 Dec. 2025].

Cossmann M. 1889. Catalogue illustré des coquilles fossiles de l'Éocène des environs de Paris. *Annales de la Société royale malacologique de Belgique* 24: 3–381.
Available from https://www.biodiversitylibrary.org/page/5502754 [accessed 2 Dec. 2025].

Cossmann M. 1901. *Essais de Paléoconchologie comparée*. Quatrième livraison. Cossmann, Paris. https://doi.org/10.5962/bhl.title.52314

Cossmann M. 1902. Mollusques éocéniques de la Loire-Inférieure. Tome 2, Deuxième fascicule. Gastropodes (suite et fin). *Bulletin de la Société des Sciences naturelles de l'Ouest de la France, **sé**rie 2* 2: 5–157. Available from https://www.biodiversitylibrary.org/page/5853400 [accessed 2 Dec. 2025].

Cossmann M. 1908. Pélécypodes du Montien de Belgique. *Mémoires du Musée royal d'Histoire naturelle de Belgique* 5 (3): 1–76. Available from https://www.biodiversitylibrary.org/page/43205763 [accessed 2 Dec. 2025].

Cossmann M. 1918. *Essais de Paléoconchologie comparée*. Onzième livraison. Cossmann, Paris. https://doi.org/10.5962/bhl.title.52314

Cossmann M. 1919. Révision des Scaphopodes, Gastropodes et Céphalopodes du Montien de Belgique. Première partie. *Mémoires du Musée royal d'Histoire naturelle de Belgique* **6 (4)**: 1–71. Available from https://www.biodiversitylibrary.org/page/42309762 [accessed 2 Dec. 2025].

Cossmann M. & Pissarro G. 1904–1913. *Iconographie complète des coquilles fossiles de l'Eocène des environs de Paris*. Tomes 1–2 and errata. Cossmann, Paris. https://doi.org/10.5962/bhl.title.52315

Cox L.R., Newell N.D., Boyd, D.W., Branson C.C., Casey R., Chavan A., Coogan A.H., Dechaseaux C., Fleming C.A., Haas F., Hertlein L.G., Kauffman E.G., Keen A.M., Larocque A., McAlester A.L., Moore R.C., Nuttall C.P., Perkins B.F., Puri H.S. & Weir J. 1969. Part N: Mollusca 6, Bivalvia. *In*: Moore R.C. (ed.) *Treatise on Invertebrate Paleontology*: 1–951. Geological Society of America & University of Kansas Press, Lawrence.

Crosse H. 1888. Diagnoses molluscorum Novae Caledoniae incolarum. *Journal de Conchyliologie* 35 (4): 303–305. Available from https://www.biodiversitylibrary.org/page/15921550 [accessed 2 Dec. 2025].

Dall W.H. 1890. Contributions to the Tertiary fauna of Florida with especial reference to the Miocene silex-beds of Tampa and the Pliocene beds of the Caloosahatchie River. *Transactions of the Wagner Free Institute of Science* 3 (1): 1–200. Available from https://www.biodiversitylibrary.org/page/31456679 [accessed 2 Dec. 2025].

Dall W.H. 1898. Contributions to the Tertiary fauna of Florida with especial reference to the Miocene silex-beds of Tampa and the Pliocene beds of the Caloosahatchie River. *Transactions of the Wagner Free Institute of Science* 3 (4): 571–948. Available from https://www.biodiversitylibrary.org/page/31429583 [accessed 2 Dec. 2025].

Defrance J.L.M. 1818. Dauphinule (fossiles). *In*: Cuvier G. (ed.) *Dictionnaire des Sciences naturelles Vol. 12*: 544–546. Levrault, Strasbourg & Le Normant, Paris.
Available from https://www.biodiversitylibrary.org/page/23002225 [accessed 2 Dec. 2025].

Defrance J.L.M. 1823. Lucine (fossiles). *In*: Cuvier G. (ed.) *Dictionnaire des Sciences naturelles vol. 27*: 269–277. Levrault, Strasbourg & Le Normant, Paris.
Available from https://www.biodiversitylibrary.org/page/25298238 [accessed 2 Dec. 2025].

Defrance J.L.M. 1826. Peigne (fossiles). *In*: Cuvier G. (ed.) *Dictionnaire des Sciences naturelles vol. 38*: 251–267. Levrault, Strasbourg & Le Normant, Paris.
Available from https://www.biodiversitylibrary.org/page/25302670 [accessed 2 Dec. 2025].

Da Costa E.M. 1778. *Historia naturalis testaceorum Britanniæ, or, the British Conchology; Containing the Descriptions and other Particulars of Natural History of the Shells of Great Britain and Ireland: Illustrated with Figures*. Millan, White, Emsley & Robson, London.
https://doi.org/10.5962/bhl.title.13179

Deshayes G.P. 1856–1860. *Description des Animaux sans Vertèbres Découverts dans le Bassin de Paris, pour Servir de Supplément à la Description des Coquilles fossiles des Environs de Paris, Comprenant une Revue générale de Toutes les Espèces Actuellement Connues. Tome premier. Mollusques acéphalés dimyaires*. Baillière, Paris. https://doi.org/10.5962/bhl.title.51674

Deshayes G.P. 1864–1865. *Description des Animaux sans Vertèbres Découverts dans le Bassin de Paris, pour Servir de Supplément à la Description des Coquilles fossiles des Environs de Paris, Comprenant une Revue générale de Toutes les Espèces Actuellement Connues. Tome troisiéme. Mollusques céphalés, deuxième partie. Mollusques céphalopodes*. Baillière, Paris. https://doi.org/10.5962/bhl.title.51674

Dhondt A. 1972. Systematic revision of the Chlamydinae (Pectinidae, Bivalvia, Mollusca) of the European Cretaceous. Part 2: *Lyropecten*. *Bulletin de l'Institut royal des Sciences naturelles de Belgique* 48 (7): 1–81.

Dhondt A. 1973a. Systematic revision of the Chlamydinae (Pectinidae, Bivalvia, Mollusca) of the European Cretaceous. Part 3: *Chlamys* and *Mimachlamys*. *Bulletin de l'Institut royal des Sciences naturelles de Belgique* 49 (1): 1–134.

Dhondt A. 1973b. Systematic revision of the subfamily Neitheinae (Pectinidae, Bivalvia, Mollusca) of the European Cretaceous. *Mémoires de l'Institut royal des Sciences naturelles de Belgique* 176: 1–101.

Dhondt A. 1983. An inoceramid-like limid of Late Maastrichtian age from Maastricht. *Bulletin de l'Institut royal des Sciences naturelles de Belgique* 55 (3): 2–10.

Dutheil D. 2018. Les données paléontologiques: un réexamen des faunes – Élasmobranches. *In*: Montenat C. & Merle D. (eds) *Stratotype Danien* (Patrimoine géologique 9): 178–185. Publications scientifiques du Muséum national d'Histoire naturelle, Paris.

Faujas de Saint-Fond B. 1799. *Histoire naturelle de la Montagne Saint-Pierre de Maestricht*. H.J. Jansen, Paris. https://doi.org/10.5962/bhl.title.169047

El Qot G. M. 2006. Late Cretaceous macrofossils from Sinai, Egypt. *Beringeria* 36: 3–163.

Fleming J. 1828. *A History of British Animals, Exhibiting the Descriptive Characters and Systematical Arrangement of the Genera and Species of Quadrupeds, Birds, Reptiles, Fishes, Mollusca, and Radiata of*

the United Kingdom; Including the Indigenous, Extirpated, and Extinct Kinds, Together with Periodical and Occasional Visitants. Bell & Bradfute, Edinburgh and James Duncan, London.
https://doi.org/10.5962/bhl.title.12859

Gain O., Belliard L. & Le Renard J. 2019. Le genre *Tectus* (Mollusca, Gastropoda, Vetigastropoda) de l'Éocène Moyen du Cotentin (Manche, France). *Carnets de Voyages paléontologiques dans le Bassin Anglo-Parisien* 5: 1–100.

Glibert M. 1973. Révision des Gastropoda du Danien et du Montien de la Belgique. I. Les Gastropoda du Calcaire de Mons. *Mémoires de l'Institut royal des Sciences naturelles de Belgique* 173: 1–116.

Glibert M. & van de Poel L. 1973. Les Bivalvia du Danien et du Montien de la Belgique. *Mémoires de l'Institut royal des Sciences naturelles de Belgique* 175: 1–89.

Gmelin J.F. 1791. *Caroli a Linné Systema Naturae, ed. 13. Tome 1 (6). Vermes*. G.E. Beer, Leipzig.
https://doi.org/10.5962/bhl.title.36932

Goldfuss G.A. 1833–1841. Petrefacta Germaniae tam ea, quae in Museo Universitatis Regiae Borussicae Fridericiae Wilhelmiae Rhenanae servantur quam alia quaecunque in Museis Hoeninghusiano, Muensteriano aliisque extant, iconibus et descriptionibus illustrata. Zweiter Teil. *In*: Westphal F. (ed.) *Fossilium Catalogus, I. Animalia, pars 102*. Junk, Gravenhage.

Gray J.E. 1847. A list of the genera of recent Mollusca, their synonyms and types. *Proceedings of the Zoological Society of London.* (1847) 15: 129–219.
Available from https://www.biodiversitylibrary.org/page/12862913 [accessed 2 Dec. 2025].

Guernet C. 2018. Les données paléontologiques: un réexamen des faunes – Ostracodes. *In*: Montenat C. & Merle D. (eds) *Stratotype Danien* (Patrimoine géologique 9): 159–160. Publications scientifiques du Muséum national d'Histoire naturelle, Paris.

Guernet C. & Villier L. 2017. Les ostracodes de la collection de P. Margerie et l'âge des couches à Laffittéines du Mont Aimé (bassin de Paris, France). *Geodiversitas* 39 (2): 225–249.
https://doi.org/10.5252/g2017n2a4

Guernet C., Huyghe D., Lartaud F., Merle D., Emmanuel L., Gély J.-P., Michel F. & Pilet O. 2012. Les ostracodes de la falunière de Grignon (Lutétien du Bassin de Paris): implications stratigraphiques. *Geodiversitas* 34 (4): 909–959. https://doi.org/10.5252/g2012n4a12

Guillevin Y. 1977. Contribution à l'étude des foraminifères du Montien du bassin de Paris. *Cahiers de Micropaléontologie* 4: 1–79.

Håkansson E., Bromley R. & Perch-Nielsen K. 1975. Maastrictian chalk of north-west Europe – a pelagic shelf sediment. *In*: Hsü K.J. & Jenkyns H.C. (eds) *Pelagic Sediments: On Land and under the Sea*: 211–233. Special publication of the International Association of Sedimentologists.
https://doi.org/10.1002/9781444304855.ch9

Hansen T. 2019. Gastropods from the Cretaceous-Palaeogene boundary in Denmark. *Zootaxa* 4654 (1): 1–196. https://doi.org/10.11646/zootaxa.4654.1.1

Hart M.B., Feist S.E., Håkansson E., Heinberg C., Price G.D., Leng M.J., & Watkinson M.P. 2005. The Cretaceous–Palaeogene boundary succession at Stevns Klint, Denmark: foraminifers and stable isotope stratigraphy. *Palaeogeography, Palaeoclimatology, Palaeoecology* 224: 6–26.
https://doi.org/10.1016/j.palaeo.2005.03.029

Harzhauser M. 2014. A seagrass-associated Early Miocene Indo-Pacific gastropod fauna from South West India (Kerala). *Palaeontographica Abteilung A: Palaeozoology – Stratigraphy* 302: 73–178.
https://doi.org/10.1127/pala/302/2013/73

Harzhauser M. & Landau B.M. 2026. New Bittiinae (Gastropoda, Cerithiidae) from the Middle Miocene of the Central Paratethys Sea. *Annals of the Natural History Museum Vienna* 127: 1–12. https://doi.org/10.3897/anhmw.170289

Harzhauser M., Guzhov A. & Landau B.M. 2023. A revision and nomenclator of the Cainozoic mudwhelks (Mollusca: Caenogastropoda: Batillariidae, Potamididae) of the Paratethys Sea (Europe, Asia). *Zootaxa* 5272 (1): 001–241. https://doi.org/10.11646/zootaxa.5272.1.1

Hébert E. 1848. Notice sur les dépôts situés dans le bassin de Paris entre la Craie blanche et le Calcaire grossier. *Bulletin de la Société géologique de France, série 2* 2 (5): 388–408.
Available from https://www.biodiversitylibrary.org/page/54364987 [accessed 2 Dec. 2025].

Heinberg C. 1978. Bivalves from the white chalk (Maastrichtian) of Denmark, II: Arcoida. *Bulletin of the Geological Society of Denmark* 27: 105–116. https://doi.org/10.37570/bgsd-1978-27-11

Heinberg C. 1989. Bivalves from the white chalk (Maastrichtian) of Denmark, IV: Nuculoida. *Bulletin of the Geological Society of Denmark* 37: 227–236. https://doi.org/10.37570/bgsd-1988-37-18

Herbert D.G. 2012. A Revision of the Chilodontidae (Gastropoda: Vetigastropoda: Seguenzioidea) of Southern Africa and the South-Western Indian Ocean. *African Invertebrates* 53 (2): 381–502. https://doi.org/10.5733/afin.053.0209

Herrmannsen A.N. 1846–1852. *Indicis Generum Malacozoorum primordia*. *Vol. 1*. Fischer, Cassel. https://doi.org/10.5962/bhl.title.10147

Holzapfel E. 1888. Die Mollusken der Aachener Kreide. *Palaeontographica* 34 (1–4): 29–180. Available from https://www.biodiversitylibrary.org/page/33194592 [accessed 2 Dec. 2025].

ICZN (International Commission on Zoological Nomenclature) 1945. Opinion 189. Suspension of the rules for *Arca* Linnaeus, 1758 (Class Pelecypoda, Order Filibranchiata). *Opinions and Declarations Rendered by the International Commission on Zoological Nomenclature* 3 (8): 93–108.
Available from https://www.biodiversitylibrary.org/page/34653548 [accessed 2 Dec. 2025].

ICZN 1957. Opinion 484. Addition to the *Official List of Generic Names in Zoology* and to the *Official List of Family-Group Names in Zoology* respectively of the generic name *Chama* Linnaeus, 1758, and the family-group name Chamidae (correction of Camacea) Blainville, 1825 (class Pelecypoda). *Opinions and declarations rendered by the International Commission on Zoological Nomenclature* 17: 73–86.
Available from https://www.biodiversitylibrary.org/page/34651608 [accessed 2 Dec. 2025].

ICZN 1999. *The International Trust for Zoological Nomenclature. Fourth edition*. The International Trust for Zoological Nomenclature, London.
Available from https://www.iczn.org/the-code/the-code-online/ [accessed 2 Dec. 2025].

Jagt J.W.M, Felder W.M., Dortangs R.W. & Severijns J. 1996. The Cretaceous/Tertiary boundary in the Maastrichtian type area (SE Netherlands, NE Belgium); a historical account. *Geologie en Mijnbouw* 75: 107–118.

Jagt J.W.M, Van Bakel B.W.M., Cremers G., Deckers M.J.M., Dortangs R.W., Van Es M., Fraaije R.H.B., Kisters P.J.M., Van Knippenberg P.H.M., Lemmens H., Nieuwenhuis E., Severijns J. & Stroucken J.W. 2013. Het Vroeg Paleoceen (Danien) van zuidelijk Limburg en aangrenzend gebied - nieuwe fauna's en nieuwe inzichten. *Afzettingen WTKG* 34: 198–212.

Jagt J.W.M., van Rijsselt E. & van Rijsselt W. 2014. Opmerkelijke Luiks-Limburgse Krijtfossielen. Deel 21. Stokoude mosselen [English translation: Remarkable Liège-Limburg chalk fossils. Part 21. Ancient mussels]. *Natuurhistorisch maandblad* 103 (7): 190–193.

Jagt, J.W.M., Cooper M.R. & Jagt-Yazykova E.A. 2022. The youngest Trigoniida (Mollusca, Bivalvia) of Europe, including new genera and species from the type area of the Maastrichtian Stage. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen* 306 (1): 13–28. https://doi.org/10.1127/njgpa/2022/1094

Kantor Y.I., Fedosov A.E., Kosyan A.R., Puillandre N., Sorokin P.A., Kano Y., Clark R.N. & Bouchet P. 2022. Molecular phylogeny and revised classification of the Buccinoidea (Neogastropoda). *Zoological Journal of the Linnean Society* 194 (3): 789–857. https://doi.org/10.1093/zoolinnean/zlab031

Kaunhowen F. 1898. Die Gastropoden der Maestrichter Kreide. *Palaeontologische Abhandlungen* 8 (3) [new ser. 4 (3)]: 3–132. Available from https://www.biodiversitylibrary.org/page/11315653 [accessed 2 Dec. 2025].

Kennedy W.J., Morrys N.J. & Taylor J.D. 1970. The shell structure, mineralogy and relationships of the Chamacea (Bivalvia). *Palaeontology* 13 (3): 379–413.

Kiel S. 2006. New and little-known gastropods from the Albian of the Mahajanga Basin, Northwestern Madagascar. *Journal of Paleontology* 80 (3): 455–476.
https://doi.org/10.1666/0022-3360(2006)80[455:NALGFT]2.0.CO;2

Kiel S., Bandel K., Banjac N. & Perilliat M.C. 2000. On Cretaceous Campanilidae (Caenogastropoda, Mollusca). *Freiberger Forschungshefte* C490: 15–25.

Knight B., Cox L.R., Keen A.M., Batten R.L., Yochelson E.L. & Robertson R. 1960. Part I: Mollusca 1, Gastropoda, systematic descriptions. *In*: Moore R.C. (ed.) *Treatise on Invertebrate Paleontology*: 169–324. Geological Society of America & University of Kansas Press, Lawrence.

Koenen A. (von) 1885. Über eine Paleocäne Fauna von Kopenhagen. *Abhandlungen der Königlichen Gesellschaft der Wissenschaften* 32: 3–128.
Available from https://www.biodiversitylibrary.org/page/46410900 [accessed 2 Dec. 2025].

Kowalke T. 2002. Systematic revision of Palaeocene brackish water Gastropoda from Mons, Belgium, based on their early ontogenetic shells. *Bulletin de l'Institut royal des Sciences naturelles de Belgique, Sciences de la Terre* 72: 111–134.

Lamarck J.-B. 1803. Mémoires sur les fossiles des environs de Paris, comprenant la détermination des espèces qui appartiennent aux animaux marins sans vertèbres, et dont la plupart sont figurés dans la collection des vélins du Muséum. *Annales du Muséum national d'Histoire naturelle* 1 (4): 299–312 [February 1803]; 1(5): 383–391 [March 1803]; 1(6): 474–479 [April 1803].
Available from https://www.biodiversitylibrary.org/page/48538976 [accessed 2 Dec. 2025].

Lamarck J.-B. 1804. Suite des mémoires sur les fossiles des environs de Paris, comprenant la détermination des espèces qui appartiennent aux animaux marins sans vertèbres et dont la plupart sont figurés dans la collection des vélins du Muséum. *Annales du Muséum national d'Histoire naturelle* 3: 163–170, 266–274, 343–352, 436–444. Available from https://www.biodiversitylibrary.org/page/48387856 [accessed 2 Dec. 2025].

Landman N.H., Goolaerts S., Jagt J.W.M., Jagt-Yazykova E.A., Machalski M. & Yacobucci M.M. 2014. Ammonite extinction and nautilid survival at the end of the Cretaceous. *Geology* 42: 707–710.
https://doi.org/10.1130/G35776.1

Lapparent F. de, Bardet N., Gaudant J., Rage J.-C. & Véran M. 2018. Les données paléontologiques: un réexamen des faunes – Poissons actinoptérygiens et reptiles. *In*: Montenat C. & Merle D. (eds) *Stratotype Danien* (Patrimoine géologique 9): 185–195. Publications scientifiques du Muséum national d'Histoire naturelle, Paris.

Lauridsen B.W. & Schnetler K.I. 2014. A catalogue of Danian gastropods from the Baunekule facies, Faxe Formation, Denmark. *Geological Survey of Denmark & Greenland Bulletin* 32: 1–117.
https://doi.org/10.34194/geusb.v32.4593

Leymerie A. 1842. Mémoire sur le terrain crétacé du départment de l'Aube. 2e partie. *Mémoires de la Societé géologique de France* 5: 1–34. Available from https://www.biodiversitylibrary.org/page/42338159 [accessed 2 Dec. 2025].

Linnaeus C. 1758. *Systema Naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis*. *Tomus I. Editio decima, reformata.* Laurentii Salvii, Stockholm. https://doi.org/10.5962/bhl.title.542

Lovén S. 1847. Malacozoologi. *Öfversigt af Kongliga Vetenskaps Akademiens Förhandlingar* 4: 175–199. Available from https://www.biodiversitylibrary.org/page/59671839 [accessed 2 Dec. 2025].

Lozouet P. 1986. Redéfinition des genres *Potamides* et *Pirenella* (Gastropoda, Prosobranchia) à partir des espèces actuelles et fossiles. Implications phylétiques et biogéographiques. *Annales de Paléontologie* 72: 163–210.

Lozouet P. 1999. Nouvelles espèces de gastéropodes (Mollusca: Gastropoda) de l'Oligocène et du Miocène inférieur d'Aquitaine (sud-ouest de la France). Partie 2. *Cossmanniana* 6: 1–68.

Lundgren B. 1888. Några anteckningar om Sveriges kritfauna. *Öfversigt af Kongliga Vetenskaps-Akademiens Förhandlingar* 45: 225–231.
Available from https://www.biodiversitylibrary.org/page/32392434 [accessed 2 Dec. 2025].

Machalski M. & Duda P. 2024. The influence of burrow-generated pseudobreccia on the preservation of fossil concentrations. *Scientific Reports* 14: 18893. https://doi.org/10.1038/s41598-024-69846-x

Margerie P. 1967. Inventaire des ostracodes conservés dans les couches inférieures des formations post-campaniennes du Mont-Aimé (Marne). *Mémoires de la Société d'Agriculture, Commerce, Sciences et Arts du Département de la Marne* 82: 7–29.

Margerie P. 1968. Inventaire des ostracodes conservés dans les couches inférieures des formations post-campaniennes du Mont-Aimé (Marne), suite et fin. *Mémoires de la Société d'Agriculture, Commerce, Sciences et Arts du Département de la Marne* 83: 7–36.

Margerie P., Deroo G. & Sigal J. 1966. Sur l'âge des couches dites "pisolithiques" du Mont-Aimé (Marne). *Comptes rendus de l'Académie des Sciences* 263: 1549–1551.

Marie P. 1945. Sur *Laffitteina bibensis* et *Laffitteina monodi*, nouveau genre et nouvelles espèces de foraminifères du Montien. *Bulletin de la Société géologique de France, série 5* 15 (7–8): 419–434.

Marshall B.A. 1995. A revision of the recent *Calliostoma* species of New Zealand (Mollusca: Gastropoda: Trochoidea). *The Nautilus* 108 (4): 83–127.
Available from https://www.biodiversitylibrary.org/page/8273331 [accessed 2 Dec. 2025].

Marshall B.A. 2003. A review of the recent and Late Cenozoic Calyptraeidae of New Zealand (Mollusca: Gastropoda). *The Veliger* 46 (2): 117–144.
Available from https://www.biodiversitylibrary.org/page/42496652 [accessed 2 Dec. 2025].

Mégnien F. & Wyns R. 1980. Dano-Montien. *In*: Mégnien C. & Mégnien F. (eds) Synthèse géologique du bassin de Paris. Volume 1: Stratigraphie et paléogéographie. *Mémoires du BRGM 101*: 338–342.

Mégnien F., Villalard P., Labourguigne J., Durand R. & Dutil P. 1977. *Carte géologique de la France à 1/50 000, Feuille de Vertus et Notice*. BRGM, Orléans.

Merle D. 2005. The spiral cords of the Muricidae (Gastropoda, Neogastropoda): importance of ontogenetic and topological correspondences for delineating structural homologies. *Lethaia*: 38: 367–379. https://doi.org/10.1080/00241160500355129

Merle D. 2023. Paléoécologie des mollusques maastrichtiens du Mont Aimé et de Vertus (Marne). *Bulletin de l'Association paléontologique de Villers-sur-Mer* 2023: 21–29.

Merle D. & Montenat C. 2024. La mer du Maastrichtien, une mer mal connue. *In*: Gély J-P., Bergerat F., Le Callonnec L. & Obert D. (eds) *Géodiversité et Patrimoines d'Île de France. Roches, Paysages, Biodiversité, Ressources, Constructions* (Mémoire hors-série 11): 58–59. Association des géologues du bassin de Paris (AGBP), Paris.

Merle D. & Pacaud J.-M. 2018a. Les données paléontologiques: un réexamen des faunes – Mollusques. *In*: Montenat C. & Merle D. (eds) *Stratotype Danien* (Patrimoine géologique 9): 161–177. Publications scientifiques du Muséum national d'Histoire naturelle, Paris.

Merle D. & Pacaud J.-M. 2018b. L'inventaire du contenu paléontologique – Mollusques. *In*: Montenat C. & Merle D. (eds) *Stratotype Danien* (Patrimoine géologique 9): 304–327. Publications scientifiques du Muséum national d'Histoire naturelle, Paris.

Merle D., Pacaud J.-M., Métais G., Bartolini A., Lashari R.A., Brohi I.A., Solangi S.H., Marivaux L. & Welcomme J.-L. 2014. Volutidae (Mollusca: Gastropoda) of the Lakhra Formation (Earliest Eocene, Sindh, Pakistan): systematics, biostratigraphy and paleobiogeography. *Zootaxa* 3826 (1): 101–138. https://doi.org/10.11646/zootaxa.3826.1.3

Michelotti G. 1847. Description des fossiles des terrains miocènes de l'Italie septentrionale. *Natuurkundige Verhandelingen van de Hollandsche Maatschappij der Wetenschappen te Haarlem*, *ser. 2* 3 (2): 1–408.

MolluscaBase 2025. MolluscaBase. Available from MolluscaBase [accessed 5 Aug. 2026].

Montenat C. 2018a. Un siècle et demi de débats autour de la limite Crétacé-Tertiaire. *In*: Montenat C. & Merle D. (eds) *Stratotype Danien* (Patrimoine géologique 9): 37–69. Publications scientifiques du Muséum national d'Histoire naturelle, Paris.

Montenat C. 2018b. Vertus-Mont Aimé et bois d'Esmans: les péripéties séculaires d'une datation stratigraphique autour de la limite K-T – Les âges du "Pisolithique" de Vertus-Mont Aimé: stratigraphie et paléontologie. *In*: Montenat C. & Merle D. (eds) *Stratotype Danien* (Patrimoine géologique 9): 150–155. Publications scientifiques du Muséum national d'Histoire naturelle, Paris.

Montenat C. & Merle D. (eds) 2018. *Stratotype Danien* (Patrimoine géologique 9). Publications scientifiques du Muséum national d'Histoire naturelle, Paris.

Monterosato T.A. (di) 1884. *Nomenclatura generica e specifica di alcune conchiglie mediterranee*. Virzi, Palermo. https://doi.org/10.5962/bhl.title.51528

Montfort [Denys de] P. 1810. *Conchyliologie systématique et classification méthodique des coquilles*. *Vol. 2*. Schoell, Paris. https://doi.org/10.5962/bhl.title.10571

Müller J. 1849. Über die Gattung *Turritella*, Lam. *Amtlicher Bericht über die fünfundzwanzigste Versammlung der Gesellschaft Deutscher Naturforscher und Aerzte in Aachen im September 1847. Mit sechs Steindrucktafeln.* Beaufort, Aachen.

Müller J. 1851. *Monographie der Petrefacten der Aachener Kreideformation*. *Zweite Abtheilung*. Henry & Cohen, Bonn. https://doi.org/10.5962/t.172437

Munier-Chalmas M. 1897. Note préliminaire sur les assises montiennes du bassin de Paris. *Bulletin de la Société géologique de France, série 3* 25: 82–91.
Available from https://www.biodiversitylibrary.org/page/36026867 [accessed 2 Dec. 2025].

Neau G., Turland M., Vincent P.L., Jacob C., Monciardini C., Andreieff P., Châteauneuf J.-J., Gigot C., Cavelier C., Perreau M., Puissegur J.-J., Riveline J. & Kieken M. 1989. *Carte géologique de la France à 1/50 000, Feuille de Montereau Fault Yonne et Notice*. BRGM, Orléans.

Niebuhr B., Schneider S. & Wilmsen M. 2014. Kreide-Fossilien in Sachsen, Teil 1. Cretaceous fossils of Saxony, part 1. – 5. Muscheln. *Geologica Saxonica* 60 (1): 83–168.

Nilsson S. 1827. *Petrificata Suecana Formationis Cretaceae*. *Pars 1, Vertebrata et Mollusca*. Berling Lund. https://doi.org/10.5962/bhl.title.106190

Orbigny A. (d') 1842. *Paléontologie française. Description zoologique et géologique de tous les Animaux Mollusques et Rayonnés fossiles de France. Terrains crétacés*. *Tome 2*. A d'Orbigny & Arthus Bertrand, Paris. https://doi.org/10.5962/bhl.title.50510

Orbigny A. (d') 1847. *Paléontologie française. Description des Mollusques et Rayonnés fossiles. Terrains crétacés. Tome 3. Lamellibranches*. A. d'Orbigny & Arthus Bertrand, Paris.
Available from https://www.biodiversitylibrary.org/item/331483#page/13/mode/1up [accessed 2 Dec. 2025].

Orbigny A. (d') 1850. Note sur les fossiles de l'étage Danien. *Bulletin de la Société géologique de France série 2* 7: 126–135. Available from https://www.biodiversitylibrary.org/page/54383715 [accessed 2 Dec. 2025].

Orbigny C. (d') 1836. Note sur le terrain nouvellement découvert à Meudon. *Bulletin de la Société géologique de France, série 1* 7: 280–291.
Available from https://www.biodiversitylibrary.org/page/53841130 [accessed 2 Dec. 2025].

Orbigny C. (d') 1837. Observations faites du calcaire pisolitique près de Montereau; sa position géognostique et ses fossiles. *Bulletin de la Société géologique de France, série 1* 9: 12–13. Available from https://www.biodiversitylibrary.org/page/53835374 [accessed 2 Dec. 2025].

Pacaud J.-M. 1998. Nouvelles données sur le genre *Popenoeum* (Mollusca, Pseudolividae). Remarques taxinomiques sur une espèce ubiquiste du Paléocène inférieur, *Popenoeum ambiguum* (Binkhorst, 1861: *Pyrula*) nov. comb. *Cossmanniana* 5: 1–30.

Pacaud J.-M. 2004. Révision des mollusques du Danien (Paléocène inférieur) du Bassin de Paris. 1. Gastropoda: Patellogastropoda et Vetigastropoda (pro parte). *Geodiversitas* 26 (4): 577–629.

Pacaud J.-M. 2017. Remarques taxonomiques et nomenclaturales sur les mollusques gastropodes du Paléogène de France et description d'espèces nouvelles. Partie 1: Vetigastropoda et Neritimorpha. *Cossmanniana* 19: 181–201.

Pacaud J.-M. 2018a. Les espèces de mollusques du danien décrites par Alcide d'Orbigny en 1850. *In*: Montenat C. & Merle D. (eds) *Stratotype Danien* (Patrimoine géologique 9): 234–258. Publications scientifiques du Muséum national d'Histoire naturelle, Paris.

Pacaud J.-M. 2018b. Les espèces de mollusques du Danien décrites par Alcide d'Orbigny en 1850 – Liste des synonymes et des chrésonymes. *In*: Montenat C. & Merle D. (eds) *Stratotype Danien* (Patrimoine géologique 9), Cdrom: 40–56. Publications scientifiques du Muséum national d'Histoire naturelle, Paris.

Pacaud J.-M. & Ledon D. 2010. Révision des Mollusques de l'Éocène de Blaye (Gironde). 1. Description d'une espèce nouvelle de Turbinidae (Gastropoda, Vetigastropoda). *Bulletin de la Société linnéenne de Bordeaux* 38 (3): 349–359.

Pacaud J.-M. & Merle D. 2002. Alcide d'Orbigny, un précurseur dans l'étude de la faune du Danien du bassin de Paris / Alcide d'Orbigny, a precursor for the study of the Danian fauna of the Paris Basin (France). *Comptes Rendus Palevol* 1 (7): 587–598. https://doi.org/10.1016/S1631-0683(02)00059-3

Pacaud J.-M. & Merle D. 2016. Note taxonomique sur des Carditidae (Bivalvia: Carditoida) du Maastrichtien et du Danien du bassin de Paris introduits par Alcide d'Orbigny en 1850. *Xenophora Taxonomy* 11: 43–49.

Pacaud J.-M., Merle D. & Meyer J.-C. 2000. La faune danienne de Vigny (Val d'Oise, France): importance pour l'étude de la diversification des mollusques au début du Tertiaire. *Comptes Rendus de l'Académie des Sciences, Paléontologie* 330: 867–873. https://doi.org/10.1016/S1251-8050(00)00226-3

Perrilliat M.d.C., Vega F.J. & Corona R. 2000. Early Maastrichtian Mollusca from the Mexcala Formation of the State of Guerrero, Southern Mexico. *Journal of Paleontology* 74 (1): 7–24. https://doi.org/10.1666/0022-3360(2000)074<0007:EMMFTM>2.0.CO;2

Pervinquière L. 1912. *Études de Paléontologie tunisienne. II. Gastropodes et Lamellibranches des Terrains crétacés. Carte géologique de la Tunisie*. J. Lamarre & Cle, Paris.

Pictet F.-J. & Roux W. 1847–1853. *Description des Mollusques fossiles qui se Trouvent dans les Grès Verts des Environs de Genève*. Jules-Gme Fick. Genève. https://doi.org/10.5962/bhl.title.44875

Priem M.F. 1898. Sur des pycnodontes et des squales du Crétacé supérieur du Bassin de Paris (Turonien, Sénonien, Montien inférieur). *Bulletin de la Société géologique de France, série 3* 26: 229–243. Available from https://www.biodiversitylibrary.org/page/35978945 [accessed 2 Dec. 2025].

Pulteney R. 1813. *Catalogues of the Birds, Shells and Some of the More Rare Plants of Dorsetshire from the New Enlarged Edition of Mr. Hutchin's History of that County*. Gale Ecco, London.

Ravn J.P.J. 1933. Études sur les pélécypodes et gastropodes Daniens du Calcaire de Faxe. *Det Kongelige Danske Videnskabernes Selskabs Skrifter, Naturvisdeskabelig og Mathematisk Afdeling ser. 9* 5 (2): 1–7.

Ravn J.P.J. 1939. Études sur les mollusques du Paléocène de Copenhague. *Biologiske Skrifter udgivet af det Kongelige Danske Videnskabernes Selskab* 1: 1–106.

Roemer F.A. 1841. *Die Versteinerungen des Norddeutschen Kreidegebirges. Mit sechszehn lithographirten Tafeln*. Hahn, Hannover. https://doi.org/10.5962/bhl.title.44865

Roep T.B. & Smit J. 1996. Sedimentological aspects of the K/T boundary at Geulhemmerberg, Zuid Limburg, The Netherlands. *Geologie en Mijnbouw* 75: 119–131.

Sanders M.T., Merle D. & Villier L. 2015. The molluscs of the "Falunière" of Grignon (Middle Lutetian, Yvelines, France): quantification of lithification bias and its impact on the biodiversity assessment of the Middle Eocene of Western Europe. *Geodiversitas* 37 (3): 345–365. https://doi.org/10.5252/g2015n3a4

Saint Martin J.-P., Merle D., Cornée J.-J., Filipescu S., Saint Martin S. & Bucur I. 2007. Les constructions coralliennes du Badénien (Miocène moyen) de la bordure occidentale de la dépression de Transylvanie. *Comptes Rendus Palévol* 6: 37–46. https://doi.org/10.1016/j.crpv.2006.07.006

Schmidt F.C. 1818. *Versuch über die beste Einrichtung zur Aufstellung: Behandlung und Aufbewahrung der verschiedenen Naturkörper und gegenstände der Kunst, vorzüglich der Conchylien-Sammlungen, nebst kurzer Beurtheilung der conchyliologischen Systeme und Schriften und einer tabellarischen Zusammenstellung und Vergleichung der sechs besten und neuesten conchyliologischen Systeme*. Gotha, J. Perth. Available from https://www.biodiversitylibrary.org/page/46054299 [accessed 2 Dec. 2025].

Schnetler K.I. & Petit R.E. 2010. Revision of the gastropod family Cancellariidae from the Paleocene of Nuusuaq, West Greenland. *Cainozoic Research* 7 (1–2): 3–26.

Schlotheim E.F. (von) 1813. Beiträge zur Naturgeschichte der Versteinerungen in geognostischer Hinsicht. *Taschenbuch für die gesammte Mineralogie, mit Hinsicht auf die neuesten Entdeckungen, herausgegeben von Dr. Carl Caesar Leonhard* 7: 3–134.

Schröder M. 1995. Frühontologische Schalen jurassischer und unterkretazischer Gastropoden aus Norddeutschland und Polen. *Palaeontographica Abt. A* 238 (1−4): 1−95. https://doi.org/10.1127/pala/238/1995/1

Sénarmont H. (de) 1844. *Essai d'une Description géologique du Département de Seine-et-Marne*. Béthune et Plon, Paris.

Sohl N.F. 1961. Archeogastropoda, Mesogastropoda and stratigraphy of the Ripley Owl Creek, and Prairie Bluff Formations. *United States Geological Survey Professional Paper* 331-A: 1–151. https://doi.org/10.3133/pp331A

Sohl N.F. 1992. Upper Cretaceous gastropods (Fissurellidae, Haliotidae, Scissurellidae) from Puerto Rico and Jamaica. *Journal of Paleontology* 66 (3): 414–434. https://doi.org/10.1017/S0022336000033977

Sornay J. 1975. Trois espèces nouvelles d'inocérames du Sénonien de Madagascar. *Annales de Paléontologie*: 61 (1):19–29.

Sowerby J. 1814. *The Mineral Conchology of Great Britain; or Coloured Figures and Descriptions of those Remains of Testaceous Animals or Shells, which have been Preserved at Various Times and Depths in the Earth*. *Vol. 1*. Sowerby, London. https://doi.org/10.5962/bhl.title.14408

Sowerby J. 1816. *The Mineral Conchology of Great Britain; or Coloured Figures and Descriptions of those Remains of Testaceous Animals or Shells, which have been Preserved at Various Times and Depths in the Earth*. *Vol. 3*. Sowerby, London. https://doi.org/10.5962/bhl.title.14408

Sowerby J. de C. 1825. *The Mineral Conchology of Great Britain; or Coloured Figures and Descriptions of those Remains of Testaceous Animals or Shells, which have been Preserved at Various Times and Depths in the Earth*. *Vol. 5*. Sowerby, London. https://doi.org/10.5962/bhl.title.14408

Squires R.L. & Goedert J.M 1994. New species of Early Eocene small to minute mollusks from the Crescent Formation, Black Hills, Southwestern Washington. *The Veliger* 37 (3): 253–256. Available from https://www.biodiversitylibrary.org/page/42464959 [accessed 2 Dec. 2025].

Squires R.L. & Saul L.R. 1998. New upper Paleocene species of the bivalve *Plicatula* from Southern California. *Journal of Paleontology* 72 (6): 1024–1029. https://doi.org/10.1017/S0022336000027372

Stenzel H.B. 1971. Oysters. *In*: Moore R.C. (ed.) *Treatise on Invertebrate Paleontology, part N, Mollusca 6, Bivalvia, Vol. 3*: N953–N1224. Geological Society of America and University of Kansas Press, Lawrence.

Stephenson L.W. 1941. The larger invertebrate fossils of the Navarro Group of Texas (exclusive of corals and crustaceans and exclusive of the fauna of the Escondido Formation). *The University of Texas Publication* 4101: 1–641.

Stoliczka F. 1870–1871. The Pelecypoda, with a review of all known genera of this class, fossil and recent. *In*: Oldham T. (ed.) *Paleontologia Indica, being Figures and Descriptions of the Organic Remains Procured During the Progress of the Geological Survey of India. Cretaceous Fauna of Southern India. Vol. 3*. Memoirs of the Geological Survey of India, Calcutta.

Surlyk F. 1997. A cool-water carbonate ramp with bryozoan mounds: Late Cretaceous–Danian of the Danish Basin. *In*: James N.P. & Clarke J.A.D. (eds) *Cool-water Carbonates*. Special Publication – SEPM (Society for Sedimentary Geology) 56: 293–307.

Surlyk F., Damholt T. & Bjerager M. 2006. Stevns Klint, Denmark: Uppermost Maastrichtian chalk, Cretaceous-Tertiary boundary, and lower Danian bryozoan mound complex. *Bulletin of the Geological Society of Denmark* 54 (1–2): 1–48. https://doi.org/10.37570/bgsd-2006-54-01

Suter H. 1913. *Manual of the New Zealand Mollusca, with an Atlas of Quarto Plates*. Government Printer, Wellington. https://doi.org/10.5962/bhl.title.1716

Termier G. & Termier H. 1950. *Paléontologie marocaine. 2, Invertébrés de l'Ére primaire. Fascicule 3, Mollusques*. Hermann, Paris.

Todd J.A, 2000. Introduction to molluscan life habits databases. Neogene marine biota of tropical America (NMITA). Available from NMITA Molluscan Life Habits databases [accessed 2 Dec. 2025].

Torriani A.M. 1942. Revisione della fauna Neocretacica della Libia: gen. *Chlamys*, *Pecten*, *Neithea* e *Plicatula*. *Annali del Museo libico di Storia naturale* 3: 83–95.

Traub F. 1979. Weitere Paleozän-Gastropoden aus dem Helvetikum des Haunsberges nördlich von Salzburg. *Mitteilungen der Bayerischen Staatssammlung für Paläontologie und historische Geologie* 19: 93–123.

Tröger K.-A., Summesberger H. & Skoumal P. 1999. Inoceramidae from the Campanian (Upper Cretaceous) of the Gschliefgraben (Ultrahelvetic; Austria). *Beiträge zur Paläontologie* 24: 41–61.

Van de Poel L. 1959. Faune malacologique du Hervien. Troisième note (première partie). *Bulletin de l'Institut royal des Sciences naturelles de Belgique* 35 (15): 1–26.

Vellekoop J., Van Tilborgh K.H., Van Knippenberg P., Jagt J.M., Stassen P., Goolaerts S. & Speijer R.P. 2019. Type-Maastrichtian gastropod faunas show eapid ecosystem recovery following the Cretaceous–Palaeogene boundary catastrophe. *Palaeontology* 63 (2): 349–367. https://doi.org/10.1111/pala.12462

Vermeij G. J. 1998. Generic revision of the neogastropod family Pseudolividae. *The Nautilus* 111 (2): 53–84. Available from https://www.biodiversitylibrary.org/page/8273781 [accessed 2 Dec. 2025].

Vialov O. 1936. Sur la classification des huîtres. *Comptes Rendus (Doklady) de l'Académie des Sciences de l'URSS, série 2* 4 (1): 17–20.

Vilvens C. 2001. Description of a new species of *Calliostoma* (Gastropoda: Trochidae: Calliostomatinae) from Madagascar. *Novapex* 2 (4): 175–178.

Vincent É. 1930. Études sur les mollusques montiens du Poudingue et du tuffeau de Ciply. *Mémoires du Musée royal d'histoire naturelle de Belgique* 46: 1–115.

Viquesnel A. 1838. Sur le terrain tertiaire des environs de Vertus (Marne). *Bulletin de la Société géologique de France, série 1* 9: 296–305.
Available from https://www.biodiversitylibrary.org/page/53835632 [accessed 2 Dec. 2025].

Vogel, F. 1895. Beiträge zur Kenntniss der hollandischen Kreide. *Sammlungen des Geologischen Reichs-Museums in Leiden, Neue Folge* 2 (1): 1–64.

Wade B. 1926. The fauna of the Ripley Formation on Coon Creek, Tennessee. *United States Geological Survey Professional Paper* 137: 1–272. https://doi.org/10.3133/pp137

Waller T.R. & Marincovich L. 1992. New species of *Camptochlamys* and *Chlamys* (Mollusca: Bivalvia: Pectinidae) from near the Cretaceous/Tertiary boundary at Ocean Point, North Slope, Alaska. *Journal of Paleontology* 66 (2): 215–227. https://doi.org/10.1017/S0022336000033746

Wenz W. 1938. Gastropoda. Teil 2: Prosobranchia. *In*: Schindewolf O.H. (ed.) *Handbuch der Paläozoologie*, *Band 6, Lieferung 3*. Bornträger, Berlin.

Wood E. 1910. The phylogeny of certain Cerithiidae. *Annals of the New York Academy of Sciences* 20 (1): 1–92. https://doi.org/10.1111/j.1749-6632.1910.tb55147.x

Woods H. 1901. *A Monograph of the Cretaceous Lamellibranchia of England. Vol. I*. The Paleontographical Society, London.

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Appendix 1. Life habits (feeding types and mobility) of the taxa (genera with corresponding families) collected in the upper sandy limestones of Vertus (Grand Mont) and Bergères-lès-Vertus (Mont Aimé). Ecological data from Todd (2000) slightly modified. Abbreviations: CB = browsing carnivores; CP = predatory carnivores; DC = chemosymbiotic deposit feeders; DS = surface deposit feeders; DU = subsurface deposit feeder; EF= fixed epibionts; EM = mobile epibionts; EN = endobionts; HM = herbivores on fine-grained substrates; HO = herbivorous omnivores; HR = herbivores on rock, rubble or coral substrates; SU = suspension feeders.

Genera/taxa	Family	Feeding	Substrate relationships	Vertus	Mont Aimé
GASTROPODS					
Diodora	Fissurellidae	HR	EM		X
?*Calliostoma*	Calliostomatidae	CB	EM		X
Sparnollonia	Colloniidae	HR	EM	X	X
?*Tectus*	Tegulidae	HR	EM	X	X
?*Agathodonta*	Chilodontidae	HR	EM	X	
?*Clypeostoma*	Chilodontidae	HR	EM	X	
Calliomphalus	Eucyclidae	HR	EM	X	
Rhinoclavis	Cerithiidae	HM	EM	X	X
Pseudoaluco	Cerithiidae	HM	EM		X
?*Vicinocerithium*	Batillariidae	HM	EM	X	X
Granulolabium	Potamididae	HM	EM	X	
Haustator	Turritellidae	SU	EN		X
Campanile	Campanilidae	HO	EM		X
Sveltella	Cancellariidae	CB	EM	X	X
Fusinus	Fasciolariidae	CP	EM	X	
?*Pseudopisania*	Columbellidae	CP	EM	X	
Popenoeum	Pseudolividae	CP	EM	X	X
Volutomorpha	Volutidae	CP	EM		X
BIVALVES					
Nucula	Nuculidae	DU	EN	X	
Arca	Arcidae	SU	EF	X	X
Barbatia	Arcidae	SU	EF		X
Cucullaearca	Arcidae	SU	EF	X	X
?Ostreoidea	Ostreoidea	SU	EF		X
Isognomon	Isognomonidae	SU	EF		X
?Spondylidae	Spondylidae	SU	EF		X
Plicatula	Plicatulidae	SU	EF		X
Ctenoides	Limidae	SU	EF	X	
Glyptoactis (*Baluchicardia*)	Carditidae	SU	EN	X	X
Bathytormus	Crassatellidae	SU	EN		X
Euheterodonta (?tellinoid)	Tellinoidea	DS	EN	X	
Euheterodonta (?*Recticardo*)	Lucinidae	DC	EN	X	
Fimbria	Lucinidae	DC	EN	X	X
Euheterodonta (?small lucinoid)	Lucinidae	DC	EN	X	X
Chama	Chamidae	SU	EF	X	X