

# A new Eocene genus of Columbariidae (Gastropoda: Turbinelloidea) with a labral tooth

Geerat J. Vermeij<sup>1,3</sup> and Jean-Michel Pacaud<sup>2</sup>

<sup>1</sup> University of California, Davis; Department of Earth and Planetary Science, One Shields Avenue, Davis, CA, 95616, USA; e-mail: gjvermeij@ucdavis.edu

<sup>2</sup> CR2P Centre de Recherche en Paléontologie – Paris; Muséum national d'Histoire naturelle, Sorbonne Université, CNRS; 8 rue Buffon, CP 38, 75005 Paris (France); e-mail: pacaud@mnhn.fr

<sup>3</sup> corresponding author

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A previously unrecognized new genus, *Denticulofusus* (type species: *Fusus gothicus* Deshayes, 1834, Lutetian of the Paris Basin, France) is proposed for Middle Eocene columbariine turbinellid gastropods with a labral tooth situated at the outer lip at the end of a spiral groove. Additional species, both from the Lutetian and Priabonian of the Cotentin Basin of Normandy, France, are respectively *D. monicae* (Belliard, Gain & Le Renard, 2017) and *D. cavellieri* (Gain & Le Renard, 2017). The presence of the labral tooth distinguishes *Denticulofusus* from the Eocene to Recent genus *Coluzea* Finlay in Allan, 1926, and the Eocene genus *Falsifusus* Grabau, 1904.

KEY WORDS: Eocene, Columbariidae, *Denticulofusus*, new genus, labral tooth

## Introduction

Even in relatively well-studied fossil faunas, unexpected discoveries continue to be made. A case in point involves three species from the Lutetian and the Priabonian (Middle and Late Eocene) of France. In our examination of specimens from the Paris Basin, together with a reappraisal of relevant literature, we uncovered a new clade of gastropods with a previously unrecognized labral tooth. Here we describe this group as the new genus *Denticulofusus* and compare its characteristics to those of related fossil and living genera.

## Material Examined

MNHN.F = Muséum national d'Histoire naturelle, Collection de Paléontologie (Paris, France)

Parnes, Carrière aux Hommes (Oise, France) MNHN.F.B64775 (Sarazin coll.): 3 sp.

Parnes, Grande Cronière (Oise, France) MNHN.F.A71168 (Pacaud coll.): 5 sp.

Chaussy, Les Garennes (Val d'Oise, France) MNHN.F.A71167 (Schtrock coll.): 5 sp.

Cahaignes, Requiécourt (Eure, France) MNHN.F.A71166 (Braillon coll.): 1 sp.

Cahaignes, Requiécourt (Eure, France) MNHN.F.B64776 (Lhomme coll.): 2 sp.

Fontenay-en-Vexin, Bois du But (Eure, France) MNHN.F.A71165 (Faullummel coll.): 5 sp.

Fontenay-en-Vexin, Bois du But (Eure, France) MNHN.F.A71162 (Pacaud coll.): 4 sp.

Fontenay-en-Vexin, Bois du But (Eure, France) MNHN.F.A71163 (Pons coll.): 16 sp.

Villiers-Saint-Frédéric, Butte Saint-Léonard (Yvelines, France) MNHN.F.A71164 (Pons coll.): 3 sp.

## Systematic Palaeontology

Superfamily Turbinelloidea Swainson, 1835

Family Columbariidae Tomlin, 1928

Genus *Denticulofusus*, new genus

*Type species* – *Fusus gothicus* Deshayes, 1834, Lutetian, Middle Eocene, Paris Basin (Figure 1)

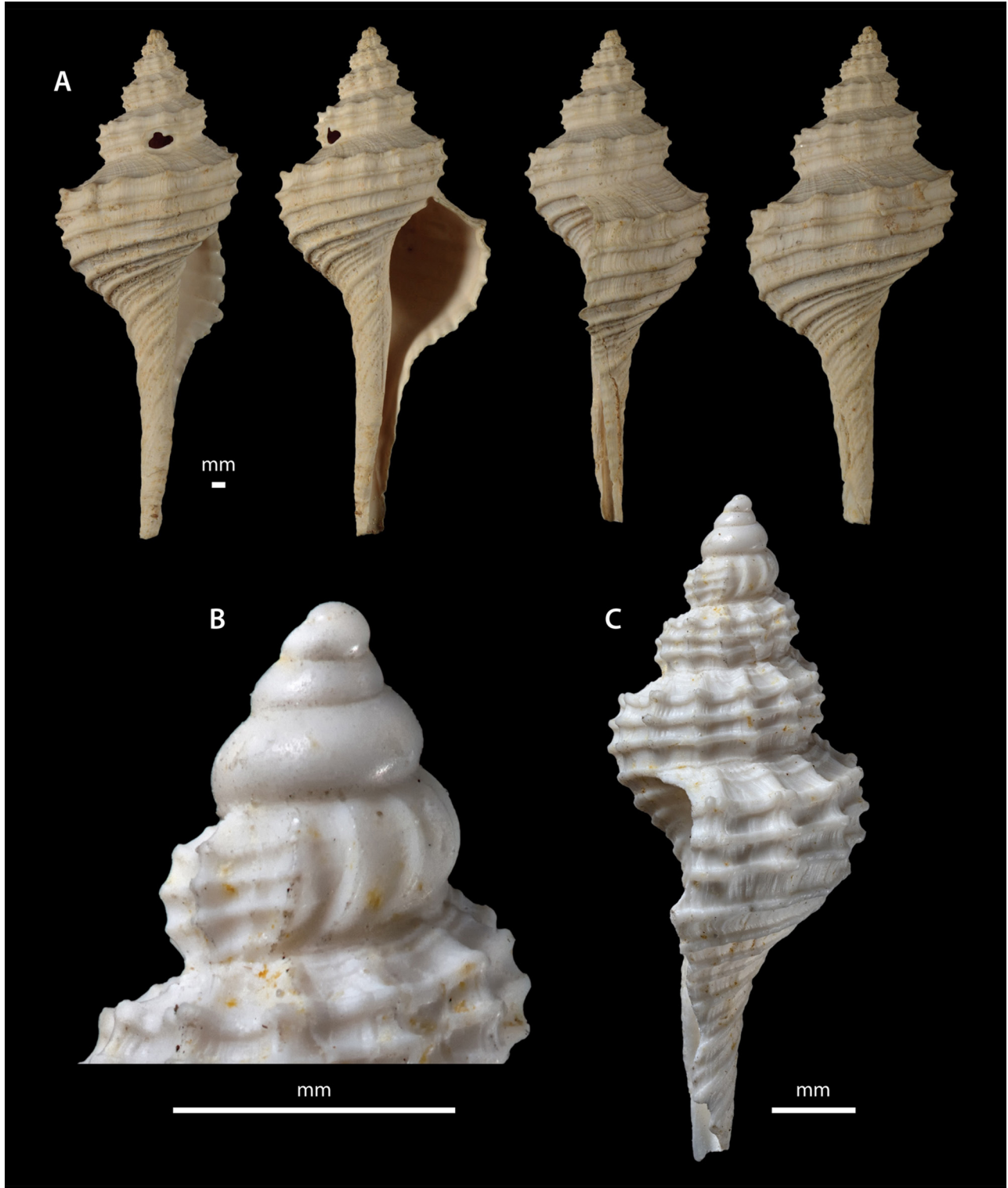
*Etymology* – Combination of Latin *denticula* (small tooth) and *fusus* (spindle).

*Diagnosis* – Shell narrowly fusiform, with relatively low spire, and a long, very narrowly open siphonal canal; protoconch multispiral, high conical, consisting of 4 convex whorls; first three whorls smooth and fourth whorl with strong, widely arched folds parallel to protoconch/teleoconch transition; sutures channeled; spiral sculpture consisting of cords and a peripheral shoulder angulation;

axial sculpture consisting of about twelve angular ribs; aperture small; outer lip with broad adapical sinus, its edge abapically with three small labral teeth, the largest of which is situated between the lowest two cords; inner side of outer lip smooth; inner lip adherent; adapical

ridge on inner lip absent.

*Included species* – *Fusus gothicus* Deshayes, 1834; *Coluzea cavellieri* Gain & Le Renard, 2017; *Coluzea monicae* Belliard, Gain & Le Renard, 2017.



**Figure 1.** A: Adult specimen : Lutetian of Parnes, Grande-Cronière (Oise), MNHN.F.A71161 (leg. Pacaud); B: Juvenile specimen, protoconch: Lutetian of Fontenay-en-Vexin, Bois du But (Eure), MNHN.F.A71180 (leg. Pacaud); C: Juvenile specimen : Lutetian of Fontenay-en-Vexin, Bois du But (Eure), MNHN.F.A71180 (leg. Pacaud). Photographs Gaëlle Doitieu (e-recolnat Project, MNHN)

*Remarks* – While examining several French and English Eocene species that have often been considered to belong to the fasciolariid subfamily Fusininae (e.g. Wrigley, 1927), we discovered a previously overlooked feature on the shell of a species originally named *Fusus gothicus* by Deshayes (1834; 1835). This feature, a blunt, small labral tooth located at the end of a groove between the lowest two cords on the last whorl, is not an artifact of preservation, for it can also be discerned at the same position at earlier apertural positions. Inspection of illustrations further revealed that a similar tooth is present at the same position and at earlier growth stages in two recently described species from the Cotentin Basin of Normandy, France, originally named *Coluzea cavellieri* and *C. monicae*. The tooth was not mentioned in the description of any of these three species.

We assign *Denticulofusus* to the Columbariidae largely because of the presence of a peripheral keel on adult whorls. The Eocene fusinine fasciolariid genus *Eofusus* Vermeij & Snyder, 2018 resembles *Denticulofusus* but it has an enlarged peripheral cord rather than a keel, and the outer lip tends to be somewhat convex rather than straight as in *Denticulofusus* and other columbariids. No fossil or living member of the Fusininae has a labral tooth (Vermeij & Snyder 2018).

All three taxa for which we establish the new genus *Denticulofusus* were assigned previously to *Coluzea* Finlay in Allan, 1926 (Pacaud & Le Renard, 1995; Belliard *et al.*, 2017; Gain & Le Renard, 2017). Other Eocene European species that have been assigned to *Coluzea* lack the labral tooth, as in *C. dissimilis* (Deshayes, 1834), *C. erecta* (von Koenen, 1889), *C. londini* (Wrigley, 1927), *C. multilirata* (von Koenen, 1889), *C. regnorum* (Wrigley, 1927), *C. uncarinata* (Deshayes, 1834) and *C. ytenae* (Wrigley, 1927). The ontogeny of the primary cords in these species without a labral tooth differs from that in *Denticulofusus* and from that in living species of *Coluzea* as well as from that in the type of *Coluzea*, the Middle Miocene *C. dentata* (Hutton, 1877) from New Zealand (see Beu & Maxwell, 1990, for a redescription). In the living fauna, species assigned to *Coluzea* are distributed in deep waters in New Zealand, tropical Australia and southeastern Africa (Darragh, 1969; 1987; 1997; Harasewych, 2011). In New Zealand the genus extends back to the Early Eocene (Beu & Maxwell, 1990). The name *Coluzea* should perhaps be restricted to the Late Eocene and younger species of *Coluzea* in New Zealand. These younger species, unlike the earlier Eocene taxa in New Zealand and living species in Africa and Australia, have nodes instead of open spines on the peripheral keel (see also Harasewych, 2019). A new generic name would then be needed for the open-spined species previously attributed to *Coluzea*. The only European species in that group is *Fusus serratus* Deshayes, 1825, from the Lutetian of the Paris Basin.

Vermeij & Snyder (2018) propose that other European species of “*Coluzea*” without a labral tooth (other than *C. serrata*) bear a very close resemblance to the Eocene American genus *Falsifusus* Grabau, 1904 (type species: *Fusus ottonis* Aldrich, 1897). The only difference

between *Falsifusus* and the European taxa is that the protoconch of the former is multispiral, whereas that of the European taxa is paucispiral. Given the frequent transitions from multispiral to paucispiral protoconchs in many gastropod lineages, we consider the European species without a labral tooth to represent derived conditions within *Falsifusus*, a genus that, as Vermeij & Snyder (2018) indicate, belongs to the Columbariidae and not to the Fusininae.

The only other Palaeogene European genus that appears to belong to the Columbariidae is *Clavogyra* Leroy, 2018 (type species: *C. ledeei* Leroy, 2018) from the Cuisian (Late Ypresian, Early Eocene) of the Paris Basin. Its shell is exceptionally large (up to 120 mm), more than twice the length of species of *Denticulofusus*; and its spiral sculpture features two keels. There is no mention of a labral tooth in this genus.

Within Columbariidae, a labral tooth also occurs in the genus *Columbarium* von Martens, 1881. In that genus, the tooth is situated at the end of a basal cord or keel (Darragh, 1969; Vermeij, 2001) rather than between cords as in *Denticulofusus*. Although the earliest species of *Columbarium*, *C. antecedens* Pacaud, 2015, is known from the Danian (Early Palaeocene) of Belgium and France, our examination of specimens at the Institut Royal des Sciences Naturelles de Belgique in Brussels and at the Muséum national d’Histoire naturelle in Paris failed to reveal a labral tooth, calling into question the generic placement of this species. Leroy (2018) has pointed out similarities between this species and Palaeogene members of *Coluzea*. The early fossil record of *Columbarium* is otherwise confined to Australasia, where it is known from the Palaeocene onward (Darragh, 1969; Harasewych, 2011). The early fossil record of *Columbarium* is otherwise confined to Australia and New Zealand, where it is known from the Palaeocene onward (Darragh, 1969; 1987; 1991). *Fusus rugatus* Aldrich, 1886 from the Late Palaeocene Gregg’s Landing Formation of Alabama, attributed by Darragh (1969) to *Columbarium*, was said by Darragh to be unlike any early Australian species, and instead is more likely a member of the Palaeocene to Recent New World genus *Fulgurofusus* Grabau, 1904 (see also Grabau, 1904). In the living fauna, *Columbarium* occurs in Australasia, the South China Sea, Japan, and southern Africa (Darragh, 1969; Harasewych, 2011). *Columbarium* therefore appears always to have been a genus in the western Pacific and Indian Oceans. Its distribution does not overlap with that of *Denticulofusus*, and we surmise that the labral tooth evolved independently in *Denticulofusus* and *Columbarium*.

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