



Scaphopoda from the Spanish coasts

Escafópodos de las costas españolas

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ABSTRACT

The scaphopod molluscs collected at 29 stations of the Fauna Iberica projects I - III along the entire Spanish mainland coast and the Balearic Islands belong to 12 species from 7 genera and 5 families. These species are listed together with their synonyms, original descriptions, and geographic and bathymetric ranges in this material and from the literature. None of the species are found to extend either range in these samples. On the other hand, some otherwise common scaphopods are not represented. Some of the species have extensive fossil records, and in *Entalina tetragona* and *Antalis inaequicostata*, problems of synonymy and historical biogeography are discussed.

RESUMEN

En el presente trabajo se relacionan aquellas especies de escafópodos encontradas en 29 estaciones de las costas españolas de la península Ibérica y de las islas Baleares durante las campañas FAUNA I-III. En total se han hallado 12 especies pertenecientes a 7 géneros y 5 familias. Para cada especie se proporciona una lista de sinónimos, la descripción original y los rangos de distribución geográfica y batimétrica, obtenidos a partir de este material y de la bibliografía. Los datos que proporcionan estas muestras no permiten extender rangos de distribución de ninguna de las especies. Por otra parte, algunas de las especies comunes de escafópodos en el área no están aquí representados. Algunas de las especies tienen registros fósiles extensos, y en *Entalina tetragona* y *Antalis inaequicostata* se discuten problemas relacionados con su sinonimia y biogeografía histórica.

KEY WORDS: Scaphopoda, systematic biogeography, Iberian Peninsula and Balearic Islands

PALABRAS CLAVE: Escafópodos, sistemática biogeografía, península Ibérica e islas Baleares.

INTRODUCTION

The main purpose of this paper is the systematic treatment of Scaphopoda collected by recent sampling cruises of the Fauna Ibérica programme along the Spanish coasts. The cruises Fauna I (July, 1989), Fauna II (June - July, 1991) and Fauna III (June - July, 1994) covered the Sea of Alborán, the Gulf of Cádiz,

the Bay of Biscay, the Atlantic coast off South Galicia, and the waters around the Balearic Islands. Scaphopod specimens are represented in 29 stations of these cruises. A list of stations of the "Fauna I" cruise is already published (TEMPLADO, GUERRA, BEDOYA, MORENO, REMÓN, MALDONADO AND RAMOS,

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1993); publications with the stations of the remaining cruises are in preparation (Templado, pers. comm.). Sources of primary faunistic information on Scaphopoda are reports of the marine expeditions "Travailleur" and "Talisman" (LOCARD, 1898), "Porcupine", "Valorous" and two smaller cruises (JEFFREYS 1870, 1877, 1882), and ALZURIA (1986, 1987). Faunistic and systematic accounts of the Eastern Pyrenean Seas were made by BUCQUOY, DAUTZENBERG AND DOLLFUS (1882) and MARS (1965). The only synopsis of Iberian and Balearic

molluscs to date (HIDALGO, 1917) also includes Scaphopoda. The fundamental monography of PILSBRY AND SHARP (1897), the comprehensive studies of CAPROTTI (1965, 1968, 1979), and the classification of higher taxa of STEINER (1992, 1996) and SCARABINO (1995) form the basis of the systematic treatment. Complementary information on synonyms is drawn from MONTEROSATO (1875) and STORK (1934). The material studied in this paper is deposited in the Museo Nacional de Ciencias Naturales, Madrid.

SYSTEMATIC ACCOUNT

The samples revealed 12 species from 7 genera and 5 families. Both orders of Scaphopoda, Dentaliida and Gadilida are represented, with 8 and 4 species respectively. Each species is listed with synonyms, original description, type locality,

distribution in the present material (with distribution maps) and as reported in the literature, and with the earliest fossil occurrence. The numbers of empty shells (e) and of shells with soft body (b) are given for each station.

Order DENTALIIDA Da Costa, 1776

Family DENTALIIDAE Gray, 1847

Genus *Antalis* H. and A. Adams, 1854

Antalis agilis (M. Sars, 1872) (Figs. 1, 4A)

Synonyms

Dentalium incertum Philippi 1844, *Enum. Moll. Sicil.* II: 207, non Deshayes 1825.

Dentalium abyssorum var. *agilis* Jeffreys 1870, *Ann. Mag. N. Hist. Ser. 4* VI: 74.

Dentalium agile M. Sars 1872, *Some remarkable forms etc.*, *Christiania* 1872: 34.

Dentalium fusticulus Brugnone 1876, *Misc. Malac.* II: 21.

Dentalium vagina Jeffreys 1877, *Ann. Mag. N. Hist. Ser. 4*, XIX: 155.

Antalis agilis (M. Sars): G. O. Sars 1878, *Moll. Reg. Arct. Norv.*, *Christiania* 1878: 102.

Dentalium (Antalis) calabrum Crema 1910, p. 68.

Original description: Shell slender, very narrow, slightly curved, almost straight, gradually attenuated towards the apex. White, faint luster, posterior part frequently darker. Apex very narrow, obliquely truncated, with a tolerably deep incision and a short, hardly protruding supplementary tube. Shell surface with circular growth lines, rarely longitudinally striated in the posterior part, the striae being little distinct and never prominent ribs. [...] Largest shell 58 mm long and 4 mm in diameter, 1 mm at the apex.

Type locality: Lofoten Islands, North Atlantic, at 360-540m.

Present material: 5 stations; Gulf of Cádiz, 500-546 m (76A: 1b, 20e; 77A: 3b); Cape Finisterre, 129-133 m (91A: 1b); Biscay, 540-1025 m (124A: 2b, 9e; 159A: 2b, 14e).

Reported distribution: North Atlantic: Portugal to Lofoten, Halifax to Cuba, Gulf of Mexico, Azores; Mediterranean; ?Red Sea; 60-5000 m.

Earliest fossil: Pliocene.

Remarks: The largest specimen from station 159A is 65 mm long, which exceeds indications of SARS (1872), PILSBRY AND SHARP (1897) and CAPROTTI (1965), but matches those of LOCARD (1898). There are no shells with apical slits in the present material, but most of the specimens are empty shells and fragments. The shell surface in the apical region may be eroded by boring organisms even in live animals. The shell then has a chalky and often cracked aspect, as was also remarked by SARS (1872). Young individuals are often more or less distinctly ribbed near the apex. The ribs intercalate to about 20 in number and then

gradually become obsolete. The younger parts of the shell (towards the anterior opening) with an intact surface are glossy and bear closely spaced growth lines. LOCARD (1898) distinguished a number of varieties according to size, curvature and sculpture. *Antalis panorma* (Chenu, 1842-47), similar in size and shape to *A. agilis* and reported from the Mediterranean and the Bay of Biscay, differs in being more curved and having a more solid shell with 12 narrow but pronounced primary ribs.

Some of the shells from station 76A have bore holes of naticid gastropods being, apart from different fishes, important predators of scaphopods in the Mediterranean.

Antalis entalis (Linné, 1758) (Figs. 1, 4B)

Synonyms

Dentalium entalis Linné 1758, *Syst. Nat.* (10): 785.

Dentalium entalum L.: Blainville 1819, *Dict. Sc. Nat.* XIII: 70.

Dentalium labiatum Brown 1827, *Ill. Conch. Gr. Brit. and Irel.*: pl. 1, fig. 4.

Dentalium striolatum Stimpson 1851, *Proc. Bost. Soc. Nat. Hist.* IV: 114. non Jeffreys, Watson, Sars, Risso.

Entalis striolata (Stimpson 1851): Gould-Binney 1870, *Invert. of Mass.*: 266.

Original description: Shell smooth, moderately curved, continuous, not fractured.

Type locality: Atlantic Ocean.

Present material: 2 stations; La Coruña, 151-152 m (101A: 1e); Biscay, 119-122 m (112DH: 2e).

Reported distribution: North Atlantic from Spain north to Spitzbergen and Maine, Massachusetts to Bay of Fundy; 6-3500 m.

Earliest fossil: Pliocene.

Remarks: The shell is up to 42 mm long, solid, white, sometimes glossy, moderately curved but in the apical region, the wider, anterior part of the shell being only slightly curved. The shell surface is smooth, very fine longitudinal striae may be present in the apical region only. Towards the anterior opening growth lines become more distinct. There may be a shallow apical notch on the convex side.

This species is infrequently cited from the Mediterranean as well, due to confusion with the apically striated *Antalis vulgaris*. However, HIDALGO (1917) retains Gibraltar and Mataró/Catalunya as localities for *A. entalis*.

Antalis dentalis (Linné 1766) (Figs. 1, 4C)

Synonyms

Dentalium dentalis Linné 1766, *Syst. Nat.* XII: 1263.

Dentalium dentale L.: Locard 1886, *Ann. Soc. Agricult., Lyon Ser.* 5, IX: 145.

Dentalium linnaeum Locard 1886, *Ann. Soc. Agricult., Lyon Ser.* 5, IX: 145.

Dentalium mutabile Döderlin in Hörnes 1856, *Abhandl. K.-K. Geol. Reichsanst.* III: 654.

Original description: Shell striated, moderately curved, fractured.

Type locality: Mediterranean Sea.

Present material: 1 station; Gulf of Cádiz, 13-15 m (71A: 1e).

Reported distribution: Mediterranean Sea, East Atlantic from Galicia to Cape of Good Hope (?), Azores, Canary Islands; 0-300 m.

Earliest fossil: Miocene.

Remarks: This rather small species is up to 24 mm long (13 mm from station 71A), mostly white, only the apex sometimes with a rose tinge. There are about 10 sharp and narrow primary ribs, becoming doubled by intercalation towards the anterior opening. The secondary ribs are of about the same height as the primary ribs. The intercostal spaces are much wider than the ribs, and smooth except for widely spaced growth lines. *Antalis dentalis* is often confused with *A. inaequicostata* (see below).

Antalis inaequicostata (Dautzenberg, 1891) (Figs. 1, 4D)

Synonyms

Dentalium dentalis Lamarck 1818, *Anim. sans vert.* V: 344; Deshayes 1825, *Anat. et Monogr. du genre Dentale*: 33; Risso 1826, *Hist. Nat. Europ. Merid.* IV: 398; Philippi 1836, *Enum. Moll. Sicil.* I: 243; Jeffreys 1870, *Ann. Mag. Nat. Hist.* VI: 10; Monterosato 1872, *Not. Int. alle conch. Medit.*: 28; non Linné 1766.

Dentalium fasciatum Lamarck 1818, *Anim. sans vert.* V: 343; non Gmelin 1790

Dentalium pseudo-antalis Scacchi 1836, *Catal. Conch. Regni Neap.*: 17; non Lamarck 1818

Dentalium novem-costatum Réquien 1848, *Coq. de Corse*: 90; non Lamarck 1818.

Dentalium novemcostatum var. *tenuis* Monterosato 1878, *Enum. et Simon.*: 16; non Lamarck 1818.

Dentalium novemcostatum Réquien: Monterosato 1884, *Nom. Gen. e Spec.*: 31; non Lamarck 1818.

Dentalium alternans Bucquoy, Dautzenberg and Dollfus 1891, *Moll. Mar. Roussillon* I: 561; non Chenu 1842.

Dentalium inaequicostatum Dautzenberg 1891, *Mem. Zool. Soc. France* 1891: 53.

Antale novemcostatum (Réquien): Sacco 1897, *Moll. terr. terz. Piemonte e delle Liguria* XXII: 104.

Dentalium (Antalis) inaequicostatum B. D. D.: Pilsbry and Sharp 1897-98, *Man. Conch.* XVII: 52. Caprotti 1965, *Atti. Soc. Ital. Sci. Nat. Milano* 105: 343.

Dentalium novemcostatum var. *inaequicostata* Fantinet 1959, *Serv. Carte Geol. Algérie* 1: 46.

Dentalium (Antalis) novemcostatum Réquien: Caprotti 1961, *Atti. Soc. Ital. Sci. Nat. Milano* 100: 353.

Dentalium (Antalis) mutabile inaequicostatum Dautzenberg: Caprotti 1979, *Boll. Malacol. Milano* 15: 233.

Original description: Shell solid, opaque, slightly to moderately curved, straightening towards the anterior aperture. Sculpture of 9 or 10 primary ribs alternating with same number of wider and less protruding secondary ribs. All ribs become obsolete towards the anterior. Numerous transverse growth lines, sometimes with irregular fractures or interruptions. Anterior shell aperture slightly polygonal. Posterior aperture truncated, polygonal, with an oval, short central pipe. No slit or notch. Colour light rose, more intense at the posterior end, transversal bands of lighter and darker colour. Shell 35 mm long, 5 mm at anterior aperture.

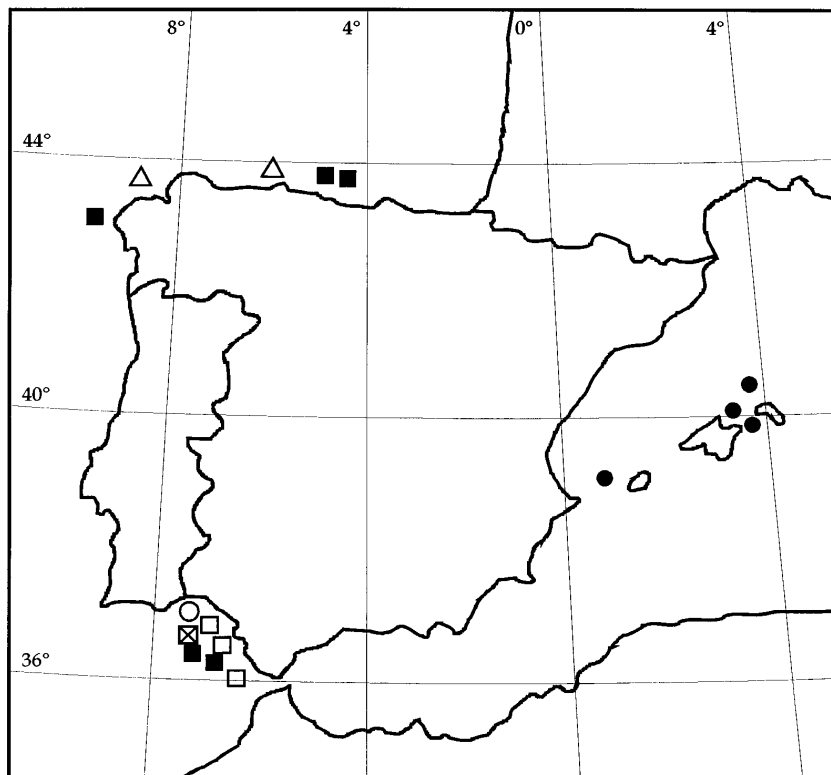
Type locality: Mediterranean Sea.

Present material: 4 stations; Gulf of Cádiz, 13-28 m (44A: 2e; 66A: 9b, 3e; 69A: 1e; 71A: about 10b, many empty shells).

Reported distribution: Mediterranean from Greece to Algeria; 5-120m.

Earliest fossil: Miocene (BUCQUOY ET AL., 1886) or Pliocene (CAPROTTI, 1979).

Remarks: This species is extremely variable in its longitudinal sculpture causing considerable confusion in studies of both fossil and recent scapho-



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|-------------------------------|---------------------------------|
| ■ <i>Antalis agilis</i> | △ <i>Antalis entalis</i> |
| ○ <i>Antalis dentalis</i> | □ <i>Antalis inaequicostata</i> |
| ⊠ <i>Antalis novemcostata</i> | ● <i>Antalis vulgaris</i> |

Figure 1. Localities where *Antalis agilis*, *A. entalis*, *A. dentalis*, *A. inaequicostata*, *A. novemcostata*, and *A. vulgaris* were collected.

Figura 1. Localidades donde se encontraron las especies *Antalis agilis*, *A. entalis*, *A. dentalis*, *A. inaequicostata*, *A. novemcostata* y *A. vulgaris*.

Pods. Small individuals of this species closely resemble *Antalis dentalis*. The latter differs, however, in having conspicuous transversal striae between the ribs, the ribs themselves are less acute, and the intercostal space is not as wide. If PILSBRY AND SHARP (1897-98, p. 52) describe "... 9-12 strong primary ribs towards the apex, narrower than their intervals..." for *A. inaequicostata*, they obviously did not consider direct com-

parison with *A. dentalis*. The atlantic *A. novemcostata* is stouter and has more conspicuous transverse striae.

Many of the empty shells shows characteristic signs of sipunculid occupation. *Phascolion strombus* (Montagu, 1804) is known to close the anterior openings of scaphopod and other mollusc shells by agglutinations of sediment, leaving open only a small tube for their introvert (TÉTRY, 1959).

Antalis novemcostata (Lamarck, 1818) (Figs. 1, 4E)

Synonyms

Dentalium novemcostatum Lamarck 1818, *Anim. sans vert.*, V: 344.

Dentalium dentalis Risso 1826, *Hist. Nat. Europ. Mérid.*, IV: 398.

Dentalium dentale Risso: Weinkauff 1862 (partim), *J. Conch.*, X: 364.

Antale novemcostatum (Lamarck): Sacco 1896, *Boll. Mus. Zool. Anat. Comp. Univ. Torino*, XI: 97.

Dentalium (Antalis) novemcostatum (Lamarck): Pilsbry and Sharp 1897-98, *Man. Conch.*, 17: 51

Original description: Shell small, greenish-white, with nine ribs, subdeccussate transverse striae.

Type locality: Atlantic coast near La Rochelle.

Present material: 1 station, Gulf of Cádiz, 110-112 m (69A: 1e).

Reported distribution: East Atlantic from La Rochelle to South Spain; 20-300 m.

Earliest fossil: Pliocene.

Remarks: The rather stout shell is up to 32 mm long and has 8 to 10 rounded ribs decreasing in height towards the anterior opening. The intercostal spaces are more concave than in the other *Antalis*

species of the region and show faint longitudinal striae. Transverse striae are not always developed, although BUCQUOY ET AL. (1886) and CAPROTTI (1965) take the strong transverse sculpture as an important character to distinguish *A. novemcostata* from the mediterranean *A. inaequicostata*. The apex often has a plug with a central pipe in larger specimens.

Antalis novemcostata seems to be living on the european Atlantic coast only, although HIDALGO (1917) lists several mediterranean locations for this species. This seems to be due to misidentifications of *A. inaequicostata* (CAPROTTI, 1961, 1965; MARS, 1965). According to CAPROTTI (1965), the extremely rare *A. novem-costatum* from the Italian Pliocene could be intermediate between *A. inaequicostata* and *A. novemcostata*.

Antalis vulgaris (Da Costa, 1778) (Figs. 1, 4F)

Synonyms

Dentale vulgare Da Costa 1778, *Brit. Conch.*: 24.

Dentalium fasciatum Gmelin 1791, *Syst. Nat.*, 13: 3737.

Dentalium striatum Montagu 1803, *Test. Brit.*, II: 492, non Born 1780, *Test. Mus. Caes. Vindob.*: 431.

Dentalium tarentinum Lamarck 1818, *Anim. sans vert.*, V: 345. Forbes and Henley 1853, *Hist. Brit. Moll.*, II: 451. Sowerby 1860, *Thes. Conch.*, II: 100. Jeffreys 1882, *Brit. Conch.*, II: 195. Clessin 1896, *Conchyl. Cab.*: 3.

Dentalium politum Blainville 1819, *Dict. Sci. Nat.*, XIII: 70. Turton 1819 (partim), *Conch. Dict. Brit. Sh.*: 38.

Dentalium labiatum Turton 1819 (partim), *Conch. Dict. Brit. Sh.*: 38. Brown 1827, *Illustr. Conch. Gr. Brit.*: 117.

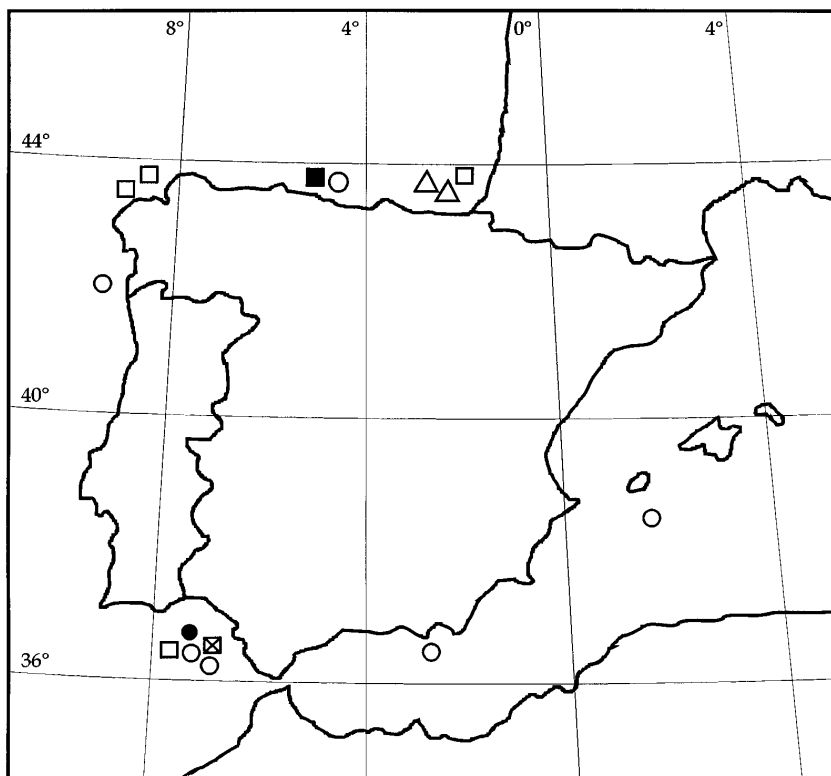
Dentalium striolatum Risso 1826, *Hist. Nat. Europ. Mérid.*, IV: 398.

Dentalium multistriatum Risso 1826, *Hist. Nat. Europ. Mérid.*, IV: 398, non Deshayes 1825, *Anat. et Monogr. du genre Dentale*.

Dentalium affine Biondi 1859, *Atti Accad. Gioenia Sci. Nat.* (2), XIV: 120.

Original description: *Dentalium* with a slender, smooth, glossy, subarcuated shell, tapering to a small point, pervious: sometimes marked with a few circular wrinkles or annulations: colour white or yellowish. Length an inch and

a half [38 mm]; diameter at the larger end two-tenths of an inch [5 mm]; and one fourth as much [1.25 mm] at the smaller end. [...] A variety is marked with dusky bands; and sometimes a little striated towards the point.



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| ■ <i>Fissidentalium capillosum</i> | △ <i>Episiphon filum</i> |
| ○ <i>Entalina tetragona</i> | □ <i>Pulsellum lofotense</i> |
| ⊗ <i>Dischides politus</i> | ● <i>Cadulus jeffreysi</i> |

Figure 2. Localities where *Fissidentalium capillosum*, *Episiphon filum*, *Entalina tetragona*, *Pulsellum lofotense*, *Dischides politus*, and *Cadulus jeffreysi* were collected.

Figura 2. Localidades donde se encontraron las especies *Fissidentalium capillosum*, *Episiphon filum*, *Entalina tetragona*, *Pulsellum lofotense*, *Dischides politus* y *Cadulus jeffreysi*.

Type locality: British shores, especially Scilly Islands, Cornwall, Devonshire, Hampshire.

Present material: 5 stations; Biscay, 119-122 m (112DH: 1e); Balearic Islands, 5-59 m (190B: 2e; 192A: 1b; 203B: 1e; 258B: 3b).

Reported distribution: Mediterranean Sea and East Atlantic Ocean; 5-1100 m.

Earliest fossil: Miocene.

Remarks: The shell is up to 60 mm long, white with a rose-coloured apex, rather broad, and moderately curved in the posterior half. There are about 30 longitudinal striae near the apex, obliterating gradually towards the anterior opening. The apical opening is entire and may have a plug with a short central pipe.

Genus *Fissidentalium* Fischer, 1885

Fissidentalium capillosum (Jeffreys, 1876) (Figs. 2, 4G)

Synonyms

Dentalium capillosum Jeffreys 1876, *Proc. Roy. Soc.*, 25: 185. (nomen nudum)

Dentalium capillosum Jeffreys: Jeffreys 1877, *Ann. Mag. Nat. Hist. Ser. 4*, 19: 153.

Dentalium (Fissidentalium) capillosum Jeffreys: Pilsbry and Sharp 1897-98, *Man. Conch.*, 17: 77.

Original description: Shell tapering to a fine point, slightly curved, rather solid, opaque, and mostly lusterless; sculpture: numerous and sharp (not rounded) longitudinal striae, some of which are intermediate and smaller than the rest; they disappear towards the posterior or narrow end, which is quite smooth and glossy for a quarter of an inch [6.4 mm]; colour whitish; margin at the posterior end having a short and narrow notch. L [length]: 1.4 [35.6 mm]. B [maximum diameter]: 0.15 [3.8 mm]. (...) This appears to attain a size considerably exceeding that given in the above description, as fragments measure nearly 0.4 inch [10 mm] in breadth.

Type locality: North Atlantic, Valorous st. 12, 13, 16; 1242-3213 m.

Present material: 1 station; Biscay, 925-1025 m (159A: 5e).

Reported distribution: North Atlantic, Caribbean Sea to Portugal, Azores to Hebrides; 400-3500 m.

Earliest fossil: No fossil record.

Remarks: This species can be 81 mm long. The shell is white or grey and may be somewhat eroded. There are about 65 fine ribs throughout most of the length. Pilsbry and SHARP (1897-98) supplement JEFFREYS' (1877) description saying that the ribs are sharply cut but rounded on the top. This is particularly obvious in the anterior part of the shell where the ribs become wider.

Family GADILINIDAE Chistikov, 1975

Subfamily EPISIPHONINAE Chistikov, 1975

Genus *Episiphon* Pilsbry and Sharp, 1897-98

Episiphon filum (Sowerby, 1860) (Figs. 2, 4H)

Synonyms

Dentalium filum Sowerby 1860, *Thes. Conch.*, III: 89.

Dentalium gracile Jeffreys 1870, *Ann. Mag. Nat. Hist.* (4), VI: 74. Fischer 1873, *Journ. Conchyl.*: 140.

Pseudantalus filum (Sowerby): Monterosato 1884, *Nom. Gen. Spec. Conch. Medit.*: 33.

Dentalium rufescens Weinkauff 1868 (partim), *Conch. Mittelm.*, II: 420.

Original description: Shell slender, very narrow, thin, finely pointed, mantle reddish brown, apex entire.

Type locality: Gibraltar.

Present material: 2 stations; Biscay, 104-132 m (152A: 2b, 1e; 153A: 2b).

Reported distribution: North Atlantic from Florida to Cape Hatteras, Algeria to Biscay; Mediterranean Sea from Aegean to Gibraltar; 20-4784 m.

Earliest fossil: Miocene.

Remarks: This is a very characteristic species, being very narrow, hardly tapering and almost straight. The length is up to 13 mm. The shell is white and glossy, semitransparent and extremely fragile. The sculpture consists of growth lines only. Typical for the genus is a long pipe at the apex continuous with the shell. It may be wanting because of its fragility.

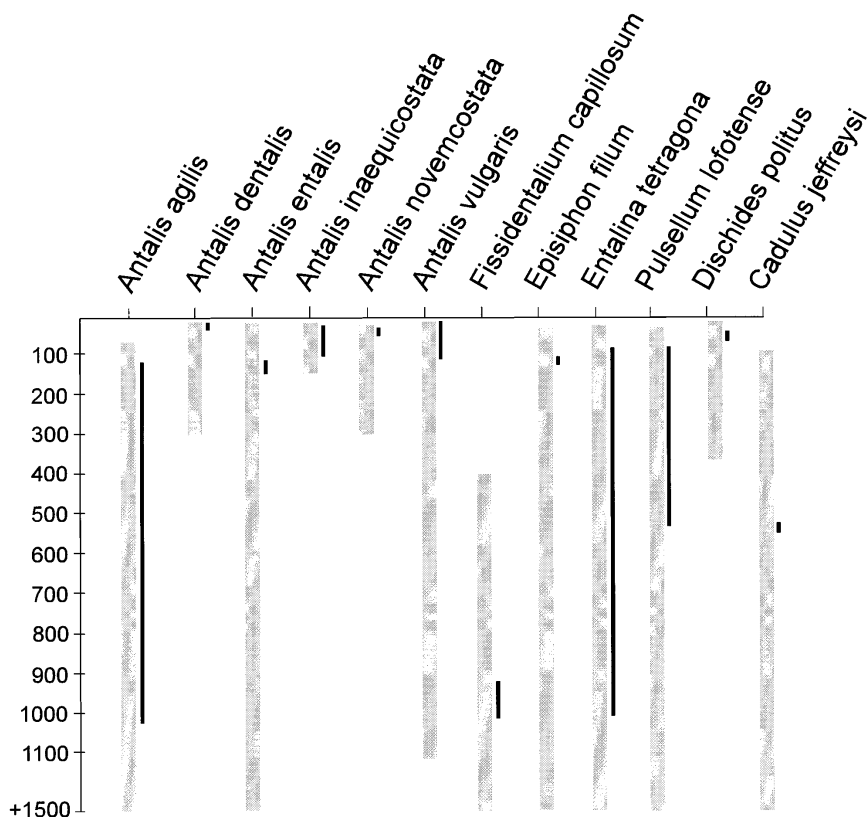


Figure 3. Bathymetric ranges of species reported in literature (shaded) and in the present material (black).

Figura 3. Rangos batimétricos de las especies: datos bibliográficos (gris), datos del presente material (negro).

Order GADILIDA Starobogatov, 1982
 Suborder ENTALIMORPHA Steiner, 1992
 Family ENTALINIDAE Chistikov, 1979
 Subfamily ENTALININAE Chistikov, 1979
 Genus *Entalina* Monterosato, 1872

Entalina tetragona (Brocchi, 1814) (Figs. 2, 5A)

Synonyms

- Dentalium tetragonum* Brocchi 1814, *Conch. foss. subapen.*, Milano: 627.
Dentalium quinquangulare Forbes 1844, *Rep. Brit. Ass. Adv. Sci.* for 1844: 188.
Siphonodentalium pentagonum M. Sars 1865, *Forh. Vidensk. Selsk. Christiania* 1864: 307.
Dentalium quinquangulatum Reeve 1872, *Conch. Icon.*: pl. 5, fig 45.
Siphonodentalium quinquangulare (Forbes): Jeffreys 1867, *Ann. Mag. Nat. Hist. Ser. 3*, XX: 251.
 Weinkauff 1868, *Conch. Mittelm.*, II: 421. Locard 1886, *Ann. Soc. Agricult., Lyon Ser. 5*, IX: 149.
 Dautzenberg 1891, *Mem. Soc. Zool. France*, IV: 609. Friele and Grieg 1901, *Norv. N. Atlant. Exp. etc.*, *Christiania* 1901, Mollusca III: 50.
Siphonentalis tetragona (Brocchi): G. O. Sars 1878, *Moll. Reg. Arct. Norv.*, *Christiania* 1878: 105.

- Siphodentalium tetragonum* (Brocchi): Norman 1879, *J. Conch., London*, 2: 49.
Entalina tetragona (Brocchi): Monterosato 1880, *Bull. Soc. Malac. Ital.*, VI: 64. Caprotti 1961, *Atti Soc. Ital. Sci. Nat. Mus. Civ. Stor. Nat. Milano*, Vol. C, IV: 356.
Siphodentalium quinquangulare (Forbes): Jeffreys 1882, *Proc. Zool. Soc. London*, 1882: 662.
Siphonentalis quinquangularis (Forbes): Carus 1889, *Prodr. faunae Medit.*, II: 176.
Pulsellum quinquangulare (Forbes): Norman 1893, *Ann. Mag. Nat. Hist. Ser. 6*, XII: 344, 362.
Entalina quinquangularis (Forbes): Hidalgo 1917, *Trab. Mus. Nac. Cienc. Nat. Ser. Zool.* 30: 306.
Chistikov and Sagaidachniy 1982, *Zool. Zhurn.*, 60: 38.

Original description: Shell four-angled, finely longitudinally striated, sides weakly carinated.

Type locality: Pliocene of Italy (BROCCHI, 1814), Aegean Sea (FORBES, 1844).

Present material: 6 stations; Mediterranean, 1001-1005 m (247A: 1e); Sea of Alborán, 276-306 m (15A: 2e); Gulf of Cádiz, 500-546 m (76A: 3e; 77A: 2e); Galicia, 81-84 m (86DL: 1b), Biscay, 540-543 m (124A: 5b, 15e).

Reported distribution: Mediterranean, East Atlantic from Biscay to Northern Norway; 10-2664 m.

Earliest fossil: Miocene.

Remarks: The shell is strongly curved, at least in the apical half. It has five primary ribs, four of them forming almost right angles, the fifth rib on the midline of the concave side forms an obtuse angle. In specimens larger than about 10 mm, 3 - 25 secondary ribs gradually appear, the pentagonal form of the cross-section smoothing out to become subcircular. The anterior opening is oblique, the apex simple and entire. The shells may be up to 93 mm long but are usually around 15 mm.

There is some confusion in the European species and the use of the names *tetragona* Brocchi, *pentagona* Sars and *quinquangularis* Forbes. BROCCHI (1814) described *tetragona* as a Pliocene fossil from Piedmont and the Vienna Basin. FORBES (1844) described the extant species from the Aegean Sea as *quinquangularis*. MICHAEL SARS (1865) described *pentagona* from the Norwegian coasts, without referring to either Brocchi or Forbes. His son, G. O. SARS (1878) considers *pentagona* and *quinquangularis* as junior synonyms of *tetragona*. MONTEROSATO (1880) comes to the same conclusion claiming the fossil and recent mediterranean species being identical. JEFFREYS (1870, 1882), however, is of different opinion and gives priority to *quinquangularis* for the recent Atlantic and Mediterranean form. PILSBRY AND SHARP (1897-98), LOCARD (1898) and FRIELE AND GRIEG (1901) agree with this view.

CAPROTTI (1968), finally, comparing recent specimens with the type material, confirms the synonymy of *quinquangularis* and *tetragona*, stressing the priority of Brocchi's name. Later, CHISTIKOV AND SAGAIDACHNIY (1982), however, not only separate *tetragona* and *quinquangularis*, but also split the latter into the Mediterranean *quinquangularis* and the Atlantic *pentagona* on grounds of shell and radula characters. However, they do not include fossil specimens in their study.

Suborder GADILIMORPHA Steiner, 1992
Family PULSELLIDAE Scarabino in Boss, 1982
Genus *Pulsellum* Stoliczka, 1868
Pulsellum lofotense (M. Sars, 1865) (Figs. 2, 5B)

Synonyms

- Siphonodentalium lofotense* M. Sars 1865, *Forh. Vidensk. Selsk. Christiania* 1864: 297.
Siphonentalis lofotensis (M. Sars): G. O. Sars 1878, *Moll. Reg. Arct. Norv., Christiania* 1878: 104. Monterosato 1884, *Nom. Gen. Spec. Conch. Medit.*: 33.



Figure 4. A: *Antalis agilis*; B: *Antalis entalis*; C: *Antalis dentalis*; D: *Antalis inaequicostata*; E: *Antalis novemcostata*; F: *Antalis vulgaris*; G: *Fissidentalium capillosum*; H: *Episiphon filum*. Scale bars, A, G: 10 mm; B-F: 2 mm; H: 1 mm.

Figura 4. A: *Antalis agilis*; B: *Antalis entalis*; C: *Antalis dentalis*; D: *Antalis inaequicostata*; E: *Antalis novemcostata*; F: *Antalis vulgaris*; G: *Fissidentalium capillosum*; H: *Episiphon filum*. Escalas, A, G: 10 mm; B-F: 2 mm; H: 1 mm.

Siphodontalium lofotense M. Sars: Jeffreys 1882, *Ann. Mag. Nat. Hist.*, Ser. 5, XI: 395.

Siphonodontalium (Pulsellum) lofotense M. Sars: Pilsbry and Sharp 1897-98, *Man. Conch.*, 17: 138.

Siphonodontalium lofotensis M. Sars: Stork 1934, *Thalassia*, 1: 10.

Pulsellum lofotensis (M. Sars): Emerson 1962, *Journ. Paleontol.* 36: 475.

Original description: Shell smooth, moderately curved, anteriorly wide and tapering to the posterior, white, walls transparent or semitransparent, thin, shiny, very fine and dense obliquely transverse growth lines well visible, posterior shell margin entire [plain]. Length 5-6 mm, basal width 0.66 mm, apical about 0.33 mm. [Description of soft body omitted.]

Type locality: Lofoten Isl., Norway; 90-216 m.

Present material: 4 stations; Gulf of Cádiz, 535-546 m (76A: 3e); Galicia, 80-120 m (168A: 3e; 171A: 3e); Biscay, 129-132 m (153A: 5b, about 20e).

Reported distribution: Mediterranean Sea; North Atlantic from Spain to

Finmark, Ireland, New England; 26-3500 m.

Earliest fossil: Pliocene.

Remarks: The small shell is rather fragile in the anterior third and easily breaks into cylindrical fragments upon handling. Breakage occurs along the oblique growth lines. The anterior opening is circular as the apical opening but slightly oblique. Most live animals have perfectly transparent shells, empty shells are opaque. The apical rim is always entire without notches or lobes, although JEFFREYS (1882) mentions specimens with regularly jagged tips. This may have been a siphonodontaliid species, also because he did not see a bulbous larval shell, which is well developed in *Pulsellum lofotense* (Steiner, 1995).

Family GADILIDAE Stoliczka, 1868
Subfamily SIPHONODONTALIINAE Simroth, 1894
Genus *Dischides* Jeffreys, 1867

Dischides politus (Wood, 1842) (Figs. 2, 5C)

Synonyms

Ditrupa polita Wood 1842, *Ann. Mag. Nat. Hist.*, 9: 459.

Dentalium coarctatum Philippi 1844, *Enum. Moll. Sicil.*, II: 208, non Lamarck 1818, *Anim. sans Vert.*, 5: 346.

Dentalium laevigatum de Rayneval, Hecke and Ponzi 1854, *Cat. Foss. Mont Mario, Versailles*, non Schlotheim 1830.

Dentalium bifissum Jeffreys 1867, *Ann. Mag. Nat. Hist.*, Ser. 3, XX: 251. Weinkauff 1868, *Conch.*

Mittelm., II: 421. Monterosato 1884, *Nom. Gen. Spec. Conch. Medit.*: 34.

Dischides olivi Jeffreys 1870, *Ann. Mag. Nat. Hist.*, Ser. 4, VI: 73.

Dischides bifissus (Jeffreys): Jeffreys 1882, *Proc. Zool. Soc. London*, 1882: 663.

Cadulus politus (Wood): Pilsbry and Sharp 1897-98, *Man. Conch.*, 17: 144. Stork 1934, *Thalassia*, 1: 9.

Original description: Shell slightly arcuated, thin, smooth, subcylindrical; anterior opening plain, posterior cleft, bilateral, with unequal terminations. The body of the [...] shell is not inflated or enlarged like that of *Dentalium gadus*, but has the posterior opening laterally cleft, somewhat resembling that of *Dentalium coarctatum* Deshayes [...] but the dorsal part of the posterior end of this

fossil is produced beyond the edge beneath and rounded, the ventral edge is shorter and truncated, an enamel-like polish covers the exterior, and was probably when inhabited subhyaline, but is now opaque. Length half an inch [12.7 mm] nearly.

Type locality: Coralline Crag, England (Pliocene).

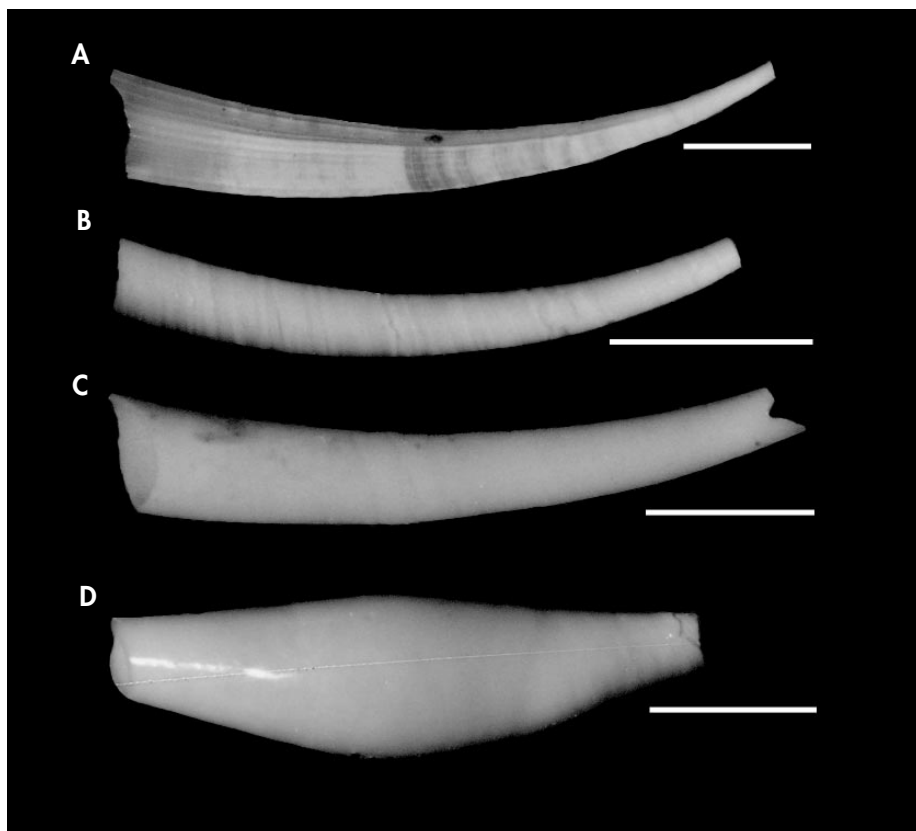


Figure 5. A: *Entalina tetragona*; B: *Pulsellum lofotense*; C: *Dischides politus*; D: *Cadulus jeffreysi*. Scale bars 1 mm.

Figura 5. A: *Entalina tetragona*; B: *Pulsellum lofotense*; C: *Dischides politus*; D: *Cadulus jeffreysi*. Escalas 1 mm.

Present material: 1 station; Gulf of Cádiz, Trafalgar, 34 m (58A: 1e).

Reported distribution: Northeast Atlantic from Morocco to Biscay, Mediterranean; 9-324 m.

Earliest fossil: Pliocene.

Remarks: The recent members of this species attain maximum lengths of 7 mm. The shell is white, glossy, moderately curved and only slightly tapering. The sculpture consists of growth lines only. The greatest diameter of the shell lies just behind the anterior opening.

The posterior opening has two lateral notches producing a dorsal and a ventral lobe. Tubes of the serpulid polychaete *Ditrupa* sp. must not be confused with *Dischides politus*. The polychaete tubes are often reddish brown in colour, the outer layer has a semitransparent aspect. They are sharply constricted at the anterior opening and lack growth lines.

Dischides has repeatedly been changing between subgenus and genus status. It was recently confirmed in its generic rank and transferred to the subfamily Siphonodentaliinae by SCARABINO (1995).

Subfamily GADILINAE Stoliczka, 1868

Genus *Cadulus* Philippi, 1844

Cadulus jeffreysi (Monterosato, 1875) (Figs. 2, 5D)

Synonyms

Helonyx jeffreysi Monterosato 1875

Cadulus jeffreysi (Monterosato): Jeffreys 1882, Verrill 1882, Pilsbry and Sharp 1897-98, Muus 1959

Cadulus propinquus Verrill 1885, non G. O. Sars

Cadulus subfusiformis Stork 1934, non M. Sars

Original description: Anterior aperture obliquely truncated, base or [?and] posterior aperture compressed, slightly deformed at each side.

Type locality: Aegean Sea, 234-450 m.

Present material: 1 station; Gulf of Cádiz, 535-546 m (76A: 18e).

Depth range: 535-546 m.

Reported distribution: Mediterranean; North Atlantic from Canary Is., Biscay to Ireland and Norway, West Atlantic from Martha's Vineyard to Barbados, South Atlantic at St. Helena; 90-2200 m.

Earliest fossil: Pliocene

Remarks: Shell small, smooth and shiny, moderately curved, with a conspicuous swelling just anterior to the middle; ventral side regularly curved, dorsal side with distinct convex area due to the swelling; anterior shell aperture obliquely truncated facing downwards, slightly laterally compressed; posterior aperture without lobes, dorsoventrally depressed.

This species may be confused with *Cadulus subfusiformis* (M. Sars 1865). It differs in being larger, conspicuously swollen near the middle of the shell and having a distinct convex area in the dorsal line. The anterior aperture is slightly laterally compressed, the posterior aperture dorsoventrally depressed, while *C. subfusiformis* has a faintly dorsoventrally depressed anterior end and a round posterior one.

DISCUSSION

Of the 19 valid species listed for the Iberian coasts by HIDALGO (1917), 12 are represented in the present material. Taking into account the recent finding of the Eastern Mediterranean species *Antalis rossati* near Barcelona (Alzuria, 1986) and the deep-water Biscayan material of the "Talisman", "Travailleur" (LOCARD, 1898) and "Valorous" (JEFFREYS, 1877) expeditions, the species list of Iberian scaphopods grows to 31. Species treated in these reports but not present in this material are listed in Table I.

The present findings provide no biogeographic novelties. Species living in both the Atlantic and Mediterranean Sea are *Antalis agilis*, *A. dentalis*, *A. vulgaris*, *Episiphon filum*, *Entalina tetragona*, *Pulsellum lofotense*, *Dischides politus* and *Cadu-*

lus jeffreysi. The only typical Mediterranean forms in the material is *A. inaequicostata*. This latter shallow-water form extends, however, beyond the Strait of Gibraltar into the Gulf of Cádiz. On the other hand, *A. entalis*, *A. novemcostata* and *Fissidentalium capillosum* are known from Atlantic waters only.

Comparing the bathymetric data of this material with reported ranges (Fig. 3), only *Antalis agilis*, *A. inaequicostata* and *Entalina tetragona* cover the greater part of their ranges. Most of the other species are found a one or two stations only, which may explain their relatively restricted bathymetric occurrence.

CAPROTTI (1968) considers *Cadulus olivii*, *C. strangulatus* and *C. tumidosus* doubtful species or mere variations of *C. ovulus*.

Table I. Scaphopoda reported from the Iberian coasts but not in present material. Asterisks mark doubtful species (see Discussion).

Tabla I. Escafópodos citados en las costas ibéricas pero no hallados en el presente material. Los asteriscos indican especies dudosas (ver Discusión)

Species	Area	Reference
Order DENTALIDA		
Family DENTALIDAE		
<i>Antalis panorma</i> (Chenu, 1842-47)	Mediterranean, Northeast Spain, Balearic IIs.	Locard, 1898; Hidalgo, 1917
<i>Antalis rossati</i> (Caprotti, 1966)	Mediterranean, Northeast Spain	Alzuría, 1986
<i>Fissidentalium candidum</i> (Jeffreys, 1877)	Biscay	Jeffreys, 1877
FUSTIARIIDAE		
<i>Fustiaria rubescens</i> (Deshayes, 1825) 1917, Alzuría, 1987	Mediterranean	Locard, 1898; Hidalgo,
Order GADILIDA		
Suborder ENTALIMORPHA		
Family ENTALINIDAE		
Subfamily BATHOXIPHINAE		
<i>Bathoxiphus ensiculus</i> (Jeffreys, 1877)	Atlantic, Portugal, Biscay	Jeffreys, 1877
Subfamily HETEROSCHISMOINAE		
<i>Heteroschismoides subterfissum</i>	Atlantic, Portugal,	Locard, 1898
Suborder GADILIMORPHA		
Family GADILIDAE		
Subfamily SIPHONODENTALINAE		
<i>Siphonodentalium lobatum</i> (Sowerby, 1860)	Atlantic, Portugal	Jeffreys, 1882
Subfamily GADILINAE		
<i>Cadulus artatus</i> Jeffreys, 1880	Atlantic, Biscay	Locard, 1898
<i>Cadulus subfusiformis</i> (M. Sars, 1865)	Atlantic, Biscay, Mediterranean	Locard, 1898; Monterosato, 1875
<i>Cadulus gracilis</i> Jeffreys, 1877	Biscay	Locard, 1898
<i>Cadulus propinquus</i> G. O. Sars, 1878	Biscay	Locard, 1898
<i>Cadulus cylindratum</i> Jeffreys, 1877	Biscay	Locard, 1898
<i>Cadulus monterosatoi</i> Locard, 1897	Atlantic, Galicia, Portugal	Locard, 1898
<i>Cadulus gibbus</i> Jeffreys, 1882	Biscay	Locard, 1898
<i>Cadulus ovulus</i> (Philippi, 1844)	Biscay, Mediterranean	Locard, 1898
<i>Cadulus amphorus</i> Jeffreys, 1882	Atlantic, South Portugal	Locard, 1898
* <i>Cadulus olivii</i> (Scacchi, 1835)	Biscay	Jeffreys, 1882
* <i>Cadulus tumidosus</i> Jeffreys, 1877	Atlantic, Biscay, Galicia, Southern Portugal	Locard, 1898
* <i>Cadulus strangulatus</i> Locard, 1897	Biscay, Mediterranean off Marseilles	Locard, 1898

The occurrence of *C. subfusiformis*, a widespread Atlantic species, in the Mediterranean remains controversial. Although MONTEROSATO (1880) identifies a variation (var. *abyssicola*) from Palermo, CAPROTTI (1968) does not list this species as constant inhabitant of the Mediterranean. Recently, GAGLINI (1985) reconfirmed *C. subfusiformis*, and also MIFUSD'S (1996) pho-

tograph of *C. jeffreysi* from Malta looks more like *subfusiformis*. However, until further reports come in, it remains possible that in the Mediterranean *C. subfusiformis* occurs in episodic pseudopopulations only (BOUCHET AND TAVIANI, 1992).

Long lists of synonyms as for some Mediterranean scaphopod species may have several reasons. One of them, espe-

cially when generic designations vary, is progress in supraspecific systematics. Another reason may be closely related but morphologically variable species and/or similar but not identical fossil forms. The species complex of *Antalis inaequicostata*, *novemcostata* and the Miocene *mutabile* (Doderlein in HÖRNES, 1856) is a good example for a combination of these causes. *Antalis mutabile* and *A. inaequicostata* are very similar and both highly variable in their shell features. BUCQUOY ET AL. (1886) recognize the close relationship of *mutabile* and *inaequicostata* (= *alternans*). PILSBRY AND SHARP (1897-98) go further and list *mutabile* as synonym of both *dentalis* (p. 53) and *novemcostata* (p. 211). RUGGIERI (1948) suggests *mutabile* being ancestral to *novemcostata*. CAPROTTI (1979) takes the alternative view and presents the recent *inaequicostata* as subspecies of the fossil *mutabile*. On the other hand, he assigns species status to *novemcostata*, although considering it the Atlantic descendant of *mutabile*. Finally, PAVIA'S (1991) questionable assignment of *mutabile* to the genus *Fissidentulum* leaves little doubt about its species status. In this case, there are two arguments for treating the presumed ancestor and the descendants as separate species. First, according to CAPROTTI (1979: 232), there is a "typical *mutabile*" to be distinguished from *inaequicostata*, the latter being extremely variable. Second, there is no fossil record of either species from the Tertiary (Lower Pliocene). Thus, there is a gap between the latest *mutabile* fossils from

the Miocene and the earliest *inaequicostata* remains from the Middle Pliocene. This suggests that *mutabile* became extinct during the desiccation of the Mediterranean in the Upper Miocene (RÖGL AND STEININGER, 1983, 1984), and *inaequicostata* radiated back into the Mediterranean Basin from the Atlantic, perhaps splitting from *novemcostata*, the possible sister species from the European southwest coasts. A study of the relationships of the recent European shallow water *Antalis* species with molecular techniques is needed to bring more clarity on this question.

That the re-colonisation of the Mediterranean by scaphopods around the Miocene-Pliocene transition is not necessarily connected with speciation is demonstrated by the cases of *A. dentalis* and *Entalina tetragona*. Both species are represented in the fossil record almost unchanged (CAPROTTI, 1965; 1968; 1979) from the Miocene on.

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