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Taxonomic notes on two bivalves (Mollusca Bivalvia) described by Charles-François Fontannes in 1882

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ABSTRACT During the study of the Pliocene malacofaunas of the Mediterranean Basin, it was ascertained that the name *Spondylus ferreolensis* Fontannes, 1882 cannot be used as a substitute for *S. concentricus* Bronn, 1831 of which the type material is here represented for the first time. The validity of *Acanthocardia perrugosa* (Fontannes, 1882) is also proposed, of which it was possible to view the type material, a species previously considered synonymous with *A. paucicostata* (GB Sowerby, 1841), or *A. bianconiana* (Cocconi, 1873) or *A. aculeata* (Linnaeus, 1758).

KEY WORDS Pliocene; Pleistocene; Spondylidae; Cardiidae.

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INTRODUCTION

By re-reading the text by Fontannes (1882) we tried to clarify the taxonomy of two bivalves described by the French author. Of the first of these, *Spondylus ferreolensis* Fontannes, 1882, the comparison with the original diagnosis of *S. concentricus* Bronn, 1831 and the subsequent observations of Fontannes (1882: 210), in addition to the vision of the type material preserved at the Laboratoire de Géologie de the Université de Lyon (France), had initially suggested that *S. concentricus* could be considered *nomen dubium*. Later, however, reviewing Bronn's type material, which was thought to be lost but it is actually deposited at the Museum of Comparative Zoology at Harvard University (Cambridge), disproved this hypothesis as the two species are identical. *S. ferreolensis* must be considered as a synonym of *S. concentricus* Bronn, 1831. As for the second species, *Acanthocardia perrugosa* (Fontannes, 1882), the examination of numerous material in addition to the syntype deposited at the Laboratoire de Géologie de l'Université de Lyon, allowed to consider the Fontannes species as a valid taxon and to speculate its paleogeographic and chronostratigraphic distribution.

MATERIAL AND METHODS

The material examined, collected during surface research, comes from various Pliocene deposits, both in the Guadalquivir basin, Spain (see Andres, 1987; Gonzales Delgado, 1985; 1988; 1989; 1993; Landau et al., 2011) and in the Zanclean/Piacenzian of Tuscany and central Lazio, Italy (Brunetti & Della Bella 2006, 2008) and southern Spain (Landau et al., 2004; 2004a; 2006; 2006a; 2007; 2011). For the generic and suprageneric determinations we followed the WoRMS (2022).

ABBREVIATIONS. La = maximum valve width; Lu = maximum length of the valve; es. =

specimen/s. LGL = Laboratoire de Géologie de Lyon, France. MNHN = Muséum National d'Histoire naturelle, Paris, France. MCZ = Museum of Comparative Zoology della Università di Harvard (Cambridge, England). CCZ = Claudio Zuccaro collection (Rome, Italy). CMB = M. Mauro Brunetti collection (Navas del Selpillar, Spain).

RESULTS

Systematics

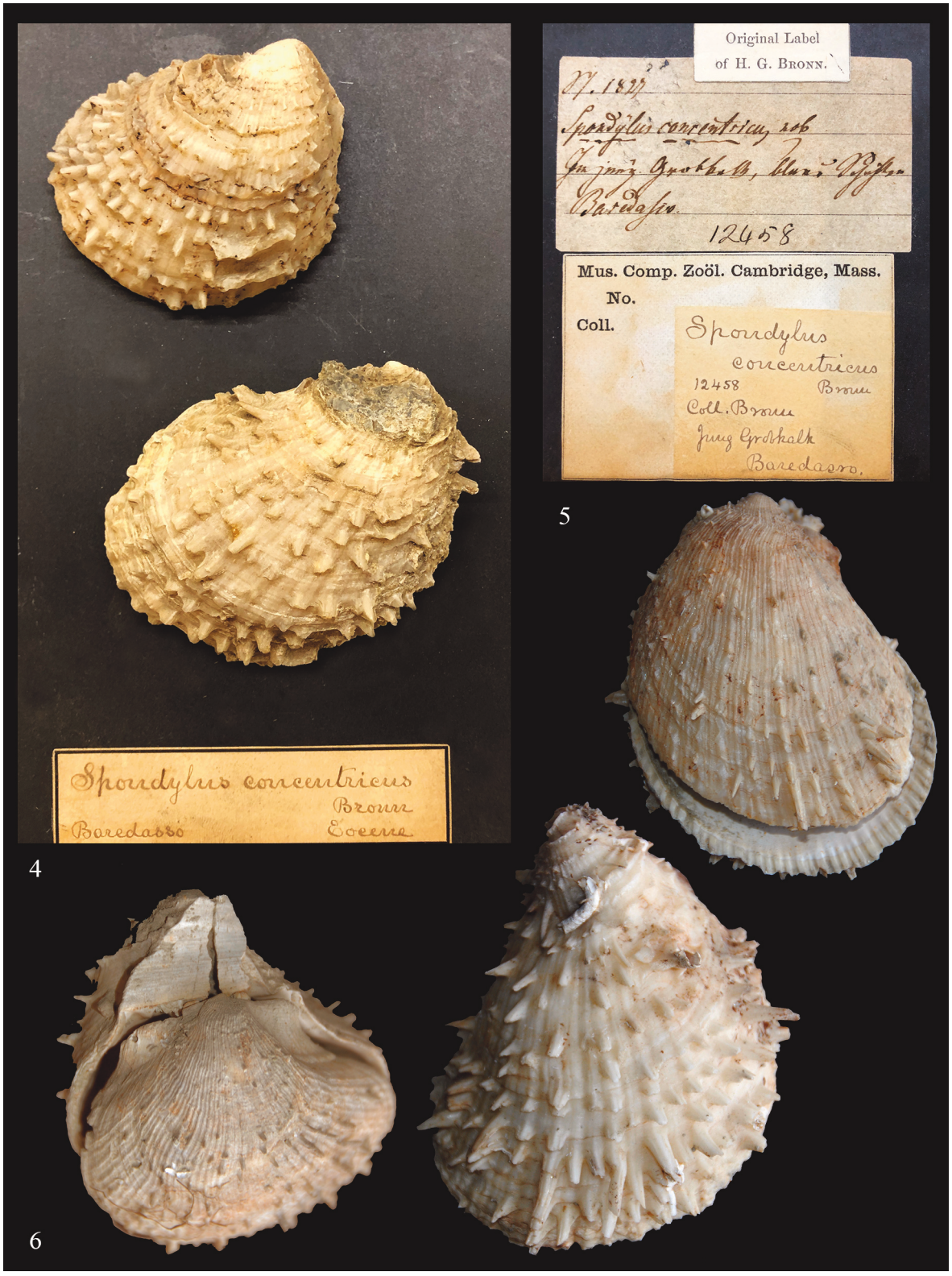
Classis BIVALVIA Linnaeus, 1758
Superfamilia PECTINOIDEA Rafinesque, 1815
Familia SPONDYLIDAE Gray, 1826
Genus *Spondylus* Linnaeus, 1758
Type species: *Spondylus gaederopus* Linnaeus, 1758

Spondylus concentricus Bronn, 1831 (Figs. 1–6)

Spondylus concentricus Bronn, 1831: 121
Spondylus ferreolensis Fontannes, 1882: 210, table 14, figs. 3–7
Spondylus concentricus Bronn - Sacco, 1898: 6, table 3, figs. 4–8
Spondylus concentricus Bronn - Kojumdgieva & Strachimirov, 1960: 75, table 26, fig. 3
Spondylus (Spondylus) concentricus (Bronn) - Malatesta, 1974: 59, table 5, figs. 1a, 1c
Spondylus concentricus Bronn - Lacour et al., 2002: 651, figs. 5F–G
Spondylus concentricus Bronn - La Croce & Repetto, 2006: p. 52, figg. 6–7.
?*Spondylus concentricus* Bronn - Chirli, 2014: 100, figs. 7–12.

MATERIAL EXAMINED. 21 es. Guidonia (Rome,

Figures 1–3. *Spondylus ferreolensis* Fontannes, 1882. Fig. 1: syntypes, Restitud (France), Lower Pliocene, with original labels, LGL. Fig. 2: syntype, inferior valve, Restitud (France), Lower Pliocene, L = 73 mm LGL. Fig. 3: syntype, inferior valve, detail of the hinge.



Figures 4–6. *Spondylus concentricus* Bronn, 1831. Fig. 4: syntypes, Bacedasco (Piacenza, Italy), Lower Pliocene, L = 70 mm, 81mm, MCZ IPBV–12458. Fig. 5: original labels. Fig. 6: Cava Formello (Guidonia, Rome, Italy) Lower/Middle Pliocene, Lu = 92 mm, CCZ.

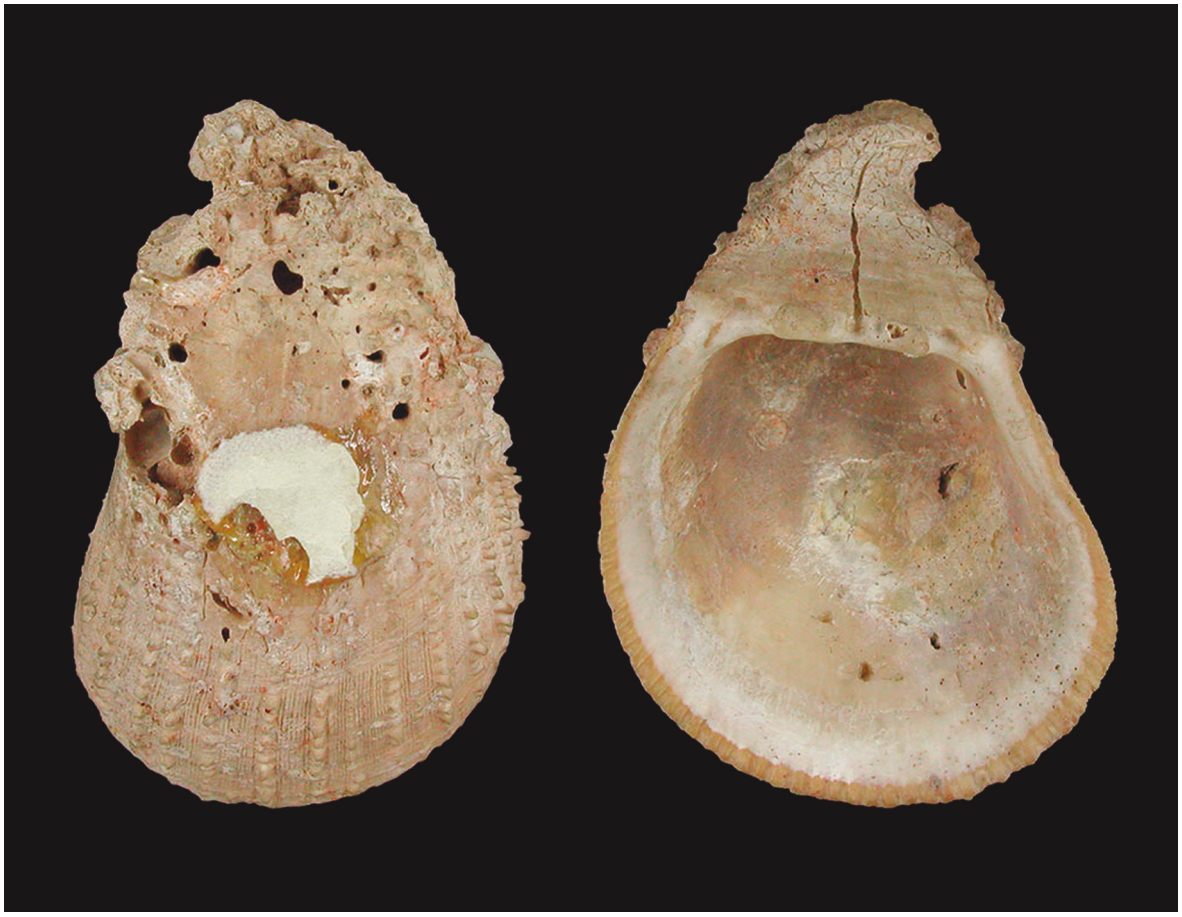


Figure 7. *Spondylus fauroti* Jousseaume, 1888, Obock, Gibuti, Upper Pliocene, syntype, Lu = 82 mm, MNHN–IM–2000–4040.

Italy), Zanclean/Piacenzian (CMB). 2 es., El Lobillo (Estepona, Malaga, Spain), Zanclean/Piacenzian (CMB).

REMARKS. Bronn (1831: 121) described *Spondylus concentricus* as a new species with this diagnosis: "*Testa ovata subobliqua; valva inferiore rugis lamelliformibus concentricis validis, in spinas validas, densas longitudinaliter seriatas productis tecta, umbone subinermi".*

He also specifies that he only has lower valves and does not provide any type of iconography. Years later, Fontannes (1882) described *Spondylus ferreolensis* with the following original diagnosis: "*Testa ovato-oblonga, antice rotundata, postice versus cardinem paulum excavata, valde inaequivalvis, subtius convexior. Valva sinistra gibbosa, irregularis, longitudinaliter costulata; costulae inaequalis, alternantes 8–9 crassioribus, primo subasperis, dein spinis subtus canaliculatis munitis; umbo minimus, acuminatus, marginem cardinalem vix superans; auriculae mediocres, inaequales postica paulo majores; area cardinalis subquadrangularis , transversa; sulcus ligamenti profundus ad basin dilatadus; fossulae cardinalis subcircularis magnae, profundae; dente in extremitate rugosae vel strietae; margo palliaris valde, arcuatus, intus striatus.- Valva dextra crassior, convexior, versus area adherentum lamelli concentricis erectis munita, alibi costis longitudinalibus plus minusve obsoletis; pro partis spiniferis sculpta; area cardinalis lata, triangularis, extum paulum reflexa; margo paliaris intus denticulatus; impressio musculuraris profunda, margini posteriori proximata. Dim. anterio-posterior, 52; altitudo 65 mm".*

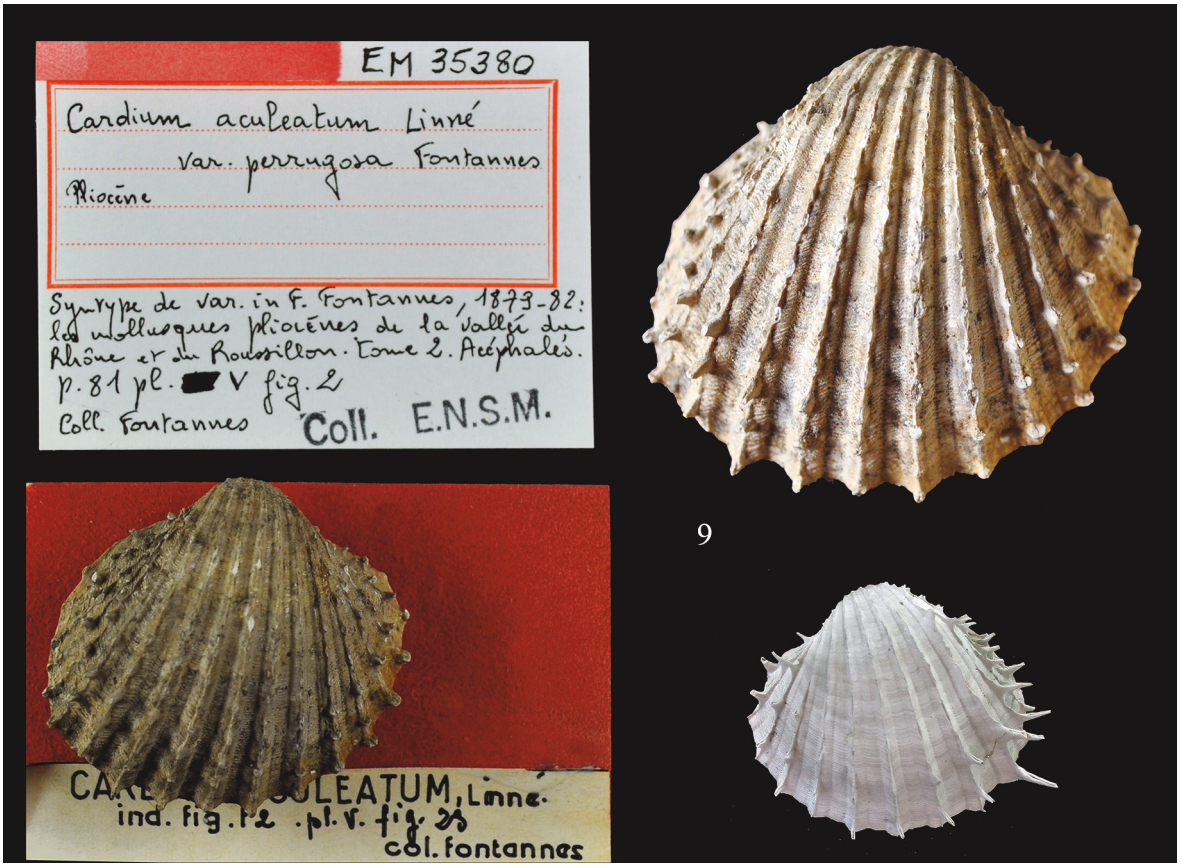
Fontannes (1882: 212) considers Bronn's diagnosis, lacking a figures, nomen dubium, since, in his opinion, there is no particular character of a distinct species. Bronn's type material (Figs. 4, 5) is identi-

cal to the Fontannes species and shows this hypothesis was wrong. *S. ferreolensis*, theillustrated type series (Figs. 1–3), is therefore to be considered synonymous with *S. concentricus* (Strachimirov, 1960; Lacour et al., 2002). This taxon, which is poorly reported in literature, is known with certainty only from the upper Miocene onwards. Markedly thermophilic species, it becomes extinct during the Piacenzian period. According to Malatesta (1974), it is found only in clayey sediments, as other more recent findings confirm (Fig. 6). The same author considered as a synonymous, in my opinion erroneously, *S. fauroti* Jousseaume, 1888 (Fig. 7), from the Upper Pleistocene of Djibouti, with *S. concentricus*, from which it differs at first glance, for its significantly more regular sculpture of the valve inferior. The specimen figured by Chirli (2014) does not seem to correspond to *S. concentricus* as it lacks its characteristic deep ligamentary sulcus (Fig. 3).

Superfamilia CARDIOIDEA Lamarck, 1809
Familia CARDIIDAE Lamarck, 1809
Genus *Acanthocardia* Gray, 1851
Type species: *Acanthocardia aculeata* (Linnaeus, 1758)

Acanthocardia perrugosa (Fontannes, 1882) (Fig. 8–11)

Acanthocardia aculeata var. *perrugosa* Fontannes, 1882: 81, table 5, figs. 2–3
Cardium paucicostatm Sowerby - Dollfus et al., 1904: 43, table 15, figs. 6–7
Cardium ciliare bianconianum (Cocconi) - Glibert & Van de Poel, 1970: 55
Acanthocardia perrugosa Fontannes - Domench, 1984: 10
Acanthocardia (A.) perrugosa (Fontannes) - Martinell & Domench, 1984: 12, table 5, figs. 3–4



Figures 8–10. *Acanthocardia perrugosa* (Fontannes, 1882). Figs. 8, 9: Syntypes, Lower Pliocene, La = 42 mm, LGL–EM353380. Fig. 10: juvenile specimen, Lucena del Puerto (Huelva, Spagna), Lower Pliocene, La = 27 mm CMB.

Figures 11–13. *Acanthocardia* spp. Fig. 11: *Acanthocardia perrugosa* (Fontannes, 1882), Lucena del Puerto (Huelva, Spain) Lower Pliocene, La = 51 mm, CMB. Fig. 12: *Acanthocardia paucicostata* (G.B. SowerbyII; 1834), Villalvernia (Alessandria), Lower Pliocene, La = 50.8 mm CMB. Fig. 13. *Acanthocardia bianconiana* (Cocconi, 1873), Torrente Arda (Piacenza), Calabrian, La = 51.5 mm CMB.

Figures 14–16. *Acanthocardia* spp. Fig. 14: *Acanthocardia echinata* (Linnaeus, 1758), Cutrofiano (Lecce), Calabrian, La = 45 mm CMB. Figs. 15, 16: *Acanthocardia paucicostata* (G.B. Sowerby II, 1834). Fig. 15: Torrente Enza (Reggio Emilia), Gelasian, La = 24 mm CMB. Fig. 16: Mazagon (Huelva, Spain), Recent, La = 30 mm.

Acanthocardia (Acanthocardia) paucicostata "morfotipo *bianconianum* Cocconi"- Andrés, 1987: 115, table 3, figs. 5–7

Acanthocardia (Acanthocardia) paucicostata Sowerby - Lozano Francisco, 1997, table 44, figs. 1, 2.

Acanthocardia paucicostata Sowerby - Cárdenas et al., 2017: 376, fig. 7J

Acanthocardia aculeata (Linnaeus, 1758) - Pimental, 2018, table 8, figs. 5–6

Material examined. 22 es. Lucena del Puerto (Huelva, Spain), Zanclean (CMB). 25 es. Santa Catalina (Huelva, Spain), Zanclean (CMB). 10 es. El Lobillo (Estepona, Malaga, Spain), Zanclean/Piacenzian (CMB). 4 es. Villarasa (Huelva, Spagna), Zanclean (CMB).

Original description (Fontannes, 1882): "*Testa minor, minus obliqua postice minuus truncata, umbones plerumque tumidiores; costae 17–18 subtriangulares in medio carinatae; rugae interstitiorum crassiores, irregulares, super costae sine alteratione transeuntes. Diam. antero-post., 42; altitudo, 40 millim*".

Remarks. Morphlogical characteristics of this species are the relatively low number of ribs (17–18), the slightly oblique shape, the swollen umbo, the triangular profile ribs crossed by the growth lines and equipped with sturdy spines, short, in the juvenile specimens long and thin. *Acanthocardia perrugosa*, often misinterpreted, has been considered time and again as a variety of *A. paucicostata* (Sacco, 1898; Dollfus et al., 1904) of *A. bianconiana* (Glibert & Van de Poel, 1970; Andrés, 1987)

or *A. aculeata* (Pimental, 2018). To understand how this could have happened, it is necessary to consider two facts. First of all, the Fontannes species, as here discussed, appears to be present only in the Tortonian of Portugal (Dollfus et al., 1904) and Spain (Cárdenas el al., 2017), in the Lower Pliocene in the westernmost part of the Mediterranean basin, from southern France to Portugal and in the Guadalquivir basin, where it is found very common, reaching considerable dimensions (>70 mm, pers. obs.), while it is absent in the Italian Pliocene and the eastern Mediterranean. Thus, for example, the exemplars figured by Sacco (1898), of the Italian Pliocene, which he interpreted as *A. perrugosa*, all belong to either *A. paucicostata* or *A. bianconiana*. The second observation is that the populations of *A. paucicostata* of the Lower/middle Pliocene (Fig. 12) are often larger than the current populations, including Atlantic ones, with fewer ribs and with other ribs that are slightly more prominent than spines. This may have induced some authors to confusion. The forms of *A. paucicostata* close to the current ones (Fig. 15) begin to appear only starting from the Gelasian (pers. obs.). The juvenile specimens of *A. perrugosa* with thorniness (Fig. 13) may have misled Fontannes who described *A. perrugosa* as a variety of *A. aculeata* species with a different, sub-quadrangular shell shape and with a greater number of ribs and a consequent more "thorny" aspect. La Perna & D'Abramo (2013) clarified the differences between *A. paucicostata* and *A. bianconiana* very well, while they are doubtful about the validity or otherwise of *A. perrugosa*. I do not agree with some statements of these two authors, first of all in considering fig. 2 and fig. 3 of Fontannes as two different species, presenting the same number of ribs and similar sculpture. Furthermore, the fact that he considered Coppi and not Cocconi the author of *A. bianconiana*, a species that he knew well, could simply be a *lapsus calami*. The specimen illustrated by Martinell & Domench (1984, plate 5, figs. 3, 4) is confirmed to belong to *A. perrugosa*, contrary to what is stated by La Perna & D'Abramo (2013).

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