

On some Pliocene Lucinidae J. Fleming, 1828 (Bivalvia) from Orciano Pisano (Pisa, Italy) with the proposal to establish a new species: *Alucinoma* (?) *persquamulosa* (Sacco, 1901)

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ABSTRACT

In the present paper, three species of bivalves (Mollusca Bivalvia) belonging to the Lucinidae J. Fleming, 1828 family, coming from the Pliocene lands of Orciano Pisano (Pisa, Italy) are described and discussed. They are: *Myrtea spinifera* (Montagu, 1803), *Gonimyrtea* (?) *meneghinii* (De Stefani et Pantanelli, 1878) and *Alucinoma* (?) *persquamulosa* (Sacco, 1901). The latter species has been described as a variety of *Lucina meneghinii* and, following the new findings in the surroundings of Orciano Pisano, we propose it as a valid species. Some discrepancies with the descriptions of the type species of the various genera used in the determinations, suggest the possibility of a systematic update of the Italian Pliocene lucinids.

KEY WORDS

Lucinidae; *Myrtea*; *Gonimyrtea*; *Alucinoma*; Pliocene; Orciano Pisano; Tuscany.

Received 28.10.2018; accepted 21.11.2018; printed 30.12.2018; published online 07.01.2019

INTRODUCTION

Orciano Pisano (Pisa, Italy) is a village known since 1800 for fossils found in its immediate surroundings; the location is interesting, both from the historical and scientific point of view, due to the abundance and variety of remains belonging to vertebrates and invertebrates. Many authors have treated them, among many: Pecchioli (1864), D'Ancona (1871, 1872), Lawley (1875, 1876, 1879), Menesini (1977), Bianucci (1996, 1997), Gatto (1997), Dell'Angelo et al. (2000), Bianucci & Landini (2005), Danise et al. (2010), Brunetti et al. (2017), Dominici et al. (2018), Brunetti & Cresti (2018). In the course of surface searching, aimed at expanding the knowledge on the fossil malacofauna present in the study area, several mollusc shells have been collected, among which we have identified numerous Lucinidae bivalves belonging to the genus *Myrtea* W.

Turton, 1822 and, with some doubts, to *Gonimyrtea* Marwick, 1929 and *Alucinoma* Habe, 1958. We attributed to this last genus a specimens originally described by Sacco (1901) as a variety of *Myrtea spinifera* (Montagu, 1803), proposing it as a new combination with the denomination of *Alucinoma* (?) *persquamulosa* (Sacco, 1901).

MATERIAL AND METHODS

Study area

As described in our recent work on the same locality area (Brunetti et al., 2017), the land around the village of Orciano Pisano (Pisa, Italy), forming part of the Fine River Basin region, consists mainly of sandy clays, sometimes accompanied, towards the upper part of the hills, by rare calcarenites. The

deposition age is between the lower Pliocene and the end of the Piacenzian (Danise et al., 2010; Dominici et al., 2018). If, on a general level, the “clays” appear at a hurried observation, similar to each other, observing the land with more attention, we can distinguish in the various hills around the country, differences in sedimentation and facies, reflected by the different content in the mollusc faunas, which sometimes can correspond to different ages within the Pliocene. The typical blue clays, from batial environment, of the lower Pliocene, are more present to the west, near the Gabbro country, where they are in continuous contact with the sediments of the upper Miocene (Bossio et al., 1981). The examined material comes from clayey sediments with sometimes a more or less evident sandy component, generally deposited at a depth corresponding to the circalittoral, of average Piacenzian age, as is shown in Dominici et al. (2018) from the position of the sections number 1, 2 and 3, corresponding to the localities of Pagliana, Pieve Vecchia and Orciano of their figure 2 (Fig. 1).

Material

The samples were obtained mainly through manual harvesting of the surface and partly from the washing and screening of sediment blocks, taken from the points where there were greater concentrations of shells. The specimens are almost always with separate valves, even if sometimes the provenance to the same individual is evident, since the two shells were very close to each other and in opposition. Often, they have the ornamentation surface corroded centrally giving the impression that the same is more evident to the sides of the shell. The few synonymous names, quoted for the species considered by us, are taken from works of a general nature or from other parts of Tuscany or relating to the locality of Orciano Pisano.

ABBREVIATIONS AND ACRONYMS. H: maximum height of the shell, measured from the top of the umbos to the opposite ventral margin; L: horizontal maximum width, distance between

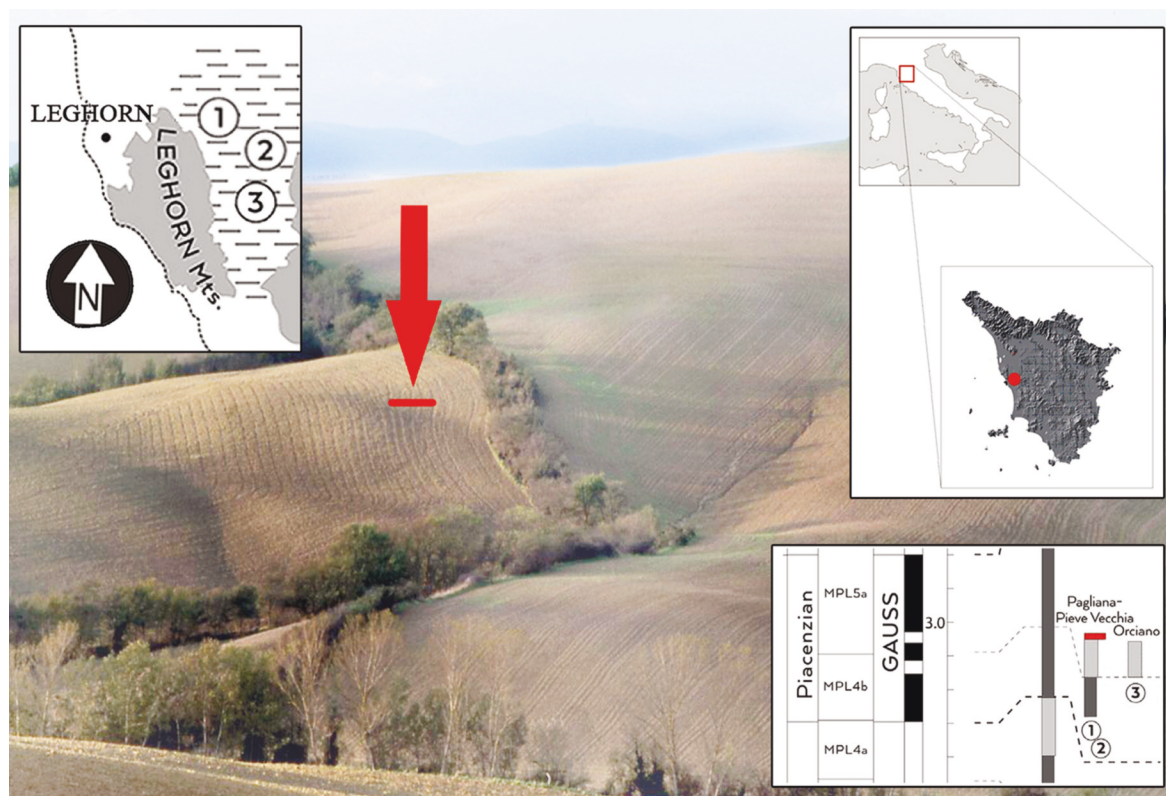


Figure 1. One of the collecting sites (red arrow) around Orciano Pisano (Pisa, Italy) corresponding to number 2, following Dominici et al. (2018).

frontal and posterior margins; vsd: loose valves, right and left, not counted; MSNF: Museo di Storia Naturale di Firenze (Italy); MRSN: Museo Regionale di Scienze Naturali di Torino (Italy); CMC: Massimo Cresti collection; MFC: Maurizio Forli collection.

RESULTS

Systematics

Classis BIVALVIA Linnaeus, 1758
Subclassis HETERODONTA Neumayr, 1884
Ordo LUCINIDA Gray, 1854
Superfamilia LUCINOIDEA J. Fleming, 1828
Familia LUCINIDAE J. Fleming, 1828
Subfamilia MYRTEINAE Chavan, 1969
Genus *Myrtea* W. Turton, 1822
Type species: *Venus spinifera* Montagu, 1803

Myrtea spinifera (Montagu, 1803) - Figs. 2–8

Venus spinifera Montagu, 1803: 577–579
Lucina astensis Bonelli - Michelotti, 1839: 25
Lucina (*Myrtea*) *spinifera* (Montagu) - Sacco, 1901: 93, tab. 21, figs. 8–23
Myrtea spinifera var. *astensis* Sacco, 1901: 94, tab. 21, figs. 11–14
Lucina (*Myrtea*) *spinifera* Montagu - Cerulli Irelli, 1909: 180–181, tab. 24, figs. 25–32
Myrtea (*Myrtea*) *spinifera* (Montagu) - Robba, 1968: 496–497, tab. 38, figs. 6a–b.
Myrtea (*Myrtea*) *spinifera* (Montagu) - Malatesta, 1974: 78, tab. 7, fig. 5
Myrtea (*Myrtea*) *spinifera* (Montagu) - Menesini, 1977: 260
Myrtea (*Myrtea*) *spinifera* (Montagu) - Brunetti, 2014: 85
Myrtea astensis (Sacco) - Brunetti & Cresti, 2018: 134, figs. 605.
Myrtea spinifera (Montagu) - Brunetti & Cresti, 2018: 134, figs. 606.

EXAMINED MATERIAL. Orciano Pisano surroundings (Pisa, Italy), Pliocene: CMC 40 vsd.; MFC 30 vsd.

DESCRIPTION. Shell equivalent, almost equilateral, outline sub-oval with posterior margin squared off, longer than high, more or less thick, com-

pressed and slightly swollen. Prosogyrous umbo, frontal margin slightly concave, rear margin slightly convex. Small dimensions with an average width of about one and a half centimeter. Sculpture consists of concentric lamellae, regularly spaced from each other, which to anterior and posterior dorsal margins, give rise to small, spiny, squamous elevations. Hinge in the right valve with a cardinal tooth and two in the left valve; dimples at the end of the lateral teeth. External ligament. Impression of the anterior adductor muscle scar, oval with central narrowing, posterior scar subcircular; they are connected, by continuous pallial line, starting from slightly above and slightly below the respective centers. Smooth interior margin.

DISTRIBUTION. *Myrtea spinifera* is reported by the Middle Miocene (Serravalliano) of the Torinese Hills and other localities (Tortoniano) both Italian and European: Benestare (RC), Montegibbio (MO), Popogna (LI), Sant'Agata and Stazzano (AL), Vigoleno (PC); Austria, Bulgaria, France, Portugal. Pliocene and European Pleistocene. Currently widespread in the North-Atlantic, North Sea, Mediterranean, on muddy debris bottoms of the infra-circalittoral plane (Chirli, 2015: 68).

REMARKS. The species is widely present in the Pliocene lands around the village of Orciano Pisano where shells of juvenile and adult specimens are available. It is common to find it both among the faunas of the clays and the fine sands of the coasts. Some specimens fall into the “variety *astensis*” (the *Lucina astensis* of Michelotti, 1839) reported by Sacco (1901) which, in agreement with Menesini (1977), here we consider synonymous of *M. spinifera*.

Subfamilia LEUCOSPHERINAE Taylor et Glover, 2011

Genus *Gonimyrtea* Marwick, 1929

Type species: *Loripes concinna* Hutton, 1885

Gonimyrtea (?) *meneghinii* (De Stefani & Pantanelli, 1878) (Figs. 9, 14, 17, 20–28)

Lucina bronni Mayer, 1858: 74–75, tab. 3, fig. 1

Lucina Meneghinii De Stefani et Pantanelli, 1878: 47

Lucina spinifera var. *Meneghinii* (De Stefani et Pantanelli) - De Stefani, 1888: 191, tab. 9, figs. 27–28

Lucina spinifera var. *Meneghinii* De Stefani et Pantanelli - Trentanove, 1901: 549

Dentilucina meneghini (De Stefani et Pantanelli) - Sacco, 1901: 85, tab. 20, figs. 1–4

Dentilucina meneghinii var. *persquamulosa* Sacco, 1901: 84, tab. 20, fig. 8

Phacoides (*Phacoides*) *meneghinii* (De Stefani et Pantanelli) - Robba, 1968: 495–496, tav. 38, figs. 5a-b

Gonimyrtea meneghini (De Stefani et Pantanelli) - Malatesta, 1974: 80–81, tab. 7, fig. 3

Gonimyrtea meneghini (De Stefani et Pantanelli) - Menesini, 1977: 260

Gonimyrtea meneghinii (De Stefani et Pantanelli) - Spano, 1989: 362, tab. 5, figs. 6, 7

Gonimyrtea bronni (Mayer) - Brunetti & Cresti, 2018: 134, figs. 611

Gonimyrtea meneghinii (De Stefani et Pantanelli) - Brunetti & Cresti, 2018: 134, figs. 612

TYPE MATERIAL. MSNF, IGF 8907E, Larniano (Siena, Italy), Pliocene: type, left valve, H = 8.6, L = 9; MSNF, IGF 7080E, Certaldo (Firenze, Italy), Pliocene: left valve, H = 10, L = 11; MSNF, IGF 9213E, Coroncina (Siena, Italy), Pliocene: left valve, H = 7, L = 7.8.

OTHER EXAMINED MATERIAL. MRSN, Rio Torsero (Savona, Italy), Pliocene: BS.154.03.042 (f. 8), left valve, H = 13, L = 15. Orciano Pisano surroundings (Pisa, Italy), Pliocene: CMC 30 vsd.; MFC 22 vsd.

DESCRIPTION. De Stefani & Pantanelli (1878): “*Testa suborbicularis, compressa, transversim striata; striae concentricae, distantes, prominulae, ad marginem magis perspicuae: antice et postice subquadrata; margines ventralis et dorsalis depressiusculi; margo pallearis convexus: umbones obtusiusculi: cardo parum crassus, bidentatus; fovea ligamenti magna; dentes laterales crassiusculi*”. Shell equivalent, almost equilateral, with circular, subquadrate, outline, more or less thick, compressed. Prosogyrus umbo, anterior dorsal margin short, concave, with recess accentuated under the umbo, almost straight back margin. Two not very evident ridges originate from the sides of the umbo, the anterior one ends to about half of the anterior

cardinal margin, while the posterior one ends to the end of the posterior slope area. Dimensions mostly small, average width around the centimeter. Surface sculpture consists of thin and dense continuous, concentric lamellae, regularly spaced from each other, which at the edges of the valves give rise to small, spiny, scaly elevations. Hinge in the right valve with a cardinal tooth, in the left valve with two, lateral ones present in both valves. External ligament. Anterior adductor muscle scar elliptical elongated, posterior scar subrhomboidal; the pallial line begins at about half of the anterior muscle scar, ending at the lower apex of the posterior muscle scar. Whole pallial line, parallel to the margin of the valve, is crossed by serrations little evident, more pronounced just above and just below the pallial line itself.

DISTRIBUTION. Considering the inconsistencies found in the identification with *Myrtea spinifera*, some old reports from Miocene should be verified with a comparison between the specimens. For the limited purpose of this note, we merely report the distribution as found in bibliography: Miocene of the Colline Torinesi (Sacco, 1901), (Robba, 1968), Langhiano - Serravalliano of the surroundings of Cagliari (Spano, 1989). Widespread throughout the Pliocene.

REMARKS. Sacco (1901) placed this species in the genus *Dentilucina* P. Fischer, 1887, type species *Lucina jamaicensis* Lamarck, 1801, currently considered in synonymy respectively of *Phacoides* Agassiz 1846 and *P. pectinatus* (Gmelin, 1791).

The generic attribution of Sacco, and consequently that of Robba (1968), can not be maintained for the completely different characters of *P. pectinatus*, for example the strength of the shell, the different conformation of the hinge, the less evident lunula, the different pallial prints and the presence of two very pronounced external ridges extending from the umbo up to the two sides of the valves. The later more recent Authors (see synonymy) have assigned this species to the genus *Gonimyrtea* Marwick, 1929 which until recently was included in the subfamily Myrteinae Chavan, 1969. New studies based on molecular analysis have modified this situation considering in the subfamily Myrteinae the species with elongated shells not subcircular. The current species of the genus *Gonimyrtea*, on the basis of further molecular data, have been assigned to the subfamily

Leucosphaerinae Taylor et Glover in Taylor et al., 2011 (Taylor et al., 2013; Glover & Taylor, 2016).

At the moment it is difficult to give a certain general attribution to the species of De Stefani and Pantanelli; the comparison between “*Gonimyrtea*” *meneghinii* and *Loripes concinna* Hutton, 1885, a type of *Gonimyrtea* Marwick, 1929, shows morphological concordance for the “roundish” shape, the small size, the concentric lamellae ornamentation extended also in the central part of the shell, the similar shape of the adductor muscle scars and the pallial line. It differs mainly due to the presence of a recess pronounced at the lunula with relative different shape of the anterior lateral tooth. The infusion of the lunula is similar to that present in the genus *Alucinoma* Habe, 1958 (species like *Alucinoma soyoae* Habe, 1958: Japan, Sagami Bay) with which it also has in common the compressed form but the other diagnostic characters, also in this case, do not fully coincide. Since we are not specialists in this family of bivalves, we prefer to continue using the genus *Gonimyrtea*, although doubtful.

The original material comes from the paleontological collections of the Museo di Storia Naturale of Firenze (Italy). These are three Pliocene specimens, the one described and illustrated by De Stefani and Pantanelli for the establishment of their species, coming from Larniano (SI) (Figs. 9–11) and two others: one coming from the Coroncina, a locality in immediate eastern suburbs of Siena (Figs. 14–16) and another labelled as a variety of *Lucina spinifera* Montagu, coming from Certaldo (Firenze, Italy) (Figs. 17–19). The nomenclatural history of this species is short but troubled because De Stefani (1888) changed opinion about the validity of the species established with Pantanelli “*I am convinced that it is a simple variety, without pointed laminae, of L. spinifera*”. The examination of the specimen indicated as variety by the Author has confirmed the correspondence with the Type and with the other coming from the Coroncina (Siena, Italy). For which, given the differences between *G. meneghinii* and *M. spinifera* (Montagu, 1803), even on a generic level, this consideration can not exist. The taxonomic validity of *G. meneghinii* has also been questioned by placing it in synonymous of *Lucina bronni* Mayer, 1858. The comparison between the original figures of the two species shows their correspondence (Figs. 12–13) but, since the name

used by Mayer can not be preserved because there is a *Lucina bronni* Merian manuscript earlier cited by Braun (1843: 147) and Bronn (1843: 66) as a synonymous for *Lucina squamosa* Lamarck, 1818. The species of Mayer loses its status, as also anticipated by Sacco (1901: 85).

Malatesta (1974) reports the species for the Pliocene of Orvieto surroundings, illustrating a specimen of medium size (H = 13.2, D = 14.4), but we could not recognize it due to the poor quality of photographic reproduction (Plate VII, Fig. 3). The author, however, makes some observations about the correspondence between the description of Mayer and that of De Stefani & Pantanelli, reporting for his sample the original diagnosis of the Swiss author. Some specimens from Orciano fit well to *L. bronni*, especially to have a more rounded shape and the ornamentation is not very visible while the hinge and internal imprints are the same so in our opinion, they are not sufficiently differentiated to constitute a separate specific entity. Among the specimens we have attributed to *G. (?) meneghinii* we have included some that have a profile a little more rounded or with less evidence of the recess in correspondence of the lunula, (Figs 22, 24), differences that to the state current knowledge we consider falling within intraspecific variability.

Genus *Alucinoma* Habe, 1958

Type species: *Alucinoma soyoae* Habe, 1958

Alucinoma (?) *persquamulosa* (Sacco, 1901)
(Figs. 32, 36–43)

Dentilucina meneghinii var. *persquamulosa* Sacco, 1901: 85, tab. 20, fig. 7

Myrtea sp. - Brunetti & Cresti, 2018: fig. 608

TYPE MATERIAL. MRSN, Castelnuovo d’Asti (Asti, Italy), Pliocene: BS.154.03.041 (f. 7), right valve, H = 14, L = 15.8.

OTHER EXAMINED MATERIAL. Orciano Pisano surroundings (Pisa, Italy), Pliocene: CMC 40 vsd.; MFC 20 vsd.

DESCRIPTION. Shell equivalent, inequilateral, with outline almost circular, rather thick, compressed and a little swollen. Prosogyris umbo, very

short anterior dorsal margin, rectum, right and oblique posterior margin. Pretty large dimensions, average width over two and a half centimeter. Surface with sculpture consists of dense continuous, concentric lamellae, regularly spaced from each other, which at the edges of the valves give rise to minute thorny scales. Hinge in the right valve with a cardinal tooth, in the left valve with two, short anterior lateral teeth, posterior lateral tooth lengthened according to the length of the corresponding margin. The whole hinge is poorly detectable and evident, in some specimens the dentition is obsolete. Impression of anterior adductor muscle scar, elongated ellipsoidal, posterior scar subrhomboidal; the pallial line start from about half the total length of the anterior scar ending to the lower apex of the posterior scar. Pallial line more or less parallel with the margin, crossed by numerous evident serrations that protrude attenuated over the entire internal surface.

DISTRIBUTION. Sacco (1901) reports it as frequent in the Miocene, Elveziano and Tortoniano, and in the Pliocene, Piacenzian and Astiano (Rio Torsero and Castelnuovo d'Asti). Considering the confusion existing in the identification of this species, so far attributed or confused with *G. meneghinii*, only the distribution for the Pliocene (Piacenzian) of Castelnuovo d'Asti and Orciano Pisano is certain.

REMARKS. The Type is established on the specimen included in the collection Bellardi and Sacco, number BS.154.03.041 (Merlino, 2007: 171), figured by Sacco (1901) at number 7 of table 20, from the Pliocene (Piacenziano) of Castelnuovo d'Asti (Piedmont) (Figs. 32–35). It is a right valve of smaller size compared to those that we estimate conspecific coming from Orciano Pisano, with the posterior margin partially broken for which the profile is less rounded and expanded. The muscle scars are unfortunately not very evident, the anterior coincides with that from Orciano specimens while the posterior is not visible because is almost completely covered by a label, with the original number, and residue of glue. The hinge, even if it conforms how arrangement of the cardinal and lateral teeth, it is more evident than the other individuals that we found, in which it is, on average, less evident.

Sacco (1901) distinguished his *persquamulosa* variety from *L. meneghinii* for “*lamellae squamu-*

lose-cristata concentric, etiam in medium perspicuous region”. Under this denomination, in Bellardi and Sacco collection (Sacco, 1901: tab. 20, fig. 8), there is also another specimen, numbered BS.154.03.042 (Merlino, 2007: 171), which at the moment we consider conspecific of *G. meneghinii* despite the profile more acute of the region ante and post umbone (Figs. 28–31).

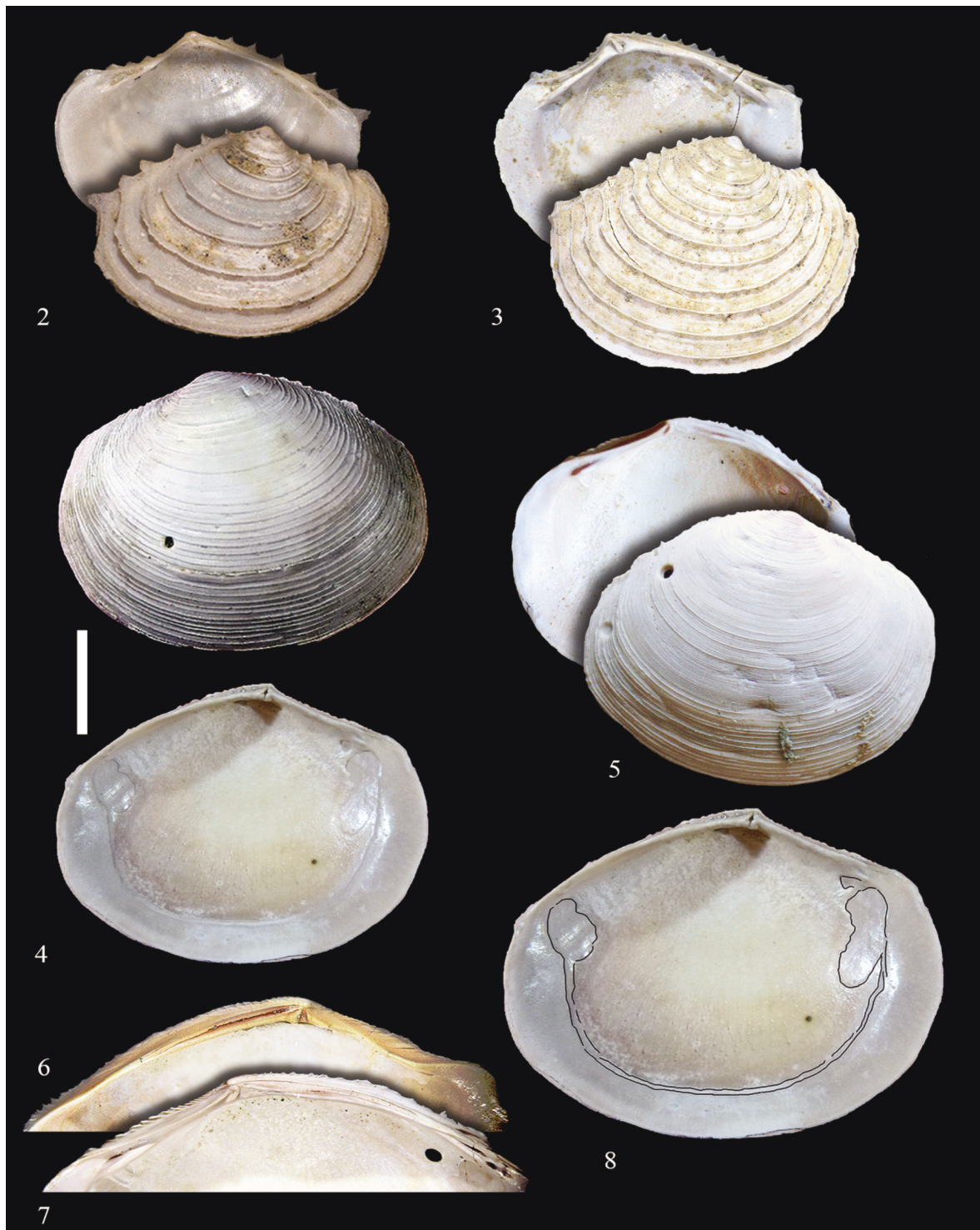
We attribute this species dubiously to the genus *Alucinoma* Habe, 1958 mainly for the obsolete appearance of the hinge, for the similar outline of the shell and of the muscular and pallial line impressions. Some morphological divergences such as the most evident ornamentation and the greater robustness, suggests also in this case, an uncertain generic attribution. Despite these doubts, we propose to raise the *Dentilucina meneghinii* var. *persquamulosa* with the denomination of *Alucinoma* (?) *persquamulosa* (Sacco, 1901).

CONCLUSIONS

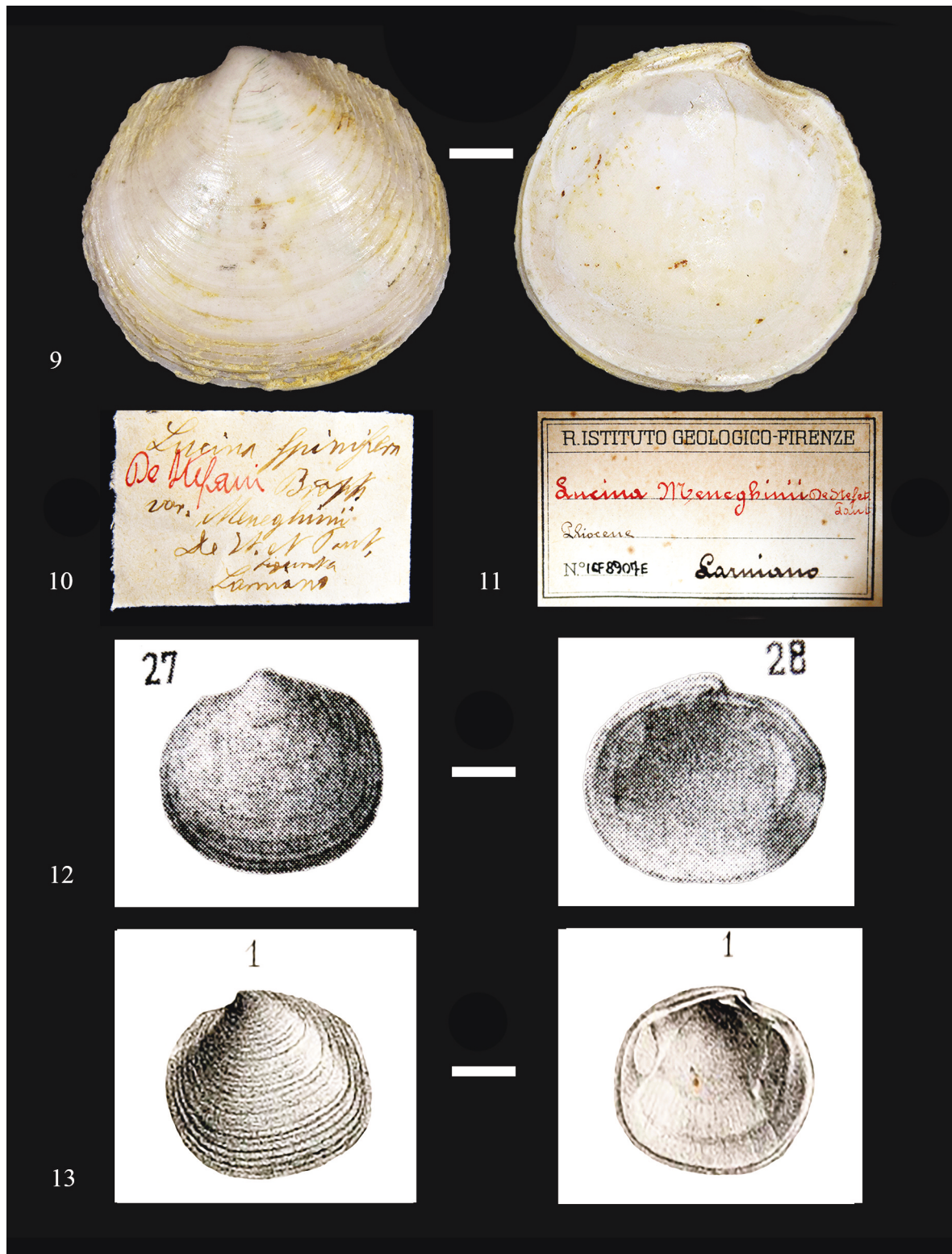
The analysis of some Pliocene specimens belonging to the Lucinidae family, coming from the surroundings of Orciano Pisano, has shown that some taxa, although considering some intraspecific variability, need a more precise definition and attribution, at a specific and above all generic level. In light of the new methods of study of current molluscs, based in large part on genetic analysis, in addition to more careful and different ways of considering morphological characters than in the past, we believe it is necessary a revision of the fossil species belonging to this family.

ACKNOWLEDGEMENTS

We would like to thank those who contributed to the drafting of the text: Mauro M. Brunetti (Navas del Selpillar, Spain) for some suggestions under review, Dr. Stefano Dominici (Museo di Storia Naturale, Università di Firenze, Italy), for the precious advice during the drafting of the text and the critical review of the original manuscript written in Italian, Dr. Daniele Ormezzano (Museo Regionale di Scienze Naturali di Torino, Italy) for sending photos of the specimens belonging to the Bellardi and Sacco collection.



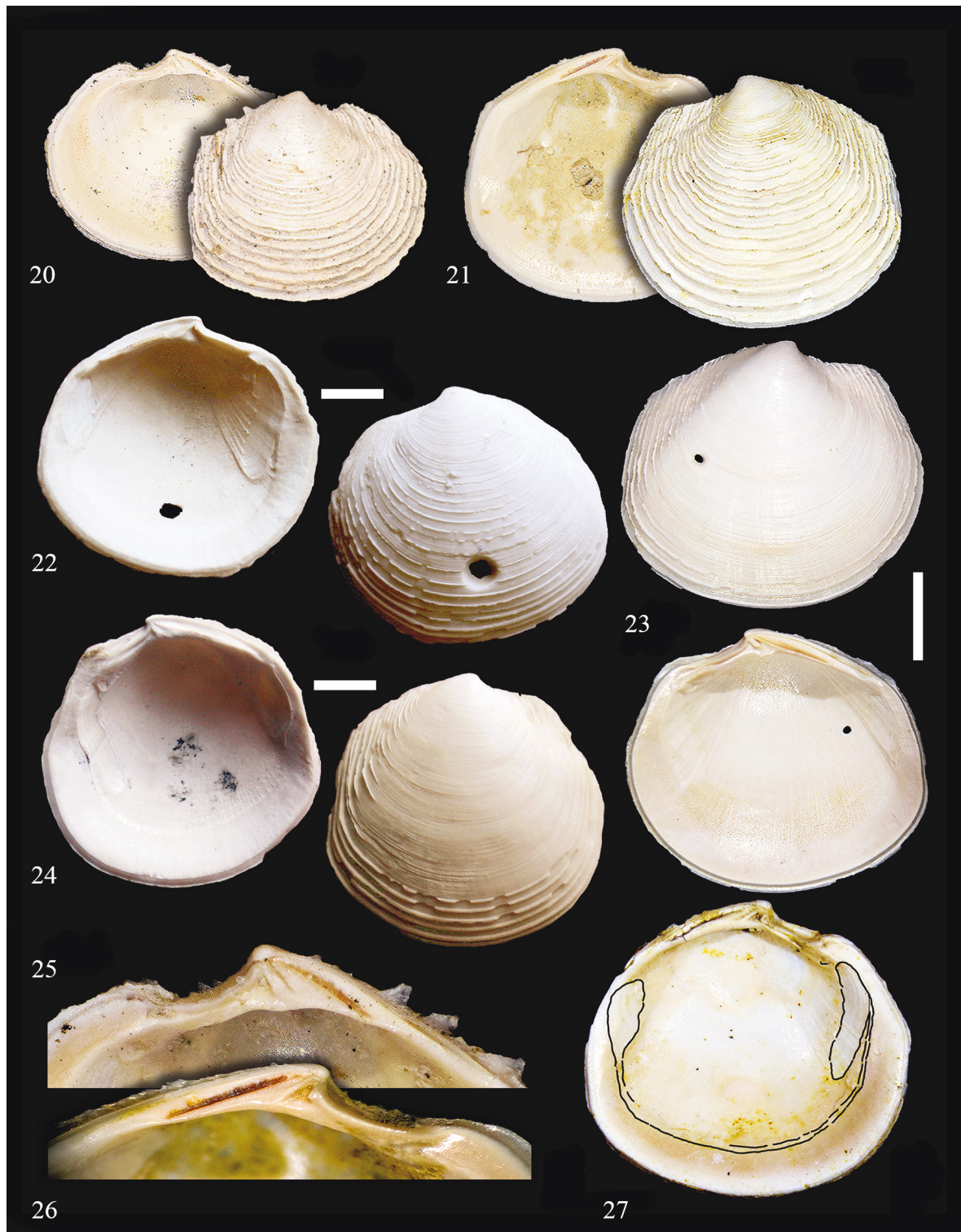
Figures 2–8. *Myrtea spinifera* (Montagu, 1803), Orciano Pisano (Pisa, Italy), Pliocene. Fig. 2: right valve, inner and upper surface, H= 2 mm, L = 4 mm. Fig. 3: right valve, inner and upper surface, H=5 mm, L = 7 mm. Figs. 4, 8: left valve, inner and upper surface, adductor muscle scars, and pallial line, H=17.2 mm, L = 23.5 mm. Figs. 5, 7: right valve, inner and upper surface, and hinge teeth, H=19.3 mm, L = 23.5 mm, morpho *Lucina astensis* Michelotti, 1839; Fig. 6: hinge teeth of the left valve, L = 18.5 mm.



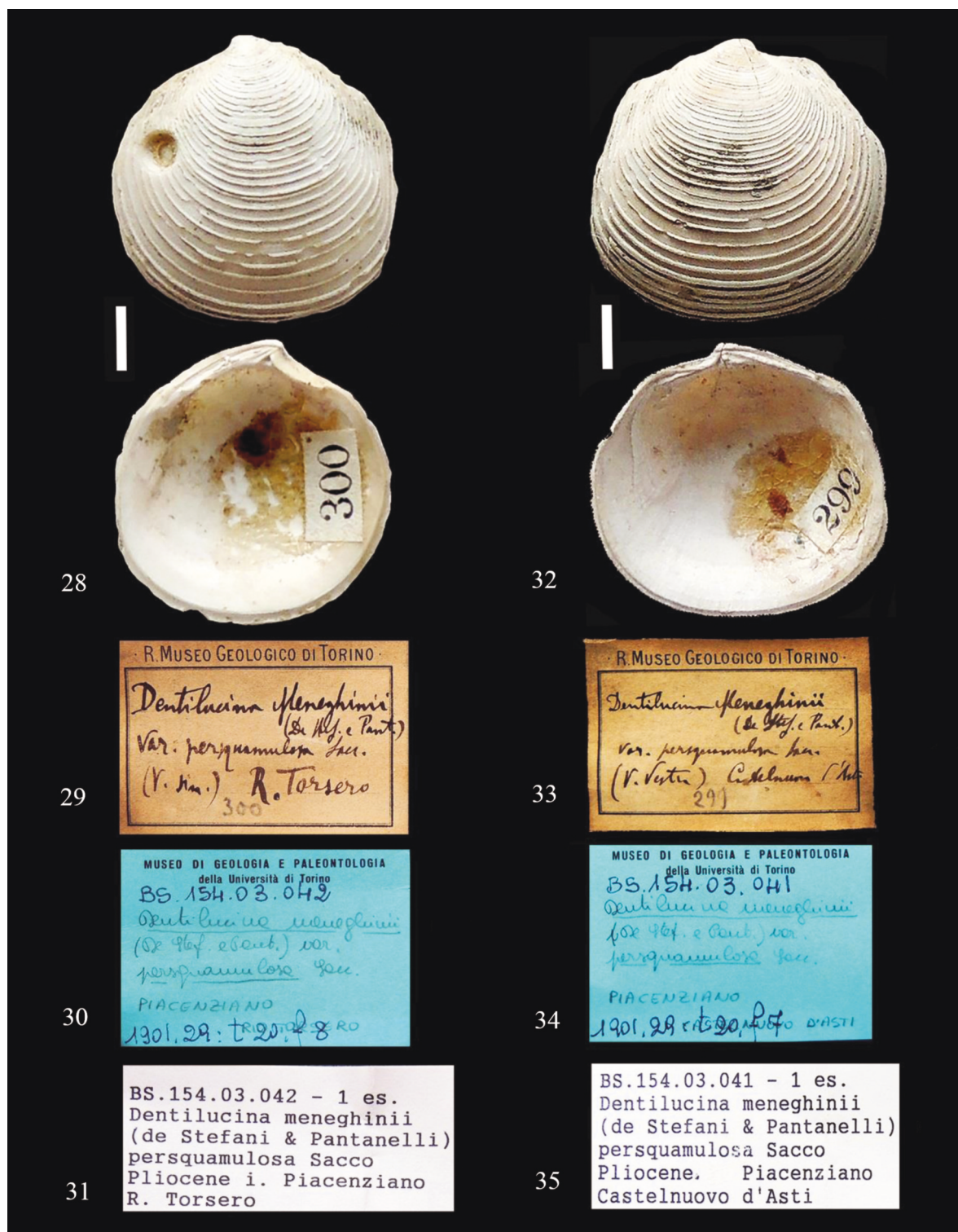
Figures 9–12. *Gonimyrtea* (?) *meneghinii* (De Stefani et Pantanelli, 1878). Fig. 9: type, left valve, H = 8.6 mm, L = 9 mm, MSNF IGF 8907E, Larniano (Siena, Italy), Pliocene. Fig. 10: original handwritten label by De Stefani. Fig. 11: label MSNF collection. Fig. 12: type specimen figured by De Stefani, 1888, p. 191, tab. 9, figs. 27–28. Figure 13: *Lucina bronni* Mayer, 1858, pp. 74–75, pl. III, fig. 1.



Figures 14–19. *Gonimyrtea* (?) *meneghinii* (De Stefani et Pantanelli, 1878). Fig. 14: left valve, H = 10 mm, L = 11mm, MSNF IGF 7080E, Certaldo (Firenze, Italy), Pliocene. Figs. 15, 16: original handwritten label by De Stefani and MSNF old label for specimen of figure 14. Fig. 17: left valve, H = 7 mm, L = 7.8 mm, MSNF IGF 9213E, Coroncina (Siena, Italy), Pliocene. Figs. 18, 19: original handwritten label by De Stefani and MSNF old label for specimen of figure 17.



Figures 20–27. *Gonimyrtea* (?) *meneghinii* (De Stefani et Pantanelli, 1878), Orciano Pisano (Pisa, Italy), Pliocene. Figs. 20, 25: right valve, inner and upper surface, hinge, L = 5.1mm. Figs. 21, 26: left valve, inner and upper surface, hinge, L = 9.5 mm. Fig. 22: left valve, inner and upper surface, H = 18 mm, L = 17.2 mm. Fig. 23: right valve, inner and upper surface, H = 13.7 mm, L = 15.5 mm. Fig. 24: right valve, inner and upper surface, H = 18.2 mm, L = 19.5 mm. Fig. 27: adductor muscles scars and pallial line of the specimen of figure 14.



Figures 28–31. *Gonimyrtea* (?) *meneghinii* (De Stefani et Pantanelli, 1878), Rio Torsero (Savona, Italy), Pliocene. Fig. 28: left valve, inner and upper surface, H = 13 mm, L = 15 mm. Fig. 29: original handwritten label from the Bellardi & Sacco collection; Figs. 30, 31: MRSN labels collection; Figures 32–35. *Alucinoma* (?) *persquamulosa* (Sacco, 1901), Castelnuovo d'Asti (Asti, Italy), Pliocene. Fig. 32: right valve, inner and upper surface, H = 14 mm, L = 15.8 mm. Fig. 33: original handwritten label from the Bellardi & Sacco collection; Figs. 34, 35: MRSN labels collection.



Figures 36–42. *Alucinoma* (?) *persquamulosa* (Sacco, 1901), Orciano Pisano (Pisa, Italy), Pliocene. Figs. 36, 37: left valve, inner and upper surface, adductor muscles scars and pallial line, H = 20.6 mm, L = 26 mm. Fig. 38: right valve, inner and upper surface, H = 19 mm, L = 20.2 mm. Fig. 39: right valve, inner and upper surface, H = 20 mm, L = 21.4 mm. Figs. 40, 41: right valve, inner and upper surface, hinge, H = 20.4 mm, L = 23.7 mm. Fig. 42: left valve, inner and upper surface, hinge, H = 18.6 mm, L = 22 mm; Figure 43. *Dentilucina meneghinii* var. *persquamulosa* Sacco, 1901: 85, tab. 20, fig. 7.

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