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A new species of the *Alvania pagodula* group (Monterosato, 1890) from the Pliocene of Italy: *A. agathae* n. sp. (Gastropoda Rissoidae)

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ABSTRACT *Alvania agathae* n.sp. is described from the Pliocene of Italy. The new species is based on 17 fossil shells found in Pliocene layers of Sicily and Tuscany and belongs to the genus *Alvania* (Risso, 1826). *Alvania agathae* n.sp. is relatively close to *A. spinosa* (Monterosato, 1890), grouped within *Alcidiella* Cossmann, 1921, usually treated as a subgenus or synonym of *Alvania*. The description and the comparison with other Mediterranean similar fossil and living species are here reported. The possible phylogeny of the new, as well as related species included *A. spinosa*, is also discussed.

KEY WORDS Rissooidea; *Alvania*; Pliocene; new species; Buccheri; Orciano Pisano.

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INTRODUCTION

Rissoidae, with related genera, is one of the most diverse families of marine molluscs in the world. In particular, species of the genus *Alvania* (Risso, 1826) inhabit a large variety of different environments, from shallow to bathyal depth, in the Mediterranean Sea, the Atlantic, the Indo-Pacific and the temperate Australian coasts (Ponder 1985). Many authors contributed to the study of the family Rissoidae, describing many new taxa and expanding our knowledge on the taxonomy of this fascinating group.

In this paper, we describe *Alvania agathae* n.sp., a new remarkable species of the genus *Alvania*, based on fossil shells found in Pliocene layers of Sicily and Tuscany. This new species belongs to a group of species once grouped under the subgeneric name *Alcidiella* Cossmann, 1921, nowadays accepted as a synonym of *Alvania*, which is poorly studied and on which there are gaps in knowledge on the difference between species. Our findings allow us to discuss the presence of *Alcidiella* in the Mediterranean Plio-Pleistocene and to hypothesise a possible phylogeny between the fossil and living species closest to *A. agathae* n. sp.

MATERIAL AND METHODS

For the present paper, 30 kilos of sediments were collected from a sandy layer with *Persistrombus coronatus* (Defrance, 1827) cropping out in contrada Pirazzo, 500 m north of Masseria Pirazzo (37°9'28.63"N; 14°52'25.03"E; 608 m a.s.l.) along

the east side of Monte Costerotte (851 m) at about 4 km from North-East of Buccheri, Siracusa, Italy. Further 50 kilos of sediments were collected from a sandy layer with *Euspira helicina helicina* (Brocchi, 1814) from excavation sites used for the construction of houses near the town of Orciano Pisano, Pisa, Italy.

Sediments were routinely washed, dried and sieved. Then, shell specimens were picked out from the > 10 mm fraction. The shell specimens were examined, measured and photographed under a stereomicroscope. In particular, the holotype and the Paratype 1 were also examined uncoated under a Zeiss LEO 1455 VP SEM microscope in Low Vacuum modality, to investigate its micromorphology. The repository number of the holotypes and the paratypes are given in the systematic descriptions.

ACRONYMS. Museo Civico di Storia Naturale di Comiso, Ragusa, Italy (MCSN); Massimo Cresti malacological collection, San Casciano in Val di Pesa, Firenze, Italy (MCC); Danilo Scuderi malacological collection, Belpasso, Italy (DSC), Alberto Villari malacological collection, Messina, Italy (AVC); Attilio Pagli malacological collection, Empoli, Italy (APC).

RESULTS

Systematic Palaeontology

Phylum MOLLUSCA Cuvier, 1797
Classis GASTROPODA Cuvier, 1795
Subclassis CAENOGASTROPODA Cox, 1960
Ordo LITTORINIMORPHA Golikov et Starobogatov, 1975
Superfamilia RISSOOIDEA Gray, 1847
Familia TROCHIDAE Rafinesque, 1815
Genus *Alvania* Risso, 1826
Type species: *Alvania europea* Risso 1826 = *Turbo cimex* Linnaeus, 1758

Alvania agathae n. sp.
http://zoobank.org:act:44508215-7C04-49FC-ADA3-BBB675C69DEF

TYPE LOCALITY. Pliocene of contrada Pirazzo, Buccheri, sandy layers with *Persistrombus coronatus* (Defrance, 1827), Siracusa, South-East Sicily, Italy (details under stratigraphy and paleoenvironment below).

EXAMINED MATERIAL. Holotype (Fig. 1), contrada Pirazzo, Buccheri, Siracusa, Sicily, Italy, (MSNC 4723). Paratypes and specimens same data of the holotype: paratype B and C (Figs. 2, 3) and paratype A (Fig. 4) (MSNC 4724), paratype D (Fig. 5) and E (MCC) from Orciano Pisano, paratypes F-R, and 8 specimens (MSNC 4725); 2 specimens (DSC), 1 specimen (AVC).

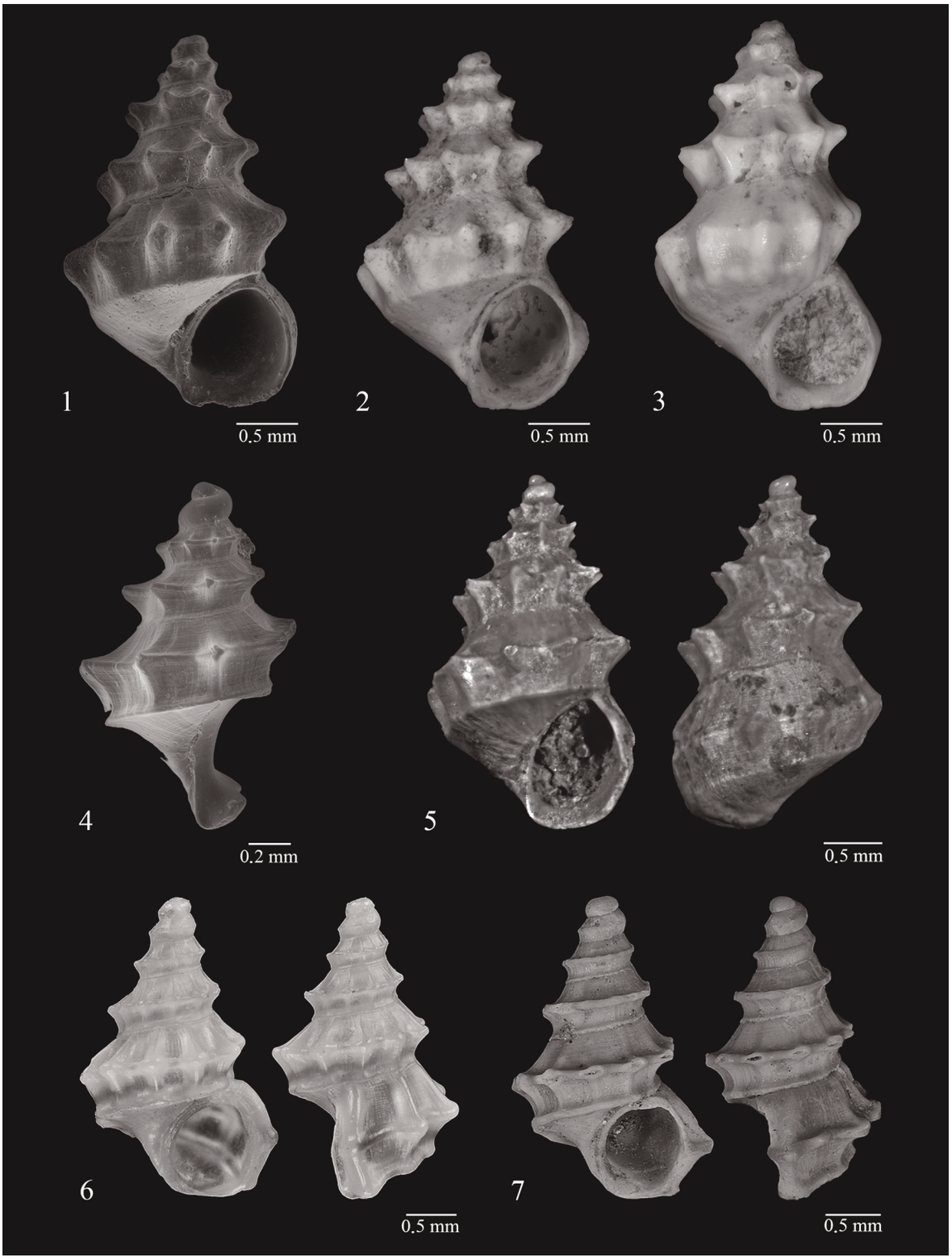
DESCRIPTION OF THE HOLOTYPE. Shell conic, slender, slightly perforated, with a weak umbilical chink, sometimes absent and a pointed spire, slightly less high than the last whorl; height 3.2 mm, width 2.03 mm, H/W 1.5. Protoconch eroded (Fig. 1).

Just below the protoconch boundary, in the first tele-whorl, the median spiral keel could be detected. Teleoconch is constituted by 5 whorls, with weak sutures and a wide subsutural ramp. Sculpture is characterised by a marked spiral keel in the middle of the each whorl and axial ribs which form prominent spines at the intersection. The axial ribs and relative spines are thicker than the spiral keels, orthocline, 9 in number on the early tele-whorls, 11 on the body whorl. In the last whorl, which is about 1/3 of the total length of the shell, a single spiral keel with 11 spines is present. From the upper insertion of the external lip to the base, there is a second keel below which the axial ribs are not visible. In fact, the base of the shell below the second keel is completely smooth. From the penultimate to the first tele-whorl this keel is visible as a faint upper-sutural cord.

The aperture is ovate and slightly drop-shaped, with thin partially damaged peristome. The umbilicus is narrow.

VARIABILITY. Paratypes variation: shell height 3.1-3.5 mm, width 2.02-2.05, H/W 1.5-1.7 (Figs. 2, 3, 5). Protoconch (paratype A, Fig. 4) almost smooth, slender, conical, paucispiral, consisting of 1.5 regularly convex whorls with only thin and faint growth-lines; height 0.25mm, maximum diameter 0.27 mm; nucleus inflated and inrolled; diameter 0.1 mm; transition boundary from proto to teleoconch is marked (Figs. 8, 9, 12, 13).

Teleoconch with 5-5.5 whorls; axial ribs and relative spines 10-11 in number on the body whorl. In the last whorl 10-12 spines are present. A clear spiral micro-sculpture, detectable only at high magnifications, is present over all the shell surface but



Figures 1–4. *Alvania agathae* n.sp., from type locality. Fig. 1: holotype, h: 3.3 mm. Fig. 2: paratype B, h: 3.1 mm. Fig. 3: paratype C, h: 3.5 mm. Fig. 4: paratype A, h: 1.63 mm. Figure 5. *Alvania agathae* n.sp., paratype D, from Orciano Pisano, h: 2.95 mm. Figure 6. *Alvania tessellata* Schwartz in Weinkauff, 1868, from Getares (Spain), beached in shell grit, h. 2.98 mm (APC). Figure 7. *Alvania alboranensis* Peñas et Rolán, 2006 , from Motril (Spain), -110 m in shell grit, h. 2.78 mm (APC).

better evident on the ab-sutural and ad-sutural zone of each whorl, where spiral lines are closer to each other (Fig. 14).

ETYMOLOGY. The specific name is after the Agata Conti (Catania, Italy), mother of the first author (A.R.).

STRATIGRAPHY AND PALEOENVIRONMENT. Buccheri (Siracusa, Sicily, Italy). Sediments were collected in contrada Pirazzo in lenticular sandy and calcarenitic layers, located in the area of Buccheri. They were characterised by the presence of Persistrombus coronatus (Defrance, 1827) and by a rich malacofauna from pliocenic shallow marine environments (Philippi, 1844; De Gregorio, 1882; Alemagna, 1920; Glibert, 1960; Glibert & Van de Poel, 1965; Grasso et al., 1979; Carbone et al, 1986; La Perna, 1999). Molluscan assemblages are characterized mainly by the *Posidonia* meadows (HP) and photophilic algae (AP) biocenosis (sensu Pérès & Picard, 1964): *Tricolia pullus* (Linnè, 1758), *Jujubinus* spp., *Clanculus* spp., *Persistrombus coronatus* (Defrance, 1827); fine-grained well sorted sands biocenonsis (SFBC): *Glycymeris* spp., *Spisula subtruncata* (Da Costa, 1778), *Neverita olla* (De Serres, 1829), *Chamelea gallina* (Linnaeus, 1758); superficial muddy sands in sheltered areas biocenosis (SVMC): *Loripes lacteus* (sensu Poli, 1791), *Bittium deshayesi* Cerulli-Irelli,1912; coastal detritic biocenosis (DC): *Tellina serrata* Brocchi, 1814, Erato spp. and muddy detritic bottom biocenosis (DE): *Timoclea ovata* (Pennant, 1777), *Plagiocardium papillosum* (Poli, 1795), *Bolma rugosa* (Linnaeus, 1767), *Calyptraea chinensis* (Linnaeus, 1758).

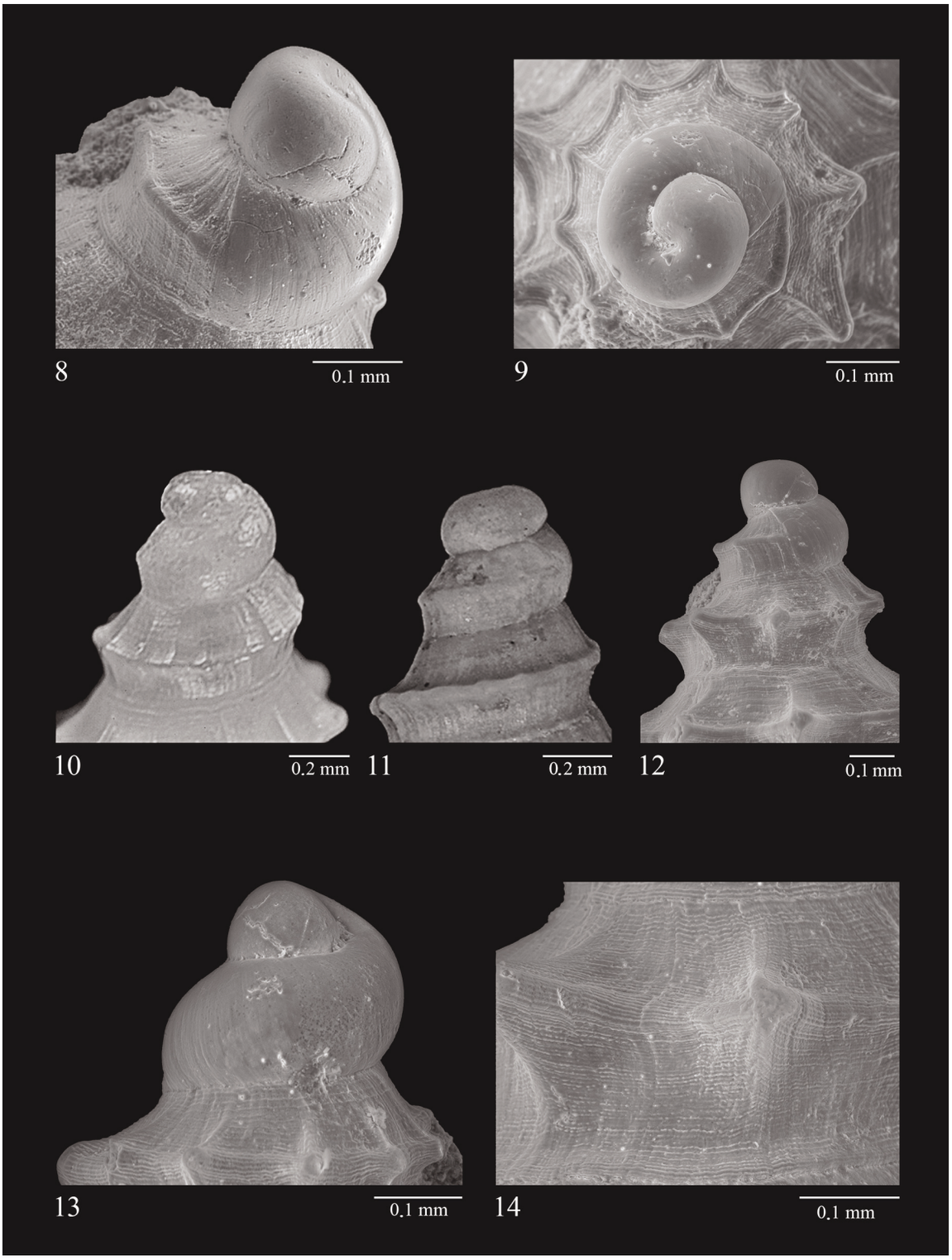
Orciano Pisano (Pisa, Tuscany, Italy). The material from Orciano Pisano was sampled in grayish clay with *Euspira helicina elicina* (Brocchi, 1814), *Ringicula buccinea* (Brocchi, 1814), *Pagodula echinata* (Kiener, 1839), probably belonging to the "facies Piacenziana" (Brunetti et al, 2017 and references therein; Brunetti & Cresti, 2018), characterized by shell assemblage from circalittoral and epibathial paleoenvironments.

REMARKS. *Alvania agathae* n. sp. belongs to the so-called *A. pagodula* group, including four different extant species Mediterranean species (WoRMS 2020): *A. alboranensis* Peñas et Rolán, 2006 (most probably a subfossil species), *A. pagodula* (Bucquoy, Dautzenberg et Dollfus, 1884), *A. spinosa* (Monterosato, 1890) and *A. tessellata* Schwartz in Weinkauff, 1868. These were previously grouped within the subgeneric name *Alcidiella* (Van Aartsen, 1976). However, Ponder (1985) did not give any taxonomical significance to the latter, in spite of the common features shared between the four species (Van Aartsen, 1976, Palazzi, 1996). The Miocene fossil species *A. munita* Palazzi, 1996, included in *Alcidiella* by the author, shares some features with the *A. pagodula* group and partially with *A. agathae* n. sp., but is different on account of a greater number of spiral cords.

At the current state of knowledge, no other Tertiary fossil *Alvania* species are directly comparable with *A. agathae* n. sp.

Alvania spinosa is known as fossil record from Pleistocene layers of Gravitelli and Milazzo (Seguenza G., 1873–1874; Seguenza L., 1903; Greco & Lima, 1974); we found some further specimens from the inferior Pleistocene (Sicilian stage) of Augusta (Di Geronimo et al., 2000). Seguenza L. (1903) did not provide any description or draw of *Alcidia spinosa*, ex *A. angulata* (Seguenza G., 1874, not 1876)= *Alcidia spinosa* (Monterosato, 1890) and for this reason, it is not possible to correctly address this species to any other known *Alvania*. Furthermore, Seguenza Luigi's collection (originally owned by his father Giuseppe) got lost and partially destroyed during the earthquake of 1908 (Bertolaso & Palazzi, 2000). However, Monterosato (1890) synonymised "R. angulata *(not Eichwald, 1830) Seguenza mss.*" as *Alcidia spinosa*; although the reason for such choice is unknown.

Tringali (2001), based on actual specimens collected in Mediterranean shores of Morocco, claims that *A. spinosa* (Monterosato, 1890) sensu Pallary (1902, 1920) is a morphotype of *A. tessellata*, considering the great variability shown by the latter species. Such assumption was recently accepted by Gofas et al. (2011), although it was not reported in WoRMS (2020). *Alvania spinosa* s.s. is characterized by a single median keel bearing spines, while *A. tessellata* presents a second less developed keel with spines, located halfway between the median region and the suture. However, Tringali's hypothesis was not based on the direct comparison between his samples and the holotype of *A. spinosa* (as reported in his study, the author was not able to find it in Monterosato's collection housed in the zoological museum in Rome) or specimens from Thyrrenian Sea. Moreover, the figure (42: 23 C) of



Figures 8, 9, 12, 13. *Alvania agathae* n.sp, paratype A from type locality, details of apex. Figure 10. *Alvania tessellata* Schwartz in Weinkauff, 1868, from Getares, (Spain) beached: detail of apex (APC). Figure 11. *Alvania alboranensis* Peñas et Rolán, 2006, from Motril (Spain) -110 m in shell grit: detail of apex (APC). Figure 14. micro-sculpture of *Alvania agathae* n.sp, paratype A.

the specimen of *A. spinosa* (Institut Royal des Sciences Naturelles de Belgique, ex Monterosato) reported in Ponder (1985), does not match with the original description of *A. spinosa* and rather looks like a specimen of *A. tessellata* s.s.

According to the recent literature (Giannuzzi-Savelli et al., 1996; Cossignani, 2011; Scaperrotta et al., 2012), *A. spinosa* is distributed only in the Alboràn Sea.

Probably, specimens referable to *A. spinosa* s.s. belong to the suprapleistocenic thanatocenoses from the deep sea in the low Tyrrhenian Sea.

In light of this, *A. agathae* n. sp. will be compared mainly with *A. tessellata* and its morphotype *A. spinosa* sensu auctores.

Alvania agathae n.sp. differs from *A. spinosa sensu auctores* in having a smoother apex, a bigger size, a different height/last whorl ratio, a wider and completely smooth base, a simple and thin peristome lacking of spines, and a more prominent teleoconch with pointed spines.

Alvania agathae n.sp. differs from *A. tessellata* s.s. in having a single median keel (Fig. 6); the species is more similar to *A. alboranensis* (Fig. 7), which also have a hint of axial sculpture. However, *A. agathae* n. sp. differs from *A. alboranensis* in its keel, located in the last whorl starting from the superior margin of the peristome; furthermore, the keel in *A. agathae* n. sp. is smooth and sharper. Ultimately, *A. agatha*e n.sp. has a more or less convex basis instead of canaliculated, being this latter character characteristic of *A. alboranensis* s.s.

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