

Further new taxonomical and paleontological notes on *Haliotis stomatiaeformis* Reeve, 1846 (Gastropoda Haliotidae)

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ABSTRACT

The finding of new both recent and fossil materials of the Mediterranean small abalone *Haliotis stomatiaeformis* Reeve, 1846 (Gastropoda Haliotiidae) allowed a more detailed study of this rare species. Analogies between the paleo-environment in which the fossil material is contextualized and the peculiar environment where nowadays it still lives are made on account of the faunal assemblage comparisons. Data on the morphology of the protoconch and the external soft parts chromatism and a new iconography complete the information set on this “neglected” species.

KEY WORDS

Gastropoda; Mediterranean Sea; Europe; Fossil; Haliotidae.

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INTRODUCTION

Haliotidae Rafinesque, 1815 is a family of marine gastropods (Vetigastropoda), worldwide distributed, consisting of 56 extant (WoRMS, 2022, last access on december 22 2023) and at least 40 fossil species (Geiger & Groves, 1999; Geiger, 2000; Eagle, 2002; Lozano-Francisco & Vera-Pelàez, 2002; Forli et al., 2003; Landau et al, 2003; Geiger & Owen, 2012; Owen & Berschauer, 2017). In the Mediterranean four extant species have been recently reported (Crocetta & Rismondo, 2009), three of which are native: *Haliotis tuberculata* Linné, 1758, also distributed in the Atlantic, *H. mykonosensis* Owen, Hanavan & Hall, 2001, synonymized only in recent times with *H. secernenda* Monterosato,

1877 (see Appolloni et al., 2018), and *H. stomatiaeformis* Reeve, 1846, endemic to the Central Mediterranean and known only from Sicily and the island of Malta, (Chiappa et al., 2022; WoRMS, 2022). The fourth species, *H. pustulata* Reeve, 1846, is a Lessepsian immigrant (Talmadge, 1971; Barash & Danin, 1973; Fainzilber, 1984; Giannuzzi-Savelli et al., 1994; Cossignani & Ardovini, 2011). Based on molecular approach, the most recent paper of Chiappa et al. (2022) for the Mediterranean reveals, instead, the presence of only *H. tuberculata*, to which they refer *H. secernenda* as synonym, and *H. stomatiaeformis*, restricted to the above reported central part of the basin, while the presence of *H. pustulata* is confirmed as an alien species. In the same paper *H. coccinea* Reeve, 1826

is considered as a subspecies of *H. tuberculata*, with the first genetic evidence of its presence in the Mediterranean area.

As concerns the Tertiary-Quaternary species of *Haliotis* in Europe, according to Landau et al. (2003), Forli et al. (2015) and Vera-Pelàez (2022), seven species are instead reported: *H. tuberculata*, *H. volhynica* Eichwald, 1829, *H. quinquecentenaris* Lozano-Francisco & Vera-Pelàez, 2002, *H. bertinii* Forli, Dell'Angelo, Ciappelli & Taviani, 2003, *H. iberica* Landau, Marquet & Grigis, 2003, *H. stalenyi* Owen & Berschauer, 2017 and *H. telescopica* Vera-Pelàez, 2022.

GEOLOGICAL SETTING

The Pleistocenic fauna from Catallarga deposit (Grammichele, Catania, Italy) has been widely studied (Travaglia, 1880; Malatesta, 1960-63; Di Geronimo, 1984; Rosso, 1987; Di Geronimo & Sanfilippo, 1993; Sciuto, 1995). Regarding the malacofauna of this locality, 255 species of Gastropods, Bivalves and Scaphopods are reported. Lithology of this deposit is characterized by coarse sands and pale (yellowish-beige) organogenic-detrital gravels, mainly loose, but locally stratified, whose terrigenous component is constituted by especially volcanic but also calcareous clasts. Deposition of sediments probably happened just after the tectonic phase occurred during the higher stage of late Pleistocene (Di Geronimo et al., 1978). The faunal assemblage of Catallarga is mainly attributable to the coarse sands and fine gravels under the influence of bottom's currents (SGCF) where peripheral contributions from adjacent areas merge to the former due to important hydrodynamism. These latter originated mainly from well sorted fine sands biocoenosis (SFBC), photophilic algae (AP), *Posidonia* beds (HP) and from coastal detrital (DC), mixed sometimes to supralittoral rocks (RS) and higher and lower mesolittoral rocks (RMS, RMI). Deposition environment could be placed between infra and circalittoral levels (Di Geronimo, 1984; Rosso, 1987; Di Geronimo & Sanfilippo, 1995). Anyway, Catallarga's paleo-community includes mixed faunistic elements, whose paleo-climatic and paleo-environmental meaning is different from that of all the other elements, probably due to Calabrian re-arrangements (see Garilli, 2011).

MATERIAL AND METHODS

The recent materials of *H. stomatiaeformis* is constituted by both empty shells and living specimens. Dry specimens were found beached or in shell grit from shallow bottoms along the rocky coasts of Catania and Malta, while living specimens were collected under stones 2/3 m depth.

All the fossil specimens have been collected by the first Author of the present note in Catallarga deposit (Grammichele, Catania, IGM 273-IV-SE: 37°13'47.40"N – 14°39'21.38"E, 489 m a.s.l.) and are now stored in the Palaeontological Museum of the Department of Biological, Geological and Environmental Sciences, University of Catania (PMC). A more detailed list of collecting data is hereafter furnished in the systematic session. Samples from PMC were collected with "picking method" according to Sciuto (1995).

ABBREVIATIONS AND ACRONYMS. ARC: Agatino Reitano Collection (Catania, Italy); DSC: Danilo Scuderi collection (Catania, Italy); I.C.Z.N. = International Code of Zoological Nomenclature; MFV-ME = Museo della Fauna del Dipartimento di Scienze Veterinarie dell'Università di Messina, Messina, Italy; PMC = Museo di Paleontologia, University of Catania, Italy; MZB = Museo Zoologico dell'Università di Bologna, Bologna, Italy; SVC = Stefano Valenti malacological collection (Catania, Italy); H = maximum height (in mm); SEM = scanning electron microscope; sh.: shell/shells without soft parts inside; sp. = living collected specimen/s.

RESULTS

Systematics

Classis GASTROPODA Cuvier, 1795
Ordo VETIGASTROPODA Salvini-Plawen, 1980
Superfamilia HALIOTIDEA Rafinesque, 1815
Familia HALIOTIDAE Rafinesque, 1815
Genus *Haliotis* Linné, 1758

Haliotis stomatiaeformis Reeve, 1846

MATERIAL EXAMINED. ITALY • 1 specimen, Sicily. Agrigento: Lampedusa Is., Cala Greca, 4 m depth (ACR). Catania: Acicastello, Cannizzaro, on

the rocky bottom mixed with sand, 1.5/4 m, 3 sh. (ACR); Capo Molini, Acireale, beached, 3 sh (ACR), 55 sh. and 3 sp. (DSC); Pozzillo, on the rocky bottom mixed with sand, 2/4 m, 10 sh. and 3 sp. (DSC).

MALTA • 1 specimen, Malta Island: Bahar ic-Caghaq, beached, 1 sh (DSC).

Fossil materials: ITALY • Catania, Catallarga, Grammichele, Pleistocene, 7 sh. [5 in PMC (Figs. 7–10), 2 in SVC (Figs. 11, 12)].

DESCRIPTION. The shell morphology has been well outlined by Geiger & Owen (2001), who has described and figured the radula's structure. Here we provide new informations on the protoconch (Fig. 5). Nucleus rounded, 190 µm in maximum diameter, sculptured by faint axial undulated folds. The remaining protoconch is 0.9 mm as maximum diameter and is constituted by almost a single wide and flat whorl, sculptured by numerous thin but well marked evenly undulated spiral threads, more pronounced near the suture, crossed by almost imperceptible axial growth lines.

DESCRIPTION OF THE EXTERNAL SOFT PARTS. Animal oval, compressed, smaller compared to those of the other Mediterranean species. Colour of the mantle and of the upper part of the foot pale green tending to grayish, while the sole is dark yellow. Epipodial sensory organs small and rounded, white, lying at the base of long brown and small green alternated epipodial tentacles (Figs. 1–4).

REMARKS. The form and dimensions of the shell distinguish in a very satisfactory way *H. stomatiaeformis* from all the other congeners. Compared to that of *H. tuberculata* (Fig. 6), the protoconch has more numerous, less undulated spiral threads, with almost regular instead denticulate margins, which give it a less granulated appearance.

This species was restored, under the name of *H. neglecta* Philippi, 1848, by Geiger (1998) and subsequently considered as junior synonym of *H. stomatiaeformis* Reeve, 1846 (Geiger & Owen, 2001), though the use of this latter taxon for Mediterranean materials has encountered various interpretations up to now. Considerations are based on the study of the type material by these Authors, which morphologically match the Mediterranean specimens, though it is labelled having a New Zealand provenance. In this case I.C.Z.N. provides for the validity of the name, but also the correction of its origin. On the basis of

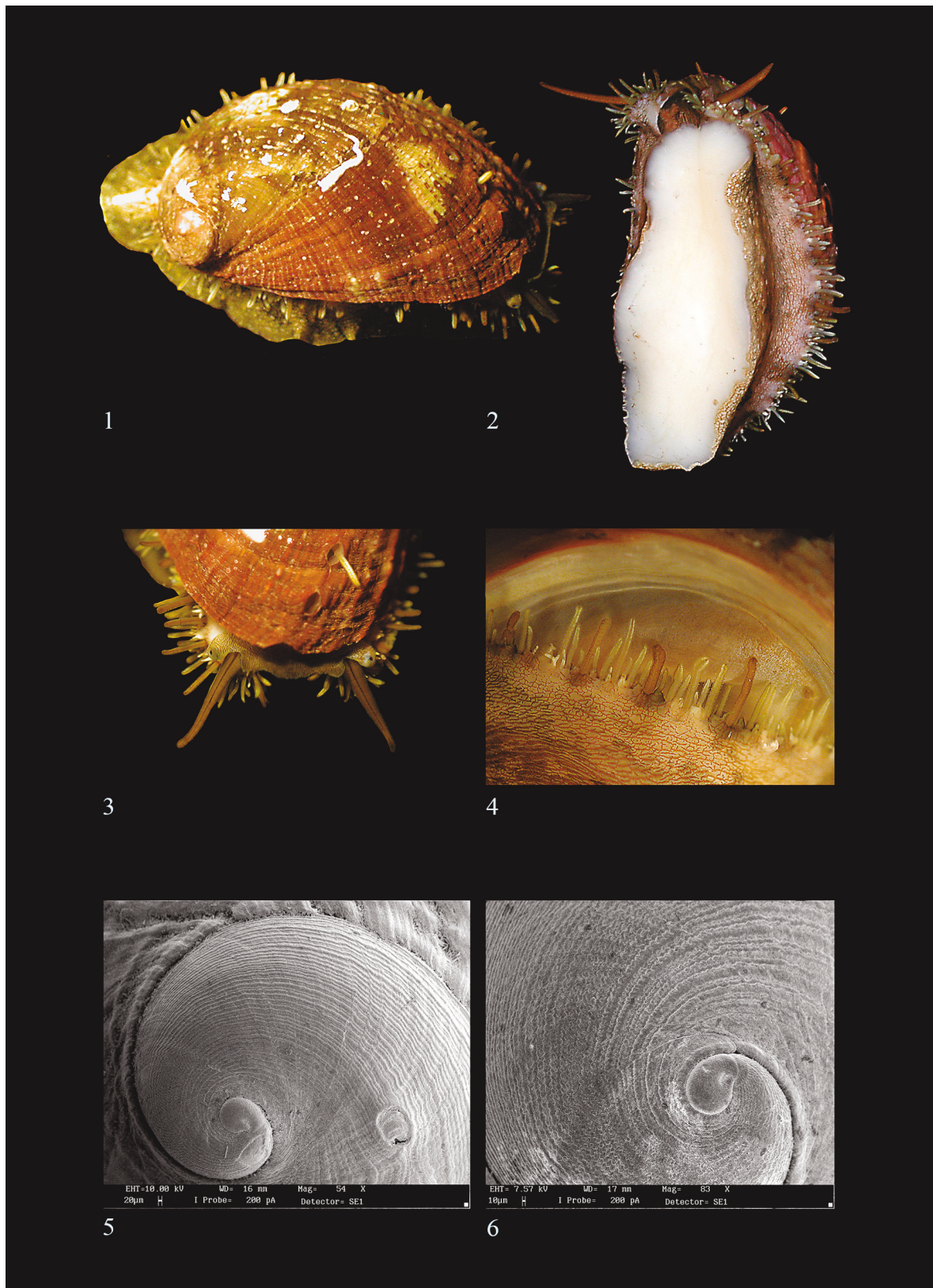
our observations and findings and of the distribution restricted only to Sicily and Malta in the Mediterranean by Geiger & Owen (2001), here we officially select this as the typical distribution of the species.

In the Mediterranean Sea, *H. stomatiaeformis* has been ever reported only for the Eastern Sicily and Malta (Geiger, 2000; Geiger & Owen, 2001, 2012; Geiger & Poppe, 2000; Gaeta et al., 2003), with occasional records from Western Sicily (Palermo) and Lampedusa Island (Geiger, 2000; Crocetta & Rismondo, 2009; Chiappa et al 2022), and, in recent times, from Cape Milazzo (Northern Sicily) (Giacobbe & Notaristefano, 2018).

Fossil shells here observed have the same morphological characters and dimensions of the extant specimens. Moreover, being very good preserved, we are able to attest that the shell colour pattern too is the same of the living material, leaving no doubt on their taxonomical identification. Finally the pleistocenic material of Catallarga and the living specimens of *H. stomatiaeformis* found has revealed a correspondence in the peculiar environmental conditions. In particular, the finding of species referable to supra and meso-littoral biocoenosis (according to Pérès & Picard, 1964) in the same fossil samples, i.e. *Phorcus turbinatus* (Born, 1778), *Melaraphe neritoides* (Linnaeus, 1758), as well as *Patella ferruginea* Gmelin, 1791, *P. ulyssiponensis* Gmelin, 1791 and *P. rustica* Linnaeus, 1758 suggests that the paleo-environment in which all these species could be set is compatible to a Mediterranean rocky bottom of very lower depth, in which *H. stomatiaeformis* currently lives.

DISCUSSION

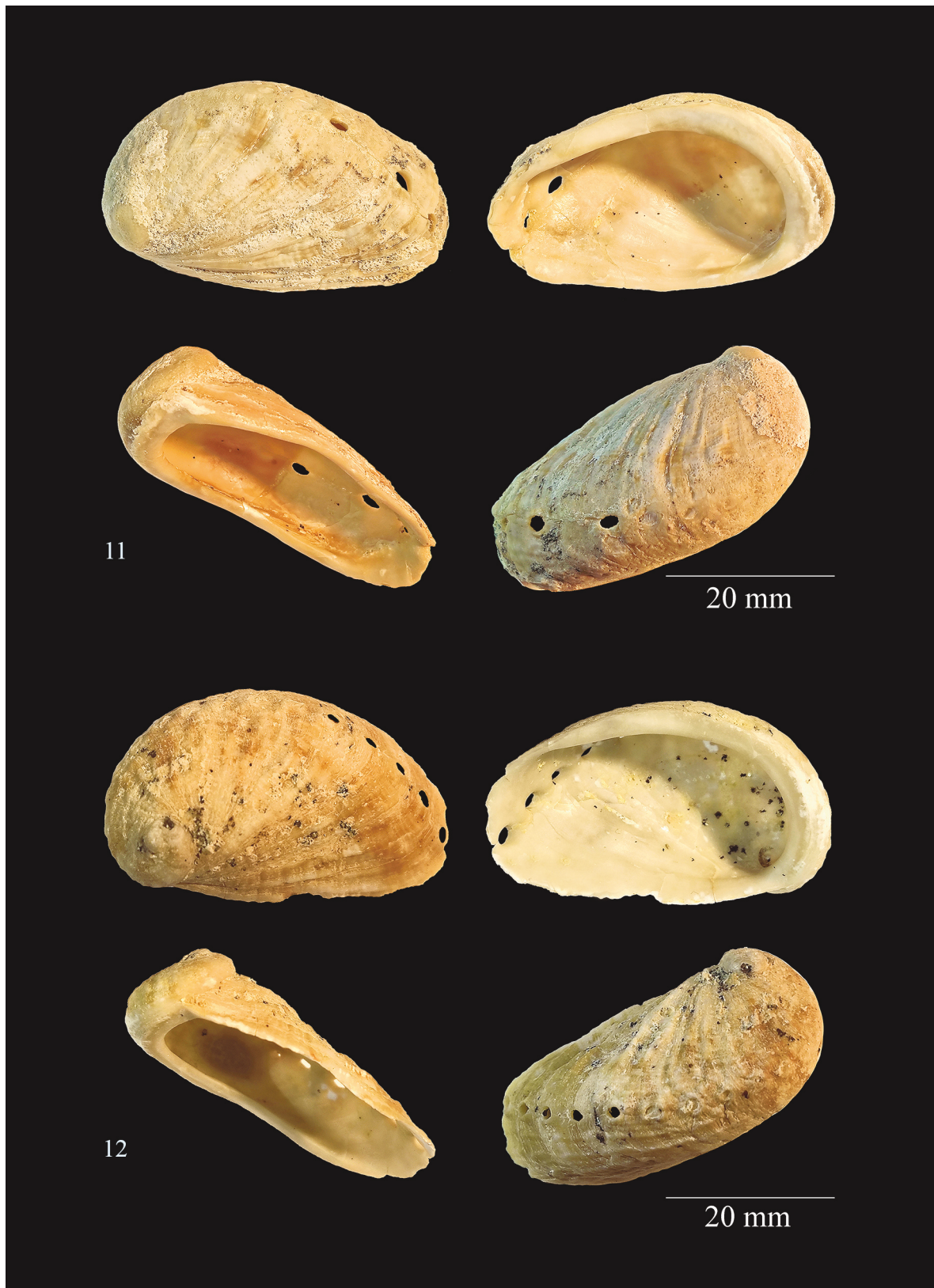
According to observations on Mediterranean living specimens, the species appears to be ecologically very deeply specialized as concerns the peculiar environment (Gaeta et al., 2003), being linked to local freshwater affluxes of the very lower fringe of littoral rocky environment, under stones placed on or near detrital deposits, in a very restricted range of depth comprised between 1.5 and 3 m. Specimens from Malta were observed in similar environmental conditions near *Posidonia* beds (Geiger & Owen, 2001). The morphology of the protoconch, to our knowledge the first reported for the species, adds further element to the taxonomical



Figures 1–4. *Haliotis stomatiaeformis*, living specimen, Capo Mulini, Catania (Italy).
 Figure 5. *Haliotis stomatiaeformis*, protoconch. Figure 6. *Haliotis tuberculata*, protoconch.



Figures 7–10. *Haliotis stomatiaeformis*, fossil specimens, Pleistocene (Italy, Catania: Grammichele, Catallarga) - PMC.



Figures 11, 12. *Haliotis stomatiaeformis*, fossil specimens, Pleistocene (Italy, Catania: Grammichele, Catallarga) - SVC.

distinction from the other congeners. Fossil abalones are not commonly found and only *H. tuberculata* has been reported for the Mediterranean area (Geiger & Groves, 1999). The above reported fossil specimens of *H. stomatiaeformis* from Grammichele date back to lower Pleistocene (Calabrian). This record improve the knowledge on Quaternary Haliotidae and enlarge the temporal distribution of this species, which is collocated between 1.8 and 0.8 mya and represents the second fossil abalone species recorded in the basin beyond *H. tuberculata*. Moreover Catallarga's fossil record adds further new important informations on paleo-environments of this area, which are referable to that of the living specimens.

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