FIRST CONTEXTUALIZED MARINE RECORD OF *PARVITURBO SERTUM* TABANELLI *ET AL.*, 2019 (GASTROPODA: SKENEIDAE) AND COMPARISON WITH THE CONGENERIC MEDITERRANEAN SPECIES

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Abstract *Dead specimens of an initially undetermined* Parviturbo *species were sampled during the EGA95 Cruise, from the Marettimo Valley, Western Sicily. Once reconsidered, the specimens were assigned to the recently described* P. sertum *Tabanelli et al., 2019, providing first data on the related marine environment. The contextual review of literature data, revealing mistakes and misidentifications that affected both recent and fossil reports, proved that in the Mediterranean four* Parviturbo *species occurs:* P. sertum, P. fenestratus P. laevisculptus *and* P. ergasticus*, plus at least one undescribed species. Such species, nevertheless, might all be extinct, and their shells attributable to outer shelf in situ Pliocene assemblages and, in minor part, to bathyal reworked deposits.*

Key words *Skeneidae,* Parviturbo*, Mediterranean, biogeography, recent, Pliocene*

INTRODUCTION

The genus *Parviturbo* Pilsbry & McGinty, 1945, excluding paleontological literature, is known for 17 species distributed in the American Pacific, Tropical South Pacific and Atlantic (Rubio *et al*., 2015). Between them, only one species, *P. fenestratus* (Chaster, 1896), has been reported both in East Atlantic and Mediterranean, apparently ranging from the Ibero-Moroccan basin to the Aegean Sea (Rubio *et al*., 2015). Such areal, that Warén (1992) indicated as incompletely known, should be quite reconsidered. First, possible misidentifications should be taken into account, according to Tabanelli *et al*. (2019), which notes how some literature images of *P. fenestratus* are almost identical to the Pliocene fossil *P. sertum*, by the same authors described as n. sp. from Romagna, Italy. Secondly, the disjoined concentration of records between Strait of Gibraltar and Sicily Channel needs to be explained. And lastly, since both these rare species, as well as all their Mediterranean congenerics, have never been sampled alive, literature data on depth range and habitat need to be confirmed and interpreted.

In this paper, the record of some dead specimens of *P. sertum* from Egadi Islands is reported, providing the opportunity to check a large set of data directly or indirectly linked to the two before mentioned species, with taxonomic, biogeographic and ecological implications.

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MATERIALS AND METHODS

Empty shells initially recognized as *Parviturbo* sp. were collected in March–April 1996 in the framework of the "EGA'96" Cruise, aimed to define zonation and distribution of benthic communities in the Egadi Islands (Leonardi *et al*., 1998). Sampling was carried out by means of modified Van Veen grabs (0.25m^2 sampling surface) and triangular dredges (60cm mouth opening), according to the expected seafloor nature. Collected samples were washed on board, employing a gentle seawater flow throughout 1mm mesh sieve, and the retained sample was fixed in 70% alcohol. The living motile fauna was sorted on board under stereomicroscope, and the residual sediment with related death assemblages was dried in 45°C muffle. Selected samples of dried sediment were examined later in the laboratory under stereomicroscope, mollusk shells were sorted, and specimens determined to species level, as far as possible. Between them, the specimens initially classified as *Parviturbo* sp. were separated, awaiting more accurate investigation. Stereomicroscope and SEM photos were taken and compared with

literature images and original photos of related species. From Monterosato collection, the lots of "*Delphinula elegantula*" and "*Tubiola sphaeroides*" have been directly examined and photographed. Photos of two syntypes of *Parviturbo fenestratus*, from Chaster collection (NMW.1910.029.02223), were provided by Harriet Wood, Curator & Collection Manager Mollusca in the Museum of Wales. Photos of *P. sphaeroideus* (S.W. Wood, 1840) were provided by Jeroen Goud, collection manager, and Hannco Bakker at NBC, Leiden, The Netherlands.

Unfortunately, specimens deposited at the British Museum of Natural History, London, as well as at the National Museum of Natural History, Smithsonian Institution, Washington, DC, according to respective curators were not accessible, due to the restrictions imposed by the COVID emergency.

Acronyms and abbreviations

BEL: Benthic Ecology Laboratory, Messina University, Italy.
BMNH: The Natural History Museum, London.
CAD: Antonino Di Bella collection, Patti, Italy.
CGN: Giuseppe Notaristefano collection, Milazzo, Italy.
CIN: Italo Nofroni collection, Rome, Italy.
CMF: Museo Civico di Scienze Naturali di Faenza.
CSB: Stefano Bartolini collection, Florence, Italy
CWR: Walter Renda collection, Amantea, Italy.
MNHN: Museum national d'Histoire Naturelle, Paris.
MCZR: Museo Civico di Zoologia Roma, Italy.
MZUT: Museum of the Department of Zoology, University of Thessaloniki.
NBC: Naturalis Biodiversity Center, Leiden, The Netherlands.
NMW: National Museum of Wales, Great Britain.
SMNH: Swedish Museum of Natural History, Stockholm.
USNM: United States National Museum (now National Museum of Natural History; Smithsonian Institution; Washington, DC).

Results

A total of 7 dead *Parviturbo* Pilsbry & McGinty, 1945 specimens were sorted from a 15 dm^3 sediment sample, collected by Van Veen Grab in the eastern side of the Marettimo Valley, Egadi Islands (St. Pic27: 38°00'48"N 12°10'08"E; 228m depth) (Fig. 1).

The sediment, consisting of a mixture of medium-fine sand and coarse biogenic clasts, was characterized by abundant fragments and disarticulated valves of the large brachiopod *Gryphus vitreus* (Born, 1778).

The specimens, ranging in size from 1.6mm to 2.2mm, showed a good state of preservation, shiny surface and protoconch intact, lacking any evidence of post-mortem displacement. According to SEM images of the specimen BEL152EGA'96Pic27Ps1, salient features of the shell were: teleoconch composed of 3.5 convex whorls with six spiral cords, crossed by numerous very fine ribs; smooth protoconch, 302µm diameter, with a rather prominent nucleus (Fig. 2). Such features, together with the whole shell shape, perfectly agree with description and photos of the recently described Pliocene fossil *Parviturbo sertum* Tabanelli *et al*., 2019, whilst clear differences exist with the congeneric species, including the only two species reported as recent from the east Atlantic-Mediterranean area: the weakly sculptured *P. laevisculptus* (Renda *et al*., 2019), and the more similar, since markedly sculptured, *P. fenestratus* (Chaster, 1896). The Egadi specimens, in fact, are more than double the diameter of *P. fenestratus*, despite counting the same number of whorls; the axial ribs are much more numerous (about double than in the Chaster, 1896 original description); the protoconch is largest, at least in comparison with the Ceuta *P. fenestratum* specimen shown by Warén (1992), with a more prominent nucleus that makes the shell shape higher in *P. sertum* than in *P. fenestratum.*

Discussion

The records of *P. sertum* specimens from Egadi Islands, in agreement with Tabanelli *et al*. (2019), confirmed the occurrence of a third *Parviturbo* species in the Mediterranean, in addition to the east Atlantic-Mediterranean *P. fenestratus* and the Mediterranean endemic *P. laevisculptus*. Nevertheless, in this regard, the sparse literature existing on the genus *Parviturbo* in

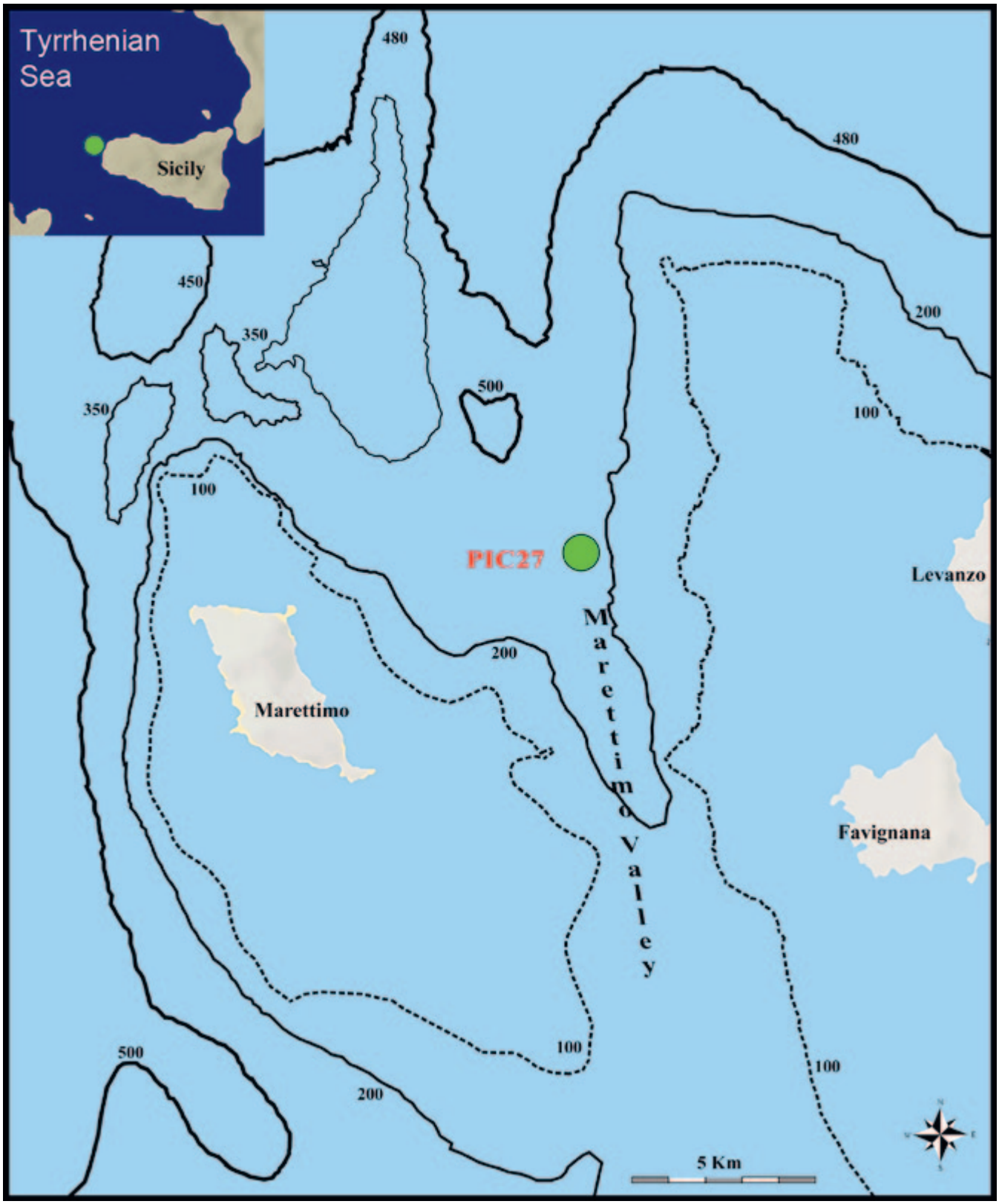

Figure 1 Sampling site of *Parviturbo* specimens (green circle) inside the Marettimo Valley (Egadi Islands).

the Mediterranean, appears controversial and contradictory. A comparison of the original description, recent data, and iconography of *P. fenestratus*, revealed several discrepancies, some of which directly or indirectly involving *P. sertum*. By the original Chaster (1896)

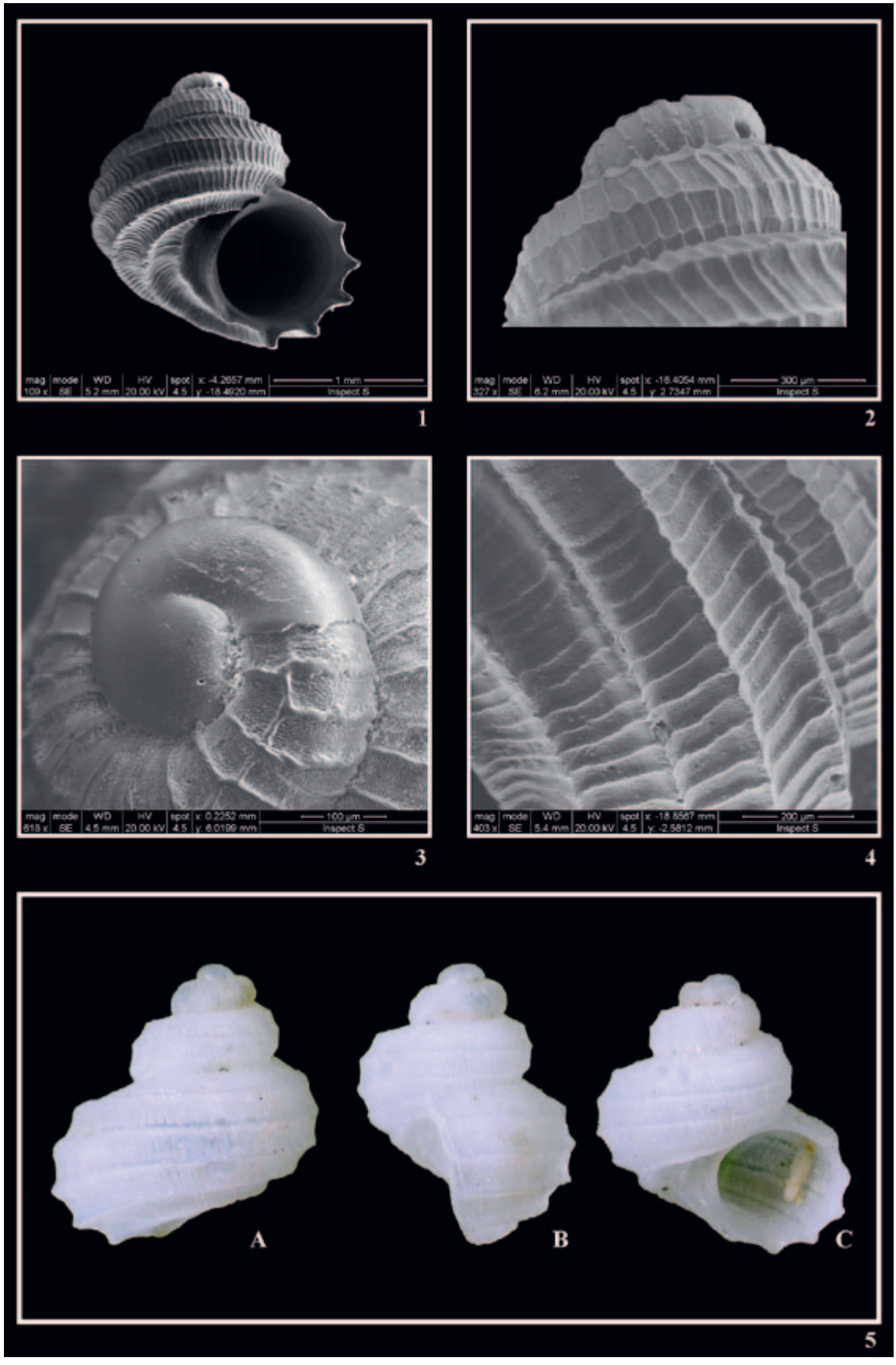

Figure 2 **1–5** *Parviturbo sertum* from Egadi Islands. BEL152EGA'96Pic27Ps1. H=2.0mm. **1–4** Details of sculpture and protoconch visible under the SEM microscope. **5** Optical photos of the same specimen.

Figure 3 **A–C** *Delphinula elegantula* Philippi, 1844 (now *Parviturbo elegantulus*) from the Monterosato collection (MCZR-M-11807). H=2.45mm. **D** original label handwritten by Tiberi.

description of *P. fenestratus*, also supported by an accurate drawing, such species is characterized by a globosely conical shell almost similar to the fossil "*Delphinula* ? *elegantula*", now *Parviturbo elegantulus* (Philippi, 1844), this latter apparently differing "only in having the longitudinal lines finer and closely crowded not giving rise to any decussation". Photos of *Delphinula elegantula* from the Monterosato collection (MCZR-M-11807) (Fig. 3), compared with photos of both two *P. fenestratus* Chaster syntypes (NMW-1910.029) (Fig. 4) and a specimen from MNHN (Warén, 1992), confirmed the two species are similar in shell shape but clearly distinguishable in sculpture and ornamentation.

Another fossil species repeatedly cited in relation with *P. fenestratus* is *Parviturbo sphaeroideus* (S. V. Wood, 1842) (Fig. 5), a variously reported taxon which has suffered misidentifications, revisions, contrasting opinion and emendations. Recently, Marquet & Landau (2006), for example, identified the *"Cyclostrema" sphaeroideum* shown by Warén (1992) as a different species, but erroneously attributing it to *Parviturbo lecointrae* (Dollfus & Dautzenberg, 1899), before the clarification in papers of Hoeksema *et al*. (2018), and Haszprunar *et al*. (2020) which identified this specimen as *Parviturbo ergasticus* Rubio, Rolan & Gofas, 2015.

As far as concerns the present question, we debate on two specimens from the Strait of Bonifacio, 100–200m depth, assigned by Warén (1992) as *P. fenestratus*, but initially reported as "*Cyclostrema*" *sphaeroides* (Wood, 1850) (*sic*) by Bogi & Nofroni (1986: p. 159, figs 9–10), which, in turn, related their specimens with a broadly similar specimen reported by Schirò (1971: p.11, fig. 686) as *Tubiola sphaeroides* (Wood, 1840) (*sic*). We must highlight that specimens of the fossil *P. sphaeroideus* from RGN (RGN.1008337) (Fig. 5), which agree with the Wood original description and figure, are rather different from two specimens deposited in the Monterosato collection, which are identical to each other, but differently labelled: the first one, as "*Tubiola sphaeroides*" (MCZR-M-30129), from Trapani, western Sicily (Fig. 6); the second one (MCZR-M-30130), according to the original Monterosato label (Fig. 7), reported by Marshall from an unspecified S. Vincent locality and, in agreement with Jeffreys, classified as *Cyclostrema sphaeroides*.

A further link between the two species may be found in Warén (1992), which affirms that

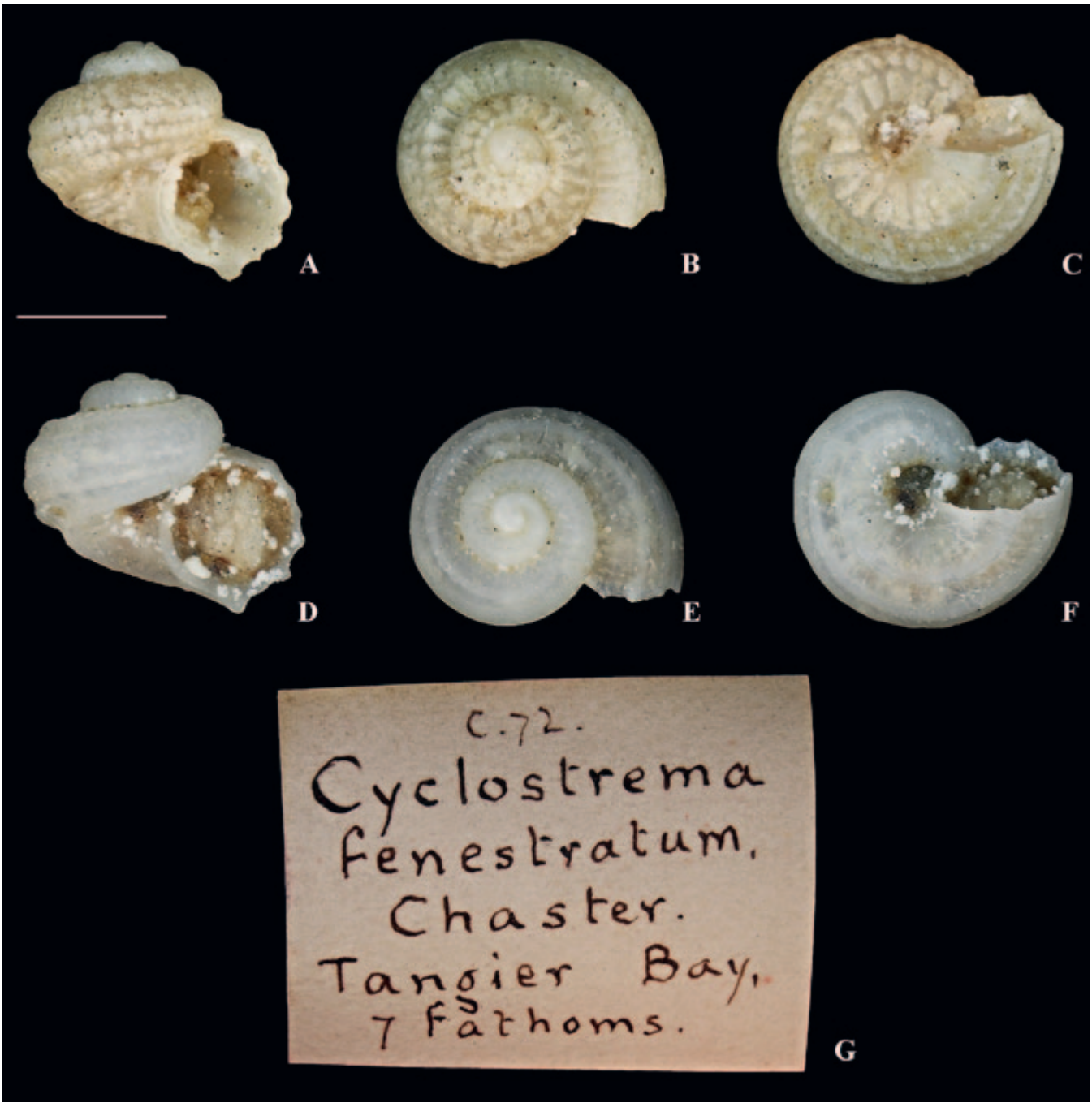

Figure 4 **A–G** *Cyclostrema fenestratum* Chaster, 1896 (now *Parviturbo fenestratus*) NMW.1910.029.02223. **A–C** sintype 1, H=0.8mm. **D–F** sintype 2, H=0.9mm. Scalebar 0.5mm. From Tangier, Morocco. **G** original label.

a sample labelled «*Cyclostrema sphaeroidea*, Adventure Bank», sent to Monterosato by Jeffreys (Fig. 8), belongs to *P. fenestratum*. A careful examination of such specimen confirmed its identity with *Cyclostrema sphaeroidea, sensu* Jeffreys, but different from the Wood's type, as well as from *P. fenestratum.* The same Jeffreys classified as *Cyclostrema sphaeroideum* a specimen from the Travailleur expedition (no locality), whose determination was rightly questioned by Warén (1980, Plate 2: 7–9), before being described by Rubio, Rolán & Gofas (2015) as a new species, i.e., *Parviturbo ergasticus*. We agree with Tabanelli *et al*. (2019), which affirm the specimen reported by Schirò (1971) from Gibraltar as *T. sphaereoides* (not belonging to the Monterosato collection, contrarily to the Warén, 1992, suggestion), is attributable to *P. ergasticus.*

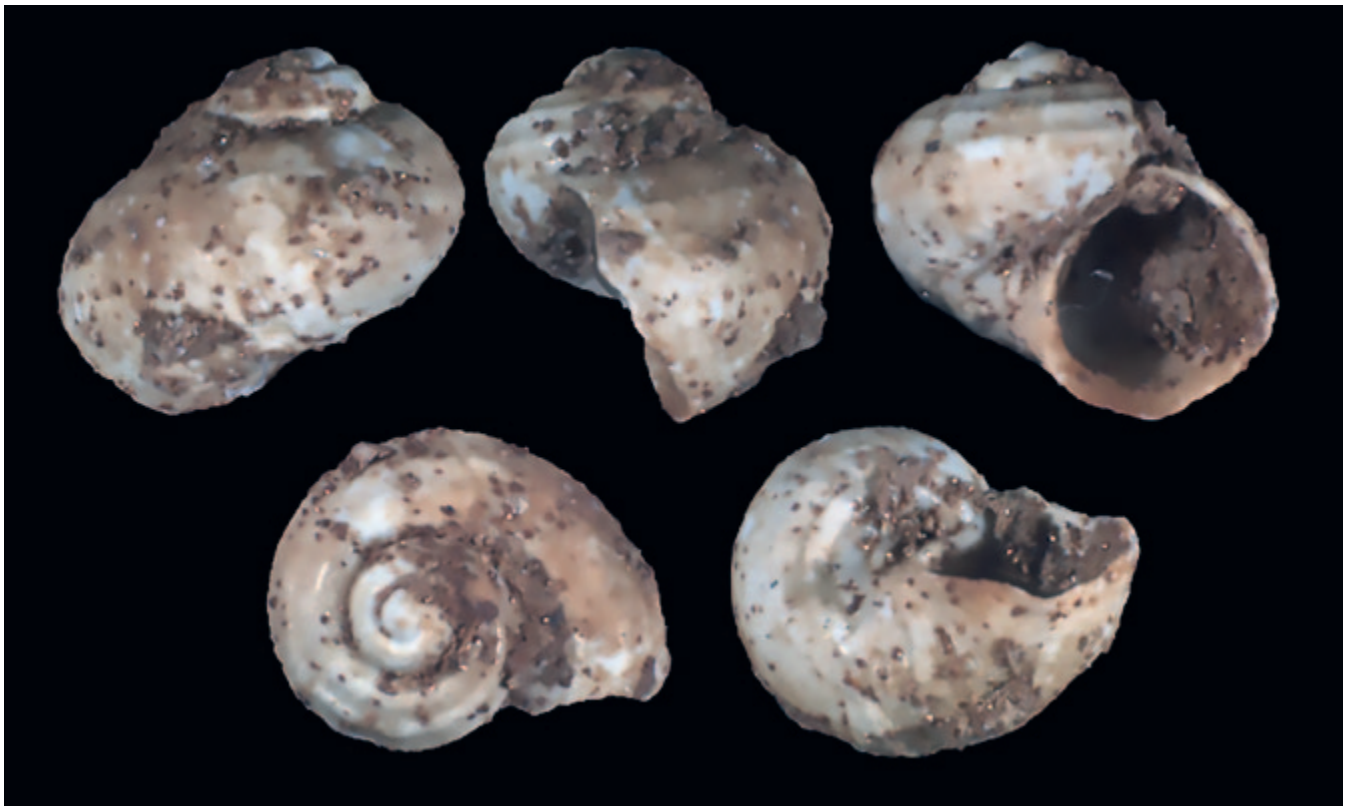

Figure 5 *Parviturbo sphaeroideus* (S.V. Wood, 1842) (RGM.1008337), H=0.9mm. Courtesy of Naturalis Biodiversity Center, Leiden, The Netherlands.

Moreover, the specimens cited as "*Cyclostrema" sphaeroides* by Bogi & Nofroni (1986), that according to Warén (1992) might be *P. fenestratus*, are very similar to *P. sertum*, as the same Tabanelli *et al*. (2019) have pointed out. The fossil specimens reported as *P. sphaeroidea* (Jeffreys, 1883) in Landau *et al*. (2003), also should be assigned to *P. sertum.*

At last, specimens attributed to juveniles *P. fenestratus* in Scaperrotta *et al*. (2015), from Ustica and Pantelleria, should be assigned to the "*Tubiola sphaeroides*" of Monterosato collection (MCZR-M-30129), to date a problematic and undescribed taxon needing further investigation (*Parviturbo* sp.1 in Table 1).

Further specimens, reported in Table 1 as *Parviturbo* spp, are not discussed here, because not shown in the original paper, and not accessible for direct examination. For example, with regret we must take note that after a long search with negative results, the specimens of *Parviturbo fenetratus* (Chaster, 1896) of the Sykes collection mentioned by Waren (1992) at the Natural History Museum, London, are to be considered lost. Otherwise, the report by Warén (1992) for the Adventure Bank, 267m, is problematic because there is no trace of it in Carpenter & Jeffreys (1870–1871), although such indication is reported in a label handwritten by Jefferys in Monterosato collection (Fig. 7). We must note, moreover, as the code reported by Warén (1992) for one alleged *P. fenestratus* specimen from the Ibero-Maroccan Gulf, Porcupine 1870 Exp. (USNM 181414), does not correspond to a *Parviturbo* species but to *Cyclostrema basistriata* Jeffreys, 1877 (http://n2t.net/ark:/65665/34e468f6f-801a-41ba-8862-4d198cbbcba3).

In conclusion, after Chaster (1896), only a small number of *P. fenestratus* records can be confirmed, i.e., the specimen from Ceuta shown by Warén (1992; Fig. 1B) and, later, the specimens from Barbate cited by Rueda *et al*. (2000) and subsequently shown in Rubio *et al*. (2015).

Based on such considerations, some questions concern the Mediterranean distribution of the *Parviturbo* species. Firstly, the alleged east Atlantic-Mediterranean areal of *P. fenestratus* is questionable, if we consider that confirmed reports do not extend east of Gibraltar, which differs to *P. ergasticus* whose areal ranges

Figure 6 Specimen labelled as *"Tubiola sphaeroides"* in Monterosato collection (MCZR-M-30129), in this paper reported as *Parviturbo* sp.

from the Bay of Biscay to the Sicily Channel (Fig. 9). In contrast, *P. sertum* should be localized in western Tyrrhenian Sea, while *P. laevisculptus* is apparently endemic to the Messina Strait. Lastly, *P. alboranensis* Peñas & Rolán, 2006, not discussed in this paper, is known only from Alboran Sea. Overall, the genus *Parviturbo* in the Mediterranean displays a clear western distribution, which follows the main branch of the Surface Atlantic Waters current (SAW), having hot spots in the Strait of Gibraltar and Sicily Channel, with two SAW converging secondary branches that agree with the Bonifacio Strait record.

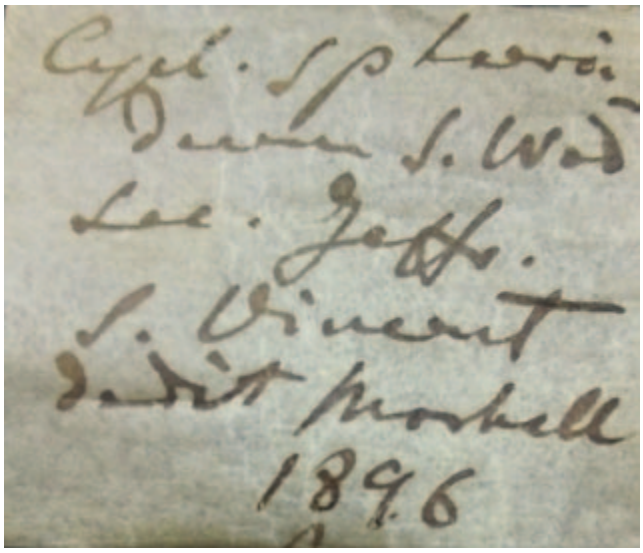

Figure 7 Original label handwritten by Monterosato of a specimen (MCZR-M-30130) from Saint Vincent, provided by Marshall and classified as *Cyclostrema sphaeroideum* S. Wood, according to Jeffreys (in this paper cited as *Parviturbo* sp.).

Figure 8 Original label handwritten by Jeffreys of a specimen from Banco Avventura, classified as *Cyclostrema sphaeroides* S. Wood, but now assigned to *P. ergasticus* (MCZR-M-11784).

In this scenario, the unconfirmed report from North Aegean (Koutsoubas *et al*., 1997), not related with a direct SAW inflow, appears discordant, except for a possible effect of the local upwelling regime (Dell'Angelo *et al*., 2018; Giacobbe & Renda, 2020). More in general, admitting an Atlantic origin of the Mediterranean *Parviturbo* species, the lack of records between Gibraltar and Tyrrhenian Sea might be explained by the western Mediterranean hydrology, whose complex interplay of eddies and fronts forces many warm Atlantic species to bypass the Algerian coasts (Valdes *et al*., 2013; Pascual *et al*., 2017). The high concentration of records in Straits and Channels, moreover, suggests that edaphic constraints, as strong laminar currents and coarse granulometry of sediments, can play a major role in some *Parviturbo* species distribution. *P. fenestratus*, for example, has been reported from shell debris (Chaster, 1896), in a "Boreal offshore gravel association" (Gofas & Warén, 1998), and bioclastic sand in "subtidal current-swept gravel bottoms" (Rueda *et al*., 2000). Similarly, *P. laevisculptus* was found in biogenic sediments submitted to a high hydrodynamic regime (Renda *et al*., 2019), as well as the specimens of *P. sertum* from Egadi Islands (this paper). The role of depth, in this respect, is less clear. The *Parviturbo* tropical species, notoriously all occur in shallow water (Engl, 2001), as the presumable Lusitanian *P. fenestratus*, but in contrast to the Mediterranean species, all found deeper than 100m depth, from the outer continental shelf to the deep bathyal plan (Table 1). This discrepancy caused Warén (1992) to suspect such deep species might belong to a different genus, which, however, he did not feel confident to introduce "before any soft parts are known". However, the fact that all European and Mediterranean *Parviturbo* species are known only by shells, leads to doubt that they are living in the Mediterranean.

The case of *P. sertum*, in this regard, is emblematic. This species, which has been described as an allochthonous element from a Pliocene outer shelf assemblage (Tabanelli *et al*., 2019), is here reported from an environment characterized by an association of "very shallow water contourites and shelf margin deposits" tied to the middle-late Pleistocene glacio-eustatic cycles (Agate *et al*., 2017), explaining the co-occurrence of high energy shallow-water and bathyal fauna in a same death assemblage. The specimens of *P. sertum*, which in such a context should be considered autochthonous but residual, suggest that all *Parviturbo* records from outer shelf might represent Pleistocene remnants, when not displaced from shallower environments.

Table 1 Synoptic table of reviewed *Parviturbo* species according to literature data and new reports. Geographical coordinates and depths are reported according to the original data.

	Code	Spm or Lots	Size mm	Dead or fossil	images viewed Y7N	Locality	Coordinates	depth m	References	Additional data
	Parviturbo elegantulus (Philippi, 1844)									
1	MCZR-M-11807	2 spm	2,45	fossil	Y	Cannitello, Reggio Calabria, Italy			Present paper	Label handwrite from Tiberi (see image)
1	Coll. Monterosato SMNH	1 spm	1,7	fossil	Y	Cannitello, Reggio Calabria, Italy			Warén, 1992	w
	Parviturbo ergasticus Rubio, Rolán & Gofas, 2015									
2	USNM 181467	3 Lots	1,6		Y	Bay of Biscay		1019	Warén, 1980 http://n2t.net/ark:/65665/36975ed63-44c8-4732-8c16-c9a1ae137c74 Rubio, Rolán & Fernández-Garcés, 2015	Travailleur exp. St.2; Jeffreys coll.
3		1 spm	2	dead	Y	Strait of Gibraltar			Schirò, 1971	
4	MCZR-M-11784	1 spm	1,2		Y	Banco Avventura, Italy			Present paper	
5	USNM 181468	1 spm			N	West off Portugal		534	http://n2t.net/ark:/65665/3f3c75917-62d4-4609-8f4a-6e51d36cb4be Warén, 1992	Porcupine Exp; Sta. 24; 292 fms; Jeffreys coll.; 1870
6	USNM 181469	6 spm			N	Portugal			http://n2t.net/ark:/65665/3f0087709-4861-49a5-816d-d9ce58e15e8e	Porcupine Exp.; Jeffreys Coll.; 1870
7	USNM 181470	2 spm			N	Spain			http://n2t.net/ark:/65665/36c29ab48-9340-4211-8107-211a42b89ec1	Porcupine Exp.; Jeffreys Coll.; 1870

	Code	Spm or Lots	Size mm	Dead or fossil	images viewed Y7N	Locality	Coordinates	depth m	References	Additional data
	Parviturbo fenestratus (Chaster, 1896)									
8	NMW.1910.029.02223 G.W. Chaster coll.	2 spm	0,8 0,9		Y	Tangier, Morocco		12,8	Chaster, 1896	Syntype. Image number: 0030526–0030533
9	Malaga University	6 spm	0,8	dead	Y	Bay of Barbate, Spain	36°88'N – 5°53'W	29	Rueda, Salas & Gofas, 2000 Rubio, Rolán & Fernández-Garcés, 2015	
10	MNHN	2 spm	1	dead	Y	Strait of Gibraltar, Ceuta, Punta Almina, Spain	35°54.1'N – 05°16.5'W	30–43	Warén, 1992	
	Parviturbo laevisculptus Renda, Raveggi, Bartolini, Micali & Giacobbe, 2019									
11	MZB60231	1 spm	1,87	dead	Y	Gioia Tauro Basin, off Bagnara Calabra, Italy	38°18'56.23"N 15°44'06.31"E	335	Renda W., Raveggi A., Bartolini S., Micali P. & Giacobbe S., 2019	Holotype
11	BEL136POP'951CB	1 spm	1,54	dead	Y	Gioia Tauro Basin, off Bagnara Calabra, Italy	38°18'56.23"N 15°44'06.31"E	335	Renda W., Raveggi A., Bartolini S., Micali P. & Giacobbe S., 2019	Paratype 5
	Parviturbo sertum Tabanelli, Bertaccini, Bertamini, Bongiardino, Gardella & Petracci, 2019									
12	CMF-222	18 spm	2,7	fossil	Y	Rio Albonello, Faenza, Italy	44°10'07"N 11°53'56"E		Tabanelli, Bertaccini, Bertamini, Bongiardino, Gardella & Petracci, 2019	
13	CIN	2 spm	2 1,8	dead	Y	Bocche di Bonifacio, Italy		100–200	Bogi & Nofroni, 1986	
14	BEL152EGA'96Pic27Ps1-2	2 spm	2 1,65	dead	Y	Egadi island, Italy	38°00'48"N 12°10'08"E	228	Present paper	EGA'96 Pic27
14	CWR	1 spm	1,9	dead	Y	Egadi island, Italy	38°00'48"N 12°10'08"E	228	Present paper	EGA'96 Pic27

	Code	Spm or Lots	Size mm	Dead or fossil	images viewed Y7N	Locality	Coordinates	depth m	References	Additional data
14	CAD	3 spm	2,2 1,7 1,6	dead	Y	Egadi island, Italy	38°00'48''N 12°10'08''E	228	Present paper	EGA'96 Pic27
14	CGN	1 spm	1,9	dead	Y	Egadi island, Italy	38°00'48''N 12°10'08''E	228	Present paper	EGA'96 Pic27
	Parviturbo sphaeroideus (S. V. Wood, 1842)									
	NBC – RGM.1008337	1 spm	0,9	fossil	Y	The Netherlands			Hoeksema et al., 2018	
	IRSNB 1ST 6962 Coll. B. Roest	1 spm	0,66	fossil	Y	Belgium			Marquet & Landau, 2006	
	Parviturbo sp.1									
15	MCZR-M-30129	1 spm	1,3		Y	Trapani, Italy			Present paper	
	MCZR-M-30130	1 spm	1,3		Y	S. Vincent			Present paper	Ex coll. Marshall 1896
16	CSB	1 spm	1	dead	Y	Pantelleria, Italy			Scaperrotta, Bartolini & Bogi, 2015	
17	CSB	1 spm	0,8	dead	Y	Ustica, Italy			Scaperrotta, Bartolini & Bogi, 2015	
	Parviturbo spp									
18	USNM 181471	1 spm			N	Morocco				Lost. Porcupine Exp.; Jeffreys Coll.; 1870
19	Sykes collection, BMNH	1 spm		dead	N	Off Tripoli, Libya		72–220	Warén, 1992	Lost. Shearwater Exp
20		1 spm		dead	N	Blata tal-Melh, Malta		120	Cachia, Mifsud, Sammut, 1996	
21	MZUT	1 spm		dead	N	North Aegean Sea, Greece		150	Koutsoubas, Koukouras & Voultsiadou – Koukourao 1997	

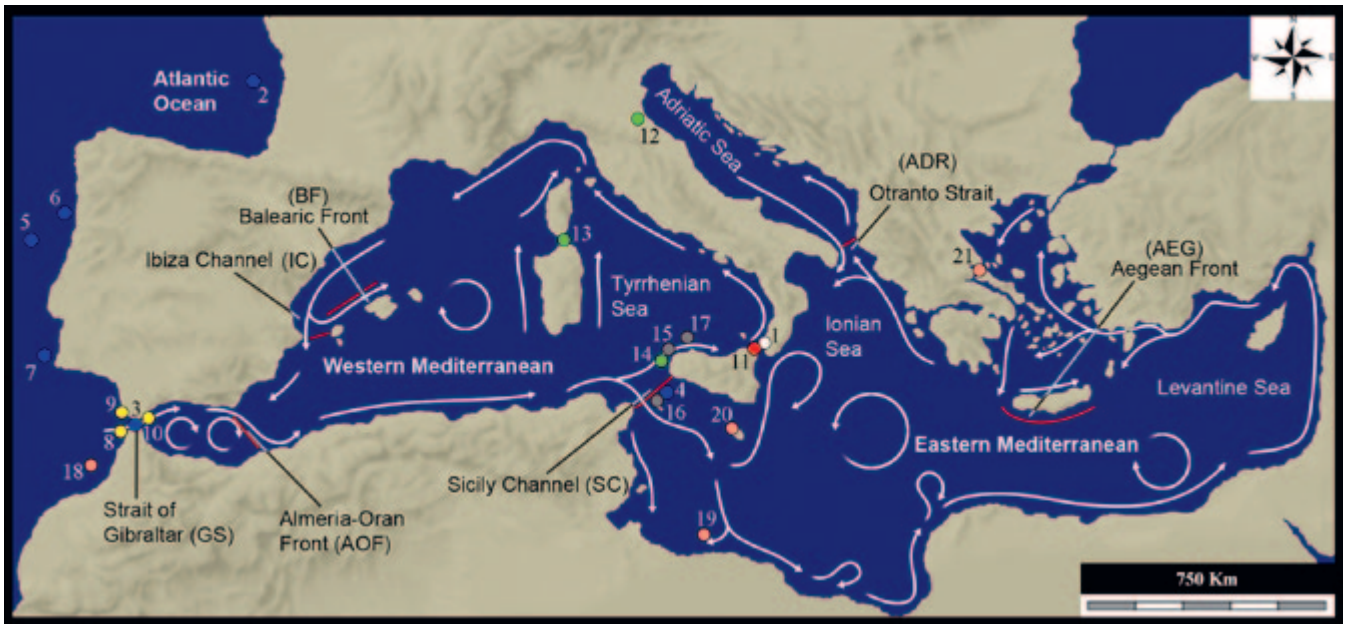

Figure 9 East Atlantic-Mediterranean distribution of the here discussed recent and fossil *Parviturbo* species. Yellow circles: *Parviturbo fenestratus;* Green circle: *Parviturbo sertum;* Red circle: *Parviturbo laevisculptus;* White circle: *Parviturbo elegantulus;* Blue circle: *Parviturbo ergasticus;* Grey circle: *Parviturbo sp.1;* Pink circle: *Parviturbo spp.* Fossils from Nederland are not indicated. The numbers correspond to those of Table 1.

Conclusion

Shells of *Parviturbo sertum* reported from the Marettimo Valley confirmed the occurrence of such poorly known species in recent marine sediments, in addition to the known *P. alboranensis, P. fenestratus* and the recently described *P. laevisculptus*. Moreover, by an accurate review of literature data and examination of types on related species, some controvertial attributions have been resolved, ascertaining the occurrence of additional species *P. ergasticus* and at least one undescribed species.

A problematic item moreover, concerns the different bathymetric range distinguishing the shallow water tropical species from the deep-water Mediterranean records. In this regard, the hypothesis that they belong to different genera, lacking living collected specimens cannot be yet confirmed.

Unfortunately, several clues suggest that the *Parviturbo* species known in the Mediterranean area might all be extinct, even if recognizable from outer shelf Pliocene in situ deposits or bathyal reworked clasts. This eventuality, for which the *Parviturbo* genus should not contribute to the Mediterranean marine biodiversity, would however highlight an interesting case study in the context of those past climatic changes that have led to the present Mediterranean ecosystem.

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