

Systematic position of “*Trochus*” *wiseri* CALCARA (Prosobranchia: Trochidae).

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With 27 figures.

Introduction.

Although the Mediterranean molluscan fauna is quite well studied, very poor anatomical studies are available. Therefore the systematic position of many species is uncertain because it is based only on the shell morphology. Very often modern authors quote acritically such poorly-known species referring to older investigators so that the misidentification is handed down from generation to generation.

A good example is “*Trochus*” *wiseri* CALCARA 1842, a little deep sea trochid till now ascribed to the genus *Calliostoma* SWAINSON 1840 – subgenus *Putzeysia* SULLIOTTI 1889 – in spite of the fact that the “*Trochus*” *wiseri* shell seems quite far from true *Calliostoma*.

In a recent revision of the Mediterranean species of *Calliostoma* (GUIDASTRI 1979) a different systematic position of “*Trochus*” *wiseri* is suggested. Now the finding of a living specimen of this species and a detailed study of its anatomy allow to state its systematic position.

Material and Methods.

The specimens (as many as 200) were collected by the n/o “Bannock” in many places of the Mediterranean Sea (Table 1) during oceanographic cruises by the Institute of Marine Geology, National Research Council, Bologna, Italy.

The shells were studied with stereomicroscope Zeiss IV at 50x for their gross morphology and scanning electron microscope (SEM) Scanscope Hitachi SSM-2A at 20 kV for fine details.

The radula was observed under optical microscope Leitz Dialux 20 and, after coating with gold-palladium, under SEM.

Station	Lat.	Long.	Depth (meters)	Collecting instrument
CST 68/14	39°15'.6 N	14°23'.3 E	704	grab
CST 68/18	39°13'.6 N	14°22'.6 E	731	grab
CST 68/20B	39°51'.4 N	12°36'.0 E	950-887	dredge
	39°51'.4 N	12°36'.4 E		
CST 68/26	40°20'.5 N	10°16'.0 E	637-483	dredge
	40°20'.8 N	10°16'.2 E		
CT 69/59	40°43'.5 N	10°13'.7 E	198-270	dredge
	40°43'.7 N	10°13'.8 E		
CS 72/21	36°27'.5 N	12°56'.9 E	379	grab
CS 73/7	36°53'.6 N	13°06'.3 E	695-410	dredge
	36°51'.8 N	13°06'.3 E		
CS 73/23	36°16'.4 N	13°42'.7 E	963-666	dredge
	36°17'.0 N	13°42'.7 E		
B 74/1	38°11'.6 N	0°26'.0 E	988-549	dredge
	38°09'.8 N	0°25'.2 E		
B 74/3	37°38'.9 N	0°01'.4 E	940-260	dredge
	37°38'.2 N	0°00'.1 E		
B 74/20	37°59'.4 N	0°30'.8 E	1700-1130	dredge
	38°01'.7 N	0°29'.4 E		
B 74/28	37°40'.3 N	0°19'.1 E	2165	dredge
	37°41'.2 N	0°18'.1 E		

Table 1. Oceanographic cruises of the n/o Bannock: stations where *P. wiseri* has been collected.

Diagnosis and synonymy

“*Trochus*” *wiseri* CALCARA 1842.

Synonyms:

Trochus wiseri CALCARA 1842 Il Maurolico, 13: 14.

Trochus gemmulatus PHILIPPI 1844: 226, T. 28 F. 5.

Trochus scabrosus JEFFREYS 1873: 112 (nomen nudum).

Calliostoma (Putzeysia) wiseri, — PILSBRY 1889: 413, T. 57 F. 43.

Margarites cancellata ionica NORDSIECK 1973: 4, F. 2.

Original description: “T. testa conoidea sub-imperforata; anfractibus 5 convexus, cancellatis, apertura rotundata, labro simplici. Conchiglia conica quasi imperforata, avente 5 giri di spira conversi, graticolati, apertura rotundata con il labbro semplice. Lunghezza 4 linee. Largh. 3. Fossile in Messina.”

Type specimens: unknown. The CALCARA's collection is in Palermo but the type specimens of *wiseri* have been lost.

Other taxa could refer to this species: *Trochus crispulus* PHILIPPI 1844 and *Trochus (Zizyphinus) profugus* GREGORIO 1889. The former, cited afterwards only by CARPENTER & JEFFREYS (1870), is clearly distinguishable from "*Trochus*" *wiseri* on the basis of the original drawing by PHILIPPI (1844: T. 25 F. 12). The original description of the latter taxon points out an ambiguous position between *crispulus* and *gemmulatus*. But, in our opinion, *Trochus profugus* is a juvenile specimen of *Danilia otaviana* (CANTRAINE) [= *Danilia tinei* (CALCARA)]. Another taxon which has been mistaken for *wiseri* is *Trochus clathratus* ARADAS 1847, type species of the genus *Putzeysia* SULLIOTTI 1889. We have observed the type specimens of *Putzeysia clathrata*, now kept at Museo Civico di Storia Naturale of Milan, and we have stated that *P. clathrata* is a different species from *wiseri*, chiefly because of its sculpture. On the other hand their general shape and protoconch are similar.

Shell morphology: Shell solid, globose, with up to 5.5 convex whorls which meet at deep sutures at a level slightly below the periphery of the upper whorl (sutural angle about 90°), each bearing spiral ridges and ribs (Fig. 1).

The protoconch is prominent and swollen, of 1.25 whorls, about 425 µm in total diameter and shows a number of delicate papillae, some of which set in two spiral rows near the suture (Fig. 2). Its aperture has a trumpet-like appearance as its edge slightly folds outwards. The tilted tip found in many trochid genera (FRETTER & GRAHAM 1977) is absent. It strongly differs from that of true *Calliostoma* which bears a reticulate pattern (RODRIGUEZ BABIO & THIRIOT-QUIEVREUX 1975, FRETTER & GRAHAM 1977).

The first whorl bears 15-18 prominent prosocline ribs (which make an angle of about 60° with the axis of the helicocone) and a number of delicate, irregular and discontinuous spiral lines downward (Fig. 3). In the second whorl the ribs become more numerous (19-22) whereas the delicate spiral lines reduce their number to 4-6 stronger ones. In the following whorls the spiral ridges reach the same size of the ribs. Ribs and spiral ridges intersect to produce a close lattice, the nodes marked by upstanding, rounded knobs.

On the body whorl between suture and periphery there are commonly 6-7 major spiral ridges, but sometimes this number is doubled because of the presence of a minor ridge in the furrows.

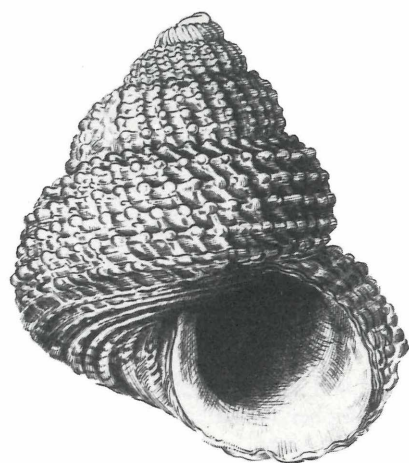
The base is convex and sculptured with concentric ridges and radial ribs. In the young specimens this sculpture is weaker with very fine concentric lines in the furrows (Fig. 4). More numerous, closed ribs are present on the base of mature specimens (Fig. 5).

A very narrow, slit-like and deep umbilicus is partly covered by the out-folding of the inner lip.

Many irregular and fine lines of growth are evident along the whole shell. Numerous minute tubercles, that seem to be arrayed in concentric rows, are scattered on the basal furrows (Fig. 6).

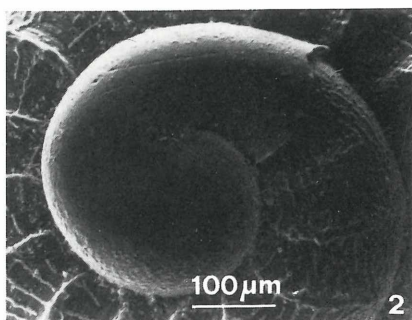
The aperture is prosocline, nearly quadrilateral. The inner lip turns slightly (more in the young shell) over the columella and makes a weak parietal shield (Fig. 5).

The colour is nacreous inside, chalky white outside, with a light reddish-brown periostracum.



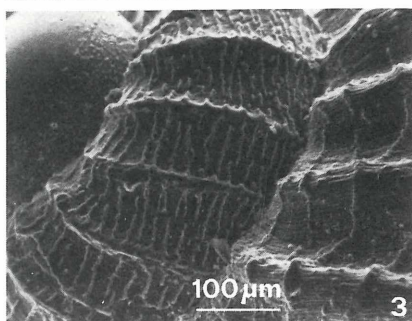
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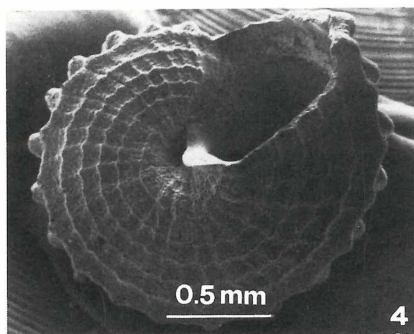
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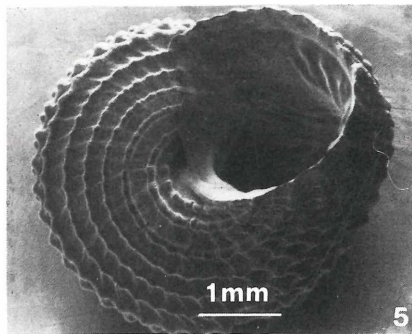
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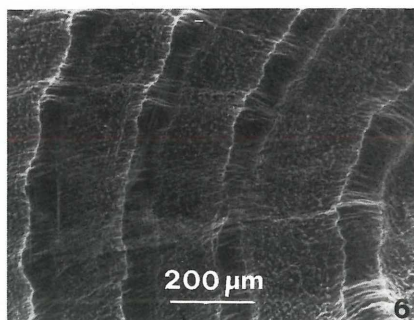
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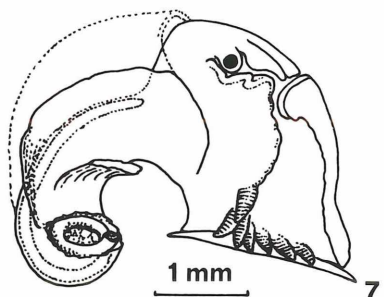
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5



200 μm

6



1mm

7

Fig. 1-7. *Putzeysia wiseri* (CALCARA). — 1) shell (GEA D'ESTE del.) 2) protoconch, 3) sculpture of the apical whorls, 4) basal view of young specimen, 5) basal view of mature specimen, 6) basal sculpture of mature specimen, 7) animal morphology.

Size up to 6.25 mm in height and 5.35 mm in breadth. Body whorl = 67-74% of total height. Height/breadth ratio = 1.09-1.20 in the adult, 1.00 in the young shell.

Animal morphology: This description and the following ones are based on the single preserved specimen we have been able to obtain from a shell 5.95 mm in height (Station CS 73/7). Since it was strongly contracted and hardened by the preservative (ethanol), during extraction the last portion of the visceral mass remained inside the apical whorls. The greatest part of the mantle, moreover, appeared destroyed (Fig. 7).

The long snout bears on both sides a long mid-externally enlarged tentacle with a stout eye stalk at its base, carrying a large eye. On each side the neck lobe is continuous with a well-developed epipodial ridge. It seems to be smooth-edged in the fore half, with many epipodial tentacles in its hinder half. There are seven epipodial tentacles on the right side, six on the left one.

The preserved specimen shows a light yellowish-white colour, the eyes are black.

The horny operculum shows the typical trochid pattern: it is circular with central nucleus, polygyrous and slightly concave. Light yellowish in colour, it measures 1.95 mm in diameter (Fig. 8).

Gut content: The gut contains much detrital material, sponge spicules, foraminifera shells, diatom cases and other unidentifiable matter. "*Trochus*" *wiseri* appears to be a detrital scraper like most trochids.

Jaw morphology: The jaws are very thin and delicate, roughly rectangular in profile, composed of hexagonal elongate scales which anteriorly extend as a fringe (Fig. 9). The two small central plates typical of the genus *Calliostoma* (CLENCH & TURNER 1960) are completely absent.

Radula morphology: Only one radula has been studied (Fig. 10). It is about 1.7 mm long with about 90 transverse rows of teeth. Its formula is: (30 + 8)-4-1-4-(8 + 30).

The central tooth shows a roughly rectangular basal plate. A posterior transverse ridge in opposition to the cusp of the following central tooth is evident. Moreover the basal plate exhibits symmetric lateral edges to allow within-row interlock with the inner edge of the two first lateral teeth (Fig. 11). The triangular cusp ends with a strong, long and sharpened denticle flanked by 3-4 little denticles on both sides.

The four strongly cusped, progressively wider, lateral teeth have complex basal plates which interlock among themselves and with the central one. Their prominent foliate cusps are wholly serrated along their edges; the first lateral tooth cusp is furrowed by a marked hollow (Fig. 12).

Lateromarginal plates (sensu HICKMAN 1977) are lacking. The marginal teeth are much more delicate structures and can be divided into two groups: the first group is made up of the first inner 8 teeth characterized by large, lanceolate cusps with finely serrated edges which give them a feather-like appearance (Fig. 13); the second group holds the remaining 30 progressively increasing marginal teeth, the last marginal tooth being the biggest (Fig. 14). They show a clear restriction of serration to a short distance on the outer edge near the apex (Fig. 15).

Remarkable differences between *wiseri* and *Calliostoma* genus radula can be observed. CLENCH & TURNER (1960: pag. 5), when describing the various types of radulae found in the Western Atlantic *Calliostoma*, say: "... the central tooth is fairly broad, though weak, with a single large cusp which is finely serrated. The lateral teeth

are quite similar to the central tooth and this produces a broad 'low' central portion extending the length of the ribbon. The first marginal tooth, however, is large, strong and heavy. The second marginal (in all Western Atlantic forms studied) is somewhat similar to the first though less powerful and never with as heavy a basal area. Beginning with the third marginal tooth, the remainder are very long, with numerous large serrations. The marginal teeth gradually diminish in size and often the outermost marginals are nearly or quite smooth."

Therefore *wiseri* is quite far from *Calliostoma* genus for both the strong central and lateral teeth and the absence of the "dominant" marginal tooth.

Ecology

No direct evidence of ecological behaviour of the species is given. From the existing literature and from the observations on dredged material collected by the n/o Bannock, which is preserved in the Institute of Marine Geology of C.N.R. in Bologna, "*Trochus*" *wiseri* can be assumed as a bathyal species. Its distribution range in Atlantic and Mediterranean sea extends from 200 to 3000 meters in depth approximately, more frequently between 500 and 2000 meters (JEFFREYS 1870, 1880, 1883, LOCARD 1898, AMICO 1912, GERONIMO & PANETTA 1973, GERONIMO & LI GIOI 1980). But the same species has been reported (SEGUENZA 1876) in less deep water (150-200 meters, coralligenous from Stretto di Messina).

More difficult is the determination of the outline of the biocoenosis of bathyal zone which "*Trochus*" *wiseri* seems to inhabit. Old literature does not provide exhaustive data on collected material which was very likely made up of dead specimens only. Moreover in the abundant material collected by the n/o Bannock the specimens of *wiseri* are for the most part without animal.

The only living specimen, together with more than 150 dead ones, comes from station CS 73/7, Canale di Sicilia (see Table 1). In the same station the presence of fauna which can be attributed to last glacial period has been ascertained in many occasions (TAVIANI & COLANTONI 1979, MELONE & TAVIANI 1980, TAVIANI & SABELLI 1982). Less rare, even if much less abundant than the subfossil shells, specimens show all or at least a part of their periostracum. From the study of the dredged samples, it can be observed that *wiseri* occurrence is maximum where white corals (deep-sea Scleractinia such as *Lophelia*, *Madrepora*, *Desmophyllum*, *Caryophyllia*, etc.) are abundant. This fact could denote a sort of association between the species and the biocoenosis of white corals (CB of PERES & PICARD 1964). On the other hand it can be pointed out that this biocoenosis is less and less abundant in Mediterranean.

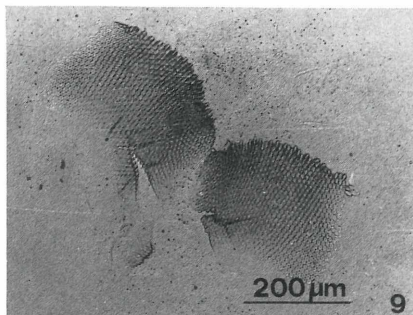
In this connection also GERONIMO's record (1979) of Pleistocene of Valle Palione relates to bottoms where deep-sea Scleractinia are common. Nevertheless in the author's opinion the species is associated with the biocoenosis of bathyal muds (VB of PERES & PICARD 1964) and the same opinion has been expressed by other authors (LE DANOIS 1948, GERONIMO & PANETTA 1973, GERONIMO & LI GIOI 1980).

Since sufficient data are, at present, lacking, it is impossible to state which biocoenosis the species lives in association with; as a matter of fact it cannot be excluded that it may take part in both biocoenoses. On the other hand the occurrence of the species in coralligenous with red coral, as it has been suggested by SEGUENZA (1876), seems unlikely: this datum has never been confirmed.



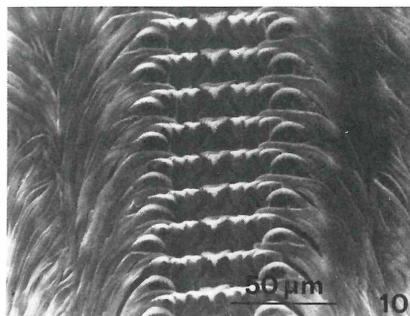
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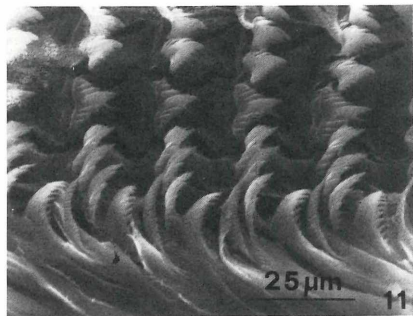
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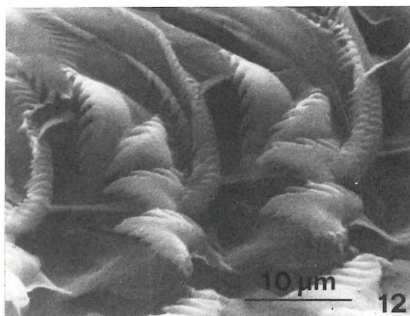
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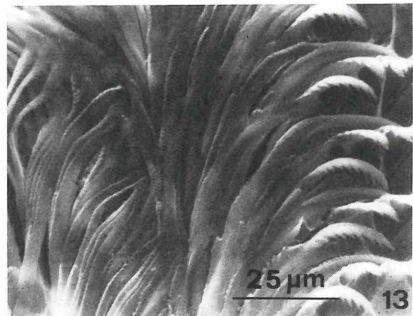
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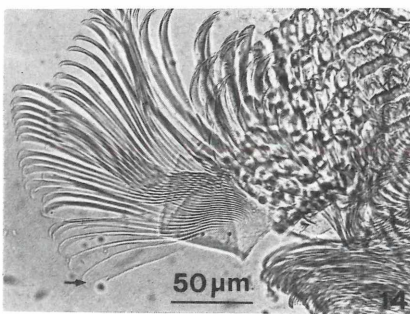
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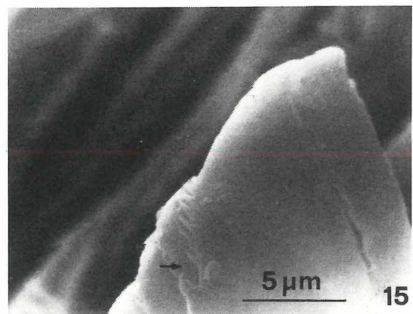
25 μm

13



50 μm

14



5 μm

15

Fig. 8-15. *Putzeysia wiseri* (CALCARA). — 8) operculum, 9) jaws, 10) radula: general view, 11) radula: lateral view, 12) the four lateral teeth, 13) the inner marginal teeth, 14) radula: general view, the last marginal tooth (arrow), 15) the last marginal tooth: its serration (arrow).

"*Trochus*" *wiseri* was previously described by CALCARA on the basis of fossil material from calcareous tufa of Messina (Sicily, Italy). Afterwards the same species was recorded in some places of Sicily by PHILIPPI (1844, sub nomine *T. gemmulatus*) and by ARADAS (1847, sub nomine *T. gemmulatus*, from Gravitelli near Messina). Recently GRECO & LIMA (1974) have quoted all ancient records of the species from Sicily.

According to JEFFREYS (1883: 105) "*Trochus*" *wiseri* belongs to Italian Pliocene. GLIBERT (1962: 36) reports that the species is present in the collection of Archæogastropoda of foreign Cenozoic in Natural History Museum of Bruxelles. More recently, GERONIMO (1979, sub nomine *Calliostoma* cfr. *wiseri*) found it in Pleistocene of Valle Palione, Catania, but it seems to be the only record of recent date. Therefore "*Trochus*" *wiseri*, as a fossil, seems to be restricted within Plio-pleistocenic beds of Sicily. But, while the pleistocenic records of the species are doubtless, the pliocenic records are not quite sure. In fact the same beds that in the last century were commonly considered Neogene, are now assumed as more recent through modern stratigraphy. Moreover it can be noted that the species is absent in recently published lists of Neogene fauna. Therefore "*Trochus*" *wiseri* can be very likely present in Mediterranean Sea only from Pleistocene onwards. It could have been thriving till last Glacial Period (Würm), declining therefore in post-glacial as well as the deep fauna of Mediterranean. At present, since living specimens are infrequently recorded, the species seems to be very rarefied.

Systematic position.

"*Trochus*" *wiseri*, for both its general morphology and its radular structure, belongs to the family Trochidae. Protoconch and teleoconch morphology leads us to place *wiseri* in the subfamily Margaritinae. Among Margaritinae, indeed, genera displaying characters close to *wiseri* can be found: for example, *Danilia* (Fig. 16) and *Mirachelus* (Fig. 22). Both genera exhibit neither umbilicus nor protoconch tilted tip. The arrangement and the shape of the teeth of *Danilia* and *Mirachelus* radulae are very close to those of *wiseri* radula.

Danilia otaviana (CANTRAINE) (type species of the genus *Danilia*) (Fig. 16) exhibits the protoconch and the first whorl sculpture similar to *wiseri* (Figs. 17, 18). Moreover same radular formula (40-4-1-4-40) and close teeth morphology can be observed in the two species (Figs. 19, 20, 21). The marginal teeth can be divided into two series: inner series of 10 and outer series of 30 teeth, both as shaped as corresponding *wiseri* teeth.

Mirachelus includes three species: *M. corbis* (DALL) (type species of the genus), *M. galapagensis* MC LEAN and *M. clinocnemus* QUINN. No datum about the radula of *M. corbis* is available. The radula of *M. galapagensis* has three lateral teeth (MC LEAN 1969) and the radula of *M. clinocnemus* (QUINN 1979) has four lateral teeth. Both central and lateral teeth are shaped as *wiseri* and *Danilia* ones. Marginal teeth have been described only in *M. clinocnemus*. They are 15 in two series: inner series of 5 and outer series of 10 teeth shaped as *wiseri* and *Danilia* ones.

Therefore great affinity among *wiseri*, *Danilia* and *Mirachelus* can be observed. But, *Danilia* and *Mirachelus* shells exhibit columella tooth that is lacking in *wiseri*. Columella of *wiseri* is straight and toothless: the same character is common to

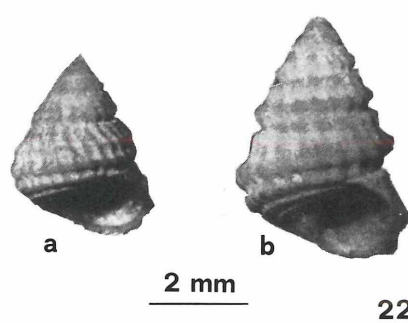
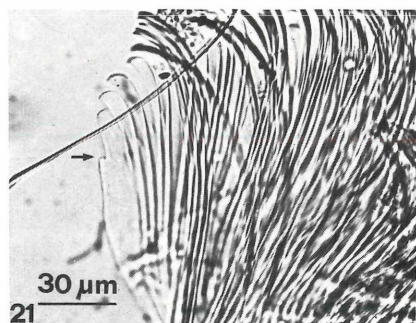
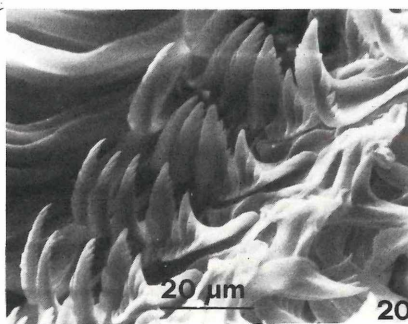
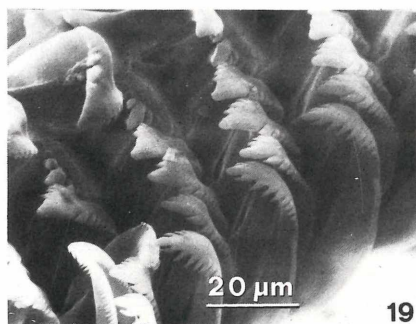
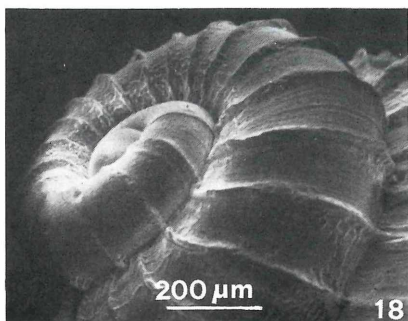
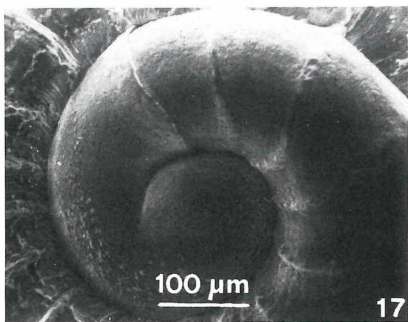
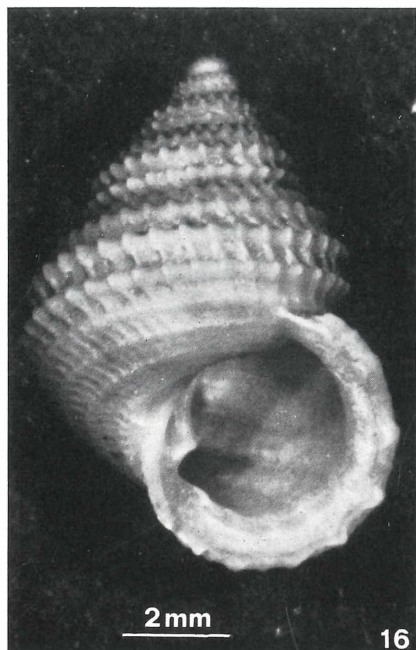


Fig. 16-21. *Danilia otaviana* (CANTRAINE). — 16) shell, 17) protoconch, 18) sculpture of the apical whorls, 19-20) radula: central and lateral teeth, 21) radula: marginal teeth, the last marginal tooth (arrow). — 22) *Mirachelus* shells (after McLEAN 1969), a) *M. galapagensis* McLEAN, b) *M. corbis* (DALL).

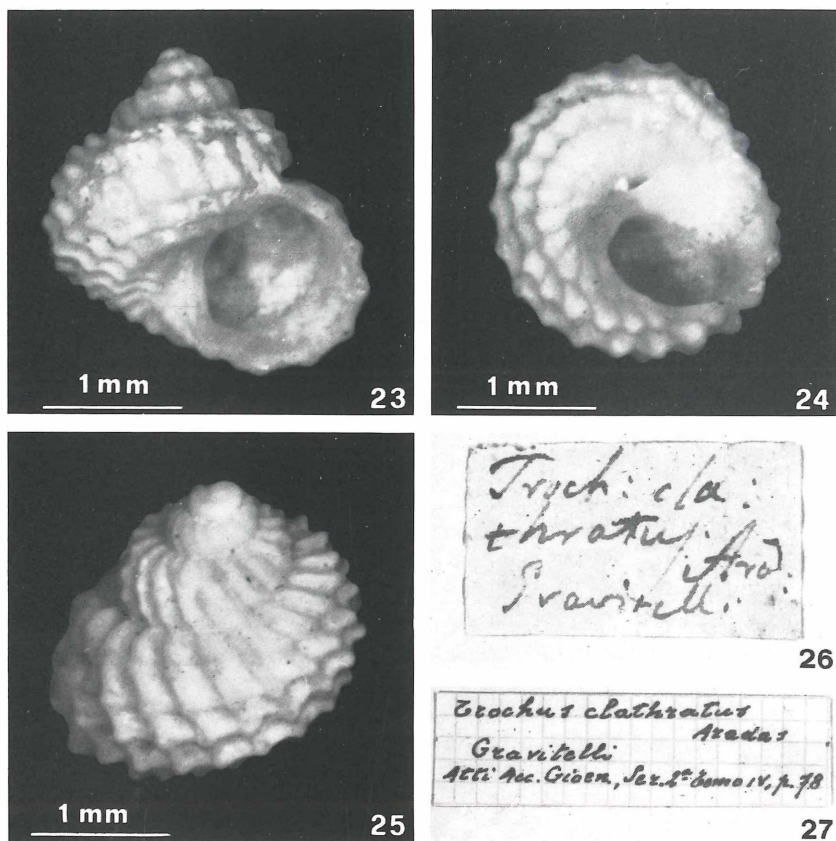


Fig. 23-27. *Putzeysia clathrata* (ARADAS). — 23-25) syntype, 26) ARADAS' autographic label, 27) PRIOLO's autographic label.

Putzeysia clathrata (ARADAS), little fossil species (Figs. 23, 24, 25) whose systematic collocation is not clear.

We have been able to examine 4 specimens of *P. clathrata* of ARADAS' collection, part of PRIOLO's collection, now kept at Museo Civico di Storia Naturale of Milan. The four specimens were identified by both ARADAS' (Fig. 26) and PRIOLO's (Fig. 27) autographic labels.

The comparison between *wiseri* and *clathrata* shells points out that: 1) the protoconchs are similar in shape; 2) the shells are lattice sculptured; 3) the umbilicus is lacking in both species; 4) the columellae are straight and toothless.

The likeness between *wiseri* and *clathrata* leads us to consider them as both belonging to the same genus, *Putzeysia*. As *wiseri* can be ascribed to the subfamily Margaritinae, *P. clathrata*, too, can be ascribed to the same subfamily. Therefore "*Trochus*" *wiseri* will be named *Putzeysia wiseri*, according to the following systema-

tic: Family Trochidae RAFINESQUE 1815: Subfamily Margaritinae STOLICZKA 1868: Genus *Putzeysia* SULLIOTTI 1889 [Type species *Putzeysia clathrata* (ARADAS 1847)].

The same relationship was recognized by PILSBRY (1889: 413), who regarded *wiseri* and *clathrata* as so close as to be ascribed to the same genus, *Calliostoma*, and to the same subgenus *Putzeysia*. He wrote that: "I do not know the systematic position of this group. SULLIOTTI says that *Tr. gemmulatus* (= *wiseri*) does not belong to the same subgenus as *Tr. clathratus*, but I am inclined to believe that it does."

In conclusion, we agree with PILSBRY's statement on *Putzeysia*, but not on *Calliostoma*.

Summary: For many years "*Trochus*" *wiseri* CALCARA 1842 was erroneously placed in the genus *Calliostoma*. A living specimen together with about 200 dead specimens of the species has been collected during n/o Bannock's oceanographic cruises. It has been possible to obtain informations about its external anatomy, radula and operculum. In this paper *wiseri* has been regarded for its shell morphology, anatomy, radula, ecology and palaeontology. On the basis of such data, we suggest that *wiseri* has to be put in the genus *Putzeysia* SULLIOTTI 1889 and in the subfamily Margaritinae.

Riassunto: "*Trochus*" *wiseri* CALCARA 1842 è da tempo attribuito al genere *Calliostoma*. La cattura di un esemplare vivente e di circa 200 esemplari morti, effettuata durante le crociere oceanografiche della n/o Bannock, ha permesso di ottenere dati sulla anatomia esterna, sulla radula e sull'opercolo. In questo lavoro si esamina *wiseri* sotto l'aspetto conchiliare, anatomico, radulare, ecologico e paleontologico. In base ai dati raccolti si propone di collocare questa specie nel genere *Putzeysia* SULLIOTTI e nella sottofamiglia Margaritinae.

Acknowledgments: We wish to thank Prof. G. PINNA for giving us the opportunity of studying the type specimens of *Putzeysia clathrata*.

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