A HISTORICAL REVIEW OF THE MOLLUSKS OF LINNAEUS

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COLLATERAL NOTES

1. I HAVE FREQUENTLY REFERRED, in previous papers of the present series, to Gmelin's treatment of the Linnaean species as well as of certain of Gmelin's own names. While the monumental nature of his catalogue of species and its universal acceptance not only as a work of reference but as a source book of new species are admitted, it is necessary to add a word of caution to those who may exaggerate its value.

Other than the fact that Gmelin relisted and often redescribed the species of the "Systema naturae" and the fact that he treated the genera in the Linnaean order and erected no new genera, there is scarcely any justification for treating his work as the "thirteenth" edition of the "Systema," a title that he himself first adopted by printing it on his title pages. The great number of species added by him, as well as the voluminous changes he made in the Linnaean diagnoses, make it a new work rather than a mere new edition. Indeed, I have found but five names under which he referred to the "Systema naturae," and these five references are all to the tenth edition,[1] as they represent cases in which Linnaeus changed the generic position of the species in the twelfth edition. For all other listings of a Linnaean species he referred to the "Museum Ulricae" or the "Fauna Suecica," if it was there described. For species not described in either of those works he made no reference at all to Linnaeus or any of his works. So great was the apparent disassociation of his catalogue from anything Linnaean that Lamarck followed his lead and never referred to any of the Linnaean works, but used instead only references to "Lin. Gmel." In other words, Lamarck appears to have considered Gmelin as the major and definitive source. In so far as we may infer from his text, he might not have even owned a copy of either the tenth or twelfth edition of the "Systema."[2]

Gmelin's task was an ambitious one, but we should study it with care before deciding upon its true value. Many conchologists have been too prone to overestimate it. The cases in which he improved the Linnaean descriptions, except in the matter of grammar and the arrangement of clauses, are few indeed. In most cases of his attempted revision of a species he only confused the identification by a grossly inharmonious synonymy which pictured, as "varieties," a greater number of distinct species than were represented even in Linnaeus' own synonymy of the species in question. If these varieties had been merely color or ecological forms or geographical races, he could merely be criticized for separating forms having no taxonomic value. However, a study of his varieties usually discloses several species, some of them generically remote from one another. For *Murex saxatilis*, for instance, he listed three varieties, each with its own synonymy, and the total of 30 figures cited show three related but distinct species. In another case, *Murex babylonius*, his five varieties cite figures which seem to show, respectively: a questionable figure from one of Chemnitz' vignettes, *Pleurotoma virgo* Lamarck, *Clavatula javana* (Linné), *Fusus colus* (Linné), and another unidentifiable *Pleurotoma*. An extreme case is his treatment of *Strombus gallus* Linné, for which he listed nine varieties in addition to the typical species, of which only variety "α" can be referred to *gallus*. Not only are his lettered varieties not always conspecific with his main species, but we often find more than one species in the synonymy of a single variety.

A further fault is that, in several instances, he used two or even three names for what is demonstrably the same species, and in one

[1] The five species are: *Voluta scabricula*, *Voluta cancellata*, *Strombus spinosus*, *Murex neritoideus* (Gmelin's no. 43), and *Turbo nautileus*. Many other changes of genera between the tenth and twelfth editions took place, and are listed by the writer in a previous paper of this series (Dodge, 1952, p. 260), but the other instances were not specifically recognized by Gmelin, who merely referred the species to the "Museum Ulricae."

[2] It is of course probable that Lamarck did possess the tenth or twelfth edition or both, and that his habitual reference to "Lin. Gmel." was merely a use of what has become a common practice of citing only the latest edition of a textbook. As said above, however, I deplore the acceptance of Gmelin's work as an edition of the "Systema."

case he placed the names in different genera. Thus his *Buccinum cingulatum* Linné (p. 3506) and *B. scala* (p. 3485) represent slight sculptural differences in a single species which is now called *Thais cingulata.* His *Strombus ater* Linné and *S. lineatus* (p. 3521) and *S. dealbatus* (p. 3523) are undoubtedly all identical, and some writers have joined *Buccinum acicula* (p. 3503) to this group of names as another synonym.[1] In contrast to this type of error, he used identical names for two distinct species. Witness *Murex neritoideus* Linné (p. 3537), which is *Drupa morum* Röding, and *M. neritoideus* (p. 3559), which is *Coralliophila neritoidea* (Lamarck).

Thus, in assessing Gmelin's treatment of many of the Linnaean names, we find, instead of a clarification or restriction of a species, a further confusion which makes it clear that Gmelin was even less certain than was Linnaeus, or had attributed to the latter a more comprehensive conception of the species than was intended. For a very large proportion of his Linnaean species Gmelin was a mere copysit, both of description and synonymy, which puts us no further on the road to identification.

I am persuaded that the interposition of Gmelin's work between the works of the two greater naturalists Linnaeus and Lamarck retarded the identification of many of the Linnaean species for almost half a century, and I think it is fair to say that a considerable portion of Lamarck's own errors, both as to the Linnaean names and those of Gmelin, were caused by the confusion in the latter's synonymies and his preoccupation with what seems to have been his concept of the word "species," a concept that was demonstrably too broad.

On the credit side of the ledger Gmelin was the author of many new species, most of which were adequately described, although their synonymies were often defective. Moreover he was a somewhat better Latinist than Linnaeus, as is shown by his frequent corrections of Linnaeus' grammatical and language errors and the improvement of his sentence structure. I submit, however, that these virtues should not blind us to the manifest weaknesses in his work and to the stumbling blocks which he placed in the path of identification.

There has been little comment in the literature on the usefulness of the "thirteenth edition." The only critical evaluation that I have found is mildly apologetic. Swainson (1840, pp. 200–201) remarked: "In examining this work we cannot help being struck by the immense labour and unwearied research that must have produced it, and regretting the judgment of the worthy editor. . . yet, as being the latest work professing to describe all the known species, it is, in some measure, of use." Swainson (*loc. cit.*) also quoted from Cuvier a much harsher opinion: "Cuvier very justly says it is 'tout indigeste et dénué de critique et de connaissance des choses.'"[2] I have not been able to locate this quotation in Cuvier's works.

2. I have several times indicated in previous papers of the present series that the record of the species actually owned by Linnaeus, frequently referred to by Hanley as "the lists," was evidenced by check marks placed opposite the specific names in Linnaeus' working copies of the tenth and twelfth editions of the "Systema." These statements were based on erroneous information. I have not had an opportunity of examining the marked copies, but I am now advised by the General Secretary of the Linnean Society of London, the custodian of Linnaeus' library, that the "owned" species are indicated by the *underlining* of the *serial numbers* of the species in the working copies.

[1] I agree with those who consider *B. acicula* Gmelin to be a synonym of *S. ater.* The most recent adherents to this view are Adam and Leloup (1938, p. 88).

[2] Cuvier's French is here extremely idiomatic, but the quotation may be freely rendered as: "confused and lacking in critical comment and in familiarity with the subject."

CLASS GASTROPODA

TROCHUS LINNÉ

Fourteen of the 23 identified species in *Trochus* of the "Systema naturae" belong in the superfamily Trochacea as at present constituted. Of these, 13 belong in the family Trochidae and one, *T. tuber*, in family Turbinidae. The remaining 10 species are now not only scattered among several other families, but belong in the widely separated superfamilies Cerithiacea, Littorinacea, Strombacea, and Aglossa. Under present arrangement *Trochus* Linné contains representatives of 15 different genera and thus approaches in its diversification the heterogeneous Linnaean genera *Venus*, *Bulla*, and *Buccinum*.

The Trochidae, as now restricted, are, for the most part, found in the littoral zone, although some of the species inhabit deeper water. While close to the Turbinidae both biologically and in shell characters, the trochids may be distinguished principally by their corneous operculum, the operculum of the turbinids being calcareous. Both families are widely distributed in both tropical and temperate waters.

Linnaeus' treatment of his *Trochus* species is distinguished by the generally excellent descriptions and by the comparatively correct synonymies, with the striking exception of the extremely discordant references supplied for *Trochus niloticus* and *maculatus*, which are discussed in detail below. Identification of some of the species is, however, handicapped by the fact that three are given no locality and eight are supplied with no references whatever. The absence of figures of these eight species in the iconographies generally consulted by Linnaeus is all the more strange, as all of them are, and are stated by Linnaeus to be, from the Mediterranean Sea, Norway, or European waters generally, which we must assume were more familiar to the pre-Linnaean writers than the Indo-Pacific and other distant regions. The exotic species, on the other hand, are for the most part referred to existing drawings of his predecessors' works, where they had been copiously illustrated.

Linnaeus divided his genus into three accurately characterized groups under the headings: (1) "Umbilicati erecti, perforata columella"; (2) "Imperforati erecti, umbilico clauso"; and (3) "Turriti umbilico exserto, qui positi cadunt in latus." The third group, the turreted shells, contains the species *telescopium*, *perversus*, and *punctatus*, all in the superfamily Cerithiacea; *dolobratus*, in the superfamily Aglossa; and the unidentified species *striatellus*. The identified species of this group are phylogenetically remote from the great majority of species in the first two groups, which, with few exceptions, consist of trochids and one turrid.[1]

Polydonta Schumacher, 1817, not of Fischer von Waldheim, 1807, and *Lamprostoma* Swainson, 1840, are synonyms of *Trochus, sensu stricto*, of which the type species is *T. maculatus*, by subsequent designation, Thiele, 1924.

Trochus, sensu stricto, is confined to the Indo-Pacific region, although several of the genera carved out of *Trochus* Linné are represented in European waters and on both coasts of the Americas.

Trochus niloticus

1767, Systema naturae, ed. 12, p. 1227, no. 579.
LOCALITY: "In O. Indico" (1767).

"T. testa conica laeviuscula subumbilicata . . . Testa magna ponderosa, picta striis oblique perpendicularibus rubris, etiam subtus; apex obsolete nodulosus. Anfractus minime nodosi. Apertura argentea labro interiore obsolete bilobo. Detracta extima tunica evadit tota argentea. Differt a T. maculato: Fauce intus minime striata est, sed laeve. Columella non denticulata. Basi ventris convexa laevi, nec decussatim striata est et planiuscula."

This long and graphic description was designed not only to describe Linnaeus' newly listed *niloticus* but to cure the extremely misleading diagnosis of *Trochus maculatus* in the tenth edition, where the synonymy of the latter species consisted almost entirely of figures of *niloticus* (see below, p. 162). *Trochus niloticus* did not appear, at least under that name, in the tenth edition. Certain important

[1] Certain of the above allocations of species of *Trochus* Linné in the superfamilies mentioned are in accordance with the classification of Thiele. There may be divergence of opinion as to some of them.

diagnostic features that distinguish *niloticus* from *maculatus* are clearly stated in the above description of the former.

The synonymy of *niloticus* is accurate with two exceptions. The figure from Olearius (pl. 29, fig. 5) is, as Hanley (1855, p. 312) said, "too rude for certain identification, yet exhibits the general aspect of the species."[1] The Argenville figure (1742, pl. 11, fig. C) might be taken either for a young *niloticus* or for *maculatus*, probably the latter. However, Argenville said in his text (p. 262) that it was streaked with *brown* and red, a color pattern not seen in *maculatus*. Linnaeus' confusion between the two species is made evident by the fact that he cited this figure not only for *niloticus* but for *maculatus* in both the tenth and twelfth editions. The remaining figures (Buonanni, pl. 102; Rumphius, pl. 21, fig. A; Gualtieri, pl. 59, figs. B, C[2]; and Regenfuss, pl. 4, fig. 42) are all acceptable drawings of *niloticus*, although some of them fail to show all the important features of the shell. Linnaeus, by a manuscript note in his copy of the twelfth edition, added a further poor figure from Lister (pl. 617), changed "labro interiore obsolete bilobo" to "labro interiore subbilobo," and also added the phrase "figura lateribus convexa," which is at least misleading, as the sides of the shell are somewhat concave just above the pronounced dilation of the lower portion of the body whorl.

Chemnitz, in his fifth volume, supplied several adequate figures of the present species, but under two different polynomials. "Trochus pyramidalis maximus ex rubro et albida maculata" (1780–1795, p. 76, pl. 167, fig. 1605, and pl. 168, fig. 1614) is figured in dorsal and basal views which are fully characteristic of the adult *niloticus* of authors and the Linnaean specific name and description are cited in the synonymy. A further name, "Trochus pyramidalis perforatus in omnibus spirarum juncturis crenato nodosus, imbricato-tuberculatus" (*tom. cit.*, p. 80, pl. 167, figs. 1608–1609), is supplied, with figures showing basal and dorsal views of a shell with imbricated nodes at the suture which appear to represent a young specimen of *niloticus*, and this identification conforms to Chemnitz' description. *Trochus niloticus* Linnaeus is cited in its synonymy. The nodes, which are always present in young individuals, are obsolescent or lacking in the adult shell.

The clear distinction between *niloticus* and *maculatus* supplied by Linnaeus in the twelfth-edition description of the former is reflected in all descriptions following Chemnitz.

Lamarck (1822, vol. 7, p. 17) added further good figures of the present species and improved the Linnaean description by saying, in his French description, that the species "shows, on its last whorl, a considerable obtusely angulated dilation." Deshayes (1843, p. 132) referred to Linnaeus' misconception of *niloticus* and *maculatus:* "In the tenth edition of the *Systema naturae*, as well as in the *Museum Ulricae*, Linnaeus confused this species with the *Trochus maculatus;* but he recognized that it should be distinguished and supplied a very correct synonymy in the 12th edition of the *Systema.*"

In the "Museum Ulricae," published in 1764, three years prior to the twelfth edition of the "Systema," *T. niloticus* was not described, as Linnaeus had evidently not yet perceived that his synonymy for *maculatus* consisted of references to both species. The identity of the *maculatus* of the "Museum" is discussed below under that name.

The present species has always been retained in the genus *Trochus* Linné. Montfort (1810, p. 178) selected it as the type species of the genus, but this designation was ineffective, as *niloticus* was not included in Linnaeus' original list. Most writers continued to treat it as the type, however, until Thiele (1924, p. 69) effectively designated *T. maculatus* Linné.[3] The only specific synonym of *niloticus* is *Trochus flammeus* Röding, 1798.

The species *niloticus* is said by Moorhouse (1932, p. 1) to be a primitive form, but no reasons were given for this statement. It is a shallow reef or littoral water dweller, although the "Challenger" expedition reported having taken it at a depth of 12 fathoms. Its

[1] The Olearius figure was cited as "plate 9" in the tenth-edition diagnosis of *maculatus*, an error for "plate 29." Plate 9 contains only figures of the horns of mammals. Figure 5 on plate 29 is crude but could be taken for a polished specimen of *niloticus*.

[2] Gualtieri's pair of figures lettered "B" (dorsal and basal aspects) show no color pattern and were apparently drawn from a polished specimen.

[3] See Cox (1927, p. 83).

range is from the tropical western Pacific to West Australia on the Indian Ocean.

An authentically marked type specimen of the adult shell is found in the Linnaean collection in London.

It is well figured in the "Tableau encyclopédique" (pl. 444, figs. 1a, b), by Fischer (1880, pl. 10), by Reeve (1843–1878, vol. 13, pl. 1 figs. 3a, b, and 4), and by Pilsbry (1889, pl. 1, figs. 5, 8, and 9). Each of the above pairs of figures shows the dorsal and basal aspects of the shell.

The only taxonomic problem raised by *niloticus* is the status of the name *T. maximus* Koch, 1844 (*in* Philippi, 1845–1851, vol. 1, p. 138, pl. 4, *Trochus*, fig. 3). This shell was described in great detail by Pilsbry (1889, p. 18) who considered it a mere form of *niloticus*, and this opinion has been followed by most writers who have mentioned it. The adult examples of this form, labeled *maximus*, that were seen by the present writer[1] show two characteristics very markedly developed: (1) their completely flat base with no hint of the convexity seen in the base of the typical adult *niloticus*, and (2) their strictly conical shape, with an almost total suppression of the dilation of the lower part of the body whorl, features highly developed in the typical adult shell. These differences seem at first glance to justify giving *maximus* at least a subspecific status. They represent, however, an extreme form, and other specimens seen provide a few intermediate forms, which suggests that *maximus* should be dropped from the nomenclature except as a possibly ecological form. The extreme form also departs from the typical, by its greater tuberculation of the whorls, even in the adult shell, this feature taking the form of semitubular imbrications, the more marked concentric grooves of the base, and the greater obliquity of the columella. Intermediate forms showing gradations of these latter forms were also seen. In the case of immature shells it is difficult if not impossible to distinguish *maximus* from the typical shell, as the young of *niloticus* shows several of the above differentiating features of *maximus*. In this connection, Moorhouse (1932, p. 153) says that the dilation of the base of the body whorl in the typical shell is not evident in shells less than 8 cm. in diameter, but in a long series of *niloticus* of all life stages I have not seen any individual in which the dilation was not apparent at a somewhat earlier stage. Pilsbry (1889, p. 18) called *maximus* "an arrested or primitive form" of *niloticus* and mentioned its larger size. The specimens seen by the present writer, however, were somewhat smaller than the largest adult typical shells. This form must not be confused, because of its name, with the "Trochus pyramidalis maximus ex rubro et albida maculata" of Chemnitz (his fig. 1605), above mentioned, which, from the figure and references, was clearly the typical form. Pilsbry's figure (pl. 1, fig. 9) was called by him "form maximus," and he suggested that Reeve's figure 3 was based on a specimen of *maximus*. I agree.

Adam and Leloup (1938, p. 23) doubtfully treat *maximus* as a good species and list the following as synonyms: *Trochus niloticus* Reeve, *non* Linné (*tom. cit.*, pl. 1, fig. 3), *Trochus marmoratus* Lamarck, 1822, as figured by Fischer (1880, pl. 11), and var. *maximus* Pilsbry (*loc. cit.*).

Adam and Leloup also refer to the difficulty of identifying the immature shells of either the typical form or *maximus*, saying: "Young individuals of *Trochus niloticus* resemble so closely the young of *Trochus maximus* that it is almost impossible to distinguish them. Based on the specimens we have been able to examine, it seems that the sculpture is more defined in *Trochus maximus;* the concentric cords of the base are very distinct and much stronger than the transverse lines, while in *Trochus niloticus* the cross lines are generally stronger, and the concentric cords very weak. . . . Our material does not permit us to solve this question and we prefer still to maintain the separability of the two species." I sympathize with the concern of these authors, and on the available evidence I prefer to unite the two forms, although I concur in their description of the slight differences between them, even in the young shells.

[1] A.M.N.H. Nos. 18788 and 18790, from Bougainville Island.

Trochus maculatus

1758, Systema naturae, ed. 10, p. 756, no. 502.
1767, Systema naturae, ed. 12, p. 1227, no. 580.

LOCALITY: "In O. Americano, Asiatico" (1758, 1767).

"T. testa contorto umbilicata conica tuberculata: carina dentata . . . Testa detracta extima tunica, tota argentea" (1758).

"T. testa conica tuberculata, umbilico obliquo, labio interiore obsolete bilobo" (1767).

As seen above, the description was entirely rewritten in 1767, as Linnaeus had apparently discovered that his diagnosis of 1758 covered a composite species, embracing both *maculatus* and another quite distinct species, which he now described for the first time under the name of *niloticus* (see p. 159, above). The new description was not entirely satisfactory, however, as it omitted the significant words "carina dentata," which he used in 1758 to describe the irregular teeth around the curved base of the columella which are not present in *niloticus*, but which are one of the most important diagnostic characters of *maculatus*.

The *maculatus* of the tenth edition not only contained a majority of figures of *niloticus*, but the description also covered both species, as the word "contorto" cannot be applied to *maculatus* and must have been meant to describe the decided bulging of the base of the body whorl of *niloticus*, although, even in this case, "contorto" is much too emphatic a word. The word "tuberculata" applies more accurately to *maculatus*, although the upper whorls of the immature *niloticus* are finely tuberculate or granulose, a feature that persists to a much less marked degree in some individuals of the adult shell. *Trochus maculatus* is normally provided with close-set series of small, rounded tubercles in all life stages.

In the twelfth edition the rewritten description of *maculatus* is not materially improved. In the last analysis the only clear expression of the differing characters of *maculatus* and *niloticus* is found in the subdescription of the latter species.

The synonymy of *maculatus* in the tenth edition may be analyzed only tentatively, owing to the equivocal character of many of the figures:

The figures from Aldrovandi (book 3, p. 363, 2 figs.) obviously show a trochid but are not sufficiently detailed to be identified specifically.

Olearius' drawing (cited as pl. 9, fig. 5, error for pl. 29, fig. 5) is crude but could be taken for a figure of *niloticus*.

The Lister figure ("4, s. 6, c. 1, t. 2, f. 1"), restated as plate 617, figure 3, in the 1770 Huddesford and later editions, is too crude to be helpful and was not cited in the twelfth edition for either *maculatus* or *niloticus*.

The Buonanni figure (pl. 102) was said by Hanley (1855, p. 313) to be too crude for identification, but "presents, however, the general features of the group in which *maculatus* is included." I concur and assume that Hanley meant to include *niloticus* in his "group."

The Rumphius figures (pl. 21, figs. A, B, 4, and 3) also probably show both species. Figures A and B seem to be meant for a young *niloticus*. Figures 3 and 4 might represent *maculatus* or a young *niloticus*. Of these four figures, figure A was later cited for *niloticus* in the twelfth edition, where the other three figures were retained for *maculatus*.

The two Gualtieri figures (pl. 59, fig. B, and pl. 61, fig. E) respectively show a colorless *niloticus* (dorsal and basal aspects) and a similar pair of good figures of *maculatus*. Both were respectively and correctly cited for these species in the twelfth edition.

The figure from Argenville (1742, pl. 11, fig. C) is a dorsal view of a shell which was probably *maculatus*, although it shows certain features of *niloticus*. Argenville's description (p. 262), "un Sabot à fond blanc bariolé de rouge et de brun," suggests *niloticus*, as both colors are seen on the base of that shell, whereas the base of *maculatus* shows only red spots or streaks. This figure was cited for *both* species in the twelfth edition, which suggests that even in 1767 Linnaeus was still confused as to the two shells in spite of his apparently clear separation of the two in the subdescription of *niloticus*.

In the twelfth edition the synonymy was restricted to the Argenville figure (*maculatus*?), three of the Rumphius figures (B, 3, and 4), all questionable, Gualtieri's good figure E, and a new figure from Buonanni (pl. 96) which could represent any of the above forms.

The above figures are discussed at length, both here and in my comments on *niloticus*, because they seem to offer some excuse for Linnaeus' apparent confusion in regard to

the two species covered. Only the Gualtieri figures (B for *niloticus* and E for *maculatus*) are worthy of being accepted as correct. The two species are, however, unmistakably distinguishable in the adult shells, and it seems certain that Linnaeus recognized these differences. In the first place, he at least partially described them in the subdescription of *niloticus*. Second, a good adult specimen of *niloticus* is found, properly documented, in the Linnaean collection, and an equally good adult specimen of *maculatus* is present. While only the receptacle containing the specimen is marked in the case of *maculatus*, there is no evidence of misplacement and no other specimen can be confused with it. I suggest, therefore, that Linnaeus' confusion was only apparent. He possessed both species and was merely handicapped by the lack of good figures in the pre-Linnaean plates, and the figures he did cite were for the most part badly drawn and confusing because of the similarity of the two species in the subadult stages. Hanley (1855, p. 313) recognized the paucity of good figures and supplied not only an ample redescription of *maculatus*, but a figure (pl. 3, fig. 7) of the actual specimen in London. Linnaeus may therefore be forgiven for the poor figures he cited. They were all that he could find. It is unfortunate, however, that he did not confine himself to the Gualtieri figures of the two shells (B for *niloticus* and E for *maculatus*), and it is curious that, with his specimens before him as he wrote, at least in 1767, he did not furnish a more convincing description of *maculatus*.

Trochus maculatus was described in the "Museum Ulricae." Only three of Linnaeus' tenth-edition references were cited, with the suppression of some of the figures in these references. The Rumphius figures A and B probably show the young *niloticus;* Gualtieri's figure B also is clearly *niloticus*. The Argenville figure C might be either *niloticus* or *maculatus*, as said above. The added subdescription in the "Museum Ulricae" contains phraseology covering *maculatus* as well as the form *maximus* of *niloticus*, which is discussed under the latter species (p. 161, above); the phrase" Testa . . . exacte conica" describes *maximus*, or possibly the young typical *niloticus;* "quasi granis exasperata" suggests *maculatus;* and "communiter subconvexa est" can describe only *maculatus*. It should not be forgotten that this description was written before the publication of the twelfth edition, when Linnaeus possibly did not own specimens of either species, and his synonymy of *maculatus* contained more discordant figures than his later synonymy.[1]

Trochus maculatus is immediately distinguishable from *niloticus*, in the adult stage of both, by its slightly convex sides, its flat base, the greater heaviness of its concentric basal cords, its smaller size, and the lack of the basal dilation of the body whorl which is so evident in *niloticus*.

It is the type species of *Trochus* Linné, by subsequent designation, Thiele, 1924 (see discussion of *T. niloticus*, p. 159, above). It has always remained in the genus *Trochus*.

Chemnitz (1780–1795, vol. 5, p. 83) described a "Trochus sanguinolentus grandinatus Nicobaricus" which he attributed to *maculatus* Linné. His figures (*tom. cit.*, pl. 168, figs. 1615–1616) are by no means clear but seem to show the *maculatus* of all authors. Hanley (*loc. cit.*) said: "For although by a kind of tacit consent the supposed recognition by Chemnitz . . . has been generally accepted, it has not escaped the acumen of Dehayes that the Chemnitzian shell was not identical with the Linnaean *maculatus*. This conclusion was arrived at by a critical examination of the synonyms." Hanley refers here to the synonyms supplied by Chemnitz and not the Linnaean synonyms. He pointed out that if Linnaeus had been describing *sanguinolentus* he should have cited another pair of Gualtieri figures (pl. 61, figs. D D) as Chemnitz did, rather than the pair of figures lettered E on the same plate, which were cited by Linnaeus for *maculatus*. Both pairs of figures are of the same size, the same convex shape, and apparently have the same flat base. Figures D D show a more heavily granulate shell in which the suture is less distinct, and with no flammules or spots of color. Chemnitz' own figures, however, are quite different from those of Gualtieri (D D).

[1] Although *Trochus maculatus* was described in the "Museum Ulricae," the specimen on which the description was based, whatever it may actually have been, has been lost, as there is nothing labeled *maculatus* in the collection at Uppsala and no specimen of *niloticus*, *maximus*, or *maculatus*.

They show a shell that is partially olive-green, a color seen frequently in *maculatus*, and, in general, might well be taken for a color form of that species. Figure 1615 of Chemnitz shows considerable red color on the upper half of the shell. I am strongly tempted to disagree with Hanley that *sanguinolentus* is not a synonym of *maculatus*. Hanley, moreover, went further. He said (*loc. cit.*), after admitting that the older writers had not adequately figured *maculatus*, that it "has never been satisfactorily identified." This statement was made after reporting the finding of the probable type in the Linnaean collection and supplying a figure of it. He himself had identified it.

Deshayes' comments, referred to by Hanley, are here quoted in full (1843, p. 136, footnote): "As we have said in a preceding note, Linnaeus separated the *Trochus niloticus* from the *Trochus maculatus* of the 10th edition of the *Systema* and of the *Museum Ulricae*. For this *Trochus maculatus* the synonymy has been considerably shortened and the description entirely rewritten. In spite of these important changes we cannot recognize to which of the known species the *Trochus maculatus* should be referred; the description is so short and the synonymy so bad that it is impossible for us, *at present* [italics mine], to identify it. Linné refers to a figure 96 of Buonanni; it shows a species with a dentate edge as in *Turbo calcar;* he then refers to three figures of Rumphius; they represent young individuals of *Trochus niloticus*. The third citation is from Gualtieri, pl. 61, f. E. This figure is *Trochus virgatus* Gmelin. The last is from Argenville, pl. 11, f. C; it could also show *virgatus*, but is doubtful. In none of these figures does one find all the features set out in the short description. Consequently we think that *Trochus maculatus* is one of those species which we must abandon and eliminate from the nomenclature. Since Linné, all authors have vainly tried to recognize the species under discussion. Born caused much confusion in the synonymy of what he called *Trochus maculatus*. Chemnitz was more careful and his synonymy is fairly applicable to a single species which Linné probably did not know. It is to this species of Chemnitz which almost all authors have given to the Linnaean name; thus one may say that in Gmelin, Dillwyn and Lamarck one does not find the *Trochus maculatus* of Linné, but the *Trochus sanguinolentus* of Chemnitz, for which the Linnaean name has been substituted. To be consistent with the principles which govern us in reforming the nomenclature, two things should be done: to suppress the *Trochus maculatus* of Linné as a very dubious species, and to restore to the shell which now bears the name *maculatus* that of *sanguinolentus* which Chemnitz first gave it."

It will be observed that Deshayes, in the above quotation, departs to some extent from the analysis of the Linnaean synonymy which the present writer has tentatively suggested above. The figures are, however, so questionable that it is scarcely possible to be too categorical in one's opinions on this score. Three other comments may be made on Deshayes' conclusions. First, I agree that, as of 1843 when Deshayes wrote, it was impossible to have identified the species *maculatus* Linné, as one would have had to rely only on a vague description and a worse synonymy, as we may be reasonably certain that neither he nor any of his continental colleagues had seen the type in London. Second, I do not agree that *sanguinolentus* Chemnitz can be separated from *maculatus* Linné, as already pointed out. Third, Deshayes' mention of Lamarck's *virgatus* (1822, vol. 7, p. 19) should be explained. That species should be cited as of Gmelin, 1791 (p. 3580). It has a peculiar synonymy in Lamarck. It is there referred to the Gualtieri figure E which was cited by Linnaeus for *maculatus*, and to a pair of figures from Chemnitz (1780–1795, vol. 5, pl. 160, figs. 1514–1515). The latter figures do suggest *maculatus* rather strongly, but *virgatus* is described by Lamarck as having no umbilicus, whereas the Chemnitz figure 1514 (the basal view) shows a definite and rather wide perforation, as does *maculatus* Linné. *Trochus virgatus* is a well-known and rather common imperforate species and is not conspecific with *maculatus*.

Trochus maculatus is extremely variable in color pattern and in sculpture, in the presence or absence of plications or of short folds around the base, and in the prominence of its granulations. Its color varies from a bluish green to a pattern of mottled red and white,

although in almost every individual there is at least a trace of red at the apex. This variability has resulted in a host of synonyms. The following list contains the most important of them but is by no means complete: *Trochus vernus*, *tentorium*, and *verrucosus* Gmelin, 1791; *incarnatus* Philippi, 1846; *gmeleni* Jonas, 1846; *regulosus* Koch, 1848; *jonasi* Philippi, 1848; *callicoccus* Philippi, 1849; *acutangulus* Menke, 1849; *smaragdus* Reeve, 1861; *altus* Reeve, 1862, not Perry, 1811; *granosus* Reeve, 1862, not Lamarck, 1822; and *subincarnatus* Fischer, 1878. The several Philippi, Jonas, and Koch names above are described in the various sections on *Trochus* in Philippi's "Abbildungen." Another synonym, *spengleri* Gmelin, is described in Philippi's "*Trochus*" in the "Neue Ausgabe" of the Martini-Chemnitz work. The most frequently used synonym is *acutangulus* Menke, which should not be confused with *acutangulus* Chemnitz, 1781.[1] Pilsbry (1889, p. 24) lists *vernus*, *tentorium*, and *verrucosus* Gmelin, *granosus* Lamarck, *incarnatus* Reeve, 1861, not Philippi, 1846, and *subincarnatus* Fischer as "varieties" of *maculatus*.

Adam and Leloup (1938, p. 19) add the following to the synonymy of *maculatus*: *Trochus maculosus* Herbst, 1778, *zebra* Humphrey, 1797, *grandinatus* Röding, 1798,[2] and *Polydonta gibberula* A. Adams, 1851.

Most of the above synonyms are listed with considerable diffidence. In a species as variable as the present, belonging to a large group of umbilicate species that resemble one another so closely that the early hand-drawn figures are less instructive than could be desired, and with their descriptions so equivocal, it is dangerous to be categorical in selecting synonyms.

Trochus maculatus, in its several known forms, is figured by Reeve (1843–1878, vol. 13, pl. 1, fig. 4, and pl. 12, figs. 4b, 4c), by Fischer, 1880, pl. 29, figs. 1, 1a), by Pilsbry (1889, pl. 9, figs. 100, 1, 2, 3), and by Adam and Leloup (1938, pl. 2, figs. 10a, 10b, the figures being referred to *T. verrucosus* Gmelin and *T. granosus* Lamarck, respectively).

[1] *Trochus acutangulus* Chemnitz has itself a considerable synonymy. It is *T. conus* Gmelin, 1791, *T. altus* Perry, 1811, not Reeve, 1862, *T. elatus* Lamarck, 1822, *T. turris* Philippi, 1846, and *T. senatorius* Philippi, 1846 ("Neue Ausgabe"). These synonyms are given by Adam and Leloup (1938, p. 29) and seem correct. I suggest that *T. virgatus* Gmelin is also this species.

[2] This is not *T. grandinatus* Chemnitz, 1788, which is an imperforate shell.

Trochus perspectivus

1758, Systema naturae, ed. 10, p. 757, no. 503.
1767, Systema naturae, ed. 12, p. 1227, no. 581.

LOCALITY: "Ad O. Asiae littora" (1758); "ad O. Asiae littora; Alexandriae frequens" (1767).

"T. testa convexa obtusa marginata, umbilico pervio crenulato . . . Umbilicus stupendum naturae artificium."

In 1799 (p. 74) Lamarck erected the genus *Solarium* for this species and its allies, the "Sun-dial Shells," but Röding's *Archtectonica* for the same group (1798, p. 78) has one year's priority and is now generally and properly used. Nevertheless, Lamarck's generic name was consistently used until Röding's names in the "Museum Boltenianum" came to the renewed attention of conchologists by the republication of its molluscan portion in 1906 and the making of that work "nomenclatorially available" by the International Commission on Zoological Nomenclature in published Opinion 96.

Based on the above description alone it would be impossible to tie Linnaeus' specific name to any single species in this group, as it might well be read as a generic definition. Hanley concluded (1855, p. 314) that there was little doubt that Linnaeus would have regarded all of the larger *Solarium* species as varieties of the same shell, if the "Systema" had been his only publication. This conclusion must have been based on the description alone, as I am able to find figures of only two species of *Architectonica*, *A. perspectiva* and *A. nobilis* Röding, in the synonymy. Röding's *nobilis* has many years' priority over Lamarck's *Solarium granulatum* (1822, vol. 7, p. 3), but I here refer to the species as *granulatum*, as that name was employed during almost the entire period covered by the present discussion.

The synonymy consists, for the most part and except for slight errors in detail, of excellent figures of the two species.

The figures from Grew (pl. 11, figs. 3–4) are *perspectivus*. The citation refers to the lower pair of figures numbered 1 and 2.

Lister's figure (1685–1692-[1697], book 4,

sect. 8, chap. 3, pl. 1–2), which was more simply stated as plate 634, figures 22, in the later editions, and the Buonanni figures (pls. 27–28), both pairs of figures showing the dorsal and basal aspects of the shell, show *S. granulatum* Lamarck and were so identified by Dillwyn in his Index to Lister's work (1823, p. 31). Indeed, Lister described his figures as "Trochus planior maculatus, *striis nodosis distinctus*" (italics mine). Dillwyn also noted that "the engraving appears to have been made by copying fig. 27 and 28 of Buonanni's Recreatione, so as to invert the figures."[1]

The Rumphius figure (pl. 27, fig. L) is unmistakably *perspectivus* Linné and is accurately drawn except that it is represented as a sinistral shell.

The figure cited from Petiver (pl. 2, fig. 14) is very crude, as are most of Petiver's figures of mollusks, but may be taken for *perspectivus*. It cannot have been based on *granulatum* Lamarck.

Gualtieri's figures (pl. 65, fig. O, four figs.) are discordant. The larger figure and the two left-hand figures in the lower row are excellent pictures of *perspectivus* except that the "teeth" in the outer ring around the umbilicus are larger instead of smaller than those in the inner ring. The right-hand figure lettered "O," a dorsal view, appears to show *granulatum* Lamarck.

The figure from Argenville (1742, pl. 11, fig. M), a basal view, is *perspectivus*, as is the Regenfuss figure (pl. 6, fig. 61). The latter shows the same fault in the drawing of the umbilical crenulations as was seen in Gualtieri's left-hand figure O.

The Seba figures (pl. 40, figs. 1, 2, 13, 14, 28, 41, 42) were added to the synonymy in the twelfth edition. Conchologists have not been unanimous in their interpretation of these figures. Chemnitz cited for his typical *perspectivus* only figures 1 and 2, referring the remainder to an unnamed variety. Dillwyn omitted figure 28. Hanley went much further and considered that figures 1 and 2, and 41 and 42, should be excluded from the synonymy, although he did not suggest what they represented. The present writer cannot detect anything in any of these figures that cannot be associated with color forms of *perspectivus*. Certainly none of them shows any features that could be referred to *granulatum* Lamarck.

In the "Museum Ulricae" Linnaeus first copied the description that later appeared in the twelfth edition of the "Systema," another illustration of the fact that by 1764, when the "Museum" was published, he had already amended many of his original tenth-edition descriptions in preparation for the publication of the twelfth. In his added descriptive material he gave much detailed information which ties the species more securely to the *perspectivus* of all authors. The words "Anfractus laeves. . . transversim striati striis remotis" clearly disassociate the species described from *S. granulatum* Lamarck. The synonymy is reduced to a citation of the Rumphius, Gualtieri, and Argenville figures which, with the exception of the right-hand figure in the lower row in Gualtieri, all show *perspectivus*. Hanley's comment on the "Museum Ulricae" description is confusing and, if I read it correctly, involves an error. It is quoted in full: "The limitation effected by the 'Museum Ulricae' enables one to particularize the species which displays the best claim to be regarded as the typical *perspectivus*, and this assuredly is not the *Solarium* to which the name has been attributed by Lamarck ('cingulis albo et fusco, aut castaneo, articulatis prope suturas') and Kiener, but the *Solar. formosum* of Hinds (Proc. Zool. Soc. 1844—Chemn. Conch.

[1] Hanley (*loc. cit.*) called attention to the fact that the Lister and Buonanni figures were not *perspectivus* and that the Lister figures were changed to plate 666 (error for pl. 636, fig. 24) by a manuscript note of Linnaeus in his working copy of the "Systema," and added that the substituted figure showed the *S. formosum* of Hinds, 1844. The Lister figures originally cited by Linneaus are unquestionably meant for *granulatum* Lamarck. *Solarium formosum* was described by Hinds (1844, p. 22) from a specimen collected by Cuming, for which Hinds gave "Amboina" as locality. His species is generally considered to be the same as *perspectivus*, and the substituted Chemnitz figures show that shell. He noted that it had previously been considered to be a mere variety of *perspectivus*, but attempted to distinguish it as follows: "In shape it is considerably more elevated and conical and it is ornamented with rich fasciations of brown and white. Near the upper part of each whorl a narrow sulcus separates a narrow portion. The base is flattened and polished; umbilicus moderately dilated, being less so than in *S. perspectivum*, and armed on the margin with a row of straight, sharp crenules, on their right faces of a darker brown color."

Cab. vol. 5. pl. 172, f. 1693.—Gevens, Conch. pl. 25, f. 267, 268.—Seba, Mus. vol. 3, pl. 40, f. 13, 14, 28), which corresponds exactly to the stated coloring [in the 'Museum Ulricae'], 'picti supra linea fusca albae superinducta.' Specimens of this very peculiarly banded shell are still preserved in the Linnaean cabinet." Of the figures cited above by Hanley, Chemnitz' figure 1693 shows several white spiral bands, the only one that is articulated with brown spots being that near the lower margin of the body whorl. The Gevens figure 267a is a dorsal view of a shell with uninterrupted white bands. His figure 268 is a dorsal view showing all bands articulated with brown spots. The Seba figures 13, 14, and 28 are *perspectivus* with unarticulated white bands. Hanley's statement that the *perspectivus* of the "Museum Ulricae" is not the *perspectivus* of Lamarck but is *formosum* Hinds is not clearly stated. He appeared to base his statement on the description of the decoration of the white bands in the two works, but these descriptions, although differently expressed, seem to describe the same color pattern. Even if they do not, the species is variable in this respect. I consider *formosum* to be a synonym of *perspectivus* Linné.

Chemnitz (1780–1795, vol. 5, pp. 121–127, pl. 172, figs. 1691–1696) relied on Linnaeus' composite conception of the species, and his own voluminous synonymy included references to the "Systema" and the "Museum Ulricae" descriptions and almost all of Linnaeus' cited figures showing both *perspectivus* and *S. granulatum* Lamarck. Of Chemnitz' own figures those numbered 1691 to 1694 show *perspectivus;* figures 1695 and 1696 are *granulatus*. Figure 1693, which was cited by Hanley for *formosum* Hinds, is a picture of a shell with uninterrupted white bands except for the band nearest the base. This color form is found in *perspectivus*. One of the difficulties in analyzing the treatments of the "sundial shells" by writers up to and including Lamarck has been their varying interpretations of these six Chemnitz figures. To cite but one example, Link (1807, p. 136) called the shell "lacking the white bands" by a new name, *S. maculatum*, citing for it Chemnitz' figure 1694, which shows the bands articulated with brown, reserving for *perspectivus* the Chemnitz figure 1693 with its uninterrupted white bands.

Lamarck (1822, vol. 7, p. 3) properly separated the true *perspectivus* from the granulated shell, calling the latter *Solarium granulatum*. His synonymy for *S. perspectivum* is, however, defective, as, in addition to the good figures of that shell cited by Linnaeus, he included the Buonanni figures, the Gualtieri figure of *granulatum*, and all six of the figures from Chemnitz. His *perspectivum* is therefore a composite species so far as concerns the synonymy. His *granulatum* is properly defined and is supported by a correct synonymy, consisting merely of the Lister figure originally cited by Linnaeus for *perspectivus* and a pair of excellent figures of *granulatum* from the "Tableau encyclopédique."

Since Lamarck the literature reveals no confusion between *perspectivus* and the granulated shell.

Linnaeus' *perspectivus* is the type species of *Architectonica* Röding, 1798, by subsequent designation, Gray, 1847, who, however, used the name *Architectoma*, an obvious misprint. It is also the type species of *Solarium* Lamarck, 1799, by monotypy.

Its synonyms are *S. formosum* Hinds, 1844, and *S. zonatum*, *incisum*, and *australis* Philippi, 1848.[1]

It is figured by Reeve (1843–1878, vol. 15, *Solarium*, pl. 2, figs. 11a, b) and by Tryon (1887, pl. 2, figs. 18–19).

Trochus hybridus

1758, Systema naturae, ed. 10, p. 757, no. 504.
1767, Systema naturae, ed. 12, p. 1228, no. 582.
LOCALITY: "In M. Mediterraneo" (1758, 1767).
"T. testa crenato umbilicata convexa, aperturae columella bidentata" (1758).
"T. testa umbilicata convexa, columella bidentata, umbilico crenulato" (1767).

As in the case of the preceding species (*T. perspectivus*), the changes in the description in the twelfth edition merely involved an improvement in the order of the stated characters, with no change in substance. With such a brief and unrewarding description, the lack of any references, and an incorrect local-

[1] It is not *Architectonica perspectiva* Tuomey and Holmes, 1857, a Pleistocene fossil shell from North Carolina, which is *A. granulata* (Lamarck).

ity, it would have been difficult if not impossible to have identified the species from the "Systema" alone. The description, however, contains but one incorrect, or at least misleading, detail. The columella is not dentate. Two small blunt teeth are seen at the lower end of the lip, which appear to be the terminations of the inner two of the concentric basal cords, and are in no sense a part of the columella.

The early identification of the species was undoubtedly based on the ample added subdescription in the "Museum Ulricae." This is quoted in full: "Habitus et figura Tr. perspectivi, sed minor absque carina, rotundata nec circum acuto-angulata, laevis, variegata. Apertura subrotunda. Labium posticum [*sic*] excurrens in angulum obtusum, rugosum.[1] Umbilicus cinctus angulo obtuso. Affinitas summa cum praecedente (Tr. perspectivo) forte sola varietas, sed quadruplo minor, flava nec lucida, peripheria vix marginata, superficie laevi."

With the exception of the phrase "Umbilicus cinctus angulo obtuso," which is not understood, there is sufficient detail in the above description, combined with the position of the name immediately after *perspectivus* in both the "Systema" and the "Museum Ulricae," and with Linnaeus' own comparison with that species, to point certainly to the *hybridus* of authors. Linnaeus was, of course, in error in suggesting that *hybridus* might be a variety of *perspectivus*, and the specific name itself possibly reflects his error.

In 1781 Chemnitz (1780–1795, vol. 5, p. 132, pl. 173, figs. 1702–1705) listed the species under its Linnaean name. He was not only familiar with the "Museum Ulricae" description, which he quoted, but felt that the shell there described was not the shell described in the "Systema," as he placed a question mark after the references to both the tenth and twelfth editions. His figures are the earliest of the post-Linnaean drawings of this species. Figure 1702 represents a color form in which the brown flammules below the suture extend over much more of the whorl than in the typical *hybridus*. He also mentioned a "noteworthy variety" which he referred to his figures 1704 and 1705. Figure 1704, however, shows a dorsal view of the typical form. Figure 1705, a basal view, shows an entirely white base. I have not seen this form, although the color of the base of the species varies from a dark brown to a pale tan. Possibly Chemnitz based the figure of the base of his variety on a bleached shell. Gmelin's specimen (1791, p. 3567), if, indeed, he had seen one, was probably such an individual, as he used the phrase "subtus tota alba." He queried all four of the Chemnitz figures and cited no others.

Lamarck (1822, vol. 7, p. 4) moved the species to his genus *Solarium* (1799)[2] and cited all four of the Chemnitz figures and the "Tableau" figures (pl. 446, figs. 2a, 2b) which are not characteristic in their color pattern. He retained the erroneous Mediterranean locality, as did Deshayes, the editor of the second edition of Lamarck. *Trochus hybridus* is an Indo-Pacific species.

Hanley (1855, p. 315) made a statement which reveals his confusion not only as to the locality of the species but as to its appearance. Having found no specimen of *hybridus* in the Linnaean collection in London, he suggested that the type specimen must be looked for in the "Dronningen" Museum, and continued: "From the details of the 'Museum Ulricae' naturalists have identified the species with the *Solarium hybridum* (Chem. Conch. Cab. pl. 173, f. 1702, 1703), which traditional recognition, although the Mediterranean locality renders it not improbable that the allied *Sol. luteum* was the shell designed in the 'Systema,' it is not desirable to gainsay." Not only is *S. luteum* not a Mediterranean shell, as Hanley implied, but it is readily distinguishable from the *hybridus* of authors. It is a smaller shell, of a light

[1] The word "rugosum" is not well-chosen. It undoubtedly refers to the two small teeth at the lower end of the lip which were mentioned above.

[2] Apparently Lamarck was unaware of, or disregarded, the name *Architectonica* Röding, 1798, which has a year's priority. *Solarium* was generally used for this group of species until the Röding names in the "Bolten Catalogue" were made "nomenclatorially available" by the terms of Opinion 96 of the International Commission of Zoological Nomenclature in 1926. *Solarium* is still used, principally by continental writers and by those who do not accept the Opinion as giving blanket validity to all the Röding names. *Architectonica* is here accepted, following the almost universal American view.

tan color as its specific name suggests, and lacks the vivid reddish brown flammules of *hybridus*. Its suture is crenulated with a single row of small reddish granules except at the base of the body whorl, which shows two such rows. This sculpture is not present in *hybridus*. It was described by Lamarck (1822, vol. 7, p. 5) as "ad periphaeriam bisulcata."

It must be admitted that *luteum* does conform to the brief details of the description of *hybridus* in the "Systema," but this conformity is deceptive, as the distinguishing characteristics of the two species are not noted under *hybridus*. Possibly the "variegata" of the "Museum Ulricae" description, and other details in that work, are sufficient, however, to distinguish them. Particularly the "quadruplo minor" of the "Museum," used as a comparison of *hybridus* with *perspectivus*, is an insufficient measure for the smaller *S. luteum*. In spite of the scintilla of doubt that is raised in my mind by the insufficient description of *hybridus* and its practical conformity with the species *luteum*, the lack of a synonymy, and the absence of anything in the Linnaean collection that can be even suggested as a type specimen, I agree with Hanley that it would be unwise to disturb the universally accepted recognition of *hybridus* auct. as the representative of the Linnaean name.

The "Museum Ulricae" description of *hybridus* is supported by an undoubted specimen of the *hybridus* of authors, accompanied by a proper label, in the collection in Uppsala. This does not necessarily identify the *hybridus* of the "Systema," as this may be one of the many suspected cases in which a different species is described in the two works under the same name, and the vagueness of the "Systema" description in this case rather deepens such a suspicion.

Other than Röding's *Architectonica radiata*, 1798, which was referred to *hybridus* Gmelin and to Chemnitz' figures 1704 and 1705, I know of no specific synonyms of the species.

The species is generally considered today to belong in the genus *Torinia* Gray, 1840. *Heliacus* d'Orbigny, 1842, and *Teretropoma* Rochebrune, 1881, are synonymous.

The species is figured by Reeve (1843–1878, vol. 15, *Solarium*, pl. 3, sp. 31), by Sowerby (1847–1887, vol. 3, *Solarium*, pl. 4, figs. 39–43),[1] and by Tryon (1887, pl. 5, figs. 59–62).

Trochus cruciatus

1758, Systema naturae, ed. 10, p. 757, no. 505.
1767, Systema naturae, ed. 12, p. 1228, no. 583.
LOCALITY: "In M. Mediterraneo" (1758, 1767).
"T. testa umbilicata convexa: striis callosopunctatis, columella unidentata . . . Testa Avellana minor, ferruginea, fasciis longitudinalibus quatuor albidis."

The above description from the twelfth edition of the "Systema" is identical with that in the tenth except for the omission of the word "aperturae" before "columella." It is adequate to isolate the species from all other species in *Trochus* Linné. While it fails to note the variation in color pattern of the shell, it gives the other important diagnostic characters of the species. The specific name is derived from the four white longitudinal flammules radiating from the apex of the shell, against a dark brown ground color, which apparently suggested to Linnaeus the form of a cross, although, even in the so-called "typical" shell, the comparison is remote. In fully one-half of the large series of the species examined by the present writer the flammules are lacking, the entire shell being a solid brown; in others the flammules are not produced into streaks but consist of irregular white blotches; in some specimens the streaks are doubled or are fewer than four in number. The columella of fresh specimens shows *two* very small pointed teeth.

No synonymy was supplied, but the Mediterranean locality, together with the reasonably clear description, is sufficient for identification of the species.

No documented specimen is found in the Linnaean collection, but, by the method of exclusion, Hanley (1855, pp. 315–316) was able to isolate a tray of specimens which he called "a variety of the *Monodonta Vielloti* of Payraudeau" as the only shells in the collection that conform to the description. These

[1] The Sowerby figures seem to resemble *Solarium variegatum* (Gmelin, 1791, p. 3575), more than *S. hybridum*. The Gmelin species is figured separately by Sowerby (pl. 5, figs. 59–64) as *S. perspectiviunculus* Chemnitz. Chemnitz' own figures of this species (1780–1795, vol. 5, pl. 173, figs. 1708–1709) are more accurate than those of Sowerby.

specimens are Linnaeus' *cruciatus*. They are all somewhat worn and show but one columellar tooth. Hanley reproduced one of the specimens (*op. cit.*, pl. 5, fig. 6), saying that Payraudeau's figures (1826, p. 135, pl. 6, figs. 21–23) do not properly show the shell.

The species was, however, almost immediately identified. In 1781, Chemnitz (1780–1795, vol. 5, p. 113, pl. 171, fig. 1674) listed a species under the name of *Trochus cruciatus* which he referred to the *cruciatus* of the tenth and twelfth editions of the "Systema." Although he placed a question mark after the references, and said: "Is not this Krausel unquestionably the Trochus cruciatus Linnaei?" his figure is very convincing, except that the four longitudinal streaks are yellowish instead of white. Schröter (1783–1786, vol. 1, p. 653, pl. 3, fig. 10) listed the species with no query as to its authorship and gave a figure which compares favorably with any reproduction of the species before the advent of photography. In spite of these identifications Hanley (*loc. cit.*) called *cruciatus* "this hitherto uncertain species."

Gmelin added nothing to strengthen the identification, as he merely paraphrased Linnaeus' description and cited the Chemnitz and Schröter figures mentioned above.

As some excuse for Hanley's expression "this hitherto uncertain species," it should be emphasized that from Schröter (1783) to Hanley (1855) writers seemed unable to identify the species, and the name *cruciatus* apparently dropped out of the literature. It did not even appear in the works on the Mediterranean fauna by Poli, Risso, and Philippi. The only mentions of the name in this long interval were by Gmelin, who merely copied Linnaeus' diagnosis, and Dillwyn (1817, p. 771) whose comments indicate that he was not familiar with the species, as he said: "Linnaeus has described this shell to be . . . ," language he often used when he was acting, like Gmelin, as a mere copyist.

In the 30 years before Hanley had isolated the species in the Linnaean collection, it had been given three specific names, none carrying any indication that their authors recognized them as being equal to *cruciatus* Linné. In addition to *Monodonta vieillotii* Payraudeau, it was called *Trochus pharaonius* var. "β" by O. G. Costa (not Linné), 1829, and *Trochus mediterraneus* by Wood in 1828, the name *vieillotii* having been used by Blainville, 1830, Deshayes, 1836, Philippi, 1836, 1844, Requien, 1848, and Petit, 1852. The first use of the Linnaean name for the species, after Hanley, was by Weinkauff in 1868 (p. 350). Incidentally, Weinkauff was the first writer after Montfort to use the genus *Clanculus* for the species. For some time both specific names (*cruciatus* and *vieillotii*) were about equally employed, but, at least since the appearance of the eleventh volume of Kiener (Fischer, 1880, p. 298), *cruciatus* has been generally used and almost universally placed in *Clanculus* Montfort, 1810. Dautzenberg (1883, p. 20) placed it in *Clanculopsis* Monterosato, 1879, an exact synonym of *Clanculus*. *Odontis* Sowerby, 1825, *Otavia* Risso, 1826, and *Fragella* Swainson, 1840, are also synonyms.

Good figures of *cruciatus* are scarce, partly owing to the fact that during the era of the mid-century manualists Kiener, Reeve, and Sowerby, the species had dropped out of the literature. It is figured by Bucquoy, Dautzenberg, and Dollfus (1882–1886, pl. 50, figs. 5, 6, 10, 11, the so-called typical form, and figs. 7, 8, 8, 12, the "varieties"). These figures are photographic, but apparently the photographs were badly developed or reproduced, as in all the copies I have seen they are almost too faded to be recognized. The species is well figured by Fischer (1880, pl. 95, fig. 3, two figs.) and by Pilsbry (1889, pl. 11, figs. 60, 61, pl. 19, figs. 16, 17). Payraudeau's original figures of *Monodonta vieillotii* (1826, pl. 6, figs. 22, 23) are reasonably characteristic.

Trochus pharaonius[1]

1758, Systema naturae, ed. 10, p. 757, no. 506.

[1] The specific name is derived from the Egyptian word "Pharaoh," as the locality of the species is the Red Sea, the west coast of which is part of Egypt. In Schröter's "Namen Register," which he prepared for the first 10 volumes of the Martini-Chemnitz work, the spelling is changed to "*pharaonis*," and this spelling was adopted by Chemnitz, Gmelin, Link, Lamarck, Sowerby, Hanley, and, indeed, by the majority of writers of the last quarter of the eighteenth and the first half of the nineteenth centuries. The spelling "*pharaonius*" has, however, been restored and must be retained, as Linnaeus' orthography shows no "evidence" of the types of error specified in Article 19 of the Code of Zoological Nomenclature.

1767, Systema naturae, ed. 12, p. 1228, no. 584.
LOCALITY: "In M. Mediterraneo, Brasiliae" (1758, 1767).

"T. testa subovata striata: punctis concatenatis globosis, columella aperturaque dentata, umbilico crenato . . . Puncta nivea et atra, alterna serie in ordinibus transversis."

The above description, which was the same in the tenth and twelfth editions except for one change in the order of the phrases, is sufficiently characteristic to enable the early followers of Linnaeus to identify the species with the *Clanculus pharaonius* of all modern writers. It should be pointed out, however, that it has one defect, in that the characteristic red color of the rows of granules between the black and white series is not mentioned.

Based on the original description and synonymy, however, it must be treated as a composite species, as it could cover at least four of a group of clanculid species which show a sculpture of close-set and contiguous spiral rows of granules in a slightly varying color pattern: *T. pharaonius* Linné, *T. puniceus* Philippi, 1846, *T. kraussi* Philippi, 1846, and *T. guineensis* Gmelin, 1791.

The figure cited by Linnaeus from Gualtieri (pl. 63, figs. B B, dorsal and basal aspects) may have been modeled after a specimen of *pharaonius*, although it might well be taken for any of the above group. The aperture of the figure is very crudely represented.[1]

The Argenville figures (1742, pl. 11, figs. L, Q) show a color pattern which is undoubtedly that of *pharaonius*. The aperture of figure Q is also crudely drawn. Argenville (text p. 263) described the color pattern as "little cordlets of a beautiful red interspersed with black dots," and the details of this pattern are clearly shown in this figure. The deficiencies of the basal view (fig. Q) are partly in his text (*loc. cit.*) where he says that the figure "is reversed to show the umbilicus, at the side of which is a very thick lip, and an aperture with a toothed edge ["déchirée avec les dents]."

Hanley (1855, p. 316) said: "The referred-to figure of Lister ['4. s. 8. c. 4. t. 1'; pl. 637, fig. 25, in later editions], and possibly of Petiver likewise ['pl. 14, fig. 10'], represents an allied congener from Madagascar (Gevens, Conch. Cab. pl. 12, fig. 101) that is finer grained and less articulated; it is not present in the collection, and, though formerly held a variety, the drawings of it must be omitted from a correct synonymy." I agree with this interpretation of the figures mentioned. He did not name the "Madagascar" species, but the Lister and Petiver figures rather point to the *puniceus* of Philippi, which comes from the Red Sea and has been reported from the coast of Abyssinia and from Zanzibar, although I have not seen a specimen from so far south as Madagascar. Gevens' figure 101 is surely not *pharaonius* but is unmistakably *puniceus*.[2]

The figure from Buonanni (pl. 22) is an enlarged drawing of a shell which was unmistakably *pharaonius*. Rondelet's very crude figure (1554–1555, pt. 2, fig. 104) is barely recognizable as this species.

The Adanson figure (1757, p. 182, pl. 12, fig. 2, error for fig. 3), which Adanson called "le Vasset," has been the cause of much discussion, and the question was only settled in 1942 by the researches of Fischer-Piette and his co-authors (p. 281). These writers said: "Adanson's text covers *Clanculus kraussi* Phil. (whorls swollen; 24 rows of granules) and *Clanculus guineensis* Gmel. (whorls flat; 12 rows of granules) except for the last phrase in the paragraph 'Color,' which applies to *Clanculus puniceus* Phil. . . . 'others are spotted with numerous brown or brown-black dots on a rose colored background, arranged in five lines which encircle the last whorl.' It is this last species which the Adanson figure represents. In the collection[3] we have not found *Clanculus kraussi* nor *Clanculus guineensis;* on the contrary we have found a specimen of *Clanculus puniceus* (pl. 10, fig. 9, 18×13 mm.) which certainly appears to be the shell figured by Adanson. It is marked with the number 2560 which is one of the two numbers under which le Vasset is registered in the manuscript catalogue. *Clanculus kraussi* and *Clanculus guineensis* are both

[1] Generally speaking, the aperture of gastropod species, and especially of the trochids, seems to have been the most difficult feature for the early artists to reproduce.

[2] Gevens' figures 101–104 are all referred to Gevens' *pharaonius*, although they show that species and three others of this closely allied group.

[3] This refers to Adanson's "retained" collection (see Dodge, 1955, p. 53).

from West Africa; but *C. puniceus* is from the Indian Ocean."

Thus Adanson did not possess, or at least did not retain, specimens of the two west African species, but placed a foreign species in his Senegal collection. Neither *pharaonius* nor *puniceus* is found either on the west coast of Africa or in the Mediterranean. They are both Red Sea species and, in the case of *puniceus*, from the northern part of the *east* African coast. *Clanculus puniceus* is more predominantly red in color than any of the others of this group, as it has only four rows of black and white granules on the body whorl, two of which are on the convex base, and one on the upper whorls. Otherwise its characters are identical with those of *pharaonius* except for the slightly less tumidity of its body whorl.[1]

The best of the early post-Linnaean figures of *pharaonius* are found in Chemnitz (1780–1795, vol. 5, p. 109, pl. 171, figs. 1672–1673). He identified the species with the *T. pharaonius* of the "Systema" and the "Museum Ulricae," and his figures are excellent representations of the shape and color pattern of the shell, although, as usual, the base and aperture are not convincingly drawn. His synonymy is almost completely accurate, the erroneous references being the Adanson figure of *puniceus* and a figure from Gualtieri (pl. 60, fig. O) which shows a strictly conical trochid somewhat resembling *T. virgatus* Gmelin, 1791. The citation of this figure was undoubtedly an error of transcription, as Chemnitz quoted for it Gualtieri's description for the passable figure of *pharaonius* (pl. 63, fig. B) which appeared in Linnaeus' synonymy.

Chemnitz also described a "Globulus asper Guinaicus variegatus" (*tom. cit.*, p. 115, pl. 171, fig. 1680) which was probably the *T. guineensis* of Gmelin, as Gmelin cited figure 1680 for his species. This Chemnitz name is mentioned because Chemnitz antedated the opinion of Fischer-Piette and his co-authors that Adanson's description of "le Vasset" included *guineensis*. Chemnitz commented: "Probably this shell is the same species which Adanson in his Histoire naturelle du Senegal described under the name of le Vasset, pages 182, 183."

The composite species that was Linnaeus' *pharaonius* was restricted to the *pharaonius* of authors by the finding by Hanley in the Linnaean collection in London of a specimen of that species. This specimen was not documented in any way, but uniquely conformed to the description in the "Systema."

Trochus pharaonius is the type species of *Clanculus* Montfort, 1810, by monotypy. Some writers continue to treat *Clanculus* as a subgenus of *Trochus* Linné. *Otavia* Risso, 1826, *Fragella* Swainson, 1840, and *Clanculopsis* Monterosato, 1879, are synonyms.

This species was described in the "Museum Ulricae," where the synonymy was confined to the Gualtieri figure (pl. 63, fig. B) and the Argenville figure (pl. 11, figs. L, Q), the first of which, as noted above, might have been modeled on a specimen of any of the species in this group. The added subdescription in the "Museum Ulricae" is extremely ample. The suppression of the questionable Buonanni and Rondelet figures and of the erroneous figures from Lister, Petiver, and Andanson brings the "Museum Ulricae" diagnosis closer to a restriction to *pharaonius* alone, but the description of the color pattern is somewhat equivocal and suggests one of the other allied clanculids: "concatenatis ex punctis globularibus rubris, quarum striae *saepius* alternae compositae sunt ex punctis alternis albis alternisque atris" (italics mine).

A correctly labeled specimen of the *pharaonius* of authors is, however, present in the Queen's collection in Uppsala.

The species is well figured by Fischer (1880, pl. 56, fig. 1) and by Pilsbry (1889, pl. 15, figs. 54–56), both sets of figures showing the dorsal and basal aspects of the shell.

Trochus magus

1758, Systema naturae, ed. 10, p. 757, no. 507.
1767, Systema naturae, ed. 12, p. 1228, no. 585.
LOCALITY: "In M. Mediterraneo" (1758, 1767).
"T. testa oblique umbilicata convexa: anfractibus supra obtuse nodulosis."

The only change in the description in the twelfth edition of the "Systema" was the in-

[1] Pilsbry (1889, p. 49) described *puniceus* as "finely granulate, the last whorl bearing 20 or 21 cinguli, of which the 4th and 9th, as well as one or two upon the base, are articulated with black; balance of shell coral red. Last whorl more deflected anteriorly than in *pharaonius*."

sertion of the word "anfractibus" before "supra."

The description correctly states some of the characters of the *Gibbula magus* of authors, although it fails to mention the most important diagnostic feature of the shell, the marked and deeply impressed suture. This latter feature is, impliedly at least, referred to in the description of *Trochus divaricatus*, another *Gibbula* species discussed on page 184 below, where it is much less noticeable, in the words "Anfractus infimo remotiore."

The synonymy is unsatisfactory and represents, for the most part, Linnaeus' use of figures which merely approximated the appearance of the shell being described, although excellent figures were shown in the works available to him.

The figures from Gualtieri (pl. 64, fig. C) and from Argenville (1742, pl. 11, fig. S) do not show the deepness of the suture. Both figures seem to be based on young shells, as in the earlier life stages the suture is shallower and the whorls are less convex. Indeed, both figures might almost be taken for another *Gibbula* species, *Trochus obliquatus* Gmelin (1791, p. 3575). Possibly owing to the angle at which the figures were drawn, they appear to show a shell more depressed than that of *magus*.

Gualtieri described his shell (text to pl. 64) as "aliquantulum depressa, undatim ex rubro, et fusco radiata," which scarcely conforms to the shape and color pattern of *magus*, with its irregular red or brown blotching. He also used the term "terrestriformis" which is meaningless. This may have been an error for "teretiformis" (slender or graceful) which is grossly inapt. Argenville's description (1742, p. 263) ties his figure somewhat more closely to *magus* except for the word "aplati": "A little Sabot depressed [aplati] and tuberculate spotted with flesh color on a white background, called *Sorcière* in Brittany." The French word "sorcière" is the Latin "magus," a magician, but the use of the latter word does not necessarily identify Argenville's species with *magus* Linné, as it may only mean that Linnaeus, in citing Argenville, believed that the latter's shell was *magus*. Nevertheless, Hanley (1855, p. 317) considered that the "traditional identification was probably established from Argenville's figure having been fortunately selected as the typical one; an idea founded upon the name 'la *Sorcière*,' Latinized by *magus*, attached to it (not always a safe method of proceeding)."

Regenfuss' figure (pl. 3, fig. 27) shows a shell with the general appearance of *magus* but wholly green in color. It bears a considerable resemblance to *Trochus tuber* Linné and, significantly, was also cited by Linnaeus for *tuber* (p. 196, below), a predominantly green shell.

The Seba figures (pl. 74, figs. 13–14) are extremely poor, although another set of Seba figures (pl. 41, figs. 4–6), which Linnaeus overlooked, are much more characteristic. I agree with Hanley (*loc. cit.*) that all of Linnaeus' figures for *magus* "exhibit an approximation to its features." Unfortunately Hanley did not include the Argenville figure in his criticism.

The locality, the Mediterranean Sea, is correct. The species is primarily a Mediterranean one, although it is found in the Atlantic from the British coast to Senegal and in the waters of the outlying Atlantic islands.

The species is described in the "Museum Ulricae" where at least one of the added details is not characteristic: "Anfractus 4 s. 5." The species has seven whorls. Moreover, the shell is stated to be "depresso-conica." A specimen of the *magus* of authors, so labeled, is present today in the collection in Uppsala.

A specimen is also found in the Linnaean collection in London. This specimen is itself unmarked but is contained in a tray marked with the name "*Trochus magus*." This situation existed when Hanley examined the collection in the years preceding 1855. The specimen uniquely conforms to the description in the "Systema" and may be accepted as the type specimen on a "probable" basis.

Adanson's "le Dalat," reported by him from Cape Dakar, Senegal, and the Canary Islands, has been authoritatively identified with *magus*. Both are *Gibbula* species. Dautzenberg (1891, p. 51) first separated it from *magus*, saying: "*G. dalat* is very close to certain varieties of *G. magus* Lin. of European seas; but its shape is more elevated and it is particularly distinguished by its very convex base provided with six to eight deep concentric grooves. Its characters, which are con-

stant, seem to us sufficient to justify the separation of the two forms, and we retain for that from Senegal the name which was given to it by Adanson." In 1900 (p. 216) Dautzenberg cited *Gibbula magus* from Branco, one of the Cape Verde Islands off the Senegal coast, and *G. dalat* from Cape Blanc, about 1400 miles north of Senegal. In 1909, however, Nobre (p. 45) united the two species. He said: "Lamarck (2nd. Ed. 9, p. 130) considered the Dalat of Adanson as identical with the *G. magus* and Dautzenberg makes them two distinct species. I think that only one species is involved. I should nevertheless remark that the specimens from Cape Verde have a quite elevated spire, though all the other characters are completely like those of specimens from European Seas."

Fischer-Piette and his co-authors (1942, p. 286), in discussing Adanson's shell, have supplied the most recent comment on this question. They reported the discovery in Adanson's "retained" collection (see Dodge, 1955, p. 53) of four specimens "whose marks and labels permit us to identify them with certainty as being the 'Dalat' of Senegal. These are *Gibbula magus* Linné." They added: "I [*sic*] cannot answer the question whether there exists a single species or two closely allied species in the neighborhood of Cape Verde. But I can affirm that the authentic specimens of le Dalat [in the collection] compare much better to the European *Gibbula magus* than the specimens reported from West Africa by the Gruvel Mission and labeled *G. dalet* (Adans.) Dautzenberg. We note, moreover, that in his text Adanson insists upon the flatness of le Dalat: 'Its shell is very depressed, seven or eight lines long and half again as wide.'" In spite of the question remaining in the minds of these authors, and in spite of the apparent contradiction in the last sentence of the above quotation, it seems to be proved that Adanson's species was *Gibbula magus*. In any event it appears in many recent synonymies of *magus*.

The earliest post-Linnaean figures of this species are a pair of fairly accurate drawings in Da Costa's "British conchology" (1778, p. 44, pl. 3, figs. 1, 2). Da Costa did not recognize it as the *magus* of Linnaeus but called it *Trochus tuberculatus*.

Three years later Chemnitz (1780–1795, vol. 5, p. 101, pl. 171, figs. 1656–1660) recognized the Linnaean authorship of *magus* and supplied three very characteristic figures (figs. 1656, 1657, and 1659). Figure 1658 is not instructive, and figure 1660, which was apparently intended for the brown and white form, was, I suggest, based on a specimen of *Gibbula umbilicaris* (Linné), which is discussed below (p. 185). Chemnitz' vernacular name for the species was "Der Hexenkrausel," the German equivalent of Linnaeus' and Argenville's name.[1]

Many years elapsed before *Gibbula* Risso, 1826, was used as a good genus. Jeffreys (1862–1869, vol. 3, p. 305) placed *magus* in *Trochus*. Weinkauff (1868, p. 380) used *Trochus*, subgenus *Gibbula*. Fischer (1880, p. 110) continued to use *Trochus* alone. Beginning with the work of Bucquoy, Dautzenberg, and Dollfus on the fauna of the Roussillon (1882–1886, p. 373), Risso's generic name has been almost universally employed for this group of species.

Trochus magus is the type species of *Gibbula*, by subsequent designation, Herrmannsen, 1847. The generic name *Apiculum* of the "Museum Calonnianum" is (*fide* Thiele, 1931, p. 50) an exact synonym of *Gibbula*.

I know of no specific synonyms other than

[1] Chemnitz described "Trochus magus Linnaei" again in the eleventh volume of the same work (p. 163, pl. 196, figs. 1886, 1887). This listing is extremely equivocal, but if Chemnitz' shell there described was, in fact, *Trochus magus*, one wonders why it was necessary to add this second mention.

The description in the eleventh volume does describe *magus* in language which is a paraphrase of that in volume 5. The figures are clearly crude and highly colored drawings of that species. However, he did not mention the "Systema naturae" in his synonymy, which consist of only two references, Gualtieri (pl. 62, fig. L, 2 figs.) and Buonanni (pl. 170). The Gualtieri figures show what is apparently a trochid, but they can be referred to *magus* only by the exercise of considerable imagination. The figure from Buonanni is recognizable as *magus*.

Chemnitz remarked (p. 164) that whoever concludes that it is somewhat different from the *Trochus* which Linnaeus called *magus* should examine figures 1658–1660 in the fifth volume, a statement that might mean that the two listings referred to the same or to different species. In the few cases in which Chemnitz repeated the diagnosis of a species in a later volume, the repetition was usually made for reasons of clarification or in order to supply a better figure. In the present case this is emphatically not true.

the *T. tuberculatus* of Da Costa and the Dalat of Adanson.

Excellent descriptions of the species and its color forms are found in Bucquoy, Dautzenberg, and Dollfus (*loc. cit.*), in Fischer (*loc. cit.*), and in Pilsbry (1889, p. 197).

It is figured in Donovan (1799–1803, vol. 1, pl. 8, figs. 1, 3 figs.), in Forbes and Hanley (1853, vol. 2, pl. 65, fig. 67), in Fischer (*op. cit.*, pl. 35, figs. 1, 2, adult, and figs. 1a, b, juvenile), and in Pilsbry (*op. cit.*, pl. 30, figs. 8, 9).

Trochus modulus

1758, Systema naturae, ed. 10, p. 757, no. 508.
1767, Systema naturae, ed. 12, p. 1229, no. 586.
LOCALITY: "... E Museo Tessiniano" (1758, 1767).

"T. testa umbilicato striata: supra plicata, subtus convexiore, apertura obovata unidentata ... Testa magnitudine T. pharaonii, albida, purpurascenti-maculata, sublenticularis, supra obtuse plicata, subtus magis convexa, undique striata, juxta umbilicum in apertura Dens e columbella plicata."

The diagnosis is identical in the tenth and twelfth editions of the "Systema," except that no references were given in the tenth. A single figure from Seba was added in the twelfth. Linnaeus did not own a specimen of his *modulus*, his description being based, as he indicated, on his examination of a shell in Count Tessin's collection. His own collection in London gives us, therefore, no assistance. The Seba figure he cited (pl. 34, fig. 12) was an obvious error of transcription, as plate 34 shows only figures of fishes. An adequate figure of the present species was available to him in Seba's work (pl. 55, fig. 17) and was probably the one intended to be cited. The description is, however, so characteristic of the *modulus* of modern authors that the species was immediately identified by Linnaeus' successors from the combination of characters stated. It has only one equivocal detail: the columella is not "striated." It is markedly arched and terminated by a prominent, tooth-like projection.

The earliest post-Linnaean figures are found in Chemnitz (1780–1795, vol. 5, p. 105, pl. 171, fig. 1665, dorsal and basal aspects). Chemnitz called the species *Trochus lenticularis*, which is a name even less apt that Linnaeus' word "sublenticularis," but he followed this name with "Trochus modulus Linnaei" and in his synonymy cited the *modulus* of both editions of the "Systema." He also cited the Seba figure mentioned above as a correction of Linnaeus' erroneous reference. He correctly located the species in the West Indies, saying that it was "found in great numbers on West Indian beaches in the 'Sugar Islands'." Schröter (1783–1786, vol. 1, pl. 3, fig. 11) also supplied an acceptable figure, as did Favanne in his edition of Argenville (1780, pl. 8, fig. D).

The localities given by the early followers of Linnaeus were in part erroneous. Both Schröter and Gmelin believed the species came from the Red Sea. Favanne listed both the West Indies and Mauritius, although Lister, a century earlier, had correctly given an American locality only, the "coasts of Barbados." Even Lamarck (1822, vol. 7, p. 34) seemed in doubt, as he cited both Lister's and Gmelin's localities.

The species was placed by Lamarck (*loc. cit.*) in his genus *Monodonta* (1799), and most conchologists retained it in that genus until the erection of *Modulus* by Gray in 1842. It is the type species of that genus, by subsequent designation, Gray, 1847. *Modulus* is today universally used for the species.

Pilsbry (1930, p. 324) used *Aplodon* Rafinesque, 1819 (emend. *Haplodon* Agassiz, 1846),[1] for *Modulus*. *Turbinopsis* Conrad, 1860, is a synonym of *Modulus*, and Dall (1890–1903, pt. 2, p. 293) cited *Pseudotrochus* Heilprin, 1887 (not H. and A. Adams, 1856), as a synonym.

Trochus modulus is one of the most common species in tropical and subtropical western Atlantic waters (Bermuda, Florida, the Gulf of Mexico, and south through the West Indies to Brazil). Dall (1890–1903, pt. 2, p. 294) reported that *Modulus*, usually considered to be a Recent genus, "has existed in America continuously since the Cretaceous."

[1] Rafinesque (1819, p. 425) had reported his "*Aplodon nodosum*" as a "stray marine shell" which had apparently become mixed with some Kentucky shells he was describing. Abbott (1944, p. 2) suggested that the use of *Aplodon* in place of *Modulus* was both unwise and untenable, saying: "To suppose that Rafinesque had a *Modulus* as a 'stray marine shell' mixed in with his Kentucky shells is only to suggest that others among the marine gastropods fitting his brief description could be used equally as well. There are a few trochids that this description would cover as well as it does *Modulus*."

The present writer has collected *M. modulus*, race *floridanus* Conrad, 1869, in fair numbers in the Pliocene marl of the Caloosahatchie area. *Modulus modulus floridanus*, which is a more heavily nodulose form and which is also found Recent in west Florida and the West Indies, was considered a good species by Conrad (1869, p. 107, pl. 12, fig. 6).

It is surprising that a species so abundant in its range as *modulus*, and so distinctive in appearance and so comparatively constant in its characters, should have acquired such a voluminous synonymy. It is *Trochus lenticularis* Chemnitz, 1781; *T. filosus* Helbling, 1779; *T. perlatus* Gmelin, 1791; *?Aplodon nodosus* Rafinesque, 1819; *Trochilus unidens* "Lister" d'Orbigny; *Trochus lenticularis* "Chemnitz" d'Orbigny; and *Cricostoma striatum* "Klein" d'Orbigny, the three last names being in de la Sagra, 1845; *Modulus floridanus* Conrad, 1869; *M. krebsii* Mörch, 1876; *M. convexior*, *pisum*, and *canaliculatus* "Beck" Mörch, 1876; *Ethalia tasmanica* Tenison Woods, 1877[1]; and *Modulus corrugatus* "Stimpson" Dall, 1884.

Trochus modulus was not described in the "Museum Ulricae," and no specimen of it is to be found in the Uppsala collection.

The best figures of the species are supplied by Abbott (1944, p. 3, pl. 2, figs. 1–4; and [°1954], pl. 21, fig. f; see also Thiele, 1931, p. 205, fig. 200). All these figures are enlarged, the largest specimens of *modulus* averaging only 15 mm. in diameter.

Trochus muricatus

1758, Systema naturae, ed. 10, p. 758, no. 509.
1767, Systema naturae, ed. 12, p. 1229, no. 587.
LOCALITY: "In M. Mediterraneo" (1758, 1767).
"T. testa subumbilicata ovata: tuberculis muricatis."

This species has not been identified. The brief description has points of similarity with that of *Turbo muricatus* Linné, and this fact, combined with a confusing situation in Linnaeus' synonymy of the present species, makes one almost suspect that Linnaeus had described the same shell twice. Deshayes (1843, p. 199, footnote to *Turbo muricatus*) remarked: "There are two shells in the works of Linnaeus which have many similarities and which nevertheless are placed in two different genera with the same specific name: these are the *Trochus* and the *Turbo muricatus*. In spite of the unfortunately too short description of *Trochus muricatus* in the Museum Ulricae, it is impossible for us to identify the species and we suspect that it belongs in the genus *Littorina* as does the *Turbo muricatus*."

Turbo muricatus, on the one hand, is identified by a passably good description, the citation of a characteristic figure (Gualtieri, pl. 45, fig. E), and the presence of a specimen of the *Tectarius muricatus* in the Linnaean collection in London, in a tray marked for *Turbo muricatus*. In the identification of *Trochus muricatus*, on the other hand, we are forced to rely on a description of seven words, a questionable locality, and a single figure in the synonymy (Gualtieri, pl. 64, fig. H), which, by a peculiar and unfortunate error on the part of Linnaeus, also shows *Turbo muricatus* and is equally characteristic of that species. I suggest that whatever confusion has existed between the two species has been caused by this synonymy.

Not only are the descriptions of the two species somewhat similar, but the description of the *Turbo* species uses language that does not conform to the characters of the shell that is accepted as its representative. The word "umbilicata" is too strong a word to use for the shallow umbilical slit of *Tectarius muricatus*.[2] The word "subumbilicata," as used for the *Trochus* species, would have been more realistic. The phrase "punctis eminentibus" hardly conforms to the series of low rounded beads of *Tectarius muricatus*, and the use of a similar expression, "tuberculis muricatis," for the *Trochus* species might make one suspect that it also was overdrawn.

[1] In 1877 Tenison Woods (p. 40), in a paper on Tasmanian mollusks, described several species as belonging to the Tasmanian fauna which no later writer has reported. One of these was his *Ethalia tasmanica*. Many years later Hedley (1902, p. 40) reëxamined these specimens and determined that they were all of foreign origin, having apparently been received by Tenison Woods from abroad and inadvertently treated as local shells. The *Ethalia* species was found to be the western Atlanic *Modulus modulus*.

[2] This umbilical slit is sometimes closed and sometimes shows a comparatively deep perforation. It is always extremely difficult to determine what meaning Linnaeus gave to the words "umbilicata," subumbilicata," and "perforata."

Incidentally, neither of the Gualtieri figures cited, respectively, for the two species, shows any hint of an umbilicus or perforation. I am inclined to the view that *Trochus muricatus* was a shell more deeply sculptured then *Turbo muricatus* and possibly equipped with sharper sculpture than the low beads of that shell.

The description of *Trochus muricatus* in the "Museum Ulricae" adds a few details but puts us no closer to a categorical identification. Most of these details may be applied to *Turbo muricatus:* "Magnitudine avellanae . . . albida, acuminata," "anfractus 7, gibba," "apertura ovata, integra," and "umbilicus parvus, oblongus." Indeed the only word in the subdescription that is repugnant to the *Turbo* species is "alba" as applied to the aperture. The aperture of *Tectarius muricatus* is a dirty white for a short distance inside the lip, but the remaining area is a dark or a light tan. Possibly Linnaeus was describing a specimen in which the color was very light or had faded. However that may be, the specimen labeled *Trochus muricatus* in the Queen's collection in Uppsala is *Tectarius muricatus.* The photograph on the microfilm of the collection available to the present writer does not show the color of the aperture. I suggest that, on all the evidence and admitting that the labeling of the Uppsala collection is always suspect, the *Trochus muricatus* of the "Museum Ulricae" was the *Turbo muricatus* of the "Systema." It is impossible to say with any assurance what shells were being described by Linnaeus as *Trochus muricatus* in the "Systema" and the "Museum Ulricae," respectively, or, if the "Systema" species was, as I believe, not *Tectarius muricatus,* what induced Linnaeus to change his concept of the species when cataloguing the Queen's collection. I must leave the "Systema" name as standing for a *species dubia* and tentatively accept the "Museum Ulricae" species as identical with the *Turbo muricatus* of the "Systema."

Hanley (1855, p. 317) could find no specimen in the Linnaean collection either marked for *Trochus muricatus* or which conformed to its description. Linnaeus did not own a specimen of the shell, as the name does not appear on either of his lists of owned species, and no further imformation is found in any of his manuscripts. Hanley suggested that it belonged to the genus *Littorina,* as did Deshayes, but on what reasoning I do not know. The Mediterranean locality given by Linnaeus is not particularly useful as a guide, as Linnaeus' localities, when not verified by the name of the collector, are always doubtful. In any case the name is not discussed by the writers on the Mediterranean fauna.

Gmelin (1791, p. 3568) copied Linnaeus' description and added a subdescription which is a paraphrase of portions of the added description in the "Museum Ulricae." He referred only to the "Museum Ulricae" and the Gualtieri figure cited by Linnaeus. I feel certain that he was a mere copyist and was not familiar with the species except through the medium of the "Systema" diagnosis.

Trochus muricatus Linné must not be confused with *Trochus muricatus* Chemnitz (1780–1795, vol. 5, p. 43, pl. 163, figs. 1547–1548). Based on Chemnitz' description and figures, the latter was a strictly conical, flat-whorled, and deeply umbilicate trochid, said to come from the "Insula Sancto Mauritio" (Mauritius). It was probably the *Trochus mauritianus* of Gmelin (p. 3582) for which Gmelin cited the Chemnitz figures of "*Trochus muricatus.*"

Trochus scaber

1758, Systema naturae, ed. 10, p. 758, no. 510,
1767, Systema naturae, ed. 12, p. 1229, no. 588.
LOCALITY: Not given in either edition.
"T. testa umbilicata convexa subovata: sulcis alternis majoribus moniliformis."

Conchologists have been unable to identify this species. The description, which is the same in the tenth and twelfth editions, seems clear but cannot be tied with assurance to a known species. The lack of a stated locality and the equivocal appearance of the single figure in the synonymy (Argenville, 1742, pl. 11, fig. T) have contributed to the doubtfulness of the species.

The cited figure is crudely drawn and cannot be certainly identified. Moreover it does not entirely conform to the language of the description of either Linnaeus or Argenville. Argenville's text (p. 263) speaks of the numerous white tubercles, very salient and of different sizes, of which there are "three rows of small ones between the large." Linnaeus says

that the rows of large and small tubercles are "alternis." Argenville's figure shows neither of these arrangements but instead shows two rows of large tubercles which are adjacent and small tubercles in groups of two, three, or four. The figure is a dorsal view and does not show the umbilicus.

Favanne, however (1780, vol. 2, pp. 365–366), cited this figure for his "Sabot cerclé" which he identified with *T. scaber* Linné. Favanne's own figure (pl. 12, fig. M) was clearly based on that of Argenville, as it is almost an exact copy.[1] I agree with Hanley (1855, p. 318) that the Argenville figure "with more propriety might have been quoted for *T. maculatus*." At best it may be regarded as the nearest approximation to the shell Linnaeus described available in the pre-Linnaean iconographies.

The description of the species in the "Museum Ulricae" is, as usual, more detailed but leads one no closer to an identification. Some of the details supply lacks in the "Systema" description. The size of the shell is given as "magnitudine pisi." The aperture is "striata." The umbilicus is said to be "perforans." The color is "pulla" (dark). The final detail of the description, however, is a puzzling statement: "Affinitas summa cum Tr. Mago." *Trochus magus* can scarcely be called rough and is certainly not "the size of a pea." Philippi (1846, p. 262) referred to this comparison with *magus*, saying: "Now appears the peculiar and absurd statement; affinitas summa cum Tr. Mago; but surely Mago is a typographical error."

If Linnaeus' odd statement did, in fact, involve a typographical error, it is difficult to suggest another Linnaean trochid which he meant to compare with *scaber*. There is a remote possibility that "Mago" was a slip for *maculatus*, and indeed, as said above, the Argenville figure cited by Linnaeus for *scaber* might be taken for that shell.

The most significant fact in a discussion of the *scaber* of the "Museum Ulricae," however, is that the Uppsala collection contains a specimen of *Euchelus scaber* of some recent writers marked for *Trochus scaber*.[2] Although the vicissitudes that Queen Louisa Ulrica's collection has suffered (see Dodge, 1952, pp. 16–18, and 1955, p. 5) make the present specimens and their labels extremely suspect, the existence of a specimen in the collection today labeled *Trochus scaber* cannot be disregarded. No other specimen in the collection conforms to the description in the "Museum Ulricae" or could be confused with it. We have no evidence that any shells were added to the collection after Linnaeus examined it, and therefore the presence of this specimen seems to justify us in saying that it is, at least, the *scaber* of the "Museum Ulricae" if not of the "Systema" as well.

Several references to *scaber* Linné in the literature are here noted:

Trochus scaber was listed by Schröter (1783–1786, vol. 1, p. 658), but, as was the case with so many of his species, I cannot be convinced that he was familiar with the shell. It was not mentioned by Bruguière, Röding, or Link.

Chemnitz (1780–1795, vol. 5, p. 107, pl. 171, fig. 1667) described and figured "Der rauhe Kräusel. Trochus scaber," and referred it to the *T. scaber* of the "Systema" and the "Museum Ulricae." His description is detailed and is obviously based on the description of *T. scaber* in the "Museum." His figure is a dorsal view of a small shell, approximately 14 mm. in height, with markedly convex whorls and a well-defined suture,

[1] Both Chemnitz and Gmelin cited the Argenville figure, the former for his "Trochus asper costatus, sulcatus ex rubro et albida colore alternatis condecoratus" (1780–1795, vol. 5, p. 93, pl. 169, figs. 1633, 1634) and the latter for *Trochus costatus* (1791, p. 3571). The present writer cannot refer either of these species or the Chemnitz figures to Argenville's figure or to *scaber* Linné.

[2] *Euchelus* is of Philippi (1847, p. 20). The original list contained only two named species: *Trochus quadricarinatus* Chemnitz (*Monodonta tricarinata* Lamarck, *fide* Philippi) and *Turbo atratus* Gmelin (*Monodonta canaliculata* Lamarck, *fide* Philippi), together with "a pair of other species." Philippi said that his genus was distinguished by a circular aperture, a small tooth at the "end" of the columella, a very crenulated outer lip, and a thickly granulated transverse band. He did not refer to an umbilicus, but it should be noted that the genus contains both umbilicated and non-umbilicated species. Indeed, of the two species named by Philippi, *quadricarinatus* Chemnitz is described by its author as "imperforata," and *atratus* Gmelin, as *canaliculata* Lamarck, is described by Lamarck as "umbilicata." Both species appear to be turbinids. The most recent treatment of *Euchelus* and its subgenera is by Pilsbry (1889, pp. 429–430).

each whorl being finely striated. The color pattern is whitish, with a series of brown dots arranged spirally on all the striae. It is not clear from this drawing whether the dots are mere dots of color or represent colored tubercles. While Chemnitz did not specifically query the references to the *scaber* of the "Systema" or the "Museum Ulricae," he said in his comments: "Can this be truly the *Trochus scaber Linnaei*?" The figure, at least, cannot be referred to Linnaeus' description of *scaber*, and I am unable to guess as to the shell that he had before him.

Gmelin's treatment (1791, p. 3568) of the name is not helpful. His main description is a copy of that of Linnaeus in the "Systema," with the omission of the word "umbilicata," an omission that loses much of its significance as he referred to the listing of this name in the "Museum Ulricae" where that word was used, and in his subdescription he referred to the comparison of *scaber* with *Trochus magus* in the same work. The fact that Gmelin did not question the curious comparison with *magus* is the strongest indication that he was not familiar with the species and that he merely drew up a description based on a combination of the two Linnaean descriptions. The only indication that he had any idea what *scaber* really was is found in his citation of Chemnitz' figure 1667, with a query.

Dillwyn (1817, p. 778) was apparently unfamiliar with the species. While he listed the name, he queried his reference to the *scaber* of the "Systema," although he cited Chemnitz' *scaber*, which was based solely on the *scaber* of the "Systema" and the "Museum Ulricae," without a query, as he did his references to Schröter and Gmelin. As was his usual practice in the case of species doubtful to him, he began his comments with the words: "Linnaeus has described this shell to be. . ." He recognized that the figure Linnaeus cited from Argenville differed from his description "and is probably *T. costatus* or *T. inequalis*." Those two species of Chemnitz are different from the Argenville figure and radically different from each other.

Neither Lamarck nor Deshayes in the second edition of Lamarck referred to the species.

Philippi (1846, p. 262, pl. 39, fig. 2) listed and figured a "*Trochus scaber* L.?" which he described in part as "umbilico perforata, granulato-cingulata, fuscescente; cingulis elevatis majoribus circa quinque in anfractu penultimo, circa 9 in ultimo, cum minoribus allemantibus, interstitiis punctato foveolatis. . ." He cited as references *T. scaber* of the "Museum Ulricae," with a query, the Chemnitz figure 1667, with a double question mark, but the *scaber* of the "Systema" and Gmelin he referred to without a query. He insisted that Chemnitz' species was something other than *scaber*. He did not give any locality for the species. His figure shows a purplish shell, striated, and with convex, step-like whorls, but it is difficult to determine from the drawing whether the dark spots on the striae are mere spots of color or granulations, although he described the shell as "granulato-cingulata."

Hanley (1855, p. 318) could not identify *scaber*, and no specimen referable to it was found in the Linnaean collection in London. Linnaeus did not own the species, as its serial number is not underlined to indicate an owned specimen in his copy of either the tenth or twelfth editions. Hanley concluded by suggesting that "our sole hope of ever recognizing it must rest in the 'Museum Ulricae.' " Hanley never saw the Queen's collection on which the "Museum Ulricae" was based, but Odhner (1953, p. 17) reports that the specimen marked for *T. scaber* is, as said above, a specimen of *Euchelus scaber*, and the microfilm of the collection fully confirms this identification.

The possible identification of the present species with the *scaber* of authors is thoroughly discussed by Fischer (1880, p. 288, pl. 93, fig. 2). Fischer called it *Trochus scaber* Chemnitz and cited for it the Chemnitz figure 1667, the *T. scaber* of both the "Systema" and the "Museum Ulricae," and *Trochus scaber* Philippi, both the Linnaean references and that of Philippi being questioned. His doubts are clearly expressed in his text (p. 289): "It has not been definitely identified with the *Trochus scaber* of Linné; it is even probable that the name does not apply to our shell; I think that Chemnitz attributed the name of *Trochus scaber* to the shell which we here describe. The figure given by Philippi appears to me to be somewhat different from

Chemnitz' type." Fischer's own figure is of a strongly striated shell, with a pronounced suture and a somewhat turreted outline, but, unlike Philippi's figure, is mottled with pinkish blotches arranged roughly in a longitudinal pattern. The figure greatly resembles that of Philippi in all other respects.

Pilsbry (1889, p. 438, pl. 38, fig. 8, pl. 57, fig. 23) also listed a *scaber*, but placed it in *Euchelus* Philippi, attributing the specific name to Fischer, rather than to Chemnitz as Fischer had done. He was, however, not entirely satisfied with this attribution, as appears from the following quotation (p. 439): "As a temporary expedient I have taken Fischer's name for this shell, giving himself instead of Chemnitz as author only. I do this because it seems to me scarcely possible that it is the form named by Chemnitz. I believe that Philippi's '?*T. scaber* L.' to be the same [?as Fischer's] but am not at all sure that it is the *T. scaber of* Linné. I would suggest Chemnitz' and Linné's names be allowed to lapse as wholly unidentifiable; Philippi's *scaber* is somewhat doubtful; but as Fischer has given us an unmistakable portrait of a distinct, well-marked species, I am willing to consider his decision final. However this question may be settled, I have before me specimens of the shell agreeing with those so well described and figured in Fischer's magnificent monograph." Pilsbry suggested no specific synonyms for this *scaber* of authors and located the species in the Indian Ocean, with the addition of a more restricted locality, "Singapore," with a query.

Thus Pilsbry accepts Fischer's name as representing a well-known species but did not accept Fischer's attribution of the species to Chemnitz, and decided not to associate it with *scaber* Linné, an unidentified name.

It is difficult to quarrel with Pilsbry's conclusions or his acceptance of Fischer as the author of the species *Euchelus scaber*. The *scaber* or the "Systema" is ill described and supported only by a figure which is crude and is utterly dissimilar to any of the later figures of "*scaber*." The *scaber* of Chemnitz is supported by no reference except that of Linnaeus, and his figure is surely not that of Philippi, Fischer, or Pilsbry. Philippi's *scaber* more resembles the *Trochus scaber of* Fischer and the *Euchelus scaber* of Pilsbry. I am, however, sufficiently impressed by the similarity of the Linnaean descriptions in the "Systema" and the "Museum Ulricae" and the significant situation in the Uppsala collection to believe that it is highly probable that the specimen of the *scaber* of authors in that collection was actually the shell described by Linnaeus in both works. It must be remembered that none of the writers mentioned above, in all probability, had ever seen that collection or knew of the existence of the specimen in question. The evidence here presented is to me convincing but is, technically speaking, not sufficient to justify our accepting Linnaeus as the author of the species, particularly in view of the question that must always arise as to the credibility of the Uppsala labels.

Euchelus scaber is well figured in the Fischer and Pilsbry colored plates above mentioned.

Since Pilsbry's comments, I have found no useful discussion of the present species.

Trochus varius

1758, Systema naturae, ed. 10, p. 758, no. 511.
1767, Systema naturae, ed. 12, p. 1229, no. 589.
LOCALITY: "In M. Mediterraneo" (1758, 1787).
"T. testa oblique umbilicata convexa, anfractibus submarginatis . . . Testa convexa, cincta margine obsoleta, pallida fasciis cinerascentibus."

It is very doubtful that this species could have been identified from its very unilluminating and equivocal description. The Mediterranean *Gibbula varia* of authors does conform to the few details of the description and to Linnaeus' locality, but certain confusing details appear in Linnaeus' language. The phrase "anfractibus submarginatis," which he habitually employed, would lead us to expect a much more obvious marginal angle than the species possesses, and, in fact, only the basal end of the body whorl shows a curve that might be termed obsoletely angulate, while the whorls of the spire are evenly rounded. Linnaeus employed the word "subangulate" very loosely and equivocally throughout his works. Secondly, the species rarely shows the "pallidis fasciis cinerascentibus" of the description. The great majority of specimens are either a uniform dirty brown or show an indistinct pattern of darker dots irregularly disposed. Moreover the descrip-

tion omits any reference to the pearly interior of the aperture or to the fine spiral striation over the entire shell, features that were habitually mentioned by Linnaeus when they were present. However, these striations are almost microscopic, and it may be that Linnaeus considered them unworthy of mention or, more probably, that he failed to examine his type with a lens.

A specimen of the *Gibbula varia* of authors complying generally with the description in the "Systema" was found by Hanley (1855, p. 318) in the Linnaean collection in London in a receptacle marked for *Trochus varius*, and, as the serial number of *varius* was underlined in Linnaeus' working copy of the twelfth edition, we have evidence that he owned a specimen of the species, and the acceptance of this specimen as his type may be justified on a "possible" basis.

Only one writer had arrived at this identification prior to Hanley's examination of the Linnaean collection. Philippi (1836–1844, vol. 1, p. 180) had already identified the Mediterranean shell with *Trochus varius*, and his figure (pl. 10, fig. 10) is a reasonably good picture of the species. The early conchologists following Linnaeus had not recognized *T. varius*. Martini, Chemnitz, Born, Poli, Chiaje, Röding, Montfort, Lamarck, and Deshayes had not mentioned this specific name. Schröter (1783–1786, vol. 1, p. 659) listed it but clearly indicated that he was not familiar with it. Bruguière's volume 1 of the "Histoire naturelle des vers," the only volume completed by him, contained the genera alphabetically only as far as *Conus*. Gmelin listed it (1791, p. 3568) and copied the Linnaean description except for the word "convexa" and for alterations in the order of the phrases. It is possible that he had a specimen before him, although his frequent alterations of Linnaeus' grammar and changes in the order of phrases or words make it possible that he was a mere copyist. I suggest that he was not familiar with the species. Dillwyn (1817, p. 779) included the name, copied Linnaeus' description in translation, and cited the Gmelin and Schröter references, but his comment that "Linnaeus . . . only says that. . ." is sufficient evidence that he was a mere reporter of prior mentions of the shell. Since Philippi and Hanley, there has been little question of the identification of the species except that Payraudeau's *Trochus racketti* (1826, p. 130, pl. 10, fig. 19) and Brusina's *G. gibbosula* and *purpurata* have been cited by some authors as representing young specimens of *G. varia*. It is possible that *T. roissyi* Payraudeau, 1826, not of Blainville, 1830, *T. pallidus* Forbes, 1843, and *G. elata* Brusina, 1866, which have been cited as synonyms by Bucquoy, Dautzenberg, and Dollfus (1882–1886, p. 385) were indeed identical with the present species. The available figures of these last species are not convincing.[1]

Trochus varius is now almost universally placed in the genus *Gibbula* Risso, 1826.

Good figures of *varia* are scarce, largely because the available figures show the color pattern as too brilliant and too well defined. It is figured by Fischer (1880, pl. 87, figs. 2, 2a, 2b) and by Pilsbry (1889, pl. 33, figs. 77, 80–81). These references show both the dorsal and apertural aspects of the shell. Philippi's figures (1846, pl. 29, fig. 13, dorsal and apertural aspects) are the most accurate figures, as being the most realistically and soberly colored.

The species was not described in the "Museum Ulricae."

Trochus cinerarius

1758, Systema naturae, ed. 10, p. 758, no. 512.
1767, Systema naturae, ed. 12, p. 1229, no. 590.
LOCALITY: "In M. Mediterraneo, Norvegico" (1758, 1767).
"T. testa oblique umbilicata ovata, anfractibus rotundatis . . . Testa cinera fasciis obliquis pallidis."

I agree with Hanley (1855, p. 318) that it is astonishing that the early followers of Linnaeus should have been able to identify this species from its inadequate description, unsupported by a synonymy. Even the few

[1] Philippi (1846, pp. 191–192) in his treatment of *Trochus varius* in the "Neue Ausgabe" of the "Conchylien-Cabinet" suggested, with some doubt, that Gmelin's *T. laevigatus* (1791, p. 3573) might be identical with *T. varius*. Gmelin referred *laevigatus* to a Chemnitz figure (1780–1795, vol. 5, p. 108, pl. 171, fig. 1670). Based on this figure and the descriptions of both Gmelin and Chemnitz ("Trochus laevis, umbilico sinuato"), Philippi's tentative suggestion seems to have merit and, if so, is another instance of Gmelin's use of two names for the same species.

words of the description do not entirely conform to the *Gibbula cineraria* of modern authors. That species bears dark, reddish brown oblique zigzag or broken stripes instead of the "fasciis . . . pallidis" called for in the description. Moreover, the very slight convexity of the whorls does not justify the word "rotundatis."

The locality given by Linnaeus is partly incorrect, as the shell is not found in the Mediterranean. Its range is on the Atlantic coast of Europe from Scandinavia to Gibraltar. I have seen only one lot of specimens labeled as from the Mediterranean Sea and suggest that this report was erroneous. No recent authors, including the important writers on the Mediterranean fauna, have reported it from that region. Fischer (1880, p. 192) said "Its presence in the Mediterranean is very doubtful." Pilsbry (1889, p. 208) added "Black Sea" to the Atlantic localities, but with a question mark.

Trochus cinerarius was listed in the "Fauna Suecica" (1761, ed. 2, p. 524), but the description was only a copy of that in the tenth edition of the "Systema," though omitting the subdescription. The specific name was apparently derived from what seemed to Linnaeus to be the background color of the shell, but in all specimens examined by the present writer this ground color is a light tan rather than ashen.

The diagnosis was so unsatisfactory to Hanley and the confusion of some of Linnaeus' successors so apparent that he was not willing to attribute the name to Linnaeus, although he had found a specimen of the *cinerarius* of authors in a tray in the Linnaean collection in London properly marked for *cinerarius*. Hanley's usual practice was to consider an unmarked specimen in an accurately marked receptacle as the probable type if, as was the case here, there was no other specimen in the collection that conformed more closely to Linnaeus' description of the species in question. In the case of *cinerarius*, however, he was so impressed with the equivocal character of the description that he felt obliged to modify that view, saying: "The Linnean appellation can have no claim to precedence, on its own merits; to quote an inapplicable description is but to foster error. This shell has been termed *lineatus* (a suggestive epithet) by Da Costa, who has clearly defined it, and, since it was impossible for him to recognize the Linnean shell from its published definition, it seems but justice to retain his name for it."

The probability is so great, however, that the specimen in the collection was, in fact, Linnaeus' type specimen that we should be unwilling to treat *cinerarius* as a *species dubia*. Hanley's argument is unrealistic, and, if my assumption as to the type authority of the specimen is sound, is a violation of the Rule of Priority. If we are to choose between the retention of a Linnaean name, which was in all probability given to a shell so known today, and a later name, we should, I submit, treat the case as one falling within the framework of the Rule of Priority.

Da Costa (1778, pp. 42–43, pl. 3, figs. 5, 6) described, and possibly attempted to figure, two species that he called *Trochus cinereus* and *T. lineatus*, respectively. He did not refer to Linnaeus' *cinerarius* for either species, and it must be assumed that he did not associate either of the species with it. Their descriptions disclose important distinguishing characters and, in spite of the similiarity of the name *cinereus* to that of Linnaeus' species, Da Costa's *lineatus* has been generally, and I think properly, accepted as the representative of *cinerarius*. Among other differences the base of *cinereus* was said to be "very concave" and that of *lineatus* "a little convex." Linnaeus' *cinerarius* has a slightly convex base. For *cinereus* he referred to the base as being deeply umbilicate, whereas *lineatus* was said to have a narrowly perforate base, which is true of *cinerarius*. Moreover the umbilical area of *cinereus* is said to be "of a fine light greenish color," a feature not seen in *cinerarius*. Based on the entire definition of *lineatus*, we are given a very complete picture of *Trochus cinerarius* Linné, and Da Costa's name is included in most later synonymies of *cinerarius*. Da Costa's figures, however, are grossly inaccurate. They seem to show dorsal and basal views of the same shell, a rather elevated specimen with a sharp apex and of a brilliant red color decorated with broad and sinuous black longitudinal stripes. Moreover they are of a shell much larger than any adult *cinerarius*. They must be disregarded in any discussion of the species. A puzzling

feature of Da Costa's treatment of this group is that good figures of *cinerarius* are found on the same plate (figs. 9, 10, dorsal and basal aspects) but are nowhere referred to in the text. It is obvious that Da Costa committed an error of transcription and a further error in not giving a name to figures 9 and 10.[1]

Born (1780, p. 330, pl. 11, figs. 19, 20) described and figured a *Trochus cinerarius* which he attributed to Linnaeus. His figures cannot be associated with the Linnaean shell, but much more closely resemble *Trochus albidus* Gmelin (1791, p. 3576) and were, in fact, cited for that species by Gmelin.[2] Chemnitz, in his discussion of *cinerarius* (1780–1795, vol. 5, p. 117), said of the Born figures: "The *Trochus cinerarius* which Herr von Born described in his Index and in his other work, de testaceis Mus. Caes., and pictured on plate 11, figures 19–20, seems to be a very different species which I would not venture to pass upon." It is possible, however, that Chemnitz indirectly referred to the species later called *albidus* by Gmelin, by mentioning what he apparently considered a color form of *cinerarius* "having reddish brown spots on a white background." Chemnitz' own figure of *cinerarius* (*tom. cit.*, pl. 171, fig. 1686) was the first acceptable figure of the species. He referred in his text to the descriptions in the "Systema" and the "Fauna Suecica," but supplied no further description except to say: "Probably Linnaeus gave the name *cinerarius* to this *Trochus* because it always appears as if dusted with fine ashes. . . . It is found on the Norwegian beaches," and adding the phrase above quoted as to the white background, and a mention of the "mother-of-pearl" surface under the outer coat.

Link (1807, p. 133) removed *cinerarius* from *Trochus*, placing it in *Turbo* in the company of *magicus*, his new name for *Trochus magus* Linné, and *obliquatus* Gmelin (see discussion of *Trochus umbilicaris* Linné, p. 185, below), all three species, being trochids, being now placed in *Gibbula* Risso, 1826. He cited for *cinerarius* both the *cinerarius* of Gmelin and Chemnitz' figure 1686 which the latter cited for *cinerarius*.

Dillwyn (1817, pp. 779–780) was the first to place *lineatus* Da Costa in the synonymy of this species.

Deshayes (1843, pp. 149–150, footnote) was the first to discuss critically the relationships of the two Da Costa species *cinereus* and *lineatus* with *cinerarius* Linné. His comments are quoted in full: "There exists in the European seas two closely related species

[1] *Trochus cinereus* Da Costa was treated by the latter as a British shell, and was accepted as such by Maton and Rackett, Turton, and other British writers of that period, and as a Mediterranean species by Montagu and Dillwyn. Donovan, however, as early as 1803 (1799–1803, vol. 5, pl. 155, fig. 2, dorsal and basal aspects) had already queried the British locality, saying: "This shell is described and figured by Da Costa from the specimen at present in our possession, the only inducement we have for inserting it, for though this writer [Da Costa] observes that it is a common shell on several of our coasts, we must acknowledge it has never occurred to us as a British shell. Exotic specimens we have, but they are said to have been brought from the South Seas. Da Costa, we have a strong suspicion, was mistaken concerning this shell."

The species has never been authoritatively reported from the British Isles or the Mediterranean, those early writers who called it British having merely followed Da Costa's locality. However, Da Costa's long and clear description of *cinereus* gives a very graphic picture of the West Indian *Tegula excavata* (Lamarck, 1822), popularly called the "Greenbase Tegula" by American writers, and I am convinced of their common identity. Forbes and Hanley (1853, vol. 2, p. 536) first adopted this identification by placing *Trochus excavatus* Lamarck in the synonymy of *T. cinereus* Da Costa, saying that the latter was a native of the West Indies. Pilsbry (1889, pp. 292–293) was of the same opinion, saying that *T. cinereus* Da Costa and some other English writers is "a species synonymous with the West Indian *Trochus* (*Omphalius*) *excavatus* Lam." *Omphalius* Philippi, 1847, is a synonym of *Chlorostoma* Swainson, 1840, which is now variously treated as a subgenus or section of *Tegula* Lesson, 1832. Pilsbry retained the name *cinereus* Da Costa, a selection which is in strict conformity with the Rule of Priority.

Da Costa's species is not *Turbo cinereus* Couthouy, 1838–1839 (*Margarita cinerea* Gould, 1841, and Binney, 1870), a much smaller northwest Atlantic and circumboreal trochid, the range of which, according to Pilsbry, is Massachusetts, the Hebrides, Norway and northward, and Bering Sea.

The green tinted umbilical area often seen in *Tegula excavata* reflects Da Costa's description of *cinereus:* ". . . the beginning of the umbilicus is generally pearly, and of a fine light greenish color." It should be noted, however, that the extent of the green color is very variable. Specimens from some localities do not show a trace of green and, where green is present, it usually forms a crescent-shaped arc around one side of the umbilicus.

[2] Gmelin's description of *albidus* conforms to the Born figures and does not apply to *cinerarius:* "Testa conica *alba*, fasciis obliquis fuscis, *anfractibus prope suturam canaliculatis*" (italics mine).

which have been often confounded under the common designation of *Trochus cinerarius*. Nevertheless, Da Costa was able to distinguish these two species: the one which is flattened and widely umbilicate was given by him the name *Trochus cinereus;* the other, more conical, merely perforate at the base and adorned with narrower and more numerous lines, was named *Trochus lineatus* by the same author. It is this which is referred to the *Trochus cinerarius* of Linné. It is certain that the Linnean species is one of the two in question, and we agree with Dillwyn that the *cinerarius* is the same shell as the *lineatus* of Da Costa. It is because of this that we give it in the synonymy."

Since Deshayes there has been no question of the identification of *cinerarius* or that Da Costa's *lineatus* is an exact synonym. The species has, however, received several other names: it is *Trochus lineolatus* Potiez and Michaud, 1838; *Trochus litteratus* T. Brown, 1827; *Trochus perforatus* J. Smith, 1839; *Trochus philberti* Recluz, 1843; and *Trochus fumosus* Philippi, 1849.

It is figured by Donovan (1799–1803, vol. 3, pl. 74, upper and lower figures only), by Fischer (1880, pl. 62, fig. 4, three figs.), and by Pilsbry (1889, pl. 30, figs. 23, 24, pl. 33, figs. 86–88).

The species belongs in the genus *Gibbula* Risso, 1826. It was not described in the "Museum Ulricae."

Trochus divaricatus

1758, Systema naturae, ed. 10, p. 758, no. 513.
1767, Systema naturae, ed. 12, p. 1229, no. 591.
LOCALITY: "In M. Mediterraneo" (1758, 1767).
"T. testa subumbilicata ovata: anfractu infimo remotiore, umbilico subconsolidato . . . Testa viridis, fasciata punctis sanguineis. Anfractus versus aperturam magis remotus a reliqua spira."

Hanley (1855, p. 319) spoke of the "insufficiency of the description" of this species. Not only is the description not less detailed than the majority of the descriptions in *Trochus* Linné, but the details given include all features necessary for identification. In particular, the description of the color pattern and the body whorl clearly differentiate this species from any other Linnaean trochid.[1] A specimen of the *Gibbula divaricata* of modern authors is present in a properly marked receptacle in the Linnaean collection in London. This method of documentation is, of course, not so conclusive as the marking of the shell itself, particularly when, as in the present case, we have no evidence that Linnaeus ever owned a specimen of the shell, and thus the question arises whether it may not have been added to the collection later.

No synonymy was supplied. The species is not figured in any of the works available to Linnaeus, and, indeed, Deshayes said as late as 1843 (p. 152, footnote) that he was unable to find a good figure of the shell. The locality is correct. *Gibbula divaricata* has not been authoritatively reported from points outside the Mediterranean Sea except by Nobre who found it on the southwest coast of Portugal.

The species was well and exhaustively redescribed by Deshayes (*loc. cit.*), whose description emphasizes the greenish ground color of the shell, "ornamented with small oblique lines, often sinuous, formed by small dots of vivid red." Both the original description and the redescription speak of this coloration as formed of spots. This arrangement is constantly true of the ornamentation of the whorls of the spire, but in many individuals these spots have coalesced on the body whorl into partially interrupted sinuous or zigzag red stripes.

In spite of Linnaeus' accurate description, many of his immediate followers omitted to mention the species. Schröter (1783–1786, vol. 1, p. 660) and Dillwyn (1817, p. 781) listed the species and copied the "Systema" description, but I am not convinced that either one was familiar with it. Indeed, Philippi (1846, p. 193) said of Schröter's treatment that it was a "mera translatio verborum Linnaei." Martini, Chemnitz, Röding, Link, and Lamarck did not refer to *divaricatus*.[2]

[1] The specific name itself is derived from the verb "divarico," to "spread apart" or "be divergent," and is based on the peculiar and abrupt swelling of the body whorl which leaves a deep, trough-like suture between this whorl and the spire whorls.

[2] Dillwyn (*loc. cit.*, in text) listed *Trochus divaricatus* Fabricius of the "Fauna Groenlandica" (1780, p. 392) as being a synonym of *divaricatus* Linné, and said that the Linnaean species "Inhabits the Mediterranean, and coasts of Norway. Linnaeus." The latter location was not given by Linnaeus in either the tenth or twelfth editions of the "Systema." Forbes and Hanley (1853,

Philippi was the first writer to recognize effectively the Mediterranean *divaricatus* of authors as the *Trochus divaricatus* of Linnaeus, and to figure it (*op. cit.*, pl. 29, figs. 16, 21) adequately, although the *Monodonta lessonii* of Payraudeau (1826, p. 139, pl. 7, figs. 3, 4) was undoubtedly the Linnaean species. Weinkauff (1868, vol. 2, p. 382) gave "*Trochus cinerarius* Petit, non Lamk." (1852, p. 179) as a synonym. Petit's *Trochus cinerarius* in the 1852 paper was synonymized with *T. divaricatus* Gmelin, which I treat as identical with *divaricatus* Linné. In his 1869 work (p. 117) he synonymized *divaricatus* with *Turbo sanguineus* "Gmel. non. L." *Trochus divaricatus* of both Linnaeus and Gmelin has no relationship with *cinerarius* Linné, and *Turbo sanguineus* of Linnaeus and Gmelin has no relationship with either. Petit's synonymies in the two works mentioned serve to show the difficulties encountered by the conchologists of the eighteenth and most of the nineteenth century in understanding the Mediterranean *Gibbula* species.

Good recent figures of *Trochus divaricatus* are found in Fischer (1880, pl. 47, figs. 1, 2, four figures), in Bucquoy, Dautzenberg, and Dollfus (1882–1886, pl. 46, figs. 15–17), and in Pilsbry (1889, pl. 33, figs. 74–76, 78, 79). All these references show the dorsal and basal aspects of the shell. The figures from Bucquoy, Dautzenberg, and Dollfus are photographic and do not show color pattern but are excellent in showing the peculiar bulging of the body whorl. Of the earlier figures, those in the "Neue Ausgabe" of the Martini-Chemnitz work (1846, vol. 2, div. 2, pl. 29, figs. 16, 21) are excellent.

The species belongs in the genus *Gibbula* Risso, 1826.

It was not described in the "Museum Ulricae."

Trochus umbilicaris

1758, Systema naturae, ed. 10, p. 758, no. 514.
1767, Systema naturae, ed. 12, p. 1229, no. 592.
LOCALITY: "In M. Mediterraneo" (1758, 1767).

"T. testa clyindrico-umbilicata conico-convexa: anfractus submarginato . . . Testa saepius ferruginea nebulosa; umbilicus pervius teres exacte clyindricus, praeter anfractus minores interiores et intus albus."

A certain amount of confusion between this species and *Trochus obliquatus* Gmelin (1791, p. 3575), a British shell, is apparent in the works of the early nineteenth century conchologists. The British species was called *T. umbilicatus* by Montagu (1803), and it is reasonable to assume that at least part of the confusion was caused by this similarity of names. In the following discussion the name *umbilicatus* is used for convenience, although Gmelin's name has priority. The confusion was not lessened by Da Costa who described as *T. umbilicalis* a shell that, based on his figure (1778, p. 46, pl. 3, fig. 4. a basal view), appears to be *umbilicatus* Montagu.

The group of species in *Trochus* Linné now placed in *Gibbula* Risso, 1826, of which *umbilicaris* is one, has been troublesome to conchologists not only because of the considerable variation within each species but because Linnaeus' descriptions are for the most part equivocal and unrewarding, and none of them, with the exception of that of *T. magus* (p. 172, above), was supplied with a pictorial synonymy. Even the synonymy of

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vol. 3, p. 62), in their discussion of *Lacuna vincta* Montagu, 1803, give "*Turbo divaricatus* (not of Linn.) O. Fabric. Fauna Groenlandia, p. 392?" as a synonym. The specific name of Fabricius has been restored as it has 23 years' priority over that of Montagu. Fabricius' shell is the species cited by Dillwyn as a synonym of *T. divaricatus* Linné. Fabricius' description does in some respects comply with the requirements of Linnaeus' description of his *divaricatus*, but in describing the color pattern as "viridis 3 fasciis ferrugineis in anfractu majore," he omitted to say whether these fascia were spiral or longitudinal. *Lacuna divaricata* typically shows three *spiral* reddish bands on the body whorl, although in many individuals and in all specimens seen by the present writer, all decoration is lacking, and, according to the figures of the species, this banding is variable in both number and disposition of the bands (see Pilsbry's figures, 1889, pl. 50, figs. 61, 62, 64–73, 75). It is a smaller shell than *divaricatus* Linné, is extremely light, and of a *Littorina*-like shape. It is, of course, entirely unrelated to the present species. It ranges from northern Europe to Iceland, Greenland, and New England (see Binney, 1870, p. 302, as *Lacuna vincta* Montagu). It is also circumboreal, as it is found on the northwest American coast. It is curious that Dillwyn could have believed that a species could live in the warm waters of the Mediterranean and also in the Arctic Seas. Philippi (*loc. cit.*, in text) also disassociated the Linnaean species from that of Fabricius, saying, "quod *Lacuna divaricata* species toto coelo diversa est." Mörch (1842, p. 19), in his work on the Mollusca of Greenland, also credited a Linnaean authorship to *Lacuna divaricata*, as he listed it as "*Trochus divaricatus* F.G.L."

magus is, as has been noted, extremely unsatisfactory.

The earliest post-Linnaean use of the name *T. umbilicaris* was by Born (1780, p. 331) who also supplied the first good figures (pl. 12, figs. 1, 2), which unquestionably show the Linnaean species. Born's treatment of the species is, however, somewhat equivocal, as in his 1778 work (p. 335) he listed the species as *T. umbilicatus*, although he could not have been confused by Montagu's name which was not proposed until 25 years later. The Born figures were said by Hanley (1855, p. 319) to show *T. fuscatus* Gmelin (1791, p. 3576). Hanley found a specimen of the shell then called *fuscatus* in a tray marked for *umbilicaris* in the Linnaean collection in London, and this specimen may therefore be accepted as Linnaeus' "probable" type. Gmelin's *fuscatus* is referred only to the Born figures above mentioned and he added the words "Trochus umbilicaris" to the reference. While he gave no locality, his short description and his sole reference adequately tie *fuscatus* to *umbilicaris* Linné. For *Trochus umbilicaris*, which Gmelin described separately, he merely copied the Linnaean description and referred to a pair of Chemnitz figures (1780–1795, vol. 5, p. 106, pl. 171, fig. 1666, two figs.), which are unlike any form of *umbilicaris* I have seen. I suggest the possibility that they were based on a specimen of *Tegula excavata* (Lamarck). (See discussion of *T. cinerarius* Linné and *cinereus* Da Costa, p. 183, footnote, above.) These figures were, however, called *umbilicaris* Linné by Chemnitz, who cited for that species the Born and "Systema" descriptions. In addition to these questionable figures, Chemnitz located the species not only in the Mediterranean, where it properly belongs, but in the West Indies as well.

Chemnitz (*tom. cit.*, p. 117, pl. 171, fig. 1685) also listed and figured a "Trochus oblique radiatus," the figure for which is recognizable as *umbilicatus* Montagu (*obliquatus* Gmelin). Gmelin cited this figure for his *obliquatus*, and it is safe to assume that he drew his name from the "oblique" of Chemnitz' name. Chemnitz located this species in the Mediterranean, whereas it is a British shell with a range extending along the European Atlantic coast. Gmelin also erred in calling *obliquatus* a Mediterranean species.

Röding (1798, p. 88) listed a *Turbo umbilicalis* which he referred to Chemnitz' figures numbered 1666 which were supplied by Chemnitz for *umbilicaris* Linné but which seem closer to *umbilicatus* Montagu. It is possible that Röding copied the spelling of his species from Da Costa's *umbilicalis*, which is *umbilicatus* Montagu. In the last analysis, I cannot determine just which species Röding was describing.

Dillwyn (1817, p. 781) disagreed with the view that *fuscatus* Gmelin and *umbilicaris* Linné were the same, as he listed them separately as good species. For *fuscatus* he referred not only to Gmelin's use of the name but to the *umbilicaris* of Born, apparently assuming that Born's species was not that of Linnaeus. For *umbilicaris*, described on the same page, he referred to the *umbilicaris* of Linnaeus, Chemnitz, Schröter, and Gmelin, and added: "Born, though he has quoted the *T. umbilicaris* of Linnaeus and Pennant, has figured under this name a very different shell, which is the *T. fuscatus* of Gmelin." His thesis is based entirely on what I consider his erroneous interpretation of the Born figures. Dillwyn's *T. obliquatus* (p. 779) is properly referred to *obliquatus* Gmelin, the *umbilicatus* of Montagu, and the "Trochus oblique radiatus" of Chemnitz. He added a reference to Da Costa's *umbilicalis* which is also *umbilicatus*.

Deshayes (1843, p. 147, footnote under *T. umbilicaris*) dissented from the view that *umbilicaris* Born was *umbilicaris* Linné. His remarks are quoted in full: "Two very different species have received the same name. The first was named by Linné in the 10th edition of the *Systema naturae;* the second was given the same name, *Trochus umbilicaris*, much later by Born. Gmelin did not confuse the two species. He left to the first its Linnaean name, and proposed to name the second *Trochus fuscatus*, a name which has been generally adopted. It happens, because of this similitude of names, that some people have persisted in preserving the name of *Ombilicaris* [*sic*] for Born's species, and others such as MM. Payraudeau and Philippi, have confused them, although there is a great difference between them. Indeed, the Linnaean species resembles *Trochus concavus*, while that of Born has quite the appearance of a

Cadran [a solarid]." I am unable to agree with this conclusion as to the two uses of the name. Moreover, *Trochus concavus* Gmelin (1791, p. 3570) can hardly be compared to *umbilicaris* Linné. Its base is far more concave, its deep umbilical depression is funnel-shaped rather than cylindrical, and it has longitudinal sinuous ribs. I can see little resemblance to a solarid species in Born's figures.

The confusion between *umbilicaris* Linné and *umbilicatus* Montagu is no longer apparent in literature, but persisted to some extent until the year 1869, when Petit de la Saussaye (p. 180), under the name *umbilicaris*, included in his synonymy *umbilicatus* Montagu, 1803, and *obliquatus* Gmelin, 1791, in addition to *Gibbula mediterranea* Risso, 1826, a new name for *umbilicaris* Linné, and *fuscatus* Born, 1780 [*sic*].

The name *fuscatus* Gmelin, as a good species, persisted for many years in the works of some writers and is occasionally found in recent lists. It should be thrown into the synonymy of *umbilicaris* Linné. The common identity of the two names was unequivocally asserted by Bucquoy, Dautzenberg and Dollfus (1882–1886, p. 376), and since that time the thesis of Dillwyn, Deshayes, and others of the earlier writers has not been seriously advanced. Bucquoy, Dautzenberg, and Dollfus insist that Gmelin could not have recognized the Linnaean *umbilicaris*, a view with which I entirely agree.

Other synonyms of *umbilicaris* are: *Gibbula mediterranea* and *desserea* Risso, 1826, and *Trochus roissyi* Blainville, 1830 (not Payraudeau, 1826).

The present species is, primarily at least, a Mediterranean shell, but it has been reported from the Atlantic coast of Europe. Born added the coast of Denmark and England to the Mediterranean locality, but localities given as early as 1780 must always be viewed with suspicion. Weinkauff (1868, p. 376) gave its range as the Atlantic coast of Spain in addition to the Mediterranean. Nobre (1931, p. 220) reported it from the coast of Portugal. While the present writer has seen no specimens labeled as from points outside the Mediterranean, these Atlantic reports may be correct, though it is possible that Weinkauff's and Nobre's specimens were the *umbilicatus* of Montagu. Fischer (1880, p. 143), Bucquoy, Dautzenberg, and Dollfus (*loc. cit.*), and Pilsbry (1889, p. 203) confine its range to the Mediterranean.

Trochus umbilicaris Linné and *T. umbilicatus* Montagu (*obliquatus* Gmelin) are readily distinguishable. The former is a chocolate-brown shell, with a convex base which is finely and closely concentrically striated, the striae being distantly articulated with white dots. The umbilicus is wide and cylindrical rather than funnel-shaped, the anterior edge being deeply wrinkled. The whorls are slightly convex and are also finely striated, the body whorl showing a series of whitish dots at the periphery and just above the suture. The species shows considerable variation in the size and frequency of the white dots, and in some individuals the dots on the upper whorls are above the suture. The aperture is nacreous, and the columella is thin and without teeth. Young specimens are more visibly spirally striated. *Gibbula umbilicata*, on the other hand, has a flatter base, the spiral striae are sharper and less numerous, and the color pattern consists of a series of longitudinal red streaks, usually sinuous or zigzag, or broken into spots by the low sculpture.

The present species was not described in the "Museum Ulricae."

Apiculum, of the "Museum Calonnianum" (1797), which is an unavailable name under the terms of Opinion 51, is an exact synonym of *Gibbula*. *Gibbula* has been drastically divided by Thiele (1931, p. 50), *umbilicaris* being included by him in the section *Tumulus* Monterosato, 1888.

Most of the figures of *umbilicaris* are unsatisfactory. The best are found in Jeffreys (1862–1869, vol. 5, pl. 62, figs. 4, two figs.), Fischer (1880, pl. 48, fig. 2, two figs.), and Pilsbry (1889, pl. 32, figs. 63–65).

Trochus umbilicatus Montagu (*obliquatus* Gmelin) is figured by Pilsbry (*tom. cit.*, pl. 30, figs. 11–16) and by Fischer (*tom. cit.*, pl. 62, fig. 2, and fig. 3, two figs., and pl. 107, fig. 5).

Trochus solaris

1767, Systema naturae, ed. 12, p. 1229, no. 593.
LOCALITY: "In India Orientali; rarissimus" (1767).

"T. testa umbilicata convexo-conica, anfractibus spinoso-radiatis, apertura semicordata."

This species first appeared in the "Museum Ulricae" (1764), where the ample and characteristic description was a more important factor in the identification of the species than the later and much shorter description in the twelfth edition of the "Systema." The identity of the species has never been questioned. The "Museum Ulricae" description is one of the longest of Linnaeus' descriptions of mollusks and is, in the opinion of the writer, the most completely characteristic and illuminating. It should be studied.

Linnaeus there stated that the specimen described came from his own collection and was donated by him to the cabinet of Queen Louisa Ulrica ("Hanc rarissimam testam *e Museo proprio* adjeci"). Hanley (1855, p. 320) referred to this gift, as did Chemnitz (1780–1795, vol. 5, p. 129) who said: "We learn from the following words . . . that this very rare shell, so minutely described by Linnaeus, was found, not in the Queen's cabinet but in Linnaeus' own collection." The Linnaean collection contains no specimen of *T. solaris*. As the preparation of the "Museum Ulricae" was probably completed in 1754, according to Lovén (1887), although it was not published until 1764, Linnaeus' failure to describe *solaris* in the tenth edition permits the inference that Linnaeus did not acquire his specimen until after 1758 and that he then added its description to his unpublished draft of the "Museum," gave the specimen to the Queen, and that he possessed no second specimen. The description in the twelfth edition varies slightly from the main description in the "Museum Ulricae" in the substitution of the phrase "anfractibus spinoso" for "anfractibus radiatis" and in the omission of the phrase "dentibus tubulosis." The first alteration is of questionable value, and the second is an unfortunate omission, as the radiating spines of *solaris* are in fact tubular and slightly open.

The synonymy in the "Museum Ulricae" consisted of two references (Buonanni, pl. 366, and Rumphius, pl. 20, fig. K). The Buonanni figure is not characteristic, and Linnaeus himself called it "male." Rumphius' figure is sufficiently accurate to be used. In the twelfth edition the synonymy was amplified by the addition of three more unsatisfactory figures. The two Gualtieri drawings (pl. 65, figs. N, P) were, in fact, queried by Linnaeus and are extremely equivocal. In the pair lettered N (dorsal and basal views) the radiating fingers are long and sharp; in the pair lettered P (dorsal and basal views) they are merely short "prickles." It is impossible to attribute either pair to *solaris*. Gualtieri's text to plate 65 described them in language which could, for the most part, be applied to *solaris*, but the figures might be referred to *Astraea calcar* (Linné) or, in fact, any one of the spinous *Astraea* species. The figure from Argenville (1742, pl. 9, fig. R) also shows an *Astraea* species which is specifically unidentifiable. Therefore, with the exception of the Rumphius figure, the synonymy is worthless as a guide, probably because of the rarity of the species and the consequent lack of good figures. Linnaeus was therefore obliged to resort to the unwise expediency of selecting figures that appeared to him to be approximations to the species.

The first acceptable figure of the species is found in Favanne's edition of Argenville (1780, pl. 13, fig. C^1). Chemnitz (1780–1795, vol. 5, p. 129, pl. 173, figs. 1700, 1701, dorsal and basal aspects) described and figured the species as "Trochus solaris Indiae orientalis," referred to the *solaris* of the "Systema" and the "Museum Ulricae," and supplied a pair of figures that are completely characteristic. His only other references were to the Rumphius and Favanne figures.

Chemnitz also described and figured three other species in the names of which the word "solaris" is included. The first was a "Trochus solaris Indiae orientalibus . . . absque spinis seu muricibus radiosis" (*tom. cit.*, p. 127, pl. 172, figs. 1697, 1698). He supplied no references for this species, and the figures show a white, almost completely smooth, flat-based, umbilicated shell, which is undoubtedly *Trochus indicus* Gmelin (1791, p. 3575) and was so identified by Lamarck (1822, vol. 7, p. 11). The second was "Trochus solaris Indiae Occidentalis, anfractuum margine non radiato nec spinosa, apice valde obtuso, umbilico subconsolidato" (*tom. cit.*, p. 135, pl. 173, figs. 1712, 1713). It was located on "the shores of the West Indian Sugar Islands." The figures show a shell

without a trace of an umbilicus in spite of the "umbilico consolidato" of the description, having white longitudinal ribs on the posterior portion of each whorl and an extremely blunt apex. They resemble a very much worn *Astraea* species which I would hesitate to identify specifically. These figures were cited by Gmelin for his *Trochus inermis* (1791, p. 3576) as well as by Lamarck (*tom. cit.*, p. 14) and by Philippi (1846, p. 55), but the last writer said: "I consider the *Tr. inermis* a very doubtful species." I share his doubt, as Gmelin's shell is based only on the peculiar Chemnitz figures and is described as "umbilico rugoso" which does not conform to the figures.

The third of Chemnitz' additional "solaris" species is "Trochus solaris occidentalis umbilicatus, margine radiato et spinoso" (*tom. cit.*, p. 139, pl. 174, figs. 1716, 1717), which probably represents *Astraea longispina* (Lamarck, *tom. cit.*, p. 10). Philippi, however (*op. cit.*, p. 56) called it *Trochus heliacus*, a new name, without referring it to *longispina*. Anton (1838–1839, p. 55, no. 2014) had already cited the two Chemnitz figures in question for *longispina* Lamarck. Both Chemnitz and Philippi located this species in the West Indies, although Lamarck said his *longispina* came from the "grandes Indes," and, with a query, referred it only to "*Turbo calcar*? Lin. Gmel." I have referred in some detail to these latter three "solaris" species of Chemnitz, as the student may be confused as to Chemnitz' conception of the true *solaris*.

Gmelin's *solaris* (1791, p. 3569) was, according to his synonymy, a composite species. For his main variety he copied Linnaeus' twelfth-edition description, with the omission of the word "umbilicata," but cited the good Rumphius and Chemnitz figures. His variety "β" was undescribed, but from the figures cited for it we can only say that it was based on a specimen of one of the western Atlantic *Astraea* species. Gmelin's localities were, however, properly separated. For the main species, *solaris*, he gave "rarissimis in India," and, for the variety, "minus rarus in mari Americam australem alluente." Lamarck (1822, vol. 7, p. 10) was the first to separate the East Indian *solaris* from the several West Indian species, and for *solaris* he cited only the good Favanne and Chemnitz figures mentioned above, locating the species in the Indian Ocean.

In 1807 Fischer von Waldheim (p. 213) erected the genus *Xenophora* for *Trochus conchyliophorus* Born (1780, p. 333, pl. 12, figs. 21, 22), the name emphasizing the habit of that species of attaching foreign objects to its shell, and properly located it in the "Oceano Americano."[1] The genus was later expanded by the addition of other species, some of which were umbilicated and some non-umbilicated and of which the habit of attaching foreign objects to the shell varied from an almost complete coverage of attachments to a partial or very sparse coverage, some species showing constantly an entire absence of such a habit. The generic name *Xenophora*, therefore, became inappropriate to many of the added species, and the genus was accordingly subdivided. As at present restricted, *Xenophora* Fischer von Waldheim included those species that are always imperforate, at least in the adult stage, and that lack the "cape" or palatal extension of some of the western Atlantic species and are moderately or completely covered with attached objects. The genus *Tugurium, sensu lato*, was separated from *Xenophora* by P. Fischer (1880, p. 450) and contains only umbilicated species with a well-developed "cape" and a submarginal depression on the base of the body whorl. Only a few attached objects are found in members of this genus. The base is finely concentrically striated. The subgenus *Trochotugurium* Sacco (1896, p. 27) is distinguished from the typical genus *Tugurium* by the strong concentric striae on the base of the shell and the absence of the submarginal depression. The genus *Haliphaebus* Fischer (*loc. cit.*) is the modern vehicle for *solaris* Linné, which is umbilicated and in which the marginal "cape" of *Tugurium* is modified into a

[1] Born's *Turbo trochiformis* (1778, p. 355), for which no locality was given, has been held by some writers, beginning with Dillwyn (1817, pp. 787–788) to be the same as Born's *Trochus conchyliophorus*, and the name *trochiformis* has therefore been applied to the western Atlantic "carrier shell." However, Abbott ([c1954], p. 173) has concluded that the two Born names are not conspecific, his *trochiformis* being the species later called *Trochus radians* by Lamarck (*tom. cit.*, p. 11) and *Calcar plano-radiatum* by Schumacher (1817, p. 193), which is a Peruvian species now called *Calyptraea* (*Trochatella*) *radians*.

series of compressed, partially open, tubular, radiating spines of varying length on all the whorls. The animal in this genus does not attach foreign objects to the shell. *Haliphaebus solaris* Linné is the type species of *Haliphaebus* by monotypy.[1]

Deshayes (1843, p. 123, footnote to *solaris* Linné) recognized the composite nature of the species as synonymized by Gmelin, saying: "The majority of authors since Gmelin and Dillwyn have confused two quite distinct species which Chemnitz took pains to separate. Lamarck properly accepted for the *Trochus solaris* of Linnaeus only the synonyms which applied to it. The excellent description of this species which Linné gave in the *Museum Ulricae* agrees perfectly with that of Chemnitz, and we do not understand why Gmelin should have associated with it, as a variety, another very different species." Deshayes did not name the shell that Gmelin and some of his followers had confused with *solaris*, but it was undoubtedly one of the West Indian *Astraea* species. It should be remarked that Deshayes praised Chemnitz' separation much too highly. The latter's two "solaris occidentialis" species mentioned above are indeed separated from the "solaris orientalis" (*T. solaris* Linné), but the descriptions and figures of both are too equivocal to allow us to identify them with certainty.

The genus *Xenophora* as unrestricted is equal to *Onustus* Humphrey, 1797, and *Phorus* Montfort, 1810. I am not aware of any post-Linnaean synonyms of the species *solaris* Linné.

The species is well figured in Reeve (1843–1878, vol. 1, *Phorus*, pl. 11, figs. 5a, b) and Tryon (1886, pl. 47, figs. 1–2).

Trochus vestiarius

1758, Systema naturae, ed. 10, p. 758, no. 515.
1767, Systema naturae, ed. 12, p. 1230, no. 594.
LOCALITY: "In M. Mediterraneo, Asiatico, Chinensi" (1758, 1767).

"T. testa imperforata conico-convexa, basi gibboso-callosa, apertura subcordata . . . Statura T. pharaonii, supra glauca, lineis transversis undatis pallidis, colore ludentibus. Subtus notata callo convexo lato albido."

The entire diagnosis of *vestiarius*, including the synonymy, is identical in the tenth and twelfth editions of the "Systema." The detailed description clearly points to the *vestiarius* of all authors, but two facts should be pointed out. The description covers only one color form of this remarkably variable species, and the comparison with *T. pharaonius* is most inapt. The largest specimens of *vestiarius* never attain the size of that shell, and the two species are distinguishable in most of the other characters, particularly in the lack of an umbilicus in *vestiarius* and in the striking and constant color pattern of *pharaonius*. Linnaeus even placed the two species in different "subgeneric" groups, the present species being found under the heading "Imperforati erecti, umbilico clauso," and *pharaonius* under the heading "Umbilicati erecti, perforata columella." The inclusion of a Mediterranean locality is also incorrect, as *vestiarius* is confined to the western Pacific and the Indian Ocean. Linnaeus recognized, however, the wide range of its color pattern in the words "colore ludentibus."

The synonymy consists of only two references. The figure from Petiver (pl. 11, fig. 6), which was very properly queried by several later writers, is too distorted and crude to show even its genus. The Gualtieri figures (pl. 65, figs. E, F, G) consist of five pairs of figures, each pair showing the dorsal and basal aspects of an undoubted trochid. Only the figures lettered F and H can I tie to *vestiarius* with any assurance. The remainder either show too large a shell or are of forms with which I am not familiar. Possibly the two smaller figures lettered E are meant for *monilifera* Lamarck, 1822, a name that probably represents a good species. The dorsal view apparently shows the subsutural nodes of *monilifera*.

It should be emphasized that in a species as variable in color patterns as is *vestiarius* the crude figures of the early artists are, for the most part, of little practical value.[2]

[1] *Haliphaebus* was erected as a subgenus of *Xenophora*, as was *Tugurium*, the former to take the place of *Onustus* H. and A. Adams (not Humphrey, 1797) and *Phorus* Montfort, 1810, to contain the non-agglutinated species *solaris* Linné. Based on the habits of the animal and the sculpture of the shell it seems clearly entitled to generic rank.

[2] Linnaeus passed over a set of usable figures in Gevens (1755, pl. 19, figs. 185–191), a work to which he occasionally referred in his synonymies. The original Gevens plates are reproduced in Bachmann's revision of Gevens' work (1830).

The earliest post-Linnaean figure is found in Favanne's Argenville (1780, pl. vol., pl. 12, fig. G). It is, to me, recognizable as the base of one form of the species. Favanne, in his text (vol. 2, p. 429), called it "l' Oeil flambe." In 1781 Chemnitz (1780–1795, vol. 5, p.70, pl. 166, figs. 1601a–h) figured eight color varieties of the species, some of which are characteristic of well-known forms. He called it "Trochus vestiarius Linnaei, basi callosa" and quoted the description from the "Systema" in his synonymy. He recognized the range of color patterns by saying: "In this disk-shaped shell . . . there is included such an astonishing difference in the combination of colors, that I might use an entire copperplate for the variations of the species." He referred specifically to the "violet" form (figs. 1601a, b), a steel-blue form (figs. 1601c, d) and a form which is "of a white color resembling enamel" (figs. 1601e, f). He did not refer to the pink form shown in figure 1601h which was undoubtedly the shell later named *rosea* by Lamarck.

Chemnitz' next species, "Fabula nanae. Trochus vestiarius maris mediterranei" (*tom. cit.*, p. 72, pl. 166, fig. 1602, nos. 1–3) was undoubtedly *Cyclope neritea* (*Buccinum neriteum* Linné, 1758), a quite different species which was discussed in an earlier paper of this series (Dodge, 1956, pp. 195–196). Chemnitz' figures are fairly characteristic of that species, and he cited for it two other pairs of Gualtieri figures (pl. 65, figs. C, I) which he had already cited for *Buccinum neriteum*. This species is referred to here because its gross characters resemble *vestiarius* and because some later writers have followed Chemnitz' lead in treating it as a variety of *vestiarius*. The earliest and most important of these was Gmelin (1791, p. 3578), one of whose six "varieties" of *vestiarius* (var. "β") was clearly *C. neritea*, as he cited for it the Chemnitz figures of "Fabula nanae." Linnaeus' inclusion of the Mediterranean in his localities for *vestiarius* was probably based on the apparent similarity of these two species.

In 1807 Link (p. 136) erected the genus *Umbonium* for *T. vestiarius* Linné and *U. excisum*, the latter of which is *Cyplope neritea*, as is evident from his citation of the Chemnitz figures of that species. Dillwyn (1817, pp. 606, 791) also separated *neriteum* and *vestiarium*, but, as was his custom, placed them in the original Linnaean genera. For *Buccinum neriteum* he properly cited Gmelin's variety "β" of *vestiarius* and Chemnitz' figures of "Fabula nanae." He characterized *neriteum* as "mottled in somewhat the same manner as *Trochus vestiarius*, with which however it possesses no other affinity." His *vestiarius* was well described and his synonymy generally accurate. He listed, however, a variety "With the whirls somewhat nodulous," for which he cited Chemnitz' Trochus vestiarius coronatus" (*op. cit.*, vol. 11, p. 168, pl. 196, figs. 1898, 1899).[1] Figure 1898, a dorsal view, might be taken for the *moniliferum* of Lamarck, while figure 1899, the basal view, shows an unmistakable umbilicus, which differentiates the figure, at least, from any *Umbonium* species. I have not found any mention of "coronatus" in the later literature, and can identify it only tentatively with *Umbonium moniliferum*, basing this identification on figure 1898 alone.

Lamarck (1822, vol. 7, p. 6) erected a new genus name, *Rotella*, for this group of species, disregarding, or being ignorant of, Link's earlier name *Umbonium*. Lamarck's basis for his new genus is explained as follows: "I have thought it necessary to divide the trochids, and to distinguish as a new genus, under the name of *roulette*, the *Trochus vestiarius* of Linné, because the lower face of the shells of this genus is markedly callous, a character which is not found in the trochids.

[1] Chemnitz' "Trochus vestiarius coronatus" is established in a most confusing manner. After listing the name, with no synonymy, he immediately followed it with the heading "item Fig. 1900. Trochus vestiarius virgineus." Figure 1900 is a dorsal view of a highly colored, depressed shell with black and white radiating stripes on each whorl and showing a brilliant pink revolving band on what appears to be the body whorl. This figure and name are in turn followed by a synonymy of two references: Gualtieri (pl. 65, figs. E, four figs.) which both he and Linnaeus had cited for *vestiarius*, but which show a series of nodes on the upper portion of the body whorl, and Schröter (1783–1786, vol. 1, pl. 3, fig. 13), the latter synonym being queried. It is impossible to state with assurance whether these two references apply to both names, "coronatus" and "virgineus," or merely to the latter, or to all three figures or only to figure 1900. The Schröter figure was also cited by Gmelin for his variety "ε" of *vestiarius*. It shows what may have been intended for a coronation of beads at the suture. Both figures were cited by Dillwyn for his "Variety. With whirls somewhat nodulous." I suspect that, in both of these figures, Chemnitz was attempting to show *moniliferum* Lamarck.

"In examining these shells, one might think he was seeing the shells of *Helicina;* nevertheless the *roulettes*, which are fairly heavy marine shells, greatly differ from the helicines in that their callosity is not limited to the columellar lip, but covers a major portion of the lower face of the shell."

Lamarck's first species was *Rotella lineolata*, a new name for *Trochus vestiarius* Linné which he included in his synonymy. The specific name was apparently derived from the close-set, sinuous, brown, longitudinal lines that are seen in one form, and perhaps the most common form, of the species, and this form is covered by Lamarck's description. His *Rotella rosea* (p. 8), the pink form, is generally considered conspecific. The name of his *R. suturalis* was derived from the slight bulging of the upper portion of the body whorl which is there colored a deep brown in one form of the shell, this structure simulating a depressed suture. Lamarck cited for *vestiarius* four of the Gualtieri figures on plate 65 (fig. H), which may be taken to show the longitudinally lined form except that two of the four show much too large a shell for this species. Moreover there is a suggestion of an umbilicus in the larger figures. Lamarck copied Linnaeus' Mediterranean locality, although with a question mark, and omitted the Asiatic localities. His statement that it was a common species is somewhat equivocal because of his ignorance of its locality.

For his *R. monilifera* Lamarck (1822, vol. 7, p. 8) cited the two references (Gualtieri and Schröter) that Chemnitz had cited for "vestiarius coronatus" (and?) "vestiarius virgineus." This is a further indication that the shell (or shells) of Chemnitz was in fact *Umbonium moniliferum.* I am inclined to treat *moniliferum* as a good species, although this view is based merely on its nodular sculpture, the other forms of *vestiarius* being smooth and glassy.

Deshayes (1843, p. 116) continued Lamarck's diagnoses of the *Rotella* species, with no changes except the addition of a few figures to the synonymies, but took occasion again to criticize Lamarck's changes of name. He said in a footnote: "Known for a long time under the name of *Trochus vestiarius* which Linné gave to it, this species has been given another appellation by Lamarck. This is unwise, as the change tends to obscure the tradition of a species clearly named by Linné; it is therefore proper to list this species under the name of *Rotella vestiaria.*" Both Lamarck and Deshayes queried the Petiver figure (pl. 11, fig. 6) that was cited for the species by Linnaeus.

The name *Rotella* persisted for many years, particularly in the works of the French conchologists to whom the catalogue of Link was probably unknown. It is still an extremely rare book.

Reeve (1843–1878, vol. 20, *Rotella*, pl. 3, sp. 12a, b) restored the name *vestiarius* and supplied good figures of six of its color forms. He listed as synonyms *Rotella lineolata* Lamarck and "Rotella rosea Chemnitz," the latter a name that Chemnitz did not use, and treated both *R. suturalis* and *monilifera* Lamarck as good species.[1]

Rotella costatus Valenciennes, which is described and figured by Fischer (1873a, p. 10, pl. 2, fig. 5) is a shell somewhat resembling *R. monilifera* Lamarck, but which is distinguished by its lack of nodes and its larger size. Reeve cited it as a good species. Sowerby (1847–1887, vol. 5, *Rotella*, single plate, figs. 21–22, 25) entirely mistook the position of *costatus*, as he placed both *monilifera* (fig. 21) and *suturalis* in its synonymy as varieties, describing them characteristically and adding: "In a number of specimens the varieties will be found to pass into each other." Sowerby's *vestiarius* was well described, but, although he referred to its variability, he named no varieties. Fischer (1873a, p. 3, pl. 1, figs. 1a–1f) listed the Linnaean species as *Rotella lineolata*, but mentioned only *rosea* as a variety. *Rotella suturalis* and *monilifera* Lamarck and, as said above, *costatus* Valenciennes, were separately described as good species.

Trochus vestiarius is the type of *Umbonium* Link.

Before *Umbonium* became known to and accepted by conchologists, this group of species acquired several other synonyms: *Pitonil-*

[1] The Linnaean collection in London contains specimens of both *vestiarius* (*lineolata* Lamarck) and *monilifera* Lamarck marked for *vestiarius*. Hanley (1855, p. 320) called attention to the fact that Linneaus' synonymy also contained figures of both forms, which indicates that he considered them forms of a single species.

lus Montfort, 1810, *Globulus* Schumacher, 1817, *Ptychomphalus* Agassiz, 1837, and *Helicina* Gray, 1847 (not Lamarck, 1799), in part.

Synonyms of the Linnean species are: *Rotella lineolata* Lamarck, 1822, *Globulus australis* Philippi, 1853, *Umbonium depressum* A. Adams, 1853, and *Rotella elegans* Beck *in* Kiener, 1873.

The present species in several of its many forms is figured by Reeve (1843–1878, vol. 20, *Rotella*, pl. 3, sp. 12e–f), Sowerby (1847–1887, vol. 5, *Rotella*, single plate, figs. 15, 19–20), and Pilsbry (1889, pl. 58, figs. 1–8).

It was not described in the "Museum Ulricae."

Trochus labio

1758, Systema naturae, ed. 10, p. 759, no. 516.
1767, Systema naturae, ed. 12, p. 1230, no. 595.
LOCALITY: "In O. Africano et Asiatico" (1758, 1767).
"T. testa imperforata ovata striato-tuberculata, apertura dentata" (1758).
"T. testa imperforata ovata substriata, columella unidentata" (1767).

As is seen above, two changes were made in the description in the twelfth edition: the word "substriata" replaced the "striato-tuberculata" of the tenth, and "columella unidentata" was substituted for the equivocal phrase "apertura dentata." The second of these changes is merely a necessary clarification. The first is more material. The *labio* of authors is shallowly striated, the comparatively heavy spiral ridges between the striae being made up of contiguous or nearly contiguous rounded tubercles. The twelfth-edition "substriata," unaccompanied by any mention of tuberculate sculpture, does not adequately describe the *labio* of authors and raises the suspicion that two different shells were described in the two editions, a very uncommon situation in the "Systema naturae."

Hanley (1855, pp. 320–321), however, adopted this view, saying that the tenth-edition tuberculate shell was represented by the Rumphius figure (pl. 21, fig. E) cited by Linnaeus, pointing out that the specific name itself had been borrowed from Rumphius and that this was the *labio* of authors. On the other hand, he felt that the twelfth-edition shell, described only as "substriata," was represented by the Gualtieri figures (pl. 63, figs. D, E, G). These latter figures consist of three pairs of drawings, each showing the dorsal and apertural aspects of the shell. Hanley considered that they showed a different species, the *Monodonta fragarioides* of Lamarck (1822, vol. 7, p. 36). That species is the same as the *Trochus turbinatus* of Born, 1780, which has over 40 years' priority.

The Rumphius figure is not sufficiently well drawn to offer so categorical an identification as Hanley gave it. It would have been more realistic if he had relied solely upon the Rumphius name *labio*. The sculpture of the figure, however, is correct for the *labio* of authors. The three pairs of Gualtieri figures also need explanation. While none of them shows any sculpture whatever, each varies in the presence or absence of the columellar tooth. The apertural view lettered D shows a somewhat swollen columella. That lettered E shows a distinct "tooth." In figure G no tooth is seen, the aperture being almost strictly circular. *Trochus turbinatus* Born, the valid name of the shell that Hanley adopted as the representative of the twelfth-edition *labio*, has a very weak and unimportant projection on the columella which I can scarcely characterize as a tooth.[1] I am willing to admit that the Rumphius figure may have been based on a specimen of the *labio* of authors, but I hesitate to refer any of the Gualtieri figures to *turbinatus* Gmelin except, possibly, those lettered D.

The remainder of Linnaeus' synonymy is also discordant. The figure from Argenville (1742, pl. 9, fig. N) does not show the aperture but seems to have been based on a non-tuberculated species. Argenville's text (p. 255) described it as "a little snail with black and white incised lines [canelures] variegated with green," which is scarcely sufficient to tie it to *turbinatus*. The Lister figure was incorrectly located. It was probably the figure re-

[1] In this connection it should be noted that while Lamarck (1799, p. 74, and 1822, vol. 7, p. 31) included a description of the columellar tooth in his generic definition of *Monodonta*, several of his *Monodonta* species in the 1822 work are not described as having a tooth and, in fact, do not possess one, and, in the genera that have been carved out of *Monodonta* Lamarck, we find many edentate species. Lamarck's description of *M. labio* mentions a "very salient" tooth. His description of *fragarioides* does not refer to a tooth.

ferred to in later editions of Lister's work as plate 584, figure 42, or plate 645, figure 37, both of which were cited by Lamarck for *M. labio*, or plate 642, figures 33 and 34, cited by Lamarck for *fragarioides*. Lamarck's allocation of these three figures is, I think, correct. Hanley (*loc. cit.*) said that the figure in Lister reminded him of that of Rumphius, and Argenville's "a little of those in Gualtier." I fully sympathize with his lack of decisiveness in allocating the figures. The Regenfuss figure (pl. 10, fig. 39) is not up to the standard of excellence of that author's figures. I cannot refer it to either *labio* or *turbinatus* with any assurance. Hanley's statement, "Strange to relate every one of the references exhibits a different species," is not in accordance with his vague analysis of the figures.

The situation in the Linnaean collection in London clearly indicates that Linnaeus believed that *labio* and *turbinatus* were forms or varieties of a single species. A specimen of *Monodonta labio* was found by Hanley in a properly marked receptacle, and a specimen of *turbinatus* was also present, loose in the collection, but was itself marked with the serial number of *labio*. An examination of the microfilm of the collection discloses these two specimens, the specimen of *turbinatus* being affixed to one of the tablets furnished by Hanley. I do not go so far as Hanley in considering that the description in the tenth edition covered only *labio* and that in the twelfth only *turbinatus*. I feel that he had confused the species in *both* editions, as indicated not so much by the descriptions as by the fact that the discordant synonymy was identical in 1758 and 1767 and covered both species.

A further name, "le Retan" of Adanson (1757, p. 181, pl. 12, fig. 2, dorsal and apertural aspects), must be considered, as it appeared in the synonymies of *labio* in Chemnitz, Lamarck, Deshayes, Fischer, and others. Adanson's original figure is clearly *labio*. Fischer-Piette and his co-authors (1942, p. 280), in their examination of Adanson's "retained" collection (see Dodge, 1955, p. 53), found a specimen of *Monodonta labio*, on which they could read, by the aid of ultraviolet light, the inscription "2541 Retan." While many western Atlantic species are found in Adanson's collection and decribed in his "Histoire naturelle du Sénégal" and while the suspicion remains that many of these species were actually collected in Senegal and may one day be rediscovered there, it is scarcely credible that *labio*, an Indo-Pacific species, could have been found in west Africa. Fischer-Piette and his co-authors very justly say: "This species, *Monodonta labio* L., comes from oriental waters." It is evidently by error that Adanson included it in his "Histoire naturelle du Sénégal." This is not the only case in which Adanson is found to have integrated shells from far distant areas in his local collection and described them as from Senegal.

Born (1780, p. 335, pl. 12, figs. 7–8) listed *Trochus labio* and cited for it the Rumphius figure cited by Linnaeus, significantly omitting the Gualtieri figures. He also cited a pair of figures from Gevens (1755, pl. 18, figs. 165a, b) which are acceptable figures of the pinkish color form of the species. Born also described, but did not figure, the species *T. turbinatus* above referred to as being the same as *Monodonta fragarioides* of Lamarck. Born's description reads: "Testa ovata, *laevi*, anfractibus convexis, columella unidentata, imperforata" (italics mine). It is apparent that his model showed a projection on the columella sufficiently marked to allow him to refer to it as a tooth, and, indeed, this swelling of the columella varies somewhat in its salience, though in some specimens it is entirely lacking. In any case, the word "laevi" in the description is sufficient to separate the species from *labio*, and thus Born became the first reviser to restrict the Linnaean composite species to *labio*. He also cited for it good figures from Gevens (*op. cit.*, pl. 20, figs. 197, 198, 200, 201) and from Knorr (1757–1772, vol. 1, pl. 10, figs. 6, 7), although he included the debatable figure from Argenville cited by Linnaeus.

Born listed another species, *T. tessulatus* (1780, p. 332, pl. 12, figs. 5, 6), which has been the cause of some confusion. Deshayes (1843, pp. 178–179, footnote under *M. fragarioides*) considered *tessulatus* to be a variety of *turbinatus*. Both the description and the figures in Born greatly resemble *turbinatus*, but it is shown as a much more depressed shell than that species, lacking its typical "strawberry" shape, from which Lamarck derived his

name *fragarioides*. Born's *tessulatus* may have been a young *turbinatus*. Other than this suggestion, I cannot identify it. Its description mentions a very small umbilicus, which would seem to remove it from any connection with *turbinatus*. However, there is apparent in some individuals of *turbinatus* a slight dent in the umbilical region which may have impressed Born as a closed umbilicus.

Chemnitz also properly separated *labio* and *turbinatus*. In 1781 (1780–1795, vol. 5, p. 60, pl. 166, figs. 1579, 1580) he listed "Die Dicklippe," described as "Trochus labeo [*sic*] cidariformis[1] fasciis nodosis granulatus, apertura lunari, labro duplicato, intus striato, labro replicato unidentato." A more graphic description of *labio* can scarcely be written. The species was referred to the *labio* of the "Systema" and the "Museum Ulricae." Chemnitz' figures are convincing, and his synonymy is almost entirely correct. He noted, however, in his text that he would prefer to place this species in *Turbo* rather than in *Trochus*, but did not wish to disturb the placement adopted by "the eminent conchologists Lister, Rumphius, Linné, and von Born."

Chemnitz described another related species as "Trochus tesselatus cidariformis imperforatus" (*tom. cit.*, p. 63, pl. 166, figs. 1583, 1584). This is the same as *T. turbinatus* Gmelin. Figure 1583 shows the typical black-spotted shell, while figure 1584 bears a close resemblance to Born's figure of *T. tessulatus* and indicates that Chemnitz, who cited *tessulatus* as a synonym, also conceived of his species and that of Born as being at least varieties of the same shell.

From Born and Chemnitz onward I find no evidence that *labio* Linné and *turbinatus* Born have been confused.

The treatment of *labio* in the "Museum Ulricae" opens with a description that is a combination of the descriptions in the tenth and twelfth editions of the "Systema," as it includes the phrases "striato-tuberculata" and "apertura dentata" from the tenth edition and "columella unidentata" from the twelfth. This indicates that Linnaeus had written his twelfth-edition description before the manuscript of the "Museum Ulricae" was submitted for publication. The synonymy is considerably shortened but is still discordant, as it consisted of the inharmonius Rumphius, Gualtieri, and Argenville figures. Following the subdescription, which, as usual in this work, is much expanded, Linnaeus added the following note: "Hic a Trocho pharaonio nequit ulla ratione separari, cum demto colore fit quasi idem; attamen in T. phar. columella contorta facit dentem oris, qui minus evidens in hocce; sed debet hic judicari ex istius structura."[2] Chemnitz (*tom. cit.*, p. 62) said, in an "Observation": "Why should the great man have written and asserted: 'a trocho Pharaonio nequit ulla ratione separari cum demto colore fit quasi idem.' The Pharaonis turban has a deeply crenulate [tiefgezahnten] umbilicus, a flat base, three teeth on the inner lip and one large prominent tooth on the outer lip and a pearly interior. Trochus labeo [*sic*] has, on the other hand, no umbilicus, a convex base, only one tooth on the inner lip, coarse granulations and ribs. Are these two so similar that one is by no means able to distinguish them?" I share Chemnitz' perplexity as to the inclusion by Linnaeus of the extraordinary comparison between *labio* and *pharaonius*, and that added note permits at least a scintilla of doubt as to what Linnaeus was describing in the "Museum Ulricae," even though specimens of *Monodonta labio* are present in the Uppsala collection today properly labeled.

Trochus labio is the type species of *Monodonta* Lamarck, 1799, by monotypy.

It is figured by Crouch (1827, pl. 16, fig. 16), Sowerby (1852, pl. 16, fig. 366), Fischer (1880, pl. 73, fig. 1, three figs., dorsal and apertural aspects, adult, and pl. 74, fig. 4, two figs., dorsal and apertural aspects, juvenile), and Pilsbry (1889, pl. 19, figs. 95, 96, dorsal and apertural aspects).

[1] The adjective "cidariformis" is derived from "cidaris," the rounded-conical cap worn by the ancient Persians. It rather imperfectly describes the shape of *labio*, but much more accurately describes the appearance of *turbinatus*, in the description of which Chemnitz also used the word.

[2] The Latin quotation may be translated as follows: "This cannot be separated from *Trochus pharaonius* by any reasoning; with the color taken away it is almost the same; however, in *T. phar.* the contorted columella forms a tooth in the mouth which is less evident in this species; but this should be decided on the basis of the manner of structure of that [tooth]."

Synonyms of *labio* are *Troculus labiosus* Humphrey, 1797; *Cidaris novae zealandiae* Röding, 1798; *Monodonta confusa* Tapparone-Canefri, 1876; and *Trochus immanis* Fischer, 1880.

Trochus tuber

1758, Systema naturae, ed. 10, p. 759, no. 517.
1767, Systema naturae, ed. 12, p. 1230, no. 596.
LOCALITY: "In M. Mediterraneo" (1758, 1767).
"T. testa imperforata depressiuscula, anfractibus subcarinatis margine superiore inferioreque nodulosis . . . Apertura subrotunda est et carina anfractuum lateralis."

The *Astraea tuber* of modern writers is accepted as the representative of Linnaeus' *tuber*, although the description is something less than perfect. The word "depressiuscula" is equivocal. Linnaeus supposed his species to be a trochid, and on that supposition the word was well chosen, as it is somewhat more depressed than many of his *Trochus* species. It is, however, a turbinid and is no more depressed than is normal in that genus. Note, moreover, that this is the only species in *Trochus* Linné for which the word "depressus" or any of its derivatives was used. The expression "carina anfractuum lateralis" is meaningless to the present writer.

Five specimens of the *Astraea tuber* of authors are found in the Linnaean collection in London, all of which are immature individuals. On one of these appears, according to Hanley (1855, p. 321), "some partially erased numerals"[1] which are not sufficiently clear to be of use.

[1] Since the above was written the present writer has been supplied, through the kindness of the General Secretary of the Linnean Society of London, with photographs of both the dorsal and apertural aspects of the five specimens. On the specimen referred to by Hanley the figure "5," written in ink, appears, followed by illegible vestiges of two further digits. In the aperture of this specimen can be seen the numeral "596," the serial number of *T. tuber* in the twelfth edition of the "Systema naturae." These latter numerals are written in pencil, a medium never used by Linnaeus. It is probable they were written by Sir James Smith who held the Linnaean collections for many years before they were acquired by the Linnean Society. Smith was accustomed to make notes in pencil on the sheets of botanical specimens in the collection, and several of the specimens of mollusks, which were illegibly marked or which lacked any documentation, are marked with the same medium. In the aperture of another of the five specimens another illegible numeral may be faintly seen.

In spite of the lack of any legible marking by Linnaeus, the specimens conform closely to Linnaeus' description, which cannot be said of any other specimen in the collection. They may be accepted as the syntypic lot, although, under the formula adopted in the present series of papers, the defective documentation will prevent their acceptance except on a "probable" basis.

The locality is incorrect, as *tuber* is confined to the western Atlantic. This error was partially corrected in Linnaeus' notes for his proposed revision of the twelfth edition, by the addition of the locality "Jamaica" in manuscript. The early writers were not united on the locality of the species. Lister had correctly located it on the "Coasts of Barbadoes" almost a century before Linnaeus described it, and Favanne, a contemporary of Linnaeus, said "Martinique and St. Domingo." Davila, another contemporary, referred to it as a "Sabot des Indes," although it is impossible to tell whether he meant the East or West Indies. Gmelin was the first writer after Linnaeus to add a certain American locality, saying: "Habitat in mari mediterraneo et Americam australem alluente." Lamarck and Deshayes, however, both returned to the single Mediterranean locality, qualifying it by saying, "according to Linnaeus."

Trochus tuber is the only species in *Trochus* Linné that properly belongs in the family Turbinidae, as it has a calcareous operculum in addition to other turbinid features. The correct placement was first adopted by Deshayes (1843, p. 129, footnote) who said: ". . . as the preceding [*Trochus caelatus* Gmelin] this species has the aperture closed by a very thick, calcareous operculum, roughened at the center.[2] If one distinguishes the trochids from the turbinids by the nature of the operculum these two species should be moved to the genus *Turbo*." Gmelin (1791, pp. 3578, 3579) had already hinted at Linnaeus' incorrect inclusion of the species in his *Trochus*, as he said: "Nonne potius turbinis species?"

The synonymy of *tuber* consisted of only two figures. The Argenville figure (1742, pl.

[2] Abbott ([°1954], p. 124) described the sculpture of the operculum of *tuber* more graphically: "Operculum with a thick, arched, tapering ridge on the exterior (like a large comma)."

11, fig. R), a dorsal view, is not characteristic. Argenville characterized the figure R as "a little Sabot, very curious because of its completely round aperture." The citation was undoubtedly an error of transcription for figure I on the same plate which is recognizable as *tuber* and is graphically described by Argenville (*op. cit.*, p. 263) as "a rough Sabot, of a green color, with white protuberances on each whorl." The figure cited from Regenfuss (pl. 3, fig. 27) shows a smaller and more depressed shell than *tuber* but obviously closely related to it. It is discussed further below. Linnaeus passed over another Regenfuss figure (pl. 12, fig. 76), which is an unmistakable picture of *tuber* and has replaced the one cited by Linnaeus in all subsequent synonymies beginning with that of Chemnitz.

Chemnitz (1780–1795, vol. 5, p. 55, pl. 165, figs. 1572–1576) described and figured a "Trochus tuberculatus maior imperforatus, plicatus," which he referred to the *T. tuber* of the tenth and twelfth editions of the "Systema." It is well described and supplied with figures, three of which (figs. 1572, 1573, and 1575) are excellent. His figure 1574, a basal view, shows a color form in which the green of the exterior of the shell is replaced by an olive brown and the decoration of the base is a reddish brown. Figure 1576 is a questionable representation of the immature *tuber*. The model for the latter figure was said to come from the Spengler collection. A fairly good figure of the immature shell (pl. 164, fig. 1561) is also referred to by Chemnitz in his text as "still another form of *Trochus tuber*." This form was described on page 50 of the same volume as "Die knotige seegrüne Kräuselschnecke," and was said by Chemnitz to be found in many forms on the beaches of St. Croix and other West Indian islands. Of the shell listed on page 55, and referred to the "Systema" species, he said that one form "is found in great numbers on Antillean beaches." He cited the corrected Argenville figure (fig. I) in his synonymy and also the Regenfuss figure (pl. 12, fig. 76) which was passed over by Linnaeus.

Gmelin (1791, pp. 3578–3579) listed a variety "β" for *tuber* without describing it and citing only the Regenfuss figure (pl. 3, fig. 27) cited by Linnaeus. This latter figure may be the same shell that was described by Dillwyn (1817, p. 796) as "Variety. Smaller and the whirls much depressed." Dillwyn cited for his variety the above Regenfuss figure, *Trochus pantherinus* Gmelin (p. 3584), "la Perruche aplatie" of Favanne, and Adanson's "le Kachin" (1757, p. 187, pl. 12, fig. 9, dorsal and basal aspects). Gmelin's *T. pantherinus* is described as: "Testa convexa alba viride fusco fulvoque maculata: spirae anfractibus bifariam tuberculatis; anfractu secundo plicato carinato." He located it in Senegal and cited for it *two* of Adanson's species: "le Kachin" for the main species and "le Gor" (1757, pl. 12, fig. 10, dorsal and basal aspects) for variety "β." The identity of both Gmelin's variety "β" of *tuber* and his two forms of *pantherinus* is clarified by Fischer-Piette and his co-authors (1942, p. 288). "Le Kachin" is *Trochus tuber* Linné and Gmelin's principal form of *pantherinus*. Thus Gmelin described the same species under two names. "Le Gor" is *pantherinus* variety "β," which was found to be *Astraea brevispina* Lamarck, 1822. These authors found in Adanson's "retained" collection (see Dodge, 1955, p. 53) two specimens of *T. tuber* Linné with labels identifying them with "le Kachin" from Senegal, saying: "It is *Astraea tuber* L. and the *Trochus pantherinus* of Gmelin, p. 3584, var. β exclus. . . *Astraea tuber* is an Antillean species; its Senegalese locality has not been confirmed." They also found (*loc. cit.*) specimens of "le Gor" associated with a label reading, "Turbo 10 Gor Hist. Nat. du Sénégal pl. 12," one of which was marked "2538 Gor." These they identified as *Astraea brevispina*. Adanson's figures of "le Kachin" are not sufficiently clear to be certainly ascribed to *tuber*. His figures of "le Gor" are clearly recognizable as *brevispina*. While Fischer-Piette and his co-authors did not refigure in their paper the newly discovered specimens, their identifications are convincingly categorical.[1] They also noted

[1] Short-spined specimens of *A. longispina* Lamarck, 1822, have frequently been incorrectly identified as *brevispina*. The real *A. brevispina* is also a well-known West Indian species. It is distinguished by a patch of bright orange-red in the umbilical area, although its other characteristics are very close to those of *longispina*. Even if the rediscovered "Senegal" specimens of "Gor" had been figured, it would probably have been impossible to tell which of the two *Astraea* species they were.

that *A. brevispina* had not been reported from Senegal by anyone except Adanson. As I have already noted in this series of papers, in discussing the Adanson species, two possibilities exist: (1) that Adanson had inadvertently placed foreign species in his collection, or (2) that certain of the species were actually collected in Senegal and that further investigation may rediscover them. Some of his specimens of foreign species are so authoritatively documented that a Senegal locality has been accepted. There is, in fact, a considerable number of western Atlantic species listed in Adanson's work which raise this suspicion.

Deshayes (1843, p. 129, footnote) remarked: "Dillwyn synonymizes with this species [*tuber*] the Kachin of Adanson and, in consequence, the *Trochus pantherinus* of Gmelin. He may be correct. We have no means of checking his opinion." Adanson's figures of the pertinent species are so questionable that no one could have answered that question before the discovery of the "retained" collection.

From Fischer (1880) onward the species has been accepted as an exclusively western Atlantic species. It is common throughout the West Indies but rare in Florida except on the extreme southeastern coast, where it is found in fair numbers.

It belongs in the genus *Astraea* Röding, 1798 (*Imperator* Montfort, 1810, and *Canthorbis* Swainson, 1840), and is generally placed in the subgenus *Lithopoma* Gray, 1850.[1]

It is figured by Fischer (1873b, pl. 22, fig. 1, dorsal and basal figs. of an adult, and fig. 1a, dorsal and basal figs. of the immature shell) and by Abbott ([° 1954], pl. 3, fig. j).

It is not described in the "Museum Ulricae," and no specimen is present in the Uppsala collection.

Trochus striatus

1758, Systema naturae, ed. 10, p. 759, no. 518.
1767, Systema naturae, ed. 12, p. 1230, no. 597.
LOCALITY: "In M. Mediterraneo" (1758, 1767).
"T. testa imperforata conica: anfractu imfimo subangulato, apertura obovata . . . Testa alba lineis longitudinalibus obliquis nigris; similis sequentibus duobus, sed infimus anfractus angulo cinctus est."

The above description, which is the same in the tenth and twelfth editions of the "Systema," has been considered adequately characteristic for the identification of the species. It has, however, certain defects. As in so many of Linnaeus' descriptions, it fails to mention the small size of the shell. Second, if black-lined forms exist the present writer has not seen them in the comparatively small series of the species examined. In the specimens seen, the color of the lines ranges from a blackish brown to a brick red, and in most of them, and in most figures, the decoration is not made up of lines, which implies a narrow feature, but of broad zigzags, usually broken on each whorl, or of irregularly shaped and asymmetrically disposed blotches. The phraseology of the subdescription covering the comparison of *striatus* with the two succeeding species (*conulus* and *zizyphinus*) is not understood. The word "cinctus" implies a sculptural or decorative feature at the periphery, and neither is apparent except in *zizyphinus*, although there is a considerable variation, at least in *striatus*, in the degree of angularity of the peripheral angle of the body whorl.

The synonymy consists of a single pair of figures (Gualtieri, pl. 61, fig. N, dorsal and basal aspects) which are characteristic of the narrow black-lined form of the species described by Linnaeus.

Linnaeus' locality is correct but incomplete, as the species is found not only in the Mediterranean, where it is plentiful, but also along the Atlantic coast of Europe from England to Gibraltar and in the island groups of the Canaries, the Azores, and Madeira.

The first post-Linnaean reference to the shell was a description by Da Costa (1778, p. 41). That author did not recognize it as Linnaeus' *striatus* but called it *Trochus parvus*. His name has been generally accepted, and I am convinced correctly, as a synonym.

The earliest post-Linnaean figure of the species is found in Favanne's edition of Argenville (1780, pl. vol., pl. 12, fig. N). It was well described in great detail by Favanne (1780, vol. 2, p. 375), who called it only "le

[1] *Astraea* is a widely dispersed genus. The subgenera *Lithopoma* Gray, 1850, and *Astralium* Link, 1807, are represented only in the western Atlantic.

fruit d'If," referring to the source of his specimen, the island of If in the Mediterranean near Marseilles.[1]

Several writers have confused *striatus* with *Trochus exasperatus* Pennant, 1777. Instances of this confusion are taken up in their historical sequence.

In 1781 Chemnitz (1780–1795, vol. 5, p. 29, pl. 162, figs. 1527, 1528, dorsal and basal aspects) first identified the Linnaean species. He listed it under the polynomial "Trochus striatus lineis nigricantibus longitudinalibus radiatus," referring it to the Gualtieri figures cited for it by Linnaeus, to the two descriptions in the "Systema," and to the Favanne figure. Chemnitz' own figures are accurate and show the longitudinal lines as narrow and black, as stated by Linnaeus, and unbroken. He added: "Probably this little Trochus remains small during all of its life and does not grow to any notable size."

Gmelin (1791, p. 3579) improved Linnaeus' description of *striatus* by adding the word "minuta." Gmelin described another species, *Trochus erythroleucos* (p. 3581), a small red trochid decorated with brown nebulosities, which he based on a Chemnitz species "Trochus minutus, striatus, ex rubro et candido nebulatus . . ." (1780–1795, vol. 5, p. 30, pl. 162, figs. 1529a, b). This name is mentioned here because it is probably the same as *Trochus exasperatus* Pennant, 1777, which was confused with *striatus* by both Dillwyn and Jeffreys, among other authors.

Curiously enough, Lamarck did not mention *striatus*, but it was added to *Trochus* by Deshayes in the second edition of Lamarck's "Histoire naturelle." Deshayes there noted that the *T. minutus* of Chemnitz, the *erythroleucos* of Gmelin, was very close to *striatus*. Dillwyn (1817, p. 797) placed *exasperatus* Pennant in the synonymy of *striatus*, but used *erythroleucos* Gmelin only as a synonym of *T. minutus* Chemnitz.

Hanley's examination of the Linnaean collection in London in the years preceding 1855 disclosed several specimens of *striatus* in a duly marked receptacle (1855, p. 321). These specimens may therefore be regarded as the "probable" syntypic lot. As Hanley could find no adequate figure of the species, he supplied a good figure of one of these specimens (pl. 5, fig. 7). The microfilm of the collection in the present writer's possession confirms the accuracy of Hanley's figure. Hanley added that the specimens found were identical with specimens of *Trochus striatus* sent to him by Philippi and described by the latter in his work on the Sicilian molluscan fauna (1836, 1844, vol. 1, p. 176). Hanley's figure shows a shell with a decidedly angular peripheral angle, which does not exactly conform to the word "subangulato" in Linnaeus' description. However, a certain amount of variation exists in *striatus* in this respect, and the remainder of the syntypic lot show this variation to a slight degree. Marshall (1915, p. 326), in commenting on *Trochus striatus*, said: "Mediterranean specimens differ from British in that they are higher and narrower, the base more convex, and the periphery less sharply keeled (as in *T. montacuti*), with the apex spiral and pointed. In British specimens the apex is invariably worn down even in the young." In the matter of the angularity of the periphery, I have detected no difference between shells from the two areas, as parallel variation occurs in both. Nor did the specimens examined confirm the other differences mentioned by Marshall.

Jeffreys (1862–1869, vol. 3, pp. 322–323) gave a detailed description of what he considered the British *striatus* to be, giving it "a rather sharply keeled periphery," longitudinal striae that cross the spiral ridges, and saying that "sometimes the ridges are partly nodulous in consequence of this decussation." This does not describe the *striatus* of either the Mediterranean or the British Isles or, indeed, conform to Linnaeus' description. Jeffreys added the following astonishing statement: "In all probability the *T. striatus* of Linné was intended for the next species [*T. exasperatus* Pennant, 1777], if, indeed it is not a variety of the one which I have now described. Gmelin and his followers named the present species *T. erythroleucos*, Da Costa *T. parvus*, Donovan *T. conicus*, and Deshayes *T. depictus*." The first sentence of the above quotation is not clear, but it is very evident that Jeffreys had confused two distinct and

[1] Argenville's figure (1742, pl. 11, fig. N) is undoubtedly based on a specimen of *Trochus conulus* or *zizyphinus* Linné, and this finds confirmation in Argenville's description of the figure (1742, p. 263) where he characterizes it as "a little flesh-colored Sabot."

good species, *striatus* and *exasperatus*. Moreover, it should be noted that of the names he gave as synonyms of his "*striatus*," *parvus* Da Costa and *conicus* Donovan are *striatus* Linné, while *erythroleucos* and possibly *depictus* are *exasperatus* Pennant. Jeffreys' figures (1862–1869, vol. 5, pl. 63, figs. 2, 3) are entitled *striatus* and *exasperatus*, respectively. While they are somewhat equivocal, they seem to be correctly named, although not in conformity with Jeffreys' descriptions. Marshall (1915, p. 327) said of them: "Gwyn Jeffreys' figures of this and *exasperatus*, by an apparent error of the artist, have been transposed; nor should this species [*striatus*] have a basal ridge encircling each whorl as there depicted." I agree as to the impropriety of showing the basal ridge in a figure of *striatus*, but one is left with a doubt whether the "error" was that of the artist or the author.

Weinkauff (1868, p. 363) also incorrectly synonymized *exasperatus* with *striatus*.

Trochus striatus Linné belongs in the genus *Calliostoma* Swainson, 1840, as *C. striatum*. Its acceptable synonyms are *T. parvus* Da Costa, 1778, *T. conicus* Donovan, 1803, *T. gravesi* Forbes, 1844, *T. parvulus* Philippi, 1836, *Jujubinus aequistriatus* Monterosato, 1884; "*T. sartorri* Aradas, fide Philippi" and "*T. littoralis* Brusina" are given as synonyms by Pilsbry, 1889, but the references referred to were not available to the present writer. *Trochus depictus* Deshayes, 1836, has been included as a synonym by some, but I agree with Fischer (1880, p. 270) that it is probably a good species.

The small size of the species makes it difficult to find clear and characteristic figures. Most of the figures reproduced without enlargement are too indistinct to be usefully cited. Reeve's figure entitled *striatus* (1843–1878, vol. 14, *Zizyphinus*, pl. 6, sp. 37) shows a shell with a nodulous band at the base of each whorl and is clearly *exasperatus*. Fischer (1880, pl. 89, fig. 2) supplied as excellent enlarged figure of the unlined form of *striatus*. The several figures of Bucquoy, Dautzenberg, and Dollfus (1882–1886, pl. 43, figs. 8–10, Atlantic specimens, and figs. 11–15, Mediterranean specimens) are the best of the figures shown in actual size. The figures of the Mediterranean shells conform to Marshall's statement that shells from this area have a more elevated spire. Pilsbry's figures (1889, pl. 17, figs. 39, 40) are enlarged and accurately show the solid color and brown lined forms.

The species was not described in the "Museum Ulricae."

The species *Trochus exasperatus* Pennant has a voluminous synonymy. The present writer has examined the descriptions and figures of the following names, and their identity with *exasperatus* seems certain: *Trochus conulus* Da Costa, 1778; *T. minutus* Chemnitz, 1781; *T. erythroleucos* Gmelin, 1791; *T. exiguus* Pulteney, 1799; *T. matonii* Payraudeau, 1826; *T. tricolor* Risso, 1826; *T. elegans* Blainville, 1826; *T. sosia* Fischer, 1880; *Jujubinus corallinus* Monterosato, 1884; and *T. monterosatoi* Bucquoy, Dautzenberg, and Dollfus, 1885. The last name was treated as a variety of *striatus* by its authors. It was *T. exasperatus* var. *excavatus* Monterosato, 1880. I am less certain of *Zizyphinus pyramis* Reeve, 1863, and *T. pyramidatus* Lamarck, 1822, which have also appeared in synonymies of *exasperatus*.

Trochus conulus

1758, Systema naturae, ed. 10, p. 759, no. 519.
1767, Systema naturae, ed. 12, p. 1230, no. 598.
LOCALITY: "In M. Mediterraneo et O. Europaeo" (1758, 1767).

"T. testa imperforata conica laevi, anfractibus linea elevata interstinctis . . . Testa sequenti simillima, ut fere varietas minima, etiam apice tuberculata, sed linea inter anfractus prominula; color pulcherrime variegatus."

This species presents no problem of identification, and its nomenclatorial history has been uneventful. The excellent description, which is the same in the tenth and twelfth editions of the "Systema," is entirely adequate, and, while Linnaeus thought it possible that it might be a small variety of *Trochus zizyphinus*, the following species, he accurately pointed out the differences between the two in shell characters.

The synonymy, which is the same in both editions, is, however, discordant. Of the two Buonanni figures cited (figs. 91, 99) the latter is a fair, though stylized picture of the species. Figure 91, a distorted drawing, is inaccurate, although it might have been based on a specimen of *conulus*.

The figure from Lister's "Historiae animalium Angliae" (pl. 3, fig. 15) shows a small imperforate trochid of a roundly conical form which is not specifically identifiable. Hanley (1855, p. 322) said that it was possibly *Trochus lineatus* Da Costa, 1778, "which is also not a smooth species, and hence manifestly not the shell intended by Linnaeus." Hanley's tentative attribution of the Lister figure to Da Costa's *lineatus* is not understood. The latter, while a roundly conical species, is a more depressed trochid decorated with red zigzag or sinuous lines and is narrowly perforate. As noted above (p. 182), it is a synonym of *Trochus cinerarius* Linné.

Neither of the Gualtieri figures cited by Linnaeus shows *conulus* (pl. 61, figs. N, M). Figure N had already been cited by Linnaeus for the preceding species, *Trochus striatus*, and probably was based on a specimen of that shell. It was apparently an error of transcription or a misprint for figure G on the same plate, as the latter figure had been already cited for *conulus* in the tenth edition of the "Systema." Figure G, however, seems to show a shell very similar to *T. granulatus* Born, 1780, another European trochid for which Linnaeus' word "laevi" is most inappropriate, rather than *conulus*. Gualtieri's figure M also shows a granulate shell.

A specimen of *conulus* is present in the Linnaean collection in London and, although not documented in any way, is the only species in the cabinet to which Linnaeus' description could apply. It may therefore be accepted, with the usual reservation that it may have been a later introduction, as the "possible" type.

The species is now placed in the genus *Calliostoma* Swainson, 1840, as *Calliostoma conulum*. It is the type species of the genus, by subsequent designation, Herrmannsen, 1846 (the "*Calliostoma conula* Mart." of Swainson). The great majority of writers today use *Calliostoma* for this group of species. Reeve, Monterosato, and others placed *conulus* and its congeners in *Ziziphinus* (emend. *Zizyphinus*) Gray, 1847.[1] *Conulus* Nardo, 1841, not Fitzinger, 1833, *Eucasta* Dall, 1889, and *Jasinthinus* Monterosato, 1889, are also synonyms. Some authors, including Weinkauff, Fischer, Bucquoy, Dautzenberg, and Dollfus, and others, continued to employ *Trochus* Linné until fairly recently.

Linnaeus called attention in his description to the close relationship between *conulus* and his next species (*Trochus zizyphinus*). It is also close to *Calliostoma conuloides* (Lamarck, 1822). It is distinguished from *zizyphinus* by its smooth surface, whereas *zizyphinus* has not only a prominent, brown-spotted cord at the base of each whorl but is supplied with slightly developed spiral striae. It is distinguished from *conuloides* by the strong spiral striae of the latter. Pilsbry makes *conuloides* a variety of *zizyphinus* and calls it the *zizyphinus* of British authors. All three forms are extremely variable, which has resulted in a number of varietal names which are listed by Bucquoy, Dautzenberg, and Dollfus (1882–1886, p. 351) and by Pilsbry (1889, pp. 388–391).

Calliostoma conulum is a native of the Mediterranean Sea but is also found in the Canaries, the Azores, and Madeira. It has been reported from as far north as British waters.[2]

The species is the same as *Trochus lucidus* and *violaceus* Risso, 1826. *Trochus laugieri* Payraudeau, 1826, is treated by Pilsbry (1889, p. 392) as a good species. I have not seen specimens so labeled, but it is difficult, after examining the description and figure of Payraudeau, for me to distinguish it from *conulus*.

It is figured by Reeve (1843–1878, vol. 14, *Zizyphinus*, pl. 4, sp. 22b), Fischer (1880, pl. 42, fig. 1), and Pilsbry 1889, pl. 65, figs. 70–71).

It is not described in the "Museum Ulricae."

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[1] The generic name *Zizyphinus* is derived from the Greek ζιζυφου, the tree (*Zizyphus jujuba*) that bears the fruit called the jujube. Monterosato's *Jujubinus*, 1884, which has been used as a synonym of *Zizyphinus* but which is probably a synonym of *Cantharidus* Montfort, 1810, together with Gmelin's *Trochus jujubinus* (1791, p. 3570), reflects a related derivation. Because the Greek upsilon becomes "y" when Anglicized or Latinized, the spelling *Zizyphinus* is correct.

[2] See Da Costa (1778, p. 40, pl. 2, figs. 4), Donovan (1799–1803, vol. 1, pl. 8, figs. 2–3), Pennant (1776–1777, ed. 4, vol. 4, pl. 80, fig. 104), and Forbes and Hanley (1853, vol. 2, p. 495). These reports probably refer to *zizyphinus* Linné, *conuloides* Lamarck, or *exiguus* Pulteney.

Trochus zizyphinus

1758, Systema naturae, ed. 10, p. 759, no. 520.
1767, Systema naturae, ed. 12, p. 1231, no. 599.
LOCALITY: "In M. Mediterraneo et Europaeo" (1758, 1767).
"T. testa imperforata conica livida laevi, anfractibus marginatis . . . Testa, exuta tunica extima, plumbea evadit."

The above description from the twelfth edition of the "Systema" is identical with that in the tenth except for the substitution of the more expressive word "marginatis" for the "subcarinatis" of the tenth. It is not a good description in one respect, as the species is not "laevi." All forms of the species have slightly to strongly developed spiral striae on all whorls except those of the apex which are finely and closely granulated. In the form *conuloides*, if that shell be considered not specifically separable, as many writers hold, the striae are more numerous and even more highly developed.

The synonymy, which was the same in both editions, is made up of good and bad figures. Of the two Gualtieri figures (pl. 61, figs. B, C, each consisting of a pair of drawings showing dorsal and basal aspects) the pair lettered B is a mixture of *T. conulus* and *ziziphinus*, as the drawings show the narrow "linea elevata interstinctis" of Linnaeus' description of *conulus* and the almost straight-sided outline of that shell, but also, as drawn, has numerous spiral striations over the entire surface, as in *zizyphinus*. The figures lettered C are good figures of *zizyphinus*. The Lister figure (1678, p. 166, pl. 3, fig. 14) is allocated by Hanley (1855, p. 322) to *zizyphinus* and seems to show that species. The Klein figure (pl. 2, fig. 36) was probably based on a specimen of *ziziphinus*. The figure from Rumphius (pl. 21, fig. 1) and that of Argenville (1742, pl. 4, fig. N), the latter cited with a query, do not resemble *zizyphinus* except superficially. The Buonanni figure (pl. 93) is crude but probably may be accepted as having been based on a specimen of *zizyphinus*.

Chemnitz (1780–1795, vol. 5, p. 66, pl. 166, figs. 1592–1594) supplied a detailed and precise description of the species, and his figures are characteristic with one exception. Figure 1594 is badly drawn and unrecognizable. He placed in his synonymy the figure cited by Linnaeus from Lister's work on the English fauna (1678, pl. 3, fig. 14). The remainder of his synonymy is made up of good and bad figures, as was that of Linnaeus. Chemnitz listed *Trochus conulus* separately, but it is clear from his description and his figures (figs. 1588-1591) that he was confused. Figure 1588 is clearly *zizyphinus*, and figures 1589 and 1590 show shells with much more strongly indicated striations than are found in any form of *conulus*.

Röding's conception of this group was also confused. For his *Trochus jujubinus*, a western Atlantic species, he cited Chemnitz' figure 1594, which Chemnitz had cited for *zizyphinus* but which, as said above, I consider unidentifiable and which, it if was based on *jujubinus*, is an extremely equivocal picture of that shell. He listed *Trochus conulus* and properly referred it to *conulus* Gmelin, but cited for it Chemnitz' figure 1588, which is *zizyphinus*. He nowhere listed *zizyphinus*, but it is possible that his *conulus* may have been based on a specimen of *zizyphinus*.

Link (1807, p. 135) may have confused *zizyphinus* with *Trochus granulatus* Born (1780, pl. 12, figs. 9, 10), as he cited for it, among other figures, Chemnitz' figures 1597 and 1598 which may be said to conform to Born's description of *granulatus*. He did not list *conulus*.

Lamarck (1822, vol. 7, pp. 23–24) was the first definitely and correctly to separate *zizyphinus*, *conulus*, and *granulatus*, and also to erect *conuloides* as a good species. All four species are supplied, with few exceptions, with well-chosen and characteristic figures.

Hanley (1855, p. 322) found undocumented specimens of *ziziphinus* in the Linnaean collection in London and said of them: "It matters little that the examples of this species in the Linnaean cabinet are not marked, since the features described, and the correct references to Lister, Gualtieri and Klein, caused the *Trochus zizyphinus* to be readily identified (Brit. Moll. pl. 67, f. 1)." It should be noted that Hanley did not assert that these specimens were Linnaeus' syntypic lot, as they were not only undocumented, but we have no evidence that Linnaeus ever owned a specimen of the shell.

Pilsbry (1889, p. 388, pl. 65, figs. 90–92) gave a most useful discussion of *zizyphinus* Linné, and his figures are characteristic. He

treated *conuloides* Lamarck as a variety of *zizyphinus*, a conclusion that seems reasonable. He distinguished the two forms as follows: "The typical *zizyphinus* is a large, handsome form found in the Mediterranean Sea. It is smooth and has only slightly developed riblets on the lower whorls. The upper (3–6) are densely granulate, showing the affinity of this form to *C. granulatus* Born etc." The typical form has been reported from the Atlantic coast of Europe, but these reports may have been based on specimens of *conuloides* which seems to have been the *zizyphinus* of the early British authors (see footnote, this page). Pilsbry described the form *conuloides* as: "Shell similar in form or more depressed than the type, with strong spiral ridges on the upper surface of the whorls. This form is the *zizyphinus* of British authors. It varies from nearly smooth to strongly spirally sulcate. There are forms nearly or entirely intermediate between *conuloides* and *zizyphinus*." He located *conuloides* on the "Atlantic coasts of Spain, France, England, etc." I have not seen it authoritatively reported from the Mediterranean Sea. Each of the three forms (*zizyphinus*, *conuloides*, and *conulus*), all of which have overlapping ranges, are so variable in themselves, and, between *zizyphinus* and *conuloides* at least, there can be found such a significant chain of intermediates, that it is dangerous to be categorical in listing varieties of any of them.

Pilsbry gave the following list of synonyms for *zizyphinus*, a list that embraces many of the sculptural and color forms that have been suggested by others as "varieties": *Trochus polymorphus* Cantraine, 1835, in part; *T. conulus* var. "β" Philippi, 1836; *Zizyphinus linnaei* and *demissus* Monterosato, 1884; *Trochus discrepans* Brown, [?1815][1]; *Zizyphinus conuloides* (Lamarck) Reeve, 1863, in part; *Z. novogradensis* "Brusina MS"; *Z. conuloides* auct., *non* Lamarck, *fide* Monterosato, 1889; *Z. virescens* (Renier) auct., Monterosato, 1889; *Z. vulgaris* (Gray) Adams, 1851; *Z. albidus* Wood, 1828; and *Trochus cingulatus* Brocchi, 1814. An examination of the descriptions of these names and, where available, of the figures reveals that they are all forms of that comprehensive affinity that is *zizyphinus*, many of them being referable to forms of *conuloides*.

Trochus zizyphinus belongs in the genus *Calliostoma* Swainson, 1840. Synonyms of the name *Calliostoma* are noted under *Trochus conulus* (p. 201, above).

The name *Trochus zizyphinus*, as described in the "Museum Ulricae," covers a composite species. The main description was a copy of that in the tenth edition of the "Systema" except for the substitution of "marginatis," later used in the twelfth edition, for the "subcarinatis" of the tenth, and the synonymy consisted of the Gualtieri and Rumphius figures of the tenth edition, which show either good or fair pictures of *zizyphinus*. It is apparent, however, that Linnaeus had before him a lot containing a specimen or specimens of *zizyphinus* and an umbilicated *Calliostoma*, as the subdescription includes the following sentence: "Umbilicus patens, albus, oblique tetragonus; in aliis clausus." He apparently considered, at least in 1764, that the umbilicated and non-umbilicated shells were mere forms of a single species, although he reverted, in the twelfth edition, to the original description of the species. No non-umbilicated *Calliostoma* is found in the Uppsala collection today, the single shell of that genus being a specimen of *Calliostoma jujubinum* Gmelin (1791, p. 3570), an umbilicated shell from the western Atlantic, and this is labeled "*Trochus zizyphinus*." Even though it be admitted that the labeling of the Uppsala collection is unconvincing, the presence of this specimen is significant in connection with the description and serves as another instance in which Linnaeus may have partially or completely altered his concept of a species in the "Museum Ulricae" but re-

[1] Brown ([?1815], p. 519) described *discrepans* as from Belfast Lough, Ireland. His description is clearly of some form of *zizyphinus*, but his figure (pl. 24, fig. 4) is too small to justify any certain identification. His shell is probably form *conuloides* which is found in the British Isles. Brown said: "The whole shell is wrought with indistinct spiral ridges. In other respects the shell agrees with the *Trochus zizyphinus* and is probably only an accidental variety of that shell. In comparing it with the specimens of the *zizyphinus* of the same size, I find it shorter in proportion to the breadth of the base; and the apex is considerably blunter." This was written seven years before the erection of *conuloides* by Lamarck.

verted to his earlier concept in the twelfth edition.

Hanley (1855, p. 322), while he had not had an opportunity of seeing the Uppsala collection, recognized Linnaeus' error, saying: "As frequently happens, the *Trochus* described in the 'Museum Ulricae' was quite different, having an 'umbilicus patens.' What it may prove becomes of less importance, since the ascribed features do not correspond with those in the previous diagnosis in the tenth edition of the 'Systema,' and consequently the Linnaean name cannot be retained for it."

The difference between the "*zizyphinus*" of the two Linnaean works had already been noted by Chemnitz (*tom. cit.*, p. 82) in his discussion of "Trochus zizyphinus umbilicatus," who said: "Linnaeus described another Jujubenkräusel which had an *umbilicus patens* (see Mus. Reg. Ulr. p. 336. p. 650). This is the species now here pictured. . . . It is found on the shores of the West Indian Sugar Islands." Chemnitz' figures of this species seem to show the subspecies of *C. jujubinum* named *rawsoni* by Dall in 1889, except that the basal view shows no sign of an umbilicus.

Calliostoma ziziphinum is figured by Reeve (1843–1878, vol. 14, *Zizyphinus*, pl. 3, figs. 16b, c), Forbes and Hanley (1853, pl. 67, fig. 1), and Pilsbry (1889, pl. 65, figs. 91, 92).

Trochus telescopium

1758, Systema naturae, ed. 10, p. 760, no. 521.
1767, Systema naturae, ed. 12, p. 1231, no. 600.
LOCALITY: Not given in either edition.
"T. testa imperforata turrita striata, columella exserta spirali."

This is the first of the species that Linnaeus grouped under the heading "Turriti umbilico exserto, qui positi cadunt in latus." The description above, from the twelfth edition of the "Systema," is identical with that in the tenth except for the substitution of the concluding phrase for the original phrase "labro columellari spirali integro," an obvious improvement. Standing alone, the description seems sufficient for the identification of the name with the *telescopium* of all authors. It should be pointed out, however, that the heading of this group of species does not conform to the description of *telescopium*. This species is, as the description requires, imperforate, whereas the heading "umbilico exserto" is a misnomer, as it refers only to the almost circular extension of the columella in *telescopium* and *dolabratus* which simulates the entrance to an umbilicus.

The synonymy is unimpeachable, as might be expected in the case of a shell so distinctive and unusual in appearance. The Gualtieri figures (pl. 60, fig. D, two figs., and E) are particularly characteristic. Of the remainder (Buonanni, pl. 92; Rumphius, pl. 21, fig. 12; Seba, pl. 50, figs. 1–12; Argenville, 1742, pl. 14, fig. B), all are unquestionably *telescopium*, the only criticism that can be made being that the Argenville figure shows a shell with a damaged outer lip and aperture, so that it does not show their distinctive details. Indeed it is difficult to find, in the hand-drawn figures, a perfect representation of the base of this species. Argenville's text did not refer to the peculiarities of the missing portion of his specimen. The Lister figure was more simply referred to by Lamarck as "t. 624, f. 10," as it was listed in the later editions of Lister.[1] I cannot find that the name "telescope" or *telescopium* was used prior to Argenville.

A specimen of the species is present in the Linnaean collection in London. The shell itself bears no marking, but the receptacle in which it is contained is properly documented. It may therefore be accepted as Linnaeus' "probable" type specimen, as no other shell in the collection can be confused with it.

Linnaeus supplied no locality for *telescopium*, although his predecessors had accurately located it, and two of these writers were cited for the species in the "Systema." Lister called it *Trochus Bengalensis;* Seba said it came from the "Indiis orientalibus." In Petiver's "Amboina" it is called "Trochus pyramidalis Indicus Nobilis. Indian Whirligig."

No question has ever been raised as to the identity of this name, although the species has appeared in several different genera. Chemnitz (1780–1795, vol. 5, p. 14, pl. 160, figs. 1607–1609) called it "Dolium marinum.

[1] Linnaeus himself simplified his original citation of the Lister figure by a manuscript note in his copy of the twelfth edition reading "624."

Telescopium" and, in addition to his three plate figures, supplied a graphic drawing of the internal structure of the shell (vignette 42, figs. A–D). He referred the species to the *telescopium* of Linnaeus and cited all of Linnaeus' references in his own synonymy with the exception of Gualtieri's figure E. Born and Schröter retained it in *Trochus*. Bruguière included it in his new genus *Cerithium*, 1799, as did Lamarck and Deshayes. Röding and Link placed it in *Plotia* Röding, 1798.

In 1810 Montfort erected the genus *Telescopium* for the species (vol. 2, p. 439), changing the specific name to *T. indicator*, which is the type species, by original designation. It is still included in that genus by the majority of conchologists, although a few writers place it in *Cerithidea* Swainson, 1840.

The species is described in the "Museum Ulricae." The additional subdescription there provided thoroughly confirms the identification with the *telescopium* of authors by the instructive phrases "colore castaneo s. corneo fusco," "basi plana," "anfractus vix distinguindi," "sinus posticus [*sic*] brevis, contortus, pallidus, recurvatus," and "Labrum recurvum cingente, spirali." A specimen of *telescopium* is present in the Uppsala collection, properly labeled.

It is figured by Reeve (1843–1878, vol. 15, *Telescopium*, pl. 1, sp. 1), Kiener (1834–1850, vol. 5, *Cerithium*, pl. 28, fig. 1), and Sowerby (1852, pl. 17, fig. 378).

Trochus dolabratus

1758, Systema naturae, ed. 10, p. 760, no. 522.
1767, Systema naturae, ed. 12, p. 1231, no. 601.
LOCALITY: Not given in 1758; "in Africa; terrestris" (1767).

"T. testa umbilicata turrita glabra, columella exserta recurvato-contorta plicata . . . Apertura singularis distorta ad columellam ore triplicato. Umbilicus perforatus. Color Bullae Virginiae."

The entire subdescription was added in the twelfth edition. As it left Linnaeus' hands it was adequate to identify the species with the *Pyramidella dolabrata* of later writers, although it must be admitted that it contains some equivocal language. The columella is not only deeply three-plaited, but its anterior end is produced into a flat, semicircular flange which curves to the right and follows the curved line of the outer lip. This member is extremely fragile, and in many specimens in collections it has been broken off. Such a break discloses the plications of the columella more clearly, so that it is seen as a produced spiral. This effect was undoubtedly responsible for the phrase "columella exserta" in the description and indicates, as is possibly proved by the specimens in the Linnaean collection in London, that Linnaeus' model was damaged in this respect. The word "longitudinalibus," used for the spiral bands of yellow-orange, was frequently employed by Linnaeus for spiral sculpture or lines of color, but I have always considered it a bad choice of a word. His usual word "transversis" is more realistic. The phrase "Color Bullae Virgineae" is justified, as the narrow spiral striping of the shell conforms to the color pattern of some forms of *Bulla virginea* (*Liguus virgineus*) of the twelfth edition. It is barely possible that it was this similarity that led Linnaeus to conclude that *dolabratus* was a terrestrial species, and it should be noted, in connection with the locality "In Africa," that Linneaus also believed that *Bulla virginea* was an African species, whereas it is confined to the island of Hispaniola.

Linnaeus' African locality for *dolobratus* has been very sparingly discussed by the early writers. The mistake in its habitat was, however, a disputed point for some years. Lister (pl. 844, fig. 72) had already, almost a century before the tenth edition of the "Systema," placed *dolabratus* among the marine species and located it in Barbados. Gualtieri (pl. 4, fig. M, two figs.) figured a shell much resembling *dolabratus* which, in his pertinent text, he described as "Turbo terrestris umbilicatus, basi lata, ore sulcato, candidus, lineis fulvis circumdatus." Writers have differed as to the identity of Gualtieri's shell, some calling it *dolabratus* and some referring it to the *Helix terebella* of Müller (1774, p. 123). Both are marine species, although Müller thought his was a terrestrial shell. I suggest that it is impossible to identify the Gualtieri figure. Müller cited it for his *terebella*, which he described as "absque dentibus." Müller also described a *Helix dolabrata* (*op. cit.*, p. 121) which is, from its description, the *T. dolabratus* of Linnaeus.

Linnaeus' synonymy consisted of a single

figure from Argenville (1742, pl. 14, fig. L). This is not a good picture of *dolabratus*, as the base and aperture are very crudely portrayed, but his description (text pp. 276–277) goes far to cure the defects in the figure: "the interior with a series of little teeth opposite to the columella which has several plications." The presence or absence of teeth in the aperture of *dolabratus* has always been one of the causes of the confusion in the understanding of this species.[1]

Owing to the long-continued discussion as to the localities and relationships of *dolabratus*, *terebellum*, and allied forms, it is wise to trace the post-Linnaean history of these names in the works of the principal eighteenth century authors.

Chemnitz (1780–1795, vol. 5, p. 73, pl. 167, figs. 1603–1604) described and figured a "Trochus turritus dolabratur [*sic*] Linnaei, umbilicatus, glabratus, columellae labro triplicato exserto," which he referred to the *dolabratus* of the tenth and twelfth editions of the "Systema" and to the "Museum Ulricae." He also referred, among other figures, to the crude drawing from Argenville cited by Linnaeus. He did not refer to the questionable Gualtieri figure M or to the *Helix terebella* of Müller but did cite Müller's *Helix dolabrata*. Müller listed four varieties of *dolabrata*, with one, two, three, and four spiral bands, respectively, and another with no bands. The forms *Pyramidella terebellum* Müller and *terebelloides* A. Adams, 1858, which are discussed below, probably represent two of these varieties.

Chemnitz was one of the few early writers who discussed the habitat and locality of the species. He said (*tom. cit.*, p. 75): "Is this really only a marine shell? It was stated by Linnaeus himself to be an African land shell, and by others to be an East Indian fluviatile shell. I agree with and follow Lister who placed it among the marine species and reported that it was obtained from Barbados. I have found my specimens among the seashells which came from the islands of St. Croix and St. Thomas."

[1] Linnaeus added another figure (Petiver, pl. 63, fig. 12) by a manuscript note in his working copy of the twelfth edition. This figure shows a shell much too slender for *dolabratus* and which more closely resembles *Obeliscus terebelloides* A. Adams.

Gmelin (1791, pp. 3585–3586), in addition to his typical *dolabratus* which he referred to most of the earlier figures and to *Helix dolabrata* Müller, listed three lettered varieties. Variety "β" was referred to Lister's figure 72b on the same plate (844) as his figure of *dolabratus*. This figure is probably intended to represent *Pyramidella maculosa* Lamarck, 1822. Variety "γ" was referred to a Petiver figure (pl. 118, fig. 15). For variety "δ" he cited Müller's *Helix terebella* and the questionable Gualtieri figure M. He was, however, the first writer after Linnaeus to locate the species correctly: "in mari Americam australem alluente," and the first to mention the teeth or ridges a short distance inside the lip.

Bruguière (1789–1792, pt. 2, p. 356) placed the species in *Bulimus* Scopoli, 1777, as *B. terebellum*, thus correcting Müller's feminine ending of the noun "terebellum," and correctly noted that the outer lip "bears, on the inside, six elevated ribs which begin to be evident at a distance of one ligne from the margin." He added a variety "B" which he described as being punctate with light brown spots instead of continuous lines of color. This "variety" was undoubtedly the *Pyramidella maculosa* of Lamarck, although Lamarck (1822, vol. 6, pt. 2, p. 223) did not include it in his synonymy of *maculosa*. It was also the *P. punctata* of Schubert and Wagner (1829, p. 152, pl. 234, figs. 4099a, b).[2]

Röding (1798, p. 95) placed *dolabratus* Linné in his *Plotia* as *P. lineata*. Link also used *Plotia* but restored the specific name *dolabrata*.

Dillwyn (1817, p. 811) accurately described the species. He distinguished *Trochus terebellus* (*sic*=*Helix terebella* Müller) by the absence of apertural teeth or ridges in that species. He confined himself to Linnaeus' locality: "Inhabits Africa, and is a land shell." He listed *T. terebellus* separately (*op. cit.*, p. 810) and correctly identified it with the variety "δ" of Gmelin's *dolabratus* and with Müller's *terebella*. His synonymy of the two species is complete and, with one excep-

[2] Schubert and Wagner said that Lamarck's *maculosa* "seems to be an immature example of this species." They cited for it Lister's plate 844, figure 72b, *maculosa* Lamarck, and the "Tableau" figures (pl. 452, figs. la, b) called *maculosa* in the "Explanation of Plates."

tion, correct, as for *dolabratus* he cited Solander's *Voluta notata* as a "Variety. With two or three transverse rows of brown spots." He did not mention *maculosa* Lamarck in connection with this variety.[1]

Lamarck (*tom. cit.*, p. 222) was still in doubt as to the locality of the species, as he located it in the "Seas of southern America" only with a query. In the case of *P. terebellum* (*loc. cit.*) he did not query the locality "Seas of the Antilles." He moved both species to his *Pyramidella*, 1799, for which he used *dolabratus* as his "example." He distinguished *P. terebellum*, as had Gmelin, Bruguière, and Dillwyn, by its lack of the apertural teeth or ridges. Since Lamarck the genus *Pyramidella* has been exclusively used for this group except by those few writers who have from time to time resurrected the unavailable name *Obeliscus* of the "Museum Calonnianum."

The Linnaean collection in London contains two specimens of *T. dolabratus*, of which one, without documentation, shows teeth in the aperture, and the second, which is marked for *dolabratus*, is edentate. Hanley complained that he could not find "a single adequate representation of it in a characteristic condition." This was to a great extent true, as many of the extant figures in Hanley's day show a damaged aperture or columella. He referred to the "Tableau" figures of *P. dolabrata* (pl. 452, figs. 2a, b) which were either based on a damaged individual or were badly drawn. They do show, however, what must be taken as teeth in the aperture.[2] He also referred to Crouch's figure (1827, pl. 16, fig. 9), saying that it "appears to me to be the edentulous form of the same shell [*dolabrata*]." The figure shows no teeth in the aperture and was listed as *P. terebellum* by Crouch. It is apparent that Hanley believed that *dolabrata* occurs both with and without teeth and further that *P. terebellum* is merely a name given to the edentate form. The present writer dissents from this view. As is suggested below, in whatever form *dolabrata* may appear, *terebellum* is a distinct edentate species from the Indo-Pacific region.

Hanley also adopted the thesis that the apertural teeth appeared only in the adult *dolabrata*. Linnaeus also appears to have held this view. Although he did not mention teeth in either the tenth or twelfth editions of the "Systema," a manuscript note is found in his working copy of the twelfth, opposite *T. dolabratus*, which reads in part: "Matura labro intus dentata evadit. . . . " Thus Linnaeus went on record, at least in manuscript, that the teeth were only an adult characteristic.

Fischer (1873a, *Pyramidella*, p. 3, pl. 1, figs. 2, 3) went even further afield. He listed only *P. terebellum* as a good species and treated *dolabrata* as a form of *terebellum* in which the lip is dentate. His comments are quoted in part in order to show his confusion in regard to this affinity: "Following M. Deshayes, we consider *Pyramidella dolabratum* [*sic*] as a fully grown adult of the *Terebellum* of Lamarck [*sic*], for it differs only in the ridges which are seen in the interior portion of its *left lip* [italics mine], so that if the edge of the lip becomes broken this edge appears to be denticulate; it is such an accident, which frequently occurs, which has given rise to the separation of the two species, for in intact specimens the plications are only visible in the depths of the aperture. Fully grown individuals also have the plications very strongly developed. There is a perfect conformity in the other characteristics of these two shells."

The writer is unable to follow Fischer's argument. The reference to the damaged portion of the shell should refer to the damage of the lower portion of the columella, as that is, as said above, a frequent "accident" in this species. If so, Fischer appears to be

[1] Two further synonyms are suggested in Dillwyn's index (1823) to the Lister plates, under the reference to plate 844, figure 72B. Dillwyn there said that this figure, which Bruguière cited for his variety "B" of *Bulimus dolabratum*, "has been arranged separately, with the name of *Voluta notata* by Solander and with that of *Pyramidella punctata* by Ferussac."

[2] These two figures were called "*Pyramidella terebellum. P. dolabrata.* Lamk. 6, pars. 2, 222" in the "Explanation of Plates," although Lamarck cited them in 1822 for *P. dolabrata* alone. The shell that appears on plate 459 (figs. 2a, b) somewhat resembles *P. terebellum*, although it clearly shows teeth in the aperture, and is referred to in the "Explanation of Plates" as follows: "*Pyramidella dolabrata.* Lamk. 6. pars 2, 222. This shell has already been represented on the plate 452, fig. 2." Either Lamarck or the editor of the plates was apparently confused as to the relationship of these two names. Hanley did not refer to the plate 459 figures.

speaking of the columellar area throughout the above quotation. It seems unrealistic, however, to speak of the columella as "dentate." It is possible that the phrase "the left lip" was a *lapsus calami*. I shall leave to the reader the task of unraveling this skein of confusion. In any case, I wholly disagree with the view that the two forms are conspecific.

The diagnosis of *Trochus dolabratus* in the "Museum Ulricae" covers, by its terms, a shell with apertural teeth but presents a situation found in very few of the diagnoses in that work. Linnaeus there first copied the tenth-edition description, as was his custom, and correctly referred it to "Syst. Nat. 10, p. 760, n. 522." He added, however, to that description two words "apertura dentata" which had not been used in the tenth edition. This amended description was written before his insertion of the manuscript note in his copy of the twelfth edition. He had apparently already concluded that the teeth appear only in the adult shell, although it is strange that this fact was not recorded later in the twelfth edition, as published, where no mention of apertural teeth is made. In any case there is no suggestion in either the "Systema" or the "Museum Ulricae" that two species were involved.

Reeve (1847–1878, vol. 15, *Pyramidella*, pl. 2, sp. 13a, b) referred *P. dolabrata* only to *T. dolabratus* Linné and to *Bulimus terebellum* Bruguière. Thus he apparently considered that *dolabratus* Linné was the species lacking teeth in the aperture, although he did not specifically follow Fischer in uniting the two species. His figure 13 for *P. dolabrata* shows no apertural teeth.[1]

Reeve's figure for *P. terebellum* (*tom. cit.*, pl. 2, sp. 14) shows an aperture and base almost identical with figure 13b of the apertural aspect of *dolabrata*. The ground color of the shell is shown as livid bluish, and the spiral lines are very dark. It is referred to "*Obeliscus*" *terebellum* Müller and to *Trochus dolabratus*, var. Gmelin. It is thinner and less ventricose than his figures of *dolabratus* Linné, and the whorls are slightly more flattened. Reeve did not say which of Gmelin's three varieties he meant, but it was undoubtedly variety "δ," as that variety cited *Helix terebella* Müller and the Gualtieri figure M. Reeve's locality for *terebellum* was the West Indies, but *dolabrata* was said to come from "Loanda, West Africa."[2] I agree with Reeve's treatment of these two species except for his implication that *dolabrata* was the species that lacks apertural teeth and for his respective localities of the two species.

Sowerby (1847–1887, vol. 2) placed all of the *Pyramidella* species in *Obeliscus* Humphrey, 1797, an unavailable generic name, under the terms of Opinion 51 of the International Commission on Zoological Nomenclature. His figures of *O. dolabratus* (pl. 171, figs. 1, 3) show the more tumid and more convex whorled shell. The drawing of the base is unsatisfactory. No teeth appear in the aperture, although teeth are mentioned in his description. The species is referred to *Trochus dolabratus* Gmelin, *Helix dolabrata* Müller, *Bulimus dolabratus* Bruguière, and the "*P. terebellum*" of the "Tableau encyclopédique" (pl. 452, fig. 2) and is described as having "the outer lip strongly grooved internally." Sowerby's *O. terebellum* is figured on the same plate (*tom. cit.*, pl. 171, figs. 5, 6). These latter figures show the slightly more slender shell with a bluish ground color. No teeth are shown in the aperture, thus following the words of his description, "labro intus laevigata." He located both species in the West Indies. With the exception of his treatment of *terebellum* as a West Indian species, this is the first convincing separation of the two shells. His inclusion of the "*P. terebellum*" of the "Tableau" in his snyonymy of *dolabrata* is merely an unthinking adoption of the erroneous indication "*Pyramidella terebellum. P. dolabrata*" in the "Explanation of Plates," and was obviously a slip of the pen, as the pertinent "Tableau" figures are clearly *dolabrata*.

In 1886 Tryon (1886, *Pyramidella*, p. 300)

[1] The absence of apertural teeth or ridges in figures of shells of this affinity is probably not significant, as it doubtless represents carelessness or ignorance on the part of the artists.

[2] This is probably an error for "Luanda," the seaport of Portuguese West Africa. This locality is below the "bulge" of west Africa and approximately 1700 miles south of Senegal. This fact is mentioned, as neither of the two species has been reported from Senegal or is mentioned in the report by Fischer-Piette and his coauthors on the "retained" collection of Adanson (1942, pp. 103–354).

said of *P. dolabrata:* "Outer lip *often* lirate within" (italics mine). He correctly located it in the West Indies and gave *Strombus columella* Meuschen as a synonym. His figure (pl. 72, fig. 71) is the thicker, more convexly whorled species. He considered three other forms as varieties of *dolabrata* as follows:

Variety *subdolabratus* Mörch, 1875, "last whorl inflated, lip without ridges, running into the typical form."

Variety *terebellum* Müller, "whorls less convex, bands a little wider and chocolate colored." Tryon located this variety in "The Sandwich Islands, Viti Islands, Mauritius and the Red Sea," and added, "Usually known under the name of the next variety, with which it is probably synonymous." I do not agree with the last statement.

Variety *terebelloides* A. Adams, 1854, "More slender than the last variety, columella with two instead of three plications, whorls with two or three slim chestnut lines." This variety is shown in Tryon (1886, pl. 72, fig. 74), in a drawing that conforms to his description. He located it in Polynesia.

The several conceptions of these closely allied forms outlined above sufficiently indicate the wide difference of opinion as to their relationship, locality, and shell characters. An examination of the figures discussed and of a considerable series of the several forms convinces the present writer that three distinct species are involved:

1. *Pyramidella dolabrata* of the West Indies and the Bahamas,[1] the least tapering species, with a body whorl noticeably tumid and with a whitish ground color and light chestnut bands.

2. *Pyramidella terebellum* Müller, a somewhat narrower and more tapering shell, with a bluish ground color and with darker, more numerous, and somewhat wider bands. This species always lacks the teeth in the aperture. It is a widely dispersed species, being reported from the Hawaiian Islands to the western Indian Ocean and the Red Sea. Specimens in collections labeled "*terebellum*" from the West Indies all seem to be edentate specimens of *dolabrata*.

3. *Pyramidella terebelloides* A. Adams, from the Pacific Ocean, is a much smaller shell, slimmer and more tapering than either of the other two, and bearing only two plications on the columella. It is difficult for the writer to unite any of these three species, considering not only their widely separated ranges but their obvious differences in shell characters. Von Martens (1880, p. 301), who listed *terebellum* from Mauritius, said: "It is impossible for me to distinguish the specimens from the West and East Indies." I suggest that his "West Indian" specimens had been improperly labeled.

On the question of the presence or absence of teeth or ridges in the aperture, I am unable to come to a conclusion. Most writers refer to *dolabrata* as dentate in the aperture. Tryon, as seen above, said that the shell is "often lirate within." It may be, as Linnaeus and Hanley believed, that the teeth do not develop until a comparatively adult stage is reached. A categorical opinion is difficult because of the fact that many small specimens show these teeth. These, however, may be fully adult dwarfs. Moreover, many large and obviously adult specimens lack the teeth, without showing signs of wear on the rest of the shell. Another handicap is that the outer lip in this species is thin and brittle, and many apparently edentate specimens were seen with the outer lip so deeply damaged that it is possible that the teeth, although beginning well within the edge, had been broken off in the damaged shell.

Trochus dolabratus is the type species of *Pyramidella* Lamarck, 1799, by monotypy. It is an exact synonym of the name *Obeliscus* Humphrey, 1797 (not Beck, 1837), which is unavailable. *Trochus dolabratus* is also the type species of *Plotia* Röding, 1798, by subsequent designation, Pilsbry and Bequaert (1923, p. 36), as *Plotia lineata* Röding.[2]

Trochus perversus

1758, Systema naturae, ed. 10, p. 760, no. 523.
1767, Systema naturae, ed. 12, p. 1231, no. 602.
LOCALITY: "In M. Mediterraneo" (1758, 1767).

[1] Abbott ([°1954], p. 289) queries a possible extension of the range of *dolabrata* to the Florida Keys.

[2] Pilsbry and Bequaert called attention to an earlier attempted designation. In 1874 Brot cited *Melania spinulosa* Lamarck as type of *Plotia*. *Melania spinulosa* belongs in *Plotia*, but nothing answering to its description is found in Röding's original list. Thiele (1931, p. 200) used *Melania* (*Plotia*) *scabra* Müller as the type of section *Plotia*, but the designation of Pilsbry and Bequaert has eight years' priority.

"T. testa imperforata turrita glabra, anfractibus contrariis serie duplici excavato-punctatis . . . Testa parva, anfractibus cylindricis, duplici serie excavato punctatis, praeter margines anfractuum etiam crenato punctatis. Apertura quadrata: columella basi prominula, at non in canalem evidentem. Color fere corneus."

In the Linnaean collection in London Hanley (1855, p. 324) found specimens of a *Triphora* species which he said conformed to the description of *Trochus perversus* in the "Systema." The original receptacle in which they were found had originally been marked with an identification of its contents, but the characters were completely illegible. The specimens, therefore, had no documentation whatever.

The sculpture noted in Linnaeus' description of this species does not conform to the sculpture of the shell long known as *Triphora perversa* (Linné), as the phrase "duplici serie excavato punctatis, praeter margines anfractuum etiam crenato punctatis" does not describe the *perversa* of authors which has four rows of granules on the body whorl and three on the whorls of the spire, the center row tending to become obsolete near the apex of the shell. Hanley said that this discordance was explained by the worn condition of Linnaeus' specimens in the collection "in which the smaller central grains are so far worn down to a level surface that the minute intervals between the rows look like punctures, whilst the coarser series of the upper and lower granules preserve more of their pristine appearance." I have not seen the specimens in the collection and the microfilm of the Linnaean shells in my possession does not show them, but Hanley's explanation does not seem reasonable. In every specimen of a considerable series of this species seen by the present writer, both from the Mediterranean Sea and the Atlantic coast of Europe, the center row is made up of noticeably and constantly smaller granules, even in fresh specimens. Under these circumstances it would seem that wear, at least by contact with rock, sand, and other solid objects, would first erode the more salient outer rows of granules, so that the condition of the middle row, as reported by Hanley, could not occur while the outer rows remained. A more reasonable explanation of the puzzling language of the description would be that Linnaeus had examined these worn shells without the aid of a lens and that the wear had progressed to a point where all the rows took on the appearance described by him.

Hanley added that, of all the shells in the collection, these specimens agreed most closely with the description and that Linnaeus did possess the species, as is indicated by the underlining of the serial number of *Trochus perversus* in his working copy of the "Systema." He concluded, therefore, "I regard their presence as confirmatory of the admitted (though hitherto somewhat problematical) identification." I would be inclined to concede the probability that the worn specimens in the collection were, in fact, before Linnaeus when he wrote his description. This possibility is strengthened by the fact that only six sinistral species are described by Linnaeus and that the other five[1] not only belong in other genera, but can be isolated and identified in the collection either by being documented by the proper name or serial number or, if undocumented, by the wide disparity of their descriptions. The lack of documentation of the Linnaean specimens, however, bars their acceptance as the syntypic lot except on a "probable" basis, and their type status is somewhat less "probable" in the present case because of the equivocal character of the description.

It should be added that Linnaeus' description contains the word "glabra," which is unexplainable unless his specimens were so worn as to justify the word. He supplied no references. The locality is correct in part only, as the species is found not only in the Mediterranean but along the Atlantic coast of Europe and in the Canary Islands.[2]

[1] These five species are *Murex perversus* (*Busycon perversum*), *Murex contrarius* of the "Mantissa" (*Neptunea contraria*), *Turbo perversus* (*Balea perversa*), *Turbo bidens* (*Clausilia bidens*), and *Helix perversa* (*Amphidromus perversus*).

[2] Tryon (1887, p. 187) states that *Triphora perversa* has been reported from the California coast. In endeavoring to find a *Triphora* on which Tryon's record could have been based, I am advised by Dr. R. T. Abbott that the Academy of Natural Sciences of Philadelphia has two specimens of a *Triphora* (A.N.S.P. No. 18204) collected by Hemphill at San Diego, California, which "closely resemble and are probably what Bartsch (1908, Proc. U.S.N.M., vol. 33, p. 250) described as *Triphoris pedroanus*. I would hardly call them *per-*

The imperfection of the description retarded the identification of *T. perversus* for many years. Born did not mention it. Schröter (1783–1786, vol. 1, p. 676) listed the name and paraphrased Linnaeus' description, but was a mere copyist, as he said: "As to this shell, which I do not know, Linnaeus says nothing more." Neither Martini nor Chemnitz listed the species under the name *perversus*, although Chemnitz described and figured a shell (1780–1795, vol. 9, pt. 1, p. 126, pl. 113, fig. 966) which may have been *perversus*. The figure, which is shown in actual size and enlarged, is a *Triphora* and closely resembles one of the less tapering forms of *perversus*. Chemnitz called it only "Ein linker gestreckter Kräusel" and added, "Have we here a form of *Trochus perversus* Linnaei?" As to the sculpture he said that "the first whorl has three rows of beads and the following are encircled with two," which is not a precise description of the sculpture of *perversus* Linné.[1] If Chemnitz' shell was in fact *perversus* Linné, it is curious that he spoke of a *form* of *perversus* but failed to describe the typical shell anywhere in his work.

Gmelin's description of the present species is in part a copy and in part a paraphrase of that of Linnaeus but is shorter, as he eliminated Linnaeus' repetitions. He added no references. It seems probable that he had not seen the species.

Bruguière's treatment of *perversus* is also extremely equivocal, and little weight can be given to it. He listed the species (1789–1792, vol. 1, pt. 2, p. 496) as "*Cerithium perversum* Nobis," but, while he cited for it the *Trochus perversus* of the "Systema naturae," adding citations of the Schröter reference and the Chemnitz figure 966, the latter with a query, he admitted that his description and identification were based on his recollection of a specimen seen only once. He said: "Linnaeus, who first described this shell, said that it was the size of a grain of barley, horn-colored, [that] the whorls of the spire are cylindrical and their surface bears four circular belts, of which the two in the middle are composed of little sunken granules [points] and the outer ones of raised granules, which make them appear to be crenulate . . . I have had occasion to see this little shell only once, but, not having taken down a description of it, I remember only that it resembles the Martini [error for Chemnitz] figure which I have cited and which I regard at present as belonging to the genus *Cerithium*. M. Schröter's description is manifestly a translation of that of Linnaeus, since it adds nothing to the details I have quoted from that naturalist. According to him it is found in the Mediterranean."

Bruguière's treatment of the species can scarcely be considered as an identification. Not only was it written from memory, but the "four" rows of granules and the "two" central rows he mentioned are seen only on the body whorl of *perversus* and not on the whorls of the spire as he claimed. It is possible that the French word "deux" was a misprint for "ceux" (those) and that the author meant to say "of which those [granules] in the middle are composed. . . . " Even this possibility leaves intact the mention of four rows on the spire whorls. The comparison of the size of the shell with a grain of barley is, incidentally, not found in the description of *perversus* in the "Systema," but is included only in the description of the following species (*T. punctatus*) as "testa magnitudine praecedentis s. Hordei."

Neither Röding nor Link mentioned *perversus*.

Montagu (1803, p. 271) described but did not figure a *Murex adversus* from the coast of Devonshire and Cornwall, a name that has appeared in most synonymies of *perversus*. Montagu's description is extremely persuasive, even in the absence of a figure. He described the whorls as being "scarcely defined by the separating line" and as having three rows of granules, "the middle row smaller than the others." I admit *adversus* as a

versus." The sculpture of *pedroanus*, as described by Bartsch, diverges in several slight but significant particulars from that of *perversus* Linné, but it seems probable, as Abbott concludes, that Tryon's California record was based on the latter species. Bartsch's figure of *pedroanus* (1908, pl. 16, fig. 1) bears a close resemblance to one of the more tumid forms of *perversus* Linné, but also discloses the slight sculptural differences.

[1] Chemnitz also referred to Schröter (1783–1786, p. 575, no. 185) in Schröter's heading "Gattungen und Abänderungen, die im Linné fehlen." Schröter there described a sinistral shell, undoubtedly a *Triphora*, which I would hesitate to identify specifically.

synonym of *perversus* Linné. The only figure cited by Montagu was the Chemnitz figure mentioned above. In spite of the fact that Chemnitz had suggested an identity of his shell with *perversus* Linné, I do not believe that Montagu suspected such a relationship for his *adversus*. Dillwyn (1817, pp. 811–812) was surely not familiar with the shell, as he said in his subdescription: "Linnaeus has described this shell to be . . . ," his usual statement when he was not familiar with a Linnaean species.

Lamarck (1822, vol. 7, p. 77) seems to have been the first to record his possession of a shell that was probably *perversus* Linné. He called it *Cerithium perversum* but did not acknowledge its Linnaean authorship, referring it only, with a query, to the *Cerithium maroccanum* of Bruguière. His description is only tolerably convincing. His specimen, for which he gave no locality, was said to be eight and three-quarter "lignes" in height (seven-eighths of an inch), which, if his shell was *perversus*, indicates a very large individual.

Payraudeau (1826, p. 142, pl. 7, fig. 8) may have been the first to figure the species. His figure shows a *Triphora*, but the suture is so ill defined that it is impossible to count the rows on each whorl and therefore to identify it specifically. His description says merely that it possesses "a multitude of granules." However, he called it *Cerithium perversum* Lamarck, which shows that he was familiar with Lamarck's correct description of the three rows of granules.

Deshayes (1843, pp. 305–306), in the second edition of Lamarck's "Histoire naturelle" attributed the species to Linnaeus, although he continued to place it in *Cerithium*. This was the first treatment of the species which amounted to a categorical identification and a definite attribution of *perversus* to the *Trochus perversus* of the "Systema." Since Deshayes the question of identification has not been seriously raised.

Bucquoy, Dautzenberg, and Dollfus (1882–1886, pp. 209–212, pl. 26, fig. 13, typical, and figs. 8–12, 14–17, varieties) have given the most considered and exhaustive account of this species, its synonymy, and its color and sculptural forms. They state the height of the shell to be 31 mm. This is not the average but represents the maximum reached by any individual seen by the present writer.

Tryon (1887, p. 187, pl. 39, figs. 44, 45) supplied a good description, recognizable figures, and an excellent synonymy, but continued to cite the species as *Triforis perversus*, as had so many of his predecessors.

The generic name *Triphora* Blainville, 1828, is now almost universally used for the species.

Its synonyms are tentatively stated as: *Cerithium maroccanum* Bruguière, 1792; *Turbo reticulatus* Donovan, 1803[1]; *Murex adversus*

[1] Donovan's *Turbo reticulatus* (1799–1803, vol. 5, pl. 159) seems unquestionably *perversus* Linné. His figures, shown in actual size and also enlarged, are the best of the early figures of this species. He compared it with a shell which a "Mr. Walker" had found at Sandwich, in the description of which Walker had used the word "punctatis" as applied to the sculpture. In this connection Donovan added a sentence significally reminiscent of Hanley's explanation of the Linnaean description: "The term 'punctatis,' on the contrary, which Mr. Walker has adopted, *must rather imply a dot depressed:* in the engraving also, by which his description is elucidated, the dots appear to be disposed in three distinct series upon each wreath, as the granulations are in the shell before us, but each dot is apparently depressed, and situated in the center of a quadrangular compartment: at the same time also it must be remarked, that the *intermediate series of these dots on every wreath, are of equal magnitude with the others*" (italics mine). The description of Walker's shell thus conforms rather closely to Linnaeus' debatable use of the words "excavato-punctatis" and raises at least a suspicion that the shell described by Linnaeus as *perversus* might not have been based on the undoubted specimens of *perversus* in the London collection but was another species. Although Donovan did not recognize the identity of his species with *perversus* Linné but said that it was "undescribed either as a British or a foreign shell," his description of the sculpture is convincing and deserves to be quoted: "In our shell, the wreaths are uniformly lineated spirally, with three prominent rows of tubercles, or more correctly speaking, granulations, except on the first wreath, where they are more numerous, and the intermediate series on each wreath, consists of *smaller granulations than those on either side of it*" (italics mine). It is not difficult to suspect a grave possibility that, while Donovan's *reticulatus* is the *perversus* of authors, Linnaeus' *perversus* and Walker's "punctate" shell are the same and represent another species. I cannot suggest what this other species may have been other than to say that it was a shell closely resembling *Triphora montereyensis* Bartsch, 1907, from Monterey, California. In any event, the attribution of the *perversus* of authors to *perversus* Linné is so well established that it should be accepted to avoid a confusing renaming of the former. I feel obliged, however, to add this footnote to emphasize my conviction as to the inadequacy of Linnaeus' description.

Montagu, 1803; *Cerithium tuberculare* Blainville, 1829, not Montagu, 1803; (?) *Cerithium inversum* O. G. Costa, 1839; and *Cerithium savignyanus* Chiaje, 1841. European authors often add *Cerithium pusillum* Pfeiffer, 1840, to the synonymy. Bucquoy, Dautzenberg, and Dollfus (*loc. cit.*) should be consulted for a list of "varieties" of *perversus*, most of them being Monterosato names. It should be pointed out that in a species so small and so variable as this, and for which the available figures are so unclear, the citation of varieties depends largely on the personal opinion of the describer. For this reason the varietal names listed by the above writers and by Tryon and others are treated by the present writer as having no nomenclatorial importance.

Triphora nigrocincta (C. B. Adams, 1839), a western Atlantic shell with a wide distribution, being found from Massachusetts to Florida and Texas and in the West Indies, has been considered by some writers as a subspecies of *T. perversa* Linné.[1] The most recent commentators treat it as a good species, based on the difference in sculpture.

Trochus perversus was not described in the "Museum Ulricae." Queen Louisa Ulrica's collection contained virtually none of the smaller species, and the European shells were very sparsely represented.

The best figures of the species are those of Bucquoy, Dautzenberg, and Dollfus and of Tryon, already referred to. Donovan's figure of his *Turbo reticulatus* should also be consulted.

Trochus punctatus

1758, Systema naturae, ed. 10, p. 760, no. 524.
1767, Systema naturae, ed. 12, p. 1231, no. 603.
LOCALITY: "In Europa australi" (1758, 1767).

"T. testa imperforata turrita, anfractibus serie triplici punctorum prominentium . . . Testa magnitudine praecedentis s. Hordei, ferruginea, undique punctis obtusis eminentibus obtecta, in singulo anfractu serie triplice, quarum intermedia minor est. Apertura quadrata cum columella prominula, vix manifeste canaliculata.

[1] In Dall (1890–1903, pt. 2, p. 263) *nigrocincta* was treated as a mere variety of *perversa*. Binney, however (1870, pp. 321–322), said: "It is closely allied to the *Murex adversa* (*T. perversa*) of Montagu, but is probably different, as that shell has the middle series smaller, and the canal straight. It is also of a lighter color."

It may be suggested that Linnaeus felt obliged to write this long and seemingly adequate description because of his inability to find an appropriate figure of the species in any of the pre-Linnaean iconographies. However, there is no shell native to his locality, southern Europe, which conforms to all its details, and the definition and the absence of references were stumbling blocks to even a tentative identification for almost a hundred years. Hanley (1855, p. 324) could find nothing in the Linnaean collection in London that answered to Linnaeus' description, nor any shell marked for *punctatus*. It is possible that the shell was described, as is so often the case in the "Systema," from a borrowed specimen or one seen in the collection of a colleague. Hanley tentatively suggested *Cerithium lacteum* or *C. lima* Bruguière, 1792, as the two species that conformed most closely to the description, but properly distinguished the first as being described as a white shell not conforming to the "ferruginea" of Linnaeus' description and the second because it bears four series of raised tubercles on each whorl instead of the three specified for *punctatus*. He then referred to Philippi's listing of *Cerithium punctatum* Linné and appeared to accept it tentatively as an identification (see p. 214, below).

Martini, Chemnitz, Bruguière, Röding, and Link did not refer to *punctatus* Linné. Gmelin's description of *punctatus* is an almost verbatim copy of that of Linnaeus, omitting the word "turrita," changing the order of some of the clauses, and adding "Africam alluente" to the locality. His treatment of the name does not convince me that he was familiar with the species, although the addition of a more specific locality is some evidence that he was. As usual he did not refer to the "Systema." Bruguière's *Cerithium punctatum* (1789–1792, pt. 2, p. 498; Lamarck, 1822, vol. 7, p. 76), described by Lamarck as "varicosa, alba" and "ultimo basi linea alba cincta," is a different species. It is found in Senegal and is figured in Keiner (1834–1875, vol. 5, *Cerithium*, pl. 16, fig. 4).

Dillwyn (1817, p. 813) lists *Trochus punctatus* Linné, but his treatment leaves no doubt that he was unfamiliar with the species and was a mere copyist, as he said: "Linnaeus has described this shell to be . . . "

He cited only the "Systema" listing and *Cerithium ferrugineum* Bruguière (*op. cit.*, p. 496) with a query. Neither Lamarck nor Deshayes listed the Linnaean species, and the latter said in a footnote (1843, p. 304) to *Cerithium punctatum* Bruguière: "The *Trochus punctatus* of Linné is possibly not the same species as that of Lamarck; in fact, Linnaeus' shell has only three rows of little tubercles, that of Lamarck has four."

The first to describe a *Cerithium punctatum* that was referred to Linnaeus' species was Philippi (1849, pp. 23–24). Although he placed a question mark after his reference to Linnaeus, he said: "I have no doubt that this species is the *Trochus punctatus* of Linné." After quoting Linnaeus' description, he continued: "*Cerithium punctatum* Brug. must be distinguished under another name if my conjecture is correct." He gave no locality for *punctatus* and supplied no figure. Hanley, as said above, impliedly accepted Philippi's identification, saying: "The *C. tuberculare* of our shores possesses the ascribed characteristics; I dare not, however, assert it to have been the *Trochus punctatus* of Linneus, although the locality (for it is found, also, in the south of Europe) likewise coincides, since Philippi, in the 'Zeitschrift für Malakozoologie' for 1848 (p. 23), has bestowed the Linnaean appellation upon a *Cerithium* which he regards as the species of the 'Systema.' " Between the works of Hanley and Tryon, I have found no useful comment on the species.

Tryon (1887, p. 170, pl. 35, figs. 34, 35) described a *Cerithiopsis punctatum* and definitely identified it with the *Trochus punctatus* of the "Systema," but he abandoned the European locality, giving the Linnaean name to a western Atlantic species ranging from Massachusetts to Florida and the West Indies. His description covered most of the details of Linnaeus' description. He said: "This species is better known to American conchologists as *C. emersoni* C. B. Ad. (fig. 35), but was previously described from accidentally occurring European specimens as *C. subulatus* Montagu[1] and *C. elegans* Blainville. Philippi was the first to identify it with *C. punctatum* Linné, the description of which suits it well." This represents a most drastic change in the treatment of the species. I cannot conjecture what Tryon meant by his phrase "accidentally occurring European specimens." While the earlier description of *punctatus* by Philippi and the tentative acceptance of Philippi's identification by Hanley did not discuss the source of Philippi's shell, Tryon's statement seems an unconvincing basis for giving the name to the American species, particularly in view of the dubious character of the Linnaean diagnosis.

The American *subulata* is a well-known and common species in its range. The most recent mention is by Abbott ([°1954], p. 157), who placed it in the genus *Cerithiopsis* Forbes and Hanley, 1849, as *C. subulata* (Montagu, 1808), giving *C. emersoni* (C. B. Adams 1839), as a synonym. His range, Massachusetts to the West Indies, follows that of Tryon for "*Cerithiopsis punctatum.*" Abbott's figure (*op. cit.*, pl. 19, fig. W) conforms to Linnaeus' *punctatus* in many respects, but Abbott did not discuss the possible common identity of the American species with *punctatus* Linné. The size of *C. subulata*, which has a height of from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch, is much larger than is indicated by Linnaeus' comparison with "a grain of barley."

Pallary (1920, p. 23), in a paper devoted largely to the Algerian species described by Poiret, 1789, indirectly recognized *Trochus punctatus* Linné as a good species. He listed Poiret's species and gave synonyms for many of them. For "*Trochus punctatus* Linné" he said: "= *Calliostoma crenulatum* Brocchi." Brocchi's name is probably a synonym of *Calliostoma exasperatum* (Pennant, 1777), a species from the Mediterranean Sea and the Atlantic coast of Europe which is very close to *C. zizyphinum* but remote from any of the descriptions of *punctatus*. Pallary added: "The observation [of Poiret] that the spire bears a triple row of salient tubercles leads us to adopt the name *crenulatum* in preference to that of *exasperatum* Pennant."

So far as I have found, no other recent author since Tryon has accepted *punctatus* Linné as an identifiable species or referred it to *Cerithiopsis subulata* of the western Atlantic. I have great hesitation in adopting such an identification. Even if it should be

[1] Montagu's *subulatus* was placed in *Murex* (1808, p. 115). No synonymy was supplied. His figure (pl. 30, fig. 6) is very small but resembles the *Cerithiospis subulata* of the western Atlantic.

accepted, it would be unwise to restore the Linnaean name for our *Cerithiopsis* species because of the unjustifiable confusion it would cause in the nomenclature.

Abbott (*op. cit.*, pl. 19, fig. W, two figs.) supplied excellent photographic figures of the American shell.

Linnaeus' *punctatus* was not described in the "Museum Ulricae."

Trochus striatellus

1758, Systema naturae, ed. 10, p. 760, no. 525.
1767, Systema naturae, ed. 12, p. 1232, no. 604.
LOCALITY: "In M. Mediterraneo" (1758, 1767).
"T. testa turrita imperforata: striis longitudinalibus parallelis obliquatis . . . Testa admodum parva, subulata, alba, apice violacea."

The above description, which was identical in the tenth and twelfth editions of the "Systema," seems at first glance to contain sufficient detail for identification. It has proved impossible, however, for conchologists to tie it to any known species with any certainty. The name is grouped with names of the other four turreted species in *Trochus* Linné: *telescopium*, *dolobratus*, *perversus*, and *punctatus*. These four species belong in the genera *Cerithidea*, *Triphora*, or *Pyramidella*, and *striatellus* could be a member of any one of them. We are not assisted by any references. The species was not described in the "Museum Ulricae" or represented by a specimen in the Queen's collection in Uppsala or in the Linnaean collection in London. Linnaeus' shell was said by him to come from the Mediterranean Sea, but none of the writers on the fauna of that region has given any hint as to its identification. Neither Martini nor Chemnitz referred to it, and Gmelin and Schröter, although both catalogued the name, added nothing to the Linnaean diagnosis. It is most probable that the two last-named writers were mere copyists and had not seen a specimen of it. Bruguière tentatively suggested (1789–1792, pt. 2, p. 497) that it might be identical with his *Cerithium zonale*, but that species does not conform to the description in the "Systema."[1] Dillwyn (1817, p. 813) described a *Trochus striatellus*, but his description is only a literal translation of Linnaeus' main description. He referred to the subdescription in the "Systema" by saying that Linnaeus "has only added that the shell is small, subulate, and white, and has the apex of a violet color," another literal translation. It is obvious that he had not seen the species. He listed four references, all followed by a question mark: Bruguière's *C. zonale; Murex minimus* Gmelin (1791, p. 3564); Schröter's *Murex* number 16, and a figure from Lister (pl. 1018, fig. 81). The last was also cited by Gmelin for his *M. minimus*. None of these references is convincing.

Neither Lamarck nor Deshayes referred to the species, except that Deshayes (1843, p. 299) placed "*Trochus striatellus* Dillwyn," with a query, in the synonymy of *C. zonale* Bruguière.

Hanley (1855, pl 325), finding no type in the Linnaean collection, dismissed the species as unidentifiable, merely suggesting that it seemed to him to be either a *Cerithium* or a *Chemnitzia*. He mentioned that the *zonale* of Bruguière did not conform to the "alba, apice violacea" of Linnaeus' description.

I know of no *Cerithium* species the characters of which conform to those stated for *striatellus* and have found nothing in the literature since Hanley which throws any light on this species. Bequaert (1942, p. 29) has made the most recent comment on the subject. He fully accepted the impossibility of identifying the shell, and added: "There is no reason to suppose that it could have been *Batillaria minima* [*Murex minimus* Gmelin]."

[1] This is not *Cerithium zonale* Quoy and Gaimard (1834, p. 133).

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The dates in brackets are based on external evidence. Plates 1–95 were published before Bruguière's departure from France in late 1792 and were probably supervised by him. He may have been responsible for plates 96–189 [1792]. The remaining plates were to have been approved by Lamarck, and the

majority probably were, although Bory de Saint Vincent, who succeeded to Lamarck's task and possibly others, were responsible for many of them. The name of Bruguière appears alone on the title page of the livraison containing plates 1–189; the plates 190–296 were anonymous so far as the title page is concerned; Lamarck's name appears alone on the title page of the livraisons containing plates 287–390 and 391–488. (See Sherborn and Woodward, 1893, 1899, and 1906.)

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CORRECTIONS FOR PART 5 (DODGE 1957)

Attention is called to an error in my explanation of the Gualtieri figures (pl. 66, figs. B B, dorsal and apertural views) cited by Linnaeus for his *Murex nodosa* (Dodge, 1957, p. 132, column 1, lines 18–25, and column 2, lines 13–15). It was there stated that those Gualtieri figures did not show the black spots on the columella and were, for other reasons as well, unidentifiable as *M. nodosa*. I had mistakenly referred to Gualtieri's pair of figures lettered B at the top of plate 66 which *are* unidentifible, and overlooked the pair of figures lettered BB at the bottom of that plate of 50 figures. These latter figures were the drawings cited by Linnaeus and accurately show the nodose *M. nodosa* with black spots on the columella. A few earlier writers had similarly overlooked these figures. The corrected interpretation of Linnaeus' reference to Gualtieri thus provides an additional good figure in Linnaeus' synonymy of *nodosa*.

Page 98, column 2, line 21: For "16" read "13."

Page 99, column 2, line 24: For "*cumena*" read "*crumena.*"

Page 108, column 2, line 13 from bottom: For "*coatatus*" read "*costatus.*"

Page 131, column 2, line 21 from bottom: Insert "of" after "genus."

Page 133, column 2, line 23 from bottom: For "*rubusidaeus*" read "*rubusidaea.*"

Page 139, column 1, footnote 1, line 2: For "latter" read "earlier."

Page 141, column 2, line 21: For "gluco" read "glauco."

Page 161, column 2, line 24 from bottom: For "his" read "the."

Page 168, column 2, line 23: For "of" read "to."

Page 171, column 1, line 20 from bottom: For "polosa" read "pilosa."

Page 175, column 2, line 10: For "*Haruplina*" read "*Harpulina.*"

Page 185, column 1, line 13 from bottom: For "*vertiaria*" read "*vestiaria.*"

Page 186, column 1, line 15 from bottom: For "*Latrius*" read "*Latirus.*"

Page 191, column 2, line 4: For "*vertebus*" read "*vertagus.*"

Page 196, column 1, line 13 from bottom: For "*Cerethium*" read "*Cerithium.*"

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