

A HISTORICAL REVIEW OF THE
MOLLUSKS OF LINNAEUS

PART 3. THE GENERA *BULLA*
AND *VOLUTA* OF THE
CLASS GASTROPODA

HENRY DODGE

BULLETIN
OF THE
AMERICAN MUSEUM OF NATURAL HISTORY
VOLUME 107 : ARTICLE 1 NEW YORK : 1955

A HISTORICAL REVIEW OF THE MOLLUSKS OF LINNAEUS

A HISTORICAL REVIEW OF THE
MOLLUSKS OF LINNAEUS



*PART 3. THE GENERA BULLA
AND VOLUTA OF THE
CLASS GASTROPODA*

HENRY DODGE

BULLETIN
OF THE
AMERICAN MUSEUM OF NATURAL HISTORY
VOLUME 107 : ARTICLE 1 NEW YORK : 1955

BULLETIN OF THE AMERICAN MUSEUM OF NATURAL HISTORY

Volume 107, article 1, pages 1-158

Issued November 7, 1955

Price: \$2.00 a copy

FOREWORD

1. SINCE THE PREPARATION of Part 2 of the present series of papers (Dodge, 1953) the writer has received, through the kindness of Prof. Åke Holm of the University of Uppsala, a microfilm of the specimens of mollusks in the collection of former Queen Louisa Ulrica of Sweden, now housed in the Zoological Museum of the University. Dr. Nils Odhner of the Naturhistoriska Riksmuseum in Stockholm has very kindly supplemented this film with a critically annotated list of the species filmed. As this was the collection described by Linnaeus in the "Museum Ulricae" in the years 1751 to 1754, at a time when the tenth edition of the "Systema naturae" was in preparation,¹ and as there is considerable doubt in several cases whether the species described by Linnaeus under the same specific name in the two works were, in fact, the same, the Uppsala specimens are of importance in any historical treatment of the Linnaean specific names. In the following pages not only the "Museum" descriptions but the identity of the specimens now in the Queen's collection are discussed. It will be noted that many of the shells described in the "Museum Ulricae" are not present in the collection today and that the labeling of many others shows that serious misplacements of specimens have taken place in the 200 years since the collection was first arranged in the Queen's cabinet by Linnaeus.

Two things must always be borne in mind in a discussion of the Uppsala collection:

A. Linnaeus did not label or number the specimens in any way, but merely arranged them in the cabinet in the order in which they appeared in the "Museum Ulricae." This is amply proved by the text of the preface of the work. The first labels, which still exist, were prepared and affixed to the shells or placed in the trays in 1789 by the then curator of the collection, the botanist Olaus Swarz, who, it is believed, took the names from the twelfth edition of the "Systema naturae."

¹ Owing to delays, the reasons for which are obscure, the "Museum Ulricae" was not published until 1764, by which time the tenth edition of the "Systema" had appeared and the preparation of the twelfth edition must have been under way.

B. Some of the Swarz labels are still found pasted to the shells, but the rest are pasted to the cotton in the trays or are loose in the trays. Moreover, the collection was moved to Uppsala in 1803, which afforded another opportunity for the mixture of species in the collection so labeled.

It is not necessary to labor the point that the history and vicissitudes of the collection do not afford a very convincing basis for the identification of the specimens with either the shell described by Linnaeus in the tenth edition or that described in the "Museum Ulricae." A fuller account of the subject can be found in Part 1 of the present series of papers (Dodge, 1952, pp. 16-18).

2. The subject of the generic names that appear as the headings of certain plates of unnamed figures in the "Tableau encyclopédique" and of the validity of the names as of the respective dates of publication of the plates has been raised several times in these papers, and it has been noted that the International Commission on Zoological Nomenclature, upon submitted request, has recommended that steps be taken to validate such names as of the respective dates of the plates.

The text of the Commission's recommendation (Hemming, 1950a) is as follows:

"The Commission agreed to recommend: "That words should be inserted in Article 25 to make it clear that a generic name published prior to January, 1931, on a legend to a plate but without explanatory matter is to be treated as having been published with an 'indication' for the purpose of Article 25."

In the case of the genera that are sought to be attributed to Bruguière on the basis of these "plate headings" it seems to have been forgotten that he had never published a word concerning these names, although it happens that he left notes showing that he had "planned the erection" of these genera, and that the "plate headings" were published only from 16 to 24 years after his death. It is not even certain that he had ever seen any of them. Certainly, under the text of Article 25 as it exists today it would be impossible to attribute these genera to Bruguière. The Commission obviously real-

ized this, as they were forced to the expedient of recommending a change in the Article. This change is considered by the present writer to be unfortunate in that it permits genera to be established by a given author by the mere suggesting of a name without any publication. That the use of a name by a later editor of a series of plates should be considered an "indication" under the terms of Article 25 is a step far beyond the conception of the framers of the Article. It validates genera with a casualness which will seriously weaken the Rule of Priority.

3. The following note on the documentation of the specimens in Linnaeus' collection of shells now in the custody of the Linnean Society of London is here inserted. It is in part a repetition and amplification of a previous note in the present series of papers (Dodge, 1952, pp. 8-9).

The first and only critical examination of this collection as a whole in which the specimens were referred, or tentatively referred, to descriptions in the "Systema naturae" was Hanley's study made a hundred years ago, as reported in his "Ipsa Linnaei conchylia," 1855. Hanley found approximately one-half of the specimens identified by a number or name written in Linnaeus' handwriting either on the shell itself or on the tray in which it was contained, each number corresponding to a serial number of a species in the tenth or twelfth edition of the "Systema." The shells so marked may, of course, be confidently accepted as Linnaeus' types. In the case of the specimens contained in a similarly marked tray, I feel that they may be so accepted if no obvious evidence of mixture or misplacement is present and if the shell in question is the only specimen in the collection of which the characters conform to the description supplied for its serial number. Hanley's references to "marked specimens" is subject, however, to the following limitation: In a very large number of cases Hanley found the number on the shell partially obliterated by time, that is, one, or in some cases two, digits of the three-digit number had been so worn as to be undecipherable. For all such specimens he painstakingly tested all possible combinations of the missing digit or digits and was successful, as to most of them, in finding a number which corresponded to

a numbered description in the "Systema" which, in turn, conformed to the characters of the shell. The identification thus arrived at was accepted by Hanley as sound, and in the great majority of cases I can see little reason for disagreeing with his conclusions.

The remaining specimens were found to be completely undocumented by any mark either on the shell or on the tray. Many of them he found to be undescribed in the "Systema," and therefore, although they were identifiable if not too worn, he reached the obvious conclusion that they had been added to the collection after the publication of the twelfth edition of the "Systema" either by Linnaeus or by another and were therefore not Linnaean types. The vicissitudes of the collection after the death of Linnaeus and particularly the additions and misplacements that apparently took place while it was in the custody of Sir James Smith, a botanist, have already been referred to (Dodge, 1952, *loc. cit.*).

Each of the remaining undocumented shells conformed to a "Systema" description and, if it was the only specimen in the collection which so conformed and if, in addition, the species was included in one of Linnaeus' two "lists" of owned species,¹ it was accepted by Hanley as the type. This is not an unequivocal identification, and in these papers I refer to such a specimen as the "probable" or "ostensible" type. The only imperfection in such an identification, however, is the possibility that the specimen owned by Linnaeus had been lost and the present specimen added by a later custodian. Sometimes this can be conclusively demonstrated, as where the name is written on the shell in a handwriting which is not that of Linnaeus or in pencil, a medium not used by him. Hanley properly recognized this exception.

It is difficult to coordinate Hanley's results with the collection in its present state. The numbers written on some of the marked specimens have suffered further obliteration since 1855, and the authors of the existing

¹ The word "lists" is used throughout this paper as the record of the species actually owned by Linnaeus usually so designated in the literature, notably by Hanley (1855). Actually the record consists of notations in the margins of the tenth and twelfth editions of the "Systema naturae" opposite the names of the species of which Linnaeus owned specimens.

labels cannot be stated with absolute certainty. A very large proportion of the specimens now bear a printed label, in Gothic lettering, pasted to the tablet to which the shell is affixed. The typography of these labels exactly matches the typography of the headings to the comments on the several species in Hanley's 1855 work and seem to have been clipped from a copy of that work or from proof sheets. Mr. A. E. Salisbury, who has recently reexamined these labels, believes that the individual specimens were affixed to the tablets by Hanley himself. If this be true, it is highly probable that Hanley supplied the labels as well. A few specimens, otherwise unlabeled, are accompanied by small pieces of paper bearing the specific name written in ink. Mr. Salisbury believes that these, too, were written by Hanley. The principal discrepancy in a check of Hanley's results is that the list of species bearing the Gothic-lettered labels does not entirely conform to the list of specimens that Hanley reported to have been "marked" by Linnaeus. That is to say, the two lists overlap.

In the last analysis the presence of the existing labels adds little to the identifications made by Hanley at a date when, as it appears, the collection had no labels. Indeed the collection is in one respect less helpful than Hanley's book, as in the latter the author refers specifically to every specimen that bore a decipherable identification in 1855. The collection is of inestimable value, however, in clearing up some of Hanley's vaguer statements and in confirming his results, and it is, of course, the final test of the identity of a large part of the "Systema" species.¹

In the present series of papers the specimens in the Linnaean collection are spoken of as being contained in trays or boxes, as

¹ Mr. A. E. Salisbury was consulted by Dr. L. R. Cox of the British Museum (Natural History), to whom the writer applied for additional data as to the history and origin of the labels in the London collection. A portion of Dr. Cox's reply of December 9, 1953, is here quoted: "I have asked Mr. A. E. Salisbury, who was present when the microfilm which you have seen was made, and he thinks that any MS. labels with the specimens are those of Hanley himself, none having been added by any subsequent worker. It was, presumably, Hanley himself who stuck the shells on their present tablets, and the printed labels in Gothic lettering to which you refer

that is the way in which Hanley found the collection and the manner in which he referred to them both in the preface to his 1855 work and in the discussions of the various species therein. After his examination they were apparently pasted to the tablets on which they are found today.

4. The following note concerns the position of Linnaeus as a binomial writer. The theory advanced in these paragraphs is not submitted as a thesis that can be proved or one on which the present writer is willing to take a categorical position. Rather, it is a possible interpretation of Linnaeus' own conception of his work as a systematist and a suggestion that, based on his entire diagnosis of a species, on the typographic style of his listings, and on the marked difference in the clarity of his "main description" and "subdescription," he was still influenced by the polynomial specific names of his predecessors. It is an argument based largely on imponderables and is presented merely in the hope that it may stimulate discussion. It is further suggested that Linnaeus was not entirely conscious of the basic importance of the advances he did make over the earlier method of designating species.

While the tenth edition of the "Systema naturae" is treated, and properly so, as a binomial work and its date (1758) as a starting point of modern zoological nomenclature, the writer suggests that it should be recognized that it is, in reality and so far as Linnaeus' own conception is concerned, a transitional stage, although a late one, between the older polynomial works and the improved and more consciously binomial works of many of his immediate successors. In choosing it as the first binomial work we are basing the choice entirely on the fact that each species is supplied with a single Latin word printed in the margin of the page opposite the diagnosis and that the "main description" begins with a capital letter which is the generic symbol.

It is, I think, conceded that for those species that are accompanied by a "sub-

seem to have been cut from a copy of his *Ipsa Linn. Conch.* I do not think that the only specimens which Hanley labeled in this manner were those accepted by him as authentic types, but I am not speaking with any real knowledge of the matter."

description," and these comprise virtually all the species with which Linnaeus was personally familiar, the "subdescription" is in most cases longer and in almost all cases more graphically descriptive than the usually brief and consequently more equivocal "main description." It is almost invariably the "subdescription" that leads to a convincing identification of the species. I feel that Linnaeus considered the entire "main description" almost, if not quite, as a *name* given to the species in question and that he conceived of the "subdescription" as the definitive and explanatory diagnosis. Thus viewed, his entire diagnosis included a polynomial specific name followed in many cases by a true description.

The placing of a single word in the margin was, it is conceded, an important step in advance of the older polynomial method of designating a species, but I cannot be entirely convinced that Linnaeus did not himself consider the marginal word as a mere descriptive guidepost, that is, a word that, whether extracted from his polynomial or not, was chosen as descriptive. If I could find in Linnaeus' writings any statement to the effect that he was proposing a new method of designating species or that he had perceived the importance of a truly binomial system the above suggestion would be seriously weakened, but I can find no such pronouncement.

It is certain that Linnaeus was profoundly influenced in his ideas of zoological nomenclature and classification by the work of his predecessor John Ray, whose "Synopsis methodica animalium" was published in 1693, 42 years before the appearance of the first edition of the "Systema naturae" and 65 years before the tenth, and was an important landmark in the history of zoological nomenclature. Ray anticipated to some extent the binomial system, as he recognized the "species" as the ultimate unit of classification, and, further, in his tables he provided for each group of animals a single adjective or adjectival phrase to illustrate the most important common characteristic of the group. It is suggested that Linnaeus borrowed this method in his specific descriptions, implementing it by placing a single word in the margin of each—a word that was descriptive, in most cases, of that

species. This interpretation of Linnaeus' marginal words is not new. William K. Gregory (1908, p. 26), after discussing Ray's classifications, said: "Even Linnaeus at first introduced the specific, 'trivial,' or common name, *merely as a marginal index or symbol of the full specific phrase*" (italics mine).

The framers of the Code of Zoological Nomenclature were wise in selecting the "Systema naturae" of 1758 as the first binomial work and in relying on the marginal word as the specific name, but it is suggested that they magnified Linnaeus' own conception and gave too much weight to his setting apart of that word. I seriously doubt that Linnaeus was as confident as they were that he was taking a revolutionary and final step in the building of a perfect and universal system of binomial nomenclature. In other words, while we arbitrarily use the marginal word as the name of the species and as proof that Linnaeus was thus establishing once and for all the modern system, the 1758 work seems a transition between the cumbersome names of his predecessors and the completely binomial works of Born, Bruguière, and Lamarck.

I am not merely attempting to prove that Linnaeus' "subdescriptions" are usually the deciding factor in identification. That needs no proof. I am merely suggesting that his attitude, as revealed by his own style of listing species, was not that of a pioneer and that he was still partially under the influence of the older writers. Otherwise why should the lack of clarity and decisiveness in his "main descriptions" be so marked and their language so brief? And why should they be so reminiscent of the earlier polynomials? It is not Article 26 of the Code that is being criticized but rather the universally held opinion of Linnaeus as the conscious innovator of a completely new system of nomenclature, a system that sprang in an instant, like Minerva from the head of Jupiter, full-fledged and perfect. When we accept his marginal designations as specific names we are acting wisely, as we must have a definite starting point to implement the Rule of Priority, but I do not believe that we are correctly reflecting his conception of his purpose.

The tenth and twelfth editions of the

"Systema naturae" were the culmination of a slowly growing feeling on the part of naturalists that zoological and botanical nomenclature should be clarified and that the same name for a species should be used by naturalists the world over. In the field of taxonomy changes are not rapid, and many years may elapse and many shades of opinion may be expressed before a change crystallizes into a universally accepted use. Linnaeus was slowly developing the binomial system. It took him nine editions to arrive at the tenth, and I feel sure that, if he had lived, he would have more drastically divorced his ideas from those of his predecessors and perfected the system, in arrangement and in text, as we know it today. It should be remembered that even some of the post-Linnaean writers were very slow in adopting Linnaeus' ideas and reverted, as did Martini and Chemnitz, to the old polynomial names.

An illuminating simile to express the thesis that Linnaeus in the tenth edition was still groping towards his final goal and that he did not yet appreciate the basic importance of his own work is found in the following quotation from a letter from William J. Clench to the writer: "How great the Mississippi depends upon where you see it—in northern Minnesota or at New Orleans. You and I see Linné's work at New Orleans. He did not." The binomial system which is today a part of the Code, in the eighteenth century was a slowly expanding system of constantly improving ideas for simplification in nomenclature. Linnaeus was the greatest of the builders of this system, but he died before he could place the capstone on the edifice.

The view here advanced may appear heretical to most workers in taxonomy and nomenclature and to those who, very properly, revere the name of Linnaeus. It is suggested with some diffidence but in the hope that it may provoke discussion and is not to be taken as an attempt to detract from the greatness and value of Linnaeus' contribution to the natural sciences.

5. A symbol shaped like a dagger or a cross is placed after the descriptions of the following species in the tenth edition of the "Systema naturae":

| | | PAGE |
|-----------------------------|---|------|
| <i>Nautilus crista</i> | <i>Turbo nautilus</i> in the twelfth edition | 709 |
| <i>Nautilus semi-Lituus</i> | Foraminifera | 710 |
| <i>Nautilus obliquus</i> | Foraminifera | 710 |
| <i>Nautilus radricula</i> | Foraminifera | 711 |
| <i>Nautilus sipunculus</i> | Foraminifera | 711 |
| <i>Serpula penicillus</i> | <i>Sabella penicillus</i> in twelfth edition | 788 |

Of these *N. crista* and *S. penicillus* are mollusks.

In the case of several of the above species the dagger mark was omitted in the twelfth edition. The same symbol is placed after the species *Sepia sepiola* in Vermes Mollusca.

Inasmuch as the meaning of this symbol seems to be unknown to the great majority of conchologists, and to all with whom the writer has discussed it, it may be useful to refer to the fact that the explanation is found on page 613 (footnote) of the tenth edition, after several species of the genus *Pediculus* in Insecta Aptera, which is the first genus in the work in which this mark was used. Linnaeus there says that the species after which it is placed are those that the author had not seen alive or in any museum. The footnote reads: "†) Signo crucis ubique notavimus animalia nobis nec viva, nec in museis asservata visa, ut Naturae consulti ad ea attentius examinanda incitentur."

During a study of the Linnaean species of mollusks it has become evident that several other species, not so marked, were not known to Linnaeus except through figures in the works of the pre-Linnaean iconographers or descriptions furnished to him by colleagues or collectors. These are referred to in their proper order in these papers.

6. Supplementing the acknowledgements in the Foreword to Part 1 of the present series of papers (Dodge, 1952) of assistance received from many friends of the writer, I wish to thank Dr. Henry A. Pilsbry of the Academy of Natural Sciences of Philadelphia, Dr. L. R. Cox of the British Museum (Natural History), and Dr. Joseph Bequaert of the Museum of Comparative Zoölogy of Harvard College for help in the solving of nomenclatural problems discussed in the present part, and Prof. Henry Poirier of Brooklyn for his kindness in unraveling the syntax and meaning of several of Linnaeus' more difficult Latin descriptions.

CLASS GASTROPODA

BULLA LINNÉ

OF THE 23 SPECIES listed in *Bulla* Linné in the twelfth edition of the "Systema naturae," only one (*B. ampulla*) remains in that genus as today restricted and constituted. One species is unidentified. The remaining 21 are scattered among 18 other later-described genera which makes *Bulla* the most heterogeneous in its make-up of any of the Linnaean groups. Three species were placed in other genera in the tenth edition—*B. ficus* and *rapa* in *Murex* and *B. terebellum* in *Conus*.

In recent years the question of the application and coverage of the name *Bulla* Linné has been prominently discussed, and the question has not yet been answered to the satisfaction of all conchologists. The "*Bulla*" problem was first raised a number of years ago by workers who suggested that the name, as applied to a genus of mollusks, was preoccupied by its use in the "Systema" as the name given to a "subgenus" in Insecta. However, the Commission wisely decided in Opinion 124 that: "The various subdivisions of genera published by Linnaeus in 1758 are not to be accepted as of this date (1758) as of subgeneric value under the International Rules." Thus the existence of the earlier "*Bulla*" does not affect the standing of *Bulla* Linné (mollusk) in any way.¹

It has been pointed out (Conchological Club of Southern California, 1945) that the name *Bulla* should be transferred from the group of species now known by that name to the group now called *Atys* Montfort, 1810, type species *B. naucum* Linné. It is argued that this is necessary because the name *Bulla* is not available for the *B. ampulla* group to which it has been traditionally applied, as it was used by Linnaeus in a specific sense as the name of one of his synonyms of *B. naucum*. This not only changes our concept

¹ In addition to the preservation of the name *Bulla* (mollusk) by the terms of Opinion 124, the case is covered by the following resolution adopted by the Commission as a Recommendation to Article 36 (on homonyms): "When homonyms are of the same date, whether by the same or by different authors, then any name proposed for a genus takes precedence over a name proposed for a subgenus. The same principle is applicable to homonyms of species and subspecies of identical date."

of the genus but brings about a case of type designation by absolute tautonymy under the terms of Article 30d of the Rules. Thus the name *Atys* Montfort would become a mere synonym of *Bulla* Linné. The species heretofore grouped under *Bulla* would take the next available name, which is *Vesica* Swainson, 1840, type species *B. ampulla* Linné, by subsequent designation, Gray, 1847. *Bullaria* Rafinesque, 1815, *Bullus* Montfort, 1810, and *Bullea* Blainville, 1825, would likewise become synonyms of *Vesica*, as they are mere substitutes for the name *Bulla* Linné as applied to the *ampulla* group of species.

The above suggestion involves an unfortunate nomenclatural change for which the categorical language of the Rules is responsible. It was suggested by Baily (Conchological Club of Southern California, 1945) who agreed with the soundness of the argument of several workers, that the group *Bulla-Vesica* is of sufficient importance to justify an appeal to the International Commission to preserve the *status quo ante* by the use of its plenary powers. This has been done, and the Commission at the 1948 Paris meeting agreed that under plenary powers all type selections for the genus *Bulla* Linné, 1758, made prior to the decision should be set aside and that *Bulla ampulla* Linné should be designated as its type species. It was further agreed that *Bulla* Linné and *Bulla ampulla* Linné should be placed upon the respective Official Lists of genera and type species (Hemming, 1950b). The Commission's action was approved by the Congress, and therefore the nomenclature remains as it was before the defect was brought to light.

It should be noted that seven species which Linnaeus included in *Bulla* in the tenth edition but moved to *Voluta* in the twelfth (*pallida*, *tornatilis*, *auris-judae*, *auris-midae*, *solidula*, *livida*, and *coffea*) are found in *Bulla* in the "Museum Ulricae." This is because the latter work was written, as mentioned above, before the publication of the tenth edition, although not published until 1764.

In spite of its heterogeneous mixture of species *Bulla* is one of the most accurately

defined of the genera in the "Systema." The descriptions are for the most part clear and characteristic, as might be expected of a group of species so well known in Linnaeus' day and so distinctive in appearance. The exceptions are the descriptions of *spelta*, *ficus*, and *fontinalis*, the last two of which, at least, are obviously composite species. The synonymies are accurate except in a few instances, which are mentioned below in the course of the discussion of individual species. The greatest weakness of the evidence from the point of view of identification is the equivocal character of many of the specimens in the Linnaean collection. Of the 23 species of *Bulla* described in the twelfth edition, only five are represented by marked specimens. Five species are not present. The remainder are represented by specimens unidentified by name or number, which deprives them of authority as holotypes, although most of them are probably Linnaeus' own specimens and were placed in the collection by him and were the shells on which the pertinent descriptions were based.

The confusing mixture of species in *Bulla* Linné was well summed up by Lamarck (1822b, p. 409): "It seems that the genus *Bulla* of Linnaeus was for him a sort of receptacle or provisional catch-all in which he placed all the univalve shells whose classification troubled him. The *tarrières* [*Terebellum*], which he did not realize constituted a separate genus, were regarded by him as congeneric, as well as the *ovules* [*Ovula*], the true *Bulla*, the *agathines* [*Achatina*], certain *Pyrula*, etc."

Bulla ovum

1758, *Systema naturae*, ed. 10, p. 725, no. 327.

1767, *Systema naturae*, ed. 12, p. 1181, no. 369.

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

"B. testa ovata obtuse subbirostri, labro dentato . . . Haec media inter Cypreas et Bullas; labro exteriore praecedentibus convenit, interiore laevi ad sequentes accedit."

The entire diagnosis of this species, including the synonymy, is identical in both the tenth and twelfth editions of the "Systema" except for two slight changes in the references to Buonanni and Petiver, due to errors in the tenth edition.

The main description and subdescription read together supply a fairly characteristic

picture of this highly distinctive shell, although the finding of a properly documented specimen in Linnaeus' collection was the deciding factor in its identification. The description in the "Museum Ulricae" (1764, p. 285) is somewhat more detailed and is completely corroborative, and the specimen of the shell in the Uppsala collection that is today labeled *B. ovum* may safely be taken as the type on which the 1764 description was based. One defect in the "Systema" description is the absence of any reference to color, either the porcelaneous white of the exterior or the orange-yellow or brown of the interior, although several of Linnaeus' predecessors had noted this feature. Thus Lister used the phrase "intus fusca," Buonanni, "intus flavida"; Klein, "intus violacea"; Argenville, "la couleur jaune qui regne dans son interieur"; Davila, "le dedans orange." This defect is remedied in the "Museum Ulricae" which uses the words "alba" and "interne lutea."¹

The synonymy is completely accurate. No question of error or the erection of a composite species can be raised, and therefore the figures need not be listed or discussed here.

The species is placed in the genus *Ovula* which I am attributing to Bruguière, 1789, and is the type species of the genus, by subsequent designation, Montfort, 1810.² The

¹ The variation in color is quite broad and is due partly to the condition of the shell and partly to its age. The young shell often has a pure white interior, and the color seems to deepen with age when unaffected by fading.

² I am assigning the date 1789 to the Bruguière genus *Ovula*, as it is adequately described in the Index preceding the 1789 portion of his "Histoire naturelle des vers." Some workers do not recognize the priority of such of the Index descriptions as are not further described, and have species assigned to them, in the text of volume 1. This view would eliminate *Ovula*, 1789, from consideration, as volume 1 treated the genera, alphabetically, only as far as *Conus*. I am unable to agree (Dodge, 1947b, pp. 489-490). The next available use of the name is *Ovula* Bruguière, 1798, based on the fact that the name was used as the heading of two plates of figures of unnamed species published in 1798 as plates 357-358 of the "Tableau encyclopédique et méthodique." The Commission has ruled that such "plate heading" names fix these genera as of the respective publication dates of the plates. Whatever one may feel as to the soundness of this Opinion, it obviously cannot affect the priority of the use of a name by Bruguière either in the Index or in the text of his volume 1.

species has had a comparatively uneventful nomenclatural history, as might be expected of a shell so distinctive in appearance. It has received but two other specific names, *O. alba* Schumacher, 1817, and *O. oviformis* Lamarck, 1810, the latter change being possibly due to Lamarck's obvious dislike of tautonymic or virtually tautonymic names. The Lamarckian specific name was in use for many years, particularly among the Continental conchologists. The species has, however, appeared from time to time in several genera. Many of the eighteenth and nineteenth century writers placed it in *Amphiperas* Gronovius, 1781, which antedated Bruguière's *Ovula* by eight years. This genus is ineligible, however, as the Commission has held that the new names in Meuschen's Index for the "Museum Geversianum" (1787) are not nomenclaturally available. Similarly, the genus *Licium* from the "Museum Calonianum" (Humphrey, 1797) is unavailable under Opinion 51. The species has been included in *Volva* Röding, 1798, by some writers. Link (1807, p. 86) went considerably farther afield, placing it in *Cyphoma* Röding, 1798.

While Linnaeus was sound in believing that *ovum* was intermediate in its phylogenetic relationship between *Bulla* and *Cypraea*, *ovum* differs materially from the other *Bulla* species in that its outer lip is thickened, involute, and wrinkled, and from the cypraeids by its markedly swollen and smooth inner lip.

The earliest post-Linnaean figures of *ovum* are those of Martini (1769-1777, vol. 1, pl. 22, figs. 205-206), published only two years after the publication of the twelfth edition of the "Systema." No better figures of the species have appeared, and they were the model for many of the later figures up to the advent of photography. Reeve figured it (1843-1878, vol. 15, *Ovulum*, pl. 1, sp. 3).¹

The description of *Bulla ovum* in the "Museum Ulricae" is more elaborate and is entirely confirmatory. The two specimens now in the Uppsala collection marked for *B. ovum* are correctly labeled.

¹ *Ovulum* was Sowerby's emendation of *Ovula* Bruguière, 1789. He said (1828, p. 145, footnote): "*Ovulum*, being a diminutive of *Ovum* which is neuter, our classical friends will acknowledge the propriety of this change in the termination."

Bulla volva

1758, *Systema naturae*, ed. 10, p. 275, no. 328.

1767, *Systema naturae*, ed. 12, p. 1182, no. 370.

LOCALITY: "Ad Jamaicani [*sic*]" (1758); "ad Jamaicaem" (1767).

"B. testa birostri, rostris elongatis striatis acutis."

The above description, although brief, is sufficiently clear to define the species. While the production of the two ends of the shell both in this and the following species (*birostris*) can be truly described as "rostris elongatis," the difference between them is plainly pointed out by the words "striatis" as applied to the beaks of *volva* and "laevibus" used for the beaks of *birostris*. This point is further discussed under *birostris*.

The locality is entirely incorrect as *volva* is an East Indian and western Pacific shell. The erroneous locality was cited by several succeeding writers, however. Lamarck (1822b, p. 370) placed the species in the "Ocean of the Antilles" and also said of the pink form, "I think it comes from the coast of Brazil." His editors, Deshayes and Milne-Edwards, copied Lamarck's locality without comment (1835-1845, vol. 10, p. 475).

Linnaeus' synonymy consisted of only two figures (Lister, pl. 711, fig. 63, according to the simplified listing in the Huddesford edition of 1770; and Argenville, 1742, pl. 21, fig. 1). While both are wretched drawings, they are unquestionably *volva*. Linnaeus added a reference to three good figures (Knorr, pt. 5, pl. 1, figs. 2-3, and pt. 6, pl. 32, fig. 1) by a manuscript note in his own copy of the twelfth edition. An unmarked specimen of the *volva* of all authors is in the Linnaean collection. The species may be said to be descriptively and pictorially defined, although the specimen in the collection can be said to be only the "ostensible" holotype.

This shell is so distinctive in the length of the beaks and the marked swelling of the mid-section of the body whorl that no other species could be confused with it. The feature that distinguishes it from all other related species is the abrupt transition from the swollen middle to the attenuated beaks. It was at once identified by Linnaeus' successors, and no author has given it any other specific name.

Post-Linnaean writers were not agreed, however, as to its generic position. Davila

(1767) called it "Porcelaine des Indes, très rare." Schröter (1783-1786, vol. 1, p. 168) and Dillwyn (1817, vol. 1, p. 473) left it in *Bulla*. Deshayes (1830, 1832, vol. 3, p. 686) placed it in *Ovula* Bruguière, 1789, as did Lamarck (1810a, p. 113), and Lamarck in the "Histoire naturelle" (*loc. cit.*) and Deshayes and Milne-Edwards (*loc. cit.*) continued that allocation. The majority of those authors who opposed the inclusion of the species in *Ovula* assigned it to *Radius* Montfort, 1810, and the use of the latter name has persisted in much of the literature up to the present day.

In 1798 Röding erected the genus *Volva*, which he seems to have proposed as a substitute for *Ovula* Bruguière. His species included *V. cygnaea* and *V. ovum*, both of which are demonstrably referable to the *Bulla ovum* of Linnaeus and Gmelin; *V. birostris* which, based on the Martini figure cited for it (1769-1777, vol. 1, pl. 23, fig. 217a, b), is clearly the *birostris* of authors, not of Linnaeus; *V. textoria*, for which he cited Martini's figure 218 and the Knorr figures mentioned above which were cited by Linnaeus for *B. volva*; and *V. perla* which is the *Bulla verrucosa* of Linnaeus. Röding's genus has been purified by later writers by the elimination of the species belonging in *Ovula* Bruguière and *Calpurnus* Montfort, but it is the proper receptacle for *volva* Linné, on which it is primarily based and from which the generic name was derived. *Volva textoria* (*V. volva* Linné) is the type species, by absolute tautonymy. *Radius* Montfort, 1810, is an exact synonym. *Amphiperas* Gronovius, 1781, *Licium* of the "Museum Calonnianum," 1797 (both of which have been declared by the Commission to be nomenclaturally unavailable), *Ovula* Bruguière, 1789, and *Birostra* Swainson, 1840, are all synonymous with *Volva* in whole or in part.

The very brief description of *volva* in the "Systema" is considerably amplified in the "Museum Ulricaë." The significant additions are a fuller description of the beaks, a mention of the striae which cover the entire shell, and the statement that the striae on the beaks are oblique and closely spaced ("oblique striatum striis elevatis confertis"). The specimen marked for *volva* in the collection at Uppsala is the *volva* of the tenth edition of the "Systema."

Volva volva (Linné) is figured in Reeve

(1843-1878, vol. 15, *Ovulum*, pl. 9, sp. 41a, b), and in the "Tableau encyclopédique" (1798, pl. 357, figs. 3a, b). See also Kiener (1834-1850, vol. 1, *Ovula*, pl. fig. 1).

Bulla birostris

1767, *Systema naturae*, ed. 12, p. 1182, no. 371.

LOCALITY: "Ad Javam" (1767).

"B. testa birostri, margine extus incrassato, rostris elongatis laevibus. . . Testa similis B. volvae, sed minor, magnitudine Fabae, angustior, laevis, incarnato-albida. Rostra aequalia, laevia, fere ventris testae longitudine, oblique truncata, altero parum adscendente. Margo extus longitudinalis incrassatus. Rima subaequalis, versus rostrum adscendens latior."

This species did not appear in the tenth edition of the "Systema," no synonymy was supplied, and it was not described in the "Museum Ulricaë." We are therefore forced to rely on the above description alone for an identification of the shell. It is a long and apparently graphic description but certainly does not apply to the shell that has been and still is universally known as *birostris*. The *birostris* of authors is a common species in the East Indies. Its beaks are not smooth, as the description requires, although the striations are not so marked as in the preceding species (*volva*). The beaks are not "almost as long as the belly of the shell" but are very short, the transition between beaks and the rest of the shell being gradual and not abrupt as in *volva*. The phrase "rostris elongatis" is used both for *volva* and *birostris*, and it does not seem reasonable to suppose that Linnaeus would have used the same unqualified words for both when the shells show such a marked difference in this respect. Hanley (1855, pp. 200-201) called attention to these facts a hundred years ago, but I cannot find that later writers have discussed it. Hanley also (*loc. cit.*) called attention to the fact that Linnaeus, in his manuscript notes for his proposed "revised twelfth edition," did not refer to Martini's figure (1769-1777, vol. 1, pl. 23, fig. 217a, b) of the *birostris* of authors, which is significant, as he consistently cited the figures in the first volume of Martini (1769) in those manuscript notes.

No specimen is marked for *birostris* in the Linnaean collection, but a box contains a white specimen of the *birostris* of authors and a pink and badly broken specimen of

Ovulum longirostratum Sowerby, 1828, which is figured in Sowerby (1847–1887, vol. 2, pl. 100, figs. 59–60). Hanley unhesitatingly declared that Sowerby's shell was the representative of Linnaeus' *birostris*, as it completely and uniquely conformed to Linnaeus' description. He explained the presence of the specimen of the *birostris* of authors by saying that Linnaeus probably conceived that the latter was a variety of his species and that the long-beaked *longirostratum* was the typical form. (It is probably more reasonable to suggest that the author felt that the "birostris" was the juvenile shell.) Indeed, a further manuscript note to *birostris* in Linnaeus' copy of the twelfth edition says, "variat albo, rostris ventre brevioribus," which is an additional corroboration of Hanley's opinion.

The evidence supporting Hanley's opinion, particularly the great discordance between the features of the so-called "*birostris*" and the plain language of Linnaeus' description, is sufficiently strong to justify us in establishing the fact that the *birostris* of authors is not Linnaeus' shell. The principle that changes should not be made which would cause confusion in the nomenclature is, in my opinion, overridden in this instance by the special facts of the case. This is not a case where a later name was given to a species for a frivolous, prejudiced, or chauvinistic reason, as was true, for instance, of most of Lamarck's changes, nor a case where a name was given in ignorance of a prior name, nor the revival of a name that had been forgotten. The assigning of the name *birostris* to a shell which Linnaeus did not describe was purely and simply an error in reading Linnaeus' Latin description. Moreover, if a further reason is necessary, the true situation was called to the attention of conchologists a hundred years ago and has been known, although disregarded, ever since. It would disclose a great weakness in our practice and an un-called-for admission of an obvious error not to continue to call a species by a Linnaean name when the Linnaean description is clear and is open to all. I would unhesitatingly recommend the revival of the name *birostris* Linné for the shell that Sowerby called *longirostratum*, the latter name being thrown into synonymy. The *birostris* of authors would take the next available name, which is *brevirostris* Schumacher, 1817.¹

Additional figures of the species are found in Tryon (1879–1888, vol. 7, pl. 4, figs. 10–11, *birostris* of authors; pl. 4, figs. 92–93, *longirostrata*).

The species is placed in the genus *Volva* Röding, 1798.

Bulla spelta

1758, *Systema naturae*, ed. 10, p. 726, no. 329.

1767, *Systema naturae*, ed. 12, p. 1182, no. 372.

LOCALITY: "In M. Mediterraneo" (1758, 1767).

"B. testa oblonga utrinque obtusiuscula aequali, labro arcuato: margine intus incrassato . . . Testa alba, laevis, semine tritici duplo major, vix birostris, sed magis patula. Apertura longitudinalis, lunata cum denticulo obsoleto ad apicem columellae. Spira externa omnino nulla."

The identification of *spelta* has always been complicated by the fact that it belongs to a considerable group of small ovuloid shells that are separated specifically from one another by very slight differences in color, attenuation of extremities, wideness or narrowness of aperture, and thickness or thinness of the shell. This has resulted in many errors of labeling in our museums and in a list of synonyms that must be used with the greatest reserve. The present species, however, being a common shell in its range, which is comparatively restricted, has offered less difficulty to conchologists than most of its congeners. In the tenth edition of the "*Systema*" the description of *spelta* differed from that in the twelfth only by the use of "attenuata" for "obtusiuscula" in the main description and the absence of the word "intus" in the phrase "margine intus incrassato." It has been accepted by the great majority of conchologists as an informative description and adequate to define the species. If read in connection with the descriptions of *volva* and *birostris*, which immediately precede it, the identification is partially confirmed. It is now universally agreed that it describes the *Neosimnia spelta* of the Mediterranean Sea, the adjacent Atlantic coast, and the eastern Atlantic islands.

Hanley (1855, p. 201) was troubled by the descriptions in the two editions, and his preoccupation with the subject resulted in one of the most curious and almost unintelligible paragraphs in his entire treatment of the Linnaean species. He believed that "this

¹ *Ovula aperta* Sowerby, 1849, and *O. rosea* A. Adams, 1854, the immature shell, are also synonymous with the *birostris* of authors.

species was far better defined in the tenth than in the twelfth edition," and that a different species was defined in the latter. As I read his confusing language, the tenth-edition description covered *Ovulum secale* of Sowerby's "Species conchyliorum" which was the *Ovula spelta* of Philippi, while the *spelta* of the twelfth edition referred to *O. obtusum* Sowerby, 1830. I have been unable to assure myself that Philippi's *spelta* is, in fact, the *spelta* of Linnaeus. Hanley based his theory on three facts:

First, he maintained that the tenth-edition phrase "utrinque attenuata" was better fitted to the *spelta* of authors than the "utrinque obtusiuscula" of the twelfth. As to this objection, while the two adjectives read without context would be held to be antithetical, it seems to this writer that the change to "obtusiuscula" was in the interests of clarity. The two preceding species had both been described as "birostri," a word that describes the marked attenuation of their extremities. The extremities of the present species are much less attenuate, and Linnaeus, in making the change, was availing himself of a word that would not recall or suggest the two markedly birostrate shells. The comparative bluntness of *spelta*, compared to the other two species, makes "obtusiuscula" the most graphic word Linnaeus could have used and permits no suspicion that in the twelfth edition he was describing a different shell, but merely the fact that he was eliminating a possible cause of confusion.

Hanley's second objection is that, while the Gualtieri figure (pl. 10, fig. 4) cited in both editions conformed both to the description and to the *spelta* of the Mediterranean, Linnaeus added three references in the twelfth edition that were either erroneous or bore only a slight resemblance to *spelta*. As to the Petiver figures (pl. 66, figs. 1, 3), figure 1 was correctly identified by Hanley as *Bulimus decollatus* (*Rumina decollata*) (Linné), and indeed the figure was cited for that species on page 1247 of the "Systema." Figure 3 on the same plate of Petiver apparently represents *Ovula carnea* (Poiret), 1789. The figure from Ginanni (pt. 2, pl. 13, fig. 95) might be taken, as even Hanley admitted, for the *spelta* of authors. The Barellier figures (31, 32, 35) are too vague to be identified. This second argument is sophistry. The origi-

nal figure from Gualtieri is a fair picture of the *spelta* of authors. Why the addition of three further bad figures and one possibly good one, none of which represents *O. obtusum*, should have induced Hanley to infer that Linnaeus was describing *obtusum* in the twelfth edition is not understood.

The third argument of Hanley is based on the phrase "denticulo obsoleto ad apicem columellae" in the description. He said that the description in the tenth edition should be referred to the *Ovulum secale* of Sowerby's "Species conchyliorum" which he believed to be the *spelta* of Philippi. He added: "The absence of any denticle upon the upper end of the inner lip in the *Ovulum* selected in the 'Species conchyliorum' as the representative of this *Bulla*, is fatal to its claims, since the presence of that characteristic . . . , however faintly indicated, is expressly enumerated in both editions." This is an obvious contradiction.

Hanley's treatment of this species is confused and illogical. In the last analysis his only honest argument is that the word "obtusiuscula" indicates that Linnaeus had changed his conception of the species between the two editions. With this I emphatically disagree. The absence of a specimen of *spelta* in the Linnaean collection and the presence of an undocumented specimen of *obtusum* have little weight when we consider the several hands through which the collection had passed. Moreover Hanley contradicted himself again in saying, "The expression 'vix birostris, sed magis patula' is not very well suited to it [*obtusum*] but is peculiarly applicable to the *spelta* of the Mediterranean." Yet he chose *obtusum* as the shell described in the twelfth edition. I cannot use Hanley's paragraph as a helpful comment on the species.

The *spelta* of the Mediterranean, as well as all other species of *Neosimnia* Fischer, shows the denticle on the columella. Indeed it is mentioned by Fischer as a diagnostic feature of the genus. In his description ([1884]-1887, p. 664) it is designated as a fold, "columellae muni en arrière d'un plait, calleux, oblique."¹ The figures of *obtusum*

¹ In referring to this feature I have used the Linnaean word "denticle." It is not an apt word. It is a callous knob or ridge. In *Neosimnia* it is not directly on the columella but slightly to the left of it.

Sowerby (1830, p. 8, fig. 34; 1847-1887, vol. 2, p. 475, pl. 100, figs. 22-24) also show this columellar knob or ridge, but the shell itself is more truncate at both ends than is *spelta*, and its dorsum is obtusely angulate. In this respect it resembles, although to a much less degree, the characteristic dorsum of the genus *Cyphoma* Röding and might be said to be intermediate between *Cyphoma* and *Neosimnia*. Several species of *Cyphoma* possess a dorsum that is obtusely angulate, although without the prominent cord-like ridge of *C. gibbosa* and its close allies. All species of *Cyphoma* also show the callous knob at the top of the columella, an exaggerated counterpart of the similar feature in *Neosimnia*. The description of *obtusum* both in the "Species conchyliorum" and in the "Thesaurus" fails to mention this feature.

Bulla spelta is the type species of *Neosimnia* Fischer, by monotypy. Fischer erected the name as a subgenus of *Ovula* Bruguière, but it is now generally treated as a good genus. The species of *Simnia* Risso and *Neosimnia* have many characteristics in common. Each varies in the thickness of the outer lip. Each varies in the color of the shell which is usually yellow or flesh color, sometimes deepening to purple. The species of each often vary in the rotundity of the "belly" of the shell. There has been a great deal of confusion in labeling species of both genera, not only because of the great similarity between species but because of the fugitive nature of the color, particularly the shades of purple. *Simnia* species may be grossly distinguished from *Neosimnia* by their sharp outer lip, but, as pointed out by Tryon (1865, p. 95), "the animal [of *Simnia*], under favorable circumstances, sometimes completes its shell by the addition of a thickened lip, when the distinction from the typical group disappears." By the typical group Tryon meant "typical" *Simnia* species, as he wrote at a date prior to the publication of *Neosimnia*.

Synonyms of *spelta* include *Bulla hordacea* Da Costa, 1778, *Ovula purpurea* Risso, 1826, *O. leathesi* Sowerby, 1825, and *O. uniplicata* Sowerby, 1849. It is not the *spelta* of Sowerby or Reeve, which is *sowerbyana* Weinkauff, 1881. The latter (*vide* Tryon, 1879-1888, vol. 7, p. 253) may be identical with the *Ovulum secale* of Sowerby which Hanley mentioned in his comments on *spelta*.

It is figured by Tryon (*tom. cit.*, pl. 5, figs. 32-33). An earlier, excellent set of figures is found in Schubert and Wagner (1829, pl. 228, fig. 4047, dorsal and apertural views).

It is not described in the "Museum Ulricae," and no specimen is found in the Queen's collection in Uppsala.

Bulla verrucosa

1758, *Systema naturae*, ed. 10, p. 726, no. 330.

1767, *Systema naturae*, ed. 12, p. 1182, no. 373.

LOCALITY: "In India Orientali" (1758, 1767).

"B. testa transverse angulata, aucta utrinque puncto osseo."

The description of this species, which mentions the two most important characters of the *verrucosa* of authors (the highly angulated dorsum and the sunken knobs near the extremities), is sufficient to identify the species, as these two features occur in combination in no other shell. It is not necessary to rely on the completely correct synonymy. The specimen of *verrucosa* in the Linnaean collection is not marked in any manner but was probably Linnaeus' own shell, as the name occurs on his list of owned species. One correction of an error of transcription should be made in the synonymy. The reference, "Pet. gaz. t. 99, f. 2" shows a botanical specimen. In the same work by Petiver, plate 97, figure 22, shows *verrucosa* and was the figure the author intended to cite, as he added the correct reference in the manuscript notes in his copy of the twelfth edition. He also revised the Lister reference to conform to the less complicated method of citation used in the Huddesford edition (1770), which had appeared by the time the note was added, citing it as plate 712, figure 67. His notes also cited the classic 1769 Martini figures (1769-1777, vol. 1, pl. 23, figs. 220-221).

Gmelin (1791, p. 3423) copied Linnaeus' description and synonymy verbatim but added, in addition to the usual reference to the "Museum Ulricae," the following useful subdescription: "Cypraeis affinis, testa tota alba, utroque fine rubescente, raro ultra pollicem longa, ovali." The pinkish color of the tips of unworn specimens of *verrucosa* is the only important diagnostic character omitted by Linnaeus.

There have been no changes in the specific name of this distinctive and easily recognized shell, although its generic position has been

varied, as is the case with most of the species of *Bulla* Linné. Bruguière first moved the species to his *Ovula*, 1789, and this genus was adopted by the majority of the nineteenth century writers, including Wood, Lamarck, Blainville, Deshayes, Sowerby, Reeve, and Kiener, and is still sometimes used today. Link (1807, p. 86) included it in *Cyphoma* Röding, 1798, possibly because its angulated and humped dorsum bore a fancied resemblance to the salient dorsal ridge of most of the species of that genus. Swainson placed it in his *Cypraella*, 1840. It is now almost universally considered to be properly placed in *Calpurnus* Montfort, 1810, as the type species, by monotypy.¹

The present species is well figured by Reeve (*loc. cit.* in footnote).

The two specimens preserved in the Uppsala collection and labeled *verrucosa* are the *verrucosa* of Linnaeus' "Systema" and of all authors.

Bulla gibbosa

1758, *Systema naturae*, ed. 10, p. 725, no. 331.

1767, *Systema naturae*, ed. 12, p. 1183, no. 374.

LOCALITY: "In Brazilia" (1758, 1767).

"B. testa angulata, cingulo elevato."

As in the case of the last species the description in the tenth and twelfth editions is identical. It would be impossible to determine which of the several species of *Cyphoma*, to which genus this species belongs, was covered by this very brief description which might well stand for the generic definition. The figures in the synonymy all represent what are clearly *Cyphoma* species, but not all are specifically determinable. This is the only member of the genus described by Linnaeus, and we must thus consider that both the description and the references cover a composite species. The name, however, is automatically restricted to the *gibbosa*² of the western

¹ Reeve, in the text describing his figure of *verrucosa* (1843-1878, vol. 15, *Ovulum*, pl. 1, sp. 2), said: "The characteristic figure of the species is similar to that in *Cypraea bicallosa*, scarcely sufficient to make it the type of a distinct genus." It is assumed that Reeve was referring to Montfort's *Calpurnus*, although he did not mention it. The quotation illustrates the unwillingness of conchologists of Reeve's day to adopt subgeneric names based on a single shell character, a procedure that we are more and more coming to consider sound taxonomy.

² In commenting on this species, the present writer has been guilty of the common error of conchologists in

Atlantic by the presence of a specimen of that shell in the Linnaean collection which we are probably justified in considering the holotype, although it is unmarked in any way. For a most practical reason it is most probable that this specimen was the shell on which the description was based. The species listed by Linnaeus from the Western Hemisphere are few in number as compared with those he described from Europe, Africa, and the Indo-Pacific region, and it may fairly be assumed that only the commonest American species, which occur in considerable populations, would be available to him. The other western Atlantic *Cyphoma* are not only considerably rarer, but most of them have been only recently described. No other *Cyphoma* is found in the collection.

The locality is correct, although much too narrow, as *gibbosa* is found as far north as Cape Hatteras, being most plentiful in the more tropical portions of its range.

The description in the "Museum Ulricae" first copies the "Systema" description and then adds other details which, however, might apply equally to any of the markedly humpbacked species in the genus. Read alone, it still covers a composite species. The Gualtieri figure cited in the "Systema," which is not unequivocal, is repeated, and the added figure from Argenville (1742, pl. 2, fig. Q) is not helpful. It is too crude to enable us to tie it exclusively to *gibbosa*, although it was probably designed for that species. The specimen in the Uppsala collection, however, is our *gibbosa*, which, with the specimen in the Linnaean collection and the identical main descriptions in the two works, sufficiently restricts this otherwise composite species to the *gibbosa* of authors.

The species was first separated from *Bulla* by Bruguière, who placed it in his *Ovula*, 1789. In 1798 Röding erected *Cyphoma* for its reception, but, with one exception,³ writers

treating *Cyphoma* as a feminine noun and calling the species *Cyphoma gibbosa*. After the submission of the present paper, Abbott (1954, p. 183) made the necessary correction to *gibbosum*. *Cyphoma* is the Latinized version of the Greek κύφωμα, a neuter noun meaning "a hump."

³ The German naturalist Link was the only early author who used Röding's *Cyphoma*. His group was, however, not the restricted genus of Röding, as he included in it such disparate species as *Bulla ferruginosa* Gmelin, 1791, *Ovula ovum* (Linné), *Volva birostris*

passed over this name until early in the twentieth century when the "Museum Boltenianum" was again brought to the attention of conchologists. Montfort erected the genus *Ultimus*, 1810, for the species, of which it is the type species, by monotypy. This name had considerable vogue in the nineteenth century but has been almost universally displaced, as has *Ovula*, by Röding's name.¹ *Binvoluta* Schlüter, 1838, and *Carinea* Swainson, 1840, are exact synonyms of *Cyphoma*.

There is a great difference in the development of the transverse dorsal cord in the various species of *Cyphoma*, but it is present, to a greater or less degree, in all. *Cyphoma gibbosa* shows the extreme form of this cord from the standpoint of salience and coarseness and the fact that it extends over both margins of the shell almost, if not quite, to the aperture. The other extreme is exhibited by *C. intermedia* Sowerby, 1828, in which the cord is only faintly indicated and in some specimens, and in most illustrations, cannot be detected. The latter species appears to connect *Cyphoma* with *Simnia* Risso, 1826, and its exact generic position was for many years undecided. In 1943 F. M. Bayer (p. 109) was able to examine a living specimen dredged from deep water off Palm Beach, Florida, and a study of the anatomy revealed it to be a *Cyphoma*.

While Röding supplied no generic definitions, both of the species in his *Cyphoma* (*gibbosa* and *dorsata*) have markedly developed dorsal cords and heavy margins, as is shown in the figures he cited in their synonymies (Martini, 1769-1777, vol. 1, pl. 22, figs. 213-214 for *gibbosa*, pl. 22, figs. 211-212 for *dorsata*). It is not possible to allocate either of these pairs of figures categorically to *gibbosa* Linné, as they are too crudely drawn. They may well represent two distinct species, although Martini in his text (*tom. cit.*, pp. 297-298) referred all four figures to *Bulla gibbosa* Linné. Dr. H. A. Rehder (personal communi-

(Linné), and *Calpurnus verrucosus* (Linné), most of which, even in 1807 when Link wrote, had already been assigned to other genera.

¹ *Ultimus* is one of the classic examples of names that are either entirely fanciful or at least have no meaning derived from the characteristics of the shell. Montfort chose the name merely because it was the last genus listed in his 1810 work.

cation) is of the opinion that the pair of figures cited for *gibbosa* "looks very much like *C. mcgintyi* Pilsbry [1939], while *C. dorsata* is the true *gibbosa* Linné." Earlier commentators have treated Röding's two species as identical, both representing *gibbosa* Linné, thus adopting Martini's view, in which case *Cyphoma* Röding would be monotypic for *gibbosa*. I am inclined to agree with Rehder's evaluation of the Martini figures. Therefore the earliest selection of a type species for Röding's genus is that of Herrmannsen, 1847, who designated *Ovula gibbosa* (Linné). This is the *dorsata* of Röding, as the latter supplied a figure of Linnæus' *gibbosa* in its synonymy.

Ovula pharetra Perry, 1811, appears to have been based on a specimen of *gibbosa* Linné and should probably be added to the synonymy.

The early figures of *gibbosa* are too stylized and show too little detail to be of much assistance, as they usually overemphasize the dorsal ridge and the heavily calloused margins. The best modern figures are those of Reeve (1843-1878, vol. 15, *Ovulum*, pl. 7, sp. 52a, b).

Bulla naucum

1758, *Systema naturae*, ed. 10, p. 726, no. 332.

1767, *Systema naturae*, ed. 12, p. 1183, no. 375.

LOCALITY: "In Asia" (1758, 1767).

"B. testa rotundata pellucida transversim striata, utrinque umbilicata."

There has been less discussion as to the identity, history, and generic position of this species than of any of the other species in *Bulla* Linné, with the possible exception of *B. ovum*. The shape, structure, and sculpture of the shell are so distinctive, and the description is so completely graphic, that there has never been a doubt of its identity. The synonymy is adequate, although some of the illustrations, notably that of Seba (vol. 3, pl. 38, fig. 45), do not properly show the fine and regular spiral striae of the shell.² Hanley (1855, p. 202) pointed out, too, that in the Lister figure (bk. 4, sect. 9, ch. 10, pl. 1,

² In all the early hand-drawn figures, details of sculpture are often confused with lines of shading. This is especially true in the case of sculpture as delicate as that of *B. naucum*, which in many specimens cannot be detected without the aid of a lens. It is possible that some of the artists were not even aware of the striations.

"f. ult.") Linnaeus was referring to the bottom figure of the first page of engravings in the chapter mentioned. This figure is now referred to as plate 714, figure 73, in accordance with the style of citation employed for the Huddesford edition of Lister, 1770. Linnaeus added further acceptable figures from Martini (1769-1777, vol. 1, pl. 22, figs. 200-201) in a manuscript note in his copy of the twelfth edition.

The Linnaean collection contains a specimen of the *naucum* of all authors in a box marked with the name. Thus we have a complete concordance between the description, the figures in the synonymy, and the holotype in the collection. This is one of the few properly documented species of *Bulla* in the collection.

The description of *naucum* in the "Museum Ultricae" covers the same species. It repeats the tenth-edition description and adds many confirmatory details, such as "subtilissime" in referring to the sculpture, "magnitudine ovi columbini," and "fragilitate membranacea." The variety " β subcylindrica, minus striata" of the "Museum Ultricae" was, according to Hanley (*op. cit.*, p. 203) "probably the *Bulla striata* of Bruguière, or some closely allied species." It is impossible to confirm the accuracy of Hanley's guess, as the Uppsala collection contains only two completely undocumented specimens of the typical *naucum*. If the other form was ever present it has been lost.

Lamarck (1822a, p. 34) cited *B. naucum* as of Linnaeus but gave it the French vernacular name "Bulle papyracée." This gave rise to some confusion between the present species and the *Bulla papyracea* of Blainville (1825, 1827, pl. 45, fig. 11), which, based on the cited figure, is distinct. Deshayes and Milne-Edwards (1835-1845, vol. 7, p. 669, footnote) said of the latter species: "The spire is distinctly visible and it appears to us to be a variety of *Bulla physis* with very faded coloring."

Bulla naucum is now placed in *Alys* Montfort, 1810, of which it is the type species, by monotypy, as *A. cymbulus*. *Naucum* Schumacher, 1817, is an exact synonym. The recent suggestion that the Rules require that *naucum* be moved to *Bulla* Linné and *ampulla* to *Vesica* Swainson as the respective types of

the changed genera has been discussed above in the introduction to the genus *Bulla*.

The species is figured in the "Tableau encyclopédique" (1798, pl. 359, 4a, b) and by Reeve (1843-1878, vol. 17, *Alys*, pl. 1, sp. 1a, b).

Bulla aperta

1767, *Systema naturae*, ed. 12, p. 1183, no. 376.

LOCALITY: "Ad Cap b. spei" (1767).

"B. testa subrotunda pellucida transversim substriata tota hians . . . Simillima B. Nauco, antice etiam umbilicata, sed tota ita hians, et universa testa intus pateat, modo labium interius versus antica parum involutum. An mera varietas?"

This species appeared for the first time in the twelfth edition of the "Systema." It is possible that Linnaeus' query as to its relationship with *Bulla naucum* may have been the reason for its earlier omission, although the evidence points more strongly to the fact that it was only acquired or brought to Linnaeus' attention between the dates of the tenth and twelfth edition, as was the case with most of the specimens accredited by Linnaeus to Spengler. There is, of course, no relationship between the two species, except that they are both cephalaspid mollusks in the Order Tectibranchia.

The species belongs in the genus *Philine* Ascanius, 1772. In common with most of the cephalaspids, *Philine* contains species that are difficult to distinguish one from another, as several of them which are now recognized as distinct have been in the past confused with one another or with *aperta*. *Philine aperta* itself is perhaps the most striking instance of this difficulty. The slight variation in shell characters between its several forms, not only from widely separated localities but even from the same region, has resulted in a great number of specific names which have now been united under the name *aperta*. Shell characters have proved a very unreliable and confusing guide to diagnosis, and this species, as well as its congeners, has been satisfactorily synonymized only since the anatomy of the animal has been critically studied, principally by the Scandinavian malacologists, Sars, Odhner, and Lemche. In a recent revision of this group of tectibranchs, Lemche says on this point (1948, p. 31):

"Several genera of Northern Atlantic cephalaspid tectibranchs contain a relatively large number of species very difficult to distinguish. A study of a large material, however, shows a very great variability in the shape of the shells, whereas their type of structure on the surface is comparatively constant (although variably distinct). The height of the spire, the width of the umbilicus, the relation of the last whorl to the spire, etc., vary extremely, even between specimens from the same locality. It is most regrettable that exactly these characters are those generally used for distinguishing "species," whereas anatomical ones have been very much neglected—or the animals themselves are completely unknown. It is not surprising, then, that some authors unite certain species whereas others regard them as distinct, and in this way much trouble arises for those wanting information on the real status of the taxonomy of the group." Lemche's paper is not only the most recent but the most exhaustive treatment of the subject and should be studied to insure a proper understanding of this group of mollusks. Its bibliography and synonymies are complete and should prove most useful to the student.

The Linnaean description of *aperta* is reasonably clear except for two details which are discussed below. The synonymy consists of a single pair of figures from Gualtieri (pl. 13, figs. E E) which are crude representations of the northern European *aperta*. One figure shows the upper end of the outer lip rounded and the other with that part slightly angulated. Both these forms occur in northern waters. The locality (Cape of Good Hope) is authenticated by Spengler, who was either the collector or at least the student of Linnaeus from whom the specimen came. This locality was for long a stumbling block in the minds of the early conchologists, and many of them chose to divorce the Cape form from the well-known northern form. It was called *Bullaea capensis* by Pfeiffer and later *Philine capensis* by von Martens in 1879, and *Bulla schröteri* by Philippi, 1844, possibly because these authors and many others felt that a geographical range of a single species from one boreal region to another, passing through both temperate zones and the tropics, was improbable. An examination of a long series of specimens from the two extremes of the

range, however, disclosed to later workers little if any differences in shell characters, as the shells from both regions passed through the same series of mutations. They are now united under the name *aperta*, and this result is confirmed by a study of the anatomy of the animal.

There is no specimen marked for *aperta* in the Linnaean collection, but the only shell present that approaches the description in the "Systema" is identical with one form of the British *aperta* of authors which is figured by Reeve (1843–1878, vol. 18, *Philine*, pl. 1, sp. 2a, b, c). As this is the only *Philine* in the collection, it has been treated as the ostensible holotype and as the shell that was presented to Linnaeus by Spengler and that came from South Africa.

The serious inconsistency in the description is the phrase "transversim substriata." Several species of *Philine* are more or less diagonally or spirally striate, but this is not true of any form of *aperta* from any region. Indeed Lemche (1948, p. 61) uses this as a diagnostic feature for one of his three groups in *Philine*. He places *aperta* in the first group which he characterizes as: "(1) Those without sculpture except slight lines of growth." One explanation of Linnaeus' phrase may be that the specimen on which his description was based was a Cape specimen that possessed such marked growth lines that they appeared to him to be sculptural. The writer has a small specimen of *P. aperta* from Sicily, the growth lines of which are much more diagonal than in most examples and so close and regular as to suggest striations. The first clearly recognizable figures of *aperta* (Chemnitz, 1780–1795, vol. 10, p. 119, pl. 146, figs. 1354–1355) do show very marked growth lines as horizontal and concentric corrugations but exhibit no true sculptural feature that can be called striations. The specimen of *aperta* in the Linnaean collection likewise shows no striations. The only alternative explanation of the phrase "transversim substriata" is that the Spengler species was merely lent to Linnaeus,¹ that the latter's

¹ Chemnitz, a close friend of Spengler, writing in 1788 (*tom. cit.* in text, p. 120) says: "To Herr Spengler is due the credit, because he first made it known (bekannt gemacht) to Linnaeus by means of a specimen of this species." There is no indication here that Spengler actually gave a specimen to Linnaeus.

description was based on faulty memory, and that therefore the specimen in the collection is not the holotype but is a shell that was not described and was added to the collection after the publication of the twelfth edition. The categorical words in the description, "antice etiam umbilicata," are also inconsistent with any form of *aperta*. Hanley (1855, p. 204) suggested that *Bulla sinensis* A. Adams, 1855,¹ might have been the species on which the description was based, but *sinensis*, while diagonally striate, has no umbilicus and moreover is from the wrong locality. In fact, the combination of the required features of Linnaeus' diagnosis are not found in any species of *Philene*.

In spite of the doubt as to whether Spengler's specimen was in fact *aperta* and in spite of the discordance between the description and the features of any of the forms of the *aperta* of authors, it is possible that the latter is the Linnaean *aperta*, although such a decision would be wholly arbitrary. Any doubts as to the identity of *aperta* have been resolved by conchologists by saying that they have been overridden by the fact that the name has become firmly fixed in the literature as applied to our *aperta*. Perhaps this is a convenient and practical solution.

The genus *Philine* was described by Ascanius in 1772 (p. 331) during the lifetime of Linnaeus and only five years after the publication of the last edition of the "Systema." The genus was monotypic for *aperta* which Ascanius called *P. quadripartita*. The latter name, although identical with *aperta* Linné, has been occasionally used, notably by Lovén, 1846, Mörch, 1852, Sars, 1853, and Menke, 1854. Many years elapsed before *Philine* was generally accepted. O. F. Müller called it *Lobaria* in the "Prodromus" of his "Zoo-

logica Danica" (1776, pp. 226, 242), giving to *aperta* the specific name *quadriloba*. It is obvious that Müller gave the generic and specific names to the animal rather than to the shell, and Gmelin (1791, p. 3143) continued this use by listing *Lobaria* and its sole species *quadriloba* in Vermes Mollusca, between the genera *Holothuria* and *Triton*. He referred to Ascanius' and Müller's works but made no mention of the shell. The latter he described separately in *Bulla* in Vermes Testacea (*op. cit.*, p. 3424), and in this description he mentioned neither Ascanius nor Müller in his synonymy, although he located the species, as Linnaeus did, as from the Cape of Good Hope. It is doubtful whether Gmelin knew that his two descriptions referred to the same organism.

Da Costa (1778, p. 30, pl. 2, fig. 3) left the species in *Bulla* as *Bulla bulla*. Born, 1780, Donovan, 1802, and Dillwyn,² 1817, used *Bulla* but revived the Linnaean name *aperta*. Pennant, in the fourth volume of "British zoology" (1766-1777, pl. 70, fig. 85; not seen) changed the specific name to *patula*. Lamarck (1801, p. 63) erected a new genus (*Bullaea*) for the reception of this species, which was still the only species in the genus to have been described. He called it *planciana*. *Bullaea* remained in use for many years, particularly by the Continental writers. *Utriculoopsis* M. Sars, 1870, is an exact synonym. The first use of *Philine* as an accepted and valid generic name, after Ascanius, was by Lovén (1846, p. 414). Since that time it came rapidly into use and is almost universally accepted today.

Philine aperta Linné is the type species of *Philine* Ascanius, 1772, by monotypy, as *P. quadripartita*, and also of *Bullaea* Lamarck, 1801, as *B. planciana*. *Amygdala marina* Plancus, 1760, "*Bulla candida* Müller, 1788" (*vide* Jeffreys, 1867), and *Bulla emarginata* J. Adams (1800, p. 2, pl. 1, figs. 9-11, the fry of *aperta*), are all synonyms.

The earliest post-Linnaean figure was that of Martini (1769-1777, vol. 1, p. 266, vignette 13, figs. 3e, 3f). It is recognizable as a *Philine* but not specifically determinable. Martini called it "Die Fingernagel." The Chemnitz figures have already been referred to above.

² Dillwyn (1817, vol. 1, p. 477) did use the name *Philine* Ascanius, but only in the synonymy of *Bulla aperta*, as *Philine quadripartita*.

¹ The *Bulla sinensis* Adams that Hanley mentioned is described and figured in Sowerby (1847-1887, vol. 2, p. 282, pl. 124, fig. 98). It should be cited as of "Adams in Sowerby, 1855," as Adams contributed the chapter on Bullidae. The figure is a *Philine* with an outer lip which rises considerably above the vertex of the shell and is markedly subacuminate. It is impossible to distinguish this figure from the form of *aperta* Linné that exhibits this feature. The shell came from the Cuming collection with a locality "China Seas." It is also figured by Reeve (1843-1878, vol. 16, *Haminea*, pl. 4, sp. 21a, b) as *H. sinensis*. Reeve said of the species: "This shell so much resembles the shells of *Philene* that it is only placed in this genus on the authority of Mr. Adams, believed to be based on a knowledge of the animal."

Reeve's figures (1843-1878, vol. 18, *Philine*, pl. 1, sp. 2a, b, c) are the classic drawings of one of the British forms of *aperta*. Figure 1 on the same plate was said by Reeve to represent *Bulla planciana* Philippi, 1844, and is probably the *quadripartita* of Ascanius which is now recognized as identical with a form of the British *aperta*. Reeve believed that the *aperta* of Britain, at least, was distinct from Ascanius' shell, and was the one that was given the same name by A. Adams in Sowerby, 1855 (1847-1887, vol. 2, p. 599). The differences in the form of the shell of this species are not always faithfully reproduced in hand-drawn figures, and one must treat most of the nineteenth century drawings, as well as the text accompanying them, with suspicion.

The generic name *Philine* has been spelled in several ways. It was emended by Lamarck (1822a, p. 31) to *Phylina* in the synonymy of *Bullaea aperta*. It was used as *Phylina* by Voigt in 1834 (vol. 3, p. 136). It is not *Phylline* Abildgaard, 1790, or *Phylina* Cuvier, 1801, both of which names were given to genera of worms.

Philina aperta was not described in the "Museum Ulricae," and no specimen is found in the Queen's collection in Uppsala.

Bulla hydatis

1758, Systema naturae, ed. 10, p. 726, no. 333.

1767, Systema naturae, ed. 12, p. 1183, no. 377.

LOCALITY: "In M. Mediterraneo" (1758, 1767).

"B. testa rotundata pellucida longitudinaliter substriata, vertice umbilicato . . . Magnitudo saepius Pisi minoris."

This species is now included in the genus *Haminoea* Turton and Kingston, 1830.¹ The generic name was emended to *Haminea* by Leach (in Gray, 1847).

Most of the description might apply to several species of the genus except for a possible conflict as to the interpretation of the

¹ The genus *Haminoea* is sometimes incorrectly cited as of Turton and Carrington. It appeared in "The Teignmouth, Dawlish and Torquay guide," edited and published by Carrington, and was one of the names in the natural history section of that work, written by Turton and Kingston. The work had no page numbers, but *Haminoea* is found on folio 8. The date 1830 is given by Neave (1939-1950, vol. 2, p. 560, *Haminoea*), while the Catalogue of the Library of the British Museum gives "1828?"

word "substriata," but the locality greatly limits the field of speculation, and the size stated, "as large as a small pea," enabled the early naturalists to identify it with the common small *hydatis* of the Mediterranean. The range of the species is, however, much more extensive than Linnaeus' locality suggests, as it is found on the Atlantic coasts of Spain and France and as far north as the south coast of England. The northern form is slightly larger. Lamarck's *Bulla cornea* (1822a, p. 36) is said to be this form. Lamarck described *cornea*, which he said came from the English and French coasts, immediately after *hydatis*, which he placed in the Mediterranean, and said: "Although close to the preceding species this shell appears to be distinct. It is more globose, rough to the touch, and provided with very fine transverse striae. Its umbilicus is hardly noticeable." I have examined a considerable series of *hydatis* from the British Isles, the west coast of Europe, and the Mediterranean, and not only can find no differences which would justify specific separability, except that the northern form is slightly larger, but the details pointed out by Lamarck for his *cornea* do not exist in any of the specimens seen. I am unable to suggest what Lamarck was describing.

The present species has been confused with *Bulla navicula* Da Costa, 1778, but that species exhibits marked differences. Pilsbry (1893, p. 353) points out that "The species is generally known as *H. hydatis*, but is quite distinct from that species in the larger size, much stronger spiral striae, more marked growth wrinkles, more concave columella etc."

The following are synonyms: *Bulla hyalina* Gmelin, 1791; *Bulla ampulla* Montagu, 1803, Turton, 1806, Fleming, 1828, and Grateloup, 1837, not Linnè; *Bulla folliculus* Menke, 1853; and *Bulla elegans* of many authors, not Leach or Gray.

As noted in the above synonymy, the "*H. elegans* of authors" is identical with *hydatis*. The true *elegans* was described by Gray in 1825 (p. 408) and is a western Atlantic shell. Pilsbry, in commenting on the latter shell, says (1893, p. 356): "The description of *Bulla elegans* given by Gray applies undoubtedly to this form, not to any European species; and Leach's *H. elegans* is also the same,

although he may have confused other shells with it . . . By no possible means can Gray's or Leach's description be made to fit the *H. hydatis* of Europe."

The Linnaean species is figured by Reeve (1843-1878, vol. 16, *Haminea*, pl. 1, sp. 4a, b). Reeve's shell is the larger British form. Pilsbry also figures it (*tom. cit.*, pl. 41, figs. 19-20).

It was not described in the "Museum Ulricaë."

Bulla ampulla

1758, *Systema naturae*, ed. 10, p. 727, no. 334.

1767, *Systema naturae*, ed. 12, p. 1183, no. 378.

LOCALITY: "Ad ins. Mauritii, Jamaica, Barbados (1758); "ad ins. Mauritii, Jamaica, Barbados, Africam" (1767).

"B. testa rotundata opaca, vertice umbilicato."

This common Indo-Pacific species, the "Nux marina" of Gualtieri and the "Muscade" and "Gondole" of the pre-Linnaean French naturalists, is the only species in Linnaeus' *Bulla* that remains in that genus as today constituted. It is the type species of the genus, by subsequent designation, Montfort, 1810. It is also the type species of *Vesica* Swainson, 1840, by subsequent designation, Gray, 1847.

The description is accurate as far as it goes but is so brief that it could cover most of the umbilicated Bullae, with the exception of the word "opaca," and is thus nearly tantamount to a generic definition. The stated localities are not helpful, as they include Jamaica and Barbados in the western Atlantic as well as Mauritius and "Africa" which are in the known range of the species. It is probable that Linnaeus based his American localities on specimens of *B. occidentalis* C. B. Adams, 1850, or *B. amygdala* Dillwyn, 1817, although there is no indication in his manuscripts or his collection that he possessed such specimens. The only other explanation is that he had received specimens of *ampulla* with incorrect documentation. The extension of the range to the western Atlantic was accepted by many of the later writers well into the nineteenth century. Lamarck (1822a, p. 33) and Deshayes and Milne-Edwards (1835-1845, vol. 7, p. 668) used "American Ocean" without comment, although Dillwyn (1817, vol. 1, p. 480) aban-

doned these localities and gave only those from the Indo-Pacific. Both the description and the localities of Linnaeus, therefore, cover a composite species.

The synonymy is extensive but also covers a mixture of species. In order to conform to the "rotundata" of the description, we must exclude those references which show cylindrical or elongated shells (Barellier, pl. 1326, fig. 37; Colonna, pl. 69, fig. 3; Buonanni, pt. 3, pl. 3; Petiver, pl. 50, fig. 13; Lister, bk. 4, sect. 9, ch. 10, pl. 1, fig. penult.¹; Adanson, pl. 1, fig. 2; the Gualtieri figures F, G, H, and I on pl. 12), which leaves only the references to Rumphius (pl. 37, fig. G), Gualtieri (pl. 12, fig. E), Petiver (pl. 99, fig. 14), Seba (vol. 3, pl. 38, figs. 34-44), and Regenfuss (pl. 5, fig. 58 and pl. 8, fig. 21) that satisfactorily show *ampulla*. Thus almost half of the figures must be expunged. A manuscript note is added by Linnaeus in his own copy of the twelfth edition referring to four Martini figures (1769-1777, vol. 1, pl. 1, figs. 188-191). The first two of these (188-189) undoubtedly represent *ampulla*. The last two may possibly be inaccurately colored drawings of *B. velum* Gmelin (1791, p. 3433), although they may have been intended for the comparatively rare banded form of *ampulla* which Menke (1854, p. 26) called *bifasciata*.² It is true, as Lamarck said (*loc. cit.*) that *ampulla* has many color varieties. One further reference in the "Systema" is to a comparatively rare work (Mus. Grev. pl. 9, figs. 7-8). This refers to Nehemiah Grew's catalogue of the Royal Society's collection (Grew, 1681). The figures referred to are in reality numbered 1 and 2 but are the seventh and eighth figures on the plate. They are too crude to be identified and are examples of Linnaeus' frequent "approximations."

In the earliest comprehensive synonymy of the species, Lamarck (*loc. cit.*) made some necessary corrections. The erroneous figures

¹ This reference is not understood. There is only one figure on plate 1. This is sometimes cited for *ampulla* but is equivocal.

² Menke's species was called *B. columellaris*, with a variety *bifasciata* which he said equaled the *B. ampulla* of Bruguière and the shell figured by Martini (1769-1777, vol. 1, p. 282, pl. 21, figs. 190-191) called *Ovum Ibicis bifasciatum*.

of Buonanni, Colonna, Borellier, Adanson, and the first figure from Petiver were omitted. The Lister reference was changed to "t. 713, f. 69 et t. 1056. f. 8." The latter shows a banded *Bulla* which is probably intended for *B. velum* Gmelin (1791, p. 3433). He added accurate figures from Knorr (pt. 2, pl. 8, fig. 1; pt. 5, pl. 17, fig. 6; pt. 6, pl. 21, fig. 2); from Favanne's Argenville (1780, pl. 27, fig. 6); and the excellent figure from the "Tableau encyclopédique" (1798, pl. 358, figs. 3a, b). He, however, made the mistake of including all four Martini drawings (188-191) referred to above and added two additional figures from the same plate (192-193) which were not mentioned even in Linnaeus' manuscript note. These last two drawings resemble *ampulla* in general contour, but the color pattern is of a form unfamiliar to the writer. Martini supplied no references to these figures and described the shell as "a rare Gondole with wide longitudinal wavy bands and two wide transverse zones." I have not seen any citation of these figures since Lamarck. They were even omitted in Deshayes and Milne-Edwards' second edition of Lamarck's work.

Martini supplied three further figures (*tom. cit.*, p. 291, pl. 22, figs. 202-204) which he referred to *ampulla* Linné. These figures are probably designed to portray the shell later called *B. striata* by Bruguière, 1789. Link (1807, p. 142) referred them to *B. umbilicata* Röding, saying, "perhaps only a variety of the preceding [*ampulla*]." Gmelin (1791, p. 3425) used the figures for his variety "β" of *Bulla ampulla*. Thus the misconception of Linnaeus that *ampulla* had cylindrical forms was accepted for many years. Link, with the exception of his query as to *umbilicata*, was the first writer to cite only the unquestionably correct figures of Martini for the Linnaean species.¹

¹ Röding (1798, p. 15) also cited for his *Bulla umbilicata* the three Martini figures mentioned (figs. 202-204) and also "Gm. sp. 10, *ampulla* β." The figures bear no resemblance to *ampulla* Linné except in color. They show a cylindrical shell. Gmelin's species 10, "*ampulla*," is the *ampulla* of Linnaeus, and his variety "β" is the cylindrical shell which is probably *B. striata* Bruguière. Thus Röding was entirely correct in his references for *umbilicata*. Röding also listed a *Bulla ovum vanelli* for

While no species is marked for *ampulla* in Linnaeus' collection, a specimen of it is present which closely and uniquely conforms to the description. This has been accepted, and probably justly, as Linnaeus' holotype.

Bulla ampulla is listed in the "Museum Ulricae" with a description which, after repeating the tenth-edition description, adds several helpful details, such as a mention of the bluish blotches ("punctis purpurascensibus") which are seen on some forms of the species, and the fact that it is umbilicated only anteriorly. There is also a mention of the variable coloration of the shell. The specimen now marked for *ampulla* in the Uppsala collection conforms to both descriptions in every detail.

In addition to the figures already mentioned, the species is figured by Reeve (1843-1878, vol. 16, *Bulla*, pl. 1, sp. 3).

Bulla lignaria

1758, *Systema naturae*, ed. 10, p. 727, no. 335.

1758, *Systema naturae*, ed. 12, p. 1184, no. 379.

LOCALITY: Not given in either edition.

"B. testa obovata oblongiuscula transverse striata, vertice subumbilicato . . . Testa statura fere Ampullae, sed magis versus apicem angustata, minus umbilicata, colore fere ligni; intus alba et columella flexuosa, ut oculo aditus pateat ad verticem usque."

Linnaeus' specimen of this species, which is properly documented in his collection, came from Count Tessin's cabinet, and no locality is given, the author adding the words "e Museo Tessiniano" in the place usually devoted to a geographical locality. The species is found along the entire western coast of Europe and in the Mediterranean. No references were given in the tenth edition, but a Lister figure (pl. 714, fig. 71) was added in the twelfth. This figure is sufficiently exact and agrees well enough with the description to have enabled the early conchologists to

which he cited Martini's figures 188-189 which are clearly *ampulla* Linné, and "Gmel. sp. 10. *Ampulla*," Gmelin's typical *ampulla*, which is also *ampulla* Linné. He also listed a *Bulla ampulla striata* for which he cited only Gmelin's typical *ampulla*. The two Röding species *ovum vanelli* and *ampulla striata* are therefore equal to *B. ampulla* Linné.

identify the species, even without recourse to the Linnaean collection.¹ The description itself is unmistakably characteristic and graphic.

It is now placed in *Scaphander* Montfort, 1810, and is the type species of the genus by monotypy. The name was not, however, used for a number of years after Montfort, and many years elapsed before it was consistently employed. Lamarck (1822a, p. 33) left *lignaria* in *Bulla* as did most of the mid-century writers, including Hanley. Schumacher's *Assula* (1817, p. 258) is a synonym, having the present species as type, by monotypy, as *Assula convoluta*. Risso (1826, pp. 30-46) appears to have been the first to use the name *Scaphander* after its original publication.

The most noteworthy features of the members of the genus *Scaphander* are not the shell characteristics, although these are distinctive, but the peculiarities of the anatomy of the animal. The dentition is unusual, but the most curious features are the gizzard plates, "two being very large and subtriangular, while the third is folded upon itself and of a narrow, lanceolate form, fitting between the large ones" (Pilsbry, 1893, v. 244). It has been reported that the principal food of the animal consists of *Dentalium* species, as it is able to break up the shell and digest the animal with the aid of this remarkable mechanism. It is not surprising, therefore, that a new generic name should have been given to the species based on this peculiarity of the anatomy. Gioeni (1783, p. 25) erected and described a new family and genus based on the gizzard plates of *Scaphander lignarius* which he had found on the beach at Catania.

¹ The Linnaean collection of shells was acquired by Sir James Smith, an English botanist, in 1784, and I have discovered no evidence that it had been seen by any of the western European conchologists up to that time. There is no reference to the collection in the works of Martini, Chemnitz, Born, Gmelin, Bruguière, Lamarck, or any of the less important early writers, and indeed, up to Hanley's "Ipsa Linnaei conchylia" in 1855, no descriptions or even mention of his specimens are found, except for a reference by Chemnitz, in 1795 (1780-1795, vol. 11, p. 95), to the fact that Linnaeus' collections had been purchased by "a D. Schmidt in London . . . to the great detriment and affront to Sweden."

Gioeni's work is not available to the writer, but it appears (Pilsbry, *loc. cit.*) that he named the new genus after himself, *Gioeni*. Bruguière (1789, 1792, Index, p. 12) described the same genus, which he emended to *Gioenia*, with the vernacular French name "Char," and listed the name of the only species as *sicula*. It is not apparent from a reading of Bruguière's description or the pertinent text for "Char" in the first volume of the "Histoire naturelle des vers" whether or not he associated the name with *S. lignarius* (Linné), but in a plate of the "Tableau encyclopédique" (1798, pl. 170, figs. 1-7) the group of figures is headed "Char. Gioena," and in the explanation of the plates, the "Liste," the figures are listed as "1-7. *Bulla lignaria ventriculo ossiculi*." Investigation seems to prove that Bruguière actually saw and possibly supervised the plates up to this point and thus was aware that *Gioenia* was merely a duplicate name based on the anatomy of the animal. He had, however, died before the publication of this portion of the "Liste" in 1816.²

Winckworth (1932, p. 232) revived the name *Tricla* Retzius, 1788 (to be altered to Philipsson, 1788),³ for *Scaphander* Montfort. Based on validity of publication and on priority of date there is no doubt as to the propriety of the change under the Rules, but *Tricla* had been entirely forgotten for almost 150 years, and this is an extreme example of the theory that stability in the nomenclature is more to be desired than a strict adherence to the Rule of Priority. Lemche (1948, p. 59) applied to the Commission on Zoological Nomenclature for a ruling that, under its plenary powers, it would validate the use of *Scaphander* Montfort as a *nomen conservandum* against *Tricla*. The Commission has not yet acted.

In referring to the varieties *brownii* Leach,

² Although volume 1 of Bruguière's work contained only the genera in alphabetical order through "Cone," *Gioenia* is described in the text of that volume, as the alphabetical order was based on the French vernacular names of the genera, e.g., "Char" for *Gioenia*.

³ The name *Tricla* and the specific name *gioeni* were erected in a work apparently published by Philipsson to which Retzius gave his name. I have not had an opportunity to examine this work (cf. bibliography, Retzius, 1788).

1852, and *zonata* Turton, 1834, of *Scaphander lignaria*, I quote from Lemche's paper (1948, p. 59): "The variety of *lignaria* found in the Northern Atlantic was described by Leach under the name of *Scaphander Brownii* in a part of his manuscript printed—but not issued—in 1820 (published 1852).¹ In 1847 the name was cited as a *nomen nudum* (Leach, 1847). The species is the same as *Bulla zonata* Turton, 1834, which name, however, has been preoccupied by *Bulla zonata* Solander, 1786. Solander (p. 8) cites it as a *nomen nudum*,² but later (p. 164) refers to Tab. 9 fig. 1 in Born (1780) showing the '*Bulla amplustre*' of Linné. So, the correct name of the Northern Atlantic variety of *Scaphander lignarius* is var. *brownii* Leach, 1852. In 1853, the same variety was mentioned by M. Sars as *S. lignarius* var. *borealis*, and in 1884 as var. *britannica* by Monterosato. Locard & Caziot (1900) raised the variety to specific rank on insufficient indications, but no one appears to have followed them in their view. The variety seems to be zoogeographically and ecologically a dwarf variety of the larger (typical) Mediterranean form."

In addition to the synonyms mentioned above the following are probably identical with *lignarius*: *Bulla gibberulus* Roux, 1862 (*fide* Locard, 1886); *Bulla gratieloupi* Micheliotti, 1847 (*fide* Pilsbry, 1893); and *Scaphander sublignaria* d'Orbigny, 1847 (*fide* Pilsbry, 1893).

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

An excellent black and white drawing of *lignaria* is found in Crouch (1827, pl. 14, fig. 9). Reeve's figure (1843–1878, vol. 18, *Scaphander*, pl. 1, sp. 4a, b), is the best colored picture of the shell. G. O. Sars (1878, pl. 18, fig. 7) figures the shell and (*op. cit.*, pl. 26, fig. 4) the animal.

¹ Leach's work on the Mollusca of Great Britain was left at his death partly in manuscript and partly in galley proof. It was not published until 1852, when J. E. Gray edited and published it. (See bibliography, Leach, 1852.)

² Lemche's use of the word "cites" is misleading. On page 8 of the Portland Catalogue Solander used the name *zonata* as a valid name, whereas it was a *nomen nudum*. The further reference by Lemche to page 164 of the Catalogue is correct as stated.

Bulla physis

1758, *Systema naturae*, ed. 10, p. 727, no. 336.
1767, *Systema naturae*, ed. 12, p. 1184, no. 380.
LOCALITY: Not given in either edition.

"*B. testa rotundata glaberrima pellucida lineis crispata, spira retusa.*"

The word "glaberrima" was added in the twelfth edition.

In this species there is a complete concordance between the description, the documented specimen in the collection of Linnaeus, and at least a part of the pictorial synonymy.

The figure Linnaeus cited from Argenville (1742, pl. 20, fig. I) in both editions of the "Systema" is questionable. It shows the depressed spire of *physis*, but the arrangement of the encircling bands is more as in *Bulla fasciata* Bruguière, 1789 (*velum* Gmelin, 1791), which also has depressed spire. I am strongly inclined to believe that Argenville intended to show the latter species, although there are arguments for and against this view. Argenville, in his text (*op. cit.*, p. 304), speaks of its "several brown bands," which suggest *fasciata* or the rare banded form of *physis*. The rest of the synonymy (Gualtieri, pl. 13, figs. FF; Seba, vol. 3, pl. 38, figs. 46–50) shows reasonably characteristic figures. Note that the Gualtieri figure had already been used in the tenth edition for *B. amplustre*. Linnaeus somewhat improved his synonymy by adding a pair of figures from Martini (1769–1777, vol. 1, pl. 21, figs. 196–197) in a manuscript note inserted at some later date in his own copy of the twelfth edition. Martini, in his account of the species (*tom. cit.*, p. 285), however, somewhat clouded the issue by also referring an additional figure to *physis* (his fig. 198), which is a mere copy of Argenville's questionable drawing.

In connection with the Argenville figure it must be remembered that the arrangement of the fine wrinkled brown lines, which typically cover the whole body whorl in *physis*, varies considerably. Usually the lines are of approximately the same width, depth of color, and distance apart, but in other forms they tend to arrange themselves into groups to form loose spiral bands or even to coalesce. At times individual lines may become thicker or of a much darker color than the others.

Another variation is that short segments of each line may be darker, the darker portions of the lines being arranged into very vague vertical bands. With this amount of variation it is easy to understand why the early, badly drawn figures should be deceptive. The Argenville figure may show a variety, which this writer has never seen, in which the coalescence of the lines is extreme, forming four deep brown and sharply defined bands around the shell. In fact the only resemblance the figure has to the typical *physis* is the depressed spire of the juvenile shell. Schumacher's comment on the Martini figures (figs. 196–198) is interesting. He said (1817, pp. 186–187): "The figures in Martini. 1. pag. 205. Tab. 21. fig. 196–197 are only mediocre; and the fig. 198 and the fig. 6, Vign. 14. represent different shells, although the author has described them as varieties of our shell."

The *physis* of all authors is represented by a specimen in the Uppsala collection, and its unique and complete concordance with the ample and characteristic description in the "Museum Ulricae" and in the "Systema" confirms that the same shell was described in the two works.

The species is placed in the genus *Hydatina* Schumacher, 1817, as *Hydatina filosa*, although the author correctly refers it to *B. physis* Linné, and is the type species of that genus, by monotypy.

Gmelin (1791, p. 3426), in addition to listing the typical *physis*, noted a variety "γ" which he called the "Striped Bulla" and referred to the figure of *Bulla virgata* in Martyn (1784–[1792], pl. 11). Schubert and Wagner (1829, p. 120) put both Martyn's figure and Gmelin's variety "8" [*sic*] in the synonymy of their own "var. [b]" of *physis* and followed the latter reference with the phrase "Unsere Abbildung." Their own figures (*tom. cit.*, pl. 228, figs. 4049a, b) are somewhat puzzling. They have the general color pattern of the typical *physis* except that some of the wrinkled lines are darker than the others and more emphasized, but the shape of the shell is not that of *physis* in either the contour of the top of the lip or the details of the spire. The columella is reduced to a narrow white band and shows no umbilical chink. Although it is true that *physis* is variable in all these fea-

tures, the figures referred to by Gmelin and shown by Schubert and Wagner are of a shell that is not present in any collection that I have examined and that is not shown in any other illustration. It would seem to demand further study. Gmelin listed varieties "β" and "γ." The first he referred to "Kaemm. Cab. Rudolst., p. 115, n. 1, t. 9, f. 55," a work that was not available to me. The second he referred to the figure from Martyn referred to above. It would appear that the variety "8" of Gmelin cited by Schubert and Wagner must have been a typographical error for "var. β," were it for the fact that it was the "var. γ" which Gmelin referred to Martyn's figure.

Hydatina physis has received two other specific names: It is the *Bulla atro-lineata* of Schröter (1804, vol. 4, pt. 1, p. 16) and the *B. quoyana* of d'Orbigny, 1845, in addition to the possibility of its being Martyn's *B. virgata*. D'Orbigny believed that his *quoyana* was distinct from *physis*. He said (1845, p. 67): "Two shells are apparently confounded in this species [*physis*]. 1, Which we recognize as the type, oblong rather than ventricose, with the spire slightly salient in its entirety and very obtuse, which is certainly the shell figured in the vignette 14 fig. 6 of Martini. 2, The other, more globose, more fragile, with the spire not salient, which inhabits the Isle of France [Mauritius], of which MM. Quoy and Gaimard (Voyage of the 'Astrolabe,' vol. 2, p. 363) have given us an account, as well as M. Deshayes (new edition of Lamarck, vol. 7, p. 670), is the *Bulla physis* . . . We propose for the latter the name of *Bulla quoyana*." He added that the true *Bulla physis* was a native of the Antilles, and that he had received specimens from Cuba, St. Lucia, and Guadeloupe from Hotessier. This implies that the shell from Mauritius (and, we may assume, from the whole Indo-Pacific region) was *quoyana*, an opinion that no other writer has ever held and that is certainly not accepted today. It is quite possible that *quoyana* was the fragile shell with the flat spire and the globose shape described by Gmelin and by Schubert and Wagner and figured by the latter and by Martyn.

Hydatina physis, the remarkably broad range of which extends in the Indo-Pacific

from the African coast to the Hawaiian Islands, has frequently been reported from the western Atlantic. The first reports were from Cuba (d'Orbigny, above) and Guadeloupe (Beau, 1858, *vide* Pilsbry), and in the last few years it has been found alive and in fair numbers by Lyman in Lake Worth, Florida. I can detect only the most insignificant differences in color or form between the Indo-Pacific and American specimens, taking account of the fact that these features both vary considerably. The shells from the two widely separated regions, however, seem to pass through the same series of variations. This would presuppose an almost impossible migration, unless the American shell was introduced. This theory, however, would necessitate introductions in localities as far apart as Florida and Guadeloupe, which is most improbable. This may be one of the cases such as *Littorina angulifera* Lamarck, the name given to the American shell, and *Littorina scabra* Linné of the Indo-Pacific. The differences between the two latter species are slight and, according to Bequaert (1943, p. 25), "probably of at most subspecific value, although their ranges nowhere touch." It is significant that, as Bequaert says, West African specimens show no consistent difference from those of tropical America. Bequaert (1946, personal communication) also says: "Although many specimens of the Atlantic and Indo-Pacific forms of *angulifera-scabra* can scarcely or not be separated on external characters, there is nevertheless a difference between them in their potentiality for variation. The Atlantic *angulifera* is very uniform. . . The Indo-Pacific *scabra* on the other hand varies a great deal, so that it has produced a number of well-marked races. . . As I conceive it, these races are modifications of a common *scabra* stock therefore more recent than and on a different level from the genetic difference now existing between *angulifera* and the *scabra* assemblage of forms." Bequaert adds that from the point of view of nomenclature it might be simpler to treat the two as distinct species and to give the several forms of *scabra* subspecific rank. I have quoted freely from Bequaert's paper and letter in order to suggest that his case and that of *Hydatina physis* might be parallel,

and that research into the potentiality of variation between the forms of *physis* in the Indo-Pacific region and those in the western Atlantic might be profitable. It is interesting to note that d'Orbigny treated the *angulifera-scabra* complex in quite a different way from his feeling about the *physis* complex. He used the specific name *scabra* for the western Atlantic form because he believed that *angulifera* was an exact synonym of *scabra* from the Indo-Pacific. In the case of *physis* he chose a new name, *quoyana*, for the Indo-Pacific shell, leaving the Linnaean name for the American form.

Hydatina physis is figured by Reeve (1843-1878, vol. 16, *Hydatina*, pl. 1, sp. 2). The American shell is figured by Maxwell Smith (1941, pl. 53, fig. 13).¹

Bulla amplustre

1758, *Systema naturae*, ed. 10, p. 727, no. 337.
1767, *Systema naturae*, ed. 12, p. 1184, no. 381.
LOCALITY: "In Asia" (1758, 1767).

"B. testa subrotunda, spira elevata obtusa, fasciis incarnatis . . . Testa alba fasciis rubris."

The subscription was added in the twelfth edition.

No other species in *Bulla* Linné possesses the combination of features required by the above description, and indeed it is necessary only to note the phrase "fasciis incarnatis" to satisfy oneself that the *amplustre* of authors has been satisfactorily defined, although all the remaining details are entirely characteristic.

It is not, however, defined pictorially. In the tenth edition Linnaeus cited a figure from Gualtieri (pl. 13, figs. FF, two figs.) and one from Lister (bk. 4, sect. 9, ch. 10, pl. 2, fig. exterior). The former shows what is apparently a vaguely banded form of *B. physis* and was later properly cited for that species in the twelfth edition. The latter cannot be located, and there is no figure of *amplustre* in Lister's work. There is no figure number given, and the meaning of "exterior" is not clear. The Lister reference was omitted in the

¹ The most recent comment on the questionable American *physis* is that of Abbott (1954, p. 276). He said that *H. physis* Linné "is believed to be limited to the Indo-Pacific," and he identifies the American shell with *H. vesicaria* "Solander" Humphrey, 1786.

"Museum Ulricae," and both references were omitted in the twelfth edition. The species, therefore, as it left the hands of Linnaeus, is entirely unsupported by synonyms except for the usual reference to the "Museum Ulricae."

The description in the latter work is more ample and explicit, except for two somewhat equivocal details. The phrase "Columella parum torta" is deceptive, as the columella of *amplustre* is a heavy, straight pillar, although it is provided with a well-defined umbilical chink which may have appeared to Linnaeus as a distortion. In the phrase "color albis lineis spiralibus obscurioribus, inter quas alternatim color albus et incarnatus" the word "obscurioribus," as applied to the black spiral lines, is, as to most specimens, incorrect and suggests that Linnaeus had before him either a badly faded specimen or the rare form in which the black lines are wider but paler than in the typical form and seemingly made up of a multitude of small spots or blotches. The specimen labeled *amplustre* in the Uppsala collection partly conforms to the description, having three interrupted spiral black lines on the body whorl and no further indication of color pattern.

A specimen of the *amplustre* of authors is also present in Linnaeus' own collection, and, although it is not marked in any way, it uniquely agrees with the description in the "Systema" and was in all probability the specimen on which that description was based. The distinctive color pattern of the species has identified it from earliest times, and it cannot be confused with any other species.¹

The post-Linnaean spellings of *amplustre* are apparently considered to be misspellings or typographical errors. It is suggested that

¹ Hanley (1855, p. 206) remarked that *Bulla vexillum* "has occasionally been confused with it, but the painting is quite different." He was referring to a Chemnitz species, *Bulla vexillum nigritarum* (1780-1795, vol. 10, p. 114, pl. 146, figs. 1348-1349). This is the *B. velum* of Gmelin (1791, p. 3433) and the *B. fasciata* of Bruguière (1789, 1792, p. 380). I can see little possibility of its being confused with *amplustre*. A glance at a specimen of *B. velum* or an examination of the Chemnitz figures or the figures in the "Tableau encyclopédique" (1798, pl. 359, figs. 1a, b) should dispel any doubt.

the error lay with Linnaeus rather than with his followers, and that he took the name from the Latin "aplustre," the "stern of a ship" but unnecessarily inserted the "m." On this assumption Lamarck's "*aplustre*" was the correct style, as was Schumacher's genus *Aplustrum*, and a strict application of Rule 19 covering a *lapsus calami* would necessitate reviving Lamarck's spelling, although Opinion 34 on the genus *Aeshna* modifies the Rule to the extent of allowing an apparently incorrect spelling to be retained where "evidence of the derivation of the word is not contained in the original publication." However, the phrase "*lapsus calami*" covers a multitude of sins, and it is not clear just how far the framers of the Rule intended to limit it. Note that Gmelin (1791, p. 3426) wrote it "*amplustra*." It has been suggested to the writer that Linnaeus derived his name from the Latin *amplus*, meaning spacious or wide. It is not clear why he should have chosen *amplustre* for this honor. Although it has a somewhat patulous lip, it is much less distinctive in this respect that several other members of *Bulla* Linné. Moreover, the addition of the termination "*tre*" to an adjective is grossly improper orthography.

The species is well figured by Reeve (1843-1878, vol. 16, *Aplustrum*, pl. 1, sp. 2a-g).

Bulla ficus

1758. Systema naturae, ed. 10, p. 752, no. 475 (*Murex ficus*).²

1767. Systema naturae, ed. 12, p. 1184, no. 382 (*Bulla ficus*).

LOCALITY: Not given in 1758; "In O. Indico ad Amboinam" (1767).

"B. testa obovata-clavata reticulato-striata, cauda exserta, spira, oblitterata."

The comma after "spira" is as in the original.

The description in the tenth edition, in *Murex*, contained the words "subdiaphana" in the first phrase and "patula" in the second.

Both Linnaeus' description and his synonymy show this to be a composite species. The description could cover the *ficus* of au-

² *Bulla ficus* was included in *Murex* in both the tenth edition and the "Museum Ulricae" but must not be confused with Gmelin's *Murex ficus* (1791, p. 3545) which is *Melongena paradisiaca* Reeve, 1847.

thors, *Ficus communis* Röding, 1798,¹ and even the later-described *F. decussata* (Wood), 1856. The phrase "spira oblitterata" does not accurately describe the low but slightly salient spire of any of the above three species. It is true that occasional specimens of the western Atlantic *communis* exhibit a spire which, including the nuclear whorls, is depressed and does not rise above the vertex of the body whorl. Such a specimen might conceivably deserve the description "spira oblitterata" and might suggest that the holotype was such a shell. This conclusion is repelled, however, by the fact that Linnaeus' collection contains no specimen of *communis* and only undocumented examples of the *ficus* of authors and of *ficoides* Lamarck.

Hanley (1855, p. 206) felt that the synonymy of *ficus* included "delineations of most of the ficulae known to the older conchologists," and, while the figures are for the most part crudely drawn, he specifically mentioned *ficus*, *ficoides* Lamarck, and *reticulata* Lamarck. Lamarck (1822b, pp. 141-142) described all three of these "species" separately, and they were so described and figured by most writers up to comparatively recent times. Reeve (1843-1878, vol. 4, *Ficula*, pl. 1) took a very radical position as to this group of names. He not only used Swainson's *Ficula* in the face of the then almost universal use of *Pyrula* Lamarck, but quite unnecessarily changed the specific name of *ficus* to *laevigata*. His reason for the latter change recalls Lamarck's dislike of tautonymic names. He said (*loc. cit.*): "Although assigned to the *Bulla ficus* of Linnaeus, it is clear that he [Lamarck] included the *F. reticulata* under this head. To avoid tautology I am under the necessity of introducing a new specific name." He also said of *reticulata*: "The cancellate sculpture of this species is subject to considerable modification; after an examination of numerous specimens it is obvious that the *P. reticulata* and *ficoides* of Lamarck are merely different states of the same." My

¹ The common Florida *Ficus* has commonly been referred to by American writers as *F. papyratia* (Say), 1822, and by Europeans as *F. reticulata* (Lamarck), 1822. Of the two names, which are synonymous, Say's *papyratia* has two month's priority of publication. Röding's *F. communis*, however, has 24 year's priority over either. It is also *Pyrula fortior* Mörch, 1877.

examination of a long series of specimens from a wide range of localities leads me to a different conclusion. I see no relation between *reticulata* and "*ficoides*," and the latter seems to be merely a color form of *ficus* Linné. Lamarck's *reticulata* (*communis* Röding) is a cancellate shell, usually, though not always, devoid of any color pattern whatever. Its spiral cords are more highly developed than the longitudinal threads, making the shell rough to the touch, though to a much less degree than in *decussata* Wood, where the spiral sculpture is dominant. *Bulla ficus* Linné is also reticulate, but the sculpture, both spiral and longitudinal, is so fine that the shell appears to be almost smooth, a feature that suggested to Reeve his new name of *laevigata*. Its color pattern consists of faint white bands which are intermittently spotted with brown, and usually shows lighter brown blotches scattered over the entire shell. In "*ficoides*" the texture of the shell is as smooth as in *ficus*, but the color pattern is more brilliant, both as regards the white bands and the spots that decorate them. The bands themselves tend to be wider and more clearly delimited. I have described the two extremes of color pattern in this variable shell, but the intermediates show such a complete intergradation that it is impossible to find any point of discontinuity between the muted coloration of the "typical" *ficus* and the more brilliant "*ficoides*." Conchologists have been wise to discontinue the use of the latter name.

Reverting to Linnaeus' synonymy of *ficus*, we find what are apparently three, and possibly four, species.

Lister's figure (bk. 4, sect. 10, ch. 8, pl. 2, fig. 30, later cited as pl. 750, fig. 46 in the Huddesford edition) is scarcely identifiable. It is a crude figure showing low cancellate sculpture and could be taken for *ficus* or *communis*. Lamarck cited it for *ficoides*.

The reference to Buonanni (pt. 3, pl. 15) is also a poor drawing, which was unfortunately used as the model for many later figures. It shows cancellate sculpture and faint brown spots. Lamarck cited it for *ficus*, and Hanley thought it represented *ficoides*.

The figure from Rumphius (pl. 27, fig. K) seems to have been copied from that of Lister.

The Petiver figure (pl. 6, fig. 9) is a copy of that of Buonanni.

One of the Gualtieri figures (pl. 26, fig. I) was probably based on a specimen of *ficus*, while his figure M on the same plate, also cited by Linnaeus, is much like *reticulata* Lamarck (*communis* Röding) and was probably based on that species, as it shows the low and fairly even reticulate sculpture of that species and no color pattern of any sort.

Some of the several Seba figures (pl. 38, figs. 13–24) certainly do not represent any of the above species, but show the globular body whorl abruptly constricted into a curved canal which is characteristic of *Rapa rapa* (Linné), the next species in the "Systema," and indeed most of them are again cited for that species. Of the other Seba figures (pl. 68, figs. 1–6) figures 1 to 4 are unmistakably *reticulata* Lamarck (*communis* Röding), while figures 5 and 6 are probably meant for *ficus*. Thus in the Seba figures we find drawings of three different species in two different genera. Owing to the slight differences which separate these species of *Ficus* and owing also to Linnaeus' vague conception of the group and the uniform mediocrity of the cited figures, the entire synonymy may well be disregarded. Klein's figure is also a copy of that of Buonanni.

Lamarck (1799, p. 73) erected the genus *Pyrula*, for which he used *Bulla ficus* as his "example," which therefore becomes its type species, by monotypy. Later (1822b, pp. 141–142) he broke up the Linnaean *ficus* into the three species *ficus*, *ficoides*, and *reticulata* (*communis* Röding) and added species belonging to such disparate groups as *Busycon*, *Melongena*, *Rapa*, and others. For *ficus* he cited those of the figures used by Linnaeus which most resemble the *ficus* of authors, i.e., Rumphius, Petiver, Gualtieri (pl. 26, fig. I), and Seba (pl. 68, figs. 5–6), together with some very questionable additions of his own, including a figure from the "Tableau encyclopédique" (1816, pl. 452, fig. 1). This figure is called *ficus* in the "Liste" and has been commonly cited for *ficus*, but is too vaguely drawn in respect to color pattern to be accepted as being based on any particular species. Lamarck's locality is accurate, being confined to the East Indies and the Moluccas, but his "hodge-podge" of figures hardly allows us to say that he adequately defined the species pictorially, although his description

is fairly characteristic. He did, however, correctly separate *reticulata* from the Linnaean complex, as his figures for that species, with one striking exception, are unmistakably correct. The exception is his citation of a Martini figure (1769–1777, vol. 3, pl. 66, fig. 733) which clearly shows *decussata* Wood. Deshayes and Milne-Edwards (1835–1845, vol. 9, p. 510, footnote) later noted the discordance of this figure with the rest of Lamarck's synonymy for *reticulata*, saying: "Lamarck included a figure of Martini . . . which certainly represents another species. M. Kiener called it *Pyrula ventricosa* Sowerby." The latter name is a synonym of *decussata* Wood.

Lamarck's *ficoides* is accompanied by only two references, Lister's figure 46, cited by Linnaeus for *ficus* but which is specifically unidentifiable, and a figure from Knorr (pt. 6, pl. 27, fig. 7). The latter is a clearer figure and plainly shows the highly colored or "*ficoides*" form of *ficus*. His description is characteristic of that form, emphasizing the brown-spotted, white bands of the shell ("fasciis albis, spadiceo-maculatis cincta"). He accurately defined the "species" descriptively.

Röding, in the "Museum Boltenianum" of 1798, erected the genus *Ficus*, under which he listed three species, *communis*, *variegata*, and *picta*. The first, *communis* (see footnote, p. 30, above), although referred to Gmelin's *Bulla ficus*, is also referred to the good figure from Knorr mentioned in the preceding paragraph which clearly shows *reticulata* Lamarck. *Ficus communis* may therefore be accepted as equaling *reticulata*, as Gmelin's *ficus*, being a copy of the *ficus* of Linnaeus, is just as obviously a composite species that includes *reticulata*. The second, *variegata*, was based on Martini's figures 734–735, which show the form "*ficoides*," and on *ficus* Gmelin. It is accepted as the restricted *ficus* of Linnaeus. The third, *picta*, was not referred to any figure, but was followed merely by the abbreviation "eod." (for "eodem"). Dall, in "An index to the Museum Boltenianum" (1915, p. 31) marks this name with a dagger, which he states is to indicate an invalid name because of being unaccompanied by a figure. He did not refer to the word "eod." The abbreviation might mean: (a) that Röding

meant to repeat the reference to *ficus* Gmelin; (b) *picta* was identical with the preceding name *variegata*; or (c) that he meant to cite for *picta* the Martini figures 734–735. Whichever alternative is adopted, *picta* is identical with *variegata* and is thus not an invalid species but a synonym. In any case, two of Röding's species (*variegata* and *picta*) are referable to a form of *ficus* Linné. Röding's list shows that he realized that Gmelin described all three shells (*ficus*, form *ficoides*, and *reticulata*) as did Linnaeus.

The present species is the type species of *Ficus* Röding, by subsequent designation, Winckworth, 1945. Winckworth's designation was in the following form (1945, p. 140): "To fix the species the latter, *F. variegata* R. = *Murex ficus* L. 1758, as traditionally interpreted = *Pyrula ficus* Lamarck, is here designated as type." I quote Winckworth's language in order to show that he apparently considered *F. communis* Röding to be identical with *reticulata* Lamarck, as does the writer, rather than with *ficus* Linné, and therefore ineligible to be selected as type as a synonym of *ficus*.

In addition to *Ficus* Röding and *Pyrula* Lamarck, *ficus* Linné has been at times included in *Ficula* Swainson, 1835, and *Sycotypus* H. and A. Adams, 1853.

The species is figured in Reeve (1843–1878, vol. 4, *Ficula*, pl. 1, sp. 4, as *Ficula laevigata*) and in Thiele (1931, p. 286, fig. 308). *Ficus communis* Röding (*papyratia* Say and *reticulata* Lamarck) is figured by Clench (1942, p. 1). The best figures of the form "*ficoides*" Lamarck are found in Schubert and Wagner (1829, pl. 226, figs. 4044–4045).

The description of *ficus* in the "Museum Ulricaë," where it is included in *Murex*, first repeats the description in the tenth edition of the "Systema naturae." This differed from the twelfth-edition description only by the use of the word "subdiaphana" and the word "patula" after "cauda." It is not understood why Linnaeus omitted these characteristic words in 1767. The remainder of the "Museum Ulricaë" description amplifies the original language in important respects. It uses the word "laevis" and speaks of the decussate character of the sculpture as "obsoletis." The color is given as "pallide flavescens maculis fuscis." With these additions the descrip-

tion clearly covers the *ficus* of authors rather than any of its congeners. The two specimens now marked for *Murex ficus* in the Uppsala collection are, however, not *ficus*. From photographs in the film of the collection in the present writer's possession, they appear to be specimens of *decussata* Wood. Although obviously worn, the spiral striae appear to be much too dominant over the longitudinal threads to be recognizably *reticulata*, and these striae appear also to have the small brown dots that are a feature of *decussata*. Dr. Nils Odhner, who has recently reexamined the collection, advises the writer, however, that the specimens are in fact *reticulata*. The important fact is that Linnaeus did not distinguish between the several species of *Ficus* in either the "Systema" or the "Museum Ulricaë," and it is certain that the types in the two collections were not the same species, if the "Museum Ulricaë" specimens are to be taken as authoritative, as to which there is always a doubt. The types in the London collection, which are undocumented, are *ficus* (typical) and *ficoides*. The specimens in neither collection can therefore be accepted as authoritative.

Bulla rapa

1758, Systema naturae, ed. 10, p. 752, no. 476 (in *Murex*).

1767, Systema naturae, ed. 12, p. 1184, no. 383 (in *Bulla*).

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

"M. testa rotundato-turbinata substriata diaphana, cauda curvata, spira exquisita . . . Hic cum praecedenti facie ad Bullas accedit, canali effusa autem differt; hujus denique cauda in junioribus recta, in senioribus longior et sursum curvata evadit" (1758).

"B. testa rotundato-turbinata substriata, cauda curva, spira exquisita . . . Muricibus proxima ob caudam, sed textura et omnis hujus cum praecedentis naturam Bullae indicant" (1767).

This species, which was included in *Murex* in the tenth edition but was moved to *Bulla* in the twelfth, is provided with a description which, while correct as to two of the features described, is misleading as to the remainder. "Testa rotundato-turbinata" is a graphic description of the shape of the shell, as is "cauda curvata," but the word "substriata" hardly describes the close-packed and coarse ridges over the whole body whorl

of the species. "Spira exquisita" is also a badly chosen phrase. Disregarding the difference between the meaning of the Latin word and the English word "exquisite," the spire of *rapa* is hardly more finely formed than that of *Bulla ficus*, the preceding species, which Linnaeus very loosely described as "obliterata." The subdescription of 1767, except for the words comparing the canal of *rapa* with the *Murex* canal, is extremely equivocal. "Textura" is difficult to translate. It does not mean the same as the English "texture," but rather means "the general make-up of the shell." I can see little resemblance between *rapa* and *ficus* in this respect, as Linnaeus would have us believe, and confess that I cannot arrive at an understandable translation of the entire last phrase in the subdescription. In short, it is not a particularly good or characteristic definition. However, the combination of the words describing the body whorl and canal, together with the highly descriptive specific name of the shell, is probably sufficient to identify the species.

The synonymy is so accurate, with the exception of one misprint, that it completely confirms the identification of Linnaeus' name with the *Rapa rapa* of authors and need not be discussed in detail. In the Seba reference the last figure ("t. 38. f. 7, 8") was a misprint for "t. 68. f. 7, 8."

A specimen of *Rapa rapa* is found in the Linnaean collection and, although unmarked, is the only shell present that agrees with the description. The locality is correct.

The description in the "Museum Ulricae" (which is found in *Murex*, as the species was placed in that genus at the time the work was in preparation) adds many useful details. The characteristic word "diaphana" is used as it was in the tenth edition, whereas it was omitted in the twelfth. "Spira parum admodum eminens, apice mucronato" is an improvement over the "Spira exquisita" of the "Systema." The word "rugosa" added to the description of the base of the shell is useful. The description of the expanded callus of the inner lip over the columella, "labium interius tenue, saepius adnatum, patens," adds a characteristic feature not mentioned in either edition of the "Systema." The entire description is tied by reference to the tenth edition, and three of the "Systema" refer-

ences are given. Inasmuch as the specimen marked for *rapa* in the Uppsala collection is indeed the *Rapa rapa* of authors and completely conforms to both descriptions, there is no doubt that Linnaeus was describing the same species in the two works.

Only one other specific name has been used for this species to any extent—the *Pyrula papyracea* of Lamarck (1822b, p. 144). It was employed by most of the nineteenth century writers, including Reeve, Kiener, Deshayes (in the "Histoire naturelle des vers"), and Sowerby. It is not *Murex rapa* Gmelin (1791, p. 3545) which was a new name given by Gmelin to the *Bulla rapiformis* of Born (1780, p. 307), and which was later called *Buccinum bulbosum* by Dillwyn (1817, vol. 2, p. 631), the name being taken from Solander's manuscript (see Solander, [n.d.]). It is probable that Gmelin was in ignorance of Born's prior name, as there is no indication of such knowledge in his synonymy. He concluded his diagnosis with the phrase "Bullae rapae affinis," but was saved from a case of homonymy by the fact that Linnaeus, in 1767, had moved *rapa* from *Murex* to *Bulla*.

Lamarck was not so blameless. He not only used the name *Pyrula rapa* (the *Murex rapa* of Gmelin) but listed as the next species *Pyrula papyracea*, which was the *rapa* of Linnaeus, with full knowledge that he was making an unjustified change of name, as he cited "*Bulla rapa*, Lin. Syst. Nat. Ed. 12" at the first item in his synonymy. Deshayes and Milne-Edwards (1835-1845, vol. 9, p. 515, footnote) sum up their opinion of these changes as follows: "Lamarck should be reproached for not having sufficiently respected the nomenclature of Linnaeus, and for having made arbitrary and useless changes; science will never advance if we should for long follow such a deplorable example. There are two rectifications to be made in *Pyrula rapa* and *Pyrula papyracea*. The name [sic] which Lamarck gave them should be changed. Linnaeus, in the 10th. edition of the *Systema naturae* established *Murex rapa* with a very good synonymy which he later made into his *Bulla rapa*. This species is exactly the same as the *Pyrula papyracea* of Lamarck; but Lamarck, instead of preserving its first name, wrongfully substituted another and gave the name *rapa* to a shell which Linnaeus had

never seen. We should then restore to the [latter] species its first name of *Rapiformis* given to it by Born, which is preferable to the name *Bulbosum* adopted by Dillwyn from the manuscripts of Solander."

The species is now generally placed in *Rapa* Röding, 1798. Röding did not use the name *rapa* in his list of species, but four of his species (*globosa*, *pellucida*, *raphanus*, and *striata*) appear to be names given to forms of *rapa*. His *R. volema* is a new name for *rapiformis* Born (*rapa* Gmelin and Lamarck). *Rapa rapa* (Linné) is the type species of *Rapa* Röding, by subsequent designation, Oostingh, 1925.¹ Thiele (1931, p. 300) attributes *Rapa* to Bruguière, 1792, which is incorrect. *Rapella* Swainson, 1840, is a synonym as is *Bulbus* ("Museum Calonnianum"), but while *Bulbus* has one year's priority over Röding's name, the "Museum Calonnianum" is not accepted as a basis for any nomenclatural work under the terms of Opinion 51.

The species is figured in Kiener (1834–1850, vol. 6, *Pyrula*, pl. 14, fig. 2) and in Reeve (1843–1878, vol. 4, *Pyrula*, pl. 7, sp. 21). The figures in Martini and Chemnitz and in the "Tableau encyclopédique" are not characteristic, which can also be said of almost all the early figures of this species.

Bulla canaliculata

1758, *Systema naturae*, ed. 10, p. 727, no. 359.

1767, *Systema naturae*, ed. 12, p. 1185, no. 384.

LOCALITY: Not given in either edition.

"B. testa cylindrica, spirae anfractibus canaliculatis."

The entire diagnosis of this species is identical in both the tenth and twelfth editions of the "Systema." No synonymy was supplied, except the reference to its inclusion in the "Museum Ulricae." Any identification, therefore, based on the above insufficient description in the "Systema" must be tentative. There is no evidence that Linnaeus

¹ Herrmannsen attempted a type selection in 1848^o but he specifically referred to *Rapa* as used by Klein (pre-Linnaean). His selection read: "*Rapa* Klein 1753 . . . Typus: *Bulla rapa* L. Adoptat Bolten 1798." It might be argued that by his reference to "Bolten" Herrmannsen had made a valid designation, but the manner of stating it is sufficiently equivocal to justify Oostingh's later selection.

owned a specimen of *canaliculata*, and therefore it is probable that he based his description solely on the specimen in Queen Louisa Ulrica's collection, which he described in the "Museum Ulricae."

The name has been generally considered to be unidentifiable, although suggestions have been advanced as to what Linnaeus had before him. Hanley (1855, p. 207) said that, based on the additional details supplied in the "Museum Ulricae," the species may have been *Akera ceylanica* (Bruguière), 1792. The added data in the "Museum Ulricae" were: "Testa oblonga, cylindrica, laxa, testacea, pallido-nebulata. Spira brevis, anfractibus excavato-caniculatis. Columella parum torta." I am not able to deduce much from this later description, except that in certain respects it suggests a young *Cypraea*.

Pilsbry (1893, p. 377) noted, as a synonym of *Akera bullata* (Müller), 1776, "*Bulla canaliculata* Olivi et al., and possibly of *Linnaeus*" (italics mine).

Another identification was suggested, with considerably more emphasis, by Hanley, that *Bulla canaliculata* Linné was the young shell of *Buccinum olearium* (*Tonna olearia*) Bruguière and later authors, not *olearium* Linné. This view has been so categorically repeated by several writers that it merits a full discussion.

Hanley, five years after the appearance of his "Ipsa Linnaei conchylia" (1855), published a paper in which he made this identification of *canaliculata* Linné with *olearium* Lamarck, which is demonstrably the same as *olearium* Bruguière (Hanley, 1860a, pp. 489–490). In this paper he listed *Dolium cepa* Martini as a good species and placed in its synonymy both *Buccinum olearium* Lamarck and "*Bulla canaliculata* Linn. Syst. Nat. ed. 10, from types; Mus. Ulric. (young)"; saying, "The fry of this well-known species proves to be the long-lost *Bulla canaliculata* of Linnaeus, but as the identity could not possibly have been discovered without an examination of the author's cabinet, the next earliest binomial appellation has been adopted." I can find no valid basis for this identification, and on all the evidence Hanley's statement is quite unexplainable. Emphasis should be placed on two facts: First, if he was referring to the "types" in the

Linnaean collection in London, as is probable owing to his use of the phrase "the author's cabinet," the state of the collection today does not bear out his statement. That collection contains three specimens labeled *Buccinum olearium* in Gothic lettering, labels that were probably supplied by Hanley himself (see Foreword, p. 7, above). They are correctly labeled, although they are the *olearium* of Bruguière and not of Linnaeus, one being a fully matured individual and the other two being either small or subadult specimens. All are equally globose, as is true of all species of *Tonna* in all life stages, and could not by any stretch of the imagination be called "cylindrica." There are no other specimens of the *olearium* of either Bruguière or Linnaeus in the collection, no specimens labeled *Bulla canaliculata*, and none that can be referred to that briefly and vaguely defined species. Indeed it is probable that Linnaeus never owned a specimen of that shell, as its name does not appear on either of his lists of owned species. Second, if it be suggested that Linnaeus was referring to the "types" in Uppsala, there is not a shred of evidence in any of Hanley's writings, nor can I find any evidence in the writings of others, that he had ever visited Sweden to examine the Queen's collection, in spite of the equivocal use of the word "types," followed by his reference to the "Mus. Ulric." Certainly he would have mentioned such a visit if it had taken place, as in his 1855 work at least, he continually referred to the fact that the species being discussed probably had its type in Sweden. To cite but two illustrations of this: He said of *Cypraea lota* Linné: "The specimen, however, in the Dronningen Museum must be regarded as the original type. *What it may prove to be I know not*" (italics mine). Of *Ostrea fasciata* Linné he said: "It is better, unless the type in the Dronningen Museum should be still preserved, and prove an unknown species, to expunge this imperfectly defined *Ostrea* from our catalogues . . ." As a matter of fact, nothing is gained by an examination of the Uppsala collection. The two specimens that are now labeled *Bulla canaliculata* are half-grown individuals of *Cypraea tigris* Linné, which already show the color pattern of the adult *tigris* and to which the word "cylindrica" could not apply. This

is obviously an instance of a misplacement of species in the 166 years since the original and only labels of that collection were supplied by the botanist Olaus Swarz.¹ It may, I think, be assumed that Linnaeus would not have placed an adult *Cypraea* in his genus *Bulla*, although it is conceivable that he might have been deceived by a very young *Cypraea* in the "Bulla" stage.

The writer therefore can find no "types" in either collection that could substantiate the statement that *canaliculata* was the young *olearium*. Hanley's opinion has, however, been accepted by several commentators, none of whom bases his opinion on an examination of the so-called "types," but only, so far as his comments disclose, on the assumption that Hanley was correct.

Reeve (1843-1878, vol. 5, *Dolium*, pl. 8, sp. 14) referred to Hanley's statement but rejected it because of the word "cylindrica" in the Linnaean description. He said: "From an observation of two young individuals of the Lamarckian *Dolium olearium* in the same [Linnaean] collection, I am inclined to think Linnaeus' *Bulla canaliculata*, which has never been identified, is this shell; there is, however, one point in which the description of that species does not agree, namely, in respect of the form 'cylindrica.' For this reason the name *olearium*, with the above explanation, may be retained." From Reeve onward all the references to Hanley's view have approved it.

Tryon (1879-1888, vol. 7, p. 263) said in his discussion of *Olearium* Bruguière, "*Bulla canaliculata* Linn. is the young shell, as determined by Hanley from the type."

In 1919 Hedley (p. 335) listed "*Tonna canaliculata* Linné," for which he referred to the correct references in the "Systema" and the "Museum Ulricae," Hanley's 1860 paper (1860a), and "*Buccinum olearium* Brug. . . . 1792 . . . not *Buccinum olearium* Linné." He added the following comment, "The type of the species should be in the Uppsala Museum,

¹ One of the two specimens of *C. tigris* in the tray has the label "*canaliculata*" pasted on the shell, but, as anyone who has studied the collection will realize, it is equally possible that a loose label, as many of the labels were, may have been erroneously affixed at any time. In any case it is unsafe to rely in case of doubt on any of the labels in this collection.

Sweden." It is curious that at this late date no effort should have been made by conchologists to investigate the existence and identity of the specimens in the Uppsala collection to which they constantly referred.

Iredale, in 1931 (pl. 23, fig. 25), supplied a typical figure of the *olearium* of Bruguière and listed it in his "Explanation of plates" as "*Tonna canaliculata* Linn." In his pertinent text on the family Tonnidae (p. 215) he did not refer to this figure, but said, "Three more species have been collected, and reference to Hedley's Revision shows his names to read . . . *Tonna canaliculata*. . . ."

The most recent adoption of the Hanley opinion is that of Winckworth and Tomlin (1933, p. 208) who include *canaliculata* in their *Tonna* catalogue as follows: "CANALICULATA, *Bulla*. Linné, 1758, Syst., p. 727. This is *olearium*, Brug. non L. (see Hanley, 1860, p. 489), from types (young shells) in M.L.U. Figured by Kiener as *olearium* var. in fig. 1a, and by Iredale, Rec. Aust. Mus., vol. 18, pl. 23, fig. 25."

These authors apparently paraphrase Reeve's language in the use of the word "type" and speak of the types in the "Museum Ulricae," although I assume that they had not seen them.

The writer is unable to associate *Bulla canaliculata* with the *olearium* of Bruguière. Regardless of the possible imperfections in the films of the London and Uppsala collections and regardless of the many equivocal statements that have been made as to the location and identity of the "types," I cannot conceive of Linnaeus' describing any stage of any of the species of *Tonna*, particularly those specimens of *olearium* in the London collection and the specimens of *Cypraea tigris* in the Uppsala collection, as "cylindrica," and on this basis alone I am content to consider *B. canaliculata* as indeterminate.

Bulla conoidea

1767, Systema naturae, ed. 12, p. 1185, no. 385.
LOCALITY: Not given.

"B. testa oblongo-turbinata laevi, basi substriata, suturis crenulatis . . . Testa magnitudine glandis, albido-flavescens, structura conici, vix striata, nisi versus basin striis aliquot punctatis. Spira conica, testa dimidio brevior. Anfractus

tenues, imbricati ad marginem punctis quasi crenulati. Basis emarginata. Columella plicis 5 s. 6. Labium obtusum."

I am disappointed and curious, after reading this long and apparently explicit description, not to be able to find that any writer has made a suggestion as to the identity of *conoidea*. The mention of five or six plaits on the columella and the emarginate base is completely inconsistent with the generic definition of *Bulla* Linné, which requires an entire base and a smooth columella, and we have no explanation as to why Linnaeus should have so placed it. Hanley (1855, pp. 207-208) suggested, except for a captious objection, that *conoidea* might be "a *Mitra* of the *Conohelix* section," but did not follow that idea to its logical conclusion. The examination of an adequate series of both the *Mitra conulus* of Lamarck and the *Imbricaria conica* of Schumacher convinces the writer that Linnaeus' *conoidea* was one of those two species. The evidence seems to favor the former. As neither species has been adequately described, new comparative descriptions are here inserted:

Imbricaria conica SCHUMACHER

Shell conic-ovate. Spire concave, approximately one-quarter of the height of the shell, with seven whorls, the upper three (sometimes four) sharply mucronate. Each whorl convex, with defined suture, often turreted. Shoulder rounded. Four distinct, sharp plaits on columella, with a fifth, and occasionally a sixth, slightly developed. The three or four upper plaits are remarkable for their slenderness and pronounced upward slant. Color pattern very constant, with a dirty white background with close-set, revolving orange or yellow-brown lines, sometimes becoming impressed towards the base and occasionally deeply so, and with scattered white or gray squarish spots set at intervals between the revolving lines. The number of the spots varies, with some tendency towards an arrangement in vertical rows. A series of larger and deeper gray blotches, less often brown, on the upper half of the body whorl, gives the appearance of an irregular broken revolving band. A strong callus is present inside the junction of the columella with the posterior end of the lip. Lip raised at this

point into a wing appressed to the callus. The juvenile shell exhibits all of these features except the callus, the tip of the spire being more strongly mucronate. The brown color of the tip is seen in approximately the same proportion of adult and juvenile shells. Lip in adult shells slightly obtuse to sharp. Height not exceeding 20 mm.

SPECIMENS EXAMINED: One hundred and thirty-five, including: Tahiti, 41; Tonga, 17; Suva, one; Tutuila (Samoa), two; Society Islands, 19; Philippine Islands, 26; Hawaiian Islands, nine; "Panama" (*sic*), one; "Pacific Ocean," 16; no locality data, three.

One specimen examined had a flat spire with mucronate apex.

Mitra conulus LAMARCK

A much larger shell than that of *conica*, adults reaching 35 mm. in height, and strictly conical, body whorl being straight-sided and spire only slightly concave. Shoulder angular and situated below suture. Spire densely granulated, the granulations extending onto body whorl in the area between suture and shoulder. Lip thickened, the thickness usually increasing interiorly towards the base. Color pattern constant, the shell being white, decorated only with blackish brown, close-set, revolving lines, becoming impressed towards the base, although usually less deeply than in *conica* or not impressed. Posterior callus of columella much less developed than in *conica* or lacking. Heavy blackish brown periostracum persistent along growth lines when worn. Columella with six plaits, the lowest usually only faintly visible.

SPECIMENS EXAMINED: Nineteen, including: Philippines, 16; Viti, Fiji Islands, one; Moluccas, two.

The two species above described clearly belong to the same genus, for which the name *Imbricaria* Schumacher, 1817, is usually employed, as that name antedated *Conoelix* Swainson, 1821, by four years.¹ Linnaeus'

¹ The statement that *Conoelix* Swainson, 1821, is a synonym of *Imbricaria* Schumacher, 1817, may, I submit, be accepted, although some workers are inclined to treat the type species of *Conoelix*, *C. lineatus*, as designated by Swainson himself, as a *species dubia*. The name has not been recognized by subsequent writers, and I have seen nothing in the collections examined which exactly conforms to Swainson's figure. He figured three "species": *lineatus*, *marmoratus*, and

description of *conoidea* might at first glance be read to cover either species were it not for the following persuasive details. The words "magnitudine glandis" ("as large as an acorn") more aptly describe the wider, stouter, larger, and more *Conus*-like *conulus* than the smaller, more slender, and more ovate *conica*. The phrase "testa dimidio brevior" ("less than half [the height of] the shell"), as applied to the spire, suggests a much higher spire than that of *conica*, the spire of which is only approximately one-fourth of the height of the shell. Moreover, *conica* has only four fully developed columellar plaits, whereas *conulus* has five. "Labium obtusum" is emphatically applicable to *conulus*, but only to occasional specimens of *conica* and then only in a slight degree. The writer suggests that the entire description describes *conulus* and was based on a specimen of that shell.

Linnaeus apparently did not possess a specimen of the shell, as it is not included in his list of owned specimens, and there is nothing in his collection in London that conforms to the description. It is to be inferred, however, from the highly detailed language of the description that he must have had a specimen before him, possibly borrowed. No locality is given, and no references are cited.

punctatus (1820-1821, vol. 1, pl. 24). The figures are confusing, as they are badly reproduced. The figure of *marmoratus* (which is the *conica* of Schumacher, the type species of *Imbricaria*) shows not only a blotchy marbling but also revolving, yellowish lines, these being the two features that apparently suggested to Swainson the respective names of the two "species." The figure of *lineatus* shows only the revolving lines of color. I have not seen any specimen of this group so decorated. Rehder (personal communication) suggests that the latter is possibly a variant of *C. marmoratus*. I think that this suggestion has merit and that Swainson erred in separating the two species. *Conoelix punctatus* seems to be a good species. The collection of the United States National Museum contains several lots labeled *punctatus*, all showing strong punctations along the revolving lines. Swainson's figure shows the lines but not the punctations.

If Swainson had not designated *lineatus* as the type species of *Conoelix*, the species *conus* Chemnitz and Gmelin (*conoidea* Linné and *conulus* Lamarck) could have been designated as type, as it was definitely one of Swainson's original species although under another name. The matter is of only historical interest,² as Schumacher had already designated another species (*conica*) as type of *Imbricaria*, a genus identical with *Conoelix*.

As the species is not described in the "Museum Ulricae," we are not even given the opportunity of taking advantage of the questionable authority of the contents of the Uppsala collection. Any identification, therefore, must be based solely on the words of the description, which the present writer finds adequate.

The nomenclatural history of the species suggested as the representative of *conoidea* Linné is consistent, and the names given to it by successive writers are connected by credible figures, references, and descriptions. Chemnitz in 1780 (1780-1795, vol. 10, p. 163, pl. 150, figs. 1415-1416) described a *Voluta conus*. Although he supplied no references and did not mention the Linnaean *conoidea*, his description is a close paraphrase of Linnaeus' description, and his figures are as accurate a representation of both the apertural and dorsal aspects of *conoidea* as have been published. The only pictured defect is the presence of only four columellar plaits, but this is a common error in most of the eighteenth century figures of the volutids. The low shoulder, the *Conus*-like outline of the shell, and the thickened lip are graphically shown. Moreover, it has apparently been overlooked by writers that Chemnitz, in his index to the Volutidae (*tom. cit.*, p. 138) listed the species as "*Voluta conoidea*, *Voluta Conus*." This is the only association of the Chemnitzian *conus* and the Lamarckian *conulus* with Linnaeus' *conoidea* that I am able to find in the literature. Gmelin's citation of *Bulla conoidea* (1791, p. 3427) appears to be a mere copy, as he quoted Linnaeus' main description, paraphrased the sub-description without any change of meaning, and supplied no references. That he did not know Linnaeus' shell is shown by the fact that he also listed *Voluta conus* (p. 3449) with an excellent description, citing the figures of *V. conus* Chemnitz. In 1798 the fascicule of the "Tableau encyclopédique" which contained plate 382 was published. Figures 2a and 2b on that plate are recognizable figures of the *V. conus* of Chemnitz and Gmelin. In the "Liste," the pertinent portion of which was not published until after the appearance of Lamarck's "Histoire naturelle," these figures are referred to as "Mitra conulus. Lamk. vii. 316. *Voluta* Gmel." Lamarck's *Mitra conulus* was first described in volume 17 of the

Annales de Musée (1811b, p. 213) and repeated in 1822 in the "Histoire naturelle." The description is entirely adequate for *V. conus* and the *conoidea* of Linnaeus, and the Chemnitz figures, those in the "Tableau," and the Gmelin listing are cited as references. There is, therefore, a complete chain of identification from Chemnitz to Lamarck, and if Chemnitz' association of the name *conoidea* with his *conus* in the index is taken to refer to the *conoidea* of Linnaeus, as I am confident it should, then the identification here suggested is completely documented. I suggest, therefore, that the species should take the first validly proposed name, which is *conoidea* Linné, rather than the *conulus* of Lamarck which has been used by the vast majority of workers, or the *conus* of Chemnitz and Gmelin. It belongs in the genus *Imbricaria* Schumacher, 1817, the type species of which is *I. conica* (above described), by monotypy.

Figures of the species, in addition to those already mentioned, are given by Kiener (1834-1850, vol. 3, *Mitra*, pl. 34, fig. 111), by Reeve (1843-1878, vol. 2, *Mitra*, pl. 12, sp. 83¹), by Sowerby (1847-1887, vol. 4, *Mitra*, pl. 358, fig. 361), and by Tryon (1870-1888, vol. 4, pl. 58, fig. 672).

Bulla fontinalis

1758, Systema naturae, ed. 10, p. 727, no. 340.

1767, Systema naturae, ed. 12, p. 1185, no. 386.

LOCALITY: "In Lacuum plantis subaquaticus" (1758, 1767).

"B. testa ovata pellucida contraria, spira obsoleta, apertura ovato-oblonga."

The tenth and twelfth editions had identical descriptions except that in the former "sinistrorsa" was used instead of "contraria." The description is hardly specific enough in its details to point uniquely to *fontinalis*, as there are several species of the genus *Physa* that could be described in these general terms, although the fact that only a few *Physa* are found in northern Europe, to which locality the species is limited by the

¹ Reeve's figure is almost identical with the figure of *Mitra conulus* in the "Tableau encyclopédique," mentioned above. He called it *Mitra conus* and referred to both *Voluta conus* Chemnitz and *Mitra conulus* Lamarck, saying of the latter, "I do not see what reason Lamarck had for making a diminutive of the specific name given to this shell by Chemnitz."

references, materially limits the field. However, the other details of the diagnosis make the identification complete. While the "habitat," which in this case is a true habitat rather than a locality, does not confine the species geographically, this omission is rectified by the two references ("Fauna Suecica," no. 2160, and "It. wgoth. 49") the latter being the account of Linnaeus' journey through the southwest part of Sweden in 1746, published in 1747 as "Wästgota Resa." These references not only localize the species but supply detailed and accurate descriptions of the *Physa fontinalis* of all authors, although no figures are included in either work. A specimen of the shell is found in Linnaeus' collection which may be taken as the holotype as it closely conforms, and uniquely so, to the diagnoses in the three Linnaean works. In his own copy of the twelfth edition Linnaeus remedied the lack of figures by citing two pictorial references (Lister, pl. 134, fig. 34, and Gualtieri, pl. 5, figs. CC). The first is reasonably accurate, but the Gualtieri figures are anything but characteristic, although they have frequently been cited for *fontinalis*.

The species was called by several specific names and included in several genera before it became established in *Physa* Draparnaud, 1801, and even well into the nineteenth century several writers failed to use Draparnaud's name.

Müller (1774, vol. 2, p. 167) placed it in his new genus *Planorbis*, calling it *Planorbis bulla*. Da Costa (1778, p. 96, pl. 5, fig. 6) put it in *Turbo* as *Turbo adversus*, although there is some doubt as to whether he was basing his species on *fontinalis* Linné or *hypnorum* Linné. His description included *hypnorum*, by name, while his figure is clearly *fontinalis*. This called forth the following remark by Chemnitz (1780-1795, vol. 9, pt. 1, p. 31): "Da Costa erred in that he made this undoubted *Bulla* into a *Turbo*, and further referred it to *Bulla hypnorum* Linné." Chemnitz (*loc. cit.*) reverted to the name *Bulla fontinalis* and supplied two adequate figures (pl. 103, figs. 877-878). Bruguière (1789, *Bulinus*, no. 17; not Scopoli's *Bulinus*, 1777) retained the Linnaean name *fontinalis*. Müller, after calling the species *Planorbis bulla* in 1774, as above noted, later adopted *Bulinus* for the species, calling it *Bulinus perla* (1781, p. 6, pl.

1, fig. 1) and Gmelin (1791, p. 3427) referred to both of Müller's names in his synonymy of *fontinalis*.

In the nineteenth century the species was included in *Rivicola* Fitzinger, 1833, *Physella* and *Physodon* Haldeman, 1842, and *Echemythes* Gistel, 1848.

The only complication in the nomenclatural history of the species has been the prolonged discussion as to the position of the "high-spined form," and there was a great divergence of opinion among the writers of the first century after Linnaeus on this point, which is still extremely debatable. An investigation into the complexities of this question reveals a puzzle which, as it is not closely germane to the purpose of this paper, need not be explained in detail. In brief, some of the problems are as follows:

While the high-spined form is probably *Bulla rivalis* Turton, 1807, which is usually dated from Maton and Rackett, 1807, the identity and synonymy of *rivalis* itself are not clear. According to Kennard and Woodward (1926, p. 99) *Bulla rivalis* is an earlier name for the common American *Physa heterostropha* Say, 1819, which also occurs in England. Moreover, based on a locality in Montagu, it has also been identified with a mainly South American species, *Aplexa* (*Stenophysa*) *rivalis* (Sowerby), originally proposed in *Limnea* without any mention by Sowerby of earlier uses of the specific name, although he possibly had *Bulla rivalis* in mind. A further difficulty is that *Aplexa rivalis* has been often, and still is, confused with *Physa cubensis jamaicensis* C. B. Adams, 1851, the high-spined form (or subspecies?) of *cubensis* Pfeiffer, 1839, a species common in the Greater Antilles. *Physa marmorata* Guilding, 1828, also appears in the discussions of the species *rivalis*. As the above is only a partial list of the difficulties encountered, and as Linnaeus' type was demonstrably not the high-spined form, it does not merit further discussion in this place.

Physa fontinalis is the type species of *Physa* Draparnaud, 1801, by subsequent designation, Fleming, 1822.

A figure of the species, in addition to the figures above cited, is given by Reeve (1843-1878, vol. 19, *Physa*, pl. 1, sp. 1).

It is curious that, as this species as well as

the succeeding one (*hypnorum*) is common in Sweden, neither was described in the "Museum Ulricae" nor found in the Queen's collection. That collection, however, emphasized the exotic species to the exclusion of many of the common north European shells.

Bulla hypnorum

1758, *Systema naturae*, ed. 10, p. 727, no. 341.

1767, *Systema naturae*, ed. 12, p. 1185, no. 387.

LOCALITY: "In Europae Muscis humentibus" (1758, 1767).

"B. testa ovata pellucida contraria, spira prominente, apertura ovato-lanceolata."

The description in the tenth edition was identical with that above from the twelfth except that "sinistrorsa" was used instead of "contraria," as was the case with the preceding species. This description standing alone can hardly be said to define the species beyond question, but we are somewhat enlightened by reading it in connection with that of the preceding species (*fontinalis*) because of the significant differences in the wording of the two descriptions. The words "spira prominente" clearly distinguish *hypnorum* from the "spira obsoleta" of at least the typical *fontinalis*, and the phrase "apertura ovato-lanceolata" distinguishes it from the "apertura ovato-oblonga" of *fontinalis*, although the aperture of the present species is somewhat variable. The only reference supplied is to number 2159 of the "Fauna Suecica," but that description is sufficiently detailed and characteristic to make up for the paucity of the definition in the "Systema," as it unmistakably points to the *hypnorum* of almost all later authors. The locality and habitat are correct. There is no specimen of the shell, marked or unmarked, in the Linnaean collection, and it was not described in the "Museum Ulricae" as is the case with the majority of the smaller species.

It is now placed in the genus *Aplexa* Fleming, 1820, of which it is the type species, by subsequent designation, Herrmannsen, 1846. *Aplexa* Fleming is equal to *Nauta* (Leach) Turton, 1831; *Aplexus* Gray, 1840; *Aplecta* Herrmannsen, 1846, not Guénée, 1838; and "*Myxas* 'Leach,' Guilding," Gray, 1847. It is also identical with *Amplexa* Brown, 1830, not *Amplexus* Brown, 1840.

Müller (1774, vol. 2, p. 169, no. 354) put the species in his *Planorbis* as *P. turritus*. Gmelin listed the species twice, first as *Bulla hypnorum*, citing for it number 2159 of the "Fauna Suecica," as did Linnaeus, and two Chemnitz figures (1780-1795, vol. 9, pt. 1, p. 34, pl. 103, figs. 882-883a, b, c) which are characteristic figures of the species, and, second, immediately following *hypnorum*, as *Bulla turrita*, citing for the latter only a reference to Müller's *Planorbis turritus*. His *turrita* is described in much greater detail than his *hypnorum*, but both descriptions accurately and clearly define the same shell. The only important difference is that the aperture of *hypnorum* is said to be "ovato-lanceolata," whereas that of *turrita* is described as "ovato-oblonga," and the words "spira prominente" are used for *hypnorum* and "spira acuminata" for *turrita*, and, while no color is given for the former, *turrita* is said to be "nitida." All these differences are well within the range of variation of the species, and the name *turritus* is now accepted as an exact synonym of *hypnorum*. Gmelin was apparently almost convinced, however, that *hypnorum* was a form of *fontinalis*, as he said in his subdescription, "Nonne varietas b. fontinalis?" The word "nonne" is used where an affirmative answer is expected. Chemnitz was the first (*loc. cit.*) to recognize that *hypnorum* and *turritus* were synonymous.

Bruguère (1789, 1792, p. 301) placed *hypnorum* in *Bulimus* Scopoli, 1777. Both Draparnaud (1801, p. 55, pl. 3, figs. 12-13) and Lamarck (1822a, p. 157) included it in *Physa* Draparnaud, and Lamarck also recognized the common identity of the species with Müller's *turritus* by citing both *P. turritus* and Gmelin's *Bulla turrita* in the synonymy of *hypnorum*. Dillwyn (1817), Wood (1828), Montagu (1803), and Maton and Rackett (1807) all retained the species in *Bulla*. The genus *Physa* was widely used for the present species by most of the nineteenth century authors and is employed to some extent today, having been used as late as 1935 by Dutertre (p. 226). *Aplexa* is utilized principally by American and British writers.

Gmelin's *Helix marmorata* (1791, p. 3665) is (*vide* Forbes and Hanley, 1853, vol. 4, p. 144) a synonym of *hypnorum*, and Dillwyn

(1817, vol. 1, p. 488) cited both *H. marmorata* and *H. achatina* Gmelin (*loc. cit.*) as synonyms. Dillwyn said (*loc. cit.*): "This species [*hypnorum*] a good deal resembles *B. fontinalis*, but is more glossy, has a produced taper spire and the aperture is shorter and more contracted. Gmelin's *Helix achatina* appears to differ from his *H. marmorata* only in being a younger shell."

It is interesting to note that Deshayes and Milne-Edwards (1835-1845, vol. 8, pp. 399-400), who also placed the species in *Physa*, followed the deplorable custom, practised by some mid-century writers, of abandoning the name of the original author after a change in the generic name. They attributed both *Physa fontinalis* and *hypnorum* to Draparnaud, although they recognized the Linnaean authorship in their synonymies.

Aplexa hypnorum is a common species both in Europe and in North America. Its American range covers a great part of northern United States and Canada, having been reported from as far north as Alaska. It is especially plentiful in the western part of its range.

The American writers recognized the similarity of the American and European forms of the shell but displayed a curious unwillingness to unite them specifically or to acknowledge Linnaeus as the author. The result was the creation of several useless synonyms. Say, 1821, and Gould, 1841, called the American form *Physa elongata*; De Kay, 1843, *P. glabra*; Lewis, 1855, *P. elongatina*. Binney (1867, p. 99) resurrected the pre-Linnaean genus *Bulinus* Adanson, 1757, for its reception, calling it *Bulinus hypnorum*. In Binney's edition of Gould's "Invertebrates of Massachusetts" (1870, p. 486) the editor called it *Bulinus elongatus* and said, "Adanson's name *Bulinus* has priority over *Aplexa* Fleming, and *Nauta*, Leach, and is accompanied by a careful description and excellent figures." In Binney's 1870 synonymy the Linnaean authorship is not referred to, although he mentioned the Linnaean specific name in the combination "*Aplexa hypnorum* Chenu" and his earlier *Bulinus hypnorum* of 1867. Binney's 1870 treatment of the species, however, concluded with the words (p. 488), "I consider it [*elongatus*] identical with the *B. hypnorum*." Even this

statement is not tantamount to acknowledging the Linnaean authorship, as the "B" is undoubtedly meant for "*Bulinus*" rather than "*Bulla*."

A further quotation from Binney (1870, p. 487) is given to illustrate his diffidence in associating the American form with the *hypnorum* of Europe, "It is in every respect similar to the *Physa hypnorum* of Europe, unless, perhaps, its spire be somewhat more produced." Binney, as well as his American contemporaries, seemed to be seeking some way to avoid the conclusion that the same species could exist on the two continents.

The European form of *Aplexa hypnorum* is figured in Reeve (1843-1878, vol. 19, *Physa*, pl. 1, sp. 7). Reeve also figured a form from Michigan (*tom. cit.*, pl. 11, sp. 7b, c), saying that it is "much larger than the European examples, but presents the same characteristics."

Bulla terebellum

1758, *Systema naturae*, ed. 10, p. 718, no. 284 (in *Conus*).

1767, *Systema naturae*, ed. 12, p. 1185, no. 388 (in *Bulla*).

LOCALITY: "In Asia" (1758, 1767).

"B. testa cylindrica, spira subulata, basi truncata . . . Textura Bullae, Apertura Coni; in bivio positae."

The words "basi truncata" and the sub-description were added in the twelfth edition.

This species was moved by Linnaeus from *Conus* in the tenth edition to *Bulla* in the twelfth. The added subdescription indicates, however, that the author was not entirely confident as to the generic placement of the species.

The brief description is completely characteristic of the *Terebellum subulatum* of most later authors. The species was on the list of the shells owned by Linnaeus, and the specimen of it in the collection, although unmarked with name or number, conforms to the description. The several figures referred to in the synonymy, which is identical in the two editions, all show one or the other of the two extreme color forms of *terebellum*, which may for convenience be called the "spotted" and the "lined" forms. The color pattern of the shell is extremely variable, although the variation does not appear to be geographical or racial, as many types of decoration are

found in a single restricted area. Most specimens exhibit a combination of small brown spots and three or four brown spiral bands, each made up of groups of non-contiguous spots on the columellar side of the body whorl, which coalesce into solid, or almost solid, bands as they near the outer lip. In some specimens the spots are lacking, and in others the bands or lines are only vaguely defined. Every possible combination of these features exists, however, so that it is, practically speaking, inaccurate to separate "spotted" or "lined" forms. The intergradation is so complete that it is impossible to establish any new specific or subspecific names.

The name *Terebellum*, as a generic appellation, was first used by Klein in 1753, who called the species *Terebellum punctatum*. Rumphius had already used it specifically as *Strombus terebellum* (pl. 30, fig. S). The first post-Linnaean use of the word was by Martini (1769–1777, vol. 2, pp. 190–191, pl. 51, figs. 568–569), who referred the species to Linnaeus' *Conus terebellum* and *Bulla terebellum*, although he himself called it "Cylinder attenuatus longus" and "Avena marina." His figures are fairly characteristic, although they show a very pale shell decorated only by three faint and narrow lines (fig. 568) and an intermediate form which exhibits a few spots in addition to the lines. In 1788 Chemnitz (1780–1795, vol. 10, pp. 124–126, pl. 146, figs. 1362–1363) definitely adopted the generic name *Terebellum*, calling this species *Terebellum punctatum* and including it among his Bullae. He described the spotted form ("seriebus punctorum ex rufo lutescentium maculata"), although several of his references were to unspotted or clearly banded forms. His own figures are heavily spotted and broadly banded in orange-yellow rather than "lined."

Röding (1798, p. 135) included the genus *Terebellum* in the "Museum Boltenianum," which was the first nomenclaturally available work to use the name in a generic sense. He listed three species (*lineatum*, *nebulosum*, and *punctulorum*), thus anticipating the tendency to break up the species into subspecies or even species which characterized the conchologists of the next generation. All three of his names are referable to one or another of the color forms of the species.

Lamarck (1799, p. 69, no. 4) supplies the first generic description of *Terebellum*, using *Bulla terebellum* Linné as his "example." The description does not mention color or color pattern.

Link (1807, pp. 98–99) adopted the genus *Terebellum* but assigned it to Lamarck instead of Röding, although Röding's work was familiar to him, as he several times cited it. The present species was called by him *T. variegatum*, but he committed a curious and confusing error in his references. He correctly referred the species to the Martini reference to Linnaeus' *Bulla terebellum* (*tom. cit.*, p. 190), and added a reference to "Linn. Gm. 3390." This latter reference was to Gmelin's own *Conus terebellum*, an entirely different species which Gmelin described in 1791, after Linnaeus had removed his *terebellum* from *Conus* to *Bulla*. Gmelin thus avoided the danger of a homonym, and his use of the name is permissible in modern practice. However, he created a situation that was probably the cause of Link's error and the cause of an unnecessary change of name by Lamarck, as is noted below. Gmelin's *Conus terebellum* is identical with *Conus clavus* Linné of the tenth edition of the "Systema" (and, in part, of the twelfth edition) and the *Conus terebra* of Born, 1780, Bruguière, 1792, and Lamarck, 1810 and 1822. (See *Conus clavus*, Dodge, 1953, pp. 46–47.)

Lamarck (1810b, p. 301) changed the specific name of *terebellum* to *subulatum*, and this name has been used by the great majority of writers up to the present day. The change of name is usually considered to have been motivated by Lamarck's known aversion to tautonymic names, but it is suggested that at least a contributing cause was his desire to avoid the danger of the same confusion into which Link fell between *Conus terebellum* Gmelin and *Conus terebellum* Linné, 1758, although it is improbable that Link's little-known work, published only three years prior to Lamarck's paper, was known to the latter.¹

¹ In the same year, 1810, Montfort erected the genus *Seraphis* for the single species *Terebellum convolutum* Lamarck, 1803, a fossil species first described by Brander (1766, pl. 1, fig. 29a) as *Bulla sopita* and *Bulla volutata*. Montfort defended his new genus, saying (1810,

Lamarck attempted to separate several color forms of this species. His "varieties" are based entirely on the color pattern of specimens in his own collection, for which he was able to find figures which seemed to him to substantiate his division. His four "varieties" are described as:

1. "Spadiceo-nebulosa quadrifasciata," for which the Martini figure 569 is cited.

2. "Lineis spadiceis flexuosis obliquis transversim picta," for which he cited several figures including one in the "Tableau encyclopédique" (pl. 360, fig. 1c).

3. "Punctata," based on Chemnitz' *Terebellum punctatum* (tom. cit., pl. 146, figs. 1362-1363).

4. "Alba," based entirely on Martini's figure 568.

An examination of these figures and the others cited is sufficient to show that many of them could be tied to more than one of his "varieties." The named forms are not used by any writer today.

In his French description Lamarck was tempted to go farther in dividing the species than even his synonymy would indicate, saying, "It presents such a remarkable variation, especially in the arrangement of the colors, that is to say, the nebulosities, bands, lines, or spots with which it is adorned, that one could distinguish them as separate species."

Reeve (1843-1878, vol. 14, *Terebellum*, pl. 1, sp. 1a-g) was one of the few nineteenth century post-Lamarckian writers to refuse to accept the specific name *subulatum*, for which he substituted Chemnitz' name *punctatum*.

vol. 2, p. 375): "We have separated the seraphs from the tarrières [*Terebellum*] because the tarrières have a very characteristic exterior spire, whereas that of the seraphs is interior and not visible; in other details the two genera immediately follow each other [in Montfort's work] as they bear the closest relationship to one another." G. B. Sowerby, in James de Carle Sowerby's "Genera of shells" (1820, 1825, 1834, text for pl. 263), did not accept *Seraphs*. He said that the genus *Terebellum* had been "divided by Montfort, who, on account of its hidden spire, separated from it the species named *convolutum* by Lamarck, under the name *Seraphs* . . . We are obliged to dissent and include Montfort's *Seraphs* in one genus with *Terebellum*. The shell called by Linnaeus *Bulla terebellum* is the type of this marine genus of which we have very few species."

Seraphs was not adopted by many conchologists and is obsolete today, not even being noted in most synonymies of *Terebellum*.

His figures show seven color forms of this shell, but he did not describe them or dignify them by any name. A few modern conchologists, notably Thiele (1931, p. 253), have revived the Linnaean name *terebellum* for the species, a decision with which I thoroughly agree.

The phylogenetic affiliation of *Terebellum* was not understood by the early writers, who had little or no knowledge of the anatomy of the animal. Lamarck (1822b, p. 410) said, "Their most obvious relationships connect them with *Ancillaria*, *Oliva* and *Conus*; and the cypraeids in their immature state somewhat resemble them." Deshayes and Milne-Edwards (1835-1845, vol. 10, pp. 582-584) agreed with Lamarck's view, but quote Sowerby in the "Genera of shells" to the effect that *Terebellum* was not far removed from the strombs, his (Sowerby's) opinion being based on the similarity between the *Terebellum* species and *Strombus terebellatus* Sowerby. They add, "This opinion must be tentative until such time as the anatomy of *Terebellum* shall definitely determine the place which this genus must occupy." While I can find no such opinion expressed in the "Genera of shells," it was the correct view, as a study of the anatomy of the animal discloses that the genus belongs in the family Strombidae, where it is placed now.²

The species is now universally placed in the genus *Terebellum*, which should be assigned to Röding 1798, as that use has one year's priority over *Terebellum* Lamarck, 1799. It is the type species of both Röding's and Lamarck's genus, by absolute tautonymy. *Lucis* plus *Artopsis* Gistel, 1848, is a synonym.

In addition to the Reeve figures mentioned above, a figure of the species is given by Thiele (1931, p. 253, fig. 263). The figures in the "Tableau encyclopédique" (1798, pl. 360, figs. 1a, b, c) well illustrate the shape of the shell, but their type of decoration is incorrect, except that figure 1c shows a rare form entirely devoid of spots but having a

² George B. Sowerby (1847-1887, vol. 1, pp. 31-32) described and figured *Strombus terebellatus*. His description mentions that it is "shaped like a *Terebellum*." Tryon (1879-1888, vol. 7, p. 131), in discussing *Terebellum subulatum*, said, "The genus has but one Recent representative, the species described below. It is related to the Strombs through *Strombus terebellatus*."

series of narrow solid lines encircling the entire body whorl. I have seen this form, the lines of which are deep red, in a series of specimens from New Caledonia (A.M.N.H. No. 13196).

The description of this species in the "Museum Ulricae" (p. 564, no. 178) is headed "*Conus terebellum*," as it was originally included in *Conus* by Linnaeus at the time the "Museum Ulricae" was being prepared. The description, however, together with the identity of the specimens so marked in the Uppsala collection, presents a situation which it is impossible to resolve. A reading of the description itself shows plainly that Linnaeus committed a curious and unexplainable error. The main description is a copy of the description of *Conus terebellum* in the tenth edition of the "Systema," that description is specifically referred to, and two of the tenth-edition references are cited (Rumphius, pl. 30, fig. S, and Argenville, 1742, pl. 14, fig. G). These figures unquestionably show the tenth-edition species. The text of the subdescription, which is here quoted, covers an entirely different shell:

"Testa subcylindrica, *albida*, *fasciis testae longitudinalibus flavis undatis punctisque purpurascens* sparsis. *Striae 44, acutiusculae, elevatae, inaequales, vix manifestae, nisi tactu.*

"Spira conica, testae $\frac{1}{4}$ longitudine *sine tuberculis majoribus*" (italics mine).

The italicized words could by no possibility be used for the *terebellum* of Linnaeus as described in the main description. That shell is only rarely "*albida*." It has no wavy longitudinal fasciae. The expression "*sine tuberculis majoribus*" implies that the shell described has at least some feature which could be called small tubercles, whereas *terebellum* Linné exhibits no saliences of any kind except for the almost flat shoulder of the shell. The sentence relating to the 44 very acute and elevated striae is particularly inapt for *terebellum* Linné, even though the striae are said to be almost invisible and only manifest to the touch, as the surface of that species is smooth and glassy without a trace of sculpture. The mixture of species in the same description is particularly strange, as we know that the "Museum Ulricae" was written in the years 1751 to 1754, and was kept up

to date until 1758, a period during which the tenth edition of the "Systema" was in preparation.

It is difficult to identify the species attempted to be described in the subdescription. Much of it would apply to the *Conus terebellum* of Gmelin, 1791, which was described by Gmelin 33 years after Linnaeus had removed *terebellum* from *Conus*, as above mentioned, and which is identical with *Conus clavus* Linné, an entirely different species. However, although the Gmelin *terebellum* has between 42 and 45 spiral striae, they are not acute but rounded, and could not be described as "*acutiusculae, elevatae*." Moreover, the spire of the Gmelin species occupies much less than one-quarter of the shell.

The question here raised is again complicated by the identity of the two specimens labeled "*Conus terebellum*" in the Uppsala collection. The writer has before him photographs of these specimens. Although worn, they are unquestionably *Conus clavus* Linné (*Conus terebellum* Gmelin and the *Conus terebra* of Born, Bruguière, and Lamarck). They are not *Conus terebellum* Linné. In other words, they do not conform to the main description of *Conus terebellum* in the "Museum Ulricae" or to important and significant details of the subdescription. The specimens are numbered 178, the number of "*Conus terebellum*" in the "Museum Ulricae." There is no specimen labeled *clavus* in the collection and no specimen of *clavus* under any other number. They are 65 mm. in height which is slightly below the average height of *clavus*. I have seen no specimen of *terebellum* Linné that exceeds 55 mm.

We have thus three questions to answer: (1) Why did Linnaeus describe two obviously different species in the same description? (2) What species is covered by the subdescription? (3) Who placed the specimen of *Conus clavus* in the collection and labeled it with a name that conforms to neither part of the description, but gave it a number that agrees with the number of *Conus terebellum* in the "Museum Ulricae"? Many theories may be suggested as to the origin of these errors, but they are now impossible to explain. We must remember that none of the specimens in the collection now at Uppsala were ever supplied with a label written by Linnaeus, and, second,

that the vicissitudes of the collection have made mixtures of species and additions of species a great and dangerous possibility.

As said above, Röding's four species listed under his *Terebellum* are merely descriptive of forms, all but one being color forms, of *terebellum* Linné. Winckworth (1945, p. 144) selected the species (form) *nebulosum* as the type species of the genus *Terebellum* which, as it is equals *terebellum* Linné, makes it the type by absolute tautonymy.

Bulla cypraea

1758, *Systema naturae*, ed. 10, p. 728, no. "0."

1767, *Systema naturae*, ed. 12, p. 1185, no. 389.

LOCALITY: "In M. Mediterraneo" (1758, 1767).

"B. testa ovata, spira oblitterata apice prominulo, apertura postice dilatatiore, columella torta . . . Magnitudo Glandis et ultra. Hic posui, ne testa confundat, quae demum labia approximant, dentesque acquirit 359."

It has been argued, and there is a widespread belief today, that this species was merely a name given by Linnaeus to the juvenile shell of *Cypraea spurca* Linné and that the author was aware of this common identity as early as 1758 and expressed this awareness in the diagnoses of the two names. If the question of the proper identification of *B. cypraea* be put aside for a moment, the solution of the second part of the question presents complexities. We are hindered, first, by the equivocal language employed by Linnaeus and, second, by an obvious inconsistency in the diagnosis of *B. cypraea*. Moreover, why should he have chosen these two particular names for pointing out the Bulla-like appearance of most young *Cypraea*?

Let us examine Linnaeus' Latin. In the subdescription of *C. spurca* he said, "Testa interdum occurit livida immaculata diaphana, nondum dentes adepta, sed tamen magnitudine justa, unde apparat has senectam exuere. n. 389." Number 389 is the number given to *Bulla cypraea* a few pages later in the "Systema." The above may be translated as follows: "The shell is occasionally found livid, unspotted, and diaphanous, not yet having acquired teeth but being, however, of a normal [adult?] size, whence it appears to have lost its original surface. Number 389." The Latin "unde apparat has senectam exuere" is meaningless unless we give to "senectam" a meaning used by Pliny the

Elder, of "the old cast-off skin of a snake," in the passage "serpentis senectam exuendo." Linnaeus' Latin phrase is a very confusing locution as well as being scientifically incorrect, as the cypraeids have no periostracum which may be "cast off" or lost.

With the exception of the mention of "389," there is nothing in the above subdescription that suggests that Linnaeus was comparing his shell with *B. cypraea*. It is merely a rather graphic description of any young *Cypraea*. The mention of "389" is not further explained by him but has given rise, together with a similar cross reference in the description of *B. cypraea*, to the belief that the two shells were merely growth stages of the same species. It should be noted that in the tenth edition *Bulla cypraea* is not given a specific number but is placed between 341 and 342 and designated by a cipher, "0." In the twelfth edition it was given a serial number, "389," in regular order. On the assumption that Linnaeus became convinced of its identity, as is suggested below, the use of a serial number could have well been an oversight.

The subdescription of *B. cypraea* quoted above is literally translated as follows: "I have placed this [species] here lest the shell be confounded with number 359, which later acquires approximating lips and teeth" (italics mine). In other words, rather than identifying 359 with 389, Linnaeus is here warning the reader not to confuse *B. cypraea* with *C. spurca*. In the first place, the number "359" is a part of the sentence and is not, as is the case of the number in the earlier description of *spurca*, a mere cross reference to show the reader that the two should not be confused. In the second place, the word "confundo" means to mix, to join together, to confuse. It seems clear that the descriptions, at least, justify the assumption that Linnaeus did not believe that the two species were identical.

Gmelin (1791, p. 3429) listed *Bulla cypraea* but did not use Linnaeus' subdescription. He was in doubt as to its relationship to *C. spurca*, as he said, "An vere larva cypraeae spurcae?"

Hanley (1855, pp. 209-210) is not entirely clear as to what Linnaeus' belief was as to the relationship of the two names, but his

translation of the above sentence in the twelfth edition is different from mine. He says (*loc. cit.*): "An examination of the tenth edition of the 'Systema' shows us that Linnaeus did not intend to constitute a species thus named, but merely inserted a description of it in *Bulla*, as a precautionary measure, because the less experienced naturalists would naturally search for the names of the young Cowries in that genus. It was not there reckoned among the species, and numbered as such, as by his subsequent carelessness it eventually appeared, but was distinguished from the rest by a cipher, and located between 341 and 342, with the remark, that it was introduced *lest the shell, which finally assumes the features of a Cowry, should puzzle us*" (italics mine). It is not clear which shell Hanley meant. If he meant *Bulla cypraea*, then his conception of Linnaeus' language is different from mine. Moreover, his explanation of Linnaeus' purpose in putting the description of the young shell in *Bulla* does not sound convincing. An inexperienced naturalist might well refer a young *Cypraea* to the genus *Bulla*, but it is not understood why Linnaeus should have chosen this particular species to illustrate his point and none of the others. A more understandable procedure would have been to state the difference between the adult and the immature shell in the generic description of *Cypraea*.

My translation of the sentence beginning "Hic posui" and the consequent suggestion that Linnaeus did not unite the two "species" is considerably weakened by two facts. In the twelfth-edition description of *B. cypraea* he added the word "Larva" after the Mediterranean locality, and in the manuscript notes in his copy of that edition he wrote the word "eadem" at the end of the description, that is to say, immediately after the mention of the number 389. Hanley (*loc. cit.*) mentioned both of these facts. The first is not necessarily fatal to my interpretation of the description. Linnaeus may have meant that *B. cypraea* was merely a young shell of some species. I suggest that it is impossible to take any categorical position as to Linnaeus' conception of this pair of names or to base any opinion on this tissue of confusion and inconsistency. It is possible that in 1758 he did not believe that there was any relation-

ship between the two names and was merely warning the student not to confuse them, but that by 1767 or, more probably, by the time he wrote the manuscript note "eadem," he had become convinced of their common identity. If so, however, why did he leave the "Hic posui" sentence unchanged?

Deshayes and Milne-Edwards (1835-1845, vol. 10, p. 589, footnote), in their discussion of the possible identity of *B. cypraea* with *Ancillaria cinnamomea* Lamarck, thus translate the pertinent sentence of Linnaeus: "We place this shell here lest one should confound it (de peur qu'on ne le confonde) with that of number 359." Thus these authors disagree with Hanley's later translation, if I read Hanley's language correctly, and agree with mine.

I see little in the description of *B. cypraea* which convinces me that it uniquely refers to the young shell of *C. spurca* in preference to many other young *Cypraea* except for the fact that both are native to the Mediterranean Sea, as Linnaeus stated. Even that fact loses much of its weight when we consider the many errors that he made in his localities. Deshayes and Milne-Edwards (*loc. cit.*) refer *B. cypraea* to *Ancillaria cinnamomea* Lamarck, 1810, and note that Dillwyn (1817, vol. 1, p. 490) was of the same opinion. Reeve (1843-1878, vol. 15, *Ancillaria*, pl. 7, sp. 19a, b, c) cites *B. cypraea* with a question mark in the synonymy of *cinnamomea*. I have not been able to find a later mention of the possible identity of the two species, and in fact the comparatively high spire of the latter and the comparative smallness of its aperture in relation to the spire, which applies to all species of *Ancillaria*, is so unlike the young *Cypraea*, or indeed the young *Bulla*, that it is difficult to accept the identification of the writers mentioned. It should be sufficient to point to the words "spira oblitterata" in the description of *B. cypraea*.

Under the circumstances I am constrained to consider *B. cypraea* as a *species dubia*. We are not assisted by the "Museum Ulricaе," as is so often possible in difficult questions of identification, as the species was not there described by Linnaeus, and there is no specimen in the Uppsala collection which can be referred to it.

It is not the *Bulla cypraea* of Born (1780,

p. 179, pl. 9, fig. 2) which Deshayes and Milne-Edwards (1835-1845, vol. 10, p. 493) referred correctly to the young shell of *Cypraea mauritiana* Linné.

It is realized that the above suggestions as to Linnaeus' belief or lack of belief in the common identity of *B. cypraea* and *C. spurca* Linné will be dismissed by the majority of conchologists as involving the giving of too much weight to the inconsistencies of Linnaeus' Latin. It is generally conceded today that he believed, in 1758, in 1767, and at the date of his manuscript note, that the two names pertained to the same species. Pilsbry has discussed the writer's suggestion (personal communication), and while he recognizes that Linnaeus' Latin was ambiguous, he believes that, based on all the available evidence and in spite of the equivocal nature of the diagnoses, Hanley's understanding of Linnaeus' intention was correct. I am including my thoughts in this paper, however, as in cases of ambiguity of language I feel it desirable to present all sides of a case in which there can be the slightest dispute.

Dr. Myra Keen (personal communication) calls my attention to a phase of this question which it is well to bear in mind. If we identify *Bulla cypraea* with *Cypraea spurca* the name *Cypraea cypraea* would have to be placed in the synonymy of *C. spurca*. It would be difficult to explain in such a situation why the latter species was not the type of the genus *Cypraea* by absolute tautonymy. If the species *B. cypraea* is treated as a *species dubia*, as I do here, this unfortunate complication does not arise.

In the Linnaean collection in London there are three specimens of a young *Cypraea*, which are labeled, on the film of that collection in the writer's possession, with the name "*Bulla cypraea*." They are shells in the "*Bulla*" stage, and the elevation of the spire is noticeable. The specimens are one-half to three-quarters of an inch in length and are too small to be identified as the young of any one species of *Cypraea*. The labeling was done by a later hand. (See Foreword, p. 7.)

Bulla virginea

1758, *Systema naturae*, ed. 10, p. 740, no. 407 (*Buccinum virgineum*).

1767, *Systema naturae*, ed. 12, p. 1186, no. 390 (*Bulla virginea*).

LOCALITY: "In Africae fluviis" (1758, 1767).

"B. testa subturrita erecta, columella truncata sanguinea . . . Varietas β eadem statura, magnitudine, sed colore diversa."

The description of variety " β " was added in the twelfth edition. The word "glaber-rima" of the tenth edition was omitted in the twelfth, as was the entire subdescription, as follows: "Testae, quotquot vidi, basi emarginate sunt, ut ad Helices referri nequeant."

The above description may be accepted with reservations as a good definition of the species. The mention of the red columella is characteristic, and, although *Bulla achatina* also has this feature, the two shells are adequately distinguished by Linnaeus by the difference in the description of the shape of the shell, *virginea* being called "subturrita erecta" and *achatina* "ovata." The weakness of the description is the failure to mention the highly distinctive color pattern of the shell. The identification is completely confirmed by the presence of a marked specimen of the *virginea* of all authors in the Linnaean collection and by the accuracy of the synonymy. The latter, however, contains two typographical errors: The reference to Lister ("t. 12") should read "t. 15," and the Petiver figure ("t. 22. f. 7") should be "t. 22. f. 11."

Linnaeus' locality ("in Africae fluviis") is incorrect, as *virginea* is neither found in Africa nor is it a fresh-water shell. Its range is restricted to the island of Hispaniola (Haiti and the Dominican Republic), and it is a terrestrial species. The African locality was not used either by Linnaeus' predecessors or by his successors, and the restriction to Hispaniola was not recognized for many years, although an American locality was reported by a few writers. Lister and Gronovius reported it from Barbados, and Petiver gave it the name *Buccinum barbadense*.¹

Gualtieri and Seba spoke of *virginea* as a

¹ In spite of the ignorance of the early writers as to the precise Antillean home of *virginea*, it was a fairly well-known shell in Europe in the seventeenth and eighteenth centuries. This is attributed by Pilsbry (1899, p. 165), and probably correctly, to the fact that Hispaniola was the first of the West Indian islands to be settled and thus at an early date became an important port of call for vessels trading to the Antilles and the north coast of South America. It is curious, therefore, that as late as 1758 Linnaeus should have located *virginea* in Africa.

"river" shell. Schröter included it in his "Flussconchylien" (1779, pl. 8, figs. 3-4), and Gmelin (1791, p. 3429) placed it in the "Rivers of Asia." Argenville (1742, p. 276) described it among the marine snails. The only early conchologists who specifically listed it as a land species were Gersaint (1736), Favart d'Herbigny (1775), Favanne (1780), Gronovius (1781), and Chemnitz (1786), and all of these except Gersaint were post-Linnaean.

Many of the pre-Linnaean writers considered it to be a *Buccinum* (see Lister, Petiver, Gualtieri, and Seba), and indeed Linnaeus himself put it in that genus in the tenth edition of the "Systema," as did Müller in 1774 (vol. 2, p. 143). Klein (1753) used it in his *Pseudotrochus*. Buonanni (1681) called it a *Turbo*. Bruguière (1789) put it in his *Bulimus*, as he did with all the species of Achatinidae. Born (1780) suggested that it might belong in the Helices, although Linnaeus had already pointed out, in the subdescription in the tenth edition, that the emarginate base would prevent it from being so assigned. Beginning with Lamarck, however, nineteenth century authors generally placed it in *Achatina*, until the priority of *Liguus* Montfort, 1810, as the proper receptacle for this group of shells was recognized.

Pseudotrochus and *Oxystrombus* (Klein) Mörch are synonyms of *Liguus*, at least in part; they were revived by Mörch (1852, pt. 2, p. 21).¹ *Orthalicinus* Fischer and Crosse, 1878, has been stated to be a synonym, but those authors merely said (p. 436) that *Liguus* was very close to *Orthalicinus*. *Plotia* Röding, 1798, is, in part, a synonym of *Liguus*, as one of Röding's species is *P. virginea*, for which

¹ Pilsbry (1899, p. 161) considered that Klein's two names did not represent natural groups and therefore said that, even if Klein's work were nomenclaturally available, Mörch's revival of the names would have no standing. Clench, however (1946, p. 120), has adopted *Oxystrombus* as a good subgenus of *Liguus* Montfort to contain the species *L. fasciatus* (Müller, 1774, *L. blainianus* (Poey), 1851, and *L. flammellus* Clench, 1934, and their many named color forms.

Henry and Arthur Adams (1858, vol. 2, p. 135) adopted *Pseudotrochus* Klein for the shell of *Liguus virgineus*, but gave another name to the animal, *P. alabaster* (Rang). Rang's species (1831, p. 16, pl. 1, figs. 2, 2a) is distinct from *virgineus*, although, as said by Deshayes and Milne-Edwards (1835-1845, vol. 8, p. 312) it is "close to *Achatina virginea* in form."

he cited *Bulla virginea* Gmelin and the classic Chemnitz figures of that species (1780-1795, vol. 9, pl. 117, figs. 1000-1004). Moreover, Röding's *Plotia puellaris* is referred to Gmelin's *virginea* var. "δ" which has been identified by some writers as a sinistral form of *virginea* and which Gmelin himself called "anfractibus contrarius," citing Chemnitz (*tom. cit.*, pl. 173, figs. 1682-1683), showing a sinistral shell. These figures are further discussed below.

The color pattern of *virginea* is its most noticeable and characteristic feature. The base color of the shell is pure white and porcelaneous, and it is decorated with narrow spiral lines of blackish brown, green, blue, purple, yellow, and red in many combinations. The commonest form carries one spiral stripe to each whorl, placed usually at the periphery of the whorls which are slightly angulated. Some shells have two stripes to each whorl, the second being just below the suture. Hjalmarson and Pfeiffer (1858, p. 153) called attention to the fact that the species lived on the "Campeche-wood tree" (*Haematoxylon campecheanum*) which produces a dye which is reddish yellow when dissolved in water and turns yellow or red in an acid solution and violet, purple, or blue in an alkaline solution. As these colors, with the addition of green, are the colors exhibited by the shell of *virginea*, those authors suggested that they were the result of the snail's diet. Von Martens (1877, p. 367), Pilsbry (1899, p. 165), and Lamy (1928, p. 130) all mentioned this theory without comment. It suggests an interesting line of research for students of shell morphology.

Linnaeus' variety "β" is only briefly described as being "of the same size but of different coloring." The figures cited for it make it apparent that it is the shell that Gmelin later described as *Bulla fasciata* (1791, p. 3430, var. "γ"), although Hanley (1855, p. 210) referred it to "the *Achatina vexillum* of authors." Both Linnaeus and Gmelin referred to the same Gualtieri figure (pl. 6, fig. C), but, whereas Linnaeus cites 13 different Seba figures for his *virginea* variety "β" (vol. 3, pl. 39, figs. 62-74), Gmelin divided them among four varieties of his *fasciata*: figures 64-66 and 69-74 for the typical species; figures 62-63 for variety "α" ("alba, fasciis

caeruleis"); figure 67 for variety "β" ("alba, fasciis fuscis"); and figure 68 for variety "γ" ("alba, fasciis variegatis"). In Gmelin's sub-description of *fasciata* the locality is given as "America australi et India," and he called it "virginiae affinis." All these figures mentioned, as well as other supplementary figures, cover several forms of *Liguus fasciatus* (Gmelin), many of which are now given sub-specific rank, or of other species of *Liguus*. Two of them were described and figured by Chemnitz (*tom. cit.*, pl. 117, figs. 1004–1008). One, which seems to be *fasciatus viridis*, is shown in figures 1004–1006 and described as Linnaeus' *virginia* variety "β," and the other, which Chemnitz called "Bulla valde tumida et ventricosa" but for which he supplied no references, is shown in figures 1007–1008. The latter figures are of a form with which I am not familiar, unless they be intended for *Liguus crenatus* (Swainson), 1821. They were used by Gmelin for his *fasciata* variety "ε."

Sinistral specimens of *Liguus virgineus* have been reported. Chemnitz had heard of such a shell, as he described and figured one, as "Bulla virginea Linnaei, testa sinistrorsa" (1780–1795, vol. 10, p. 366, pl. 173, figs. 1682–1683), and cited another figure from Favanne's Argenville (1780, pl. 65, fig. G.4). Both figures appear to be *virginea*, although Chemnitz said that he had not seen a specimen. As to locality he said, "I cannot state its real home, although it is certainly the East Indies." It is possible that the shell he had heard of was another species, but that he supposed it to be *virginea* and figured it accordingly. Favanne's report is more credible, as he said that four specimens were in Paris. Gmelin (1791, p. 3429) cited the Chemnitz figures for his *Bulla virginea*, variety "δ," described as "anfractibus contrarius." This was probably taken from Chemnitz, as the latter's figures were his only reference, and we cannot be sure that Gmelin had seen a specimen. Sinistral shells of *virginea* were reported by several of the other earlier writers, including Schröter, De Roissy, Dillwyn, Blainville, and Sowerby. In more modern times there have been rare reports, although credibly documented, one specimen being found by Rolle and published by Crosse (1891, p. 129) as "var. *sinistralis* Maltzan MS."

In addition to the Chemnitz figures cited above, which are fully as characteristic as any of the modern ones, figures of the species are given by Reeve (1843–1878, vol. 5, *Achatina*, pl. 10, sp. 36a, b, c).

The description in the "Museum Ulricae" first copied the tenth-edition main description, which differed from that in the twelfth only by the use of the word "glaberrima." The additions in the "Museum Ulricae" are, as usual, ample and in this case highly confirmatory, particularly in describing its variability in color. The specimen of *virgineum* preserved in the Uppsala collection is an example of the typical white form, with narrow bands of color on each whorl. The marked specimen in the Linnaean collection in London, if, indeed, it is *virginea*, is of a form with which I am not familiar. Hanley accepted it as the type, but referred it to a figure from Mawe (1823, pl. 22, fig. 6) which shows a typical white form with narrow bands of color. The London specimen is one in which the dark bands are so wide that they almost completely obliterate the white background, the shell appearing to be dark with narrow bands of white. It has much the appearance of one of the darker forms of *L. fasciatus* (Müller), a fact that throws doubt on the accepted opinion of what Linnaeus was describing in *Bulla virginea*.

Bulla achatina

1758, *Systema naturae*, ed. 10, p. 728, no. 343.

1767, *Systema naturae*, ed. 12, p. 1186, no. 391.

LOCALITY: "In O. Americano, media inter Helices et Bullas" (1758, 1767).

"B. testa ovata, apertura obovata apiceque sanguineis, columella truncata... Genus dubium, vix Bullae ob dissectam et truncatam columellam, uti praecedentis. Varietas livida lineis fuscis, undulatis, longitudinalibus: intus albida."

In the tenth edition the last phrase of the main description reads "columella laevi" instead of "columella truncata." The entire subdescription was added in the twelfth.

This species is today placed in the genus *Achatina* Lamarck, 1799, of which it is the type species, by monotypy. In such a populous genus as *Achatina*, many species of which are separated by very small differences in the shell, it would need a far more detailed description than the above to define the spe-

cies unequivocally. The description might cover several members of the genus and certainly covers two, as the "variety" in the sub-description is undoubtedly *Achatina zebra*.

The remainder of the description, as applied to the *achatina* of authors, is equivocal in two important respects. First, it fails to state categorically that the columella is red. The color of the columella is such a distinctive character that it is curious that Linnaeus did not mention it. Second, inasmuch as the word "sanguineis" is plural, the phrase containing it must be read as saying that both the "aperture" and the apex are red. Although the columella and the parietal wall of the mouth are red (and both may be considered as parts of the aperture), the aperture proper shows no red color, and Linnaeus' statement that the aperture is red is therefore unjustifiably broad and misleading. It is difficult to believe that the shell that he had before him was *achatina*. It may be significant that, in describing the "variety," he was careful to say "intus albida."

The identification has, however, been established to the satisfaction of conchologists by other evidence. If we exclude the references to Petiver and Adanson,¹ both of which are unrecognizable, and two of the Seba figures (vol. 5, pl. 71, figs. 4-5), both of which are usually cited for *Achatina zebra* (Müller), 1774, and were probably based on that species, the remainder of the very ample synonymy is clearly referable to the *achatina* of authors. Hanley (1855, p. 210) was of the opinion that the "variety" described in the sub-description was *Achatina zebra* (which he called *Cochlitoma zebra*). The suggestion seems reasonable and is to some extent supported by the two Seba figures mentioned

¹ Adanson's figure (1757, pl. 1, fig. 1) may be an error of transcription on the part of Linnaeus. Figure 1, entitled "La Gondole Cymbium," and called "Le Sormet" in his text, is a group of drawings of *Sormetus adansonii* Féussac. Figure 2, called "Le Bulin. Bulinus," consists of three views of the shell and animal of a mollusk which Fischer-Piette and his co-authors (1942, p. 129) identified from specimens in the retained collection of Adanson (see p. 53, below) as *Bulinus senegalensis* Müller, 1781. The drawings are unlike *achatina* in shape and size and show no color pattern in the shell. The Müller species is a minute sinistral shell, the specimens examined by Fischer-Piette ranging from 2 to 3.4 mm. in height. Even an error of transcription could hardly justify the citation of this figure for *achatina*.

and by the fact that the main description of *achatina* does not mention the surface decoration of the shell, the brown stripes of *zebra* being so much more numerous and striking than the variable and blotchy vertical stripes of *achatina*. Moreover, the ground color of *achatina* is white rather than livid, as is required for *zebra*. If Hanley was correct, as I believe he was, and as the two Seba figures show the other species, we have in *B. achatina* a composite species, although 11 of the 15 figures cited show the *achatina* of authors. The name was adequately restricted to the latter by both Bruguière and Lamarck, although the restriction was made by the actual separation of the two species rather than by any apt language. The only unexplainable thing in the synonymy is the citation of the Adanson figure.

Two generic names were proposed for the group of species containing *achatina* prior to the publication of Lamarck's *Achatina*. The first was *Chersina*, a Humphrey name used in the "Museum Calonnianum," 1797. It was equal to *Achatina* Lamarck only in part and is, moreover, unavailable by the terms of Opinion 51 covering Humphrey's work mentioned. The other was *Ampulla* Röding, 1798, which was also synonymous only in part, as it included species belonging to other genera and was purified by Lamarck by removing from it the true *achatinas*. Röding's genus included five names which can be referred to *achatina* Linné; three names which were, apparently at least, forms of *zebra*, and one, *priamus*, for which Röding referred to Gmelin's *Bulla stercus pulicum* (1791, p. 3434). Gmelin himself referred his species to a Chemnitz species, "*Stercus pulicum*" (1780-1795, vol. 9, pt. 2, p. 35, pl. 120, figs. 1026-1027). These figures clearly represent the shell now known as *Halia priamus* (Röding), 1798, the genus *Halia* Risso, 1826, being the sole genus in the subfamily Haliinae in the Volutidae. In 1908 (p. 83) Pilsbry selected *Ampulla priamus* as the type species of *Ampulla* Röding as follows: "This name, proposed in the Museum Boltenianum, p. 110, for species of *Achatina*, *Limicolaria* and *Halia*, evidently has precedence for some part of this assemblage. I propose to restrict it, however, to the last genus (*Halia*), *Ampulla priamus* Bolt. being the type." This

fixation of a type species limits the use of *Ampulla* to the group of *Halia* Risso, and thus the priority of date of *Ampulla* has no effect on the use of *Achatina* Lamarck, which is not supplanted. Winckworth (1945, p. 147) selected *Achatina zebra* (*Buccinum zebra* Müller, 1774) as the type species, evidently being unaware of Pilsbry's earlier designation. The designation of *zebra*, had it been effective, would have obliged us to abandon the well-known and long-used name of *Achatina*, which has a voluminous literature, in favor of the little-known *Ampulla*.

The following names, subsequent to *Achatina* Lamarck, are exact or partial synonyms: *Achatium* Link, 1807, embracing species of *Achatina*, *Cochlitoma* (Férussac) Pilsbry, 1904, *Liguus* Montfort, 1810, and *Amphidromus* Albers, 1850; *Achatinus* Montfort, 1810; *Oncaea* plus *Geodes* Gistel, 1848; *Parachatina* plus *Serpaea* plus *Pintoa* Bourguignat, 1889; and *Urceus* Jousseau, 1884. The last name was revived from Klein, 1753 (pre-Linnaean). Two further generic names, *Cochlitoma* Férussac, 1821, and *Archachatina* Albers, 1850, synonymous with *Achatina* Lamarck only in part, were subsequently broken up. *Cochlitoma*, although it contained species of several genera, was long considered an exact synonym of *Achatina* by most conchologists. It was, however, whittled down by subsequent writers by the removal of most of its species to other new genera, leaving only *zebra* Müller as the sole unassigned species of Férussac's list. Pilsbry (1904-1905, pp. 4, 78) specifically restricted the name to species of the type of *zebra* and selected that species as the type species of the restricted genus. *Archachatina* Albers was also a mixed genus and Pilsbry (*op. cit.*, pp. 5, 105) restricted it to species of the group of *Bulimus bicarinatus* Bruguière, 1792, the first species on Alber's list, and designated *bicarinatus* as type species.¹

The early history of the species shows sev-

eral changes of specific name. It was called *tigrina* and *africana* in the "Museum Calonianum," 1797. Five of Röding's species in his *Ampulla* (*achatina*, *bombarda*, *flammea*, *lactea*, and *purpurea*) are almost certainly referable to color forms of *achatina* Linné. Lamarck, 1801, used the name *Achatina variegata*, probably making the change to avoid a tautonymic name. Link, 1807, listed an *Achatium elegans* which, it has been suggested, was merely the young shell of *achatina* Linné, although the figures he cited (Chemnitz, 1780-1795, vol. 9, pt. 2, pl. 118, figs. 1012-1013) are usually cited for the adult

ACHATINA Lamarck, 1799. Type *Bulla achatina* Linné, by monotypy.

AMPULLA Röding, 1798. Type *Ampulla priamus* Röding, 1798, by subsequent designation, Pilsbry, 1908.

CHERSINA [Humphrey], 1797. Type *Bulla achatina* Linné, by subsequent designation, Pilsbry, 1919. ■■

ACHATIUM Link, 1807. Type *Achatium elegans* Link = *Achatina achatina* (Linné), by subsequent designation, Pilsbry, 1919.

ACHATINUS Montfort, 1810. Type *Achatinus zebra* (Müller), 1774, by original designation, Montfort, 1810. Pilsbry added a footnote to this genus as follows: "De Montfort seems to have confused *A. zebra* and *A. panthera* under the former name, but as he stated that *Achatinus zebra* is the type, the name belongs rather to *Cochlitoma* than to *Achatina*. Since he says that Lamarck founded the genus, it is evident that he intended *Achatinus* merely as an emendation of *Achatina* Lam., and not as a new name. It cannot therefore replace *Cochlitoma*, but will be regarded merely as a variation in orthography."

COCHLITOMA Férussac, 1817. Type *Bulimus zebra* (Müller), 1774, by subsequent designation, Pilsbry, 1904.

ARCHACHATINA Albers, 1850. Type *Archachatina bicarinata* (Bruguière), 1792, by subsequent designation, Pilsbry, 1904.

GEODES Gistel, 1848. Type *Bulla achatina* Linné. [*Geodes* is a mere substitute for *Achatina* Lamarck.]

ONCAEA Gistel, 1847. Type *Oncaea perdix* = *Achatina perdix* Lamarck, 1822 = *Achatina achatina* Linné. [*Oncaea* is a mere substitute for *Achatina* Lamarck.]

PARACHATINA Bourguignat, 1889. Type *Achatina dohrniana* Pfeiffer, 1870, by subsequent designation, Pilsbry, 1904.

SERPAEA Bourguignat, 1889. Type *Achatina hortensiae* Morel, 1866, by subsequent designation, Pilsbry, 1904.

PINTOA Bourguignat, 1889. Type *Achatina pfeifferi*, Dunker, 1845, by subsequent designation, Pilsbry, 1904.

URCEUS (Klein) Jousseau, 1884. Type *Achatina achatina* Linné. [*Urceus* is a mere substitute for *Achatina* Lamarck. Jousseau merely mentioned "le genre *Urceus* Klein (*Achatina* Lam.)" but named no species.]

¹ Until the year 1919 type designations had not been made for several of the generic names applied to the Achatinae. Pilsbry (1919, pp. 98-99) supplied this lack, and his list of genera and types, including those already designated by him, is here appended for reference. I have taken the liberty to modify the list only by stating the manner of designation in each case, by crediting Pilsbry with his own designations, and, in some instances, by giving the original author and date of a name.

shell and show no signs of immaturity. Pilsbry (see footnote, p. 51, above) considered it to represent the adult shell and made it the type species of *Achatium* Link. In 1822 Lamarck made a further change of name to *A. perdix* (1822a, p. 127), although he admitted in his synonymy that *perdix* was the same as *achatina* Linné. Blainville (1825, p. 456, pl. 40, fig. 1) listed an *Achatina zebra*, and claims have been made that his shell was in fact *achatina* Linné and that he had confused it with Müller's *zebra*. I can find no basis for this claim in his description, his figure, or the figures he cited. His own figure, however, is not *zebra* or *achatina*. It may be a badly executed drawing of *A. fulica* Férussac, 1821. Reeve (1843-1878, vol. 5, *Achatina*, pl. 1, sp. 3) reverted to Lamarck's 1801 name, *variegata*.

Achatina achatina (Linné) is one of the largest members of the genus. Linnaeus' locality, the American Ocean, is not only incorrect, as all *Achatina* species are natives of tropical Africa, but indicates that he supposed it to be a marine species. It is well figured in the Reeve plate mentioned in the preceding paragraph.

The question of the existence and whereabouts of Linnaeus' type of *achatina* presents a puzzling situation. Hanley (1855, p. 210), in discussing the Linnaean collection in London, says of *achatina*: "Like most very large

a portion of the base is cut off by the edge of the film. It seems incredible that Hanley's exhaustive examination of the collection should have failed to disclose this specimen. In the light of the safeguards which have surrounded this collection since its acquisition by the Linnean Society, it seems equally incredible that the specimen could have been added since Hanley made his examination. It is, of course, possible that Hanley himself introduced the specimen after he had completed his study and published his book, at the time when he probably supplied the printed labels that were apparently cut from a copy of that work. In the last analysis the evidence definitely repels the idea that the specimen was Linnaeus' type.

In the "Museum Ulricae" the species is more amply described, and the color of the columella and the great size of the shell, omitted in the "Systema," are mentioned. This description clearly covers the *achatina* of authors. The specimen marked for *achatina* in the Queen's collection in Uppsala is the typical subspecies of *achatina*, and it seems very possible that this specimen was the one on which Linnaeus based the "Systema" description, as well as the description in the "Museum Ulricae."

The following species, placed in *Bulla* in the tenth edition, were moved to *Voluta* in the twelfth:

TENTH EDITION

Bulla pallida, no. 338
Bulla tornatilis, no. 342
Bulla auris-midae, no. 344
Bulla auris-judae, no. 345
Bulla solidula, no. 346
Bulla livida, no. 347
Bulla coffea, no. 348

shells for which there was no room in his cabinet, no specimen is preserved in his collection." The film of the London collection in the present writer's possession contains a photograph of an undoubted specimen of *Achatina achatina* accompanied by a printed label in Gothic lettering (see Foreword, p. 7, above) bearing that name. The specimen is a small example of what is apparently the typical subspecies, although the film does not show the apertural aspect of the shell, and

TWELFTH EDITION

Voluta pallida, no. 405
Voluta tornatilis, no. 394
Voluta auris-midae, no. 392
Voluta auris-judae, no. 393
Voluta solidula, no. 395
Voluta livida, no. 396
Voluta coffea, no. 397

VOLUTA LINNÉ

The 27 original species of *Voluta* in the tenth edition of the "Systema" were augmented in the twelfth edition by the transfer of seven species from the tenth-edition *Bulla* and by the addition of 12 new species. Thus the genus as it left the hands of Linnaeus comprises 46 species in the "Systema" plus one species in the "Mantissa." The species moved from *Bulla* are even more com-

pletely out of place in *Voluta* than they were in *Bulla*.

Compared with *Bulla*, *Voluta* Linné is not a particularly heterogeneous group, although its members fall into many different genera and several different families under modern classification. With the exception of the seven transferred species, all but three of its species belong to genera falling within the superfamily Volutacea. The three species are *mercatoria*, *rustica*, and *mendicaria* which are usually attributed to genera in the Buccinacea. The species in *Bulla* Linné as now classified are found in seven superfamilies: Cypraeacea, Cephalaspidea, Doliacea, Strombacea, Achatinacea, Hygrophila, and Bulimacea,¹ the biological relationship between some of these large groups being extremely remote.

Voluta Linné contains many species from the west African coast, including the majority of the Linnaean species now included in *Marginella*, *Pyrene*, and *Cancellaria*. Linnaeus referred to the figures of Michel Adanson for most of these species. For this reason a special mention of Adanson's classic work, the "Histoire naturelle de Sénégal," is inserted at this point, although it might well have been discussed at the beginning of this series of papers, as it describes and figures many other Linnaean species, both gastropods and pelecypods.

The work was published in 1757, one year prior to the appearance of the tenth edition of the "Systema naturae" of Linnaeus. In spite of the fact that Adanson supplied no Latin names, using for each species a monomial vernacular name often of African origin, the work is useful for its careful and correct descriptions, and, indeed, represents the most comprehensive and usable faunistic conchological work written prior to the nineteenth century. Adanson has been termed "the founder of malacology" by Tryon (1879-1888, vol. 2, p. 57) and by Fischer-Piette and his co-authors (1942, p. 103), as he was the first to base a classification of mollusks on the sum total of both conchological and malacological factors.

The great majority of the species described in the book are figured, the plates having

¹ These superfamilies are used according to Thiele's classification, who used for them the term Stirps.

been prepared by a Mlle. Reboul. These figures are in many cases less informative than the descriptions, and generally speaking the many differences of opinion as to the identity of Adanson's species have stemmed from the vagueness or inaccuracy of the figures rather than from any defects in the text.

About 1760 a part of Adanson's collection was lent or leased to the "Cabinet du Roi," the King's private Museum, the contents of which later became the nucleus of the Museum d'Histoire Naturelle in Paris. The Adanson shells, however, were lost, destroyed, or dispersed, probably because of the political disturbances in France during the latter part of the eighteenth century, and there is left only a single specimen which can be definitely said to have come from his collection. In the present century, however, through the researches of Pallary, Dollfus, Dautzenberg, P. H. Fischer, and Fischer-Piette, it was discovered that a collection of shells made by Adanson in Senegal still existed in the Chateau de Balaine, near Moulins, France, the home of the descendants of Adanson. An examination of this collection, first by Chevalier and later by Fischer-Piette, together with a study of Adanson's original manuscripts and catalogues and a portfolio of original designs by Adanson himself, all in the possession of Adanson's descendants, has disclosed beyond a doubt that his original loan or lease to the "Cabinet du Roi" consisted of only a part of his specimens of shells and that he had retained duplicates in his own collection. Some specimens still bear notations in Adanson's own handwriting. Moreover, the designs of shells executed by him are for the most part superior to those by Mlle. Reboul which were published in the "Histoire naturelle du Sénégal." The reevaluation of the Adanson names, with the use of the retained specimens and the newly discovered figures, has answered most of the questions so long in dispute.

The historical data in the above paragraphs are taken from the exhaustive paper by Fischer-Piette and others, "Les mollusques d'Adanson" (1942, pp. 103-351). In this paper the principal author and his collaborators, P. H. Fischer, L. Germain, and P. Pallary, not only have given a detailed history of Adanson's collection and the recent redis-

covery of an adequate part of it, but have supplied a critical revision of the identity and synonymy of each of his names, based on the newly discovered evidence. A competent understanding of the Adanson species is hardly possible without a knowledge of this work, which is recommended to all students interested in conchological and malacological history and in the historical aspects of nomenclature.

Only one confusing question remains to be solved in the case of the Senegal species. Adanson included in his work a number of western Atlantic shells which no subsequent worker has reported from west Africa. This may be due to the fact that the molluscan fauna of the region, in spite of the comparatively voluminous literature on it, still remains, in the words of Fischer-Piette and his collaborators (1942, p. 270), "very imperfectly known." Thus, when one finds descriptions and figures of western Atlantic shells in Adanson's work and specimens of them in his collection, it is impossible to determine whether he purposely described shells known to be foreign or whether we should assume that further investigation may reveal them in the west African fauna. This inevitably brings up the much-discussed question of a migration of species across the Atlantic by means of a land bridge or an Atlantic continent in a former geological era. Among the western species of Linnaeus so included in Adanson's book and represented by specimens in his collection are: *Columbella mercatoria*, *Livona pica*, *Teclarius muricatus*, and *Astraea tuber*, and, among the bivalves, *Codakia orbicularis*, *Macrocallista maculata*, and *Donax denticulatus*. Thus we have an appreciable number of cases in which a serious question of distribution arises.

In treating the *Voluta* of Linnaeus we meet for the first time species of which the columella is sculptured by the development of plaits of varying size, number, and position. These project into the aperture and are often of such length that they continue, unseen, as they follow the winding of the columella. Their existence suggests two questions which should be noted:

First, the statement was often found in the literature until comparatively recent times that the Volutidae are separated from the

mitras by the more horizontal plaits of the latter and by the fact that the plaits of *Voluta* increase in size from the posterior end of the columella to the anterior, whereas in *Mitra* the progression in size is in the reverse direction. Lamarck was, I think, the first to note this supposed difference. In his "Observations" on *Voluta* (1822b, p. 328) he said: "It is to the Mitras that the volutes are most closely related, but they are noticeably distinguished: 1. by the plaits of their columella, of which the anterior [les inférieurs] are the largest and the most oblique." In 1890 Dall (1890-1903, pt. 1, p. 63) successfully demolished this theory in the course of his study of the dynamic origin of the shell characters of the family Volutidae. He there compared *Mitra* and *Voluta*, explained the manner of production of the plaits, and concluded: "But a complete series of Volutidae will show that about every variety of horizontality or obliquity may be found, that the plaits are sometimes unequal and sometimes equal in size, and that the more prominent of them may be situated in either part of the series."

Second, it is suggested that the difference in the number of plaits noted in different descriptions of the same species is not entirely caused by variability in the species itself, although it is true that the number of plaits may be more or less in different life stages of the shell. At the extreme anterior end of the shell in many species of this group the sharp inner edge of the base, as it winds into and becomes a part of the columella, often shows a long, knife-like ridge projecting into the aperture. This simulates a plait, and authors have often apparently included it in the number of plaits. I do not take a position as to whether this feature should or should not be called a plait but merely emphasize that authors have been divided on the question. It is essential in the identification of specimens, therefore, that workers be on their guard, as an apparently incorrect description may be purified if one solves the author's conception of the word "plait." I have found only two authors who have clarified their position in this respect. Schumacher (1817, p. 234, footnote) in his proposal of *Hyalina*, said: "In order to dispel any doubt as to the number of plaits, I should point out that the

inner smooth edge of the columella is included in the number of plaits." Lamarck's comments on the question are given under *Voluta auris-midae* (p. 56, footnote, below).

Voluta auris-midae

1758, *Systema naturae*, ed. 10, p. 728, no. 344 (*Bulla auris-midae*).

1767, *Systema naturae*, ed. 12, p. 1186, no. 392 (*Voluta auris-midae*).

LOCALITY: Not given in tenth edition (1758); "in Indiae orientalis paludibus" (1767).

"V. testa coarctata ovali-oblonga, spira rugosa, columella bidentata . . . Haec, antecedens et insequens, quasi mediae Bullas inter et Helices."

The word "coarctata" was added in the twelfth edition. Otherwise the descriptions in the two editions are identical. The three species mentioned in the subdescription as "Haec, antecedens et insequens" are *Bulla achatina*, *Voluta auris-midae*, and *V. auris-judae*.¹

The description, so far as it goes, is fairly characteristic of the *auris-midae* of authors, but is not sufficiently detailed to point uniquely to that species. One discordant detail is the use of the word "coarctata." The shell is rather swollen than "narrowed," and, indeed, the description in the "Museum Ulrique" more accurately described it as "undique gibba." Another misleading detail is the expression "spira rugosa." If Linnaeus had examined his specimen more closely, he would have seen, first, that the rugosity is in reality a series of small, closely packed granulations or papillae, arranged roughly in spiral and longitudinal rows, and, second, that this sculpture covers the entire shell and not merely the spire. In fact it is most prominently developed at the top of the body whorl just above the angulated shoulder of the shell. Below this point the granulations become farther apart and fainter and almost disappear on the middle third of the whorl, growing much more prominent at the base of the shell. Klein, 1753, whose work was in Linnaeus' library and whose figure of *auris-midae* was cited by Linnaeus in his synonymy, used the word "granulata" for this species,

so that Linnaeus had had his attention called to this feature.² There are several very marked characteristics of the shell which are omitted in the description, such as the ridge or carina along the upper part of the parietal wall, the thickening of the lip just inside the aperture, forming an outwardly sloping shelf, and the very dark and extremely resistant periostracum. At worst, the description errs on the side of omission. In the proposed new edition of the "Systema" the word "bidentata" was to be replaced by "biplicata," as appears from a manuscript note in Linnaeus' copy of the twelfth edition. The sculpture on the columella in this genus, and indeed throughout the *Voluta* of Linnaeus, is generally referred to by him as "plicata" or "striata," and "dentata" was not used by him for any other species except *coffea*, *mercatoria*, and *rustica*, where it is possibly more appropriate. It is certainly inapt as applied to *auris-midae*, and to *auris-judae* where it was also used.

The references, when three corrections have been made, all satisfactorily show *auris-midae*. The Lister reference should read "t. 1058. f. 6," and the Buonanni drawing is so inaccurate that it was erased in the copy of the "Systema" owned by Linnaeus' son, although Linnaeus' himself left it in the synonymy. Of the Seba figures, number 6 must be omitted, as it does not even show a member of the genus to which *auris-midae* belongs.

A specimen of the *auris-midae* of all authors is present in the Linnaean collection and uniquely agrees with Linnaeus' description and with the corrected synonymy.

Rumphius, 1705, whose characteristic figure (pl. 33, figs. HH) was cited in the "Systema," was the first to use the name *auris-midae*, as far as I have been able to determine. Eight years later the English naturalist Petiver called the species "Midas-ear," and this name in its various translations was used by virtually all of the predecessors and contemporaries of Linnaeus, in-

¹ The last two species were in *Bulla* in the tenth edition and, as the succeeding three final species in the genus were moved to later positions in *Voluta*, the three species mentioned follow one another in both editions.

² Martini (1769-1777, vol. 2, p. 121) also used "granulata" for *auris-midae*. Lamarck (1822a, p. 137) employed the expression "striis decussata, superné granosa" which is an improvement over Linnaeus' "rugosa," although his word "superné" describes the sculpture only in part.

cluding Klein, Lesser, Davila, and Argenville. Martini (*tom. cit.*, p. 121, pl. 43, figs. 436-438) called it "Auris midae fusca, granulata," a very descriptive title, and his figures are characteristic except, as usual, for the details of the sculpture. Müller, 1774, put the species in *Helix*. Bruguière, 1792, included it in his *Bulimus*¹ which seems to have been his "catch-all" for several distinct groups, including *Auricula*, *Achatina*, and *Liguus*.

In 1798 Röding described the genus *Ellobium* (p. 105), a mixed genus containing several of the "Midas-ear" group, along with other discordant species. He divided the genus into two "subgenera," *Cylindraceae* and *Buccinoideae*, the true *Ellobium* species being included in the first. Lamarck's *Auricula* (1799, no. 41) was erected for the reception of this species which he cited as his sole "example" and which is its type species, by monotypy. In his major work (1822a, pp. 137-141) he added many other species but did not restrict it to the true *Ellobium*, as he included species that should probably be referred to the genera *Pythia* Röding, 1798; *Melampus* Montfort, 1810; *Cassidula* Férussac, 1821; and *Alexia* "Leach" Gray, 1847. He changed the specific name of *auris-midae* to *midae*, although citing Linnaeus' name in the synonymy.²

¹ This is not *Bulimus* Scopoli, 1777. The International Commission on Zoological Nomenclature, in Opinion 116, held that "*Bulimus* Bruguière, 1792, type *haemastomus* seu *oblonga*, is a dead homonym of *Bulimus*, 1777."

² Lamarck, in his 1799 description, employed a phrase describing the plaits on the columella in language that is more accurate than the "biplicata" of the 1822 description or the "bidentata" of Linnaeus. He said (*loc. cit.*): "One or more folds on the columella excluding the crossing of the columella by the outer lip (indépendans du bord droit remontant sur le gauche)." The lowest of the plications in this species, as in many other species in the Volutacea, is less a plait on the columella than an extension of the lip at the base of the shell.

The purification of the group included in *Auricula* Lamarck had commenced even before 1822 and continued until the *auris-midae* group was restricted to its present content in *Ellobium* Röding, as at present conceived. In 1812 (p. 116) Lamarck attempted to separate the *Melampus* group by erecting for it a genus called by the vernacular name "Conovule" which was not again used. *Cassidula* Férussac became the receptacle for *A. auris-felis* Lamarck (*Bulimus auris-felis* Bruguière, 1792). *Alexia* "Leach" Gray, 1847, received *A. myosotis* Lamarck (*Auricula myosotis* Draparnaud, 1801).

In spite of the partial restriction and purification of *Auricula* in the nineteenth century, that genus was still used for the *auris-midae* group (including the next species, *auris-judae* Linné) by the great majority of writers until the validity and priority of Röding's *Ellobium* again came to the attention of students with the publication of a reprint of the conchological portion of the "Museum Boltenianum" in 1906. Indeed, the German zoologist Link (1807) was the only one of the nineteenth century writers who used many of the Röding names. The use of *Ellobium* is now generally approved. The present species, as *E. midae* Röding, is the type of the genus, by subsequent designation, Gray, 1847.³

Voluta auris-midae is figured in Reeve (1843-1878, vol. 20, *Auricula*, pl. 1, sp. 1). The figures in the "Tableau encyclopédique" (pl. 460, figs. 6a, b) are only passably accurate. The sculpture of granulations is made too obvious, as the occurrence of the granules is shown as virtually the same on all parts of the shell. They picture a much more ventricose shell than any specimen seen by the writer, although, as pointed out by Mermod (1852, p. 25), the specimen of *auris-midae* in the Lamarck collection in Geneva, which he figures, is like the "Tableau" shell in this.

The species, as *Bulla auris-midae*, is more amply described in the "Museum Ultricae." Two details should be noted. As the description was written in the years 1751 to 1754, the word "coarctata" which was used in the twelfth edition is not used here, and the tenth-edition description is much improved by the addition of a subdescription that employs the phrase "undique gibba" which, as already noted, is a much more apt description of the outline of the shell. On the other hand, the color of the shell is described as "opalinus, incarnato albove niger." When the periostracum is removed the shell is a pure white which might be called "opalinus," but no specimen the

³ It has been stated that the Greek word ελλοβιον, from which Röding's name was derived, has the same meaning as the Latin *Auricula*. This is not strictly correct. "Auricula" means "the lobe of the ear." The Greek word means "that which is put in the lobe of the ear" (εϋ λοβος), hence "earring."

writer has seen shows any red, except that the faint violet of the inside of the lip, and often of the columella, sometimes takes on a pinkish tinge. The word "niger" is unexplainable, unless Linnaeus was referring to the color of the periostracum, which is a chocolate brown verging on blackish brown. In one respect the description in the "Museum Ulricae" is better than that in the "Systema." The lowest of the columellar plaits, which are here called "teeth," is described as "ex inflexione labii," a paraphrase of the graphic expression used many years later by Lamarck, as already mentioned above.

The specimen labeled *auris-midae* in the Queen's collection in Uppsala is the *Bulla auris-midae* of Linnaeus, 1758, and *Voluta auris-midae* of Linnaeus, 1767.

Voluta auris-judae

1758, Systema naturae, ed. 10, p. 728, no. 345 (*Bulla auris-judae*).

1767, Systema naturae, ed. 12, p. 1187, no. 393 (*Voluta auris-judae*).

LOCALITY: Not given in either edition.

"V. testa coarctata oblonga, spira laevi, columella tridentata . . . Affinis nimium praecedenti."

The word "coarctata" and the subdescription were added in the twelfth edition.

The description of the preceding species (*V. auris-midae*) was here considered insufficient, standing alone, to identify it, and we were compelled to verify the identification by recourse to the synonymy and the unmarked ostensible type in the collection. Once *auris-midae* has been identified, however, the description of *auris-judae* by its very language points out sufficient details to identify it not only by its likeness to its congener but also by certain specific differences. It is correctly said to be "oblonga" instead of "oval-oblonga," and the columella is described as "tridentata" rather than "bidentata." In both species Linnaeus considered the lowest flexure on the columella to be a tooth or plait, whereas it seems more just to treat it as an extension of the lip as it joins the columella. In the subdescription he stated it to be very close to the preceding species.

In one respect Linnaeus erred. He failed, as he did in the case of *auris-midae*, to study

the sculpture of the shell. No mention of sculpture is made, except that the spire is said to be smooth, in contrast to the "spira rugosa" of the other. An examination of the body whorl, even without the aid of a lens, shows a series of close, longitudinal, wavy rugae made up of fine granulations. The spire is also granulate, but here the rugae are not developed, the granules giving the spire a decussate appearance. No synonymy or locality was supplied. A specimen of the *auris-judae* of authors is in the collection, but it can have only a very questionable authority as the type on which the description was based, as the name does not appear on the list of Linnaeus' owned species, which raises the presumption that the specimen was added at some later date. In the proposed revision of the twelfth edition, evidenced by Linnaeus' manuscript notes in his copy of that work, a single figure was supplied as "List. 32." In Gmelin (1791, p. 2437) this reference is expanded to "t. 32. f. 30." The figure is a tolerable representation of the *auris-judae* of authors. By a further note Linnaeus changed "tridentata" to "triplicata." This change in the word was also made in the case of *auris-midae*. The revision, however, added the following equivocal words: "sed haec subtilissime striata, illa vero glaberrima." Thus Linnaeus in his later years had apparently discovered the longitudinal sculpture of *auris-judae*, but still believed that the body whorl, at least, of *auris-midae* was smooth. The difference in size of the two shells was nowhere mentioned.

The history of the species and the genera in which it has from time to time been placed exactly parallels that of *auris-midae*, and the student is referred to the discussion of that species above. Lamarck (1822a, p. 137) abbreviated the specific name as he did in the case of *auris-midae*, calling it *judae*. Other than that change, the species has had no synonyms.

The present species is now included in the genus *Ellobium* Röding, 1798. Röding called it *E. labrosum* and cited for it three figures from Martini (1769-1777, vol. 2, pl. 44, figs. 449-451). The figures are fairly graphic, though the last shows an apparently decorated, snow-white shell.

It is also figured in Reeve (1843-1878, vol.

20, *Auricula*, pl. 3, sp. 16a, b) as *A. judae*, and in Crouch (1827, pl. 15, fig. 7).

The description in the "Museum Ulricae," as *Bulla auris-judae*, is as usual much more detailed. It adds several important details to the "Systema" description. The shell is here described as "facie B. auris-midae, sed angustior," although the size is again not mentioned, and the phrase "tota glabra" is even more inaccurate than the "spira laevi" of the "Systema." In one respect the "Museum Ulricae" description is more illuminating than the other. Linnaeus correctly evaluates the distinction between the two plaits on the columella and the lower, almost perpendicular ridge which develops out of the lower part of the lip as it flows into the columella. He said: "Nota praecipuas in labio interiore, quod praeter marginem inflexum adhuc gaudeat rugis transversis s. dentibus duobus, quum praecedens unico tantum instruatur." Thus he here considers *auris-midae* as having only one plait and *auris-judae* as having only two, a much more accurate conception of the word "plait."

The specimen labeled *Bulla auris-judae* in the Uppsala collection is a specimen of *Voluta flavicans* Gmelin (1791, p. 3464), which is probably *Aulica scafa* ("Solander" Humphrey, 1786). No specimen of *auris-judae* is present. Odhner suggests (personal communication) that *flavicans* "may have been chosen as more similar to a human ear by someone trying to put the collection in order." I assume that this must have happened prior to the loss of *auris-judae* from the collection.

Voluta tornatilis

1758, *Systema naturae*, ed. 10, p. 728, no. 342 (*Bulla tornatilis*).

1767, *Systema naturae*, ed. 12, p. 1187, no. 394 (*Voluta tornatilis*).

LOCALITY: Not given in either edition.

"V. testa coarctata ovata substriata, spira elevata acutiuscula, columella uniplicata . . . Testa rubicunda fasciis albis."

As in the case of the two preceding species (*auris-midae* and *auris-judae*), the word "coarctata" was added in the twelfth edition.

The description is otherwise the same in both the tenth and twelfth editions. It is reasonably graphic, although it is probable

that its inclusion in *Voluta* immediately following *auris-midae* and *auris-judae*, with a description which differentiates the three species by a comparison of the sculpture of the columella, was a factor in its identification. The one equivocal phrase is "Testa rubicunda" in the subdescription. The color of the shell is a pale grayish brown, which in some specimens can be said to be flesh color, with two white bands, one or both of which may be lacking in whole or in part, and both of which are usually only vaguely defined. The word "rubicunda" is much too strong to describe the color of the vast majority of specimens and has possibly been the cause of some of the brilliantly colored figures of the shell in the works of the iconographers. The writer has not seen a single example for which the word could be accurately used, unless it is to be translated as "pale, dusty pink." The color was best described many years before the publication of the "Systema" by Janus Plancus, who called it (1739, ch. 17, p. 24, pl. 2, fig. 8) "colore plumbeo vel cinereo." Davila, a contemporary of Linnaeus, spoke of the shell (1767, p. 134) as "grise, fasciée de blanc." Bucquoy, Dautzenberg, and Dollfus (1882-1898, vol. 1, p. 513) gave somewhat more importance to the occasional flesh-colored cast of the shell by speaking of the color as a pinkish gray ("d'un gris rosé"). The only member of the genus *Acteon* to which even the word "pink" could be properly and consistently applied is *A. nitidulus* Lamarck, 1822, which is deeply flesh-pink.

No synonymy was supplied for *tornatilis*, nor any locality. There is, however, in the Linnaean collection an unmarked specimen of the shell which is the only one present that complies with all the details of the description. As Linnaeus listed *tornatilis* as having been owned by him, we may say that the identification is based partly on the correctness of the short description and partly on what we may consider to be the ostensible type in the collection, although to this writer the description, together with its position in the list of *Voluta*, is sufficient.

Martini (1769-1777, vol. 2, p. 125, pl. 43, figs. 442-443) listed a species which he called *Auricula bifasciata* and described as "Auricula midae non fimbriata carnea, unidens, ex

albo fasciata." While the description could be applied to *tornatilis*, the figures are extremely poor. They show the dorsal and apertural aspects of a shell shaped vaguely like *tornatilis* but with too pronounced a spire, with a stylized representation of a "tooth" on the columella, but with a vivid color pattern of brick-red and white bands on a yellowish background. The only suggestion of the colors of *tornatilis* is the pair of white bands, and even these are too broad, brilliant, and sharply delimited to resemble the vague white bands of *tornatilis*. He did not cite the "Systema" species as a synonym, although his references all seem to show it. The Lister figure (pl. 835, fig. 58) is fairly accurate and was quoted by Klein (p. 37, par. 96, 1) to whom Martini also referred. The references to Plancus¹ and Davila, above mentioned, were also cited. Martini's own figures, bad as they are, have been several times cited for *tornatilis*, notably by Lamarck (1822a, p. 220) who described the color as "rufo-rubente."

Gmelin (1791, pp. 3436-3437) introduced a complication by apparently describing the species under two names, *Voluta bifasciata* and *V. tornatilis*. The first is described as "testa tenui transversim striata incarnata: fasciis duabus albis, columella unidentata," a perfect definition of *tornatilis* with the possible exception of the color, and a somewhat improved paraphrase of the Linnaean description, with the addition of the word "tenui." For the second, *V. tornatilis*, he copied Linnaeus' description and subdescription exactly. In the synonymy of both names he cited the two dubious Martini figures and the Lister figure above mentioned. For *tornatilis* he added a "variety β ," for which a figure from Knorr (1757-1772, vol. 3, pt. 6, pl. 19, fig. 4), which he had already cited for his "typical" species, was supplied with a query. This figure is not informative, as it shows only a dorsal view of the shell. It has too pointed a spire and base for *tornatilis* and could not be described as "ovata." The base color is shown as a dark brick-red. I am

¹ The Plancus figure resembles *tornatilis* closely enough to be accepted, the description is entirely consistent with it, and the locality, "in littore nostro" (the Mediterranean), is within the range of the species.

unable to find that it has been cited for *tornatilis* by any other author.

The details of Gmelin's treatment have been stated at length in order that the reader may use his own judgment, not only as to what was meant by the two names but as to what the cited figures represent. Both descriptions speak of the shell as red. His *bifasciata* is said to be "tenui," which is certainly true of the *tornatilis* of authors, although the word was not used for that name by either Linnaeus or Gmelin. It seems probable that in *bifasciata* Gmelin had before him a specimen of *tornatilis* that had a more vivid color pattern of banding and seemed to him to have a thinner shell. Lamarck (*loc. cit.*) also used both the Martini and Lister figures in his synonymy of this species, which he called *fasciata*. Whatever was in Gmelin's mind, the names *tornatilis*, *fasciata*, and *bifasciata*, as used by the early writers, are conceded to be synonymous.

Bruguère retained the Linnaean specific name but threw the species into his comprehensive genus *Bulimus* (not *Bulimus* Scopoli, 1777) along with species of *Achatina*, *Auricula*, and *Liguus*, as already noted.

In 1822 Lamarck (*loc. cit.*) erected the genus *Tornatella*² for the reception of this species, using the new specific name *fasciata* as above noted, and this combination was generally used by the continental writers for many years. Dillwyn (1817, vol. 1, p. 503), Donovan (1799-1803, vol. 2, pl. 57),³ and other British writers all retained the species in *Voluta*.

In the meanwhile Montfort (1810, vol. 2, p. 315) had proposed the genus *Acteon*, with *A. tornatilis* (Linné) as type species, by monotypy. This name was neglected by conchologists for many years but is now almost universally used. Goldfuss emended it to *Actaeon* in 1820, and this spelling was widely used and is employed by many authors to-

² In 1812 (p. 117) Lamarck used the vernacular name "Tornatelle" for this group.

³ It seems possible that Donovan did not have a specimen of *tornatilis* before him but merely based his plate on the Martini figures. His plate contains five beautifully executed figures almost certainly suggested by Martini's, but even more brilliantly colored. He said: "This pretty species," says Da Costa, 'I have received from Tinmouth and Exmouth in Devonshire'; and Pennant notes it from Anglesea only."

day. In addition to *Tornatella* Lamarck, *Speo* Risso, 1826, is an exact synonym. It is not *Actaeon* Oken, 1815, or Fleming, 1828.

The specific name *tornatilis* has had several synonyms other than those already noted: *Turbo ovalis* Da Costa, 1778; *Actaeon subulatus* Wood, 1848, *A. tenellus* Lovén, 1846, Saussaye, 1869, and Paetel, 1888. Jeffreys (1862-1869, vol. 4, p. 436) believed that *A. globulina* Forbes, 1844, from the Aegean Sea, was identical with *tornatilis*, but Vaysière (1885, p. 165) described the shell of *globulina* in language that makes this identification uncertain. Lemche (1948, p. 36), after reading Vaysière's description, said: "I have not included it [*globulina*] in the synonymy of *tornatilis*."

Hanley (1855, p. 212) did not consider Linnaeus' description of this species sufficiently informative to define it. He said: "How so briefly described and illustrated a species could have been recognized by naturalists is passing strange." He therefore based the identification squarely on the ostensible type in the collection. Bucquoy, Dautzenberg, and Dollfus (1882-1898, vol. 1, p. 513) agreed with Hanley that the diagnosis in the "Systema" was too incomplete and also used the specimen in the collection as the best evidence. As said above, the language of the description, together with the position of the name in the list of *Voluta* Linné, seems to this writer sufficient to define the species.

Acteon tornatilis is figured by Reeve (1843-1878, vol. 15, *Tornatella* pl. 2, sp. 7a, b). These figures are also too highly colored. Pilsbry's figures (1893, pl. 19, figs. 7-11, 15) are graphic and show only a slight tinge of pink. An excellent black and white drawing is found in Crouch (1827, pl. 16, fig. 8).

The species was not described in the "Museum Ulricae," and no specimen of it is found in the Queen's collection at Uppsala.

Voluta solidula

1758, *Systema naturae*, ed. 10, p. 728, no. 346 (*Bulla solidula*).

1767, *Systema naturae*, ed. 12, p. 1187, no. 395 (*Voluta solidula*).

LOCALITY: Not given in either edition.

"V. testa coarctata oblongo-ovata opaca striata, spira elevata acutiuscula, columella subpli-

cata . . . Testa albo griseoque longitudinaliter lineata."

The word "coarctata" was added in the twelfth edition, and "biplicata" changed to "subplicata."

In allotting the name *Voluta solidula* Linné to the *solidula* of authors, I confess to a certain lack of confidence. No locality was given for the species by Linnaeus, and no specimen of the *solidula* of authors is present in the collection nor, indeed, any specimen that agrees with the description. The single figure cited (Buonanni, pt. 3, fig. 143) is not only too crude to be useful but does not show a plicated columella as the description requires. It was erased by Linnaeus' son from his copy of the "Systema." We are therefore forced to rely on the description alone. This contains two controversial phrases. The words "columella subplicata" are far too weak to describe the two strong folds which are seen at the basal end of the columella. After the description of the preceding species *auris-midae*, *auris-judae*, and *tornatilis* as "bidentata," "tridentata," or "uniplicata," the fact that Linnaeus used "subplicata" is confusing. The two columellar folds of the present species are much more obvious and highly developed, in proportion to the size of the shell, than in the other three. The word is particularly surprising, as it was a change from the tenth edition, where "biplicata" was used, showing that its use was not mere carelessness but was apparently motivated by a critical reëxamination of the species. It raises at least a suspicion that the shell before Linnaeus was not our *solidula*. Second, the phrase "longitudinaliter lineata" does not describe the *solidula* of authors. That shell is markedly grooved spirally and has no longitudinal sculpture. If the word "lineata" was intended to describe a detail of the color pattern, as is possible, it is equally incorrect. The squarish brown spots which decorate the shell are strung at approximately equal distances along the convex ridges between the spiral grooves *but do not arrange themselves in a longitudinal pattern*. While many of the spots lie directly above or below a corresponding spot on the next ridge, the majority are offset, thus destroying any semblance of a longitudinal arrangement. It is impossible, after a glance at the

shell, to describe it as lineate longitudinally. *Voluta flammea* Gmelin (1791, p. 3435), a closely allied species, does have its color arranged in longitudinal stripes or rows of spots. That species, however, is quite distinct from the *solidula* of authors. It is described as "apertura ampla," which does not conform to the "coarctata" and the "oblongo-ovata" of the description of *solidula* or to *solidula* auct., and is, moreover, "uniplicata." This last detail would lose its significance if it could be demonstrated that Linnaeus had had before him a specimen in which the two plaits had coalesced, thus appearing to be one bifid plait. Linnaeus did not use the word "biplicata" for the twelfth-edition *solidula*, and the two plaits of the *solidula* of authors, are, in fact, so close together that it would not have been unreasonable to have used "uniplicata." The description of the shape of the shell and of the aperture, however, weakens the theory that Linnaeus was describing *flammea*, a shell which, moreover, has a yellow columella and is so described.

In spite of these differences, two writers seem to have concluded that the Linnaean *solidula* was *flammea* Gmelin. Röding (1798, p. 110) listed two names in his genus *Pupa*. The first was *P. solidula*, for which he cited *Voluta flammea* Gmelin and Martini's figure of *flammea* (1769-1777, vol. 2, pl. 43, fig. 439). The second was *P. griselba*, which he called "Die gebandete Puppe," for which he cited *Voluta solidula* Gmelin (1791, p. 3437) and Chemnitz' figure of *solidula* (1780-1795, vol. 10, p. 154, pl. 149, fig. 1405), a graphic picture of the sculpture and color pattern of the *solidula* of authors, though somewhat more ventricose than any individual this writer has examined. His German name for the species was apparently derived from the fact that two of the convex ridges between the spiral grooves of his *griselba* (the *solidula* of authors) are devoid of brown spots and thus appear like colorless encircling bands. Thus Röding identified *solidula* Gmelin, which is demonstrably *solidula* Linné, with *flammea* Gmelin, and gave a new name to the shell that we now call *solidula* Linné, although it is impossible to guess at the identity of the specimens which Röding found in the Bolten collection

and to which he allotted those two names. The other author who made the identification with *flammea* was Chemnitz, whose treatment of the name is discussed below. In the last analysis Linnaeus' "Systema" description of *solidula* is not satisfactory. Our attribution of the name to the *solidula* of authors must be based on tradition and justified by its universal use today.

The most important treatments of the species by the earlier authors are here given for their historical value.

Martini, in 1773 (*tom. cit.*, p. 124, pl. 43, figs. 440-441), called it *Auricula punctata* and his figures (dorsal and apertural aspects) unmistakably show the *solidula* of authors. The sculpture of the columella is not well represented, but the contiguity of the two plaits near the base is clearly shown and in one drawing (fig. 440) they could well be described as a bifid plait. Martini did not cite *solidula* Linné for his species and referred only to two museum catalogues which were not available to the writer.

Chemnitz, in 1788 (*loc. cit.*), called the species *Voluta solidula Linnaei* and supplied a much better description of the *solidula* of authors than did Linnaeus. He used the phrases "transversim sulcata," "fascia alba angusta circumdata," and "columella biplacata" and omitted any suggestion of a longitudinal pattern in the decoration of the shell, thus purging the defects in Linnaeus' diagnosis. His comments on the species, however, contain the following significant and confusing statement which is quoted at length (*loc. cit.*): "Whoever would seek to find representations of the real *Voluta solidula* Linné, which must show a white color and longitudinal wavy red lines, should refer to the figure in Lister's *Hist. Conchyl.* pl. 814. fig. 24, and the second volume of this systemat. *Conchyliencabinets* pl. 43. fig. 439, in which, however, the late Martini did not realize that in these figures and in his figures 440. 441 he had the *Voluta solidula* of Linnaeus before him. Linnaeus, in the 10th. edition of his *Systema naturae* and in the *Mus. Reg. Lud. Ulr.*, considered this a *Bulla* and attributed to it a *columellam biplacatam*. However, in the 12th. edition of his *Systema naturae*, he called it a *Voluta*, in spite of the fact that it has an *apertura*

coarctata, and attributed to it a *columellam subplicatam*, since a strong white fold is seen at its lower end which usually appears to be separate from the others and which may, therefore, be called *biplicata* or *duplicata*. Very often the columella has only one plication or tooth, a point which I can verify from examples in my collection."

It is impossible to explain all the above statements of Chemnitz or reconcile his description of *V. solidula* Linné with them. He considered that *solidula* was the shell with the "longitudinal, wavy red lines." It is possible that in the shell which he called *solidula* he was really describing *flammea*, but that does not explain how he could say that Martini's figures 440 and 441, which show the *solidula* of authors, and 439, which is unquestionably *flammea*, could both be referred to *solidula* Linné. The last three sentences of the quotation are entirely correct as referring to the *solidula* of authors, though not to *flammea*.

Gmelin (1791, p. 3437) copied Linnaeus' entire description but added the Martini and Chemnitz figures already noted above. His *flammea* was separately described (p. 3435) with three lettered varieties in addition to the "typical" species. For the latter he cited the figures referred by Chemnitz to "the real *Voluta solidula* Linné" (Lister, pl. 814, fig. 24, and Martini, pl. 43, fig. 439), both of which show the ventricose, red-striped, and one-plaited *flammea*. For varieties "β," "γ," and "δ" he cited three further figures from Lister (pl. 827, fig. 49e; pl. 834, fig. 60; and pl. 834, fig. 61, respectively). These figures are not helpful. The first appears to be a *Columbella*. The second has almost the shape of a *Melampus*. The last could be taken to represent *solidula*, but the columella is badly drawn. Gmelin appears to have used "approximations," as Linnaeus often did. Thus Gmelin accepted the Linnaean definition of *solidula* as applying to the *solidula* of authors.¹

¹ Arthur Adams (1854, p. 61) mentions *Helix naevia* Gmelin as a synonym of *V. solidula* Linné. *H. naevia* is listed by Gmelin (1791, p. 3623) as coming from the island of St. Croix (?Virgin Islands). He referred to a Chemnitz figure (1780-1795, vol. 9, pt. 2, p. 152, pl. 133, fig. 1207) and a figure from Gualtieri (pl. 3, fig. Q), both of which show the *Helix variegata* of Chemnitz, a West Indian land species. Adams' error can only have been an error of transcription.

Röding's *Pupa* is discussed above. The synonymies of his two species almost certainly indicate his entire agreement with Chemnitz that the real *solidula* was *flammea* Gmelin. In the dismemberment of *Voluta* Linné, *Pupa* Röding is the earliest name for the group to which *solidula* of authors belongs, and its use is now generally agreed upon. Its type species is *P. griselba* Röding (*Bulla solidula* Linné, 1758), by subsequent designation, Suter, 1913. It is not *Pupa* Draparnaud, 1801, which is *Cerion* Röding, 1798, in part. The use of *P. griselba* as type species in no way dispels my conviction that Linnaeus' *solidula* may not have been the *solidula* of authors. The use of the Linnaean name for the species is, however, so firmly fixed in the literature that it must stand. *Pupa* Röding has many years' priority over *Solidula* Fischer von Waldheim, 1807, which has been generally used by American writers. *Dactylus* Schumacher, 1817, and *Buccinulus* H. and A. Adams, 1858, are exact synonyms.

Lamarck (1822a, p. 220) placed *solidula* in his genus *Tornatella* (1822), in which he also included *flammea* and *fasciata* (*Voluta tornatilis* Linné). This genus was used for the species for many years, particularly by the continental writers, but has latterly been abandoned, *flammea* and *tornatilis* being transferred to *Acteon* Montfort, 1810, and *solidula* being placed first in *Solidula* Fischer von Waldheim, 1807, and now in *Pupa* Röding, 1798, as already stated. Lamarck's description is an excellent definition of the *solidula* of authors, particularly as to the details of the columella; "columella biplicata: plica majore biloba." In the face of the word "biloba," his use of "biplicata" is probably a reference to the small tooth seen at the upper end of the columella, although it is hardly sufficiently developed to be called a plication. Lamarck accepted the identification of *solidula* Linné with *solidula* of authors, referring it to "Lin. Gmel." and citing the proper figures from Martini and from Chemnitz. Since his day I know of no author who has commented on or questioned the unconvincing Linnaean description.

The species is figured in Reeve (1843-1878, vol. 15, *Tornatella*, pl. 1, sp. 3a, b).

The description of *solidula* in the "Museum Ulricaë," where the species is included in the genus *Bulla*, raises the question of identi-

fication even more seriously than the description in the "Systema," as it contains details that point even more clearly to *flammea*. The words "Color albus fasciis lineato-undatis rubris longitudinalibus" describe the color pattern of *flammea*. Unfortunately no specimen of either species is now found in the Uppsala collection.

Voluta livida

1758, *Systema naturae*, ed. 10, p. 729, no. 347 (*Bulla livida*).

1767, *Systema naturae*, ed. 12, p. 1187, no. 396 (*Voluta livida*).

LOCALITY: "In Africa" (1758, 1767).

"V. testa coarctata ovato-cylindrica, spira subelevata obtusiuscula, columella quinqueplicata . . . Testa livida fasciis transversis, pallidis, obsoletis."

The word "coarctata" was a twelfth-edition addition.

This species cannot be identified from its description in the "Systema." The fact that the columella is said to be five-plaited and that the shell is cylindrical-ovate suggests a *Marginella*, but its position in the "Systema," separated from that group of Linnaeus' volutes which are now included in *Marginella*, repels that suggestion, at least to a certain extent. It is listed between *solidula*, which is a *Pupa*, and *cofea*, a *Melampus*, and Hanley (1855, p. 213) considered this to be some indication that the species was a *Marginella* or a *Melampus*, although no member of the latter genus, at least, has a five-plaited columella.

None of the specimens in the Linnaean collection agrees with the description in its entirety. The single figure cited (Gualtieri, pl. 25, fig. B) is plainly intended for a *Marginella* but is not sufficiently clear to be identified with any one species. Hanley (*loc. cit.*) said of this figure: "The alleged number of folds, as well as the synonymy, for Gualtieri's figure is that of a decided *Marginella*, favor the claim of the former, yet its position in the 'Systema' . . . argues against them." Hanley then tentatively selected *M. prunum* (Gmelin), 1791, a specimen of which is in the Linnaean collection, as the representative of *V. livida*. Although *prunum* has only four plaits, Hanley's suggestion must not be entirely disregarded, as Linnaeus, by a manuscript note in his copy of the twelfth edition, struck out the word

"quinqueplicata" and substituted "quadriplicata."¹

A further criticism of the reference to Gualtieri may be made, as his figure was said to be "candida," which does not conform to the description of *livida* or to its name.

Schröter (1783-1786, vol. 1, p. 200) could not recognize the species and also doubted the correctness of the Gualtieri figure. He suspected that *livida* might be a *Marginella*, but the only species he mentioned was *M. persicula*, from which he distinguished it. Gmelin (1791, p. 3438) merely copied, as usual, the Linnaean description and, like Schröter, queried the Gualtieri figure. He added a variety "β" for which he referred to another Gualtieri figure (pl. 25, fig. C). This latter drawing cannot be identified. It shows a dorsal view of a symmetrically ovate shell having what are either spiral striations or spiral lines of color. He expanded the subdescription, but the additions are not informative. The Linnaean locality, "in Africa," was changed to "rarior in Africa," a locution that gives one the impression that he was familiar with the species.

Lamarck did not list *livida* in any of his works, and I have been able to find no further citation of it or any later discussion of its validity or identity.

Reeve (1843-1878, vol. 20, *Auricula*, pl. 7, sp. 58) described and figured, as *Auricula livida*, a shell that he referred to "Linnaeus Syst. Nat.," without giving date, page, and number as was his usual custom. He supplied as the only other synonym "*Auricula liberiana* ? Adams." The species is described in language that does not suggest *V. livida* Linné or comply with the Linnaean description. The five plaits are not mentioned, the aperture being said merely to be "toothed

¹ Two specimens which seem to be *M. prunum* are shown on the film of the Linnaean collection in the writer's possession. They are labeled *Voluta livida* and are probably the specimens of *prunum* that Hanley referred to as being present in the collection. The label is one of those printed in Gothic lettering (see p. 7, Foreword) which were, in all probability, affixed by Hanley himself. The photographs, which are not clear, show a very dark shell with apparently four plaits on the columella and an elevated and pointed spire. The outer lip is winged and projecting posteriorly. The specimens, being undocumented by Linnaeus himself, cannot be accepted as the type of *livida*, and in any case their color would disassociate them from a shell bearing the descriptive name *livida*.

on both sides." Reeve's figure is clearly a *Melampus* shaped much like *M. coffeus* of authors, showing the lirations inside the outer lip, no teeth on the lip, and exhibiting four clear columellar plaits. One of the plaits is basal and separated from the other three. Its color is a grayish green, with a necklace of short brown flammules just above the shoulder. I am unable to identify this figure, and in view of its discordance with the Linnaean description of *V. livida* I would question its identity with that species. I cannot find an *A. liberiana* in any of the writings of either of the Adams brothers or of C. B. Adams. Sherborn does not refer to it.

In the "Museum Ulricae" the tenth-edition description is copied verbatim. This was identical with that in the twelfth except that the word "coarctata" was not used. No references were supplied. The additional details in the subdescription are: "oblonga, subdiaphana, glabra," "spira obtusa, vix eminens," and "columella parum torta." Hanley (*loc. cit.*) commented on this description as follows: "It is not improbable, for too often this proves to be the case, that the shell which bears the same name in the 'Museum Ulricae' may have been, even generically, distinct from that intended in the final edition of the 'Systema'; the columella is there spoken of as 'parum torta' instead of 'plicata,' and the fact of the shell having been originally placed with the *Bullae* manifests that the folds of the pristine *livida* were by no means conspicuous." It is difficult to read, from the 1764 description, the suspicion felt by Hanley. In any case, question of the identity of the "Museum Ulricae" shell cannot be solved, as there is no specimen found in the Uppsala collection today which is marked for *livida*, nor any specimen which conforms to the description.

The evidence that *Voluta livida* Linné was the *Marginella prunum* (Gmelin) is inconclusive, and, as no further serious attempts at identification have been made, I am constrained to leave it as a *species dubia*.

Voluta coffea

1758, *Systema naturae*, ed. 10, p. 729, no. 348 (*Bulla coffea*).

1767, *Systema naturae*, ed. 12, p. 1187, no. 397 (*Voluta coffea*).

LOCALITY: Not given in either edition.

"V. testa coarctata laevi, spira obtusa, apertura utrinque dentata . . . Testa lurido-livida, facie Coni, sed apertura postice coarctata."

The word "coarctata" was inserted in the place of the "ovata" of the opening phrase of the tenth-edition description.

The above description could cover any member of the genus *Melampus* having the aperture "dentate on both sides," which would include almost the entire genus. We are not assisted by any synonymy, and no locality is given, although Linnaeus supplied a fairly accurate, or at least usable, figure (Lister, pl. 834, fig. 59) by a manuscript note in his copy of the twelfth edition. The figure shows the teeth or plaits on the columella but not the lirations inside the outer lip. The lip itself shows faint suggestions of teeth, and the figure is, to that extent, inaccurate and was possibly chosen as the best available. It was, however, cited for the species by Bruguière, Gmelin, and Lamarck. Hanley (1855, p. 214) concluded that it was meant for *Bulimus auris-felis* Bruguière, 1792 (*Auricula felis* Lamarck, 1822), "or some closely allied congener." The figure, however, is too far removed from *auris-felis* in appearance to be cited for it.

The name *coffea* is found in Linnaeus' list of owned shells, and as an unmarked specimen of the western Atlantic *Melampus coffeus* of all authors, which uniquely conforms to the description in the "Systema," is present in Linnaeus' collection, it may be accepted as the ostensible type.

The species is somewhat variable both in color pattern and in the details of the columella, and this may have been at least a contributing cause of the vague conception of the species which was held by Martini and Chemnitz and later by Deshayes and Milne-Edwards. The color ranges from a livid or greenish gray to a pale fawn. Typically the shell shows two or three narrow spiral bands of white, one at or just below the shoulder of the body whorl and two lower down. The lower bands are usually less distinct, and one or both are often obsolete or even lacking. The unbanded forms tend to be the largest. The plication of the columella consists of one prominent fold sloping upward into the aperture, which is

often bifid or accompanied by a contiguous or almost contiguous smaller fold below, and nearer the base of the shell a smaller, less salient fold which is, in effect, a mere production of the lip where it blends into the columella. This smaller fold is sometimes lacking or only faintly indicated on the visible face of the columella, although in such cases it may usually be seen to be more fully developed as it winds to the left well within the aperture. This latter feature is seen in two other species already discussed, *Ellobium auris-midae* and *auris-judae*. Just inside the sharp lip of the shell of *coffea*, but not reaching the margin, there is a band of low, parallel, milk-white lirations, which extend well into the aperture with diminishing strength. These lirations are weakened or broken by a shallow longitudinal trough in most forms of the shell.

Martini (1769–1777, vol. 2, p. 126, pl. 43, fig. 445) listed and figured a shell which he called "Auricula Midae non fimbriata, bidens," and which has been cited for *V. coffea*. Neither the description nor the figure is useful. He cited Petiver (no. 493)¹ who had called it *Persicula barbadensis fasciatus*. Martini's comments are not informative except for the fact that he gave the species a locality, Island of Barbados, which is in the range of *M. coffeus*. Martini's figure tells us nothing. It is a dorsal view of a shell less than a centimeter in height, blackish brown, with a pattern consisting of a white perpendicular streak not reaching either extremity of the shell and crossed by three short, white dashes, a pattern that vaguely suggests the Cross of Lorraine. Curiously enough, Martini says in his description that the "five or six bands" are "exactly like figure 444 above." The latter figure, which is described on the same page as "Auricula Midae, parva, non fimbriata, bidens," is of a shell that Martini said he obtained from the East Indies. It shows a light brown shell with no bands, a white, twisted columella with one small tooth, and what is apparently a row of white tubercles along the outer

lip. It may have been designed for *coffea* but is grossly inaccurate. The details of Martini's treatment are mentioned only because of Petiver's assertion that the shell cited in Martini's reference came from Barbados and because Lamarck (1822a, p. 141) cited Martini's figure 445 for his *Auricula coniformis* which, according to Lamarck's own synonymy, was *V. coffea* Linné.

Chemnitz (1780–1795, vol. 9, pt. 2, p. 45, figs. 1043–1044) described and figured *Voluta coffea Linnaei*, for which he referred to the proper page and number in both the tenth and twelfth editions of the "Systema," and said: "The late Martini has reproduced a small, unimportant and unrecognizable figure of this species in the second volume of this 'Conchylien werke' pl. 43. fig. 445, a drawing which does not make unnecessary or superfluous the figure of the present much larger and impressive shell. Martini believed that it was a marine snail with only two teeth on the columella. However, it is a river snail which actually has three white teeth on the columella." Chemnitz' criticism of the Martini figure is, of course, quite just, but the figures he supplied for his *coffea* are equally incorrect. They bear a strong resemblance to *Bulimus auris-felis* Bruguière, 1792 (*Auricula felis* Lamarck, 1822), and indeed Lamarck cited them for that species. In brief, Martini may be disregarded as a factor in the identification of *coffea*, and the same may be said of Chemnitz, except that the latter used the Linnaean name and cited four references, three of which might be referred to *coffea*: Klein's description (1753, p. 37, par. 96, sp. 2, lit. B), unaccompanied by a figure, is of a shell that he called "Ore dentato . . . fasciata, bidens . . . rugosus seu corrugatus." He cited the Lister figure added by Linnaeus to the twelfth edition, a figure that might be said to represent *coffea*. The description in Schröter's "Einleitung" (1783–1786, vol. 1, p. 472, no. 107) is a fairly accurate definition of *coffea* and criticizes the Martini figure 445. The drawing in the Favanne edition of Argenville (1780, pl. 65, fig. H7; cited by Gmelin as "47") is not characteristic. It shows what seems to be three plaits on the columella and one large tooth near the base. The outer lip is thickened rather than sharp. The color pattern is also

¹ This refers to one section of Petiver's "Gazophylacium" entitled "Pteri-graphia Americana," which contains a list of American mollusks (nos. 415–506) which were not figured.

incorrect. It cannot be said, therefore, that Chemnitz pictorially defined the species either by his own figure or by those cited in his references, with the possible exception of the dubious Lister drawing, and his description, as well, is partly erroneous, as it includes the words "transversim subtilissime striata" and "labro lato albo," which are not descriptive of *coffea*.

Gmelin (1791, p. 3438) copied Linnaeus' main description and paraphrased the sub-description with no change of meaning. He cited the dubious Lister figure and also the unacceptable Favanne, Martini, and Chemnitz figures.¹

Röding (1798, p. 106), in his genus *Ellobium*, which, as already said, was erected around *Voluta auris-midae* and *V. auris-judae*, included two names, *E. inflammatum* and *E. barbadense*, both of which he referred to *Voluta coffea* Gmelin. The first was supported by the questionable Lister figure, which had been used by many of his predecessors for *coffea* and which resembles vaguely the *coffea* of authors, and by the erroneous Chemnitz figure of *Bulimus auris-felis* Bruguière. The second name was referred only to the fantastic figure of Martini (fig. 445) which had been so criticized by Chemnitz. The name *inflammatum* has no discernible descriptive application, but *barbadense* was undoubtedly derived from the locality given by Petiver for his *Persicula barbadensis fasciatus* (see above), and by Lister for the shell on which his figure was based. It is obvious from these references that

¹ Gmelin described a *Voluta minuta* on page 3436 as follows: "V. testa ovali, oblonga fasciata, columella triplicata . . . testa nunc fusca: fasciis 2-6 albis, nunc alba; fasciis 4, alternatim luteis et coffeae colore tinctis, labroque tricostrato." Gmelin seems to have here described two species, neither of which is the *coffea* of authors. The phrase "labroque tricostrato" may be a clumsy way of describing the columellar plait or plaits and the columellar tooth of some *Melampus*, but the description of the color pattern of the two forms described is not enlightening. The species is mentioned to show that Gmelin was sadly confused as to the identity of Linnaeus' *coffea*, as he cited for *minima* two of the figures he cited two pages later for *coffea*, the Lister figure (pl. 834, fig. 59) mentioned above, which Linnaeus added by a manuscript note, and the Martini figure 445, which is unrecognizable. Dall (1885a, p. 280) listed Gmelin's *minuta* as a synonym of *coffea* Linné, "ex parte," but such an identification seems to involve too great an assumption.

Röding had but the vaguest idea of the *coffea* of Linnaeus and Gmelin, and it is idle to conjecture as to the identity of the specimens which he reported to be in the Bolten Museum and to which he gave these two names. In any event they were wrongly placed in *Ellobium*.

Bruguière (1789) placed the species in his *Bulimus* (not *Bulimus* Scopoli, 1777) with the rest of the Auriculæ, but gave it the new name *coniformis*. His description is a fair definition of the Linnaean *coffea*.

In 1810 Montfort erected the genus *Melampus* with *Melampus coniformis* (Bruguière), which is *Bulla coffea* Linné, 1758, as type species, by monotypy. The type is not an *Auricula* and even less a *Bulimus*, and *Melampus* is the earliest validly published name for the restricted group to which it belongs and in which it is universally used today. Montfort correctly located the species in the words, "Il vit sur les côtes de Cayenne."

In 1812 (p. 116) Lamarck used the vernacular name "Conovule" for the genus to receive the present species. This name was later used in its Latin form as a plate heading, *Conovulus*, in the "Tableau encyclopédique" (1816), pl. 459) and in the later "Liste," figure 2 on that plate being there referred to as "*Conovulus coniformis. Auricula*. Lamk. 6. pars 2. 141."² Even this ineffective use was short-lived, however, as Lamarck abandoned it in 1822³ and placed this species in *Auricula* Lamarck, 1799. He gave a poor description of *coniformis* but referred it unequivocally to "*Voluta coffea* Lin. Gmel. p. 3438." He cited the Lister figure, the Martini figure 445 which Chemnitz dismissed as unrecognizable, a new figure from Favanne (pl. 65, fig. H8) which cannot be tied to *coffea*, and the pair of figures from the "Tableau" mentioned above, which are accurate representations of *coffea* so far as shape and sculpture are concerned but which

² This manner of reference proves that this part of the "Liste," at least, was published after the appearance of the second part of the sixth volume of the "Histoire naturelle" (1822).

³ Later uses of some form of the word are by Schweigger, 1820, as *Conovula*; Bowdich, 1822, as *Conovulus* and *Conovula*; Beck, 1837, as *Conovulus*; Sowerby, 1846, as *Conovulum*; and Gistel, 1848, as *Conovulus*.

show the color pattern in reverse, that is, with three dark bands on a light ground. It is a peculiarly unrewarding synonymy. If Lamarck's description is to be considered as a description of the *M. coffeus* of authors it needs considerable editing. He used the phrase "longitudinaliter subrugosa" for the inequalities of the body-whorl. In *M. coffeus* these are mere growth wrinkles rather than sculptural rugae. He described the color pattern as it is shown in the "Tableau" figures referred to above, that is, in reverse, although he stated he was describing specimens in his own collection which came from "America." Apparently he made the mistake of following these figures, which were published eight years previously, instead of his own specimens, unless he possessed specimens of a form that the present writer has never seen. In other words, although Linnaeus' description of *V. coffea* is sufficiently characteristic, when supported by the ostensible type in his collection, to identify the species adequately, the authors through Lamarck had not been able to supply a competent description or an accurate synonymy. Indeed, in the second edition of the "Histoire naturelle," the editors Deshayes and Milne-Edwards said, in a footnote to *Auricula felis* (1835-1845, vol. 8, p. 326): "It is difficult to refer certainly the *Voluta coffea* of Linné to any one species in the collections; the characteristic phrase . . . which we find in the 12th. edition of the *Systema naturae* can be applied to many species at present found in the collections. Linné cited the work of Lister too often in his synonymies to make us believe that he would have passed over that author's figure (pl. 834, fig. 69 [sic]¹), if it had represented *Voluta coffea* as Chemnitz and other conchologists supposed. In the absence of more positive data than those which we possess on this species, we must abandon to *Incertae sedis* the *Voluta coffea* of Linné and pro-

visionally adopt the *Auricula felis* of Lamarck."² While we cannot be certain what these authors meant by the "characteristic phrase" in the description of the Linnean species, it was probably the phrase "apertura utrinque dentata," a feature that fits *felis* Lamarck but not *coffea* Linné, unless we admit that Linnaeus considered the lirations in the aperture of the latter species to be "teeth." However, the descriptions of *coniformis* and *felis* are both unsatisfactory in this respect. The description of *felis* does not mention the dentition of the aperture. That of *coniformis* says "labro intus dentato et sulcato" which might be said to mean both lirations and teeth, or lirations and the sulcus that crosses the lirations in *M. coffeus*. The most cogent evidence of the separability of the two species *coffea* and *felis* are the words "obverse conica" for *coniformis* and "facie Coni" for *coffea* as contrasted with the "ovata" of the description of *felis*. However, the many inconsistencies in the descriptions and figures applied to these names would make the present writer willing to consider *Voluta coffea* Linné a *species dubia* were it not for the existence of what must be considered at least the ostensible type in the collection of Linnaeus. In any case the universal and long-standing acceptance of *Melampus coffeus* of authors as its representative would make it unwise to disturb the existing nomenclature.

Since the confusion brought about by the early authors and the categorical refusal by Deshayes and Milne-Edwards to accept *Voluta coffea* Linné as a good name, the species has been many times accurately described and separated from its numerous closely allied congeners. Most of the available figures are, however, unsatisfactory, as they necessarily show a single form of this variable species, in respect to its color pattern and the dentition of its aperture. Reeve's figure (1843-1878, vol. 20, *Auricula*, pl. 4, sp. 47) is called *coffea* but is attributed to Chemnitz.

¹ Deshayes and Milne-Edwards meant "figure 59." The figure they cite shows a *Terebra*. Moreover, it is apparent that these authors had not had an opportunity of examining the Linnaean collection, where the ostensible type of *coffea* is present, Linnaeus' list of owned species, in which *coffea* is given, or of studying Linnaeus' manuscript notes, in which the proper Lister figure was cited for *coffea*.

² Deshayes and Milne-Edwards repeated this suggestion in a footnote to *A. coniformis* (*tom. cit.*, p. 332), as follows: "If this species be the *Voluta coffea* of Linné, Lamarck should have retained the Linnaean name for it, but we have no proof that the name *Voluta coffea* should be applied to this species rather than to the following [*A. nitens* Lamarck], or to *Auricula felis*."

It has the shape and color pattern of one form of the *M. coffeus* of authors but has a much thicker and dentate lip. It resembles a miniature *felis*. Reeve also figured (*tom. cit.*, pl. 7, sp. 57) *Auricula coniformis* Lamarck. His locality for this species was Barbados, which recalls the Petiver and Martini locality, and his figure is an accurate picture of one form of *coffeus*, except that it shows no lirations within the lip. The best figure of the form showing both the accessory upper plait on the columella and the basal tooth, as well as the three white bands and the lirations within the outer lip, is found in Perry (1940, pl. 39, fig. 286).

This species is not described in the "Museum Ulricae," and no specimen of it is found in the Queen's collection at Uppsala.

Voluta porphyria

1758, *Systema naturae*, ed. 10, p. 729, no. 349.

1767, *Systema naturae*, ed. 12, p. 1187, no. 398.

LOCALITY: Not given in 1758; "in Brasilia" (1767).

"V. testa emarginata cylindroide laevi, spirae basi oblitterata, labro medio retuso, columella oblique striata . . . Testa sequenti quadruplo major, incarnata, scripta lineis testaceis ziczac, in foramen castrorum. Affinitas tanta sequenti, ut potius varietas, quam distincta species, quamvis pretium hanc nobilitaverit."

The phrase "columella oblique striata" and the entire first sentence of the subdescription, relating to the size and color pattern of this *Oliva*, were added in the twelfth edition of the "Systema." The omission of these necessary and significant details in the tenth left such a serious gap in the list of characteristics that it is doubtful whether the species could have been recognized without them.

The synonymy is not good and covers at least two species. Two figures (Argenville, 1742, pl. 16, fig. K, and Gualtieri, pl. 24, fig. P) unmistakably show *porphyria*. Gualtieri's other figure cited (pl. 24, fig. O) was, I would guess, designed for a form of the very variable species *O. miniacea* Röding, 1798 (*O. erythrostoma* Lamarck, 1810). Two of the other four figures (Lister, pl. 727, and Rumphius, pl. 39, fig. 1) were thought by Hanley (1855, pp. 214-215) to be forms of *miniacea*, but are so generalized, and the color of the

aperture and the characters of the spire and upper edge of the lip are shown in so little detail, that their specific identity cannot even be suggested. The Regenfuss figure (pl. 2, fig. 15) shows a grayish shell with two black bands plus a broken black band near the base and a red aperture. It was probably designed for the red-mouthed *miniacea*, although the conformation of the spire and the upper edge of the lip rather suggests the *O. oliva* affinity which is discussed below. The last figure (Buonanni, pt. 3, fig. 142) is, as Hanley (*loc. cit.*) agreed, merely a very bad drawing of an unidentified *Oliva* species.

The stated locality, "Brazilia," is incorrect. *Oliva porphyria* is an eastern Pacific species, ranging along the west coast of the American continent from Panama to the Gulf of California. Linnaeus' locality was, however, used for many years, and even as late as the *Oliva* section of the "Neue Ausgabe" of the Martini-Chemnitz work (1837-1907 [1868], vol. 5, pt. 1, p. 11) Weinkauff located it on the "Coast of Brazil," but later in his "*Oliva*-Forsetzung," usually bound with it (1878, p. 23), he corrected this to "West coast of Central and North America."

The collection of Linnaeus also reveals a mixture of species. Specimens of two of the shells certainly included in the synonymy (*porphyria* and *miniacea*) are found lying loose in the collection, neither being identified in any way. Hanley said (*loc. cit.*): "Both of these, indeed, might equally pass for the *Voluta porphyria* of the diagnosis, yet, since the specific epithet must be assigned to one alone, authors have acted wisely in bestowing it exclusively upon the former, which both answers more precisely to the specified characters and locality, and had been termed 'Porphyria' before the days of Linnaeus." This comment was both unnecessary and incorrect. Both shells could not by any possibility "pass for the *Voluta porphyria* of the diagnosis" if, by "diagnosis," Hanley meant the description alone. The language of the twelfth edition is highly characteristic and cannot be read as referring to any other species than the *porphyria* of all authors. The word "incarnata" and the description of the zigzag "tented" lines, combined with the other stated details, give a graphic picture of this unusual species the features

of which are more constant than those of any other *Oliva*. Even before the publication of the tenth edition of the "Systema," Argenville (*loc. cit.*) had said that it was "remarkably distinct from any other." This is one of the rare cases in the "Systema" where a description is so uniquely applicable to a single species that it outweighs, as a probative factor, an incorrect locality, a synonymy that covers more than one species, the lack of a documented type, and the presence of both of these species in the collection. The mistake in the locality was not the fault of Linnaeus but of whoever provided him with his specimen. The confusion in the collection might have been caused by someone after him, who removed the specimens from what may have been labeled trays, a thing that we suspect may have frequently happened. The composite synonymy is, it is true, a greater fault and one of which Linnaeus was often guilty, as it is curious that he could have chosen figures that did not conform with the striking size and pattern of *porphyria*. The description, on the other hand, was peculiarly Linnaeus' own work, written with the specimen before him, and, as I have consistently urged, a description is the soundest evidence of the identity of a species.

Hanley said (*loc. cit.*) that conchologists have acted wisely in attributing the Linnaean name to the *porphyria* of authors. On the theory of identification that I support in these papers it was hardly necessary for a later reviser to restrict the name to a single species, as I do not consider that the Linnaean description indicates a composite species, and, indeed, no reviser has done so by apt language. The restriction, if we can so call it, was a cumulative use by common consent. However, in the interest of a perhaps too punctilious conformity with the principles of nomenclature, I here restrict the name *Voluta porphyria* Linné to the species long known by that name, the *Oliva porphyria* (Linné) of the west coast of Central America.

The name, as Hanley correctly says, was derived from "le Porphyre" of Argenville, whose figure is clearly the *porphyria* of Linnaeus. The slight variation exhibited by the species is only in the paleness or depth of color in the flesh-pink of the ground and in

the varying shades of purple of the fasciole.

The only statement in the description that might be called equivocal is the phrase "labro medio retuso." The bluntness of the lip is no greater in its middle portion than at the base. In fact the lip increases in thickness progressively from the suture to the base. It is suggested that "medio" was a misprint for "medie," which would make the description read "lip moderately blunt," a much more accurate phrase.

The mixture of species in Linnaeus' synonymy, together with the lack of good figures of the several forms of *miniacea*, apparently confused his immediate successors, who seem to have relied on the figures rather than the description. Martini (1769-1777, vol. 2, pp. 152-154) described two different shells under the same heading and supplied two different figures for them, and attributed both to *Voluta porphyria* Linné. He called the first "Cylinder ventricosus porphyreticus, bifasciatus," and supplied a pair of figures (pl. 45, figs. 476-477) which show a form of the red-mouthed *miniacea* provided with two interrupted brown, spiral bands. The second he called "— — non fasciatus," and referred it to another figure (pl. 48, fig. 519), a dorsal view of a shell much like the form of *ispidula* called *tigridella* by Duclos. On page 157 of the same volume Martini described "Cylinder ventricosus, maximus, elegantissimus, Castra Turcica repraesentans." This language describes most graphically the color pattern of *porphyria*, and the figures supplied for it (pl. 46, figs. 485-486, and pl. 47, fig. 498) are clearly *porphyria* (particularly fig. 498, which is as accurate a picture of the species as had appeared before the advent of photography). Neither in this latter description, however, nor in his synonymy did Martini refer to *porphyria* of the "Systema," although he cited two of the figures that Linnaeus had cited for that species—the good figures from Argenville and Gualtieri. It should be noted that Argenville, in his description of the species in his second edition (1757), gave its locality as "ex urbe Panama."¹ Knorr (1757-

¹ In the 1742 edition of Argenville, which was in Linnaeus' library and to which he constantly referred, the plate containing figure K was numbered 16 and the description pertaining to the species did not refer to the Panama locality.

1772, pt. 1, pl. 15, fig. 1) called it the "Rouleau de Panama" and Davila (1767, p. 258) the "Olive de Panama." It is strange, with the locality of the shell so well known to Linnaeus' contemporaries, that he should have been unaware of it and that his successors should have followed him so blindly.

Chemnitz apparently concluded that Martini had satisfactorily treated *V. porphyria* and did not include the species in any of the volumes written by him.

Bruguère in 1789 (1789, 1792, Index, p. xv) described the new genus *Oliva*. He left no descriptions of any of its species, as volume 1 of the work cited, at the beginning of which the Index was placed, covered only the genera as far as *Conus*, listed alphabetically according to their vernacular French names. Martyn's earlier use of the name *Oliva*, 1784, is not generally accepted, as Martyn's "Universal conchologist" is not consistently binomial.¹ *Dactylus* Klein, 1753, *Porphyria* Röding, and *Ispidula* Gray, 1847, are synonyms.

Gmelin's treatment also reveals his confusion in regard to this species. He copied Linnaeus' main description verbatim. His synonymy covers a "typical" *porphyria* and four lettered "varieties." For the "typical" he cited most of the figures used by Linnaeus, both of *porphyria* and *miniacea*, including the good *porphyria* figures of Gualtieri and Argenville and the even better figures of Martini (figs. 485-486, 498). His "varieties" seem to be all forms of *ispidula* or *miniacea*. For "β" he gave another Argenville figure (1757, pl. 13, fig. N) which shows the bifasciate, red-mouthed *miniacea*, and the Martini figures 476 and 477 which seem to have been copied from the figure N of Argenville. For "γ" he cited only a Martini figure (pl. 48, fig. 519) which is the *tigridella* form of *Oliva ispidula*. For "δ" he cited a Lister figure (pl. 724, fig. 11) with a query. This figure may have been designed for some form of *miniacea*.

¹ Winckworth (1929b, p. 228), in discussing the unavailability of the Martyn names, said: "*Oliva*, by a happy chance, remains *Oliva* Cuvier, 1798, which has several months' priority of *Porphyria* Bolten, 1798." There is no occasion, in the case of *Oliva*, to raise the question of the priority of Cuvier's use of the name over that of Röding, as Bruguère's *Oliva* has a clear nine years' priority over both (Dodge, 1947b, p. 448).

Röding seems to have satisfactorily separated *porphyria* from this confusion of figures. The first species in his genus *Porphyria* (1798, p. 32) is *P. porphyria*, for which he cites the acceptable Martini figures 485 and 486. It is strange that he did not refer to Martini's much better figure 498, to which I have referred as being as good a figure of the species as had appeared until recent times. The remaining 52 names in his genus include many that can be referred to various forms of *miniacea*, *ispidula*, and *oliva*, but, based on their synonymies, none can have any relation to *porphyria*.

Lamarck adopted Bruguère's *Oliva* in 1799, and in his first monograph on the genus (1810b, p. 309) and in his final work (1822b, p. 418) he accurately and graphically described *porphyria* and purified its synonymy by excluding all figures of *miniacea* Röding, which he separately described as *O. erythrostoma* (1822b, p. 419). His only error was in the persistent use of the wrong locality. Although he used the vernacular name "l'olive de Panama," he stated that the shell came from "South American Seas, the coast of Brazil."

Since Lamarck's day the species has enjoyed a completely uneventful history from the point of view of nomenclature and separability from any other species. The most complete and characteristic description of the species is found in Tryon (1879-1888, vol. 7, p. 74), to which the reader is referred. It is figured in Reeve (1843-1878, vol. 6, *Oliva*, pl. 1, sp. 2) and in Thiele (1931, p. 336, fig. 389).

The species is described in the "Museum Ulricae" which added details which only serve to confirm the identification with the *porphyria* of all authors which is based upon the twelfth-edition description. The final sentence, however, is instructive: "Varietas fere sola est *V. olivae*." It reveals Linnaeus' belief that all three of the Olives described by him were varieties of a single species even more emphatically than does his suggestion to that effect in the twelfth-edition description of *Voluta ispidula* which is pointed out under the latter species (below). Another detail of the "Museum Ulricae" description should be noted. The phrase "Faux saepius virescens" seems to be a *lapsus calami* or a

misprint for "Faux saepius violescens." The "throat" or lower end of the aperture of the species is violet-purple. I have not seen a specimen with any trace of green.

In the Queen's collection in Uppsala, the same mixture of species is present that is found in the synonymy of *porphyria* in the "Systema" and in the Linnaean collection in London. Under the label "*Voluta porphyria*" three specimens are found. One is *porphyria*; the other two are *Oliva miniacea* (Röding). It is perfectly apparent that Linnaeus consistently confused the two shells, although, by good fortune, his descriptions defined *porphyria* alone.

Voluta porphyria is the type species of *Oliva* Bruguière, by subsequent designation, Montfort, 1810, as *O. panamensis seu porphyrius*.

Voluta oliva

1758, Systema naturae, ed. 10, p. 729, no. 350.

1767, Systema naturae, ed. 12, p. 1188, no. 399.

LOCALITY: "In M. Indico" (1758, 1767).

"V. testa emarginata cylindroide laevi, spira basi reflexa, columella oblique striata . . . Varietates coloribus infinite ludentibus; Literata praefertur."

The description of this species is so brief that, except for the phrase "spira basi reflexa," it could be applied to any member of the genus *Oliva*. This phrase is probably a somewhat ambiguous way of saying that in *oliva* the base of the last whorl of the spire is compressed into a sharp edge which projects above the equally sharp edge of the posterior end of the lip, which latter member is at this point free and not appressed to the parietal wall of the aperture. Although this feature is seen in the other two Linnaean Olives (*porphyria* and *ispidula*) it is there so slightly developed that it may be taken as a distinguishing diagnostic characteristic of *oliva*. Moreover, *oliva* can be distinguished from *porphyria* by the distinctive and constant color pattern of the latter, and from the *ispidula* of authors by its white aperture, the aperture of *ispidula* being colored a dark brown.¹ Reeve (1843-1878, vol. 6, *Oliva*)

¹ As is noted below, one form of the *ispidula* of authors, form *flaveola* (Duclos in Chenu, 1844-1845, pl. 7, figs. 17-20) has a pale tan or white aperture. Dautzenberg (1927, p. 46) mentions the distinctive color of

suggested as a further distinction that "the base of the columella [in *oliva*] is, with rare exception, tinged with a blush of red." I have not found this a reliable guide, even in unworn shells.

The phrase "Literata praefertur" in the subdescription of *oliva* is ambiguous. It may be read as "the form Literata is preferred" or "displaying characters or letters," the former reading implying that Linnaeus was choosing that form as "typical" of his species. While the primary and most often used meaning of "praefertur" is "preferred," it is not certain which reading Linnaeus intended. In either case it is probable that he was referring to the figure from Argenville (1742, pl. 16, fig. R) which he cited in his synonymy. Argenville said of this figure (1742, p. 286) that the shell "is white with two bands at its extremities, formed of brown letters, where one distinctly reads two B's and one D. It is called Litterata." The figure clearly conforms to Argenville's description but as drawn cannot be referred to any form of *oliva* known to the writer or figured by any other author. Lamarck (1810b, p. 316) first used the combination *Oliva litterata*, but for another species, describing it in a manner that does not closely conform to Argenville's description or figure, which he did not cite. The figure of *O. litterata* in the "Tableau encyclopédique" (1798, pl. 362, figs. 1a, b), which should be seen, does not resemble Argenville's. If Linnaeus intended to use the word "praefertur" in its primary meaning, that is, to restrict the name *oliva* to a particular form or to use that form as his "typical" species, it would mark the first time in the conchological portion of the "Systema" in which he did so by apt language, yet I suggest that that reading of the phrase is better Latin and was probably the one Linnaeus meant.

The extreme variability of the species was

the aperture in the "*ispidula*" complex and refers to the non-conforming *flaveola*, saying: "The dark brown color of the aperture always enables us to identify the *Oliva ispidula*. Nevertheless, in the variety *flaveola*, which may, it is true, be regarded as a case of albinism, the aperture is usually a very pale brown and sometimes even white."

The name "*ispidula* of authors" is used here because, as is shown below under that species, the *ispidula* of Linnaeus was a different species.

graphically expressed by Linnaeus in his subscription, and the naming of the many color forms commenced at an early date. Born (1780, pp. 213–215) cited *oliva* as a good species with 11 “varieties.” Gmelin (1791, pp. 3439–3440) listed 35 lettered “varieties,” each accompanied by references to one or more figures. Although most of these figures are the crude drawings of the pre-Linnaean iconographers, it is apparent that in many instances Gmelin was referring to forms of the *ispidula* of authors, as these figures show the spire and shoulder of that species rather than of *oliva*. None of the figures examined, however, reproduces the brown aperture of *ispidula*. Many of the colored figures (Martini and Chemnitz), which clearly represent *oliva*, show the reddish tinge of the striated portion of the base that was mentioned by Reeve. In summary, Gmelin’s synonymy of *oliva* does not indicate that he had a clear conception of the difference between that species and the *ispidula* of authors. Röding (1798, p. 32), in his genus *Porphyria*, cited *Voluta oliva* Gmelin for three of his listed species. Dillwyn (1817, vol. 1, pp. 511–514) listed and described 20 lettered “varieties,” for all of which he supplied references, most of them being referred indiscriminately to recognized and named forms of both *oliva* and *ispidula*.¹

None of the writers of the first half of the nineteenth century contributed much to our knowledge of *Voluta oliva*. Lamarck did not even use the Linnaean specific name (either in 1810b or in 1822b), although he listed as good species several of the color forms under their respective names as used by us today, *maura*, *sepulchralis*, and *fulminans*, the first two having each a “variety” of its own. He did not tie any of them to *Voluta oliva*. Deshayes, in the “Histoire naturelle des vers” (1830, 1832, vol. 3), also failed to list *V. oliva*. Reeve did not list it even as a synonym. In his listing of *Oliva maura* Lamarck, 1810, Reeve cited as synonyms three of Lamarck’s 1810 species, *fulminans*, *sepulchralis*, and *funeralis*, and also *macleaya*

and *leucostoma* Duclos in Chenu, 1844–1845. These are all recognized color forms of *oliva*, with the exception of *funeralis* and *leucostoma*. Reeve did, however, recognize the shell characters that distinguish *O. oliva*, as all his figures of its forms (*loc. cit.*) correctly show the details of its spire and shoulder.

Although the description of *Voluta oliva* in the “Systema” is not entirely satisfactory, we may say that the species, with its many forms, was adequately defined. Moreover, in the “Museum Ulricae,” the description of the spire of the shell is worded more graphically. It cures the vagueness of the “Systema” description and unmistakably points to the *oliva* affinity. The synonymy in the “Systema” is acceptable, as the majority of the cited figures show some form of *oliva*, and those from Regenfuss (pl. 1, fig. 2) and Lister (pl. 718, fig. 2) are obviously meant for one of the dark forms. Hanley (1855, pp. 215–216) felt that all the figures cited in the tenth edition, at least, showed *O. maura* Lamarck, and, while some of them are crudely drawn, I am constrained to agree. In the “Museum Ulricae” only three of Linnaeus’ twelfth-edition references are used (Gualtieri, pl. 23, fig. B; Argenville, pl. 16, fig. R; and Rumphius, pl. 39, figs. 2, 5). The last was an unfortunate choice, as both of Rumphius’ figures are unrecognizable. Five “varieties” were briefly described in the “Museum Ulricae,” of which the first, “nigra,” may probably be accepted as being based on the form *maura* Lamarck. In the twelfth edition the synonymy underwent several changes, new figures from some of the cited authors being substituted and other references being added. The changes were not for the better. It will suffice to say that of the 10 figures cited in that edition only three can with any confidence be tied to *oliva*.

In summary, while the tenth-edition description, “V. testa cylindroide, spirae basi reflexa,” is somewhat ambiguous, any lack of clarity is cured by the elaborate details in the “Museum Ulricae,” which demonstrably refer to the same species, and the synonymy in the tenth edition is almost entirely correct. The species may be cited as of Linnaeus, 1758.

An examination of the Linnaean collection in London is disappointing. All of the species

¹ Dillwyn supplied the first clear and graphic explanation of the characteristic of *oliva* that Linnaeus described as “spira basi reflexa.” He said (p. 511): “Spire short, depressed, with the whirls thickened at the base and ending in a projecting claw.”

of *Oliva* known to Linnaeus are mingled together in the cabinet, just as the figures of many are consolidated in the twelfth-edition synonymy of *oliva*.

The attitude of those nineteenth century conchologists who failed to preserve the name *oliva* as a good species but who nevertheless gave specific names to its color forms was undoubtedly based on their inability to select a single form to bear the name. This is, of course, a completely specious reason. Linnaeus was emphatic in saying that the name covered many color forms, yet he gave a single name to this variable species. Many other instances of species involving a wide range of variation are found in the "Systema," and conchologists have not hesitated to retain the Linnaean specific name for the entire group. Hanley (*loc. cit.*) was unnecessarily preoccupied with another reason. He said: "It is not of momentous importance to ascertain what member of the genus should be regarded as pre-eminently entitled to the name, since the specific epithet must necessarily be changed, through the elevation of '*Oliva*' to the rank of a generic appellation." This seems to be a late survival of Lamarck's apparent antipathy towards tautonymic names. This curious unwillingness to use the name *oliva* is noted again as late as 1910. Johnson (1910-1911, p. 64) in a paper on the Olividae, listed *Oliva vidua* (Röding), 1798, as a good species, giving *Oliva maura* Lamarck as a synonym. The latter name is now recognized as a form of *Oliva oliva* (Linné). Although Johnson did not mention *oliva* in his comments, he evidently knew he was suppressing the Linnaean name, as, a few months later, in a continuation of his paper, he said (p. 124): "Since my notes appeared in the October Nautilus my friend Mr. Charles Hedley, of Sydney, Australia, has written that *Oliva oliva* Linné should be used in place of *Oliva vidua* Bolten. In this I now agree although at first I thought it was difficult to decide just what form should bear Linné's name." And in 1915 (p. 100) the same author said: "The species *oliva* Linné cannot be ignored in the light of our present ruling in nomenclature."

The most recent comments on *Oliva oliva* and *O. ispidula* are contained in the Johnson papers noted above, in a paper by Vanatta

(1915) and in Dautzenberg's paper on the Olives of New Caledonia (1927, 1928). Based on these works, the recognized and named forms of *Oliva oliva* may be listed as follows:

Form *maura* Lamarck, 1810 and its synonyms *Porphyria vidua* Röding, 1798, *Cylindrus nigellus* Meuschen, 1787, and *Olivia mauritiana* (Martini) Marratt, 1870, *pars*. This is a deep brown form.

Form *fenestrata* Röding, 1798, which equals *Porphyria fusca* Link, 1807, a golden yellow or greenish form.

Form *fulminans* Lamarck, 1810, a shell with broad, irregular, longitudinal stripes.

Form *sepulturalis* Lamarck, 1810, with narrow, irregular stripes and bands.

Form *mackleaya* Duclos¹ in Chenu, 1844-1845, a form with a pearl-gray ground color and less conspicuous markings.

Form *aurata* Röding, 1798, which is of a uniform orange.

Form *cinnamomea* Menke, 1830, a form with a cinnamon ground color and longitudinal stripes of darker brown.

Form *rumphii* Dautzenberg, 1927, a yellowish shell ornamented with lines and spots of brownish black. Dautzenberg (1927, p. 67) said of this form: "This variety corresponds to the description and figure of Rumph." I cannot read the figure of Rumphius as accurately as that.

Form *albofasciata* Dautzenberg, 1927, a grayish shell with bands bearing irregular markings of black.

The last five forms were tied to *oliva* by Dautzenberg.

Three specimens are found in the Queen's collection in Uppsala under the label *Voluta oliva*. One is a specimen of *Oliva vidua* (Röding) which is *Oliva maura* Lamarck. The others are of forms of the *Oliva ispidula* of authors. It is impossible, of course, to say whether the mixture of species was an error of Linnaeus or the result of a later mixture of specimens. Inasmuch as Linnaeus, in his description of *ispidula* in the "Museum Ulricaë," said that it was probably a variety of *oliva*, and in spite of the fact that certain details of the subdescription suggest that he was not describing the same species that he described in the "Systema,"

¹ Most of the *Oliva* names described by Duclos were first proposed by him in his "Histoire naturelle" in 1835. The date of the *Oliva* monograph by Duclos in Chenu's "Illustrations" is here used for these names in the interests of consistency, as the latter work contains Duclos names not included in his 1835 work.

it is possible that the mixture was effected by Linnaeus himself.

As there is no possible justification for abandoning a validly described and well-defined name on the mere grounds that it comported a variable or even a composite species, Hedley's opportune statement to C. W. Johnson was entirely sound and must be followed. If restriction be necessary, I here restrict the name *Oliva oliva* to the form called *Porphyria vidua* by Röding (*O. maura* Lamarck). The several other names applied to color patterns of the species may be retained as describing the other forms.

The best figures of the various forms of the species are to be found in the *Oliva* plates in Chenu (1844-1845) and in Reeve (1843-1878, vol. 6, *Oliva*, pl. 7, sp. 40, all figs.).

The history of the genus *Oliva* is noted above under the species *Voluta porphyria*.

Voluta ispidula

1758, *Systema naturae*, ed. 10, p. 730, no. 351.

1767, *Systema naturae*, ed. 12, p. 1188, no. 400.

LOCALITY: Not given in either edition.

"V. testa emarginata cylindroide laevi, spira prominente margine unico, columella oblique striata . . . Varietates potius hae tres, quam distinctae species."

This name has been traditionally identified with the shell that all subsequent authors have called *Oliva ispidula*. The retention of the name for that very variable species cannot, however, be supported. As is shown below, Linnaeus' type specimen for *ispidula* was a fossil *Olivancillaria* which has not been specifically identified. The Linnaean species must therefore be treated as a *species dubia*.

The description in the "Systema" is helpful in only two respects. First, it distinguishes the species from *oliva* by pointing out the significant difference in the spire and shoulder of the two species by the substitution of the phrase "spira prominente margine unico" for the words "spira basi reflexa." The latter phrase, as noted in the discussion of *oliva* (above) may be considered a diagnostic character of that shell. Second, it implies, at least, that *ispidula* was not a particularly variable shell, as it does not mention variability, a feature that was so graphically referred to in the case of *oliva*. This should have been a warning to his successors who mis-

takenly referred it to a different and very variable shell and loaded their diagnoses with lettered color varieties. Linnaeus emphasized the fact that *ispidula* was close to *oliva* as well as to *porphyria* and that the three names might be mere varieties of a single species. This statement is less significant than the other two details mentioned, as the genus *Oliva* is a group that exhibits little differentiation in shell characters. In spite of these differences, however, the description is not sufficiently detailed to define the species.

No locality was given by Linnaeus.

The synonymy is poor, as only one figure cited, that from Adanson, can be said to be identifiable. The Petiver figure (pl. 59, fig. 8) shows an unidentifiable two-banded form which is a copy of Buonanni's drawing (pt. 3, pl. 369). They represent, according to Hanley (1855, p. 216), "a Brazilian shell with somewhat the aspect" of the *ispidula* of authors. I am unable to recognize it. Of the two figures from Rumphius (pl. 39, figs. 6, 7) figure 6 shows (again according to Hanley) *Oliva cruenta* (Dillwyn), 1817. The latter shell is close to, and possibly a form of, *Oliva annulata* (Gmelin), 1791, a species with a raised thread around the periphery of the body whorl. This ridge is only rarely seen in *cruenta* and is not seen in Rumphius' figure.¹ I cannot share Hanley's confidence in this categorical identification. Rumphius' figure 7 has the appearance of some form of the *ispidula* of authors but is too crudely drawn for identification. The figure from Borellier (pl. 1322, fig. 17) is, as usual, too vague and cannot be said to agree with the description of *ispidula*. In the case of the Adanson figure, I agree with Hanley (*loc. cit.*) that it plainly shows an *Olivancillaria* and was probably based on *Olivancillaria hiatula* (Gmelin), a Senegal shell which Adanson called "l'Agaron." It has no resemblance to any form of the *Oliva ispidula* of authors.

¹ Dillwyn (1817, vol. 1, p. 515) was confused as to the relationships of *annulata* and followed his predecessors in connecting it with the affinity we now know as the *ispidula* of authors. He said: "Some traces of the elevated ridge may be occasionally observed in *V. cruenta*." According to Dillwyn's synonymy *O. cruenta* was the "*V. ispidula*" of Martini, 1773, the "*V. ispidula* var. 'e'" of Gmelin, 1791, and *O. guttata* Lamarck, 1810.

Complete confirmation of the identity of the Adanson shell is supplied by Fischer-Piette and his collaborators (1942, p. 173). The senior author found three specimens labeled "l'Agaron" in his examination of the retained collection of Adanson now in the custody of Adanson's descendants in France (see p. 53, above). One of these is photographically reproduced in the paper referred to (pl. 3, fig. 11) and is clearly *O. hiatula* and was so identified by Fischer-Piette and his co-authors. To add another link to the chain of evidence Hanley (*loc. cit.*), in his examination of the Linnaean collection in London, found "a fossil, which has much the general aspect of *O. hiatula*" and added that it is marked for the species "*V. ispidula*." The microfilm of the Linnaean collection in the present writer's hands afforded little information, as the photograph of the specimen in question is not clear, although it seems to be an *Olivancillaria*. It is not identifiable specifically and does not reveal any markings of either name or number. The fossil character of the shell is not apparent in the photograph.

In order to obtain more exact data on the supposed type specimen, the present writer referred the question to Dr. L. R. Cox of the British Museum, who very kindly reexamined the shell in the Linnaean collection, which had not been critically studied since Hanley's day. His report (1953, personal communication) reveals: First, the specimen is entirely unrelated to Recent shells of *Oliva ispidula* in the British Museum which he took for comparison. Second, it is a fossil with the outer lip slightly damaged and very close to specimens identified as *Olivancillaria hiatula* (Gmelin). It appears to be slightly more slender and has a less flaring aperture. Two further specimens, not marked in any way, are attached to the same tablet as the type and are small Recent specimens of *hiatula*. These may have been added to the collection by Sir James Smith, who owned it prior to its acquisition by the Linnean Society, or by some later examiner of the collection, and in any event cannot be accepted as syntypes. Third, the fossil specimen bears the number "351," the number of *Oliva ispidula* in the tenth edition of the "Systema," in the known handwriting of Linnaeus. It may

therefore be accepted as the authentic type.

As to the identity of the fossil type, I quote directly from Dr. Cox's letter to the writer: "Whether the type specimen is identifiable in view of the close similarity between the various recognized fossil species of this group I cannot say. In our collection are very closely comparable specimens from the Pliocene of Northern Italy identified in an old handwriting as *Oliva canalifera* Lamarck, but the true *O. canalifera* is a Paris Basin Eocene species, and according to Bellardi the Pliocene species misidentified as it was by early authors should be known as *O. suturalis* d'Orbigny. Lamarck, when first describing *O. canalifera*, commented that this species was scarcely distinguishable from the Recent *O. hiatula* Gmelin. I cannot guarantee that the Linnaean type of *ispidula* is of Pliocene age, or that it came from Italy. I think that the species would best be written off as a *species dubium* founded on a fossil of uncertain age and locality, and the specific name dropped."

Inasmuch as the Linnaean name *ispidula*, as applied to the complex known to all authors as *Oliva ispidula* today, has been entrenched in the nomenclature for almost 200 years, it is realized that the abandonment of that name and the substitution of another would be most unwelcome to the majority of conchologists, and contrary to the increasing adoption of the unofficial theory that stability of nomenclature is paramount over nomenclatural accuracy. The perpetuation of a demonstrable error is often held to be justified on the grounds of tradition and expediency, but the writer in the present case would accept the retention of the name only with the greatest reluctance. It is therefore suggested that a substitute name be chosen for the *ispidula* of authors, and I here select *Oliva ispida* (Röding). This is the first of the specific names in Röding's *Porphyria*, 1798, that can be referred to a form of the *ispidula* of authors and is the earliest validly published name for a member of this affinity. Röding's name was referred to two Martini figures (1769-1777, vol. 2, pl. 49, figs. 524-525) which show the form later named *tigridella* by Duclou, 1835.

Because of the present use of the *ispidula* of authors as the representative of the Lin-

naean name, it is necessary to discuss that complex briefly. It is even more variable, from the point of view of color and color pattern, than the *O. oliva* affinity. It has had, however, a more normal nomenclatural history, largely because, for a reason which is not apparent, the conchologists of the nineteenth century were not tempted to suppress the name because of a fancied necessity of choosing a single form to bear it. The features that distinguish all its forms from all the forms of *O. oliva* are its generally higher spire, its rounded rather than angular shoulder, the lack of those peculiarities of the base of the whorls and the upper end of the lip that have already been referred to under *oliva*, and in most forms its dark brown aperture.

The recognition of distinguishable color forms began early, as did the erroneous identification of them with the *ispidula* of Linnaeus. Gmelin (1791, p. 3443) listed five "varieties" in addition to his "typical" species. It is apparent that he had accepted, thus early, the mistaken conception of the specific name. He copied Linnaeus' twelfth-edition description in full, but in citing the Adanson figure (pl. 4, fig. 7), which represented *Olivancillaria hiatula* and was the best figure in Linnaeus' synonymy, he did so only with a query. Röding (1798, p. 35) referred four of his *Porphyria* species to *Voluta ispidula* Gmelin, of which at least two, based on the figures he cited, may be referred to named forms of the *ispidula* of authors. Lamarck listed four "varieties," all of which may be similarly referred. From Lamarck onward the discovery and naming of new species based on color forms of the shell mistakenly called *ispidula* added to the difficulty of synonymizing this very variable species.

The forms generally recognized today are:

Form *taeniata*¹ Link, 1807, a form with a broad, dark, subsutural band.

Form *oriola* Lamarck, 1810, described as a slender brown shell with a spire somewhat shorter than in most other forms and a white aperture.

¹ Link said of the name *taeniata* (1807, p. 98): "Perhaps only a form (Abänderung) of the preceding (*ispidula*), from which it is distinguished by the dark, unicolored band at the upper end of the first whorl." Link placed these names and the other *Oliva* species in Röding's *Porphyria*.

Form *candida* Lamarck, 1810, an albino form with the aperture more orange than brown.

Form *flaveola* Duclos in Chenu, 1844-1845, a yellow form with a white aperture.

Form *stellata* Duclos in Chenu, 1844-1845, a white form with broad, coarse brown markings and a shorter spire than in most forms of this species.

Form *tigridella* Duclos in Chenu, 1844-1845, fawn colored with dark spots.

Form *gratiosa* Vanatta, 1915, a dark brown, slender form with an elevated spire. It is possibly the form which Lamarck called *O. oriola*, although its spire is considerably higher. The columellar callus is cream-white.

Form *algida* Vanatta, 1915, a bluish white shell with light brown, longitudinal streaks, a yellow-brown lip, and shorter than usual spire. A brown and white callus is seen in the posterior corner of the aperture.

Form *samarensis* Johnson, 1915, a high-spired, reticulated form.

Form *longispira* Bridgman, 1906, a name given to a high-spired form which Johnson believed to be identical with the latter's *samarensis*.

Form *lactanea* Dautzenberg, 1927, white with a dark brown aperture.

Form *martini* Dautzenberg, 1927, a white or flesh-colored form with a subsutural band of orange.

Form *jayana* Ducros de St. Germain, 1857, white or flesh-colored with fine longitudinal brown lines and two or more less prominent bands of irregular markings.

The genus *Oliva*, in which this complex belongs, was erected by Bruguière in 1789 (1789, 1792, Index, p. xiv). Other uses of the name *Oliva* are discussed under *Voluta porphyria* (p. 68, above).

Oliva ispidula auct., in its various forms is figured by Reeve (1843-1878, vol. 6, *Oliva*, pl. 17, sp. 34a-k). The excellent figures of many of the forms in Chenu should be examined. The only figures in the "Tableau encyclopédique" (1798) that can positively be referred to any form of *ispidula* auct. are figures 3a and b, called *O. oriola* Lamarck, on plate 366; figures 6a and b on the same plate, called *O. hispidula*; and figures 4a and b on plate 368, called *O. candida*.

A good figure of *Olivancillaria hiatula* is found in Reeve (*tom. cit.*, pl. 18, fig. 35a-c). The figures of that species in the "Tableau encyclopédique" (1798, pl. 368, figs. 5a, b) are characteristic.

The "Museum Ulricae" collection in Uppsala presents a curious situation if the labels are to be believed. In the tray marked for *O. oliva* are found not only one specimen of the form *maura* Lamarck of *O. oliva*, but two specimens of *ispidula* auct., one being form *taeniata* Link and the other form *candida* Lamarck. No specimen of *Olivancillaria hiatula* is found. As Linnaeus could hardly have given the same name to *hiatula* in the tenth and twelfth editions of the "Systema" and to the *ispidula* of authors in the intervening work, it must be assumed that labels have been mixed or that the specimens of the *ispidula* of authors were added later.

Voluta dactylus

1767, Systema naturae, p. 1188, no. 401.

LOCALITY: "In India" (1767).

"V. testa obovata laevi decussatim striata obtusa, columella sexplicata . . . Testa albido incarnatoque variegata. Labium vix crenatum. Columella plicae valde compressae."

The description of *dactylus* in the "Systema" is, I consider, adequate to define the species, although it has one somewhat misleading phrase. The sculpture of the shell consists, first, of a series of shallowly incised brown spiral lines, moderately close together, which occur both on the body whorl and on the spire. The spire also shows longitudinal striae, making this part of the shell really decussate. Just below the suture between spire and body whorl occurs a series of low nodules which develop into low longitudinal ridges which extend about one-sixth of the distance to the base, gradually becoming obsolete, and reappear with less intensity at the base. In these two latter regions, therefore, the body whorl may be said to be decussately sculptured. Between these points, or roughly one-half of the shell, no decussation is apparent. The misleading phrase "decussatim striata" in the description was soon partially corrected. Born (1780, p. 219) and Chemnitz (1780-1795, vol. 10, p. 160) both said "transversim et prope spiram decussatim striata," thus limiting the decussate sculpture to the upper part of the body whorl. The figures supplied by Chemnitz, however (*tom. cit.*, pl. 150, figs. 1411-1412), clearly show decussation on the three areas of the shell described above, although it is only

faintly indicated at the base. The median portion of the body whorl appears trellised because of the combination of the spiral incised lines and the longitudinal color pattern. The figures are inaccurate, however, in showing a more twisted columella than is shown by the *dactylus* of authors and in indicating five plaits instead of six. Lamarck (1822b, p. 314) went too far in the other direction, as he said only "spira . . . subdecussata" and "spire . . . faintly trellised." The first description that comes close to explaining the sculpture properly is that of Kiener (1834-1850, vol. 3, *Mitra*, p. 102).

The single figure in the synonymy (Gualtieri, pl. 28, fig. P) is an inappropriate choice. It cannot be tied to *dactylus* and, indeed, fits none of the species having six plaits on the columella. The locality "In India" is correct although, as usual, too restricted. An unmarked specimen of the *dactylus* of authors is present in the Linnaean collection, which uniquely conforms to the description, and as its ownership by Linnaeus has been recorded on his list of owned species, it may safely be accepted as at least the ostensible type. The identification is confirmed pictorially by the addition of a Lister figure (pl. 813, fig. 23) in a manuscript note by Linnaeus in his copy of the twelfth edition.

The writers who followed Linnaeus had no doubt as to the identity of the name *dactylus*, although it was some time before its generic relationship was established. Some authors followed Seba and placed it in his "*Cylindrus*," the group later called *Oliva*. Favanne, in his edition of Argenville (1780, vol. 2, pp. 803-804, pl. 25, fig. F), thought it should be placed with the "Rochers" (Muricidae) and gave several reasons for his choice, one of which was that it possessed both an operculum and a periostracum, whereas the *Oliva* species have neither. Chemnitz left it in *Voluta*, as did Born. In 1811 (1811b, p. 212) Lamarck included it in *Mitra* Röding, 1798.¹ It was continued in *Mitra* by Lamarck in 1822 and by most conchologists of the next 50 years.

¹ Lamarck described the genus *Mitra* in the "Prodrome" of 1799, and as it is most improbable that he had seen the "Museum Boltenianum," 1798, in which Röding had erected the genus, he undoubtedly believed the name to be his own creation.

Schumacher (1817, p. 236) erected the genus *Cylindra* (not *Cylinder* Montfort, 1810, which was based on *Conus textile* Linné) for *Voluta crenulata* Gmelin. The latter species is distinct from *dactylus*, although closely allied to it. Schumacher's *Cylindra* was used for *dactylus* by most European conchologists for many years, although Dall (1915, p. 52) considered it unavailable as a homonym of *Cylinder* Montfort, and in this opinion he was joined by many American writers.¹ In 1884–1887 (p. 614) Fischer published the new name *Cylindromitra* for this group, using *V. crenulata* as his "example," apparently agreeing with Dall that *Cylindra* was unavailable. Fischer's name was widely adopted until the "Museum Boltenianum" of Röding, 1798, came to the renewed attention of conchologists with the republication of its conchological portion in 1906. It was then realized that *Pterygia* Röding contained *V. dactylus* under the name *Pterygia nucella*. *Pterygia* was a mixed genus, containing species belonging in other generic groups, but Dall (*loc. cit.*) designated *P. nucella* as its type species. This designation limits the use of *Pterygia* to the group containing *nucella* (*V. dactylus* Linné) and makes it the earliest name for the group.

Iredale (1929, p. 289) did not accept Dall's designation of *nucella* as type species of *Pterygia*. He designated *P. vulgaris* Röding, a new name for *Voluta mercatoria* Linné. This designation, if accepted, would create an unfortunate situation, as it would make *Columbella* Lamarck, 1799, an exact synonym of *Pterygia*. Iredale did not explain his choice except in so far as the following quotation may

¹ The abandonment of *Cylindra* Schumacher as a homonym must be based on the slight change in the termination of the word. This change is not one of those specified in the list of variations given in Article 35a to e of the Rules. This Article, in its original draft, covered only specific names, but by the terms of Opinion 147 its provisions were extended to cover generic names as well. Dall, in declaring *Cylindra* a homonym, wrote prior to this amendment and it is suggested that his opinion was motivated by the Recommendation under Article 36 which provides that "it is well to avoid the introduction of new generic names which differ . . . only in termination or in a slight variation in spelling which might lead to confusion." The question is of only historical interest as, in any case, *Pterygia* Röding is the earliest valid name, but I am of the opinion that the framers of Article 35 meant the list of variations to be exclusive and that therefore *Cylindra* is not a homonym.

be said to constitute an explanation: "However, *Pterygia* Bolten has not been scientifically eliminated, so, in order to preserve *Marginella*, Dall, by a curious method of working, fixed on *P. nucella* as type, and this would have made *Pterygia* equal to and older than *Cylindromitra* Fischer. However, the third species in Bolten's list was *P. vulgaris* and this species must be regarded as the type of Bolten's genus. Unfortunately this species would finally crush the claims of *Columbella* to recognition" (italics mine). The basis of Iredale's reasoning in the italicized passage is not understood, unless he was using, as a binding Rule, the recommendation "m" under Article 30 to the effect that the trivial name "*vulgaris*" should be preferred in the selection of a type.

According to Tryon (1879–1888, vol. 4, p. 197) *Mitra obesa* Reeve, 1844, was merely a specimen covered with a greenish epidermis (?stain) and *Cylindra potensis* Montreux, 1859, was a small cylindrical variety from New Caledonia. The work of Montreux was not available to the writer, and no specimen has been examined bearing this name. It is suggested that it might have been the *Voluta crenulata* of Chemnitz and Gmelin, referred to above, which was Schumacher's type species of *Cylindra*. Both Chemnitz and Gmelin give fairly correct localities, "East Indian Seas" and "Oceano Indico," and the figures supplied by Chemnitz and cited by Gmelin (1791, pl. 150, figs. 1413–1414) show a cylindrical shell very similar to *dactylus* Linné except in slenderness and apparently having seven plaits instead of six. Chemnitz cited for it the Gualtieri figure (pl. 28, fig. P) which was wrongly cited by Linnaeus for *dactylus*. Were it not for the specimen of *dactylus* in the Linnaean collection, where *crenulata* is absent, and the variation in the number of plaits, which, after all, may have been merely a draftsman's error, I would suspect that this was the shell Linnaeus described as *dactylus*. Chemnitz described it as "octoplicata," and this possibly repels the identification, although the early conchologists were somewhat casual in counting plaits.

Pterygia dactylus is figured by Reeve (1843–1878, vol. 2, *Mitra*, pl. 12, sp. 88). Reeve, however, listed it as *Mitra dactylus* Lamarck,

although he gave *V. dactylus* Linné as a synonym. His attribution of the species to Lamarck may have been an oversight, but was probably an example of the unfortunate practice already referred to of changing the name of the author when the genus is changed.

It is not described in the "Museum Ulri-cae," and no specimen conforming to the description in the "Systema" is found in the Queen's collection in Uppsala.

Voluta miliaria

1758, *Systema naturae*, ed. 10, p. 730, no. 354.

1767, *Systema naturae*, ed. 12, p. 1189, no. 402.

LOCALITY: "In M. Mediterraneo, frequens" (1758, 1767).

"V. testa submarginata obovata alba, spira oblitterata flaveola, columella oblique striata . . . Similis sequenti, sed minor, glaberrima, spira lineola flava."

The word "submarginata" and the phrase "columella oblique striata" were added in the twelfth edition, and the word "brevior" of the tenth edition was omitted. The tenth edition also used the wording "spirae anfractibus lineola flava."¹

This is the common *Marginella miliaria* of the Mediterranean Sea, the Atlantic coasts of Spain and Portugal, west Africa, and the eastern Atlantic islands. The description, which lacks any mention of the minute size of the species or of the number of plaits on the columella, could hardly have identified the shell without recourse to that of the following species, *V. monilis*. Even read together, the two descriptions are certainly not unequivocal. The mention of the "lineola flava" around the spire of *miliaria* would not be helpful in the case of the majority of specimens, as it is not often seen except in fresh and unworn individuals, the color being extremely fugitive. The word "obovata" is used for both species, although they are quite different in shape. In fact, there is little in the description of *miliaria* to distinguish it from several other of the small white marginellas with a depressed spire, such as *M. minuta* of the western Atlantic. Neither Reeve nor Tryon mentions the yellow or

reddish line on the spire. George B. Sowerby (1847-1887, vol. 1, p. 399) described the shell as "white or pale brown with a broad brown band, spire small, encircled with a reddish line," and his figures (*tom. cit.*, pl. 78, figs. 227-230) show this decoration plainly. I have not seen a banded form of *miliaria*. The *miliaria* of authors usually shows four plaits on the columella with one or two small denticles above them, a feature that Lamarck (1822b, p. 364) described as "subquinqueplicata."

However, the presence in the Linnaean collection of an undocumented specimen of the *miliaria* of authors, which is the only shell in the collection that conforms to the description, together with the Mediterranean locality where the species is said by Linnaeus to be common, sufficiently confirms the identification. The single figure cited by Linnaeus (Barellier, fig. 30) does not conform either to the description or to the probable type in the collection. It more nearly resembles *M. monilis*, the next species, and was possibly misplaced through an error of Linnaeus or the printer.

The nomenclatural history of the species reflects the complexities of the many classifications of the Marginellidae that have been proposed. As *miliaria* is the first member of the broad genus *Marginella* to be discussed, a brief digest of the erection and subdivision of the genus is here inserted:

Lamarck, in the "Prodrome" (1799, p. 70), erected *Marginella* with *Volva glabella* Linné as type species, by monotypy. In 1801 (p. 93) he created a new genus, *Volvaria*, for a fossil *Marginella*, *Volvaria bulloides*, a cylindrical shell with a sharp outer lip. He later included several Recent species in *Volvaria*, some with a sharp and some with a thickened lip, and some of an ovate-conic shape and some more or less cylindrical, so that the coverage of the genus was considerably broadened. In his 1822 list (1822b, pp. 363-364) three of the Linnaean species were included in the total of six: *miliaria*, which he renamed *miliacea*, which is minute and conic-ovate with a thickened lip; *monilis*, which is cylindrical with a thickened lip; and *pallida*, a markedly cylindrical shell with an extremely sharp lip.

For the thick-lipped, cylindrical species

¹ The positions of *miliaria* and *monilis* were reversed in the tenth edition, and the subdescription of *miliaria* thus began with the words "Simillima praecedenti."

Schumacher (1817) proposed the name *Hyalina*, and separated the conic-ovate or volutiform species with a sunken or depressed spire under the name *Persicula*, type *Persicula variabilis*, which is *Voluta persicula* Linné, by monotypy. Swainson (1840) carried out a more elaborate classification, dividing *Marginella* into four subgenera: *Volutella*, *Persicula*, *Gibberula*, and *Glabella*. In 1844, Hinds divided the species into two groups, the first, *Phaenospira*, for those species with a more or less elevated spire, and the second, *Cryptospira*, for those with a hidden spire. His first group is in effect *Marginella* as restricted by Schumacher; the second is, in part, Schumacher's *Persicula*. Weinkauff (1879), Tryon (1883), Thiele (1931), and others have proposed classifications of this genus, but it is without the scope of the present paper to describe them in detail. There is a wide divergence between them, and the coverage of certain of the older names has been in some cases radically altered. Here the Thiele arrangement is used for those *Marginella* of the "Systema" that are referred to in Thiele's work.

As mentioned above, Lamarck changed the name of *miliaria* Linné to *milliacea*, although he doubtfully referred the species to "*Voluta miliaria* ? Lin. Gmel. p. 3443." Lamarck's specific name was used by most of the conchologists who followed the Lamarckian system, and its use has persisted, although the original Linnaean name has been increasingly employed in recent years.

Martini (1769-1777, vol. 2, p. 109, pl. 42, fig. 428) described and figured a shell that he called "*Persicula, granum triticium magnitudine*." He referred only to Adanson's "le Stipon" (1757, p. 79, pl. 5, fig. 4). Martini's figure is not illuminating, except that it shows a white shell of the approximate size of *miliaria* and of the same general outline, as it is somewhat too cylindrical and shows a small but prominent spire. Martini said that it is "occasionally found with a broad golden-red band on the body-whorl." This banded shell is referred to below. Adanson's figure was accepted by Schröter (1783-1786, vol. 1, p. 270) for an unnamed shell which was probably *miliaria* Linné. Neither Born nor Chemnitz mentioned *miliaria* either under that name or any other. Gmelin (1791, p. 3443)

listed the species with a description which shows little change from that of Linnaeus.¹ He omitted the word "obovata" in the main description. His subdescription compared the shell to the succeeding species *monilis*, as did Linnaeus, and added the word "brevior." He also inserted the phrase "interdum tota mellea," which may refer to a honey-colored form and, incidentally, to the absence of the reddish line around the spire. I am not familiar with this color form, and have referred above to the fact that the reddish line is usually lacking. Gmelin's concept of the species is also impugned by the listing of an unlettered "variety" of the succeeding species, *monilis*, for which he cited the Adanson figure given by Martini and the questionable Martini figure 428, neither of which shows *monilis*, and both of which could be doubtfully referred to *miliaria*.

With the exception of Gmelin, who in the case of the Linnaean species was usually a mere copyist, the first post-Linnaean mention of the name *miliaria* that I have found is that of Dillwyn (1817, vol. 1, p. 524), who said: "This species has not hitherto been ascertained by any subsequent author. . . . The description [of Linnaeus] agrees with the shell figured by Martini, to which Gmelin referred for a variety of *V. monilis* and which is described [by Martini] to be white and sometimes banded with yellow. Some specimens have only a yellow line at the suture and both Martini and Schröter appear to have considered it distinct from *V. monilis*." Dillwyn arrived at a correct result by this rather illogical route, although he still mentions a banded form of the species. He cited for *miliaria* Martini's figure 428, *miliaria* Gmelin, *monilis* variety "β"² Gmelin, and "Voluta no. 101 Schröter" (*loc. cit.*).

The early confusion as to *miliaria* was due partly to the uninformative figures available to authors and partly to the difficulty of counting the plaits on the columella of such

¹ Gmelin often paraphrased Linnaeus' descriptions without materially changing their meaning. He corrected errors in grammar and altered for the better some of Linnaeus' clumsy Latin locutions.

² Gmelin's single "variety" of *monilis* mentioned here was not designated by a Greek letter, as was his custom probably by a printer's error. Later commentators have very properly called it "var. β."

a minute species, most specimens of which are found beach-worn, but the confusion was certainly aggravated by the fact that Linnaeus, contrary to his usual custom, did not specify the number of plaits in either *miliaria* or *monilis*, contenting himself with saying of each of them: "columella oblique striata." I have not been able to examine the ostensible type in London, and the photograph before me does not adequately show the plaits of this minute species. Later conchologists have found little difficulty in identifying the species, however, and it has been accurately described and figured many times.

Thiele did not include this species as type of any of the genera or subgenera discussed by him. Tryon (1879-1888, vol. 5, p. 42) placed it in *Marginella*, subgenus *Gibberula* Swainson, 1840.

It is figured by Tryon (*tom. cit.*, pl. 11, figs. 47-48) and by Reeve (1843-1878, vol. 15, *Marginella*, pl. 27, sp. 154) as *M. miliaria*. The Kiener figure (1834-1850, vol. 3, pl. 6, fig. 26), as *M. miliacea*, shows two transverse brown lines around the body whorl instead of the all-white shell described by Linnaeus and Lamarck, and shows also a small pointed spire. The most recent figure of *miliaria* is found in Nobre (1931, pl. 15, fig. 11).

The species is not described in the "Museum Ulricae," and no specimen of it is found in the Queen's collection at Uppsala, which contained very few of the minute species.

The species *Volvaria oryza* Lamarck, 1822, has been reserved for discussion at this point. This is a species that Lamarck referred, although with a query, to "le Stipon" of Adanson, while his *Volvaria miliacea* (*Voluta miliaria* Linné), which immediately follows it, was referred to Linnaeus' *miliaria* without mention of the Adanson shell. Lamarck's Latin description of the two species show only slight differences. *Volvaria miliacea* is described as "alba," whereas *oryza* is said to be "fulvo late zonata"; *miliacea* is "minuta," whereas *oryza* is "parva"; *miliacea* is said to have a "columella . . . subquinqueplicata" but *oryza* is "quadriplicata." Under *oryza* Lamarck referred in his French description to the fact that Adanson had said that the columella of "le Stipon" had "eight or ten teeth," but Lamarck himself gave it only four. The great discrepancy in the number of

teeth or plaits in the descriptions of the various authors who have described *miliacea* or *oryza* is explained by Pallary (1902, p. 8). He established that the immature shell has six to eight visible plaits, but that in the adult a callous deposit hides one or more of them. It seems inescapable that Lamarck's separation of *oryza* and *miliacea* was at least partly due to his failure or inability to examine a sufficiently large series of the shell in various life stages. The two names refer to the same species. The difference in the stated sizes of the two is cured by suggesting that in *oryza* Lamarck had a fully matured shell in which all but the four most prominent plaits had been covered by callus. In *miliacea* he had a younger, and therefore smaller, specimen in which one or more of the juvenile denticles remained visible. The mention of a fuscous band in *oryza* and not in *miliacea* confirms the many reports of a banded variety, which may be a characteristic of either the young or adult shell, but this writer has never detected a band in the many specimens examined. Jousseume (1875, p. 241) went to the extreme of separating *oryza* from "le Stipon" because of the apparent disparity in the number of columellar plaits in the descriptions of the two names.

George B. Sowerby (1847-1887, vol. 1, p. 399, pl. 128, figs. 227-230) was the first to recognize that Lamarck's *oryza* was identical with *miliaria* Linné, but his opinion was apparently not accepted by the majority of conchologists. Both Weinkauff and Tryon, for instance, not only separated the two species but placed them in different subgenera of *Marginella*. Weinkauff's reasons were not explained, but Tryon was explicit. He said (1879-1888, vol. 5, pp. 36, 41) that *Persicula* Schumacher, 1817, in which he placed *oryza* Lamarck, has a spire which is "depressed or sunken," but that the spire of *Gibberula* Swainson, 1840, to which he allotted *miliaria* Linné, is "slightly prominent."¹ Fischer-Piette and others (1942, p. 189) partly explain Tryon's confusion by saying: ". . . for this species [*oryza*] he reproduced Reeve's

¹ Lamarck's descriptions of the spire of the two supposed distinct species are almost identical, the description for *oryza* saying "vix prominula" and that for *miliacea* "vix conspicua." I would hesitate to predicate any real difference in meaning upon these two phrases.

figure 75; now, that figure, which does not really show the apex of the shell, is itself merely a bad reproduction of figures 227-228 of Sowerby, where the apex is apparent. Moreover, Reeve, in the text, says 'spire minute.'" Tryon made a further equivocal statement in distinguishing between *Persicula* and *Gibberula* by saying (p. 36) that the outer lip of the former is "generally denticulated within," whereas the lip of *Gibberula* is "not denticulated" (p. 41). In fact, the outer lip of *miliaria* Linné is finely crenulate over its whole length, although the crenulations are often obsolescent and are, of course, not apparent in worn specimens and not yet developed in young shells. On both these two points Tryon partially contradicted himself. As to the spire of *oryza* he said (p. 40), "Specimens before me, agreeing otherwise with the figures of the species, have the spire apparent, although short." In the description of *Gibberula miliaria* (p. 42) he said, "Usually the outer lip is smooth, but occasionally it is very slightly, minutely crenulated." Thus the differences claimed by Tryon are not susceptible of proof, and, moreover, he considerably weakened his position by his admissions.

Fischer-Piette's opinion, with which I agree, is the first definitive statement since Sowerby that *oryza* Lamarck should be thrown into the synonymy of *miliaria* Linné and that the species is confined to the Mediterranean Sea and the west and northwest coasts of Africa. On the question of the range of the species, one recent author disagrees with this result. Dollfus (1911, p. 23) concluded that *oryza* was a western Atlantic shell close to *miliaria* and often confused with it. Dollfus apparently gave little weight to the fact that Lamarck's *oryza* was said to come from Senegal and was referred to Adanson's "le Stipon." I have compared a considerable series of specimens labeled *oryza* and *miliaria*, with a wide range of locality labels, and could detect no differences that could justify specific separation.

Voluta monilis

1758, *Systema naturae*, ed. 10, p. 730, no. 353.

1767, *Systema naturae*, ed. 12, p. 1189, no. 403.

LOCALITY: "In China, unde Armillae, Monilia" (1758, 1767).

"V. testa integra obovata alba, spira oblitterata alba, columella oblique striata."

The description of this species shows only two word changes from that of the preceding, yet the shells are quite distinct in their characteristics. The use of the word "integra" for *monilis*, in contrast to the "submarginata" of *miliaria*, differentiates the shells in respect to the shape of the lip, although "integra" is almost too emphatic a word, as the base of *monilis* is only slightly less open than that of its companion species. The spire of *miliaria* is described as "flaveola," by which we must assume that Linnaeus meant the single encircling line of color in the suture between the spire and the body whorl, while that word is properly omitted in *monilis*. There is, however, one marked difference between the two species which was not described by Linnaeus. The spire of *monilis* is not "oblitterata," if by that word the author meant that it was not visible. Although heavily calloused, the spire shows a noticeable elevation, whereas the spire of *miliaria* is much less evident and in many individuals is almost flat. The use of the same word for both is therefore misleading and casts at least a shadow of doubt on the identification of the name with the *monilis* of authors. The shell of *monilis* is much larger than that of *miliaria* and this is referred to in the subdescription of the latter species: "Similis sequenti, sed minor." *Marginella monilis* reaches a size of 10 to 12 mm., whereas *miliaria* rarely exceeds 5 mm. The locality "China" is incorrect, as it is not known except from the west African coast. Lamarck's mention of Senegal is correct but may have been used merely because Martini's figure (1769-1777, vol. 2, pl. 42, fig. 426), which was used by Lamarck, was referred by Martini to a shell from Senegal which Adanson (1757, p. 78, pl. 5, fig. 2) called "le Falier" and which much resembles *monilis* and was probably that species.

The Linnaean collection contains several specimens of the *monilis* of authors. These have been bored, having presumably been used in, or designed for use in, a necklace or bracelet. As these specimens uniquely agree with the description, except for its equivocal phrase regarding the spire, and as the name *monilis* appears on the list of Linnaeus' collection, they may safely be regarded as representing syntypes. Indeed, Linnaeus' specific name and his statement "unde Armillae,

Monilia" are strongly confirmatory of the identification, as these perforated specimens may have constituted Linnaeus' only means of knowing that the species was used for ornament.

The identification has been accepted from earliest times. Neither Martini nor Chemnitz lists the species, although Martini's figure 426, mentioned above, resembles the species very closely in size and in form.¹ Born (1780, p. 219), Schröter (1783-1786, vol. 1, p. 209, no. 12), Dillwyn (1817, vol. 1, p. 524), and Lamarck (1822b, p. 363) all cited the species by the Linnaean specific name and attributed it to Linnaeus, although Lamarck took it out of *Volva* and placed it in his *Volvaria*, as he did *V. miliaria* and *V. pallida* Linné. Wood (1828, p. 93, pl. 19, fig. 53) figured, as *V. monilis*, a shell which is plainly a different species. Deshayes and Milne-Edwards (1835-1845, vol. 10, p. 459) suggested that Wood's figure bore a resemblance to *Marginella interrupta* Lamarck, 1822.

From the middle of the nineteenth century onward the genus *Marginella* Lamarck was increasingly used for this species, and it is today universally cited as *Marginella monilis*. Thiele did not list *monilis*, as it is not the type of any of the genera or subgenera employed by him, and therefore we cannot be sure of the group in which he would have placed it. Tryon and most other systematists include it in subgenus *Gibberula* Swainson, 1840.

Petit de la Saussaye (1851, pp. 57-58) apparently noticed that the figures of *monilis* in Sowerby (1847-1887, vol. 1, pl. 76, figs. 117-118) had a more elevated spire than Linnaeus' description seemed to warrant and renamed the Sowerby shells *Marginella sowerbyana*. He was apparently confused by Linnaeus' misleading description, and his new

¹ Martini, in this case, supplied two figures for the same species (figs. 426 and 427). The latter figure shows a yellow shell, banded with brown, which is obviously not *monilis*. He called the composite species "Percicula parva, alba vel flavescens, interdum luteo fasciata," and his synonymy embraces both. The yellow shell with the darker bands was undoubtedly based on a species described by Petiver (pl. 102, fig. 13) which Martini cited and which Petiver described as "Veneroides exilis alba, fasciis duabus rufescentibus." I know of no banded or yellow form of *monilis*, and it is suggested that both Martini and Petiver based their species on the shell later called *Volvaria oryza* by Lamarck, which I consider to be identical with *miliaria* Linné (see p. 82, above).

name has not been recognized by subsequent authors. Tryon (1879-1888, vol. 4, p. 41) mentions that Petit (1851, p. 49) also described a species which he reported from the island of Socotra and the Red Sea as *M. terveriana*. Tryon could not separate it from *monilis*. Petit's figure (1851, pl. 2, fig. 2), however, seems to show no visible elevation of the spire and to that extent is different from *monilis*. It may have been a worn specimen.

Marginella monilis is figured by Reeve (1843-1878, vol. 15, *Marginella*, pl. 21, sp. 111) but is referred to *Voluta monilis* Born.² The figure is accurate. Tryon (*tom. cit.*, pl. 11, figs. 45-46) also gives characteristic figures.

The species is not described in the "Museum Ulricae," and no specimen is found in the Queen's collection in Uppsala.

Voluta persicula

1758, *Systema naturae*, ed. 10, p. 730, no. 352.

1767, *Systema naturae*, ed. 12, p. 1188, no. 404.

LOCALITY: "In O. Africano" (1758, 1767).

"V. testa emarginata obovata laevi, spira retuso-umbilicata, columella septemplicata, labro marginato crenato . . . Variat colore: alia Cingulata striis rubris; alia Punctata maculis sanguineis."

The word "emarginata" was added in the twelfth edition.

The above main description standing alone is adequate to define the species as the *persicula* of all authors. The subdescription, however, which is devoted entirely to the color pattern, covers two species, *V. persicula* and *V. cingulata* Dillwyn, 1817, which were thought by Linnaeus to be varieties of the same species. An undocumented specimen of each is present in the Linnaean collection which uniquely conforms to the respective shells. The locality is correct.

The synonymy is only partly correct. For the "typical" *persicula*, three references are

² Reeve's attribution of this species to Born is unexplainable. The latter cited it as of Linnaeus and copied Linnaeus' description with the omission of the word "alba" in the phrase relating to the spire. This was in any case an unnecessary word, as Linnaeus called the whole shell "alba" in the same sentence. Born also cited for the species a figure from Adanson (pl. 5, fig. 3), an erroneous reference. Adanson's figure shows *V. exilis* Gmelin, which Adanson called "le Simeri." Reeve's figure, however, is clearly *monilis* Linné, so that he could not have been misled by the reference to Adanson.

given. Borellier's figure (pl. 1326, no. 33) is unrecognizable. Petiver (pl. 8, fig. 2) shows what is apparently an *Auricula*. Three Gualtieri figures are cited (pl. 28, figs. C, D, E). Figure C may be taken for *persicula* so far as concerns the color pattern, but it shows a small acute spire and only five plaits on the columella. Figures D and E are fair representations of *persicula*, showing only a few spots. Figure E shows spots larger than those in the typical form of the species and seems to have been based on the form later called *avellana* by Lamarck (1822). Linnaeus' *persicula* "β," the shell described by him in the subdescription as "Cingulata striis rubris," is better defined pictorially than his "typical" *persicula*. The Buonanni figure (pt. 3, fig. 238), unlike the crudeness and vagueness of most of that author's drawings, is a reasonably accurate picture of *V. cingulata* Dillwyn (1817, vol. 1, p. 525), although Linnaeus called the figure "male." The Gualtieri figure (pl. 28, fig. B) shows only five (or possibly six) plaits on the columella. While the figure shows little detail, the number of plaits suggests *cingulata*, and the pattern of revolving lines is confirmatory of that species. Adanson's figure (pl. 4, fig. 4), which he called "le Bobi," is accurate for Linnaeus' variety "β" and is the most graphic figure in the synonymy.¹ The Petiver reference (pl. 8, fig. 10) is a recognizable figure of *cingulata*.

No complications arise in the identification and generic position of *V. persicula* except in the treatment of the form *avellana* Lamarck and of *cingulata* Dillwyn. Lamarck (1822b, p. 360) listed *avellana* as a good species immediately preceding *persicula* with a description that varied from that of the latter, so far as the color pattern is concerned, only in calling the shell "nitida, pallide fulva" instead of "alba," and in describing the spots

as "rufis creberrimis adpersa" as contrasted with "luteis confertis adpersa" of his *persicula*. *Voluta persicula* varies not only in the base color of the shell, which ranges through white to various shades of yellow, but in the color of the spots and their size and frequency. Most of the authors who used the name *avellana* confined it to the form with larger and fewer spots. If Lamarck intended to make this distinction, he failed to do so, as "creberrimus" and "confertis" have the same meaning of "crowded" or "numerous." For *avellana* Lamarck cited only two figures from the "Tableau encyclopédique" (1798, pl. 377, figs. 5a, b) which are accurate as to the form of the shell but show *thickly sown small spots*, and carry three obscure spiral bands of color which are only rarely seen in this species. As the "Tableau" figures he cited for *persicula* (pl. 377, figs. 3a, b) show the large-spotted form, it is evident either that the editors of the plates had reversed the pairs of figures, or that Lamarck's successors have failed to understand his conception of the difference between the two shells. Lamarck's descriptions are erroneous in that they provide for eight plaits on the columella of both shells instead of seven. The "Tableau" figures are also to be criticized for showing 10 clearly drawn plaits for *avellana* and nine for *persicula*.²

George B. Sowerby (1847-1887, vol. 1, p. 399, pl. 78, figs. 189-191) figured for *persicula* three of its above-mentioned forms and said that *avellana* was indistinguishable except for its larger spots. This comment was written in 1847 and is the first mention of *avellana* as a synonym of *persicula* that I have found. Since then the common specific identity of the two shells has been, at least tacitly, admitted by authors. Tryon (1879-1888, vol. 5, p. 36, pl. 10, fig. 10) does not mention *avellana* in his text, but in the Index covering *Marginella* (*tom. cit.*, p. 203) he synonymizes it with *persicula*.

Linnaeus' *persicula* "β" is similar in appearance to his typical *persicula*, but instead of brown or red spots it carries a series of

¹ While Adanson figured only Linnaeus' *persicula* "β," his description of "le Bobi" was composite, involving not only *persicula* "β," but also the typical *persicula*, and, in addition, *Marginella cornea* Lamarck. He said (1757, p. 61): "The color varies greatly in the shells of this species. Some are white [*M. cornea*]; others are sprinkled with little red spots [*M. persicula*]. Others have 15 to 16 very narrow lines which encircle it; these lines are yellow in some and red in others [*M. cingulata*]." He purified this composite species in a later manuscript catalogue examined by Fischer-Piette and co-authors (1942, p. 169) by separating its three members.

² As with most of the early figures of shells with plaited columellas, the artists were extremely casual in reproducing the plaits, and many figures erroneous in this respect were cited by authors regardless of the number of plaits specified in the pertinent description.

narrow, distant, revolving lines of red. These lines tend to become zigzag or to run into one another. To quote Reeve (1843-1878, vol. 15, *Marginella*, pl. 13, sp. 56a, b): "The red lines, it may be observed, lose their parallelism below the middle of the shell." This species was named *lineata* by Lamarck (1822b, p. 361). He, however, referred it to "*V. persicula*. Var [b]. Lin. Gmel." and cited for it all the references Linnaeus cited for his *persicula* "β." However, five years before the publication of Lamarck's *lineata*, Dillwyn (1817, vol. 1, p. 525) had named the same shell *V. cingulata*, and, although some of Lamarck's immediate followers retained his specific name, the name *cingulata* was soon adopted and is universally used today. Indeed, in the second edition of Lamarck's "Histoire naturelle," Deshayes and Milne-Edwards (1835-1845, vol. 10, p. 445) referred to Lamarck's action and recommended the restitution of Dillwyn's name. There was for some time, however, no unanimity of opinion as to whether *cingulata* was worthy of specific rank. George Sowerby, writing in 1847 (1847-1887, vol. 1, p. 399, pl. 78, figs. 185-186), listed *lineata* as a good species distinct from *persicula*. Tryon (1879-1888, vol. 5, p. 36, pl. 10, figs. 10-11) also lists the two as good species but says of *cingulata*: "In some specimens before me the revolving lines have broken up into spots; so that, distant as the two patterns of painting normally appear, this and the preceding species may prove to be varieties of a single species." The present writer has not seen any specimens of *cingulata* that grade into *persicula* in the manner noticed by Tryon, but, in spite of any tendency of the color pattern to imitate that of *persicula*, there is at least one significant difference between the two shells. The Linnaean *persicula*, has, as stated by Linnaeus himself, seven plaits on the columella, and in some individuals an obsolete eighth plait is faintly seen at the posterior end of the row. No specimen of *cingulata* examined had more than six plaits, and they are, moreover, less developed than in *persicula*, that is, they are shorter and less defined. In most specimens they become obsolete or at least smaller so rapidly as they approach the posterior end of the columella that often no more than five can be counted, even in shells that show no wearing else-

where. Dillwyn, in his original description of the species (*loc. cit.*), gave it six plaits and said, "The number of plaits on the spire [*sic*] is, I believe, invariably smaller [than in *persicula*]." This distinction seems to have been passed over by the writers who subsequently synonymized the species with *persicula*.¹

There is also another difference between the two species. The eversion and thickening of the outer lip in *persicula* are so marked that, viewed dorsally, the shell recalls some of the small, margined *Cypraea*. In *cingulata* this thickening is less developed, and the eversion and margination are less marked. This difference is perhaps less significant than the difference in the number of the plaits, and the extent of difference is not so great. The distinction was, however, constant in the comparatively small series of specimens examined, and I suggest that it may be considered a diagnostic factor. In view of the radically different color patterns of the two shells and the differences noted above, I entirely agree with those who consider the two shells to be distinct species. On this point Reeve said (*loc. cit.*), "It was formerly believed to be a variety of the preceding [*persicula*] but it differs constantly in form as well as in painting."

Voluta persicula Linné is therefore a composite species. While there has been a tacit restriction of the name to the *persicula* of authors, no later writer has categorically so restricted it. Owing to the real dispute as to the separability of *cingulata* and in order to resolve any doubts by the use of apt language, I here restrict the name *persicula* Linné to the *Marginella persicula* of authors from the northwest African coast. Both *persicula* and *cingulata* have this comparatively restricted range which includes the adjacent eastern Atlantic islands. The several references in the literature to the occurrence of *persicula* in the Indian Ocean or the East Indies were undoubtedly based on specimens of *Marginella porcellana* (Gmelin), 1791 (= *M. tessellata* Lamarck, 1822). That shell has a color pattern remarkably like that of *persicula*, except that the spots, instead of being scattered asymmetrically, are arranged in

¹ The use of the word "spire" by Dillwyn must have been a *lapsus calami*. The spire of both *persicula* and *cingulata* is hidden.

spiral rows and are roughly quadrangular instead of round. Chemnitz (1780–1795, vol. 10, pl. 150, figs. 1419–1420) clearly figured the species, although Lamarck (*tom. cit.*, p. 362) criticized the figures as showing the spots shaped like arrowheads instead of being quadrangular.

Voluta persicula is today placed in the genus *Marginella* Lamarck, 1799. It is the type of the subgenus *Persicula* Schumacher, 1817, by monotypy, as *P. variabilis*.

It is well figured by Reeve (1843–1878, vol. 15, *Marginella*, pl. 13, sp. 57a, b) and by Thiele (1931, p. 354, fig. 426). *Marginella cingulata* is figured on the same plate of Reeve (sp. 56a, b) and by Tryon (*tom. cit.*, pl. 10, fig. 11).

The only other specific names that have been given to *persicula*, in addition to *avellana* Lamarck already referred to, are (*Pterygia*) *crassa* Röding, 1798, and *variabilis* Schumacher.

The species is not described in the "Museum Ulricae," and no specimen of it is found in the collection of Queen Louisa Ulrica in Uppsala.

Voluta pallida

[1758, *Systema naturae*, ed. 10, p. 727, no. 338 (*Bulla pallida*).]

1767, *Systema naturae*, ed. 12, p. 1189, no. 405 (*Voluta pallida*).

LOCALITY: Not given in 1758; "in O. Africano" (1767).

"B. testa cylindrica, spira elevata acuta . . . T. livida, longitudinaliter griseo undulata" (1758).

"V. testa integra oblongo-ovata, spira elevata, columella quadriplicata . . . Testae venter superne minime subcarinatus est, ut in *V. glabella*, sed aequalis" (1767).

The name and description of the *Bulla pallida* of the tenth edition are included in the above heading, as it has often been considered identical with *Voluta pallida*, 1767, or possibly the young shell of that species. There seems little evidence of such a relationship and the majority of workers today consider both to be *species dubiae*. Indeed, the three descriptions, in the tenth and twelfth editions of the "Systema" and in the "Museum Ulricae," show such differences in wording that Hanley (1855, pp. 218–220) suspected that they referred to three different species and was not willing to identify

any one of them positively. It is useful to compare these descriptions:

In shape the tenth edition called the shell "cylindrica"; the "Museum Ulricae" changed this to "ovato-cylindrica"; the twelfth edition used "oblongo-ovata." As to color, the tenth said "livida, longitudinaliter griseo undulata"; the "Museum Ulricae" said "incarnato-pallida, saepe variegata." The twelfth edition did not mention color. The columella is not mentioned in the tenth; in the "Museum Ulricae" it is said to be "postice quadruplicata"; in the twelfth, quadruplicata." The spire, which is "elevata acuta" in the tenth and "elevata" in the twelfth, becomes "convexo-conica, mucronata, laevigata, *obsoletior*" (italics mine) in the "Museum Ulricae." The italicized word appears to disassociate the *pallida* of the "Museum Ulricae" from that of either edition of the "Systema," although it is to some extent inconsistent with the remainder of the phrase. The description of the outer lip in the "Museum Ulricae" ("laeve, crassiusculum, minus hians in medio") stands alone, as the lip was not referred to in either edition of the "Systema." In so far as concerns the tenth and twelfth editions, the only detail common to both is the phrase "spira elevata." The description in the "Museum Ulricae" begins by copying the tenth-edition description and referring to it by volume, page, and number, and the added details of color and of the outer lip indicate a shell that cannot be associated with the *pallida* of authors.

The West Indian *pallida* of all authors is a shell that is characterized by Tryon (1879–1888, vol. 5, p. 48, pl. 12, fig. 84) as more cylindrical than the other marginellas of Linnaeus. It is whitish or yellowish, sometimes with obscure bands of a darker color. The spire is low, convex, and slightly mucronate. The columella is sinuous below and provided with four distinct plaits at the extreme lower end. The outer lip is sharp and entire, and the aperture, owing to the sinuosity of the columella, is widest at the base. I can see no possibility of identifying it with the *pallida* of the "Museum Ulricae." The color does not conform to the "undulating, gray longitudinal (?stripes)" of the tenth edition. It comes closest to the twelfth-edition description, although it is more cylindrical than is suggested

by the words "oblongo-ovata." No references were cited until the twelfth edition, when Linnaeus supplied two figures. Lister's plate 714, figure 70a, might be taken for the *pallida* of authors, although the details of the columella are not shown. The Adanson figure (pl. 5, fig. 3) is badly drawn. It shows a spire too well developed for *pallida* and a straight instead of a sinuous columella. It is, in fact, the figure Adanson cited for "le Simeri" (*M. exilis* Gmelin).

No specimen of the *pallida* of authors is found in the Linnaean collection. Examples of *Marginella caerulescens* Lamarck, 1822 (*Voluta prunum* Gmelin, 1791), are present, but this is a much more solid and less cylindrical shell with a brownish aperture and a color that is described by both Gmelin and Lamarck as "caerulescente." Both Gmelin and Lamarck referred to Adanson's "l'Egouen" (pl. 4, fig. 3), a figure that Fischer-Piette and his co-authors (1942, p. 168) identify with *Marginella amygdala* Kiener, 1841. Hanley (*loc. cit.*), with considerable diffidence, suggested *caerulescens* as a possible identification for the twelfth-edition *pallida*. Moreover the type of the *Bulla pallida* of the "Museum Ulricaë" is missing from the Queen's collection at Uppsala (Odhner, 1953, personal communication), and therefore we are left with only the three descriptions and a dubious figure from Lister to assist us in the identification.

In this situation Hanley suggested that the *pallida* of the tenth edition be abandoned as a *species dubia* and that the *pallida* of the "Museum Ulricaë" was a *Marginella*, possibly resembling *M. rosea* Lamarck, 1822, or *M. carnea* Storer, 1837. The latter is a much heavier shell and conforms to the "Museum Ulricaë" description only in its flesh-colored bands. As to the *pallida* of the twelfth edition, Hanley could only suggest *caerulescens* as its representative, but said, "It is better to erase the species altogether from our catalogues." It is curious that Hanley did not mention the *pallida* of authors, the common West Indian shell, and appeared to be ignorant of its existence.

Tomlin (1917, p. 287) abandoned the name *pallida* for the *pallida* of authors and renamed it *Marginella tenuilabra*. He adopted the view of Hanley almost in its entirety,

saying: "Linné, Syst. Nat., 10th. ed., p. 727, described a *Bulla pallida* which is indeterminate. In Mus. Lud. Ulr., p. 588, is a *Bulla pallida*, referred to the one of the 10th. ed., but evidently a different shell, possibly a *Marginella*, but also indeterminate. In the 12th. ed. of the Syst. Nat., p. 1189, we have a *Voluta pallida*, referred to the *Voluta pallida* of the Mus. Lud. Ulr., and also to List. Conch. t. 714, f. 70a, and Adanson's t. 5, f. 3. The latter author's figure is that of the 'simeri,' i. e. *Marg. exilis* Gm.; the reference in Lister is to three figures, one of which might possibly be guessed to be *Marg. lactea* Kiener, one is probably *Bulinella cylindracea* Pennant ('Barnstable'), and the third is hopeless. Under the circumstances we have no choice but to discard the name *pallida* L. altogether. Many authors have already recognized that the Linnaean name is untenable and solve the difficulty by using *pallida* as of Donovan (Nat. Hist. Br. Shells, 2, pl. 66, 1801 [*sic*¹]). Donovan figures the West Indian shell well and clearly and refers back to Mus. Lud. Ulr., p. 588. But this usage is likewise untenable on account of the unidentifiable *Bulla pallida* of Linne's 10th. ed. and as I have not cognizance of a later synonym, I now rename the shell represented by Donovan (l. c.) and by Sowerby, Thes. Conch., 1, pl. 76, f. 108, *Marginella tenuilabra*."

I am in sympathy with Tomlin's dissatisfaction with the various Linnaean descriptions of *pallida*, even the description in the twelfth edition of the "Systema." In that diagnosis Linnaeus did cite a very bad figure from Adanson, although he probably based this reference on Adanson's excellent text rather than on his figure. Moreover, Linnaeus' description calls the shell "oblongo-ovata," which is something less than apt for this cylindrical, or at least subcylindrical, shell. Then, too, the word "elevata" is too strong to describe its low, obtuse spire. The description is, however, no worse than many of Linnaeus' descriptions and is better than some that we accept without question, and I am convinced that in the twelfth edition he was in fact describing the *pallida* of the West Indies. I am opposed to abandoning a Lin-

¹ The second volume of Donovan's work is dated "1800."

naean name except for the most cogent reasons, which I suggest are not present in this case, and prefer to cite the species as *Marginella pallida* (Linné), 1767.

Marginella pallida is essentially a West Indian shell. Reeve (1843–1878, vol. 15, *Marginella*, pl. 17, sp. 86) cited it from the West Indies alone, as did George Sowerby (1847–1887, vol. 1, p. 390) and Tryon (*loc. cit.*). Da Costa (1778, p. 31, pl. 2, figs. 7, 7, two figs.) had reported it from the west coast of England, but Jeffreys (1862–1869, vol. 4, p. 417) showed that Da Costa had confused it with *Bulla cylindracea* Pennant.¹ As to whether the species exists in west Africa, as Linnaeus stated, the question has recently been raised by Fischer-Piette. A shell from Senegal was described by Adanson (p. 78, pl. 5, figs. numbered 2) as "le Falier." These figures cannot be taken to represent the *pallida* of the West Indies. However, Fischer-Piette and his collaborators, in their examination of the collection which Adanson retained (see p. 53, above) found a tray marked "falier, hist. nat. du Seneg. pl. 5," which contained nine specimens of the West Indian *pallida* (Fischer-Piette and others, 1942, p. 184). This tray, with its contents are reproduced in the paper by Fischer-Piette and his co-authors (pl. 4, fig. 5). I have already mentioned (p. 54) the possibility that Adanson had introduced foreign shells into his Senegal collection, and this seems to confirm the possibility, although there is no evidence in the collection or in Adanson's writings that these specimens were not collected in Senegal.

¹ *Bulla cylindracea* Pennant is somewhat similar to *pallida*, except that it is much more cylindrical, and indeed Donovan (1799–1803, vol. 2, pl. 66, and text), who also reported it from the English west coast, referred it both to the *pallida* of the "Museum Ulricae" and of the twelfth edition of the "Systema." The figures on Donovan's plate 66 cannot be distinguished from the *pallida* of the West Indies. In a later volume, however, he accurately refigured it, as *Bulla cylindrica* (vol. 4, pl. 120, fig. 2) as an extremely cylindrical shell, and corrected his earlier text, saying: "This is a very scarce species on our coasts, and approaches so nearly to *Bulla pallida* of Da Costa (*Voluta pallida* Linn.) described and figured in plate 66 of this work, that it may easily be confounded with it, unless the two shells be compared. . . . In the description of the *Voluta pallida* we were led to think with Da Costa, that the shell figured by Pennant in the British Zoology, no. 85A might be of the same species . . . there can be no impropriety in removing the reference from the former to the present species."

Adanson's description clearly covers the West Indian shell, and, while the tray containing the specimens bears a legend referring to the tenth edition of the "Systema," the unlikelihood of a migration across the Atlantic must not be ruled out entirely. Our *pallida* and the Adanson specimens do not represent geographical races, as these might be expected to show certain evolutionary or ecological differences. They are apparently identical in every respect, and, unless we are prepared to admit a long-continued migration across the ocean, by whatever means, which resulted in no morphological differences in the shell characters, we must admit that the Adanson specimens were obtained from the western Atlantic. Fischer-Piette and his co-authors are of this opinion, saying (1942, p. 185), "Adanson described the animal of Falier with precision; now, *Marginella tenuilabra* is an Antillean species which no other author has cited from Africa. . . .² We must assume that Adanson made his notes on the animal from a specific specimen, and then described, as belonging to this species, some shells coming from the Antilles and inadvertently mixed in his Senegal collection."

The *pallida* of authors, by whatever name it should be called, is now placed in *Marginella* Lamarck, 1799, and is generally included in the subgenus *Neovolvaria* Fischer, 1883. It was formerly in *Hyalina* Schumacher, 1817, the type species of which is *H. pellucida* Schumacher, by monotypy. It is not certain whether Schumacher's type was a new name for *pallida* Linné. Martini's figure (1769–1777, vol. 2, p. 108, pl. 42, fig. 426), on which Schumacher's type was based and which Martini called *Cochlis volutata*, not only makes it clear what group Schumacher intended to name but seems to the present writer to portray *pallida* to the exclusion of any other species. Indeed, Martini referred to Adanson's "le Falier" for his species.

Under several recent classifications *Neovolvaria* Fischer, 1883,³ is used as a subgenus

² However, the first localized report of the species, that of Linnaeus in 1767, placed it in the "Oceano Africano."

³ Fischer's "Manuel de Conchyliologie" was published in parts between 1880 and 1887, the part containing the proposal of *Neovolvaria* appearing in 1883. The complete work appeared in a bound volume bearing the date 1887 on the title page.

of *Hyalina*, but Fischer originally erected it as a section of subgenus *Volvarina* Hinds, 1844. *Voluta pallida* is its type species, by monotypy.

The present species is figured by Reeve (1843-1878, vol. 15, *Marginella*, pl. 17, sp. 86). Crouch's figure (1827, pl. 19, fig. 15) is an accurate pencil drawing, the best of the uncolored figures of this shell.

It is not *Voluta pallida* Gray, 1834 [*Amoria* (*Amoria*) *grayi* Ludbrook, 1953, p. 136].

Voluta faba

1758, *Systema naturae*, ed. 10, p. 730, no. 355.

1767, *Systema naturae*, ed. 12, p. 1189, no. 406.

LOCALITY: "In O. Africano" (1758, 1767).

"V. testa submarginata ovata laevi supplicata, spira prominente, columella quadriplicata, labro marginato crenulato . . . Testa postice vix emarginata, sed margine tenuiore et arcuato notata."

The entire diagnosis of this species is identical in both editions of the "Systema" except for the addition of the word "submarginata" in the twelfth.¹

The description of *faba* is not entirely characteristic, but the single figure cited (Gualtieri, pl. 28, fig. Q) clearly represents the *faba* of authors, agrees with most details of the description, and conforms to the ostensible type in the collection, which, although unmarked, is the only specimen present that so conforms. The species may therefore be said to be pictorially defined and represented by a "probable" specimen in the collection. A single detail in the description should be noted. The columella is said to be "quadriplicata." The anterior "plait" in some species of *Marginella* appears to come from a different source than the plaits above it, in that it arises from the more or less sharp edge of the left side of the outlet or rudimentary canal

¹ A word describing the edge of the aperture, such as "integra," "emarginata," "submarginata," and the like, was added by Linnaeus to many of the *Voluta* species, particularly in the first three of his so-called "subgeneric" divisions, and the descriptions of these divisions were amended accordingly in the twelfth edition. An examination of these "subgeneric" descriptions, as well as of the descriptive added word in several of the species, discloses that Linnaeus had badly conceived the contents of the groups, particularly the group containing the marginellas, and that he was sometimes inaccurate in choosing the proper word for a species. The specific descriptions must be read with this in mind.

rather than from the columella proper. This lowest member might well in such species be called the "false plait" or "basal ridge." I suggest that both *faba* and the next species (*glabella*) fall into this category. It has already been noted that Linnaeus, as well as later conchologists, was inconsistent in counting the number of plaits, and that describers of species of *Marginella* are not agreed as to whether to count this lowest irregularity of the inner lip as a "plait" or not. Much of the difficulty in separating species and in citing figures for them has, I suggest, stemmed from this lack of unanimity.

The stated locality of *faba*, "O. Africano," is correct. It is a Senegal species and is one of the few Linnaean marginellas that has not been frequently reported from the western Atlantic.

It is strange that neither Martini nor Chemnitz referred any of his species to *faba*, which was a well-known and common shell in contemporary collections. Two of Martini's figures, however (1769-1777, vol. 2, pl. 42, figs. 432-433), should plainly be referred to *faba* and have been frequently cited for it. Martini's text described the shell in terms that only partially suggest *faba* (*tom. cit.*, p. 113), but one of the figures he cited for it was the same Gualtieri figure (pl. 28, fig. Q) that was cited by Linnaeus.

The species is now placed in *Marginella* Lamarck, 1799. Tryon places it in the subgenus *Glabella* Swainson, 1840, of which it is the type species, by monotypy. It is figured in Reeve (1843-1878, vol. 15, *Marginella*, pl. 7, sp. 24a, b), in Tryon (1879-1888, vol. 5, pl. 6, fig. 91), and in the "Tableau encyclopédique" (1798, pl. 377, figs. 1a, b). These last figures are extraordinarily clear and characteristic of *faba*. The plate heading is "*Mitra*," as the plate was published one year prior to Lamarck's erection of the genus *Marginella*.

It is not described in the "Museum Ulrica," and the collection of Queen Louisa Ulrica at Uppsala does not contain a specimen.

Voluta glabella

1758, *Systema naturae*, ed. 10, p. 730, no. 356.

1767, *Systema naturae*, ed. 12, p. 1189, no. 407.

LOCALITY: "In O. Africano" (1758, 1767).

"V. testa integerrima ovata laevi, spira laevi-

gata, columella quadriplicata, labro gibbo-marginato denticulato . . . Testa postice vix ac ne vix quidem emarginata, sed margine undique crasso circumdata; variat labro dentato."

The word "integerrima" and the final phrase "variat labro dentato" were added in the twelfth edition, and the word "antice," immediately preceding the phrase "gibbo-marginato denticulato" in the tenth edition was omitted.

The added word "integerrima" is in direct conflict with the rest of the description, which describes the lip as "denticulato" in both editions. Linnaeus partially reconciled this inconsistency by adding "variat labro dentato," but the present author has not seen a specimen of *glabella* that did not show a denticulate or crenulate lip. Otherwise the description is an adequate definition of the species.

The synonymy is only partially correct. The sole figure cited in the tenth edition (Gualtieri, pl. 28, fig. L) only vaguely suggests the *glabella* of authors, although it was called *glabella* in Gualtieri's accompanying text. It gives no hint of the decoration of the shell and shows no basal outlet. Of the figures added in the twelfth edition, the one from Buonanni (pt. 3, pl. 326) is not identifiable as *glabella*, as it shows only two plaits, and the outer lip is sharp. It pictures a sinistral shell as do so many of Buonanni's drawings. The Klein figure (pl. 5, fig. 92) is apparently a copy of a very poor Lister figure (pl. 818, fig. 31), although it was cited for *glabella* by Lamarck (1822b, p. 355). It has only two plaits. In the notes for the "revised twelfth edition" of the "Systema" Linnaeus added this Lister figure, which, while it was probably meant for this species, was not the same shell as is described in Lister's accompanying text under "no. 31." The figure from Adanson (pl. 4, fig. 1) is characteristic and is one of the unmistakably correct drawings in that work. The proper number of plaits are shown, and the color pattern is indicated as well as the crenulation of the lip.¹ Adanson, however, was not consistent.

¹ This species has three well-defined plaits plus a very distinct and sharp basal ridge parallel to the plaits. This was evidently considered by Linnaeus to be counted as a "plait" (see p. 89).

In his description of the shell (1757, p. 57) he first described the "basal ridge" or "false plait," saying that the base "in bending around into (en se repliant sur) the left lip, forms there a long tooth which extends into the interior of the shell." In the same paragraph he said: "The left lip is swollen, rounded and adorned with *four* large teeth *between its upper section and the middle*" (italics mine). Not only is the position of the plaits wrongly stated, but he seems to imply that the shell has four plaits in addition to the basal ridge.

No specimen of *glabella* is found in the Linnaean collection, and, while the name appeared on Linnaeus' original list of owned species, it was not on his final list, which suggests that the type had been lost. Thus, in the identification of the species, we are given a partially inconsistent description, a correct locality, and two out of four figures which represent the shell with more or less clarity. The evidence is not so satisfactory as we would wish but has been accepted by all conchologists.

The description does not mention the color, or color pattern, of the shell. While this is somewhat variable, the color forms tend to fall into two main groups: those with a flesh-colored or tan background thickly sprinkled with small whitish spots or dashes and with three deeper brown bands encircling or partially encircling the body whorl, and those in which the white spots are lacking in all or some areas of the shell and are replaced in those areas by an irregular white mottling, the darker bands being invaded by the white blotches. All combinations of color detail between these two extremes are found.

The species belongs in the genus *Marginella* Lamarck, 1799, of which it is the type species, by monotypy, and in the subgenus *Glabella* Swainson, 1840. Röding (1798, p. 51) listed it in his very comprehensive genus *Pterygia* under its Linnaean specific name. *Pterygia* has, however, been restricted to the group of *Voluta dactylus* Linné (see p. 78, above).

The figures in the "Tableau encyclopédique" (1798, pl. 377, figs. 6a, b) are the best of the early figures of this species. They show two of the color forms. The species is

figured by Reeve (1843–1878, vol. 15, *Marginella*, pl. 1, sp. 1); see also G. B. Sowerby (1847–1887, vol. 1, pl. 72, figs. 52–53) and Tryon (1879–1888, vol. 5, pl. 5, figs. 57–58).

The description of the species in the "Museum Ulricae" first copied the description in the tenth edition, referred to it by page and number, and cited the Gualtieri figure used in the "Systema." The remainder of the description supplies more detail but is merely confirmatory of the accepted identification. It should be noted that it is silent as to whether the lip is entire or denticulate. Hanley (1855, p. 220) admitted that this description conformed to the characteristics of the *glabella* of authors, but added that the details "from their paucity might suit more than one species." He must have referred merely to the lack of details as to the outer lip, as otherwise the description is adequate.

A serious mixture in the Uppsala collection has, however, occurred. Nils Odhner advises me (personal communication) that in 1927 the specimen there marked for *Voluta glabella* was a specimen of *Marginella limbata* Lamarck, 1822. Recently, in editing the microfilm of the collection that was being prepared for the author, he found that a specimen of *Nerita peloronta* was in the tray marked for *glabella*. I have already referred to the fact that the earliest labels found with the collection were post-Linnaean, and that Linnaeus himself had not supplied any labels whatever. The case of *Voluta glabella* affords a striking example of another handicap encountered in discussing Linnaeus' types in the "Museum Ulricae."

Voluta reticulata

1767, Systema naturae, ed. 12, p. 1190, no. 408-

LOCALITY: Not given.

"V. testa ovata decussatim subsulcata, labro interne striato, columella subperforata . . . Testa magnitudine pruni, albo luteoque varia, ovata, oblongiuscula sulcis obsolete longitudinalibus transversalibusque striata. Apertura alba, effusa labro anterie transversim sulcato. Columella plicis aliquot geminatis. Cauda brevis, subperforata."

After a study of the many inadequately or equivocally described species in the "Systema," it is a relief to read the eminently satisfactory description of *reticulata*. No im-

portant diagnostic feature of the shell is omitted, and it is among the best of Linnaeus' descriptions of mollusks. A detailed discussion of it is unnecessary, as it contains no errors or confusing language. Although no locality is supplied, it is supported by a fairly accurate figure (Argenville, 1742, pl. 20, fig. M),¹ although the figure does not show the aperture.

That Linnaeus owned the shell is shown by its appearance on his list, and therefore the specimen of the *Cancellaria reticulata* of authors in the Linnaean collection, which alone of all the specimens in his cabinet conforms to the description, may be taken as the ostensible holotype. It is interesting to note that Linnaeus apparently failed to perceive its close generic affinity with *Voluta cancellata* no. 413, as it is separated from that species by four other names now belonging in three other genera in Volutacea, i.e., *Columbella*, *Mitra*, and *Engina*. Even in a later note for Linnaeus' proposed "revised twelfth edition," the author wrote "Locanda post 431," which would have moved it to a position immediately after *V. turbinellus* in the group of species now in *Vasum* Röding.²

One of the important diagnostic features of *V. reticulata* is the apparently bifid character of the upper (posterior) columellar plait. This plait is not only more highly developed, longer, more horizontal, and more shelf-like than the one immediately below it but carries a sulcus along its anterior face, producing the appearance of a secondary but coalescing plait below the sulcus. This section of the plait is much shorter than the upper section. Linnaeus referred to this feature in

¹ The only copy of Argenville's work owned by Linnaeus must have been the 1742 edition, as is shown by his manner of citation. In the second edition of 1757 the plates are renumbered, although the make-up of the individual plates remained the same, and post-Linnaean writers, almost without exception, referred to this later edition. Workers interested in the iconographies of the predecessors and contemporaries of Linnaeus may be confused by not finding the proper figures in the edition at their disposal.

² *Cancellaria* has, however, a certain gross affinity with the turbinellids because of its rudimentary canal, and in the Lamarckian system it is placed in the group of families Lamarck called Canalifera. Lamarck commented on this affinity (1822b, p. 211).

the words "plicis aliquot geminatis."¹ The twinning is much more noticeable in *Cancellaria conradiana*, a closely related species and one almost identical with *reticulata* except for very minor differences. Abbott (1954, p. 252) is of the opinion that "*C. conradiana* Dall is probably only a form of this species." It is suggested that the decided tendency of *conradiana* to produce twinning in all its columellar plaits may turn out to be a specific character. In a fossil specimen in the writer's collection the "anterior edge of the pillar," mentioned by Dall in his description as being "sharp and prominent," is visible winding into the aperture as a plait only slightly less developed than the two folds above it, and all three are deeply and decidedly twinned. *Cancellaria conradiana* is found Recent only at considerable depths but is fairly common in the Florida Pliocene.

The first post-Linnaean writer to suggest a locality for *reticulata* was Martini (1769–1777, vol. 3, p. 452, pl. 121, figs. 1107–1109). He stated it to be "the West Indies and the coast of Guinea." Gmelin used "the American Ocean and Guinea," and Lamarck, "the southern Atlantic." The African locality was soon dropped and the species restricted to its true range in the western Atlantic, from Cape Hatteras to the northern coast of South America, including both coasts of Florida.

It is placed in the genus *Cancellaria* La-

¹ If Linnaeus correctly used the word "aliquot," his phrase is misleading, as it must be translated "some of the plaits twinned." This would mean that he considered that the species had more than two plaits and that the lower fold was also bifid. I have seen specimens in which this lower plait bears a suggestion of twinning, but this appearance is rare. As to the number of "plaits," in shells having a plaited columella it is often difficult to decide whether the one nearest to the base should be considered a true plait or a mere extension of the curved base of the shell as it blends into the columella. In species such as those in the Auriculae, in which the outer lip and base are so continuous as almost to justify the use of the word "peristome," I suggest that the phrase "columellar plait" should not be used for the lowest member. In others, the lowest member is so distant from the base and often so apparently unrelated to it that it would be correct to include it as a plait. There are, of course, many borderline cases, and therefore it should be the duty of authors in describing new species to be specific in stating just what they mean by plaits. Not only Linnaeus but many modern writers have written misleading descriptions in this respect, which often add greatly to the difficulty of identification.

marck, 1799, of which it is the type species, by monotypy. The Cancellariidae have been subdivided by many systematists, including H. and A. Adams, Crosse, Tryon, Jousseaume, and Cossmann, and more recently by Thiele and, for the American Pliocene species and the American West Coast Recent species, by Olsson and Strong,² respectively. The wide divergence between these arrangements and the failure of some of them to take account of the relationships between the fossil and Recent species make it evident that the group is in need of much further study. Three groups of cancellariids have, however, been recognized by most workers: *Cancellaria* Lamarck, *Trigonostoma* Blainville, 1826, and *Admete* Moller, 1842. Both of the cancellariids in the "Systema" belong in the typical subgenus of the first of these.

Good figures of this common and distinctive species are plentiful. It is figured by Reeve (1843–1878, vol. 10, *Cancellaria*, pl. 1, sp. 3) and Tryon (1879–1888, vol. 7, pl. 2, figs. 25–26). Crouch's figure (1827, pl. 17, fig. 6) is the most characteristic of the uncolored drawings of the shell.

It is not described in the "Museum Uricae," and no specimen labeled for it is found in the Queen's collection at Uppsala.

Voluta mercatoria

1758, Systema naturae, ed. 10, p. 730, no. 357.

1767, Systema naturae, ed. 12, p. 1190, no. 409.

LOCALITY: "In M. Mediterraneo" (1758, 1767).

"V. testa emarginata ovata striata, spira obtusata, columella retusa dentata, labro gibbo denticulato . . . Simillima insequenti, a qua differt, quod crassior, brevior, nitidius colorata albo luteoque, saepe etiam cingulo ferrugineo articulato notata, sed imprimis, quod transversim striata, striis elevatis subtuberculatis."

² Strong's paper, "A review of the eastern Pacific species in the molluscan family Cancellariidae," was left in manuscript and unfinished at the time of his death in 1951. It is being published as it stands, without completion or editing, in the Minutes of the Conchological Club of Southern California, through the courtesy of Dr. Leo G. Hertlein of the California Academy of Sciences who collaborated with Strong in much of the latter's work. At the time of the writing of this note the following parts have appeared: Minutes 135, January, 1954, pages 7–14; Minutes 136, February, 1954, pages 16–18; Minutes 137, March–April, 1954, pages 28–32; Minutes 138, May, 1954, pages 44–47; Minutes 139, June, 1954, pages 56–59.

The above description, as is the description of the previous species, is one of the best in the conchological portion of the "Systema." Read in connection with that of the following species (*Voluta rustica*) it is an adequate definition of the *Columbella mercatoria* of all authors. The Mediterranean locality is erroneous. It is primarily a western Atlantic species, although it has been reported from the Canary Islands by Dautzenberg (1890, p. 153). Adanson described it as from Senegal under the name of "le Staron," and in fact specimens of it were found in the Adanson collection by Fischer-Piette (Fischer-Piette and others, 1942, p. 233). While Adanson described and figured several species from the western Atlantic which only doubtfully exist in west Africa, as he was the only writer so reporting them, Fischer-Piette and his co-authors (*loc. cit.*) are inclined to concur in the case of *mercatoria*, saying, "Its presence in Senegal should be considered as very probable." An undocumented specimen of *mercatoria* is found in the Linnaean collection and was undoubtedly Linnaeus' type, as it completely and uniquely conforms to his description. Both of the figures cited in the synonymy (Petiver, pl. 9, fig. 4; Gualtieri, pl. 43, fig. L) are reasonably accurate figures of *mercatoria*, although it is dangerous to put too much faith in the early figures of any of the *Pyrene* or *Columbella* species, as several of them are differentiated from one another by details too elusive to be reproduced adequately except by careful photography.

The genus *Pyrene* was erected by Röding (1798, p. 134) with a single species, *P. rhombiferum*, which, according to Winckworth (1945, p. 144), is synonymous with *Buccinum punctatum* Bruguière, 1789, which thus becomes the type species, by monotypy. Other synonyms are *Voluta discors* Gmelin, 1791, and *Columbella semipunctata* Lamarck, 1822. The type species is usually stated as *Voluta discors* Gmelin, apparently on the theory that the earlier Bruguière name is not a synonym of Röding's *rhombiferum*. The genus *Columbella* was proposed in the following year by Lamarck (1799, p. 70) with *Voluta mercatoria* as type species, by monotypy. Until the "Museum Boltenianum" came to the renewed attention of conchologists in 1906, and was accepted by the International

Commission on Zoological Nomenclature in Opinion 96 as "nomenclatorially available," *Columbella* Lamarck was almost exclusively used for all the species of both *Columbella* and *Pyrene*. The two groups are, however, clearly differentiated by the relative extent and strength of their sculpture. All species of *Columbella* bear rather deep spiral striations over the entire shell, including the spire, while the *Pyrene* species are either smooth or with striae, usually shallow and sometimes hardly visible, confined to a small area near the base. Opinion is still divided as to whether *Columbella* should not be considered a subgenus of *Pyrene*. Most workers, however, are properly reluctant to disregard the long-employed Lamarckian genus and feel that the sculptural and other differences justify giving generic rank to both. In this paper both are treated as good genera.

The family Pyrenidae, in the arrangement of Grant and Gale (1931, pp. 679-704), the most recent commentators on the family, contains the genera *Parametaria* Dall, 1916, *Microcithara* Fischer, 1884, *Anachis* H. and A. Adams, 1853, *Murella* Risso, 1826, *Strombina* Mörch, 1852, *Amphissa* H. and A. Adams, 1853, *Cosmioconcha* Dall, 1913, and *Aesopus* Gould, 1860, in addition to *Pyrene*.¹ This list includes genera perhaps too differentiated to be grouped in one family, and Grant and Gale apparently justify their inclusion by the fact that most of them are clearly connected by borderline species. They say (p. 679): "Some species possess some of the characters of two or even three genera, and their assignment to any one genus becomes a matter of personal opinion." While their classification of the family has not been universally adopted, their pages on this group should be read, although they include only the fossil and Recent species from the west coast of America.

Later synonyms of *Pyrene* Röding include *Conella*, *Pusiostoma*, and *Conidea* Swainson, 1840, at least in part. *Columbus* Montfort, 1810, is an exact synonym of *Columbella* Lamarck and also has *Voluta mercatoria* Linné as its type species, by monotypy. Woodring (1926, p. 272) proposed the name *Eurepyrene*

¹ Grant and Gale use *Columbella* as a subgenus of *Pyrene*.

for those species that, among other differences, have a more patulous aperture than *Pyrene*, *sensu stricto*, lack the inward bulge of the outer lip, and have lirations on the outer lip instead of teeth. *Eurepyrene* is only found fossil.

Köding's conception of the generic position of the present species was quite different from the modern placement. It was not placed in *Pyrene* but in his *Pterygia* (1798, p. 51) as *Pterygia vulgaris*. Iredale's attempted designation of the latter species as the type of *Pterygia* is referred to above under *Voluta dactylus* (p. 78).

Synonyms of *mercatoria* include *Columbella rudis* Sowerby, 1844, which Reeve figured as *C. peleei* "Kiener," although Kiener's *peleei* is a different shell; *C. zulmis* Duclos in Chenu, 1848; and *C. affinis* Risso, 1826. Tryon (1879-1888, vol. 5, p. 106) cited *C. gualteriana* Risso, 1826, as a synonym, although with a query.

It was long before the fact that the species was confined to the western Atlantic was recognized.¹ Martini (1769-1777, vol. 2, pp. 118, 130, pl. 44, figs. 452-458) was even more vague than Linnaeus, giving the locality as the Mediterranean Sea, the Indian Ocean, the island of Gorea (Senegal), and Jamaica. An American locality had already been suggested by Petiver who called it "the American Olive" (No. 578, pl. 9, fig. 4). Gmelin located it in the Mediterranean, Ethiopian, American, and Indian seas, saying that it was "*rusticae affinis*," a remark that throws some light on the confusion of the early writers as to both *mercatoria* and *rustica* (the next species) as is noted below. Lamarck (1822b, p. 294) reported it from the Antilles but added the west African coast. The first author to confine the species to the western Atlantic was G. B. Sowerby. In 1847 (1847-1887, vol. 1, p. 115) his only locality was "common in the West Indies."

Voluta mercatoria is figured in Reeve (1843-1878, vol 11, *Columbella*, pl. 10, sp. 47). An excellent color photograph of a series of specimens showing color varieties is found in Platt (1949, pl. 74, fig. 8) which,

¹ The exclusiveness of the western Atlantic locality is limited by the possibility expressed by Fischer-Piette and his co-authors (p. 93, above) that the species may be found in Senegal.

however, does not show any view of the aperture. Photographs of the dorsal and apertural aspects of the shell are given by Maxwell Smith (1941, pl. 46, figs. 8a, b).

It is not described in the "Museum Ulricaе," and no specimen is present in the Queen's collection at Uppsala.

Voluta rustica

1758, *Systema naturae*, ed. 10, p. 731, no. 358.

1767, *Systema naturae*, ed. 12, p. 1190, no. 410.

LOCALITY: "In M. Mediterraneo" (1758); "in M. Mediterraneo, Africano" (1767).

"V. testa emarginata ovata laeviuscula, spira prominula, columella retusa denticulata, labro gibbo denticulato . . . Differt a Praecedente quod non striata; convenit columella planiuscula utrinque denticulata et labro introrsum gibbo; ludit coloribus variis, sed tristioribus."

The description of *rustica* is equally as good as that of its relative *mercatoria* which immediately precedes it, and the specific differences separating the two are clearly brought out in the descriptions. "Laeviuscula" is used in the place of "striata" and "spira prominula" instead of "spira obtusata." In the subdescription it is again specifically stated that it differs from *mercatoria* in not being striated, and its color pattern is said to be varied but "tristior," in contrast to the more brilliant colors of *mercatoria*.

The three figures to which Linnaeus referred, while all show *Pyrene* species, are not all *rustica*. The Adanson figure (pl. 9, fig. 28), which is described by its author as being "sulcata," must therefore have been used by Linnaeus as a mere approximation to his species, although it is curious that he used it, in the face of the word "laeviuscula" in his description, rather than for the preceding species. Hanley (1855, p. 221) commented that the figure must be discarded, not only because of its sculpture, but because of "the African locality, attached to the species from its supposed identity with that Senegal shell." This comment is not clear. I am unable to identify with any assurance the species that Adanson figured, but it appears, at least, that Hanley was not aware that *rustica* occurs on the west coast of Africa as well as in the Mediterranean. Two Gualtieri figures were cited by Linnaeus (pl. 43, figs. G and H). Figure H is certainly the

Pyrene rustica of authors and conforms to Linnaeus' description. I share Hanley's feeling that Gualtieri's figure G is unrecognizable. Nothing in the Linnaean collection is labeled *rustica*, although several specimens of the *rustica* of authors are present. Inasmuch as *rustica* appears on Linnaeus' list of owned species, these specimens are at least the ostensible types, as they uniquely conform to the description. A further figure (Lister, pl. 824, fig. 44) was added by Linnaeus in a manuscript note. This figure, said to be based on a specimen from the Mediterranean, is a *Pyrene* but is too crude to be specifically identifiable.

Although Linnaeus correctly located the species, his followers were strangely vague as to locality. Martini (1769-1777, vol. 2, p. 138, pl. 44, figs. 469-470) listed a species that he referred to *rustica* Linné and supplied two recognizable figures, but added Barbados to Linnaeus' locality, citing Petiver, who had called the figure *Olivaris barbadensis*, as his authority. Gmelin (1791, p. 3447) reported it from Mediterranean, Ethiopian, and American waters. He divided the species into nine lettered varieties, and among his many references cited 10 figures from Martini's plate 44, only two of which (mentioned above) can be cited for it. He mentioned a long list of color patterns. Undoubtedly his broad geographical range was the cause of his broad conception of the species and his supposed "varieties." Lamarck (1822b, p. 293) was even more vague. He omitted the Mediterranean entirely and located the species in the "Atlantic Ocean and the Antilles." His synonymy was better than Gmelin's, however, as he cited one of the two good Martini figures (fig. 470). In the second edition of Lamarck (Deshayes and Milne-Edwards, 1835-1845, vol. 10, p. 267), the editors did not comment on Lamarck's localities except to say in a footnote: "We have had occasion to observe *Columbella rustica* in a wide variety of locations (sur une grande étendue de côtes) and we are assured, based on a great number of varieties, that the elongate individuals do not represent a distinct species." While *rustica* does vary in elevation and acuteness of its spire, it is not possible to determine whether or not these authors, as well as Gmelin and Lamarck,

had confused *rustica* with one or more of the distinct high-spined species from localities in which *rustica* does not exist. It is suggested that all these early writers, when they were not merely referring to Petiver's Barbados report, were basing their western Atlantic locality on the common *Pyrene rusticoides* (Heilprin), 1887, from Florida and the West Indies, which greatly resembles the high-spined and spotted form of *rustica*.¹ George B. Sowerby, in 1847 (1847-1887, vol. 1, p. 144), was apparently the first writer to confine *rustica* to eastern waters and to omit an American locality, just as he was, I believe, the first to confine the preceding species (*mercatoria*) to the western Atlantic. However, even after his correct restriction of locality, some writers continued to report *rustica* from American locations.

The *rustica* of the Mediterranean is well described and figured by Bucquoy, Dautzenberg, and Dollfus (1882-1898, vol. 1, fasc. 2, p. 71, pl. 12, figs. 30-31, the typical form, and figs. 32-37, the varieties) as *Columbella rustica*. Among the non-typical forms, figures 32 and 33 represent the high-spined form, which, as said above, strongly suggests the American *rusticoides* and which these authors called "var. *elongata* Philippi." The latter shell was described by Philippi (1835, 1844, vol. 1, p. 228) as *rustica*, var. β , as follows: "fusiformis, spira acutissima, of the same color as var. α [the typical low-spined form]."² Bucquoy, Dautzenberg, and Dollfus added that the varieties were not found in the area with which their book was concerned (the Roussillon) and that most of them were confined to the African coast of the Mediterranean.

The synonymy of *rustica* is enormous, as might be expected in the case of such a vari-

¹ "*Columbella*" *rusticoides*, which was described by Heilprin as a fossil from the Florida Pliocene, is also a fairly common Recent shell on the west coast of Florida, the Florida Keys, and Cuba. It has been called *rustica* by many American collectors, and, indeed, Heilprin supposed his fossil to be more nearly related to the European *rustica* than to the Recent American species. It cannot, however be united to *rustica* Linné.

² Philippi added: "This variety, which is frequently collected here [Sicily], is the *Mitra tringa* Costa, p. 72 and 74, no. 5, and possibly (forte) *Voluta tringa* Gm. p. 3449." This quotation from Philippi is further referred to below in the discussion of *Voluta tringa* Linné (p. 102).

able species, and is too long to be given here. Many synonyms are listed by Tryon (1879–1888, vol. 5, p. 107). The species falls in the genus *Pyrene* Röding, 1798.

In addition to the figures already cited, the species is figured by Reeve (1843–1878, vol. 11 *Columbella*, pl. 23, sp. 211a, b) and by Kiener (1834–1850, vol. 4, pl. 2, figs. 1–2, for the low-spired form, which he called "*rustica* var.," and pl. 1, fig. 3, for the high-spired form, which he conceived to be the "typical" shell).

Voluta rustica is not described in the "Museum Ulricae," and no specimen is present in the Queen's collection in Uppsala.

Voluta paupercula

1758, *Systema naturae*, ed. 10, p. 731, no. 359.

1767, *Systema naturae*, ed. 12, p. 1190, no. 411.

LOCALITY: "In M. Mediterraneo" (1758, 1767).

"V. testa integra ovata laeviuscula basi striata, spira prominula, columella quadriplicata, labro obtusato . . . Testa ferruginea, nigra lineis albis, longitudinalibus subrepandis. Statura duarum praecedentium."

The only details of the above description of 1767 that were lacking in the tenth edition are the useful word "integra" and the concluding phrase "Statura duarum praecedentium."

The description is universally accepted, standing alone, as describing the well-known *Mitra paupercula* of all authors. It is a characteristic description with one possible exception. The phrase covering the size of the shell, added in the twelfth edition, is somewhat equivocal. The much smaller size of the two preceding species, as compared with the normal adult *paupercula*, suggests that Linnaeus' type was either a young shell or an abnormally small adult. Such dwarfs are occasionally seen, although the normal size of *paupercula* is comparatively constant, ranging from 25 to 30 mm.

The locality is incorrect, as *paupercula* in an Indo-Pacific species with a very wide range, being found from the Red Sea eastward to Polynesia. The single figure cited in the tenth edition (Gualtieri, pl. 54, fig. L) is a satisfactory picture of the species. The Buonanni figure added in the twelfth edition is completely erroneous, as it does not show the longitudinal color pattern of *paupercula*

and was, in fact, again cited for the next species (*Voluta mendicaria*) which it more nearly resembles. Although the identification of the species with the *paupercula* of authors is not perfect, we may say that it was acceptably defined both descriptively and pictorially.

Martini did not list or figure any shell resembling *paupercula*. Chemnitz (1780–1795, vol. 4, p. 227, pl. 149, figs. 1386–1387) described and figured a *Turricula pauperum* and referred, among other references, to the "Systema" shell and to the Gualtieri figure cited by Linnaeus. His figures are unmistakably *paupercula* and are as clear and well drawn as any figures of the species before the advent of photography. He located it in the Nicobar Islands, thus correcting Linnaeus' locality. Chemnitz also referred to Born's description of *Voluta paupercula*, written in the same year (1780) as the Chemnitz description.¹

In the tenth volume of the Martini-Chemnitz work (*op. cit.*, p. 163, pl. 150, figs. 1417–1418) Chemnitz described and figured a *Voluta paupercula adornata* from the East Indies. The only significant difference in the description of this shell from Linnaeus' definition of *paupercula* is the phrase "labro denticulato, antice sinuoso." His figures show a shell with the color pattern of *paupercula* Linné but with the stripes more numerous and more undulating. The lip shows narrow transverse bands or dashes which may be intended for the denticulations mentioned in the description. The lip is, however, only very slightly sinuous, hardly justifying the use of that word in the description. I have not seen Chemnitz' two figures cited by any later author. The men-

¹ It should be noted that the majority of those who have described *paupercula* speak of the color pattern as consisting of white or yellow lines on a dark brown background, following Linnaeus' language. Lamarck (1811b, p. 215) was one of the few who reversed the color scheme, and spoke of its "dark brown, wavy, longitudinal lines." The species is variable in the respective width of the light and dark longitudinal zones, and it seems probable that Lamarck and the few who followed him in his conception of the pattern were describing their models accurately. There is evidence of this in the case of Lamarck, as he referred to the figures in the "Tableau encyclopédique" (1798, pl. 372, figs. 8a, b) which do show a preponderance of the white color.

tion of a toothed lip would seem to disassociate Chemnitz' shell from any form of *paupercula*. It is possibly the species that Lamarck (1811b, p. 217) called *Mitra retusa* and that Dillwyn (1817, vol. 1, p. 534) referred to as a "variety" of *paupercula*. It is quite distinct from the latter, however. It has a much more obtuse spire and shows a narrow white band around the middle of the body whorl and impressed spiral striae at its base. Its dark stripes are more numerous and narrower, and its lip is denticulate.

Lamarck (1822b, p. 317), who had called the Linnaean species *Mitra zebra* in 1811, changed it to *paupercula* in 1822 and added a "variety" [b] which he described as "penitus transversim striata." The word "penitus" may be translated as either "deeply striate" or "with all-over striations." He added that the lip was not sinuous. The latter detail alone might distinguish the "variety" from Chemnitz' *paupercula adornata*. For this "variety" he cited a pair of Chemnitz figures (1780–1795, vol. 11, pl. 178, figs. 1721–1722) which Chemnitz (p. 24) had called *Voluta pica*. These figures, which he cited with a query, show a more fusiform shell than *paupercula*, with what may be either striations or dark lines over the entire body whorl and with an outer lip which is not thickened, as is the lip of *paupercula*, and is not sinuous. The shell is obviously not related to *paupercula*, and Deshayes and Milne-Edwards (1835–1845, vol. 10, p. 331, footnote) suggested its removal from the synonymy of that species and its establishment as a distinct species. Chemnitz said it came from "the little Swedish Island Barthelemi, which lies in the Antilles." This is apparently the island of St. Barthelemy in the Leeward group, now owned by France. Both *pica* Chemnitz and *retusa* Lamarck were confused with *paupercula* by many of the early authors, but *retusa*, at least, is quite distinct. As for *pica*, the descriptions and figures available seem completely to disassociate it from *paupercula*. As far as I have been able to determine, no one since Dillwyn (1817, vol. 1, p. 534) has listed it as a good species. Tryon (1879–1888, vol. 4, Index, p. 232) merely referred to it as: "? = *M. paupercula*."

Linnaeus' *paupercula* belongs in the genus

Mitra Röding, 1798,¹ with *Mitra episcopalis* Röding [which is *Voluta mitra (episcopalis)* Linné, 1758] as type species, by subsequent designation, Winckworth, 1945. It is probably properly placed in the subgenus *Strigatella* Swainson, 1840, of which it is the type species.

It is figured by Reeve (1843–1878, vol. 2, *Mitra*, pl. 12, fig. 84). The figures in the "Tableau encyclopédique" (1798, pl. 372, figs. 8a, b) already referred to above, are clearly *paupercula* Linné and are called "*paupercula* α " in the "Liste." The "*paupercula* β " of the "Liste" is figured on the same plate (figs. 7a, b). They show a slightly smaller shell with narrower and more numerous stripes and a lip that is neither thickened nor sinuous. If Lamarck was correct in referring his "variety" [b] to the Chemnitz figures of *Voluta pica*, the "Tableau" *paupercula* β is a different species, as *pica* is said to have striations over the entire body whorl. The *paupercula* β of the "Tableau" seems merely a form of *paupercula*, as it is well within the limits of variation in the color pattern of that species. The details of its lip suggest that it is a young shell.

Voluta paupercula is not described in the "Museum Ulricaë," and no specimen of it is found in the collection in Uppsala. The Linnaean collection in London does not contain a specimen.

Voluta mendicaria

1758, *Systema naturae*, ed. 10, p. 731, no. 360.

1767, *Systema naturae*, ed. 12, p. 1191, no. 412.

LOCALITY: "In Asia" (1758, 1767).

"V. testa ovata substriata, spira obsolete granulata, columella subdentata, labro introrsum gibbo attenuato denticulato . . . Testa magnitudine seminis Phaseoli, atra, obsolete scabra. Anfractus ventris fasciis 3 flavis. Spira linea unica adscendente, anfractibus subnodosis; neque columella neque labrum dentatum est" (1758).

"V. testa submarginata ovata substriata,

¹ Up to comparatively recent times *Mitra* was credited to Martyn, 1784, by many writers, with the type species *Mitra tessellata* Martyn, 1784, by subsequent designation, Dall, 1905. Martyn's names are no longer accepted by most workers owing to his questionable status as a binomial writer. Some authors continue to cite the genus as of Lamarck, 1799, with *Voluta episcopalis* Linné as type species, by monotypy, but Röding's *Mitra* has one year's priority.

spira subgranulata, columella laevi, labro gibbo denticulato" (1767; subdescription as in 1758).

As seen above, the main description was rewritten in the twelfth edition, although the subdescription remained unchanged. There is at least one apparent conflict and one completely unexplainable conflict in the two descriptions. In the main description of the twelfth edition the columella is said to be "laevi." In the tenth it is "subedentula." In fact, the columella of the species is smooth, although not flat, throughout most of its length, but shows a well-developed protuberance or knob on its inner face which probably appeared to Linnaeus in 1758 as almost deserving the name of "tooth." Hence the vague term "subedentula." On his reëxamination of the species for the twelfth edition he must have decided that the feature could not be called a tooth and therefore omitted the quoted word. This feature should have been described, however, as it, in combination with the other details of the shell, is an important diagnostic factor. As to the lip, the conflict in the description is not cured. In the main description in both editions the lip is said to be "gibbo denticulato," although the language of the tenth edition modified this by the addition of "introrsum" and "attenuato." On the other hand, the subdescription in both editions states the exact opposite in the phrase "neque columella neque labrum denticulatum est." Unless this was an oversight, the diagnosis of this species must cast at least a scintilla of doubt upon the identification of the species. The lower two-thirds of the lip of *mendicaria* is, in fact, strongly but bluntly denticulate within, from three to five protuberances being seen, depending on the amount of callus present.

The synonymy is not helpful. All three figures cited show a small, dark shell with white bands, but all three differ materially. The figure from Petiver (pl. 11, fig. 5), though very crudely drawn, might be taken for *mendicaria*. The Gualtieri figure (pl. 52, fig. E) is apparently meant for a congener of this species, and Hanley (1855, p. 222) doubtfully referred it to *Columbella zonalis* Lamarck, 1822. That shell, however, although resembling *mendicaria* in color pattern, has a much more elevated spire than

even the young, unworn *mendicaria*, it being almost as long as the body whorl.¹ Buonanni's drawing (pt. 3, pl. 50), added in the twelfth edition is unrecognizable and badly chosen, as it might almost be taken for *Acteon tornatilis* Linné.

Gmelin (1791, p. 3448) supplied a paraphrase of Linnaeus' description and cited the same figures, among others. He retained the "columella laevi" and the "labro gibbo denticulato" of the twelfth edition and purified Linnaeus' description by omitting the conflicting phrase as to the lack of dentition of the lip. On the debit side, however, he added an incorrect locality (the Mediterranean Sea) which he probably copied from Petiver, who called the figure cited by Linnaeus *Buccinulum madraspatanum* and another figure, which might also be taken for *mendicaria*, *Buccinulum mediterraneum*.

The earliest post-Linnaean figures of the present species are those of Martini (1769-1777, vol. 2, p. 132, pl. 44 figs. 460-461). These figures, which appeared in 1773, unquestionably represent *mendicaria* and compare favorably with many of the later figures except in color pattern, as the shell appears to be white with dark brown bands, instead of the reverse. Martini did not refer to the *mendicaria* of Linnaeus, but called his species *Columbula incubitans*, although he cited all the Linnaean references. As two of these references are definitely not *mendicaria*, he would probably not have cited them unless he had copied them from the "Systema." It is curious, therefore, that he did not cite that work in his synonymy.

The species has had an uncomplicated nomenclatural history owing to its early identification and distinctive features. Lamarck (1822b, p. 296) placed it in his genus *Columbella*, 1799. In 1839 Gray separated it from *Columbella* to be placed in his new genus *Engina*, in which it is universally used today.

¹ Few adult specimens of *mendicaria* are found without some erosion of the spire. The young shell shows a fairly elevated and acute spire. In adult shells the eroded spire and sometimes the entire shell are often covered with a limy deposit. Specimens from the waters of the Indian Peninsula examined by the present writer were constantly less eroded and cleaner than those from other regions, possibly because of a difference in the mineral composition of the water.

It is well figured in Reeve (1842, pl. 258, fig. 4), in the "Tableau encyclopédique" (1798, pl. 375, figs. 10a, b), and in Tryon (1879-1888, vol. 5, pl. 63, fig. 62).

It is not described in the "Museum Ulricaë," and no specimen of it is found either in the Queen's collection in Uppsala or in the Linnaean collection in London.

Voluta cancellata

1758, *Systema naturae*, ed. 10, p. 751, no. 473 (*Murex scabriculus*).

1767, *Systema naturae*, ed. 12, p. 1191, no. 413 (*Voluta cancellata*).

LOCALITY: Not given in 1758; "in O. Africano" (1767).

"V. testa integra ovata plicata decussatim reticulata, columella triplicata subumbilicata productiuscula . . . Testa magnitudine nucis Coryli, cancellata rugis longitudinalibus striisque transversis, elevatis, acutis. Color albus ventris fasciis 2 ferrugineis. Spira acuta. Apertura alba. Columellae cauda brevis, subperforata. Affinitas summa Muricis ob suturas rarius occurrentes, membranaceas, et Labrum intus canaliculatum cum obsolete dentibus; simillima Murici senticoso, sed brevior."

This species was placed in *Murex* in the tenth edition of the "Systema" as *M. scabriculus*. Not only are the two descriptions almost identical, the changes being made merely for the sake of clarity, but Linnaeus, in the twelfth edition, specifically referred to the tenth-edition listing of the shell.¹ In the subdescription of 1758 the author took pains to distinguish the species from the buccinids because of differences in the canal and sutures, while in 1767, although he removed it from *Murex*, he called attention to its great similarity to *Murex senticosus*, distinguishing it from that shell only by its shortness. Although he was correct in moving it from *Murex* to *Voluta*, because *Cancellaria* properly belongs in the superfamily Volutaacea rather than with the muricids, he did not appreciate its affinity with his already described *V. reticulata*, as he placed it in the twelfth edition among the *Mitra* species. In his manuscript notes for his "revised twelfth edition" he did admit its relationship to *reticulata*, but committed a further error,

as he proposed to move both *cancellata* and *reticulata* to a position among the *Vasum* species by the note "post 431 locanda," which would place it between *V. capitellum* and *V. ceramica*.

Hanley (1855, p. 223) was inclined to base the identification of this species with the *Cancellaria cancellata* of authors entirely on the correct locality and the unmarked specimen of that shell in the Linnaean collection. It is true that this specimen uniquely agreed with the details of the description, but Hanley appeared to doubt that the description alone could have identified the species, as he did not enter into any discussion of the description or even mention it. Linnaeus' language seems to the present writer to be entirely adequate, in spite of Linnaeus' vagueness as to the generic relationship of *cancellaria* and *reticulata*.

Cancellaria cancellata is often cited from the Mediterranean Sea and west Africa. It is, however, rare in the Mediterranean. Bucquoy, Dautzenberg, and Dollfus (1882-1886, vol. 1, pp. 32-33) say that it is rarely taken by fishermen and that they had never found a beach specimen. Its real center of distribution is the west African coast. The occasional reports of this species from the West Indies may have been based on specimens of *Cancellaria reticulata*, although it is difficult to understand how the two species could be confused.

The synonymy is poor, although it hardly deserves the stricture laid upon it by Hanley, who said (*loc. cit.*): "An assortment of synonyms more heterogeneous than the one which accompanies the present species has rarely embarrassed a student. Gualtieri alone exhibits four distinct shells of three different genera ! none of which can be positively pronounced identical with the three figures of Seba, nor look like Adanson's engraving either." The references are: Gualtieri (pl. 48, figs. B, C, D, E), Adanson (pl. 8, fig. 16), and Seba (pl. 49, figs. 45, 46, 48). It is admitted that the majority of these are not helpful. Figures D and E of Gualtieri show no plaits on the columella. Figures 45 and 46 from Seba look much like *Murex senticosus* Linné (*Phos senticosus*) and were, indeed, again cited for the latter species by Linnaeus. Seba's figure 48 is much too elongate to con-

¹ Linnaeus, by a curious error, called the species *Murex scabriculus* in referring back to the tenth-edition name.

form to the "ovata" of the description of *cancellata* and may also have been intended for *senticosus*. Adanson's figure is, however, somewhat less objectionable. While the sharpness of the sculpture is too little emphasized and the details of the columella are too stylized, it seems decidedly designed for *cancellata*, although it has been at times identified with *C. similis* Sowerby, 1833 (see below). It entirely conforms to Adanson's description of *cancellata*, to which he gave the vernacular name of "le Bivet." Moreover, Gualtieri's figures B and C are, in the present writer's opinion, intended for *cancellata*. They both show the sculpture of the shell with considerable accuracy. In the last analysis, the synonymy is no worse than a considerable proportion of Linnaeus' references and is much better than some. Hanley's statement that Gualtieri shows "four distinct shells of three different genera" is hypercritical. What he conceived these genera to be is not stated, and I cannot guess what he meant.

The only species with which *cancellata* has been seriously confused is *C. similis* Sowerby, 1833. This is also a Senegal shell. It resembles *cancellata*, but is consistently smaller and has more numerous and finer spiral ribs and an occasional interstitial rib. Bucquoy, Dautzenberg, and Dollfus (*loc. cit.*) treat *similis* as a form of *cancellata*. Aside from the questionable soundness of this view, those authors refer to it as the "West African form" of *cancellata*. This is misleading as implying that *cancellata* is not found on the west African coast, whereas both species are fairly common there.

Voluta cancellata Linné is now placed in the genus *Cancellaria* Lamarck, 1799, and has frequently been cited as its type species (see *V. reticulata*, above). It is also, although somewhat doubtfully, the type species of *Bivetia* Jousseume, 1887. Marks (1949, p. 456) discusses this question fully. Jousseume established *Bivetia* in *Le Naturaliste* (1887, ser. 2, vol. 1, fasc. 14, p. 103, fig. 1), with *B. mariae*, *nomen novum*, with locality unknown, as type species, by monotypy. In fascicule 16 of the same serial, page 193, Jousseume again proposed *Bivetia* with *Voluta cancellata* Linné as type species, an invalid designation as the earlier selection of

mariae has priority. Marks admits, however, that *mariae* conforms to Adanson's concept of "le Bivet" and cites Fischer-Piette and his co-authors (1942, p. 219) as saying that Adanson described his shell with three specimens of *C. cancellata* and one of *C. similis* before him, but that his figure showed *similis*. I have already suggested that the two species are similar, and a figure would have to be much clearer than that of Adanson for it to be assigned to one or the other. *Bivetia mariae* is represented by only a single worn specimen in the Muséum National d'Histoire Naturelle in Paris which is undocumented as to locality. Fischer-Piette said (personal communication to Marks) that its first sculptured whorls are "quite worn but nevertheless one can perceive that it is completely like . . . *C. cancellata*." Until such time as well-preserved specimens of *mariae* are found and, I gather, found to be separable from either *cancellata* or *similis*, Marks suggests the tentative abandonment of *Bivetia* Jousseume and proposes the new subgenus *Bivetiella* with the type species *C. similis* Sowerby.

On the question of the specific separability of *cancellata* and *similis*, I am strongly inclined to disagree with Bucquoy, Dautzenberg, and Dollfus that the latter is either a geographical race or an ecological form of the Linnaean species. I would consider them as distinct species.

There is a wealth of good figures of *cancellata*. Even many of the earlier drawings are satisfactory. Born (1780, pl. 9, figs. 7, 8) supplies the earliest of the post-Linnaean figures and shows a shell which is clearly and characteristically *cancellata*. Martini did not describe or figure it, although it was a well-known shell to the conchologists of his day, and Chemnitz commented on this fact in figuring the species (1780-1795, vol. 11, p. 27, pl. 179, figs. 1727-1728) as follows: "To my great astonishment I see that the well-known *Voluta cancellata* of Linnaeus, which we receive in fair numbers from the West Indies and the coast of Guinea, a clear figure of which is seen in Born's Testac. Mus. Caes. pl. 9, figs. 7, 8, has been up to now forgotten and passed over in this Conchylien work." The figures in the "Tableau encyclopédique" (1798, pl. 374, figs. 5a, b) are good except for

the omission of the lirations within the lip. Schubert and Wagner, in the supplemental twelfth volume of the Martini-Chemnitz work (1829, pl. 225, figs. 4006–4007), show the best of the colored figures that had appeared up to that time. Their illustrations were probably supplied because Chemnitz' own figures were somewhat equivocal. Reeve figures it (1843–1878, vol. 10, *Cancellaria*, pl. 3, sp. 13a, b) and shows *similis* on the same plate (sp. 10a, b). *Cancellaria similis* is also well figured by G. B. Sowerby (1847–1887, vol. 2, p. 450, pl. 94, fig. 42).

The species was not described in the "Museum Ulricaе," and no specimen is found in the Queen's collection at Uppsala.

Voluta tringa

1758, *Systema naturae*, ed. 10, p. 731, no. 361.

1767, *Systema naturae*, ed. 12, p. 1191, no. 414.

LOCALITY: "In M. Mediterraneo" (1758, 1767).

"V. testa integriuscula oblonga laevi, spira prominente detrita, columella triplicata, labro introrsum subdentato . . . Testa nitida, lutea, albo-nebulosa. Spira mucro in omnibus, quotquot vidi, detritus. Labrum exterius minime marginatum, in medio vero introrsum gibbum, sed minus quam in praecedentibus."

The word "integriuscula" was added in the twelfth edition, and the phrase "labro introrsum subdentato" was substituted for the tenth-edition phrase "labro introrsum gibbosiore scabro." If Linnaeus' *tringa* was a *Pyrene*, as is suggested below, the change from "scabro" to "subdentato" might be held to be a slight improvement.

The Linnaean collection in London contains a specimen accompanied by a label, not in Linnaeus' handwriting, bearing the legend "*tringa*?" The specimen is an undoubted *Pyrene*, showing a white band around the upper part of the body whorl and another around the penultimate whorl of the spire. The shell is much worn and not specifically determinable. Mr. A. E. Salisbury (see Foreword, p. 7) believes the label to have been written by Hanley. In any case the equivocal documentation of the specimen leaves it without any authority whatever.

Considerable doubt surrounds the identification of this name. A shell labeled *Columbella tringa* Lamarck is frequently found in collections and referred to in the literature.

The present writer suggests that there is reason to believe this shell to be the *tringa* of Linnaeus. The early history of the name gives some substance to the theory, as is pointed out below.

Linnaeus supplied only two references, neither of the figures cited being authoritative. The first (Gualtieri, pl. 43, fig. B) seems to be a *Pyrene* and possibly was intended for a form of *rustica* Linné and is found on the same plate as the figure Linnaeus referred to for that species. The second (Adanson, pl. 9, fig. 27) is on the same plate as the figure (fig. 28) that is conceded to be *rustica*. The figure itself, which Adanson called "le Bigni," may be an inaccurately drawn *Pyrene* but shows no irregularities of either the lip or the columella. Adanson's description of "le Bigni," however, strongly suggests something very close to *Pyrene*. The investigations of Fischer-Piette and his co-authors (1942, p. 232) partially demolish such an identification and settles the identity of Adanson's shell. They found in Adanson's retained collection (see p. 53) 29 specimens marked "le Bigni," all from Senegal. A photograph of one of these specimens is reproduced in their paper (pl. 7, figs. 12a, b). It is the species called by Linnaeus *Buccinum laevigatum*. Fischer-Piette and his co-authors cite it as *Columbella laevigata*, but most American conchologists place it in *Nitidella* Swainson, 1840. Thus, although Linnaeus cited for *tringa* a figure of a species of another genus, it does represent a species very close to *Pyrene*, as *Nitidella* was separated from *Columbella* only in 1840 and properly belongs in the family Pyrenidae.

Gmelin (1791, p. 3449) repeated the twelfth-edition description of *tringa*, cited Linnaeus' two references, and added a further reference (Schröter, 1783–1786, vol. 1, p. 220, pl. 1, fig. 12). This figure, which Schröter continued to call *Voluta tringa*, is a very fair picture of the high-spired form of *Pyrene rustica* in shape, in dentition of the aperture, and in color pattern.

Lamarck (1811b, p. 211) listed a *tringa* as of "Lin. Gmel." but placed it in the genus *Mitra*. He referred to the Schröter figure used by Gmelin for *tringa* and added the figures from the "Tableau encyclopédique"

(1798, pl. 374, figs. 10a, b). These latter figures, which are called *Mitra tringa* Lamarck in the "Liste," were almost certainly based on the high-spined, subfusiform variety of *rustica*. Although he called the shell a *Mitra*, he said in his subdescription, "The three plaits of the columella are not pronounced and the shell seems to resemble the columellas in the tumidity of its outer lip."

Oronzio G. Costa (1829, p. 72) listed *Voluta tringa* without stating the author but identified it with the "Mitre bigarée" of Lamarck (*Mitra tringa*). He listed *Voluta rustica* separately. While he did not specifically attribute *tringa* to Linnaeus, his description of it strongly suggests that of *tringa* Linné. Moreover, he specifically compares it to a *Columbella*. Costa's treatment of the species is too vague to be of much significance. It is mentioned merely because it served as the basis of a more important statement by Philippi.

Philippi (1836, 1844, vol. 1, p. 228), after his description of *Columbella rustica* ("Lamarck"), listed a "var. β *elongata*," which he described as "fusiformis, spira acutissima" and "of the same color as variety α [the typical form with the moderately low spire]." He added, "This variety, which is frequently collected here [Sicily] is the *Mitra tringa* Costa, p. 72 and 74. no. 5, and possibly *Voluta tringa* Gmelin p. 3449."

Deshayes and Milne-Edwards (1835-1845, vol. 10, p. 325, footnote) discussed the identity of Lamarck's shell without, however, passing specifically on the point at issue here. They said: "If one relies entirely on the synonymy of Linnaeus one could not include the species among the Mitras, for the figure B of plate 43 of Gualtieri resembles *Columbella rustica* rather than a *Mitra*. As for the Bigni of Adanson, even though the figure is not very good, the description tells us that there are no plaits on the columella. If this synonymy of the species is not satisfactory for the species in question, the very short description of Linnaeus does not, however, leave any doubt, and his species is surely the same as that of Lamarck. The species is not a *Mitra*, but a *Columbella*."

While no categorical identification of *tringa* Linné was made by any of the above writers, the sequence of these early treat-

ments of the name, the repetition of the references, the almost complete unanimity in the citation of certain good figures (except for the figure in Adanson), and the similarity of the descriptions to the description by Linnaeus make it easy to convince oneself that it was a close relative, if not a mere form, of *rustica* Linné. I am inclined to the belief that all the descriptions referred to the Linnaean species and that *tringa* was in fact the shell called *rustica*, variety *elongata*, by Philippi, and, although it is conspecific with *rustica* Linné, that its Linnaean authorship is established.

There has been little recent discussion of the name. Tryon (1879-1888, vol. 5, p. 181, pl. 59, figs. 65-66) listed and figured a shell that he referred to as *Columbella tringa* Lamarck, although he expressed himself as being reluctant to call it a *Columbella*. His figures have a distinct resemblance to the elongate form of *rustica*, in shape, spire, and color pattern. He said: "*Voluta tringa* of Linnaeus and Lamarck's first edition is a difficult species to make out; it has been referred, with some justice, to *Mitra*. In the second edition of Lamarck, Deshayes repeats the original description including the three-plaited columella, but decides that the shell is a *Columbella*. I do not think he had good grounds for this decision, but as the shell I herein figure has become known to conchologists under this specific name and authority [Lamarck] it appears more convenient to use them. *C. undatella* Duclos (fig. 66) is a synonym." The writer is inclined to agree with Deshayes and Milne-Edwards rather than with Tryon.

The Tryon figures mentioned above, as well as the figures from the "Tableau encyclopédique," are clear and convincing and should be seen.

The species was not described in the "Museum Ulricae," and no specimen of this form is found in the collection in Uppsala.

Voluta cornicula

1758, Systema naturae, ed. 10, p. 731, no. 362.

1767, Systema naturae, ed. 12, p. 1191, no. 415.

LOCALITY: "In Mari Mediterraneo" (1758, 1767).

"V. testa submarginata oblonga laevi cornea, spira longuiscula, columella quadriplicata, labro aequali mutico . . . Similis antecedenti, sed spira magis elongata; testa tota colore cornu; Labrum

minime dentatum aut incrassatum; variat colore totius atro."

The diagnosis of this species was identical in the tenth and twelfth editions of the "Systema."

The description indicates a *Mitra*. Philippi (1836, 1844, vol. 2, p. 195) suggested either *M. lutescens* or *M. ebenus*, both of Lamarck, 1811, as the possible representative of the Linnaean species, but *ebenus* does not conform to the "testa tota colore cornu" of the description,¹ and *lutescens*, while it resembles the Linnaean shell and has been confused with it, has a somewhat turreted spire which contrasts with the smoothly sloping spire of *cornicula*. It is now accepted that the *cornicula* of modern authors, which was called *M. cornea* by Lamarck, an identification first established by Deshayes and Milne-Edwards as is noted below, is the shell Linnaeus described. Hanley (1855, p. 225), however, accepted Philippi's selection of *M. lutescens* Lamarck, as an unmarked specimen of that species was found in the Linnaean collection in London which "alone of the specimens there present . . . satisfactorily answers to the definition." *Mitra cornicula* is recorded on Linnaeus' list of owned species, but while this fact may sometimes be used as evidence of the authority of an undocumented specimen in the collection, it should not override a discrepancy between the description and the specimen. I do not agree that *lutescens* "satisfactorily answers" to the description.

The single figure in the synonymy of *cornicula* (Gualtieri, pl. 43, fig. N) is unresponsive to the description. It probably was based on a species of *Nassarius*. It agrees with the description in some respects but, being devoid of plaits on the columella, must be considered as having been chosen by Linnaeus merely as an approximation to his species.

The locality "in M. Mediterraneo" is correct for the *M. cornicula* of authors.

The identity of this species was not understood by most of the early writers. Martini

¹ Linnaeus' description of *cornicula* mentions an all-black form ("testa colore totius atro"), but this does not describe *ebenus*, which has a yellowish band below the suture of each whorl and, moreover, has a turreted spire, unlike the smoothly sloping spire of *cornicula*. The writer is not familiar with an all-black form of *cornicula*.

did not list the name. Chemnitz (1780-1795, vol. 4, p. 233, pl. 150, figs. 1400, 1408-1411) described and figured a group of species which he called only "Einige Arten der kleine Thürmchen. Turriculae." This reference is noted here only because Deshayes and Milne-Edwards (1835-1845, vol. 10, p. 325) cited figure 1408 for *M. cornea* Lamarck, which they correctly identified with *cornicula* Linné. The citation was wrong, however, as the figure, in the opinion of the present writer, is of *M. ebenus* Lamarck.

Schröter (1783-1786, vol. 1, p. 221, pl. 1, fig. 13) committed the error that was responsible for the early confusion as to this species. He described a *Mitra cornicula* as of Linnaeus that was not Linnaeus' species but rather a tan-colored shell with pale bands, which is repugnant to the "tota colore cornu" of the description of *cornicula* Linné. It was probably *cornicula* Lamarck, 1811 (*cornicularis* Lamarck, 1822). The error was detected by Chemnitz (1780-1795, vol. 11, p. 30, pl. 179, figs. 1733-1734), who renamed Schröter's shell *Voluta cornicula Schröteri*. He there said, "The Herr Superintendent Schröter believed he had found in this shell the *Voluta cornicula* of Linnaeus." He pointed out the striking difference between the color pattern as described by Linnaeus and by Schröter, and continued, "Therefore it cannot be *Vol. cornicula Linnaei*." Chemnitz also figured the true *cornicula* of Linnaeus in a pair of figures on the same plate (figs. 1731-1732). A comparison of these two sets of figures is instructive.

In the meanwhile Gmelin (1791, p. 3449) had repeated Schröter's error. His subdescription is definitely repugnant to the uni-colored *cornicula* Linné and suggests Schröter's shell, which he cited as a synonym. He also cited the incorrect Gualtieri figure used by Linnaeus, although with a query. He undoubtedly supposed his shell to be that of Linnaeus.

Lamarck's *cornicula* (1811b, p. 210), which was changed to *cornicularis* in 1822 (1822b, p. 312) was demonstrably based on Schröter's species. He cited not only Schröter's figure but also the Chemnitz figures of *cornicula Schröteri*, and his description of the color pattern of his species ("albo fulvoque nebulata") definitely points away from the Linnaean shell. In both the 1811 and 1822 works he

listed also a *Mitra cornea* which he appears to use as a new species, as no references are given. Based on the description alone this species seems to be the true *cornicula* of Linnaeus, and it is so considered today. Deshayes in Deshayes and Milne-Edwards (*loc. cit.*, footnote), while he cited the species as *cornea* Lamarck, corrected Lamarck's error in the following words: "The *Voluta cornicula* of Linné appears to me to be exactly the same species as the *Mitra cornea* of Lamarck. The two short phrases of Linné are so precise and conform to the species in question with such exactness, that I do not hesitate to unite, with a common synonymy, the shell of Linnaeus and that of Lamarck. The species should naturally resume its specific name and become *Mitra cornicula*. The shell which Schröter, Enl. pl. 1, f. 13, listed as the *cornicula* of Linné, is very different from this, both in form and coloring."

Reeve, whose description of *M. schroeteri* (Chemnitz) was published in the same year as Deshayes and Milne-Edwards' comments quoted above (1844), adopted the latter's correct treatment of the two species and said (1843-1878, vol. 2, *Mitra*, pl. 21, sp. 167), "To Chemnitz and M. Deshayes are we indebted for having dissipated the confusion occasioned by Schröeter [*sic*] mistaking this species for the *Voluta cornicula* of Linnaeus." The true *cornicula* Linné was described and figured by him in the same monograph (pl. 35, fig. 295).

George B. Sowerby (1847-1887, vol. 4, *Mitra*, p. 6), Tryon (1879-1888, vol. 4, p. 122), and virtually all recent writers follow the views of Deshayes and Milne-Edwards.

The following names are listed by Tryon (*loc. cit.*) as synonyms or forms of *cornicula* Linné: *Mitra philippiana* Forbes, 1844, a shell that Weinkauff treated as a minor form, but that Tryon considered to be merely the immature shell; *M. graja* Reeve, 1845; *M. lactea* Lamarck, 1811; and *M. plumbea* Reeve, 1844, not Lamarck, 1811, *fide* Tryon. Tryon also listed *M. schroeteri* Deshayes and Milne-Edwards, 1844, as being conspecific with *cornicula* Linné, calling it "var. *schröeteri*." This is the only point on which Tryon disagreed with his predecessors, who treated *schröeteri* as a good species distinct from *cornicula* Linné. Reeve (*tom. cit.*, pl. 35, sp. 295)

asserted that *Voluta laevigata* Gmelin, 1791, was a synonym of *cornicula*, but both Gmelin's description and the sole figure he cited from Chemnitz (1780-1795, vol. 4, pl. 150, fig. 1408) point much more surely to Gmelin's *cornicula*, the shell later given the name of *schröeteri*. It must not be forgotten that the separation and identification of the small *Mitra* species, and particularly the group of small, unicolored, or almost unicolored shells covered by the above names, are extremely difficult. The differences that distinguish them are often almost imperceptible, and it is not at all certain that some species and their forms have ever been properly classified.

Agreement with the view of Deshayes and Milne-Edwards has, however, not been unanimous. Weinkauff (1868, p. 28) rather sharply disagreed, saying: "The doubts as to Linnaeus' name have been passed over. Deshayes concluded that, based on the two short descriptions of Linnaeus, he had undoubtedly described *Mitra cornea* Lamarck. In both [descriptions], however, it is stated that the shell is smooth, while Lamarck says of his *cornea*, 'apice basique transversim striata.' How then can we say 'undoubtedly'?"

Bucquoy, Dautzenberg, and Dollfus' treatment of *cornicula* Linné adopts the views of Weinkauff. They apparently use the name for the *cornicula* of Schröter, as they place both *M. schroeteri* (Chemnitz) Deshayes and *cornicularis* Lamarck in its synonymy. The inclusion of a dark form by Linnaeus did not trouble them, as they say (1822-1898, vol. 1, p. 118): "Although Linnaeus cited a black variety of his *Voluta cornicula*, which would imply that he had included *Mitra ebenus* under this name, we believe that we must adopt the Linnaean name for the present species." The reasons for their conclusion that Weinkauff was correct are not stated. In spite of the authority of Weinkauff and the Dautzenberg collaborators as specialists in the Mediterranean shells, the present writer agrees with the conclusions of Deshayes and Reeve that Linnaeus was describing the *cornea* of Lamarck, and this is based largely on the language of the several descriptions of this affinity.

The species was not described in the "Museum Ulricaë," and no specimen of it is found in the Queen's collection in Uppsala.

The Reeve figure cited above is the best representation of what I conceive to be the *cornicula* of Linnaeus.

Voluta virgo

1767, *Systema naturae*, ed. 12, p. 1192, no. 416.

LOCALITY: Not given.

"V. testa integra turrita plicata transverseque striata, columella triplicata perforata . . . Testa longitudine pollicis, supplicata sulcis circiter 12, transversim striata et basi reticulata, anfractibus 10 bifasciatis inferne albo, superne luteo; linea sanguinea distinguit anfractus et fere fascias. Cauda producta fere Strombi et perforata."

This species, which appeared for the first time in the twelfth edition, has not been identified. The description is detailed, but the described features are unusual for a species placed, as it is, among the mitras. The phrase "cauda producta" in particular is not used for any other Linnaean *Mitra*, although the majority of them are described as fusiform. Linnaeus compared this "tail" to that of *Strombus*, but as that feature in *Strombus* is less produced than in many *Mitra* species, the comparison is not helpful.

Hanley (1855, p. 225) said: "Judging from the produced tail and elongated spire one might have expected to have found it in a *Turbinella* of the *infundibulum* section, but none such are to be descried in the cabinet." The shell mentioned is now *Latirus infundibulum* (Gmelin), 1791. This is a more reasonable suggestion. The genus *Latirus* Montfort, 1810, contains species, once included in *Turbinella* Lamarck, which show several of the features noted in Linnaeus' description, among them being the transverse striations. One such species is the one mentioned by Hanley. Moreover, *infundibulum* has a color pattern that conforms very closely to that described for *virgo* Linné, including the striking "linea sanguinea." I mention the *Latirus* species merely to point out that Hanley's tentative guess, which was, in fact, the only suggestion as to the identity of *virgo* that I have been able to find, was not unreasonable. However, in other respects, *infundibulum* does not conform to the description of *virgo*. It has eight longitudinal sulci instead of the "circiter 12" stated, it lacks the required reticulated base, and its columella has two instead of three plaits. These or other differences are shown in all other species of *Latirus*.

As Linnaeus tells us that the specimen of *virgo* was furnished him by Spengler, a competent and careful naturalist, it is surprising that no locality is given. We know that Linnaeus must have based his description on an actual specimen, as the name appears on his list of owned species, but nothing is present today in the Linnaean collection to which the description can be referred, and Hanley reported the same situation in 1855. The only additional shred of evidence is a manuscript note in Linnaeus' copy of the twelfth edition, adding the word "elongata" to the phrase "columella triplicata perforata," and the words "Faux striata" to the end of the description. The latter words are somewhat equivocal unless they refer to the columellar plaits, an unnecessary amendment, as that feature had already been mentioned.

No mention of *virgo* is found in Martini, Chemnitz, Born, or Lamarck. Schröter (1783-1786, vol. 1, p. 222) and Dillwyn (1817, vol. 1, p. 540) listed the name, but it is obvious from their comments that they merely paraphrased Linnaeus' description, and there is no indication that either had ever seen the shell. Neither cited a figure. Schröter referred to the fact that Spengler had furnished the specimen, and Dillwyn used a locution indicating that he was a mere copyist. He said: "Linnaeus has described the shell to be. . . ." Neither Sowerby nor Reeve, nor Tryon and Pilsbry, in their comprehensive monographs on the volutids, mentioned *virgo*, nor have I found any reference to it since Dillwyn. It is not *Mitra virgo* (Swainson), 1835. It was not described in the "Museum Ulricaë."

Voluta scabricula

1758, *Systema naturae*, ed. 10, p. 740, no. 412 (*Buccinum scabriculum*).

1767, *Systema naturae*, ed. 12, p. 1192, no. 417 (*Voluta scabricula*).

LOCALITY: "In M. Mediterraneo" (1758); "in India orientali" (1767).

"B. testa ovato-oblonga scabra transversim rugosa, longitudinaliter striata, columella plicata, labro inaequali . . . Media inter Volutas et Buccina; a priori differt columella subperforata, convenit columella plicata; ad hanc imprimis accedit fissura baseos elevata" (1758).

"V. testa emarginata fusiformi striata transversim rugosa, columella quadriplicata perforata, labro crenulato" (1767).

In transferring this species from *Buccinum* to *Voluta* Linnaeus completely rewrote the description and considerably shortened it, as he found possible owing to his corrected conception of its generic position. Any differences are therefore more fancied than real. The author made one curious error. In both editions he used the spelling *scabriculum* or *scabricula* for the name of the species, but in referring it back to its listing in *Buccinum*, in writing the twelfth-edition diagnosis, he called it *Buccinum scabriusculum*. Moreover, in the subdescription of the next species (*Voluta ruffina*) he said: "Similis V. scabriusculae." This mistake, which can have been only a series of errors of transcription, fixed the name *scabriuscula* in the minds of many of his successors and has complicated the identification of the species. The correct spelling was used by Gmelin (1791, p. 3450), although in his reference to the tenth-edition listing he blindly copied Linnaeus' error. Gmelin's work is full of similar instances, which is one of the most cogent reasons why we should regard him as a mere copyist in his treatment of the Linnaean species and which renders much of his work devoid of usefulness. Chemnitz, in 1780 (1780-1795, vol. 4, pp. 229-230, pl. 149, figs. 1388-1389), in describing and figuring a shell that he called "*Turricula filis ferreis cincta, rugosa*," which was not, however, the *scabricula* of Linnaeus, cited as a reference "*Buccinum scabriusculum*" as from the tenth edition, and *Voluta scabricula* of the twelfth. Born (1780, p. 225) also used the spelling *scabriuscula*. Dillwyn (1817, vol. 1, p. 542) reverted to the correct spelling.

While we cannot be certain that the species of any of the above authors was in fact the *scabricula* of Linnaeus, it is reasonably certain that Lamarck's conception of the species was faulty. Lamarck (1811b, p. 203) described a *Mitra scabriuscula* and repeated the diagnosis and name in 1822 (1822b, p. 305). This Lamarckian name is not *scabricula* Linné but seems to be the species that Martyn called *sphaerulata*, a name that was validated by Reeve in 1844, Martyn's names having been universally accepted up to that time. This identification was first advanced by Deshayes and Milne-Edwards (1835-1845, vol. 10, p. 310). They made *scabriuscula* equal to *sphaerulata* Martyn, but did not question

its relation to the Linnaean name, as they synonymized it with *B. scabriculum* of the tenth edition and *V. "scabriuscula"* of the twelfth.

Reeve (1843-1878, vol. 2, *Mitra*, pl. 5, sp. 37) continued to identify *scabriuscula* Lamarck with Martyn's *sphaerulata* but specifically disassociated the Lamarckian name from the "*scabriuscula*" of Linnaeus. In species 35 on the same plate he identified the Linnaean name with another species, *Mitra granatina* Lamarck, 1811, but his treatment of species 35 only perpetuated the earlier confusion. It is entitled *Mitra scabriuscula* and in its synonymy he cited: "Gray. MSS. British Museum; *Mitra granatina* Lamarck; and *Voluta 'scabriuscula'* Linnaeus, Syst. nat. 12th. edit. . . ." Yet after the synonymy he said: "I quite agree with Mr. Gray in referring this shell to the *Voluta scabricula* of Linnaeus." There is, of course, no difference between Linnaeus' *scabricula* of the two editions, but I cannot feel certain that Reeve was convinced of that fact.

In spite of this vagueness of the early writers, a comparison of the various figures and descriptions involved, including the two pairs of figures in the "Tableau encyclopédique" (1798, pl. 371, figs. 4 and 5) and their names as given in the "Liste," convinces the writer that Deshayes and Milne-Edwards, and Reeve, were correct in distinguishing the Linnaean *scabricula* from *scabriuscula* Lamarck and in uniting the latter with Martyn's *sphaerulata*.

It may be added that Schubert and Wagner (1829, p. 80, pl. 225, figs. 3090-3091) figured, as *scabriuscula* Lamarck, a shell that is apparently the *scabricula* of Linnaeus, but their synonymy reveals that they identified it with *sphaerulata* Martyn. The two species are, in fact, very similar in appearance. *Mitra sphaerulata* is a species with rugose spiral ridges, as required by Linnaeus' description of *scabricula*, but possesses a feature not mentioned by the latter, a series of black dots and dashes along the ridges. In the shell now universally accepted as *scabricula* Linné, these markings are reddish brown and the rugosity is much less pronounced.

Hanley (1855, p. 226) suggested that if Linnaeus had before him a specimen of *sphaerulata* it was unexplainable why he

should not have cited a figure from Seba (1758, vol. 3, pl. 50, fig. 47) which, he said, accurately showed that species. The Seba figure bears little resemblance to *sphaerulata* but shows an extremely ventricose and patulous shell, almost as high as wide, although in sculpture and in the crenulation of the lip it does resemble *sphaerulata*. Hanley also said that Linnaeus should have cited Gualtieri's figure L instead of D on plate 53 if he had intended to portray *sphaerulata*. In this Hanley was correct. Figure L is clearly *sphaerulata*, while figure D, which Linnaeus cited, is the smoother shell without the black dots and dashes that we accept as a characteristic of *scabricula* Linné.

Linnaeus had recorded his possession of *V. scabricula* by its inclusion in his list of owned species. There are several *Mitra* species in his collection. Hanley was impressed by the fact that only one of these showed any evidence of the basal perforation which Linnaeus mentioned as "columella . . . perforata" (twelfth edition) and "fissura baseos elevata" (tenth edition). This was a specimen of *Mitra texturata* Lamarck, 1811, of which Hanley said: "I can entertain no doubt . . . of its typical authority." This is not only an unwarranted assumption, as many of the mitras of Linnaeus show a perforation or at least a fissure, and we have no assurance that Linnaeus' specimen had not been lost before the collection came into the possession of the Linnean Society, but *texturata* does not conform to Linnaeus' description of *scabricula* in two most important particulars: It is a much more ventricose shell than *scabricula* and was so described by Lamarck. It has crowded spiral ribs crossed by longitudinal ribs of almost equal strength, which gives it a symmetrically "pebbly" appearance instead of the scabrous look of *scabricula*. The very figures which Lamarck approved for it in the "Tableau encyclopédique" (1798, pl. 372, figs. 2a, b) show that the details of the shell are repugnant to the Linnaean description. It is admitted that the artist of the plate made the figures too ventricose and also that the species is somewhat variable in this respect, but in any case *texturata* could hardly be mistaken for *scabricula*.

Both Tryon and Sowerby accepted the distinction between *scabricula* Linné and *scabri-*

uscula Lamarck, which was adopted by Reeve, and is set forth above. Tryon (1879-1888, vol. 4, *Mitra*, Index, p. 238) said: "*Scabriuscula* (*Mitra*) Lamarck (not Linn.) = *M. sphaerulata*, Martyn." George B. Sowerby (1847-1887, vol. 4, *Mitra*, p. 8) lists "'*scabriuscula*' Linnaeus" and *sphaerulata* Martyn, both as good species. His short descriptions of the two species constitute as concise and accurate a distinction as could be devised in a few words. He described the Linnaean species as "Sculptured with thin beaded ridges," and *sphaerulata* as "Sculptured with thick beaded ridges." The figures supplied by both Tryon and Sowerby are inadequate to show even this single differentiating factor. The best figures of both species are those from Reeve, cited above. The figure from Gualtieri (pl. 53, fig. D) cited by Linnaeus in the tenth edition is not convincing, although it shows some of the characteristics of *scabricula*. In the twelfth edition he supplemented this reference with the following: "vel t. 48. f. o." There is no figure "o" on the plate mentioned. If a misprint was involved one might naturally turn to figure "c," but that figure shows a fairly accurate picture of *Cancellaria cancellata* Linné except that the artist made the shell sinistral.

Linnaeus' *Voluta scabricula* belongs in the genus *Mitra* Röding, 1798, and in the subgenus *Scabricola* Swainson, 1840 (emended to *Scabricula* by Sowerby in 1842). It is the type species, as *S. "scabriuscula"* Linné.

Voluta ruffina

1767, *Systema naturae*, ed. 12, p. 1192, no. 418.

LOCALITY: "In India Orientali" (1767).

"V. testa integriuscula fusiformi transversim rugosa, columella quadriplicata, labro crenulato . . . Similis V. scabriusculae, sed angustior, longior, passim incarnato-maculata. Cauda integra absque umbilico. Labrum recurvum, crenulatum tuberculis rotundatis."

This species, which first appeared in the twelfth edition of the "Systema," has not been satisfactorily identified. Both Schröter (1783-1786, vol. 1, p. 222) and Gmelin (1791, p. 3450) copied the Linnaean description, with unimportant verbal and grammatical changes in the case of Gmelin, but both writers queried the accuracy of the Gualtieri figure (pl. 54, fig. G) which had been cited by

Linnaeus. That figure suggests *Voluta aurantia* Gmelin (p. 3454), which was described and figured by Chemnitz (1780–1795, vol. 4, p. 231, pl. 150, figs. 1393–1394) and by Reeve (1843–1878, vol. 2, *Mitra*, pl. 23, sp. 182a, b). The resemblance between these figures and the Linnaean description is too uncertain to be seriously entertained. It is true that *aurantia*, as figured by Reeve at least, has four plaits on the columella and a crenulated lip, as required by the description of *ruffina*, but the lip is not “crenulatum tuberculis rotundatis.” Moreover, neither *aurantia* nor the Gualtieri figure is similar to *V. scabricula*, as Linnaeus insisted in the subdescription.

Dillwyn (1817, vol. 1, p. 545) believed *ruffina* to be identical with *Mitra adusta* Lamarck, 1811. That species, although it presents some of the features prescribed for *ruffina*, is not spirally rugose and is in any case a much larger shell than any ever suggested for *ruffina* and has a five-plaited columella. Deshayes and Milne-Edwards (1835–1845, vol. 10, p. 304, footnote) first tentatively suggested *Mitra versicolor* Lamarck, 1811, as the representative of the Linnaean species.¹ They said: “If it were possible to determine the *Voluta ruffina* of Linné exactly, it would be to this species . . . rather than to *Mitra adusta* Lamarck, that it should be referred.” *Mitra versicolor* does bear a vague resemblance to the description of *ruffina* but is not rugose on any part of the shell. Their second suggestion (*tom. cit.*, p. 311, footnote) was *M. crenifera* Lamarck, 1811.² This has somewhat more merit than their first suggestion, although the words “passim incarnato-maculata” in the subdescription of *ruffina* do not apply to *crenifera*. They said: “Perhaps the *Voluta ruffina* of Linné (Syst. nat. Edit. 12, p. 1192, no. 418) is the same species as this: several characters common to each can be found but the identity cannot be established because the description of Linnaeus is too short and is not accompanied by a sufficient synonymy.”

Hanley (1855, p. 227) is responsible for the first categorical identification. After his ex-

haustive and critical investigation of the Linnaean collection he concluded that he had found the type of *V. ruffina* in *Mitra ferruginea* Lamarck, 1811. He said: “Linnaeus having declared his possession of an example, and an analysis of his collection (where none of the previously mentioned *Mitres* are to be found) having demonstrated that one species alone (*texturata* might perhaps be accepted, but that is already appropriated) of its entire contents will answer to the description, no reasonable doubt of the typical authority of that species can be entertained. It has been thought desirable to figure it (pl. 4, f. 5), since it presents certain peculiarities specified by Linnaeus which are not displayed by any published drawing that I can at present discover. Martini’s figures 1380–1381 [Chemnitz, not Martini, 1780–1795, vol. 4, p. 224, pl. 149] form the nearest approach: these have almost invariably been referred to *M. ferruginea* (delineated by Swainson in plate 66, f. 2, of his first series of ‘Illustrations’).”

Hanley’s opinion is certainly open to several objections. In the first place, the Chemnitz figures referred to by Hanley do not resemble Hanley’s colored figure in a single particular and might be taken for *V. aurantia* Gmelin, which was well figured by Reeve (*loc. cit.*). Hanley’s figure shows an extremely slender shell with seven whorls in the spire and a base that is only slightly produced. It is a generally rose-pink shell, with pinkish brown longitudinal stripes on the body whorl and the last two whorls of the spire, and appears to have flat, sinuous longitudinal ribs which are not nodose, the spaces between the ribs showing narrow, impressed spiral lines. Second, *ferruginea* is a distinctive shell, much more ventricose than Hanley’s permits, sculptured with close spiral ridges over its entire length and with a crenulated lip which is, however, not tuberculate as the description of *ruffina* requires. Its color is pale yellow, decorated with vaguely longitudinal broken brown blotches. It resembles Hanley’s drawing as little as do the Chemnitz figures. The Hanley figure is a dorsal aspect of the shell, but, while it does not show the columella or the lip, Hanley described the latter feature as follows: “the recurvation of the outer lip, which is edged with conspicuous rounded

¹ This name was borrowed by Lamarck from Martyn. It is the *V. nubila* of Gmelin, 1791 (p. 3450).

² Deshayes and Milne-Edwards synonymize *Voluta clathrus* Gmelin (1791, p. 3457) with *crenifera*.

tubercles, precisely accords with the features specified in the description." *Mitra ferruginea* resembles Hanley's figure only in the crenulated lip. Third, the only details that Hanley's figure, supplemented by his description of it, has in common with the description of *ruffina* are the four-plaited columella and the crenulated lip, a feature found in several species of *Mitra*, and the color, which Linnaeus described as "passim incarnato-maculata." On the last point Hanley even partly contradicted himself, as he said: "The spotted coloring of the specimen ('incarnato' with Linnaeus has the signification of orange rather than flesh-colour, as we learn from his account of the well-known *Strombus pugilis* in the 'Museum Ulricae') is not the ordinary painting of *ferruginea*."

The present writer has seen no specimen of *ferruginea* that bears any resemblance to Hanley's figure. The film of the Linnaean collection in the writer's possession shows nothing that conforms to it, and Hanley's use of it is unexplainable. Two specimens, which are almost certainly *ferruginea*, are photographed and accompanied by a printed label which reads "*Voluta ruffina*." As the collection contains, according to Hanley, no specimen marked by Linnaeus for *ruffina*, this label represents an identification with the Linnaean shell made by some later investigator and was undoubtedly based on Hanley's conclusions. The spire of the photographed specimens is slightly higher than any examples seen by the present writer, but the many figures of this species show that it is somewhat variable in this respect.¹

The various suggestions as to the identification of *ruffina* that have been noted above are all of shells that possess some features noted in the Linnaean description, but none of them, least of all the suggestion of Hanley, is sufficiently convincing to be accepted, and

¹ I have discussed Hanley's observations at some length. In spite of the often vague and prolix language employed by him, his use of locutions that might better be employed in a popular work than in a scientific treatise, his confusion in the use of pronouns, and his constant failure to supply either the author or the date of cited species, the writer has often referred to him as a careful and conscientious observer. The conclusions he reached in the case of *Voluta ruffina* and the preceding species (*V. scabricula*) almost persuade one to reconsider our estimate of Hanley's powers of observation.

I am constrained to leave the species as inadequately defined. No subsequent author has referred *ruffina* to *ferruginea*.

George B. Sowerby (1847-1887, vol. 4, *Mitra*) did not cite *ruffina* among his good species, but in the "Explanation" of his plate 253 he tentatively reverted to Dillwyn's opinion and mentioned *Mitra adusta* Lamarck, which he showed in figures 16 and 17, as being questionably equal to *ruffina* Linné and characterizes the comparison as being "very doubtful." Tryon (1879-1888, vol. 4, Index, p. 237) also spoke of Dillwyn's "*Voluta ruffina* Linné" as equaling *M. adusta*, and on the same page he repeats Deshayes and Milne-Edwards' guess and refers *ruffina* Linné to *crenifera* Lamarck, with, however, a query.

Voluta sanguisuga

1758, *Systema naturae*, ed. 10, p. 732, no. 364.

1767, *Systema naturae*, ed. 12, p. 1192, no. 419.

LOCALITY: "In M. Mediterraneo" (1758, 1767).

"V. testa emarginata fusiformi longitudinaliter sulcata transverse striata, columella quadriplata, labro laevi . . . Fasciae anfractuum e punctis sanguineis distantibus."

The description in the tenth edition was much shorter, omitting the words "emarginata" and "longitudinalibus" and all reference to the columella and lip.

The species has enjoyed an uneventful nomenclatural history, except for the serious difference of opinion that has existed as to the possible relationship between it and the *sanguisuga* of Lamarck and the use of the name *stigmataria* Lamarck. It is well to have in mind at the outset the differences between the two shells here involved. The shell commonly called *stigmataria* has a white or yellowish base color with two bands of squarish, brilliant red spots arranged spirally on the body whorl and one band on each whorl of the spire, the spots being placed at intervals on a series of longitudinal ribs. The shell to which the name of *sanguisuga* Linné has often been erroneously applied is similarly sculptured, but the red spots, while still confined to the longitudinal ribs, are so numerous and thickly dispersed that they are almost contiguous vertically, and the ribs thus appear as a series of longitudinal stripes of red. Each shell also possesses fine, close-set, transverse striae which cross the longitudinal ribs. There

is a certain amount of variation in each, although it is slight in the case of the thickly spotted shell, but at the extremes of their range the shells are sufficiently differentiated to justify the opinion held today that they are distinct species. The present writer has been unable to find any intergradation that would warrant calling them conspecific.

The species *Mitra stainforthii* Reeve, 1844, in which the red spots are larger and form five revolving bands, has not to my knowledge been associated with either, although its other characters are very close to those of *stigmataria* Lamarck, with the exception of the fact that its longitudinal ribs are wider and less closely spaced. It is not improbable that it should be given subspecific rank.

On the question of which shell was actually described by Linnaeus as *sanguisuga*, there was a difference of opinion for many years, but the wording of the Linnaean description of *sanguisuga* would seem to be conclusive in favor of the larger shell with the two spiral bands of red spots.

Lamarck (1811b, p. 208) described a *Mitra sanguisuga* as of Linnaeus and characterized the ribs and their decoration as "costis granulatis sanguineis." He then described another species, *M. stigmataria*, which he conceived to be new, as he referred only to figures from the pre-Linnaean iconographies and to Chemnitz' *Voluta granosa*. From the description it is incontestable that he was describing the form with the spiral bands of red spots which was Linnaeus' *sanguisuga*. His Latin definition reads "lineis punctatis sanguineis cincta," and in the French description he distinguishes the species from his *sanguisuga* by the words "distinguished by the transverse rows of red spots situated on the ribs" (italics mine). Compare these words with his description in French of the color pattern in his *sanguisuga*: "Its longitudinal ribs are very slender, granulated, and of a brilliant red" (italics mine). The misinterpretation of Linnaeus' species is all the more surprising in that he cited for *stigmataria* many of the same figures as Linnaeus did for *sanguisuga*.

Deshayes and Milne-Edwards (1835-1845, vol. 10, pp. 319-320, footnote to *sanguisuga* Lamarck) were the first to detect Lamarck's error. They said: "Linnaeus united, under

the name of *Voluta sanguisuga*, the entire synonymy of this species and of the following named *Stigmataria* by Lamarck; it seems to us that Lamarck should preferably have given the Linnaean name to his *Stigmataria*, and [?as] Linnaeus said that the transverse bands of *Sanguisuga* are made up of red spots; it would therefore be to this species, which has no bands of red spots, that the new name should be given, the Linnaean name properly belonging to the following."

In the identification of *stigmataria* Lamarck with *sanguisuga* Linné, the fact that Lamarck gave his species (*stigmataria*) only three columellar plaits is not significant. Every specimen of either species examined by the present writer shows four plaits, although the lowest is often so little developed that it is barely distinguishable and might have been overlooked, as it doubtless was by Lamarck.

Hanley (1855, p. 228) adopted the views of Deshayes and Milne-Edwards, putting special emphasis on Linnaeus' phrase "Fasciae anfractuum e punctis sanguineis distantibus." It should be noted that Linnaeus always used the word "fascia" to mean spiral, rather than longitudinal, bands or lines. Hanley also called attention to the fact that the addition of the two figures from Seba (vol. 3, pl. 49, figs. 11-12) in the twelfth edition "disturbed the previous harmony of the synonymy." The figures cited in 1758 were clearly all of the true *sanguisuga* Linné, while the Seba drawings represent *sanguisuga* Lamarck. This observation justifies the statement of Deshayes and Milne-Edwards (above) that the synonymy of *sanguisuga* Linné embraced both species here considered.

A difference of opinion, however, still existed for many years, although it is now almost universally conceded that the Lamarckian treatment of the two species was based on error. Reeve (1843-1878, vol. 2, *Mitra*, pl. 14, sp. 99) repeats the error. The above figure, designated in the text as *sanguisuga* Lamarck, accurately shows the shell with the longitudinal lines of red spots, but Reeve placed *sanguisuga* Linné in its synonymy and added in his text: "A well-known species of which the *Mitra stigmataria* might be considered a variety differing in having merely one or two spots of blood-red col-

ouring on each rib." His figure of *stigmataria* Lamarck, on the other hand (*tom. cit.*, pl. 3, sp. 15), while it is a graphic representation of that shell, is referred only to Lamarck, 1822, without any reference to Linnaeus.

George B. Sowerby (1847–1887, vol. 4, *Mitra*, p. 29, pl. 235, figs. 47–49) listed *sanguisuga* and *stigmataria* as distinct species. No description was supplied for *stigmataria*, but *sanguisuga* was described as "smaller, with ribs and colouring less defined than in *stigmataria*." Although the phrase "less defined" is equivocal, I interpret the quotation as saying that he agreed with Lamarck rather than with the modern identification. His figures of *stigmataria*, however, show the two spiral bands of red spots. His figures of "*sanguisuga*" are less clear. Two apparently show *sanguisuga* Lamarck and one shows *sanguisuga* Linné (*stigmataria* Lamarck). His treatment of the two species is confusing and unsatisfactory.

Tryon (1879–1888, vol. 4, *Mitra*, p. 165, pl. 48, figs. 393–395 for *sanguisuga* Linné and figs. 396–397 for *stigmataria* Lamarck) uses *stigmataria* as a variety of the Linnaean species.

Dautzenberg and Fischer (1905, pp. 386–387) corrected the erroneous impression left by the equivocal comments and figures of Sowerby and Tryon, in that, while they did not describe *stigmataria*, they threw it into the synonymy of *sanguisuga* Linné.

Dautzenberg and Bouge (1922, pp. 182–187) were more explicit and finally crystallized the opinion now held by conchologists as to the identification and relationship of the names here discussed, saying that Lamarck had misinterpreted the Linnaean description, "as he reserved the name for the shell whose longitudinal ribs are decorated from one end to the other with red granules and in creating a new name, *M. stigmataria*, for those which only show two transverse rows of distant red spots on the body whorl."

The latter authors reiterated the same view in 1933 (pp. 188–189): "Hanley remarked that the terms of the Linnaean description . . . prove that the typical color pattern of *M. sanguisuga* is incontestably that to which Lamarck gave the name *stigmataria*, which is then a synonym and does not represent a variety as Tryon thought."

Inasmuch as the evidence for the opinion expressed by Dautzenberg and his collaborators, and earlier by Deshayes and Hanley, is incontrovertible, as the diagnosis of *sanguisuga* Lamarck is not responsive to the Linnaean description, while that of *stigmataria* is eminently so, it is necessary to restrict the name *sanguisuga* to the shell called *stigmataria* by Lamarck and to throw the latter name into its synonymy. It is also necessary to employ another name for Lamarck's *sanguisuga*, the shell with the longitudinal ribs thickly studded with red granules. In the 1922 paper of Dautzenberg and Bouge (pp. 184–185) such a name (*transposita*) was proposed, for what they considered to be a new variety of *sanguisuga* Linné. While I do not agree that *transposita* (*sanguisuga* Lamarck) has any specific relationship to Linnaeus' *sanguisuga*, even as a variety, it is clear from the comments of Dautzenberg and Bouge and from their synonymy that they realized that their new name referred to the misnamed *sanguisuga* Lamarck. They list four other names which they properly call varieties of *sanguisuga* Linné: *caerulescens*, new variety, a form with a bluish white base color with black dashes in the interspaces of the spiral striae, rendering the two bands of red spots less apparent; var. *granosa* (Chemnitz) Gmelin, 1791, which lacks the red spots and has a bluish or brownish base color and a narrow white band near the suture; *albida*, new variety, an almost entirely white shell, the only color being a brown tinting of the base and the apex of the spire; and *castaneosticta*, new variety, distinguished by wider and more distant longitudinal ribs, the spiral striae being separated by orange-colored grooves and the two spiral series of spots being dark brown instead of red.

The best figures of *sanguisuga* Linné and *transposita* Dautzenberg and Bouge are those of Reeve referred to above. The only pertinent figure in the "Tableau encyclopédique" is figure 2 on plate 373 (1798). This is called in the "Liste" *sanguisuga* Lamarck. It is a poor figure showing details of both species.

Both *sanguisuga* and *transposita* belong in the genus *Scabricula* Swainson, 1840.

Neither form is described in the "Museum Ulricaе," nor is a specimen of either found in the Linnaean collection in London.

The most exhaustive treatment of this complex is contained in a later work by Dautzenberg (1935, pp. 142-148) to which the reader is referred for complete synonymies and descriptions of all the named forms of both species.

Voluta caffra

1758, *Systema naturae*, ed. 10, p. 732, no. 363.

1767, *Systema naturae*, ed. 12, p. 1192, no. 420.

LOCALITY: Not given in 1758; "in O. Asiatico" (1767).

"V. testa emarginata fusiformi tereti laevi: spirae anfractibus plicato-striatis columella subquadriplicata . . . Variat colore atro, violaceo, flavo, fasciis albidis cincto. Variat etiam ventre subplicato, obsoleto."

The description in the tenth edition, "V. testa fusiformi laevi," unaccompanied by any subdescription or any locality would have made a specific determination of this species impossible. The sole reference, however (Gualtieri, pl. 53, fig. E), was probably designed for the *caffra* of all authors, and the expanded description of the twelfth edition, the statement of a correct locality, the repetition of the Gualtieri figure,¹ and an added reference to two figures from Seba (vol. 3, pl. 49, figs. 21-22) add a perhaps unnecessary confirmation.

This is a variable species in both color pattern and sculpture, as Linnaeus fully realized and stated in his subdescription. Most specimens of what we may call the typical form are of a dark chocolate color, with revolving bands on the body whorl which vary in width, in color from white to orange-yellow, and in number from one to three, the upper band being situated close to the suture. There is one such band on each whorl of the spire. A less common form has a much lighter base color, which is probably the color form "violaceo" of Linnaeus. The spire, with the exception of the last whorl, is strongly longitudinally ribbed, as well as being shallowly striate transversely, the remainder of the shell being typically smooth. However, this sculpture often extends over the last whorl of the spire, in which case it usually invades the upper part of the body whorl and at times extends almost to the base before becoming ob-

¹ In the twelfth edition the Gualtieri reference was misprinted as figure "2" instead of "E." There is no figure 2 on plate 53.

solete. The base is deeply striate, the striated area sometimes, in unribbed specimens, covering almost one-half of the shell. A form with a yellow base color and white bands is occasionally seen. This form is usually ribbed all over and has a much thickened lip. All specimens of *caffra* that the writer has examined were collected in the Moluccas and the Philippine island of Ticao; the latter locality seems to be its center of distribution. Both Reeve and Hanley give Ticao as sole locality.

The variability of the shell has produced at least one instance of confusion. Tryon (1879-1888, vol. 4, p. 167, pl. 49, fig. 409, pl. 50, fig. 424) said, "This species approaches so nearly to some forms of *T. vulpecula* that their specific identity is not improbable." Linnaeus' *vulpecula* would seem to be distinguished by two fairly constant features: its longitudinal ribs, even in the comparatively smooth forms of the shell, are wider and much more obtuse than those in *caffra*, and a slight callus, stained a dark brown, is present in the angle between the posterior end of the columella and the lip.² (But see discussion of *V. vulpecula*, below.)

Deshayes and Milne-Edwards (1835-1845, vol. 10, pp. 318-319, footnote) believed that the next species (*Voluta morio*) was identical with *caffra*, as Linnaeus had cited the same figures from Seba for both. It seems that a much more cogent reason would have been the similarity of the descriptions, which Linnaeus, however, apparently differentiated to his own satisfaction, as the citation of the same figures might have been a misprint or error of transcription. Linnaeus obviously believed the two species to be distinct, as he not only listed them separately but said that *morio* had only three columellar plaits. That differentiation has little weight, as *caffra* is stated to be only "subquadrilatera," and in fact the lowest plait is extremely small and sometimes lacking. Thus it is possible that Linnaeus based his two descriptions on speci-

² It might be mentioned in this connection that Cuming, who collected both *caffra* and *vulpecula* in the Philippine Islands, reports the same habitat for both: "found under stones and on mud-banks at low water," adding, for *caffra*, "and in sandy mud at the depth of six fathoms." (Reeve, 1843-1878, vol. 2, *Mitra*, pl. 3, sp. 20, pl. 8, sp. 55.)

mens of *caffra* that differed only in this respect and in other slight details covered in the long subdescription of *morio*. This question is further discussed where the description of *morio* is analyzed below.

Voluta caffra Linné belongs in the genus *Vexillum* Röding, 1798. *Vexillum bifasciatum* (Swainson), 1840, and *V. zonalis* Quoy and Gaimard, 1832,¹ are synonyms. Tryon (*loc. cit.*) treated *zonalis* as a synonym, while Deshayes and Milne-Edwards (*tom. cit.*, p. 319) placed it in the synonymy of *caffra* as a variety, with a query.

The earliest figures of *caffra* are those of Chemnitz (1780–1795, vol. 4, pl. 148, figs. 1369–1370), which reproduce correctly all the features of the smooth form of the shell. It is also figured in the "Tableau encyclopédique" (1798, pl. 373, fig. 4) and by Reeve (1843–1878, vol. 2, *Mitra*, pl. 3, sp. 20).

The description of *caffra* in the "Museum Ulricae" points to the smooth form of the shell, in which the longitudinal plications appear only on the spire, do not extend beyond the penultimate whorl, and do not appear on the body whorl. There is no mention of color variation, the shell being described as "brown, with two narrow white revolving bands." The two specimens in the collection are of the typical form described. The description adds that the shell "has the appearance of *V. plicaria* and *V. vulpecula*, without angles [? angular ribs] or striae, but is larger." Apparently by the time that the twelfth edition was published in 1767, Linnaeus had concluded that *plicaria* was too strongly sculptured to be compared even with the ribbed form of *caffra*, although he there continued to compare this species with *vulpecula*.

A specimen of *Voluta caffra* is found in the Linnaean collection in London and uniquely conforms to Linnaeus' description.

Voluta morio

1767, *Systema naturae*, ed. 12, p. 1193, no. 421.

LOCALITY: Not given.

"V. testa submarginata fusiformi tereti laevi, columella triplicata . . . Simillima *V. caffrae*, ut nota una nequeant non et altera dignosci: haec colore eodem fusco, ventre subtus cincto unica

¹ While Quoy and Gaimard do not mention *caffra* in connection with their *zonalis*, their description (1832, pp. 654–655) indicates *caffra*, as do their figures (pl. 45 bis, figs. 16–17).

linea alba, qua etiam destituuntur Spirae anfractus. Corpus testae duplo crassius, nec spira striatum. Columella absque omni labio interiore et dentibus s. plicis tantum 3, iisque parvis."

This species has not only not been identified, but the great majority of conchologists have not even mentioned it, and no convincing suggestions as to its identity have been advanced. The reasonably detailed description, together with the fact that Linnaeus gave the name of the collector of the shell, his friend Spengler, strongly suggests that he had a specimen of something before him when he wrote the description. It is therefore surprising that no locality for the species was available. It is even more curious that Chemnitz, who knew Spengler and often availed himself of the specimens in the latter's collection, should not have mentioned it. It does not appear on the twelfth-edition list of Linnaeus' owned species, and there is nothing marked for it in his collection and nothing that conforms to the description. We must infer that it was borrowed.

Deshayes and Milne-Edwards (1835–1845, vol. 10, p. 318–320, footnote to *Mitra caffra*) "conjectured" ("Il est à présumer") that *morio* was only a variety of *caffra*, basing their conclusion on the fact that Linnaeus cited the same figures from Seba (vol. 3, pl. 49, figs. 21–22) for both species. This is not, of course, conclusive evidence. In the first place, the citation of these figures for *morio* was obviously either a misprint or represents the use of figures that were the nearest approximations to his specimen that Linnaeus could find. Second, Linnaeus did not cite for *morio* the entire synonymy of *caffra* but omitted the Gualtieri figure (pl. 53, fig. E, misprinted as fig. "2" in the twelfth edition). In any case it is certain that Linnaeus was convinced that the two names represented different species. Deshayes and Milne-Edwards then (*loc. cit.*) weakened their own theory by noting that Linnaeus gave the columella of *morio* only three plaits, "and these are small," in contrast to the four plaits of *caffra*. This suggestion may, however, be answered if we remember that the lowest plait in *caffra* is much less strongly developed than the upper three plaits and is sometimes lacking, although "iisque parvis," as presumably applied to all the plaits of *morio*, is not appropriate for

caffra. The upper plaits of the latter, in all the specimens examined, are as strongly developed as in most species of *Mitra* described in the "Systema."

The Linnaean subdescription is in rather unnecessarily complicated Latin, but freely translated reads: "Very similar to *Volva caffra*, so that one being known the other also is inevitably identified." We must assume that the words "duplo crassius" meant "twice as thick," although Hanley was puzzled by the phrase. He said (1855, p. 229): "If I might dare to understand the 'Corpus testae duplo crassius' as 'the body whorl twice as broad as in the other,' I could almost fancy the *Turbinella leucozonalis* of Lamarck to have been intended." As Linnaeus did not own a specimen of *morio*, the name not being present on either of his lists of "owned" species, the specimen of *leucozonalis* that is present in his collection need not be considered in this connection. Moreover, Hanley's interpretation of the word "crassius" is incorrect. The description contains details that apply to both *morio* and *caffra*. Even the mention of a single white band on the body whorl is not discordant, as such a color pattern is frequently found in *caffra*, although not typically, and, as said above, the difference in the stated number of columellar plaits is more apparent than real.

In the last analysis, however, I cannot find in the definition of *morio* sufficient evidence of the common identity of the two names. Three stated details are definitely repugnant to the characteristics of *caffra*. The spire is said to be not striated. The plaits of the columella are stated to be "small," a distinction not mentioned in any of the other Linnaean mitras. Finally, and this is, I suggest, the most significant departure from the description of *caffra*, the shell is "duplo crassius," a phrase that not only materially weakens Deshayes and Milne-Edwards' suggested identity, but almost convinces us that the shell before Linnaeus was not even a *Mitra*. The name should be dropped as undefined.

Volva vulpecula

1758, *Systema naturae*, ed. 10, p. 732, no. 365.

1767, *Systema naturae*, ed. 12, p. 1193, no. 422.

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

"V. testa emarginata fusiformi subangulata inermi transversim striata, columella quadriplacata, fauce striata."

The description of *vulpecula* in the tenth edition was even less detailed than the above description of 1767. In addition to the omission of the word "emarginata," it did not contain the last two phrases relating to the columella and the ridges in the aperture. The species was, however, considered by Hanley to have been pictorially defined in the tenth edition by the barely recognizable figures of the *vulpecula* of authors from Rumphius (pl. 29, fig. R) and from Gualtieri (pl. 54, figs. B, C). The two figures added in the twelfth edition are not helpful. The figure from Petiver (pl. 56, fig. 1) was probably designed for *Volva plicaria* (the next species) and may have been improperly transferred to *vulpecula*.

A specimen of this species was owned by Linnaeus, as it appears on the list of the species in his collection, and an unmarked specimen of the *vulpecula* of authors is present in his collection in London, which may with the usual reservations be taken for the "ostensible" type. Hanley (1855, pp. 229-230) considered that this specimen was the only one in the collection that agreed with the description. With such generalized language as that in the description of *vulpecula*, which omits important features and contains equivocal phrases, it is idle to talk of agreement. The two specimens in London, however, although worn, are typical of the form with ribs reaching almost to the base.

The description of *vulpecula* is unsatisfactory and confusing, as are the descriptions of most of its congeners in the "Systema." It is, of course, difficult to describe succinctly species which are so variable both in sculpture and color pattern as most of the mitras of Linnaeus, as any description must of necessity be of a specimen rather than of a species. For *vulpecula*, however, Linnaeus did not even properly describe his specimen. All forms of *vulpecula* have longitudinal ribs of greater or less strength and extent, particularly on the spire. These are not referred to unless we accept the equivocal term "subangulata" as pertaining to the ribs, although that word was probably used to describe the angulation of the entire shell at the periphery of each whorl, which in this species is extremely slight. The phrase "transversim striata" is, however, used, wrongly emphasizing a supposed dominance, which does not

exist, of the spiral over the longitudinal sculpture. The word "inermi," which Linnaeus ordinarily used to describe a lack of armature in the aperture or the lack of spines or denticles at the shoulder of the whorls, is completely redundant here, as none of the Linnaean mitras is so "armed" with the exception of *papalis*, and in that species there is no mention of the coronation. If by "inermi" and "subangulata" he was referring to the slight angulation of the shell, he was guilty of redundancy. The phrase "fauce striata" is descriptive of the series of parallel ridges in the aperture, well removed from the edge of the lip. This is characteristic of the majority of specimens of *vulpecula* but is not a constant feature.

If we are to accept the *vulpecula* of authors as the Linnaean species, it must be on the basis that the defects of the description are cured by the fairly recognizable figures cited in the tenth edition and the probability that the specimen in the collection is Linnaeus' type specimen.

The color variations of this species are numerous and deceptive. Most forms are banded in chocolate brown, yellow, and white in various combinations and with varying widths of bands. Sometimes the brown bands are lacking, the shell being of a yellow base color with only white bands. Melanistic forms occur which are entirely dark brown except for occasional individuals with lighter color in the suture. The longitudinal ribs on the body whorl also vary in length and strength but are always wide and obtuse, thus distinguishing the species from the next (*Voluta plicaria*), the ribs of which are markedly narrower and more angulated. In most forms they extend only a short way over the shoulder but in many specimens extend to the base of the shell. The species might sometimes be confused with *Mitra vittata* Swainson, 1841, most specimens of which are, however, distinguishable by the narrow black lines bordering the bands of color.

In the discussion of *Voluta caffra* (p. 112, above) there was pointed out a feature of *vulpecula* that Reeve used to distinguish this species from *caffra*, namely, a "black stain on the body whorl where the outer lip joins with the columella." Reeve (1843-1878, vol. 2, *Mitra*, pl. 8, sp. 55) used this feature as a diagnostic guide. It is apparent that he had

not examined a sufficient series of specimens. The brown, not black, stain in *vulpecula* is not a constant feature. It is often overlain by a further deposition of white callus which partially, and in many specimens entirely, hides the brown stain. It is curious that in the dark forms of this species the whitening of the callus is particularly noticeable. Moreover, in many cases the lighter and more brilliantly colored shells show a white or brown and white callus. The callus is present in all forms but is not a diagnostic feature, as it is seen in several other species of *Mitra*, notably in *M. sanguisuga* and *caffra* Linné.

George B. Sowerby (1847-1887, vol. 4, *Mitra*, p. 30, pl. 369, fig. 123) described a dark brown, strongly ribbed form of *vulpecula* as *Mitra umbrosa*, saying, "The colouring of this shell is dark, rich, burnt brown, ribs more defined than in *M. vulpecula*, raised into tubercles at the angles of the whorls." This elicited the following comment from Tryon (1879-1888, vol. 4, *Mitra*, p. 167), a comment with which I entirely agree: "I might make several equally good species out of the series of *vulpecula* before me."

Voluta vulpecula is figured by Reeve (1843-1878, vol. 2, *Mitra*, pl. 8, sp. 55), in the "Tableau encyclopédique" (1798, pl. 373, fig. 2), by Kiener (1834-1850, vol. 3, pl. 21, fig. 65), and by Sowerby (1847-1887, vol. 4, *Mitra*, pl. 353, figs. 10-14).

The description of *vulpecula* in the "Museum Ulricae," the longest description of any of the mitras in that work, is much more detailed than the "Systema" description and corrects many of its confusing phrases. It is to be noted that the words "sulci longitudinales profundiores, ut angulos efforment" indicate that his model was an extremely heavily and angularly ribbed specimen, whereas the type on which the "Systema" description was based was a comparatively smooth shell, so smooth, in fact, that Linnaeus apparently saw no necessity of mentioning the longitudinal ribs, even those on the spire. The specimen now labeled *vulpecula* in the Uppsala collection does not entirely conform to the description in the "Museum Ulricae," as, while it is heavily ribbed, the ribs are rounded and cannot be termed angular. The phrase "anfractibus saepe octo" is misleading as applied to the spire, if not incorrect. The spire of *vulpecula* always has

at least eight whorls, and in most specimens that are not decollate nine can be counted. In this description Linnaeus has again confused the meaning of "anterior" and "posterior." Of the inner lip he said: "antice codunatum [*sic*] cum exteriore" when he should have said "postice." He could not have meant the anterior end of the shell, as the base is emarginate, as he himself states. Of the plaits on the columella he said: "anterioribus majoribus," whereas in all Linnaean mitras the plaits increase in size posteriorly.

Voluta vulpecula Linné belongs in the genus *Vexillum* Röding, 1798.

Voluta plicaria

1758, *Systema naturae*, ed. 10, p. 732, no. 366.

1767, *Systema naturae*, ed. 12, p. 1193, no. 423.

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

"V. testa emarginata fusiformi angulata, angulis anticis subspinosi, columella quadriplicata, labro laevi."

The description in the tenth edition was much shorter and omitted several important characteristics. It read: "Testa fusiformi angulata, angulis anticis subspinosi."

The phrase "angulis anticis subspinosi" in both editions is confusing in two respects. First, Linnaeus has again reversed the meaning of the words "anterior" and "posterior," as he was undoubtedly referring in that phrase to the blunt nodes where the longitudinal ribs cross the shoulder of the shell and for which the word "posticis" should have been used. Second, not only is "angulis" too emphatic a word to describe these sculptural features, but "subspinosi" is even more inapt. I have not seen even fresh specimens to which any variation of the word "spinose" could be applied. A less important defect is the omission of any reference to the striated aperture, as the striations are less obvious than in the preceding species (*Voluta vulpecula*) and might have been overlooked in the specimen on which the description was based. Hanley (1855, p. 230) commented on the words "labro laevi" as follows: "The 'labro laevi' must not be understood as equivalent to 'labro intus laevi'; it is merely put antithetically to the 'labro denticulato' of the succeeding species, the edge of whose lip has a toothed appearance." This suggests

that Hanley had detected the faint striations in the aperture which I cannot find that any previous writer had mentioned.

The description, however, correctly describes the *plicaria* of all authors, and the defects pointed out are either explainable or involve a mere choice of words.

The synonymy is acceptable, as all the figures cited clearly represent *plicaria* with the exception of the figure from Rumphius (pl. 29, fig. S) which is obviously based on another *Mitra*, although some of its characters recall *plicaria*.¹

This is one of the most easily distinguishable of the Linnaean mitras. It is not only one of the least attenuated of the fusiform species, that is to say, one of the most tumid in proportion to its height, but its color pattern is generally constant in the presence of a continuous brown band edged with a narrower, darker band around the middle of the body whorl, and a narrow brown band above and below, which is interrupted by the very salient longitudinal ribs. Occasionally there are two interrupted bands above, and in some specimens the lower band is lacking. One interrupted band appears on the whorls of the spire. The shoulder of each whorl is constantly nodose.

There were no changes in the specific name of *plicaria* until Reeve in 1844 (1843-1878, vol. 2, *Mitra*, pl. 8, sp. 56) reverted to the name *plicata* which had been used by the pre-Linnaean writers Rumphius (1705, p. 28) and Klein (1753, p. 74, pl. 5, fig. 87). Reeve defended this unfortunate choice by specious reasoning, saying, "it is not usual to allow any priority in name beyond that of Linnaeus . . . I retain, however, the more ancient termination in this instance because it is better Latin and ought never to have been changed." George Sowerby (1847-1887, vol. 4, *Mitra*, p. 30) and Tryon (1879-1888, vol. 4, *Mitra*, p. 167) were the most important writers who adopted Reeve's name, Tryon incorrectly saying that Lamarck had used it, but

¹ Lamarck (1822b, p. 308) cited the Rumphius figure for his *Mitra corrugata*, and this identification of the figure seems sound. *Mitra corrugata* is a variable species both in color pattern and in the number and proximity of the ribs. The differences between Lamarck's description and the figure are therefore probably not significant.

all writers since their day have reverted to the Linnaean specific name. Dautzenberg and Bouge (1922, pp. 180–181), after referring to the earlier error, rather nostalgically said: "The use of the name *plicata* in place of *plicaria* cannot be admitted because of the decision of the Zoological Congress, which has fixed the tenth edition of the *Systema naturae* as the beginning of binomial nomenclature. While regretting this decision we do not think that it is opportune to revert to the name *plicata*, erected by Rumphius and not by Klein, as several authors have said. Tryon committed an error in saying that the name *plicata* had been adopted by Lamarck, for that author wrote *plicaria* in his work on the animaux sans vertèbres and did not even cite *plicata* in its synonymy."

Good figures of this species are numerous. The best is the figure in Reeve, cited above, although the Chemnitz figures (1780–1795, vol. 4, pl. 148, figs. 1362–1363) are almost as well executed and characteristic as the modern colored drawings of the shell. The figure in the "Tableau encyclopédique" (1798, pl. 373, fig. 6) is characteristic.

The species belongs in the genus *Vexillum* Röding, 1798, and, as *Vexillum plicatum* Röding, is the type species, by subsequent designation, Woodring, 1928.

The description in the "Museum Ulricae" clearly refers to the same species and fills in the gaps in the "Systema" description by a comparison with *V. vulpecula* and a note on the color pattern, "albidus fascia livida et cingulis fuscis interruptis." The specimen labeled *plicaria* in the collection at Uppsala is a good and typical example of that shell, although the color pattern is of a form that is unusual, having two solid bands around the body whorl instead of one.

A specimen of *plicaria* is still preserved in the Linnaean collection in London.

Voluta pertusa

1758, *Systema naturae*, ed. 10, p. 732, no. 367.

1767, *Systema naturae*, ed. 12, p. 1193, no. 424.

LOCALITY: Not given in either edition.

"*V. testa emarginata fusiformi striata punctis pertusis, labro denticulato, columella quintuplicata.*"

It is not possible to identify this species with certainty. The details of the description

might be used to describe two distinct species, *Mitra cardinalis* Gmelin, 1791, and *Mitra digitalis* (Dillwyn), 1817, and both identifications have been proposed from time to time. There are, however, inconsistencies in applying the Linnaean name to either. Before the Linnaean description and its application to either species is analyzed, each species is here redescribed and its history traced.

Mitra cardinalis: This name first appeared as *Pileus cardinaliteus* in the third volume of Seba (1758, pl. 50, figs. 50–51). Chemnitz, in 1780 (1780–1795, vol. 4, p. 203, pl. 147, figs. 1358–1359) adopted this name and a vernacular name "cardinal's hat." He gave numerous references from pre-Linnaean and contemporary writers and specifically referred to *Voluta pertusa* Linné in both the tenth and twelfth editions of the "Systema" and in the "Museum Ulricae." Gmelin (1791, p. 3458) used the name *Voluta cardinalis*, which was the first use of that spelling of the specific name and the first valid proposal of the species. Lamarck (1811b, p. 199) moved the species to *Mitra*. The name is often credited to Gronovius, 1781, notably by Kuster in 1841 in Martini and Chemnitz (1837–1907, vol. 5, pt. 2, pl. 7, figs. 3–4) and by Reeve in 1844 (1843–1879, vol. 2, *Mitra*, pl. 4, sp. 26). Gronovius, however, listed the species polynomially.¹

The species is fusiform, with a markedly swollen body whorl and a short, extremely acute and somewhat concave spire of seven whorls. The spire has very shallow, impressed striae which are closely punctate. The punctate striae are clearly seen on the upper quarter of the body whorl and at the base but tend to be obsolescent and scarcely visible on the remainder of the shell except with the aid of a lens. The columella has five plaits and in addition a faint inferior ridge which is almost vertical, and the lip is provided with short

¹ Gronovius' "Zoophylacium Gronovianum" appeared in three fascicules. (See Bibliography.) The completed work contained an index of specific names contained in all three fascicules, the work of Meuschen. By Opinion 89 the Commission ruled that the 1763 fascicule is eliminated from consideration as respects its systematic names, and has now agreed (Hemming, 1950c) that Meuschen's index did not consistently apply the principles of binomial nomenclature and that therefore no new names published therein are available under the Rules.

but sharp denticulations most clearly visible on its inner aspect. The shell is white, decorated with squarish or oblong brick-red spots, arranged rather strictly in spiral rows, and two series of larger asymmetrical blotches which also tend to be arranged spirally, one immediately below the suture and one on the lower third of the shell. Periostracum lacking.

Mitra digitalis: This species was first figured by Seba (1758, vol. 3, pl. 50, fig. 28). Chemnitz in 1788 (1780–1795, vol. 10, p. 169, pl. 151, figs. 1432–1433), without referring to Seba's figure, called it *Voluta digitalis* and supplied an excellent and graphic description and characteristic figures. His only reference was to Favanne's edition of Argenville (1780, vol. 3, pl. 31, fig. D3) and Favanne's "Catalogue raisonné" (p. 181, pl. 4, fig. 869).¹ In the latter work, according to Chemnitz' reference, Favanne called the species "Tiare à Cul de Dé," a vernacular name used by several of the early conchologists, and referred it to *Voluta pertusa Linnaei*, with a very clear description which was quoted by Chemnitz. Gmelin's *Voluta pertusa* var. "γ" (1791, p. 3458) is obviously this species, as he cited merely the Favanne figure. Link's *Voluta pertusa* (1807, p. 127) is also clearly *digitalis*. He listed *pertusa* only as "L. G."

¹ The "Catalogue raisonné" credited to Favanne is a work of which the bibliographies seem to be ignorant. It is not listed in the catalogues of the library of the American Museum of Natural History, of the Library of Congress or of the Library of the British Museum (Natural History). It was, however, apparently well known to Chemnitz and other naturalists up to the time of Lamarck as the work of Favanne, as it was frequently cited by them as "Cat. rais. Favanne." Dr. Henry A. Pilsbry (personal communication, 1954) reports that the Academy of Natural Sciences of Philadelphia owns a copy of a work which he presumes is the one referred to. It is an octavo volume published anonymously in 1774 in Paris entitled "Catalogue systématique et raisonné ou description du magnifique cabinet appartenant ci-devant a M. le C. de ***", etc. Par M. de ***."

I quote from Dr. Pilsbry's letter: "The copy in Academy library is numbered GNH 751. At top of title page some former owner had written *Favanne* in a small, neat hand. On account of the low number, I suppose it was acquired about a hundred years ago."

Presumably this work is the one quoted by Chemnitz. Another copy is in the library of the Division of Mollusks of the United States National Museum. It also bears the name "Favanne," handwritten, on its title page.

(Linné-Gmelin) as usual, but his description is unmistakably that of *digitalis*,² the var. "γ" of Gmelin. Lamarck (1811b, p. 198) removed the species to *Mitra* and changed the specific name to the more descriptive *millepora*, citing *digitalis* Chemnitz as a synonym, and including *Voluta pertusa* Linné in the synonymy with a query. The name *digitalis* was resumed by Dillwyn (1817, vol. 1, p. 559) and was the first valid proposal of the name. The Lamarckian *millepora* was, however, adopted by Wood, 1828, Kiener, 1839–1841, and Kuster, 1841, but not by Reeve, who reverted to the earlier name *digitalis* (1843–1878, vol. 2, *Mitra*, pl. 3, sp. 21), throwing *millepora* Lamarck into its synonymy, as well as *pertusa* Linné, the latter with a query. Since that time *digitalis* has been consistently used for the species.³

Mitra digitalis is a much smaller shell than *cardinalis*. It is fusiform, narrower than *cardinalis*, and has one less whorl in the spire. The whorls are strikingly coronate, with blunt, white-tipped nodes. The ground color is a dirty white covered with a thick ochre periostracum relieved by lighter tan blotches, the extent of which is very variable. Where numerous, these blotches tend to be arranged in one or more spiral bands. The entire shell is covered with close-set, revolving, deeply impressed striae which are deeply, punctate, the punctations being more distant than in *cardinalis*. The columella is five-plaited and the outer lip denticulate, although less noticeably so than in *cardinalis*.

In the application of the characteristics of these two species to Linnaeus' description of *pertusa*, the difficulty of identification becomes immediately apparent. Both are emarginate and fusiform. Both have a den-

² Link's description reads: "The whorls are coronated and well set-off (abgesetzt). The spiral striae between the rounded ribs show deep pittings. White with brown nebulosities."

³ *Mitra millepora* Lamarck, 1811, was the first validly proposed name for the species called *digitalis* by Chemnitz. In order to avoid confusion, however, the name *digitalis* is used in the present paper, not only because it is commonly used today, but because the opinions of Hanley, Sowerby, Tryon, and Dautzenberg and Bouge, whose comments on the identification of the species are the most useful, are chosen for discussion below, and these authorities call the species *digitalis*.

ticulate lip and five plaits on the columella. Both may be generally described as being "striata punctis pertusis." Thus they both conform to every detail of the description. They are, however, radically different in appearance, in size, in shape, and in color pattern. Moreover, the difference in the denticulation of the lip, the absence of a periostracum in *cardinalis*, and the over-all, deep striations and deep pittings in *digitalis* as compared to the slight development of these sculptural features in *cardinalis* are not such distinctions as are usually covered by Linnaeus' descriptions. The most important feature of *digitalis*, the marked and contrastingly colored coronation of the whorls, is lacking in *cardinalis* and is not mentioned in the description of *pertusa*.

So far, then, as concerns the description, the diagnosis of *pertusa* gives us no hint of which species Linnaeus intended to describe. The synonymy as well is equivocal, as it presents a mixture of several species. The figure from Gualtieri (pl. 54, fig. H) fails to show the coronation of *digitalis*, although in its color pattern it somewhat resembles it. Hanley (1855, p. 231) suspected it was meant for *Mitra fulva* Swainson, 1829. The figure has been cited for *Mitra nubila* (Gmelin), although that shell has only four plaits on its columella. Gualtieri's figure is so uncertain that I would hesitate to predicate any identification upon it. It may be intended to represent *M. cardinalis* and was, in fact, cited by Lamarck for *M. archiepi-scopalis* (1811b, p. 199) which is now generally conceded to be a synonym of *cardinalis*. Three figures were cited from Seba (vol. 3, pl. 50, figs. 28, 47-48). The first of these is clearly *digitalis*, as figured by Chemnitz, and completely conforms to the description of that shell. The other two were compared by Hanley (*loc. cit.*) with *M. sphaerulata* Reeve, 1844, a scabrous shell,¹ but figure 47 seems very close to the less punctate *cardinalis*, although it appears somewhat less swollen. Figure 48 is slightly less scabrous than *sphaerulata*. Moreover, *sphaerulata* is a four-plaited shell.

A specimen of *digitalis* is found in the Lin-

¹ This is the *scabricula* of Lamarck, not Linné (see p. 106, above).

naean collection in London, as well as an example of *cardinalis*, and these are the only two specimens that answer to the description of *pertusa*. As the name *pertusa* appears on the list of Linnaeus' owned shells, this is strong, although not conclusive, evidence that one of the two is the type. Indeed Hanley chose *digitalis*, saying (1855, p. 231): "The specimen is a remarkably fine characteristic one, with the spiral punctures most strikingly developed: it agrees most perfectly with the characteristics specified in the twelfth edition of the 'Systema'; and as the presence of *pertusa* in the Linnaean cabinet is expressly declared, I entertain but little doubt of its being the true representative of that doubtful shell." The present writer is unable to share Hanley's almost complete conviction and cannot make a choice between the two species concerned that would not be purely arbitrary. In spite of some bits of contrary evidence in the description and the synonymy, each species presents at least one very strong claim to precedence which the other lacks. In favor of *digitalis* is the use of the phrase "striata punctis pertusis" and the very name Linnaeus gave to the shell.² It is difficult to conceive of his giving that name to *cardinalis*, a shell in which the sparse and shallow striations and almost invisible "punctures" are so much less evident than in *digitalis* or, indeed, than in his other "punctate" shells. In favor of *cardinalis* is the fact that no mention is made by Linnaeus of the very striking coronation of the whorls in *digitalis*. It seems equally incredible that he could have failed to note this distinctive feature if present in his type. It is true that he also failed to mention this feature in *papalis*, the only other coronate species among his mitras, but *papalis* was, for some unexplained reason, not provided with any description of the shell itself. It is suggested that *Voluta pertusa* be necessarily left as a *species dubia*.

Reeve, as stated above, used the name only as a synonym of *digitalis*. George Sowerby

² The fact has already been referred to in these papers that Linnaeus has misused the word "pertusus" which means "bored through" or "perforated." Linnaeus, here as well as elsewhere, uses the word to describe pin-point depressions in the shell which are in no sense perforations.

(1847–1887, vol. 4, *Mitra*) was unable to identify it. He listed *digitalis* "Chemnitz" on page 20 and figured it (pl. 364, fig. 207).¹ In the "Explanation" of the plate he gave as synonyms "*Pertusa* Linn.? *Millepora* Lamarck" and in his Index to *Mitra* he said of *pertusa*: "*pertusa* Lin.? = *digitalis* 264 f. 207," and "*pertusa* Sw. = *cardinalis*. 15 f. 32." He also listed and figured *cardinalis* (p. 3, pl. 354, fig. 32) as of Gronovius, and in the "Explanation" of the latter plate said: "*Pileus cardinalitius* Gmel. [sic]" and "*M. pertusa* Sw. as of Lin." Tryon (1879–1888, vol. 4, *Mitra*) likewise does not list *pertusa* as an identified species, but in his Index to *Mitra* he noted: "*Pertusa* (*Mitra*) Linn. . . = ?*M. digitalis* (Chem.) Dillw." and "*Pertusa* (*Mitra*) Linn.? Dill. Desc. Cat. 558 = *M. cardinalis* Gmel."

Dautzenberg and Bouge (1922, pp. 84–85) cite "*Mitra pertusa* Swainson, Exot. Conch., 1841, non. L." in the synonymy of *cardinalis* "Gronovius." These authors add: "Hanley has demonstrated (*Ipsa* Linn. Conch., p. 231) that it is impossible to interpret *Voluta pertusa* L., as Swainson and other authors did. None of the figures, all of which show different species, cited as references in the 'Systema Naturae,' represent *M. cardinalis*. It is probable that it is a question of (il s'agit de) *M. digitalis* Chemnitz, for that is the only specimen in Linnaeus' collection to which the description applies" (italics mine).²

The synonyms of the two species are here recapitulated: For *digitalis*: *Voluta pertusa* var. "γ" Gmelin, 1791; *Mitra millepora* Lamarck, 1811. For *cardinalis*: *Voluta pertusa* Dillwyn, 1817, not Linné; *Mitra pertusa* Swainson, 1922, not Linné; *Mitra archiepiscopalis* Lamarck, 1811; *Pileus cardinaliteus* (Seba, 1758) Chemnitz, 1780.

The best figures of both species are found in Reeve (1843–1878, vol. 2, *Mitra*, pl. 3, sp.

21 for *digitalis*, pl. 4, sp. 26 for *cardinalis*).

The two species belong in different subgenera of *Mitra* Röding, *cardinalis* falling into the typical subgenus and *digitalis* into *Scabricula* Swainson, 1840, and the section called *Chrysame* by H. and A. Adams in 1853. If *Scabricula* be used as a good genus, as many writers use it, *Chrysame* could be treated as a subgenus.

The description of *pertusa* in the "Museum Ulricae" first copied the twelfth-edition description³ verbatim. The added subdescription is sufficiently interesting to be quoted in full:

"Habitus V. Mitrae, cujus forte sola varietas.

"Differt 1. quod brevior, crassior.

"2. Fasciis longitudinalibus testaceo-fuscescentibus.

"3. Striis exarata transversis ex punctis excavatis, sic etiam *Mitra saepius striata* est."

The second numbered paragraph above is repugnant to the characters of *M. cardinalis*; the third is descriptive of that species. The *pertusa* of the "Museum Ulricae" is also compared to the *Mitra mitra* of the "Systema," as *M. episcopalis* of authors should probably be called owing to the peculiar manner of its listing. *Mitra cardinalis* and *M. mitra* both belong in the typical subgenus of *Mitra* and are closely related species. They are distinguished from each other by the details of two of the numbered paragraphs of the above subdescription. Two points should, however, be noted. First, the paragraph numbered 2, relating to the longitudinal fasciae, is entirely inconsistent with either *cardinalis* or *digitalis* and equally inconsistent with either of the two species *episcopalis* or *papalis* included under the *Mitra mitra* of the "Systema." It is perhaps possible that Linnaeus had before him a specimen in the Queen's collection in which the red spots seemed to him to assume a longitudinal rather than a spiral arrangement. This would be a form quite un-

¹ This plate, through a printer's error, is numbered "353," but the correct number, "364," appears in the "Explanation" of the plate.

² Dautzenberg and Bouge apparently misread Hanley's comments or were unfamiliar with the Linnaean collection. A specimen of *cardinalis* is in the collection and was specifically mentioned by Hanley as being present. That the description of *pertusa*, as far as it goes, covers it has already been shown.

³ It is evident that Linnaeus had drafted the twelfth-edition description of *pertusa*, published in 1767, before the publication of the "Museum Ulricae" (1764). This is one of the rare instances where the twelfth-edition description was used in the "Museum Ulricae." Note, however, that Linnaeus erroneously referred this description to "Syst. Nat. 10. p. 732. no. 367."

familiar to the writer, and the quoted paragraph seems unexplainable. Second, by the phrase "sic etiam *Mitra saepius striata est*" Linnaeus must have been referring to the *papalis* member of the *Mitra mitra* affinity rather than to *episcopalis*, as the latter is consistently devoid of spiral sculpture or "punctures" except near the base and, very faintly, on the upper whorls of the spire. The only figure referred to in the "Museum Ulricae" was the same Gualtieri figure cited in the "Systema." Thus, from the entire diagnosis, I am unable to identify the shell which Linnaeus had before him other than to say that, with the exception of the phrase relating to the longitudinal fasciae, he was describing *cardinalis*.

No further assistance is afforded by an examination of the Queen's collection. The two specimens now labeled for *pertusa* are both *digitalis*. This offers some evidence that Linnaeus' *pertusa* of the "Systema" was in fact *digitalis*. It is far from conclusive evidence, however, as the vicissitudes of the Queen's collection have made the writer skeptical of all the labels, and in any case we know of several instances where the species given the same name in both works were in fact different.

Voluta mitra

1758, *Systema naturae*, ed. 10, p. 732, no. 368 (sp. *episcopalis*) and no. 369 (sp. *papalis*).

1767, *Systema naturae*, ed. 12, p. 1193, no. 425 (sp. *episcopalis* unnumbered); p. 1194, no. 426 (sp. *papalis*).

"V. testa emarginata fusiformi laevi, labro denticulato, columella quintuplicata."

(Subdescription after sp. *papalis*): "Instrumento venenato tangentum et carnes edentem laedit. R."

In addition to the changes made in the description of the two species *episcopalis* and *papalis* between the two editions of the "Systema" and the slight additions to the synonymy of *papalis*, all of which are noted below, the treatment of *Voluta mitra* presents a curious alteration between 1758 and 1767. In 1758 *Voluta mitra* itself was not numbered, but the names *episcopalis* and *papalis* were given individual numbers. This might suggest that *episcopalis* and *papalis* were conceived by Linnaeus to be good species, mem-

bers of an affinity to which he gave the superfluous name *Mitra*, were it not for the fact that "*Mitra*" is printed in the same roman type in which all "species" in the "Systema" are printed, while the other two names are printed in italics, a font that Linnaeus elsewhere reserved for "varieties." In 1767 *Voluta mitra* received a number, 425, as indicating a good species. The names *episcopalis* and *papalis* were treated differently: the first was left without a number; the second was numbered 426, and both were printed in italics. This writer can suggest no explanation for these differences in the manner of listing between the two editions, and it is not possible to state with any assurance just what Linnaeus' conception of these names was. This appears more clearly below where the description in the "Museum Ulricae" is discussed and the specimens in the Queen's collection in Uppsala are noted.

Writers have treated the nomenclature of this group in several different ways. Most of them, at least up to comparatively recent times, have abandoned the name *mitra* as a specific name and treated both *episcopalis* and *papalis* as good species. This was the style of citation adopted by Chemnitz, 1780, Gmelin, 1791, Röding, 1798, Lamarck, 1811, Swainson, 1831, Kiener, 1838, Kuster, 1841, Reeve, 1844, Sowerby, 1880, and Tryon, 1882, to mention only the most important references. Dillwyn, 1817, while he used *episcopalis* and *papalis* as valid specific names, called them varieties of *Voluta mitra* in his two synonymies.

In 1922, Dautzenberg and Bouge, in their paper on the Mitridae of New Caledonia (p. 88) revived the name *Mitra mitra* for the *episcopalis* of authors. They said: "It is disappointing that we cannot retain for this species the name *episcopalis* under which it is so well known, but it is under the name of *Voluta mitra* that it figures in the tenth edition of the *Systema Naturae* and the words *episcopalis* and *papalis* are only written in italics and below the specific name, which obviously means that Linné attributed these two names to varieties of his *Voluta mitra*. This fact is also confirmed in the *Museum Ludovicae Ulricae* where the *M. episcopalis* of authors is written under (est

inscribed) the single name of *V. mitra*.¹ The name *episcopalis* was employed for the first time in a regular manner by Huddesford in the Index to the second edition of Lister, 1770."

Dautzenberg and Bouge then list *Mitra papalis* Petiver as a good species, using as the first two items in its synonymy "*Voluta mitra (papalis)*" as of the tenth edition of the "Systema" and "*Mitra papalis* Petiver 1767." This is a later edition of the "Gazophylacium" of Petiver, 1702-1711, edited by J. Empson, part 9 of which contained the "Aquatilium animalium Amboinae," 1713. Their thesis is that, as in the case of *episcopalis*, the listing of *papalis* in the "Systema" was only as a variety and that the first valid use of the name as applied to a species was that of Petiver's editors, a very questionable conclusion so far as it credits Petiver with the name.

Eleven years later the same authors, in their study of the molluscan fauna of French Oceania (1933, p. 177), adopted a different style of citation. They there listed the two shells as *Mitra mitra-episcopalis* Linné and *Mitra mitra-papalis* Linné, giving as synonyms "*Voluta mitra episcopalis* Linné, 1758" and a similar reference for *papalis*. This can hardly, however, be considered as a complete abandonment of their original theory of citation.

Linnaeus' unusual and inconsistent treatment of the two species creates a problem in nomenclature, no matter which of the several styles is used, not the least of which is the question of how to cite *papalis* in view of his change of emphasis on the two respective names in 1767. No one style of citation is perfect. It seems to the writer, however, that the one that offers the least objection is to

cite the first as *Mitra mitra*, following Dautzenberg and Bouge, 1922, and the second as *Mitra papalis*, crediting the name to Linnaeus, 1758, not to Petiver.

Grant and Gale (1931, p. 634) comment on the question as follows: "Linnaeus appears to have used *Mitra* as a subgenus of *Voluta* with the species *episcopalis* and *papalis*, but the inconsistencies in Linnaeus' treatment of such minor subdivisions have led authors to disregard his minor group names." Opinion 124, which was published (1936) after Grant and Gale's work, settled the question raised by them, in ruling that Linnaeus' "subdivisions of genera" in 1758 are not acceptable as of subgeneric value.

The two species here discussed are so well known and so distinctive in appearance that the question of the style of citation is the only thing that complicates an otherwise uneventful nomenclatural history. They are readily separable in shape, in coloring, and in sculpture. While the spiral striae are more numerous and extensive in *papalis*, *episcopalis* shows this feature to a limited extent, at least in juvenile shells. In the adult stage of *episcopalis* the striae appear only faintly on the upper whorls of the spire, the rest of the shell being smooth. In both the striae are punctate to a variable degree. *Mitra papalis* might be confused, at a casual glance, with *M. pontificalis* Lamarck, 1811. They are, however, distinguished by the following constant differences. *Mitra pontificalis* is a smaller and more slender shell; its spots of color are orange instead of blood-red and some of them tend to be longitudinally oblong rather than spirally oblong as in *papalis*; its denticulate coronation is sharper and more pronounced and the spire generally more turreted; the punctate spiral striae on the body whorl are, in many specimens, much deeper and more numerous than in either *episcopalis* or *papalis*, its range of variability in this respect being very wide, the striae in one not uncommon form being so close and the "punctures" so deep that the shell shows a cancellated sculpture.

Some evidence that Linnaeus considered both *episcopalis* and *papalis* to be varieties of a single species is afforded by the fact that the description in the "Systema" is placed opposite the specific name *mitra* and that no

¹ These authors either have made use of a curious and very equivocal French locution or have misread the diagnosis of *Voluta mitra* in the "Museum Ultricae." That diagnosis is headed "*Voluta mitra*," and the name *episcopalis* is not "written" anywhere in the description. Their comment also implies that the description covers *episcopalis* alone, which is incorrect. The description clearly covers both *episcopalis* and *papalis* by its terms, although neither name is mentioned. The following phrases, "Spira . . . interdum spinosa, interdum non" and "Variat uti dictum spira laevi et denticulata, unde duas formarunt species varii," clearly indicate that both species were included as varieties.

separate main description of the two italicized names is supplied. This follows Linnaeus' almost invariable practice of omitting varietal descriptions, even though the variety may have been given a name. The description of *mitra* in the "Systema," however, is worded so as to cover only the *episcopalis* of authors, and this is, I suggest, the most convincing reason for adopting *mitra* as the specific name of that shell.

The only other necessary comment on the description is as to the short subdescription relating to the alleged poisonous character of *M. papalis*.¹ This is couched in perhaps the most barbarous Latin to be found in the conchological portion of the "Systema." Its curious syntax renders it almost impossible to make a correct literal translation. A rough translation would be: "It injures anyone who touches it and eats its flesh." This is not the earliest reference to the fact that *papalis* was supposed to be poisonous. Hebenstreit, in the "Museum Richterianum" (1743, p. 322), called the species *Buccinum venenatum*. Later Chemnitz (1780-1795, vol. 4, p. 199) described *papalis* not only as having inedible and even poisonous flesh but said that "a little leg," probably meaning a specialized apparatus on the radula, could deliver a poisonous sting sufficient to cause death. Chemnitz (*tom. cit.*, p. 209) attributes the same characteristic to *M. episcopalis*. The writer seriously questions these statements of Linnaeus and his contemporaries. He has not been able to find a single reference to the poisonous character of either species in the work of any subsequent author. When the exhaustive collection of and reference to these common shells are considered, it seems impossible that the fact could have gone unnoted.

In spite of the fact that the description in the "Systema" covers only *episcopalis*, the synonymy under each italicized name is voluminous, and the majority of the cited figures are correct. There are, however, four errors, two of which are mere misprints or errors of transcription. In the reference to

Argenville for *episcopalis* (pl. 12, fig. G) the reference should read "fig. C" in the twelfth edition. In the Regenfuss reference for *episcopalis* (pl. 5, fig. 33) the number "5" was a misprint for "3". The Gualtieri reference for *papalis* (pl. 53, figs. I, L) added the figure "L," which does not show *papalis*, in the twelfth edition. It is indeterminable, although somewhat resembling *M. scabricula* Linné. In the Seba figures for *papalis* (vol. 3, pl. 51, figs. 1-5, 37) figures 1-5 are characteristic of the species. Figure 37 was erroneously included.

The description in the "Museum Ulricae" has already been noted. The specimens labeled for *Voluta mitra* in the Queen's collection at Uppsala are two specimens of *episcopalis*, two of *papalis*, and one of *pontificalis* Lamarck. Linnaeus had apparently considered the last species as belonging to the same entity as the other two, and this union of all three under the single name *mitra* is evidence against the Dautzenberg nomenclature here adopted, that the name *mitra* be considered as solely applicable to the *episcopalis* of authors. That treatment must be considered as a mere "rule-of-thumb" and a compromise answer to an unsolvable riddle.

Both *Mitra mitra* and *Mitra papalis* belong in the typical subgenus of *Mitra* Röding, 1798. The type species is "*Mitra episcopalis* Röding = *Voluta mitra (episcopalis)* L., 1758," by subsequent designation, Winckworth, 1945.

The best figures are found in Reeve (1843-1878, vol. 2, *Mitra*; *M. mitra*, described as *episcopalis*, pl. 1, sp. 5; *M. papalis*, pl. 2, fig. 9).

Voluta musica

1758, *Systema naturae*, ed. 10, p. 733, no. 370.

1767, *Systema naturae*, ed. 12, p. 1194, no. 427.

LOCALITY: "In O. Americae ad Jamaicam, Barbados" (1758, 1767).

"V. testa marginata fusiformi, anfractibus spinis obtusis, columella octoplicata, labro laevi crassiusculo."

The word "marginata" and the final phrase pertaining to the lip were added in the twelfth edition.

Voluta musica enjoys, with *V. ebraea* and *vespertilio* (the two following species), the

¹Owing to the confused manner of arranging the diagnosis of *episcopalis* and *papalis* in the twelfth edition it is impossible to say whether the phrase relating to the poisonous character of the animal relates to both species or to *papalis* alone.

distinction of being the only three species in the *Voluta* of Linnaeus remaining in the genus as now restricted, and even *vespertilio* has been moved to *Aulica* Gray, 1847, in some modern arrangements.

Both the description and the synonymy of *musica* are entirely sufficient to identify it. Strangely enough, however, the description, while it accurately describes the shape and structure of the shell, does not mention the striking feature of its decoration which gave it its specific name. This is one of the most highly descriptive trivial names in the "Systema." It was not invented by Linnaeus, as the species was known as "la musique" or "musica" by several of his predecessors. Thus Argenville used the French form of the name, and Gualtieri spoke of the musical staff and notes with which it is decorated. As to the synonymy, each of the 28 figures cited, though many of them are crude drawings, shows unmistakably this distinctive pattern. Two further figures from the "Museum Olearium" were not seen by the writer. The greatest defect of the synonymy is that the 13 figures from Seba all show a sinistral shell. Moreover, the Seba plate cited (pl. 5) was a misprint or error of transcription for "plate 57." By a manuscript note in his copy of the twelfth edition Linnaeus added a further figure, "List. 805," a fair figure.

The history of the species could be concluded at this point were it not that the variability of its color, color pattern, and, to a less degree, its shape have given rise to a number of other specific or subspecific names. Lamarck's *guiniaca*, *carneolata*, *thiarella*, *laevigata*, and *chlorosina* (all 1811), and Dall's *damula* (1907) all differ only in color pattern, principally in the distinctness with which the musical bars and notes are shown, or even in their absence, in slight variation in shape, and in the relative prominence of the sculpture. *Voluta sulcata* Lamarck is *plicata* Dillwyn, 1817,¹ and probably *poly-*

¹ Deshayes and Milne-Edwards (1835-1845, vol. 10, p. 396, footnote) say of *sulcata* Lamarck: "As all conchologists know, the Mitres are included in the genus *Voluta* Linné and have been retained there by the Linnaean writers. It happens that a shell of the genus *Mitra* was called *Voluta sulcata* by Gmelin and adopted by Dillwyn. This latter author, in order not to repeat the same name in citing the *Voluta sulcata* of Lamarck,

zonalis Kiener (1839-1841), not Lamarck (1811). *Voluta chlorosina* Lamarck may be identical with *V. polypleura* Crosse, 1876. Variety *zona undato nebulosa* Lamarck (1822) and *V. musica elongata* Chemnitz, 1788, may be slight variants of the form *thiarella* Lamarck.

The writer is in accord with the modern view that all these names may be discarded as not having even subspecific value.

Voluta musica is the type species of *Voluta* Linné, by subsequent designation, Montfort, 1810.

The Linnaean collection in London contains a properly marked specimen which may be accepted as Linnaeus' type.

The description in the "Museum Ulricae" adds many clarifying and characteristic de-

which is not a *Mitra* but a true *Voluta*, was obliged to change its name; but it is felt today that there can be at the same time a *Mitra sulcata* for the Gmelin species and a *Voluta sulcata* for that of Lamarck." Thus Dillwyn lists a *Voluta plicata* which he credits to Lamarck's *sulcata* and a *Voluta sulcata* which he credits to Gmelin's *V. sulcata* (1791, p. 3455).

If Deshayes and Milne-Edwards had told the entire story, the real complication in this change of name would have appeared. Gmelin used the name *Voluta sulcata* for two different species. The first, on page 3436, is referred to Martini (1769-1777, vol. 2, pl. 43, figs. 440-441). It was called by Martini *Auricula Midae non fimbriata* and *Auricula punctata*, and the same figures were used by Martini for *Voluta solidula* Linné (p. 3437). These figures apparently show *solidula* Linné or possibly *Pupa griselba* Röding. As is pointed out above (p. 61) Röding's *P. griselba* is probably the true *solidula* Linné, while his *P. solidula* is another species, *Voluta flammea* Gmelin. Gmelin's second use of the name *Voluta sulcata* was on page 3455. He referred this "sulcata" only to another "Martini" (error for Chemnitz) figure (vol. 4, pl. 150, fig. 1407). I am unable to identify this second "sulcata" from either Gmelin's description or his figure. The point to be made is that neither of Gmelin's uses of the name *sulcata* can by any possibility be referred to any form of *V. musica* Linné. Dillwyn's *V. sulcata* is referred to Gmelin's *sulcata*, page 3455, and to the unidentifiable Chemnitz figure 1407. His *V. plicata* is referred to Lamarck's *sulcata*, to *V. musica* var. "δ" Gmelin, and to two further Chemnitz figures (1780-1795, vol. 10, pl. 149, figs. 1403-1404), which clearly show the *sulcata* form of *V. musica*. This question is here discussed in some detail in order to show that Deshayes and Milne-Edwards, when they speak of a shell "called *Voluta sulcata* by Gmelin and adopted by Dillwyn," might confuse the reader who has not investigated the various descriptions and figures, particularly the existence of the two Gmelin species called *sulcata*.

tails, and here Linnaeus amply described the color pattern, saying of it, "ut fasciae referant notas musicales." Two specimens of the shell are found under the proper label in the Queen's collection in Uppsala. While the various forms of the shell are not easily separated, as they intergrade with one another to some extent, the two specimens in Uppsala seem to be (1) the "typical" *musica* and (2) either *carneolata* or *laevigata* Lamarck.

Many good figures of *musica* and its forms are available, but the earliest of the colored drawings (Martini, 1769-1777, vol. 3, pl. 96, figs. 926-931) can hardly be improved upon. Reeve's figures are characteristic (1843-1878, vol. 6, *Voluta*, pl. 8, sp. 18a, b, c, d).

Voluta vespertilio

1758, *Systema naturae*, ed. 10, p. 733, no. 371.

1767, *Systema naturae*, ed. 12, p. 1194, no. 428.

LOCALITY: "In O. utriusque Indiae" (1758, 1767).

"V. testa emarginata fusiformi, anfractibus spinis acutis, columella quadriplicata, labio laevi."

As in the case of the preceding species (*musica*), the word "emarginata" ("marginata" in the case of *musica*) and the last phrase pertaining to the lip were added in the twelfth edition.

The description follows the same plan seen in that of *musica*, but the changes in wording sufficiently distinguish it from that species. Thus, "spinis acutis" occurs in place of "spinis obtusis," "columella quadriplicata" in place of "octoplicata," and "emarginata" instead of "marginata." It is not a very complete description, but its comparison with that of *musica* is instructive. This is another highly descriptive specific name, the shoulder spines, which are generally curved or "hooked" recalling the hooked talons on the feet and wings of the bat (Latin, "vespertilio"). It is strange that Linnaeus did not mention this in his description.

The synonymy embraces several forms of the species which were given rank as good species by Lamarck: *V. pellis-serpentis*, *mitis*, and *serpentina* (all 1811). These names are today given only subspecific rank, if, indeed, they should not be treated as mere forms of the species, although the writer

would be inclined to treat them as subspecies owing to the rather wide variation that they show from the "typical" *vespertilio* not only in shape but in color pattern and in the degree to which the shoulder spines are developed. Kuster, 1841, described a *Voluta lineolata* that is often used as a subspecies of *vespertilio*. I have not seen a specimen of the Kuster form, but from the available figures, it appears much like an immature example of the "typical" *vespertilio*. Deshayes and Milne-Edwards (1835-1845, vol. 10, p. 387, footnote) were the first to insist that these Lamarckian names should be utilized only for "varieties." They said: "Inasmuch as this species [*vespertilio*] is not often found in collections, it is easy to deceive oneself as to the value of its principal varieties; and as they are numerous, it has been necessary to assemble them and study them with care in order to assure oneself of their relationships. It results from our examination that three other species of Lamarck should be united to this one, as varieties: the *pellis serpentis*; . . . the *Voluta mitis*; and finally the *serpentina*. If one has before one a large number of individuals of these different varieties, they are seen to blend into one another through numerous intergradations, while the real specific characters remain constant, those which are found on the spire, the opening at the base, and the number, shape and relative position of the columellar plaits." This seems to be the modern and accepted view, although the present writer would accept them as subspecies with less unwillingness than in the case of the several forms of *musica* (above).

Linnaeus added a manuscript note to the description which is helpful, "Spinae saepius canaliculatae," as well as adding another figure to the synonymy, plate 808 of Lister.

Voluta vespertilio is now contained in the genus *Aulica* Gray, 1847, in most arrangements of the Volutidae.

As is the case with *musica*, the early Martini figures (1769-1777, vol. 3, pl. 97, fig. 936, pl. 98, figs. 937-940) are about as characteristic of several of the forms of *vespertilio* as may be found, although the Reeve figures (1843-1878, vol. 6, *Voluta*, pl. 5, sp. 11a, b, c, d) show better draftsman-ship.

A marked specimen of the species is present in the Linnaean collection in London and may therefore be accepted as Linnaeus' holotype. The description of the shell in the "Museum Ulricaë" is, as usual, more detailed and completely confirms the identification based on the entire diagnosis in the "Systema." The two specimens labeled for the species are *vespertilio*, the typical form of the species.

Voluta ebraea

1758, *Systema naturae*, ed. 10, p. 733, no. 372.

1767, *Systema naturae*, ed. 12, p. 1194, no. 429.

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

"V. testa emarginata fusiformi, anfractibus spinis subacutis, columella plicis quinque validioribus tribusque obsoletis . . . Labrum laevi est."

The word "emarginata" and the sub-description were added in the twelfth edition.

This description is not so satisfactory as that of *musica* and of *vespertilio* (the two preceding species). It differs from the latter only in the use of the word "subacutis" for "acutis" for the spines of the shoulder, a somewhat vaguely stated difference, and in the number of columellar plaits. It is said to have five "strong" plaits ("validioribus") and three that are obsolete. This would almost describe the columella of *musica* in which the eight plaits diminish so markedly in size posteriorly that the upper ones could with reason have been described as "obsolete."¹ The *ebraea* of authors, which has, however, been generally accepted as the shell that Linnaeus described, is markedly different from either *musica* or *vespertilio*. The shoulder spines are thicker and much blunter than those of *vespertilio*, are, moreover, never recurved, and are more prominent than those of *musica*. Its aperture is more capacious than in either of its two congeners mentioned. As to color pattern the "musical staff and notes" of *musica* are lacking and are replaced by a series of wavy

lines, and a series of squarish brown spots is usually seen around the upper third of the body whorl. Many of the early figures of *ebraea*, however, were obviously based on forms of *musica*.

The synonymy is generally poor, as most of the references show *vespertilio*, and two of them were in fact so cited by Linnaeus. The Buonanni figure (pt. 3, pl. 293), although crude, has been often cited for *ebraea* and was probably based on a specimen of this species. The figure from Rumphius (pl. 32, fig. H) is more like *vespertilio*. Five figures from Gualtieri were cited (pl. 28, figs. I, M, G, V, and F); most of these are equivocal. The one certainly identifiable figure is G. This is assuredly *vespertilio* and was cited again for that species by Linnaeus. The Argenville figure (pl. 17, fig. D) is too uncharacteristic of *ebraea* to be accepted, although it has been cited for it. The longitudinal sculpture is shown as much too prominent, and the spines of the last whorl of the spire and the shoulder are somewhat recurved as in *vespertilio*. Eight figures from Seba are cited (vol. 3, pl. 57, figs. 1-6, pl. 64, figs. 5-6). Figures 1, 2, 3, and 6 of plate 57 show *ebraea*. The rest either seem to show *vespertilio* or are too uncharacteristic to be identified. Seba's figure 5 on plate 57 was also cited for *vespertilio* by Linnaeus. The two Seba figures on plate 64 clearly show the *Voluta scapha* of Gmelin [*Aulica nobilis* ("Solander" Humphrey, 1786), a shell so far removed from *ebraea* that an error of transcription would seem to have been involved. By a manuscript note Linnaeus added "List. 809," a correct figure of *ebraea*.

In the last analysis *ebraea* is not well defined either descriptively or pictorially. The locality is also incorrect. It is not found in Asiatic waters. It occurs in the tropical and subtropical parts of the western Atlantic. It has been several times reported from West Africa, though it is not listed by Adanson, and Fischer-Piette and his co-authors (1942, pp. 103-351) do not mention it as having been found in the retained collection of Adanson (see Foreword, p. 53).

There is no specimen of the shell in the Linnaean collection in London, and as it is not described in the "Museum Ulricaë" we are not assisted by the existence of a "pos-

¹ It is apparent that Linnaeus, who did not, so far as is known, own a specimen of *ebraea*, had not even seen any considerable series. In all specimens examined by the present writer the columella always shows five major plaits of approximately equal size on the anterior and median portion, with from five to seven much smaller and more crowded obsolescent plaits above.

sible" type. Any identification of *ebraea* Linné with the *ebraea* of authors must be based on the clairvoyance of the early followers of Linnaeus and on tradition. The most that can be said for the accepted identification is that the figure cited by Buonanni and some of the Seba figures (pl. 57, figs. 1, 2, 3, 6), in all, five figures out of the 16 cited, do conform to the few characters found in the Linnaean description.

Voluta ebraea is retained in the genus *Voluta* Linné as now restricted. It is the type species of *Plejona* Röding, 1798, by subsequent designation, Winckworth, 1945. There is another type designation on which Winckworth (1945, p. 142) comments as follows: "Unfortunately, in 1906, Dall suggested and in 1907 designated, *P. fossilis* R. as the type of *Plejona* by elimination, identifying this species with *Conus spinosus* Linné, 1758. This has not been accepted, as the references for *P. fossilis* represent four species of four different genera and one cannot say definitely which is intended. See R. B. Newton, 1906, and B. Smith, 1907." The present writer agrees that Dall's choice was unfortunate and should not be accepted.

The best figures of the *ebraea* of authors are those of Reeve (1843-1878, vol. 6, *Voluta*, pl. 9, sp. 20a, b) and Maxwell Smith (1942, pl. 2, fig. 15). The earliest figures are those of Martini (1769-1777, vol. 3, pl. 96, figs. 924-925) and are cited because of their excellent portrayal of the color pattern, although the shoulder spines are much exaggerated in size, particularly the last spine on the body whorl.

The name *ebraea* was emended to *hebraea* by Gmelin, and the latter spelling has been widely utilized by writers. The change is indefensible, however, as it does not involve an error of transcription, a *lapsus calami*, or a typographical error, so far as can be determined, and therefore the name *ebraea* should be preserved under the terms of Article 19 of the Rules.

Voluta turbinellus

1758, *Systema naturae*, ed. 10, p. 750, no. 466 (*Murex turbinellus*).

1767, *Systema naturae*, ed. 12, p. 1195, no. 430 (*Voluta turbinellus*).

LOCALITY: "In O. Asiatico, ad Nussaanan" [*sic*] (1758, 1767).

"V. testa integriuscula turbinata spinis conicis erectiusculis: superioribus majoribus, columella quadriplicata."

In the tenth edition (in *Murex*) the description omitted the words "integriuscula" and "erectiusculis" and described the columella as "plicata." It also included the words "testa ecaudata."

The description is adequate to define the species. The only detail that might have been added is a mention of its variability with regard to the plaits on the columella. There are always four principal plaits which generally increase markedly in size posteriorly, but there is often, in fully mature specimens, another small additional plait between the fourth (upper) plait and the one below it. Moreover, in mature individuals, the lowest plait is usually bifid. I have not seen this latter detail pointed out in any of the descriptions of *turbinellus*, although Hanley (1855, p. 234) mentions that "some doubt may exist about the correctness of the term 'quadriplicata.'" He offered no further comment. Abbott (1950a, p. 209) pointed out that the number of plaits varies.

The synonymy is only partly correct. Three of the cited figures unquestionably represent the *turbinellus* of authors (Rumphius, pl. 24, fig. B; Gualtieri, pl. 26, fig. L; and Argenville, 1742, pl. 17, fig. P). The very poor drawing of Buonanni (pt. 3, pl. 373) has some resemblance to this species. Of the Seba figures (vol. 3, pl. 49, figs. 76-77, pl. 60, fig. 8) only the last figure is anything like *turbinellus*. Figure 76 was, with some reason, cited by Lamarck (1822b, p. 106) for *V. capitellum* Linné (the next species in the "Systema") and figure 77 also suggests *capitellum*. Regenfuss' figure (pt. 8, pl. 2, fig. 18), while it has a general resemblance to *turbinellus*, was probably based on a specimen of *Murex hippocastanum* Linné (*Thais hippocastanum*) as Hanley (*loc. cit.*) suggested. All these figures, with the exception of the Seba figures, were also cited in the tenth edition (in *Murex*). It should be noted that in the "Museum Ulricae," which appeared between the dates of the two editions of the "Systema," Linnaeus confined his references to the three unques-

tioned figures (Rumphius, Gualtieri, and Argenville), which indicates that he regarded these as the most authoritative, even though the incorrect or questionable figures were repeated in the twelfth edition as was his almost invariable custom.

In 1798 (p. 56) Röding erected the genus *Vasum* to receive this species and certain of its congeners, and in the dismemberment of the Linnaean *Voluta* this is the earliest valid generic name for the *turbinellus* group. Since the "Museum Boltenianum" came to the renewed attention of conchologists, *Vasum* has been increasingly used. Several selections of type species have been made from time to time, but it is possible that only the indirect designation by Winckworth in 1945 is valid. Winckworth stated (1945, p. 145) that Cossmann in 1901 had designated as type species "*V. turbinellus* Röding = *Voluta turbinellus* Linné 1767 = *Murex turbinellus* Linné 1758." Abbott (1950a, p. 209) fully discussed the "dubious and complex history" of the various designations and redesignated "*V. turbinellus* Röding = *Murex turbinellus* Linné, 1758." As *Vasum* is a neuter noun the name of the species has sometimes been cited as *Vasum turbinellum*, apparently on the incorrect assumption that "turbinellus" is an adjective. It is a noun meaning "a top" or "a little whirlwind" and therefore the correct name of the species is *V. turbinellus*.

One year later Lamarck (1799) erected the genus *Turbinella* with a woefully inadequate description (Dodge, 1947a, p. 64) in which the sculpture was not mentioned and emphasis was placed only on the columellar plaits, which were described as "three to five folds on the columella, unequal in size, narrow and oblique." Lamarck used *Voluta pyrum* Linné as his "example," which thus became the type species, by monotypy. Whether or not he then conceived his genus as embracing the turbinellids is not certain, but in his later work (1822b, pp. 102-110) he included not only the *Xancus* species known to him but all the turbinellids (now *Vasum*) species and added certain species of *Leucozonia*, *Latirus*, and *Peristernia* in this very comprehensive genus. In the case of *turbinellus* Linné, he changed the specific name to *cornigera*, probably be-

cause of his well-known antipathy to tautonymic names, and this name has persisted in the works of many writers, particularly in Europe, and is still in use in many unrevised American collections. With the re-discovery of Röding's *Xancus* and *Vasum* and the consequent break-up of *Turbinella* Lamarck, the latter name is fast disappearing from use. *Volutella* Perry, 1810, *Cynodonta* Schumacher, 1817, and *Scolymus* Swainson, 1835, not Deshayes, 1843, are equal to *Vasum* Röding.¹

The present species is confined to the Indo-Pacific region, as Linnaeus correctly stated.

The Linnaean collection in London contains three specimens labeled in Gothic lettering, apparently by Hanley (see Foreword, p. 7). Hanley mentioned only one specimen in his 1855 work, and the microfilm of the Linnaean collection in London does not disclose whether they bear any documentation by Linnaeus. I cannot therefore say whether or not they represent Linnaeus' paratypes.

The description of *turbinellus* in the "Museum Ulricae" (in *Murex*) copies the tenth-edition description and adds several details confirmatory of the accepted identification. It mentions that the spines are hollow and the larger ones are open on the left side. It refers to the varied black and white color of the shell and to the fact that the spire is low and nodulous. It mentions a white variety with a produced spire. Hanley (*loc. cit.*) said that the white variety "was of course a distinct species." I know of no identification of this variety. It may have been a specimen of *capitellum* with long spines. The specimen now labeled for *turbinellus* in the Queen's collection is the

¹ Dall (1885b, p. 347), who did not, at least at that date, accept the nomenclatural availability of the Röding names in the "Museum Boltenianum," used *Vasum* Link, 1807, as the earliest valid use of the name. Link himself (1807, p. 119), however, credited Röding with the name by placing "(Bolt.)" after it.

Schumacher (1817, p. 73), in his preliminary list of genera, erected the genus *Cynodonta*. On a following page (241) in his elaboration of the genus, he gave the name as *Cynodona*, an obvious *lapsus calami* or misprint, and in the latter place he stated the type species as *Cynodona ceramica*. *Cynodona* is only a subjective synonym of *Vasum*, and therefore *ceramica* cannot be transferred as the type species of *Vasum*.

Vasum turbinellus of authors. The white "variety" is not present.

This species is well figured by Reeve (1843–1878, vol. 4, *Turbinella*, pl. 8, sp. 40, as *Turbonilla cornigera* Lamarck).

Voluta capitellum

1758, *Systema naturae*, ed. 10, p. 751, no. 470 (*Murex capitellum*).

1767, *Systema naturae*, ed. 12, p. 1195, no. 431 (*Voluta capitellum*).

LOCALITY: Not given in 1758; "in O. Indico" (1767).

"V. obovata rugosa nodosa, columella quadriplicata . . . Alba simillima Murici truncato."

The twelfth-edition description quoted above omitted the words "testa ecaudata," as was the case with the preceding species (*turbinellus*). The "tail" in the turbinellids is so inconsiderable as hardly to merit being mentioned. Also, as in the case of *turbinellus*, "plicata" was changed to "quadriplicata." The description, although almost correct so far as it goes, is hardly adequate to define the species, as it omits any reference to the most important sculptural feature, the heaviness of the spiral cords and their apparent dominance over the longitudinal sculpture. The words of the subdescription, "Alba simillima Murici truncato," are not understood. There is no "*Murex truncatus*" in the "*Systema*," and although *capitellum* has a siphonal canal which is moderately short and slightly turned up and to the left at its tip it is not more marked in this respect than the other Linnaean turbinellids. A comparison with those murices that have a short canal is not helpful. The description also errs in calling the columella "quadriplicata." The species always shows three plaits only on the columella, as was recognized by Lamarck (1822a, p. 106) and by Dillwyn (1817, vol. 1, p. 566).

The locality, which was omitted in the tenth edition, was erroneously stated as "the Indian Ocean" in the twelfth. It is purely a western Atlantic species, ranging from Puerto Rico through the Lesser Antilles to the north coast of South America as far west as Colombia. The true locality of the species was, however, recognized by a contemporary of Linnaeus, as Davila, in his "Catalogue systématique" which was pub-

lished in the same year as the twelfth edition of the "*Systema*," called the species "le Rocher blanc de l'Amérique" (1767, p. 163, no. 256). This is amply proved by the clear description he supplied and by the additional fact that Martini (1768–1777, vol. 3, pp. 262–264, pl. 99, figs. 947–948) cited Davila's listing as a reference for his own unquestioned description and classic figures of *capitellum* Linné. Martini, however (*tom. cit.*, p. 264), persisted in using the Linnaean locality, placing it in "the East Indies and Jamaica," and this vagueness as to the locality was not entirely corrected for some time. Dillwyn (*loc. cit.*) used "Indian Ocean and coast of America." Lamarck (*loc. cit.*) said "the Indian Ocean," although with a query, and Deshayes and Milne-Edwards, in their second edition of Lamarck (1835–1845, vol. 9, p. 382), repeated the same queried locality. It is probable that Lamarck had, to some extent, confused this species with the western Atlantic *Voluta muricata* Born, 1780 (*Vasum muricatum*). The latter species was separately described by him, was called *Turbinella pugillaris* without a mention of Born's earlier name, and was given the proper locality, "the ocean of the Antilles." It was, however, referred to the "*Turbinella capitellum*" of the "Tableau encyclopédique" (1798, pl. 431 bis*, fig. 3) which shows an undoubted figure of Born's *muricatum*, although the figure is called *capitellum*, with a query, in the "Liste." Figures 4a and b on the same plate were properly cited by Lamarck in his synonymy of *capitellum* Linné but were there identified as *Turbinella muricata*, and this pair of figures is referred to in the "Liste" as "*Turbinella muricata*. T. *capitellum* Lamk." Deshayes and Milne-Edwards (*tom. cit.*, p. 379) partially cleared up this confusion in a footnote, saying: "A long time before Lamarck, this species [*pugillaris*] had received the name *Voluta muricata* by Born, the description of that author and the figure of Martini to which he referred it leaving no doubt in this respect.¹ It is therefore necessary to rectify the nomenclature by giving to this species its first name

¹ The figures referred to (Martini, *tom. cit.*, p. 265, pl. 99, figs. 949–950) are clearly *muricatum*. Martini extended the range of this species as well, locating it not only in the West Indies at St. Croix but in Madagascar.

of *Turbinella muricata*." Deshayes and Milne-Edwards, as said above, continued to give the locality of the true *capitellum* as "the Indian Ocean." The name *pugillaris* is not used today.

Lamarck's *Turbinella mitis* (*tom. cit.*, p. 106), for which he cited no references but spoke of a specimen in his collection, seems to have been identical with *capitellum* Linné. Reeve (1843-1878, vol. 4, *Turbinella*) listed *mitis* only as a form of *capitellum*, calling it a variety "with scales decumbent."

An undocumented specimen of *capitellum* is present in the Linnaean collection in London. It is accompanied by a label supplied by Hanley (see p. 7, Foreword) cut from a copy of the "Ipsa conchylia Linnaei," and it cannot therefore be established that it represents Linnaeus' type, as it bears no name or number in the latter's handwriting. The description of *capitellum* in the "Museum Ulricae" (in *Murex*) first copied that in the tenth edition and added little of diagnostic importance. It initiated the error of attributing four plaits to the columella, an error that was continued in the twelfth edition. The specimen now labeled *capitellum* in the Queen's collection in Uppsala is the *capitellum* of the "Systema."

In both editions of the "Systema naturae," as well as in the "Museum Ulricae," Linnaeus supplied only a single figure (Argenville, 1742, pl. 18, fig. K) as a synonym for this species. This is a crudely drawn figure, but it has been accepted as representing *capitellum*. With a brief and partially incorrect description, the citation of a single questionable figure, and an incorrect locality, it is not possible to say that the species has been adequately defined by the Linnaean diagnosis. It is suggested that the acceptance of its identification with the *capitellum* of authors by Linnaeus' immediate successors was based as much on its position between the other two turbinellids as on any data in its own diagnosis. Linnaeus, in a manuscript note for his "revised twelfth edition," added as a further reference a figure from Gualtieri (pl. 39, fig. A?). Not only did he query the figure, but it was probably an error of transcription for "plate 37, figure A." The latter is a very fair picture of *capitellum* and has

been often cited for that species, notably by Gmelin (1791, p. 3462), Lamarck (1822b, p. 106), and Dillwyn (1817, vol. 1, p. 566). The present writer has not had an opportunity of examining the Linnaean Society's copy of the twelfth edition in which these manuscript notes are written and therefore is unable to say whether the apparent error was attributable to Linnaeus or Hanley.

The species is now included in the genus *Vasum* Röding, 1798, and the subgenus *Alivasum* Hedley, 1914.

The earliest figures of *capitellum* are those of Martini (1769-1777, vol. 3, pl. 99, figs. 947-948). They are unquestionably based on specimens of the *capitellum* of authors, and the characteristic heavy spiral cords are well brought out. The other early figures are not helpful. The species is well figured by Reeve (1843-1878, vol. 4, *Turbinella*, pl. 5, sp. 30).

Voluta ceramica

1758, *Systema naturae*, ed. 10, p. 751, no. 470 (*Murex ceramicus*).

1767, *Systema naturae*, ed. 12, p. 1195, no. 432 (*Voluta ceramica*).

LOCALITY: "In O. Asiae ad Ceram" (1758, 1767).

"V. testa ovata acuta spinis divergentibus, columella subquinqueplicata . . . Similis V. turbinello, sed elongatus."

The above description from the twelfth edition was altered from that in the tenth (in *Murex*) in the following particulars: the word "eacaudata" was omitted, as it was in the case of the two preceding species (*turbinellus* and *capitellum*); "obovata" was changed to "ovata"; the word "acuta," as applying to the shell itself and not to the spines, was added; and the columella was "subplicata" in the tenth edition and "subquinqueplicata" in the twelfth. The subdescription was also added in the twelfth. The entire description satisfactorily describes the *V. ceramica* of all authors. The species is not particularly variable, the principal variability being in the length and stoutness of the spines on the spire and at the shoulder of the body whorl which may be occasionally short and blunt instead of long and sharp as on the typical shell. It is to be noted that Linnaeus, in the tenth

edition, placed all three of his turbinellids in the same group in *Murex* as *M. nodus*, *hystrix*, *mancinella*, *hippocastanum*, and *melonigena*, under the subgeneric heading "Ecaudati subechinati," probably because he conceived that the greater or less development of the spines in all these species gave them a generic and subgeneric relationship. It might be added that the word "subechinati" is itself hardly emphatic enough to describe either the three turbinellids or certain of the other species mentioned that remained in *Murex*. In the twelfth edition, where the turbinellids were moved to *Voluta*, they were placed under the "subgeneric" heading "fusiformes," Linnaeus apparently feeling that their very slightly fusiform shape was more important in their classification than their prominent spines.

The species is placed in the genus *Vasum* Röding, 1798, as *V. ceramicum*. It may be particularly distinguished from its close congeners *turbinellus* and *capitellum* by its high spire and elongated shape, and this is reflected in the words of the subdescription.

The synonymy in the "Systema" is, with one exception, characteristic of the *ceramicum* of all authors. The following corrections should, however, be made: In the reference to the "Museum Ulricae" in the twelfth edition, which reads "M.L.U. 634. n. 286," not only should the serial number be "308," but Linnaeus erroneously wrote "*Murex capitellum*" after this reference. Next, in the twelfth-edition reference to Buonanni (pt. 3, pl. 368) the plate number was a misprint or an error of transcription for plate 286, as the reference stood in the tenth edition. With these corrections the synonymy is correct, with the possible exception of a questionable figure from Rumphius (pl. 24, fig. A). This is a crude figure which I would hesitate to refer to *ceramicum*, although it was used by several later writers, notably Lamarck (1822b, p. 106).

The locality is correct, although too restricted.

Linnaeus did not, so far as we know, own a specimen of this species. At least it does not appear on his list of owned species, and no specimen of it is found in the Linnaean collection in London. The description in the

"Museum Ulricae" copies that in the tenth edition of the "Systema" and adds the useful phrases "utrinque turbinata," "solida," "spinae subulatae, varie serie multiplici," and "Columella rugis 3 majoribus, vel 2 alternis minoribus." The entire description is a decided improvement over even the later description in the twelfth edition. In particular, the details of the columellar plaits are more helpful than the single word "subquinqueplicata." Dillwyn (1817, vol. 1, p. 568) put this into English in the words "The pillar has three strong, and two intermediate smaller plaits." The specimen now labeled *ceramica* in the Queen's collection in Uppsala is the *ceramicum* of all authors.

Although in the typical subgenus of *Vasum*, its moderately elevated spire suggests a relationship with the subgenus *Aliviasum* Hedley, 1914 (see *V. capitellum*, above). As Abbott points out (1950a, p. 214), however, it is excluded "by its 5 columellar plicae, stoutness of shell, absence of delicate, axial foliations or lamellae in the shell and complete absence of an umbilicus."

It is the type species, by monotypy, of *Cynodona* Schumacher, 1817 (see p. 128, footnote 2, above).

Tryon (1879-1888, vol. 4, p. 72) treated *Turbinella vexillulum* Reeve, 1842 (p. 198), as being based on a very young stage of *Vasum ceramicum* Linné, and *Turbinella armatum* Broderip, 1833, as another stage of the juvenile *ceramicum*. The present writer has not seen specimens labeled either *vexillulum* or *armatum* nor specimens of *ceramicum* in a sufficiently wide growth series to be able to pass on Tryon's opinion.

The first post-Linnaean figure of *ceramica* is that of Martini (1769-1777, vol. 3, pl. 99, fig. 943). It is inaccurate as being slightly distorted in shape, although recognizable for the species for which Martini cited it. Reeve figures it well (1843-1878, vol. 4, *Turbinella*, pl. 9, sp. 46). It is curious that no figure of this well-known shell appears in the "Tableau encyclopédique," although numerous figures existed elsewhere in prior and contemporary works. Lamarck's own synonymy of the species in 1822 contains references to 10 figures, all characteristic representations of the shell with the possible exception of the

Rumphius figure noted above and cited by Linnaeus and also referred to above.

Voluta pyrum

1767, *Systema naturae*, ed. 12, p. 1195, no. 433.

LOCALITY: "In Tranquebar" (1767).

"V. testa obovata subcaudata, spirae anfractibus striatis, apice producto glaberrimo, columella triplicata . . . Testa pyriformis, undulatum striata, pallido-punctato fasciata. Apex cylindricus basi angulatus, glaberrimus, obtusus. Cauda exserta, patula, integra."

This is the sacred Chank Shell of India and Ceylon. It appeared for the first time in the twelfth edition of the "Systema." The description is entirely accurate. It describes both the juvenile and adult forms of the shell but appears to have been based on a juvenile specimen. The two figures cited in the synonymy (Rumphius, pl. 36, fig. 7, and Gualtieri, pl. 46, fig. C) are extremely poor drawings and can hardly be said to define the species pictorially. Hanley (1855, p. 235), however, rather tepidly accepted them, saying: "Although neither of the wretched figures that were quoted in illustration of this shell can be positively pronounced the *Turbinella pyrum* of authors . . . nevertheless the ideal produced by both of them, *when modified by the words of the description* [italics mine] so correspond to the general aspect of the species as to have caused its general recognition as the Linnean *Volute*." This is but another way of saying that it is the description rather than the figures that identifies the species, a statement with which I am in thorough accord.

The treatment of the species by many of the post-Linnaean early writers is complicated by the fact that there was a tendency to consider the juvenile and adult shells as forms of a species or even as different species. The rare sinistral form was also sometimes treated as a distinct species. The young shell is more slenderly pyriform than the adult. Its color pattern consists of several spiral series of roughly quadrangular, brick-red spots on the upper half of the body whorl, the spots being most plentiful on the apertural face of the shell. There are three plaits on the columella, which increase in size posteriorly, with a fourth faintly indicated below in some individuals. The adult shell has the same com-

bination of columellar plaits but is slightly more ventricose, shows a highly developed parietal shield, and the brick-red dots are less frequently seen. The aperture becomes pink in many adult specimens. The most marked difference between the two life stages, however, is the fact that the protoconch is usually eroded in the adult. In the young shell it is usually retained and consists of four nuclear whorls nearly equal in size, the whole protoconch appearing as a deeply sutured cylinder. This is reflected in the words "apice producto" and "Apex cylindricus" in the Linnaean description. It seems probable that all descriptions mentioning this feature were based on young specimens. The species has a heavy dark brown periostracum which completely hides the color pattern when retained.

The details of a number of early treatments of this species are here given to illustrate the confusion into which some of them fell: Martini (1769-1777, vol. 3, pp. 206-210, pl. 95, figs. 916-917) listed a *Pyrum sacrum ponderosissimum* and referred it to the *V. pyrum* of the "Systema." His figure 917 is not sufficiently characteristic to be referred to any particular species. His figure 916 is apparently based on the *Turbinella rapa* of Lamarck, 1822, a related but distinct species. It is a more ponderous and more ventricose shell than *pyrum* and has a shorter basal canal. It can hardly be called pyriform. Martini then described and figured (*tom. cit.*, pp. 211-212, pl. 95, figs. 918-919), as a distinct species, a shell which he called *Pyrum sacrum punctatum*, both the name and description of which, as well as the figure 918, were obviously based on the young, more heavily spotted *pyrum* Linné prior to the development of the parietal shield. This name was referred to "Lin. S. N." without a mention of the name *pyrum*. Thus Martini never described or figured the adult *pyrum* or the sinistral form of the shell.

In 1786 Chemnitz (1780-1795, vol. 9, pp. 37-51, pl. 104, figs. 884-885) described and figured the adult sinistral form of the species, calling it "*Voluta pyrum sinistrorsum pyriformis*. Die Xancus Schnecke." His specimens came from the Spengler collection and his references included figures from Rumphius and Valentyn, but he failed to mention Lin-

naeus or the "Systema." His 13 pages of text on this species are largely taken up with the history of the extensive collection of the shell from earliest times, and he goes into great detail as to the ritual uses to which it is put and the veneration in which the shell, particularly the sinistral form, is held. He then described and figured, as a distinct species (*tom. cit.*, pp. 51-53, pl. 104, figs. 886-887), a shell that he called *Voluta pyrum sinistrorsa, testa obovata . . .*," gave no references except to an obscure museum, the Museum van der Mied, and stated that his specimen came from the Museum Geversianum. His figures show a sinistral shell with a well-developed parietal shield and a color pattern of a ground color of light brown with paler spiral bands embellished with slanting streaks of a much darker brown. The shell is much more fusiform than pyriform and can be said to conform to the word "obovata" in his description, as it has a much higher spire than *pyrum* Linné and a longer basal canal and lacks the rather abrupt constriction of the body whorl as it curves into the tail. In other words, it does not show the typical shape called pyriform. If the figures are not merely the attempt of an incompetent and unobserving artist I have no idea of the shell on which they were based. Later (*op. cit.*, vol. 11, pp. 12-13, pl. 176, figs. 1697-1698) Chemnitz described and figured "*Voluta Pyrum Linnaei, Ponderosa Solandri*" with no reference to Linnaeus or the "Systema" except in the name he gave it. It is described as "pyriformi . . . maculis tigrinis rufescentibus [*sic*] seriatim positis variegata . . . spira producta, apice papillari cylindrico columella triplicata, cauda canaliculata," a description that fits the juvenile shell more closely than the adult, and his figures are clearly of the immature shell (dorsal and apertural aspects). The specimen was dextral.

Gmelin (1791, p. 3463) copied the main description of Linnaeus and supplied a sub-description which is much more ample than that in the "Systema" and seems to include both the juvenile and adult shells. For his references he used a long list of figures, including all the Martini-Chemnitz figures mentioned above, with the exception of 1697-1698, and the two figures cited by Linnaeus. He divided his species into four varieties

which were, based on the Martini-Chemnitz figures he cited for them, respectively, *rapa* Lamarck, the immature dextral *pyrum*, the adult sinistral *pyrum*, and a shell represented by the questionable Chemnitz figures (figs. 886-887). While he did not treat these various forms as good species, he did still follow the earlier error of treating the juvenile shell as a form or variety and apparently did not perceive that it represented merely a life stage.

Röding (1798, p. 134) erected the genus *Xancus*, adopting the name from the vernacular "Xancus," "Sjanco," or "Tsjanko" of many of his predecessors. Of his three "species" the first is called *Xancus pyrum* and is referred to two figures. One is Martini's figure 916 which, as said above, I believe to be based on *Turbinella rapa* Lamarck; the other (Knorr, pt. 6, pl. 39, fig. 1) is a good figure of the dextral adult *pyrum*. Röding's second species, *X. punctatus*, referred to two figures (Martini, vol. 3, pl. 95, fig. 918, and Knorr, pt. 6, pl. 27, fig. 2); both show the juvenile *pyrum*. His third species is called *X. perversum*. For this he cited the Chemnitz figures 884-885 which are traditionally cited for the adult sinistral *pyrum*. He did not cite any figures for the adult dextral shell. While *Xancus* Röding is based on *pyrum* Linné and is the earliest valid name for the group that includes it, it must be admitted that he apparently had no clearer idea than his predecessors had as to the common specific identity of the juvenile and adult shell and the dextral and sinistral forms. Link (1807, p. 116) was the first after Röding to use the generic name *Xancus*, attributing it to "(Bolt.)" (abbreviation for Röding, "Museum Boltenianum."). For his *X. pyrum* he again cited the Martini figure 917 which shows *rapa* Lamarck. For his only other species, *X. maculatus*, he referred to Martini's figure 918 which shows the juvenile *pyrum*, thus treating this stage in its growth as a good species.

Dillwyn (1817, vol. 1, p. 568) united these several shells in a single species, and his treatment is the first accurate and intelligent discussion of the species. He retained *pyrum* in *Voluta*. His numerous references included both adult and juvenile representations of the shell and of the sinistral form, but he

went a step further than his predecessors, as he described the young shell as "Junior" and accurately described it. He also mentioned the Chemnitz figures 886 and 887 as "Variety, with whirls reversed."¹ Dillwyn did not, for some reason, cite the companion pair of Chemnitz figures (884-885) of the adult sinistral form. He made one error in his references, citing two figures from the "Tableau encyclopédique" (pl. 390, figs. 2b, c) which, while they clearly show a *Xancus*, are described in the "Liste" as follows: "The species found on this plate as *Voluta* appear to be *Turbinellas* in the fossil state, very close to *Turbinella scolymus* and *rapa* (vii, p. 102) which are seen again on plate 431, bis, fig. 1 and 2." *Turbinella scolymus* Lamarck is a synonym of the western Atlantic *Xancus angulatus* Solander. Thus both figures on the plate show a species distinct from *pyrum* Linné.

Lamarck (1822b, p. 104), both in his Latin description and in his synonymy, included both the juvenile and adult stages of the shell, but in his French description he pointed out one of the differences between the two in the words "prettily spotted or punctate, especially in young individuals." Thus, like Dillwyn, he was not guilty of the error of the earlier writers, and all later authors have united the several life stages of the shell and the dextral and sinistral forms under the single species *pyrum*.

There is no mention in the "Systema" of the ritual uses to which the shell is put, although many of Linnaeus' predecessors called attention to these uses, which had persisted in India and Ceylon for over 3000 years. They are mentioned in the Indian epics, the Ramayana and Mahabharata, and were even in existence in the old Dravidian civilization, before the Aryan-speaking hordes invaded India by way of the north-west passes. The shell is used today by the priests of several Indian religions as trumpets in religious ceremonies and as sacred vessels for many ritual purposes. Bangles carved from the shell material are widely used by the women of all castes as amulets. Sinistral specimens, which are exceedingly rare, occurring, according to Abbott (1950a, p. 202),

¹ These latter figures, if they show *pyrum* at all, are based on the juvenile sinistral shell.

in only one out of 100,000 specimens, are held in particular veneration, and most of them are found in the temples, the Chank fisheries being, practically speaking, in the hands of the local governments and are zealously protected. The Chank Shell is, in fact, one of the emblems of the god Vishnu. The most exhaustive account of the history of the Chank fisheries and the ritual importance of the shell is by Hornell (1914).

Specimens of *X. pyrum* are present in the Linnaean collection in London, but as the name was not on either of Linnaeus' lists of owned species they have no authority as his types. The shell was not described in the "Museum Ulricaë."

As said above, *pyrum* is included in the genus *Xancus* Röding, 1798, and is the type species, by subsequent designation, Dall, 1906. Synonyms of *Xancus* are: *Turbinella* Lamarck, 1799, *Turbinellus* Lamarck, 1801, *Turbinellarius* Duméril, 1806, *Buccinella* Perry, 1811, *Scolymus* Deshayes, 1843, *Mazza* 'Klein' H. and A. Adams, 1853, and *Turbofusula* Rivereto, 1900. *Scolymus* Deshayes must not be confused with *Scolymus* Swainson, 1835, which is a synonym of *Vasum* Röding.

The species is figured by Reeve (1843-1878, vol. 4, *Turbinella*, pl. 3, sp. 15). An excellent pencil drawing of the juvenile *pyrum* is found in Crouch (1827, pl. 17, fig. 5).

Voluta lapponica

1767, *Systema naturae*, ed. 12, p. 1195, no. 434.
LOCALITY: "In O. Americano" (1767).

"V. testa obovata laevi, spire acuminata, ventre dilatato."

The very brief Linnaean description, while it is entirely characteristic so far as it goes, could hardly, standing alone, have led to an unequivocal identification of the species, as the scant details might well apply to any one of several species. The three figures in the synonymy, however (Rumphius, pl. 37, fig. 3, and Seba, vol. 3, pl. 57, figs. 25-26), are characteristic of the *lapponica* of authors in both shape and color pattern, so that it may be said that the species has been defined pictorially if not descriptively.

The great defect in the description is that there is no mention of the color pattern, which is highly distinctive among the volutes.

It has a cream base color with crowded spiral lines consisting of a series of short brown dashes over the entire body whorl and spire. There are usually two or three interrupted spiral bands of roughly quadrangular tan blotches, although in some specimens these are only faintly seen. The shell has seven, or rarely eight, columellar plaits which become rapidly smaller posteriorly.

The locality is, of course, wrong, as the species is a native of the Indian Ocean. The mistake in locality, however, has not troubled writers as much as the highly non-descriptive specific name. Martyn (1784–[1792], pl. 127) changed the name to *interpuncta*, and George B. Sowerby (1847–1887, vol. 1, p. 210, pl. 51, figs. 68–70) changed it again to *indica*, both names being undoubtedly given in an effort to do away with a geographical name that was inappropriate.

Reeve (1843–1878, vol. 6, *Voluta*, pl. 6, sp. 12) was more explicit in his objection to the Linnaean name. He adopted the Martyn name *interpuncta*, and his comment is sufficiently interesting to be quoted in full: "I quite agree with Mr. Sowerby in the propriety of abandoning the name *lapponica* given to this species, indicating a country and climate in which such a mollusk could not by any possibility exist. Instead of inhabiting the arctic shores of Lapland, it is a native of the seas of tropical India. The error did not however originate with Linnaeus. The species was known before his time to Dutch naturalists as the 'Lapphoorn' or 'Lapphoren' signifying the Flap-Ear or Dog's Ear Shell. This seems to have been then corrupted by them into 'Ailée Laponne,' 'Alata Lapponica,' *Voluta lapponica*, and Meuschen and Rumphius compounded the name 'Laplandsche Lapphoorn.' It only remains a matter of wonder that, whilst Seba described the species as an exotic shell from India, the error should have remained so long unexplained." Whatever were the real derivations of the pre-Linnaean names and whether or not any of them honestly reflected a supposed Lapland locality, Reeve's reason for abandoning *lapponica* is completely indefensible. Many valid early names have been attempted to be cavalierly rejected for trivial reasons, but Reeve's seems the weakest reason of all. If a name is to be dropped because it is inappropriate or non-descriptive, there

would have to be a drastic housecleaning of the older valid specific names. Of the geographical names alone, *Cassis madagascarensis* Lamarck and *Turbo sarmaticus* Linné,¹ to mention but two, would have to fall.

The early post-Linnaean writers, almost unanimously, had no difficulty in identifying the species with *lapponica*. Martini (1769–1777, vol. 3, pp. 213–214, pl. 95, figs. 920–921) referred to the *V. lapponica* of the "Systema," although he called the shell *Alata lapponica* and located it in Tranquebar and the East Indies, His figures are reasonably characteristic, although they show the form in which the spiral dashes are largely absent, being replaced by broader longitudinal zigzag lines. In the same volume Martini (p. 167, pl. 89, figs. 872–873) described and figured an *Alata plerorumque Lapponica*, which he also called "Das Lapplandsche Lapphorn," but supplied no references. The figures show what is clearly *lapponica* Linné and much nearer to the typical shell than are figures 920 and 921. Both pairs of Martini figures were widely cited for *lapponica* by later authors.

The species is now placed in the genus *Harpulina* Dall, 1906, type species *Voluta arausaica* "Solander" Humphrey, 1786, by original designation.

The species is figured by Reeve (*loc. cit.*) and by Maxwell Smith (1942, pl. 7, fig. 61). Smith's figure shows a non-typical shell so far as concerns color pattern. The spiral series of brown dashes are much less crowded and the dashes are much less plentiful than in any of the considerable series of specimens seen by the writer.

Voluta aethiopica

1758, *Systema naturae*, ed. 10, p. 733, no. 373.

1767, *Systema naturae*, ed. 12, p. 1195, no. 435.

LOCALITY: "In M. Persico & Key Asiae" (1758, 1767).

"V. testa emarginata ventricosa, spira coronata spinis fornicatis, apici papillari, columella quadruplicata . . . Umbilicus absque papilla. Fasciae 2 ferrugineae interruptae."

The word "emarginata" was added in the twelfth edition, as is the case with the de-

¹ *Turbo sarmaticus* is a South African species, whereas the ancient Sarmatia was a territory embracing parts of modern Poland and Russia, and Mare Sarmaticum was the Romans' name for the Baltic Sea.

scriptions of all three of the Melon Shells listed, the others being the two succeeding species *cymbium* and *olla*. The entire sub-description was also added in the twelfth edition.

The description had been generally held to point to the *aethiopica* of authors, although a dissection of the synonymy has assisted writers in selecting that species in preference to the other coronated species.

I discuss the synonymy in some detail: The figure from Buonanni (pt. 3, pl. 1) is an extremely equivocal drawing. It has been referred to the related species *tessellata* Lamarck, 1811, probably because of the two interrupted bands of dark brown square spots around the body whorl, and may have been based on that species. Lamarck said: "It appears to be constantly distinct from the following species [*aethiopica*], in that it is more ventricose and shows two rows of brown spots which are almost square." Many specimens of the several forms of *aethiopica* in our museums show these spots, and I am inclined to believe that *tessellata* was merely a color form. Hanley (1855, p. 236) mentioned the opinion that the figure showed *tessellata* but said, "judging from the comparative erectness of its spines [it] approaches nearer to the shell delineated in Sowerby's 'Thesaurus' (p. 82, fig. 14) as a spotted variety of *Aethiopicus*."

Rumphius' two figures (pl. 31, figs. A, B) are somewhat different. Figure A is clearly the ventricose form of *aethiopica*. Figure B is more elongate, and the spines of the coronation are longer and narrower. It might be based on either Lamarck's *diadema* or *armata*.

The same is true of Gualtieri's two figures (pl. 29, figs. H and I). Figure I seems clearly the common form *aethiopica aethiopica*, while H is closer to *diadema*.

The numerous Seba figures (vol. 3, pl. 65, figs. 2, 4, 10-12, and pl. 66, figs. 3, 6, 7, 8-10, 15) all seem to show one or another of the many color forms of this complex.

Argenville (pl. 20, fig. F) shows a shell rather nearer the *diadema-armata* type.

Hanley (*loc. cit.*) then listed the various figures as they had been distributed by the writers of his day, as follows:

For *aethiopica*, Rumphius' figure A, Gualtieri's figure I, Argenville's figure, and the following

figures from Seba: plate 65, figures 4 and 11, and plate 66, figures 6 and 9.

For *tessellata*, Seba's plate 65, figure 10.

For *diadema*, Gualtieri's figure H, and Seba's plate 65, figure 12, and all the remaining figures on his plate 66.

For *armata*, Rumphius' figure B (*vide* Deshayes), and Seba's plate 65, figure 2 (*vide* Lamarck).

I have set out this distribution from Hanley in full to illustrate the confidence with which the writers of the first half of the nineteenth century regarded these names as good species. In almost all modern arrangements there has been an effort to treat them somewhat less seriously. In the most recent classification (Maxwell Smith, 1942) none of them are included under *aethiopica*. The name *diadema* he gives as a synonym of the earlier name *cithara* "Solander" Humphrey, 1786, and *armata* as a subspecies of *cithara*. Lamarck's *tessellata* is made a good species. Linnaeus' *aethiopica* is given subspecies of its own: *broderipii* Gray, 1834, *nautica* Lamarck, 1822, and *regia* Schubert and Wagner, 1829. All the above names are now placed in the genus *Cymbium* Röding, 1798. I quite recognize that the differences between the *aethiopica* group of shells and the so-called "*diadema* complex" are obvious. The latter includes in general more elongate forms, and the spines of their coronation are longer, more slender, sharper, and more erect as compared with the sturdier and sometimes recumbent spines of the *aethiopica* group. We are probably correct in separating them specifically.

In spite of the composite nature of the synonymy of *aethiopica* Linné, containing, as it does, representatives of both groups, Hanley attempted to rationalize it, saying of the distribution of the four names represented by the several figures, "the last two [*diadema* and *armata*] are excluded by the 'quadriplata' of the diagnosis; and as the second [*tessellata*] was not comprised in the earlier synonymy (neither in the tenth edition nor in the 'Museum Ulricaе') naturalists have very properly regarded the first as the intended typical form, not only because it solely agreed with the described features, but because, also, of the great preponderance of its representations, and the name itself having been derived from that previously applied to it by Argenville." It is true that

diadema and *armata* have only three plaits on the columella and that the figure supposed to be *tessellata* is found only in the twelfth edition. It is also probably true that Linnaeus intended to describe *aethiopica* rather than any of the other figured shells. The synonymy is, however, extremely discordant and casts considerable doubt on the identification. It has, nevertheless, been generally accepted as defining the present species.

The generic name *Melo* Humphrey, which has been declared unavailable by Opinion 51 of the Commission, in common with all the names in the "Museum Calonnianum," was used by many of the early conchologists and even persisted as late as Tryon. It was generally used for the coronate species. George Sowerby, however (1847-1887, vol. 1, pp. 412-416), included in it not only the coronate "species" *aethiopica*, *diadema*, *tessellata*, *armata*, *mucronata*, *miltonis*, *broderipii*, and *nautica*, but *indica* Gmelin as well, although the latter has no spines.¹

Tryon also used *Melo* in 1882 (1879-1888, vol. 4, p. 81) for the spinous species. He recognized, however, the fact that one must not be too eager to adopt many of the older names as good species. In his discussion of *aethiopica* he said (*loc. cit.*): "In deference to the opinion of British conchologists, the following 'species' may retain their names as stages of variation in the form, coloration and development of spines. It is easy to pick out from the numerous excellent illustrations given by Reeve and Sowerby how these authors differ in estimating these so-called species, and how even some of their figures refute their argument for distinctness."

The above words of Tryon sum up the present writer's feeling as to most of the classifications of the Melon Shells that have been attempted. I am not in agreement with all of the Maxwell Smith arrangement. Thiele's brief treatment of the group (1931, p. 349) is confined to his conception of the subgeneric

¹ The two gross divisions of the Melon Shells are the coronate shells and those that have no coronation of spines but are "channeled," that is, possess a depressed vertex almost or entirely concealed by a ledge arising from the top of the body whorl. Gmelin's *indica* falls between the two divisions, as it is neither coronate nor channeled, the upper portion of the body whorl being slopingly contracted so as almost to cover the spire.

division of *Cymbium* Röding which is the only genus he recognizes. This is a limitation with which I cannot agree. The great disparity between all of the classifications, from the earliest to the most modern, is very marked, as might be expected in a group in which individual species present such obvious variations in shape, in color pattern, and in the sculpturing of the vertex of the shell. A glance at Reeve's descriptions and figures illustrates this great variability as well as the danger of failing to distinguish between the several life stages of the same shell, and the difficulty of solving the many systematic problems presented. A treatment of the Melon Shells that will satisfy all workers can probably never be developed.

Linnaeus' *aethiopica* presents little difficulty in identification, if one is willing to resist the temptation to allocate specific or subspecific names to its many forms. I think I follow the majority of workers in placing it in the genus *Cymbium* Röding, 1798, of which it is the type species, by subsequent designation, Montfort, 1810, as "*Voluta corona aethiopica*, Lin. Gmel." The "Yet" of Adanson, 1757, *Yetus* Bruguière, 1792, and *Melo* Humphrey of the "Museum Calonnianum," 1797, were probably exact synonyms of *Cymbium*.

No specimen of any form that can be associated with *aethiopica* is found in the Linnaean collection in London. A specimen of *Voluta indica* Gmelin, 1791, is, however, present. The latter specimen may explain the manuscript note that appears in Linnaeus' handwriting in his own copy of the "Systema": "Variat absque corona." Linnaeus thus considered the shell later called *indica* as a form of *aethiopica*, which further illustrates the fact that his conception of the species was faulty.

The main description of *aethiopica* in the "Museum Ulricae" is a combination of the descriptions in the tenth and twelfth editions of the "Systema," although it is referred to that in the tenth as was Linnaeus' invariable custom. The added details show that the specimen before him in 1764 was the form with the wavy or zigzag longitudinal brown lines. The specimen now marked for *aethiopica* in the Queen's collection in Uppsala is the form that we are accustomed to regard

as the typical *aethiopica*. Its color pattern is not shown on the photograph, however, and the specimen may not be his type.

Reeve's figures (1843-1878, vol. 13, *Cymbium*, pls. 1-16) are cited to illustrate the many forms that have been allotted to this species under many original specific names, but the reader must choose for himself those that he may consider conspecific or sub-specific. A comparison of the several tentative or categorical arrangements of these forms will hardly assist him. See also the "Tableau encyclopédique" (1798, pl. 387, figs. 1-2, pl. 388, figs. 1-3).

Voluta cymbium

1758, *Systema naturae*, ed. 10, p. 733, no. 374.

1767, *Systema naturae*, ed. 12, p. 1196, no. 436.

LOCALITY: "In M. Iberico" (1758, 1767).

"V. testa emarginata ventricosa, spire anfractibus canaliculato-marginatis, apice papillari, columella biplicata."

In spite of the lack of clarity in Linnaeus' diagnosis of this species it is now clear that it is identical with the shell called *Voluta porcina* by Lamarck (1811a, p. 61) and *Cymbium cisium* by Menke (1828, p. 51). The identification has been complicated by the absence of detail in the description, the composite nature of the cited figures, the assumption by Deshayes and Milne-Edwards (1835-1845, vol. 10, footnote to *V. cymbium*, p. 380) that the *cymbium* of the "Systema" was necessarily the same as the *cymbium* of the "Museum Ulricae," an opinion that had many adherents up to comparatively recent times, and the failure of many writers to separate the species *porcina* and *proboscidalis* Lamarck.

The confusion was quite unnecessary, however, and was initiated by writers who had not examined the Linnaean collection in London or who, after 1855, had not read Hanley's exhaustive report thereon. That collection contains a specimen of the *porcina* of Lamarck which is authoritatively marked by Linnaeus for *V. cymbium*, as Hanley pointed out. As late as 1882, Tryon (1879-1888, vol. 4, p. 79) made *cymbium*, which he called *cisium* Menke, equal to *proboscidalis* Lamarck.

The description merely indicates that Linnaeus was describing one of the so-called

"channeled" Melon Shells, in which only the nuclear portion of the spire is visible and is found in a depression at the top of the shell, bounded by a more or less sharp and erect extension of the body whorl which forms a ledge around the depression. This feature is described as "spira anfractibus canaliculato-marginatis, apice papillari." There is nothing in the description that distinguishes the shell described from any of the other "channeled" shells, in some of which the nuclear whorls of the spire rise above the ledge and in others is almost buried at the base of the depression or channel.

Any discussion of the synonymy is of little value. All the figures are equivocal, some suggesting *porcina*, some *proboscidalis*, and some are even reminiscent of *V. olla* (the next species described). The widely varying ideas of writers as to the species on which the several figures were based is sufficient evidence that not too much faith should be placed in this synonymy. It is useful to mention only the Gualtieri figure (pl. 29, fig. B). This shows a "channeled" shell in which the nucleus projects well above the ledge. As Hanley said (1855, p. 237), "the 'biplicata' of the 'Systema' clearly excludes it." In some features it suggests the *olla* of authors rather than *cymbium*. It is mentioned here principally because of the reference to it in the "Museum Ulricae," as appears below.¹

¹ In the light of Fischer-Piette's investigation of the retained collection of Adanson (Fischer-Piette and others, 1942; see introduction to *Voluta* Linné, pp. 53-54, above) it is well to refer to another of Linnaeus' references for *V. cymbium* (Adanson, pl. 3, fig. 2). The figure is not well drawn, but might be taken for either *porcina* or *proboscidalis*. Adanson called it "le Philin." Fischer-Piette and his co-authors found in Adanson's retained collection a specimen of *porcina* Lamarck which Adanson had marked with the number "123." It had no label or other documentation and Fischer-Piette and his co-authors (*ibid.*, p. 159) were unable to say what the number signified. It is probable that it represents the type of "le Philin." The specimen is not reproduced in the plates accompanying the paper of Fischer-Piette and his co-authors. Prior to the discovery of this probable type Dautzenberg (1910, p. 91), apparently relying on Adanson's text and possibly on the equivocal figure, had stated that Adanson's species should be referred to *porcina*. Fischer-Piette *et al.* also quote Pallary ("1930, p. 59") as saying: "It is almost certain that, under this name, Adanson incorporated the *V. proboscidale*, since the measurement he indicates

Lamarck (1811a, pp. 60–61) correctly described both *porcina* and *proboscidalis* as good species, without, however, referring either to Linnaeus' *cymbium*. Many later writers have united the two species of Lamarck, sometimes treating one as the young of the other. Lamarck described *V. cymbium* separately (*tom. cit.*, p. 60), but, although he specifically referred it to *cymbium* Linné, it seems obviously a distinct species and must have been based on a shell much closer to *olla* than to *cymbium* Linné. Lamarck referred to the Gualtieri figure cited by Linnaeus, to a pair of figures from Martini (1769–1777, vol. 3, pl. 70, figs. 762–763) which show features of both *cymbium* (*porcina*) and the *olla* of authors, and to a figure in the "Tableau encyclopédique (1798, pl. 386, fig. 3) which was called *cymbium* Lamarck in the "Liste." The latter figure is certainly not *cymbium* Linné, and is a form, as is that shown in the Martini figures, that I am unable to identify.

In 1828 Menke (*loc. cit.*), apparently feeling that the Linnaean diagnosis was too vague, renamed the species *Cymbium cisium*. This name was adopted by many writers and is in use to some extent today.

In 1844 Deshayes and Milne-Edwards (1835–1845, vol. 10, p. 380) in a footnote to their discussion of "*Voluta cymbium*" Lamarck, introduced a complication which has probably done more than anything else to cloud the issue. It is apparent that they not only had not examined the type of *cymbium* in the Linnaean collection, but they were guilty of an incorrect assumption on another point. Their comment is quoted in full: "The *Voluta cymbium* of Linné is not the species which bears that name in Lamarck and the majority of authors; if one refers only to Linnaeus' synonymy, one finds the same situation as in many other cases; it is necessary to disregard it because Linné

there brought together several species. But on consulting the description in the *Museum Ulricaë*, it is easy to recognize the *Voluta cymbium* in that work. Linnaeus suppressed the entire synonymy, and only mentioned the figure B from plate 29 of Gualtieri, in order to use it as a means of comparison and to point out the differences between it and his species. The Linnaean description serves to control the synonymy and permits us to rectify it. We have the conviction that the *Voluta cymbium* of Linné is the same as the species to which Lamarck gave the name of *Voluta proboscidalis*. It is then to the latter to which should be restored the name of *Voluta cymbium* Linné. These are the reasons which probably induced M. Menke to propose the name *Voluta cisium* for the *Cymbium* of Lamarck."

There is a misconception involved in the above quotation, which these writers did not appreciate. The species described in the "Museum Ulricaë" as *V. cymbium* represents what must have been a change in Linnaeus' conception of the species from that which he held in the tenth edition of the "Systema." The "plicis 4 s. 5" of the "Museum" description, the phrase "quasi truncata," and the disassociation of the Gualtieri figure from the species being described¹ all point to a different shell from the *cymbium* of the "Systema." Deshayes and Milne-Edwards did not appreciate that two different shells were described by Linnaeus. Moreover, if the comment on the Gualtieri figure is studied, it becomes increasingly difficult to identify the "Museum Ulricaë" shell, particularly the phrase "caeterum similis *V. aethiopicæ*." The most unexplainable feature of the "Museum Ulricaë" description is the fact that after repeating the tenth-edition description of *cymbium*, with its "columella biplicata," Linnaeus, in his added descriptive details, said, "Columella plicis 4 s. 5."

In 1861 Reeve (1843–1878, vol. 13, *Cymbium*, pl. 21, sp. 13), in his discussion of *cisium* Menke, made the latter a synonym of "*Voluta cymbium* Lamarck . . . (not of

(1 pied, 32 cts.) can only agree with the latter." The writer is unable to locate a paper by Pallary to which the above reference conforms or from which the quotation was taken. The single Pallary item in the bibliography of Fischer-Piette and his co-authors is of a different date and does not contain the quoted language.

On all the evidence, it seems that Adanson's type was actually *porcina* but that he considered that it and *proboscidalis* were forms of the same species.

¹ The comment on the Gualtieri figure is as follows: "Accedit ad Gualt. t. 29. f. B. sed differt colore incarnato; magnitudine decupla; spira truncata; apice ultra anfractus minime prominente: caeterum similis *V. aethiopicæ*."

Linnaeus),” and adopted the view of Deshayes and Milne-Edwards. His further comments show that he tentatively united *porcina* and *proboscidalis* but was as confused as were his predecessors as to the identity of the shell in the “Museum.” Reeve’s comments are also quoted in full: “It is to be regretted that Mr. Broderip, Mr. Adams, and Dr. Gray have followed Lamarck in assigning *Voluta cymbium* to this species [*cisium* Menke], notwithstanding the convincing testimony given by Deshayes . . . It was the practice of Linnaeus to attach numbers on specimens in ink against the description in his private copy of the ‘Systema Naturae.’ The original type of Linnaeus’ *V. cymbium* is in the possession of our Linnaean Society, and I find it, upon examination, to be a young *Cymbium porcinum*, or *proboscidale*, which are probably one and the same species. The number on this specimen agrees with the number in Linnaeus’ private copy of the ‘Systema.’ Linnaeus’ synonymy was, however, very confusing on this point. The shell of *C. cisium* was not known to him, and he referred to a figure of it in Gualtieri (Test. pl. 29, f. B) in illustration of his *Voluta cymbium*. On looking to this figure in Linnaeus’ own copy of Gualtieri, I find the name *V. cymbium* in the margin in Linnaeus’ handwriting; *but he appears, subsequently, to have discovered his error, for in his latest synonymy of the species in the ‘Museum Ultricae’ the reference to this figure is suppressed*” (italics mine).

Thus Reeve was partially correct in his statement as to the type in the Linnaean collection, although he erred in adopting Deshayes and Mile-Edwards’ “convincing testimony.” As to the Gualtieri figure he was possibly correct in saying that it represented *cisium* (*cymbium* Linné and *porcina* Lamarck), but his explanation of Linnaeus’ change of mind in the “Museum Ultricae” applied only to this figure and not, as it should have done, to the identity of the *species* there described.

Reeve advanced the same thesis in a paper published in the same year as the monograph in the “Conchologica iconica” (1861, p. 271)¹

¹ In this paper Reeve listed *porcina* and *proboscidalis* as distinct species and placed “*Voluta cymbium* (pars) Linnaeus” in the synonymy of each.

and his complete approval of Deshayes and Milne-Edwards’ opinion only served to fix the error. Tryon (1879–1888, vol. 4, p. 79) was one of those who followed Reeve. In his listing of *cisium* Menke he said, “Others have referred *C. cymbium* to this species, but the evidence given by Mr. Reeve that the true *C. cymbium* = *C. proboscidalis* is pretty conclusive.”

The United States National Museum has recently revised its collection of this group and follows Hanley in treating *cymbium* as equal to *porcina* Lamarck and *cisium* Menke. There seems to be no reason against establishing the name *cymbium* Linné and throwing both *porcina* and *cisium* into its synonymy. This is based almost entirely on the authority of the specimen in the Linnaean collection, although the correct locality given by Linnaeus, “M. Iberico,” is a confirmatory detail.

One of the last workers to reject the name *cymbium* Linné and adopt *porcina* Lamarck was Dautzenberg (1910, p. 91), who said: “Although Hanley found in the Linnaean collection a specimen of this species [*porcina*] marked ‘*Voluta cymbium*,’ it is difficult for us to adopt this ancient name because of the discordant references which figure in the last two editions of the *Systema Naturae*, and we prefer to preserve for it the name which Lamarck gave it and which cannot be said to be equivocal. Tryon wrongly considered the *Yetus porcinus* to be the young shell of *Yetus proboscidalis* Lam.; these are two perfectly distinct species.”

The best figures of the species are those of Reeve (1843–1878, vol. 13, *Cymbium*, pl. 20, figs. 12a, b, c, d.). He called the species *Cymbium porcinum* Lamarck.

It belongs in the genus *Cymbium* Röding, 1798, of which it is the type species, by absolute tautonymy, as *C. jacobinum* Röding, under the terms of Article 30d of the Code of Zoological Nomenclature. *Voluta cymbium* Gmelin, which equals *V. cymbium* Linné, is cited by Röding as a synonym, and four figures from Martini are supplied, one of which shows *V. cymbium* Linné.

Voluta olla

1758, *Systema naturae*, ed. 10, p. 734, no. 375.
1767, *Systema naturae*, ed. 12, p. 1196, no. 437.

LOCALITY: "In Philippinis Asiae" (1758, 1767).
 "V. testa emarginata ventricosa, spira laevigata, apice papillari, columella quadriplicata."

The word "emarginata" was added in the twelfth edition.

The description of this species, although its few details conform to the *olla* of modern authors with the exception of "Columella quadriplicata," is still inadequate to identify it with certainty with that shell, the characters of which, at least in the adult state, are distinctive. The posterior end of the lip in the *olla* of authors is much produced in the adult shell and is recurved and widely flaring into a semicircular extension which is deeply hollowed out. The region of the spire is neither spinose, as in the *aethiopica* group, nor does it possess the elevated ledge and the almost immersed spire of the *proboscidalis* group, which has been characterized as the "channeled" species. The top of the shell can better be described as canaliculate, with the nuclear whorls of the spire well raised above the body whorl. Neither of these features, which are diagnostically important, is mentioned in Linnaeus' description. Moreover, the *olla* of authors has only two plaits on the columella, whereas *olla*, as described by Linnaeus, has four.

Our *olla* is native to the western end of the Mediterranean, the Portuguese coast, the Canary Islands, and northwest Africa and is a well-known and easily recognized species, distinguished by the features mentioned in the preceding paragraph. Linnaeus' synonymy is a "hodge-podge" of bad figures, some of which resemble *proboscidalis* Lamarck, 1811, and some the *olla* of authors, although none is a completely unequivocal figure.

The Buonanni figure (pt. 3, pl. 2) shows a three-plaited columella and was almost certainly based on a "channeled" shell of the *proboscidalis* group, as it appears to have a cavernous depression inside the ledge of the body whorl. It is shown as a sinistral specimen.

The figure from Lister (pl. 794, fig. 1) is a passable figure of the *olla* of authors and correctly shows two columellar plaits, although Hanley (1855, pp. 237-238) said that it, along with the figures cited from Aldrovandi and Colonna (neither of which has been seen

by this writer) and the figures from Buonanni and Klein (see below), "cannot be regarded as illustrative, since they represent a shell, the characters of which are not in harmony with those described."

Klein's figure (pl. 5, fig. 97) was copied from a figure of Buonanni which had been already cited by Linnaeus for the preceding species (*V. cymbium*).

The drawing from Gualtieri (pl. 29, fig. A) shows a markedly protruding nucleus but has an apex which appears to be almost as cavernous as that in *proboscidalis* and shows three plaits on the columella. It should be noted that, while *proboscidalis* has typically four plaits, the posterior one is much smaller than the rest and may have been disregarded by the artist.

The Argenville figure (pl. 20, fig. G) is almost useless as a guide but certainly represents the young of some one of the spineless Melon Shells. It has an evenly rounded apex and what seem to be two plaits on the columella. It is a wretched figure and quite unrecognizable, although the sharp projection of the upper end of the lip suggests the young of the *olla* of authors.

A figure from Adanson is cited (pl. 3, fig. 1). If the *olla* of Linnaeus was in fact the *olla* of authors, one would naturally be tempted to give greater credence to Adanson's figure than to the others, as his shells came from the region where the *olla* of authors is found. The figure is, however, much like *proboscidalis*. I cannot find in it any resemblance to our *olla*.

Lamarck (1811a, p. 60) described *Voluta olla* as of "Lin. Gmel.," used the phrases "spira canaliculata" and "mamilla glandiformis prominente," and said that the shell had two columellar plaits, a description that entirely conforms to the *olla* of authors. He added in his French description that the young specimens had three plaits. There is little question but that he was describing the *olla* of authors, yet his synonymy cited, among several good figures of that shell, the Gualtieri figure cited by Linnaeus which shows a "channeled" shell very close to *proboscidalis*, and the Buonanni figure (pt. 3, fig. 6) which Linnaeus had cited for *cymbium*. His references to the "Tableau encyclopédique" (1798, pl. 385, fig. 6) and to

Martini (1769–1777, vol. 3, pl. 71, fig. 766) both show the *olla* of authors. The writers through Lamarck seemingly had no difficulty in accepting Linnaeus' description and synonymy, vague and discordant as they were, as defining the eastern Atlantic shell we know as *olla*.

Later writers dissected Linnaeus' synonymy and attempted to choose the figures they believed to be authoritative. Hanley (*loc. cit.*), after dismissing certain figures as incorrect or not responsive to the description, sought among those remaining for "a *Cymba* which will accord with the specific diagnosis." He said: "Unfortunately there are two, if not three, more members of that genus represented, *C. Neptuni* (Adanson [!]) and *Columna*, f. 4), *C. proboscidalis* (Bonanni, f. 2; from hence the locality was copied), and, perchance, the fry of the pseudo *C. cymbium*, at least the engraving of Argenville has been quoted by Lamarck for it." Hanley is not entirely clear as to his conclusions, as is so often the case, but he did make two categorical statements: "Assuredly, however, the *Cymba olla* of authors cannot be termed the *Voluta olla* of Linnaeus," and, speaking of the *olla* of the "Museum Ulricaë," "There is a fair probability, then, that the *Cymba Neptuni*, which correctly answers to the description in the 'Museum' . . . was the *V. olla* of that work; but whether it may be desirable or not to alter the established nomenclature I presume not to decide."

In 1860 (p. 191) R. T. Lowe, apparently relying on Hanley's opinion, proposed a new name for the *olla* of authors, *Cymbium productum*. A year later, in 1861, Reeve (1843–1878, vol. 13, *Cymbium*, pl. 25, text for sp. 17) said of the *olla* of authors: "The error of dissociating this shell from the Linnaean *Voluta olla*, and assigning *C. Neptuni* to that species, needs also to be removed¹ . . . Having carefully examined the evidence on both sides, I can confidently state that the only evidence of any value against this species [*olla auct.*] being the Linnaean *Voluta olla* is that the columella is two-plaited, whereas it is described in the 'Systema' as being four-

plaited. The evidence *in favor* of its being the Linnaean *Voluta olla* is as follows: All the best references referred to in the Linnaean synonymy, namely, those of Klein, Lister, Argenville, Adanson, and Gualtieri, represent unquestionably the species under consideration. The figure of Gualtieri is a particularly characteristic one and in Linnaeus' own copy of that work, in the library of the Linnean Society, the name *Voluta olla* is written against that figure in Linnaeus' handwriting . . . Another circumstance in favor of the shell being the Linnaean *Voluta olla* is, that the only specimen among the Linnaean types in the possession of the Linnean Society that can be referred to it is the species before us, and upon examining Linnaeus' own working copy of the 'Systema Naturae,' I find against *V. olla* the ink score corresponding to that on the specimen, both in Linnaeus' handwriting."

Reeve's argument presents a chain of evidence which seems at first glance to be unanswerable, but, whatever we may think as to the identity of *olla* Linné, his argument is imperfect in several respects. First, his statement that the figures mentioned all represent "unquestionably" the *olla* of authors is certainly open to criticism. At least two of them, from Adanson and Gualtieri, seem to the present writer to be closer to *proboscidalis* than to *olla*, and all of them are equivocal. Second, I am unable to substantiate his statement that a specimen of the *olla* of authors is marked for *olla* Linné, in Linnaeus' handwriting, in the collection. Hanley, who had published his close study of the collection only five years previously, does not mention such a specimen, which, in the case of such a debatable species, he would have done if it had been present. He merely said that *C. Neptuni*, which he felt was shown in the Adanson and Colonna figures, was not present. The complete microfilm of the collection in the present writer's possession does not show anything resembling the *olla* of authors, marked in Linnaeus' handwriting or not, and, because of the safeguards that have always surrounded the specimens in the hands of the Linnean Society, it seems incredible that it could have been abstracted before Hanley's examination, restored before Reeve wrote, and be

¹ Reeve is not quite correct. Hanley merely said that the *olla* of the "Museum Ulricaë" was probably *C. Neptuni* and did not pass categorically on the *olla* of the "Systema."

now missing. Third, the Gualtieri figure, against which Linnaeus had written the words "*Voluta olla*," seems to the present writer to be much closer to *proboscidalis*, a "channeled" species, than to the *olla* of authors. It may be that the microfilm of the collection omitted the specimen in question by mistake, as it was photographed, probably hurriedly, before the collection was removed from London for safekeeping during the air raids of the second World War. It is also possible that Reeve mistook the specimen of *Voluta cymbium*, which is present in the collection, for *olla*.

If these three criticisms of Reeve's argument are sound, his reasoning becomes valueless, particularly when combined with the fact of his admission that the biplicate columella of the *olla* of authors does not conform to the Linnaean description. The Linnaean description, which is certainly equivocal, and Linnaeus' synonymy, which shows two species and possibly three or four and is made up, moreover, of vague and questionable figures, do not present a very convincing basis for identification. I do not know the species Linnaeus was describing, whether he had a specimen before him or was writing from memory, or was basing his diagnosis solely on the pre-Linnaean descriptions and figures.

Inasmuch as the identification of Linnaeus' *olla* with the eastern Atlantic shell which now bears that name has seemingly become firmly fixed in the literature, it would perhaps be unwise and unnecessary to disturb it, and therefore it is suggested that we treat Linnaeus' *olla* as a composite species, and I here restrict it to the modern *olla* of authors. I do this with some reluctance, as I have little faith in either Linnaeus' description or synonymy, and the temptation is great to treat *olla* Linné as a *species dubia* and to resurrect Röding's name of *philipinum* for the eastern Atlantic shell. My reluctance is somewhat strengthened by Linnaeus' locality "Philippinis Asiae," as it may, I believe, be assumed that he would have been less likely to err in his locality in the case of a shell that occurs in the western Mediterranean.

Reeve's identification is generally accepted. George B. Sowerby (1847-1887, vol. 1, p. 410, pl. 79, figs. 3, 4, 11) accepted it, as his

figures show. Tryon (1879-1888, vol. 4, p. 80, pl. 22, fig. 13) gave the proper eastern Atlantic localities for *olla*, and his figures are completely characteristic. He admitted that the species had only two plaits on the columella in contrast with the four of the Linnaean description. In the most recent treatment of the Melon Shells by Maxwell Smith (1941, p. 49), the *olla* of Linnaeus is also referred to the *olla* of authors, and Smith's photographic reproduction of the latter shell is characteristic. Thiele (1931, p. 349) does not include *olla* in his very short treatment of this group.

The *olla* of authors is now placed in the genus *Cymba* Broderip, 1826. Reeve's figure mentioned above is the most characteristic representation of the species before the advent of photography. The earliest post-Linnaean figure is that of Martini (1769-1777, vol. 3, pl. 71, fig. 766), a drawing that is too stylized but does suggest *olla*.

Dr. H. A. Rehder (personal communication, 1954) distinguishes between *olla* Linné and the *olla* of Lamarck and later writers. He drops the name *olla* Linné as a *species dubia* and gives to the *olla* of Lamarck and authors the name *Cymbium philipinum* Röding, 1798. I am not so confident that Lamarck's shell is not the same as that of Linnaeus, but I am sympathetic, as said above, with Rehder's feeling that the name *olla* Linné should be abandoned and that a new name should be given to the *olla* of authors. Röding's *philipinum* is the earliest valid proposal of such a name.

The collection in Uppsala, which was described in the "Museum Ulricaë," gives us no assistance in the identification of *olla*. Hanley is quoted, above, as saying that there was "a fair probability" that the *Voluta neptuni* of Gmelin was the *olla* of the "Museum Ulricaë." The shell now labeled for *olla* Linné in that collection is, however, neither *neptuni* nor the *olla* of authors but a specimen of *Aulica nobilis* ("Solander" Humphrey), 1786 (the *Voluta scapha* of Gmelin). This is a species so comparatively remote from the species under discussion that it is evidently one of the many instances of mislabeling or misplacing of specimens that one encounters in studying this collection. A specimen of *neptuni* is present in the collection but it is labeled for *Voluta cymbium* and

represents another wrong label. There is no specimen of the *olla* of authors present.

Voluta filaris

1771, *Mantissa plantarum, regni animalis appendix*, p. 548.

"Testa emarginata subturrita tereti decussatim striata succincta filis rubris, columella triplicata . . . Testa fusiformis, longitudine extimi pollicis, decussatim subtilissime striata, pallida. Anfractus cincti quasi filis rubris, moniliformis, tribus, at in infimo anfractu 12. Faux labiis simplicibus, alba. Columella triplicata."

As is the case with the great majority of the "Mantissa" species, the locality of the shell was not known to Linnaeus.

It is probable that very few of the species in this work were described from specimens belonging to Linnaeus. Hanley (1855, p. 453) was of the opinion that the original types of most of them were located in the cabinets of Ziergovell or de Geer, which were the most important collections in Sweden aside from those of Queen Louisa Ulrica and of Linnaeus himself. The descriptions, although long, were worded with even less clarity than those in the "Systema," and this fact has been responsible for the difficulty writers have experienced in identifying most of them. In the case of *Voluta filaris*, however, the description is eminently characteristic and adequate to identify the species with the *filaris* of, at least, the modern authors. The one confusing detail is the mention of a three-plaited columella. The species has four columellar plaits, although the last is very obscure and must have escaped Linnaeus' attention, and it is possible that this was a partial cause of the difficulty of identification experienced by the early writers. The point is further commented on below.

Born (1780, p. 225, pl. 9, figs. 9-10) described a *Voluta filosa*. He did not mention the *filaris* of Linnaeus and supplied no references, but both his description and his figures make it clear that his shell and that of Linnaeus were identical.

Neither Martini nor Chemnitz mentions *filaris*, although each uses the name *filosa* Born. Martini (1769-1777, vol. 2, p. 306, pl. 59, figs. 663-664) called *Conus miles* Linné by the name *Voluta filosa*. Chemnitz

(1780-1795, vol. 10, p. 175, vignette 20, figs. C, D), in describing his own *Voluta casta*, cited for it the *V. filosa* of Born. The two figures supplied, however, although they have the shape of that shell, show a different color pattern, as the lowest of the red-brown bands occupies over half of the body whorl.¹

The complication in the identification of *filaris* during the period immediately following the publication of the "Mantissa" was primarily caused by Gmelin. On page 3457 of his "thirteenth" edition of the "Systema" he described a *Voluta filaris* and specifically referred it to the *filaris* of the "Mantissa," his only reference. His description is entirely clear. A few pages later (p. 3465) he described a *V. filosa*, citing the correct reference to Born. Both descriptions, while couched in different language, could be applied to *filaris*. Following the Linnaean description his *filaris* was said to have three columellar plaits, while his *filosa* was given four. He was the first to disassociate clearly Linnaeus' species from that of Born.

Dillwyn (1817, vol. 1, p. 540) continued Gmelin's error and listed both *filaris* Linné and *filosa* Born as good species. He attempted to distinguish them in two respects: First, in the number of plaits of the columella, he gave three to *filaris* and four to *filosa*. It seems obvious that both Gmelin and Dillwyn were, to that extent, mere copyists. As said above, the difference in the number of plaits is not a specific distinction, as the lowest fold may be so vaguely defined that it might not be distinguishable as a plait. Second, he distinguished the two "species" in size, *filaris* being described as "of the length of the little finger," while *filosa* was "an inch and a quarter or an inch and three quarters long, and about a third as broad." This ratio of width to height is somewhat too great for the typical *filaris*, although there is an obese form to which the ratio would apply. Incidentally, Dillwyn placed the description of the length of *filaris* in quotation marks, saying that he was quoting from the Linnaean description. His translation was, however, incorrect, as Linnaeus' Latin phrase

¹ Lamarck (1822b, p. 304), in describing *Mitra casta*, did not associate it with Born's *filosa*, although he referred to the Chemnitz figures mentioned above.

read "longitudine extimi pollicis," "as long as the end [? the last joint] of the thumb." Dillwyn's second distinction between the two "species" has no specific significance, as *filaris* is variable in the ratio of height to breadth. This point was referred to many years later by Tryon (1879-1888, vol. 4, p. 138) who said: "Philippi considers *M. filosa* Born (= *filaris* L.) the equivalent of the obese form, and makes of the narrow form a *var. gracilis*."

Lamarck (1811b, p. 209) listed only *filosa* and gave as references *filosa* Born and Gmelin, and did not mention *filaris* even in synonymy. He correctly gave the species four columellar plaits. The common identity of the two names was finally pointed out by Deshayes and Milne-Edwards (1835-1845, vol. 10, p. 321, footnote) who said: "The description which Linné gave for his *Voluta filaris* in the Mantissa leaves no doubt as to its identity with the *Voluta filosa* of Born. We are astonished that authors who have studied Linnaeus with care have not recognized this fact; also we suggest to those who are interested in this question that they reread the Mantissa, with the shell in their hands, and they will be astonished at the correctness and precision of a description which is, nevertheless, too short. Consequently we propose to restore to the species its Linnaean name. We add that the *Mitra nexilis* of Lamarck [*tom. cit.*, p. 309] is a double use of the present species."¹

In spite of this emphatic clarification of the species by Deshayes and Milne-Edwards, Reeve (1843-1878, vol. 2, *Mitra*, pl. 12, sp. 81) reverted to the original error and listed *filosa* only, referring it to Born, Gmelin, and Lamarck.

Hanley (1855, p. 455) followed the opinion of Deshayes and Milne-Edwards in identifying *filosa* with the Linnaean species, and since that time *filaris* has been exclusively used, although *filosa* is occasionally seen on labels in unrevised collections. Hanley said: "*Voluta filaris*, which followed *ruffina* in the revised 'Systema,'² was assuredly the *Mitra filosa* of Lamarck, who has rightly ascribed four folds to the columella. The fourth or lowest fold is often very obscure, hence Linnaeus had characterized it as 'triplicata.' "

The species is now included in the genus *Tiara* Swainson, 1831. Tryon (*loc. cit.*) puts it in *Cancilla* Swainson, which he uses as a section of *Mitra*, *sensu stricto*.

It was not described in the "Museum Ulricaë."

¹ Dall, in his analysis of the foreign species in the Portland Catalogue (1921, pp. 124-132), makes *Voluta filosa* "Solander" Humphrey, 1786, a synonym of *Mitra nexilis* Martyn, 1783. The *filosa* of "Solander" Humphrey is the *filosa* of Born, Gmelin, and Lamarck, and Lamarck's *M. nexilis*, first described in 1811 (1811b), is referred to the *nexilis* of Martyn both in 1811 and 1822.

² By the "revised 'Systema'" Hanley meant the manuscript notes written on the margins of Linnaeus' working copy of the twelfth edition, looking to a revision that was never completed.

BIBLIOGRAPHY

- ABBOTT, R. TUCKER**
 1950a. The genera *Xancus* and *Vasum* in the western Atlantic. *Johnsonia*, Mus. Comp. Zoöl., vol. 2, pp. 201–218.
 1950b. The molluscan fauna of the Cocos-Keeling Islands, Indian Ocean. *Bull. Raffles Mus.*, no. 22, pp. 66–98.
 1954. American seashells. New York.
- ADAMS, ARTHUR**
 1847. Notes on certain molluscous animals. *Proc. Zool. Soc. London*, pp. 19–24.
 1854. Monograph of *Actaeon* and *Solidula*, two genera of gasteropodous Mollusca, with descriptions of several new species from the Cumingian collection. *Ibid.*, pp. 58–62.
- ADAMS, CHARLES BAKER**
 1851. Descriptions of new fresh-water shells which inhabit Jamaica. *Contributions to conchology*, New York, vol. 1, no. 9, p. 174.
- ADAMS, HENRY, AND ARTHUR ADAMS**
 1858. The genera of Recent Mollusca arranged according to their organization. London, 2 vols. text, 1 vol. pls.
- ADANSON, MICHEL**
 1757. *Histoire naturelle du Sénégal. Coquillages*. Paris.
- [D'ARGENVILLE, ANTOINE JOSEPH DEZALLIER]**
 1742. *L'histoire naturelle . . . La lithologie et la conchyliologie . . . éclaircie . . . par . . . M . . . de la Société Royale des Sciences de Montpellier*. Paris.
 1757. [Second edition.] Paris.
 1780. [Third edition by "MM. de Favanne de Montcervelle, père et fils."] Paris, 3 vols.
- ASCANIUS, PEDER**
 1772. *Philene quadripartita, et förut obekant Sjä-Krak, aftecknad och beskrivet*. *Handl. K. Vidensk. Acad.*, Stockholm, vol. 33, p. 331.
- BAILY, JOSHUA L., JR.**
 1945 [No. title.] *Minutes Conchol. Club Southern California*, no. 47, p. 20.
- BAKER, HORACE BURRINGTON**
 1946. Some of Férussac's generic names. *Nautilus*, vol. 59, pp. 115–121.
- BARNARD, K. H.**
 1950. The "Zoophylacium Gronovianum," 1781, and Meuschen's "Index." *Jour. Soc. Bib. Nat. Hist.*, vol. 2, pt. 6, pp. 185–186.
- BAYER, C.**
 1939. Catalogue of the Pirulidae in the Riksmuseum van Natuurlijke Historie. *Zool. Meded.*, vol. 21, pp. 369–383.
- BAYER, F. M.**
 1943. Observations on marine Mollusca, with descriptions of new species. *Nautilus*, vol. 56, pp. 109–115.
- BEAU, M.**
 1858. De l'utilité de certains mollusques marins vivant sur les côtes de Guadeloupe et de la Martinique. *Petit Jour. Conchyl.*, Paris, vol. 3, pp. 25–40. (Not seen.)
- BECK, HEINRICH HENRICHSEN**
 1837. *Index molluscorum praesentis aevi Musei Principis Christiani Frederici*. Copenhagen. (Not seen.)
- BEQUAERT, JOSEPH C.**
 1943. The genus *Littorina* in the western Atlantic. *Johnsonia*, Mus. Comp. Zoöl., vol. 1, no. 7, 28 pp.
 1950. Studies in the Achatininae, a group of African land snails. *Bull. Mus. Comp. Zoöl.*, vol. 105, pp. 1–216.
- BINNEY, WILLIAM GREEN**
 1867. Land and fresh water shells of North America, pt. 2. *Smithsonian Misc. Coll.*, vol. 7, no. 143.
 1870. A report on the Invertebrata of Massachusetts. Boston.
 This is the second edition of Gould, 1841.
- BLAINVILLE, HENRI MARIE DUCROTAY DE**
 1825, 1827. *Manuel de malacologie et de conchyliologies*. Strasbourg, 1 vol. text, 1 vol. pls.
- BORN, IGNATIUS**
 1778. *Index rerum naturalium Musei Caesarei Vindobonensis*. Vienna. (Not seen.)
 1780. *Testacea Musei Caesarei Vindobonensis*. Vienna.
 The "Index" of Born, which bears the date 1778 on the title page, was not actually published until 1780. The "Testacea" bears the date 1780 and was published in that year. The latter is a folio volume limited to Mollusca and is not a second edition of the "Index," which included other matter. The two works were prepared simultaneously, as they quote each other.
- BOURGUIGNAT, JULES RENÉ**
 1884. *Histoire des mélanienens du système Européen*. *Ann. de Malacol.*, vol. 10, pp. 1–168.
- BOWDICH, T. EDWARD**
 1822. *Elements of conchology, including the fossil genera and the animals*. Paris.
- BRANDER, GUSTAVUS**
 1766. *Fossilia Hantoniensia collecta, et in Musaeo Britannica deposita*. London.

- BRODERIP, JOHN**
1830. A monograph of the genus *Cymba*. In Broderip, John, and G. B. Sowerby, Species conchyliorum. London, vol. 1, pt. 1.
- BRUGUIÈRE, JOSEPH GUILLAUME**
1789, 1792. Histoire naturelle des vers. Paris and Liège, vol. 1.
1791 [1792]. Tableau encyclopédique et méthodique des trois regnes de la nature. Paris, pls. 1-189.
[Anon.]
1797. [*Idem*], pls. 190-286.
[Lamarck, Jean Baptiste Pierre Antoine de Monet de]
[1798.] [*Idem*], pls. 287-390.
1816. [*Idem*], pls. 391-488.
See note under this item in Part 1 (Dodge, 1952) or Part 2 (Dodge, 1953) of this series of papers.
- BUCQUOY, E., PHILIPPE DAUTZENBERG, AND GUSTAVE F. DOLLFUS**
1882-1898. Les mollusques marins du Rousillon. Paris, vol. 1 and atlas.
- BUONANNI, FILIPO**
1684. Recreatio mentis et oculi. Rome, pts. 1-3, text; pt. 4, plates.
The plates are not numbered. Each contains one or more consecutively numbered figures.
- BUSH, CATHARINE J.**
1910. On the variation of *Aplustrum amplustre*. Nautilus, vol. 24, pp. 1-2.
- CHEMNITZ, JOHANN HIERONYMOUS**
1780-1795. Neues systematisches conchylien Cabinet. Nuremberg, vols. 4-11. (Continuation of Martini, 1769-1777.)
- CHIAJE, STEPHANI DELLE**
1826, 1827. Testacea utriusque Siciliae eorumque historia et anatome. Parma, vol. 3, pts. 1, 2.
Posthumous volume of Poli's work of the same title, with additions and notes by Chiaje. Part 2 was written entirely by Chiaje.
- CLENCH, WILLIAM J.**
1942. The genus *Ficus* in the western Atlantic. Johnsonia, Mus. Comp. Zoöl., no. 2, 2 pp.
1946. A catalogue of the genus *Liguus* with a description of a new subgenus. Occas. Papers on Mollusks, Dept. Mollusks, Mus. Comp. Zoöl., vol. 1, no. 10, pp. 117-128.
- CLENCH, W. J., C. G. AGUAYO, AND R. D. TURNER**
1947. The West Indian marine shells. By Henry Krebs. Rev. Soc. Malacol. "Carlos de la Torre," Havana, vol. 5, pp. 23-40, 59-80, 91-116.
- CONCHOLOGICAL CLUB OF SOUTHERN CALIFORNIA**
1945. [Discussion of the generic name *Bulla* Linné.] Minutes Conchol. Club Southern California, no. 47, p. 20.
- COSTA, EMANUEL MENDES DA**
1778. Historia naturalis testaceorum Britanniae, or the British conchology. London.
- COSTA, ORONZIO GABRIELE**
1829. Catalogo sistematico e ragionato de testacei delle Siciliae. Naples.
- CROSSE, H.**
1891. Faune malacologique terrestre et fluviatile de l'île de Saint-Domingue. Jour. Conchyl., vol. 39, pp. 69-211.
- CROUCH, EDMUND A.**
1827. An illustrated introduction to Lamarck's conchology. London.
- DALL, WILLIAM HEALEY**
1885a. Notes on some Florida land and freshwater shells with a revision of the Auriculacea of the eastern United States. Proc. U. S. Natl. Mus., vol. 8, pp. 255-289.
1885b. On *Turbonilla pyrum*, Lamarck, and its dentition. *Ibid.*, vol. 8, pp. 345-348.
1890-1903. Contributions to the Tertiary fauna of Florida. Trans. Wagner Free Inst. Sci., Philadelphia, vol. 3, pts. 1-6.
1906. Notes on the names in Volutidae. Nautilus, vol. 19, pp. 143-144.
1907. A review of the American Volutidae. Smithsonian Misc. Coll., vol. 48, pp. 341-373.
1915. An index to the Museum Boltenianum. Washington, Smithsonian Institution, Publication 2360.
1921. Molluscan species named in the Portland Catalogue 1786, Part 2, Foreign species. Nautilus, vol. 34, pp. 124-132.
- DAUTZENBERG, PHILIPPE**
1910. Contribution à la faune malacologique de l'Afrique occidentale. Actes Soc. Linnéenne Bordeaux, vol. 64, pp. 47-203.
1890. Récoltes malacologiques de M. L'Abbé Cullieret aux Isles Canaries et au Sénégal en Janvier et Février, 1890. Mem. Soc. Zool. France, vol. 3, pp. 147-168.
1927. Olividés de la Nouvelle Calédonie et de ses dépendances. Jour. Conchyl., vol. 71, pp. 1-72.
1928. [Same title.] *Ibid.*, vol. 71, pp. 103-147.
1935. Terebridae and Mitridae. Mem. Mus. Roy. Hist. Nat. Belgique, hors ser., vol. 2, fasc. 17, pp. 3-208, pls. 1-4.

- DAUTZENBERG, PHILIPPE, AND J. L. BOUGE
1922. Mitridés de la Nouvelle Calédonie et de ses dependances. *Jour. Conchyl.*, vol. 67, pp. 83-159, 179-259.
1933. Les mollusques testacés marins des établissements de l'Océanie. *Ibid.*, vol. 77, pp. 145-326.
- DAUTZENBERG, PHILIPPE, AND HENRI FISCHER
1905. Liste des mollusques récoltés par M. H. Mansuy en Indo-Chine et au Yunnan et descriptions d'espèces nouvelles. *Jour. Conchyl.*, vol. 53, pp. 343-471.
- DAVILA, PEDRO FRANCISCO
1767. Catalogue systématique et raisonné des curiosités de la nature et de l'art qui composent le cabinet de M. Davila. Paris, vol. 1.
- DESHAYES, GÉRARD PAUL
1830, 1832. Histoire naturelle des vers. Paris. vol. 2 (1830), vol. 3 (1832).
Second edition and continuation of Bruguière, 1789, 1792.
- DESHAYES, GÉRARD PAUL, AND HENRI MILNE-EDWARDS
1835-1845. Histoire naturelle des animaux sans vertèbres. Paris, vol. 6-10.
Second edition of Lamarck, 1822a, 1822b.
- DILLWYN, LEWIS WESTON
1817. A descriptive catalogue of Recent shells arranged according to the Linnaean system. London, 2 vols.
- DODGE, HENRY
1946. Notes on Lamarck's "Prodrome," 1799. *Nautilus*, vol. 60, pp. 25-31.
- 1947a. Lamarck's "Prodrome d'une nouvelle classification des coquilles." *Ibid.*, vol. 61, pp. 60-70.
- 1947b. The molluscan genera of Bruguière. *Jour. Paleont.*, vol. 21, pp. 484-492.
1952. A historical review of the mollusks of Linnaeus. Part 1. The classes Loricata and Pelecypoda. *Bull. Amer. Mus. Nat. Hist.*, vol. 100, pp. 1-264.
1953. A historical review of the mollusks of Linnaeus. Part 2. The class Cephalopoda and the genera *Conus* and *Cypraea* of the class Gastropoda. *Ibid.*, vol. 103, pp. 1-134.
- DOLLFUS, GUSTAVE F.
1911. Les coquilles du quaternaire marin du Sénégal (Pleistocene moyen). *Mém. Soc. Geol. France*, vol. 18, fasc. 3-4, no. 44, pp. 1-64.
- DONOVAN, EDWARD
1799-1803. The natural history of British shells. London, vols. 1-5.
- DRAPARNAUD, JACQUES-PHILIPPE RAYMOND
An 9 [1801]. Tableau des mollusques terrestres et fluviatiles de la France. Montpellier and Paris.
- An 13 [1805]. [Same title.] Paris. (Published posthumously.)
- DUCLOS, P. L.
1835. Histoire naturelle générale et particulière de tous les genres de coquilles univalves marines . . . *Oliva*. Paris.
[1844-1845.] *Oliva*. In Chenu, Jean Charles, Illustrations conchyliologiques. Paris.
The Chenu work was issued in 85 "livraisons" by Chenu and other contributors. These are bound in various combinations. The *Oliva* monograph is in volume 4 of the set used by the present writer, no part of which is dated. The dates given above are taken from Sherborn and Smith (1911) and are based on external evidence.
- DUMÉRIL, ANDRÉ MARIE CONSTANT
1806. Zoologie analytique ou méthode naturelle de classification des animaux. Paris.
- DUTERTRE, A. P.
1935. Les mollusques continentaux quaternaire du Boulonnais. *Jour. Conchyl.*, vol. 79, pp. 211-235.
- FERUSSAC, D. de, AND GÉRARD PAUL DESHAYES
1820-1851. Histoire naturelle générale et particulière des mollusques terrestres et fluviatiles. Paris, 4 vols. text and 2 vols. pls.
- FISCHER, PAUL
1880-1887. Manuel de conchyliologie. Paris.
1891. Catalogue et distribution géographique des mollusques terrestres, fluviatiles et marins d'une partie d'Indo-Chine. *Bull. Soc. Hist. Nat. d'Autun*, vol. 4, pp. 87-276.
- FISCHER, PAUL, AND JOSEPH CHARLES HIPPOLYTE CROSSE
1878. Études sur les mollusques terrestres et fluviatiles du Mexique et du Guatemala. In Milne-Edwards, Henri (ed), Recherches zoologiques pour servir a l'histoire de l'Amérique Centrale et du Mexique. Paris, pt. 7.
- FISCHER-PIETTE, E., AND OTHERS
1942. Les mollusques d'Adanson. *Jour. Conchyl.*, vol. 85, pp. 103-351.
- FLEMING, JOHN
[1818]. Conchology. In *Encyclopedia Britannica*, suppl. to fourth, fifth, and sixth eds. London, vol. 3, p. 284.
It appears from the advertisement at the end of volume 6, that volume 3, although dated 1824, was issued in February, 1818.
1822. Mollusca. In *Encyclopedia Britannica*, suppl. to fourth, fifth, and sixth eds. London, vol. 5, p. 567.

- FORBES, EDWARD, AND SYLVANUS HANLEY
1853. A history of British Mollusca and their shells. London, vols. 1-4.
- GAGE, A. T.
1938. A history of the Linnean Society of London. London.
- GIOENI, GUISEPPE
1783. Descrizione di una nuova famiglia e di un nuovo genere di testacei trovati nel littorale di Catania. Naples. (Not seen.)
- GISTEL, JOHANNES VON NEPOMUK FRANZ XAVIER
1848. Naturgeschichte der Thierreichs für höhere Schulen. Stuttgart. (Not seen.)
- GMELIN, JOHAN FRIEDRICH
1791. Systema naturae per regna tria naturae . . . editio decima tertia, aucta, reformata. Leipzig, vol. 1, pt. 6.
- GOULD, AUGUSTUS ADDISON
1841. A report on the Invertebrata of Massachusetts. Boston.
For the second edition of this work, see Binney, 1870.
- GRANT, ULYSSES SIMPSON, IV, AND HOYT RODNEY GALE
1931. Catalogue of the marine Pliocene and Pleistocene Mollusca of California and adjacent regions. Mem. San Diego Soc. Nat. Hist., vol. 1.
- GRAY, JOHN EDWARD
1825. A list and description of some species of shells not taken notice of by Lamarck. Ann. Phil., new ser., vol. 9, pp. 134-140, 407-415.
- GREGORY, WILLIAM K.
1908. Linnaeus as an intermediary between ancient and modern zoology; his views on the Class Mammalia. Ann. New York Acad. Sci., vol. 18, pp. 21-31.
- GREW, NEHEMIAH
1681. Museum regalis societatis or a catalogue of the natural and artificial rarities belonging to the Royal Society and housed at Gresham College. London.
- GRONOVIVS, LAURENTIUS THEODORUS
1760. Bibliotheca regni animalis atque lapidei. Leiden.
1781. Zoophylacium Gronovianum. Leiden.
This work is in three parts. The first two are dated 1763 and 1764, respectively. The third was unpublished at the date of Gronovius' death in 1778. Meuschen published the entire work in 1781 in a single volume containing reprints of parts 1 and 2 and an original publication of part 3. The 1781 part is referred to in this paper as volume 3.
- GUALTIERI, NICOLAI
1742. Index testarum conchyliorum. Florence.
- HANLEY, SYLVANUS
1855. Ipsa Linnaei conchyliia. The shells of Linnaeus, determined from his manuscripts and collection. London.
1860a. Systematic list of the species of *Dolium* restricted. Proc. Zool. Soc. London, for 1859, pp. 487-493.
1860b. On the Linnean manuscript of the "Museum Ultricae." Jour. Proc. Linnean Soc. London, vol. 4, pp. 43-89.
- HEBENSTREIT, JOHAN ERNST
1743. Museum Richterianum. Leipzig. (Not seen.)
- HEDLEY, CHARLES
1919. A review of the Australian Tun shells. Rec. Australian Mus., vol. 12, pp. 329-336.
- HEILPRIN, ANGELO
1887. Explorations on the west coast of Florida and in the Okeechobee wilderness. Trans. Wagner Free Inst. Sci., Philadelphia, vol. 1, pp. 1-134.
- HEMMING, FRANCIS (ED.)
1950a. Recommendation to amend Article 25 to make it clear that a generic name published prior to January, 1931, on a legend to a plate but without explanatory matter is to be treated as having been published with an "indication." Bull. Zool. Nomenclature, London, vol. 4, 9th meeting, July 23, 1948, opinion no. 19, p. 255.
1950b. *Bulla* Linnaeus, 1758 (Class Gastropoda): designation of type species of, under the plenary powers. *Ibid.*, vol. 4, 11th meeting, July 26, 1948, opinion no. 29, p. 305.
1950c. Meuschen's Index to Gronovius, 1763-1781, *Zoophylacium Gronovianum*: rejection of, for nomenclatorial purposes. *Ibid.*, vol. 4, 14th meeting, July 26, 1948, opinion no. 29, pp. 502-504.
- HJALMARSON, J., AND LUDWIG GEORG CARL PFEIFFER
1858. Beiträge zur Fauna von Westindien. Malakozool. Blätter, vol. 5, pp. 135-172.
- HORNELL, JAMES
1914. The sacred Chank of India. Madras Fisheries Bull., no. 7, pp. 1-181.
- [HUMPHREY, GEORGE]
1786. A catalogue of the Portland Museum . . . sold by auction, April, 1786. London.
1797. Museum Calonnianum. Specifications of the various articles which compose the . . . museum of natural history collected by M. de Calonne in France. London.

INGERSOLL, ERNEST

1874. Special report on the Recent Mollusca of Colorado. Ann Rept. U. S. Geol. and Geogr. Surv. Terr., for 1874, pp. 389-410.

IREDALE, TOM

1929. Queensland molluscan notes, no. 1. Mem Queensland Mus., vol. 9, pp. 261-297.
1931. Australian molluscan notes, no. 1. Rec. Australian Mus., vol. 18, pp. 201-233.

JEFFREYS, JOHN GWYN

- 1862-1869. British conchology, or an account of the Mollusca which now inhabit the British Isles and the surrounding seas. London, 5 vols.

JOHNSON, CHARLES WILLISON

- 1910-1911. Some notes on the Olividae. Nautilus, vol. 24, pp. 49-51, 64-68, 121-124.
1915. [Same title.] *Ibid.*, vol. 28, pp. 97-103, 114-116.
1928. A review of certain species of the Olividae. *Ibid.*, vol. 42, pp. 6-13.
1934. List of the marine Mollusca of the Atlantic coast from Labrador to Texas. Proc. Boston Soc. Nat. Hist., vol. 40, pp. 1-204.

JOUSSEAUME, FÉLIX PIERRE

1875. Coquilles de la famille des Marginelles. Rev. Mag. Zool., Paris, ser. 3, vol. 3, pp. 164-271, 429-435.

KAEMMERER, CHRISTOPHE LUDWIG

1786. Die Conchylien im Cabinet des Herrn Erbprinzen von Schwarzburg-Rudolstadt. Rudolstadt.

KENNARD, ALFRED SANTER

1942. The Histoire and Prodrome of Férussac. Proc. Malacol. Soc. London, vol. 25, pp. 12-17, 111-118.

KENNARD, ALFRED SANTER, AND BERNARD BARHAM WOODWARD

1920. On the Linnaean species of non-marine Mollusca that are represented in the British fauna. Jour. Linnean Soc. London, Zool., vol. 34, pp. 203-215.
1922. On the genesis of the designation of "types" among malacological writers. Proc. Malacol. Soc. London, vol. 15, pp. 47-51.
1926. Synonymies of the British non-marine Mollusca. London, British Museum (Natural History).

KIENER, LOUIS CHARLES

- 1834-1850. Species général et iconographie des coquilles vivantes. Paris.

The monographs on the several genera appeared as separate livraisons. There is no uniformity in the manner in which the groups

of monographs are bound in the various libraries, and although some bound volumes are supplied with printed title pages, the latter do not carry dates. The volume numbers used in the following references are those used on the temporary jackets of the set in the library of the American Museum of Natural History, and the dates are those added in pencil on the respective title pages. The dates are based on external evidence (after Sherborn).

Vol. 1, 1843-1844, *Ovula, Ancillaria*.

Vol. 3, 1839-1841, *Mitra, Voluta*.

Vol. 4, 1839-1840, *Columbella*.

Vol. 6, 1840-1841, *Pyrula, Turbinella, Cancellaria, Marginella, Tornatella*.

KLEIN, JACOB THEODOR

1853. Tentamen methodi ostracologicae sive disposito naturalis cochlidum et concharum in suas classes genera et species. Leiden.

KNORR, GEORG WOLFGANG

- 1757-1772. Vergnügen der Augen und des Gemüths in Vorstellung einer allgemeinen Sammlung von Schnecken und Muscheln. Nuremberg, [vol. 1], pts. 1-2; [vol. 2], pts. 3-4; [vol. 3], pts. 5-6.

All parts of the Knorr work are separately paged. Each has a title page carrying the part number and the date, but there are no volume numbers on any title page or on the spines of the contemporary bindings. The set consulted was in its original binding and carried on the spines the numbers of the parts contained.

KREBS, HENRICK J.

1864. The West Indian marine shells with some remarks. Nykjöbing.

See Clench, W. J., C. G. Aguayo, and R. D. Turner, 1947.

LAMARCK, JEAN BAPTISTE PIERRE ANTOINE DE MONET DE

1799. Prodrome d'une nouvelle classification des coquilles. Mém. Soc. Nat. Hist. Paris, vol. 1, pp. 63-91.

1801. Système des animaux sans vertèbres. Paris.

1804. Suite des mémoires sur les fossiles des environs de Paris. *Volvaria*. Ann. Mus. Hist. Nat., Paris, vol. 5, pp. 28-29.

- 1810a. Sur la détermination des espèces parmi les animaux sans vertèbres, et particulièrement parmi les mollusques testacés. [*Ovula*.] *Ibid.*, vol. 16, pp. 110-114.

- 1810b. [Same title. *Terebellum* and *Oliua*.] *Ibid.*, vol. 16, pp. 300-328.

- 1811a. [Same title. *Voluta*.] *Ibid.*, vol. 17, pp. 54-80.

- 1811b. [Same title. *Mitra*.] *Ibid.*, vol. 17, pp. 195-222.
1812. Extrait du cours de zoologie du Muséum d'Histoire Naturelle sur les animaux sans vertèbres. Paris.
- 1822a. Histoire naturelle des animaux sans vertèbres. Paris, vol. 6, pt. 2.
- 1822b. Histoire naturelle des animaux sans vertèbres. Paris, vol. 7.
- LAMY, EDOUARD**
1928. Quelques mots sur l'albinisme et melanisme chez les mollusques. *Jour. Conchyl.*, vol. 72, pp. 127-146.
- LEACH, WILLIAM ELFORD**
1847. The classification of the British Mollusca. *Ann. Mag. Nat. Hist.*, vol. 20, pp. 267-273.
1852. *Molluscorum Britanniae synopsis* . . . London. (Edited from author's manuscript and proof by J. E. Gray.)
- LEMICHE, HENNING**
1948. Northern and Arctic tectibranch gastropods. I. The larval shells. II. A revision of the cephalaspid species. *Biol. Skr. K. Danske Vidensk. Selsk.*, vol. 5, no. 3, 136 pp.
- LESSER, FRIEDRICH CHRISTIAN**
1742. *Sammlung von Muscheln, Schnecken* . . . *Recueil de coquillages, de Limaçons*. Copenhagen.
Appended to many copies of Regenfuss, 1758, *q. v.*
- LINK, HEINRICH FRIEDRICH**
1807. *Beschreibung der Naturalien-Sammlung der Universität zu Rostock*. (Facsimile reprint of the pages relating to Mollusca. Hertford, 1931.)
- LINNÉ, CARL VON**
1747. *Wästgota Resa* . . . Förrättad år 1746. Stockholm.
1758. *Systema naturae per regna tria naturae* . . . editio decima, reformata. Stockholm, vol. 1, *Regnum animale*.
1761. *Fauna Suecica sistens animalia Sveciae regni*. Stockholm.
1764. *Museum s:ae m:tis Ludovicae Ulricaе reginae Svecorum*. Stockholm, pt. 2.
1767. *Systema naturae per regna tria naturae* . . . editio duodecima, reformata. Stockholm, vol. 1, pt. 2.
1771. *Mantissa plantarum* . . . *Regni animalis appendix*. Stockholm.
- "LISTE"
1791-1822. [Introductory pages of text to the volumes of plates of the "Tableau encyclopédiques," commonly called "La Liste."]
- LISTER, MARTIN**
1678. *Historiae animalium Angliae*. London.
1685-1692. *Historiae sive synopsis methodicae conchyliorum*. London, 2 vols. (Not seen.)
1770. [Same title.] *Editio altera, recensuit et indicibus auxit Gulielmus Huddesford* S. T. B. Oxford.
- LOWE, RICHARD THOMAS**
1860. A list of the shells observed or collected at Mogador and in its immediate environs during a few days visit to the place in April 1859; with notes and observations. *Proc. Linnean Soc. London*, pp. 169-204.
- LOVÉN, SVEN**
1887. The Museum Ludovicae Ulricaе. *In* On the species of Echinoidea described by Linnaeus in his work *Museum Ludovicae Ulricaе*. *Proc. Roy. Swedish Acad. Sci. Stockholm*, suppl. 13, pt. 4, no. 5.
- LUDBROOK, N. H.**
1953. Systematic revision of the volutid genus *Amoria*. *Proc. Malacol. Soc. London*, vol. 30, pp. 131-153.
- MARKS, JAY GLENN**
1949. Nomenclatural units and tropical American Miocene species of the gastropod family Cancellariidae. *Jour. Paleont.*, vol. 23, pp. 453-464.
- MARTENS, EDUARD CARL VON**
1877. Die Variationen von *Liguus virgineus*. *Jahrb. Deutschen Malakozool. Gesell.*, vol. 4, pp. 362-367.
- MARTINI, FRIEDRICH HEINRICH WILHELM**
1769-1777. *Neues systematisches conchylien Cabinet*. Nuremberg, vols. 1-3.
- MARTINI, FRIEDRICH HEINRICH WILHELM, AND JOHANN HIERONYMOUS CHEMNITZ**
1837-1907. [Second edition, or "Neue Folge" of the "Conchylien Cabinet," by various authors.]
- MARTYN, THOMAS**
1784[-1792]. *The universal conchologist*. London.
- MATON, WILLIAM GEORGE**
1807. A descriptive catalogue of the British Testacea. *Trans. Linnean Soc. London*, vol. 8, pp. 17-250.
- MAWE, JOHN**
1823. *The Linnaean system of conchology*. London.
- MELVILL, JAMES COSMO, AND ROBERT STANDEN**
1895. Notes on a collection of shells from Lifu and Uvea, Loyalty Islands. *Jour. Conchol.*, London, vol. 8, pp. 84-132.
- MENKE, KARL THEODOR**
1828. *Synopsis methodica molluscorum ge-*

- nerum omnium et specierum eorum quae in Museo Menkeana adservantur. Pyrmont.
1854. Nach eine *Bulla* und einige andere Konchyliden. Malacol. Blätter, vol. 1, p. 26.
- MERMOD, GASTON
1951. Les types de la collection Lamarck au Museum de Genève. Mollusques vivantes, pt. 2, *Achatina*. Rev. Suisse Zool., vol. 58, pp. 737-752.
1952. [Same title, pt. 3, *Auricula*.] *Ibid.*, vol. 59, pp. 24-32.
- MEUSCHEN, FRIEDRICH CHRISTIAN
1787. Museum Geversianum, sive index rerum naturalium . . . comparavit A. Gevers publice distrahendum. Rotterdam. (Not seen.)
- MÖRCH, OTTO ANDREAS LOWSON
1852. Catalogus conchyliorum quae reliquit D. A. d'Aguirra et Gadea, Comes de Yoldi. Copenhagen, vol. 1.
- MONTFORT, DENYS DE
1810. Conchyliologie systématique et classification méthodique des coquilles. Paris, 2 vols.
- MONTFORT, DENYS DE, AND FELIX DE ROISSY
- 1801-1805. Histoire naturelle, générale et particulière des mollusques. Paris, 6 vols.
- Volumes 1-4 inclusive, dated "an 10," were written by de Montfort. Volumes 5 and 6, dated "an 13," were a continuation by de Roissy. The Republican year 10 extended from September 23, 1801, to September 23, 1802; the year 13, from September 23, 1804, to September 23, 1805.
- MÜLLER, OTTO FREDERIK
1744. Vermium terrestrium et fluviatilium. Copenhagen and Leipzig.
1776. Zoologiae Danicae prodromus. Copenhagen.
1781. Geschichte der Perlen-Blasen. Die Naturforscher, vol. 15, pp. 1-20.
- NEAVE, SHEFFIELD AIREY
- 1939-1950. Nomenclator zoologicus. London, 5 vols.
- NEWTON, R. BULLEN
1906. Note on Swainson's genus *Volutilithes*. Proc. Malacol. Soc. London, vol. 7, pp. 100-104.
- NOBRE, AUGUSTO FERRIERA
1931. Moluscos marinhos de Portugal. Oporto.
- 1938-1940. Fauna malacologica de Portugal. Pt. 1. Moluscos marinhos e das aguas salobras. Oporto.
- ODHNER, NILS HJALMAR
1953. Annotated list of the specimens of mollusks described in the "Museum Ulricae," now at the University of Uppsala, to accompany a microfilm of the collection. (Mimeographed.)
- D'ORBIGNY, ALCIDE
1845. Mollusca. In de la Sagra, Ramon, Historia fisica, politica y naturel de la Isla de Cuba. Paris, vol. 5.
- PALLARY, PAUL
1902. Liste des mollusques testacés de Tanger. Jour. Conchyl., vol. 50, pp. 1-37.
- PENNANT, THOMAS
1812. British zoology. Fifth edition. London.
- PERRY, GEORGE
1811. Conchology, or the natural history of shells. London.
- PERRY, LOUISE M.
1940. Marine shells of the southwest coast of Florida. Bull. Amer. Paleont., vol. 26, pp. 1-260.
- PETIT DE LA SAUSSAYE, S.
1851. Notice sur le genre Marginelle, *Marginitella*, Lamarck, suivie d'un catalogue synonymique des espèces de ce genre. Jour. Conchyl., vol. 2, pp. 38-59.
- PETIVER, JAMES
- 1702-1711. Opera historiam naturalem spectantia or gazophylacium. London.
1713. Aquatiliu animalium Amboinae. London.
- The 1702-1711 work consists of a number of parts on separate subjects or on the fauna or flora of different regions, and these are bound in various combinations. The 1713 work is a series of plates of Mollusca which forms part 6 of the completed work.
- PFEIFFER, LOUIS
1840. Übersicht der in Januar, Februar und März, 1839, auf Cuba gesammelten Mollusken. Arch. für Naturgesch., 6th year, vol. 1, pp. 250-261.
- PHILIPPI, RUDOLPHUS AMANDUS
- 1836, 1844. Enumeratio molluscorum Siciliae. Berlin (vol. 1); Halle (vol. 2.)
- PILSBRY, HENRY AUGUSTUS
1893. Manual of conchology. Philadelphia, vol. 15.
- 1895-1896. [Same title.] Philadelphia, vol. 16.
1899. [Same title.] Philadelphia, ser. 2, vol. 12.
- 1904-1905. [Same title.] Philadelphia, ser. 2, vol. 17.
1908. Type of *Ampulla* Bolten. Nautilus, vol. 22, p. 83.
1919. Types of genera proposed for Achatinae. *Ibid.*, vol. 32, pp. 98-99.
1929. Bolten's species of *Liguus*. *Ibid.*, vol. 42, p. 141.
1934. Note on *Chersina* Beck, 1837. *Ibid.*, vol. 47, p. 147.

- PILSBRY, HENRY AUGUSTUS, AND JOSEPH C. BEQUAERT
1923. The type of *Plotia* "Bolten." *Nautilus*, vol. 37, p. 36.
- PILSBRY, HENRY AUGUSTUS, AND TOM L. MCGINTY
1939. The genus *Cyphoma* in Florida. *Nautilus*, vol. 53, pp. 1-4.
- PLANCUS, JANUS
1739. *Ariminensis de conchis minus notis liber*. Venice.
- PLATT, RUTHERFORD
1949. Shells take you over world horizons. *Nat. Geogr. Mag.*, vol. 96, pp. 33-84, 31 color pls.
- POIRET, JEAN LOUIS MARIE
1789. *Voyage en Barbarie . . . Avec un essai sur l'histoire naturelle*. Paris.
- POIRIER, HENRY
[1952.] *Marine Mollusca of the eastern coast of North America: their names and meanings*. New York. (Mimeographed.)
- POLI, JOSEPH XAVIER
1791, 1795. *Testacea utriusque Siciliae erorumque historia et anatome*. Parma, 2 vols. (See Chiaje.)
- PORTLAND CATALOGUE
1786. (See Solander, Daniel Carl, 1786, and Humphrey, George, 1786.)
- QUOY, JEAN MARIE CONSTANT, AND JOSEPH PAUL GAIMARD
1832. *Mollusques. In Voyage de . . . l'Astrolabe . . . pendant . . . 1826-1829, sous le commandement de M. J. Dumont d'Urville*. Paris, *Zoologie*, vol. 3.
- RANG, PAUL KAREL SANDER LEONARD
1831. *Description des coquilles terrestres recueillies pendant un voyage à la côte occidentale d'Afrique et au Brésil*. *Ann. Sci. Nat.*, Paris, vol. 24, pp. 5-63.
- RAY, JOHN
1693. *Synopsis methodica animalium quadrupedum et serpentini generis*. London.
- REDFIELD, JOHN H.
[1870.] *Catalogue of the known species, Recent and fossil, of the family Marginellidae*. (Bound in *Conchological Tracts*, vol. 3.)
- REEVE, LOVELL AUGUSTUS
1842. *Conchologica systematica or complete system of conchology*. London, Paris, Berlin, and New York, vol. 2.
1843-1878. *Conchologica iconica; or illustrations of the shells of molluscous animals*. London, vols. 1-20.
1861. A revision of the synonyms of the Boat and Melon Volutes, "Les Gondolières" of Lamarck. *Ann. Mag. Nat. Hist.*, ser. 3, vol. 7, pp. 268-277.
- REGENFUSS, FRANZ MICHAEL
1758. *Auserlesne Schnecken, Muscheln und andre Schaalthiere*. Copenhagen.
- RETZIUS, ANDERS JAHAN
1788. *Dissertatio historico-naturalis nova testaceorum genera quam praeside . . . A. J. Retzio . . . defert L. M. Philipsson*. Lund. (Not seen.)
- RISSE, ANTOINE
1826. *Histoire naturelle des principales productions de l'Europe méridionale, particulièrement de celle de Nice et des Alpes-Maritimes*. Paris and Strassbourg, vol. 4.
- RÖDING, PETER FRIEDRICH
1798. *Museum Boltenianum, pars secunda continens conchylia*. Hamburg.
- RUMPHIUS, GEORGE EVERHARD
1705. *Amboinische rariteitkammer*. Amsterdam.
1711. *Thesaurus imaginum piscium testaceorum*. Leiden.
- SARS, GEORG OSSIAN
1878. *Bidrag til Knudskapen om Norges Arktiske fauna*. Universitetsprogram. Christiania, vol. 1.
- SAY, THOMAS
1822. An account of some of the marine shells of the United States. *Jour. Acad. Nat. Sci. Philadelphia*, vol. 2, pt. 2, pp. 221-248, 302-325.
- SCHENCK, EDWARD T., AND JOHN H. McMASTERS
1948. *Procedure in taxonomy*. Revised edition . . . by A. Myra Keen and Siemon William Muller. Stanford, Stanford University Press; London, Oxford University Press.
- SCHILDER, FRANZ ALFRED
1925. Revision der Cypraeaacea. *Arch. für Naturgesch.*, vol. 91, div. A, no. 10, pp. 1-171.
- SCHRÖTER, JOHANN SAMUEL
1779. *Die Geschichte der Flussconchylien*. Halle.
1783-1786. *Einleitung in die Conchylienkenntnis nach Linné*. Halle, 3 vols.
1804. *Neue Conchylienarten und Abänderungen, Anmerkungen und Berichtigungen nach dem Linnéischen System, der 12 Ausgabe*. *Arch. Zool. Zoot.*, Wiedemann, vol. 4, pt. 1. (Not seen.)
- SCHUBERT, GOTTHILF HEINRICH, AND JOHANN ANDREAS WAGNER
1829. *Neues systematisches conchylien-Cabinet*. Nuremberg, vol. 12. Continuation of Martini and Chemnitz, same title.
- SCHUMACHER, CHRÉTIEN FRÉDÉRIC
1817. *Essai d'un nouveau système des habitations des vers testacés*. Copenhagen.

- SCHWEIGGER, AUGUST FRIEDRICH
1820. Handbuch der Naturgeschichte der skelettlosen ungegliederten Thiere. Leipzig. (Not seen.)
- SCOPOLI, GIOVANNI ANTONIO
1777. *Introductio ad historiam naturalem*. Prague.
- SEBA, ALBERTUS
1758. *Locupletissimi rerum naturalium thesauri accurata descriptio*. Amsterdam, vol. 3.
- SHERBORN, C. DAVIES, AND ALEXANDER REYNELL
1915. Notes on Swainson's Exotic conchology. *Proc. Malacol. Soc. London*, vol. 11, pp. 276-282.
- SHERBORN, C. DAVIES, AND EDGAR A. SMITH
1911. A collation of J. C. Chenu's *Illustrations conchyliologiques* . . . *Proc. Malacol. Soc. London*, vol. 9, pp. 264-267.
- SHERBORN, C. DAVIES, AND BERNARD BARHAM WOODWARD
1893. On the dates of the *Encyclopédie méthodique* (Zoology). *Proc. Zool. Soc. London*, p. 582.
1899. On the dates of the "*Encyclopédie méthodique*"; additional note. *Ibid.*, p. 595.
1901. Notes on the dates of publication of the parts of Kiener's "*Species general et iconographie des coquilles vivantes*." *Proc. Malacol. Soc.*, London, vol. 4, pp. 216-219.
1906. On the dates of the publication of the natural history portion of the "*Encyclopédie méthodique*." *Ann. Mag. Nat. Hist.*, ser. 7, vol. 17, pp. 577-582.
- SMITH, EDGAR ALFRED
1894. A list of the Recent species of the genus *Pirula* Lamarck. *Jour. Malacol.*, vol. 3, pp. 64-69.
- [SMITH, JAMES EDWARD]
1832. *Memoirs and correspondence of the late Sir James Edward Smith*. Edited by Lady Smith. London, 2 vols.
- SMITH, BURNETT
1907. Book review of "A review of the American Volutidae," by William H. Dall *Nautilus*, vol. 20, pp. 129-131.
- SMITH, MAXWELL
1940. World-wide sea shells. *Lantana*.
1941. East coast marine shells. *Ann Arbor*.
1942. A review of the Volutidae. *Lantana*.
- [SOLANDER, DANIEL CARL]
1786. A catalogue of the Portland Museum . . . sold by auction, April, 1786. London.
[n.d.] [Manuscript descriptions of shells by the late Dr. Solander, in the library of the Right Hon. Sir Joseph Banks.]
Referred to by Dillwyn and others as "Solander's MSS." The above title is taken from Dillwyn's Bibliography (1817, vol. 1, pp. vii-xii).
- SOWERBY, GEORGE BRETtingham
1828. On the Recent species of the genus *Ovulum*. *Zool. Jour.*, vol. 4, pp. 145-162.
1830. Monograph of the genus *Ovulum*. In "Species conchyliorum." London, vol. 1, pt. 1.
1846. A conchological manual. Ed. 3. London.
1847-1887. *Thesaurus conchyliorum*, or monographs of genera of shells. London, 5 vols.
- SOWERBY, JAMES DE CARLE
1820, 1825, 1834. *Genera of shells*. London, vols. 1-2, with continuation by G. B. Sowerby.
- SWAINSON, WILLIAM
1820-1821. *Zoological illustrations or original figures and descriptions of new, rare or interesting animals*. London, vol. 1.
1821. *Exotic conchology, or figures and descriptions of rare, beautiful or undescribed shells*. London, pts. 1-3.
1822. [Same title.] London, pt. 4.
1835. *The elements of modern conchology*. London.
1840. *A treatise on malacology or the natural classification of shells and shell-fish*. London.
- TABLEAU ENCYCLOPÉDIQUE ET MÉTHODIQUE
(See Bruguière.)
- TAYLOR, JOHN W.
1894-1914. *Monograph of the land and fresh-water Mollusca of the British Isles*. Leeds.
- TEN BROECK, A. N. H.
1950. On some brackish water Mollusca from the Lake of Maracaibo. *Zool. Meded.*, vol. 31, pp. 79-97.
- THIELE, JOHANNES
1931. *Handbuch der systematischen Weichtierkunde*. Jena, vol. 1.
- TOMLIN, JOHN READ LE BROCTON
1917. A systematic list of the Marginellidae. *Proc. Malac. Soc. London*, vol. 12, pp. 242-306.
- TRYON, GEORGE WASHINGTON, JR.
1865. Note on the genus *Simmia* Risso. *Amer. Jour. Conchol.*, vol. 1, pp. 94-95.
1879-1888. *Manual of conchology*. Philadelphia, vols. 1-10.
- TURTON, WILLIAM
1807. *British fauna*. Swansea, vol. 1.
1819. *A conchological dictionary*. London.
1840. *Manual of the land and fresh-water shells of the British Islands*. London. (New edition by J. E. Gray.)

- TURTON, WILLIAM, AND J. F. KINGSTON**
 1830. The natural history of the district. In Carrington, Noel Thomas, The Teignmouth, Dawlish, and Torquay guide. Teignmouth, pt. 2.
- VANATTA, E. G.**
 1915. Notes on *Oliva*. Nautilus, vol. 20, pp. 67-72.
- VAYSSIÈRE, ALBERT**
 1885. Recherches zoologiques et anatomiques sur les mollusques opisthobranches du Golfe de Marseille. Ann. Mus. Nat. Hist. Marseille, Zool., vol. 2, mem. no. 3.
- VOIGT, FRIEDRICH SIEGMUND**
 1834. Das Thierreich. Leipzig.
 A translation of Cuvier, "Le règne animal," containing additional matter, 6 vols.
- WEINKAUFF, HEINRICH CONRAD**
 1868. Die Conchylien des Mittelmeeres. Cas-
 sel, vol. 1.
- WINCKWORTH, RONALD**
 1929a. Notes on nomenclature, no. 3. The geno-
 types selected by Fleming in 1818 and
 1828. Proc. Malacol. Soc. London, vol.
 18, pp. 224-228.
- 1929b. Notes on nomenclature, no. 4. Martyn's
 Universal conchologist. *Ibid.*, vol. 18,
 pp. 228-229.
1932. The British marine Mollusca. Jour.
 Conchol., vol. 19, pp. 211-252.
1943. Holten's systematic list of the shells of
 Chemnitz. Proc. Malacol. Soc. London.,
 vol. 25, pp. 146-150.
1945. The types of the Boltenian genera.
Ibid., vol. 26, pp. 136-148.
- WINCKWORTH, RONALD, AND JOHN READ LE
 BROCTON TOMLIN**
 1933. Recent species of the genus *Tonna*
 (= *Dolium*). Proc. Malacol. Soc. Lon-
 don, vol. 20, pp. 206-213.
- WOOD, WILLIAM**
 1818. Index testaceologicus or a catalogue of
 shells, British and foreign. London.
 1828. [Same title.] Second edition. London, pls.
- WOODRING, WENDELL PHILIPPS**
 1928. Miocene Mollusca from Bowden, Ja-
 maica, pt. 2, gastropods. Publ. Carnegie
 Inst. Washington, no. 385, pp. 310-313.
- WOODWARD, SAMUEL PICKWORTH**
 1851-1856. A manual of the Mollusca. London.

CORRECTIONS FOR PART 2 (DODGE, 1953)

Page 43, column 1, line 21: For "subspecies" read "variety."

Page 82, column 1, line 25: Delete "lineis," last word of line.

Page 91, column 1, line 2 of footnote: For "(1829)" read "(1828b)."

Page 124, column 1, line 10 from bottom: For "*cervus*" read "*punctata*."

INDEX TO SPECIES

The generic name in parentheses that follows each species refers to the genus in which the species is found in the twelfth edition of the "Systema naturae" (1767) or in the "Mantissa" (1771).

- achatina (Bulla), 49
aethiopica (Voluta), 135
amplustre (Bulla), 28
ampulla (Bulla), 23
aperta (Bulla), 19
auris-judae (Voluta), 57
auris-midae (Voluta), 55
birostris (Bulla), 13
caffra (Voluta), 112
canaliculata (Bulla), 34
cancellata (Voluta), 99
capitellum (Voluta), 129
ceramica (Voluta), 130
coffea (Voluta), 64
conoidea (Bulla), 36
cornicula (Voluta), 102
cymbium (Voluta), 138
cypraea (Bulla), 45
dactylus (Voluta), 77
ebraea (Voluta), 126
episcopalis (Voluta), 121
faba (Voluta), 89
ficus (Bulla), 29
filaris (Voluta), 144
fontinalis (Bulla), 38
gibbosa (Bulla), 17
glabella (Voluta), 89
hydatis (Bulla), 22
hypnorum (Bulla), 40
ispidula (Voluta), 74
lapponica (Voluta), 134
lignaria (Bulla), 24
livida (Voluta), 63
mendicaria (Voluta), 97
mercatoria (Voluta), 92
miliaria (Voluta), 79
mitra (Voluta), 121
monilis (Voluta), 82
morio (Voluta), 113
musica (Voluta), 123
naucum (Bulla), 18
oliva (Voluta), 71
olla (Voluta), 140
ovum (Bulla), 11
pallida (Voluta), 86
papalis (Voluta), 121
paupercula (Voluta), 96
persicula (Voluta), 83
pertusa (Voluta), 117
physis (Bulla), 26
plicaria (Voluta), 116
porphyria (Voluta), 68
pyrum (Voluta), 132
rapa (Bulla), 32
reticulata (Voluta), 91
ruffina (Voluta), 107
rustica (Voluta), 94
sanguisuga (Voluta), 109
scabricula (Voluta), 105
solidula (Voluta), 60
spelta (Bulla), 14
terebellum (Bulla), 41
tornatilis (Voluta), 58
tringa (Voluta), 101
turbinellus (Voluta), 127
verrucosa (Bulla), 16
vespertilio (Voluta), 125
virginia (Bulla), 47
virgo (Voluta), 105
volva (Bulla), 12
vulpecula (Voluta), 114

