Chronological analysis of the *Conus gradatus* complex (Gastropoda, Prosobranchia, Conidae), with the rediscovery of the holotype of *Conus scalaris* Valenciennes, 1832.

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KEY WORDS: Conidae. *Conus scalaris* Valenciennes, 1832, rediscovery of the holotype, identity. Provisional review of the *"Conus gradatus* complex*"*.

ABSTRACT: the study of the "*Conus gradatus* complex" reveals that in literature a large confusion had been perpetuated from one author to the other since Sowerby II, 1857. The whole group is here re-examined in order to clear up the identity of *Conus scalaris* Valenciennes, of which the holotype was just retraced in M.N.H.N. A new description of this species is given. Lectotypes are designated for *C. gradatus thaanumi* and *C. recurvus helenae*.

RÉSUMÉ: l'étude du "Complexe de *Conus gradatus*" révèle qu'il existe, dans la littérature consacrée à ce groupe, une grande confusion qui a été répercutée d'un auteur à l'autre depuis Sowerby II, 1857. L'ensemble du groupe est révisé afin de dégager l'identité de *Conus scalaris* Valenciennes, dont l'holotype vient d'être retrouvé au M.N.H.N. Une nouvelle description de cette espèce est donnée. Des lectotypes pour *C. gradatus thaanumi* et de *C. recurvus helenae* sont désignés.

INTRODUCTION

Conus scalaris Valenciennes belongs to a group of Conidae, generally classified in the subgenus *Leptoconus* Swainson, 1840. The distribution range of this group stretches along the American west coasts, from the extreme North of the Gulf of California to the Ecuador. This group may be called the "*Conus gradatus* complex", from the oldest and first available name in this group.

This "complex" has been often erroneously treated in literature. An utter confusion prevails in its taxonomy, partly due to former misidentifications which were perpetuated for nearly one and a half century by successive authors, partly due to the morphological resemblances between different species, and to a remarkable variability in the populations from one area to the other.

Another reason of this taxonomical confusion can be found in the fact that for 14 taxa described during the 19th. century, only 4 have been based on a type-shell, 9 remaining ones are identifiable only by more or less precise type-figures, one other has no available type or type-figure. For this study, following taxa (in chronological order) will be analysed:

	TYPES	TYPE-LOCALITIES
14 taxa described before 1900		
C. gradatus Mawe, 1823	none	"California"
C. gradatus Wood, 1828	lectotype figure	"San Pedro Isl., Sonora, Mexico"
C. scalaris Valenciennes, 1832	lectotype figure	"Acapulco"
C. regularis Sowerby, 1833 (17 May)	lectotype figure	none
C. monilifer Sowerby, 1833 (24 May)	lectotype	"Salango, Ecuador"
C. recurvus Broderip, 1833 (24 May)	lectotype	"Monte Christi"
C. incurvus Sowerby, 1833 (June or July)	lectotype figure	"Monte Christe"
C. syriacus Sowerby 1833 (post July)	lectotype figure	none
C. dispar Sowerby, 1833 (post July)	lectotype figure	none
C. arcuatus Gray, 1839 (1)	lectotype figure	"Pacific Ocean"
C. gradatus Reeve, 1843 (2)	lectotype	"Salango"
C. emarginatus Reeve, 1844	lectotype figure	"Near Mazatlan, Mexico"
C. candidus Kiener, 1845 (3)	lectotype figure	none
C. angulatus A.Adams, 1853	lectotype	none
6 taxa described after 1900:		
C. scariphus Dall, 1910	holotype	"Isl.del Coco, Costa Rica"
C. magdalenensis Bartsch & Rehder, 1939	holotype	"Bahia de Magdalena, Baja California"
C. gradatus thaanumi Schwengel, 1955	lectotype	"Bahia Salinas, Costa Rica"
C. recurvus helenae Schwengel, 1955	lectotype	"Curu,Gulf of Nicoya,Costa Rica"
C. poormani Berry, 1968	holotype	"Morro Colorado, Sonora, Mexico"
C. scalarissimus Da Motta, 1988	holotype	"Salango"

Nota:
1) - *C. arcuatus* Gray, 1839, being a junior homonym of *C. arcuatus* Broderip & Sowerby, 1829, has been rediscribed as *C. emarginatus* Reeve, 1844.
2) - *C. gradatus* Reeve, 1843, being a junior homonym of *C. gradatus* Mawe 1823 and *C. gradatus* Wood, 1828, has been replaced by *C. scalarissimus* Da Motta, 1988, *nomen novum*.
3)- The true identity of *C. candidus* Kiener, 1845 today remains uncertain (see below).

I
C. scalaris Valenciennes
(in Humboldt et Bonpland, 1832, 2: 338)

Achille Valenciennes (1794-1865) was a French zoologist and full professor at the Museum d'Histoire Naturelle in Paris (Chair of molluscs, zoophytes and worms). He translated Humboldt's "Zoologische Beobachtungen", published the "Histoire Naturelle des poissons"(1829-1849), of which the first 8 volumes where elaborated in collaboration with Cuvier, the "Histoire naturelle des mollusques, des annelides et des zoophytes" (1833), etc. .. In 1831, he was put in charge of publishing the description of the new species collected during the travel of Alexander von Humboldt and Aimé Bonpland through the equatorial America 1799-1803 ("Je dois à l'amitié dont m'honore depuis si long-temps M.de Humboldt, d'avoir été chargé du soin de ces publications." (Valenciennes in Humboldt & Bonpland, 2: 262.)

1) Original diagnosis:

"Conus scalaris, *testa oblonga, fusiformi, subtiliter costigera, albida, rufo longitudinaliter variegata, anfractibus ad basim angulatis et in spiram scalarim decurrentibus, spira conica acuta.* (Conus scalaris, elongated shell, fusiform, finely striated, whitish, longitudinally mixed with reddish-brown, with coils angulated towards their base, extending along the spire like ladder steps, spire conical and pointed.)

Habitat ad portum Acapulco."

2) Original description (tranlated from French):

" This nice shell is composed of nine distinct separated whorls, less closely coiled than those of other Cones. Near the base of each whorl there exists a sharp carina which forms a flat spiral ramp along the spire. The height of the basal cone (1) represents almost the half of the shell's height. The axial striae are not very distinct; but the spiral ones are separated and accentuated with well marked granules. The

basal ridges, towards the siphonal canal are only weakly visible.

The shell shows, on a white background, some large, more or less regular, yellow dashes. Some of them form flames which are not distinctly drawn. On the spire, the dashes are more reddish brown and generally more regular.

The shell measures only 11 lines in height (= 24.8 mm).

If we compare this species with the "Lost Cone" (*Conus deperditus*), a fossil which is common in the deposits of Grignon, Courtagon and Bordeaux, we can see that it differs from it only by a lower height of the basal cone (1), by the lack of transverse ribs, by numerous oblique well-marked folds above the serration, and by a more oblique and less broad spiral ramp.

These differences are sufficient to establish specific characters between both Cones; however the affinity between both species remains very stricking."

(1) Valenciennes uses the term "cône de la base", which may be interpreted as designating the body whorl of the shell.

3) *Conus scalaris* Valenciennes in literature:

The shell material Humboldt and Bonpland had collected during their voyage has been stored in the Museum d'Histoire Naturelle in Paris, where it has been, according to Valenciennes' statement (p. 262), passed on Lamarck. But strangely, after Valenciennes' description of *C. scalaris*, this name seems to have been unknown by the eminent conchologists of the Museum, except by Kiener.

KIENER (1845: 158) was the first to mention *C. scalaris*, and he wrote out Valenciennes' Latin diagnosis, with only a few changes of punctuation or accents. He gave a new description:

"Shell elongate, fusiform, with a very acute spire, composed of nine narrow whorls, carinate at their base with a flat spiral ramp. The body whorl is slightly ventricose towards its upper part. The entire surface of the shell is covered with weakly distinct axial striae and with granulated, narrow, equidistant spiral ones. The aperture is very narrow; its right border is fine and arched. The shell, with a white background, is stained with large, yellowish, more or less irregular dashes; some of them form longitudinal flammules. On the spire, the dashes are deeper coloured and more regular.

Long. 28 mm. - Lives in Pacific Sea, on the coasts of Acapulco."

Kiener adds: "This species, described for the first time by M. Valenciennes ... has strong analogy with *Conus acutangulus*; however it is distinct by its narrower and more slender form."

Kiener indicated that the shell was in "Collect. du Mus." (p. 158). He also was the first to illustrate *C. scalaris,* pl. 88, Fig. 5 (FIG. 7). There is no doubt that the figured shell was the specimen Valenciennes had described. The size difference between Valenciennes' statement (11 lines ~ 25 mm) and Kiener's one (28 mm) may be explained by Kiener's habit to "restore" and "beautify" somewhat damaged shells.

Neither REEVE (1843), SOWERBY I (1833-1839) nor LAMARCK (1845) mentioned *C. scalaris*. However in 1849 (p. 6) REEVE compared it with *C. acutangulus*, following Kiener's comment: "This species I have not seen, but the figure is so like the fusiform variety of *C. acutangulus* that I cannot forbear suggesting the comparison". SOWERBY II (1857: 14, n° 106, Pl. 9, fig. 192) misidentified *C. scalaris* and considered it as a junior synonym of *C. gradatus* Reeve (FIGS. 1 & 2). Thus it can be considered that Sowerby II was at the origin of the concept of what may be called "*C. scalaris* auctorum" (not Valenciennes), concept which was reflected by the large majority of following authors, such as TRYON (1884: 122) who differentiated *C .scalaris* ValenC. from "*C. ocalaris*" (a misprint for *scalaris* (p. 136)) "Valenciennes in Kiener, pl. 88, fig. 5" (FIG. 3), which he considered as a synonym of *C. arcuatus* Broderip & Sowerby, 1829.

In more recent literature, DALL (1910: 221) only mentioned the name, ranking *C. scalaris* among the forms which may be regarded as "species or varieties" of "*C. gradatus* Mawe". The author did not provide any illustration, so that no conclusion may be deduced about the identity of the concerned species. KEEN (1958: 486) misinterpreted *C. scalaris* and figured a shell (p. 487, fig. 942) which belongs to another, seemingly until today undescribed species, which subsequently I shall call *C. species* n°1. Also HANNA (1963, pl. 3, fig. 11; pl. 4, figs .1 & 3 (FIG. 4); pl. 7, fig. 3) figured the same species with the erroneous name *C. scalaris*, as well as MARSH & RIPPINGALE (1974, pl. XXIII, fig. 20) (FIG. 5), KAICHER (1977, part II, card n°1119) (FIG. 6), WALLS (1979: 527, 530-531, 534; figs. p. 340 below left, p. 344 all), and LAUER & RICHARD (1989: 18).

The specimen illustrated by EMERSON & OLD (1962: 23-24, fig. 12) is here attributed to *C. incurvus* Sowerby, but they figured a specimen of 38 mm, with the name "*C. regularis* form *monilifer*", on p. 21, fig. 8, which is here assigned to *C. scalaris*. This print

probably is the single figure of *C. scalaris* in literature after Kiener's and Tryon's ones.

DA MOTTA (1989), in his "Review of the *Conus regularis* complex" noted that "Kiener's figure (FIG. 7) (is) the most probable representation of Valenciennes' controversial *C. scalaris*", and concluded: "it remains an indeterminate species" which therefore should be regarded as a *nomen dubium*.

KOHN (1992: 237) concluded: "The original specimen is not preserved in the MNHN. It is very likely, however, to be the specimen figured by Kiener. The figure (KIENER, 1845: pl. 88, fig. 5) is here designated as representation of the lectotype of *C. scalaris* Valenciennes." He considered *C. scalaris* as "a valid species occuring on the Pacific Coast of Mexico".

4) Holotype of *C. scalaris* Valenciennes (FIGS. 8).

Although Kohn designated the figure in Kiener as "representation of the lectotype", Valenciennes did not mention another specimen he had examined, described or measured. Thus we must conclude that the description was based on a single individual, and this "lectotype" must be regarded as the holotype-figure.

This holotype was considered lost by all the recent authors. In the collections of the M.N.H.N. in Paris, a lot of 6 *Conus* specimens are preserved with the label of "*C. scalaris*" Valenciennes. However five of them are here attributed to other species of this group. The sixth one has been labelled "*C. fusiformis*" Lamarck, with an aberrant locality: "Océanie", and perhaps therefore somewhat disregarded. Dr.Georges RICHARD, in the course of a recent revision of the Conidae in M.N.H.N., re-labelled it as *C. scalaris* Valenciennes. During my first revisionary researches on the "*C. gradatus* complex", this specimen did not peculiarly draw my attention, but at my last stay in the Museum, I borrowed this specimen for examination. After a slight cleaning of the shell, and an examination under binocular microscope, it became obvious that this specimen was the one described by Valenciennes and figured by Kiener. All the details: number, forms, colours and locations of the dashes are strictly the same as in the type-figure. The holotype of *C. scalaris* Valenciennes was retraced.

Actual condition (FIGS. 8, 12):

Measurements: Shell height: 23.5 mm. Largest diameter: 9.6 mm. height of the body whorl: 15.8 mm. height of the spire: 7.7 mm. Weight: 1.18 gr.

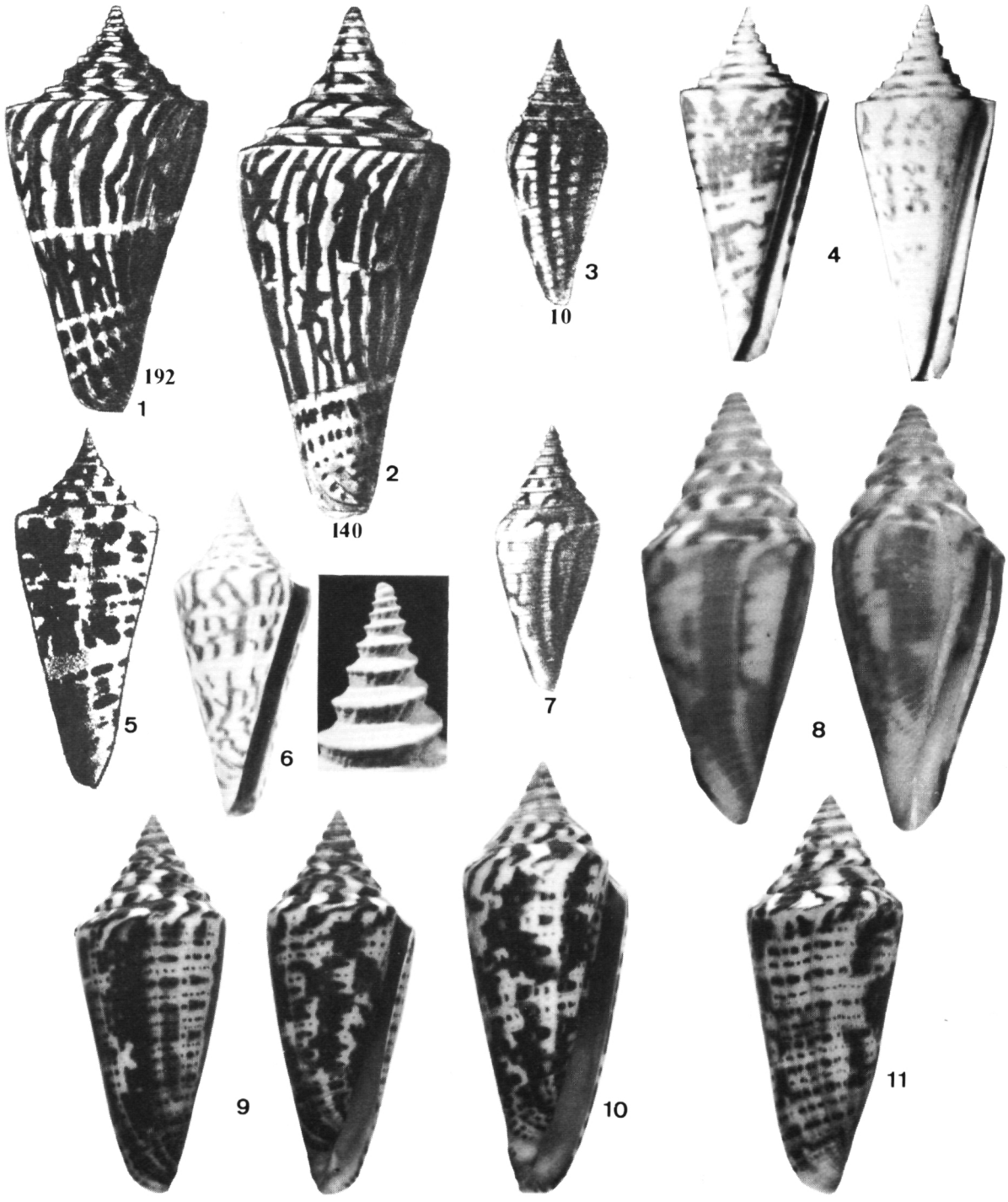
Figures 1 to 11 (opposite page)

1 - "*C. scalaris*" (= *C. scalarissimus* da Motta, 1988) in Sowerby II, 1857, pl.9, fig.192) (x 1.4).
2 - *C. gradatus* Reeve (= *C. scalarissimus* da Motta), type-figure in Reeve, 1843, pl. 25, fig.140 (x 1).
3 - *C. scalaris* Valenciennes in Tryon, pl.27, fig.10 (x 1.4).
4 - "*C. scalaris*" (= *C. species* n°1) in Hanna, 1963, pl.4, figs 1 & 3 (x 1.2).
5 - "*C. scalaris*" (= *C. species* n°1) in Marsh & Rippingale, 1974, pl.XXIII, fig.20 (x 1.2).
6 - "*C. scalaris*" (= *C. species* n°1) in Kaicher, 1977, Card 1119 (x 0.8). Right: detail of the spire sculpture.
7 - *C. scalaris* Valenciennes, type-figure in Kiener, 1845, pl.88, fig.5 (x 1.4)
8 - *C. scalaris* Valenciennes, holotype, MNHN, Paris, 23.5 mm.
9-11 - *C. scalaris* Valenciennes, Bahia de los Angeles, Ballenas Channel, North-West of the Cortez Sea, Baja California. - **Fig.9**: dorsal and apertural view of a 43.7 mm specimen. - **Fig.10**: 49.4 mm. - **Fig.11**: 45.6 mm (Coll. Lauer).

Although the height given by Valenciennes is "11 lignes" (= 24.6 mm), the French line (= 2.26 mm) was the smallest length unit used at his time. Thus the actual length of the shell agrees with Valenciennes' original statement (11 lines = 23.5 - 25.7 mm)

Shell condition: protoconch eroded. Number of teleoconch whorls: 9. Basal border somewhat chipped and eroded. Outer lip broken in a length of about 11 mm. A deep growth-reformation scar runs along the height on the ventral side towards the columella. The colours are very faded.

Observations: the shell was obviously dead and bleached when taken, which is confirmed by sandy gravel still wedged in the aperture. The erosion of the protoconch and partly of the base seems to be the original condition of the shell. The break of the lip is certainly more recent, since Kiener noted that the aperture "right border is fine and arched".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Additional description of the holotype:

The turreted spire shows strongly stepped teleoconch whorls, showing an oblique, slightly concave upper ramp and an inwards slanting lateral riser. The riser of the 5.5 earlier whorls is sculpted with solid oblique axial striations on its entire height, which give a slightly granulose aspect to the external whorl border (FIG. 12). This sculpture dwindles and disappears after 5 to 6 volutions. The following whorls are nearly smooth, showing only slight radial curved striae. Suture well marked. The body whorl is almost smooth and bears obsolete prominent, spiral somewhat granulated cords with nearly 1 mm wide flat spaces. Near the base, a series of 11 to 12 flat ribs separated by narrow sulci are observed. The earlier whorls are slightly tawnish coloured, the aperture is white inside.

The holotype of *C. scalaris* almost certainly is a juvenile shell, which explains the high value of the body whorl-Height/Spire-Height ratio (this ratio typically decreases with the growth of the shell). The colour pattern is incompletely formed and, as such, is hard to compare with other known species. Therefore it appears advisable to provide a description of adult shells:

5) Description of *Conus scalaris* Valenciennes (FIGS. 9-11):

Shell of medium size (38 to 55 mm) with a heightened, turreted and strongly stepped spire. Body whorl smooth, relatively glossy, showing fine and weak longitudinal, axially curved growth striae and 10 to 12 narrow, obsolete spiral ribs towards the base.

The protoconch is seldom intact. From the whole examined material is deduced an intermediate multispiral protoconch of 2.4 to 2.7, whitish to very pale chestnut larval whorls, followed by 5 early (postlarval) more deeply coloured teleoconch whorls. There are 10 strongly stepped teleoconch whorls, with a steep and slightly concave to nearly flat upper ramp, sculptured with narrow, close, fine and leftward strongly arched radial striae. No spiral sculpture is visible. Their external border is formed of an obtuse angle. The lateral riser, of which the oblique axial striations observed in the holotype (FIG. 12) are eroded and hardly visible, reaches nearly half the height of a whorl, and slopes inwards at its base. The general spire outline is slightly concave to nearly straight.

The shoulder, like the spire whorls, shows an obtuse angle with a slightly raised border.

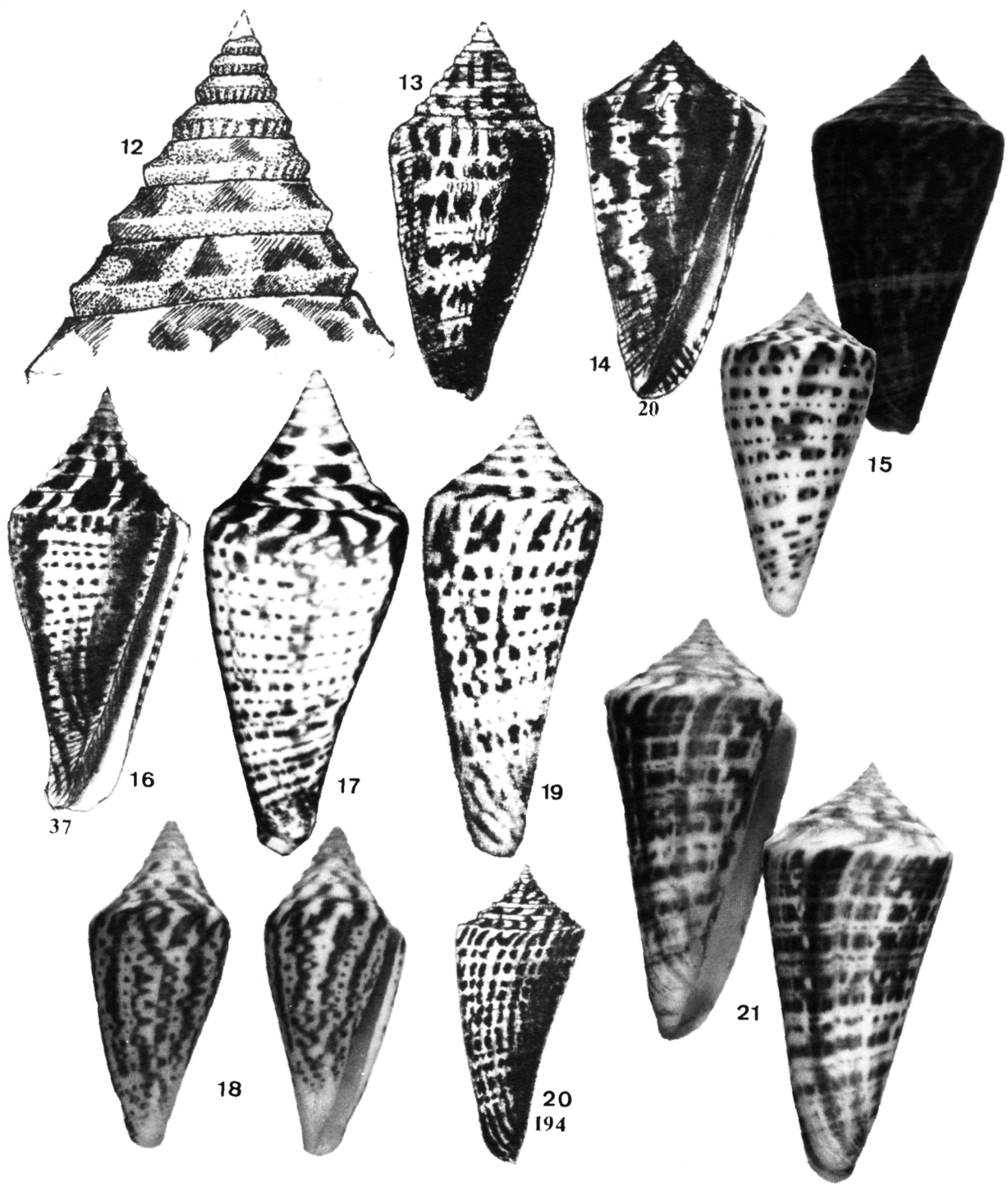
The body whorl has a fusiform profile, with slightly convex to nearly straight sides. The aperture is narrow, scarcely enlarging towards the base. The outer lip, fine and sharp, shows, along its internal narrow whitish border, the outer dotted colour pattern by translucence. Then, the aperture shows a more or less deep chestnut to lilac-chestnut lunula which lightens towards the inside. The columellar fold, fine and hardly visible is relatively rectilinear and is tinged with pinkish chestnut.

All teleoconch whorls, except the 2 or 3 earlier (postlarval) ones, are stained with reddish chocolate-brown dashes in form of leftward arched commas. The body whorl has a grayish to slightly bluish-white background which is covered with 5 to 7, more or less zigzaging, chocolate-brown axial flames. This pattern is overlaid with a series of 10 to 12 spiral alignments of more or less squarish deeper brown dots, alternated with alignements of smaller dark spots.

Periostracum, living animal, operculum, radulas and egg capsules remain unknown to me.

Figures 12 to 21 (opposite page)

12 - *C. scalaris* Valenciennes: earlier spire-whorls.
13 - *C. gradatus* Wood: lectotype-figure in Wood, pl.3 fig.6*b*, 17 mm (x 3.6).
14 - *C. regularis*: lectotype-figure in Sowerby I, 1833: pl.29, fig.29 (x 1.4)
15 - *C. regularis*: - left: light colour pattern, 45.6 mm, Bahia Conception, Mexico (Coll. Lauer)- right: dark colour pattern, 53.5 mm, "Asia" (Coll. Ballot, MNHN, Paris).
16 - *C. monilifer*: type figure in Broderip, 1833, part.29, fig.37 (x 1.4).
17 - *C. monilifer*: lectotype, "Salango", 50 mm, BM(NH), London.
18 - *C. monilifer*: "Montezuma" ?, 39.9 mm (Coll. Staadt, MNHN, Paris).
19 - *C. recurvus*: lectotype, "Monte Christi", 53 x 23 mm, BM(NH), London.
20 - "*C. incurvus*" (= *C. recurvus*) in Sowerby II, pl.9, fig.194 (x 1.4).
21 - *C. recurvus*, (Colombia ?) 59.9 mm (Coll.Lauer).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Distribution range: *C. scalaris* seems to be a rare species and thus its distribution range is poorly known. Only 5 specimens are known to me:

-the holotype: "Acapulco",

-one specimen figured - EMERSON & OLD, 1962 : 21 fig.8: 38 mm) from "San Marcos Island, Baja California (Sur - off Bahia Magdalena), Mexico, Station 149, shore collecting" stored in AMNH, n°76716,

-three adult specimens (43.7, 45.6, and 49.4 mm) in the author's collection , from Bahia de Los Angeles, Ballenas Channel, North-West of the Cortez Sea, Gulf of California, Baja California Norte, at about 3 m depth on shingle and scree bottom.

II
Provisional review of the taxonomic environment of *C. scalaris*.

To disentangle definitely the identity of *C. scalaris* as a separate valid species, it appeared advisable to revise, even if shortly, and on the basis of the available material, the whole *C. gradatus* complex:

A valuable revisionary work of this group should be based on a large lot of adequate shell material in good condition. Such material is nearly impossible to obtain for the moment. The type-material consists partly in type- figures which are hard to interpret, partly of type-shells in bad condition with broken or strongly eroded protoconchs. Thus the structure and the number of the larval whorls cannot be determined in a large majority of cases, and the number of teleoconch whorls is difficult to count. For this reason, I refer below to the "visible" whorls, which does not predjuge if they include one or more eroded larval whorls.

NYBAKKEN (1970) analysed the radula of all these species, but unfortunately he did not redefine or illustrate them. He only noted (p. 1) that he adopted the identifications given by KEEN (1958) and by HANNA (1963), whose opinions nevertheless diverged for several species. This way, only a small number of the examined radulas may be assigned with some certainty to well identified species. Thus, in the absence of more precise or adequate investigation methods (protoconchs, colour of living animals, egg capsules, radulas etc.) the following revision is essentially based on the general outline and structure of the shells, and on the number, profile, structure and sculpture of the remaining spire whorls. The colour patterns being very close from one species to another, these characters are here considered most often as secondary. For all these reasons the following review should be considered as only provisional, to be reconsidered only when more substantial material is available.

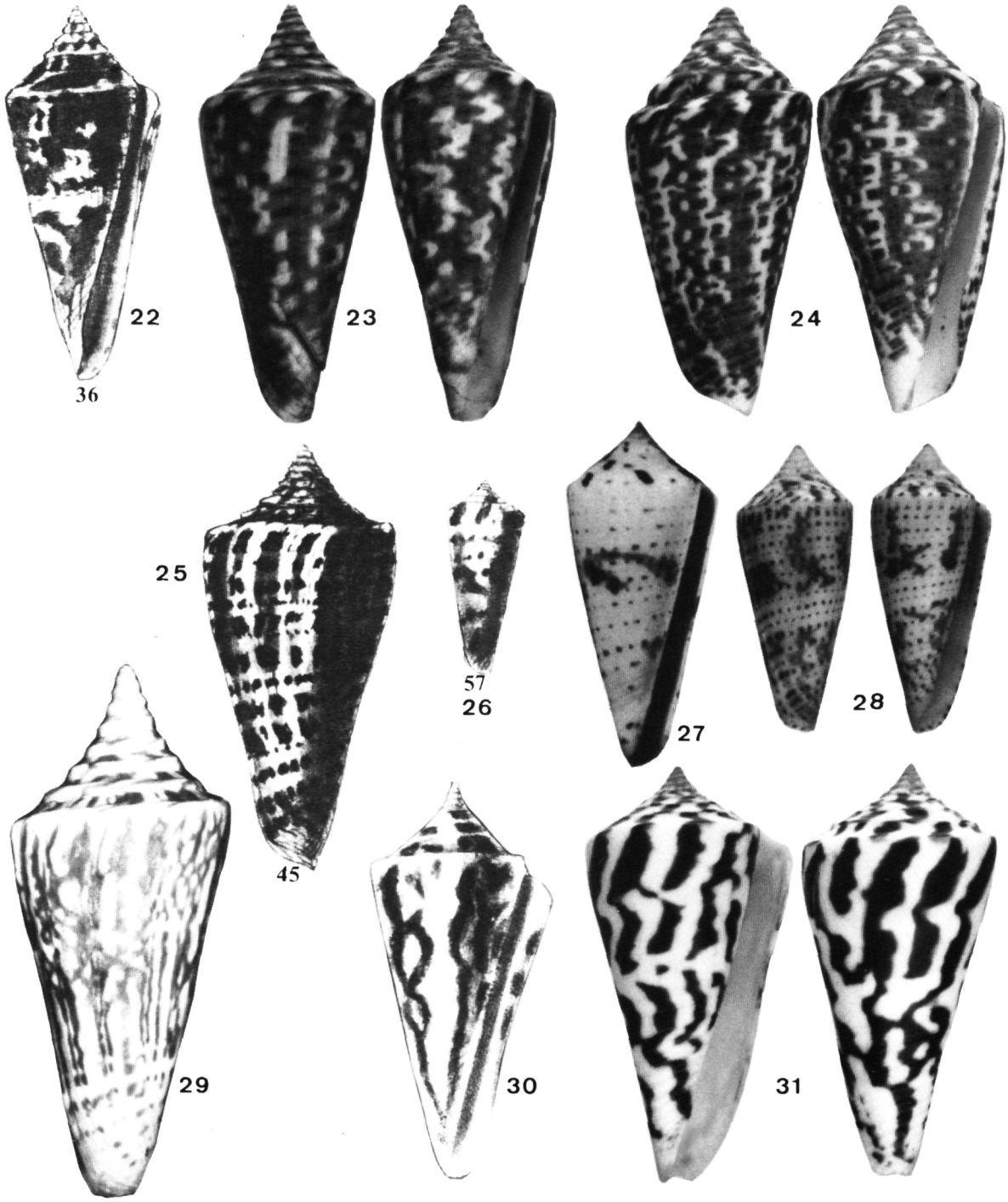
1) *Conus gradatus* Mawe, 1823: 90:

The name *C. gradatus* has been attributed to Mawe successively by DALL (1910), HANNA & STRONG (1949), HANNA (1963), NYBBAKEN (1970, 1971), and RICHARD (1990). However most authors attributed it to Wood, 1828.

A careful examination of the original material "The Linnean system of conchology" reveals that Mawe nowhere gave a description, an indication (in the sense of the "Code"), or a reference which allow to identify what species he intended to denote with the name *C. gradatus*. The single information he provided is: "*C. gradatus --- California --- Stepped Cone" (p. 90) among 36 Conus taxa he listed as "Elongated and rounded at the base". No figure is provided, no type shell is available. Thus *C. gradatus* Mawe must be considered a *nomen nudum*. ("Code", Art. 12). The same conclusion already has been suggested by EMERSON and OLD (1962: 20) and by KEEN (1971: 665).

Figures 22 to 31 (opposite page)

22 - *C. incurvus*, lectotype-figure in Sowerby, part 33, fig.36 (x 1.4).
23 - *C. incurvus*, "Guanacoste"(?), 48.8 mm (Coll.Staadt, MNHN, Paris).
24 - *C. incurvus*, San Felipe (Mexico), 47 mm (Coll. Estival, MNHN, Paris).
25 - *C. syriacus* (= *C. regularis*), lectotype-figure in Sowerby, 1833, part 36, fig.45 (x 1.4).
26 - *C. dispar*, lectotype-figure in Sowerby, 1933, part 37, fig.57 (x 1.4).
27 - *C. dispar* in Kaicher, 1977, Card 1126, Gulf of California (x 1.6)
28 - *C. dispar*, Santa Iñes Isl., Mexico, 28.8 mm (Coll. Lauer).
29 - *C. scalarissimus* da Motta, 1988: lectotype of *C. gradatus* Reeve, 1843 and holotype of *C. scalarissimus*, "Salango", 81 mm, BM(NH), London.
30 - *C. emarginatus* Reeve, 1844: lectotype-figure of *C. arcuatus* Gray, 1839 (pl.36, fig.22) (x 1.2).
31 - *C. emarginatus* Reeve, Panama, 56 mm (Coll. Lauer).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***2) Conus gradatus* Wood, 1828**: 8, *Conus* n° 6, pl. 3, fig. 6*b* (FIG. 13):

Wood (p. 8 n° 6) did not either give a description of his own *C. gradatus*. He only indicated its "English name": "interrupted". However, he illlustrated a specimen on pl. 3, fig. 6*b*.

Wood's figure, even if very small (17 mm high), is finely drawn, and represents a moderately elongate shell with a slightly ventricose body whorl, a straight-sided spire of 8 stepped volutions with a more or less flat to concave upper ramp. The body whorl is covered with 7 spiral alignments of brownish, more or less squarish, medium sized blotches and two intermediate alignements of fine blackish spots. The plates having been hand coloured, the colours slightly vary from one copy to another. Type locality: "California".

Wood indicates (Preface, p. iv) that a "mark or a letter of the alphabet is added after the number engraved on the plate", the letter β signifying a shell-length of about 2 inches (= approximately 57 mm). Wood's figure is hard to assign with some certainty to a known species.

In literature *C. gradatus* (see *C. gradatus* Reeve, n° 10) has been most often considered as being the taxon Reeve introduced in 1843 (with a strongly stepped spire and a straight sided, to slightly concave body whorl), or confused with forms of *C. regularis* Sowerby 1833. The difficulty to determine what a "real" species Wood intended to denote is, among others, pointed out by following authors:

- KEEN (1958: 486), under the name *C. gradatus* Wood, figured a shell (p. 487, fig. 939) she later considered (1971: p. 666, n° 1506) a specimen of *C. recurvus* Broderip, 1833 (which is here assigned to *C. gradatus* Reeve (= *C. scalarissimus* da Motta). Also in 1971 (p. 665) she noted "Until the type" (of *C. gradatus* Wood) "is detected and studied, it seems wisest to regard the species as indeterminate and to utilize for the complex of which it might be a member a name based on well-figured type material".

- EMERSON & OLD (1962: 22) noted: "*C. gradatus* of Wood, 1828, as has often been pointed out, is the earliest name available for this complex. However, until the holotype is critically examined and is refigured, it is best considered a *species inquirendae* and is referred here questionably to the synonymy of *Conus regularis* Sowerby, 1833." The authors figured (p. 21: fig. 9) a specimen of *C. monilifer* Sowerby, 1833 under the name of *C. gradatus* Wood, nevertheless with a question mark.

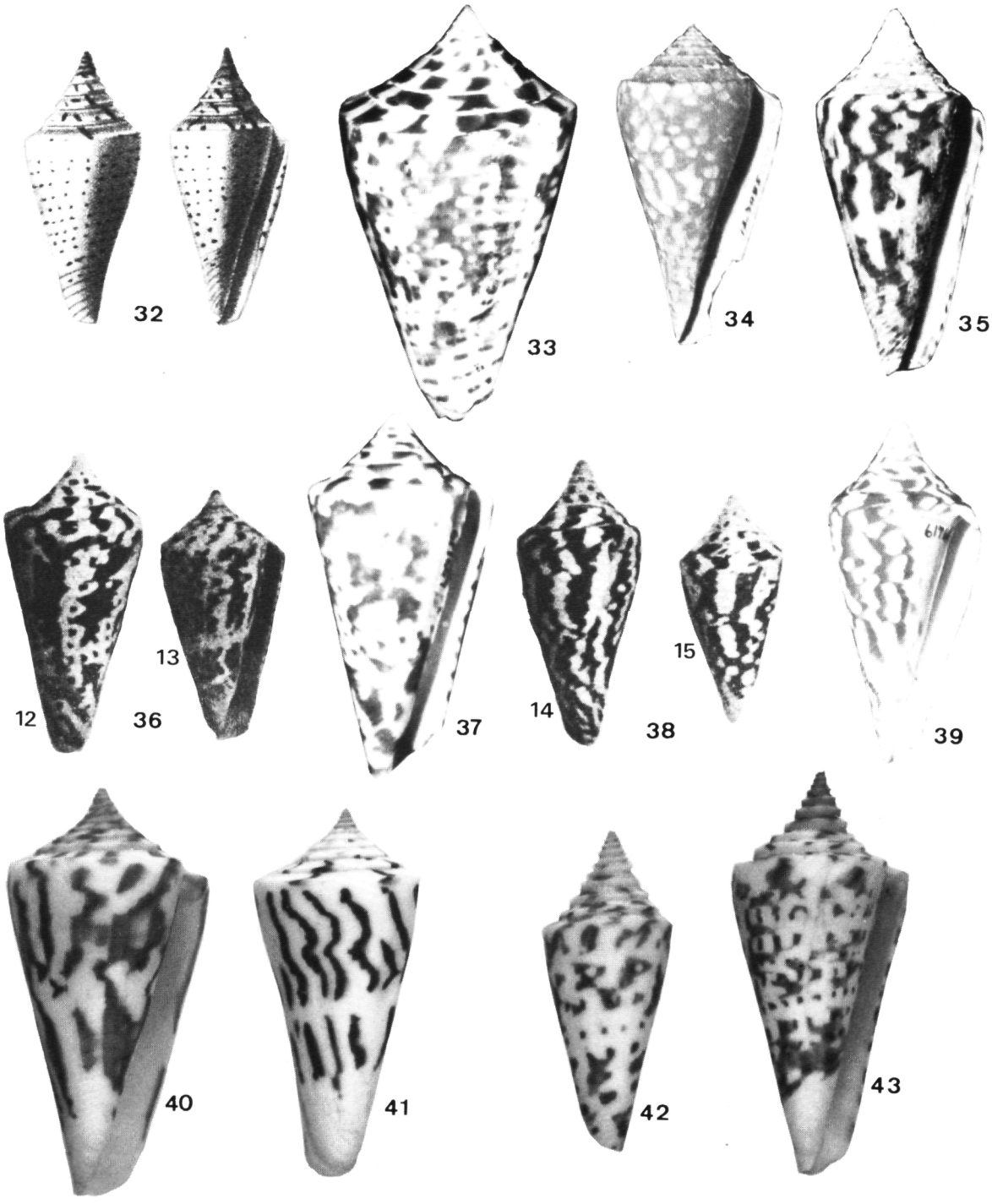
- COOMANS *et al.* (1980: 40 (*angulatus*)) considered the identity of *C. gradatus* Wood as "still questionable at the moment".

- DA MOTTA, (1989: 9) held it as a valid species, designated Wood's fig. 6*b* as representative of the lectotype, and noticed that *C. gradatus* might be recognized in the shells Walls figured on p. 341, "bottom left frame: both figures; and bottom right frame: the two figures in the lower row". His distinction from other Cones of this groupe was largely based on the straight sided spire profile and strongly stepped whorls.

- KOHN (1992: 218) concluded as follows: "Because this figure" (Wood's one) is so small (17mm) and so crude, it is not possible to assign it unequivocally to any known species. I thus conclude that *C. gradatus* Wood, 1828 is a *nomen dubium*." I provisionally agree with both, KEEN (1971) and KOHN (1992) in reaching the same conclusion.

Figures 32 to 43 (opposite page)

32 - *C. candidus* Kiener, 1845: lectotype-figures in Kiener, pl.97, fig.1 (x 1.4).
33 - *C. angulatus* A.Adams, 1853 (= *C. regularis*): holotype, 40 mm, BM(NH), London.
34 - *C. scariphus* Dall, 1910: holotype, Cocos Island, 41 mm, USNM, Washington.
35 - *C. magdalenensis* Bartsch & Rehder, 1939 (= *C. incurvus*): holotype, Magdalena Bay, 33.6 mm, USNM, Washington.
36 - *C. gradatus thaanumi* Schwengel, 1955 (=*C. incurvus* ?), Bahia Salinas: syntypes-figures, pl.2, figs.12-13, 47 and 39 mm.
37 - *C. gradatus thaanumi* Schwengel: "holotype", 45.5 mm, USNM, Washington (After Hanna).
38 - *C. recurvus helenae* Schwengel, 1955 (= *C. incurvus*), Curu: syntypes-figures, pl.2, figs.14-15, 44 and 36 mm.
39 - *C. recurvus helenae* Schwengel: "holotype", 45.2 mm, USNM, Washington (After Hanna).
40-41: *C. poormani* Berry, 1968: Panama, 50.1 mm - Las Perlas Isl., 45.5 mm. (Coll. Lauer).
42-43 - *Conus species* n° 1: Punta Eugenia, Baja California, 40 mm and Galapagos, 49.8 mm (Coll. Lauer).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3) *Conus regularis* Sowerby, 1833 (17 May, Part 29, fig. 29) (Fig. 14):
- *C. regularis* (valid) - SOWERBY II: 1857: 16, pl. 9, figs. 208-210.
- *C. regularis* (valid) - DALL, 1910: 221-222- no figure.
- *C. regularis* (valid) - KEEN, 1958: 486, fig. 941.
- *C. regularis* (valid) - EMERSON & OLD, 1962: 20-23, fig. 7.
- *C. regularis* (valid) - HANNA, 1963: 29; pl. 2, fig. 2; pl .6, fig. 5.
- *C. regularis* (valid) - KEEN, 1971: 665, 666, fig. 1507 (only right).
- "*C. regularis*" (=*C. incurvus)* - NYBAKKEN, 1971: 104; 102, fig. 18 (fig. 19 unidentified).
- *C. regularis* (valid) - MARSH & RIPPINGALE, 1974: 63; pl. 7 fig. 21.
- "*C. regularis*" (= *C. recurvus)* - KAICHER, 1977, II, Card 1327.
- synonym of "*C. gradatus* Wood" - WALLS, 1979: 527; 531; (340-341, 344 see below).
- *C. regularis* (valid) - DA MOTTA,1989: 9.
- *C. regularis* (valid) - RICHARD, 1990: 181.
- *C. regularis* (valid) - KOHN, 1992: 243-244.

No type-specimen being available, DA MOTTA (1989: 6) designated the figure in Sowerby as representative of the holotype of *C. regularis*. In accordance with the "Code" (Art. 74b) Da Motta's designation should be considered of a lectotype and not of a holotype. In addition, the availability of this designation as a nomenclatural act is questionable. KOHN (1992: 243-244) correctly designated the same figure as "representation of the lectotype".

Sowerby I gave neither a diagnosis nor a description in his "Conchological Illustrations". BRODERIP (1833,-24 May) makes no mention of *C. regularis*. For this reason KOHN (1992: 247) referred to the diagnosis and description given by SOWERBY II in 1857 (p. 16, n° 128):

Diagnosis: "*C. subturbinatus, laevis, lateribus subcontractis; maculis quadratis rubro-nigrescentibus regulariter fasciatim pictus; spirâ acuminatâ, lateribus incurvis*". (C. subturbinate, smooth, with subcontracted sides; squarish blackish-red dots regularly arranged in fascies. Pointed spire with incurved sides.)

Description: "Broader at the upper angle than the preceeding ("*C. incurvus*" = *C. recurvus*) and marked with regular, square, reddish-brown spots."

Sowerby II gave three figures (pl. 9, figs. 208-210) for *C. regularis*, which rather well illustrate the variability of the species. Although Sowerby I did not indicate a type locality, Sowerby II localized the species in: "Bay of Nicoya, Central America, etc, Bay of Panama, *Cum.*" KIENER (1845: pl. 25, figs 3, 3a) also illustrated two different "varieties" of this species which he considered valid.

C. regularis (FIGS. 15) is a well known species, of which further description appears unnecessary, and a large majority of authors (REEVE, 1843, SOWERBY, 1857, TRYON, 1884, DALL, 1910, TOMLIN, 1937, etc.) held it as valid. KEEN (1958: 486, n° 941; 1971: 665, n° 1507) gave an exhaustive list of synonyms: *C. monilifer* "Broderip", *C. syriacus* Sowerby, *C. angulatus* Adams, ? *C. gradatus thaanumi* Schwengel. In 1971, she added *C. magdalenensis* Bartsch & Rehder and *C. recurvus helenae* Schwengel. (See these taxa below). HANNA (1963: pl. 2, fig. 2; pl. 6, fig. 5; pl. 9 fig. 9) published three colour photographs of *C. regularis* of which pl. 9 fig. 9 is here assigned to *C. recurvus* Broderip. NYBBAKEN's study on radular teeth (1971) in this group is of little help for identification of closely patterned *Conus*, because he adopted the partly erroneous determinations from HANNA & STRONG (1949), KEEN (1958) and HANNA (1963). For example, he figured (1971: 102, figs. 18-19) under the name *C. regularis* four specimens which in my opinion belong to *C. incurvus*. Strangely WALLS (1979: 527) synonymised *C. regularis* with "*C. gradatus* Wood" of which he considered *C. regularis* as "the more typical lower-spired form" and illustrated it on p. 341 above left, and at the bottom, extreme right of the second row. Successively RICHARD (1990: 181) and KOHN (1992: 244) considered *C. regularis* a valid species, opinion which is here agreed with.

4) *Conus monilifer* Sowerby in Broderip, 1833 (24 May: 54), *Conchological Illustrations, part 29*, fig. 37. (Figs 16-18):
- *C. monilifer* (valid) - SOWERBY II: 1857: 14 n° 109; pl. 16 fig. 380 - fig. 381 unidentifiable, fig. 382: probably *C. incurvus*.
- *C. monilifer* (valid) - DALL, 1910: 222 - no figure.
- synonym of *C. regularis* - TOMLIN, 1937: 278.
- synonym of *C. regularis* - KEEN, 1958: 486.
- "*C. regularis* form *monilifer*" - EMERSON & OLD, 1962: 21, fig. 9; 23.
- synonym of *C. regularis* - HANNA, 1963: 30.
- synonym of *C. regularis* - KEEN, 1971: 665.
- synonym of *C. gradatus* Wood - WALLS, 1979: 527, 534.
- *C. monilifer* (valid) - DA MOTTA, 1989: 9.
- *C. monilifer* (valid) - RICHARD, 1990: 170.

- tentatively synonym of *C. regularis* - KOHN, 1992: 245.

DA MOTTA (1989:6) selected and figured (p. 7), from four specimens preserved in the BM(NH), the specimen measuring 50 x 22 mm as the lectotype of *C. monilifer* (FIG. 17). KOHN (1992: 245) designated the same specimen as the lectotype (see abowe the comment on the type of *C. regularis*).

Original diagnosis (in Broderip, 24 May 1833: 54): "*Con. testâ subfusiformi, transversim striatâ, albicante, castaneo-variegatâ, punctis castaneis seriatim ordinatis; spirâ acuminatâ, albo castaneoque variâ, apice acuto: long.2, lat.11/12 poll.*" (Cone shell subfusiform, transversally striate, whitish, varied with chestnut, with serially disposed chestnut spots; spire acuminate, varied with white and chestnut, sharp apex: long: 2, width:11/12 inch. (50.8 x 23.3 mm)).

Type locality: "Salango", "dredged at a depth of nine fathoms in sandy mud. A single specimen. - G.B.S.". Salango (today Salanga isl.) is a little island in the vicinity of López, Ecuador)

SOWERBY II (1857: 14, n° 109) gave a second diagnosis and description:

Diagnosis: "*C.solidus, subfusiformis, infra contractus, punctis articulatis castaneis cinctus flammeisque variegatus; spirâ acuminatâ.*" (Solid Cone, subfusiform, contracted towards the base, encircled with articulate chestnut points which are mixed with flames; acuminate spire.)

Description: "Distinguished by the articulated rows of semicircular spots by which all the varieties are more or less encircled."

To the preceding diagnoses and descriptions should be added that the lectotype has a slightly bulbous shoulder with a relatively rounded angle, an elevated, sharp, but not scalar spire with feebly stepped whorls, the earlier ones being more strongly gradate, a smooth body whorl constricted towards the base. All these characters are sufficient to distinguish *C. monilifer* from its congeners. Even if it is close to *C. incurvus* in general shape [what seemingly had somewhat disturbed Sowerby II in his fig. 381 and 382 (pl. 16)], the higher spire of 11 to 12 visible volutions with a strongly steep upper ramp and a more rounded shoulder in *C. monilifer*, and its rather peculiar colour pattern, allow separation of both species. *C. monilifer* is here considered a valid species (FIGS. 16-18).

Figs.44 - *Conus species* n° 2: Bahia Santa Iñes, Baja California, respectively 33.8, 35.7, 33.8 and 33.9 mm. (Coll. Lauer).

5) *Conus recurvus* Broderip, 1833 (24 May:) (FIGS. 19-21):
- "*C. incurvus*" - SOWERBY II: 1957: pl. 9 fig. 194. - the name *recurvus* was not mentioned by Sowerby II (FIG. 20).
- not mentioned by DALL, 1910.
- "*C. recurvus*" (= *C. emarginatus)* - EMERSON & OLD, 1962: 16-17, fig. 3.
- "*C. recurvus*" (= *C. emarginatus)* - KEEN, 1958: 487, fig. 940.
- "*C. recurvus*" (= *C. emarginatus*) - HANNA, 1963: pl. 1, fig. 3; pl. 2, fig. 7.
- "*C. recurvus*" (= *C. scalarissimus*) - KEEN, 1971: 665, fig. 1506.
- "*C. recurvus*" (= *C. emarginatus)* in NYBBAKEN (1971: 98, fig. 13; 102, figs. 14-17.
- "*C. recurvus*" (= *C. emarginatus)* - MARSH & RIPPINGALE, 1974: pl. 7, fig. 20.
- "*C. recurvus*" (= *C. emarginatus)* - KAICHER, 1977, II, Card 1160.
- "*C. recurvus*" (= *C. emarginatus)* - WALLS, 1979: 577, above and below right.
- synonym of *C. regularis* - COOMANS *et al.*, 1981, 4: 13-14 (under *arcuatus* Gray).
- synonym of *C. regularis* (form) - DA MOTTA, 1989: 9.
- synonym of *C. emarginatus* - RICHARD, 1990: 180.
- synonym of *C. regularis* (tentatively) - KOHN, 1992: 246.

Original diagnosis (p. 54): "*Con.testâ elongato-conicâ, subrecurvâ, albâ rubro-castaneo nebulosâ et vittatim punctatâ; spirâ prominente, acutâ albo castaneoque maculatâ; epidermide tenuissimâ: long.2, lat.7/8 poll.- Hab.* in Americâ Meridionali. (Monte Christi)" (Cone, shell elongate-conical, somewhat incurved, suffused with pale reddish chestnut and showing punctuated bands; spire prominent, sharp, white and chestnut stained; very thin epidermis (periostracum) - Lives in Southern America, Monte Christi (Today: Manta, near Cape San Lorenzo, Ecuador): length 2, width 7/8 inches (= 50.8 x 22.2 mm).

Original description: "In young specimens the top of the body whorl, just as it joins the spire, is surrounded by a thin elevated edge. This, in young individuals, is almost sharp: with age all traces of it disappear. In its markings it sometimes resembles *Conus amadis*. - Found in gravel at a depth of twenty-two fathoms".

Although DA MOTTA (1989: 6) stated that the holotype was preserved in the BM(NH), KOHN (1992: 246), noticing that this specimen was certainly not the sole Broderip had studied, and according with the "Code", designated this specimen (53 x 23 mm) as the lectotype of *C. recurvus* Broderip (FIG. 19).

The lectotype has an elongate body whorl, somewhat concavely incurved in its lower third, with a narrow aperture. The medium-high spire, of 11 visible, slightly depressed volutions, has a nearly straight to weakly concave profile. The whole of the body whorl is patterned with spiral rows of chestnut more or less squarish and axially elongate dots, suffused by some axial flammules of a lighter chestnut, and sometimes separated by spiral alignments of minute chestnut spots. The spire is stained whith analogous white and chestnut articulate dots (FIG. 21).

C. recurvus is here tentatively considered as a valid species.

6) *Conus incurvus* Sowerby, 1833 (June or July, Part 33, fig. 36) (Figs. 22-24):
- "*C. recurvus*" - KIENER, 1845 : pl. 97 figs. 4-4a.
- "*C. incurvus*" (= *C. recurvus*) - SOWERBY II: 1857: 127, pl. 9 fig. 194 (FIG. 20).
- "*C. incurvus*" - DALL, 1910: 222: unidentified, no figure.
- synonym of "*C. recurvus*" (= *C. emarginatus*) - KEEN, 1958: 486, fig. 940.
- synonym of "*C. recurvus*" (= *C. emarginatus*) - EMERSON & OLD, 1962: 16-17, but figured p. 19 fig. 6 as "*C.* cf. *magdalenensis* B. & Rehder").
- "*C. recurvus*" (= *C. emarginatus* Reeve) - HANNA, 1963: 27.
- synonym of "*C. recurvus*" (= *C. scalarissimus*) - KEEN, 1971: 665, fig. 1506.
- synonym of "*C. recurvus*" (= *C. emarginatus* Reeve) - WALLS, 1979: 829, 831.
- synonym of *C. emarginatus* - RICHARD, 1990: 162.
- synonym of *C. regularis* (tentatively) - KOHN, 1992: 247.

Sowerby I gave neither a diagnosis nor a description in his "Conchological Illustrations". For this reason KOHN (1992: 247) referred to the diagnosis and description given by Sowerby II in 1857 (p. 16, n° 127):

Diagnosis: "*C. attenuatus, laevis, coerulens, rubronigrescente seriatim maculatus; lateribus incurvis, spirâ acuminatâ, gradatim angulatâ.*" (Shell slender, smooth, bluish, with blackish-red series of dashes; incurved sides, pointed spire with angular gradations."

English description: "Longer than *C. dispar*, with the sides elegantly incurved."

However Sowerby's II diagnosis and description are the ones of the specimen he illustrated on pl. 9, fig. 194, which is *C. recurvus* and most probably drawn after the lectotype of this species. Thus his text is of no help in the identification of *C. incurvus*.

Sowerby only indicated the type locality: "Monte-Christe" (see above under *C. recurvus*)

Sowerby's I figure n° 36 (FIG. 22) was designated as "representation of the lectotype" of *C. incurvus* by KOHN (1992: 247, fig. 483). This figure shows an elongate shell with straight to sligthly concave body whorl sides, a rather high and slightly concave spire of 10 visible volutions with a weakly depressed upper ramp bordered with a moderately elevated bank. The earlier whorls are more strongly stepped. Near the base, seven faint oblique spiral sulci are visible. The colour pattern consists of some spiral arrangements of brown dots on more or less zigzaging axial orange-brownish flames. In its whole, the pattern is close to the one of *C. regularis*. However, with its less broad shouldering and higher, more concave spire, *C. incurvus* is rather easy to separate from *C. regularis*. I tentatively consider it as a separate valid species.

7) *Conus syriacus* Sowerby, 1833 (Post July, Part 36, fig. 45) (FIG. 25):
- synonym of *C. regularis* - SOWERBY I 1841: Index.
- synonym of *C. regularis* - KEEN, 1958: 486; 1971: 665.
- synonym of *C. regularis* - HANNA, 1963: 30.
- synonym of *"C. gradatus* Wood" - WALLS, 1979: 527; 534.
- synonym of *C. regularis* - DA MOTTA,1989: 1, fig. 3; 6.
- Tentatively synonym of "*C. regularis* ?" - RICHARD, 1990: 187.
- synonym of *C. regularis* - KOHN, 1992: 248.

C. syriacus is a junior homonym of *C. syriacus* (Röding, 1798) (= *C. spurius* Gmelin, 1791), thus invalid. Sowerby I himself in his "Index" of the "Conchological Illustrations" (1841) changed the name to "*C. regularis* Nob. Z.P.1841". No type specimen being available, Kohn (1992: 248, fig. 485) designated the original figure 45, in Part 36 (48 x 22 mm) "as representation of the lectotype" (FIG. 25). Type locality: none. The lectotype-figure confirms Sowerby's I second opinion and shows a specimen of a light-patterned form of *C. regularis*. Thus *C. syriacus* is considered as a synonym of *C. regularis*, as it was already stated by KOHN (1992).

8) *Conus dispar* Sowerby, 1933 (Post July, Part 37, fig. 57) (Figs. 26-28):
- *C. dispar* (valid) - REEVE, 1849: pl. 4, fig. 238.
- *C. dispar* (valid) - SOWERBY II, 1857: 16 n° 126, pl. 9, fig. 195 (= *C. recurvus* ?).
- C. *dispar* (valid) - DALL, 1910: 222 - no figure.
- C. *dispar* (valid) - KEEN, 1958: 485, fig. 937.
- *C. regularis* forma *dispar* (tentativ.) - EMERSON & OLD, 1962: 20-21, fig. 10.
- *C. dispar* (valid) - HANNA, 1963: pl. 7 fig. 18, and maybe pl. 3, fig. 11 as "*scalaris* Valenciennes".
- *C. dispar* (valid) - NYBAKKEN, 1970: 17, fig.25.
- Tentatively synonym of "*C. scalaris* ?, variant" - KEEN, 1971: 667.
- *C. dispar* (valid) - MARSH & RIPPINGALE, 1974: pl. 7 fig. 22, whose identity is questionable).
- *C. dispar* (valid) - KAICHER, 1977, II, Card 1126 - an outstanding figuration.
- synonym of "*C. gradatus* Wood" - WALLS, 1979: 527, 531 (fig. which is *C. dispar*), 534.
- *nomen dubium* - COOMANS *et al.*, 1985, 8: 171, fig. 647.
- *nomen dubium* - DA MOTTA, 1989: 6.
- *C. dispar* (valid) - RICHARD, 1990: 153.
- *C. dispar* (tentatively valid) - KOHN, 1992: 249.

Sowerby I gave neither a diagnosis nor a description of *C. dispar* in his "Conchological Illustrations". No type-locality has been mentioned. As a substitute, KOHN (1992: 249) cites the ones of Sowerby II (1857: 16, n° 126). However, in pl. 9, the fig. 190 which Sowerby assigned to this species does not match with the type-figure and cannot be unequivocally attributed to this species. Kohn admitted this when he wrote: "the diagnosis and figure in the *Thesaurus* almost certainly apply to a different species from that illustrated in *The Conchological Illustrations"* (1992: 249), and designated (fig. 489) Sowerby's I original figure (part 37, fig. 57 - 22 x 9 mm) "as representation of the lectotype" (FIG. 26). This lectotype-figure is rather crude, and the species should be definitely fixed by the designation of a neotype. I agree with Keen's, Hanna's and Kaicher's concept of *C. dispar*, which is very well figured in Kaicher's card n° 1126 (FIG. 27). *C. dispar* is a rather small species (30 to 38 mm), with a moderately high and feebly concave spire of about 8 to 9 flat, nearly unstepped teleoconch whorls of which the two last ones show three

weak spiral sulci. Such sulci are rarely observed in this group. The body whorl has nearly straight sides, the aperture is narrow and does not enlarge towards the base. The shell is white, partly suffused by light tan to bluish-tan, more or less large and undefined dashes, and encircled by alignements of chestnut to orange-brown spots. The spire is sparsely stained with dark brown markings. *Conus dispar* is here considerd a valid, seemingly rather rare species which occurs in the Gulf of California (Keen, Hanna, Kaicher) (FIG. 28). *C. dispar* is sometimes confused with *C. species* n° 2 (FIG. 44), which has a strongly concave spire of 10 stepped teleoconch whorls.

9) *Conus arcuatus* Gray, 1839 (119; pl. 36, fig. 22) (FIG. 30):

The name being a junior homonym of *C. arcuatus* Broderip & Sowerby, 1829, another valid species belonging to the subgenus *Conasprella* Thiele, 1929, the species was redescribed by REEVE (1844, pl. 43 fig. 232) as *C. emarginatus*. (See hereunder: *C. emarginatus* Reeve.)

10) *Conus gradatus* Reeve, 1843 (pl. 25, fig. 140) (FIGS. 2, 29):

- *C. gradatus* Reeve (= *C. scalarissimus*) - KIENER, 1845: 140-141, pl. 94, fig. 6, which is probably taken from Reeve).
- synonym of "*C. scalaris* Valenc. " (= *C. scalarissimus*) - SOWERBY II, 1857: pl. 9, fig. 192, which is a reproduction of Reeve's figure.
- "*C. scalaris*" (= *C. scalarissimus*) - TRYON, 1884: pl. 10, fig. 83, which is a reproduction of Reeve's (n° 140) or of Sowerby's (n° 192) figure.
- "*C. gradatus* Mawe" (?) - DALL, 1910: 221.
- "*C. gradatus* Wood" (= *C. scalarissimus*) - KEEN, 1958: 486; 487, fig. 939.
- "*C. scalaris* Valenc " (= *scalarissimus* Da Motta ?) - EMERSON & OLD, 1962: 24, fig. 12 ?.
- "*C. gradatus* Mawe" (= *C. scalarissimus*) - HANNA, 1963 :pl. 2 fig. 3.
- "*C. gradatus* Mawe" (= *C. scalarissimus* ?) - NYBAKKEN, 1970: 15, fig. 23 (radula).
- "*C. gradatus* Mawe" (= *C. incurvus*) - NYBAKKEN, 1971: 99-100; 98, fig. 6.
- synonym of "*C. gradatus* Wood" - WALLS, 1979: 527.
- *C. scalarissimus* - DA MOTTA, 1988: 47.
- *C. scalarissimus* - DA MOTTA, 1989: 6-9.

C. gradatus Reeve, 1843, being a junior homonym of *C. gradatus* Wood, 1828, was renamed *C. scalarissimus* Da Motta, 1988, *nomen novum*. Its lectotype (Reeve himself stated that he had seen several specimens when he described this taxon) is kept in BM(NH) and is the (originally designated) holotype of *C. scalarissimus* Da Motta (81 x 35 mm) (FIG. 29).

Diagnosis: "*Con. testâ elongato-turbinatâ, laeviusculâ, albidâ, rubido-fusco longitudinaliter inquinatâ; spirâ turrido-exsertâ; apice valdè elato*".

Description (which is a literal translation of the diagnosis): " Shell elongately turbinated, rather smooth, whitish, longitudinally bedaubed with reddish-brown; spire exserted in the form of a turret; apex very elevated. - Gray, MSS., British Museum." (The indication: "Gray MSS." refers to a manuscript kept in BM(NH) which was never published in the sense of the "Code", so that Reeve must be considered as the author who made the name available.)

Type locality: "*Hab.* Salango, South America (found on the sands; Cuming." (Salanga Isl. near López, Ecuador)).

Reeve added: " I have seen several specimens of this remarkable shell, each exhibiting the same peculiarly turreted spire, and the same exact style of painting. It approximates in its general outline to the *Conus generalis*, and is certainly very closely allied to it; I cannot however agree with my excellent friend the Rev. Stainforth, in considering it to be a monstrosity of that species." (Comments of plate 25). Sowerby II too (1857: 14, n° 106: "*C. scalaris* Valenc. ") tentatively expressed such an opinion when he wrote: "the whorls (*accidentally* ?) gradated."

C. scalarissimus is a large-sized species with a rather strongly concave and elevated spire of 9 visible volutions which are strongly stepped, and which have a depressed profile bordered with a rising, slightly rounded external bank. It can hardly be confused with other species of the group. *C. scalarissmus* da Motta, 1988 (nomen novum for *C. gradatus* Reeve, 1843) is here considered as a valid species which occurs in Baja California and Mexico.

11) *Conus emarginatus* Reeve, 1844: pl. 43 spec. 232 (FIGS. 30-31):

- "*C. arcuatus* - Brod. & Sow. Zool. Journ, iv 379" - GRAY, 1839: 119, pl. 36 fig. 22.
- *C. emarginatus* (valid) - SOWERBY II, 1857: 15 n° 115; pl. 16, fig. 387.
- *C. emarginatus* (valid) - DALL, 1910: 221-222.

- "*C. recurvus*" (synon.:*C. emarginatus*)" - KEEN, 1958: 486, fig. 940.
- synonym of "*C. recurvus*" (= *C. emarginatus*) - EMERSON & OLD, 1962: 17; 17 fig. 3.
- synonym of "*C. recurvus*" (= *C. emarginatus*) - HANNA, 1963: 27, 41; pl. 1, fig. 3; pl. 2, fig. 7.
- "*C. recurvus*"(= *C. emarginatus*) - NYBAKKEN, 1970: 6; 8, fig. (radula); 23, figs. 35-39.
- "*C. recurvus*" (= *C. emarginatus*) - NYBAKKEN, 1971: 101-104, figs. 14-17.
- synonym of "*C. recurvus*" (= *C. scalarissimus*) but not figured - KEEN, 1971: 665.
- "*C. recurvus*" - MARSH & RIPPINGALE, 1974: pl. 7, fig. 20; p. 141.
- synonym of "*C. recurvus*" - WALLS, 1979: 829, 831; 577: all figures.
- *C. emarginatus* (valid) - COOMANS *et al.*, 1986, 6: 112-113, fig. 720.
- *C. emarginatus* (valid) - RICHARD, 1990: 154.
- *C. emarginatus* (valid) - KOHN, 1992: 273-274, fig. 547 - *C. gradatus* Gray.

When Broderip & Sowerby described their *C. arcuatus*, this taxon was based on two specimens which did not belong to the same species. Reeve misinterpreted *C. arcuatus* Broderip & Sowerby, the description of which closely agrees with what today is accepted as *C. emarginatus* Reeve. (For more information, consult COOMANS *et al*, 1981, 4: 12-14; 1986, 9: 112-113, and KOHN, 1992: 220, 273-274.)

Diagnosis: "*C. testâ fusiformi, albidâ, castaneo-marmoratâ, striis et labio spiram versus marginato arcuatis; spirâ mediocri, carinatâ; epidermide tenui." 2" x 0.9"* (51 x 23 mm).(Cone fusiform, whitish, marbled with chestnut, with striae and lip arcuate next to the margin of the spire; medium spire, carinate; thin epidermis.) (BRODERIP & SOWERBY, 1829: 379)

The type-locality should also be taken from Broderip & Sowerby: "Pacific Ocean, near Mazatlan". The subsequent restriction by COOMANS *et al.* (1981:13) to "Cape San Lucas, Baja California, Mexico", as the authors themselves later stated (1986:112) is "not correct". KOHN (1992: 273, fig. 547) designated the figure in Gray (pl.36, fig.22) as "representation of the lectotype of *C. arcuatus* Gray" (FIG. 30). Therefore, *C. emarginatus* Reeve being a nomen novum of *C. arcuatus* Gray, and not a type-shell being available, the same figure should be considered as representative of the lectotype of *C. emarginatus* as well.

C. emarginatus is a rather common species which is easy to identify (FIGS. 31): spire of 11 volutions with an excavated and radially striated upper ramp and a rising margin bank. The apex is generally more or less deep tawnish. Shoulder angle sharp, body whorl with straight to sigmoid sides. Shell smooth and glossy showing strongly engraved sulci near the base, rather thin and light, whitish to creamy, covered with large axial zigzaging chestnut to deep brown flames. Spire stained whit arched brown dashes. Aperture white, outer lip sharp.

C. emarginatus is considered a valid species, occuring from Baja California to Colombia.

12) *Conus candidus* Kiener, 1845 (p. 214, spec. 183; pl .47 fig. 1) (FIGS. 32):

- synonym of *C. monilifer* - REEVE, 1849, Emendations:3.
- synonym of *C. pealii* Green - SOWERBY II: 1857: 50.
- synonym of C. pealii Green - TRYON, 1884: 36.
- synonym of *C. floridanus* Gabb - SOWERBY II, 1887: 255-256.
- synonym of *C. floridensis* Sowerby - TOMLIN, 1937: 225.
- synonym of *C. delessertii* Recluz - WALLS, 1979: 394, 398.
- *nomen dubium* and possible synonym (?) of *C. kerstitchi* Walls (= *C. selectus* Adams, 1855 ?) - COOMANS *et al.*, 1983, 6: 79.
- *C. candidus* Kiener (valid to be renamed) - RICHARD, 1990: 145.

Diagnosis: "*C. testâ elongato-turbinatâ, ad basim attenuatâ; albâ, punctis minimis fuscis regulariter seriatis; spirâ elevatâ, acutâ, variegatâ, apice fusco.*"(Cone, elongately turbinated, restricted towards the base; white with series of little, regularly disposed tawny points; spire elevate, acute, stained, apex tawny.)

Description (translated from French: " A slender shell, very constricted towards its lower part, where it seems likely nipped-in. The spire is very elevated, acuminate and pointed; One may count eleven to twelve narrowly coiled whorls, stepped, showing a well visible angle on their external part. The suture is finely marked; the last whorl is smooth all the way to the base wich offers five to six large transverse grooves. This shell is white with transverse series of very regularly spaced small brown spots. The spire is sprinkled with brown oblique blotches. The top is entirely brown coloured."

Kiener added: "This species, of a smart form, is remarkable by its transverse series of

small points with which it is ornated." Type locality: none.

No specimen(s) that may be considered as belonging to the original material is (are) today available in MNHN, nor in other Museums so that this must be considered lost. For this reason I herewith designate Kiener's original figure (1845, Pl.97 fig.1) as representation of the lectotype (31 x 13 mm) of *C. candidus* Kiener, 1845 (FIGS. 32).

Although *C. candidus* Kiener (not *C. candidus* Born, 1778) is unavailable, its specific validity remains questionable and is still under study. In addition no reliable argument allow to consider it as a West American species. However, the examination of the taxon *C. candidus* Kiener in the present paper appears judstified on grounds of its remarkable resemblance with what I hereunder call *C. species* n° 2 (FIGS. 44).

The possible synonymies advanced by successive workers, with a better knowledge of the synonymized earlier species, and a careful reading of Kiener's descripion and figure, may today be reconsidered: *C. monilifer* (syn. in Reeve) has a white apex and a pattern of very larger dots; *C. pealii* (syn. in Tryon) is a totally different species and such a synonymy cannot be longer retained; also neither *C. floridanus* Gabb nor *C. floridensis* Sowerby match with what is known of *C. candidus*. *C. delessertii* is much larger, with three spiral bands of orange-tawny and covered with very closer and larger chestnut blotches. The synonymy with *C. kerstitchi* Walls, 1978, suggested by Coomans *et al.*, should be examined more carefully, although the latter is more ventricose with a broader shoulder, shows a "yellowish (body whorl), variously tinted with salmon or salmon-tan; usually the salmon is strongest at base and below the shoulder...; early whorls faintly violet brown" (WALLS, 1979: 618). *C. candidus* Kiener is here tentatively considered a valid species, to be renamed.

13) *Conus angulatus* A. Adams, 1853 (118, n° 14) (FIG. 33):
- *C. angulatus* A. Ad. (valid) - SOWERBY II, 1857: 15, n° 113, Pl. 16, fig. 388.
- synonym of *C. regularis* - TOMLIN, 1937: 212.
- synonym of *C. regularis* - KEEN, 1958: 486.
- synonym of *C. regularis* - EMERSON & OLD, 1962: 20.
- synonym of *C. regularis* - HANNA, 1963: 30.
- synonym of *C. regularis* - KEEN, 1971: 665.
- synonym of "*C. gradatus* Wood" - WALLS, 1979: 527, 534.
- synonym of *C. regularis* - COOMANS *et al.*, 1980, 3: 40.
- *C. angulatus* (valid) - DA MOTTA, 1989: 9.
- synonym of *C. regularis* - RICHARD, 1990: 139.

Original diagnosis: "*C. testa turbinato-conica, laevi, nitida, solida, alba, maculis rufescentibus variegata, maculisque rufis, in fasciis transversis dispositis, ornata; spira acuta, concava, anfractibus laevibus, anfractu ultimo postice acuteangulato; labro tenui, acuto, in medio producto, postice valdeinciso. Hab.* ? Mus.Cuming."- (C. shell pyramid-conical, smooth, glossy, solid, white mixed with russet dashes, and ornated with reddish-brown transversely arranged blotches; Spire acute, concave, whorls smooth, the last one sharply angular; lip fine, sharp, arched in the middle, strongly incised towards the base. Lives ?)

The holotype of *C. angulatus* A.Adams is preserved in BM(NH), and measures 40 x 22 mm (FIG. 33). No type locality was indicated. Da Motta (1989: 9) designated Puerto Peñasco, Sonora, West Mexico as type locality. This locality belongs to the distribution area of *C. regularis*.

After examination of the damaged and basally shortened holotype, I here agree with COOMANS *et al.* (1980) in concluding that *C. angulatus* belongs to the natural variability of *C. regularis*.

C. angulatus A.Adams, 1854 is a junior homonym of *C. angulatus* Perry, 1810, a fossil. However, being conclusively considered as a synonym of *C. regularis* Sowerby, it does not need a *nomen novum*.

14) *Conus scariphus* Dall, 1910 (225-226) (FIG. 34):
- *C. scariphus* (valid) - TOMLIN, 1937: 301.
- synonym of "*C. recurvus*" (= *C. emarginatus*) - KEEN, 1958: 486.
- "*C. recurvus* forma *scariphus*" (= *emarginatus* f. *scariphus*) - EMERSON & OLD, 1962 :17, fig. 4; 19.
- synonym of "*C. recurvus*" (= *C. emarginatus*) - HANNA, 1963: 27-29, pl. 5, fig. 8 (holotype))
- synonym of "*C. recurvus*" (=*C. emarginatus*) - KEEN, 1971: 665.
- synonym of "*C. recurvus*" (= *C. emarginatus*) - WALLS, 1979: 830-831; 577, below left.
- synonym of *C. emarginatus* - RICHARD, 1990: 183.

Original description: "Shell biconic, attenuated in front, slightly swelling in front of the shoulder, which is sharply carinate; spire

low, of about eight whorls without the (lost) nucleus; the summit of the whorls between suture and carina is excavated and smooth; walls of the shell rather thin, outer lips nearly straight; ground-color yellowish white covered with a thin smooth yellowish periostracum; pattern of fluctuating longitudinal streaks of yellowish brown, which by their zigzag direction and anastomosis leave roughly triangular patches of white of small size all over the shell, except in the middle, where a tendency to the usual paler girdle is manifest; near the canal there are about sixteen paired prominent spiral threads, the intervals between the pairs being more or less channeled; sutural sinus and canal rather deep. Height of the shell 41; of shoulder 35; maximum diameter of shell 15; of canal 5 mm.

There are a few small brown spots along the shoulder keel. Though the pattern of coloration is different, the aspect of the shell recalls the Antillan *C. delessertianus*." -(= *C. delessertii* ?)- "If the white triangles were bounded by a definite dark line, this shell would approximate the pattern of the *Textile* group. As it is, it is somewhat unique in character.

Type. - Cat.N°. 123085, U.S.N.M.)" (FIG. 34)

Type locality: "Off Cocos Island, Gulf of Panama, at station 3366, in 66 fathoms, rocky bottom, one specimen with hermit crab, by the U.S. Bureau of Fisheries steamer *Albatross*."

C. scariphus is here considered belonging to the natural variability of *C. emarginatus* Reeve, as it was already stated by Hanna (who confused *C. emarginatus* with *C. recurvus*). At the most it might be considered a deep-water colour form of the latter, the zigzaging flammulated pattern being more closely interlaced, and the outline being slightly bulbous towards the shoulder, which is not observed in shallow-water specimens of the same locality.

15) *Conus magdalenensis* Bartsch & Rehder, 1939 (4, pl. 1, figs. 5 (spire), 9) (FIG. 35):
- synonym of "*C. recurvus*" (= *C. emarginatus*) - KEEN, 1958: 486.
- Synonym. or form of *C. recurvus* (= *C. emarginatus*) - EMERSON & OLD, 1962: 17-18.
- synonym of "*C. recurvus*" (= *C. emarginatus*) - HANNA, 1963: 27, pl. 9, fig. 4 (holotype).
- synonym of *C. regularis* - KEEN, 1971: 665.
- synonym of *C. regularis* - NYBAKKEN, 1971: 104.
- synonym of "*C. gradatus* Wood" - WALLS, 1979: 527, 534 (as "*magdalensis*").
- synonym of "*C. gradatus* Mawe" - RICHARD, 1990: 168.

Summary of the original description: Shell medium sized, with a rather elevated and slightly concave spire. Spire whorls ornated alternatively with dark brown and flesh colored ground color, also as the body whorl in axial "fulgurations" arrangements. Periostracum "hairy golden". Inside of the aperture bluish white. Early whorls eroded, strongly keeled in the middle with a finely nodulose margin. The keel becomes less marked on the latter whorls. Top of the whorls incised with arched striae and "some obsolete spiral striations". Rather strong low spiral cords towards the base. The holotype has 10 visible whorls. The authors add: "This cone is related to *C. regularis* Sowerby, from which it is distinguished by its higher spire and the light medium bands of the body whorl."

The holotype (FIG. 35) is preserved in USNM, n°472521, and measures 33,6 x 15.3 mm. Type locality: "It was dredged in Magdalena Bay, Lower California, in 10-15 fathoms on sandy, weedy bottom, at the entrance to the bay between Belcher Point and the anchorage."

From the description and the examination of the holotype figures, *C. magdalenensis* is here tentatively considered as belonging to the natural variability which exists between the different local populations of *C. incurvus* Sowerby, 1833.

16) *Conus gradatus thaanumi* Schwengel, 1955 (15, pl. 2, figs. 12-13) (FIGS. 36-37):
- synonym of *C. regularis,* with a question mark - KEEN, 1958: 486.
- synonym of *C. regularis* - EMERSON & OLD, 1962: 20.
- synonym of "*gradatus* Mawe" (= *C. scalarissimus*) - HANNA, 1963: 26, pl. 5, fig. 7 (holotype).
- synonym of *C. regularis,* - KEEN, 1971: 665.
- synonym of "*C. gradatus* Wood" - WALLS, 1979: 527, 534.
- synonym of "*C. gradatus* Mawe" - RICHARD, 1990: 189.

Extract from the original description:" Length 47 mm., width 21 mm. Specimens... are much more slender than *C. regularis* Sowerby, a moderate spire, neither as high as Reeve's illustration of *C. gradatus* Gray nor as flat as *C. regularis* Sowerby. They are marked with the spiral dotted lines, scarcely broken below the center for one faint band,... and with the heavy

longitudinal markings of chestnut brown of *C. gradatus* Gray". Type Locality: "Bahia Salinas, Costa Rica".

No holotype was designated in the original publication. Schwengel figured two specimens on pl.2, figs. 12 and 13, which must be considered as the syntypes (FIGS. 36). The largest one (fig. 12, 47 x 21 mm, according to Schwengel) is here designated as the lectotype of *C. gradatus thaanumi*. According to HANNA (1963: 27, 86) a "holotype" is preserved in USNM, n°617607 and measures 45.5 x 22.4 mm (FIG. 37). This specimen has a broken lip towards the base, and its measures differ, so that it is questionable if the prints in Schwengel and in Hanna represents the same shell. Whatever may be, the specimen figured in Hanna cannot be considered as the holotype ("Code", Art. 73.)

Both figures (lectotype in Schwengel and "holotype" in Hanna) show a shell with a feebly concave spire of 10 visible slightly stepped volutions. The body whorl has nearly straight sides, and is covered with sparsely spread more or less zigzaging reddish-brown flames. Structure and colour pattern strongly suggest that the shells belong to the natural variability of *C. incurvus*. Thus, provisionally, *C. gradatus thaanumi* may be considerd as a local colour form (or an "ecological race") of *C. incurvus*.

17) *Conus recurvus helenae*, Schwengel, 1955 (15, pl. 2, figs. 14-15) (FIGS. 38-39):

- synonym of "*C. gradatus* Wood" (= *C. scalarissimus*) - KEEN, 1958: 486.
- Synonym. or form of *C. regularis* - EMERSON & OLD, 1962: 20; 22, fig. 11, which is here assigned to *C. incurvus*.
- synonym of "*C. recurvus*" (= *C. emarginatus*) - HANNA, 1963: 27, pl. 5, fig. 6 (holotype) as "*C. scalaris helenae*".
- synonym of *C. regularis* - KEEN, 1971: 665, 666 fig. 1507 left (holotype).
- synonym of "*C. gradatus* Wood" - WALLS, 1979: 527, 534.
- synonym of "*C. emarginatus* ?" - RICHARD, 1990: 161.

Excerpt of the original description: "Length 44 mm., width 18 mm.... quite slender, a high spire, with slightly rounded shoulder, and no bands of white, though nearer to *C. recurvus* Broderip than any other named species. Beginning below center of body whorl are deep spiral lineations, which do not seem to be mentioned in any of the descriptions of *C. recurvus* Broderip in the various books..." Type locality: "Curu, Gulf of Nicoya, Costa Rica".

No holotype was expressely designated in the original publication, thus also here the figured shells in Schwengel must be considered as the syntypes (FIGS. 38). The largest one (fig. 14, 44 x 18 mm, according to Schwengel) is here designated as the lectotype of *C. recurvus helenae*.

A "holotype" is preserved in USNM, n°617608 or 617609 (?), according to HANNA (1963: respectively on p. 27 and p. 86), and measures 45.2 x 19.2 mm (FIG. 39). As for *C. gradatus thaanumi*, and for the same nomenclatural reasons, this specimen cannot be considered as the holotype, and it is questionable if it is the shell figured by Schwengel. The lectotype figure shows a concave spire of 9 visible, slightly stepped and nearly flat ramped volutions. Body whorl, with feebly sigmoid to nearly straight sides, is covered with reddish-brown, zigzaging axial flames. Although the type material should be reexamined, the figured shells in Schwengel provisionally are here assigned to the variability of *C. incurvus*.

18) *Conus poormani* Berry, 1968 (156-157) (FIGS. 40-41):

- *C. poormani* (valid) - NYBAKKEN, 1970: 17-18, figs. 26-27 (radula).
- *C. poormani* (valid) - NYBAKKEN, 1971: 100-101; 98, figs. 9-10.
- *C. poormani* (valid) - KEEN, 1971: 665, fig. 105.
- *C. poormani* (valid) - KAICHER, 1977, IV, card 1430.
- *C. poormani* (valid) - WALLS, 1979: 805-807; 549, all figs.
- *C. poormani* (valid) - RICHARD, 1990: 177.

Original description: "Shell of medium size, trimly conic below the sharp carina-like angle of the very high shoulder; spire low, barely yet acutely turreted by the exposed shoulder-carination, the slope distinctly concave, apex acute. Aperture narrow, of nearly constant width; labrum thin, arcuate; canal slightly produced; anal sulcus open and moderately deepened to its almost rectangular junction with the whorl above. Shell pure white inside and out, save for a variable amount of warm brown maculation, the spots mostly rather large and vertically elongate, besides often tending to a certain alignment in 2 to 3 spiral bands, the spire carrying a series of smaller spots. Periostracum soft brown, the darker shell markings showing through; cloth-like, the pile incrementally aligned and scratchy-looking under a lens, with 20 to 25 well-spaced, sparsely

fringed, spiral threads on unknown areas of the body-whorl; on the anal fasciole the increments become shaggily lamellose and more or less cut spirally, when unbroken rising on the angle to form a conspicuous fringe of fuzzy hair-like processes rather absurdly suggesting a tonsure. Alt. of holotype: 45.0, max.diam. at shoulder 21.9 mm; whorls ca. 10.8.

Type-locality: "Trawled in 24-26 fms., off Morro Colorado, Sonora Mexico."

According to NYBAKKEN's statement (1971: 100) it seems that the holotype ("type-specimen") is preserved in the Los Angeles County Museum. *C. poormani* is close to *C. emarginatus* by its general shape and colour pattern, but differs by its smooth body whorl showing a series of obsolete prominent small and separate ridges, whithout the deep engraved sulci near the base in *C. emarginatus*. The spire has 11 teleoconch whorls showing rather strong spiral grooves, which are absent in *C. emarginatus*. The species is also identifiable by its rather thick and brown periostracum with a hairy fringe around the shoulder.

As NYBAKKEN (1971: 101) noted: "It does seem strange, however, that so distinctive and relatively large a species as this one should have remained undescribed until 1968". *C. poormani* is here considerd as a valid species.

19) *Conus scalarissimus* Da Motta, 1988: 47.
Nomen novum for *C. gradatus* Reeve, 1843 (see this taxon, n° 11).

20) - *Conus species* n° 1 (FIGS. 4-6, 42-43):
- "*C. scalaris* Valenciennes" - KEEN, 1958: 486-487, fig. 942.
- "*C. scalaris* Valenciennes" - HANNA, 1963: pl. 4, figs. 1 & 2 (FIGS. 4); pl. 7, fig. 3.
- "*C. scalaris* Valenciennes" - NYBAKKEN, 1970: 15-16, fig. 24 (radula).
- "*C. scalaris* Valenciennes" - KEEN, 1971: 667; 666, fig. 1508.
- "*C. scalaris* Valenciennes" - MARSH & RIPPINGALE, 1974: pl. 23 fig. 20 (Fig. 5).
- "*C. scalaris* Valenciennes" - KAICHER, 1977, II, card 1119 (Figs. 6).
- "*C. scalaris* Valenciennes" - WALLS, 1979: 340 below, 344: all.

The true identity of *C. scalaris* having been misinterpreted by all the preceeding authors, *C. species* n° 1 was mostly confused with them in literature. This species is still under study and will be described and published later.

21) *Conus species* n° 2 (FIGS. 44):

As far as I know, this species has never been figured in literature, and is poorly known. It is today only recorded from Baja California, and is still under study.

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Abbreviations:
AMNH: American Museum of Natural History, New York, U.S.A.
BM(NH): The Natural History Museum, London, England
MNHN: Museum National d'Histoire Naturelle, Paris, France.
USNM: United States National Museum (Natural History) Washington D.C. , U.S.A.

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