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Middle Miocene *Conus* (Class Gastropoda) from Piedmont, northern Italy

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ABSTRACT — Of the 44 species and 216 varieties of Conus *recognized by Sacco from Burdigalian and lower Helvetian rocks of the Piedmont region in northern Italy, there are 33 valid species. These include at least 15 sympatric species from a single locality, and 11 that are now known only from Italy.*

To judge from the present-day bathymetric distribution of Conus, *almost all of the fossil species probably lived in water less than 20 meters deep. Considering the present-day geographic distribution of cones, and the other molluscs associated wiht them, it tentatively suggested that the sea-surface temperature of the water in which the Miocene cones lived was at least 20°C for six months of the year.*

Many factors played a role in the speciation of the Miocene Conus *of Italy and those suggested here are doubtless only a few. Detailed studies of the ecology of present-day* Conus *by Kohn and others suggest that the Middle Miocene species of* Conus *from Piedmont most probably lived in different microhabitats, as do many living* Conus. *Their present-day food requirements suggest that food specialization may have been a dominant isolating mechanism, depending on the microgeographic distribution or the microhabitat of the prey. There may have been microadaptations, in terms of food bias and other ecologic factors, among species within microhabitats of the same region that resulted in segregation. The possibility that local populations acquired isolating mechanisms such as food preferences, breeding differences, etc. while in the same region is strengthened by the 11 species that are known only from Italy. However, geographic speciation may have been the dominant mode of differentiation for most of the species. New areas of habitation were opened to* Conus *during the Burdigalian. Populations could have become isolated in new regions due to, for example, the distance from the parent species. Following isolation and after the establishment of sympatry selective pressures could have strengthened the population differences.*

Many of the Piedmont Conus *may have occupied microhabitats on a littoral and shallow neritic shelf crowded with life. Perhaps there were times of abrupt discharge of coarse clastic material from the mouths of streams, or there was submarine sliding, and the* Conus *and nearshore organisms were swept into a deeper sedimentary environment.*

RIASSUNTO — Sulla fine del secolo scorso Sacco distinse 44 specie del genere Conus *fra i Gasteropodi presenti nei complessi burdigaliano-elveziani della Collina di Torino. Dodici di queste specie erano considerate nuove. Inoltre, Sacco istituiva 216 nuove « varietà » dello stesso genere.*

Un tale cospicuo numero di specie non poteva non invitare ad un esame più approfondito ded problema, per varie ragioni. Anzitutto, se è vero che, di 400 ± 200 *specie valide di* Conus *oggi viventi, 30 sono nel golfo di California, 33 nelle Hawaii, 196 nei mari del Giappone, 168 nelle Filippine, è pur vero che fra le forme viventi è soprattutto la diversa colorazione del guscio che costituisce il più valido criterio sistematico; criterio non adottabile nel caso di fossili. Quanto alle specie fossili, la loro condensazione è ovunque minore che nei colli di Torino: 12 specie dal Terziario della California (che pure doveva essere più basso di latitudine e più caldo del bacino di Torino), 16 dal Terziario di Giava, 7 dal Terziario del Giappone. Se poi si considera che la letteratura riporta circa 600 specie fossili solo per l'Italia, sopra un totale di 1700 specie note di* Conus *vivi e fossili, viene da supporre che qui le condizioni d'ambiente*

clastici grossolani dalla foce di un fiume o per opera di una frana sottomarina avrebbe spostato i Conus *e altri organismi littorali verso aree di sedimentazione più profonde ove, forse, vivevano anche altre specie di* Conus.

Si ritiene che lo studio limitato ai Conus, *quale il presente, non possa da solo risolvere il problema. Analisi tecniche speciali per chiarire i luoghi di vita e di morte delle associazioni e soprattutto un accurato studio ecologico comparato, insieme alle analisi sedimentologiche, potranno permettere un vaglio più concreto delle supposizioni enunciate.*

Nutrimento e substrato. Non tutti i Conus *(Kohn, 1959) amano lo stesso cibo: alcuni mangiano policheti, altri mangiano enteropneusti o gasteropodi o pesci. Kohn ha scoperto a) che nelle Hawaii sono differenti i Coni che vivono nelle scogliere sotto la linea intercotidale da quelli che abitano all'orlo di piattaforme marine, b) che la maggioranza delle popolazioni ha ben precise preferenze di substrato, c) che una buona parte di ogni popolazione può essere parzialmente infossata o esposta all'aria nella bassa marea.*

Si deduce che i Coni miocenici dovevano avere anche diverse preferenze di cibo e che occupavano nidi ecologici analoghi a quelli in cui vivono oggi. Si suppone che la maggior parte vivessero sopra o entro sabbie grossolane e conglomerati, benchè alcune delle forme incluse come « Conospirus » *e* « Chelyconus » *possano aver vissuto su sedimenti fini, più profondi.*

Temperatura a livello del mare nel Miocene medio. E' supposta — in accordo anche con Chevalier — una temperatura di tipo tropicale. Il clima doveva essere intertropicale, con almeno 6 mesi a temperatura > *20° C, almeno 4 mesi a 20° C e nessun mese più freddo di 18° C. Ciò è in accordo con gli habitat attuali dei* Conus, *in particolare nelle coste del Giappone (Kuroda) e dell'Africa meridionale (Barnard). Nel Mediterraneo le note condizioni di temperatura vietano la vita ai* Conus, *di cui sopravvive solo una specie, raccordabile al miocenico* C. bitorosus. *Dunque nel Miocene la temperatura doveva essere molto più alta che oggi.*

A questo proposito vengono esposte alcune idee relative al problema, se la vicinanza delle Alpi — ammesso che fossero alte come o più di oggi — possa aver influito abbassando o meno la temperatura del mare piemontese. Varie ragioni fanno supporre che in quell'epoca le Alpi fossero soggette a rapida erosione e prive di ghiacciai.

Speciazione. Di 33 specie torinesi di Conus *burdigaliani-elveziani, 27 esplosero nel primo Burdigaliano. Ci si chiede che cosa può aver prodotto in così breve spazio e tempo una speciazione tanto ricca da dare 22 specie di uno stesso genere in una località sola.*

Studi sulla speciazione di popolazioni viventi di altri organismi mostrano che la differenziazione non esige un alto grado di isolamento (es. 101 specie di Haplochromis *nel lago Nyasa in Sudafrica). Comunque si suppone che le cause di evoluzione possano esser state soprattutto isolamento e « adaptive radiation ». Le condizioni paleogeografiche del mare mediomiocenico europeo dovettero favorire largamente la speciazione in questo lembo di Mediterraneo, anche se al momento non si conoscono bene nè il tracciato nè le eteropie delle linee di riva piemontesi nel Burdigaliano. La speciazione di coni attuali mostra che microhabitat e natura del cibo sono ottime cause, non meno che macroisolamento. Il problema di una speciazione nella stessa area geografica è difficile che trovi soluzione in paleontologia e in particolare in un genere polispecifico. Ma poichè Wieser, Kohn e Huth sostengono speciazioni simpatriche non meno che geografiche, si può dire che* i Conus *piemontesi confortano tali asserzioni. Si conclude con un confronto ecologico fra i coni mediomiocenici della California e quelli coevi (e ben più ricchi di specie) del Piemonte. (E. M. G.).*

INTRODUCTION

In the type area of the Miocene, near Superga, approximately 10 km east of Turin, Italy, 44 species of the gastropod genus *Conus* were reported by Sacco (1893, 1904). He described 12 of these species as new and named an additional 216 varieties [or subspecies]. The occurrence of 44 species of a single gastropod genus from one area and from a few hundred feet of strata straddling the boundary between the Burdigalian and Helvetian is perhaps not remarkable if one considers that out of 500 to 600 (Keen, 1958) living species or 400 ± 200 valid species (A. J. Kohn, written communication, 1965) of *Conus,* approximately 30 are reported from the Gulf of California and Panamic provinces, 30 from the western Atlantic (Clench, 1942), 33 from Hawaii (Kohn, 1959b, 1962), 96 from Japan (Kuroda and Habe, 1952), and 168 from the Philippines

(Faustino, 1928). However, the number of species and varieties reported by Sacco becomes unusual when it is realized that living species are in part distinguished by color, whereas fossil specimens most commonly lack color. Further, there are among living *Conus* morphologically intergrading species such as *Conus regularis, C. gradatus, C. scalaris,* and *C. recurvus* (Hanna, 1963, p. 30) that a paleontologist might consider as only one or perhaps two species.

The number of fossil species of *Conus* from Turin differs significantly from that recorded in other areas. Keen (1944, p. 147-148), for example, lists only 12 fossil species from the entire Tertiary of California, these specimens coming from lower and presumably warmer latitudes than the Italian Miocene; Hatai and Nisiyama (1952, p. 192-193) list only seven species of *Conus* from the Tertiary of Japan, at approximately the same latitude as the Italian Late Tertiary; and Martin (1879, p. 9-15) gives a list of 16 species from the Tertiary rocks of Java. Since 600 (Sacco, 1893, 1904) of the approximately 2700 [about 1700, *fide* A. J. Kohn (written communication)] species, subspecies, and varieties listed by Tomlin (1937, p. 205-330) are from the type Miocene and Pliocene of Italy, it is evident that the fossil cones of Italy provide a basis for investigation of speciation. If Sacco's taxonomic data are valid the northern Italian region during the Middle and Late Tertiary may have been a unique area in which speciation was proceeding at an exceptionally rapid rate. To provide an answer, it is apparent that a detailed taxonomic review is called for. There was a need for a study of the intraspecific and interspecific variation of fossil *Conus* populations from localities and horizons that are close to one another, and also widely separated geographically and stratigraphically. This study has resulted in a revision of the systematics of 33 species of the gastropod genus *Conus* from the Burdigalian and Helvetian rocks of Piedmont, and of several of the fossil cones from younger strata.

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MATERIAL STUDIED

Most of the 1000-odd fossil specimens of *Conus* studied from the Middle Miocene rocks of Piedmont in the northern Italian region were collected 5 to 25 km east of Turin (Fig. 1). These specimens were collected by Sacco, Sturani and the author and form the

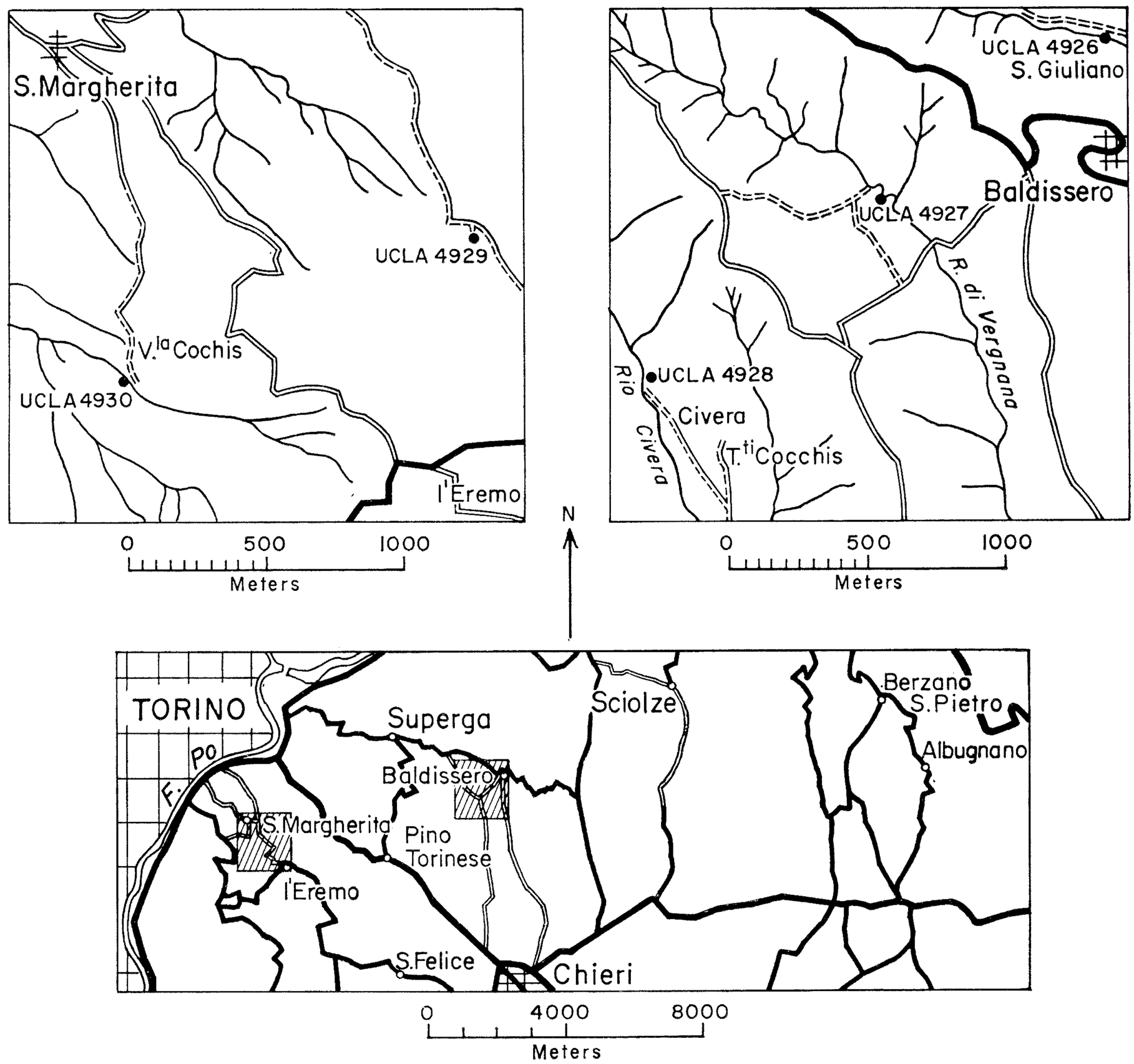


Fig. 1 - Fossil locality and index maps. University of California, Los Angeles, fossil localities are shown. as well as the general localities collected by Sacco.

principal basis for this investigation. Intraspecific and interspecific variations were studied within fossil cone populations from several localities where Burdigalian and Helvetian rocks crop out in the Piedmont region, and which are well-located stratigraphically.

An attempt was made to apply statistical methods to species discrimination after all of the collections were studied. Several hundred specimens were measured and over ten thousand calculations made. However, the parameters of length, width, body-whorl length used in the statistical tests did not prove to be significant as an aid to specific determination.

Locality descriptions and lists of *Conus* found by Sacco, Sturani, and the author for localities in the Turin area are given in the Appendix. Unfortunately, the exact localities of the fossil cones described or figured by Sacco from the hills of Turin are often

unknown, and of the approximately 260 taxa listed by him from the Middle Miocene rocks only about 75 have moderately precise locations.

The existing types in the collections of Lamarck; Brocchi; Eichwald; Grateloup; Sacco, including the few remaining types of the collections of Borson, Bellardi, and Michelotti, now in the collections of Turin; Mayer-Eymar, Friedberg, and Peyrot were also studied. In many cases the types in these collections were found to be missing, and these are noted in the systematic section.

MORPHOLOGY AND SUBGENERA

Since it was first named by Linnaeus (1758, p. 212) the gastropod genus *Conus* has been intensively studied and collected chiefly because of the beauty of its shell. Owing to this interest, a large number of living taxa have been named, often almost exclusively on color pattern. Regardless of the merits as the use of color and color pattern for classification, fossil specimens rarely show color markings. Hence, it is necessary to rely on other shell characteristics for the differentiation of fossil species. Some of the more important morphologic features used to distinguish species of Conus, listed without regard to relative importance, are: (1) size, (2) body whorl, whether smooth, with spiral ridges, pustulose, or striate, and its shape, (3) thickness of shell, (4) nature of shoulder whether angular with a sharp edge, with a ridge at the periphery, smooth, rounded, sloping, or with blunt nodes, and (5) spire, whether straight, concave, convex, low, markedly obtuse, high, depressed, striate, channelled, scalariform, deeply sutured, or with beaded youthful or adult whorls.

There is a marked difference of opinion among conchologists as to the status of subgenera in *Conus*. For example, Keen (1958, p. 489) figures *Conus* (*Lithoconus*) *regularis* Sowerby, Emerson (1962, p. 20) figures the same species as *Conus* (*Leptoconus*), and Hanna (1963, p. 29) simply cites *Conus regularis* Sowerby. Hanna and Strong (1949, p. 251) and Hanna (1963, p. 5-6) discuss the problem of recognition of subgeneric names of *Conus*. They point to the fact that subdividers, such as Montfort (1810), Swainson (1840), Morch (1852), Cotton (1945), [and Robertson (1954)] differ markedly in their classification. Hanna and Strong cite the work of Bergh (1895) who studied the anatomy of *Conus* without finding characteristic anatomical features useful in recognizing subgenera, and they conclude that subgeneric designations are not warranted. Since subgenera described for living cones and assigned to fossil species do not always agree with the supposed distinguishing characters of the subgenera, and since the fossil species might be included under one of several subgenera, no attempt is made here to assign subgeneric names to fossil cones.

Clearly, there seem to be different broad groupings of shells, that may be differentiated largely on the basis of the shape of their crowns. It is unfortunate that the present nomenclature and gradation among these groups or subgenera are such as to make assignments difficult. Further studies should be made on other taxonomic groupings, such as subgenera, because of their importance to the interpretation of evolving lineages. Perhaps if appropriate parameters are chose statistical analyses may prove rewarding.

STRATIGRAPHY

The rocks from which the *Conus* were collected by me, Sturani, and Sacco are near Superga, at and near the type localities of the Termofourà and Baldissero formations (see Cita and Elter, 1960).

The Termofourà Formation overlies about 50 meters of the Lower Pteropod Marls, the latter consisting of siltstone, siliceous siltstone, and limestone. The Termofourà Formation is composed of silty mudstone, marl, fine- to coarse-grained dirty greenish-gray sandstone, with some serpentine

clasts and conglomerate (mainly serpentine clasts). These lithologies are associated with lateral and vertical facies changes throughout the unit (*fide* Sturani). The finer grained sediments of this formation are locally channelled, and the channels are filled with coarse-grained sandstone and conglomerate. Within the conglomerate are large silty lumps. Sturani (written communication, 1965) has noted other sedimentary features, such as « graded-bedding, groove casts, and current crescent casts », in the coarse-grained sedimentary rocks which suggest to him « re-sedimentation ». Sturani has also found that neritic fossils are confined to the coarse-grained sediments that show evidence for turbid flow and that planktonic and bathyal fossil are confined to mudstone and marl.

Stratigraphically above the Termofourà is the Upper Pteropod Marls, a unit similar in lithology to the Lower Pteropod Marls.

The Baldissero Formation, above the Upper Pteropod Marls, is commonly 200 to 300 meters of fine-grained sandstone. Locally at the base of the Baldissero Formation is the Villa Cochis Conglomerate. Near the base of the Baldissero is 50 meters of clayey siltstone and fine-grained sandstone. This part of the formation contains abundant *Aturia,* pelagic swimming opisthobranch gastropods, called pteropods, and pelagic foraminifers. Above the basal 50 meters of siltstone and sandstone is 100 to 200 meters of sandstone that grades laterally into coarse-grained deltaic conglomerate (*fide* Sturani). The sandstone contains the fossil « *Pentacrinus gastaldii* » (auctt.). The upper 50 to 100 meters of the Baldissero Formation are clayey siltstone that grades into the Tortonian clays and marls. The upper part of the formation contains abundant foraminifers of the *Globorotalia mayeri* Zone (*fide* Sturani).

The ages of the above formations are as follows: (1) Lower Pteropod Marls (= Sacco's « Langhiano »), probably upper Aquitanian [*Miogypsina gunteri* Zone]. (2) Termofourà Formation (= lower third of Sacco's « Elveziano ») uppermost Aquitanian [possibly *Miogypsina gunteri* Zone] to uppermost Burdigalian (including the *Miogypsina socini, M. burdigalensis, M. negrii, M. globulina,* and *M. globulina-intermedia* Zones) (*fide* Drooger, 1954; Sturani). (3) Upper Pteropod Marls (= middle part of Sacco's « Elveziano »), uppermost Burdigalian or possibly an unnamed interval between the type Burdigalian and the type Helvetian. (4) Villa Cochis Conglomerate (named by C. Sturani), same age as the Upper Pteropod Marls. This unit contains *Miogypsina globulina-intermedia* that may have been derived from the older rocks. 5) Baldissero Formation (= upper part of Sacco's « Elveziano »), of Helvetian age, and lacking *Miogypsina.*

The Burdigalian and Helvetian rocks are here referred to as Middle Miocene for convenience and brevity. It is recognized that the Burdigalian is either Oligocene (Vella, 1965, p. 349-355) or Lower Miocene (see the review by Sorgenfrei, 1958, v. 1, p. 9-19). The Helvetian, although considered by most authors as Middle Miocene, may be older.

NUMBER OF SPECIES

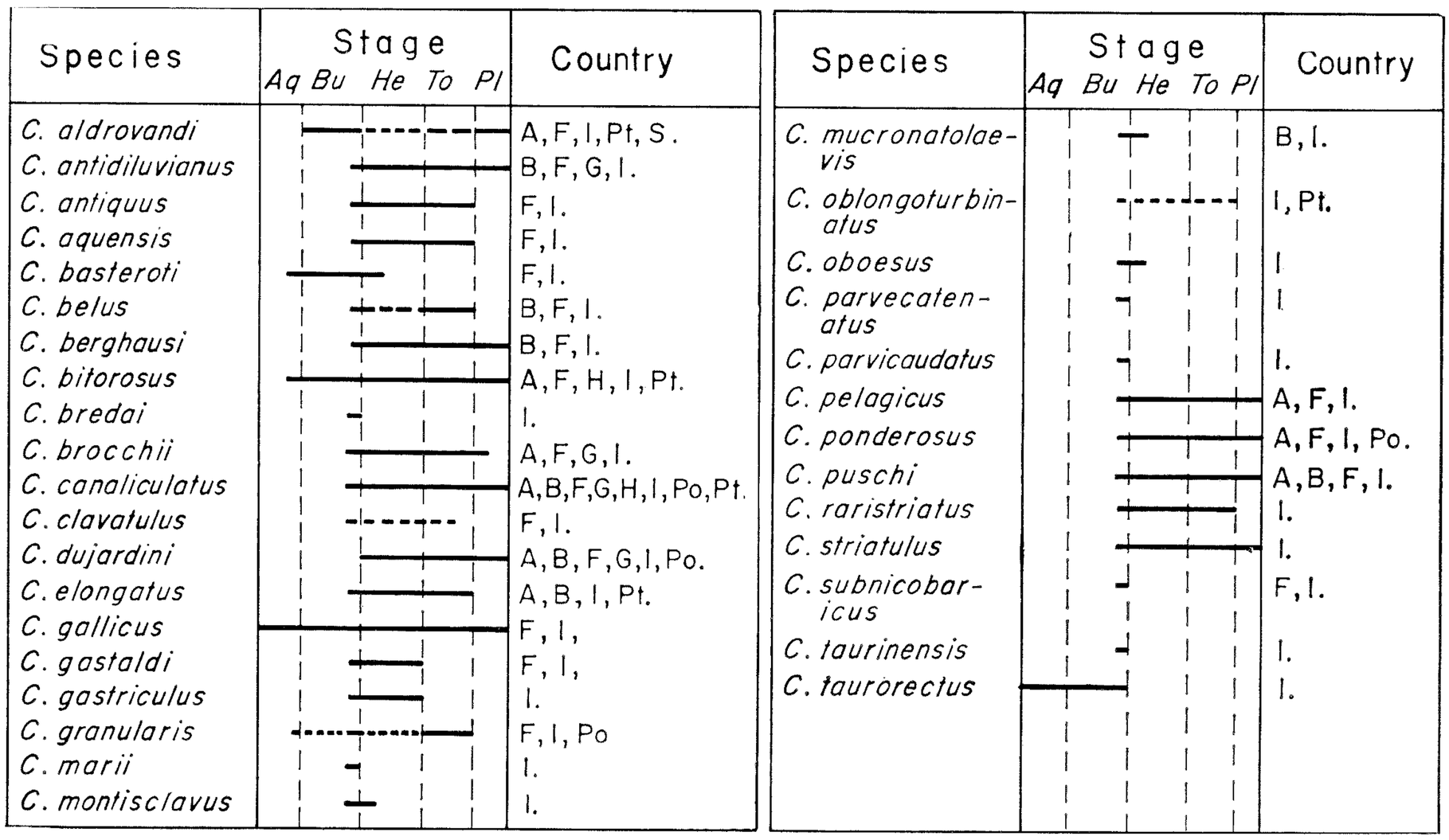
From my study of the Miocene *Conus* collected near Turin, Piedmont it is concluded that of the 44 species and 216 varieties listed by Sacco (1893, 1904) from this region there are actually 33 valid species of Burdigalian and early Helvetian age. They have been distinguished on morphologic characters such as length of body whorl, shape of the spire, nature of the shoulder, and other features noted above.

Of the 33 species now recognized, 22 have been found at the Baldissero [or Val Sanfrà] locality (upper Burdigalian), 11 at Sciolze (upper Burdigalian), 10 at the Termofourà locality (Burdigalian), 8 at Villa Cochis (uppermost Burdigalian?), 7 at Valle di Vergnana (upper Burdigalian), 2 at Valle Ceppi (upper Burdigalian), 2 at Albugnano (? Burdigalian), 5 at Monte dei Cappuccini (Helvetian), and 5 of those studied are known only from the general locality of the « hills of Turin » (see locality map, Fig. 1). Eleven

of the species are known only from Italy, and 6 of them are restricted to rocks of Burdigalian Age.

The *Conus* populations were dense, occasionally 6 per square foot of fossil bed, to judge from the number of specimens found at a single locality such as Baldissero. There were many species of other genera living with *Conus,* constituting the rich assemblage at Baldissero and other localities. For example, Bellini (1905) lists 14 species of « *Pleurotoma* », 18 species of « *Drillia* », 30 species of « *Nassa* », etc., from the Baldissero locality and (p. 637) as many as 54 species of *Mitra* from the Valle Ceppi locality. Clearly the large number of species of *Conus* near Turin is not unique for the fauna. A. J. Kohn (written communication, 1965) notes that in modern coral reefs, where assemblages of many sympatric species of *Conus* occur, the presence of a large number of other Toxoglossa such as « *Pleurotoma* » (Turridae) and « *Drillia* » (Turridae) is unusual. Such an unusual occurrence might be explained by re-working of the sediments or by submarine slumping. Sedimentation or re-sedimentation of this type would have brought forms living in different, but closely associated or nearby environments together. The sedimentary features or structures would strongly support such a conclusion. Kohn further notes that large assemblages of *Mitra* (Toxoglossa, Mitridae) commonly occur with *Conus* assemblages. Kohn states in his written communication to me that « the remarkable species diversity in prosobranch gastropods (and some other groups) on modern coral reefs is due in large measure to the great adaptive radiation of certain genera, rather than many genera each with a few species ».

There seems to have been an increase in numbers of species of *Conus* near the end of the Burdigalian since 27 of the 33 species do not have a stratigraphic range that extends



Text-Table 1 - Generalized stratigraphic and geographic distribution of species of *Conus* from the hills near Turin, Italy. *Aq,* Aquitanian; *Bu,* Burdigalian; *He,* Helvetian; *To,* Tortonian; *Pl,* Plaisancian. A, Austria; B, Bulgaria; F, France; G, Germany; H, Hungary; I, Italy; Po, Poland; Pt, Portugal; S, Switzerland.

into the Aquitanian. Although quantitative estimates are difficult to determine, it would seem as though the increase in numbers of species during the Burdigalian in Piedmont was accompanied by an increase in the numbers of individuals and an increase in the variability of the shell morphology. However, such a hypothesis is highly conjectural, many factors might account for the differences in numbers of species in the Aquitanian and Burdigalian rocks.

Since the specimens studied in Piedmont are largely from the same general area, and often from nearly the same horizon, those specimens that differ slightly from one another and from the type are considered individual variants and not subspecies. The only exceptions are the tentatively recognized subspecies, *C. antiquus wheatleyi* (Michelotti), with its unchannelled flat-topped to slightly convex spiral whorls, and *C. antiquus percanaliculatus* (Sacco) with its more robust and straight-sided body whorl. In this case the end members of varying clines are dissimilar to such a degree as to suggest individual species. Yet the lineages are similar in so many aspects that they cannot always be differentiated, suggesting that they are only variants. Since these similar but different taxa can be recognized in other regions, and they are almost completely intergrading in Italy, it is suggested that they are subspecies. It is possible that in Piedmont the populations of *C. antiquus* were wholly intergrading, while elsewhere the clinal gradients are so distrupted that the end members are essentially distinct variants. Before a final conclusion can be reached as to the validity of these subpecies comparative studies must be made using populations from France, Austria, Hungary, etc.

ECOLOGY

Depth. — The bathymetric distribution of Recent species of *Conus* given by Clench (1942, 1953), Keen (1958), Kohn (1959a), Kohn and Weaver (1962), Wolfson (1962, Kira (1962), and Hanna (1963) shows that most are restricted to the littoral or very shallow neritic zones. Habe (1961) and Kira (1962), for example, list 77 species of *Conus* from Japan, of which 19 (25%) live in water less than 5 fathoms deep and 35 (45%) live in water less than 10 fathoms deep; thus, 70% of these species live in water less than 10 fathoms. Six of the Japanese species occur in water deeper than 25 fathoms, 7 species in water over 30 fathoms deep, and 5 in water greater than 40 fathoms deep. It is possible that most of the Piedmont *Conus* of Burdigalian-Helvetian age lived in water from near the low-tide line to 30 feet (10 meters) and probably no more than 60 feet (20 meters) deep. The shallow, near-shore depth suggested here is in contrast to that given by Chevalier (1961, p. 91) of about 100 meters, as based on corals collected from Baldissero (Val Sanfrà). Chevalier based his statement on the fact that corals occur at Val Sanfrà as single colonies, like the corals living at depths of 100 meters off the southern China coast, and not as coral reefs. He did not consider that at Val Sanfrà the whole fauna most probably had undergone transport. Transport could account for the absence of coral reefs and the presence only of single individuals or fragments of colonies. An alternative hypothesis, to explain the lack of well-developed reefs in the Middle Miocene Piemontese Sea, may have been excessive turbidity of the water.

Several species of the decapod *Callianassa* described by Crema (1895) and included in a list of 22 crustaceans given by Bellini (1905) may suggest a near-shore environment. Weimer and Hoyt (1964, p. 766) conclude from their study of *Callianassa* that the living and fossil species studied by them suggest a wave-agitated or shallow neritic environment. Others also have studied *Callianassa* collected from a near-shore environment; however, Schmitt (1921) lists five species of *Callianassa,* some of which have

been taken from 21 to 271 fathoms. Thus, it is not possible to say definitely that the Turin species of *Callianassa* are near-shore or deep-water indicators. However, other crustacean genera such as the crabs « *Xantho* » (Bellini, 1905, p. 640) and « *Gonoplax* » (Crema, 1895) reported with *Conus* from the hills of Turin are known to live along rocky shores or just below low-tide line (Leach, 1815), which strengthens the argument for a near-shore environment for many of the *Conus* of Piedmont.

A displaced fauna. — Since sedimentary structures indicate turbidity flow, transport, and submarine slumping, then it is possible that many of the *Conus* collected from the hills of Turin are part of a displaced fauna. Quite probably both the corals and *Conus* represent a displaced fauna — that is, a near-shore fauna that has been displaced to another part of the sedimentary basin.

The fossils from the localities near Turin and within what Bellini (1905, p. 622) calls Facies B — the zone of littoral gastropods and corals — show no clear evidence of rigorous transport. They are not worn and although there are numerous fragments of pelecypod and gastropod shell, there also are many fragile shells or highly ornamented molluscs that are intact and well preserved. Yet, there has been some local mixing because attached and nonattached faunal elements are mixed.

The assemblages of fossils from the Piedmont containing the *Conus* described in this paper suggest a littoral or shallow-neritic environment. This conclusion is based on the present-day distribution of *Conus* and other molluscs and arthropods. The following factors suggest some slight amount of faunal mixing, but only between closely associated forms from the same general environment: a) the occurrence together of gastropods, not normally associated in living communities, b) the mixture of nonattached and attached faunal elements, c) the presence of fragile-shelled near-shore molluscs with other shallow-water marine taxa, d) the absence of deep-water taxa associated with the shallow-water forms, and e) the presence of coral fragments. On the other hand, a) the occurrence of the abrupt changes in lithology, b) the intercalation of coarse-grained sediments, and their contained near-shore fauna, with siltstone and marl, and their contained deeper water fauna, c) the blocks of fine-grained sedimentary rocks locally incorporated within the coarse-grained rocks, d) the slump structures, and e) the other sedimentary structures that suggest turbidity currents and submarine slumping all imply that the shallow-water, near-shore coarse-grained sediments and fauna have been displaced down submarine canyons or from the edge of a shallow-water platform.

Perhaps most of the Piedmont *Conus* probably occupied microhabitats on a narrow littoral and shallow neritic platform crowded with life. At times of abrupt discharge of coarse clastic material from the mouths of streams or by submarine landsliding *Conus* and other near-shore organisms were swept in part and in mass into a deeper sedimentary environment, where perhaps some other species of *Conus* were living and where fine-grained sediments were being deposited. Clearly, a study of the entire fauna and not just of *Conus* is required to furnish more definitive evidence as to the probable depths at which all the different faunal elements lived. An attempt must be made to use the important principles and techinques developed by Boucot (1953), Boucot, Brance and De Mar (1958), and Craig and Hallam (1963) for the analysis of life and death assemblages, and those discussed by Johnson (1960) regarding the formation of fossil assemblages. Such studies, coupled with those now in progress by Sturani & Parea in the sedimentary structures and rocks of the Piedmont region should provide a more definitive solution.

Feeding and substratum. — Kohn (1959a) has shown in his study of the Hawaiian cones that some are particularly fond of polychaet worms as a food source, while others

prefer enteropneusts, gastropods, or fish. He discovered: 1) that species inhabiting marine benches are sometimes different from those that inhabit subtidal reefs; 2) that the majority of the populations has a definite substrate preference; and 3) that a large segment of any one population may either be partly buried in the substrate or exposed to air at low tide. It is inferred that the Miocene *Conus* also had different food habits and that they occupied ecologic niches analogous to those in which *Conus* occur today. It is supposed that most of the Piedmont *Conus* lived on or in coarse-grained sand and conglomerate, although some of the forms included under « *Conospirus* » and « *Chelyconus* » may have lived on fine-grained deeper water sediments.

Middle Miocene sea-surface temperature. — To judge from preliminary comparative studies of the distribution of living *Conus* (Kuroda and Habe, 1952; Keen, 1958; Warmke and Abbott, 1961; Hanna, 1963) and other molluscs with the Middle Miocene Piedmont fauna the marine paleoclimate was probably tropical. Chevalier (1961) reached a similar conclusion after his study of coral faunas. The climate may even have been inner tropical (Hall, 1964, p. 232), *i.e.* with no months cooler than 18°C and six months or more when the water was at least 20°C. At the coolest, the marine paleoclimate was outer tropical, with a water temperature of 20°C for at least four months. This interpretation is in part based on the distribution of living species of *Conus*. For example, of the 96 species of *Conus* listed by Kuroda (1952) 70 live in water that has a sea-surface temperature of at least 20°C far six or more months of the year; 22 live in a region where the sea-surface temperature is 20° C for at least four months a year; and there is only 1 species that lives along the Pacific coast of Japan in water that is 20°C for less than four months a year. The distribution data for the other three species of *Conus* given by Kuroda are incomplete. Barnard (1958) reports 29 species of *Conus* along the coast of South Africa. The sea-surface temperatures along the southeast coast of South Africa and Mozambique, 36°S to 26°S Latitude, are warmer than 18°C for 12 months of the year and they are 20°C or warmer for 8 months of the year (Director, Chief of Naval Operations, 1957). These temperatures are for the coolest part of the coast (*i.e,* 36°S Lat.). The sea-surface temperatures at the lower latitude, nearer the equator, are warmer than 20°C for 12 months of the year.

In the present-day Mediterranean Sea region, where there is only one species of *Conus* living [*Conus ventricosus* Gmelin (= *C. mediterraneus* Hwass) (see remarks under *C. bitorosus*)], the sea-surface temperature in the Adriatic Sea is 10°C or cooler for 4 months, 18°C or warmer for 6 months, and 20°C or warmer for 4 months. In the Ligurian and Tyrrhenian Seas the sea-surface temperatures are slightly warmer (12-13°C) during the 5 months of November to April. If temperature is an important factor in controlling the presence of *Conus,* then the Piemontese Sea during the Burdigalian-Helvetian must have been much warmer than the present-day Mediterranean, since there are more than a score of fossil *Conus* from Piedmont.

If the Alps were as high or higher than they are today during the Burdigalian and Helvetian, cold water from melting glaciers probably had no effect on the temperature af the Piemontese Sea. If there had been glacial melt-water it would have been warmed by the time it emptied into the sea after passing through the tropical regions below the high Alps. Consideration should be given to the possibility that the Alps in the Miocene were not as high as they are today. It would seem possible that moist air moving from the northwest, from the Atlantic Ocean or across the warm Zürich-Vienna seaway, and from the southeast, across the tropical Mediterranean and Piemontese Seas, could have provided ample rain to rapidly erode the Alps. If isostatic adjustment kept place with erosion the Alps could have remained

low, supplied vast quantities of sediments to the deepening basins bounding the Alps, and remained free of glaciers.

SPECIATION

There were 33 species of *Conus* living in the Burdigalian-Helvetian sea of Piedmont, 27 of which are not known from rocks older than the Burdigalian. Thus, during the late Aquitanian and early Burdigalian many new species evolved. This diversification raises the problem as to the possible conditions under which these species lived and what types of ecologic niches were available to as many as 22 species of a single genus from a single locality. A difficult problem is faced when formulating mechanisms by which as many as 22 species of a single genus can co-occur in similar ecologic niches or by which 33 species of a single genus, that are in some cases morphologically somewhat similar, can live in a region of similar ecology and not be identical. Studies of speciation among living populations, made by others, make it possible to suggest some mechanisms that are possibly coupled with the speciation of the Miocene *Conus*.

The remarkable speciation among the fresh water fish *Haplochromis* from Africa affords an example of speciation in which differentiation must have occurred without a large degree of isolation. Trewavas (1935) reports 101 species of this genus from Lake Nyasa, southeast Africa, while other examples of speciation within genera of fresh water fish are cited by Worthington (1937, 1940). Greenwood (1958) suggests that this multiple speciation is due to the isolation of populations during periods of drought and the subsequent joining of ponds bringing together populations that later would not mate. Fryer (1959), on the other hand, attributes the speciation to: (1) the size of the lake, enabling evolution of the species by effectively isolating some populations; (2) predators facilitating speciation; (3) adaptive radiation among some groups in terms of their feeding habits; and (4) adaptive radiation with respect to brooding, egg production, and egg size. Two of the factors considered by Greenwood and Fryer that might be applicable to the speciation of Burdigalian-Helvetian cones are isolation and adaptive radiation.

As for isolation, referring here to macro-isolation, Termier (1960, maps, 33, 24) and Chevalier (1961, p. 521, 522) show that during the Middle and Late Miocene the Piedmont Sea was a narrow gulf. They also show that the ancient Mediterranean Sea was more divided and compartmented, and that there was the addition of new narrow passages and a seaway from France to Poland during the Burdigalian and Vindobonian.

Thus there was the possibility of a larger degree of isolation between the populations in France, Austria, Italy, etc. However, these maps do not provide suitably detailed information for determining the northern Italian shore outline, nor does the present knowledge of the Burdigalian-Helvetian rock distribution permit the precise determination of the Middle Miocene coast-configuration or reef distribution in western Europe. It is not readily possible to state whether northern Italy, during the Miocene, had a rugged coast pockmarked with bays, or had a smooth coast. Sturani (written communication, 1965) believes that the coast near Turin was high with small beaches studding the rugged coast. A more complete analysis of the associated fauna and the distribution of rock-types should provide further evidence as to the nature of the shoreline and the niches available. Such analyses would also strengthen or weaken the possibility that, what appear to be, filled channels, in the Burdigalian-Helvetian rocks, are part of an ancient submarine canyon system that was filled with fossil detritus and coarse-grained sediments carried from a more near-shore environment.

The work of Sturani (written communication, 1965) would seem to negate any suggestion that the channel-filling is no more than wave and current scouring and that

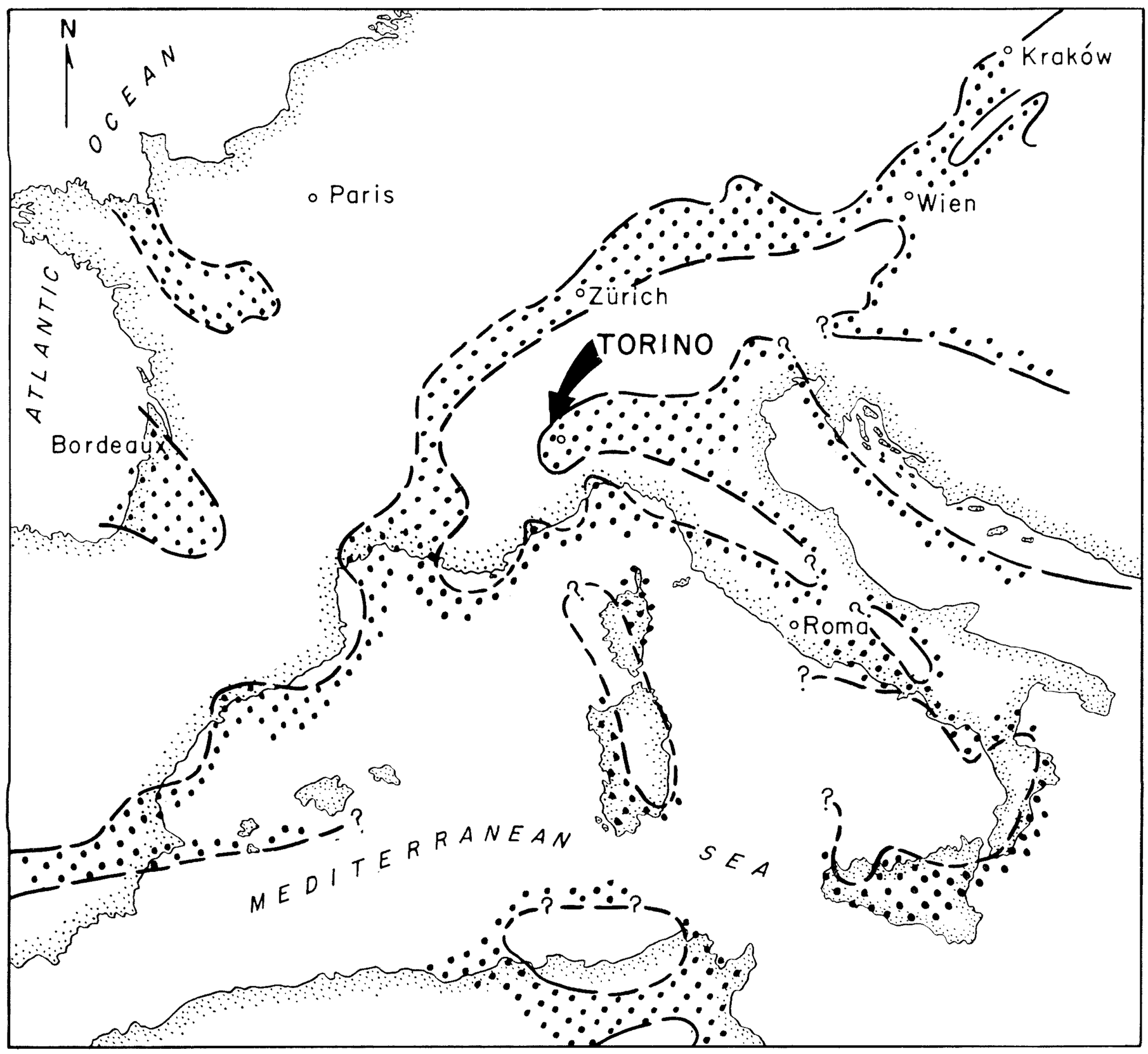


Fig. 2 - Paleogeographic map of Italy during the Middle Miocene. (After Brinkmann, 1960; Chevalier, 1960). Pattern represents the Burdigalian-Helvetian sea.

by and large the Piemontese Sea was for the most part protected.

Macro-geographic isolation, if it did occur, was probably not the only factor in speciation of cones. Micro-geographic isolation and adaptive radiation also must have played a role. The important work of Kohn (1959a; 1964) suggests mechanisms whereby ecologically similar Recent species of *Conus* can coexist in proximity. He has shown that there is a direct relationship between the numbers or diversity of species of *Conus* and the nature of their food and the microhabitats in which they live. From his work it is inferred that the diversity of Miocene species may well be correlated with the diversity of micro-environments and food specialization. Food preferences in other animals have also been noted by others. For example, Carpenter (1952) has demonstrated the preference for different foods by species of snakes within the same genus that inhabit similar habitats, and Andrewartha and Birch (1954, p. 461) give other examples of animals that differ in the feeding habits. Of the 17 sympatric species

of limpets (*Acmaea*) reported by Test (1955) there were only two instances of possible interspecific competition. In the other cases there are differences in food specialization or there is some restriction of the habitat that makes it possible for them to coexist at the same locality. Hubbs (1961, p. 13) cautions « that adaptations to differential feeding are apt to be terminal phenomena of no great phylogenetic significance ». However, such adaptations to differential feeding would seem compatible with his idea (p. 20) that « gradual speciation *in situ* by increasing segregation may often have been the process » of speciation. Heterogeneous micro- and macro-habitats would also help explain the coexistence in close proximity of two or more species of the same genus that might have had similar dietary habits, or there may have been evolving differences in physiology or breeding habits that would have provided mechanisms for isolation.

The question of whether adaptations to feeding, habit, etc. took place during a period or periods of isolation, or whether the adaptations and fragmentation of existing populations into new and different populations took place in one region, cannot be definitively answered. Information relative to the question of geographic speciation versus speciation within the same geographic area is provided with difficulty by paleontology, or, at least in this case, by a single polyspecific genus. Wieser (1960, p. 513), Kohn (1960, p. 571), Hubbs (1961, p. 5) and others cogently argue for sympatric as well as geographic speciation. Some support for their arguments regarding sympatric speciation are provided by the Italian fossil species of *Conus*. *Conus bredai, C. marii, C. parvacatenatus, C. parvicaudatus,* and *C. taurinensis,* which are restricted to the Italian late Burdigalian, and *C. gastriculus, C. montisclavus, C. oboesus, C.raristriatus, C. striatulus,* and *C. tauroectus,* which are restricted to the Cenozoic rocks of Italy, are thought to be distinct and valid species; thus it would seem necessary to call upon speciation within the same geographic region to account for the mode of speciation of these restricted species. Without some record of these species outside of Italy it is difficult to argue for isolation and later establishment of sympatry. In short, it is not possible to call upon emigration from elsewhere when the species are not known to occur elsewhere.

Mayr (1954) in his discussion of geographic speciation among tropical echinoids and later in his synthesis (Mayr, 1963, p. 449-515) of evidence for geographic speciation has reasoned that extrinsic barriers are essential to speciation. Since 22 of the 33 species of *Conus* studied from northern Italy are found elsewhere in western Europe these may have differentiated by geographic speciation. The possibilities for isolation that arose from the changing geography during the Middle Miocene cannot be discounted. *Conus* populations could have migrated into new environments and following their isolation and adaptive radiation to different breeding or feeding habits events might have led to the invasion or reinvasion of the northern Italian environments by the differentiated populations. However, geographic speciation, unless we include micro-geographic speciation, cannot account for the 11 species of *Conus* restricted to Italy.

One cannot help but wonder why there were larger and more varied populations of cones and other animals in Piedmont than along the more southerly Middle Miocene coasts of North America and Japan. From our present knowledge of the Miocene coastal configuration of California, for example, it is apparent that there was a diversified coastline marked by different bathymetric zones and supplied by variable sedimentary types. The California coast may have been affected by cold water upwelling that influenced the faunal makeup of the entire coastal area. The Miocene sea, in Piedmont, may have been relatively protected from the wind, there may have been sheltering reefs (some are shown by Chevalier, 1961, p. 520-522), and there may have been an absence of cold water upwelling. These and other factors,

such as a rich supply of nutrients, favorable substrate, oxygen content, salinity, etc. may have been responsible for the richness of the Miocene Piedmont faunal assemblages. If no more than the protection of the Piemontese Sea is considered there could have been cold water upwelling. From the studies in the Gulf of California (Roden and Groves, 1959; Byrne and Emery, 1960) there is upwelling in this relatively protected gulf. However, there aren't any coral reefs in the Gulf of California (Wells, 1957, Pl. 9) and there were reefs in the Piemontese Sea or gulf.

SUMMARY

Thirty-three fossil species of the gastropod genus *Conus* from the Burdigalian and lower Helvetian rocks of Piedmont lived in numerous near-shore microenvironments such as fine- to coarse-grained sand, grit, and under clasts. They are part of the rich Middle Miocene fauna of Italy that included more than 1000 species of gastropods, several hundred species of pelecypods, 25 species of annelid worms, etc. (Bellini, 1905), tens of species of corals (Chevalier, 1961), and probably a wealth of soft-bodied organisms not preserved in the fossil record. Within a makeup of an increasingly varied environmental setting and conditions in Italy, and elsewere in Europe, large communities probably were undergoing adaptive radiation and perhaps macro- and micro-geographical isolation. During the Aquitanian and, or early Burdigalian some species of *Conus* broke into geographic isolates (Mayr, 1954, p. 11), both micro- and macrogeographic isolates, adapted to new environments or conditions, acquired new habits, underwent reproductive isolation, and later overlapped in range without interbreeding. Such an interpretation is highly speculative and is offered only as one possible suggestion for the presence of several species, some of which are restricted to the region, occupying what seems to have been the same general environment.

SYSTEMATIC DESCRIPTIONS

Class GASTROPODA
Subclass PROSOBRANCHIA (1)
Milne Edwards, 1848
Order STENOGLOSSA (2) Bouvier, 1887
Suborder TOXOGLOSSA (3) Troschel, 1848
Family CONIDAE
Genus CONUS Linnaeus, 1758 (4)
CONUS ALDROVANDI Brocchi, 1814
Pl. 1, figs. 1, 5, 12, 14

Conus clavatus LAMARCK, 1810, p. 440 [*non C. clavatus* RÖDING (5), 1798 = *C. mediterraneus* HWASS *in* BRUGUIÈRE, 1792 = *C. ventricosus* GMELIN, 1791]; HÖRNES, 1851, p. 25; HÖRNES, 1856, pl. 2, figs. 4a, b, c, 5a, b; COSTA, 1866, pl. 4, figs. 1a, b, c; CLERC and FAVRE, 1918, pl. 14, figs. 219a, b.

Conus aldrovandi BROCCHI, 1814, pl. 2, fig. 5 [named for U. Aldrovandi (1522-1607)].

Conus aldrovandi BROCCHI [*emend.* for *aldovrandi* BROCCHI]. RISSO, 1826, p. 228.

Conus (Lithoconus) aldrovandi BROCCHI, HOERNES and AUINGER, 1879, p. 25, pl. 4, fig. 2.

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(1) See Cox, 1960 (p. I 153).

(2) Renamed Neogastropoda by Wenz (1938). Hanna (1963, p. 11) gives the order as Ctenobranchiata, Cox (1960, p. I 152) gives the spelling as Ctenobranchia.

(3) Given as a superfamily by Hanna (1963, p. 11) as a « group » by Cox (1960, p. I 153) and as a suborder by Keen (1958, p. 436). Keen (1963, p. 86, 88) considers Toxoglossa under Order Monotocardia.

(4) Hanna (1963, p. 11) gives a short synonymy to Linnaeus (designated by Children) as the type of the genus.

(5) Röding (1798, p. 46) in « describing » his species *C. clavatus* referred to plate 52, figure 578 in Martini (1773, p. 229) as a part of his description. On the same page and following the *C. clavatus* entry he again referred to Martini's figure (*i.e.*, fig. 578) in describing *C. cinereus*. *C. cinereus* is preoccupied by *C. cinereus* Bruguière, 1792 [the latter may be equal to *C. rusticus* Linné, 1758 but the systematics of *C. rusticus* are not clear (see Dodge, 1953, p. 41) and Kohn (1963, p. 309) has petitioned that the name be suppressed]. Further the figure in Martini which Röding calls *C. clavatus* agrees with *C. mediterraneus* Bruguière, 1792.

Chelyconus subovoclavata SACCO, 1893, p. 70 [new name for *C. clavatus* COSTA (1866, pl. 4, fig. 1].

Chelyconus conoponderosus? var. *tauroelongata* SACCO, 1893, p. 76, pl. 7, fig. 25; var. *tauropileata* SACCO, 1893, p. 76, pl. 7, fig. 27.

Conus (*Chelyconus*) cf. *ponderosus* BROCCHI, RUTSCH, 1929, p. 17, pl. 1, fig. 5.

Conus (*Lithoconus*) *mercati* BR. var. *aldovrandii* BROCCHI, RONCHETTI, 1955, p. 295, 296, fig. 158.

Description — Shell large (more than 70 mm long) and thick. Body whorl robust and heavy, smooth except for heavy growth lines near anterior and aperture. Aperture wide and flaring at anterior.

Shoulder angular, periphery smooth. Top of ultimate whorl with a slight slope but nearly flat. Spire, scalariform, straight, whorls similar to shoulder in shape except for early whorls that are not scalariform and with a very weak suggestion of beading near the suture.

Holotype — Collection of Brocchi, Museo Civico di Storia Naturale, Milan. Number 1035, Crete Senesi, Pliocene.

Dimensions — Length, 77.7 mm; width, 47.5 mm.

Type of *C. clavatus* Lamarck: Collection of Lamarck, Muséum de Genève (no number]. From Dax, France. *Dimensions* — Length, 75.9 mm; width, 41.5 mm.

Distribution. — France, Miocene (Burdigalian?); Portugal, Miocene (Late?); Switzer-

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EXPLANATION OF PLATE 20

Figs. 1, 12 - *Conus aldrovandi* Brocchi. Unnumbered holotype of *Conus clavatus* Lamarck, Muséum de Genève. « Dax », France. Burdigalian (?). Lenght, 75.9 mm; width, 41,5 mm. Page 125.

2, 3 - *Conus taurinensis* (Bellardi and Michelotti). Number 143, collection of Sacco; Type of *Conus striatulus* var. *taurinensis* Bellardi and Michelotti. Rio della Batteria, Torino, Italy. Uppermost Burdigalian (?). Length, 24.2 mm; width, 11.5 mm. Page 159.

4 - *Conus taurinensis* (Bellardi and Michelotti). Number 147, collection of Sacco; Type of *C. taurinensis* var. *anomalomamilla* Sacco. Baldissero, near Torino, Italy. Upper Burdigalian. Length, 25.0 mm; width, 13.3 mm. Page 159.

5, 14 - *Conus aldrovandi* Brocchi. Number 1035, Holotype, Museo Civico di Storia Naturale, Milano, Italy. Crete Senesi, Pliocene. Length, 77.7 mm; width, 47.5 mm. Page 125.

6, 7 - *Conus mercati* Brocchi. Number 1038, Holotype, Museo Civico di Storia Naturale, Milano, Italy. San Miniato, Pliocene. Length, 55.1 mm; width, 30.0.

8, 13 - *Conus taurorectus* Sacco. Number 120, collection of Sacco; type of *C. deshayesi* var. *mioantiqua* Sacco. Torino, « Elveziano » of Sacco (Burdigalian?). Length, 54.4 mm; width, 30.5 mm. Page 161.

9 - *Conus subnicobaricus* Orbigny. Number 174, collection of Sacco; type of *Stephanoconus subnicobaricus* var. *taurocoronata* Sacco. Torino, « Elveziano » of Sacco (Burdigalian?). Length, 44.6 mm; width, 27.2 mm. Page 159.

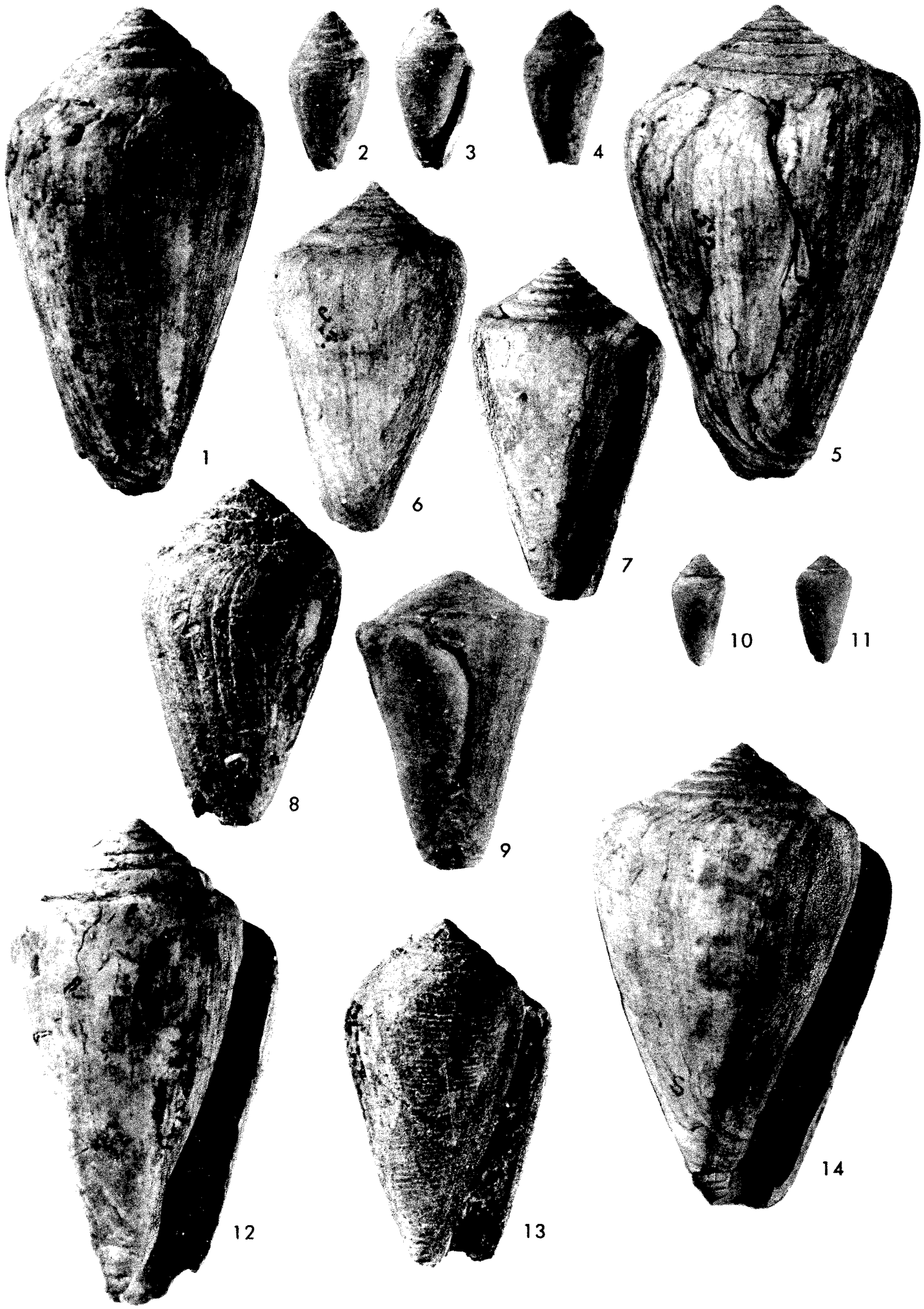
10 - *Conus parvecatenatus* (Sacco). Number 140, collection of Sacco; type of *C. parvus* var. *miosubuloides* Sacco. Torino, « Elveziano » of Sacco (Burdigalian?). Length, 17.9 mm; width, 8.0 mm. Page 153.

11 - *Conus parvecatenatus* (Sacco). Number 142, collection of Sacco; type of *C. parvus*? var. *longanfractus* Sacco. Torino, « Elveziano » of Sacco (Burdigalian?). Length, 17.0 mm; width, 8.4 mm. Page 153.

Where no locality is given in the plate explanation, the locality is known only as the hills of Turin.

Numbers were assigned by me to Middle Miocene specimens in the collection of Sacco. A complete list of the numbers appears in the Appendix, *e.x.,* Number 143, collection of Sacco.

CLARENCE A. HALL, Jr., MIDDLE MIOCENE *CONUS* FROM PIEDMONT, ITALY



land, Miocene, Helvetian; Italy, Pliocene; Austria, Miocene (Vindobonian?).

Remarks — *Conus aldrovandi* Brocchi, which authors have included as a variety of *C. mercati,* can be distinguished from *C. mercati* by the rounded and convex scalariform spiral whorls. The spiral whorls of *C. mercati* are flat or concave, scalariform, and the sides of the spire are usually more concave.

CONUS ANTIDILUVIANUS (6)
Bruguière, 1792 (7)
Pl. 22, fig. 7

Volutilites KNORR and WALCH, 1768-73 [*fide* Catalogue of the books . . . British Museum (Natural History), KNORR, v. 2, p. 998], v. 2, p. 160, pl. 102, fig. 6 [*fide* Sacco, 1893, p. 39. Sacco gives the date as 1786].

Conus antidiluvianus BRUGUIÈRE, 1792, v. 1, pt. 2, p. 637; BRUGUIÈRE, 1798, v. 3, pl. 347, fig. 6; BROCCHI, 1814, v. 2, p. 291, pl. 2, fig. 11a, b, c; HÖRNES, 1851, p. 38-39.

Conus antediluvianus BRUGUIÈRE. GRATELOUP, 1835, 1847, pl. 44, fig. 2 (*non* fig. 6); BEYRICH, 1853, p. 19, pl. 1, figs. 1a, b; HÖRNES, 1856, pl. 5, figs. 2a, b, c, d, e [d and e are two different specimens].

Conus antediluvianus var. *scalata* GRATELOUP, 1847, pl. 45, figs. 13, 14.

Conus catenatus SOWERBY. HÖRNES, 1851, p. 42; HÖRNES, 1856, pl. 5, figs. 4a, b, c [& an unlettered specimen of fig. 4].

Conus extensus HÖRNES, 1851, p. 37; HÖRNES 1856, pl. 5, figs. 1a, b, c.

Conus (*Leptoconus*) *berwerthi* HOERNES and AUINGER, 1879, v. 1, p. 35, pl. 5, fig. 11 [three views], fig. 12a, b, c.

Conospirus antediluvianus (BRUGUIÈRE). SACCO, 1893, p. 39; SACCO, 1904, p. 111, pl. 24, fig. 35; *Conospirus antediluvianus* (BRUG.) varieties *pseudogibbosa, dertonensis, compressospira, dertogranosa turritospira, fasciornata, dertoblita, crassogranosa, mioblita, tauroblitoides, tauroscalarata, miosubagranosa, taurocatenatoides, subagranulata* SACCO, p. 41-45, pl. 4, figs. 28-45 [*non* 44a, b, = *C. canaliculatus*]; *C. antediluvianus* var. *turripiana* and *empena* DE GREGORIO, SACCO, p. 42, 44, pl. 4, figs. 33, 43.

Conospirus dujardini var. *taurostriolata* SACCO, 1893, p. 4, pl. 5, fig. 1 ter.

Conospira antediluvianus BRUG. COSSMANN, 1896, v. 2, p. 155, pl. 8, figs. 7, 8.

Conus (*Conospira*) *antediluvianus* BRUG. var. *scalata* GRATELOUP. PEYROT, 1930, p. 84; PEYROT, 1931, pl. 1, figs. 21, 22 [topotype].

Conus (*Conolithus*) *antediluvianus* BRUG. WENZ, 1943, p. 1470, figs. 4153; KOJUMDGIEVA and STRACHIMIROV, 1960, p. 209, pl. 49, fig. 3.

[Note that the spelling *C. antediluvianus* was first used by Deshayes (1824, p. 749; 1837, pl. 98, figs. 13, 14), this spelling is not an emendation but a spelling error; however, note too that Deshayes' specimen is *C. dujardini* Deshayes, 1845].

Description — Small to large size (15-55 mm long) elongate shells. Body whorl elongate, usually smooth below the shoulder becoming covered with spiral or spiral pustulose ridges near the middle and base. Body whorl more deeply striate near the base and in some finely striate just below the periphery of the shoulder and the spiral whorls; striations regularly spaced. Aperture usually narrow, straight, or weakly inflated, flaring weakly at base. Shoulder angular but either smooth or ridged with closely spaced transverse beads around the periphery on small shells. Top of ultimate whorl concave or channelled and with a slight slope. Spire variable, usually moderately high, weakly concave, scalariform, concave whorls, and whorls

(6) Spelling « *C. antidiluvianus* », Bruguière (1792, p. 637) not « *C. antediluvianus* » of authors.

(7) Date of publication, 1792, *fide* C. D. Sherborn and B. B. Woodward, 1906.

beaded and often transversed by spiral striations. Spiral whorls drawn out to compressed and always with an angular periphery.

Holotype — The type of *C. antidiluvianus* is apparently lost or destroyed. The type was in the collection of Lamarck (1802, p. 386, 387; 1810, p. 441) but could not be found in the Muséum National d'Histoire Naturelle, Paris (written communication, J. Sornay, 1964) nor was it found in the Muséum d'Histoire Naturelle, Genève (written communication, E. Lanterno, 1964; and a search by the author). The original specimen was from the Courtagnon region France (*fide* Bruguière, 1792; Lamarck, 1802, 1810).

Neotype — No neotype is selected because material from the type locality has not been studied. The variant figured by Peyrot (1931, pl. 1, figs. 21, 22) is one of the best figures of *C. antidiluvianus* and even though it is not the type or a topotype, it would make a suitable neotype.

Hypotype — Istituto di Geologia, Turin, red label no. 40 = the type of Sacco's *C. antediluvianus* var. *taurocatenatoides*.

Distribution — Middle Miocene, Italy (Sacco, 1893, 1904); France (Peyrot, 1930); Late Miocene, Italy (Sacco, 1893, 1904), France (Peyrot 1930), Bulgaria (Kojumdgieva and Strachimirov, 1960); Miocene, North Germany; Pliocene (more commonly Lower), Italy (Sacco, 1893).

Remarks — The specimens from the Middle Miocene of the Turin hills are closely allied to *C. dujardini* and this species may represent the stock from which the distinctive Late Miocene and Pliocene species evolved.

The close relationship between *C. antidiluvianus, C. dujardini, C. bronnii,* and *C. aquensis* has prompted some authors to group these within a distinct subgenus, *i.e., Conospirus, Conospira,* or *Conolithus*.

The specimens figured by Noetling (1901, pl. 23, figs. 27, 27a, 27b) may belong to *C. antidiluvianus* and not *C. galensis* Noetling, but the figures of Noetling are too poor to make a definitive identification.

CONUS ANTIQUUS Lamarck, 1810
Pl. 21, figs. 1-12

Conus antiquus LAMARCK, 1810, p. 439; GRATELOUP, 1847, pl. 43, fig. 1 (8).

Conus acuminatus BORSON, 1820, p. 194, pl. 1, fig. 2.

Conus tarbellianus GRATELOUP, 1835, p. 102; GRATELOUP, 1847, pl. 43, figs. 2, 5; HÖRNES, 1851, p. 33, 34, 1856, pl. 4, figs. 1a, b, 2 [non 3]; COSTA, pl. 5, figs. 1, 2a, 2b; pl. 6, figs. 1, 2a, 2b [fig. 1 of pls. 5 and 6 may = *C. elongatus* (= *C. elatus*)], pl. 7, figs. 1, 2.

Conus wheatleyi MICHELOTTI, 1847, p. 339, figs. 18, 18'.

Conus subacuminatus ORBIGNY, 1852, v. 3, p. 56, 26e étage.

Conus hardi MARTIN, 1879-80, p. 12, 13, figs. 2, 2a.

Conus virginalis var. *epellus* GREGORIO, 1885, p. 103 [named by GREGORIO for *C. tarbellianus* HÖRNES, 1856, pl. 4, fig. 1-3; however, figs. 1 and 2 = *C. antiquus* and fig. 3 = *C. elongatus* (= *elatus*)]; var. *grolpus* GREGORIO, 1885, p. 103 [new name for *C. tarbellianus* COSTA, 1866, pls. 5 and 6].

Conus antiquus var. *producta* MYLIUS, 1891, p. 8, 9, pl. 1, fig. 2.

Lithoconus antiquus (LAMARCK). SACCO, 1893, p. 23, pl. 3, figs. 6a, b, 7.

Lithoconus antiquus (LAMARCK) var. *wheatleyi* (MICHELOTTI) subvar. *permucronata* SACCO, 1893, p. 24, pl. 3, figs. 8a, b; subvar. *perangulata* SACCO, 1893, p. 24, pl. 3, fig. 9.

Lithoconus antiquus var. *concavespira* [on plate spelling is « *concospira* »] SACCO, 1893, p. 24, pl. 3, fig. 10; var. *percanaliculata* SACCO, 1893, p. 25, pl. 3, fig. 11; var. *acanaliculata* SACCO, 1893, p. 25, pl. 3, fig. 12; var. *elatocanaliculata* SACCO, 1893, p. 25; var. *subscalarata* SAC-

(8) There is a close resemblance between this specimen and *C. parvicaudatus* (Sacco).

co, 1893, p. 25; var. *elatospirata* SACCO, 1893, p. 26, pl. 3, fig. 13; var. *perelatospira* SACCO, 1893, p. 26, pl. 3, fig. 14; var. *elongatissima* SACCO, 1893, p. 26, pl. 3, fig. 15.

Lithoconus subacuminatus (*Orbigny*) SACCO, 1893, p. 21, 22, pl. 3, figs. 1a, b.

Lithoconus subacuminatus var. *conoidospira* SACCO, 1893, p. 22, pl. 3, fig. 2; var. *subpyrulata* SACCO, 1893, p. 22, pl. 3, fig. 3; var. *subamarginata* SACCO, 1893, p. 23, pl. 3, fig. 4; var. *tauroconnectens* SACCO, 1893, p. 23, pl. 3, fig. 5.

Conus literatus LINNAEUS. NOETLING, 1901, p. 359, pl. 23, figs. 12, 12a, 13, 13a; TESCH, 1915, p. 23, pl. 75, fig. 29.

Conus (*Lithoconus*) *antiquus* LAMARCK, PEYROT, 1930, p. 89, 90; PEYROT, 1931, p. 2, figs. 12, 16, 17, 18, 26.

Conus (*Lithoconus*) *mercati* var. *daciae* (HOERNES and AUINGER). KOJUMDGIEVA and STRACHIMIROV, 1960, p. 211, pl. 50, fig. 1, a, b.

Description — Shell variable in size, 12.5 to 120 mm, with the length being two or more times the width in the more typical forms. Body whorl usually elongate and moderately thin to very thin at base, blunt at the anterior end, rarely pinched or straight, regularly spaced incised spiral grooves, but indistinct on large forms. Aperture narrow and straight. Shoulder angular and ultimate whorl horizontal or nearly so. Spire concave, occasionally depressed, or raised, usually weakly striate.

The typical specimens of *C. antiquus* have channelled or concave outer spiral whorls, with or without striations, and have a body whorl that is commonly weakly pinched near the central part of the shell. Those forms with unchannelled flat-topped to slightly convex spiral whorls might be grouped under the subspecies *C. antiquus wheatleyi* (Michelotti, 1847). The small forms of this subspecies have an elongate and thin or pinched body whorl bearing regularly spaced incised spiral grooves more deeply incised and frequent near the base of the body whorl; where the grooves are closely spaced near the anterior tip they are grouped into a raised ridge. The shoulder is very angular and sharp and the spire is concave or nipplelike in profile with a pointed and raised striate apex. The ultimate spiral whorls are horizontal and the whorls near the apex are beaded near the suture.

Another subspecies, *Conus antiquus percanaliculatus* Sacco, 1893, that might be erected has a moderately large and heavy shell. Body whorl robust, straightsided, triangular-shaped, smooth or rarely with ridges at the base, Aperture moderately large, flaring at base. Shoulder angular and usually grooved, Spire low, concave to raised. Not as elongate as the typical forms.

Holotype — The type is lost. It is reported to be a large specimen, 92 mm long and from the Piedmont region of Italy (Lamarck, 1810, p. 439). The specimen is neither in Paris nor Geneva.

Neotype — Collection of Sacco, red label no. 4, Istituto di Geologia, Turin = *Lithoconus antiquus* Lamarck in Sacco, 1893, p. 23, pl. 3, figs. 6a, 6b. From Baldissero Sciolze, or Albugnano (Piedmont region, Italy).

Dimensions — Length, 97.4 mm; width, 52.8 mm.

Hypotypes — UCLA Catalogue number 39396.

Subspecies — *Conus antiquus wheatleyi* (Michelotti). The type of this taxon is missing and a neotype, red label no. 6, Istituto di Geologia, Turin *i.e.* pl. 3, fig. 8 Sacco (1893), is selected. The neotype of this subspecies is probably from the Baldissero locality (see Appendix). Other figured specimens included in this subspecies are: *Lithoconus antiquus* (Lamarck) Sacco, 1893, pl. 3, fig. 7, not 6a, b; *Lithoconus antiquus* var. *elongatissima* Sacco, 1893, pl. 3, fig. 15; *Lithoconus antiquus wheatleyi* subvar. *permucronata*, Sacco, 1893, pl. 3, fig. 8a, b; *L. antiquus* var. *perelatospira* Sacco, 1893, pl. 3, fig. 14; and the specimens figured by Noetling and Tesch (see above) of *C. litteratus*.

The type of the subspecies *Conus anti-*

quus percanaliculatus (Sacco) is in the collection of Sacco, red label no. 9, Istituto di Geologia, Turin = the specimen figured by Sacco, 1893, pl. 3, fig. 11 is from Sciolze or Baldissero. Other figured specimens of this subspecies include:
Conus antiquus producta Mylius, 1891, pl. 1, fig. 2.

Distribution — Most common from the Middle and Late Miocene of Europe; Lower Miocene to Pliocene rocks of the Indo-Pacific Islands.

Remarks — Although the larger shells of *C. antiquus* may be tentatively divided into at least two subspecies the small, and presumably juvenile forms, show such marked intraspecific variation that they might be considered by some authors as variants and there is no evidence to warrant the raising of the subspecies to specific rank. *C. antiquus wheatleyi* most probably represents a youthful stage of *C. antiquus* as first suggested by Sacco, despite the fact that the spiral whorls are not grooved or channelled, are imperceptibly raised at the suture, are more angular at the shoulder, and are generally more elongate and constricted at the base. The morphologic feature that strongly supports Sacco's systematics are the spiral whorls near the apex. Even the largest shells bear a close resemblance to the smaller forms because both have flat striate spiral whorls near the apex and these whorls may be beaded below the periphery. It is on the later and more recent whorls of the adult forms of *C. antiquus* that the whorls are raised or channelled, and most of the large shells still possess the deeply grooved body whorl near the base.

Some of the small or juvenile forms of *C. antiquus wheatleyi* are similar to *C. dujardini* because both have a striate body whorl and both have beaded early spiral whorls. However, the presence of the conspicuous spiral striations on the spire of *C. antiquus* and the horizontal or nearly horizontal sur-

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EXPLANATION OF PLATE 21

Fig. 1 - *Conus antiquus* Lamarck. Number 19, collection of Sacco; type of *Lithoconus antiquus* var. *subascalarata* Sacco [one of several specimens upon which he based his new varietal name. Torino, Middle Miocene. Length, 32 mm; width, 17.6 mm. Page 128.

2-3 - *Conus antiquus* Lamarck. UCLA hypotype number 39396; UCLA locality 4926, Baldissero, upper Burdigalian. Length, 25.9 mm; width, 11.3 mm. Page 128.

4 - *Conus antiquus* Lamarck. Number 183, collection of Sacco; type of *Conus antiquus* var. *producta* Mylius. Santa Margherita, Burdigalian. Length, 45 mm; width, 26.4 mm. Page 128.

5, 8-9 - *Conus antiquus* Lamarck. Holotype of *Conus acuminatus* Borson, 1820 [*non C. acuminatus* Brug, 1792], type of *Lithoconus subacuminatus* Orbigny *in* Sacco; collection of Sacco. Tortonese, Tortonian. Length, 75.2 mm; width, 40.5 mm. Page 128.

6 - *Conus antiquus* Lamarck. Number 5, collection of Sacco; hypotype of *Lithoconus antiquus* Lamarck *in* Sacco. Torino, Middle Miocene. Lenght, 35.5 mm; width, 18.8 mm. Page 128.

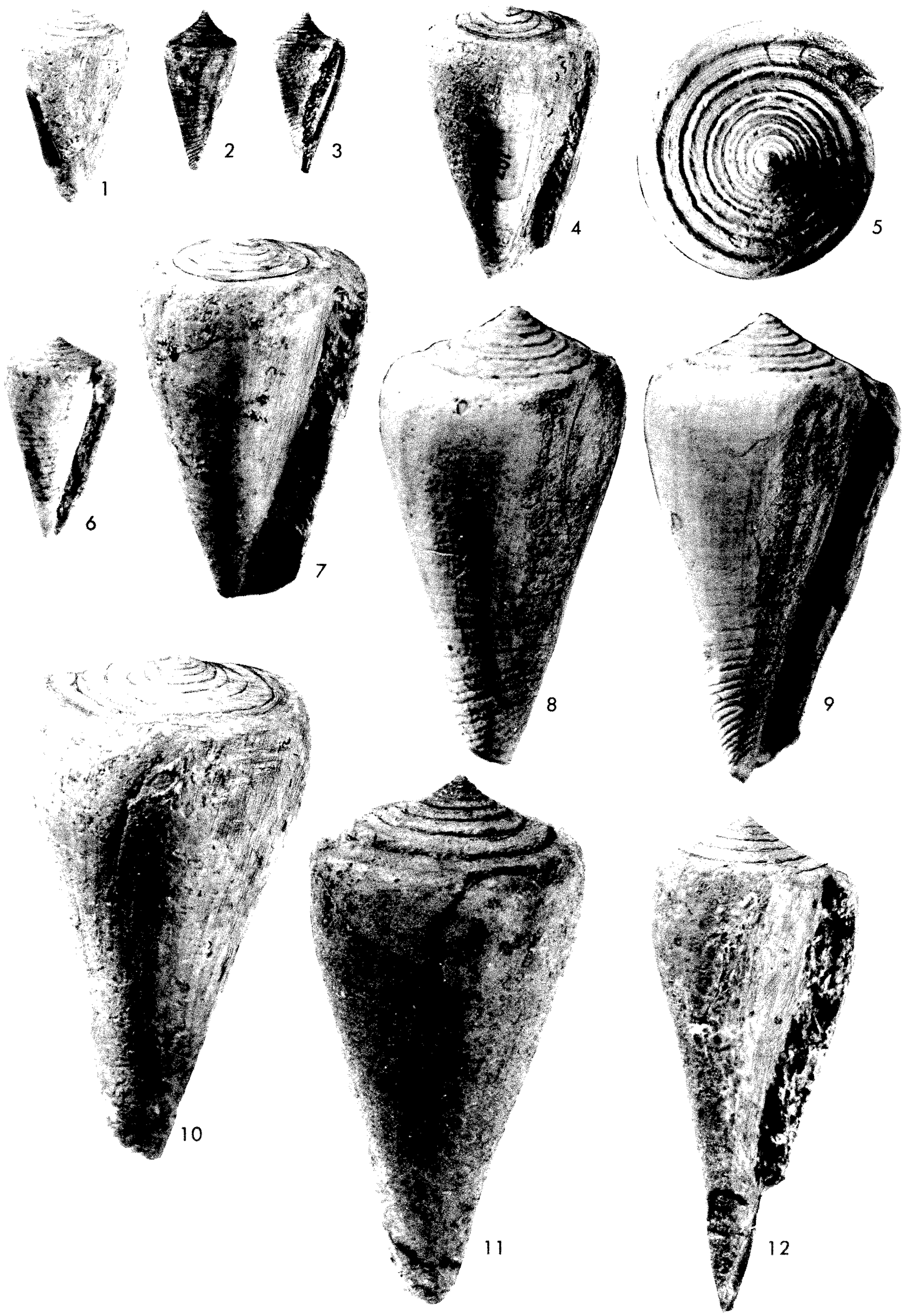
7 - *Conus antiquus* Lamarck. Number 9, collection of Sacco; type of *Lithoconus antiquus* var. *percanaliculata* Sacco. Sciolze or Baldissero, Burdigalian (?). Length, 59.0 mm; width, 34.8 mm. Page 128.

10 - *Conus antiquus* Lamarck. Number 4, collection of Sacco; hypotype of *Lithoconus antiquus* Lamarck in Sacco. Selected as neotype. Baldissero, Sciolze, or Albugnano; Middle Miocene. (Burdigalian?). Length, 97.4 mm; width, 52.8 mm. Page 128.

11 - *Conus antiquus* Lamarck. Number 12, collection of Sacco; type of *Lithoconus antiquus elatocanaliculata* Sacco [one of several specimens upon which he based his variety]. Sciolze, Burdigalian. Length, 90.9 mm; width, 45.7 mm. Page 128.

12 - *Conus antiquus* Lamarck. Number 23, collection of Sacco; type of *Lithoconus antiquus elongatissima* Sacco. Torino, Middle Miocene. Length 75.3 mm; width, 31.9 mm. Page 128.

CLARENCE A. HALL, Jr., MIDDLE MIOCENE *CONUS* FROM PIEDMONT, ITALY



face of the ultimate whorls distinguish it from *C. dujardini.*

Conus subacuminatus Orbigny 1852 [type = *C. acuminatus* Borson, 1820] differs only from the more typical *C. antiquus* by its very pronounced spiral striae, and because this feature is known to be extremely variable within *C. antiquus, C. subacuminatus* is included as a synonym.

This species shows a marked resemblance to the living *Conus litteratus* Linnaeus and to slightly lesser degree to *C. generalis* Linnaeus. Both of these later species are from Indo-Pacific waters. Two other of the living species that resemble, but are different from *C. antiquus* are *C. millepunctatus* Lamarck, (*non C. millepunctatus* Röding) and *C. litteratus* Linnaeus.

C. antiquus is almost certainly genetically related to the older *Conus ineditus* Michelotti, 1847, because of the strong morphologic similarities between *C. ineditus* and variants of *C. antiquus* such as the earlier mentioned species *C. subacuminatus* Orbigny, 1852. The subspecies *C. antiquus wheatleyi* is also similar to *C. ineditus* as both have spirally striate crowns, but *C. antiquus wheatleyi* does not have the concave spiral whorls. *C. ineditus* itself grades to *C. deperditus* Bruguière, 1792 [probably = *C. diversiformis* Deshayes, 1824], and in fact may be a synonym because the only difference is the more pronounced concave spiral whorls.

Conus (*Dendroconus*) *reussi* Hoernes and Auinger, 1879 (p. 20, pl. 2, fig. 1) may be a synonym of *C. antiquus* and not of *C. mercati* var. *subaustriaca* Sacco as suggested by Sacco (1893, p. 20) because this specimen has a more elongate body than *C. mercati,* but first it will be necessary to compare the actual specimens before a conclusion may be drawn.

Conus (*Leptoconus*) *catenatus* Sowerby cited by Woodring (1928, pl. 11, fig. 5) is close to *C. antiquus* [cf. *C.* (*L.*) *subacuminatus* Orbigny *in* Sacco, 1893, pl. 3, fig. 1]; however, it is distinct. The specimen of Woodring is from the Middle Miocene of Jamaica.

CONUS AQUENSIS Orbigny, 1852

Pl. 22, figs. 1, 2, 8, 9, 13, 18, 19, 23, 27, 28

Conus antidiluvianus GRATELOUP, 1847, pl. 44, fig. 6 [*non antidiluvianus* BRUGUIÈRE, 1792] [*non* = *burdigalensis* MAYER-EYMAR, 1858 *fide* TOMLIN, 1937, p. 213, 223].

Conus antidiluvianus var. *elongata* GRATELOUP, 1847, pl. 44, fig. 18. [= pl. 4, fig. 7 in PEYROT, 1931].

Conus aquensis ORBIGNY, 1852, v. 3, p. 11, 26e-étage [new name for *C. antediluvianus* (spelling error his) GRAT.]; PEYROT, 1931, pl. 4, figs. 4, 7, 16, 19 [16 and 19 are topotypes].

Conus puschi MICHELOTTI. COSTA, 1866, pl. 9, figs. 1, 2; MYLIUS, 1891, p. 9, pl. 1, fig. 3.

Chelyconus puschi var. *pseudobiconica* SACCO, 1893, p. 60, pl. 5, fig. 43; var. *peractolonga* SACCO, 1893, p. 61, pl. 5, fig. 46; var. *ascalaris* SACCO, 1893, p. 61, pl. 5, fig. 51.

Chelyconus expuschilonga SACCO, 1893, p. 60 [new name for *C. puschi* MICHELOTTI. (COSTA, 1866)].

Chelyconus montisclavus var. *pagodaeformis* SACCO, 1893, p. 68, pl. 4, fig. 40.

Conospirus bronni? var. *rotundulata* SACCO, 1893, p. 50, pl. 5, fig. 15; var. *rotundospiratissima* SACCO, 1893, p. 50, pl. 5, fig. 15 bis; var. *rotundulogranosa* SACCO, 1893, p. 51, pl. 5, fig. 17.

Leptoconus elatus var. *fusuloparva* SACCO, 1893, p. 38, pl. 4, fig. 23.

Chelyconus oboesus ? var. *sociabilis* SACCO, 1893, p. 58, pl. 5, fig. 32; var. *paucisuturata* SACCO, 1893, p. 58, pl. 5, fig. 33; var. *elatoides* SACCO, 1893, p. 59, pl. 5, fig. 35.

Chelyconus marii tauroperlonga SACCO, 1893, p. 64, pl. 6, fig. 18.

Conus clavatus var. *perfusulata* SACCO, 1893, p. 71, pl. 7, figs. 5a, b.

Description — Shell of moderate to small size (25-55 mm long), moderately elongate to elongate. Body whorl mostly smooth

EXPLANATION OF PLATE 22

Fig. 1 - *Conus aquensis* Orbigny. Number 49, collection of Sacco; Paratype of *Conospirus bronni* ? *rotundulata* Sacco. Torino, Middle Miocene. Length, 22.5 mm; width, 9.2 mm. Page 131.

2 - *Conus aquensis* Orbigny. Number 66, collection of Sacco; type of *Conus oboesus* ? *paucisuturata* Sacco. Torino, Middle Miocene. Length, 50.6 mm; width, 21.4 mm. Page 131.

3, 14 - *Conus basteroti* Mayer-Eymar. Collection of Grateloup, Faculté des Sciences, Bordeaux; type of *C. pelagicus* Brocchi *in* Grateloup, 1847, pl. 2, fig. 8. Saint-Paul-les-Dax, Burdigalian. Length, 41,8 mm; width, 21.6 mm. Page 133.

4, 10 - *Conus belus* Orbigny. UCLA hypotype number 39397; UCLA locality 4926, Baldissero. Upper Burdigalian. Length, 25.0 mm; width, 15.3 mm. Page 134.

5 - *Conus basteroti* Mayer-Eymar. UCLA hypotype number 39398; UCLA locality 4929. Termofourà, Burdigalian. Length, 14.7 mm; width, 8.7 mm. Page 134.

6 - *Conus granularis* Borson. Number 180, collection of Sacco; Holotype of *Conus ornatus* Michelotti, 1847, pl. 14, fig. 4. Torino, Middle Miocene. Length, 9.2 mm; width 5.1 mm. x 2. Page 148.

7 - *Conus antidiluvianus* Bruguière. Number 40, collection of Sacco, type of *Conospirus antediluvianus taurocatenatoides* Sacco. Torino, Middle Miocene. Length, 26.8 mm; width, 11.1 mm. Page 127.

8 - *Conus aquensis* Orbigny. Number 67, collection of Sacco; type of *C. oboesus* ? var. *elatoides* Sacco. Torino, Middle Miocene. Length, 4.56 mm; width, 1919 mm. Page 131.

9, 28 - *Conus granularis* Borson. Collection of Sacco, *Hemiconus granularis* var. *stachei* (Hoernes and Auinger) *in* Sacco, pl. 11, fig. 37. Stazzano, Tortonian. Length, 13.3 mm; width, 6.9 mm. x 2. Page 131.

11 - *Conus granularis* Borson. Collection of Sacco, *Hemiconus granularis* var. *stachei* (Hoernes and Auinger) *in* Sacco, pl. 11, fig. 37. Stazzano, Tortonian. Length, 13.3 mm; width, 6.9 mm. Page 148.

12 - *Conus granularis* Borson. Collection of Sacco, *Hemiconus dertogranularis* Sacco, 1893, pl. 11, fig. 39. Stazzano, Tortonian. Length, 16.5 mm; width, 8.8 mm. x 2. Page 148.

13, 23 - *Conus aquensis* Orbigny. Number 71, collection of Sacco; type of *C. puschi* var. *pseudobiconica* Sacco. Torino, Middle Miocene. Length, 51.5 mm; width, 20.8 mm. Page 131.

15 - *Conus belus* Orbigny. Number 166, collection of Sacco; type of *C. belus* var. *tauroinflata* Sacco. Baldissero. Upper Burdigalian. Length, 30.7 mm; width, 19.7 mm. Page 134.

16 - *Conus belus* Orbigny. Number 167, collection of Sacco. Baldissero. Upper Burdigalian. Length, 30.7 mm; width, 19.7 mm. Page 134.

17 - *Conus gastriculus* Coppi. Number 49, collection of Sturani, Torino. UCLA locality 427, Valle di Vergnana. Uppermost Termofourà Fm., upper Burdigalian. Length, 24.0 mm; width, 11.6 mm. Page 147.

18 - *Conus aquensis* Orbigny. Number 73, collection of Sacco; type of *C. puschi* var. *peracutolonga* Sacco. Torino, Middle Miocene. Miocene. Length, 55.9 mm; width. 20.8 mm. Page 131.

19 - *Conus aquensis* Orbigny. Collection of Sacco; type of *Leptoconus elatus* var. *fusuloparva* Sacco, 1893, pl. 4, fig. 23. S. Agata, Tortonian. Length, 48,8 mm; width, 14.9 mm. Page 131.

20 - *Conus basteroti* Mayer-Eymar. Number 63, collection of Sacco; type of *C. expelagicus* var. *tauroincerta* Sacco. Sciolze or Baldissero, upper Burdigalian. Length, 34.5 mm; width, 19.5 mm. Page 133.

21, 25 - *Conus basteroti* Mayer-Eymar. UCLA hypotype number 39401; UCLA locality number 4930. Villa Cochis, uppermost Burdigalian. Length, 39.5 mm; width, 22.3 mm. Page 133.

22 - *Conus belus* Orbigny. Number 115, collection of Sacco; type of *C. clavatus dendroconoides* Sacco. Torino, Middle Miocene. Length, 32.6 mm; width, 17.4 mm. Page 134.

24, 29 - *Conus basteroti* Mayer-Eymar. Paratype number S2678, collection of Mayer- Eymar, Eidg. Tech. Hoch. Geol. Institut. Zürich. Larriery-Saucats, late Aquitanian. Length, 42.0 mm; width, 22.9 mm. Page 133.

26 - *Conus basteroti* Mayer-Eymar. Number 53, collection of Sturani, Torino. Valle Ceppi, upper Termofourà Fm., upper Burdigalian. UCLA loality number 4928. Length, 34.5 mm; width, 19.9 mm. Page 133.

27 - *Conus aquensis* Orbigny. Number 184, collection of Sacco; type of *Conus puschi* Michelotti *in* Mylius, 1891, pl. 1, fig. 3. Santa Margherita, near Torino. Length, 53.6 mm; width, 21.7 mm. Page 131.

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Fig. 30 - *Conus basteroti* Mayer-Eymar. UCLA hypotype number 39400; UCLA locality number 4930. Villa Cochis, uppermost Burdigalian. Length, 39.0 mm; width, 21.2 mm. Page 133.

31 - *Conus basteroti* Mayer-Eymar. Number S2890, collection of Mayer-Eymar, Eidg. Tech. Hoch. Geol. Institut, Zürich. Holotype of *C. peregrinus* Mayer-Eymar. Saucats, Upper Langhian of Mayer-Eymar. Length, 27.6 mm; width, 14.6 mm. Page 133.

32 - *Conus basteroti* Mayer-Eymar. Number 64, collection of Sacco; type of *C. expelagicus* var. *subcingulellata* Sacco. Torino, Middle Miocene. Length, 46.6 mm; width, 23.2 mm. Page 133.

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with moderately strong spiral ridges at base, base not narrow. Aperture narrow, with slight flare at base. Shoulder smooth and weakly angular, prominent. Some variants may rarely have a shoulder with a pronounced slope. Spire mostly straight, deeply sutured, more recent whorls usually convex and rounded. Early whorls have a weak angular periphery and may be weakly beaded.

Lectotype — Orbigny (1852, p. 11) selected « *C. antediluvianus* Br. » *in* Grateloup (1847, pl. 44, fig. 2) and « *C. antediluvianus* junior » from Grateloup (pl. 44, fig. 6) as type. Peyrot (1931, pl. 4, fig. 4) figures the same specimen as in Figure 6 of Grateloup and this specimen, at Bordeaux, is selected as the type of *C. aquensis*. The specimens are from Saubrigues, faluns bleus; Tortonian. Collection of Degrange-Touzin, Bordeaux, France.

Hypotype — UCLA catalogue number 39399.

Distribution — Miocene, Tortonian, France; Burdigalian, Helvetian, Italy.

Remarks — Differs from *C. puschi* by its higher spire relative to shorter body whorl and by the weakly angular periphery of the early whorls. Distinguished from *C. aquensis* by its more obese body whorl and moderately wide base, more weakly ridged spiral whorls, and usually less distinct shoulder.

CONUS BASTEROTI Mayer-Eymar, 1890

Pl. 22, figs. 3, 5, 14, 20, 21, 24-26, 29-32

Conus pelagicus BROCCHI. GRATELOUP, 1847, pl. 44, fig. 8 [*non C. pelagicus* BROCCHI, 1814].

Conus basteroti MAYER-EYMAR, 1890, p. 293; MAYER-EYMAR, 1891, p. 323-324, pl. 8, fig. 6; PEYROT, 1930, p. 109; PEYROT, 1931, pl. 2, figs. 4, 6, 25.

Conus peregrinus MAYER - EYMAR, 1890, p. 296; MAYER-EYMAR, 1891, pl. 9, fig. 7.

Chelyconus expelagicus SACCO, 1893, p. 57.

Chelyconus expelagicus var. *tauroincerta* SACCO, 1893, p. 57, pl. 5, fig. 29; var. *subcingulellata* SACCO, 1893, p. 57, pl. 5, figs. 30a, b.

Chelyconus mediterraneus pyramidatospira SACCO, 1893, p. 104, pl. 10, fig. 4.

Conus (*Chelyconus*) *clavatus* LK., PEYROT, 1930, p. 105; PEYROT, 1931, pl. 3, fig. 7.

Description — Shell, average size (25-40 mm long). Body whorl, straight to slightly inflated or rounded below shoulder becoming straight sided near anterior, with irregularly spaced spiral grooves and ridges. Aperture, convex below shoulder becoming straight near center, widening at the anterior. Shoulder angular, surface of ultimate spiral whorl is sloping and not grooved or channelled on top. Spire is straight, of moderate height, striate, and weakly scalariform.

Holotype — In February of 1964 the types of *Conus* described by Mayer-Eymar were sent to me in Turin by Dr. R. Hantke. Mayer-Eymar (1891, p. 324) states that there were four examples of *C. basteroti* and gives the dimensions of the type. Only three examples were sent by Hantke and none of the three match the dimensions given by Mayer-Eymar. Later a search was made by me of the collections at the Eidg. Technische Hochschule Geologisches Institut at Zürich for the missing type but it could not be found. Because the other types of Mayer-

Eymar are in the collection the holotype of *C. basteroti* is considered to be only temporarily missing. If the holotype cannot be found, then I recommend the selection of one of Mayer-Eymar's paratypes as the neotype, namely, number 2678 (figured here) in the Mayer-Eymar collection at the Eidg. Tech. Hochschule Geologisch. Inst. Zürich. Types from the upper Aquitanian, Saucats, near Bordeaux.

Hypotypes — UCLA catalogue numbers 39398, 39400, and 39401.

Dimensions — Holotype: Height, 50.0 mm [48.7 mm as shown on figure of the type]; width, 26 mm. Paratype [or neotype]: Height: 45 mm; width, 26 mm.

Distribution — Upper Aquitanian (Mayer-Eymar, 1891, p. 324) or ? Burdigalian (Denizot, 1957, v. 1, pt. 4a, n. 7, p. 176) and Lower Langhian (Mayer-Eymar, 1891, p. 332), Helvetian (Sacco, 1893, p. 57, 104) of Italy.

Remarks — *C. basteroti* approaches *C. notatus* Tomlin, especially forms such as *C. raulini* Peyrot (1931, pl. 219, 20) but can be distinguished by its more angular shoulder. It is distinguished from *C. bitorosus* Fontannes by the lack of channelled spiral whorls.

CONUS BELUS Orbigny, 1852
Pl. 22, figs. 4, 10, 15, 16, 22

Conus pyrula BROCCHI. GRATELOUP, 1847, pl. 44, fig. 12, 13 [non *pyrula* BROCCHI, 1814].

Conus belus ORBIGNY, 1852, p. 11 [new name for *C. pyrula* GRATELOUP].

Conus avellana LAMARCK. HÖRNES, 1851, p. 29, 30; 1856, pl. 3, figs. 3a, b, c [*non* d].

Chelyconus clavatus dendroconoides SACCO, 1893, p. 72, pl. 7, figs. 8a, b.

Chelyconus? belus (ORBIGNY). SACCO, 1893, p. 110.

Chelyconus belus var. *tauroinflata* SACCO, p. 112, pl. 10, fig. 27; var. *taurocompressula* SACCO, 1893, p. 112, pl. 10, fig. 28; var. « *rovasendae* (MICHELOTTI) (*in litteris*) « SACCO [*non* MICHELOTTI], p. 112, pl. 10, fig. 29; var. *tauroborsoni* SACCO, 1904, p. 111, pl. 24, fig. 40.

Conus clavatulus ORBIGNY. PEYROT, 1930, p. 49; PEYROT, 1931, pl. 4, fig. 21.

Conus (*Chelyconus*) *vindobonensis* PARTSCH [*non* PARTSCH but HÖRNES]. KOJUMDGIEVA and STRACHIMIROV, 1960, p. 213, pl. 50, figs. 5a, b.

Description — Shell small (20-40 mm long) and obese. Body whorl short and rounded, covered by irregularly spaced spiral striae that are not present near the shoulder, moderately wide at base, widest immediately below the shoulder. Aperture, moderately wide and mostly straight. Shoulder well rounded. Spire usually low, pointed, eroded with more recent whorls weakly convex, markedly oblique apical angle, spire weakly convex.

Holotype — In the collection of Grateloup. Laboratoire de Géologie, Faculté des Sciences, Bordeaux, France. Grateloup, 1847, pl. 44, figs. 12, 13; Dax, Saubrigues, fauns bleus.

Hypotype — UCLA catalogue number 39397.

Distribution — Tortonian, Late Miocene of France and Bulgaria; Helvetian, Middle Miocene, Italy.

Remarks — *C. belus* approaches the shape of *C. eschewegi* Costa. The unfigured specimens from the Helvetian rocks in the collection of Sacco that he places in *C. eschewegi* are actually *C. belus* and serve to illustrate the close relationship. The overlap of the spiral whorls, characteristic of *C. eschewegi,* is absent in *C. belus.*

CONUS BERGHAUSI Michelotti, 1847
Pl. 23, figs. 11, 18, 22, 23, 28

Conus figulinus GRATELOUP, 1835, p. 107; GRATELOUP, 1847, pl. 44, fig. 11 [*non figulinus* LINNAEUS, 1758].

Conus maculosus GRATELOUP, 1835, p. 110; GRATELOUP, 1847, pl. 44, fig. 17, pl. 45,

figs. 4, 5 [*non maculosus* RÖDING, 1798; *non maculosus* SOWERBY, 1833].

Conus berghausi MICHELOTTI, 1847, p. 342, pl. 13, fig. 9, 9'; HÖRNES, 1851, p. 19-20, HÖRNES, 1856, pl. 1, figs. 3a, b, c, d; COSTA, 1866, pl. 1, figs. 2a, b, 3a, b, pl. 2, figs. 3-6.

Conus subfigulinus ORBIGNY, 1852, p. 11 [new name for *C. figulinus* GRATELOUP].

Conus mercati BROCCHI. HÖRNES, 1856, pl. 2, fig. 2a, b.

Conus striatellus JENKINS, 1864, p. 54, pl. 7, figs. 3a, b; MARTIN, 1870-80, p. 9, pl. 1, figs. 2, 2a, 3, 5, 5a.

[?] *Conus broteri* COSTA, 1866, pl. 9, figs. 25, 26, 27a, b, 28, 29, 30.

Conus (*Dendroconus*) *daciae* HOERNES and AUINGER, 1879, p. 21, pl. 3, fig. 1.

Conus (*Dendroconus*), *Cops loroisii* KIENER. HOERNES and AUINGER, 1879, p. 21, pl. 3, fig. 1.

Conus (*Dendroconus*) *vaceki* HOERNES and AUINGER, 1879, p. 22.

[?] *Conus* (*Dendroconus*) *voeslauensis* HOERNES and AUINGER, 1879, p. 22, pl. 1, fig. 8, pl. 3, fig. 4 [*C. voeslauensis in* KOJUMDGIEVA and STRACHIMIROV, 1960, pl. 51, figs. 4a, b = *C. betulinoides*].

Conus (*Dendroconus*) *subraristriatus* COSTA. HOERNES and AUINGER, 1879, pl. 1, fig. 22.

Conus (*Dendroconus*) *hochstetteri* [= *C. steindachneri* on plate explanation] HOERNES & AUINGER, 1879, p. 24, pl. 3, fig. 3.

Conus (*Leptoconus*) *neumayri* HOERNES and AUINGER, 1879, p. 27, pl. 1, fig. 17, 18.

Dendroconus berghausi (MICHELOTTI). SACCO, 1893, p. 7, pl. 1, fig. 9.

Dendroconus berghausi var. *subaspira* SACCO, 1893, p. 8; var. *propebetulinoides* SACCO, 1893, p. 8, pl. 1, fig. 10; var. *bifasciolata* SACCO, 1893, p. 8, pl. 1, fig. 11; var. *moravicoides* SACCO, 1893, p. 9, pl. 1, fig. 13; var. *triangularis,* SACCO, 1893, p. 9, pl. 1, fig. 14; var. *planocylindrica* SACCO, 1893, p. 10, pl. 1, fig. 15; var. *percommunis* SACCO, p. 10, pl. 1, fig. 16; var. *vaecki* (H. & A.), SACCO, 1893, p. 10, var. *glandiformis* SACCO, 1893, p. 10, pl. 1, fig. 17; var. *conotriangula* SACCO, 1893, p. 11, pl. 1, fig. 18; var. *semisulcatula* SACCO, 1893, p. 11, pl. 1, fig. 19; var. *conicospira* SACCO, 1893, p. 11, pl. 1, fig. 20; var. *permucronata* SACCO, 1893, p. 11, pl. 1, fig. 21.

Conus (*Dendroconus*) *maculosus* GRATELOUP. PEYROT, 1930, p. 96, 97; PEYROT, 1931, pl. 4, figs. 2, 6, 8, 9, 13, 15.

Conus (*Dendroconus*) *bergausi* MICHELOTTI. KOJUMDGIEVA and STRACHIMIROV 1960, p. 215, pl. 51, figs. 3a, 3b.

Description — The shell is of moderate to large size (25-60 mm long) and generally fig-shaped. Body whorl smooth on upper 2/3 or 1/2 becoming deeply striate near anterior. Shoulder smooth rounded, broad periphery. Spire low, rarely striate, overlapping whorls, depressed concave to convex. Color pattern when present characterized by black or brownish yellow rectangles, or as irregularly shaped patches on the more weathered shells. The color pattern is actually a series of spiral and transverse widely spaced and wide stripes of gray or black and closely spaced thin grayish or brown stripes on a yellow background. It is this background that weathers to the yellow or black rectangular pattern, the stripes becoming white.

Holotype — Missing. The original specimen was collected at Stazzano near Serravalle. It is figured by Sacco, 1893, pl. 1, figs. 9a, b, c. The specimen of *Dendroconus berghausi* var. *percommunis* Sacco, 1893, pl. 1, figs. 16a, b, from the type area and showing color would make a suitable neotype.

Hypotype — UCLA catalogue number 39406.

Distribution — Burdigalian, Helvetian, Tortonian, France; Burdigalian, Helvetion, Tortonian, Plaisancian, Italy; Miocene, Austria; Tortonian, Bulgaria; Miocene, Pliocene, Indo-Pacific Islands.

Remarks — The shape of *C. loroisii* Kiener (1847, p. 91, pl. 65, fig. 1) [= *C. figu-*

linus Linnaeus, *fide* Cotton, 1937, p. 269] resembles the shape of *C. berghausi,* but differs in color markings and the body whorl of *C. loroisii* Kiener is more elongate. *C. loroisii* in Tesch (1915, p. 20, pl. 74, figs. 22a, b) has a more angular shoulder than *C. loroisii* Kiener, but may be *C. berghausi.*

C. berghausi also bears some resemblance to *C. crassus* Sowerby, usually considered a junior synonym of *C. eburneus* Hwass (A. J. Kohn, written communication, 1965).

CONUS BITOROSUS Fontannes, 1880

Pl. 23, figs. 1, 2, 7-9, 13-17, 19-21, 24, 25

Conus ventricosus BRONN. COSTA, 1866, pl. 4, figs. 9-11.

Conus ventricosus BRONN. HOERNES and AUINGER, 1879, pl. 6, figs. 5a, b, 6a, b [pl. 1, figs. 6, 7 may also be synonyms].

Conus bitorosus FONTANNES, 1880, p. 146 [pl. 8, fig. 12a, b; FONTANNES, 1880, p. 85; SACCO, 1893, p. 108, pl. 10, fig. 19].

Conus perpinianus FONTANNES, 1880, p. 148, pl. 8, fig. 14; Fontannes, 1880, p. 86.

Conus betulinoides LAMARCK var. *pusilla* MYLIUS, 1891, p. 9, fig. 1.

Conus falloti MAYER-EYMAR, 1890, p. 294; MAYER EYMAR, 1891, p. 327-328, pl. 9, fig. 1 [two views].

Conus saucatsensis MAYER-EYMAR, 1890, p. 297; MAYER-EYMAR, 1891, p. 333, 334, pl. 10, fig. 3 [two views].

Conus bitorosus var. *tauroantiqua* SACCO, 1893, p. 108, pl. 10, fig. 20; var. *elatoastensis* SACCO, 1893, p. 109, pl. 10, fig. 21; var. *crassovata* SACCO, 1893, p. 109, pl. 10, fig. 22; var. *exventricosa* SACCO, p. 109, pl. 10, fig. 22 bis; var. *perpiniana* (FONTANNES) SACCO, 1893, p. 109, pl. 10, fig. 23; var. *pliotransiens* SACCO, 1893, p. 110, pl. 10, fig. 24a, b; var. *exilior* «(DODERLEIN)» [*exilior* DODERLEIN, *nomen nudum*] SACCO, 1893, p. 110, pl. 10, fig. 26.

Conus avellana var. *pusilla* (MYLIUS) SACCO, 1893, p. 102, pl. 9, fig. 6. [The type of *Conus betulinoides* var. *pusilla* MYLIUS is close to *C. bitorosus* in appearance but it is also similar to *Conus subtextilis* ORBIGNY new name for *textilis* BELL. & MICH]. Other specimens, if found, may more accurately determine the true relationships, but until they are found *C. pusilla* MYLIUS will be considered a variant of *C. bitorosus.*

[?] *Conus tauroventricosus*? and varieties *miovoeslauensis* and *magolapugyensis* SACCO, 1893, p. 107, 108, pl. 10, fig. 18 [questionably placed here as variants of *C. bitorosus*].

Conus mediterraneus var. *depressissima* SACCO, 1893, p. 105, pl. 10, fig. 8; var. *miosubscalarata* SACCO, 1893, p. 104, pl. 10, fig. 3.

Conus avellana LAMARCK. SACCO, 1893, p. 101, pl. 9, fig. 60 [selected as neotype by Sacco, but does not agree with comparative material used by Lamarck when describing his species].

Conus avellana var. *pseudofusata* SACCO, 1893, p. 102, pl. 9, fig. 61, var. *pseudoplanata* SACCO, 1893, p. 102, pl. 9, fig. 63; var. *pseudocanaliculata,* SACCO, 1893, p. 102, pl. 9, fig. 64; var. *pseudoturbinata* SACCO, 1893, p. 103, pl. 9, fig. 65; var. *longoturbinata* SACCO, 1893, p. 102, pl. 9, fig. 66; var. *pseudogibbosa* SACCO, 1893, p. 103, pl. 9, fig. 67.

Conus parvus var. *taurocrassulosa* SACCO, 1893, p. 97, pl. 9, fig. 42; var. *anomalocrassulosa* SACCO, 1893, p. 97, pl. 9, fig. 43.

Conus (*Chelyconus*) *pelagicus* BROCCHI. CERULLI-IRELLI, 1910, p. 49, pl. 4, fig. 49.

Conus (*Dendroconus*) *falloti* MAYER-EYMAR. PEYROT, 1930, p. 100; PEYROT, 1931, pl. 2, figs. 27, 28.

Conus (*Leptoconus?*) *saucatsensis* MAYER-EYMAR. PEYROT, 1930, p. 119; PEYROT, 1931, pl. 1, figs. 4, 5.

Conus (*Chelyconus*) *gallicus* MAYER-EYMAR. PEYROT, 1930, p. 110-112; Peyrot, 1930, pl. 3, figs. 2, 3.

Conus sp. STRAUSZ, 1954, p. 113, pl. 7, fig. 145.

Description — Shell small to moderate (23-45 mm long). Body whorl robust with nearly straight sides to somewhat fig-shaped, spiral ridges near anterior 1/4, smooth otherwise. Aperture wide and flaring, outer part inflated or convex. Shoulder angular but smooth becoming sub-rounded. Spire low to moderate height, whorls grooved or channelled and striate, straight or weakly concave.

Holotype — *Conus bitorosus* Fontannes, 1880, pl. 8, fig. 12a, b. From Perpignan, France; « argile plioc.; Argilles sableuses », Pyrenees-Orientales; environs of Millas (Fontannes, 1880).

Hypotype — UCLA catalogue numbers 39402, 39404, and 39405.

Distribution — Aquitanian, Burdigalian, Pliocene, France; Miocene, Portugal; Helvetian-Tortonian, Austria; Middle Miocene to Pliocene, Italy; Late Miocene, Hungary.

Remarks — Further investigation may prove that *C. puncticulatus* Grateloup (1847, pl. 44, fig. 16) [*non puncticulatus* Hwass *in* Bruguière, 1792] = *nisus* Orbigny, 1852 [*non nisus* Dillwyn, 1817] = *ozennii* Crosse, 1858 [new name for *nisus* « Michelotti » (Crosse must have meant Orbigny)] is equal to *C. bitorosus,* and *C. ozennii* Crosse, 1858 would become the valid specific name for *C. bitorosus.* At the present time there seems to be enough difference between the spires of *C. ozennii* and *C. bitorosus* to warrant two species.

Subsequent study may prove that *C. bitorosus* Fontannes, 1880 is equal to *Chelyconus rotundus* Höernes and Auinger, 1879. The closest affinity of *C. rotundus* is *C. bitorosus,* yet there are enough differences to warrant separation. Since Hoernes and Auinger consider *C. rotundus* to be distinct from *C. ventricosus* Bronn [*non C. ventricosus* Gmelin] in their monograph, and their latter species seems to be similar to *C. bitorosus,* perhaps *C. rotundus* is a distinct species. If it is equal to *C. bitorosus,* which I doubt, and if *C. ozennii* Crosse is distinst from *C. bitorosus,* which I believe, then *C. rotundus* would be the valid species.

The shape, coloration, and markings of *C. ventricosus* Gmelin (1791) [= *C. mediterraneus* Hwass *in* Bruguière (1792), *fide* Dautzenberg (1920, p. 333) and A J. Kohn (written communication, 1965)] are extremely variable. The specimens of *C. mediterraneus* and *C. franciscanus* in Lamarck's collection at Geneva are very different in appearance, yet they are considered by authors as the same but variable species. Thus, it is difficult to determine which fossil species are synonyms or possibdy ancestral because variants may be nearly identical with variants of several fossil species.

The variants of *C. mediterraneus* figured by Bucquoy and Dautzenberg (1887, pl. 13, figs. 12, 13, 14, 15) are close to *C. pyrula* Brocchi; however, the striations at the anterior of the specimens of Bucquoy and Dautzenberg are not as pronounced as those of *C. pyrula* nor are the shoulders as rounded, therefore, they are considered distinct species. The specimen of *C. mediterraneus* shown in figure 11 [Bucquoy and Dautzenberg (1887, pl. 13)] does not have any striations and is shorter than the variants, thus the presence or absence, and the strenght or weakness of the striations, may be such a variable characteristic that it is not always suitable for specific differentiation. The specimens of *C. argillicola* Eichwald (1830, 1859) [not the specimens figured by Friedberg (1928)] are similar to *C. ventricosus* Gmelin [= *C. mediterraneus*]. The striations at the base are present or absent on specimens of *C. argillicola* Eichwald.

Conus ventricosus Bronn, 1831 [? = *C. ventricosus* Gmelin, 1791; both species equal to *C. mediterraneus* Hwass *in* Bruguière *fide* authors in Tomlin, 1937, p. 326, 327)] is equal to *C. vindobonensis* Partsch [Partsch *in* Hörnes] according to Hörnes (1851, p. 32). However, the type of *C. ventricosus* Bronn cannot be found (written communication, R. Kraatz, Geologisch-paläontologisches Inst. Universität Heidelberg, 1964) so that a comparison cannot be made with *C.*

EXPLANATION OF PLATE 23

Figs. 1, 7 - *Conus bitorosus* Fontannes. Number 2743, collection of Mayer-Emar, Eidg. Tech. Hoch. Geol. Institut, Zürich. Holotype of *C. falloti* Mayer-Eymar. Saucats, Langhian 1b of Mayer-Eymar (Aquitanian). Length, 31,2 mm; width, 18.5 mm. Page 136.

2 - *Conus bitorosus* Fontannes. UCLA hypotype number 39402; UCLA locality number 4926. Baldissero. Upper Burdigalian. Length, 23.2 mm. Page 136.

3, 4 - *Conus bredai* Michelotti. Neotype. Number 175, collection of Sacco; *Stephanoconus bredai tauroscalarata* Sacco. Possibly from Baldissero, Upper Burdigalian. Length, 33.2 mm; width, 20.9 mm. Page 139.

5, 10 - *Conus brocchii* Bronn. Number 1043, Museo Civico di Storia Naturale, Milano. Type of *Conus deperditus* Bruguière in Brocchi [non *deperditus* Bruguière, 1792]. San Luca (Bologna), Pliocene. Page 140.

6 - *Conus brocchii* Bronn. UCLA hypotype number 39403; UCLA locality number 4930, Villa Cochis. Uppermost Burdigalian (?). Length, 24.6 mm; width, 11.3 mm. Page 140.

8 - *Conus bitorosus* Fontannes. UCLA hypotype number 39404; UCLA locality number 4926, Baldissero. Upper Burdigalian. Length, 32.7 mm; width, 20.4 mm. Page 136.

9 - *Conus bitorosus* Fontannes. Number 158, collection of Sacco; *C. avellana pseudoturbinata* Sacco. Baldissero. Upper Burdigalian. Length, 31.3 mm; width, 20.0 mm. Page 136.

11, 18 - *Conus berghausi* Michelotti. Collection of Grateloup, Faculté des Sciences, Bordeaux; paratype of *Conus maculosus* Grateloup. Orthez, France. Helvetian. Length, 23,4 mm; width, 14.6 mm. Page 135.

12 - *Conus brocchii* Bronn. Number 29, collection of Sacco type of *Leptoconus allionii* var. *perconicospirata* Sacco. Torino, Middle Miocene. Length, 28.5 mm; width, 11.9 mm. Page 140.

13 - *Conus bitorosus* Fontannes. UCLA hypotype number 39405; UCLA locality number 4930, Villa Cochis. Uppermost Burdigalian (?). Length, 30.6 mm; width, 18.0 mm. Page 136.

14 - *Conus bitorosus* Fontannes. Number 165, collection of Sacco; type of *C. bitorosus* var. *antiqua* Sacco. Baldissero. Upper Burdigalian. Length, 36.1 mm; width, 20.3 mm. Page 136.

15 - *Conus bitorosus* Fontannes. Number 153, collection of Sacco; specimen is type of *C. avellana* [*i.e.* selected by Sacco as the neotype] Lamarck *in* Sacco. Baldissero or Sciolze. Upper Burdigalian. Length, 27.7 mm; width, 16.4 mm. Page 136.

16 - *Conus bitorosus* Fontannes. Number S 2944, collection of Mayer-Eymar, Eidg. Tech. Hoch. Geol. Institut, Zürich. Paratype of *C. saucatsensis* Mayer-Eymar. Saucats (Bordeaux). U. Langhian of Mayer-Eymar (? Burdigalian). Length, 35.0 mm; width, 19.5 mm. Page 136.

17 - *Conus bitorosus* Fontannes. Number 164, collection of Sacco. Albugnano or Baldissero, ? Burdigalian. Length, 35.7 mm; width, 23.9 mm. Page 136.

19 - *Conus bitorosus* Fontannes. Number S 2944, collection of Mayer-Eymar, Eidg. Tech. Hoch. Geol. Institute, Zürich. Holotype of *C. saucatsensis* Mayer-Eymar. Saucats (Bordeaux). U. Langhian of Mayer-Eymar (? Burdigalian). Length, 37.6 mm; width, 20.0 mm. Page 136.

20 - *Conus bitorosus* Fontannes. Number 159, collection of Sacco; type of *C. avellana* var. *longoturbinata* Sacco. Torino, Middle Miocene. Length, 31.6 mm; width, 18.7 mm. Page 136.

21 - *Conus bitorosus* Fontannes. Number 16, collection of Sturani, Torino. UCLA locality 4926, Baldissero. Upper Burdigalian. Length, 37.4 mm; width, 24.0 mm. Pag. 136.

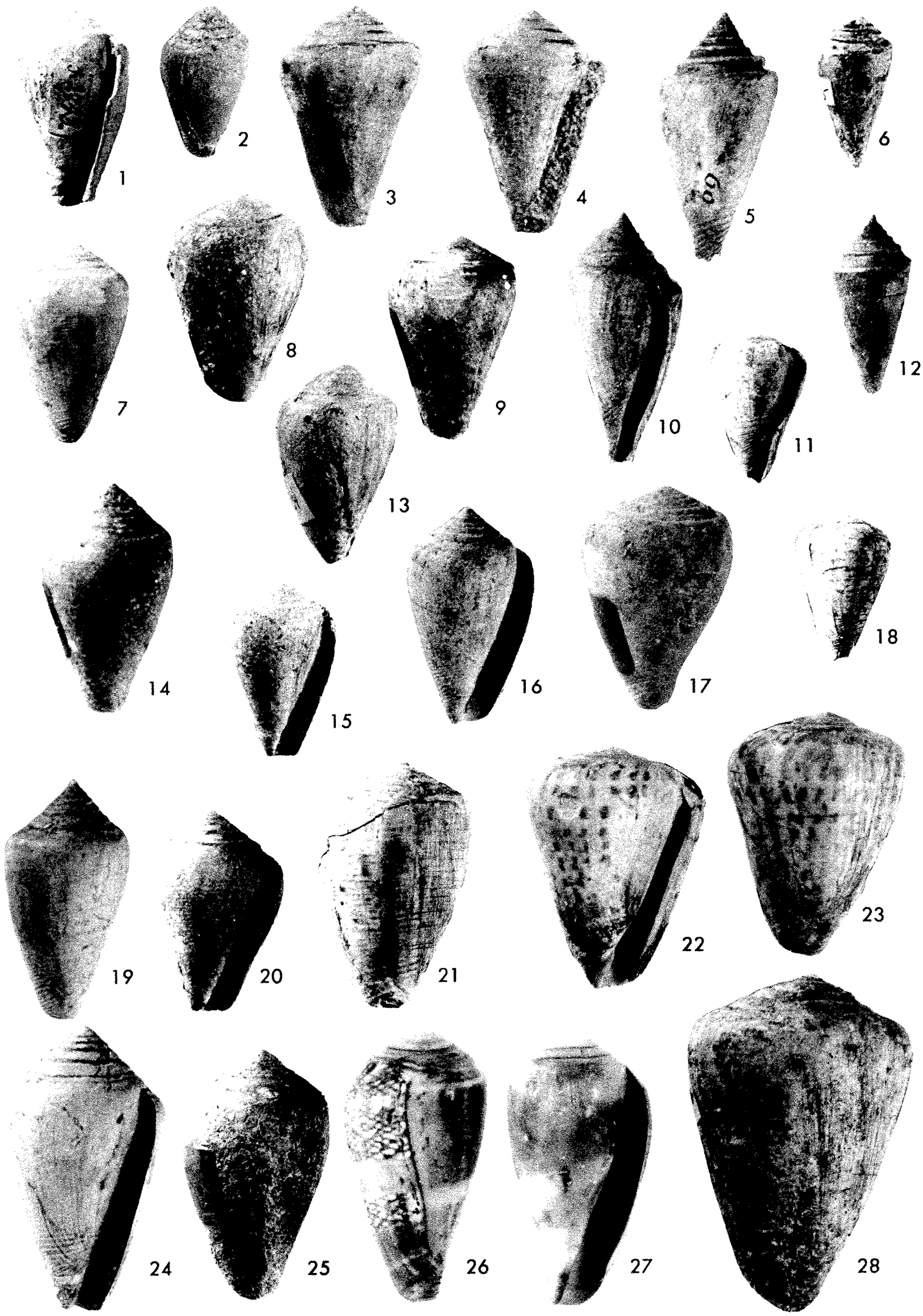
22, 23 - *Conus berghausi* Michelotti. Collection of Sacco; type of *Dendroconus berghausi* var. *percommunis* Sacco, 1893, p. 10, pl. 1, fig. 16. Stazzano, Tortonian. Length, 36.9 mm; width, 26.1 mm. Page 135.

24 - *Conus bitorosus* Fontannes. Collection of Sacco; type of *C. bitorosus* var. *elatoastensis* Sacco, 1893, pl. 10, fig. 21. Astigiana, Astian. Length, 45 mm; width, 25.7 mm. Page 136.

25 - *Conus bitorosus* Fontannes. Number 158, collection of Sacco; type of *C. avellana* var. *pseudoturbinata* Sacco. Baldissero. Upper Burdigalian. Length, 38.5 mm; width, 22.5 mm. Page 136.

26, 27 - *Conus mercator* Linnaeus. Catalogue number 101, Lamarck no. 86. Type of *Conus mercator* var. *D* Lamarck. Indian Ocean. Length, 42.0 mm; width, 22.0 mm. Lamarck in his description of *C. avellana* [the type is now missing] compared his *C. avellana to C. mercator.* It is included here to show the lack of similarity between this species and what Sacco considered as *C. avellana.*

28 - *Conus berghausi* Michelotti. UCLA hypotype number 39406; UCLA locality number 4926, Baldissero. Upper Burdigalian. Length, 51.9 mm; width, 33.7 mm. Page 135.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vindobonensis. Thus, *C. vindobonensis* might be selected as a possible new name for *C. ventricosus* Bronn [*C. ventricosus* Bronn, preoccupied], with *C. ventricosus* Bronn *in* Hörnes (1856, pl. 3, figs. 5a, b, c) as lectotype [figs. 6a, b, c = *C. mercati*; figs. 7a, b = *C. vindobonensis;* and fig. 8 = *C. ventricosus* Gmelin]. However, *C. argillicola* Eichwald [*non Friedberg*], *C. vindobonensis* Hörnes [in part *C. ventricosus* Bronn *in* Hörnes] and *C. ventricosus* Gmelin are sufficiently similar to be considered the same species.

If the view is taken that living species should have different specific names from fossil species then *C. argillicola* Eichwald (1830) would be the fossil and ancestral form of the living *C. ventricosus* Gmelin (1791). It is likely that *C. ventricosus* Gmelin (or its ancestral fossil form) evolved in the Polish-Austrian region during the Late Miocene. The marine temperatures in the region were doubtless lower than those in Piedmont during the Middle and Late Miocene. With the retreat of the Tertiary seas from Poland and continued cooling, the tropical faunal elements of Piedmont moved southward into tropical regions, while *C. ventricosus* moved southward into a temperature regime not unlike the one it occupied during the latter part of the Tertiary Period.

C. bitorosus can be distinguished from *C. ventricosus* by its flattish or weakly convex channelled spiral whorls; *C. ventricosus* Gmelin has convex spiral whorls.

CONUS BREDAI Michelotti, 1847

Pl. 23, figs. 3, 4

Conus bredai MICHELOTTI, 1847, p. 345, pl. 13, figs. 15, 17.

Stephanoconus bredai (MICHELOTTI), SACCO, 1893, p. 118, pl. 11, figs. 17 and 17 bis [fig. 17 = fig. 15 of MICHELOTTI; fig. 17 bis = fig. 17 of MICHELOTTI].

Stephanoconus bredai var. *tauroscalarata* SACCO, 1893, p. 118, pl. 11, fig. 18; var. *subaturbinata* SACCO, 1893, p. 118, pl. 11, fig. 19; [*non* pl. 11, fig. 20, SACCO, 1893 = *C. parvicaudatus* SACCO].

Description — Shell short. Body whorl narrowing at base, pinched below shoulder. Aperture straight. Shoulder weakly coronate with closely spaced tubercles, ultimate spiral whorl horizontal or with a slope. Spire straight, low very weakly coronate, spiral whorls convex, scalariform, not grooved or channelled, and weakly striate.

Neotype — *Conus bredai,* pl. 23, figs. 3, 4. Sacco (1893, explanation of pl. 11, figs. 17, 17 bis) states that his figure 17 [*i.e.* his 17a, 17b] is the specimen figured by Michelotti (1847, pl. 13, fig. 15); however, Sacco's figure and that of Michelotti do not agree and no specimens in the Turin collection agree with Michelotti's type. Sacco also states in his explanation of plate 11 that his figure 17 bis is the same specimen as figured by Michelotti (1847, pl. 13, fig. 17) — those figures agree. The specimens represented by the figures mentioned above are missing [all of the types of Michelotti are missing, they are not in Turin, at the Istituto de Geologia dell'Università di Roma (*fide* written communication to Prof. Malaroda, Turin, from Prof. B. Accordi), nor are they at the Servizio Geologico d'Italia, Roma (*fide,* written communication to Prof. Malaroda from E. Beneo)] and *Stephanoconus bredai* (Micht.) var. *tauroscalarata* Sacco, 1893, p. 118, pl. 11, fig. 88 is selected from the collection of Sacco at the Istituto di Geologia dell'Università di Torino as the neotype. The missing type is from Baldissero, the only locality for the neotype given by Sacco is the hills of Turin. Burdigalian.

Distribution — Middle Miocene, Burdigalian, Italy.

Remarks — Distinguished from *Conus parvicaudatus* by a spire which is coronate and without grooves, the body whorl outline is the same. Distinguished from *C. gastaldii* by the presence of its pinched body whorl

and from *C. subnicobaricus* Orbigny by its more closely spaced tubercles and more pinched and less elongate body whorl. Because of the lack of sufficient material it was not possible to study the variability between *C. bredai, C. gastaldii,* and *C. subnicobaricus.* These species are considered to be distinct but because these coronated forms occur at or near the same horizon one wonders if they are not possibly variants of a single species.

CONUS BROCCHII Bronn, 1828
Pl. 23, figs. 5, 6, 10, 12

Conus deperditus BRUGUIÈRE. BROCCHI [*non deperditus* BRUGUIÈRE, 1792] 1814, p. 292, pl. 3, fig. 2; BRONGNIART, A., 1823, p. 61, pl. 3, figs. 1a, b.

Conus brocchii BRONN, 1828, p. 740; FONTANNES, 1880, p. 149, pl. 8, fig. 15.

Conus brocchii BRONN. 1831, p. 12.

Conus brocchii BRONN. HÖRNES, 1845 [emendation of *brocchii* BRONN, 1831], p. 795.

Conus allionii MICHELOTTI, 1847, p. 338, pl. 17, fig. 17; BEYRICH, 1853, p. 24, 25, pl. 1, figs. 4?, 5, 6.

Conus discors MICHELOTTI, 1847, p. 338 [holotype figured as a var. by Sacco].

Conus oblitus MICHELOTTI, 1847, p. 340, pl. 14, fig. 2, 2'.

Conus dujardini DESHAYES. HÖRNES, 1856, pl. 5, figs. 7a, b, c.

Leptoconus brocchii (BRONN). SACCO, 1893, p. 30, pl. 4, figs. 1a, b [=holotype], 1 bis.

Leptoconus brocchii var. *antediluvianoides* SACCO, 1893, p. 31, pl. 4, fig. 2; var. *fusulospirata* SACCO, 1893, p. 31, pl. 4, fig. 3; var. *crassospirata* SACCO, 1893, p. 31, pl. 4, fig. 4; var. *brevidepressula* SACCO, 1893, p. 32, pl. 4, fig. 5.

Leptoconus allionii (MICHELOTTI). SACCO, 1893, p. 32, pl. 4, fig. 6a, b, c.

Leptoconus allionii var. (?) *granulocatenata* SACCO, 1893, p. 33, pl. 4, fig. 7; var. *conicospirata* SACCO, 1893, p. 33, pl. 4, fig. 8; var. *perconicospirata* SACCO, 1893, p. 33, pl. 4, fig. 9; var. *discors* (MICHELOTTI), SACCO, 1893, p. 34, pl. 4, fig. 10; var. *pupoidespira* SACCO, 1893, p. 34, pl. 4, fig. 11; var. *perpupoidespira* SACCO, 1893, p. 34, pl. 4, fig. 12; var. *oblita* (MICHELOTTI) SACCO, 1893, p. 34, pl. 4, fig. 13, 13 bis [not the holotype of Michelotti]; var. *perfuniculata* SACCO, 1893, p. 35, pl. 4, fig. 14.

Conus malaccanus HWASS in BRUGUIÈRE. NOETLING, 1901, p. 360, pl. 23, figs. 17, 17a, 18, 19, 19a.

Conus (*Leptoconus*) *petrolei* MARTIN, 1933, p. 17, pl. 2, figs. 9, 9a.

Conus (*Conospira*) *brocchii* BRONN. RONCHETTI, 1955, p. 288, fig. 154.

Description — Shell size moderate (20-40 mm). Body whorl weakly striate or smooth becoming deeply striate and with rather broad spiral ridges near the base, rarely pustulose, with straight sides, narrow at base. Aperture straight and with only slight flare at base. Shoulder angular and with smooth inflated raised edge or ridge at periphery. The top of the ultimate whorl is concave. Spire low to moderately high, pointed to nipple-like; whorls not drawn out, marked at peripheries by raised or inflated edge, concave, underside of periphery of whorls near apex rarely weakly beaded and with spiral striae.

Holotype — Plate 23, figs. 5, 10. Collection of Brocchi, Museo Civico di Storia Naturale, Milano, n. 1043 or n. 60; Pliocene, Bologna, type figured by Ronchetti, 1955, p. 288, fig. 154.

Hypotype — UCLA catalogue number 39403.

Distribution — France, Pliocene; North Germany, Miocene; Austria, Vindobonian; Italy, Burdigalian (?), Helvetian to Astian; Burma, Miocene; Boeton Island (Banda Sea), Late Miocene (?).

Remarks — Distinguished from *C. antidiluvianus* by the more common presence

of concave spiral whorls and by the smooth and inflated or slightly raised angular edge of the whorls. Very rarely (1 out of 100) some of the variant forms may have weak beading several whorls below the apex.

The types of *C. brocchii* Bronn and *Conus allionii* Michelotti were compared and there is no doubt that these are the same species; although, previously one was supposed to be restricted to the Pliocene and the other to the Miocene, respectively.

Conus (*Leptoconus*) *imitator lius* Woodring (1928), pl. 10, fig. 5) from the Middle Miocene of Jamaica is very close to *C. brocchii* Bronn.

CONUS CANALICULATUS Brocchi, 1814

Pl. 24, figs. 4-9

Conus canaliculatus BROCCHI, 1814, v. 2, p. 636, pl. 15, fig. 28 [*non canaliculatus* RÖDING, 1798 *nomen nudum, fide* Tomlin, 1937, p. 224].

Conus exaltatus EICHWALD, 1830, p. 222; EICHWALD, 1853, p. 208, pl. 9, figs. 3a, b, c.

Conus bronni MICHELOTTI, 1847, p. 339, pl. 14, fig. 3.

Conus turritus LAMARCK. GRATELOUP, 1847, pl. 45, figs. 12, 15, 19 [because the type of *C. turritus* LAMARCK, 1803, is missing there is no way of telling if *C. turritus* LAMARCK and *C. turritus* GRATELOUP are equal. Orbigny thought not and gave a new name to *C. turritus* GRATELOUP].

Conus subturritus ORBIGNY, 1852, p. 57 [new name for *C. turritus* GRATELOUP].

Conus dujardini DESHAYES. BEYRICH, 1853, p. 23, pl. 1, fig. 3; HÖRNES, 1856, pl. 5, figs. 3a, b, c [one specimen], 3d, and questionably 3e, 3f; COSTA, 1866, pl. 9, figs. 3 through 13, 14a, b, c, 15, 16a, b, 17; FRIEDBERG, 1911-28, p. 48, fig. 9.

Conospirus bronni (MICHT.). SACCO, 1893, p. 48, pl. 5, fig. 8.

Conospirus bronni var. *stazzanensis* SACCO, 1893, p. 48, pl. 5, fig. 9; questionably var. *evolutospira* SACCO, 1893, p. 48, pl. 5, fig. 9; questionably var. *evolutospira* SACCO, 1893, p. 49, pl. 5, fig. 10; var. *crassocolligens* SACCO, 1893, p. 49, pl. 5, fig. 11; var. *depressoastensis* SACCO, 1893, p. 49, pl. 5, fig. 12; var. *subbiconica* SACCO, 1893, p. 49, pl. 5, fig. 13; var. *obtusangulata* SACCO, 1893, p. 50, pl. 5, fig. 14; [?] var. *fusoliva* SACCO, 1893, p. 51, pl. 5, fig. 20; var. *taurotransiens* SACCO, 1893, p. 51, pl. 5, fig. 18; var. *subascalarata* SACCO, 1893, p. 51, pl. 5, figs. 19a, b and 19 bis a, b.

Leptoconus brocchii? var. *excanaliculata* SACCO, 1893, p. 31 [Sacco points out that *canaliculatus* BROCCHI is not *canaliculatus* CHEMNITZ, 1795; however, the names of Chemnitz, 1795, are invalid, *fide* ICZN].

Conospirus antidiluvianus var. *transiens* SACCO, 1893, pl. 4, figs. 44a, b.

Conospirus dujardini var. *astensis* SACCO, 1893, p. 47, pl. 5, figs. 7a, 7b.

Conus (*Conospira*) *subturritus* ORBIGNY. PEYROT, 1930, p. 19; PEYROT, 1931, pl. 1, figs. 8, 10, 17, 28, 35, 36.

Conus (*Conospira*) *dujardini* DESHAYES. STRAUSZ, 1954, p. 113, pl. 7, fig. 144.

Conus (*Conolithus*) *dujardini* var. *brezinae* HOERNES and AUINGER. KOJUMDGIEVA and STRACHIMIROV, 1960, pl. 49, figs. 7a, b.

Description — Shell small (21-30 mm long), elongate. Body whorl moderately elongate, pronounced grooves near base and lower half of shell, finer striae near shoulder, central part smooth or with fine striations. Aperture straight and narrow. Shoulder angular, dropped, sloping and weakly concave or nearly flat. Spire high, concavely elevated, striate whorls above sutures, spiral whorls of similar shape to shoulder, weakly beaded near apex.

Holotype — Apparently missing from the Brocchi collection (*fide* Ronchetti, 1955, p. 5), Museo Civico di Storia Naturale di Milano.

Neotype — Plate 24, figs. 6, 7. Number 1032, Brocchi collection, Museo Civico di Storia Naturale di Milano. Valle d'Andona, Pliocene (Astian).

Hypotype — UCLA catalogue number 39407.

Dimensions of Neotype — Height, 21.7 mm; width, 9.1 mm.

Distribution — France, Miocene; North Germany, Miocene, Burdigalian, Tortonian, Plaisancian Astian; Portugal, Miocene; Austria, Vindobonian; Poland, Tortonian; Hungary, Tortonian; Bulgaria, Tortonian.

Remarks — *Conus canaliculatus* Brocchi can be distinguished from *C. antidiluvianus* by the almost complete lack of beading on

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EXPLANATION OF PLATE 24

Fig. 1 - *Conus gallicus* Mayer-Eymar. Number 69, collection of Sturani, Torino. UCLA locality 4929, Termofourà. Termofourà Fm., Burdigalian. Length, 24.9 mm; width, 13.2 mm. Page 146.

2 - *Conus gallicus* Mayer-Eymar. Collection of Sacco; holotype of *Conus lineatus* Borson, 1820 [non *C. lineatus* Solander 1766] [= *Dendroconus betulinoides* var. *exlineata* Sacco, 1893, p. 5, pl. 1, fig. 4]. Astigiana, Astian. Length, 54.4 mm; width, 31.1 mm. Page 146.

3 - *Conus dujardini* Deshayes. Number 42, collection of Sacco; type of *Conospirus dujardin* var. *taurostriolata* Sacco. Monte dei Cappuccini. Lower Helvetian. Length, 24.6 mm; width 9.3 mm. Page 143.

4 - *Conus canaliculata* Brocchi. Number 54b, collection of Sacco; type of *Conospirus bronni subascalarata* Sacco. Baldissero. Upper Burdigalian. Length, 23.9 mm; width, 9.0 mm. Page 141.

5 - *Conus canaliculatus* Brocchi. UCLA hypotype number 36407; UCLA locality 4929, Termofourà. Termofourà, Fm., Burdigalian. Length, 23.9 mm; width, 9.3 mm. Page 141.

Figs. 6, 7 - *Conus canaliculatus* Brocchi. Number 1032, collection of Brocchi, Museo Civico di Storia Naturale, Milano. Holotype apparently missing from the Brocchi collection. This specimen is selected as the neotype. Valle Andona, Astian. Length, 21.7 mm; width, 9.1 mm. Page 141.

8, 9 - *Conus canaliculatus* Brocchi. Collection of Sacco; type of *Conospirus bronnii* var. *stazzanensis* Sacco, 1893, pl. 5, fig. 9. Stazzano, Tortonian. Length, 29.2 mm; width, 11.1 mm Page 141.

10, 11 - *Conus gallicus* Mayer-Eymar. Collection of Sacco; paratype of *C. lineatus* Borson [= *Dendroconus betulinoides* var. *exlineata* Sacco, 1893, pl. 1, fig. 4 bis]. Vezza d'Alba, Astian. Length, 25 mm; width, 13.5 mm. Page 146.

12, 13 - *Conus gallicus* Mayer-Eymar. Number 2648, collection of Mayer-Eymar, Eidg. Tech. Hoch. Geol. Institut, Zurich. Holotype of *Conus vasserui* Mayer-Eymar. Saucats (Bordeaux), Langhian (of Mayer-Eymar). Length, 21.5 mm; width, 11.2 mm. Page 146.

14, 15 - *Conus pyrula* Brocchi. Collection of Grateloup; type of *C. avellana* var. *A* Grateloup, 1847, pl. 2, fig. 5, « Dax-Saubrigues ». Burdigalian?. Length, 36.9 mm; width, 18.2 mm.

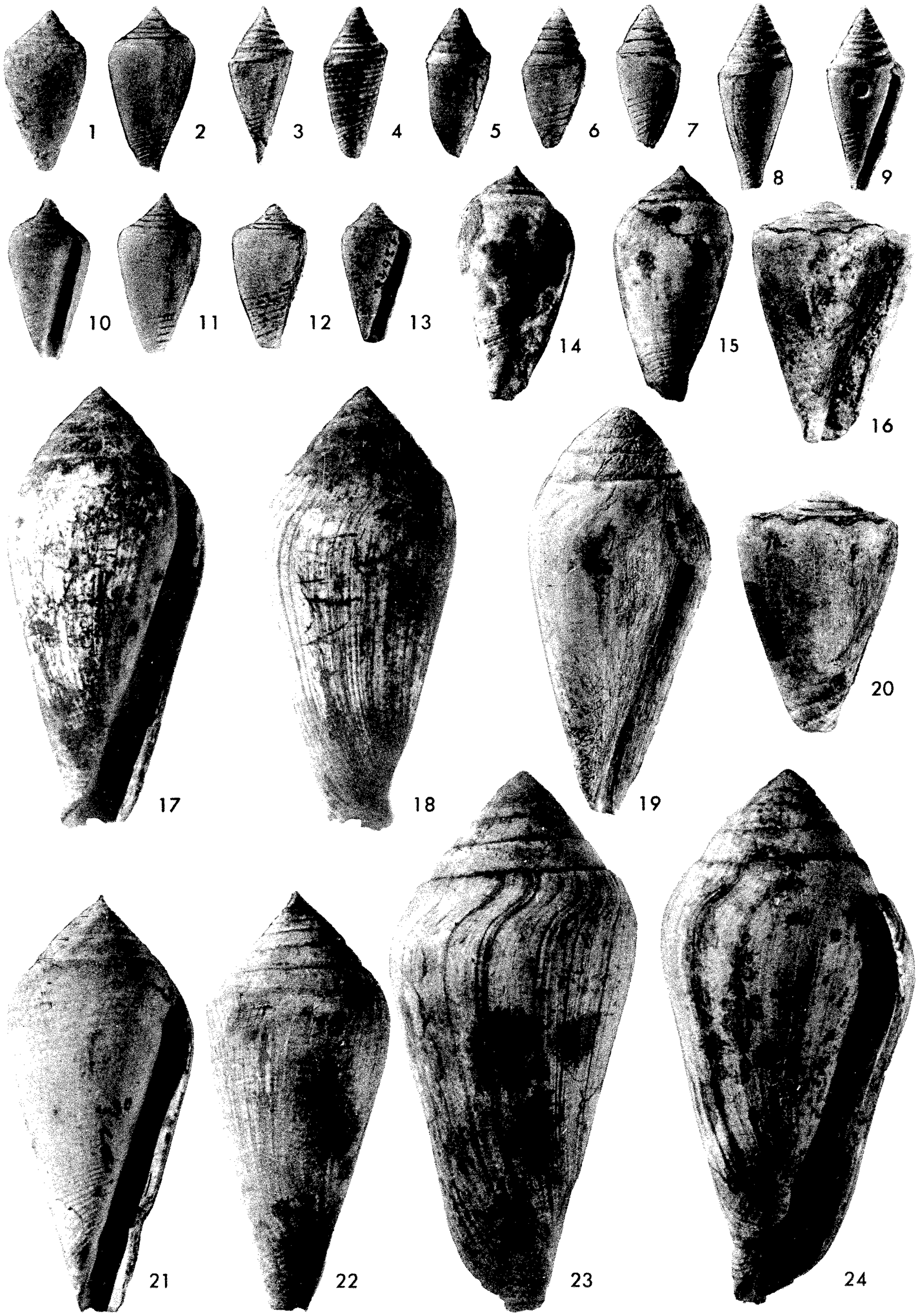
16, 20 - *Conus gastaldii* Michelotti. Holotype. Number 169, collection of Sacco; type of *Conus imperialis* in Bellardi and Michelotti 1840 [*non imperialis* Linnaeus 1758]; = holotype of *C. gastaldii* Michelotti 1847; = type of *Stephanoconus gastaldii* in Sacco. Torino, Middle Miocene. Length, 36.7 mm; width, 23.7 mm. Page 147.

17, 18 - *Conus clavatulus* Orbigny. Collection of Grateloup, Faculté des Sciences, Bordeaux; *C. noe* Brocchi *in* Grateloup, 1847, pl. 2, fig. 3. « Dax-Saugrigues ». ? Burdigalian. Length, 72 mm; width, 31.5 mm. Page 143.

19 - *Conus clavatulus* Orbigny. Number 85, collection of Sacco; type of *C. marii perglandiformis* Sacco. Torino, Middle Miocene. Length, 64.8 mm; width, 27.0 mm. Page 143.

21, 22 - *Conus clavatulus* Orbigny. Collection of Grateloup; type of *C. noe* Brocchi var. *B* Grateloup, 1847, pl. 1, fig. 10. « Dax-Saubrigues ». Burdigalian ?. Length, 67.8 mm; width, 29.2 mm. Page 143.

23, 24 - *Conus clavatulus* Orbigny. Collection of Grateloup; type of *C. clavatus* Lamarck var. *B* in Grateloup, 1847, pl. 2, fig. 4 [= the type of *C. clavatulus* Orbigny] « Dax-Saubrigues ». Burdigalian?. Length, 83.4 mm; width, 37.9 mm. Page 143.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the early whorls and the absence of a very narrow drawn-out anterior part of the body whorl. The spiral whorls of *C. canaliculatus* are flat-topped with more slope and without any hint of a raised periphery.

Conospirus bronnii? var. *fusoliva* Sacco (1893, p. 51, pl. 5, fig. 20) is questionably included under this species.

Some of the variants of *C. canaliculatus* closely approach *C. atractus* Tomlin [new name for *C. fusiformis* Lamarck, *non fusiformis* G. Fischer] figured in Kiener, 1845-50, pl. 76, fig. 3 (?from the Pacific Ocean, *fide* Kiener, p. 195).

There are strong similarities between *Conus* (*Chelyconus*) *marginatus* Sowerby var. *boussaci* Cossmann (1915, pl. 3, fig. 16) from the Miocene of Martinique and the specimen figured by Sacco (1893, pl. 5, fig. 19) as *C. bronni* var. *subascalarata* [= *C. canaliculatus*].

CONUS CLAVATULUS Orbigny, 1852

Pl. 24, figs. 17-19, 21-24

[?] *Conus noe* BROCCHI. BRONGNIART, 1823, p. 61, pl. 3, fig. 2 [From Turin].

Conus clavatus LAMARCK var *B.* GRATELOUP, 1847. pl. 44, fig. 4 [*non clavatus* LAMARCK, 1810].

CONUS *noe* BROCCHI. GRATELOUP, 1847, pl. 44, fig. 3.

Conus noe var. *B.* GRATELOUP, 1847, pl. 43, fig. 10.

Conus clavatulus ORBIGNY, 1852, p. 11, no. 166 [new name for *C. clavatus* GRATELOUP].

Conus baldus ORBIGNY, 1852, p. 11, no. 172 [new name for *C. noe* GRATELOUP].

Conus noae BROCCHI var. *ruscinensis* FONTANNES, 1880, p. 142, pl. 8, fig. 9.

[?] *Chelyconus marii* var. *perglandiformis* SACCO, 1893, p. 63, pl. 6, fig. 9.

Conus (*Chelyconus*) *clavatulus* ORBIGNY. PEYROT, 1931, pl. 4, fig. 1 [= *C. noe* GRATELOUP, pl. 43, fig. 10].

Conus (*Chelyconus*) *clavatulus* ORBIGNY. PEYROT, 1931, pl. 4, figs. 3, 5 [=*C. clavatus* GRATELOUP, pl. 44, fig. 4].

Conus (*Chelyconus*) *umbgrovei* MARTIN, 1933, p. 18, pl. 2, fig. 10.

Description — Shells large (70 mm long) and elongate, also rather robust at the shoulder. Body whorl striate, straight except for siphonal bend at the anterior. Aperture narrow and straight with a flare at the anterior due to the bend. Shoulder rounded and smooth. Spire moderately high, convex, striate, and whorls not raised.

Holotype — Collection of Grateloup, Laboratoire de Géologie, Faculté des Sciences, Bordeaux, France. Saubrigues, Burdigalian.

Distribution — Burdigalian? Pliocene, France; ? Burdigalian or? Helvetian, Italy; ? Late Miocene, Boeton Island (Banda Sea).

Remarks — *Conus noe* Brocchi, 1814, is intermediate between *C. clavatulus* and *C. ponderosus*. Future workers may consider *C. noe* a synonym of *C. ponderosus* because of the similarity of striations on the crown or to *C. clavatulus* because of the similarity between their shapes. Because *C. noe* is not as broad, and the spire is more drawn out it is considered here to be distinct from *C. ponderosus*. Because there isn't the bend at the anterior and the presence of prominent striations on the crown it is considered here to be distinct from *C. clavatulus*. Sacco thought that *C. noe* Brocchi, 1814, might be an extreme variant of *C. ponderosus*, an opinion with which I concur.

CONUS DUJARDINI Deshayes, 1845

Pl. 24, fig. 3

Conus antidiluvianus BRUGUIÈRE. DESHAYES, 1824, p. 749; (1837, pl. 98, figs. 13, 14), [Gives Lamarck as author not Bruguière]; DUBOIS, 1831, p. 23, 24, pl. 1, fig. 1.

Conus dujardini DESHAYES, 1845, p. 158; DESHAYES 1839-57 [50], Atlas, pl. 120, fig. 8; HÖRNES, 1851, p. 40-41; HÖRNES,

1856, pl. 5, figs. 5a, b, c. fig. 8a through o [14 different specimens]; FRIEDBERG, 1911-28, p. 47, pl. 2, fig. 11a, b; SORGENFREI, 1958, v. 1, p. 248-249, v. 2, pl. 52, fig. 171.

Conus (*Leptoconus*) *brezinae* HOERNES and AUINGER, 1879, p. 36 [= Hörnes, 1856, pl. 5, fig. 8].

Conus cazioti MAYER-EYMAR, 1890, p. 294; MAYER-EYMAR, 1891, p. 325, 326, pl. 9, fig. 3.

Conospirus dujardini (DESHAYES). SACCO, 1893, p. 45.

Conospirus dujardini var. *taurostriolata* SACCO, 1893, p. 46, pl. 5, figs. 1, 1 bis and 1 ter [1 ter may be a juvenile of *C. antidiluvianus*]; var. *pseudoantediluviana* SACCO, 1893, p. 46, pl. 5, fig. 2; var. *pseudocatenata* SACCO, 1893, p. 46, pl. 5, fig. 3; var. *depressulina* SACCO, 1893, p. 47, pl. 5, fig. 4; var. *taurominor* SACCO, 1893, p. 47, pl. 5, fig. 5; var. *brevi caudata* SACCO, 1893, p. 47, pl. 5, fig. 6.

Conus dujardini var. *exaltatus* (EICHWALD). FRIEDBERG, 1911-28, p. 50, pl. 2, fig. 12,

Conus avellana LAMARCK. FRIEDBERG, 1911-28, p. 56, fig. 10, pl. 2, fig. 20 [*non* fig. 19 = *pyrula*].

Conus (*Conospira*) *dujardini* DESHAYES. PEYROT, 1930, p. 17-19; PEYROT, 1931, pl. 1, figs. 45, 46, 47, 48, 49, 50, 51.

Conus (*Conospira*) *subturritus* ORBIGNY. PEYROT, 1930, p. 21; PEYROT, 1931, pl. 1, fig. 20, 39 [fig. 20?].

Conus (*Conolithus*) *dujardini* DESHAYES. GOTZINGER *et al.*, 1954, pl. 8, fig. 23; KOJUMDGIEVA and STRACHIMIROV, 1960, p. 209, pl. 49, figs. 4a, b.

Description — Shell small to moderate size (22-32 mm long). Body whorl moderately elongate and occasionally pinched or drawn out near the anterior. Deep regularly spaced striations or grooves near the anterior. On the small specimens the striations may cover the body whorl or there are two or three fine striae immediately below the periphery of the shoulder. Rarely covered with postulose ridges. Aperture straight or slightly pinched. Shoulder angular, may be weakly ridged, not dropped, so that the suture between each whorl is very near the periphery or edge of the whorl. Spire is concave, moderately high, with early whorls beaded just above suture, not striate, and whorls flat-topped or weakly concave.

Holotype — *Conus dujardini* Deshayes, from the « faluns de la Touraine . . . », Miocene (*fide* Denizot, 1957, pl. 195), is at the Ecole des Mines, Paris.

Distribution — Miocene, France, northern Germany, Poland, Austria, Italy, Bulgaria; Pliocene, France, Italy.

Remarks — This species is similar in many ways to *C. canaliculatus* Brocchi but does not have spiral whorls with such a pronounced slope and the early whorls are beaded. *C. dujardini* Deshayes may be ancestral to *C. antidiluvianus*. The small or juvenile forms of *C. antidiluvianus* have beaded ultimate whorls, while *C. dujardini* does not. *C. antidiluvianus* has a more elongate body whorl and irregularly spaced fine and coarse striations near the anterior. Large specimens of *C. antidiluvianus* may not have the beaded ultimate whorl but can be distinguished by using these last two criteria. *Conus* (*Lithoconus*) *dalli* Toula *in* Cossmann (1913, pl. 3, figs. 30, 31) is very close to *C. dujardini*. The specimen of Cossmann's comes from the West Indies.

Cernoharsky (1964, p. 66) places « *Conus acutanculus*, Friedberg, Rozp. Wiadom... 14:17 » in synonymy with *C. acutangulus* Lamarck. Tomlin (1937, p. 207) noted that the entry of « *acutanculus* » [spelling of Tomlin] in Friedberg is a spelling error. Actually the spelling in Friedberg is « *angutanculus* », not *acutanculus*. In spite of these double spelling errors, Friedberg did not include his entry of « *C. angutanculus* » under Lamarck's species but placed « *C. angutanculus* (false) Desh. Pusch [*in* Pusch] Polens Palantologie . . . str. 115 » in synonymy with *C. dujardini* Deshayes. *C. dujardini* is not a synonym of *C. acutangulus* Lamarck.

CONUS ELONGATUS Borson, 1820 (9)
Pl. 25, figs. 6, 10, 11, 12, 13

Conus elongatus BORSON, 1820, p. 198, pl. 1, fig. 4 [*non Conilites elongatus* SCHLOTHEIM 1820 (-23) [1823 date *fide* BM (NH)]; *non Conus elongatus* CHEMNITZ (*see* Sacco, p. 36), the Chemnitz names are rejected by ICZN as non binomial].
Conus elatus MICHELOTTI, 1847, p. 341, pl. 13, fig. 16, 16'.
Conus tarbellianus GRATELOUP. HÖRNES, 1851, p. 33, 34; HÖRNES, 1856, pl. 4, fig. 3 [*non* figs. 1a, b, 2 = *C. antiquus*].
Conus haueri PARTSCH in HÖRNES 1851, p. 34, 35; PARTSCH *in* HÖRNES, 1856, pl. 4, figs. 4a, b [*non* figs. 5 = *C. puschi*].
Conus puschi MICHELOTTI. COSTA, 1866, pl. 8, fig. 4, 6, 7a, b [fig. 3 is intermediate between *C. aquensis* and *C. elongatus,* but probably more allied to the latter].
Leptoconus elatus (MICHELOTTI). Sacco, 1893, p. 35, 36, pl. 4, figs. 15a, b.
Leptoconus elatus var. *depressulespirata* SACCO, 1893, p. 36, pl. 4, fig. 16; var. *taurobrevis* SACCO, 1893, p. 36, 37, pl. 4, fig. 17; var. *tauroparva,* SACCO, 1893, p. 37, pl. 4, fig. 18; [*non* fig. 19, there isn't any fig. 20]; var. *convexuloides* SACCO, 1893, p. 37, pl. 4, fig. 21; var. *fusulatimspirata* SACCO, 1893, p. 38, pl. 4, fig. 22; [*non* fig. 23] var. *perconicospirata* SACCO, 1893, p. 38, pl. 4, fig. 24; var. *funiformispirata* SACCO, 1893, p. 38, pl. 4, fig. 25; var. *perlongespirata* SACCO, 1893, p. 38, pl. 4, fig. 26.
Leptoconus tauroelatus SACCO, 1893, p. 38, pl. 4, fig. 27.
Conus (*Leptoconus*) *haueri* PARTSCH *in* HÖRNES. KOJUMDGIEVA and STRACHIMIROV, 1960, p. 210, pl. 49, fig. 1a, b.
Conus (*Leptoconus*) *extensus* PARTSCH *in* HÖRNES. KOJUMDGIEVA and STRACHIMIROV, 1960, p. 210, pl. 49, figs. 6a, b.

Description — Large elongate (40-150 mm long) shell with smooth body whorl with straight sides, elongate, moderately narrow at base, rarely striate at base. Aperture narrow, especially near center of body whorl. Shoulder angular and slightly smooth, ultimate spiral whorl usually with horizontal surface. Spiral whorls scalariform to weakly rounded step-like. Whorls near apex mostly rounded and weakly beaded.

Holotype — Both the type of *C. elongatus* and *C. elatus* are missing from the geologic museum at the department of geology, University of Turin.

Distribution — Miocene (Late?), Portugal; Burdigalian-Helvetian, Tortonian, Early Pliocene?, Italy; Vindobonian, Austria; Tortonian, Bulgaria.

Remarks — *C. elongatus* Borson is distinguished from *C. puschi, C. oboesus* and *C. aquensis* by the presence of its characteristic spiral whorls and shoulder — *i.e.,* the vertical wall and flat sloping top of the individual spiral whorls and by the nearly horizontal top of the ultmate whorl. The exception is *Leptoconus elatus taurobrevis* Sacco which does not have the characteristic spiral whorls (the drawing of this specimen figured by Sacco is not accurate). This variety of Sacco's is included here because the closest resemblance is to *C. elongatus.* The Tortonian or younger specimens of *C. elongatus* are generally larger and have a more elongate body whorl; however, the type of the species *C. elatus* Michelotti figured by Sacco more closely agrees with Helvetian species.

(9) The name *C. elongatus* Borson is used provisionally owing to the fact that *C. elongatus* Borson and *Conilites* (= *Conus*) *elongatus* Schlotheim were both named in 1820. The entry of « 1820 (23) » in the British Museum's (Natural History Catalogue of Books, associated with the work of Schlotheim, is considered the only justification for using Borson's name in preference. The « (-23) » part of the entry could not be confirmed by the British Museum (N.H.) Paleontological Library, nor were they able to give a more precise date for the two works in question [written communication, Anthony P. Harvey, B.M. (N.H.)]. Thus, the ICZN must render a decision as to the acceptability of one of these two names. If Schlotheim's name should take precedence, then *C. elatus* Michelotti becomes the first valid name for the species discussed here.

CONUS GALLICUS Mayer-Eymar, 1890

Pl. 24, figs. 1, 2, 10-13; Pl. 25, figs. 3-5, 7-9

Conus lineatus BORSON, 1820, p. 189 [*non lineatus* SOLANDER, 1766; *non lineatus* HWASS *in* BRUGUIÈRE, 1792; *non lineatus* RÖDING, 1798; *non lineatus* CRISTOFORI, 1832].

Conus gallicus MAYER-EYMAR, 1890, p. 295; MAYER-EYMAR, 1891, p. 328, pl. 9, fig. 2 [? = *gallicus* VASSEUR, 1881 but this is a *nomen nudum*].

Conus larraldei MAYER-EYMAR, 1890, p. 296; Mayer-Eymar, 1891, p. 330, pl. 9, fig. 6.

Conus vasseuri MAYER-EYMAR, 1890, p. 297; MAYER-EYMAR, 1891, p. 335, pl. 9, *fig.* 5 [note: *Tomlin*, (1937, p. 326 states « = *ixion* Orb. f. Peyrot »; however, Peyrot (1930, p. 91, 11) includes the Mayer-Eymar figure of *C. vasseuri* in the synonymy of both *C. ixion* and *C. gallicus*].

Dendroconus betulinoides LAMARCK var. *exlineata* SACCO, 1893, p. 5, pl. 1, fig. 4, 4 bis [new name for *C. lineatus* BORSON, 1820].

Conus (*Lithoconus*) *ixion* ORBIGNY. PEYROT, 1930, p. 91-93; PEYROT, 1931, pl. 2, fig. 15 [*non* figs. 21-24; note that the specimens of *C. ixion* PEYROT (fig. 21, 22) do not seem to be similar to his other specimen (figs. 23, 24), although figs. 23, 24 are similar to the type (*C. aldrovandi* GRATELOUP, 1847, pl. 43, fig. 3, *ixion* being the new name selected by Orbigny).

Conus (*Dendroconus*?) *larraldei* MEYER-EYMAR. PEYROT, 1930, p. 101 (figure on p. 101).

Conus notatus TOMLIN, 1937, p. 206 [new name for *C. lineatus* BORSON, 1820].

Description — Shell small (22-30 mm long) with weakly spirally ridged body whorl, Shoulder angular but smooth and with a ridges becoming pronounced near base. Aperture nearly straight with a weak flare at base. weak slope. Spire concave slightly elevated and spirally striate whorls.

Holotype — Collection of Mayer-Eymar, Eidg. Technische Hochschule Geologisches Institut, Zürich, number S2776.

Distribution — Aquitanian, Burdigalian, France; Burdigalian, Astian, Italy.

EXPLANATION OF PLATE 25

Figs. 1, 2 - *Conus Pyrula* ? Brocchi. Collection of Grateloup; type of *C. avellana* Lamarck var. *B* Grateloup, Faculté des Sciences, Bordeaux. Saint-Paul-les-Dax. Burdigalian. Length, 29,4 mm; width, 14.0 mm.

3, 4 - *Conus gallicus* Mayer-Eymar. Number S 2776, collection of Mayer-Eymar, Eidg. Tech. Hoch. Geol. Institut, Zürich; Holotype. Larriey-Saucats (Bordeaux). Aquitanian. Length, 54.4 mm; width, 30.9 mm. Page 146.

5, 9 - *Conus gallicus* Mayer-Eymar. Collection of Sacco; Holotype of *Conus lineatus* Borson [= *Dendroconus betulinoides* var. *exlineata* Sacco, 1893, pl. 1, fig. 4] Astigiana, Astian. Length, 54.4 mm; width, 31.1 mm. Page 146.

6, 12 - *Conus elongatus* Borson. Collection of Sacco; type of *Leptoconus elatus* var. *perconicospirata* Sacco, 1893, pl. 4, fig. 24. Topotype of *C. elatus* Michelotti, 1847. There is a label on the specimen with the number 10669. Stazzano, Tortonian. Page 145.

7, 8 - *Conus gallicus* Mayer-Eymar. Number S 2774, collection of Mayer-Eymar, Eidg. Tedg. Hoch. Geol. Institut, Zürich; holotype of *C. larraldei* Mayer-Eymar. « Abesse, S. Paul près Dax, Langhien, I a » [Burdigalian]. Length, 54.1 mm; width, 30.4 mm. Page 146.

10, 11 - *Conus elongatus* Borson. Collection of Sacco; type of *Leptoconus elatus* var. *convexuloides* Sacco, 1893, pl. 4, fig. 21. Stazzano, Tortonian. Length, 105.4 mm; width, 39.8 mm. Page 145.

13 - *Conus elongatus* Borson. Number 36, collection of Sacco; type of *Leptoconus elatus* var. *tauroparva* Sacco. Torino, Middle Miocene, Length, 38.0 mm; width, 15.0 mm. Page 145.

CLARENCE A. HALL, Jr., MIDDLE MIOCENE *CONUS* FROM PIEDMONT, ITALY

Remarks — This species is not as broad at the shoulder, not as pinched near the middle, nor is the suture of the ultimate whorl above the periphery of the shoulder as in *C. betulinoides* Lamarck.

CONUS GASTALDII Michelotti, 1847
Pl. 24, figs. 16, 20

Conus imperialis LINNAEUS. BELLARDI and MICHELOTTI, 1840, p. 59, pl. 8, fig. 17 [*non imperialis* LINNAEUS].
Conus gastaldii MICHELOTTI, 1847, p. 344.
Conus nocturnus GRATELOUP, 1847 (10), pl. 44, fig. 20 [*non C. nocturnus* SOLANDER, 1786].
Conus subnocturnus ORBIGNY, 1852, p. 57 [new name for *C. nocturnus* GRATELOUP].
Stephanoconus gastaldii MICHELOTTI. SACCO, 1893, p. 117, pl. 11, figs. 10a, b.
Stephanoconus gastaldii var. *supracompressa* SACCO, 1893, p. 117, pl. 11, fig. 11; var. *superneasulcata* SACCO, 1893, p. 117, pl. 11, fig. 12; var. *supraproducta* SACCO, 1893, p. 117, pl. 11, fig. 13.
CONUS (*Stephanoconus*) *subnocturnus* ORBIGNY. PEYROT, 1930, p. 82, 83; 1931, pl. 1, fig. 37, 38.

Description — Shell short (35 to 40 mm) to moderately elongate. Body whorl raised with none to 3 heavy striae at the base. Aperture straight with weak flare at base. Shoulder coronate with 10 to 12 closely spaced tubercles that become obscure. Spire low, concave, weakly coronate and striate. Spiral whorls channelled.

Holotype — Pl. 24, figs. 16, 20. *Stephanoconus gastaldii* Michelotti in the collection of Sacco, red label number 169, Istituto di Geologia, Turin. The specimen that Sacco says is the type is slightly larger than the figure of *C. imperialis* figured by Bellardi and Michelotti and used for the type of *C. gastaldii* by Michelotti. However, no other specimens in the Sacco collection agree more closely and number 169 is accepted as the type.

Distribution — Burdigalian and Helvetian, France; Middle Miocene, Italy.

Remarks — *Conus lividus* Hwass *in* Bruguière, Tesch (1915, p. 20, pl. 74, figs. 21a, b) closely approaches *C. gastaldii.*

This species is distinguished from *C. bredai* Michelotti and *C. subnicobaricus* Orbigny by its more inflated body whorl. Some specimens have a weakly pinched body whorl near the base but not as close to the shoulder as in *C. bredai.*

There is a close resemblance between the shapes of *C. gastaldii* and *C. brunneus* Wood (see Hanna, 1963, pl. 3, fig. 1).

CONUS GASTRICULUS Coppi, 1876
Pl. 22, fig. 17

Conus gastriculus COPPI, 1876, p. 196 (9).
Chelyconus gastriculus (COPPI). SACCO, 1893, p. 107, pl. 10, fig. 17.

Description — Shell moderate size or small (11 mm long). Body whorl robust but somewhat elongate with spiral ridges near anterior. Aperture wide with a flare at the anterior. Shoulder angular at periphery, inflated and rounded below, top of the outer whorl concave. Spire narrow, convex to straight, spiral whorls flat to convex, except for ultimate, extremely weak spiral striations.

Holotype — Perhaps in the collections of the University of Modena. The type specimen is from Modena; the figure in Sacco (1893) is not the type.

Distribution — The type is from Tortonian rocks of Italy, the other specimens are from Burdigalian rocks.

(10) Note that *C. gastaldii* Michelotti, 1847, must take priority over *C. subnocturnus* Orbigny 1852 [new name for *C. nocturnus* Grateloup, 1847] despite the fact of confusion over the dates of Michelotti's or Grateloup's names as pointed out in Peyrot (1930, p. 83) because it is *C. subnocturnus* and the 1852 date of Orbigny and not *C. nocturnus* and the 1847 date of Grateloup that is being considered because *C. nocturnus* Grateloup is preoccupied.

Remarks — Resembles *C. parvecatenatus* [= *C. parvus* of authors] and may be a variant, but is more obese and is without the flat angular spiral whorls. It is distinguished from the variants of *C. bitorosus* that Sacco called *C. avellana* by its more elongate body whorl and more convex spire; it is not as broad as *C. bitorosus* and the spiral striations are not as conspicuous.

Pietro Doderlein in 1862 did not describe this species in his paper « Cenni geologici intorno la giacitura dei terreni miocenici superiori dell'Italia centrale » *in* Atti del X Congresso degli Scienziati Italiani tenuto, a Siena nel settembre del 1862, p. 107 (25). The name appears as a *nomen nudum* in Doderlein.

CONUS GRANULARIS Borson, 1820
Pl. 22, figs. 6, 11, 12

Conus granularis BORSON, 1820, p. 17, pl. 1, fig. 3.
Conus granuliferus GRATELOUP, 1835, p. 113; GRATELOUP, 1847, pl. 45, figs. 21, 22.
Conus ornatus MICHELOTTI, 1847, p. 345, pl. 14, fig. 4.
Stephanoconus stachei HOERNES and AUINGER 1879, p. 16, pl. 6, figs. 14, 15, 16.
Hemiconus granularis (BORSON). SACCO, 1893, p. 121, pl. 11, figs. 31a, b; FRIEDBERG, 1911, p. 45, pl. 2, fig. 10a, b.
Hemiconus granularis var. *dertosimplex* SACCO, 1893, p. 122, pl. 11, fig. 32; var. *tauroscabricular* SACCO, 1893, p. 122, pl. 11, fig. 33; « anom. » *supraproducta* SACCO, p. 122, pl. 11, fig. 34; var. *mioperovata* [questionably placed] SACCO, 1893, p. 122, pl. 11, fig. 35; var. *ornata* (MICHELOTTI) SACCO, 1893, p. 122, pl. 11, fig. 36 and 36 bis; var. *stachei* (H. & A.) SACCO, 1893, p. 123, pl. 11, fig. 37; var. *taurolaevigata* SACCO, 1893, p. 123, pl. 11, fig. 38.
Hemiconus dertogranularis SACCO, 1893, p. 123, pl. 11, fig. 39; var. *ovulellata* SACCO, 1893, p. 124, pl. 11, fig. 40.
Hemiconus granulifer (GRATELOUP). emend. PEYROT, 1930, p. 78, 79; PEYROT, 1931, pl. 1, figs. 11, 12.
Hemiconus clanculus MAYER-EYMAR. PEYROT, 1930, p. 80; PEYROT, 1931, pl. 1, figs. 42, 43.

Description — Shell small (5-14 mm long), obese. Body whorl short and with pustulose spiral ridges near base or covering the entire body whorl, with fine spiral ridges near base, or almost smooth. Aperture open and convex. Shoulder angular to almost rounded, rarely coronate or pustulose. Spire straight, relatively high, beaded or weakly coronate, raised striate spiral whorls with a more pronounced groove near the center.

Holotype — Missing. The type is figured by Sacco (1893, pl. 11, fig. 31).

Distribution — Miocene, France; Miocene, Pliocene, Italy; Tortonian, Poland.

Remarks — Confusion has arisen regarding this species. The number of spiral grooves on the spiral whorl, the absence, presence, or number of pustulose spiral ridges, and the amount of rounding of the shoulder are morphologic features that are variable. Large collections at Turin are available for study that show the extent of this variation.

CONUS MARII (Sacco), 1893
Pl. 26, figs. 8, 15, 16, 21, 22

Chelyconus puschi var. *longogracilis* SACCO, 1893, p. 61, pl. 5, fig. 47.
Chelyconus marii SACCO, 1893, p. 62, pl. 6, fig. 1a, b, c.
Chelyconus marii var. *fusulopupoides* SACCO, 1893, p. 62, pl. 6, fig. 2; var. *ovatopupoides* SACCO, 1893, p. 62, pl. 6, fig. 4 [approaches *C. ponderosus* BROCCHI]; var. *digitiformis* SACCO, 1893, p. 62, pl. 6, fig. 5; var. *asparagispira* SACCO, 1893, p. 62, pl. 6, fig. 6; var. *perfusulospira* SACCO, 1893, p. 63, pl. 6, fig. 7; var. *clavatoidea* SACCO, 1893, p. 63, pl. 6, fig. 8; var. *subconicospira* SACCO,

1893, p. 63, pl. 6, fig. 10; var. *medioventrosa* SACCO, 1893, p. 63, pl. 6, fig. 11; var. *subpileospira* SACCO, 1893, p. 63, pl. 6, fig. 12; var. *ovatobrevis* SACCO, 1893, p. 63, pl. 6, fig. 13; var. *pileospira* SACCO, 1893, p. 64, pl. 6, fig. 14; var. *mamillatospira* SACCO, 1893, p. 64, pl. 6, fig. 15.

Chelyconus taurinensis (BELLARDI and MICHELOTTI) var. *perlongopupoides* SACCO, 1893, p. 98, pl. 9, fig. 48; var. *turritopupoides* SACCO, 1893, p. 98, pl. 9, fig. 48; var. *turritopupoides* SACCO, 1893, p. 98, pl. 9, fig. 49; var. *perolivaeformis* SACCO, 1893, p. 99, pl. 9, fig. 51.

Chelyconus puschi var. *longovulata* SACCO, 1893, p. 60, pl. 5, fig. 42.

Description — Small to large with elongate shell (12-74 mm long). Body whorl usually without spiral ridges at base, mostly smooth. Aperture moderately wide and straight. Shoulder round to weakly angular dropped, with smooth edge to periphery. Spire convex to nearly straight. Spiral whorls convex and usually drown out. Sutures pronounced.

Holotype — Plate 26, figs. 21, 22. Sacco collection, red label number 78, Istituto di Geologia, Turin. Type figured by Sacco (1893) as *Chelyconus marii* in plate 6, figures 1a, b, c. From Albugnano, many other specimens from the Baldissero locality. « Helvetian » of Sacco (= Burdigalian).

Distribution — Burdigalian, Italy, most commonly from Baldissero.

Remarks — Shoulder less pronounced than *C. puschi* and spire is more drawn out and convex.

CONUS MONTISCLAVUS (Sacco, 1893)
Pl. 26, figs. 1-3, 5, 6

Chelyconus montisclavus SACCO, 1893, p. 68, pl. 6, figs. 38a, b.

Chelyconus montisclavus var. *cappucinorum* SACCO, 1893, p. 68, pl. 6, fig. 39; var. *pagodaeformis* SACCO, 1893, p. 68, pl. 6, fig. 40; var. *inflatulospira* SACCO, 1893, p. 68, pl. 6, fig. 41; var.*mamillatocrassa* SACCO, 1893, p. 69, pl. 6, fig. 42; var. *angulatocrassa* SACCO, 1893, p. 69, pl. 6, fig. 44; var. *magnomamillata* SACCO, 1893, p. 69, pl. 6, fig. 45; var. *mamillospira* SACCO, 1893, p. 69, pl. 6, fig. 46.

Chelyconus pondersulcatus var. *mamillatoides* SACCO, 1893, p. 82, pl. 8, fig. 22.

Chelyconus cidarispiratus SACCO, 1893, p. 99, pl. 9, figs. 54a, b.

Chelyconus cidarispiratus var. *subglandiformis* SACCO, 1893, p. 99, pl. 9, fig. 55; var. *minimespirata* SACCO, 1893, p. 99, pl. 9, fig. 56; var. *magnoconica* SACCO, 1893, p. 100, pl. 9, fig. 57.

Description — Shell small, moderately elongate (19-34 mm long), and peg-shaped. Body whorl smooth with very faint spiral ridges preserved on a few specimens near the anterior end. Thin at the anterior and weakly pinched near the middle. Aperture narrow and straight. Shoulder is pronounced, angular, but smooth, some specimens with a shoulder that has a slope. Spire straight with prominently rounded, weakly striate spiral whorls that become nearly flat, nipple-like to pointed.

Holotype — Plate 26, figs. 2,5. Sacco collection, red label number 100, Istituto di Geologia, Turin. Type from Monte dei Cappuccini, Turin, Helvetian.

Distribution — Helvetian and Burdigalian, Italy.

CONUS MUCRONATOLAEVIS Sacco, 1893
Pl. 26, figs. 9-11, 14, 20

Chelyconus mucronatolaevis SACCO, 1893, p. 66, pl. 6, fig. 26a, b.

Chelyconus mucronatolaevis SACCO var. *fusoelegans* SACCO, 1893, p. 66, pl. 6, fig. 27a, b; var. *longovuloides* SACCO, 1893, p. 66, pl. 6, fig. 28; var. *laevispira* ROVASENDA *in* SACCO, 1893, p. 66, pl. 6, fig. 29; var. *taurobiconica* SACCO, 1893, p. 66, pl. 6, fig. 30a, b; var. *glan-*

dispira SACCO, 1893, p. 67, pl. 6, fig. 31a, b; var. *globospira* SACCO, 1893, p. 67, pl. 6, fig. 32a, b; var. *permamillata* SACCO, 1893, p. 67, pl. 6, fig. 33; var. *conicangulata* SACCO, 1893, p. 67, pl. 6, fig. 34a, b.

EXPLANATION OF PLATE 26

Fig. 1 - *Conus montisclavus* (Sacco). Number 150, collection of Sacco; type of *Chelyconus cidarispiratus* var. *minimespirata* Sacco. Torino, Middle Miocene. Length, 19.5 mm; width, 10.4 mm. (slightly crushed). Page 149.

2, 5 - *Conus montisclavus* (Sacco). Holotype. Number 100, collection of Sacco; holotype of *Chelyconus montisclavus* Sacco. Monte dei Cappuccini. Lower Helvetian, Middle Miocene. Length, 32.0 mm; width, 15.5 mm. Page 149.

3 - *Conus montisclavus* (Sacco). Number 106, collection of Sacco; type of *C. montisclavus* var. *humilispirata* Sacco. Torino, Middle Miocene. Page 149.

4 - *Conus parvicaudatus* (Sacco). UCLA hypotype number 39408; UCLA locality number 4928, Valle Ceppi. Termofourà Fm., Upper Burdigalian. Length, 39.9 mm; width, 24.3 mm. Page 155.

6 - *Conus montisclavus* (Sacco). Number 132, collection of Sacco; type of *C. ponderosulcatus* var. *mammallatoides* Sacco. Torino, Middle Miocene. Length, 34.2 mm; width, 17.0 mm. Page 149.

Figs. 7, 12 - *Conus parvicaudatus* (Sacco). Holotype. Number 24, collection of Sacco; type of *Lithoconus ? parvicaudatus* Sacco. Locality given by Sacco (1893, p. 28) as Sciolze, but on the label as Val Ceppi. Burdigalian. Length, 37.4 mm; width, 23.2 mm. Page 155.

8 - *Conus marii* (Sacco). Number 144, collection of Sacco; type of *C. taurinensis* var. *perlongopupoides* Sacco. Baldissero. Upper Burdigalian. Length, 29.2 mm; width, 11.7 mm. Page 148.

9, 11 - *Conus mucronatolaevis* (Sacco). Holotype. Number 92, collection of Sacco; Holotype of *Chelyconus mucronatolaevis* Sacco. Baldissero. Burdigalian. Length, 31.9 mm; width, 15.3 mm. Page 149.

10 - *Conus mucronatolaevis* (Sacco). UCLA hypotype number 39409; UCLA locality number 4930, Villa Cochis. Uppermost Burdigalian. Length, 25.4 mm; width, 14.6 mm. Page 149.

13 - *Conus parvicaudatus* (Sacco). Number 177, collection of Sacco; type of *Stephanoconus bredai* var. *globulospira* Sacco. Torino. Middle Miocene. Length, 36.4 mm; width, 23.6 mm. Page 155.

Fig. 14 - *Conus mucronatolaevis* (Sacco). Number 126, collection of Sacco; type of Sacco; type of *C. ponderosus miopermamillata* Sacco. Baldissero. Upper Burdigalian. Length, 43.9 mm; width, 21.7 mm. Page 149.

15 - *Conus marii* (Sacco). Number 82, collection of Sacco; type of *C. marii* var. *digitiformis* Sacco. Baldissero. Upper Burdigalian. Length, 60.4 mm; width, 21.4 mm. Page 148.

16 - *Conus marii* (Sacco). Number 84, collection of Sacco; type of *C. marii* var. *clavatoidea* Sacco. Torino. Middle Miocene. Length, 57.2 mm; width, 23.8 mm. Page 148.

17, 18 - *Conus oboesus* Michelotti. Number 69, collection of Sacco; type of *Chelyconus oboesus* ? var. *gracilispira* Sacco. Torino. Middle Miocene. Length, 42.0 mm; width, 22.0 mm. Page 153.

19 - *Conus oblongoturbinatus* (Sacco). Lectotype Number 59, collection of Sacco; *Conospirus oblongoturbinatus* Grateloup var. *fusolaevis* Sacco. Torino. Middle Miocene. Length, 44.1 mm; 16.4 mm. Page 152.

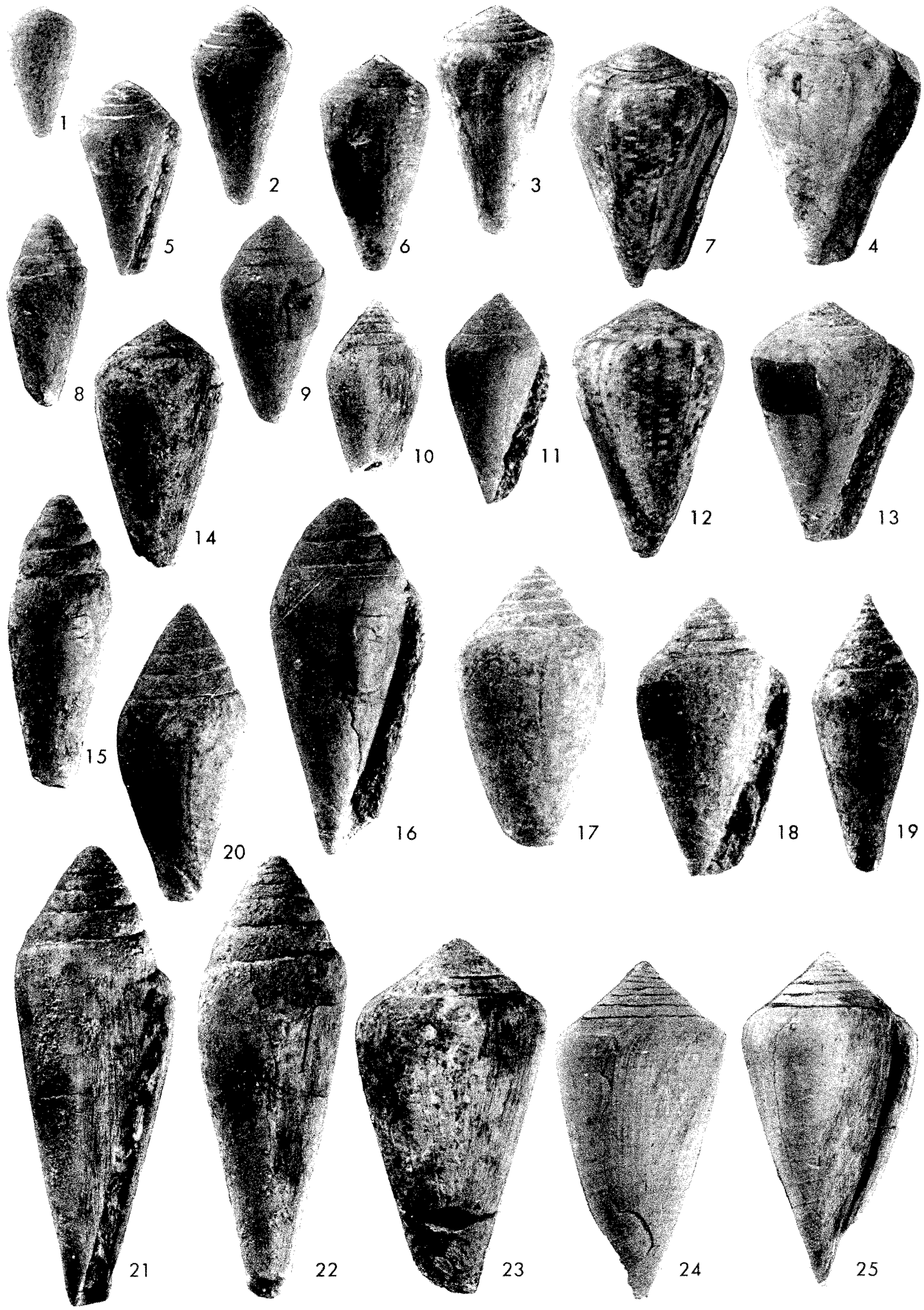
20 - *Conus mucronatolaevis* (Sacco). Number 80, collection of Sacco; type of *C. marii* var. *fusulobrevis* Sacco. Torino. Middle Miocene. Length, 44.6 mm. Page 149.

Figs. 21, 22 - *Conus marii* (Sacco). Holotype Number 78, collection of Sacco. Albugnano. Middle Miocene Length, 74.0 mm; width, 25.0 mm. Page 148.

23 - *Conus raristriatus* Bellardi and Michelotti. Number 122, collection of Sacco; type of *Chelyconus conoponderosus* ? var. *taurosuturata* Sacco. Torino (possibly Baldissero). Middle Miocene (? Burdigalian). Length, 53.5 mm; width, 27.2 mm. Page 158.

24, 25 - *Conus raristriatus* Bellardi and Michelotti. Collection of Sacco, Holotype. [= *Chelyconus raristriatus* (Bell. and Micht) in Sacco, p. 89, pl. 9, figs. 13a, b] S. Agata. Tortonian. Length, 48.2 mm; width, 24.0 mm. Page 158.

CLARENCE A. HALL, Jr., MIDDLE MIOCENE *CONUS* FROM PIEDMONT, ITALY



Chelyconus marii SACCO var. *fusulobrevis* SACCO, 1893, p. 62, pl. fig. 3.

Chelyconus ponderosus BROCCHI var. *miopermamillata* SACCO, 1893, p. 78, pl. 8, fig. 5.

C. (*Chelyconus*) *praelongus* HOERNES and AUINGER. KOJUMDGIEVA and STRACHIMIROV, p. 213, pl. 50, fig. 7.

Description — Shell of moderate size (32-45 mm). Body whorl elongate but usually short, smooth. Shoulder, smooth rounded or occasionally with a weak angular periphery. Aperture straight and narrow. Spire of moderate height or drawn out, nipple-like shape not pronounced, weakly convex, spiral whorls not raised.

Holotype — Plate 26, figs. 9, 11. Sacco collection red label no. 92, *Chelyconus mucronatolaevis* Sacco, 1893, p. 66, pl. 6, figs. 26a, b. From the upper Burdigalian rocks of the Baldissero fossil locality.

Hypotype — UCLA catalogue number 39409.

Distribution — Middle Miocene of Italy; Late Miocene, Bulgaria.

Remarks — The species is gradational with *C. marii* Sacco and is distinguished by its shorter and less elongate body whorl, shorter spire, and flatter spiral whorls.

C. pyrula Brocchi, 1814, may de related to *C. mucronatolaevis* Sacco and except for the straight body whorl of this later species they are difficult to distinguish.

Because of the similarities between *C. pyrula* and *C. mucronatolaevis* it is appropriate to mention the relationship with *C. avellana* Lamarck. *C. avellana* Lamarck 1810, p. 441, was inadequately described, not figured, and the type is missing. Deshayes (1845, p. 154) gave a short description of the shell and stated that *C. avellana* resembles *C. mercator* Linnaeus, and that the spire of *C. avellana* is very short and weakly convex with a little point at the summit. The specimen of *C. mercator* Linnaeus in Lamarck's collection at Geneva was studied by me and is figured here for comparative purposes. This species with an imagined point at the apex bears a resemblance to *C. mucronatolaevis, C. pyrula,* and to *C. eschwegi* Costa [= *C. pyruloides* Sacco and the emendation of *pyruloides* to *piruloides* by Peyrot, 1930]. It does not agree in any way with the informal neotype of *C. avellana* selected by Sacco, 1893, pl. 9, fig. 60. Because of the lack of a detailed description and location, a figured type, and because the type is missing, *C. avellana* is considered to be a species *inquirenda.* Although it is possible that Grateloup (1847, pl. 44, fig. 5) saw Lamarck's type of *C. avellana* when he figured specimens with this name there is considerable doubt as to his identification and his specimens are not from Piedmont, the type locality of Lamarck's type. Grateloup's specimen of *C. avellana* is considered by me as *C. pyrula* (?) Brocchi, while Peyrot (1931, pl. 4, fig. 20) figured Grateloup's specimen as *C. clavatulus* Orbigny 1852.

In order to clarify the taxonomy of this group of species that might be confused with *C. mucronatolaevis* the following characteristic features and partial synonymies are given:

A. Straight body whorl, body whorl with grooves to near middle of shell. Suture of ultimate whorl at or above the periphery of shell or shoulder. There is a gradation from European fossil forms with a marked callus or fasciole near the anterior end to the Pliocene and Recent forms of the Indo-Pacific region without this callus.

A-1. *Conus eschewegi* COSTA 1866 (11) [with callus or fasciole].

C.eschewegi COSTA, 1866, p. 29, pl. 9, figs. 18-23; Sacco, 1893, [selected as lectotype: fig. 23 of Costa], p. 12, 13, pl. 1, figs. 24, 25. [Late Miocene, Early Pliocene].

Dendroconus pyruloides (SACCO) [not DODERLEIN, 1863, *nomen nudum*], 1893, p. 13, 14, pl. 1, figs. 26-27.

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(11) Note that *Conus demissus* Philippi, 1836, 1844, resembles in some ways this species. Further investigation may prove *C. eschewegi* is a synonym of Philippi's species.

A-2. *Conus cinereus* BRUGUIÈRE, 1792.

Conus cinereus BRUGUIÈRE, 1792, p. 673, 1798, pl. 331, figs. 4, 7; TESCH, 1915, p. 21, 22, pl. 74, fig. 25, pl. 75, fig. 26. [Pliocene to Recent].

B. Nearly straight body whorl, body whorl with fine to coarse irregularly spaced grooves or striations near anterior 1/3 of shell, suture of ultimate whorl below periphery of shell or shoulder.

B. *Conus pyrula* BROCCHI 1814 [Late Miocene-Early Pliocene].

C. pyrula BROCCHI, 1814, p. 288, pl. 2, fig. 8; SACCO, 1893, p. 88, pl. 9, fig. 4.

C. avellana LAMARCK. HÖRNES, 1851, p. 29; 1856, pl. 3, fig. 3d [3a, b, c agree more closely with *C. belus* ORBIGNY]; questionably, Costa pl. 4, figs. 8a, b.

C. ponderosus var. *juventula* SACCO, 1893, pl. 8, fig. 19.

C. pyrula Brocchi var. *fulminans* (BRONN). SACCO, 1893, p. 88, 89, pl. 9, fig. 6a, b; var. *supraconvexulata* SACCO, 1893, p. 89, pl. 9, fig. 9; var. *supradepressulata* SACCO, 1893, p. 89, pl. 9, fig. 10 [the other varieties figured by Sacco are less like the type in terms of the shell, but the coloration of the shell is identical].

C. sturi HOERNES and AUINGER. FRIEDBERG 1911-28 [reprint 1951], p. 52, pl. 2, fig. 15.

C. argillicola EICHWALD. FRIEDBERG, 1911-28, p. 53, pl. 2, fig. 16 (12).

C. cf. C. avellana LAMARCK. FRIEDBERG, 1911-28, p. 55, pl. 2, fig. 19 [p. 56, fig. 10, pl. 2, fig. 20 = *C. dujardini* DESHAYES].

C. ponderosus var. *steinabrunnensis* SACCO. FRIEDBERG, 1911-28, p. 58, fig. 12 [pl. 3, fig. 3 = *C. mercati*].

C. (Puncticulis) (Chelyconus) pyrula BROCCHI, 1814. RONCHETTI, 1955, p. 286, fig. 153 [three views of the type].

C. (Chelyconus) vindobonensis PARTSCH [actually Hörnes]. KOJUMGIEVA and STRACHIMIROV, 1960, p. 213, pl. 50, fig. 4.

[?] *Conus (Chelyconus) vindobonensis* var. *mariae* (HOERNES and AUINGER). KOJUMDGIEVA and STRACHIMIROV, 1960, pl. 50, figs. 6a, b.

It is not known whether or not *C. pecchioli* Crosse [new name for *C. puchellus* Pecchioli, 1864, p. 514, pl. 5, figs. 15, 16, from Orciano] is a separate species or should be grouped with *C. mucronatolaevis* Sacco, or *C. pyrula* Brocchi, it differs from both in the nature of the spire, shoulder, and body whorl.

(12) Note that *C. argillicola* Eichwald, 1830, p. 222 and 1853, p. 206, pl. 9, fig. 2a, b and other specimens identified as this species in the Polish collections are very similar to *C. ventricosus* Gmelin, 1791 (= *C. mediterraneus* Hwass *in* Bruguière, 1792).

CONUS OBLONGOTURBINATUS (Sacco, 1893)

Pl. 26, fig. 19

Conus puschi MICHELOTTI. COSTA, 1866, pl. 9, figs. 1, 2.

Conospirus ? oblongoturbinatus (GRATELOUP). SACCO, 1893, p. 52 [Grateloup gave the name « *C. antediluvianus* var. *A* » to his specimen and used the word « oblongoturbinata » to describe his variety — he did not give it the name *oblongoturbinatus*, this is the name given by Sacco, not Grateloup].

Conus expuschilonga SACCO, 1893, p. 60 [new name for *C. puschi in* COSTA].

Conospirus oblongoturbinatus var. *propegallica* SACCO, 1893, p. 52, pl. 5, fig. 22; var. *taurogracilis* SACCO, 1893, p. 53, pl. 5, figs. 23a, b, 23 bis; var. *taurogracilis* anom. *angulatissima* SACCO, 1893, p. 53, pl. 5, fig. 24; var. *fusolaevis* SACCO, 1893, p. 53, pl. 5, fig. 25; var. *biconolonga* SACCO, 1893, p. 53, pl. 5, figs. 26a, b; *non* fig. 27; var. *taurochelyconoides* SACCO, 1893, p. 53, pl. 5, fig. 28.

Description — Shell moderately large to large (40+mm long), elongate. Body whorl

elongate and narrow with striations at base. Aperture usually straight, may be weakly convex or pinched near middle. Shoulder smooth and weakly angular with sloping surface of ultimate whorl. Spire high and pointed, more recent whorls flat, ronded and raised with a weak angular periphery, whorls becoming angular near the middle of the whorl close to the apex, and some weakly beaded.

Holotype — Sacco chose as the type the figure of *C. antidiluvianus in* Grateloup (1847, pl. 44, fig. 6). This same figure is the type of *C. aquensis* Orbigny 1852 [note that fig. 2 of Grateloup is *C. antidiluvianus* and not *C. aquensis*]. The first variety of *C. oblongoturbinatus* figured by Sacco (pl. 5, fig. 22) from the collection of Rovasenda is missing, and the next two variants he figured are so close to *C. antidiluvianus* that they would not be appropriate lectotypes; his third variant is damaged.

Lectotype — Plate 26, fig. 19. *Conospirus oblongoturbinatus* Sacco var. *fusolaevis* Sacco, 1893, p. 53, pl. 5, fig. 25 is selected as the lectotype. This specimen has red label number 59 and is in the Istituto di Geologia, Turin. Hills of Turin, Helvetian of Sacco (Burdigalian) Miocene.

Distribution — Miocene, Portugal; Middle and rarely Late Miocene, Italy.

Remarks — Distinguished from varieties of *C. antidiluvianus,* with which it may be confused, by its thin elongate body whorl, variously rounded shoulders and smooth almost rounded later whorls.

CONUS OBOESUS Michelotti, 1847

Pl. 26, figs. 17, 18

Conus oboesus MICHELOTTI, 1847, p. 342 [type figured by Sacco, 1893, pl. 5, figs. 31a, b].

Chelyconus oboesus (MICHELOTTI). SACCO, 1893, p. 58, pl. 5, figs. 31a, b.

Chelyconus oboesus? var. *gracilispira* SACCO, 1893, pl. 5, fig. 37.

Conus puschi var. *crassuloides* SACCO, 1893, pl. 5, fig. 44; [?] var. *crassuloclava* SACCO, 1893, p. 61, pl. 5, fig. 45.

Description — Shell small to moderately large (42 mm long). Body whorl robust, smooth and inflated, wide at base. Aperture narrow near middle, with a pronounced flare near base. Shoulder angular and weakly smoothed, slightly dropped, ultimate spiral whorl with a gentle slope to spiral surface or nearly horizontal. Spire straight with weakly convex spiral whorls.

Holotype — Missing. Figured by Sacco (1893).

Distribution — « Elveziano » of Sacco.

Remarks — Distinguished from *C. elongatus* by the absence of the horizontal ultimate spiral whorl and by the convexity of the relatively short body whorl.

This species is questionably retained as a distinct species. The type may be a variant of *C. puschi,* a variant with a short body whorl; and the variant of *C. oboesus* called *C. gracilispira* by Sacco may be a variant of *C. pelagicus* with a short body whorl. The absence of the type makes the systematics of this species difficult to resolve.

CONUS PARVECATENATUS (Sacco, 1893)

Pl. 20, figs. 10, 11

Conus parvus BORSON, 1820, p. 196 (type figured by Sacco, 1893, pl. 9, fig. 40) [*non parvus* RÖDING, 1798].

Chelyconus parvus (BORSON). SACCO, 1893, pl. 9, fig. 40.

Chelyconus parvus var. *parvecatenata* SACCO, 1893, p. 97, pl. 9, fig. 41.

Chelyconus parvus var. *miosubuloides* SACCO, 1893, p. 97, pl. 9, fig. 44; var. *longanfractus* SACCO, 1893, p. 98, pl. 9, fig. 46; [?] *mioanomalospira* SACCO, 1893, p. 97.

Description — Shell 17 mm long, with nearly smooth body whorl except for weak ridges near base. Aperture straight or weak-

EXPLANATION OF PLATE 27

Figs. 1 - *Conus pelagicus Brocchi.* Number 141, collection of Sacco; type of *C. parvus miofuluvoides* Sacco. Torino. Middle Miocene. Length, 19.8 mm; width, 9.2 mm. Page 155.

2 - *Conus pelagicus* Brocchi. Number 109, collection of Sacco; type of *C. clavatus tauroclavatula* Sacco; type of *C. clavatus tauroclavatula* Sacco. Sciolze. Burdigalian. Length, 23.2 mm; width, 10.6 mm. Page 155.

3 - *Conus pelagicus* Brocchi. Number 178, collection of Sacco; type of *Sthephanoconus oatiliae* ? Hoernes and Auinger var. *asperula* Géné *in* Sacco (1893, pl. 11, fig. 21). Sciolze. Burdigalian. Length, 15.5 mm; width, 7.5 mm. x 2. Page 155.

4 - *Conus pelagicus* Brocchi. Number S 2765, collection of Mayer-Eymar, Eidg Tech. Hoch. Geol. Institut, Zürich. Holotype of *C. granulato-cinctus* Mayer-Eymar. Saubrigues near Bayonne, lower « Dertonian » [probably Burdigalian]. Length, 16 mm; width, 7 mm; x 2. Page 155.

5 - *Conus pyrula* Brocchi. collection of Sacco, type of *C. pyrula* var. *perrubigniosa* Sacco, 1893, p. 89, pl. 9, fig. 1.. Astigiana. Astian. Length, 50.2 mm; width, 25.5 mm. Included to show similarities with *C. pelagicus* and preserved color pattern.

7 - *Conus pelagicus* Brocchi. Number 127, collection of Sacco; type of *C. ponderosus* var. *miosubtypica* Sacco. Sciolze. Burdigalian. Length, 43.6 mm; width, 22.3 mm. Page 155.

8, 9 - *Conus striatulus* Brocchi. Number 1029, collection of Brocchi, Museo Civico di Storia Naturale, Milano. Holotype. Piacentino. Pliocene. Length, 14.1 mm; width, 7.1 mm. Also figured by Ronchetti (1955, p. 279) who has an enlarged figure. Page 159.

10 - *Conus puschi* Michelotti. Number 70, collection of Sacco; type of *C. puschi* Michelotti var. *demissespirata* Sacco. Baldissero or Sciolze. Middle Miocene. Length, 40.8 mm; width, 16.8 mm. Page 158.

11, 17 - *Conus burdigalensis* Mayer-Eymar. Number 2741, collection of Mayer-Eymar, Eidg. Tech. Hoc. Geol. Institut, Zürich. Holotype. Saucats near Bordeaux. Burdigalian. Length, 60.9 mm; width, 23.6 mm. Questionably found in the Italian section (a single specimen in the UCLA collection, Baldissero locality) and included here for comparison with *C. elongatus.* Page 145.

12 - *Conus atractus* Tomlin, 1937 [new name for *C. fusiformis* Lamarck, 1810 (*non C. fusiformis* G. Fischer, 1807)] Holotype. Number 62, catalogue or number 129 Number in Lamarck, Museum d'Histoire Naturelle, Geneva. Length, 48 mm; width, 21 mm. Figured here to illustrate the strong resemblance to *C. burdigalensis* Mayer-Eymar. Page 143.

13 - *Conus deshayesi* Bellardi and Michelotti. Collection of Sacco. Astigiana. Astian. Length, 50.2 mm; width, 25.5 mm. Figured here for comparative purposes with *C. pelagicus.* Page 155.

14 - *Conus puschi* Michelotti. Number 75, collection of Sacco; type of *C. puschi* var. *parvulespirata* Sacco. Torino. Middle Miocene. Length, 49.3 mm; width, 21.6 mm. Page 158.

15 - *Conus pelagicus* Brocchi. Number 161, collection of Sacco; type of *C. mediterraneus* var. *taurovata* Sacco. Baldissero. Upper Burdigalian. Length, 50.4 mm; width, 24.5 mm. Page 155.

16 - *Conus pelagicus* Brocchi. Collection of Sacco; type of *C. pelagicus mostruosa* (Brocchi) subvar. *permaculata* Sacco (1893, pl. 9, fig. 19). Astigiana. Astian. Length, 46.2 mm; width, 20.0 mm. Page 155.

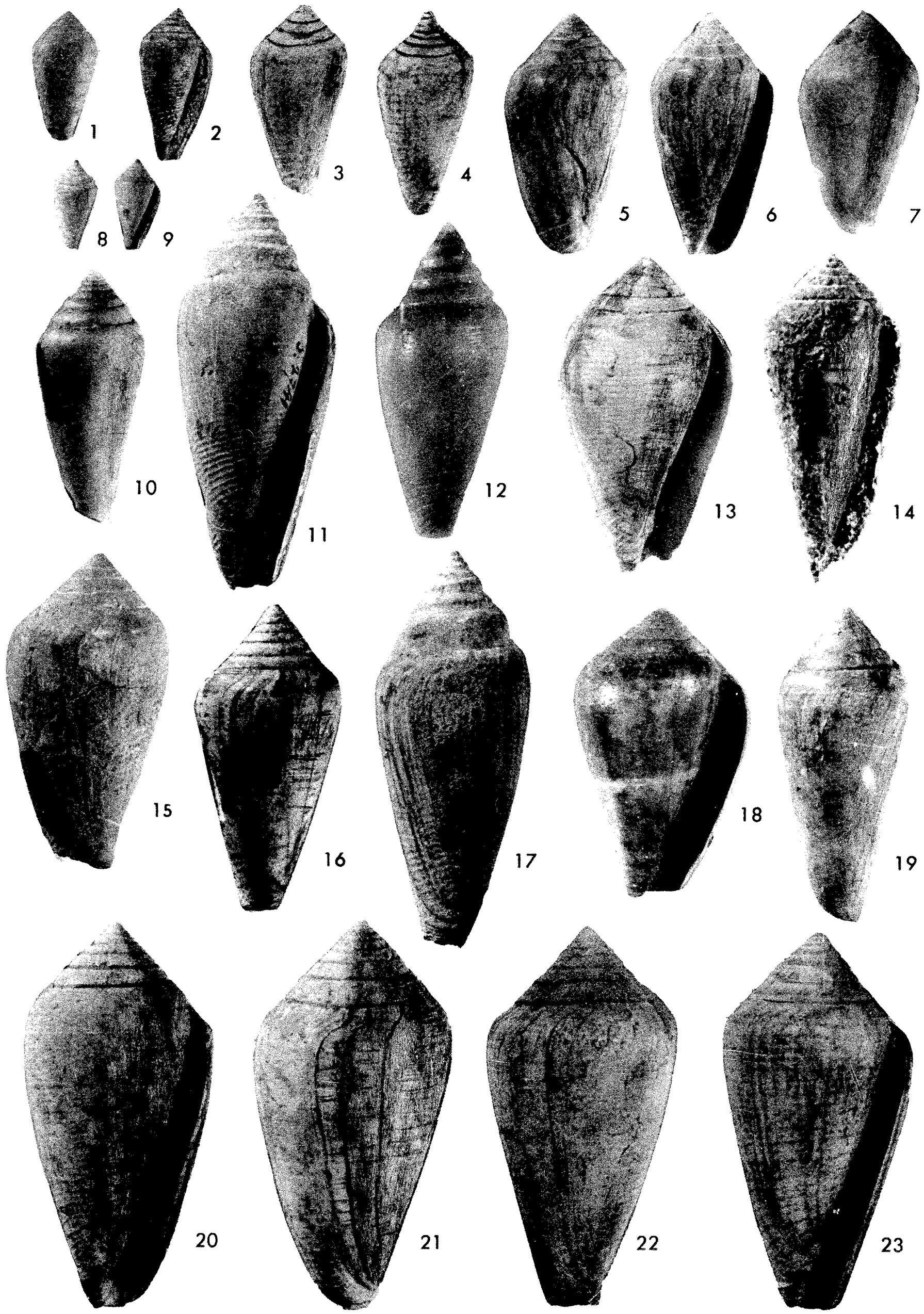
18 - *Conus franciscanus* Hwass in Bruguière [considered by authors as a synonym of *C. mediterraneus* Hwass in Bruguière]. Holotype. Nat. Hist. Mus., Geneva. Catalogue number 58, Lamarck number 109. Mediterranean Sea. Length, 47 mm; width, 28 mm. Not similar to the type of *C. mediterraneus.* Figured here for comparative purposes with *C. pelagicus* and others. Page 155.

19 - *Conus puschi* Michelotti. Collection of Sacco; type of *C. puschi* ? var. *dertoelatoides* Sacco, 1893, pl. 5, fig. 41. Stazzano. Tortonian. Length, 49.2 mm; width 19.6 mm. Page 158.

20, 21 - *Conus pelagicus* Brocchi. Collection of Sacco; type of *C. pelagicus* var. *astensinflata* Sacco, 1893, pl. 9, fig. 29. Astigiana. Astian. Length, 60.8 mm; width. 29.0 mm. Page 155.

22, 23 - *Conus pelagicus* Brocchi. Number 1031, collection of Brocchi, Museo Civico di Storia Naturale, Milano. Holotype. Piacentino. Pliocene. Length, 62.4 mm; width, 30.4 mm. Page 155.

CLARENCE A. HALL, Jr., MIDDLE MIOCENE *CONUS* FROM PIEDMONT, ITALY



ly curved. Shoulder angular and with a flat spiral surface that slopes gently away from the apex. Spire straight to convex with weakly striate flat whorls, ridged just above the suture. The suture of the ultimate whorl is on some dropped well below the edge of the preceding whorl.

Holotype — Sacco collection red label no. 138a, Istituto di Geologia, Turin. Hills of Turin (including Sciolze locality). Burdigalian.

Sacco's variety [= subspecies] of *Conus parvus* Borson [preoccupied by *Conus parvus* Röding] is chosen here as the name to replace *C. parvus* by elevating the variety [subspecies] to specific rank.

Distribution — Burdigalian, Italy (Baldissero and Sciolze).

Remarks — Distinguished from *Conus taurinensis* (Bellardi and Michelotti) by the flat early whorls, otherwise the same.

Conus parvecatenata (Sacco) is not always easily distinguished from *C. striatulus* Brocchi but can usually be recognized by its more convex spire that may become concave near the apex.

CONUS PARVICAUDATUS (Sacco, 1893)

Pl. 26, figs. 4, 7, 12, 13

Lithoconus? parvicaudatus SACCO, 1893, p. 28, pl. 3, fig. 25.

Lithoconus parvicaudatus var. *turbinatissima* SACCO, 1893, p. 29, pl. 3, fig. 26; var. *taurotessellata* SACCO, 1893, p. 29, pl. 3, fig. 27.

Lithoconus mercatii tauromaxima SACCO, 1893, p. 21, pl. 2, fig. 16; var. *compressicauda* SACCO, 1893, p. 21, pl. 2, fig. 17.

Stephanoconus bredai var. *globulospira* SACCO, 1893, p. 119, pl. 9, fig. 20.

Description — Shell length from less than 23 mm to more than 120 mm. Body whorl wide at shoulder and anterior end, pinched near middle, faintly striate near anterior. Aperture narrow and pinched near center. Shoulder angular, but not sharp. Spire straight, ultimate whorl of spire nearly horizontal and usually grooved, faintly striate. Remnant color pattern is irregularly checkerboard. The color patern of the recent species *C. taeniatus* Hwass is very similar (A. J. Kohn, written communication, 1965.

Holotype — Plate 26, figs. 7, 12. Sacco collection, red label number 24, Istituto di Geologia, Turin. In the text the locality is given as « Sciolze », on the label it is « Val Ceppi ». Burdigalian.

Hypotype — UCLA catalogue number 39408.

Distribution — Burdigalian, Italy. At the Val Ceppi and Sciolze localities of the Turin Hills.

Remarks — *Conus parvicaudatus* (Sacco) doesn't have the shoulder nodes that are present on *C. bredai.*

CONUS PELAGICUS Brocchi, 1814

Pl. 27, figs. 1-4, 7, 15, 16, 20-23

Conus pelagicus BROCCHI, 1814, p. 289, pl. 2, fig. 9; Hörnes, 1851, p. 31, 32; HÖRNES, 1856, pl. 3, figs. 4a, b, c.

[?] *Conus ventricosus* BRONN [*non ventricosus* GMELIN]. HÖRNES, 1856, pl. 3, figs. 5, 7.

Conus (*Chelyconus*) *lapugyensis* HOERNES and AUINGER, 1879, p. 42, pl. 1, fig. 9, pl. 5, fig. 8.

Conus (*Chelyconus*) *mariae* HOERNES and AUINGER, 1879, p. 49, pl. 6, figs. 7a, b, c.

Conus granulato-cinctus MAYER-EYMAR, 1890, p. 295; MAYER-EYMAR, 1891, p. 329, pl. 10, fig. 1.

Chelyconus clavatus var. *tauroclavatula* SACCO, 1893, p. 70, pl. 7, fig. 1 bis [*non* 1 or 1 ter].

[?] *Conus deshayesi* (BELLARDI and MICHELOTTI) var. *taurosubscalaris* SACCO, 1893, p. 74, pl. 7, fig. 19; var. *lineoclavata* SACCO, 1893, p. 74, pl. 7, fig. 20.

Chelyconus ponderosus var. *taurocrassa* SACCO, 1893, p. 78, pl. 8, fig. 3; var. *miosubtypica* SACCO, 1893, p. 78, pl. 8,

fig. 6; var. *miofusuloides* SACCO, 1893, p. 78, pl. 8, fig. 7.

Chelyconus pelagicus (Brocchi). SACCO, 1893, p. 90, pl. 9, figs. 17a, b.

Chelyconus pelagicus var. *monstruosa* SACCO, 1893, p. 91, pl. 9, fig. 18; var. *permaculata* SACCO, 1893, p. 92, pl. 9, fig. 19; var. *astensiscalaris* SACCO, 1893, p. 92, pl. 9, fig. 20; var. *taurogigantea* SACCO, 1893, p. 92, pl. 9, fig. 22; var. *acutiusculoides* SACCO, 1893, p. 92, pl. 9, fig. 23; var. *pseudopyrula* SACCO, 1893, p. 92, pl. 9, fig. 24; var. *depressoconica* SACCO, 1893, p. 93, pl. 9, fig. 26; var. *colorata* (DEFRANCE) SA664, 1893, p. 93, pl. 9, fig. 28.

Chelyconus parvus var. *miofusuluvoides* SACCO, 1893, p. 97, pl. 9, fig. 45.

Chelyconus mediterraneus var. *taurovata* SACCO, 1893, p. 103, pl. 10, fig. 1.

Stephanoconus ottiliae? var. *asperula* (GÉNÉ). SACCO [*Conus asperulus* appears as a *nomen nudum* in Bonelli, 1827, and again in Sismonda, 1842, thus the varietal name here is of Sacco], 1893, p. 119, pl. 11, fig. 21; var. *ovulatina* Sacco, 1893, p. 120, pl. 11, fig. 22; var. *longogracilis* Sacco, 1893, p. 120, pl. 11, fig. 23.

[?] *Chelyconus oboesus* var. *tauroconnectus* SACCO, 1893, p. 58, pl. 5, fig. 36.

Conus (*Chelyconus*) *clavatulus* ORBIGNY. PEYROT, 1931, pl. 1, fig. 13 [= *C. avellana* from the collection of Grateloup].

Conus (*Punticulis*) (*Chelyconus*) *pelagicus* BROCCHI. RONCHETTI, 1955, p. 284-386, fig. 152. [Holotype].

Description — Shells 20 to 65 mm long, nearly subcylindrical, maximum diameter about one half the length. Body whorl weakly striate near anterior end; small forms with a weak flare near anterior. Shoulder with a slope and sub-rounded. Spire moderately elevated, weakly convex to straight, weakly striate. Color markings are transverse yellow flamules and interrupted yellow brownish orange closely spaced spiral lines.

Holotype — Plate 27, figs. 22, 23. Collection of Brocchi, Museo Civico di Storia Naturale, Milano. Number, 1031, Piacentino, Pliocene.

Distribution — Burdigalian (*see* « Saubrigues » *in* Chevalier, 1961, p. 21), France; Middle Miocene, Pliocene, Italy; Vindobonian, Austria.

Remarks — *Conus pelagicus* resembles *C. ponderosus* in general shape but differs from *C. ponderosus* by having a more pronounced shoulder, widely spaced spiral ridges on the body whorl, prominent color markings, and it lacks the often present « pencil-line » grooves at the periphery of each whorl on the spire of large specimens and the prominent striations of the spire of smaller forms of *C. ponderosus*.

Small forms of *C. pelagicus* can be distinguished from *C. striatula* by the less prominently raised spiral whorls and the greater obesity.

Conus deshayesi Bellardi and Michelotti (13) can be separated from *C. pelagicus* by its different color markings and the less robust or rounded body whorl.

The figures of *Conus purpurascens* Broderip *in* Hanna (1963, pl. 3, figs. 2, 3) have an almost identical color pattern with some of the Pliocene variants of *C. pelagicus*, but the shapes of these two forms are markedly different.

CONUS PONDEROSUS Brocchi, 1814
Pl. 28, figs. 1-21

Conus ponderosus BROCCHI, 1814, p. 293, pl. 3, fig. 1; HÖRNES, 1851, p. 26; HÖRNES, 1856, pl. 2, figs. 6a, b.

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(13) The specimen of *C. deshayesi* figured by Sacco (1893, pl. 7, fig. 14) is not the type, but the specimen figured by him as *C. deshayesi* var. *fusacuta* Sacco (1893, pl. 7, fig. 15) agrees very closely with the figure of the type in Bellardi and Michelotti (1840, pl. 6, figs. 7, 8 [*non* fig. 13]). The latter variety, which may be the type, is in the Sacco collection in Turin.

Conus clavatus LAMARCK. GRATELOUP, 1835, p. 110; GRATELOUP, 1847, pl. 44, fig. 1.

Conus subclavatus ORBIGNY, 1852, p. 57 [new name for *C. clavatus* GRATELOUP].

Conus (*Chelyconus*) *transsylvanicus* HOERNES and AUINGER, 1879, p. 41, pl. 4, fig. 4.

Conus (*Chelyconus*) *olivaeformis* HOERNES and AUINGER, 1879, p. 52, pl. 1, fig. 23.

Chelyconus clavatus var. *tauroclavatula* SACCO, 1893, p. 70, pl. 7, fig. 1; var. *taurofusulata* SACCO, 1893, p. 71, pl. 7, fig. 2; var. *fusoidoliva* SACCO, 1893, p. 71, pl. 7, fig. 3; var. *fusoidovata* SACCO, 1893, p. 71, pl. 7, fig. 4; [?] var. *taurovulata* SACCO, 1893, p. 71, pl. 7, fig. 6; [?] var. *dertovulata* SACCO, 1893, p. 71, pl. 7, fig. 7; var. *expyramidales* SACCO, 1893, p. 72, pl. 7, fig. 10; var. *subrotundospira* SACCO, 1893, p. 72, pl. 7, fig. 11; var. *tauroconica* SACCO, 1893, p. 73, pl. 7, fig. 12; [?] var. *pileospiroides* SACCO, 1893, p. 73, pl. 7, fig. 13.

Chelyconus marii var. *depressomamilla* SACCO, 1893, p. 64, pl. 6, fig. 16.

Chelyconus ponderoglans? var *taurolonga* SACCO, 1893, p. 77, pl. 7, fig. 30.

Chelyconus ponderovulata SACCO, 1893, pl. 7, fig. 21.

Chelyconus ponderosus (BROCCHI). SACCO, 1893, p. 77, pl. 8, fig. 1.

Chelyconus ponderosus var. *miopraecedens* SACCO, 1893, p. 78, pl. 8, fig. 2; var. *miosubmamillata* SACCO, 1893, p. 78, pl. 8, fig. 4; var. *miopermamillata* SACCO, 1893, p. 78, pl. 8, fig. 5; var. *tauroponderosa* SACCO, 1893, p. 79, pl. 8, fig. 8; var. *tauroperlaevis* SACCO, 1893, p. 79, pl. 8, fig. 9; var. *miovulea* SACCO, 1893, p. 79, pl. 8, fig. 10; var. *unisulculata* SACCO, 1893, p. 80, pl. 8, fig. 12.

Chelyconus ponderosulcatus SACCO, 1893, p. 81, pl. 8, fig. 21.

Chelyconus ponderosulcatus var. *pseudovuloides* SACCO, 1893, p. 82, pl. 8, fig. 23; var. *supraconvexoides* SACCO, 1893, p. 82, pl. 8, fig. 24.

Chelyconus laeviponderosus SACCO, 1893, p. 82, pl. 8, fig. 25; var. *tauroperlata* SACCO, 1893, p. 83, pl. 8, fig. 26; var. *perpupoides* SACCO, 1893, p. 83, pl. 8, fig. 27.

[?] *Chelyconus taurinensis* var. *fusolivoides* SACCO, 1893, p. 99, pl. 9, fig. 50.

Chelyconus cidarispiratus var. *pseudolivoides* SACCO, 1893, p. 100, pl. 9, fig. 58; var. *pseudavellanoides* SACCO, 1893, p. 100, pl. 9, fig. 59.

Chelyconus mediterraneus var. *mioventrosa* SACCO, 1893, p. 104, pl. 10, fig. 2.

Chelyconus bitorosus var. *postvindobonensis* SACCO, 1893, pl. 10, fig. 25.

Conus laeviponderosus Sacco var. *gracilicaudata* SACCO, FRIEDBERG, 1928, p. 574, pl. 37, fig. 2; var. *mucronatina* SACCO, FRIEDBERG, 1928, p. 575, pl. 37, fig. 3.

Conus (*Chelyconus*) *mucronatolaevis* var. *globospira* SACCO. PEYROT, 1930, p. 112; PEYROT, 1931, pl. 2, figs. 10, 11.

Conus (*Puncticulis*) (*Chelyconus*) *ponderosus* BROCCHI. RONCHETTI, 1955, p. 281-283, fig. 150 [the neotype as selected by Ronchetti, this same specimen was figured as the type by Sacco, 1893, pl. 8, fig. 1].

Description — Shell small to large (19-92 mm long). Body whorl moderately elongate and with an even taper to the nearly straight sides; some specimens with spiral ridges near anterior especially on small forms, smooth otherwise. Aperture moderately wide to wide and straight with a weak flare towards the anterior. Shoulder weakly angular and smooth. Spire elevated, straight, weakly convex, convex smooth spiral whorls that are weakly striate especially on the small individuals.

Neotype — A neotype was selected by Ronchetti (1955) from the Brocchi collection, Museo Civico di Storia Naturale, Milano; this is the same specimen that Sacco figured as the type of Brocchi. It is possible that the specimen figured by Ronchetti and Sacco is actually the specimen figured by Brocchi and that Brocchi's figure is not accurate. The number in ink on the neotype is 61.

Hypotype — UCLA Catalogue numbers 39410 and 39411.

Distribution — Helvetian, France; Middle and Late Miocene, Pliocene, Italy; Vindobonian, Austria; Miocene, Poland.

Remarks — The Pliocene specimens of *C. ponderosus* attain a larger size than the Miocene ones, but the shape remains the same.

There is a complete gradation between forms of *C. laeviponderosus* Sacco, *C. ponderosulcatus* Sacco and *C. ponderosus* Brocchi.

CONUS PUSCHI Michelotti, 1847
Pl. 27, figs. 10, 14, 19

Conus puschi MICHELOTTI, 1847, p. 340, pl. 14, fig. 6; Hörnes, 1851, p. 35, 36; HÖRNES, 1856, pl. 4, fig. 6a, b, c, [?] 7.
Conus haueri PARTSCH *in* HÖRNES, 1856, pl. 4, fig. 5 [*non*] fig. 4].
Chelyconus puschi (MICHELOTTI) SACCO, 1893, p. 59, pl. 5, fig. 39.
Chelyconus puschi var. *demissespirata* SACCO, 1893, p. 60, pl. 5, fig. 40; var. *dertoelatoides* SACCO, 1893, p. 60, pl. 5, fig. 41; var. *parvulespirata* SACCO, 1893, p. 61, pl. 5, fig. 49; var. *scalaratula* SACCO, 1893, p. 61, pl. 5, fig. 48.
Chelyconus oboesus var. *pseudosuessi* SACCO, 1893, p. 58, pl. 5, fig. 34.
Conus (*Chelyconus*) *puschi* MICHELOTTI. PEYROT, 1930, p. 113; PEYROT, 1931, pl. 4, figs. 10-12.
Conus (*Chelyconus*) *austriaconoae* SACCO. KOJUMDGIEVA and STRACHIMIROV, 1960, p. 212, pl. 50, fig. 2a, b.

Description — Shell moderate to large (40-49 or more mm long), elongate and relatively low-spired. Body whorl elongate, smooth, weakly pinched below widest part of whorl. Aperture narrow especially near middle of body whorl, flaring weakly near base. Shoulder convexly rounded and distinct, usually dropped well below periphery of the next to last whorl. Spire weakly concave to straight, deeply sutured, early whorls rather flat and without edge at periphery.

Holotype — Type missing. The type is figured by Michelotti (1847, pl. 14, fig. 6), but not by Sacco. Sacco questions the type locality of Tortona.

Distribution — Helvetian, France; Burdigalian, Tortonian, Italy; Vindobonian, Austria; Tortonian, Bulgaria.

Remarks — Distinguished from *C. elongatus* by the absence of a flat-topped ultimate spiral whorl and its more rounded spiral whorls; from *C. aquensis* by its more rounded shoulder, by the rounded or flattish early whorls and the absence of an angular periphery to the spiral whorls. Distinguished by its more elongate body whorl from *C. oboesus*.

CONUS RARISTRIATUS
Bellardi and Michelotti, 1840
Pl. 26, figs. 23-25

Conus raristriatus BELLARDI and MICHELOTTI, 1840, p. 61, pl. 5, fig. 8, 9.
Chelyconus raristriatus (BELLARDI and MICHELOTTI), SACCO, 1893, p. 89, 90, pl. 9, figs. 13a, b.
Chelyconus raristriatus var. *mucronatula* SACCO, 1893, p. 90, pl. 9, fig. 14; var. *dertangulata* SACCO, 1893, p. 90, pl. 9, fig. 15; var. *subafunicillata* SACCO, 1893, p. 90, pl. 9, fig. 16.
Chelyconus conoponderosus? var. *taurosuturata* SACCO, 1893, p. 76, pl. 7, fig. 26.

Description — Shell of moderate size (48-53 mm long). Body whorl, straight, not inflated, elongate, covered with widely spaced spiral ridges interrupted at growth lines. Weak and closely spaced spiral ridges at base. Aperture narrow and straight. Shoulder smooth, rounded or subangular. Spire of moderate height, straight, covered by extremely fine spiral striations, whorls smoothly convex, weakly beaded at suture near apex.

Holotype — Plate 26, figs. 24, 25. In the collection of Sacco, unnumbered specimen labeled *Chelyconus raristriatus* (Bell. & Micht), Sant'Agata, Tortonian. Figured by Sacco, 1893, pl. 9, fig. 13a, b.

Distribution — Middle (not common) and Late Miocene, Italy.

CONUS STRIATULUS Brocchi, 1814
Pl. 27, figs. 8-9

Conus striatulus BROCCHI, 1814, p. 294, pl. 3, fig. 4; CERULLI-IRELLI, 1910, p. 49, pl. 4, figs. 50, 51.
[?] *Conus lineolatus* COCCONI, 1873, p. 560, pl. 4, figs. 4-6 [*non lineolatus* VALENCIENNE, 1832].
Chelyconus striatulus (BROCCHI). SACCO, 1893, p. 93, 94, pl. 9, fig. 30.
Chelyconus striatulus var. *cingulellatula* SACCO, 1893, p. 94, pl. 9, fig. 31; var. *anomalospira* SACCO, 1893, p. 94, pl. 9, figs. 32a, b; var. *compressoconica* SACCO, 1893, p. 95, pl. 9, figs. 34a, b, bis; var. *clavinflata* SACCO, 1893, p. 95, pl. 9, fig. 36; var. *fusulobronnoides* SACCO, 1893, p. 95, pl. 9, fig. 37; var. *fusulovoides*, SACCO, 1893, p. 96, pl. 9, fig. 38.
Conospirus bronni? var. *tauroafusula* SACCO, 1893, pl. 5, fig. 21.
Conospirus oblongoturbinatus var. *paucispiralata* SACCO, 1893, p. 53, pl. 5, fig. 27.
Conus (*Puncticulis*) (*Chelyconus*) *striatulus* BROCCHI. RONCHETTI, 1955, p. 279, fig. 149.

Description — Shell small (14 mm long). Body whorl elongate with nearly straight sides and spiral ridges covering about anterior 1/3 of the body whorl. Aperture straight. Shoulder angular with top of ultimate spiral whorl being slightly tilted and weakly concave. Spire concave and moderately high, without striations. Spiral whorls flat, weakly scalariform, periphery very close to the suture.

Holotype — Plate 8, figs. 8, 9. Collection of Brocchi, numer 1029, Museo Civico di Storia Naturale, Milano. Piacentino, Pliocene.

Distribution — Late Miocene (less commonly Middle Miocene) and Pliocene, Italy.

Remarks — Distinguished from *C. parvecatenatus* by its concave spire, more angular shoulder, and straight body whorl. Shoulder not dropped, spiral grooves or ridges at anterior end not as pronounced, and spire not as drawn out as *C. canaliculatus* Brocchi. The body whorl below the shoulder is often marked by fine spiral striae, while with *C. canaliculatus* the central part of the body whorl is smooth. Subsequent workers may find that *C. parvecatenatus* (Sacco) [new name for *C. parvus*], *C. canaliculatus*, and *C. striatulus* are no more than variants or different growth stages of the same species. This possibility could not be confirmed by me.

CONUS SUBNICOBARICUS Orbigny, 1852
Pl. 20, fig. 9

Conus nicobaricus GRATELOUP, 1835, p. 104; GRATELOUP, 1847, pl. 43, figs. 6a, b [*non nicobaricus* HWASS in BRUGUIÈRE, 1792].
Conus subnicobaricus ORBIGNY, 1852, p. 56, no. 960 [new name for *C. nicobaricus* GRATELOUP].
Stephanoconus subnicobaricus ORBIGNY. SACCO, 1893, p. 117.
Stephanoconus subnicobaricus var. *taurorara* SACCO, 1893, p. 118, pl. 11, fig. 14; var. *taurocoronata* SACCO, 1893, p. 118, pl. 11, fig. 15; var. *taurotuberculata* SACCO, 1893, p. 118, pl. 11, fig. 16.

Description — Shell 45 mm long. Body whorl not elongate, straight, slightly pinched near middle. Wide at base. Aperture opening wider at base. Shoulder coronate — heavy tubercles. Spire low, coronate, spiral whorls uneven and slightly raised.

Holotype — Collection of Grateloup, Laboratoire de Geologie (Faculté des Sciences, Bordeaux, France. Saint-Paul-les-Dax, Burdigalian.

Distribution — Burdigalian, France; « Elveziano » (of Sacco), Italy.

CONUS TAURINENSIS
(Bellardi and Michelotti, 1840)
Pl. 20, figs. 2-4

Conus striatulus var. *taurinensis* BELLARDI and MICHELOTTI, 1840, p. 62, pl. 7, figs. 12, 13. [They refer their species to

Conus emmanuelis « GÉNÉ » (Bonelli, *fide* Sacco, 1893, p. 98) 1826, a *nomen nudum*].

Cheliconus [spelled *Chelyconus* on plate explanation] *taurinensis* (BELL. & MICHT.). Sacco, 1893, p. 98, pl. 9, fig. 47.

EXPLANATION OF PLATE 28

Fig. 1 - *Conus ponderosus* Brocchi. Number 151, collection of Sacco; type of *C. cidarispiratus* var. *pseudolivoides* Sacco. Albugnano. ? Burdigalian, Middle Miocene. Length, 19.0 mm; width, 9.0 mm. Page 156.

2 - *Conus ponderosus* Brocchi. UCLA hypotype number 39410; UCLA locality number 4926, Baldissero. Upper Burdigalian. Length, 22.8 mm; width, 12.0 mm. Page 156.

3 - *Conus ponderosus* Brocchi. 152, collection of Sacco; type of *C. cidarispiratus* var. *pseudoavellanoides* Sacco. Torino. Middle Miocene. Length, 22.0 mm; width, 12.6 mm. Page 156.

4 - *Conus ponderosus* Brocchi. Number 63, collection of Sturani, Torino. UCLA uocallty number 4929, Termofourà. Burdigalian. Length, 24.2 mm; width, 13.4 mm. Page 156.

5 - *Conus ponderosus* Brocchi. Number 134, collection of type of *C. ponderosulcatus* var. *supraconvexoides* Sacco. Torino. Middle Miocene. Length, 27.5 mm; width, 14.9 mm. Page 156.

6 - *Conus ponderosus* Brocchi. Collection of Sacco; type of *C. laeviponderosus* Brocchi. Collection of Sacco; type of *C. laeviponderosus* var. *brevipupoides* Sacco, 1893, pl. 8, fig. 28. Vezza d'Alba. Astian. Length, 28.4 mm; width, 15.6 mm. Page 156.

7, 8 - *Conus ponderosus* Brocchi. Collection of Sacco; type of *C. laeviponderosus* Sacco, 1893, pl. 8, fig. 25. Vezza d'Alba. Astian. Length, 34,4 mm; width, 17.6 mm. Page 156.

9 - *Conus ponderosus* Brocchi. Collection of Sacco; type of *C. bitorosus* var. *postvindobonensis* Sacco, 1893, pl. 10, fig. 25. Astigiana. Astian. Length, 41.0; width, 20.7 mm. Page 156.

10 - *Conus ponderosus* Brocchi. Collection of Sacco; type of *C. laeviponderosus* var. *perpupoides* Sacco, 1893, pl. 8, fig. 27. Vezza d'Alba. Astian. Length, 33.7 mm; width, 16.9 mm. Pag. 156.

11 - *Conus ponderosus* Brocchi. Number 131, collection of Sacco; type of *Chelyconus ponderosulcatus* Sacco. Torino. Middle Miocene. Length, 38.2 mm; width, 20.5 mm. Page 156.

12 - *Conus ponderosus* Brocchi. Number 29, collection of Sturani, Torino. UCLA locality number 4927, Valle di Vergnana. Upper Burdigalian. Length, 38.0 mm; width, 19.6 mm. Page 156.

13 - *Conus ponderosus* Brocchi. Number 26, collection of Sturani, Torino. Collegio delle Vedove e Nubili, Monte dei Cappuccini. Villa Cochis Conglomerate, uppermost Burdigalian (?). Length, 48.0; width, 23.4 mm. Page 156.

14 - *Conus ponderosus* Brocchi. Number 108, collection of Sacco; type of *C. clavatus* var. *tauroclavatula* Sacco. Sciolze. Burdigalian. Length, 52 mm; width, 27 mm. Page 156.

15 - *Conus ponderosus* Brocchi. UCLA hypotype number 39411; UCLA locality number 4926, Baldissero. Upper Burdigalian. Length, 49.6 mm; width, 25.8 mm. Page 156.

16 - *Conus ponderosus* Brocchi. Number 90, collection of Sacco; type of *C. marii* var. *depressomamilla* Sacco. Torino. Middle Miocene. Length, 44.4 mm; width, 19.2 mm. Page 156.

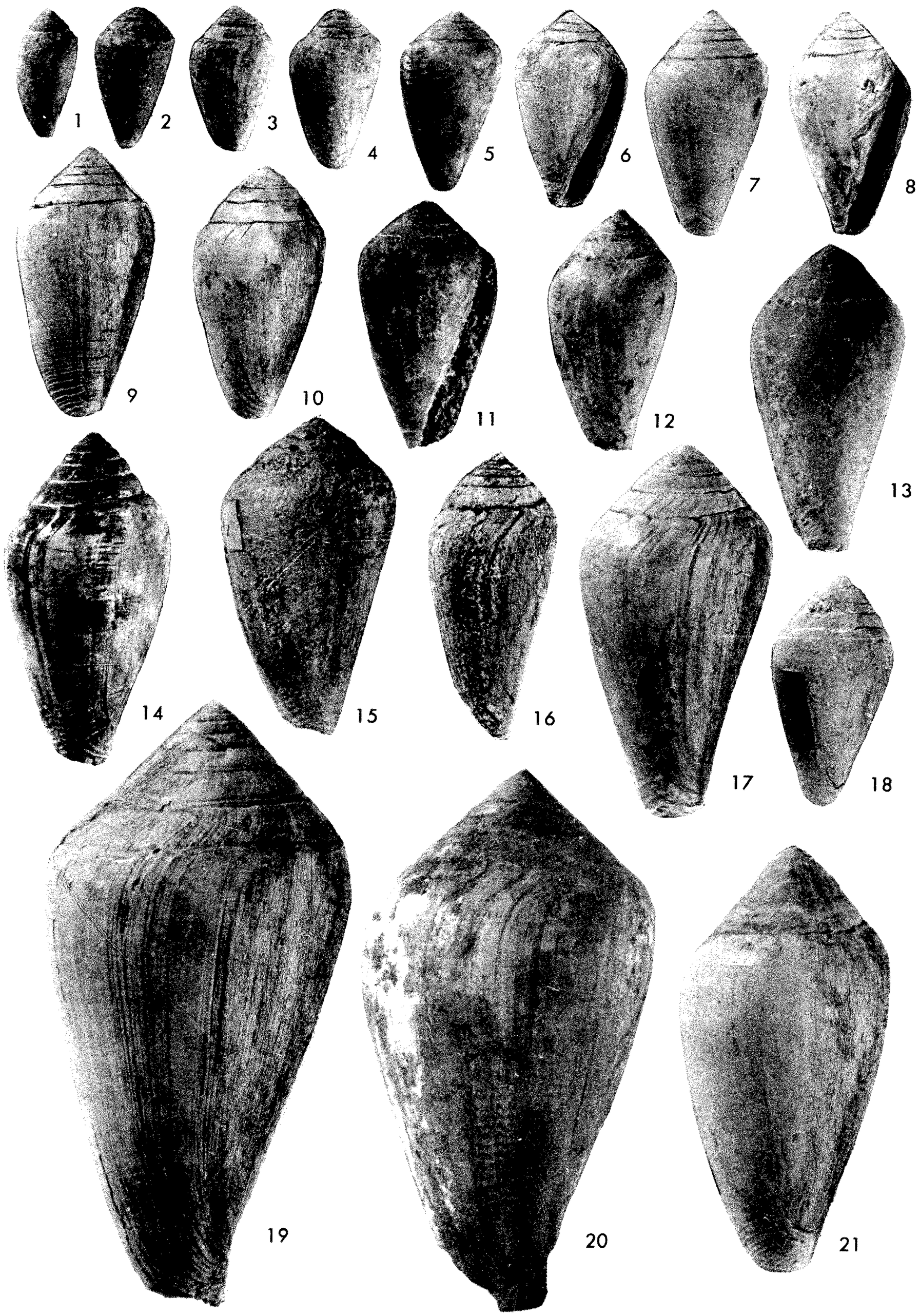
17 - *Conus ponderosus* Brocchi. Collection of Sacco; type of *C. laeviponderosus* var. *ponderolineata* Sacco, 1893, pl. 8, fig. 36. Astigiana. Astian. Length. 57.3; width, 28.4 mm. Page 156.

18 - *Conus ponderosus* Brocchi. Number 130, collection of Sacco; typo of *C. ponderosus* var. *miovulea* Sacco. Baldissero. Upper Burdigalian. Length, 36.1 mm; width, 18.5 mm. Page 156.

19 - *Conus ponderosus* Brocchi. Collection of Sacco; type of *C. ponderosus fusoclavata* Sacco, 1893, pl. 8, fig. 12. Astigiana. Astian. Length, 92.4 mm; width, 43.8 mm. Page 156.

20 - *Conus ponderosus* Brocchi. Collection of Grateloup, Faculté des Sciences, Bordeaux; type of *C. clavatus* Lamarck in Grateloup, pl. 2, fig. 1. Saint-Paul-les-Dax Burdigalian. Length, 88.5 mm; width, 45.8 mm. Page 156.

21 - *Conus ponderosus* Brocchi. Collection of Sacco; type of *C. ponderovulata* Sacco, 1893, pl. 7, fig. 21. Astigiana. Astian. Length, 65.0 mm; width, 20,4 mm. Page 156.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Chelyconus taurinensis var. *fusolivoides* SACCO, 1893, p. 99, pl. 9, fig. 50; var *anomalomamilla* SACCO, 1893, p. 99, pl. 9, fig. 52.

Description — Small shell (25 mm long) with weak spiral lines that covers the entire surface, although they are rarely preserved and most often only in the body whorl. Characterized by its dropped shoulder, flat to weakly channelled ultimate spiral whorl, and rounded convex earlier spiral whorls.

Holotype — [?] Sacco collection red label number 43, figured by Sacco in plate 9, figure 47, Istituto di Geologia, Turin. There is a slight difference between the specimen in the Sacco collection and the figure of the type by Bellardi and Michelotti. Bellardi and Michelotti (1840, p. 63) give the type locality as Rivo della Batteria, Torino while all of Sacco's specimens have as their locality Baldissero or Sciolze.

Distribution — Burdigalian, Italy.

CONUS TAURORECTUS (Sacco), 1893
Pl. 20, figs. 8, 13

Chelyconus taurorectus SACCO, 1893, p. 67, pl. 6, fig. 36; var. *proappenninica* SACCO, 1893, p. 68 pl. 6, fig. 37.

[?] *Chelyconus deshayesi?* var. *mioantiqua* SACCO, 1893, pl. 7, fig. 18.

Description — Large heavy shell 54 mm long. Body whorl obese, wide at base, with prominent growth lines that give a weak reticulate pattern with the weak evenly spaced spiral lines. Aperture moderately wide and with a pronounced flare at the base. Shoulder smooth and sub-rounded to almost rounded. Top of ultimate whorl nearly flat, weakly convex and broad. Spire of moderate height, straight or weakly concave, deeply sutured; spiral whorls slightly convex, more nearlyly flat near apex.

Holotype — Sacco collection, red label number 99, Istituto di Geologia, Turin. From the hills of Turin, a paratype is from the Baldissero locality.

Distribution — Tongrian, Burdigalian, Helvetian, Italy.

Remarks — Distinguished from *C. oboesus* by its more rounded shoulder. It has a broader base than the younger *C. mercati.*

APPENDIX

Register of Fossil Localities

All numbers below refer to localities described in the Invertebrate Paleontology locality catalogue, University of California, Los Angeles. The localities can be located with a 1950 Chieri topographic map (sheet 56, Chieri, IISO; IGM, 5th ed.), scale 1:25,000 or 4 cm equal one kilometer. The Chieri map adjoins the Torino map to the west and lies between 45° and 45°5' N. Lat., and between 4°45' and 4°47'30" W. Long. (Mt. Mario, Rome Meridian) or 7°42'08" and 7°49'38" E. Long. (Greenwich Meridian).

4926. Baldissero Locality (or Val Sanfrà) — Refers to locality near Baldissero Torinese in the northeastern part of the Chieri topographic map and immediately above the words « S. Giuliano » along the Rio di Baldissero; topographic coordinates: MQO68917. The fossils are in a coarse-grained sandstone and serpentine pebble conglomerate that crops out in a prominent embankment 30 meters up the creek. The locality is referred to as Val Sanfrà by authors. Uppermost beds of the Termofourà Formation. Upper Burdigalian Age.

4927. Valle di Vergnana Locality — Between Valle Ceppi and Baldissero, 250 to 300 meters northwest of the bridge over the Valle di Vergnana Creek on the road to Baldissero; Chieri map, coord: MQ061913. Along the creek in coarse-grained sandstone and conglomerate. The uppermost beds of the Termofourà Formation. Upper Burdigalian Age.

4928. Valle Ceppi Locality — Near the little settlement of Civera north of the Village of Valle Ceppi. The locality is to the east of Rio Civera, approximately 100 meters from the Creek in a cliff of coarse-grained sandstone and conglomerate. Chieri map coord: MQ053906. The rocks at this locality are the same stratigraphic horizon or slightly lower than the Val Sanfrà or Baldissero locality. Upper Termofourà Formation. Upper Burdigalian.

4929. Termofourà Locality — North of the small settlement of l'Eremo, and referred to as the Termofourà locality. An old villa of this name is shown on older maps. The locality is almost directly below the electric power lines that pass over the road along which the fossils occur; Chieri map, coord: MQ007892. Middle part of the Termofourà Formation. Burdigalian.

4930. Villa Cochis Locality — Between l'E remo and Santa Margherita some 50 meters south of Villa Cochis. Along the creek and below an unpaved road that passes over the crek at right angles Chieri map, coord.: LQ994886. In poorly consolidated medium — to coarse — grained sandstone and conglomerate. Some authors refer to this locality as Val Salice, Rio della Batteria or Villa Forzano. Villa Cochis Conglomerate (a local unit lying between the older Upper Pteropod Marls and the Baldissero Formation). Uppermost Burdigalian or an unnamed gap between type Burdigalian and type Helvetian.

CHECKLIST OF FOSSIL CONES FROM THE HILLS NEAR TURIN

Fossil cones in the collections of Sacco, Sturani (+), and Hall (*), Turin and UCLA.(?) = questionably reported from the locality.

BALDISSERO (UCLA loc. n. 4926)

1. *C. antiquus* (*)
2. *C. aquensis* (*)
3. *C. basteroti* (*)
4. *C. belus* (*)
5. *C. berghausi* (*)
6. *C. bitorosus* (*)
7. *C. bredai*
8. *C. brocchii* (*)
9. *C. burdigalensis* (?)
10. *C. canaliculatus*
11. *C. elongatus* J+I
12. *C. gastriculus* (*)
13. *C. marii* (*)
14. *C. montisclavus*
15. *C. mucronatolaevis* (*)
16. *C. parvacatenatus* (*)
17. *C. pelagicus* (*)
18. *C. ponderosus* (*)
19. *C. puschi* (*)
20. *C. raristriatus* (?)
21. *C. taurinensis* (+)
22. *C. taurorectus*

VALLE DI VERGNANO (UCLA loc. no. 4927)

1. *C. antiquus* (+)
2. *C. aquensis* (+)
3. *C. bitorosus* (+)
4. *C. brocchii* J+I
5. *C. gastriculus* (+)
6. *C. pelagicus* J+I
7. *C. ponderosus* (+)

VALLE CEPPI (UCLA loc. no. 4928)

1. *C. basteroti* (+)
2. *C. parvicaudatus* (*)

TERMOFOURÀ (UCLA loc. no. 4929)

1. *C. antiquus* (+)
2. *C. basteroti* (*)
3. *C. brocchii* (*)
4. *C. canaliculatus* (*)
5. *C. dujardini* (*)
6. *C. gallicus* (+)
7. *C. mucronatolaevis* (*)
8. *C. parvecatenatus*

9. *C. pelagicus*
10. *C. ponderosus*

VILLA COCHIS (UCLA loc. no. 4930)

1. *C. antiquus* (*)
2. *C. aquensis* (*)
3. *C. basteroti* (*)
4. *C. bitorosus* (*)
5. *C. brocchii* (*)
6. *C. dujardini* (*)
7. *C. parvecatenatus* (*)
8. *C. pelagicus* (*)

REGISTER OF NUMBERS

Numbers assigned by me to the Burdigalian-Helvetian specimens of *Conus* described by Sacco, of the Istituto di Geologia, Palazzo Carignano, Torino. These numbers are on red labels

Names in brackets are the revised names.

1. *Lithoconus mercatii tauromaxima* [*C. parvicaudatus*]
2. *Litrhoconus mercatii compressicauda* [*parvicaudata*]
3. *Lithoconus subacuminatus ? tauroconnectens* [*C. antiquus*]
4. *Lithoconus antiquus* [*C. antiquus*]
5. *Lithoconus antiquus* [*C. antiquus*]
6. *Lithoconus antiquus wheatleyi permucronata* [*C. antiquus*]
7. *Lithoconus antiquus wheatleyi perangulata* [*C. antiquus*]
8. *Lithoconus antiquus concavespira* [*C. antiquus*]
9. *Lithoconus antiquus percanaliculata* [*C. antiquus*]
10. *Lithoconus antiquus elatocanaliculata* (one of five specimens, numbers 10-14, none of which was selected as the type of his variety by Sacco) [*C. antiquus*]
11. *Lithoconus antiquus elatocanaliculata* [*C. antiquus*]
12. *Lithoconus antiquus elatocanaliculata* [*C. antiquus*]
13. *Lithoconus antiquus elatocanaliculata* [*C. antiquus*]
14. *Lithoconus antiquus elatocanaliculata* [*C. antiquus*]
15. *Lithoconus antiquus subscalarata* (one of six specimens, numbers 15-20, used by Sacco to describe his variety, none of which was selected as the type) [*C. antiquus*]
16. Same as 15
17. Same as 15
18. Same as 15
19. Some as 15
20. Same as 15
21. *Lithoconus antiquus elatospirata* [*C. antiquus*]
22. *Lithoconus antiquus perelatospira* [*C. antiquus*]
23. *Lithoconus antiquus elongatissma* [*C. antiquus*]
24. *Lithoconus ? parvicaudatus* [*C. parvicaudatus*]
25. *Lithoconus ? parvicaudatus turbinatissima* [*C. parvicaudatus*]
26. *Leptoconus allionii* (Michelotti) [*C. brocchii*]
27. *Leptoconus allionii ? granulocatenata* [*C. brocchii*]
28. *Leptoconus allionii conicospirata* [*C. brocchii*]
29. *Leptoconus allionii perconicospirata* [*C. brocchii*]
30. *Leptoconus allionii discors* [*C. brocchii*]
31. *Leptoconus allionii pupoidespira* [*C. brocchii*]
32. *Leptoconus allionii perpupoidespira* [*C. brocchii*]
33. *Leptoconus allionii oblita* (Michelotti) [*C. brocchii*]
34. *Leptoconus allionii perfuniculata* [*C. brocchii*]
35. *Leptoconus elatus* (Michelotti) *taurobrevis* [*C. elongatus*]
36. *Leptoconus elatus tauroparva* [*C. elongatus*]
37. *Leptoconus elatus taurotransiens* [*C. aquiensis*]
38. *Conospirus antediluvianus mioblita* [*C. antidiluvianus*]
39. *Conospirus antidiluvianus tauroascalarata* [*C. antidiluvianus*]

39x. *Conospirus antidiluvianus miosubagranosa* [*C. antidiluvianus*]

40. *Conospirus antediluvianus taurocatenatoides* [*C. antidiluvianus*]
41. *Conospirus dujardini taurostriolata* [fig. 1] [*C. dujardini*]
42. *Conospirus dujardini taurostriolata* [fig. 1 bis] [*C. dujardini*]
43. *Conospirus dujardini taurostriolata* [fig. 1 ter] [*C. antidiluvianus*]
44. *Conospirus dujardini pseudoantediluvianus* [*C. dujardini*]
45. *Conospirus dujardini pseudocatenata* [*C. dujardini*]
46. *Conospirus dujardini depressulina* [*C. dujardini*]
47. *Conospirus dujardini taurominor* [*C. dujardini*]
48. *Conospirus bronnii* Michelotti *evolutospira* [*C. canaliculatus*]

49 *Conospirus bronnii ? rotundulata* [*C. aquensis*]

50. *Conospirus bronnii rotundospiratissima* [*C. aquensis*]

51. *Conospirus bronnii exfusus* [not the type of *C. fusus* Borson] [not *C. canaliculatus* or *C. aquensis,* probably *C. fusus* Borson]
52. *Conospirus bronnii rodundulogranosa* [*C. aquensis*]
53. *Conospirus bronnii taurotransiens* [*C. canaliculatus*]
54a. *Conospirus bronnii subascalarata* [Figs. 19a, b] [*C. canaliculatus*]
54b. *Conospirus bronnii subascalarata* [Figs. 19 bis a, b] [*C. canaliculatus*]
55. *Conospirus bronnii tauroafusula* [*C. striatulus*]
56. *Conospirus oblongoturbinatus taurogracilis* [Fig. 23] [*C. oblongoturbinatus*]
57. *Conospirus oblongoturbinatus taurogracilis* [*C. oblongoturbinatus*]
58. *Conospirus oblongoturbinatus taurogracilis angulatissima* [*C. oblongoturbinatus*]
59. *Conospirus oblongoturbinatus fusolaevis* [*C. oblongoturbinatus*]
60. *Conospirus oblongoturbinatus bioconolonga* [*C. oblongoturbinatus*]
61. *Conospirus oblongoturbinatus paucispiralata* [*C. striatulus*]
62. *Conospirus oblongoturbinatus taurochelyconoides* [*C. oblongoturbinatus*]
63. *Chelyconus expelagicus tauroincerta* [*C. basteroti*]
64. *Chelyconus expelagicus subcinguellata* [*C. basteroti*]
65. *Chelyconus oboesus sociabilis* [*C. aquensis*]
66. *Chelyconus oboesus pseudosuessi* [*C. puschi*]
67. *Chelyconus oboesus elatoides* [*C. aquensis*]
68. *Chelyconus oboensus tauroconnectens* [*C. pelagicus*]
69. *Chelyconus oboesus gracilispira* [*C. oboesus*]
70. *Chelyconus puschi demissespirata* [*C. puschi*]
71. *Chelyconus puschi pseudobiconica* [*C. aquensis*]
72. *Chelyconus puschi crassuloides* [*C. oboensus*]
73. *Chelyconus puschi crassuloclava* [? *C. oboesus*]
74. *Chelyconus puschi longogracilis* [*C. marii*]
75. *Chelyconus puschi parvulespirata* [*C. puschi*]
76. *Chelyconus puschi ascalaris* [*C. aquensis*]
77. *Chelyconus puschi ? subuliformis* [*C. oblongoturbinatus*]
78. *Chelyconus marii* Sacco [*C. marii*]
79. *Chelyconus marii fusulopupoides* [*C. marii*]
80. *Chelyconus marii fusulobrevis* [*C. mucronatolaevis*]
81. *Chelyconus marii ovatopupoides* [*C. marii*]
82. *Chelyconus marii digitiformis* [*C. marii*]
83. *Chelyconus marii asparagispira* [*C. marii*]
84. *Chelyconus marii clavatoidea* [*C. marii*]
85. *Chelyconus marii perglandiformis* [*C. clavatulus*]
86. *Chelyconus marii subconicospira* [*C. marii*]
87. *Chelyconus marii subpileospira* [*C. marii*]
88. *Chelyconus marii pileospira* [*C. marii*]
89. *Chelyconus marii mamillatospira* [*C. marii*]
90. *Chelyconus marii depressomamilla* [*C. ponderosus*]
91. *Chelyconus dertogibbus tauroperlonga* [*C. aquaensis*]
92. *Chelyconus mucronatolaevis* Sacco [*C. mucronatolaevis*]
93. *Chelyconus mucronatolaevis fusoelegans* [*C. mucronatolaevis*]
94. *Chelyconus mucronatolaevis longovuloides* [*C. mucronatolaevis*]
95. *Chelyconus mnucronatolaevis taurobiconica* [*C. mucronatolaevis*]
96. *Chelyconus mucronatolaevis glandispira* [*C. mucronalolaevis*]
97. *Chelyconus mucronatolaevis globospira* [*C. mucronatolaevis*]
97x. *Chelyconus mucronatolaevis permamillata* [*C. mucronatolaevis*]
98. *Chelyconus mucronatolaevis conicangulata* [*C. mucronatolaevis*]
99. *Chelyconus taurorectus* Sacco [*C. taurorectus*]
100. *Chelyconus montisclavus* Sacco [*C. montisclavus*]
101. *Chelyconus montisclavus cappucinorum* [*C. montisclavus*].
102. *Cheiyconus montisclavus pagodaeformis* [*C. montisclavus*]
103. *Chelyconus montisclavus inflatulospira* [*C. montisclavus*]
104. *Chelyconus montisclavus mamillatocrassa* [*C. montisclavus*]
105. *Chelyconus montisclavus angulatocrassa* [*C. montisclavus*]
106. *Cheliconus montisclavus humilispirata* [*C. montisclavus*]
107. *Chelyconus montisclavus mamillospira* [*C. montisclavus*]
108. *Chelyconus clavatus tauroclavatula* [Fig. 1] [*C. ponderosus*]
109. *Chelyconus clavatus tauroclavatula* [Fig. 1 bis] *C. pelagicus*]
110. *Chelyconus clavatus taurofusulata* [*C. ponderosus*]
111. *Chelyconus clavatus fusoidoliva* [*C. ponderosus*]
112. *Chelyconus clavatus fusoidovata* [*C. ponderosus*]
113. *Chelyconus clavatus perfusulata* [*C. aquensis*]
114. *Chelyconus clavatus taurovulata* [*C. ponderosus*]
115. *Chelyconus clavatus dendroconoides* [*C. belus*]
116. *Chelyconus clavatus expyramidales* [*C. ponderosus*]
117. *Chelyconus clavatus subrotundispira* [*C. ponderosus*]

118. *Chelyconus clavatus tauroconica* [*C. ponderosus*]
119. *Chelyconus clavatus pileospiroides* [*C. ponderosus*]
120. *Chelyconus dashayesi mioantiqua* [*C. taurorectus*]
121. *Chelyconus deshayesi lineoclavata* [*C. pelagicus*]
122. *Cheliconus conoponderosus ? taurosuturata* [*C. raristriatus*]
123. *Chelyconus ponderoglans ? taurolonga* [*C. ponderosus*]
124. *Chelyconus ponderosus miopraecedens* [*C. ponderosus*]
125. *Chelyconus ponderosus taurocrassa* [*C. pelagicus*]
126. *Chelyconus ponderosus miopermamillata* [*C. ponderosus*]
127. *Chelyconus ponderosus miosubtypica* [*C. pelagicus*]
128. *Chelyconus ponderosus miofusuloides* [*C. pelagicus*]
129. *Chelyconus ponderosus tauroponderosa* [*C. ponderosus*]
130. *Chelyconus ponderosus miovulea* [*C. ponderosus*]
131. *Chelyconus ponderosulcatus* [*C. ponderosus*]
132. *Chelyconus ponderosulcatus mamillatoides* [*C. montesclavus*]
133. *Chelyconus ponderosulcatus pseudovuloides* [*C. ponderosus*]
134. *Chelyconus ponderosulcatus convexoides* [*C. ponderosus*]
135. *Chelyconus laeviponderosus tauroperlata* [*C. ponderosus*]
136. *Chelyconus pelagicus taurogigantea* [*C. pelagicus*]
137. *Chelyconus striatulus compressoconica* [*C. striatulus*]
138a. *Chelyconus parvus parvecatenata* [*C. parvecatenatus* (Sacco)]
138b. *Chelyconus parvus taurocrassulosa* [*C. bitorosus*]
139. *Chelyconus parvus anomalocrassulosa* [*C. bitorosus*]
140. *Chelyconus parvus miofusolivoides* [*C. pelagicus*]
142. *Chelyconus parvus* (?) *longanfractus* [*C. parvecatenatus*]
143. *Chelyconus taurinensis* (Bell. and Mich.) [*C. taurinensis*]
144. *Chelyconus taurinensis perlongopupoides* [*C. marii*]
144x. *Chelyconus taurinensis turritopupoides* [*C. marii*]
145. *Chelyconus taurinensis fusolivoides* [? *C. ponderosus*]
146. *Chelyconus taurinensis ? perolivaeformis* [*C. marii*]
147. *Chelyconus taurinensis ? anomalomamilla* [*C. taurinensis*]
148. *Chelyconus cidarispiratus Sacco* [*C. montisclavus*]
149. *Chelyconus cidarispiratus subglandiformis* [*C. montisclavus*]
150. *Chelyconus cidarispiratus minimespirata* [*C. montisclavus*]
151. *Chelyconus cidarispiratus pseudolivoides* [*C. ponderosus*]
152. *Chelyconus cidarispiratus pseudoavellanoides* [*C. ponderosus*]
153. *Chelyconus avellata* [*C. bitorosus*]
154. *Chelyconus avellana pseudofusata* [*C. bitorosus*]
155. *Chelyconus avellana pusilla* [? *C. bitorosus*]
156. *Chelyconus avellana pseudoplanata* [*C. bitorosus*]
157. *Chelyconus avellana pseudocanaliculata* [*C. bitorosus*]
158. *Chelyconus avellana pseudoturbinata* [*C. bitorosus*]
159. *Chelyconus avellana longoturbinata* [*C. bitorosus*]
160. *Chelyconus avellana pseudogibbosa* [*C. bitorosus*]
161. *Chelyconus mediterraneus taurovata* [*C. pelagicus*]
162. *Chelyconus mediterraneus miosubscalarata* [*C. bitorosus*]
163. *Chelyconus mediterraneus pyramidatospira* [*C. basteroti*]
164. *Chelyconus tauroventricosus* Sacco [? *C. bitorosus*]
165. *Chelyconus bitorosus tauroantiqua* [*C. bitorosus*]
166. *Chelyconus belus tauroinflata* [*C. belus*]
167. *Chelyconus belus taurocompressula* [*C. belus*]
168. *Chelyconus belus rovasendae* [*C. belus*]
169. *Stephanoconus gastaldii* [*C. gastaldii*]
170. *Stephanoconus gastaldii supracompressa* [*C. gastaldii*]
171. *Stephanoconus gastaldii superneasulcata* [*C. gastaldii*]
172. *Stephanoconus gastaldii supraproducta* [*C. gastaldii*]
173. *Stephanoconus subnicobaricus taurorara* [*C. subnicobaricus*]
174. *Stephanoconus subnicobaricus taurocoronata* [*C. subnicobaricus*]
175. *Stephanoconus bredai tauroscalarata* [*C. bredai*]
176. *Stephanoconus bredai subaturbinata* [*C. bredai*]
177. *Stephanoconus bredai globulospira* [*C. parvicaudatus*]
178. *Stephanoconus ottiliae ? asperula* [*C. pelagicus*]
179. *Hemiconus granularis tauroscabricula* [*C. granularis*]

180. *Hemiconus granularis ornata* (Mich.) [C. *granularis*]
181. *Hemiconus granularis taurolaevigata* [C. *granularis*]
182. *Hemiconus granularis taurolaevigata* [C. *granularis*]
183. *Lithoconus antiquus producti* Mylius [C. *antiquus*]
184. *Conus puschi* in Mylius [C. *aquensis*]
185. *Chelyconus belus tauroborsoni* [Sacco,, 1904] [C. *belus*]

LIST OF FOSSIL CONES AND THEIR LOCALITIES DESCRIBED OR FIGURED BY SACCO

The fossils are from specific localities given by Sacco and appearing as a single locality in the text of Sacco's monograph, as the locality accompanying the figure on the plate explanation, or as the locality appearing on the fossil label.

The numbers refer to « red label » numbers given by me to the *Conus* from the « Elveziano » (as used by Sacco). When the fossil is missing, and no number is assigned to the fossil because of its absence, the name used by Sacco appears below.

Baldissero (UCLA) 4926).

Lithoconus antiquus wheatleyi (Michelotti); 7; 26 [perhaps Termofourà instead]; 28; 53; 54a, b; 81; 86; *Chelyconus marii vedioventrosa;* ? 91; 92; 95; *Chelyconus permamillata; Chelyconus taurorectus perileata;* 130; *Chelyconus miosubmamillata*; 126; 130; 138; 144; *Chelyconus miosubmamillata;* 126; 130; 138; 144; *Chelyconus taurinensis* (Bell. and Mich.); 147; 148; *Chelyconus cidarispiratusmagnoconica;* 154; 158; 161; *Chelyconus mediterraneus permiocenica;* 164; 165; 166; 168; *Stephanocinus oboesus* (Michelotti); 65; 72; 84; *Chelyconus marii ovatobrevis;* 118; 127; 128; *Chelyconus* parvus (Borson); 139; 160; 178; *Stephanoconus ottiliae ovulatina; Stephanoconus ottiliae longogracilis*; 180.

Sciolze [= in part Villa Rovasenda], northeast of Chieri approximately 13.7 km. 2; 10; 11; 12; 13; 14; *Lithoconus* ? *Parvicaudatus taurotessellata; Chelyconus*

Albugnano, 4 km north of Castelnuovo and east of Chieri. 3; 48; 78; *Chelyconus ponderosus tauroperlaevis*; 151.

Valle Ceppi (UCLA Loc. 4928)
24; 98; *Chelyconus deshayesi taurosubscalaris.*

Santa Margherita, no more definite locality given; 54 mm east of the west edge of the Chieri map and 142 mm south of the northern edge, 183.

Berzano San Pietro, approximately 7 km north of Castelnuovo and east of Chieri and Torino.
(39x) *Conospirus dujardinii brevicaudata;* 143; 146.

Val Salice or Villa Cochis

Chelyconus puschi scalaratula

Monte dei Cappuccini, on the southeast bank of the Po River, near Torino, at the foot of the hills of Torino. Basal Baldissero Formation (Helvetian). 42; 100; 101; 102; 104; 105; 106; *Chelyconus montisclavus* var. *magnomamillata* Sacco, 107.

Undifferentiated localities of Baldissero, Sciolze, Albugnano, and a few from these plus Berzano San Pietro. Although not differentiated one from the other the localities are of some value because they probably represent nearly the same stratigraphic horizon.
4; 5; 9; *Lithoconus antiquus wheatleyi;* 21; 53; 63; *Chelyconus puschi* (Michelotti); 108; 109; 110; 114; 117; 118; 119; 143; 153; 162.
Note: None of the species listed by Sacco under the subgenera *Cylindrus* and *Rhizoconus* are from the Helvetian rocks and only a few listed by him under *Dendroconus* are from these rocks.

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to the fact that on plate 22 of Grateloup there is a date of April 16, 1847. Because of the numerous entries in the bibliography of Grateloup of 1847 and the fact that the plates of *Conus* (*i.e.*, 43, 44, 45) appear later it does not seem logical that Grateloup could have had the entire work printed by April, perhaps the work of Grateloup did not appear until late 1847 or in 1848].

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ERRATA FOR MIDDLE MIOCENE *CONUS* (CLASS GASTROPODA) FROM PIEDMONT, NORTHERN ITALY (C. A. HALL)

p. 111, line 7: for wiht read with.

p. 116, col. 2, line 15 from bottom: for chose read chosen.

p. 121, col. 2, line 2 from bottom: for place read pace.

p. 125, col. 2, line 10: for Pl. 1 read Pl. 20.

p. 126, Expl. of Plate 20, line 2: for lenght read length.

p. 132, Expl. of Plate 22, Fig. 9, 28: delete 3 lines and substitute « *Conus aquensis* Orbigny. UCLA hypotype number 39399; UCLA locality 4930. Villa Cochis, uppermost Burdigalian (?). Length, 33.5 mm; width, 14.0 mm. Page 131 ».

p 132, Expl. of Plate 22, Fig. 11: add « x 2 ».

p. 132, Expl. of Plate 22, Fig. 25 (not fig. 21) add « *Conus basteroti* Mayer-Eymar. Number 163, collection of Sacco: type *C. mediterraneus* var. *pyramidatospira* Sacco, 1893, p. 104, pl. 10, fig. 4. Torino, Middle Miocene. Length, 39.5 mm; width, 22.0 mm ».

p. 135, col. 2, 6 lines from bottom: for Helvetion read Helvetian.

p. 146, Expl. of Plate 25, Figs. 1,2 - line 1: read *pyrula*.

p. 159, col. 1, 12 lines from bottom: delete Plate 8 and substitute « Plate 27 ».

p. 162, col. 2, 11 lines from top and other times in col., not J + I, but «(+)».