

History of a marine, Cainozoic gastropod taxon, *Conus antidiluvianus* Bruguière, 1792 and its nomenclatural implications

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More than two centuries of discussions and conflicting opinions have not led to general agreement or consensus on the identity of the gastropod species *Conus antidiluvianus* Bruguière, 1792, nowadays assigned to the genus *Conilithes* Swainson, 1840. An extensive survey of the nomenclatural history of this taxon is given. To establish a future non-controversial stability in nomenclature the International Commission on Zoological Nomenclature will be requested to set aside the existing non-distinctive lectotype under their plenary power and designate a neotype which accords with prevailing usage. We suggest a specimen, from the northern Italian Piacenzian, of *C. antidiluvianus* in the sense of Brocchi (1814), who was the first author to illustrate the species after Bruguière's original description.

KEY WORDS: Mollusca, Gastropoda, Conidae, nomenclature, synonymy.

Eighteenth century: first introduction of the taxon

More than two centuries ago Jean Guillaume Bruguière described a new fossil gastropod species in the '*Histoire naturelle des vers*' (part 10 of the famous '*Encyclopedie Méthodique*') (Bruguière, 1792, p. 637) with the name *Conus antidiluvianus*. The introduction of this new name was accompanied by a short, three-line diagnosis in Latin, but also a quite extensive description in French language was added. In his description the author emphasized the slenderness of the shell compared to other cone species, a shell height of '*deux pouces trois lignes*' (= c. 61 mm) and the fact that the acuminate spire comprised one third of the shell height. The shell's surface was described as covered with numerous shallow transverse striations ('*Sa superficie est garnie de stries transverses, nombreuses, peu profondes*'). The spire consisted of 13 whorls, each of which had in its middle a beaded carina ('*une côte saillante, garnie d'un rang de tubercules*').

Of this new gastropod Bruguière had a single specimen in his own collection ('*l'individu de cette coquille que je possède*') and three further specimens were known to him in other collections ('*Je n'en connois en tout que quatre exemplaires, qui sont dispersés dans différents cabinets de Paris*'). The origin of the species is given as

very rare at Courtagnon ('*où on n'en rencontre que très-rarement*') in the Paris Basin (Marne, France), which is a former classic locality of Eocene, Lutetian age.

An illustration of the new species was not given in the 1792 volume and was published only in the 1798 issue of the atlas of the '*Histoire naturelle des vers*' (pl. 347, fig. 6) (publication date after Evenhuis, 2003). That drawing

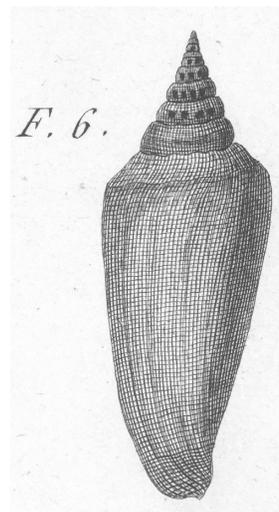


Figure 1. *Conus antidiluvianus* Bruguière, 1792, as illustrated in Bruguière (1798, pl. 347, fig. 6). Locality Courtagnon (Marne), Paris Basin, France. Shell height c. 61 mm.

indeed shows a slender cone with an acute apex, but the carina on the whorls is barely indicated and the beading of the whorls is absent on the two final, more gradually rounded whorls.

Considering Lamarck's (1810, pp. 27-28; 1822, p. 529) notes and data received from Alan J. Kohn (pers. comm., April 2014) it seems unlikely that Bruguière, who actually died in 1798, was personally involved in the art work.

Although many of the *Conus* species included in the 1792 part of the '*Histoire naturelle des Vers*' were actually not described by Bruguière himself, but by C.H. Hwass, this seems not to be the case for the present fossil species, as Hwass's name is absent from the description and also his collection is not mentioned. As noted above the four syntypes were housed in various, but unspecified collections.

Nineteenth century interpretations and discussions

Lamarck (1802, p. 386) mentioned *Conus antediluvianus* with reference to Bruguière's description and illustration. Of the latter he wrote that '*La figure citée lui donne trop de largeur*' (= the illustration represents it as too wide). The locality given is Courtagnon, which agrees with that stated by Bruguière. One (or more?) specimens were in Lamarck's private collection ('*Mon Cabinet*'), which much later made Hall (1964, p. 128) believe that with that statement Lamarck referred to the original syntype specimen(s).

Lamarck (1810, p. 442), using the same name *Conus antediluvianus*, repeated Bruguière's description in his own words, also mentioned the Courtagnon locality and again indicated one (or more?) specimen(s) in his private collection ('*Mon Cabinet*'), which once more gave Hall (1964) the impression that he meant with this statement Bruguière's original material. The shell height Lamarck gave as 62 mm.

In 1814 Giovanni Battista Brocchi's landmark '*Conchologia fossile subapennina*' appeared in two volumes. On pages 291-292 of the second volume, a description of *Conus antediluvianus* is included and illustrated on pl. 2, fig. 11a-c. Brocchi referred to Bruguière's description and illustration as '*egregiamente descritto e mediocrementemente figurato*' (= excellently described and moderately well illustrated'), but in his text itemized a number of differences between Bruguière's description and illustration, compared to the numerous specimens available to him from a number of Italian localities, seemingly all of Miocene (?) and Pliocene age. Here he emphasized, among other differences, that the spiral ornament described by Bruguière as covering the last whorl, was restricted in his Italian specimens to the basal part of the shell, exactly agreeing with the illustrations in his pl. 2. In spite of these differences Brocchi accepted Bruguière's name for the Italian material, without noting the large difference in age between his Italian specimens and those from the Paris Basin. Apparently Lamarck's (1802, 1810) papers

were not available to Brocchi, who only referred to the pre-Linnean paper of Montius (1746, p. 296, fig. 1), who had illustrated a cone of similar shape with carinated, but unbeaded whorls.

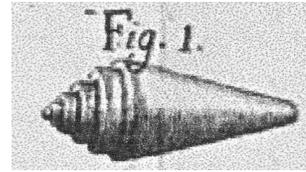


Figure 2. *Cochlea cylindroides nativo cortice obducta*, as illustrated in Montius (1746, p. 296, fig. 1). Montius (p. 288) refers to the locality as '*in Divi Lucae monte*' which is further defined by Brocchi (p. 293) as being '*nel colle di San Luca presso Bologna*' (= in the hills of San Luca near Bologna). Shell height (measured from illustration) 22 mm.

If Brocchi's illustrations are compared with that of Bruguière (1798), the differences are clear. Furthermore, the Italian specimens agree far better with the 1792 description than with the 1798 figure, especially in relation to their clearly carinated and beaded spire whorls. We conclude that this cone species, so commonly represented in the Italian Pliocene and identified as *Conus antediluvianus* by Brocchi, has often continued to be reported until the present day using Bruguière's name, in spite of the differences and uncertainties relating to the original description and illustration.

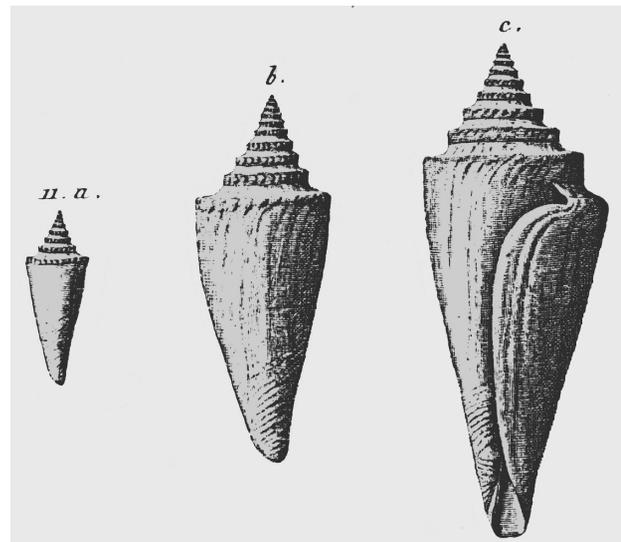


Figure 3. *Conus antediluvianus*, as illustrated in Brocchi (1814, pl. 2, figs 11a-c). Locality not indicated, but from northern Italy. Shell heights (measured from illustration) c. 23, 48 and 66 mm, respectively.

Taking into account the differences in shell morphology: absence of spirals on the body of the last whorl, and the wide gap in their geological age, Brocchi's identification

as *Conus antediluvianus* was, to say the least, doubtful. To maintain Bruguière's name for the Italian material as described by Brocchi one has to suppose that the Courtagnon locality was erroneous and that both the description and the 1798 illustration were incorrect in several respects.

In volume 10 of the '*Dictionnaire des Sciences naturelles*' Defrance (1818, p. 263) listed several Conidae, among which was *Conus antediluvianus*, referring to the original description and to Brocchi (1814), stating the common occurrence of this species in Italy. Defrance qualified Bruguière's illustration as '*mauvaise*' (= poor) and the Courtagnon locality was merely mentioned. Specimens seen by Defrance in the Lamarck collection and received by himself from the 'Plaisantin' (= Piacenza area, Italy) differ from Bruguière's description in having only spirals on the base of the shell.

In very well-preserved specimens from the Italian Pliocene, however, we noticed (Fig. 19) faint spirals all over the last whorl and it might very well be that Bruguière's specimen was similar.

Lamarck (1822, p. 529) again mentioned the species *Conus antediluvianus* Bruguière for the Paris Basin, only mentioning the Courtagnon locality and again referring to specimen(s?) in his private collection. The author discussed the resemblances of this species to *Conus deperditus* Bruguière, 1792 from Paris Basin localities, among which was also Courtagnon. No reference was made to Brocchi's 1814 paper.

Eichwald (1830, p. 222) just mentioned '*Conus antediluvianus* Brug.' (emending spelling) from the Shukowze (Poland) locality. Also von Buch (1830, p. 133) listed *Conus 'antediluvianus'* on the basis of material collected by 'Friedrich Dubois von Locle' (= Frédéric Dubois de Montpéroux) from Bialazurka (Ukraine). No illustrations were given for these records. Such Miocene Central Paratethys records were later considered to belong to *Conus dujardini* Deshayes, 1845, e.g. by Eichwald (1853, p. 207) and Friedberg (1911, p. 47, fig. 9).

It seems that Eichwald was the first to misspell the original name '*antediluvianus*' as '*antediluvianus*', a change that may have been a lapsus rather than deliberate, as it makes linguistically more sense. Still, this has to be considered an 'unjustified emendation' (ICZN Article 33.2). This different spelling, however, was afterwards widely used in literature and was only corrected much later (e.g. Hall, 1964; Kohn, 1968; Robba, 1968, Caprotti & Vescovi, 1973, Caprotti, 1976, Le Renard, 1992; Tracey & Todd, 1996; Landau *et al.*, 2013).

Bronn (1831, p. 12) mentioned *Conus 'antediluvianus'* in a listing of Italian fossils and also added its occurrence in Courtagnon (based on Lamarck, 1810) and in Podolia (based on von Buch, 1830, without description or illustration). Also Dubois de Montpéroux (1831, p. 23, pl. 1, fig. 1) referred to specimens from the same area, and repeated the Italian and Paris Basin localities. Such Central Paratethys records, however, were later (e.g. Glibert, 1960)

considered to represent *C. dujardini* Deshayes, 1845.



Figure 4. *Conus antediluvianus*, as illustrated (upside down) by Dubois de Montpéroux, 1831. Locality not indicated (several Central Paratethys sites were mentioned). This specimen was designated lectotype of *Conus dujardini* by Glibert (1952). Shell height 38 mm.

In their sale catalogue de Cristofori & Jan (1832, p. 15) offered specimens of '*Conus antediluvianus* Brug. Br.', from Castell'Arquato. The double author notation should probably be read as 'Bruguière, in the sense of Brocchi' and seems to indicate that these authors already realized the existing uncertainty concerning the species. They sold specimens for the lowest price (5 fr.), which demonstrates the common occurrence of this species at the mentioned locality.

Deshayes (1832, p. 222) criticized the 1831 Dubois de Montpéroux paper, among many further changes rejecting the name '*Conus Antediluvianus*' for Dubois's specimen, as it is not the same as the Paris Basin species, reidentifying it as '*C. Acutangulus*', as known from '*Bordeaux, Dax et dans la Touraine*'. No author was given for the name *C. acutangulus*.

Deshayes in Lyell (1833, appendix 1, pp. 40-41) summarized his opinions on *Conus* species, mentioning *C. 'antediluvianus'* exclusively from the Eocene of the Paris and London basins, as well as from Valognes (Normandy). *Conus acutangulus*, here again without author, was mentioned from the Miocene of Angers, Volhynia and Moravia. This identification is remarkable, as the name *C. acutangulus* had already been used by Lamarck (1810, p. 286) for a living Indo-Pacific species. Only *C. brocchii* was listed for the Italian Pliocene and, with a question mark, also for Dax in the Aquitaine Basin.

The name *C. brocchii* was introduced by Bronn (1828, p. 740) as a replacement name for *C. deperditus* Brocchi non Bruguière.

In the twelfth part of his '*Tableau des coquilles fossiles*', with descriptions of *Conus* species occurring in the Adour Basin (Aquitaine, SW France) Grateloup (1835, pp. 111-112) discussed the species *Conus 'anti-diluvianus'*, distinguishing two varieties: a. *Testa splendente laevis-simâ*, and b. *testa minore scalariformi*. For the second variety a reference is given to Brocchi's plate 2, fig. 11d, but on that plate are only figures 11a-c, no 11d. As localities Grateloup mentioned several sites in the Adour Basin and furthermore Courtagnon (after Lamarck) and Italian localities (after Brocchi).

Interesting is his remark ‘*Ce Cône est l’analogue parfait de celui des environs de Paris, et de l’espèce d’Italie*’ (this Cone agrees perfectly with the one from the Paris area, and the Italian species), which seems to suggest that Grateloup was acquainted with Paris Basin specimens resembling his Miocene shells.

Illustrations were only given in Grateloup [1845, pl. 44 (*Conus* 2), figs 2 (= var. A), 6 (= var. B) and pl. 45 (*Conus* 3), figs 2a, b (var. C), 13-14 (var. D) and 18 (var. E)]. In our opinion only figs 13-14 of pl. 45 are related to the *C. antediluvianus*-complex. They are indicated in the explanation of pl. 45 at the base of the plate as ‘var. *Scalata*’. In the text at the bottom of pls 44-45 the species is referred to as *C. ‘antediluvianus*’. However, in the explanatory texts to the plates (unnumbered pages) the reference is correctly stated as *Conus antediluvianus*. Contrary to the designation on the plate (var. *scalata*), Var. D is here referred to as var. *junior*. Also on page 4 of the *Table Général*, the Index of species, it says *Conus antediluvianus* Var. D *junior*, and *Scalata* does not occur anywhere in Grateloup’s texts, neither in his 1835 ‘*Tableau des coquilles fossiles*’ nor in the texts of the Atlas of 1845.

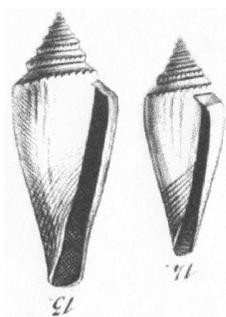


Figure 5. *Conus ‘antediluvianus’* var. D, named ‘var. *Scalata*’ below the plate (= ‘var. *junior*’ in the text), as illustrated (upside down) in Grateloup, 1845, pl. 45 (*Conus* 3), figs 13 and 14. Locality: Saubrigues (Aquitaine Basin, France). Shell heights (measured from illustration) 36 and 29 mm, respectively.

Deshayes (1837, p. 749, pl. 98, figs 13, 14) (this paper is frequently, but incorrectly, cited as being published in 1824) discussed *Conus ‘antediluvianus’*, but attributing this name to Lamarck, not to Bruguière, believing that Bruguière’s name was not based on a Paris Basin *Conus*, but rather on a species ‘*que l’on rencontre assez fréquemment en Italie*’ (= that is frequently found in Italy), but no reference is made to Brocchi (1814). Lamarck (1810, 1822) (see above) had restricted the name *C. antediluvianus* to another species known to him from the Paris Basin, somewhat smaller than Bruguière’s shell, with spirals restricted to the base, but otherwise agreeing with the original description. Deshayes (1837) referred to Lamarck’s text and also mentioned the localities of Parnes, Mouchy and Courtagnon, all Lutetian localities in the Paris Basin. Deshayes had never found specimens with the size given by Bruguière (c. 61 mm), but ‘*nous avons rencontré dans plusieurs autres localités une espèce plus petite et dont les caractères s’accordent assez exactement avec la description de Bruguière, et c’est à elle que nous avons réservé la nom de Conus antediluvianus*’ (in several other localities we have found a smaller species, the characters of which agree rather exactly with Bruguière’s description, and for which we have restricted

the name *Conus antediluvianus*). A locality for the specimen, illustrated on pl. 98 is not given, neither in the text nor in the explanation of the plate, but from the context it is clear that it is from the Paris Basin, also as later (1865, see below) Deshayes introduced a new Paris Basin species (*C. parisiensis*) referring to these 1837 illustrations. Surprisingly, Hall (1964) mistook Deshayes’ illustration to represent *Conus dujardini* (see below). Also, Hall (1964, p. 127) stated that Deshayes in 1824 was the first to change Bruguière’s spelling of *antediluvianus* to ‘*antediluvianus*’. But Deshayes’ paper was published in parts between 1824 and 1837 and the relevant page where the name *C. antediluvianus* was used appeared only in 1837, which makes Eichwald (1830) ‘guilty’ of having introduced that spelling for the first time.

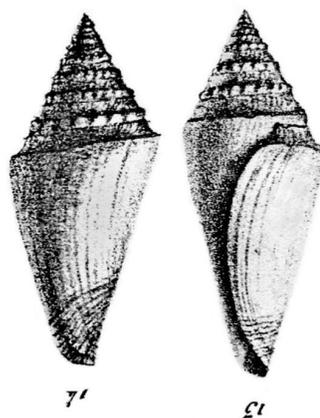


Figure 6. *Conus ‘antediluvianus’*, as illustrated (upside down) by Deshayes (1837, pl. 98, figs 13, 14). Locality not indicated, presumably Parnes, Mouchy or Courtagnon, Paris Basin (France). Shell height 38 mm. This specimens was later (Deshayes, 1865) included in *C. parisiensis*.

In the same year Pusch (1837, p. 115) included a species with the name *Conus angutangulus* Desh.’ (obviously a lapsus for *C. acutangulus* Deshayes, as the latter spelling is instead used in Pusch’s discussion on the same page) from several Central Paratethys localities, applying this name for *Conus ‘antediluvianus’* in the sense of Eichwald and ‘Dub.’ (= Dubois de Montpéreux). His opinion was apparently based on Deshayes *in* Lyell (1833) where the Paratethian occurrences were mentioned with that name.

The name ‘*Conus acutangulus* Deshayes’ was also used by Dujardin (1837, p. 305) for a small cone from the Miocene of the Loire Basin, France. This reference, together with the 1833 references of Deshayes *in* Lyell (1833), Pusch (1837) and several others, were later (Deshayes, 1845, pp. 158-159) considered to belong to *Conus dujardini*.

Bronn (1838, p. 1119), contrary to his 1831 opinion, restricted the name *Conus ‘antediluvianus’* Desh. to the Paris Basin specimens, as interpreted by Deshayes (1837, p. 749) and also referred by Deshayes *in* Lyell (1833).

The taxon '*Conus concinnus* Sow.' was given as a synonym of the Eocene *C. 'antediluvianus'*. As this made the name '*antediluvianus*' unavailable for the Italian species a new name, *Conus apenninicus* Bronn (1838, p. 1119, pl. 42, fig. 15) (spelled as '*appenninicus*' in the explanation of the plate), was introduced for shells formerly called *Conus antediluvianus* from the Italian Pliocene. For the specimens recorded by Eichwald, von Buch and Dubois de Montpèreux from Central Paratethys localities, as well as for occurrences in Algeria, the Aquitaine and Touraine regions of France and in the Vienna Basin, Bronn applied the name *Conus acutangulus* Deshayes.

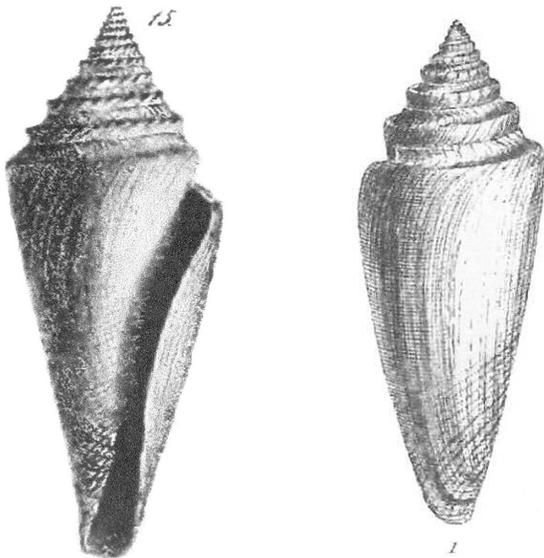


Figure 7 (left). *Conus apenninicus* Bronn (1838, p. 1119, pl. 42, fig. 15). Locality not indicated, presumably Italy. Shell height (measured from illustration) 73 mm.

Figure 8 (right). *Conus 'antediluvianus'*, as illustrated in Sowerby (1823, pl. 266, fig. 1), Locality Piacenza (Italy). Shell height (measured from illustration) 66 mm.

A new genus *Conilithes* was introduced by Swainson (1840, p. 311), with as type species *C. 'antediluvianus'*, without mention of age or locality, but referring to 'Sow. Gen. f. 1', obviously Sowerby (1823, plate 266, fig. 1), where a specimen with that name is illustrated, indicated as 'a fossil species from Piacenza'. Therefore the type of *Conilithes* is *Conus antediluvianus* in the sense of Brocchi (1814), with which the Sowerby illustration basically agrees in having a high-spined apical shell part with carinated whorls, the ultimate ones of which, however, are barely beaded.

In 1845 Deshayes in Deshayes & Milne Edwards, published the authoritative paper '*Histoire des mollusques*' in the 11th volume of '*Histoire naturelle des animaux sans vertèbres*'. *Conus 'antediluvianus'* was discussed on pages 155-157, attributing this taxon to Lamarck, not to

Bruguière, although Bruguière is cited among the synonyms (albeit with the erroneous citation '*antediluvianus*' and also reference was made to Lamarck 1810, amongst others. As locality, Deshayes gave the Eocene locality of Courtagnon, so his text refers only to the Paris Basin form. However, in an extensive footnote the origin Courtagnon of Bruguière's specimens is strongly doubted and it is supposed to have been a species from Italy: '*nous avons la conviction qu'elle s'applique à une espèce d'Italie et non à une coquille de Courtagnon*' (we are convinced that [the name] is based on an Italian species and not on a shell from Courtagnon'). Obviously this footnote was added after completion of the basic texts, as it is completely contradictory.

On p. 159 the taxon *C. acutangulus*, as used by Deshayes in Lyell (1833) was renamed *Conus dujardini* because of preoccupation by *Conus acutangulus* Lamarck (1810, p. 286) (= *Conus acutangulus* Chemnitz (1795, p. 59, pl. 182, figs 1772-1773) (invalid). Deshayes (1853, p. 73, pl. 120, fig. 8) gave an illustration of *C. dujardini*, without mentioning size or locality. The drawing closely resembles the illustration given by Dubois de Montpèreux (1831).

Nyst (1845, p. 585) in his discussion of *Conus brocchii* Bronn, noted that this species closely resembled *Conus 'antediluvianus'*. As, according to Nyst, Deshayes had restricted the name '*Conus antediluvianus*' to a Paris Basin species, that name was no longer valid for the Italian species. Consequently, Nyst proposed the new name *Conus bruguierii* for the species represented by Brocchi (1814, pl. 2, fig. 11). Nyst's name, however, is a junior synonym of *Conus apenninicus* Bronn, 1838 (see above).

Michelotti (1847, p. 336), as *Conus antediluvianus* Brug., supported Deshayes (1845) by acknowledging that Bruguière and Lamarck erroneously considered Courtagnon to be the type locality of *C. antediluvianus* and recorded this species as being common in northern Italian localities and in the Vienna Basin. Interestingly, just one year earlier Michelotti (1846, p. 52) published a list of fossils to be included in a manuscript on northern Italian fossils, that appeared in 1847. However, the species *C. apenninicus* Bronn, listed in 1846, is not mentioned in the 1847 publication. In contrast, two species not mentioned in the 1846 list are included: *C. antediluvianus* Bruguière and *C. acutangulus* Deshayes. It seems that Michelotti changed his mind over these identifications at a rather late stage, but no further discussion on nomenclature was added.

In a listing of invertebrate fossils from Piemonte (northern Italy) Sismonda (1847) listed *Conus antediluvianus* Brug., referring to 'Lam. An. s. vert. 11. p. 155', which, however, considering the volume and page numbers, is more likely to refer to Deshayes in Deshayes & Milne Edwards, 1845) than to Lamarck. Brocchi's (1814) illustrations were also mentioned, as well as *Conus apenninicus* Bronn, as synonyms. Sismonda gave as distribution '*Terr. mioc. Dert. Pedem.*' (= Miocene of Tortona and Piemonte).

Von Hauer (1848, p. 312) reported on a fossil collection made by J. Russegger (see <http://www.deutschebiographie.de/sfz77440.html>) from Hudh in Karamania (Turkey), not to be confused with the city of Karaman in the fossil-rich Miocene Karaman Basin SE of Konya. Russegger's locality is located at the southern end of the Antitauros Mountains, c. 110 km NNE of Adana. In a listing the species *Conus 'antediluvianus'* Desh. was mentioned. Also a new species, '*Conus Russeggeri*' [von Hauer], 1848, was introduced with a very short description: '*Mit sehr schmaler Schale und ungewöhnlich weit vorstehendem Gewinde*' (= with a very narrow shell and an unusually far extending spire). Even this extremely short diagnosis makes one think of earlier descriptions of *C. antediluvianus*. Hörnes (1851, p. 36) considered this new species related to *Conus puschi* Michelotti, 1847. Subsequently, however, de Gregorio (1882, p. 217) recognized '*Conus Russeggeri* (Hauer.) De Greg.' from Malta, stating that it belongs to the same group as *C. antediluvianus* ('*allo stesso gruppo ... nell'antediluvianus tipo*') but in which the apical shell part always is lower than in *C. russeggeri* ('*la spira è sempre assai meno prominente*'). Then, de Gregorio (1895, p. 12, pl. 3, figs 6-8) decided to rename these Maltese specimens to *Conus melitoticulus* de Gregorio, as *C. russeggeri* could not be recognized with absolute certainty ('*car l'espèce de Hauer n'est absolument reconnaissable*').

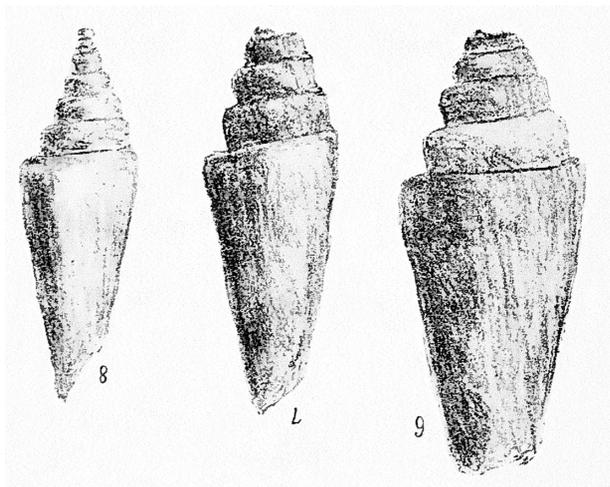


Figure 9. *Conus melitoticulus* de Gregorio, 1895 (internal moulds) from Malta (level unknown) as illustrated in de Gregorio (1895, pl. 6, figs 6-8 (upside down)). Shell height not indicated.

Gatt (2006, p. 191) described and illustrated internal moulds from Malta identified as *C. melitoticulus* and gave *C. russeggeri* as a synonym. Such specimens indeed have a quite high spire, but being internal moulds cannot be identified to species. It cannot be excluded, however, that they are moulds of *C. antediluvianus*, although the two specimens represented seem quite different.

Hörnes (1851, p. 38, pl. 5, fig. 2a-e) accepted Deshayes'

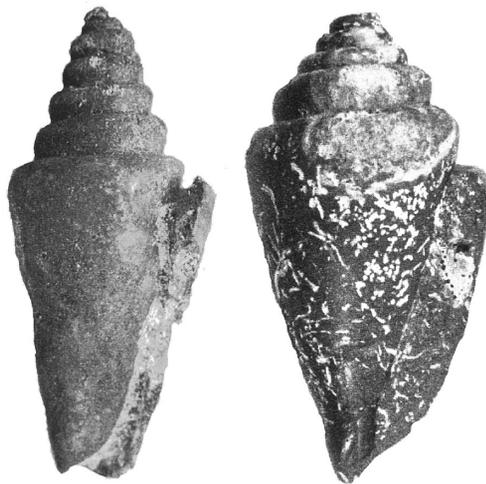


Figure 10. *Conus melitoticulus* de Gregorio, 1895 (internal moulds) from Malta (Greensand Formation, Tortonian), as illustrated by Gatt (2006, p. 191, unnumbered figures). Size of illustrated specimens not indicated, but Gatt mentioned a maximum height of 72 mm.

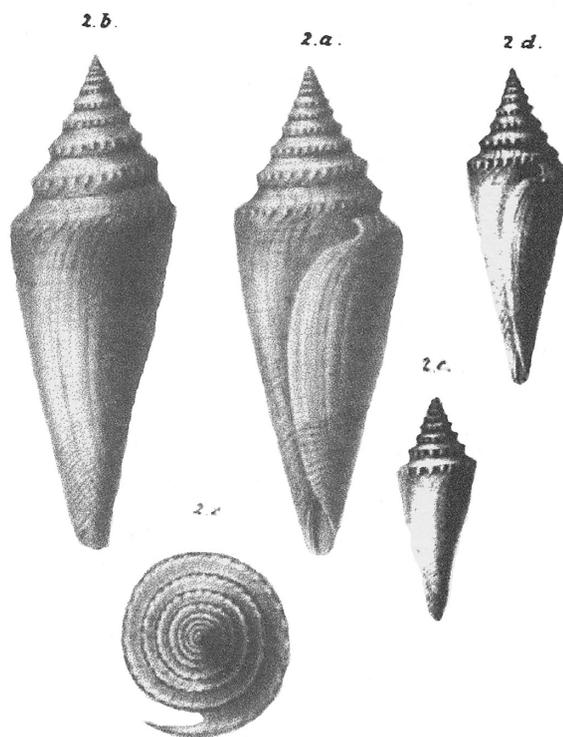


Figure 11. *Conus 'antediluvianus'* as illustrated in Hörnes (1851, pl. 5, fig. 2a-e). Locality not specified, but presumably from Baden, Vöslau, Möllersdorf or Grund, Vienna Basin (Austria). Shell height (fig. 2a) 60 mm.

(1845) statement that Bruguière's material did not originate from the Paris Basin locality Courtagnon, but rather from northern Italy. Consequently, identifications of the Vienna Basin specimens by Hörnes are predominantly based on Brocchi's (1814) interpretation, as is also clear

from the distribution of the species given by Hörnes. The specimens illustrated from the Vienna Basin indeed resemble Brocchi's specimens closely.

Hörnes compared this species to a Recent cone, *Conus orbigny* Audouin, 1831, from China and Japan, which according to him demonstrated 'die grösste Uebereinstimmung' (the greatest similarity). The original description and illustration of Audouin (1831, pl. 20), however, point to differences in the (strong) spiral ornament of the last whorl and a different shape of the basal part of the shell. Also the beaded carina, according to the illustration, is less strongly developed.

In 1850 (p. 355, nr 335) d'Orbigny listed *Conus 'antediluvianus'* Lamk., mentioning five localities in the Paris Basin and referring to Lamarck (1810, 1822) and Deshayes (1837, but using the incorrect year 1824).

In his third volume of the 'Prodrome' (1852, p. 11, nr 174) d'Orbigny introduced the new name *Conus aquensis* d'Orbigny, 1852 (mentioning the year 1847 himself, which is a manuscript date) for two specimens described and illustrated as *Conus 'antediluvianus'* by 'Gratteloup' (1845, pl. 44, figs 2 and 6, respectively var. A and var. B). In the same 1852 paper d'Orbigny (p. 56, nr 965) listed the name *C[onus] apenninensis* Bronn, referring to Bronn's pl. 52, fig. 15 (where, however, *Conus apenninicus* was illustrated, not *apenninensis*). It is unclear whether this is a lapsus or an intentional emendation. Reference is also made to Sismonda (1847), who used the correct spelling *C. apenninicus* as a synonym of *C. antediluvianus*. Finally, in the same paragraph 965, d'Orbigny mentioned '*C. antediluvianus*, Brocchi, pl. 2, fig. 11 (non Brug., 1791)' as a synonym, and 'Piemont, Dertona; Autriche, Baden' as occurrences.

On p. 58 (nr 1003) of the same volume the new name *Conus subacutangulus* d'Orbigny, 1852 is introduced, as a replacement name for *C. acutangulus* Bronn, 1837, no doubt because of preoccupation by *C. acutangulus* Lamarck, 1810, although that is not mentioned. *Conus antediluvianus* Dubois non Bruguière is given as a synonym. Based on earlier literature d'Orbigny listed the distribution as: 'France, Bordeaux, Touraine; Volhynie à Bialosurka, Belka, Jakowce; Autriche, Gainfaren, Vienne'. *Conus subacutangulus* d'Orbigny, 1852 therefore is a junior synonym of *C. dujardini* Deshayes, 1845.

Hoffmann (1828, p. 119) recorded an external mould of *Conus antediluvianus* from the Miocene of Bockup (Mecklenburg-Vorpommern, Germany); Philippi (1847, p. 90) listed *Conus 'antediluvianus* var.' from Miocene mica clays at Lüneburg (Lower Saxony, Germany), Zimmermann (1848, p. 187) found presumably the same species (identified as '*C. Apenninicus*, Desh.') from the Miocene mica clay of Reinbek (Schleswig-Holstein, Germany) and Meyn (1848, p. 31) mentioned Spandetgaard (Jylland, Denmark) as a Miocene locality for *Conus 'antediluvianus'*.

Beyrich (1853, p. 291, pl. 1, fig. 1a, b), however, was the first to give a description and illustrations of this species (as *Conus 'antediluvianus'*) from Miocene North Sea Basin localities. The author accepted Deshayes' conclu-

sion that Bruguière's taxon was based on Italian material and concluded that there was no longer need for the name *C. apenninicus* Bronn, 1838. Furthermore, Beyrich argued that no new name was necessary for the Paris Basin specimens, if the name *Conus concinnus* Sowerby was accepted. *Conus concinnus* J. Sowerby, 1821 (p. 180, pl. 302, fig. 2) is a species described from the Ypresian of London, UK and (erroneously) from Barton, in the Hampshire Basin (UK). The lectotype of this species has a shell height of 13.7 mm only.



Figure 12. Lectotype of *Conus concinnus* J. Sowerby, 1821. London Clay Formation, Highgate Hill, London. Shell height 13.7 mm. J. Sowerby Collection, Natural History Museum, London, UK. Photo: Steve Tracey.

Edwards (1856, p. 195, pl. 25, fig. 3a-c) introduced a new name, *Conus lamarckii*, for what he described (p. 191) as 'the Eocene species still miscalled *C. antediluvianus*', obviously referring to the Paris Basin form. Unfortunately, Edwards' name is preoccupied by *Conus lamarckii* Kiener, 1847, a Recent species, which itself is a junior synonym of *Conus mercator* Linnaeus, 1758 (WoRMS website). Edwards rejected the identification of the Paris Basin Eocene form as *C. concinnus*, as had been done by Bronn (1838). Also Philippi (1847, p. 80) applied that name for a specimen from the late Eocene-early Oligocene of Magdeburg, Germany. *Conus lamarckii* Edwards, 1856 non Kiener, 1847 was later replaced by *C. selseiensis* Cossmann (1896, p. 163).

Deshayes (1865, p. 418), reconsidering his 1833-1837-1845 decisions, introduced a new name, '*Conus Parisiensis*', for the Eocene Paris Basin form earlier indicated as *Conus 'antediluvianus'*, referring to his 1837 (p. 749, pl. 98, figs 13, 14) illustrations. As localities he mentioned the Paris Basin localities Parnes, Mouchy, Chaussy and Liancourt (not Courtagnon!) and 'Calcaire grossier' (Eocene, Lutetian) for the stratigraphical origin. The name *C. parisiensis* Deshayes, 1865 was in fact a replacement name for *C. lamarckii* Edwards, 1856 non Kiener, 1847, predating *C. selseiensis* Cossmann, 1896. Deshayes also accepted Edward's opinion that the Paris Basin form was not *C. concinnus*.

In 1874 Mørch (p. 291) introduced *Conus (Conolithes) poulsenii*, based on specimens from Sylt (Germany) and Gram, Spandet, Esbjerg and Sandfuldgaarde (Denmark), all late Miocene (Tortonian) in age. The single specimen from Sylt had a shell height of 65 mm. The shell was described as different from *C. antediluvianus* Brocchi in having fewer and coarser knobs ('differt nodulis coronae majoribus et paucioribus') and *Conus 'antediluvianus'*

Beyr. *non* Brug.’ is mentioned as a synonym. Furthermore Mørch described as ‘var.? *C. gymnospira*’ another form from Sylt with a shell height of 50 mm, differing by ‘*t. latiore spira brevior, anfr. infra carinam obsolete undulatis, C. derelictus non absimilis*’ (= ~ having a broader shell and shorter spire, the whorl part below the carina very slightly undulating, not unlike *C. derelictus*). *Conus derelictus* Deshayes, 1865 is a Paris Basin species.

De Stefani & Pantanelli (1879, p. 133) recorded *Conus antediluvianus* Bruguière from several localities in the area of Siena (Tuscany, Italy), records repeated by de Stefani (1888, p. 219).

Hoernes & Auinger (1879, pp. 12, 14, 15, 34) included *Conus antediluvianus* in the subgenus *Leptoconus* Swainson (1840, p. 312), instead of in the subgenus *Conilithes*, in which Swainson originally included it (type species), but the name *Conilithes* does not occur in Hoernes & Auinger. They referred to *C. antediluvianus* as belonging to a group of cones with beaded whorls, in which the beading disappears on the last whorls. Eighteen years earlier Semper (1861, p. 222) had also included *C. antediluvianus* in the subgenus *Leptoconus*.

De Gregorio (1890, p. 21) introduced the name *Conospirus*, as a subgenus of *Conus*, with type species *C. antediluvianus*, Brug., including several other species in this subgenus, among which also *C. parisiensis* Deshayes. The author furthermore stated that the genus *Leptoconus*, applied to the species *C. antediluvianus*, by ‘R. Hoernes Moll. Wien’ (meant was apparently Hoernes & Auinger, 1879, p. 34, as *C. antediluvianus*) groups species with completely different characters.

Sacco (1890, p. 284) listed *Conus antediluvianus* Brug. from the Tortonian of Piemonte (northern Italy) and a ‘var. *empenus* De Greg.’ from the Astian. Moreover, he distinguished *Conus apenninensis* Bronn, also from the Tortonian. The name *apenninensis*, however, was not introduced by Bronn, but by d’Orbigny, 1852, either as an emendation or as a lapsus for *C. apenninicus* Bronn (see above).

In volume 13(1-2) of the well-known series ‘*I molluschi dei terreni terziarii del Piemonte e della Liguria*’ Sacco (1893a, p. 39) accepted the genus *Conospirus* de Gregorio, 1890, but made remarks on similarities to the genera *Hemiconus* and *Leptoconus*, leading to difficulties in assigning species to one or the other genus. He restricted *Conospirus* therefore to the group of *Conospirus antediluvianus* and related forms (‘*forme affini*’). This author referred to the original description of the type species as ‘*Conus antediluvianus* Brug.’ but nevertheless kept the name spelled as ‘*antediluvianus*’ throughout. The species was recorded from a number of Tortonian, Piacenzian and Astian localities in Italy. He gave a long list of synonyms, of which we here discuss only the ones illustrated. As usual for Sacco, he distinguished no less than 16 named ‘varieties’ (illustrated Sacco 1893b, pl. 4, figs 28-45) within the species *Conospirus antediluvianus*.

Cossmann (1896, pp. 155-156) emended the name *Conospirus* de Gregorio, 1890 to *Conospira* as the original Greek word for spire ‘σπείρα, la spire’ was feminine. Cossmann considered the name *Conospira* to be valid, above *Conilithes* Swainson, 1840, which he believed to be a junior synonym of ‘*Conilites*, Schloth. 1820, nec Lamk. 1822’. Consequently, Cossmann took *C. antediluvianus* Bruguière as the type species of the genus *Conospira*. An illustration of the type species (as *Conospira antediluviana*, pl. 8, figs 7, 8) is given based on a specimen from the Pliocene of southern France (Biot), which is a large shell with beading of the whorls barely developed (Fig. 13 herein).

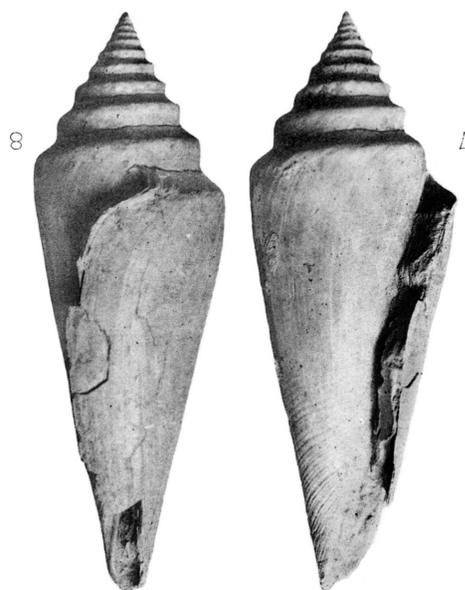


Figure 13. *Conospira antediluviana* Brug., as illustrated (upside down) by Cossmann (1896, pl. 8, figs 7, 8). Locality Biot (France). Shell height (measured from illustration) 76 mm.

A discussion on validity of the various generic names was given by Fleming (1968), who concluded that *Conilithes* was a valid name, which made *Conospirus* and *Conospira* junior objective synonyms of *Conilithes* (based on the same type species).

Twentieth century and beyond: the confusion goes on

Canavari (1910, p. 107, pl. 7, fig. 5) described and illustrated a poorly preserved specimen from the Tortonian of Fabriano (Marche, Italy), identified as ‘*Conus (Conospirus) antediluvianus* Br. var. *turritospira* Sacco’. Among his synonyms *Conus apenninensis* Sacco, 1890, was cited, which is a lapsus for ‘*apenninensis*’, as spelled by Sacco (1890), which name is itself an emendation or a lapsus for *apenninicus*.

Cossmann & Pissarro (1913, pl. 48, fig. 214-6), published two illustrations of a shell identified as *Conus (Cono-*

spira) parisiensis Desh. from Mouchy (Lutetian) and indicated that the species was also known from the Bartonian. The illustrated specimen, compared to Deshayes' (1837, pl. 98, figs 13, 14) figures, has a wider apical angle and there is no trace of beading.

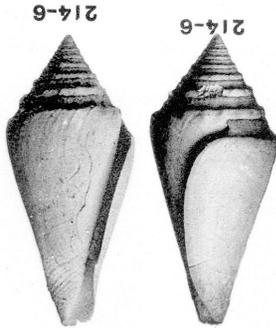


Figure 14. *Conus (Conospira) parisiensis* Desh. as illustrated (upside down) by Cossmann & Pissarro (1913, pl. 48, fig. 214-6). Shell height (measured from illustration) 35 mm.

Kautsky (1925, p. 145) recognized both '*Conus (Conospira) antediluvianus*' Brug.' and '*C. (C.) Dujardini* Desh.' for Miocene assemblages in northwestern Germany, illustrating only the latter (pl. 10, fig. 14, 15) and giving ample characters to distinguish the two species.

From three locations in the Aquitaine Basin (SW France) Peyrot (1931, p. 84, pl. 1, figs 21-22) described a form of *Conus antediluvianus* which, in his opinion, was aberrant and identified it as '*mut. scalata* Grateloup'. This form differed in having a more elevated spire, stronger carinated whorls, a more concave subsutural zone, characters which make it strongly resemble Sacco's var. *dertonensis* from the Miocene of Stazzano, northern Italy. Peyrot also gave characters distinguishing *Conus dujardini* and recorded the latter from quite a number of localities in the same basin.

Roman (1940) in his publication '*Listes raisonnées des faunes du Pliocène et du Miocène de Syrie et du Liban*' mentioned '*Conus (Conospira) antediluvianus*' Br.' from two localities in what in 1940 was Syria: 'Karakillissé' and 'Lattaquié'. The first locality is now Turkish territory, N of Antakya, in the Hatay Basin. Lattaquié (today's port of Latakia) is situated on the Syrian coast. Roman wrote '*Cette espèce paraît assez rare en Syrie et n'est représentée que par quelques rares échantillons jeunes.*' (This species seems to be rather rare in Syria and is only known from a few rare juvenile specimens). The species was not illustrated.

Wenz (1943, p. 1470, fig. 4153 - copied from Cossmann, 1896) listed *Conolithus* Herrmannsen, 1847 as a subgenus of *Conus*, with *C. (C.) antediluvianus* as monotype and listed '*Conolithes [sic]* Swainson, 1840 non *Conolites [sic]* Schlotheim, 1820 nec Lamarck', 1822 and *Conospirus* Gregorio, 1890 as synonyms.

The genus *Conolithus* Herrmannsen, 1847 (p. 294), as given by Wenz, was not a misspelling of *Conilithes* Swainson, 1840, as said by Landau *et al.* (2013, p. 252). Herrmannsen 'corrected' the name *Conilithes* on the basis of etymology

of the Greek components: 'Etym. $\chi\acute{o}\nu\omicron\varsigma$, *conus*; $\lambda\acute{\iota}\theta\omicron\varsigma$, *lapis*. Rectius *Conolithus*', which makes *Conolithus* an unjustified emendation rather than a spelling error.

In his monograph on the Miocene gastropods of Belgium Glibert (1952, p. 133) described *Conus (Conospira) dujardini*, stating that all specimens of *C. antediluvianus* previously recorded from Belgium (as in von Koenen, 1872, p. 213) belonged to *C. dujardini*. The author's statement '*La figure type est celle qu'a publiée Dubois de Montpéroux (1831, pl. 1, fig. 1) d'un exemplaire du Tortonien de Wolhynie*' may be considered a valid lectotype designation of *C. dujardini*. The specimen was a syntype as it was referred to in Deshayes' (1845) introduction of the species and Glibert's statement fulfills ICZN art. 74.5. Glibert also considered the specimen illustrated by Peyrot (1931, pl. 1, figs 21, 22) as '*Conus antediluvianus mut. scalata*', to belong to *C. dujardini*. Unexpectedly this very specimen of Peyrot was later (Hall, 1964) considered to be the most typical and best candidate for a possible neotype of *C. antediluvianus*.

Erünal-Erentöz (1956, p. 30; 1958, p. 124, pl. 20, fig. 11) recorded a single specimen of *Conus antediluvianus* from the Pliocene of the Hatay Basin, near Antakya (Turkey). Its illustration agrees very well with the 'Brocchi type' as known from northern Italian Pliocene occurrences. This coincides with Roman's (1940, see above) observations made in the same area. Erünal-Erentöz was not quite consistent in her references: in 1956 she referred to *Conus (Conospirus) antediluvianus*. In 1958 she used the subgeneric name *Conospira* in her systematics text and *Conospirus* in the explanation of pl. 20 (and also *Conospirus* in her text for *C. dujardini*). Harzhauser *et al.* (2002, p. 128) found '*Conus antediluvianus*' in late Burdigalian deposits of the Mut Basin, southern Turkey. According to Landau *et al.* (2013) this species is absent from the rich Miocene assemblages of the Karaman Basin.

Kojumdgieva (1960, p. 209, pl. 49, fig. 3) recorded both '*Conus (Conolithus) antediluvianus*' and *C. (C.) dujardini* from the Badenian of Bulgaria.

In Glibert (1960, p. 98) the species was listed as *Conus (Conolithus) antediluvianus* Bruguière, 1792. Its distribution (based on samples in the Brussels museum) is given as: Burdigalian, clay facies of Saubrigues, SW France (which, however, is Langhian in age, Cahuzac & Janssen, 2010, p. 16), Tortonian of northern Italy, Vienna Basin and northern Germany, Spain and several 'Diestian' and Pliocene occurrences in Germany, Denmark, France and Spain, as well as a number of Italian localities.

Hall (1964, p. 127, pl. 22, fig. 7) described *Conus antediluvianus*, giving quite extensive earlier synonymies. Concerning the type material she remarked that the holotype was originally in Lamarck's collection, referring to Lamarck (1802, p. 386, 387; 1810, p. 441), where, however, there is no mention of a type specimen, just a note

that one (or more) specimens were in Lamarck's private collection (see above). This could refer to one or more of the four specimens mentioned by Bruguière, or still to another specimen not seen by Bruguière. No holotype has ever been designated. Hall discussed the need of a neotype but refrained from designating one because no material from the type locality was studied. She went on to say 'The variant figured by Peyrot (1931, pl. 1, figs. 21, 22) is one of the best figures of *C. antediluvianus* and even though it is not the type or a topotype, it would make a suitable neotype'. That specimen (considered by the way by Glibert, 1952, to represent not *C. antediluvianus*, but *C. dujardini*) originated from the Langhian of Saubrigues (Aquitaine Basin, France) and was identified by Peyrot as *Conus (Conospira) 'antediluvianus'* Brug. var. *scalata* Grateloup. Hall's statement concerning a possible neotype was repeated by Pelosio (1966, p. 168) and Davoli (1972, p. 75).

The Paris Basin Eocene shell illustrated by Deshayes (1837, pl. 98, figs 13, 14) as *C. antediluvianus* was considered by Hall to represent *C. dujardini*. This Eocene shell was later renamed *C. parisiensis* and is clearly not conspecific with the Miocene *C. dujardini*.

Kohn (1968, p. 439), under *Conus antediluvianus* Bruguière, repeated the essential details of the original description, mentioned the lack of original material as 'based on a fossil specimen in Bruguière's collection not presently at Geneva or Paris (see Hall, 1964)' and concluded that the description and illustration 'are consistent and adequately identify the nominal species'. Kohn referred to the type locality Courtagnon as 'generally considered erroneous'. For distribution of the species European Miocene and Pliocene occurrences were cited according to Brocchi (1814), Deshayes (1865) and Hall (1964). Bruguière, however, mentioned four specimens in several collections, only one of which was in his private collection. Kohn did not mention discrepancies between the 1792 description and 1798 illustration of Bruguière.

Robba (1968, p. 611) recorded *Conus (Conolithus) antediluvianus* from the classic Tortonian stratotype between S. Agata Fossili and Bavatore, along the Rio Mazzapiedi section (Alessandria, N. Italy), stressing the extreme vari-

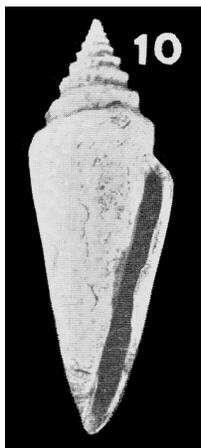


Figure 15. *Conus (Conolithus) antediluvianus*, as illustrated in Caprotti & Vescovi (1973, pl. 3, fig. 10). Locality Castell'Arquato (Italy). Shell height (measured from illustration) 55 mm.

ability ('è estremamente polimorfa') of the species and listing numerous localities of Miocene and Pliocene age in various basins.

Caprotti & Vescovi (1973) and Caprotti (1976) listed and illustrated *Conus (Conolithus) antediluvianus* from the Piacenzian stratotype at Castell'Arquato (Piacenza, Italy).

In a monograph on a Miocene (Late Burdigalian-Langhian) mollusc assemblage from Winterswijk-Miste (The Netherlands) Janssen (1984, p. 334, pl. 13, figs 18, 19; pl. 76, figs 4-9) discussed '*Conus (Conolithus) antediluvianus*' Bruguière, 1792 *s. lat.*'. From this assemblage two protoconch types were described, differing in slenderness and number of whorls. An attempt, however, to relate these two larval shell morphologies to more adult specimens in the same assemblage did not lead to a reliable distinction of two species and therefore all material was identified as *C. 'antediluvianus' s. lat.* However, Landau *et al.* (2013, p. 253) identified one of the illustrated specimens (pl. 76, fig. 5) as *Conolithes dujardini* (Deshayes, 1845).

Janssen also described, with the same species name *C. 'antediluvianus'*, a relatively small form from Winterswijk-Miste, in which the last whorl below the carina is covered with granulated spirals. Similar specimens were already illustrated by Sacco (1893, p. 44, pl. 4, fig. 42a, b), identified as *Conospirus 'antediluvianus'* var. *taurocatenatoides* Sacco. As a similar ornamentation was known to occur in several other Conidae, Sacco did not believe this to be a specific character.

Le Renard (1992) discussed the name *Conus parisiensis*, stating that this species had originally been described as *Conus antediluvianus*, 'corrected' to *antediluvianus*. He argued that it was wrong to pretend ('*abusif de prétendre*') that Bruguière's shell did not originate from the Courtagnon locality but to consider it to be from the Italian 'sub-apennin', as authors had done ever since Deshayes. Although Le Renard did not offer any proof that the original description was indeed based on a Paris Basin specimen, he accepted the name *C. antediluvianus* Bruguière for the Paris Basin form, of which *C. parisiensis* in his opinion might be considered a synonym or a subspecies at the most. Le Renard's statement '*Le Conus parisiensis Deshayes (1865, p. 418; avec C. antediluvianus en synonymie*' is incorrect in so far as Deshayes did not synonymize Bruguière's taxon, but stated explicitly '*Conus antediluvianus, Desh. (non Brug.)*', indicating that he did not consider Bruguière's taxon to be a synonym, but referred to his own earlier interpretation.

Le Renard went on to comment that Edwards had indicated that the name *C. 'apenninus'* (should be *apenninicus*) Bronn was introduced for the Italian species. That concept was repeated in Le Renard & Pacaud (1995, p. 122) and Pacaud & Le Renard (1995, p. 169), who listed *Conus (Lithoconus) antediluvianus* Bruguière, 1792 as nr GA 214-6 (in place of *C. parisiensis*) for the Paris Basin Eocene.

In 'Chronological taxonomy of *Conus*, 1758-1840' Kohn

(1992, p. 67, fig. 117) listed *Conus antediluvianus* Bruguière, stating that the species was based 'on a fossil specimen in Bruguière's collection not presently at Geneva or Paris', with reference to Hall ('1966', should be 1964). Kohn concluded that 'The marked differences from any previously described species, and the diagnosis, French description, and *Tableau* figure were consistent and adequately identified the nominal species'. Consequently, Kohn wrote 'I thus designate the *Tableau* figure (pl. 347, fig. 6) as representation of the lectotype of *C. antediluvianus* Bruguière'. Contrary to Kohn's statement the taxon was based on four specimens (not one), present in several Paris collections, and the various literature references in which the quality of Bruguière's illustration was criticized were not mentioned. Also his statement that the type locality Courtagnon was 'erroneous' was based on the opinions of several early authors, without any proof. From the above discussions it is clear that Kohn's lectotype designation does not help to clarify the confusion surrounding the identity of Bruguière's taxon.

Tracey & Todd (1996) discussed '*Conilithes antediluvianus*' with type locality Courtagnon, erroneously stating that the 'unique type' is lost: Bruguière had recorded four specimens in the first description of this species. That syntypes do no longer exist is acknowledged by G. Mermoud in Dodge (1946) and Hall (1964). In their paper Tracey & Todd seem to have accepted Le Renard's concept that the name *C. antediluvianus* had to be interpreted as the Paris Basin form. But in their last line they concluded that '... *antediluvianus* (s.s.) qualifies as a *nomen dubium*, an unrecognized taxon based on a unique lost specimen whose provenance is suspect, and whose name is still widely applied to a Mediterranean Pliocene species'. Consequently they also listed *Conilithes parisiensis* (Deshayes) in their paper, giving the reference of 'Le Renard & Pacaud' (should be Pacaud & Le Renard) (1995, p. 169) with *Conus* (*Lithoconus*) *antediluvianus* as a synonym.

Chirli (1997), in a paper describing Pliocene conoidean gastropods from Tuscany (Italy) included *Conus* (*Conolithus*) '*antediluvianus*' (but giving *C. antediluvianus* as a synonym) and *C. (C.) dujardini*, listing extensive synonyms for both taxa. Both species were recorded for the Siena Basin of Tuscany, albeit not from the same localities. The illustrated (pl. 3, figs 11–13) *C. antediluvianus* specimens agree with this species as illustrated by Brocchi (1814).

Muñiz-Solís (1999, p. 69, figs 5/E, 8/O-Q) described and illustrated '*Conus* (*Conolithes*) *antediluvianus*'. In the heading of the paragraph the author spelled the genus-name as '*Conotithes*', which is an obvious spelling error for '*Conolithes*', as used in the species name. But also *Conolithes* is a spelling error (for *Conilithes* Swainson, or for *Conolithus* Herrmannsen). The illustration of the protoconch (fig. 5/E) shows about 3½ larval whorls and a blunt apex, which is two whorls less than the rather pointed ones illustrated by Janssen (1984) as *C. antediluvianus* s. lat.' and by Moths *et al.* (2010). In the specimens

illustrated in fig. 8/O-P, indicated as '*C. antediluvianus* f. *apiacuta* Sacco, 1893' the carina on the whorls is situated close to the lower suture. We have not been able to locate this name in Sacco's 1893a or b papers and wonder where it came from. But such specimens resemble closely what Sacco (1893b, pl. 5, figs 7a-b) illustrated as *Conospirus dujardini* (Deshayes) var. *astensis* Sacco, from the Pliocene of the Asti area (northern Italy). Fig. 8/Q more closely agrees with the Pliocene northern Italian type of *C. antediluvianus* indeed. Muñiz-Solís (1999, p. 40) included Sacco's var. *astensis* (but spelled as '*astensi*') in the species '*Conus* (*Chelyconus*) *canaliculatus* Brocchi, 1814'. The size of this form as given in Sacco (1893a, p. 47) is 50 mm. In Brocchi's (1814, pl. 15, fig. 28) illustration of *C. canaliculatus*, however, the carina is situated in the middle of the whorls.

In his monograph on the Miocene assemblages from boreholes in the Lower Rhine area (Germany), Wienrich (2007, p. 719, pl. 116, figs 1-4, pl. 155, figs 1-8), mentioned '*Conus* (*Conolithus*) '*antediluvianus*' Bruguière, 1792 s. lat.', including in his list of synonyms also various earlier records of *C. dujardini* (e.g. von Koenen, 1872; Kautsky, 1925; Anderson, 1964; Nordsieck, 1972) and found all possible transitional forms between these two species present in the German assemblage, adding that 'typical *antediluvianus* forms' were more commonly represented in his oldest samples. Two of Wienrich's illustrations (pl. 155, figs 5, 6) represent the form with granulated spirals on the last whorl as described by Janssen (1984).

Merle (2008, p. 220, pl. 33, figs 3, 4) included *Conus* (*Lithoconus*) *antediluvianus* (Bruguière 1792) (should not be between brackets) for the Paris Basin Lutetian and described its colour pattern as seen under UV-light in specimens from Châteaurouge and Fercourt. In applying this name for the Eocene species Merle followed Le Renard (1992), Pacaud & Le Renard (1995) and Le Renard & Pacaud (1995).

Tucker & Tenorio (2009) introduced the new family Conilithidae, based on the genus *Conilithes* Swainson, 1840, with type species *Conilithes antediluvianus*, and two sub-families: Californiconinae and Conilithinae. In a short diagnosis characterizing the genus *Conilithes* they said that the protoconch was paucispiral. Janssen (1984), however, found protoconchs of 5½ whorls in his material indicated as *C. antediluvianus* s. lat. from the Miocene of the Netherlands. Tucker & Tenorio's illustrations on pp. 136-137 represent the northern Italian Pliocene type. Among several further species they also included *C. dujardini* and *C. parisiensis* in the genus *Conilithes*. Conilithidae is considered a synonym of Conidae by Bouchet *et al.* (2011).

In a description of *Conus*-species from the middle Miocene of the Loire Basin Vaessen (2010, p. 6, figs 2-5) extensively described *Conus dujardini* Deshayes, 1845, giving distinguishing characters between that species and *C. antediluvianus*, and stressing that specimens were

frequently found which were difficult to ascribe to one or the other species. The latter, however, was found to be absent from the Loire Basin Miocene. Specimens of *C. antediluvianus* from Estepona (Malaga, SE Spain) and Winterswijk-Miste (Netherlands) were illustrated (p. 8, figs 6-8) for comparison.

Moths *et al.* (2010, p. 61, pl. 18, figs 11, 12; pl. 41, figs 2, 3), describing molluscs from a Miocene assemblage at Werder (NW Germany), listed *Conus (Conolithus) sp.*, and included as synonyms various references to *C. dujardini* and *C. antediluvianus*, some with question marks. As they were unable to clearly identify their shells they were recorded in open nomenclature. They also found the same two types of multispiral protoconchs as described by Janssen (1984). In our opinion, however, the two adult specimens illustrated by them on pl. 41 have the carina placed low on the whorls, and more closely resemble *C. dujardini*.

Landau *et al.* (2013, p. 252), in their text on *Conilithes dujardini* (Deshayes, 1845) synonymized several literature references of *Conus anti(e)diluvianus* with *Conilithes dujardini* and gave distinguishing characters. *Conilithes antediluvianus* is absent from the Miocene (Serravallian) assemblage of the Karaman Basin (Turkey) studied in their paper.

In addition to the papers referred to above there are quite a number of publications and websites, mainly focusing on western and northwestern European basins, on Paratethys localities or the Mediterranean, in which the name *Conus anti-* or *antediluvianus* is mentioned, often together with (comparisons to) *Conus dujardini*. These are not further specified here, as no other views or opinions are presented. Based on the history and discussion outlined above, we arrive at the following

Conclusions

- Conus antediluvianus* Bruguière, 1792 is an available name.
- The originally published type locality Courtagnon (Eocene, Paris Basin) of *Conus antediluvianus* Bruguière, 1792 is debatable and was rejected by a number of subsequent authors, who supposed that the description was, on the contrary, based on Neogene, presumably Pliocene specimens from northern Italy.
- In the absence of syntype specimens, no objective criterion is available to decide whether or not the originally published type locality is correct. However, the majority of authors accepted Brocchi's (1814) and Deshayes' (1865) standpoint that the name *C. antediluvianus* referred to the Italian species.
- Eichwald (1830) was the first to change the name *C. antediluvianus* to '*antediluvianus*', either as a lapsus or intentionally. Eichwald's spelling, although being linguistically more correct, however, is an unjustified emendation, despite being the predominantly applied spelling in later literature.
- The name *Conus parisiensis* Deshayes, 1865 was introduced for the Paris Basin Eocene specimens which had earlier been referred to as *C. antediluvianus*.
- Specimens from the Miocene Paratethys and Loire Basin, initially referred to as *Conus anti(e)diluvianus* and later as *C. acutangulus* Deshayes, were renamed *C. dujardini* Deshayes, 1845.
- Conus apenninicus* Bronn (1838) was introduced as a replacement name for Italian *C. antediluvianus* Bruguière, 1792 as Deshayes (1837) had restricted Bruguière's name to the Paris Basin form. The spellings *appeninus*, *appenninicus*, *apenninensis* and *appenninensis* are errors.
- Looking over more than 200 years of nomenclatural history it is evident that in this entire time interval no final consensus has been reached on the interpretation of Bruguière's taxon, although the majority of authors seem to have accepted Deshayes' (1865) conclusion that *Conus antediluvianus* should be interpreted as representing the northern Italian Pliocene form, as described and illustrated by Brocchi (1814).
- It is not in the interest of nomenclatural stability to declare Bruguière's name a *nomen inquirendum* and accept *Conus apenninicus* Bronn, 1838 as the valid name for the Italian Neogene species.
- We do not follow Hall's (1964) idea, although acknowledged by Pelosio (1966) and Davoli (1972), to suggest the specimen from Saubrigues illustrated by Peyrot (1931) as a neotype. To stay in line with the opinion of most authors a neotype should be a specimen from the Pliocene of northern Italy. Peyrot's specimen is of Miocene age and was not considered to represent the 'typical' form. Furthermore it was considered to represent *Conus dujardini* by Glibert (1952).
- Kohn's (1992) lectotype designation by choosing Bruguière's illustration as representing the lectotype did not contribute to clarify the existing confusion.
- We see no better solution than to declare *Conus antediluvianus* Bruguière, 1792 as an unidentifiable taxon (*nomen dubium*), as already suggested by Tracey & Todd (1996).
- We will request the International Commission on Zoological Nomenclature to set aside under its plenary power the existing lectotype and designate a neotype (Janssen, Janssen, Tracey, Vaessen & van der Voort, in prep.).
- As neotype of *Conus antediluvianus* Bruguière, 1792 we suggest a well-preserved specimen (Fig. 16) from Badagnano, Rio dei Carbonari, Piacenza Province, Italy (Pliocene, Piacenzian, Castell'Arquato Formation) (Pedriali & Robba, 2005, p. 178), which presumably is from the same area and stratigraphical horizon in northern Italy where Brocchi's illustrated specimens were found. Brocchi was the first author after Bruguière to illustrate the species and his interpretation has been followed during two centuries by most subsequent authors. Unfortunately Brocchi's illustrated specimens could not with certainty be recognized in the collections of the Museo Civico di Storia Naturale at Milano (Italy), where the Brocchi collec-



Figure 16. Suggested neotype of *Conus antdiluvianus* Bruguière, 1792 from Badagnano, Rio dei Carbonari, Piacenza Province, Italy (Pliocene, Piacenzian, Castell'Arquato Formation). Specimen collected and made available by Luca Pedriali (Ferrara, Italy; collection nr B796). Photographs by Eleonora Pedriali. Collection of Museo Civico di Storia Naturale (Milano), registration number MSNM i 28027. Bar length is 1 cm.

tion is housed. Furthermore Brocchi's specimens lack a precise locality and stratigraphic origin, and, as is usual with adult shells, the apical whorls are water-worn and devoid of diagnostic characters. The neotype suggested here is housed in the Milano museum with registration number MSNM i 28027.

Distinguishing the three species

From all the literature cited above it is clear that the distinction of the three *Conolithes*-species is problematic. For that reason we have concentrated important characteristics, based predominantly on literature illustrations, in two tables below. Table 1 gives measurements and in Table 2 the most important distinguishing characters are summarized. In Figs 17-19 we illustrate representative specimens.

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information on the Brocchi collection and Martina Paolini of the same institute made photographs of specimens in the Brocchi collection. Luca Pedriali (Ferrara, Italy) made the suggested neotype specimen available from his personal collection and his daughter Eleonora photographed the specimen. We also are grateful to Giulio Pavia (Museo Regionale di Scienze Naturali, Torino, Italy) for his much appreciated intermediation. Ronald Pouwer (Naturalis Biodiversity Center, Leiden, The Netherlands) made the photographs of Figs 17-19. Frank Wesselingh of the same institute read an earlier version of the manuscript. Also we thank Henk Boerman (Krimpen aan den IJssel, The Netherlands) for allowing us to study Conidae samples in his private collection.

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species	MD (mm)	SL (mm)	HDM (mm)	AH (mm)	SA (°)	LWr	RD	RSH	PMD
<i>C. antediluvianus</i>	23	650	40	40	65	2.6	0.53	0.28	0.93
<i>C. parisiensis</i>	17	38	23	24	55	2.2	0.71	0.37	0.96
<i>C. dujardini</i>	17	38	26	27	70	2.2	0.63	0.29	0.96

Table 1. Shell dimensions (following Hendricks, 2008) of *Conilithes antediluvianus* (Bruguière, 1792) (measured from Brocchi's illustration (1814, pl. 2, fig. 11c); *Conilithes parisiensis* (Deshayes, 1865), illustrated as *C. 'antediluvianus'* in Deshayes (1837, p. 749, pl. 98, figs 13, 14); *Conilithes dujardini* (Deshayes, 1845) (lectotype, Glibert, 1952), illustrated as *Conus antediluvianus* in Dubois de Montpéroux (1831, pl. 1, fig. 1).

SL: shell length; MD: maximum diameter; HDM: height of the maximum diameter; AH: apertural height; SA: spire angle; LWr: length-width ratio (LWr = SL/MD); RD: relative diameter (RD = MD/AH); RSH: relative height of spire (RSH = [SL-AH]/SL); PMD: position of maximum diameter (PMD = HMD/AH).

	<i>Conilithes antediluvianus</i>	<i>Conilithes parisiensis</i>	<i>Conilithes dujardini</i>
height of adult shell	moderately large (> 65 mm)	moderately small (~ 38 mm)	moderately small (~ 38 mm)
spire height	high	high	high to medium high
relative diameter	elongated to medium wide	wide	medium to wide
carina position on spire whorls	mid whorl	near lower suture	just below mid whorl
beading of carina	fine on nearly all whorls, carina on last and penultimate whorl often smooth	coarse to fine on all whorls	less strong than in <i>C. antediluvianus</i> , only on early whorls or absent
subsutural cord	absent	present, finely beaded	absent
last whorl	elongate; coarse spiral cords at the base; fine spiral striae on the whole whorl in well preserved examples	relatively wide; coarse spiral cords at base;	medium to relatively wide; coarse spiral cords at base; fine spiral striae on the whole whorl in well preserved examples
protoconch	multispiral (5½ whorls)	multispiral (3 whorls)	multispiral
colour pattern	three horizontal bands (rarely visible) (Sacco 1893b)	central horizontal dark band with darker edges, small spirally arranged spots; clear subsutural band and spots on spire (Merle 2008)	irregular horizontal dashes, blotches and bands (Landau <i>et al.</i> 2013)
geological distribution	Miocene and Pliocene	Eocene (Lutetian-Bartonian)	Miocene

Table 2. Main differences in shell characteristics.

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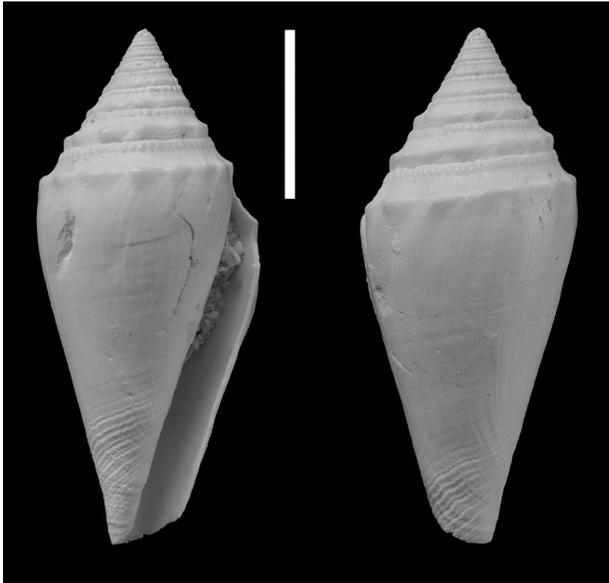


Figure 17. *Conilithes parisiensis* (Deshayes, 1865). Fercourt (Oise, France); Calcaire Grossier, Lutetian, Eocene. RGM 1 007 737 (ex collection F.A.D. van Nieulande).

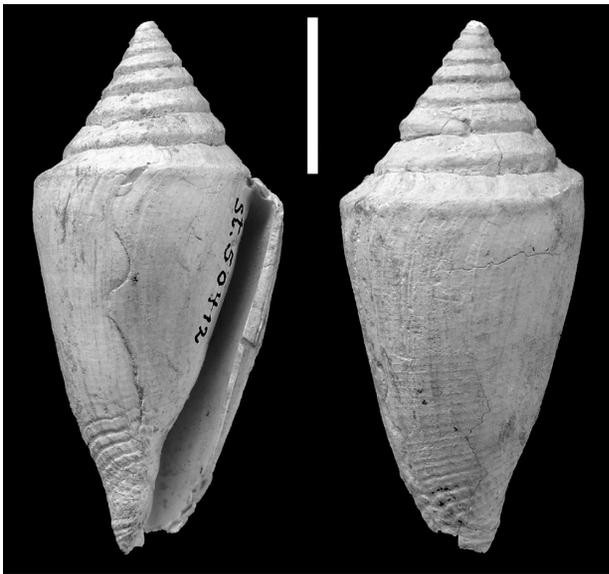


Figure 18. *Conilithes dujardini* (Deshayes, 1845). Steinabrunn (Nieder-Österreich, Austria). Badenian, Miocene, RGM 50 412 (leg. unknown, old collection).

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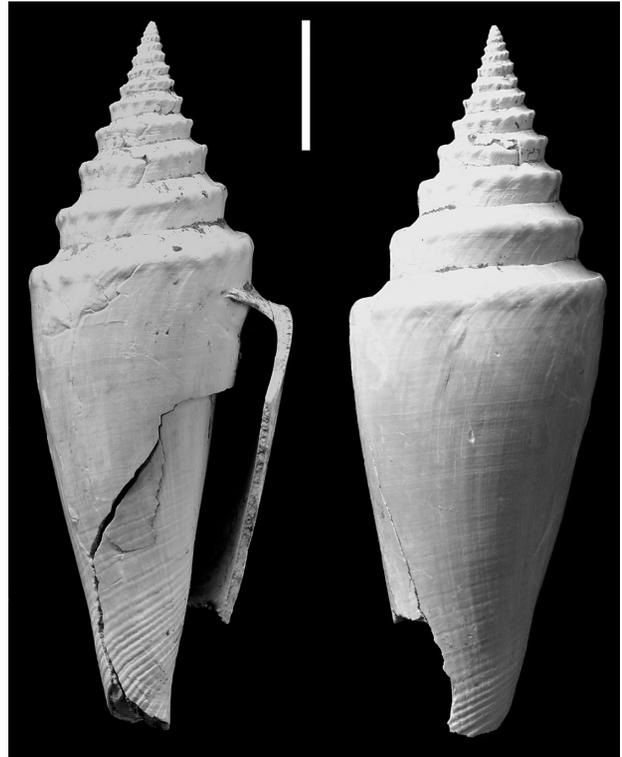


Figure 19. *Conilithes antidiluvianus* (Bruguière, 1792). Chiavenna-Rocchetta (Emilia-Romagna, Italy). Piacenzian, Pliocene. H. Boerman collection. Damaged specimen showing superficial striations on entire last whorl.

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