

## SOME SPECIFIC CRITERIA IN CONUS

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The present paper is the outcome of attempts to identify a number of late Tertiary cones from the Atlantic Coastal Plain. This has involved comparisons with recent material. One chief result of the study has been a demonstration of the importance of young stages in specific discrimination. Somewhat less useful, but apparently of higher taxonomic value, are the characters shown by the subsutural flexure.

The claim cannot be made that every species of *Conus* has a diagnostic apex, but evidence is presented to show that at least four distinct apical types occur within the genus. It is probable that these four variations are but a small fraction of those which one might encounter among the many species. Such a search would require a very protracted investigation, for most shells are without a studiable apex.

The subsutural flexure in *Conus*, unlike the apex, is almost always manifest. It shows as a striking backward bend of the growth lines, being most conspicuous in the region between whorl angulation and suture.

The shell features employed in this paper distinguish very definite species among Tertiary and Recent cones. The supposedly unavoidable guess work brought about by absence of color markings<sup>1</sup> may be completely counteracted if apex and subsutural flexure are well preserved.

These morphologic characters are relatively constant in any one species and quite tangible. They compare favorably with most criteria of specific discrimination. However, they were not employed by the older authors. It therefore becomes necessary in some cases to attempt to tie these features with descriptions of varying excellence and to make reference to figures, some good, others of uncertain value. These difficulties may explain what appear to be digressions from the main topic of this paper.

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<sup>1</sup> Dall, W. H. Contributions to the Tertiary Fauna of Florida, etc. Wagner Free Inst. of Sci. Trans., 3, Part 1, p. 27, 1890.

Gabb, William M. On the Topography and Geology of Santo Domingo. Am. Phil. Soc. Trans. XV, pp. 228, 229, 1873 (1881).

curve is quite regular, with its backwardmost point about midway between whorl angulation and suture. In *Conus diluvianus*, on the other hand, this curve becomes decidedly unsymmetrical while its backwardmost point may be nearer to the whorl angulation than to the suture.

The use of the angulated subsutural flexure in diagnosis will be considered in the discussion of the following form which is sometimes referred to *Conus marylandicus* Green, less often to *Conus agassizii* Dall, but which is here treated as a new species.

***Conus waccamawensis*** n. sp. (Figures 9, 9a, 10, 11, 12).

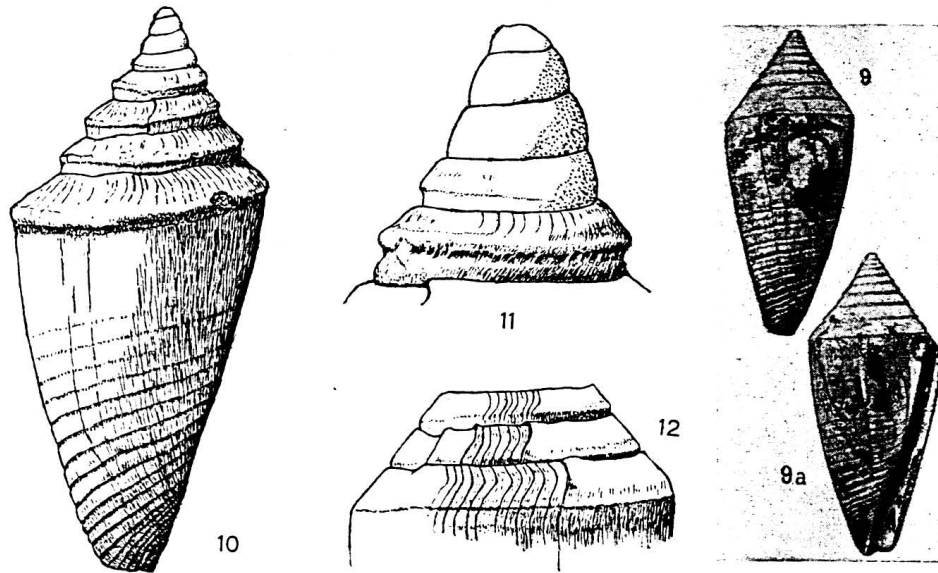
This species is relatively small, the shell seldom having a long dimension of more than 34 mm. Its proportions are rather slender for a cone, the spire being well defined. The final whorl exhibits a slightly convex outer wall and strong diagonal spirals anteriorly. In their typical impressed condition these latter do not approach the whorl angulation closely.

A certain amount of apex restoration has been necessary but on any system of counting the smooth and rounded stage is long when judged by the number of its volutions. These cannot be less than 3 and may run to  $4\frac{1}{4}$  whorls. The keeled stage follows abruptly without the intervention of a noded stage. The keeled stage persists to the end of the ontogeny. With the initiation of the keeled stage there appears an impressed spiral line just below the whorl angulation and usually well separated from the anterior diagonal spirals with which it must not be confused. Growth lines crossing this impressed line cause a slightly rib-like appearance but there is nothing in the species which can be correlated with a true ribbed or noded stage. The impressed spiral in question is a conspicuous feature of the early keeled stage and is easily recognized as far as whorl 6. Beyond this it appears to degenerate, but an overlapping of the whorls soon hinders observation. The last whorl of old individuals is virtually without such a spiral below the keel.

The subsutural flexure is of the angulated type and affords a ready means of distinction from other associated species when the apex is lost or the impressed spiral obscured. In general the angulation of the flexure becomes more marked with the progress of the ontogeny. Sometimes the point of this angulation is nearer to the suture than to the whorl angulation.

As far as known *Conus waccamawensis* is extinct. It occurs in the Waccamaw Pliocene at Nixon's Landing, Waccamaw River, South Carolina, and at Acme, North Carolina; in the Duplin Miocene of the "Natural Well" near Magnolia, North Carolina; and probably also in the Miocene of Mayesville, South Carolina.

In large Tertiary collections shells assignable to this species are usually labelled *Conus marylandicus* Green. *Conus waccamawensis*, however, is



Figs. 9-12. *Conus waccamawensis* n. sp. Pliocene (Waccamaw). Nixon's Landing, Waccamaw River, So. Carolina. Figs. 9, 9a. Holotype (Acad. of Nat. Sciences of Philadelphia 8721). Long dimension of specimen measures about 33 mm. Fig. 10. Academy of Natural Sciences of Philadelphia 8722. Immature individual of about  $8\frac{1}{2}$  whorls showing smooth and rounded stage and early keeled stage. Long dimension of shell measures about 9 mm. The keeled stage shows the impressed spiral below whorl angulation and early phases of the angulated type of subsutural flexure. Fig. 11. Early whorls of the immature individual shown in figure 10. In the largest illustrated whorl the diameter at whorl angulation measures about 1.5 mm. Smooth and rounded stage estimated at about 4 whorls. This is followed by the keeled stage without the intervention of a noded stage. The last whorl illustrated shows the keeled stage with impressed spiral below whorl angulation and an immature subsutural flexure which has not yet acquired the angulated form of adult life. Fig. 12. Holotype. Whorls determined as numbers 11, 12, and 13 showing the angulated type of subsutural flexure. Details omitted at sides of figure. In whorl 13 the diameter at whorl angulation measures about 14 mm.

more slender than the subject of Green's figure<sup>7</sup> and its anterior diagonal spirals are less forwardly directed. It also has too narrow an aperture and lacks the strong anterior columellar constriction which is shown in the figure of *C. marylandicus*. The chief diagnostic characters of *Conus waccamawensis*—long smooth stage, impressed spiral, and angulated flexure—are certainly not shown in Green's figure nor is there anything in his text which can be applied to any of these features unless it is the statement that in *C. marylandicus* the whorls are "channeled and carinated on their lower edges." The writer wishes to recognize fully the enterprising pioneer work of Green, but he feels that this cannot be accomplished by a continued reference of the present species to *Conus marylandicus*. If the perpetuation of this latter name seems desirable it is suggested that a much more appropriate neotype occurs in the Miocene beds of Yorktown, Virginia.

<sup>7</sup> Green, Jacob. Monograph of the Cones of North America, including three new species. Albany Inst. Trans. 1, p. 124, pl. 3, fig. 2, 1830.

*Conus waccamawensis* is apparently related rather closely to *Conus* (*Chelyconus*) *oniscus* Woodring.<sup>8</sup> In the discussion of the latter species occurs the following passage: "Some specimens from the Pliocene Waccamaw marl of South Carolina referred to *C. marylandicus* Green are somewhat similar, but their shoulder, even on the later whorls, is a sharp-edged ridge and their anal notch is a little deeper."

Occasionally one finds *Conus waccamawensis* labelled *Conus agassizii* Dall. This is very far from correct for Dall's figured specimen<sup>9</sup> (United States National Museum 37472), has a subsutural flexure which is clearly of the curved type.

#### SUMMARY

The chief deductions from the foregoing study may be briefly reviewed.

*Color Markings.* These features, though valuable in the determination of recent cones, have little practical use among fossils. It is not conceded that color markings are always necessary for accurate determination. Sufficiently good preservation may render the color pattern superfluous as a means of identification.

*Apex.* It has been demonstrated that the apex shows not a little variation within the genus *Conus* and that it may be of great value in specific determination especially when reinforced by the features of later ontogenetic stages. No evidence has, so far, been discovered which points to the apex as a possible criterion of subgeneric rank. This latter point can only be settled by a thorough investigation of the genus, and then only if apices are found in sufficient numbers.

*Subsutural Flexure.* Two types can be distinguished in *Conus*. One of these is curved above the whorl angulation and appears to be prevalent throughout the genus. In contrast, the second or angulated type of flexure seems to be rare in *Conus*. A possible employment of the subsutural flexure in subgeneric grouping must await further study.

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<sup>8</sup> Woodring, Wendell P. Miocene Mollusks from Bowden, Jamaica, Part II, Gastropods and Discussion of Results. Carnegie Inst. Washington Pub. 385, pp. 207, 208, Pl. 10, Fig. 3, 1928.

<sup>9</sup> Dall, W. H. A Preliminary Catalogue of the Shell-Bearing Marine Mollusks and Brachiopods of the Southeastern Coast of the United States, etc. U. S. National Museum Bul. 37, pl. IX, fig. 8, 1889.