The Rediscovery, Morphology, and Identity of *Conus emersoni* Hanna, 1963

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ABSTRACT

Conus emersoni is reported from 310 m off Isla Santa Maria (Floreana), Galapagos Islands, the first record subsequent to its original description. The species is redescribed from eight additional specimens; its operculum, radula, and periostracum are described for the first time. Affinity of the species to *C. teramachii* Kuroda, 1956, is discussed.

Key words: Conidae, *Conus emersoni*, Galapagos Islands, radula.

INTRODUCTION

Subsequent to its description 29 years ago (Hanna, 1963) from two dead, faded and poorly preserved specimens, *Conus emersoni* has remained an enigmatic member of an otherwise extensively studied genus in the Eastern Pacific region. Even as he proposed the species, Hanna (1963) suggested that it might be conspecific with the Indo-West Pacific species *C. australis* Holten, 1802, whereas Walls (1979) placed it as a possible synonym of another Indo-West Pacific species, *C. orbignyi* Audouin, 1831. Keen (1971) treated the species as valid but made no comments on its relationships. Finally, Coomans *et al.* (1986) considered it to be a tentatively valid species but noted that it could be based on fossil material.

Here we report upon eight recently collected specimens from moderately deep water at the Galapagos Islands, two of which are in the collections of the Natural History Museum of Los Angeles County and six in the American Museum of Natural History. All were provided by André and Jacqueline DeRoy, residents of the Galapagos Islands. These specimens extend the distribution from Cabo San Lucas, Baja California Sur, to the Galapagos Islands, Ecuador, and allow a redescription of the species with the first report on the morphology of the radular tooth, the operculum, and the periostracum.

Abbreviations of museums mentioned in the text: AMNH, American Museum of Natural History, New York; CAS, California Academy of Sciences, San Francisco; LACM, Natural History Museum of Los Angeles County.

SYSTEMATICS

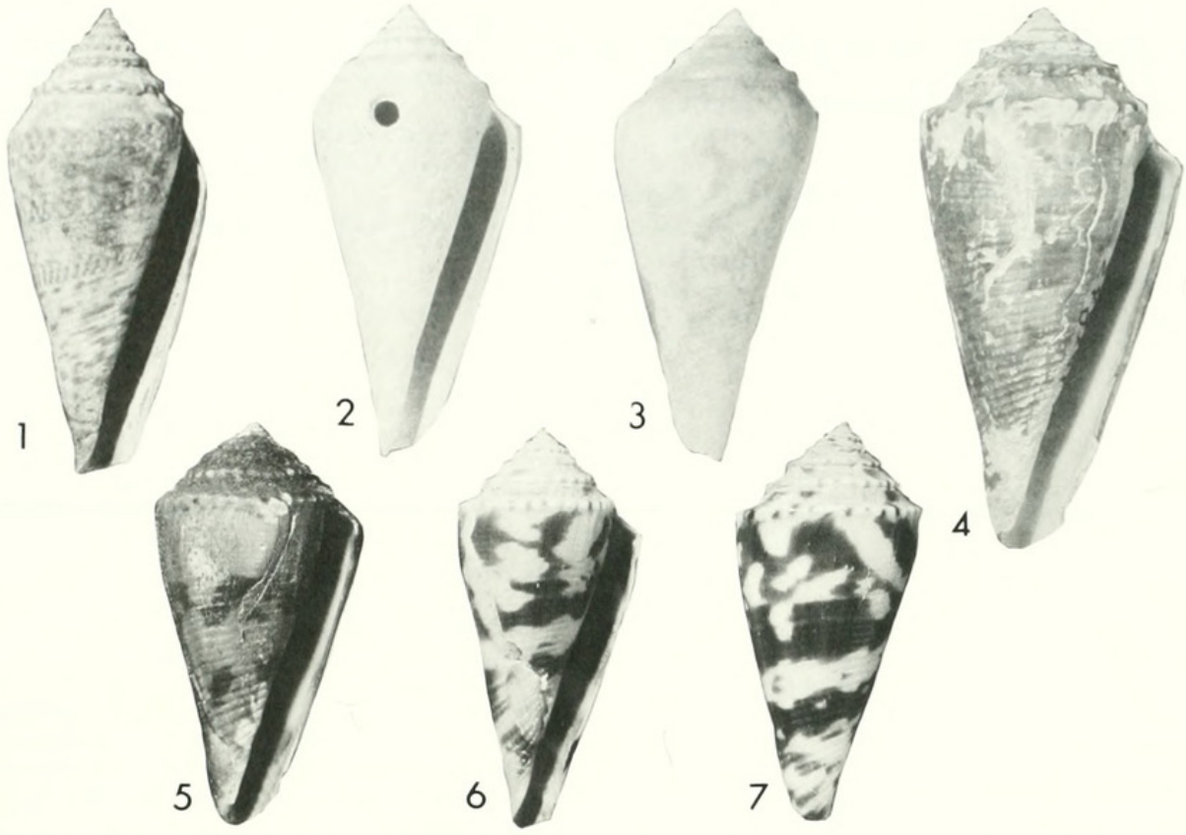
Conus emersoni Hanna, 1963
(figures 1–13)

Conus emersoni Hanna, 1963:25, pl. 1, fig. 2; Walls, 1979:776 [with unnumbered figure of CAS paratype]; Coomans, Moolenbeek & Wils, 1986:114, fig. 718 [holotype, 2 views].
Conus (Asprella) emersoni; Keen, 1971:663, fig. 1497 [holotype].

Diagnosis: Spire scalariform throughout its length, shoulder angle retaining square nodules; sculpture on final whorl of numerous, closely spaced, shallow sulci; posterior notch shallow; whorl tops sculptured by one to two cords that fade in whorl three to be replaced by numerous fine striae.

Description: Shell elongate-conical, whorl sides flat to very slightly convex; shoulder angular. Anterior end not deflected dorsally. Sculpture of numerous (30–50) closely spaced, shallow sulci, most pronounced at anterior end and fading in intensity towards shoulder. Color pattern variable, consisting of three irregularly developed bands, at shoulder, in area just posterior to midbody area, and in area just anterior to midbody. Bands variously interrupted and scalloped, producing reticulate or blotched pattern; bands separated by areas with rows of spiral dashes or longitudinal reticulations. Dashes and reticulations may be quite pronounced (holotype) or lacking (Galapagan specimens). Anterior end marked by spirally elongated blotches or lines. Color markings in fresh specimens medium brown, fading to light brown in dead specimens.

Spire very slightly convex in profile, scalariform throughout and moderately elevated, carinate, carina interrupted by numerous square nodules, 30–40 per whorl; nodules fading in whorl six although carina may remain pronounced. Protoconch unknown (not intact in any of the specimens). One or two spiral cords on first two or three teleoconch whorls, replaced on later whorls by numerous, exceedingly fine striae. Whorl tops colored by variably developed markings, matching those of body whorl, between nodules or crossing entire width of whorl



Figures 1–7. *Conus emersoni* Hanna, 1963. **Figures 1–3.** Type material dredged off Los Frailes, Baja California, depth 549 m. **1.** Holotype, AMNH 105211, length 43.0 mm, faded, dead-collected specimen, lacking periostracum. **2, 3.** Paratype, CAS 12405, length 49.0 mm, subfossil specimen (surface gray), showing naticid bore hole. **Figures 4–7.** Newly reported specimens dredged off Isla Santa Maria (Floreana), Galapagos Islands, Ecuador, depth 310 m. **4.** AMNH 248261, length 46.2 mm, dead-collected specimen. **5.** LACM 146906a, length 33.3 mm, live-collected specimen with periostracum intact. This specimen was used for opercular and radular illustration. **6, 7.** LACM 146906b, length 34.0 mm, dead-collected specimen with periostracum removed to show color pattern.

top. Whorl tops slightly but distinctly concave in cross section. Posterior notch shallow and C-shaped.

Aperture narrow, white inside except where exterior coloration shows through near lip. Interior constrictions and apertural flanges absent or at least not developed in available specimens.

Periostracum thick, dark brown, markedly pilose both on body and spire. Extremely fine hairlike extensions of periostracum not organized into any obvious pattern. These projections are apparently easily worn off, as they are pronounced on the dorsal side of one live-collected specimen (figure 5) but are not obvious on the ventral side of the same specimen.

Dimensions (see table 1): The known specimens range in length from 23.0 mm to the 49.0 mm length of the paratype (figures 2, 3). The ratio of width to length ranges from 0.43 to 0.50 (table 1). The largest Galapagan specimen (figure 4) is 46.2 mm in length. All specimens have the protoconch eroded, the spire tips filled by secondary shell deposition.

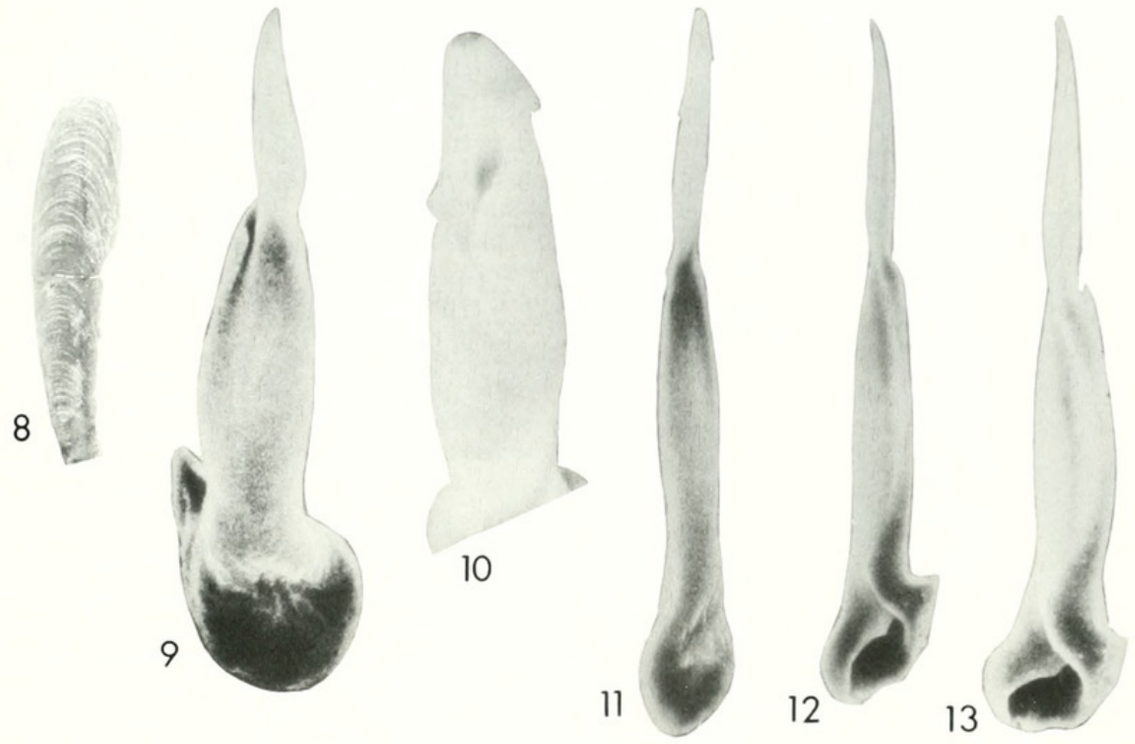
Operculum illustrated in figure 8 is 27% of apertural length, weakly serrate on outer edge.

Radular tooth (figures 9–13) small, 285 μm in length; massive base with pronounced basal spur; waist located on anterior half of tooth, with small spine on posterior border in same plane as basal spur. Tooth opening rather long, extending about one-quarter the length. Tip with small barb opposite short blade.

Distribution: The holotype and one paratype were collected off Los Frailes, Cape San Lucas, Baja California in 550 m (given originally as 300 fathoms by Hanna, 1963). The eight newly discovered specimens were dredged in 310 m (170 fathoms) off Isla Santa Maria (Floreana), Galapagos Islands, 7 May 1979 by André and Jacqueline DeRoy (table 1).

DISCUSSION

The rediscovery of *Conus emersoni* in the Galapagos Islands should put to rest speculation that this species is a synonym of either *Conus australis* (suggested by Hanna, 1963) or *C. orbignyi* (suggested by Walls, 1979). Each of these Indo-Pacific species is unlike *C. emersoni* in having persistent sulci on the body whorl along with persistent cords on the spire whorl tops. *Conus emersoni* differs in having the sulci strong only anteriorly and in having fine spiral striae on the whorl tops. Radular differences are that the radular tooth of *C. orbignyi* has three anterior barbs (Kilburn, 1973: fig. 6), whereas that



Figures 8–13. *Conus emersoni* Hanna, 1963. **8.** Operculum, same specimen as figure 5, length 7.3 mm, nucleus lost. **Figures 9–13.** SEM views of single radular tooth, length 285 μm, from same specimen as in figure 5. SEM photos by H. Chaney. **9.** Oblique anterior view showing apical surface, with pronounced basal spur and small spine on posterior border of waist. **10.** Enlarged view of apical surface, with small barb and enrolled blade. **11–13.** Three lateral views, showing differing axial rotation of tooth.

of *C. emersoni* has but two. The radular tooth of *C. australis* has a serrate shaft along with an enlarged cusp at the posterior end of the row of serrations (A. J. Kohn, radular slide collection); neither feature is present on the radular tooth of *C. emersoni*.

The scalariform spire and color markings of *Conus emersoni* have a superficial resemblance to that of the Panamic species *C. emarginatus* Reeve, 1844 (a species often misidentified as *C. recurvus* Broderip, 1833). Differences are that *C. emarginatus* has a deep posterior notch (rather than shallow notch) and a smooth (rather than pilose) periostracum. The radula of *C. emarginatus* (Nybakken, 1970: fig. 5, as *Conus recurvus*) has three barbs anteriorly, like that of *C. orbignyi*, rather than *C. emersoni*, in which there are two barbs.

The scarcity of *C. emersoni* may be due to the great depth at which it occurs and the paucity of sampling at depths below 300 m.

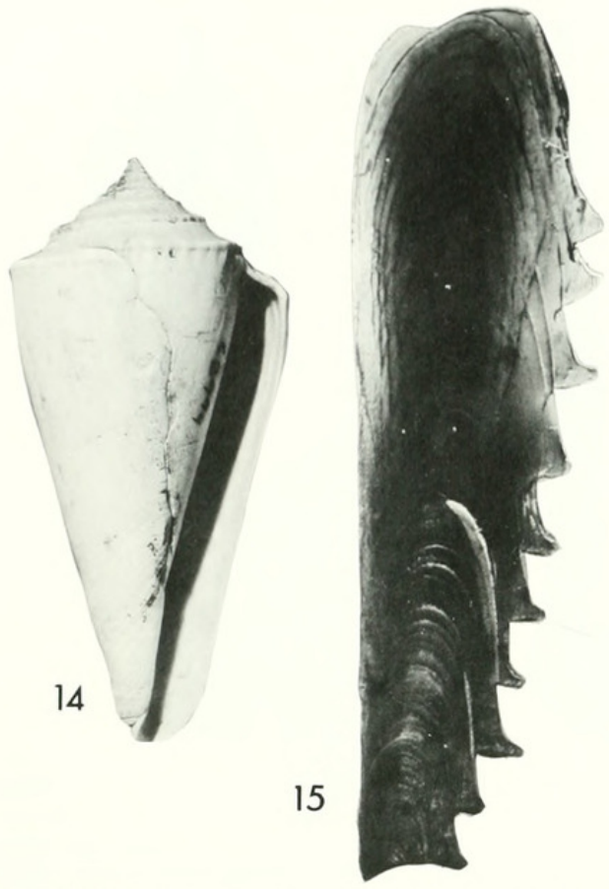
It is possible that the specimens from the Galapagos Islands are specifically or subspecifically distinct. They differ in color pattern (that of the holotype being more intricate) and in spire profile (that of the holotype appearing to be more acute). However, such intraspecific differences in color pattern are not uncommon in *Conus*. In fact, the faintly indicated color pattern of the paratype that shows on the better preserved dorsal surface (figure 3) is more similar to that of the Galapagan specimens (figures 5–7) than to that of the holotype (figure 1). The ground color of the paratype has a gray cast that is suggestive of fossil or subfossil condition. The holotype is in fresher condition, although it retains no periostracum; it shows evidence of growth damage to the shoulder at a stage two whorls above the termination of the lip, which appears to have altered the profile of the final two whorls, resulting in a greater downward slope to the spire and the loss of the nodules in the final two whorls.

The question as to whether the two widely disjunct records represent the same species can only be answered after additional specimens from the vicinity of the type locality become known. It is our opinion, based on the specimens examined, that there is no clear evidence to suggest that the Galapagan specimens are not conspecific with the Mexican specimens.

Conus emersoni is not closely similar to any other eastern Pacific conid. Shell morphology, including the

Table 1. Shell dimensions and proportions of the known specimens of *Conus emersoni* Hanna, 1963.

Specimen	Condition	Length	Width	Width/ length
AMNH 92200 (holotype)	dead	43.0	18.5	0.43
CAS 12405 (paratype)	subfossil	49.0	22.5	0.46
LACM 146906a	live	33.9	17.0	0.50
LACM 146906b	dead	34.0	15.5	0.46
AMNH 248262	live	35.0	15.7	0.45
AMNH 248263	live	31.5	14.3	0.45
AMNH 248261	dead	46.2	22.3	0.48
AMNH 248169a	live	23.0	10.8	0.47
AMNH 248169b	dead	30.0	14.9	0.50
AMNH 248169c	live	26.8	12.8	0.48



Figures 14, 15. *Conus teramachii* Kuroda, 1956. **14.** Specimen with growth scar producing lowered shoulder angle of final whorl, periostracum removed. Off NE coast Taiwan, trawled, depth unknown. LACM 68994, length 79.8 mm. **15.** Operculum with strongly serrate edge, nucleus lost, trawled off Taiwan. Specimen in H. Chaney collection, length 19.1 mm.

shoulder carina with square nodules, is similar to that of *C. teramachii* Kuroda, 1956 (figure 14), a species reported from similar depths off Japan and Taiwan (Kuroda, 1956; Walls, 1979). Our illustrations of the radular tooth of *C. emersoni* (figures 9–13) are comparable to those of Azuma (1961: fig. 11) for *C. teramachii* (as *C. petricosus* Azuma, 1961). In addition, *C. teramachii* also has a strongly serrate operculum (figure 15), much more pronounced than that of *C. emersoni* (figure 8). The character state of the serrate operculum was stressed in the original diagnosis of the subgenus *Profundiconus* Kuroda, 1956—type species *Chelyconus* (*Profundiconus*) *profundorum* Kuroda, 1956 [= *Conus smirna* Bartsch and Rehder, 1943]. The type species of *Profundiconus* also has square nodules on the shoulder carina, but these are apparent only in young stages.

We refrain, however, from further treatment of the subgeneric allocation of the species under discussion because comparison to other available generic level taxa is beyond the scope of this paper. We recognize that a generic level classification of Conidae needs to be based on all the recognized species, including fossils, at a minimum treating characters that include adult and juvenile shell morphology, and, for the living species, the operculum, and radula.

ACKNOWLEDGMENTS

We thank Alan J. Kohn of the University of Washington for allowing one of us (JKT) to study his radular slide of *C. australis*. William K. Emerson and Walter E. Sage of the American Museum of Natural History made the holotype and other specimens of *C. emersoni* available for study. Terrence M. Gosliner of the California Academy of Sciences arranged for loan of the paratype specimen. We thank Henry W. Chaney of the Santa Barbara Museum of Natural History for the SEM photos of the radular tooth of *C. emersoni* and the photograph of the operculum of *C. teramachii*. We are grateful to Henry W. Chaney, William K. Emerson, Alan J. Kohn and Walter E. Sage and two anonymous referees for reading the manuscript and offering helpful suggestions. Finally, and most importantly, we thank Jacqueline and André DeRoy for providing the specimens of *C. emersoni* that form the basis for this paper.

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