



Figures 73-77. *Coronula barbara* Darwin (?); (73-75) exterior, alar edge, and radial edge, Hypotype LACM 1231, LACM Locality 305, height (73-74) 36 mm, (75) 30 mm; (76-77) exterior and sculpture, Hypotype USNM 651308, U. S. Geological Survey locality M-2090, width (76) 36 mm, height (77) 35 mm.

Remarks: The single large specimen agrees with Darwin's (1854a, b) description of *C. barbara* in having prominent transverse ridges on the exterior of the shell and the interior surfaces of the transverse flanges, and in the zig-zag pattern of the teeth that serve to interlock adjacent flanges of the outer shell wall. The space between the radius and the special alar plate is not as completely filled in the San Diego specimen as it is in the examples figured by Darwin (1854a, b) and Alessandri (1906), and more closely approximates the condition seen in *C. diadema* (Linnaeus). For this reason the identification of the San Diego specimen with *C. barbara* is questioned. Another specimen that is specifically identical to the San Diego *Coronula* was collected by Dr. J. Vedder of the U.S. Geological Survey, Menlo Park, California, from the Late

Pliocene upper part of the Fernando Formation of the Tustin quadrangle, Orange County, California (U.S. Geological Survey Loc. M-2090, 1650 ft. SE and 900 ft. SW of N corner Irvine Block 57).

KEYS TO THE BALANOMORPH CIRRIPIEDIA
OF THE SAN DIEGO FORMATION

Scuta

1. Exterior longitudinally striate 2.
Exterior lacking longitudinal striae 4.
2. Adductor ridge clearly present 3.
Adductor ridge absent *Balanus kanakoffi*
3. Adductor ridge bifurcate *Balanus gregarius*
Adductor ridge single *Balanus pacificus*
4. Adductor ridge present 5.
Adductor ridge absent *Balanus wilsoni*
5. Ridged callus between articular and adductor ridges *Balanus proinus*
No such callus; vertical rib present
in depressor muscle pit *Balanus nubilus*

Terga

1. Spur furrow open 2.
Spur furrow at least partially closed 4.
2. Base of spur truncate 3.
Base of spur broadly rounded *Balanus proinus*
3. Juncture of spur with basal margin
gently arched on both sides *Balanus nubilus*
Juncture angular on scutal side,
gently arched on carinal side *Balanus kanakoffi*
4. Exterior growth lines crossed by longitudinal striae at
least on scutal side *Balanus gregarius*
No longitudinal striae externally 5.
5. Base of articular ridge confluent with scutal margin *Balanus pacificus*
Base of articular ridge widely
separated from scutal margin *Balanus wilsoni*

Shells

1. Compartmental plates solid throughout *Balanus proinus*
Compartmental plates, when viewed from base, with rows
of pores or large enclosed cavities 2.
2. Radii, as well as parietes, porose 3.
Radii without pores 4.
3. Shell smooth externally, with color stripes *Balanus wilsoni*
Shell with conspicuous horizontal and/or vertical ridges
forming distinct external sculpture *Cetolepas herileini*

4. Parietal "septa" as seen from base in form of T-shaped buttresses enclosing large basal cavities; base of shell wall as thick as diameter of body cavity *Coronula* spp.
Parietal septa not T-shaped; shell wall much thinner than diameter of body cavity 5.
5. Parietal tubes with transverse septa; basis usually elongate and filled at least in part with vesicular material *Balanus gregarius*
Parietal tubes without transverse septa; basis flat and not vesiculose 6.
6. No radii visible externally between carina and carinolaterals *Balanus kanakoffi*
Radii clearly present between carina and carinolaterals 7.
7. Shell externally roughened and plicate; without color pattern *Balanus nubilus*
Shell smooth externally; usually showing color stripes *Balanus pacificus*

LITERATURE CITED

- ALESSANDRI, G. DE. 1895. Contribuzione allo studio dei Cirripedi fossili d'Italia. Società Geol. Ital., Boll., 13: 234-314, text-figs. 1-2, pls. 3-5.
- . 1906. Studi monographici sui Cirripedi fossili d'Italia. Palaeontogr. Ital. 12: 207-324, text-figs. 1-9, pls. 13-18.
- ALLISON, E. C., J. W. DURHAM, AND V. A. ZULLO. 1961. Cold-water late Cenozoic faunas of northern California and Oregon. Geol. Soc. Amer., Spec. Paper, 68: 2 (abstr.).
- CONRAD, T. A. 1856. Descriptions of three new genera; twenty-three new species Middle Tertiary Fossils from California, and one from Texas. Acad. Nat. Sci. Philadelphia, Proc., 8: 312-316.
- . 1857a. Description of the Tertiary fossils collected on the Survey. In Pacific Railroad Reports, 6 (Geol. Rpt., 2):69-73, pls. 2-5.
- . 1857b. Report on the palaeontology of the Survey. *Ibid.*, 7: 189-196, pls. 1-10.
- . 1864. Notes on Shells, with descriptions of new fossil Genera and Species. Acad. Nat. Sci. Philadelphia, Proc., 16: 211-214.
- . 1876. Note on a Cirripede of the California Miocene, with remarks on fossil shells. Acad. Nat. Sci. Philadelphia, Proc., 28: 273-275.
- . 1877. Note on the relations of *Balanus estrellanus* of the Californian Miocene. Amer. Jour. Sci. (3) 13: 156-157.
- DALL, W. H. 1902. On the true nature of *Tamiosoma*. Science (n.s.) 15: 5-7.
- DARWIN, CHARLES. 1854a. A monograph on the sub-class Cirripedia 2. Balanidae, Verrucidae. Ray Soc., London, viii + 684 pp., 11 text-figs., 30 pls.
- . 1854b. A monograph on the fossil Balanidae and Verrucidae of Great Britain. Palaeontogr. Soc., London, 44 pp., 6 text-figs., 2 pls.
- DURHAM, D. L., AND W. O. ADDICOTT. 1965. Pancho Rico Formation Salinas Valley, California U.S. Geol. Surv. Prof. Paper 524A: i-iii, 1-22, text figs. 1-7, pls. 1-5.
- GABB, W. M. 1869. Cretaceous and Tertiary fossils. California Geol. Surv., Paleontology, 2: i-xiv, 1-299, pls. 1-36.

- HENRY, D. P., AND P. A. McLAUGHLIN. 1967. A revision of the subgenus *Solidobalanus* Hoek (Cirripedia Thoracica) including a description of a new species with complementary males. *Crustaceana* 12: 43-58, text-figs. 1-3, pl. 1.
- HERTLEIN, L. G., AND U. S. GRANT IV. 1944. The geology and paleontology of the marine Pliocene of San Diego, California. Pt. 1, Geology. San Diego Soc. Nat. Hist., Mem., 2: 1-72, text-figs. 1-6, pls. 1-18.
- . 1960. The geology and paleontology of the marine Pliocene of San Diego, California. Part 2a, Paleontology. San Diego Soc. Nat. Hist., Mem., 2: 73-133, pls. 19-26.
- PILSBRY, H. A. 1916. The sessile barnacles (Cirripedia) contained in the collections of the U. S. National Museum, including a monograph of the American species. U. S. Natl. Mus., Bull. 93: i-xi, 1-366, text-figs. 1-99, pls. 1-76.
- . 1919. Cirripedia from the Panama Canal Zone. U. S. Natl. Mus., Bull. 103: 185-188, pl. 67.
- ROSS, ARNOLD. 1962. Results of the Puritan-American Museum of Natural History Expedition to Western Mexico. 15. The littoral balanomorph Cirripedia. *Amer. Mus. Novitates* 2084: 1-44, figs. 1-24.
- . 1964. Cirripedia from the Yorktown Formation (Miocene) of Virginia. *Jour. Paleontol.*, 38: 483-491, text-figs. 1-2, pls. 71-72.
- WITHERS, T. H. 1953. Catalogue of fossil Cirripedia in the Department of Geology, vol. III. Tertiary. *Brit. Mus. (Nat. Hist.)*, London, xv + 396 pp., 105 text-figs., 64 pls.
- WOODRING, W. P., AND M. N. BRAMLETTE. 1950. Geology and paleontology of the Santa Maria District, California. U. S. Geol. Surv., Prof. Paper 222: i-iv, 1-185. text-figs. 1-9, pls. 1-23.
- . R. STEWART, AND R. W. RICHARDS. 1940. Geology of the Kettleman Hills oil field, California. U. S. Geol. Surv., Prof. Paper 195: 1-170, text-figs. 1-15, pls. 1-57.
- ZULLO, V. A. 1961. A new whale barnacle from Late Pleistocene deposits at San Quintín Bay, Baja California. *Veliger* 4: 13-14, pl. 3.
- . 1964. Re-evaluation of the late Cenozoic cirriped "Tamiosoma" Conrad. *Biol. Bull.* 127(2): 360 (abstr.).
- . 1966. A new species of *Balanus* (Cirripedia, Thoracica) from the Late Eocene Cowlitz Formation of southern Washington, U.S.A. *Crustaceana* 11: 198-204, text-figs. 1-2.

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