

PLEISTOCENE BRACHYURA FROM THE LOS ANGELES AREA: CANCRIDAE¹

ROBERT JAMES MENZIES
University of Southern California, Los Angeles

ABSTRACT—Five species of Pleistocene Brachyura belonging to the genus *Cancer* are figured and described from the Los Angeles area. Because of their abundance and specific nature, it is suggested that fossil appendage segments may be useful in stratigraphic paleontology.

INTRODUCTION

PLEISTOCENE crabs of the genus *Cancer* have been known from the Pacific coast and particularly from the Los Angeles area for some time, and Dr. Mary Rathbun (1926) recorded six of the nine known Recent and Pleistocene species in her monograph on the fossil stalk-eyed Crustacea of the Pacific slope of North America. Figures or adequate descriptions of the appendages and fragments commonly found fossil, however, generally are not available in either zoological or paleontological literature.

The distal elements of the chelipeds of crabs appear to resist disintegration by wave and organic action more than do the somewhat fragile carapaces and proximal articles. For this reason, and because they exhibit several specific characteristics, the dactyls and propods (movable and immovable fingers, respectively) merit consideration not hitherto given them by paleontologists. Such fragments are abundant in some ancient strata and they seem to be stratigraphically useful, but one must have considerable knowledge of these fossils and of the Recent Decapoda in general before one can identify them. Because most paleontologists lack detailed knowledge of the Recent Decapoda, the fossil crabs from the Pleistocene have been quite useless to them. It is hoped that this paper will provide a ready means of identification of fragments of Pleistocene *Cancer* from the area studied.

The fossil specimens on which this paper is based were received from the very extensive collections of Mr. George Kanakoff,

Curator of Invertebrate Paleontology of the Los Angeles County Museum, to whom grateful acknowledgment is made. The study was conducted at the Allan Hancock Foundation of the University of Southern California. I am indebted to Dr. John S. Garth, Research Associate at the Foundation, for the privilege of examining the Foundation's large collections of Recent species of *Cancer*. Miss Janet Haig, Research Assistant at the Foundation, gave the writer much valuable taxonomic advice. Special thanks are due Dr. William H. Easton, Associate Professor, Department of Geology, University of Southern California, for his direction of this study.

THE TAXONOMIC LIMITS OF FRAGMENTS OF *Cancer*

Cancer cheliped propods and dactyls can be differentiated from many, but not from all, of the decapod groups by a combination of the following characteristics:

1. Usually large size, with a generally ovoid cross-section at the largest most proximal cutting tooth.
2. Moderate number (4 to 11) of cutting teeth.
3. Relative shortness of dactyls and propods; ratio of length to height (measured at the largest most proximal tooth) of 2 to 2.2 for propods and 2.5 to 3.5 for dactyls, at least in the species studied.
4. Fingers (tips of dactyls and propods) pointed, not spoon-shaped.

The presence of these characters excludes most of the grapsoid, portunid, oxystomatous and anomuran crabs, but probably not many of the xanthid fragments. Few species of xanthids were encountered in the strata studied and these could scarcely be con-

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fused with the species of *Cancer* figured in this paper. In the writer's opinion, fragments from similar strata having the characteristics listed above are likely to be *Cancer* fragments. Others could belong to xanthid genera or to other species of *Cancer*, or they could be aberrant forms of the species herein reported.

Cancer anthonyi Rathbun, listed by Dr. Rathbun (1926, p. 7) as being a Pleistocene species, is not considered in this report because it is lacking in the collections examined by the writer.

The fossil specimens recorded here are deposited in the collection of invertebrate paleontology at the Los Angeles County Museum, Exposition Park, Los Angeles, California. The abbreviation "LACMIP" refers to this disposition of specimens.

LOCALITIES

Specimens were examined that had been collected from the following Los Angeles County Museum invertebrate paleontology localities.

Loc. 131: Pleistocene. San Pedro formation, Palos Verdes Hills, at the 500-block of North Pacific Avenue, San Pedro, California. Collector, James C. Marsh, 1937. Species represented: *Cancer branneri*, *C. jordani*, *C. productus*.

Loc. 66-1: Pleistocene. Gully No. 1, Upper Newport Bay at the northeast corner of the military air strip, about $\frac{1}{4}$ mile southwest of the salt reducing plant, Orange County, California. Collector, George Kanakoff. Species represented: *Cancer branneri*, *C. gracilis*, *C. jordani*, *C. magister*.

Loc. 130-7: Pleistocene. Timm's Point formation, type locality, Hole No. 7, across the street and railroad tracks from Berth 79, Los Angeles Harbor. Species represented: *Cancer branneri*, *C. productus*.

Loc. 142: Pleistocene. Second and Orizaba Streets, San Pedro, California. Collector, Dr. A. T. Tieje, 1915-1916. Species represented *Cancer branneri*, *C. jordani*.

SYSTEMATIC PALEONTOLOGY

Phylum ARTHROPODA

Class CRUSTACEA

Order DECAPODA

Family CANCRIDAE Alcock

CANCER GRACILIS Dana

Text-figures 1, 10

Cancer gracilis DANA, 1852, Acad. Nat. Sci. Philadelphia Proc., vol. 6, p. 73; RATHBUN, 1926, U. S. Nat. Mus. Bull. 138, p. 65; —, 1930, idem, Bull. 152, pp. 219-222 (contains prior synonymy).

Description of cheliped parts.—Dactyl: laterally compressed, very high and oval in cross-section. Superior surface with a single marginal row of sharp irregular spines. Lateral and medial surfaces covered with small tubercles. Setiferous pits scattered over lateral surface but tending to be in rows. Teeth about six, the most proximal (first) of which has three apical teeth; third tooth smaller than second and fourth; fifth smaller than fourth and sixth. Propod: teeth about six, triangulate and laterally compressed. Lateral and medial areas covered with tubercles. Lateral surface with setiferous pits scattered but tending to be in rows.

Modern ecology.—Shallow water bay localities having a sandy bottom.

Bathymetric range: intertidal to 56 fathoms (Rathbun, 1930, p. 222). Geographic range: Prince of Wales Island, Alaska, to Playa Maria Bay, Lower California, Mexico (Rathbun, 1930, p. 222)

C. gracilis is abundant enough north of Point Conception, California, to be of commercial value; south of that point it appears to be relatively uncommon. It occurs in fairly shallow water on sandy bottoms and is often taken from localities where *Cancer magister* is abundant.

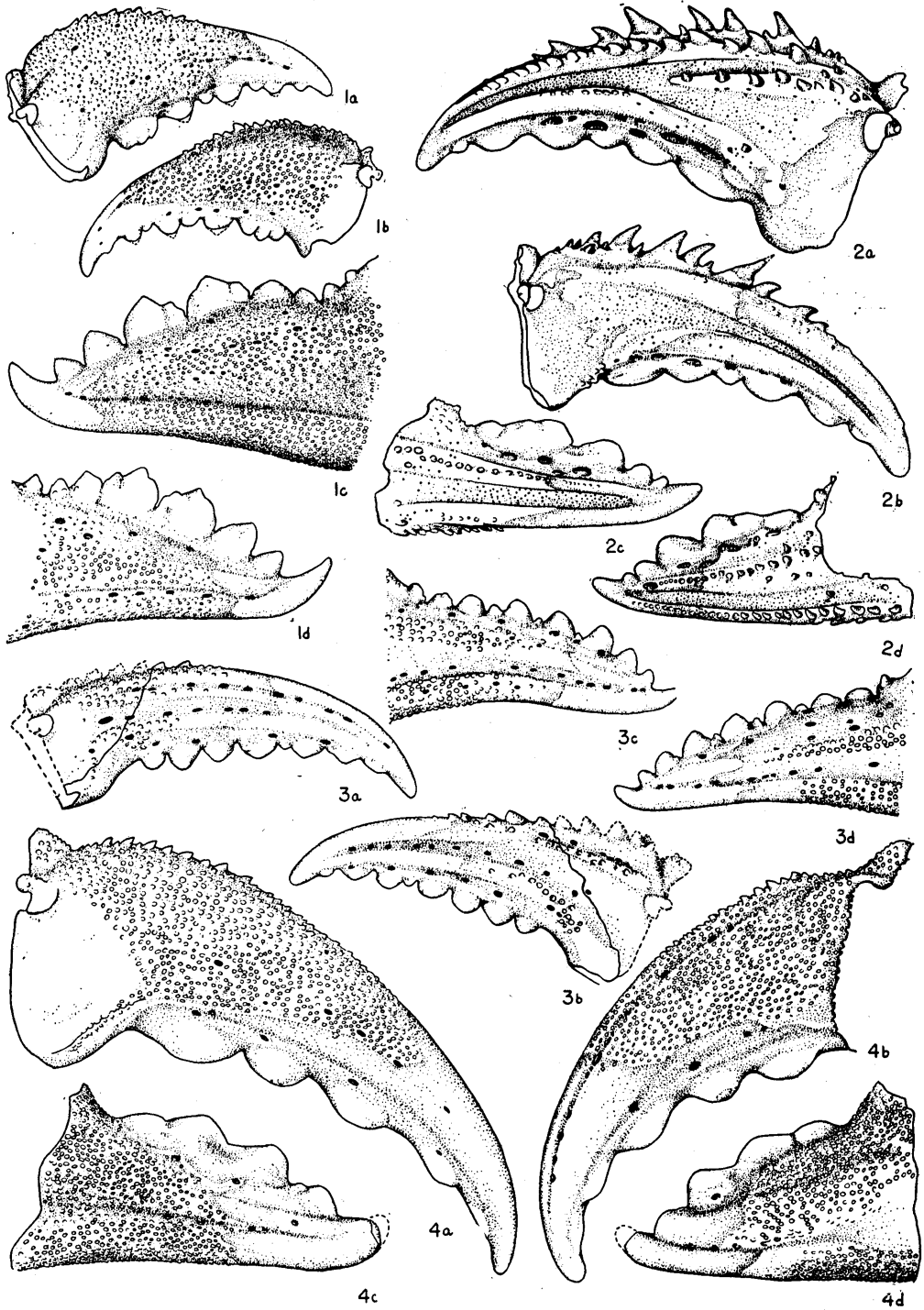
Stratigraphic range.—Pleistocene to Re

FIG. 1—*Cancer gracilis* Dana. $\times 3.3$. *a*, Dactyl, medial surface; *b*, dactyl, lateral surface; *c*, propod lateral surface (Recent specimen); *d*, propod, medial surface (Recent specimen). LACMIP 66-1.

FIG. 2—*Cancer branneri* Rathbun. $\times 3.3$. *a*, Dactyl, lateral surface; *b*, dactyl, medial surface; *c*, propod medial surface; *d*, propod, lateral surface. LACMIP 130-7.

FIG. 3—*Cancer magister* Dana. $\times 3.3$. *a*, Dactyl, lateral surface (composite of fossil and Recent specimen); *b*, dactyl, medial surface (composite of fossil and Recent specimen); *c*, propod, lateral surface (Recent specimen); *d*, propod, medial surface (Recent specimen). LACMIP 66-1.

FIG. 4—*Cancer productus* Randall. $\times 3$. *a*, Dactyl, medial surface; *b*, dactyl, lateral surface; *c*, propod medial surface; *d*, propod, lateral surface. LACMIP 130-7.



FIGS. 1-4

cent. California: Santa Monica, San Pedro, San Diego (Rathbun, 1926, p. 65).

Locality.—LACMIP No. 66-1, eight dactyls (one hypotype), one propod.

CANCER MAGISTER Dana

Text-figures 3, 9

Cancer magister DANA, 1852, Acad. Nat. Sci. Philadelphia Proc., vol. 6, p. 73; RATHBUN, 1926, U. S. Nat. Mus. Bull. 138, pp. 64-65; —, 1930, idem, Bull. 152, pp. 222-226 (contains prior synonymy).

Description of cheliped parts.—Dactyl: reniform in cross-section. Superior surface with a conspicuous row of fairly large, often spinulate, spines. Lateral and medial surfaces covered with tubercles and having low, tuberculate or spinulate ridges. Setiferous pits generally confined to rows in depressed areas between low ridges. Teeth about eight. Tips of fingers usually white. Propod: teeth about ten. Setiferous pits generally confined to sunken areas. Lateral and medial surfaces with elevated tuberculate ridges.

Modern ecology.—Shallow water; bay or offshore fauna.

Bathymetric range: intertidal to 50 fathoms (Rathbun, 1930, p. 223). Geographic range: Unalaska to Monterey Bay, California (Rathbun, 1930, p. 223). The literature indicates that this species favors a fine gray sand bottom.

Stratigraphic range.—Pleistocene to Recent. California: San Pedro (Rathbun, 1926, p. 64), Newport Bay.

Locality.—LACMIP No. 66-1, three dactyls (one hypotype).

CANCER PRODUCTUS Randall

Text-figures 4, 8

Cancer productus RANDALL, 1839, Acad. Nat. Sci. Philadelphia Jour., vol. 8, pt. 1, p. 116; RATHBUN, 1926, U. S. Nat. Mus. Bull. 138, p. 62; —, 1930, idem, Bull. 152, pp. 203-205 (contains prior synonymy).

Description of cheliped parts.—Dactyl: ovoid in cross-section. Superior area with numerous small spines which are largest near the superior medial margin. Lateral and medial areas tuberculate, but lacking sulci or elevated areas. Setiferous pits present, no setiferous sulci. Teeth about five. Tips of fingers black. Propod: teeth about four. Lateral and medial surfaces tuberculate; longitudinal grooves fairly prominent. Setiferous pits present; tend to be arranged in longitudinal rows.

Modern ecology.—Shallow bay or offshore water.

Bathymetric range: intertidal to 43 fathoms (Rathbun, 1930, p. 207). Geographic range: Alaska to Laguna Beach, California (Rathbun, 1930, p. 205). Like *C. magister*, this species appears to be most abundant at localities north of Monterey Bay, California. A sand or mud-sand bottom appears to be favored by this species.

Stratigraphic range.—Pliocene to Recent. California: Santa Barbara, San Pedro (Rathbun, 1926, p. 62), Timm's Point, San Pedro.

Localities.—LACMIP No. 131, three dactyls; No. 130-7, one dactyl, one partial cheliped (hypotype).

FIG. 5.—*Cancer jordani* Rathbun. $\times 5$. a, Dactyl, lateral surface; b, dactyl, medial surface; c, propod, lateral surface; d, propod, medial surface. LACMIP 142.

FIG. 6.—*Cancer branneri* Rathbun. Setiferous pits of lateral surface, highly magnified.

FIG. 7.—*Cancer branneri* Rathbun. Magnification of large lateral sulcus showing the many minute perforations.

FIG. 8.—*Cancer productus* Randall. Semi-diagrammatic cross-section of dactyl at proximal tooth. S = superior surface, L = lateral surface, M = medial surface, IN = inferior surface.

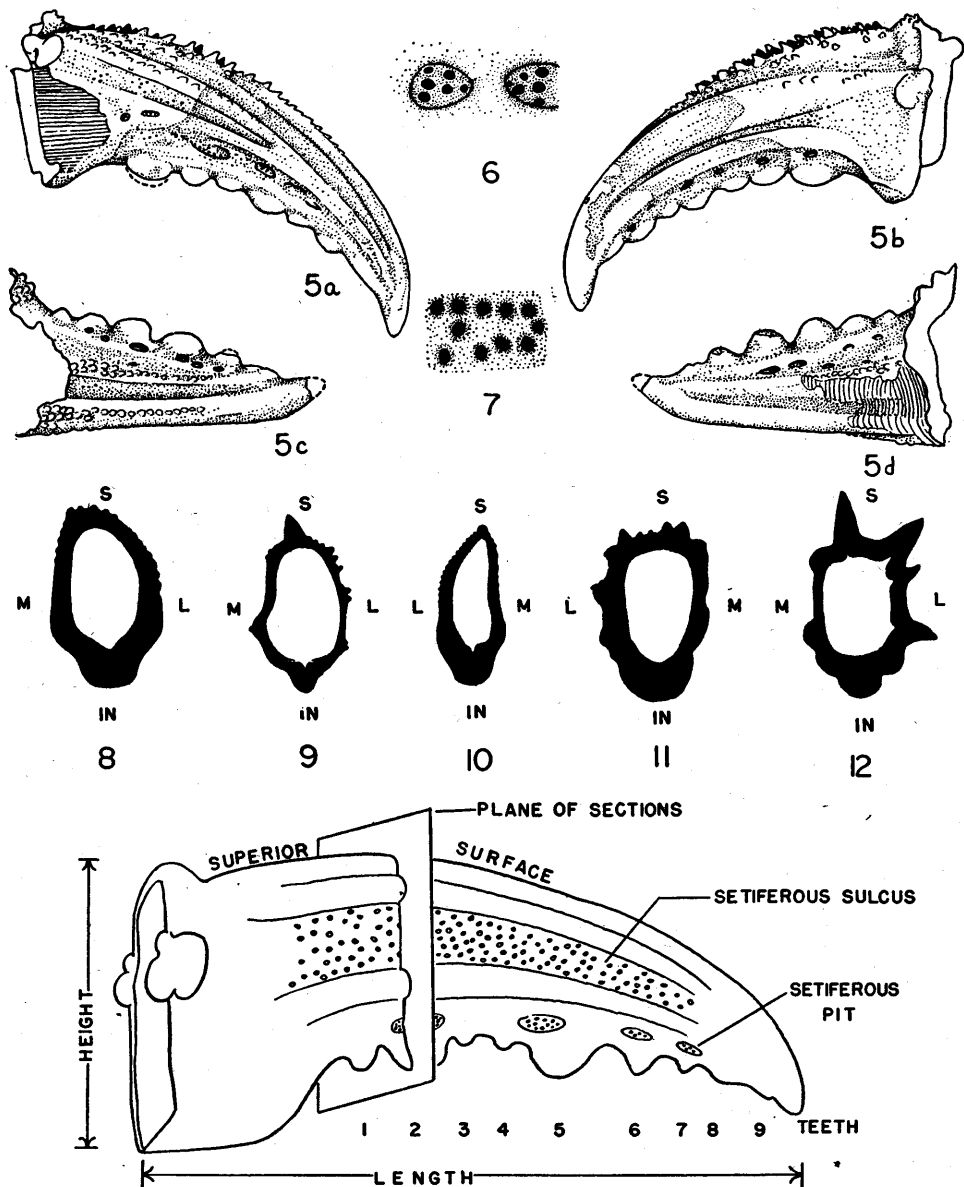
FIG. 9.—*Cancer magister* Dana. Semi-diagrammatic cross-section of dactyl at proximal tooth.

FIG. 10.—*Cancer gracilis* Dana. Semi-diagrammatic cross-section of dactyl at proximal tooth.

FIG. 11.—*Cancer jordani* Rathbun. Semi-diagrammatic cross-section of dactyl at proximal tooth.

FIG. 12.—*Cancer branneri* Rathbun. Semi-diagrammatic cross-section of dactyl at proximal tooth.

FIG. 13.—Diagram of dactyl illustrating morphological terms used in this paper.



13
FIGS. 5-13

CANCER JORDANI Rathbun
Text-figures 5, 11

Cancer jordani RATHBUN, 1900, Am. Naturalist, vol. 34, p. 133; —, 1926, U. S. Nat. Mus. Bull. 138, p. 64; —, 1930, idem, Bull. 152, pp. 215-217 (contains prior synonymy).

Description of cheliped parts.—Dactyl:

almost hexagonal in cross-section. Superior surface with several rows of small spines. Lateral and medial surfaces lacking setiferous pits except above teeth but having conspicuous setiferous sulci. Teeth about seven. Propod: teeth about five. Lateral area with a deep sulcus bordered by elevated spinulate

ridges. The dactyls and propods of this species in general resemble those of *C. branneri* considerably. These species differ primarily only in the more numerous and smaller spines present on specimens of *C. jordani*.

Remarks.—The average ratio of the carapace width to the dactyl length of three Recent specimens is about 4.7. The largest fossil dactyl in the collections is 11 mm. in length. If the above ratio holds true for large crabs this indicates an individual having a carapace width of about 51.7 mm., which is considerably larger than any Recent specimens thus far recorded. This accords with Miss Rathbun's statement (1926, p. 64), "These fingers (Pleistocene, Nob Hill, Lower San Pedro formation) are of unusual size indicating that the species was much larger in the Pleistocene than now."

Modern ecology.—Shallow bay or offshore water.

Bathymetric range: intertidal to 24 fathoms (Rathbun, 1930, p. 216). Geographic range: Humboldt Bay, California, to San Geronimo Island, Lower California, Mexico. This species occurs on bottoms ranging from fine sand to rocky sand and it has been taken frequently from kelp hold-fasts. Most of the records of this species are from localities off San Pedro, California.

Stratigraphic range.—Pleistocene to Recent. California: San Pedro, San Diego (Rathbun, 1926, p. 64), Newport Bay.

Localities.—LACMIP No. 131, two dactyls; No. 66-1, 16 dactyls; No. 142, 34 dactyls (one hypotype), two propodi (one hypotype).

CANCER BRANNERI Rathbun
Text-figures 2, 6, 7, 12

Cancer branneri RATHBUN, 1926, U. S. Nat. Mus. Bull. 138, p. 63, pl. 16, fig. 4: —, 1930, idem, Bull. 152, pp. 211-215 (contains prior synonymy).

Description of cheliped parts.—Dactyl: almost hexagonal in cross-section. Superior surface with a medial and lateral row of large spines. Lateral surface with two rows

of large spines. Lateral and medial surfaces lack setiferous pits except above teeth but have large setiferous sulci. These are perforated by numerous holes which represent the setae attachment points on Recent specimens. Teeth about six. Propod: about four teeth. Lateral and medial areas with setiferous sulci and ridges bearing fairly large spines.

Modern ecology.—Shallow offshore water with sand or sand-mud bottom.

Bathymetric range: intertidal to 40 fathoms (Rathbun, 1930, pp. 214-125). Geographic range: Alaska to Santa Catalina Island, California (Rathbun, 1926, p. 64). This species is known mostly from localities north of the Farallone Islands, California, and usually occurs on a sandy bottom.

Stratigraphic range.—Pleistocene to Recent. California: San Pedro (Rathbun, 1926, pp. 63-64), Upper Newport Bay, Timm's Point.

Localities.—LACMIP No. 131, one dactyl, one propod; No. 66-1, nine dactyls; No. 130-7, four dactyls (one hypotype), one propod (hypotype); No. 142, one cheliped, dactyl lacking.

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