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TWO NEW SPECIES OF *TRIDENTELLA* RICHARDSON, 1905 (ISOPODA: FLABELLIFERA: TRIDENTELLIDAE) FROM CALIFORNIA, WITH A REDIAGNOSIS AND COMMENTS ON THE FAMILY, AND A KEY TO THE GENERA OF TRIDENTELLIDAE AND CORALLANIDAE

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ABSTRACT

Two new species of the marine isopod genus *Tridentella* Richardson, 1905, are described from California. The monogeneric family Tridentellidae Bruce, 1984, is rediagnosed and a comparison to the original diagnosis is presented. A list of the ten described species of Tridentellidae is given, with synonymies and general distributional information. Notes on the ecology and biogeography of the family are presented, as well as a key to the genera of the closely related families Tridentellidae and Corallanidae.

The families Tridentellidae and Corallanidae have only recently come under study in the eastern Pacific (see Bruce *et al.*, 1982; Delaney, 1982, 1984). The two new species described herein are based primarily upon Allan Hancock Foundation RV *Velero* Pacific Expeditions material collected in the 1940s and 1950s. In this paper we expand Bruce's (1984) diagnosis of the family Tridentellidae, list the 10 described species in this widespread family (with synonymies and distributions), present a key to the genera of the closely related families Tridentellidae and Corallanidae, and describe two new species of *Tridentella.*

The following abbreviations are used in this paper: AHF, Allan Hancock Foundation; CAS, California Academy of Sciences; PMS, plumose marginal setae; and USNM, United States National Museum of Natural History.

Tridentellidae Bruce, 1984

Diagnosis.—Eyes well-developed, placed at posterolateral angles of cephalon. Body often with dorsal spines, tubercles, or carinae. First antenna peduncle 3-articulate, basal article not enlarged. Second antenna peduncle 5-articulate, articles 4 and 5 elongate. Frontal lamina narrow, pentagonal; clypeus short, broad, inverted V-shaped, lateral angles produced to, or almost to, base of mandible; labrum small, partly or largely encompassed by clypeus. Mandible narrowing from base to short acute incisor; molar process present, usually large but weakly sclerotized (and often lost in dissection); often well developed; lacinia wanting; middle and distal articles of 3-articulate palp with PMS. Maxillule lateral (outer) lobe styliform, slightly curved, tapering toward apex with 3–5 stout, hooked apical spines and with smaller subapical spines; medial (inner) lobe simple, highly reduced. Maxilla uniramous, stout, 2-articulate; distal region of conical second article with small spines and/or scalelike setae; maxillary spines tridentate in many species. Maxilliped palp 5-articulate, with PMS, middle article not elongate; endite elongate, with or without coupling hooks. Coxae of pereionite I fused to body; coxae of pereionites II–VII free. Pereiopods I–III subprehensile; dactyl stout, nearly as long as propodus or distinctly shorter than propodus; often with small spines on posterior medial margins of merus and ischium. Pereiopods IV–VII ambulatory, often with many large spines on anterior and posterior margins. Pleopods 1–4 peduncle with 4–6 coupling spines on medial margin and PMS proximal to coupling spines; rami lamellar, with PMS; only endopod of pleopod 5 lacking PMS. Appendix masculina of male pleopod 2 rodlike, with simple apex; arising from proximal medial margin of endopod.

Remarks.—Bruce (1984) established the monogeneric family Tridentellidae for the genus *Tridentella* Richardson, 1905; the above diagnosis expands upon that of Bruce. The family is closely allied to four similar flabelliferan families (Cirolanidae, Corallanidae, Aegidae, and Cymothoidae). In species of *Tridentella* with strong dorsal ornamentation (spines, tubercles, "horns") these structures are always better developed in males, and often wanting altogether in females.

Bruce's (1984) diagnosis of Tridentellidae states that the maxillae are "densely covered with tridentate scale-like spines." However, in neither of the two new species described herein are the maxillary spines tridentate. In his character matrix (his table 1) Bruce notes that the mandibular molar process in Tridentellidae is vestigial. However, in most tridentellids a molar process appears to exist and is often quite large. The molar process is weakly chitinized, quite fragile, and often lost during dissection. Bruce further states that the maxillae of Corallanidae are vestigial. It is not clear to us what Bruce means by "vestigial," but maxillae are always present in this family. Corallanid maxillae are simple structures resembling reduced tridentellid maxillae: most are simple 1- or 2-segmented lobes (*Alcirona, Argathona, Austroargathona, Corallana,* and *Tachaea*); one has a bilobed apex (*Excorallana*); still another is 3- or 4-segmented, with a sublinear, elongate apical article (*Lanocira*). Finally, Bruce states that the maxillipeds of Corallanidae lack an endite, consisting of nothing more than a slender palp. While this is usually the case, at least one species does have an endite on the maxilliped (*Excorallana houstoni* Delaney, 1984, female). The endite of *E. houstoni* is reduced, but not any more so than the maxillipedal endites of Aegidae.

The above considerations largely reduce the distinction between Tridentellidae and Corallanidae to a matter of subtleties and degree. The only reliable characters separating these two families appear to be: the simple falcate maxillules of corallanids versus the complex spinose aegidlike maxillules of tridentellids; and the reduced or absent maxillipedal endite of corallanids versus the well-developed endite of tridentellids.

Genus *Tridentella* Richardson, 1905

Tridentella Richardson, 1905: 161.—Thielemann, 1910: 22.—Nierstrasz, 1931: 54.—Kussakin, 1955: 228.—Menzies, 1962: 120.—Schultz, 1969: 213.—Carvacho, 1977: 28.—Kussakin, 1979: 223.—Bruce *et al.,* 1982: 464.—Bruce, 1984: 447.
Smicrostoma Hale, 1925: 223.

Diagnosis.—Same as for family.

Type-species.—*Tridentella virginiana* (Richardson, 1900). Originally described as *Cirolana virginiana* Richardson, 1900: 216. Type series at USNM.

Described Species:

Tridentella virginiana (Richardson, 1900)

Cirolana virginiana Richardson, 1900: 216; 1901: 512.
Tridentella virginiana.—Richardson, 1905: 161.—Thielemann, 1910: 23.—Nierstrasz, 1931: 54.—Schultz, 1969: 213.—Kussakin, 1979: 224.—Bruce, 1984: 448.

Distribution.—Western Atlantic: Nova Scotia to Virginia.

Tridentella japonica Thielemann, 1910

Tridentella japonica Thielemann, 1910: 22.—Nierstrasz, 1931: 54.—Kussakin, 1979: 223.—Bruce, 1984: 454.

Distribution.—Japan, off Tokyo.

Tridentella saxicola (Hale, 1925)

Smicrostoma saxicola Hale, 1925: 166.—Nierstrasz, 1931: 54.
Tridentella saxicola.—Bruce, 1984: 454.

Distribution.—Australia: Queensland and New South Wales.

Tridentella sculpturata Kussakin, 1955

Tridentella sculpturata Kussakin, 1955: 228; 1979: 225.—Bruce, 1984: 454.

Distribution.—Northwest Pacific.

Tridentella laevicephalax Menzies, 1962

Tridentella laevicephalax Menzies, 1962: 120.—Carvacho, 1977: 28.—Kussakin, 1979: 223.—Bruce, 1984: 454.

Distribution.—Southern Chile.

Tridentella cornuta Kussakin, 1979

Tridentella cornuta Kussakin, 1979: 228.—Bruce, 1984: 454.

Distribution.—Northwest Pacific.

Tridentella ornamenta (Menzies and George, 1972)

Cirolana ornamenta Menzies and George, 1972: 24.
Tridentella ornamenta.—Bruce, 1981: 961; 1984: 454.

Distribution.—Peru-Chile Trench (11°50′S, 77°58′W).

Tridentella vitae Bruce, 1984

Tridentella vitae Bruce, 1984: 449.

Distribution.—Fiji.

Remarks.—The 10 described species of *Tridentella* show a wide range in habitat and distribution. Seven species are known from temperate latitudes, three from tropical/subtropical areas, and one (*T. ornamenta*) from the Peru-Chile Trench (Fig. 1). Reported depths range from shallow tropical reefs (*T. saxicola,* 11 m) to continental slope depths (*T. japonica,* 600 m) to bathyal depths (*T. ornamenta,* 907–935 m, Peru-Chile Trench). Reported substrates include "burrowing into subtidal conglomerate boulders" (*T. saxicola*), "coral rock" (*T. saxicola*), "green mud" (*T. glutacantha,* new species described below), "stones with calcareous algae" (*T. laevicephalax*), and apparently soft benthic sediments (*T. ornamenta, T. japonica, T. virginiana*). *Tridentella vitae, T. sculpturata,* and *T. cornuta* have been taken as "parasites" on various fishes. Based on what little is known of the species of *Tridentella,* their habits appear quite similar to those of the Corallanidae and Aegidae. Members of the genus *Tridentella* probably are benthic-epibenthic dwellers that enter the water column to attach temporarily and take a meal from

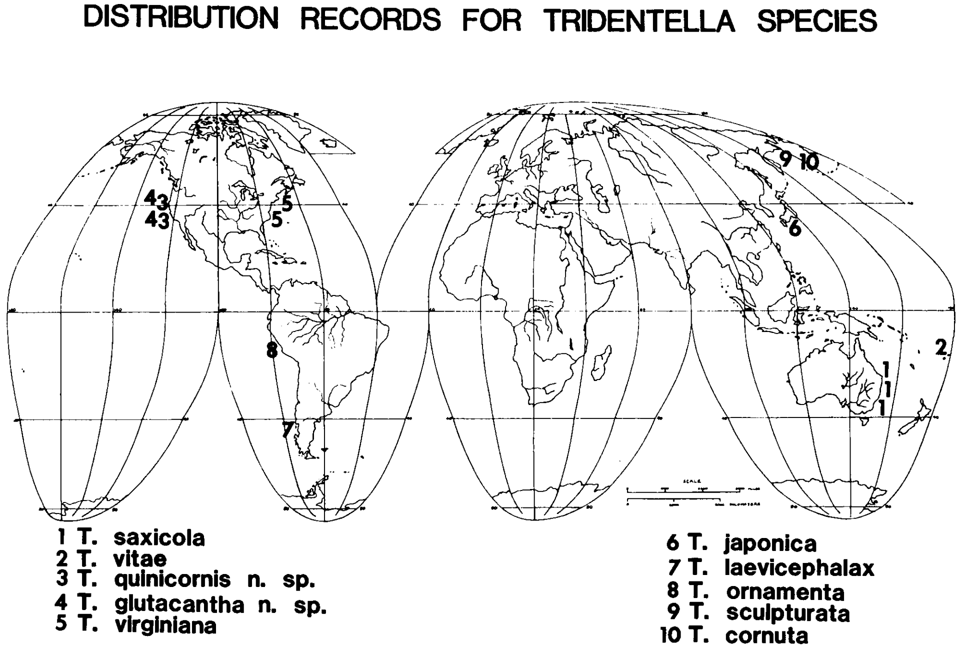

Fig. 1. Distribution records for *Tridentella* species.

a fish "host." The mouth parts are well suited for such feeding; the mandibles bear bladelike slicing structures, and perhaps a rasping molar process (e.g., *T. glutacantha,* new species). The terminal hooked spines on the maxillules and maxillae probably aid in holding the buccal field tightly appressed to the "host" fish during feeding. In these regards, *Tridentella* species are probably best considered not as true parasites but as micropredators.

The genus *Tridentella* closely resembles the seven described genera of the family Corallanidae, being distinguished primarily by modifications of the mouth appendages; the mouth appendages are somewhat between those of the Corallanidae and the Aegidae. A key to the genera of Tridentellidae and Corallanidae is presented below.

Key to the Genera of Tridentellidae and Corallanidae

1. Maxillule (maxilla 1) lateral lobe slender, style-like, apex with 3–5 stout, hooked spines, smaller spines subapically; maxilliped with conspicuous endite .... (Tridentellidae) *Tridentella* Richardson, 1905
– Maxillule not as above; maxilliped without an endite (the female of at least one species, *Excorallana houstoni,* known to have a small endite) .... 2 (Corallanidae)
2. Maxillule lateral lobe with single large recurved (falcate) spine, with 1 or more smaller hooked spines at base of large spine .... *Argathona* Stebbing, 1905
– Maxillule not as above 3
3. Maxillule lateral lobe with 2 large recurved spines, occasionally with 1–3 smaller spines between the 2 large ones .... *Alcirona* Hansen, 1890
– Maxillule lateral lobe apex a single large recurved spine, without smaller hooked spines at base 4
4. Mandible with elongate incisor .... *Excorallana* Stebbing, 1904
– Mandible with short incisor 5
5. Maxilla 3- or 4-articulate, apical article sublinear, elongate .... *Lanocira* Hansen, 1890
– Maxilla a simple lobe with rounded apex 6

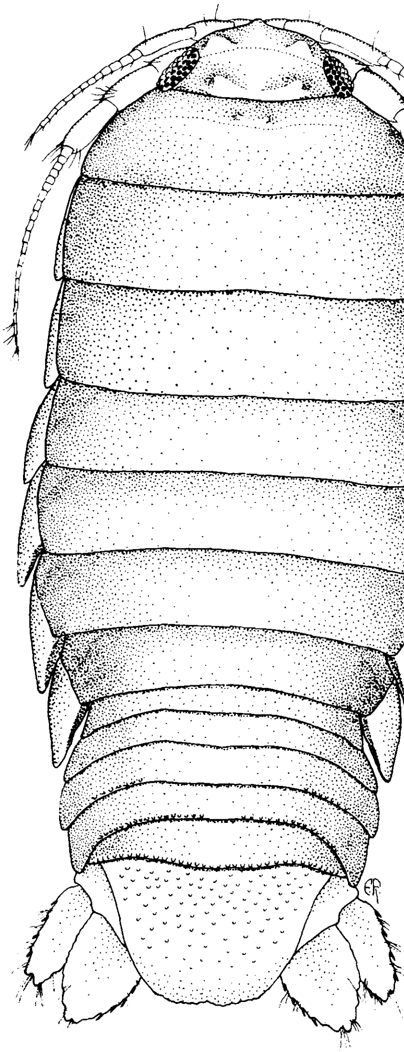

Fig. 2. *Tridentella quinicornis,* new species, dorsal view. Male, holotype.

6. Maxilliped narrow, basis elongate, palp 5-articulate .... *Corallana* Dana, 1853
- Maxilliped broader than in *Corallana,* basis less elongate, palp 3–5-articulate 7
7. Maxilliped palp 3-articulate; mandible without molar process and lacinia .... *Austroargathona* Riek, 1953
- Maxilliped palp 3–5-articulate; mandible without molar process, but with lacinia .... *Tachaea* Schioedte and Meinert, 1879

Tridentella quinicornis, new species
Figs. 2–5, 8j

Material Examined.—(1) California, Los Angeles County, Farnsworth Bank (near Catalina Island). RV *Velero* No. 1903–49. Holotype, male (AHF No. 4926) 10.73 mm; allotype, female (AHF No. 4926a) 9.75 mm (gravid); paratype, female (AHF No. 1903–49), 6.44 mm. (2) California, Santa Barbara Islands, S.W. Rock (Richardson's specimens). RV *Albatross* Station No. 4417. Depth 53 m. 12 April 1904. USNM 33432; paratypes, one male, 9.57 mm, one female, 6.93 mm.

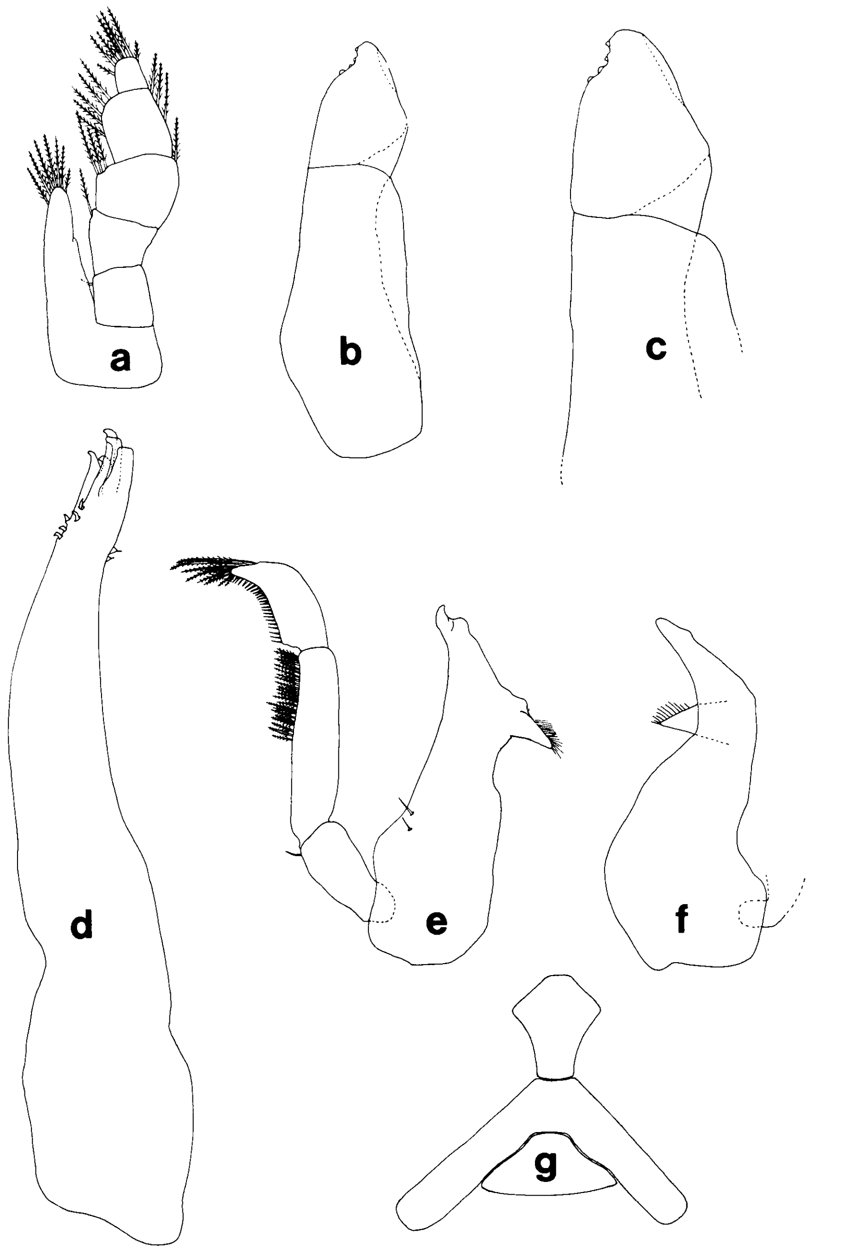

Fig. 3. *Tridentella quinicornis*, new species, holotype. a, maxilliped; b, maxilla; c, apex of maxilla; d, maxillule; e, left mandible; f, right mandible; g, frontal lamina, clypeus, and labrum.

Description of Male.—Cephalon with 5 tubercles; 1 rostral, 1 pair near anterior margin, 1 pair near posterior margin (Fig. 2). Slight furrow running between eyes, posterior to anterior tubercle pair. Antenna 1 flagellum of 10–14 articles, extending to middle of pereionite I (Fig. 4c); antenna 2 flagellum of 15–20 articles, extending to posterior margin of pereionite III (Fig. 4d). Frontal lamina pentagonal; clypeus

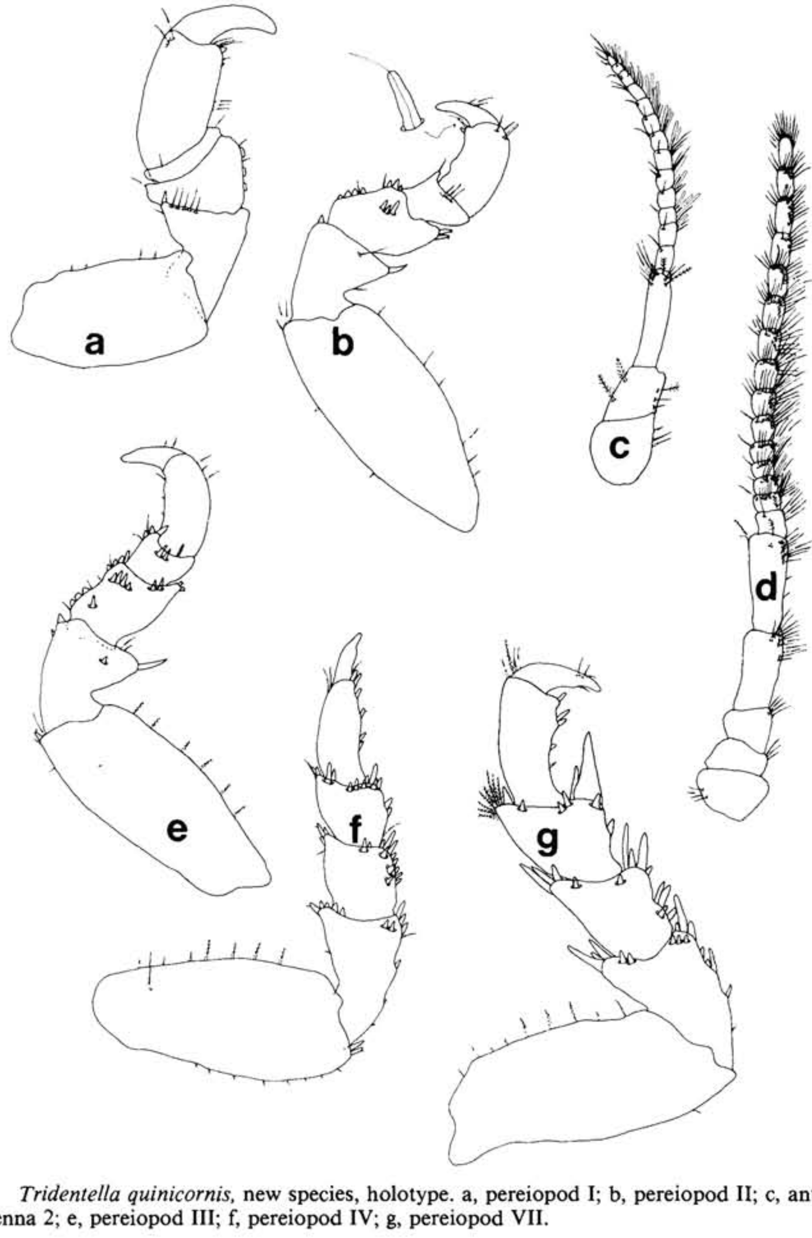

Fig. 4. *Tridentella quinicornis,* new species, holotype. a, pereiopod I; b, pereiopod II; c, antenna 1; d, antenna 2; e, pereiopod III; f, pereiopod IV; g, pereiopod VII.

short, very broad, produced almost to articulation of mandibular palps; labrum small, encompassed by clypeus (Fig. 3g). Left mandible with acute bladelike incisor process and triangular, setose molar process (Fig. 3e). Right mandible with small triangular molar process (Fig. 3f). Maxillule lateral lobe with 5 large apical spines, 5 small median subapical hooklike spines, and 2 small lateral subapical spines (Fig. 3d); median lobe minute, simple (not figured). Maxilla apex with 4 stout denticles (Fig. 3b, c). Maxilliped palp with PMS as figured; endite extending to middle of third palp article; without coupling hooks (Fig. 3a).

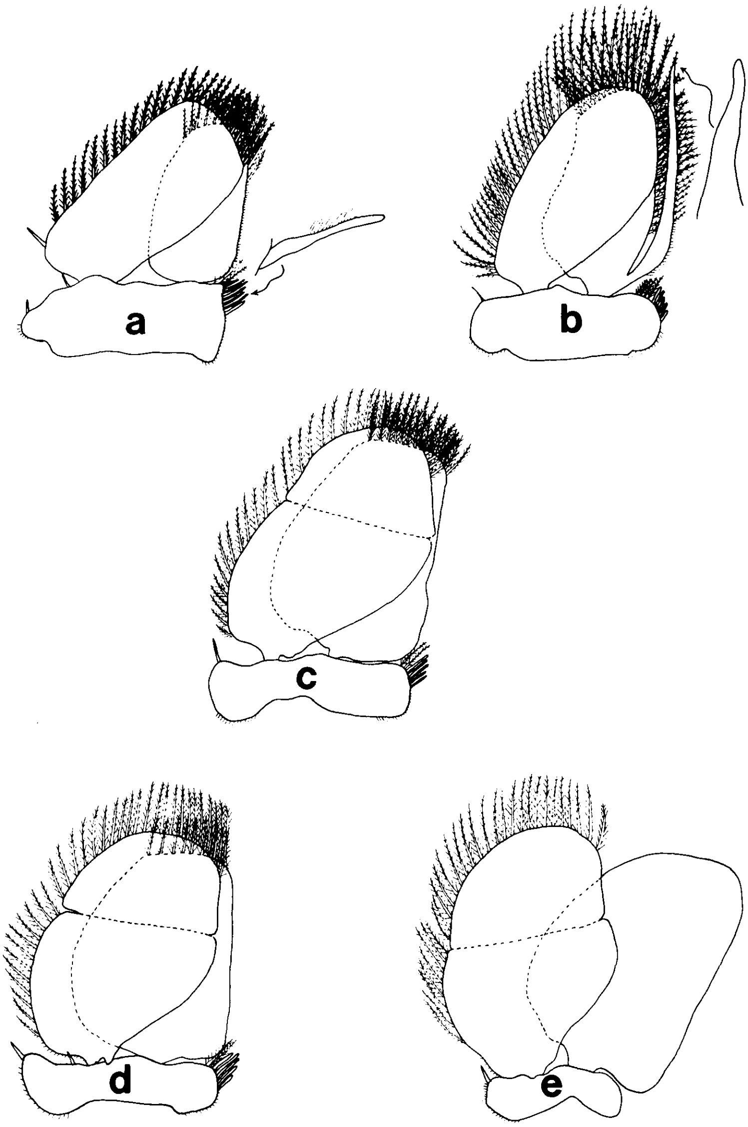

Fig. 5. *Tridentella quinicornis*, new species, holotype. Anterior view of left pleopods: a, pleopod 1; b, pleopod 2; c, pleopod 3; d, pleopod 4; e, pleopod 5.

Pereionite I with pair of small, median tubercles near anterior margin; with furrow posterior to tubercles (Fig. 2). Pereionites II–VII without dorsal tubercles, I–VII without dorsal setae. Pereion widest at pereionites III–VI. Coxal plates large, increasing in size and acuteness posteriorly; extending beyond posterior margins of their respective pereionites; coxae VII extending to pleonite 3; coxae II–VII with 2 oblique carinae, no spines or setae. Pereiopods with complex spination, and simple, bifid and plumose setae as figured (Fig. 4a, b, e–g). Well-developed, unfused penes on pereionite VII.

Pleonites 1–5 without dorsal setae; 3–5 with small tubercles on posterior mar-

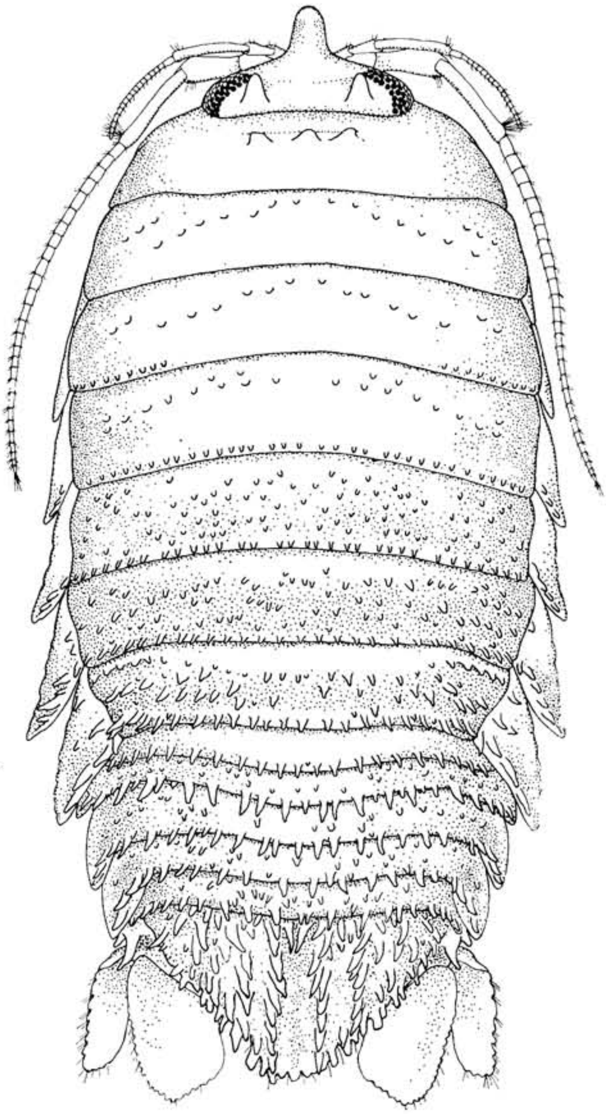

Fig. 6. *Tridentella glutacantha*, new species, dorsal view. Male holotype.

gins. Pleonite 1 partly overlapped by pereionite VII; 1 and 5 narrower than 2–4. Pleotelson posterior margin widely rounded; without lateral incisions or carinae; minutely tuberculate; apex slightly crenulate. Uropods extending well beyond posterior margin of pleotelson; exopod one-half width of endopod, with 4–8 marginal spines; endopod broadly rounded, with 4–10 marginal spines; groups of 1–4 setae on margins and apex of endopod and exopod (Fig. 8j). Pleopods with PMS as figured; endopod of pleopod 5 not setose (Fig. 5a–e).

Female.—Similar to male but lacking cephalic and pereional tubercles.

Etymology.—*Tridentella quinicornis* is named for its diagnostic 5 cephalic tubercles, and is derived from Latin *quini,* five, and *cornis,* horn.

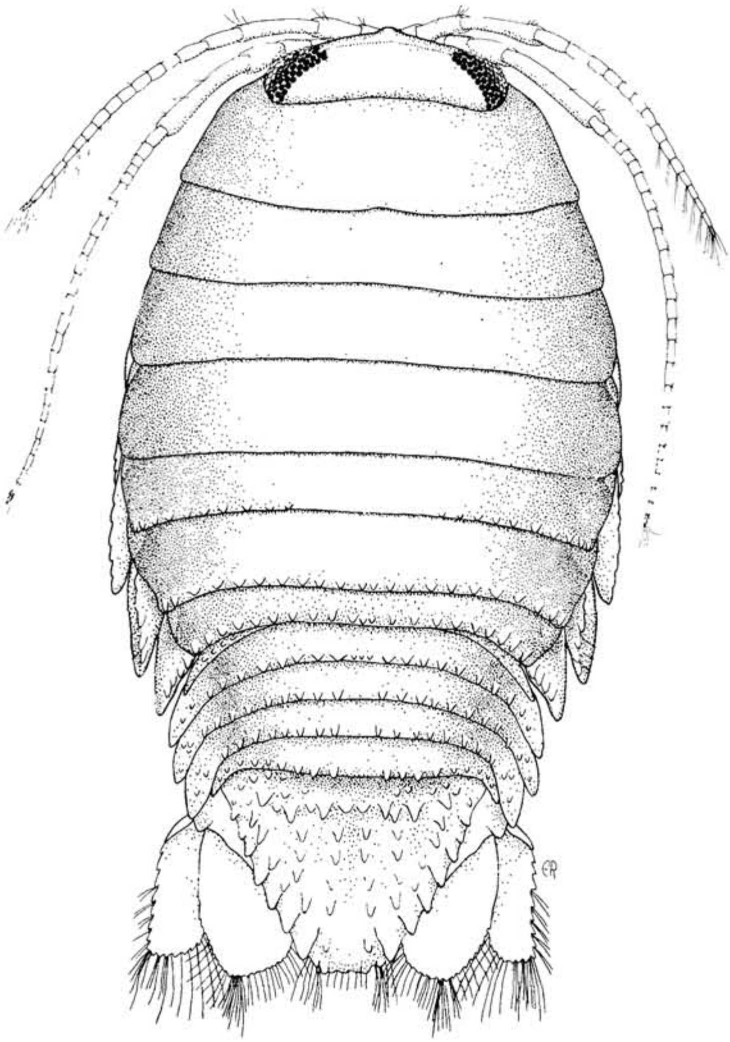

Fig. 7. *Tridentella glutacantha,* new species, dorsal view. Female, allotype.

Remarks.—Richardson (1905) described two specimens from the Santa Barbara Islands, California, while noting that she was unable to distinguish them from the Atlantic species *Tridentella virginiana.* However, the two descriptions (1905: 161–163) contain clear differences, the Atlantic species bearing four cephalic tubercles and large eyes, the Pacific species with five cephalic tubercles and somewhat smaller eyes.

Tridentella quinicornis and *T. laevicephalax* Menzies, 1962, are apparently the only species in the genus with marginal uropodal spines (Fig. 8j).

Tridentella glutacantha, new species
Figs. 6–10

Material Examined.—(1) California, west of North Farallon Islands, 37°43.8′N, 123°11.3′W. 26 August 1949. Taken with bottom dredge on green mud at 128–231 m by USS *Mulberry,* CAS and U.S. Navy,

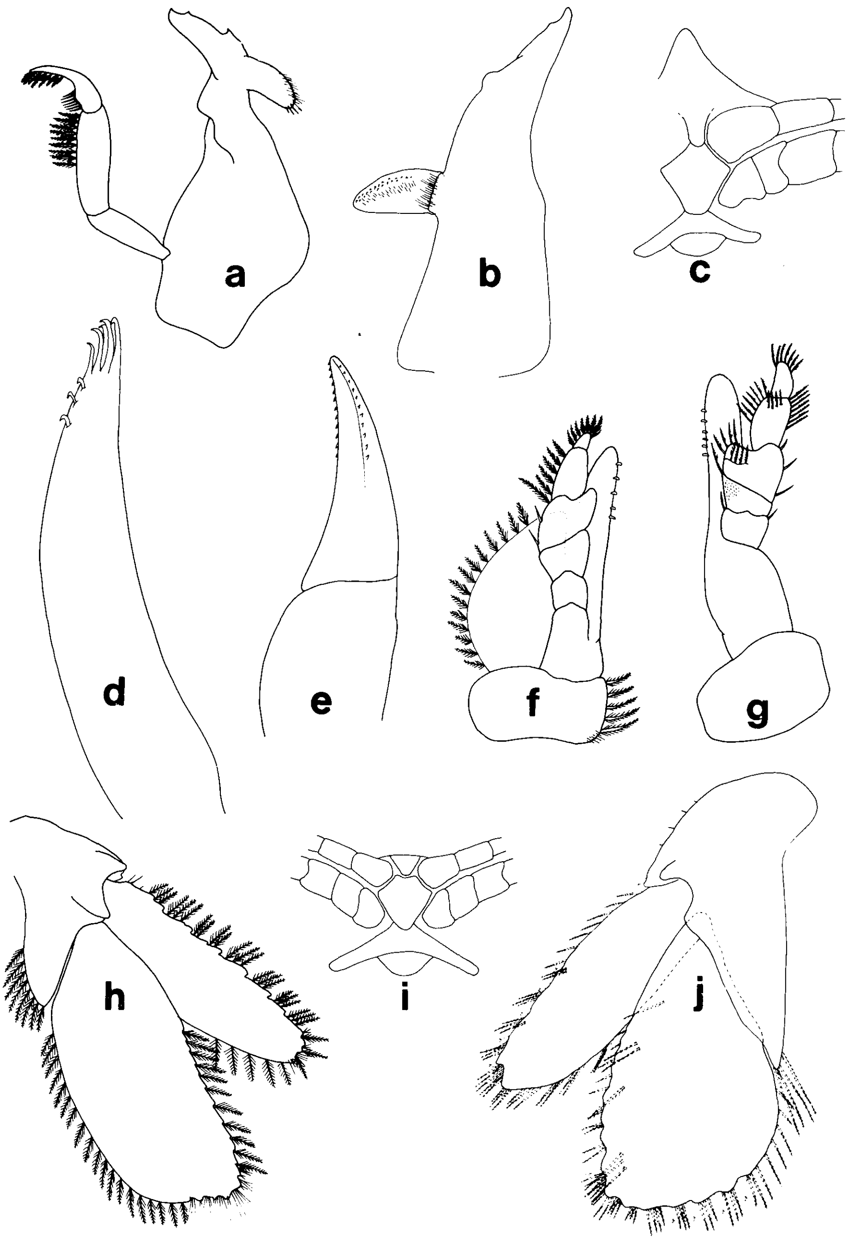

Fig. 8. *Tridentella glutacantha,* new species, holotype except as noted: a, left mandible; b, right mandible; c, frontal lamina, clypeus, and labrum; d, maxillule; e, maxilla; f, maxilliped of allotype; g, maxilliped; h, right uropod; i, frontal lamina, clypeus, and labrum of allotype; j, left uropod, *T. quinicornis,* new species.

SLF No. S-01. Station 14. CAS Catalog No. 025948. Holotype: male (CAS IZ025948), 18.0 mm. (2) California, 21.7 km SSE of Los Angeles breakwater light, bearing 155° true. Rock dredge on large boulders at 320–360 m. RV *Velero* Station No. 2416-53. AHF No. 2053-02. Allotype: female (AHF 5323), 16.7 mm. (3) California, Santa Catalina Island, 11.3 km WSW of Church Rock, 33°14′40″N, 118°12′15″W, loose rock bottom at 304–310 m. RV *Velero* Station No. 1323-41. 18 May 1941. Paratype: female (AHF 1323-41), 9.2 mm.

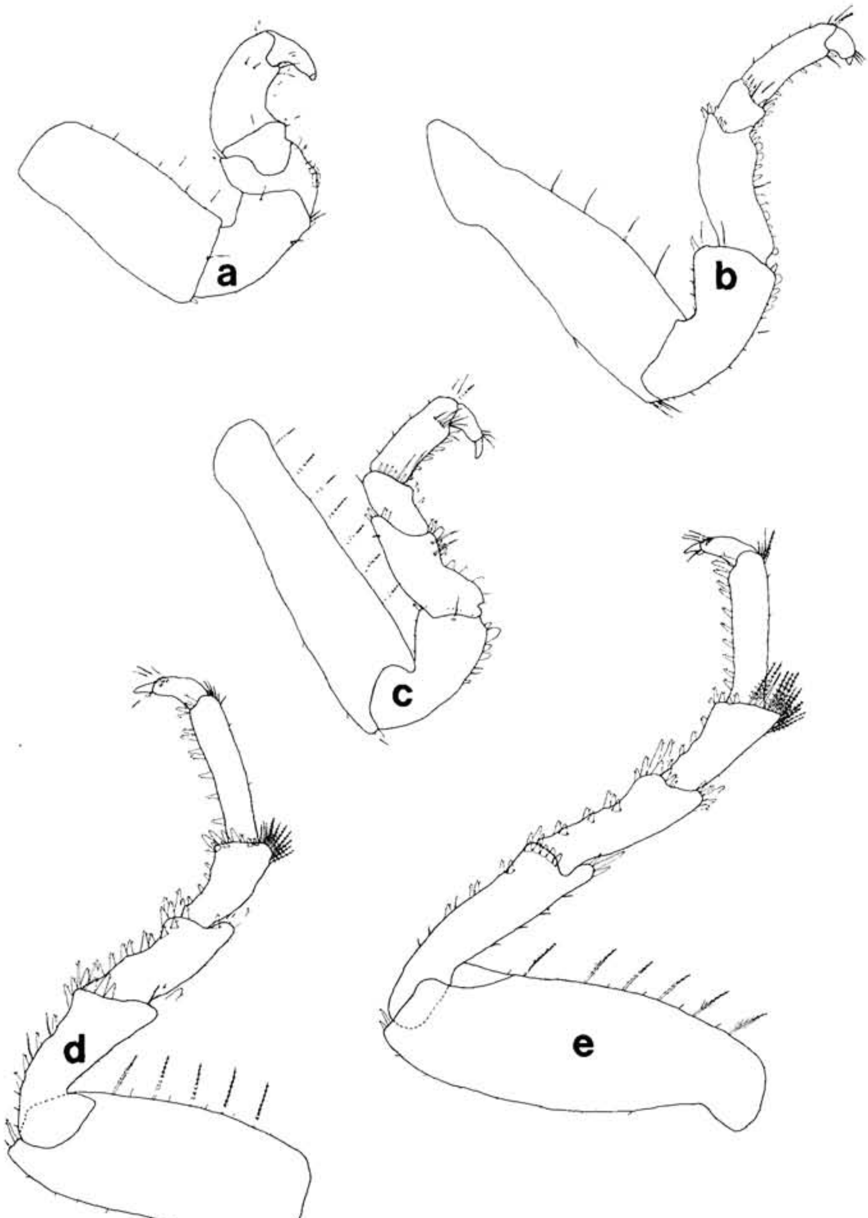

Fig. 9. *Tridentella glutacantha,* new species, holotype. a, pereiopod I; b, pereiopod II; c, pereiopod III; d, pereiopod IV; e, pereiopod VII.

Description of Male.—Dorsum highly sculptured (Fig. 6). Cephalon frontal margin produced into large upturned process and smaller ventrally projecting rostrum; with 2 large dorsal posterolateral horns. Dorsum of pereionite I with 3 large processes. All pereionites with numerous dorsal tubercles, increasing in size posteriorly, becoming spinelike on posterior pereionites and pleon, and extending onto coxae; pereionites III–VII and all pleonites with row of large tubercles along

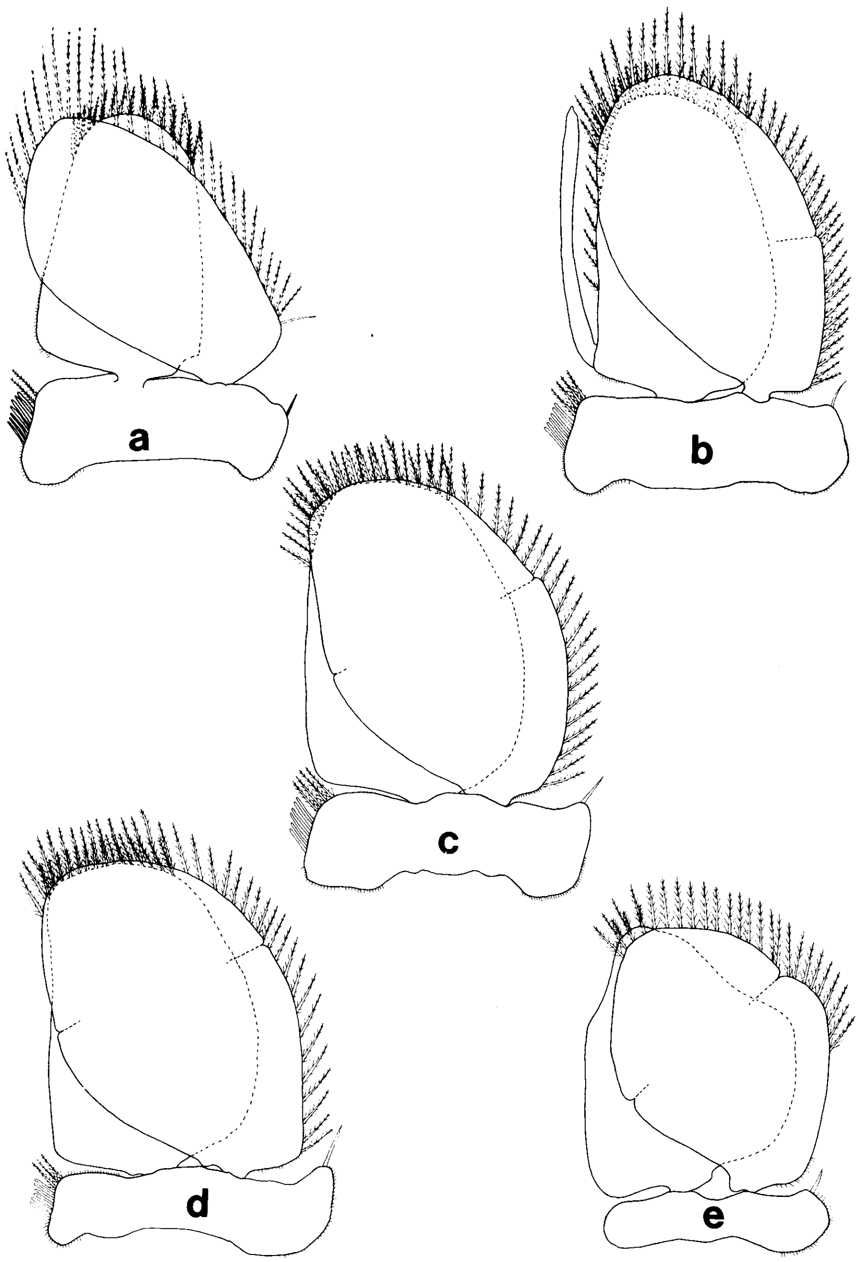

Fig. 10. *Tridentella glutacantha*, new species, holotype. Anterior view of left pleopods: a, pleopod 1; b, pleopod 2; c, pleopod 3; d, pleopod 4; e, pleopod 5.

posterior margin, these also increasing in size posteriorly; pleotelson with longitudinal rows of large spinelike tubercles.

Cephalon with rostrum projecting ventrally to meet broad, subpentagonal frontal lamina. Clypeus short and very broad, produced laterally to meet bases of mandibles; labrum small, partly encompassed by clypeus, with evenly rounded free margin (Fig. 8c). Antenna 1 flagellum of 16 or 17 articles, extending to middle of pereionite I; antenna 2 flagellum of 25–28 articles, extending to posterior margin of pereionite IV (Fig. 6). Left mandible with acute bladelike incisor, triangular molar process (Fig. 8a). Right mandible with acute incisor; with large triangular molar process; molar process arising from base of setose lobe and bearing denticles and fine hairs (Fig. 8b). Maxillule lateral lobe with 5 stout apical spines and 3 subapical hooked spines (Fig. 8d); medial lobe not seen. Maxilla distal article with faint longitudinal carina and 2 longitudinal rows of denticles, one running along carina (Fig. 8e). Maxilliped palp with plumose and simple setae as figured; endite large, extending to distal palp article and bearing 5 or 6 coupling hooks (Fig. 8g).

Pereion widest at pereionites III–VI; coxal plates large, increasing in size posteriorly, extending beyond posterior margins of their respective pereionites on all segments, those of VII extending to pleonite 3 (Fig. 6). Coxal plates with 2 oblique carinae, increasing in size posteriorly. Pereiopods with complex ornamentation, consisting of various types of setae and spines; pereiopods I–III with blunt spines on carpus, merus, ischium, and propodus, and with more acute dactyl (Fig. 9a–e). Well-developed unfused penes present on pereionite VII, extending nearly to pleonite 2.

Pleonites 2–4 subequal in width; pleonites 1 and 5 narrower than 2–4; pleotelson triangular, posterior margin subtruncate; margin of pleotelson highly sculptured (Fig. 6). Uropods extending barely beyond posterior margin of pleotelson; endopod width about 2 times exopod width; endopod longer than exopod; both rami with PMS, simple terminal setae, and highly sculptured lateral margins (Fig. 8h). Pleopods 1–5 with setae as figured; endopod of pleopod 5 with 3 setae only (Fig. 10a–e).

Etymology. —*Tridentella glutacantha,* named for its diagnostic highly spinose posterior, is formed from Greek *gloutos,* rump, and *akantha,* spine.

Remarks.—*Tridentella glutacantha* closely resembles *T. cornuta* Kussakin, 1979. In these two species the cephalon bears three large horns and pereionite I has three large hornlike tubercles. In *T. cornuta* these processes are very large, about twice those of *T. glutacantha.* Further, the pereion and pleon of *T. cornuta* lack the robust spination of *T. glutacantha,* although in the former strong longitudinal carinae are present on the pleotelson of both sexes. In addition, both of these species have six prominent coupling hooks on the endite of the maxilliped, a feature uncommon in *Tridentella.* Other, more subtle differences exist on the various appendages (e.g., the maxilla).

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