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PRELIMINARY DESCRIPTIONS OF TWO NEW SPECIES OF THE BATHYPELAGIC SQUID *BATHYTEUTHIS* (CEPHALOPODA: OEGOPSIDA)

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Two new species were discovered during the course of a study on the systematics and distribution of the world-wide deep-sea squid genus *Bathyteuthis*. Both species occur in the eastern Pacific Ocean, one from the tropical waters of the Bay of Panama and the other from the cooler waters off southern California. The species are briefly described here so that the descriptions and names will be available for use by workers currently engaged in regional surveys, e.g., that in preparation by R. E. Young, Institute of Marine Sciences, University of Miami. Detailed descriptions will be presented in the more comprehensive study (Roper, 1968).

I am grateful to the following persons for supplying specimens: E. Bertelsen (Carlsberg Foundation, Dana collections), G. L. Voss (Institute of Marine Sciences, University of Miami, Eltanin and Pillsbury collections), R. E. Young (I.M.S., Velero collections from the University of Southern California). The Eltanin material was collected under the sponsorship of the Office of Antarctic Programs, National Science Foundation. I wish to thank Constance Stolen for her accurate preparation of the illustrations. R. E. Young, J. Rosewater, and R. B. Manning kindly read the manuscript and made valuable comments.

The standard measurement of size is mantle length, abbreviated ML. Abbreviations for ships are Elt. for Eltanin, Pil. for Pillsbury, D for Dana and V for Velero.

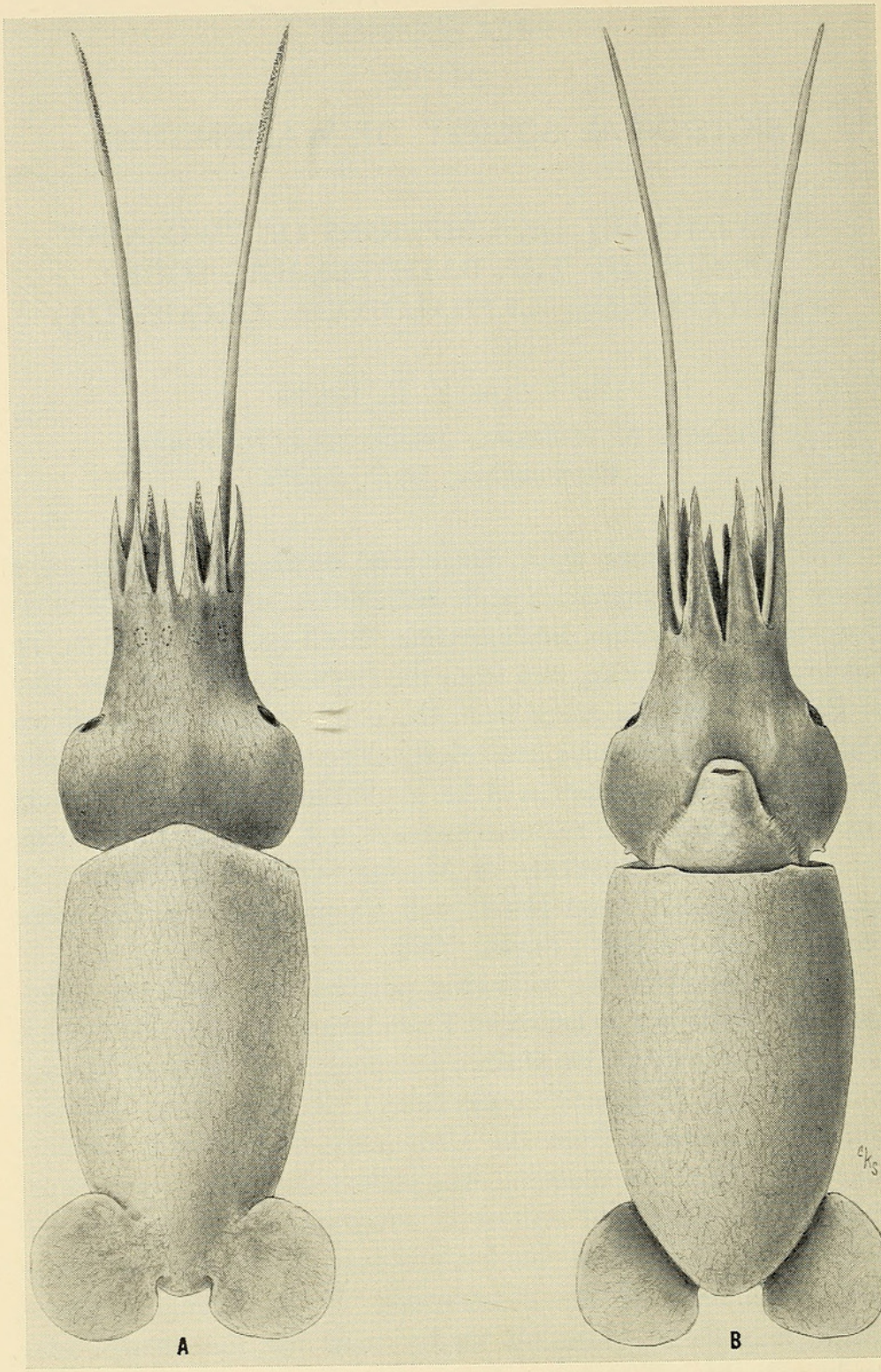

PLATE 1. *Bathyteuthis bacidifera*. Holotype, female, 37 mm ML, ELT. 34. A. Dorsal view. B. Ventral view.

Bathyteuthis bacidifera n. sp.
Plates 1–4, 7 G, H

?*Benthoteuthis megalops,* Chun, 1910, pp. 185–199, pls. 24–27 (*pars;* station 221, 18 mm specimen only).—Pfeffer, 1912, pp. 325–331 (*pars;* using Chun's description).

MATERIAL STUDIED

Sex	ML, mm	Ship Sta.	Location	Date	Depth, m	Gear
Holotype:						
♀	37	Elt. 34	07°47′S 81°23′W	7 VI 62	683	10′ IKMT
Paratypes:						
♀	37	Elt. 34	07°47′S 81°23′W	7 VI 62	683	10′ IKMT
♀	34	Elt. 54	18°23′S 72°39′W	16 VI 62	1373	10′ MW Beam
♂	28	Pil. 510	06°54′N 79°57′W	3 V 67	3182	40′ Otter
♀	26	D 1208 XIV	06°48′N 80°33′W	12 I 22	1550	S 150[1]

[1] Stramin tow-net of 150 cm diameter.

Diagnosis: Protective membranes on arms lacking; long, free, finger-like trabeculae present; tentacles and clubs relatively long; suckers on arms numerous; sucker rings with 18–34 protuberances; gills long, broad.

Description: Mantle short, broad, bullet-shaped; width about 50% of length. Fins short, small, paddle-like, circular in outline, subterminal; anterior and posterior fin lobes project well beyond bases of fins (pl. 1). Funnel broad basally, tapers anteriorly (pls. 1B, 2A), extends to a level between posterior margins of eye openings; bridles weak. Posterior end of funnel groove with small median orifice (pl. 2F). (This unusual structure is currently being investigated.) Funnel component of locking apparatus simple, long, narrow; sulcus anteriorly deeper and narrower than posteriorly (pl. 2A, B). Mantle component a simple, low ridge (pl. 2A, C). Funnel organ an inverted **Y** with narrow, rounded posterolateral limbs and broad, narrow anterior limb; a flat apical papilla present (pl. 2E). Head short, broad with large, anterolaterally-directed eyes. Eye openings circular; optic sinus lacking. Olfactory papilla small. Nuchal folds lacking.

A small, flat, ovoid photophore embedded on base of each of dorsal six arms (pl. 1A). Arms short, conical, not attenuate; ventral arms shortest, others subequal. A fleshy web connects basal third of arms (pl. 3A, B, F) except between ventral arms. Swimming keels present on all arms. Protective membranes lacking proximally, but trabeculae are modified as long, fleshy, blunt, finger-like cirri (pl. 3A, B), becoming shorter, broader, more lobate distally; protective membranes normal toward arm tips. Arm suckers small to minute, numerous, arranged biserially basally, becoming 3- to 4-rowed distally (pl. 3A, B). Inner rings of largest arm suckers 0.12–0.16 mm in diameter with 20–34 minute closely packed teeth grading from long and truncate distally to stubby and knobby proximally; smaller suckers have fewer teeth (pl. 4B, C, D, F, G). Tentacles long, thin, muscular, 125%–150% of ML;

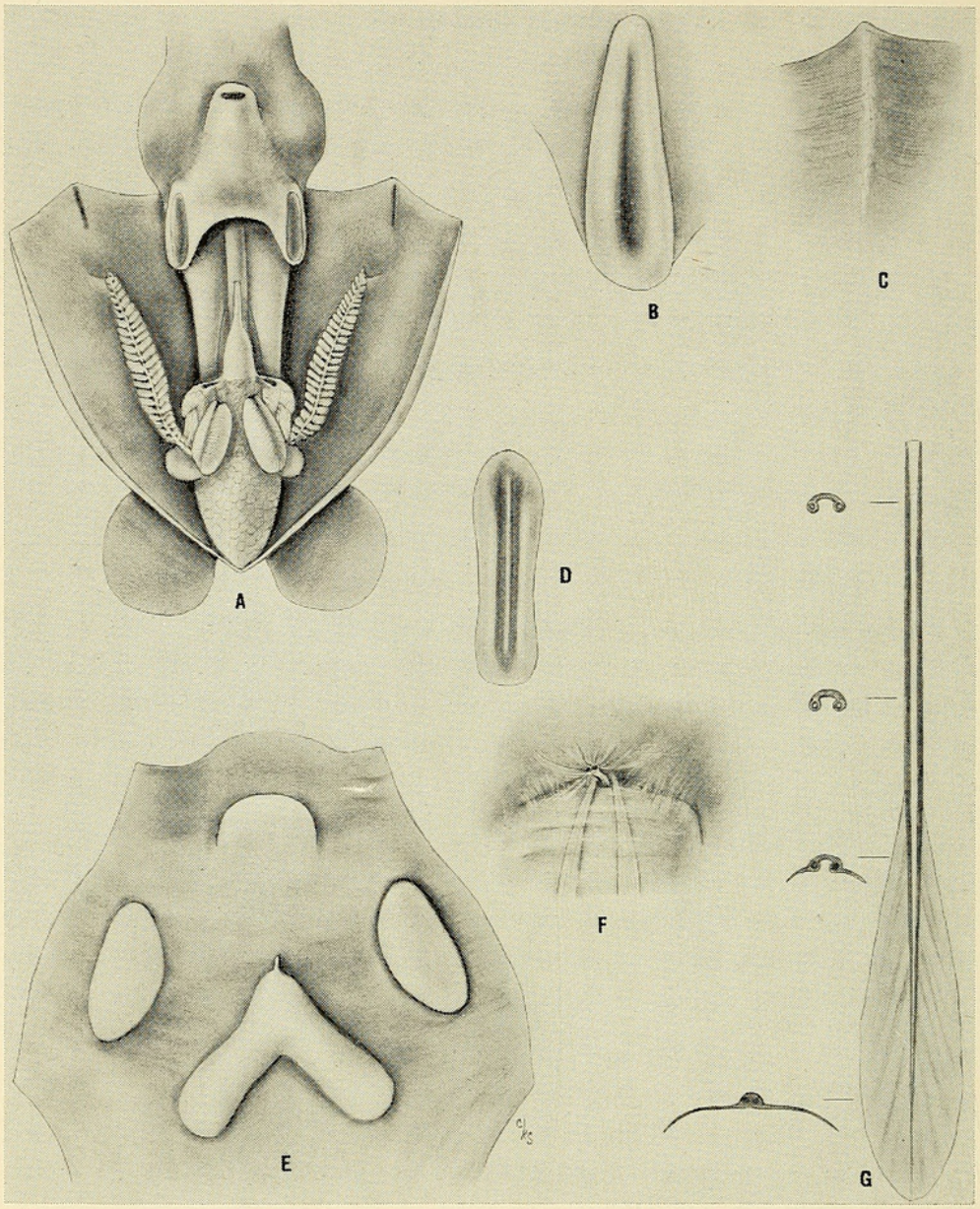

PLATE 2. *Bathyteuthis bacidifera*. Holotype, B–F, and a paratype, A, G, females, 37 mm ML, ELT. 34. A. Open mantle cavity. B, C. Funnel and mantle components of locking apparatus. D. Nuchal cartilage. E. Funnel organ and funnel valve. F. Pore of funnel groove. G. Gladius.

tentacular clubs long, narrow, undifferentiated into carpus, manus, or dactylus (pl. 4A). Club suckers numerous, minute, closely-packed, in 8–10 rows. Largest sucker rings 0.08–0.10 mm in diameter with 8–10 minute, widely-spaced truncate to knob-like teeth (pl. 4I). Protective membranes absent; weak swimming keel present.

Buccal connectives attach to dorsal, dorsal, ventral, dorsal edges of arms I–IV respectively (pl. 3F). Sucker rings from 7 buccal lappets

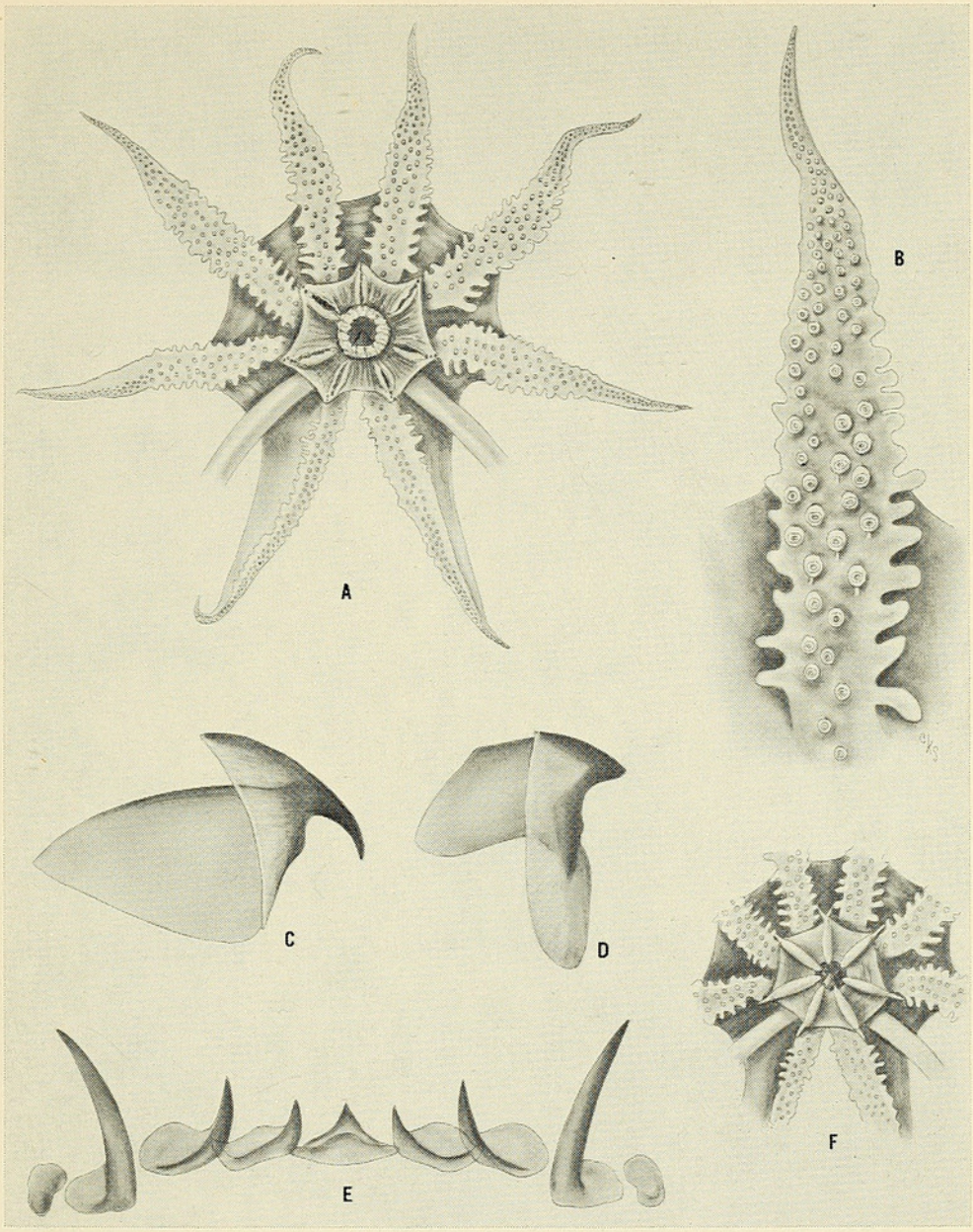

PLATE 3. *Bathyteuthis bacidifera*. Holotype, A, B, F, and a paratype, C, D, E, females, 37 mm ML, ELT. 34. A. Brachial crown with buccal membrane expanded. B. Right arm I. C. Upper mandible. D. Lower mandible. E. Radula. F. Brachial crown showing connectives of the buccal membrane.

0.08–0.10 mm in diameter with 8–12 minute, widely-spaced, truncate teeth (pl. 4H). Buccal mass and beaks relatively small, beaks with strong rostra, weak lamellae (pl. 3C, D). Radula with 7 transverse rows of pointed teeth, 2 rows of marginal plates (pl. 3E). Rhachis of gladius long, slender, with rolled, rod-like lateral edges; vane broad, thin, weak; conus absent (pl. 2G).

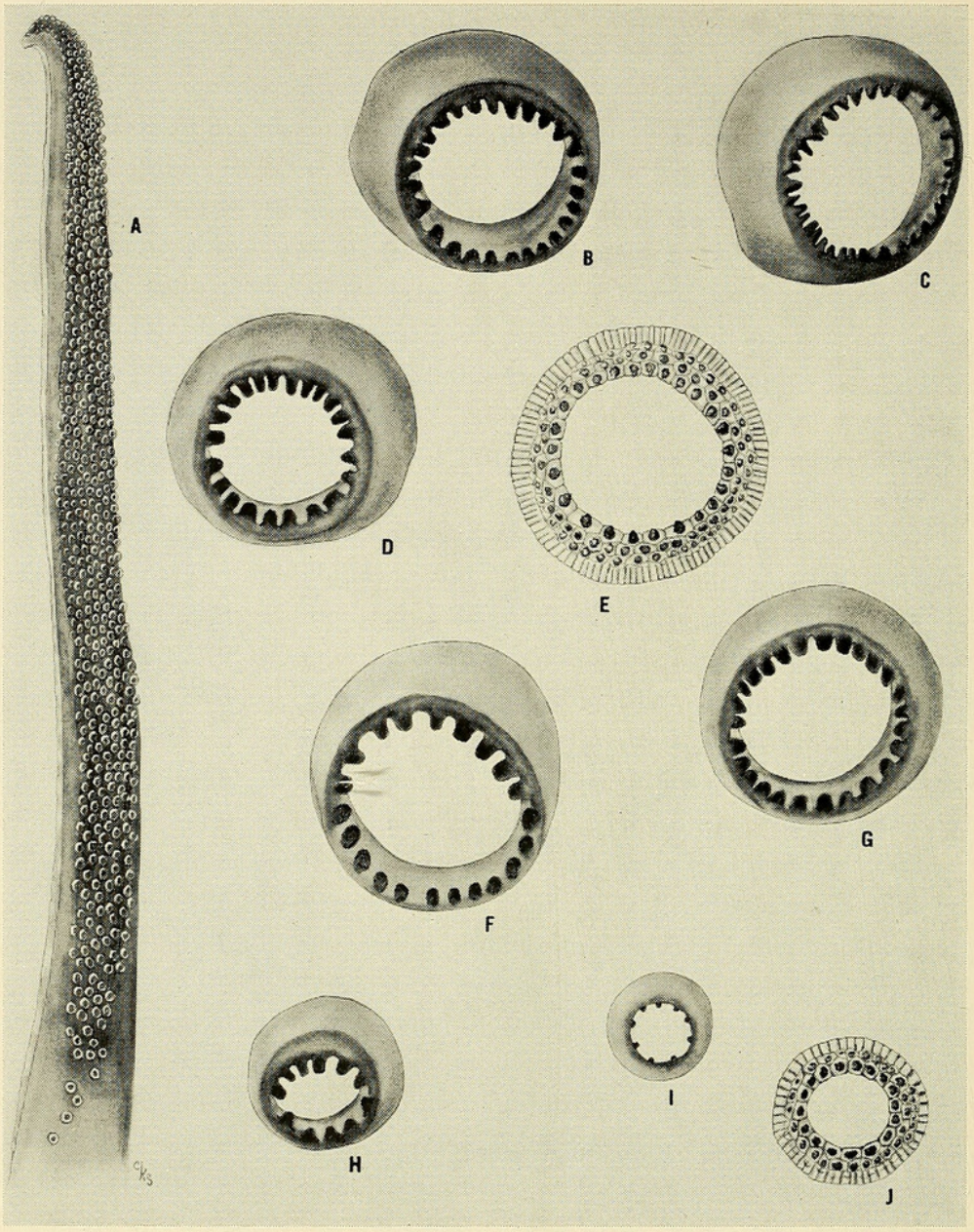

PLATE 4. *Bathyteuthis bacidifera.* Holotype, female, 37 mm ML, ELT. 34. A. Tentacular club. B, C. Inner sucker rings from Arm I. D, E. Inner and outer sucker rings from Arm II. F. Inner sucker ring from Arm III. G. Inner sucker ring from Arm IV. H. Buccal sucker ring. I, J. Inner and outer sucker rings from left tentacular club.

Color maroon.

Cement body of spermatophore cigar-shaped with flaring lip anteriorly; base of ejaculatory apparatus barrel-shaped (pl. 7G, H). Sperm mass 63%–66% of total length of spermatophore, cement body 17%–20%, ejaculatory apparatus 15%–20%. Hectocotylus absent. Gills long, broad.

Holotype: United States National Museum, No. 576148.

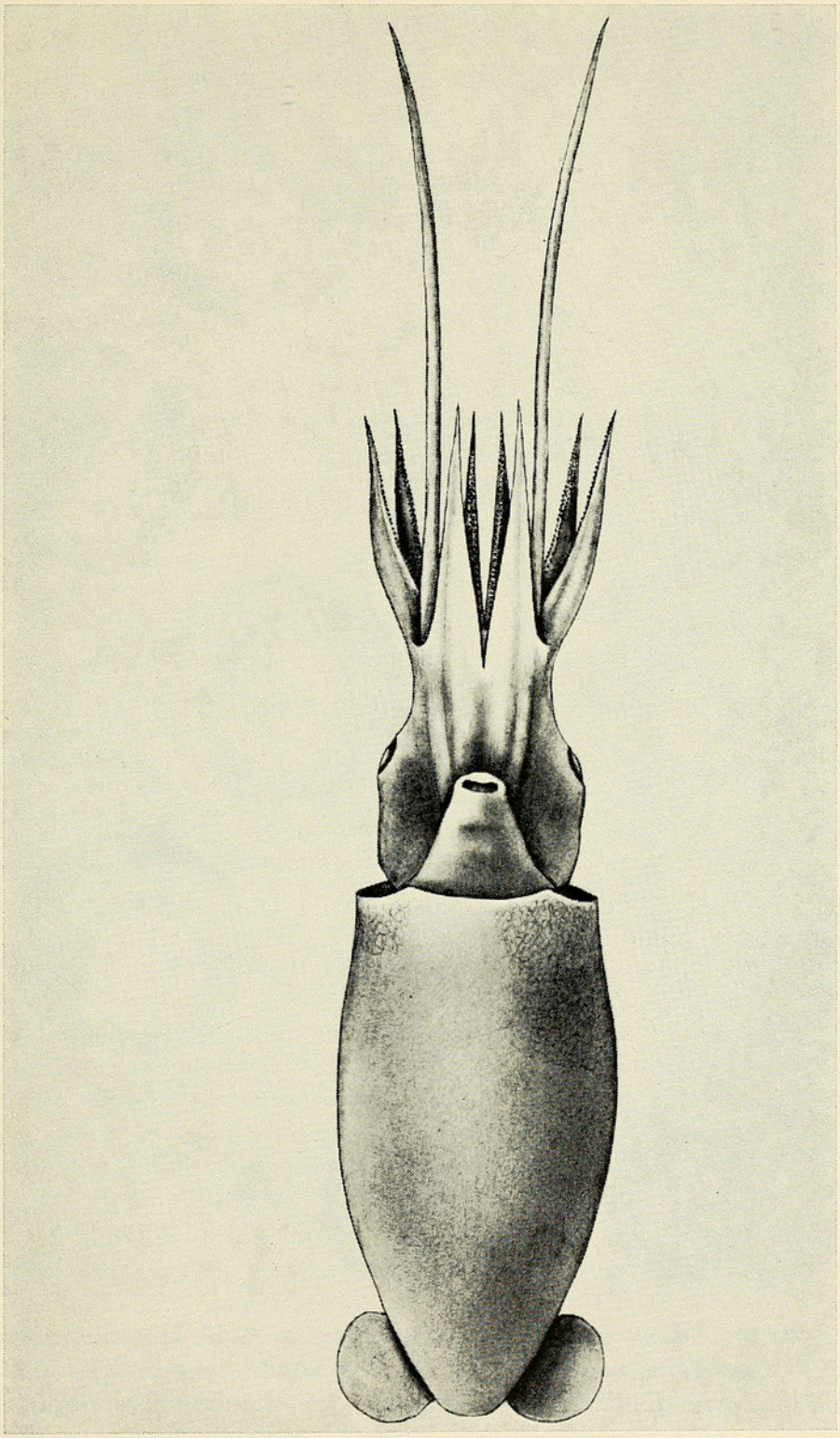

PLATE 5. *Bathyteuthis berryi.* Holotype, male, 49 mm ML, VELERO 8714. Ventral view.

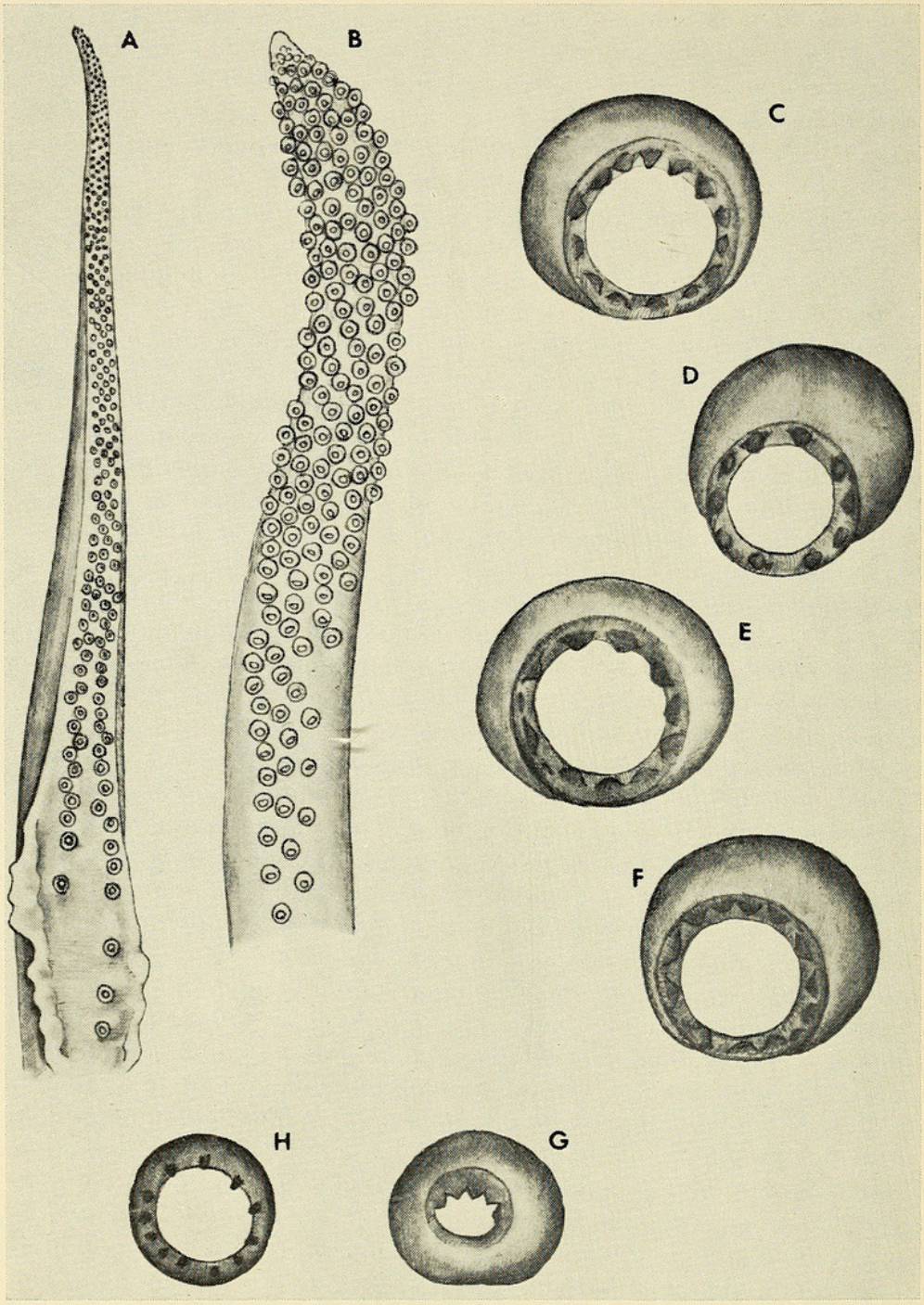

PLATE 6. *Bathyteuthis berryi.* Holotype, A, C–F, H, male, 49 mm ML, VELERO 8714, and a paratype, B, G, juvenile, 19 mm ML, VELERO 10976. A. Arm I. B. Tentacular club. C–F. Inner sucker rings from Arms I–IV. G. Inner sucker ring from tentacular club. H. Buccal sucker ring.

Type locality: Off northern Peru at 07°47′S 81°23′W. USNS ELTANIN Sta. 34, 7 June 1962.

Distribution: Bathypelagic in the productive waters of Eastern Pacific Equatorial Water Mass; possibly in the Indian Ocean Equatorial Mass (based on Chun's (1910) single specimen).

Etymology: The specific name *bacidifera* is a neo-Latin word meaning "bearing little rods"; this is derived from the old Latin *baculum*, a staff, stick or rod, the diminutive *-idium*, and *-fer*, a suffix meaning bear, carry. The name alludes to the outstanding characteristic of the species, the rod-like trabeculae.

Bathyteuthis berryi n. sp.
Plates 5–7A–F

MATERIAL STUDIED

Sex	ML, mm	Ship Sta.	Location	Date	Depth, m[1]
Holotype:					
♂	49	V. 8714	33°14′45″N 118°37′20″W	7 VI 63	1200
Paratypes:					
♂	23	V. 10540	29°05′04″N 118°12′00″W	6 IV 65	1300
♂	20	V. 10377	33°25′00″N 118°50′45″W	24 II 65	1100
♀	19	V. 10976	32°35′00″N 120°35′06″W	17 II 66	1300

[1] Estimated depths of capture. All specimens were captured by a 10′ Isaacs-Kidd midwater trawl.

Diagnosis: Protective membranes on arms present, well developed and fleshy proximally, no free trabeculae; suckers on arms extremely numerous; sucker rings with 10–14 protuberances; gills long and broad.

Description: Mantle very plump, robust, bullet-shaped; width 50% of length. Fins rounded, short, separated, with free anterior and posterior lobes (pl. 5). Funnel very large, prominent; extends to level between anterior margins of eye openings. Small pore at base of funnel groove. Funnel component of locking apparatus simple, with shallow sulcus; mantle component with low ridge. Funnel organ **Y**-shaped with short, broad limbs; apical papilla spatulate. Head long, narrow. Eyes large, directed anterolaterally; eye openings circular, lacking optic sinus. Olfactory papilla minute. Nuchal folds absent.

A single, small, simple photophore embedded at base of each of dorsal six arms, most readily seen in juvenile and larval specimens. Arms long, slender, attenuate, joined basally by a deep web except between ventral arms; adult arm formula 4=3=2=1. Swimming keels low on arms I–III, well-developed as tentacular sheath on IV. Thick, fleshy, ruffle-like protective membranes well-developed basally on arms, diminishing distally; no free trabeculae. Arm suckers small to minute, extremely numerous (275 on dorsal six arms, 150 on arms IV of holotype); sucker rows increase from 1 proximally to 3–4 along mid-portion of arms (pl. 6A). Inner sucker rings with 10–14 small, low, rounded or subtriangular, knob-like teeth (pl. 6C–F). Tentacles missing from holotype; tentacles

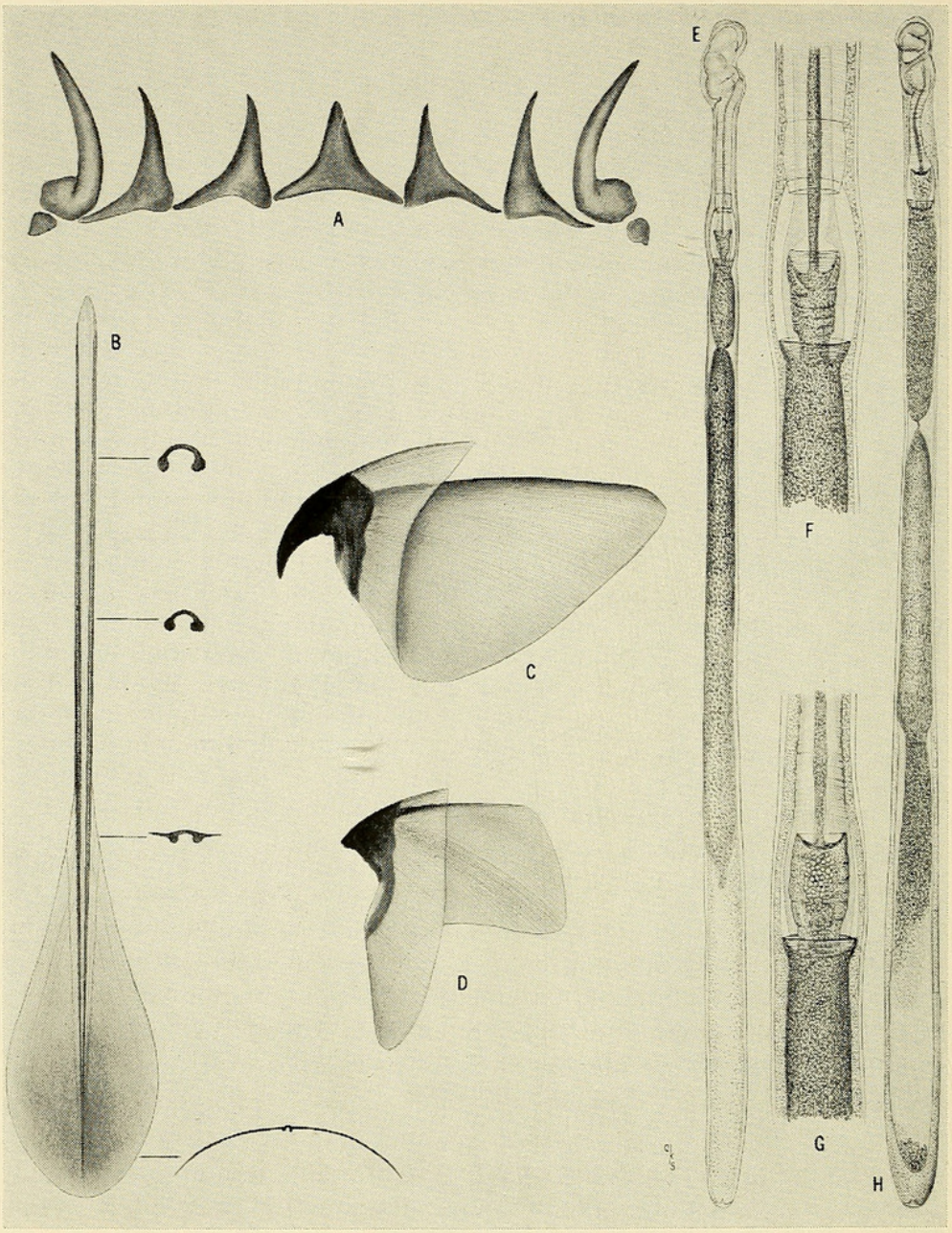

PLATE 7. *Bathyteuthis berryi*, A–F. Holotype, male, 49 mm ML, VELERO 8714. *B. bacidifera*, G–H, Paratype, male, 28 mm ML, PILLSBURY 510. A. Radula. B. Gladius. C. Upper mandible. D. Lower mandible. E. Spermatophore. F. Enlarged section of spermatophore. G. Spermatophore. H. Enlarged section of spermatophore.

available only from small specimen (19 mm ML, VELERO 10976); long, robust, with short, unexpanded, undifferentiated club with 7–8 transverse rows of numerous minute suckers (pl. 6B); inner rings smooth, scalloped, or with small, low, subtriangular teeth (pl. 6G).

TABLE 1. Distinguishing features of the three species of *Bathyteuthis*.

Character	*abyssicola*	*bacidifera*	*berryi*
Free trabeculae	absent	present	absent
Protective membranes	present	absent	present
Arm Suckers[1]	few (100)	numerous (150)	extremely numerous (275)
Sucker Ring Dentition (Arms)	8–18, truncate	18–34, truncate	10–14, subtriangular
Arms	short, blunt	short, blunt	long, attenuate
Gills	short, narrow	long, broad	long, broad
Spermatophore proportions[2]	68–72; 6–8; 20–25	63–66; 17–20; 15–20	72; 8; 20
Tentacles and clubs	short	long	missing from material

[1] The numbers in parentheses represent the approximate number of suckers on each of the six dorsal-most arms from specimens of about the same size (49 mm ML).

[2] The size of the sperm mass, cement body and ejaculatory apparatus respectively, expressed as a percentage of the total length of the spermatophores.

Buccal lappets possess 4–6 small suckers with about 10 small, low, papilla-like teeth (pl. 6H). Buccal connectives attach dorsally to arms I, II, IV, ventrally to III. Beaks small, with strong, curved rostra, weak lamellae (pl. 7C, D). Radula with 7 transverse rows of teeth, 1–2 rows of platelets (pl. 7A). Rhachis of gladius long, slender; vane very broad, thin, weak; conus absent (pl. 7B).

Color maroon.

Cement body elongate, vase-shaped with collar at junction with short, bell-shaped end of spiral filament (pl. 7E, F). Sperm mass = 72% of spermatophore length, cement body = 8%, ejaculatory apparatus = 20%. Hectocotylus absent. Gills long, broad.

Holotype: University of Southern California. U. S. C. Hancock collections, AHF cephalopod type No. 10.

Type locality: Catalina Basin, 10.9 miles SSW of West End Light, Catalina Island at 33°14′45″N 118°37′20″W. VELERO Sta. 8714, about 1200 m.

Distribution: Bathypelagic in the waters off Southern California.

Etymology: The specific name, *berryi*, is given in honor of Dr. S. Stillman Berry who has contributed a lifetime of study to malacology and teuthology.

Discussion: The addition of two new species brings to three the number of species that belong to *Bathyteuthis*. The originally described species, *B. abyssicola* Hoyle, 1885, has a broad geographic distribution in the bathypelagic zone of the major oceans of the world; distinct

geographic populations occur in the Atlantic, tropical eastern Pacific, and Antarctic Oceans. The species is particularly abundant in the nutrient-rich waters of the Antarctic Ocean. *B. bacidifera* is sympatric with *B. abyssicola* in the Panama Bay region of the tropical eastern Pacific, while *B. berryi* occurs alone in the colder water mass to the north off California. Systematic problems at the familial and generic levels, geographical variation, and environmental aspects of geographic and bathymetric distribution are discussed in Roper (1968).

The three species of *Bathyteuthis* are distinguishable by several features, the most prominent of which are listed in Table 1.

The most striking and easily recognized character of *bacidifera* is the presence of long, finger-like trabeculae on the arms that have no interconnecting protective membrane. This feature is apparent even on the smallest larva available (6 mm ML) and readily separates the species. Both *abyssicola* and *berryi* possess thick, fleshy protective membranes. Considerable variation exists in the membranes, but they are always present and connect unmodified trabeculae.

B. berryi is most readily distinguished from *abyssicola* by the extreme abundance of suckers on the arms and by long, wide gills. (The significance of gill size is discussed in Roper, 1968). The arms of the holotype of *berryi* are 5–7 mm longer than the arms of *abyssicola* of the same mantle length (49 mm), and they are more attenuate. This trend holds in all specimens available. When material with tentacles in tact becomes available, differences in the clubs may be found. Although it is difficult to demonstrate quantitatively with the limited number of specimens on hand, the mantle of *berryi* appears to be slightly more plump than that of *abyssicola.*

Literature Cited

Chun, C. 1910. Die Cephalopoden. I. Teil Oegopsida. Wiss. Ergebn. Deutschen Tiefsee-Exped. 'Valdivia,' 18(1): 1–410. Atlas of 61 plates.

Roper, C. F. E. 1968. Systematics and Zoogeography of the world-wide bathypelagic squid *Bathyteuthis* (Cephalopoda: Oegopsida). Bull. U. S. Nat. Mus. In press.