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FIRST RECORDS OF JUVENILE GIANT SQUID, *ARCHITEUTHIS* (CEPHALOPODA: OEGOPSIDA)

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The literature on cephalopods contains numerous records of individuals of the giant squid *Architeuthis* (see review in Clarke, 1966), the sole genus in the Architeuthidae. Most reports, of course, stress the large size of specimens, including the total length (a measure otherwise little used in cephalopod descriptions). Larvae and juveniles of *Architeuthis*, however, have remained unknown during the century following the original zoological recognition of the genus by Japetus Steenstrup (1857, et seq.).

Two juvenile specimens of *Architeuthis*, representing separate species, were discovered in the collections of the Institute of Marine Sciences, University of Miami during studies on pelagic Cephalopoda. One specimen, 57 mm in mantle length (ML), was taken from the stomach of a fish, *Alepisaurus ferox* (cf.), captured off Camara de Lobos, Madeira Island, Atlantic Ocean. The second specimen (45 mm ML) also was taken from the stomach of a fish, very probably *Alepisaurus* (fide W. Klawe, personal communication), captured by the R/V *Shoyo Maru* in the eastern Pacific off Chile. These specimens represent the smallest known individuals of *Architeuthis*; they are one order of magnitude smaller than the smallest previously reported specimen, an individual of *A. physeteris* of 460 mm ML (Joubin, 1900). Iwai (1956) reported *Architeuthis* specimens of 92 and 104 mm ML, but both

of these specimens are demonstrated in this paper to be misidentifications.

This report describes and compares the two juvenile *Architeuthis* specimens, establishes the first record of the genus from the eastern Pacific Ocean, and provides a brief discussion of certain aspects of their biology and phylogeny.

The authors acknowledge the following persons and institutions: Witek Klawe, Inter-American Tropical Tuna Commission, provided the *Shoyo Maru* specimen and traced down information concerning its capture; G. E. Maul supplied the specimen and information from Madeira; John Fitch, California Fish and Game Department, examined the stomach contents; Robert H. Gibbs, Jr., Smithsonian Institution, examined the stomach contents and provided information about the vertical distribution of *Alepisaurus*; G. L. Voss, Institute of Marine Sciences, Miami, provided the opportunity to study the material and information about an unreported *Architeuthis* specimen in his collections; Constance Stolen McSweeny, Molly Dwyer and Carolyn Gast rendered the illustrations; Mrs. McSweeny also discovered the second specimen in the I. M. S. collections; M. J. Sweeney prepared the distribution chart. The manuscript was read and valued comments given by F. A. Aldrich and C. C. Lu, Marine Sciences Research Laboratory of Memorial University, St. John's, Newfoundland and by G. L. Voss. We are most grateful to these people for their aid.

Descriptions

Because of the chaotic state of the systematics of *Architeuthis*, in which until recently nearly every specimen found was named a new species, we will not attempt to assign specific names to our specimens. Table 1 presents the measurements and indices of both specimens.

Atlantic Specimen: *Architeuthis* sp. A. Camara de Lobos, Madeira; 18 February 1961; Stomach of *Alepisaurus ferox*, No. 18123; G. E. Maul; 57 mm ML. Figures 1a, 1b, 1c, 2, 3, 4, 5a.

Mantle very long, slender; tapers posteriorly to pointed tip; mantle wall thick, muscular; marginal lobes distinct (Fig. 1a). Mantle and pen terminate together as a pointed tip an-

TABLE 1. Measurements (mm) and indices of juvenile *Architeuthis*.[a]

	Measurements			Indices	
	18123	Fish 17		18123	Fish 17
Sex	F	M	Sex	F	M
ML	57	45	ML	57	45
MW	12	8	MWI	21	18
FL	20	14	FLI	35	31
FW	15	11	FWI	26	24
HL	17	11	HLI	30	24
HW	11	9	HWI	19	20
Gill L	16	14	GLI	28	31
	L	L			
Arms I	47	20	ALI I	83	44
II	59	27	II	103	60
III	58	27	III	102	60
IV	58	28	IV	102	62
Tent. L	90	33	TLI	158	73
Club L.	25	14	CLI	44	31
Suck.			Suck.		
Diam. I	0.96	0.72	Ind. I	.017	.016
II	1.04	0.88	II	.018	.020
III	0.96	0.80	III	.017	.018
IV	0.64	0.56	IV	.011	.012
Club Suck.			Club Suck. Ind.		
Diam. (manus)					
medial	0.96	0.56	medial	.017	.012
marginal	0.40	0.24	marginal	.007	.0053

[a] Indices expressed as % of ML × 100. Sucker measurements based on size of largest sucker on each arm or club.

terior to posterior border of fins; only a weak rod of fibrous tissue extends to tip of fins. Fins small (35% of ML), longer than wide, narrow anteriorly, broadest in posterior half, broadly rounded terminally; fins a broad paddle-blade shape in outline. Fins thick, muscular basally; thin, fragile marginally (difference, however, not as great as in adult). Free anterior lobes absent; lobe insertions broadly separated (Fig. 5a).

Funnel short, muscular; extends anteriorly to level of posterior border of bulbus of eye. Funnel locking-cartilage simple, straight, long, narrow; cartilage narrowest, bluntly pointed anteriorly, broadly rounded posteriorly; entire margin thin, almost membranous; groove deep, narrow anteriorly, shallow,

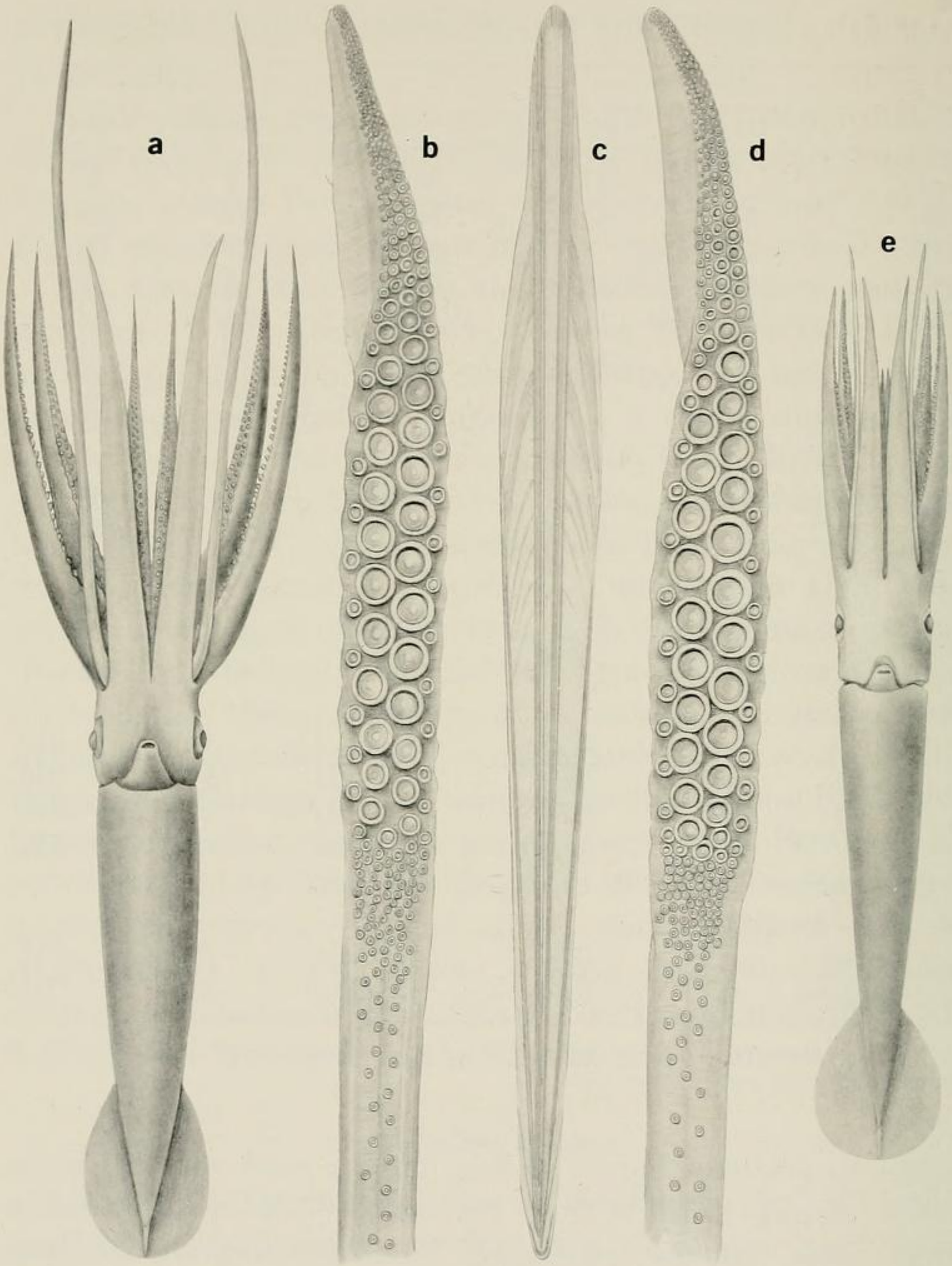

FIG. 1. a-c: Atlantic specimen, 57 mm ML (54 mm ventral ML). a. Ventral view of whole specimen. b. Left tentacular club. c. Gladius. d, e: Pacific specimen, 45 mm ML (43 mm ventral ML). d. Left tentacular club. e. Ventral view of whole specimen.

broad at posterior tip. Groove slightly undercut along medial surface. Mantle locking-cartilage long, robust anteriorly; it tapers and narrows posteriorly; ridge distinctly overhung along medial border. Dorsal part of funnel organ missing; ventral

pad damaged, broadly pointed anteriorly, long, tapered posteriorly. Funnel valve broad, crescent shaped.

Head rounded in cross section; eyes prominent, large; eye openings circular; sinus broad, indistinct. Tissue along posterior border of eye opening distinctly thickened, crescent shaped. Surface of bulbus of eye covered with silvery-gold iridescent tissue. Silvery-white fibrous tissue covers mantle, head, and aboral surfaces of arms but is completely lacking from posterior margin of head where a low nuchal crest occurs. Funnel groove short, deep; distinct lateral edges extend posteriorly and dorsally from groove to form nuchal fold. "Olfactory" papilla a thumblike flap on posteroventral section of nuchal fold. Nuchal cartilage narrow posteriorly, broad, rounded anteriorly; groove on raised median ridge narrow, deep.

Arms extremely long (arms II–IV about equal to ML), robust, muscular, attenuate (Fig. 1a); arm formula IV = III = II > I. Distal half of arms I–III strongly compressed in cross section. Protective membranes low, weak on all arms. Broadly bilobed trabeculae, each with bases in common with broad, expanded base of sucker stalk (Fig. 2). Aboral surface of arms I–IV with sharply defined band of silvery fibrous tissue. Suckers biserial, very numerous, 40 on proximal half of left III (measured from basal-most sucker); rings lacking due to damage by digestion. Suckers attain maximum size at about the third to fourth pair; suckers gradually decrease in size distally becoming minute toward arm tips; arm tips with minute sucker-precursor knobs only. Suckers on arms IV very numerous (64 on proximal half) and very small (Table 1).

Tentacles very long (nearly 1½ times ML), robust; clubs long, broad (Fig. 1b). Proximal-most sucker on tentacular stalk originates about 10 mm from base; about 6–7 mm separate the 3–4 widely spaced single suckers that occur along proximal stalk; they occur on alternating sides of the tentacular midline; knobs that are paired with the tentacular stalk suckers and carpal suckers in adults are not developed at this size; therefore, these suckers occur singly. Suckers progressively closer together distally and, proximal to the 14th single sucker

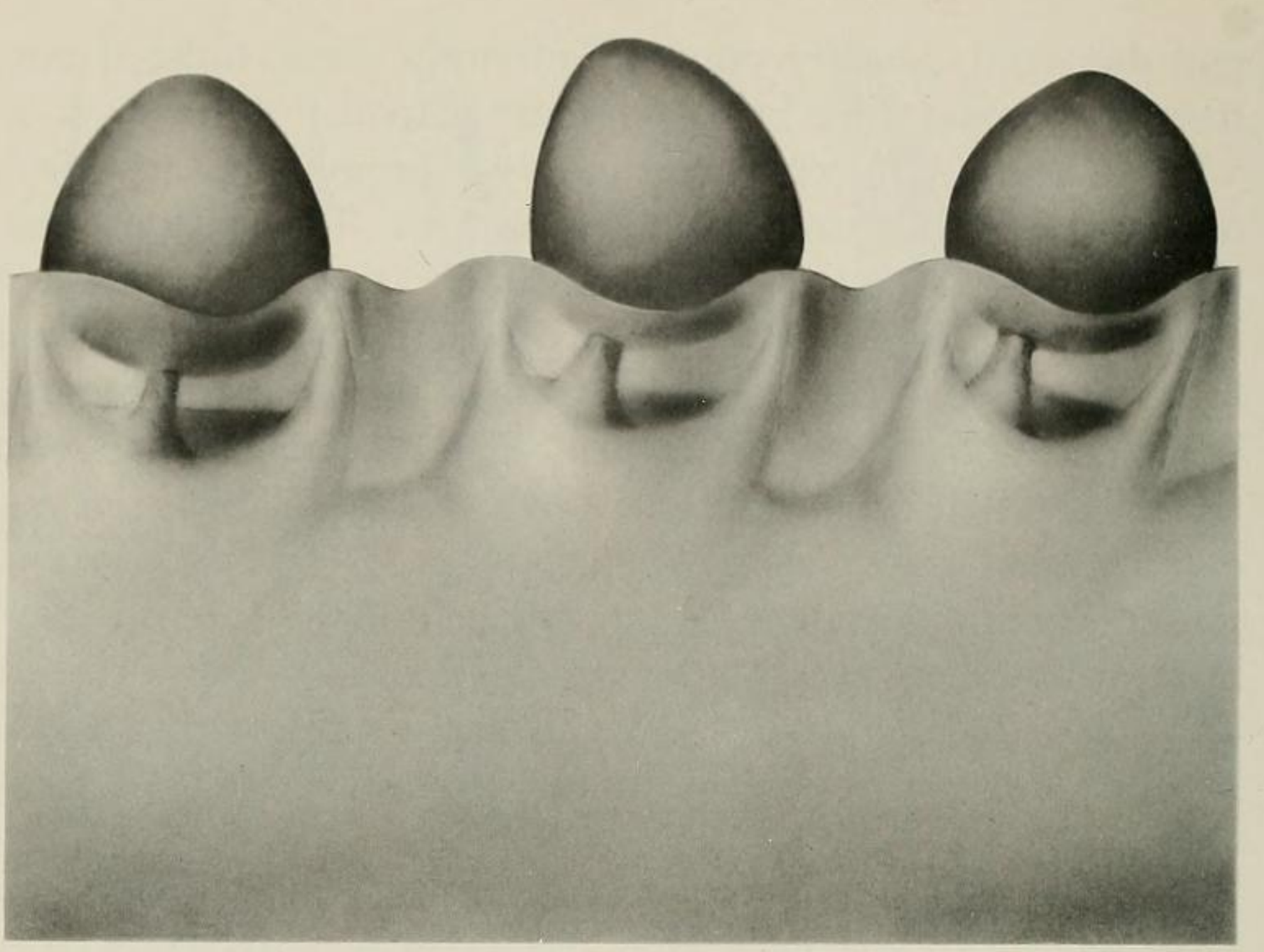

FIG. 2. Atlantic specimen; lateral view of section of right arm III.

at about ⅔ the length (right tentacle stalk), they become biserial for 4 pairs; suckers then increase in number and become clustered in carpal area where 6–7 small suckers (maximum) occur in a transverse line across the carpal area just proximal to manus (approximately 100 suckers in carpal area). Suckers on manus tetraserial; 26–28 enlarged suckers (13–14 pairs) in medial 2 rows, those in ventromedial row slightly larger. Medial suckers 2½ times larger in diameter than marginal suckers. Dactylus long, attenuate; suckers tetraserial (in about 34 transverse rows), those in ventral row proximally about 2–3 times the diameter of those in dorsal row; difference diminishes distally and all suckers are about equal sized (minute) near tip. Terminal group of suckers at tip lacking. Protective membranes weak; trabeculae bilobed; lateral sucker stalks arise from bases of trabeculae between lobes (Fig. 3). Swimming keel along entire length of manus and dactylus narrow.

Buccal membrane with 7 lappets; connectives attached to dorsal borders of arms I, II, and IV and to ventral borders of III (DDVD).

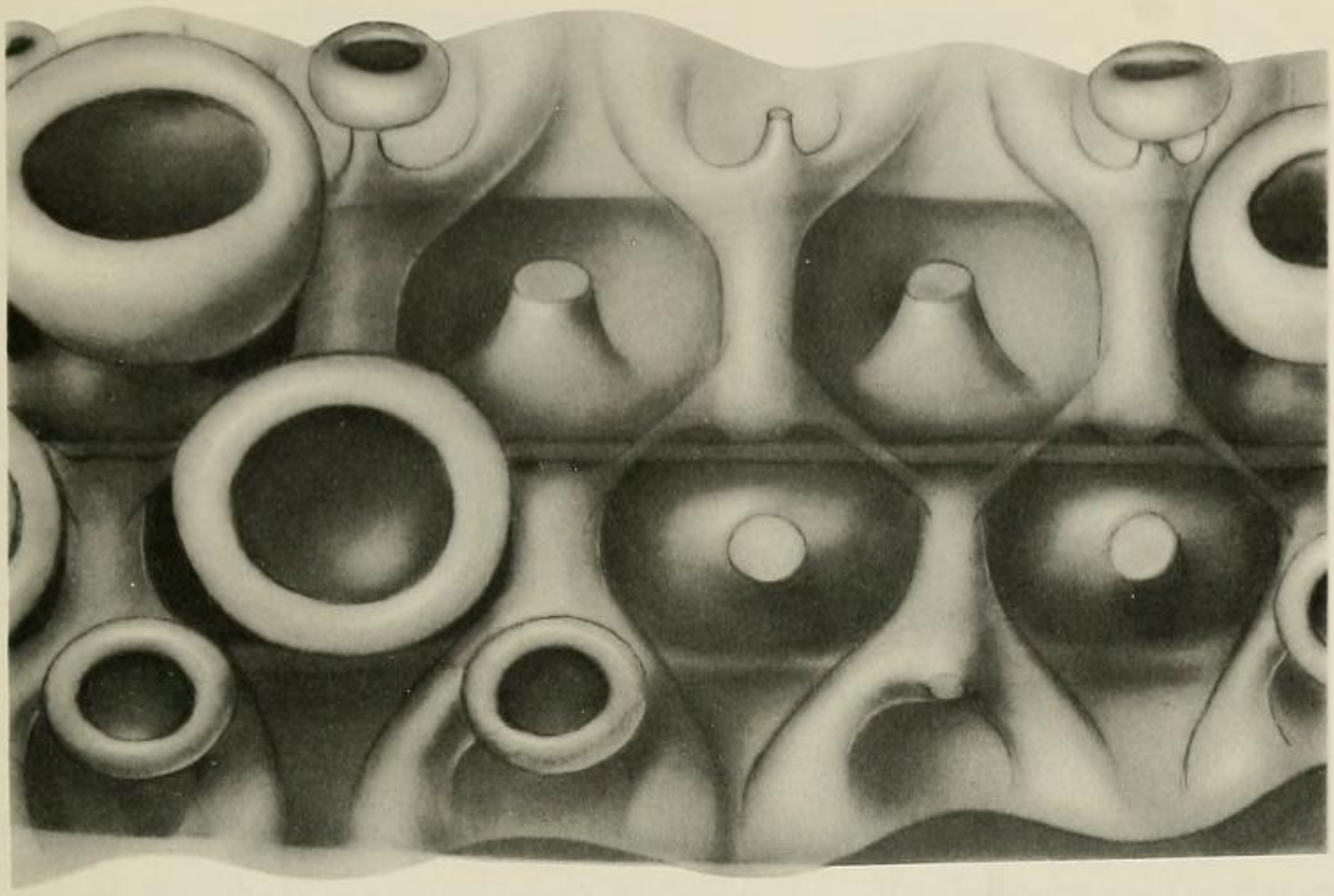

FIG. 3. Atlantic specimen; oral view of section of left tentacular club. Some suckers removed to show bilobed trabeculae and lateral sucker stalk bases (somewhat diagrammatic; sucker rings lacking).

Beaks are illustrated in Figure 4. Dorsal mandible with strong, acutely pointed rostrum, strong and well-defined jaw angle. Ventral mandible with short, blunt rostrum, broad, rounded wings and distinct jaw angle. Measurements (mm), as defined by Clarke (1962), are as follows:

Upper beak		Lower beak	
1. length of rostrum	1.2	1. length of rostrum	1.0
2. hood length	4.5	2. hood length	2.0
3. crest length	5.8	3. crest length	3.5
4. wing length	1.7	4. wing length	2.5
5. width of rostrum	0.7	5. rostral gap	2.2

Radula with 7 transverse rows of teeth. Rachidian tricuspid with moderately long, bluntly pointed medial cusp, 2 low bluntly pointed lateral cusps. First lateral bicuspid with short, straight, blunt, medial cusp and blunt lateral cusp. Second lateral moderately long, curved; no lateral cusps. Third lateral very long, curved, pointed; no lateral cusps. Marginal plates single, oval.

Gladius long, slender (Fig. 1c). Vane thin, narrow; reaches

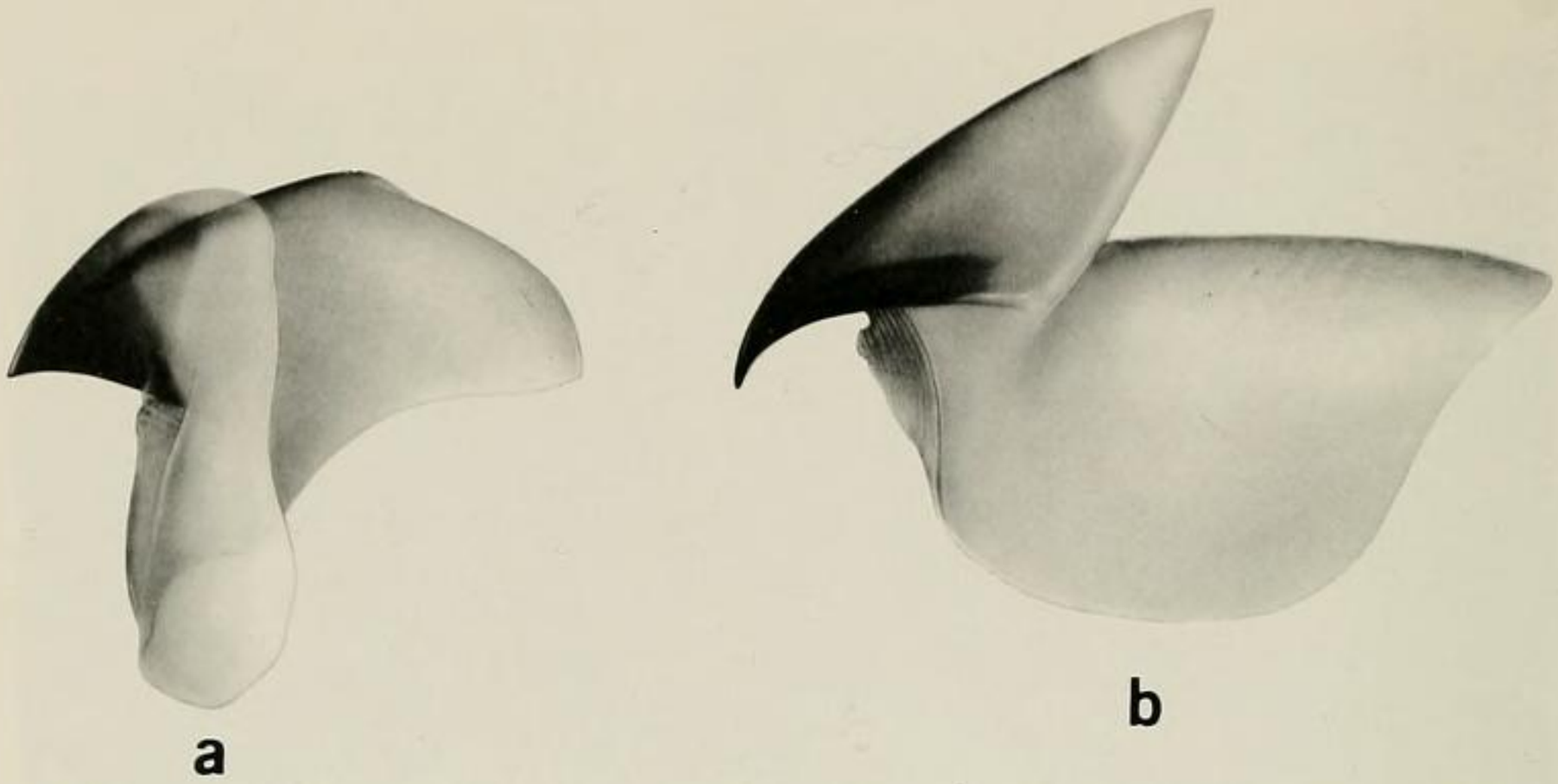

FIG. 4. Atlantic specimen. a. Ventral mandible. b. Dorsal mandible.

maximum width anteriorly shortly after its origin; vane and rhachis taper gradually to pointed terminus; no distinct conus; thickened lateral rib arises at midpoint of vane and extends posteriorly, passing medial to lateral edge. Free portion of rhachis short, narrow; remaining portion of rhachis moderately thick, sharply convex dorsally, broadly concave ventrally in cross section.

Viscera: Gills long, bases situated just anterior to midpoint of mantle; about 50 pairs of gill lamellae. Pancreas short, connects anteriorly to large liver. Ink sac large with long duct; both sac and duct covered with silvery-gold iridescent tissue. Sexual organs undeveloped.

Pacific Specimen: *Architeuthis* sp. B. 19°51′S, 95°09′W off Chile, South America; R/V *Shoyo Maru* Cruise 13, Fish Station 17, 17 December 1963; Stomach of fish (probably *Alepisaurus*); W. L. Klawe and E. D. Forsbergh; 45 mm ML. Figures 1d, 1e, 5b.

Mantle, long, slender, thick, muscular; tapers gradually from anterior margin to pointed tip; marginal lobes small, distinct (Fig. 1e). Muscular portion of mantle terminates posteriorly at tip of pen; only a slender cone of muscular tissue extends to posterior border of fins. Fins small (31% of ML), slightly longer than wide, widest posterior to midpoint, broadly rounded posteriorly, oblong (paddle-blade shape) in outline. Free anterior lobes absent; insertions broadly spaced (Fig. 5b).

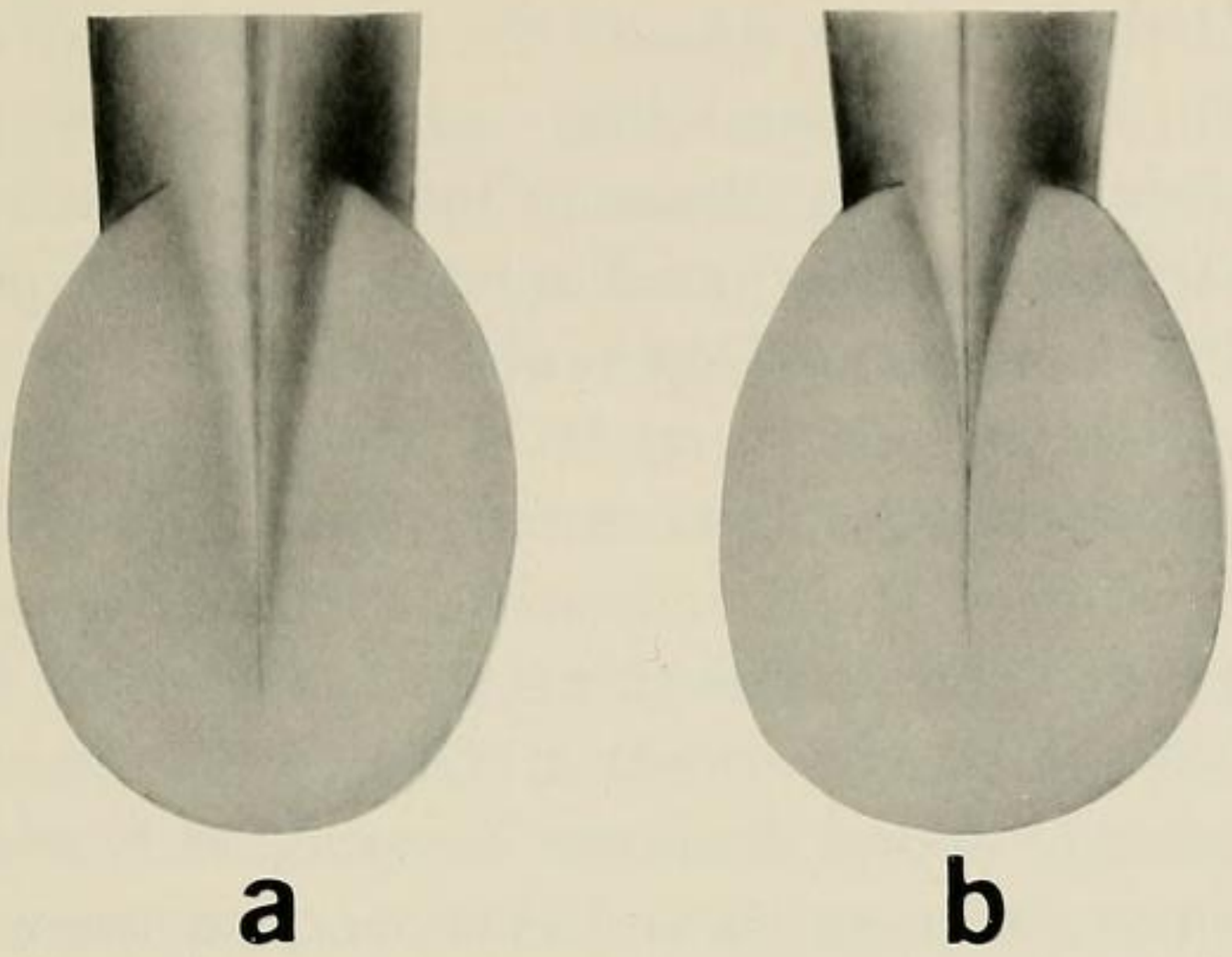

FIG. 5. Dorsal view of fins. a. Atlantic specimen. b. Pacific specimen.

Funnel short, muscular; anterior end reaches just past level of posterior edges of eyes. Funnel locking-cartilage long, straight (a slight medial curvature anteriorly), narrow; cartilage narrowest and pointed anteriorly, broadest and rounded posteriorly. Groove straight, deep; shallow and broad posteriorly; medial edge undercut. Mantle locking-cartilage straight, tapers posteriorly to termination; ridge with distinct medial overhang. Funnel organ damaged; dorsal pad an inverted V-shape, very long; limbs extend posteriorly onto funnel retractor muscles. Anterior portions of limbs constricted and raised into ridges or low flaps. Small anterior papilla present at apex. Ventral pads large, nearly oval with posterior portion slightly narrower. Funnel valve broadly U-shaped.

Head cylindrical in cross section, slightly broader than mantle width; eyes large, openings circular, sinus broad, very ill-defined. Lateral surfaces of eyes bear silvery-bronze iridescent tissue. Posteriorly the eyelid incorporates a distinct crescent-shaped tissue that is thicker than adjacent head tissue. A thick layer of white iridescent fibrous tissue covers mantle, head, and aboral surfaces of arms; tissue terminates abruptly around posterior margin of head, forming a very distinct but unelevated nuchal crest. Funnel groove deep, sharply delimited; posterior margin of groove continues as a thin

nuchal fold that extends dorsally on posterolateral surface of head until level with dorsal edges of lenses of eyes. Nuchal fold bears short, broad "olfactory" papilla on posteroventral portion. Nuchal cartilage broad anteriorly, narrow posteriorly; median ridge contains a deep central groove.

Arms moderately long (arms II–IV about 60% of ML), very muscular, robust (Fig. 1e); arm formula IV = III = II > I. Distal half of arms II–III somewhat flattened dorsoventrally in cross section. Trabeculate protective membranes low, weak on arms I–IV; trabeculae bilobed. Outer integument of arms entirely lacking; aboral surfaces covered with well-defined bands of silvery fibrous tissue. However, no trace of aboral keels on arms I–III. Thick lateral keels present on arms IV. Suckers biserial on all arms; 30 suckers on proximal half of left III. Suckers extremely small near arm tips, represented only by small knobs (sucker precursors) at the tips. Sucker rings destroyed. Suckers of ventral arms much smaller than those of other arms (Table 1) and very numerous (57 on proximal half).

Tentacles short, moderately slender; clubs elongate, slender (but expanded) (Fig. 1d). Proximal-most sucker on tentacular stalk originates 3 mm from base; second sucker 2 mm distal to first on alternate side of midline; 8 additional alternating single suckers occur along stalk progressively closer to each other until, at about the ⅔ point on the stalk, suckers become truly biserial for 8 pairs (16 suckers). Distal to the pairs, suckers increase to about 7–8 in an irregular transverse series forming a carpal cluster with at least 64 suckers. Suckers on manus and dactylus tetraserial; 13 transverse rows on manus, 32 transverse rows on dactylus (right club). Terminal grouping of suckers absent from tip of dactylus. Suckers of medial 2 rows on manus enlarged to about twice the size of suckers of marginal rows. At about midpoint of dactylus, suckers of ventral 2 rows are nearly equal in size, the ventralmost suckers slightly larger; suckers of the dorsal medial row are much smaller, and suckers of the dorsal marginal row are minute. All suckers about equal in size near tip of dactylus. Trabeculate protective membrane along carpus and manus

relatively low and weak. Bilobed trabeculae share common base with marginal sucker stalks along manus. A low keel extends from proximal end of manus to distal tip of club.

Buccal membrane contains 7 lappets; connectives attach to dorsal borders of arms I, II and IV and to ventral borders of arms III (DDVD).

Beaks, radula and gladius were not removed for examination.

Viscera: Gills very long with bases situated well posteriorly in mantle cavity (posterior to the midpoint of mantle); about 55 pairs of gill lamellae. Pancreas long, slender, extends forward to a relatively small liver. Ink sac small, with long duct; ink sac and duct covered with a gold or silvery iridescent tissue. Sexual organs undeveloped.

Discussion

Comparisons: Table 1 lists the measurements and indices of the two juvenile specimens of *Architeuthis*. The data indicate that differences in some body proportions exist. These differences are great enough that they cannot be accounted for by ontogenetic differences between the specimens which differ only slightly in size. The most striking difference occurs in the lengths of the arms. The Atlantic specimen has arm lengths that are nearly as long as the mantle (arm I) or are equivalent in length to the mantle (arms II–IV). The Pacific specimen has proportionately much shorter arms, the longest of which (arms II–IV) are only 60% of the length of the mantle.

Although tentacle measurements are notoriously variable in cephalopods, the differences here are so great that they must be significant: the Atlantic specimen has long tentacles half again as long as the mantle, while the Pacific specimen has short tentacles that measure only three-quarters the length of the mantle. Clubs also exhibit differences in length, although not so striking; those of the Atlantic specimen are longer.

Although the arm suckers on both species appear to be of comparable size, the large and small manal suckers on the

clubs of the Atlantic specimen are proportionately larger than those on the Pacific specimen.

Sucker arrangement on the tentacular stalk differs markedly between the two species. In the Atlantic specimen the proximal-most sucker originates more distally than that of the Pacific specimen; the unpaired stalk suckers are fewer (3–4 suckers) and more widely spaced (6–7 mm) in the Atlantic form than in the Pacific form (10 suckers; 2 mm and less). Suckers in the carpal region of the Atlantic specimen are more numerous than in the Pacific specimen (approximately 100 vs. 65, respectively).

Suckers may be more numerous on arms III of the Atlantic specimen (40 on proximal half of III vs. 30 in Pacific specimen). Both specimens, however, were still in the process of adding suckers to their arms as the arm tips were studded with numerous knoblike precursors of suckers.

Some differences in viscera are noted. The Atlantic specimen, in comparison to the Pacific specimen, has: slightly shorter gills with slightly fewer lamellae, a shorter pancreas, a a larger liver, and a larger ink sac.

Robson (1933) has shown that dentition of arm and club suckers in *Architeuthis* frequently is of specific value, but the sucker rings of both of the present specimens have been destroyed by the digestive juices of their captors, or by the original fixatives (formalin). Dell (1970, p. 32) reported that a specimen from New Zealand lacked sucker rings entirely and suggested that the species may not possess horny rings on the arm suckers. In our experience, we feel this is untenable and suggest that the sucker rings of Dell's specimen were dissolved after immersion in formalin. C. C. Lu (personal communication) reports similar degradation of sucker rings in *Architeuthis* from Newfoundland after preservation in formalin.

The differences described here demonstrate that the Atlantic and Pacific specimens belong to separate species. Twenty nominal species have been described in *Architeuthis* (Clarke, 1966); certainly many of these are synonyms. Because the state of systematics of *Architeuthis* is currently in utter confusion, it is impossible to determine how many of these are

valid species (see Dell, 1970 for brief discussion). In addition, it is impossible to relate the juvenile specimens described here to any of the named species because of their small size and imperfect condition. It is interesting to note, however, that the juveniles are in general form strikingly similar to adults, although differences do exist, for instance in the relative proportions of the arms and tentacles and in the configuration of the tail. At least some of the arms and the tentacles of the juvenile specimens appear to be proportionately shorter than in adults; this is particularly so in the Pacific specimen. In adults the mantle extends posterior to the fins as a short, stout tail and the borders of the fins curve posteriorly along the tail. In juveniles no tail exists; the muscular portion of the mantle terminates anterior to the posterior borders of the fins; the bases of the fins are joined posteriorly along the midline and are supported by a turgid conical extension from the mantle which probably develops into the tail of the adult.

The distinctive structure of *Architeuthis* beaks is recognizable even in the small specimens (Fig. 4). Therefore, it should be possible to identify specimens of the genus *Architeuthis* of nearly any developmental stage from beaks that are commonly found in the stomachs of many marine predatory fish and mammals.

Distribution: Clarke (1966) has presented a chart of localities from which specimens of *Architeuthis* have been recorded. The chart is reproduced here as Figure 6 with the addition of the localities of our juvenile specimens and recent records of *Architeuthis* from Newfoundland (Aldrich, 1968) and New Zealand (Dell, 1970). The juvenile from the Pacific off Chile, South America, represents the first known record of the genus from the eastern Pacific Ocean. Previous Pacific records of the genus originate only from the far western Pacific waters of Japan and New Zealand (see Dell, 1970, for recent record in New Zealand and for summary of New Zealand strandings). The Atlantic specimen was taken from off Madeira Island, an area from which *Architeuthis* has been recorded on a number of occasions.

Depth Distribution: Both specimens of *Architeuthis* were

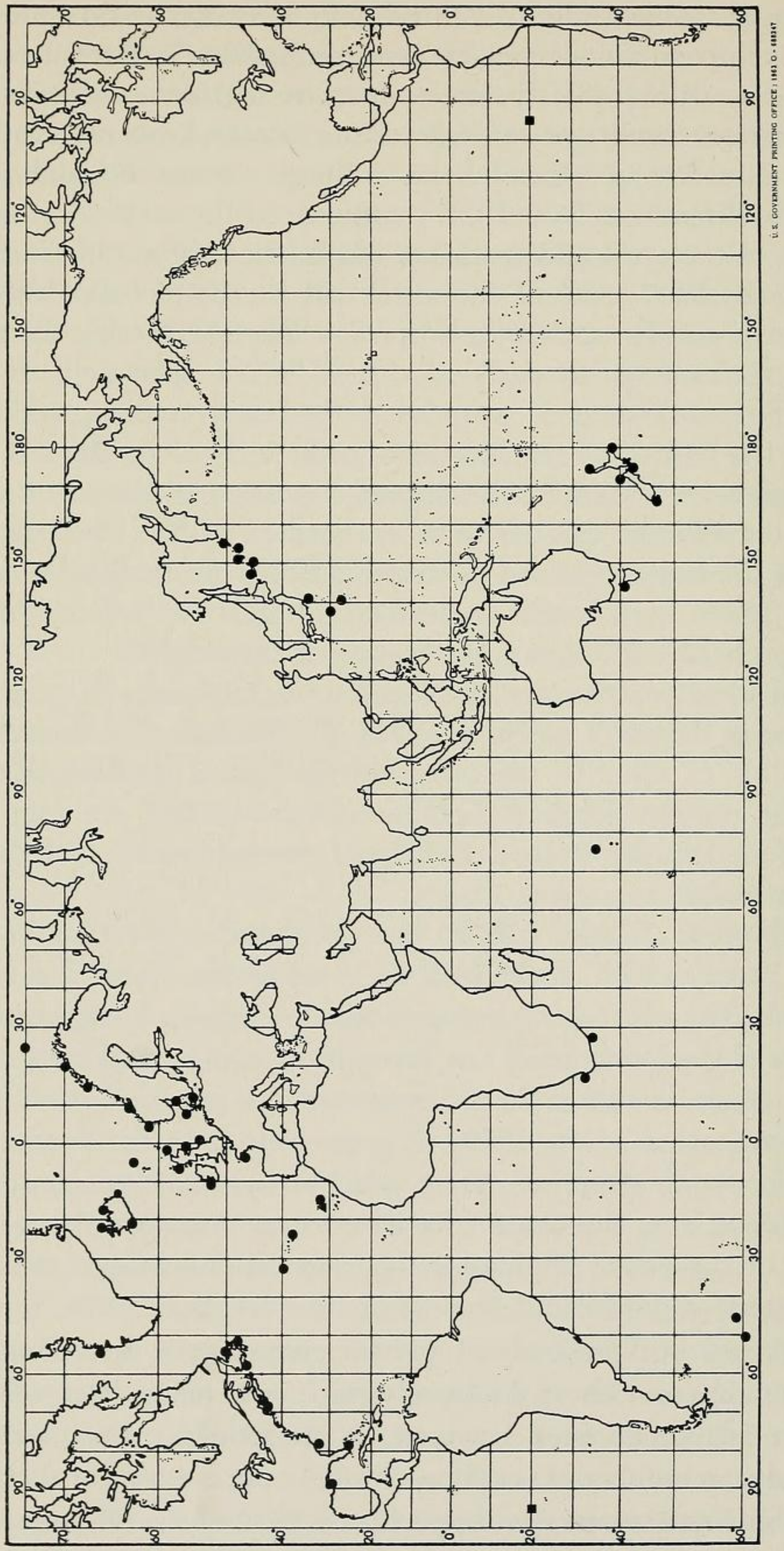

Fig. 6. Locality records of *Architeuthis* (redrawn after Clarke, 1966, fig. 2). Localities reported here indicated by the solid triangle (Atlantic) and the solid square (Pacific). Additional records from Newfoundland (Aldrich, 1968) and New Zealand (Dell, 1970) indicated by **x**'s.

taken as stomach contents from the fish, *Alepisaurus*, species of which feed on a wide variety of oceanic fishes and invertebrates (Haedrich, 1964; Haedrich and Nielsen, 1966). It was hoped that a knowledge of the feeding habits and depth distribution of *Alepisaurus* would shed light on the possible depth layer inhabited by juvenile *Architeuthis*.

Although the *Alepisaurus* specimen in the Pacific was captured on a long-line somewhere between 80 and 150 m, Haedrich and Nielsen (1966) pointed out that *Alepisaurus* must feed over a broad range of depths on members of a particular "high-seas community," since both epipelagic and deep-living species of fishes are found in their stomachs, while some other common middepth species are excluded.

The Atlantic specimen was taken from the stomach of an *Alepisaurus ferox* which was caught on a tuna long-line set to 50 to 150 m over deep water off Camara de Lobos, Madeira (G. E. Maul, personal communication). Rees and Maul (1956, pp. 278–279) recorded 18 species of cephalopods as stomach contents of *A. ferox*, caught at depths down to 200 m off Madeira. None of these species is a restricted deep-sea form, and all occur in the upper 200–300 m either as permanent residents, nocturnal visitors, or during early stages of development. Rancurel (1970, p. 82), in a report on cephalopods taken from stomachs of *A. ferox* in the southwestern Pacific, concluded that the hunting area of the predator is rarely deeper than 300 m.

Although neither of these studies is conclusive, they do suggest that our specimens of *Architeuthis* probably were devoured in the upper few hundred meters. Whether these species are vertical migrators or residents at these depths is uncertain. Their muscular appearance and the presence of reflecting layers on the head, body and arms strongly suggest that they occur no deeper than the lower mesopelagic zone during the day.

Spawning: Although nothing is known of the spawning areas of any member of the family Architeuthidae, the small size of the present specimens suggests that they were spawned in the nearby region of their localities of capture in tropical or warm temperate waters.

Stomach Contents: The Atlantic specimen contained a large quantity of food in a greatly distended stomach, which occupied the entire posterior mantle cavity. The stomach contents consisted almost entirely of amorphic material and a few small bony fragments from the skeletal remains of small fishes; all fragments were otherwise unidentifiable (J. E. Fitch, R. H. Gibbs, Jr., personal communication).

The stomach of the Pacific specimen was empty.

Size: The two specimens described here, a female of 57 mm ML from the Atlantic and a male of 45 mm ML from the Pacific, represent the smallest known specimens of *Architeuthis*. Heretofore, the smallest specimen was the holotype of *A. physeteris* (Joubin, 1900) of which only the mantle, with a length of 460 mm, was known. A second relatively small specimen of *A. physeteris* was a mature male with a mantle length of 612 mm (Voss, 1956). A small mature male of 664 mm ML was taken floating at the surface off the east coast of Florida (Voss, personal communication). Knudsen (1957) described a mature male of *Architeuthis* sp. with a mantle length of 1,010 mm.

Iwai (1956) identified as *Architeuthis* two specimens with mantle lengths of 92 and 104 mm taken from the "digestive canal" of a sperm whale captured off the Borrin Islands south of Japan. Our examination of the descriptive notes and particularly of the illustrations, however, leaves no doubt that the identification is incorrect. The features of the mantle, fins, tentacles, clubs and arms are entirely nonarchiteuthid in nature. Some nonarchiteuthid characters of Iwai's specimens are: the mantle is too broad for its length; the fins are too long, too broad and too angular; the clubs have "five" rows of suckers, no carpal cluster, and no paired suckers occur on tentacular stalk; the arms are too short; the rhachis of the gladius is too long, and the vane is too broad. Although positive identification is difficult to establish, the specimens appear to be members of the Psychroteuthidae, a little-known family of oceanic squid, previously known only from Antarctic waters.

Familial Relationships: Young and Roper (1968) aligned the Architeuthidae with a number of other families that shared

straight funnel locking-cartilages and buccal connectives that attach to the dorsal borders of arms IV. These families are: Lycoteuthidae, Enoploteuthidae, Histioteuthidae, Psychroteuthidae, Neoteuthidae (= Alluroteuthidae) and Bathyteuthidae.

A striking similarity exists in the structure of the tentacular clubs between *Architeuthis* and *Alluroteuthis* (family Neoteuthidae); both have enlarged medial suckers on the manus and numerous small suckers on the carpus. An important difference, however, exists: in *Alluroteuthis* only the suckers along the dorsal margin of the carpus are paired with knobs and participate in tentacular locking, while in *Architeuthis* all of the carpal suckers are paired with knobs. A second similarity exists between these two families: members of both lack free anterior fin lobes. This is an unusual feature and would have considerable significance were it not for the fact that the posterior fin lobes are free in the Neoteuthidae (also an unusual feature), but they are united in the Architeuthidae (Fig. 5). Although these similarities exist between the two families, a strong case cannot be made for their close relationship. However, the similarities between the Architeuthidae and Neoteuthidae, though weak, are stronger than those between the Architeuthidae and any other family listed above. Therefore, we feel that the closest relatives of the giant squid belong to the family Neoteuthidae, members of which are small, generally deep-living species.

Note: Since this paper went to press, recent additional records of *Architeuthis* in the eastern Pacific have come to our attention: Iverson, I. L. K. (1971; California Fish and Game, Fish Bulletin 152) listed one specimen (beaks?) from the stomach of an albacore (*Thunnus alalunga*); C. H. Fiscus & D. Rice (personal communication, in ms.) discovered beaks of *Architeuthis* in stomachs of sperm whales taken off California.

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