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NEW AND RARE CEPHALOPODS FROM THE ANTARCTIC WATERS

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Abstract: Three species of Antarctic cephalopods, *Grimpoteuthis antarctica* n. sp., male specimens of *Megaleledone senoi* TAKI and *Gonatus antarcticus* LÖNNBERG are described with some considerations to their systematic status.

1. Introduction

Cephalopods living in the Antarctic waters attract scientific interest not only from a viewpoint of faunistic composition and zoogeography but also from a standpoint of fisheries potential and trophic relations of the marine ecosystem. In the ages of exploration of Antarctica by the powers, taxonomic studies of the Antarctic cephalopods were contributed by JOUBIN (1905, 1906), HOYLE (1907), MASSY (1916), BERRY (1917), ODHNER (1923), THIELE (1921), ROBSON (1930) among others. The more comprehensive and systematic works on the Antarctic cephalopods were made public after World War II based on collections by scientific cruises, such as TAKI (1961), ROPER and YOUNG (1968), MCSWEENY (1970), FILIPPOVA (1972), ROPER (1981), and so forth. Even so, the Antarctic cephalopods have never been fully known; especially, systematics and distribution of meso- to bathypelagic and benthic species have been insufficiently worked out up to this date.

The present paper describes three species of the Antarctic cephalopods, which include a new species of *Grimpoteuthis*, and male specimens of *Megaleledone senoi* TAKI and *Gonatus antarcticus* LÖNNBERG. Since they represent only a part of the Antarctic cephalopod collection from various sources, further studies of them are badly needed to clarify the cephalopod fauna in the Antarctic region.

2. A New Species of the Genus *Grimpoteuthis*
(Family Stauroteuthidae)

Among the octopod specimens presented by Dr. T. IWAMI, Nihon Kasei Gakuin College, an interesting cirromorph was found. We are inclined to think this large specimen represents the species new to science.

Grimpoteuthis antarctica n. sp.
(Fig. 1A–F; Plate 1, Figs. A–D)

Material examined: Holotype specimen (NSMT Mo-63958) collected at Lat. 62° 59′S, Long. 62°09′W, 803–804 m (January 30, 1982) and paratype specimen (NSMT Mo-63959) collected at Lat. 61°23′S, Long. 55°11′W, 509–525 m (January 23, 1982) by T.

IWAMI. See measurements for size (Table 1). Deposited in National Science Museum, Tokyo.

Diagnosis: A cirromorph characterized by transversely semiovoidal fins, short cirri and U-shaped fin support with widened rami.

Description: Mantle is short and dome-shaped, flabby to gelatinous, with numerous irregular warts and wrinkles due to preservation (Plate 1, Fig. A). Color dark purplish dorsally, but paler posteriorly and ventrally.

Fins are also flabby, ovo-quadrangular in outline, and indistinctly demarcated off the mantle (Fig. 1A). The anterior embayment near the base seems to be deeper than the posterior one. Coloration of the fins is the same as the dorsal surface but paler basally and darker distally.

Head is still darker in color than the rest of body. Eyes of moderate size are situated laterally. The mantle opening is moderately wide extending over almost the entire transverse distance of the ventral mantle. Funnel is small and short, tapering distally. Funnel organ is not well preserved, but seems to be almost thick, indistinct W-shaped.

Arms are subequal in length. Webs are as broad as half the arm length at medial part, but broadly margining both sides of the arms. Ventrally margining web seems to be somewhat broader than dorsal frill. The arms are sub-trapezoid to sub-triangular in cross section.

Suckers are arranged in a single row. They occasionally look like as if sunken below the integumental folds as the integument is so loose that it creates fairly pronounced warts (Fig. 1D). The number of suckers is 70 to 80 in each arm (because of the skewed posture by fixation, counts not always precise). The suckers of the proximal half are large enough to be counted by the naked eye, but distal 20–30 are very tiny and countable only by means of a magnifying glass (Fig. 1C). Cirri are not always very apparent but spaced, arranged along both sides of sucker row, and their length is a little shorter or equal to the diameter of adjacent suckers (Fig. 1C–D; Plate 1, Fig. C). The oral surface is also purplish in color but central portions of webs and suckers are much paler than proximal and marginal areas of the web (Plate 1, Figs. B–C).

The fin-supporting cartilage is broadly U-shaped. Both rami, particularly at postero-lateral portion, are widened. The posteriormost connective of both rami seems to be weaker than the remaining area (Fig. 1B).

The buccal mass is large, but there is no radula except the odontophore of which dorsal surface seems to be lined with a thin chitinous substance.

The upper beak has a long rostrum without any groove on either rostral and hood areas. The lateral surface, down to the wing is heavily pigmented leaving only a narrow strip of less darkened area behind. There is a deep notch behind the rostrum. The lateral wall is quadrangular and heavily darkened except a narrow marginal paler belt (Fig. 1F).

The lower beak is also well chitinized. The rostrum is blunt and rather short, LRL (lower rostral length) in the Paratype specimen measuring only 4.0mm. The jaw angle is nearly the right angle with no fold but presents a narrow cutting edge. There are many "radiating" lines on the hood to wing area, which become less darken posteriorly. There are roughly three grades of darkening in this area. No notch present posteriorly

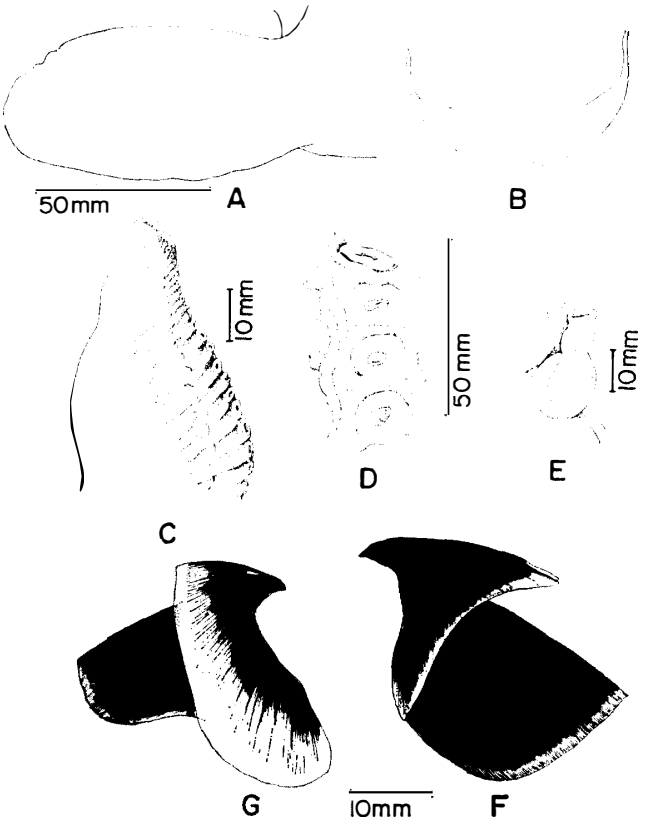

Fig. 1. Grimpoteuthis antarctica *n. sp. A. Left fin (holotype); B. Outline of the fin supporting cartilage (paratype); C. Distal portion of left Arm II (paratype); D. 30th–33rd suckers of right Arm I (paratype); E. An ovum reached near the oviductial opening (paratype); F. Upper beak (paratype); Lower beak (paratype).*

in the hood. The lateral wall is moderately apart from the hood and subquadrangular in profile but has a very round top (Fig. 1G).

Discussion: The establishment of a new species within the genus *Grimpoteuthis* ROBSON, 1932 was made with some hesitation, because of the still subtle status of the cirromorph taxonomy (ROBSON, 1932). However, some of characters of the present species never accord with those of known members of the genus. Except for fragments and very immature specimens, only two species of the genus have been known from the Antarctic waters. The rest of the members are mostly from the North Atlantic and several tropical localities. They are, *Grimpoteuthis mawsoni* (BERRY, 1917) from off the Mertz Glacier Tongue, Adelie Land, and *G. glacialis* (ROBSON, 1930) from the Schollaert Channel, Palmer Archipelago. The former species differs from the present new species in having quite unequal lengths of arms and quadrangular fins. The latter species has a certain similarity of external appearance to the present new species, but differs in having an angulated U-shaped cartilage and very weak and not fully chitinized beaks. In describing *G. glacialis* (as *Chirroteuthis*) ROBSON (1930) referred to a North Atlantic species, *G. megaptera* (VERRILL, 1885), and *G. umbellata* (FISCHER, 1883). But, it is hardly realistic that the cirromorph fauna in the North Atlantic is common to those in the

Table 1. Measurement of Grimpoteuthis antarctica *n. sp. in mm.*

Characters		Holotype (NSMT Mo-63958)	Paratype (NSMT Mo-63959)
Sex		—	Female
Eye-Posterior end of mantle		91	180
Eye-Edge of web		120	150
Interocular width		45	100
Body maximum width		95	135
Fin length		80	70
Fin width		40	33
Arm I	right	200	300
	left	200	310
II	right	220	280
	left	220	310
III	right	220	350
	left	225	320
IV	right	215	260
	left	220	300
Web A		110	140
B	right	95	160
	left	105	160
C	right	100	160
	left	110	150
D	right	105	155
	left	110	160
E		55	110
Sucker count I	right	72	76
II	right	73	73
III	right	69	78
IV	right	73	55+

Antarctic area, judging from the characteristic Antarctic cephalopod fauna of other kinds hitherto known.

The paratype specimen is a mature female. Although the visceral organs were so heavily mutilated that the general orientation of them was not clear, several dozens of ripe ova which might have been drived from ovary were found scattered within the cavity. A single ovum measures 12×16 mm with an ellipsoid shape. There seems to be certain mature stages within them. The probably most advanced egg has longitudinal stripes (Plate 1, Fig. D), but some including the one situated near the oviductial opening have no such stripes. The immature ones were opaque and mostly smashed when they were observed.

It is not striking that the present new species lacks radula. Both of two species previously described from the Antarctic, *G. mawsoni* and *G. glacialis*, reportedly have no redula.

The grade of chinization in beaks of the present new species seems to be far advanced in comparison with ROBSON's species. The general characters of the lower beak agree well with what CLARKE (1985) described. The specific character on the beak will be hardly designated.

3. A Male Specimen of *Megaleledone senoi* TAKI (Family Octopodidae)

A large eledonin, *Megaleledone senoi* was described by TAKI (1961) as a new genus and species based on a single female collected at Lat. 67°51.5′S, Long. 33°13.5′E by the T. V. UMITAKA MARU in 1957. Since then male specimen or status of hectocotylization have never been made public. The octopod specimens collected by Japan Marine Fishery Resource Research Center in 1985 from off the Palmer Peninsula contained two large *M. senoi* both of which have hectocotylized arms. Discovery of male *M. senoi* will be worth reporting.

Megaleledone senoi TAKI
(Fig. 2A–B; Plate 2, Figs. A–D)

Megaleledone senoi TAKI, 1961, p. 297–308, text-fig. 1–8, pl. 1–2.

Material examined: NSMT Mo-63960, NSMT Mo-63961, Lat. 61°10′S, Long. 55°55′W, off the Palmer Peninsula, bottom trawl at about 120m depth, "BANSHU-MARU", Japan Marine Fishery Resource Research Center (January 16, 1985). See measurements for size (Table 2). Deposited in National Science Museum, Tokyo.

Diagnosis: An eledonin characterized by great size, exceeding 40cm in total length, relatively short and stout arms with deep web, absence of crop and marginal teeth in radula, and possession of large eggs.

Description: External and internal morphology agree well with TAKI's (1961) description except for the hectocotylized arm and male genital organs. Minor differences are found in arm formula, sucker counts and web formula. Refer to TAKI (1961) for general characters.

Right Arm III is hectocotylized, shorter than the left Arm III. Hectocotylized portion is about 3–4% of the arm. Ligula length is about 40–50% of the hectocotylized portion with rounded distal end. Very shallow grooves run transversely in the ligula, separating 3–4 low mounds in larger specimen but almost smooth in smaller specimen. Ligula index is about 1.6–1.7%. Calamus is short, distinct, inverted V-shaped thick ridge with rounded tip, about 40–55% of the hectocotylized portion (Fig. 2A–B).

Penis opening is situated at the anterior left side of mantle septum (Plate 2, Fig. C-d), continuing to a thick penis diverticle (Plate 2, Fig. C-f). Needham's sac is not developed with no spermatophore (Plate 2, Fig. D-c). Spermatophoric gland coils together with its accessory gland (Plate 2, Fig. D-b and -e). Testis is not developed (Plate 2, Fig. D-d).

Discussion: TAKI (1961) proposed a new subfamily Megaleledoninae and new genus *Megaleledone* based on *M. senoi* collected with a beam-trawl at about 630–680 m deep. He pointed out that Megaleledoninae differs from Eledoninae by the short arms with deep web, absence of crop and lacking marginal teeth in radula, and from Bathypolypodinae by wide mantle aperture, presence of ink-sac and large gills with a large number of filaments. The present study revealed that *M. senoi* has a small hectocotylus with short and distinct calamus. This type of hectocotylization agrees well with that of genus *Pareledone* in Eledoninae. However, propriety of a sub-familial rank of Megaleledoninae will not be discussed here due to our insufficient knowledge on elenonins. Standing on ROBSON's (1929, 1932) point of view, characters such as deep web, absence of crop and

ink-sac, degeneration of radular teeth and gill filament indicate adaptation to a deep benthic habitat. Megaleledoninae might be situated between littoral Eledoninae and bathyal Bathypolypodinae. The present specimens were collected at a relatively shallow bottom, about 120m in depth, probably indicating a considerable vertical range of distribution of this species.

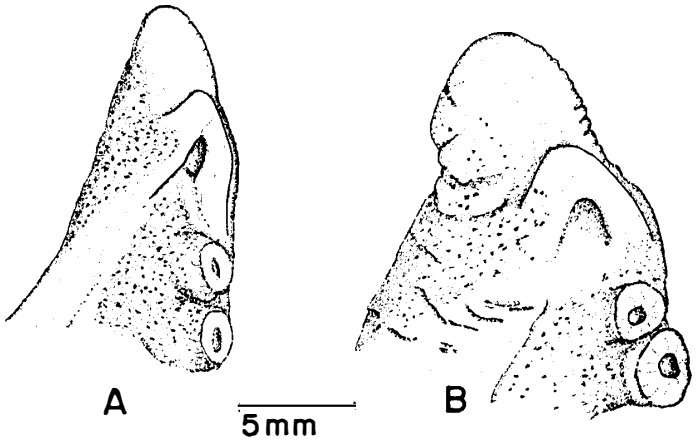

Fig. 2. Megaleledone senoi *TAKI. Hectocotylized portion of right Arm III. A. NSMT Mo-63960; B. NSMT Mo-63961.*

Table 2. Measurement of Megaleledone senoi *TAKI, 1961 in mm.*

Characters	NSMT Mo-63960	NSMT Mo-63961
Sex	Male	Male
Total length	470	350
Eye-Posterior end of mantle	145	110
Eye–Tip of Arm II	335	255
Ventral mantle length	125	95
Mantle width	140	100
Head width	95	60
Funnel length	55	38
Arm I right	285*	225
left	305	220*
II right	310	220
left	330	240
III right	285**	205**
left	310	235
IV right	310	220
left	290*	240
Web A	100	70
B right	115	85
left	125	90
Web C right	135	100
left	120	105
D right	130	90
left	125	100
E	90	50
Sucker count I right	44+10	45+8
left	44+8	44*
II right	45+10	46+12
left	46+9	49+6
III right	38**	39**
left	46+9	48+10
IV right	48+10	48+10
left	42*	50+6
Largest sucker diameter I	17.0	9.7
II	16.0	10.0
III	16.5	10.3
IV	16.5	11.4
Hectocotylus	9.6	8.0
Calamus	3.8	4.4
Ligula	5.0	3.3

* arm tip lacking; ** hectocotylized.

4. Detailed Redescription of *Gonatus antarcticus* LÖNNBERG (Family Gonatidae)

Gonatus antarcticus was first described by LÖNNBERG in 1898 based on a stranded specimen near the Straits of Magellan. Prior to LÖNNBERG, STEENSTRUP (1882) reported a *Gonatus* squid from the stomach contents of an albatross collected at 40°S, 15°E, but the specimen was too badly damaged to be described systematically. LÖNNBERG thought that the *Gonatus* reported by STEENSTRUP might belong to *Gonatus antarcticus*. He stressed that *G. antarcticus* markedly differs from *G. fabricii*, which was a sole *Gonatus* species known at that time from the northern North Atlantic, by having greatly reduced marginal suckers, compressed hooks of Arms I–III, and a little broader and different-shaped gladius. Although LÖNNBERG gave a carefull description of *G. antarcticus*, no external appearance nor important systematic characters were shown in illustration.

Thereafter, *G. antarcticus* had been thought to be a sole *Gonatus* species distributed in the Southern Hemisphere. Beaks of *G. antarcticus* have often been found in the stomachs of sperm whales (CLARKE *et al.*, 1976; CLARKE 1977, 1980) and Weddell seals (CLARKE and MACLEOD, 1982), but the whole specimen has scarcely been collected. In 1978, IMBER described *Gonatus phoebetriae*, from off New Zealand based on a single lower beak from the stomach of a sooty albatross. However, the validity of *G. phoebetriae* is very dubious due to the incomplete comparison among beaks in the families and the lack of sufficient consideration to the species identity.

Recent extensive systematic studies on Gonatidae in the Northern Hemisphere revealed that two *Gonatus* species exist in the North Atlantic (KRISTENSEN, 1981) and at least eight in the North Pacific (YOUNG, 1972; KUBODERA and OKUTANI, 1977, 1981; JEFFERTS, 1985). However, the relationships among those species and *G. antarcticus* have not always been worked out.

In recent years, some cephalopods incidentally collected by bottom trawl from off southern Argentina were brought to our depository. A *Gonatus* specimen, among them, was well identical with *G. antarcticus* deposited in the Zoological Museum, Copenhagen, and the U.S. National Museum of Natural History.

Here a detailed description and drawings of *G. antarcticus* based on a well preserved specimen are given, referring to the specimens deposited in Copenhagen and Washington. This will be of some help for elucidating the relationship and evolution of genus *Gonatus*.

Gonatus antarcticus LÖNNBERG, 1898 (Figs. 3A–B, 4A–J)

Gonatus species: STEENSTRUP, 1882, p. 150.
Gonatus antarcticus LÖNNBERG, 1898, p. 51–55, pl. v.
Gonatus antarcticus: CLARKE, 1980, p. 138–142, text-fig. 103.

Material examined: NSMT Mo-63957, Lat. 47°24′S, Long. 59°37′W, north of Forkland Islands in the South Atlantic Ocean, bottom trawl at about 928 m depth, "BANSHU-MARU", Japan Marine Fishery Resource Research Center (October 13, 1984). Deposited in National Science Museum, Tokyo.

Specimen deposited in the U.S. National Museum of Natural History, Smithsonian Institution, Lat. 40°18′S, Long. 35°07′W, South Atlantic Ocean (September 3, 1971).

Specimen deposited in Zoological Museum, Copenhagen, SAM A6514, locality unknown, date unknown. See measurements for size (Table 3).

Diagnosis: A gonatid with slender body (MW/DML=18%), short arms (AL/DML =45%) and sagittate fins (FW/FL=84%). Suckers in outer rows of Arms I, II, III are 2/3 smaller in size than those of Arm IV. Tentacular manus with a large central hook, a medium-sized distal hook and 3–4 small proximal hooks remarkably decreasing in size proximally.

Description: Mantle is slender, cylindrical in the anterior half, but gently tapering posteriorly to the blunt end of gladius cone from which a long gelatinous tail continues

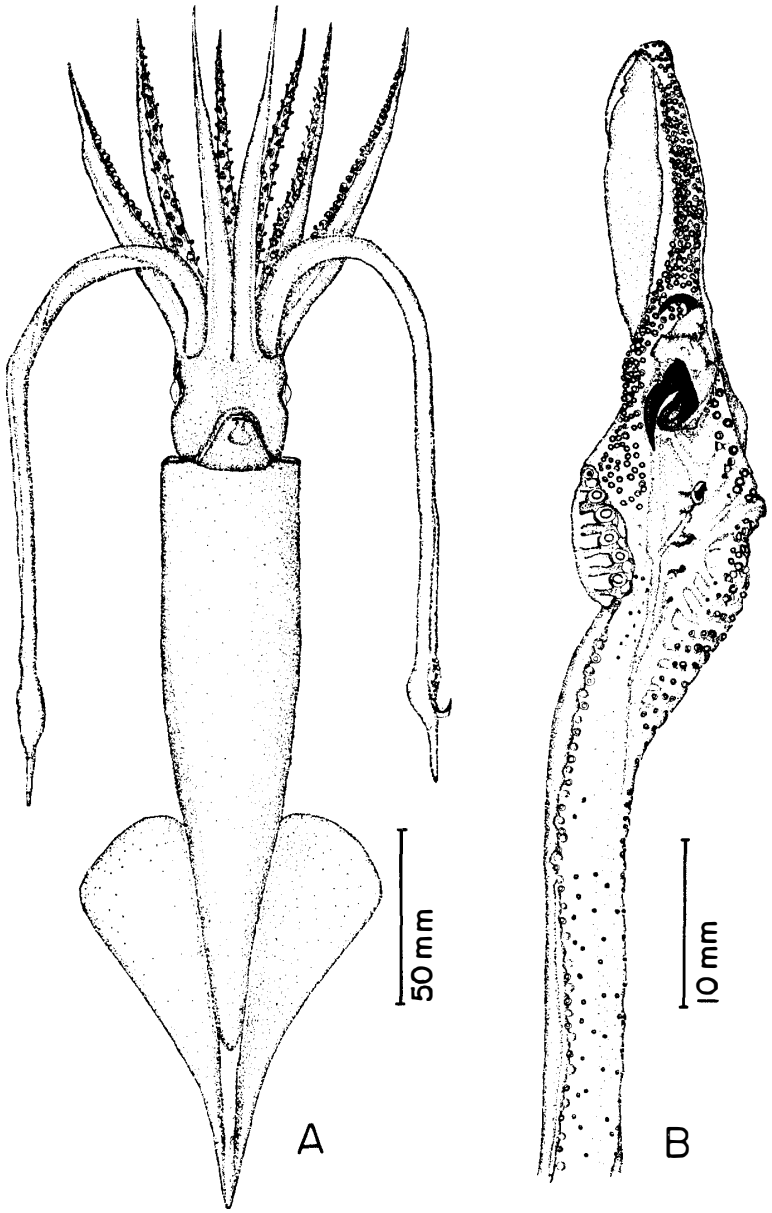

Fig. 3. Gonatus antarcticus LÖNNBERG. *A. Ventral view of NSMT Mo-63957; B. Left tentacular club of the specimen deposited in U.S. National Museum of Natural History, Smithsonian Institution.*

to the posterior end of the fin. Mantle wall is moderately thick and muscular but soft to touch. Ventral excavation is shallow (Fig. 3A).

Body is covered with a thin epidermis densely spotted with purplish chromatophores on ventral and aboral surfaces but epidermis is easily torn off by handling.

Fins are sagittate with roundish sides. Fin length is about half of the DML, FW/FL being about 84%. Posterior margins are slightly concave, but anterior margins are convex with small lobe to the fin base.

Head is squarish, slightly narrower than the mantle opening. Eyes are large, occupying almost entire lateral sides of the head with distinct sinus on the orbit. Neck is moderately constricted with two pairs of olfactory crests, one situated near the funnel groove and the other on dorso-lateral sides.

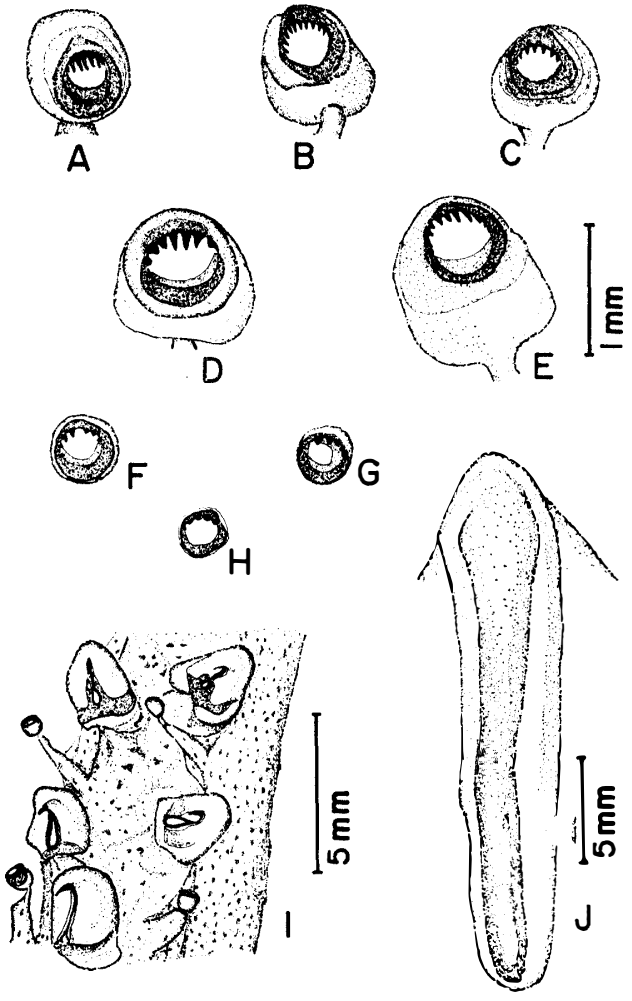

Fig. 4. Gonatus antarcticus *LÖNNBERG. A–J. (NSMT Mo-63957); A. Marginal sucker of middle portion of Arm I; B. ditto, of Arm II; C. ditto, of Arm III; D. ditto, of Arm IV; E. Median sucker of middle portion of Arm IV; F. Sucker on dorso-marginal zone of manus; G. Sucker on ventro-marginal zone of manus; H. Sucker on dactylus; I. Middle portion of Arm III; J. Left funnel locking cartilage.*

Funnel is moderate in size, reaching the posterior level of the eye lenses with smooth funnel groove. Funnel cartilages are lanceolate with rounded ends, about 9.5% of DML. Median groove is almost straight, widened anteriorly (Fig. 4J). Mantle locking cartilages are linear ridges, nearly of the same length as the corresponding funnel cartilages. Funnel organs are not observed.

Nuchal cartilage is rectangular with rounded ends, about 10% of DML in length, 3% of DML in width. Three straight grooves run along the longitudinal axis of the cartilage.

Arms are short, 40–45% of DML, stout proximally and tapering to the distal tips. Arm formula is IV, II=III, I, but the difference in length is not prominent. Arm IV has a thin lateral keel. Right Arm III of NSMT Mo-63957 shows regeneration of injured arm tip.

Arm armature is quadriserial. Median two rows of Arms I, II, III consist of hooks, arranged in a zigzag row. Marginal rows consist of small suckers arranged likewise. Hooks are covered with fleshy hood, connnected to the oral surface of the arm by short pedicel. Marginal suckers are situated at the distal end of long trabecula which supports a thin protective membrane along the margins of oral surface of the arms (Fig. 4I). Median two rows of Arm IV are not modified into hooks and this arm has quadriserial suckers throughout. The median and marginal suckers of Arm IV are nearly the same in size. Marginal suckers of Arms I, II and III are smaller, about 2/3 of the suckers of Arm IV. Both hooks and suckers decrease in size distally. Armatures in a proximal half length of the arms vary from 20 suckers plus 17 hooks in Arm I to 24 suckers plus 20 hooks each in Arms II and III. That of Arm IV is 44–46 suckers. Marginal suckers at the middle portion of Arms I, II and III have 6–9 pointed teeth on the distal margin of chitinous rings with smooth proximal margin (Fig. 4A–C). Chitinous rings of both marginal and median suckers of Arm IV have 7–8 pointed teeth (Fig. 4D–E).

Tentacles are long, stout and as long as DML, with medium-sized tentacular club. Tentacular stalk is nearly rectangular in cross section.

Tentacular club is about 15% of DML, having a large hook at the central portion of manus with a small hook, about 1/3 of the largest one, distal to it. Proximal to the large central hook, 3–4 much smaller hooks and/or suckers continue longitudinally, with a remarkable decrease in size proximally. Manus formula HHhhhh or HHhhhs or HHhhss. Dactylus has a well-defined dorso-aboral keel (Fig. 3B). Suckers on dactylus are about 150–160 in number, 4–5 rows densely beset, terminating in a circle at the tip. Suckers on dactylus have 4–5 rounded teeth on the distal margin of the chitinous ring (Fig. 4G). Suckers on dorso-marginal zone of manus are about 50–60 in number, continuing to the inner carpal group. Suckers on dorso-marginal zone have 6–7 blunt teeth (Fig. 4F). Ventro-marginal zone of manus consists of 14–15 trabeculae connected with a thin membrane, each of them bears 3–4 suckers, continuing to the ventral marginal suckers of tentacular stalk in a single row. Ventro-marginal suckers have 7 blunt teeth (Fig. 4H). Carpal group consists of 5–6 large, smooth-ringed suckers set alternately on a thick ridge with fleshy knobs. Proximal to the carpal group, a series of alternating small, smooth-ringed suckers and pads continues almost in entire length of oral-dorsal margin of the tentacular stalk. Between ventral and dorsal marginal suckers of ten-

Table 3. Measurement of Gonatus antarcticus *LÖNNBERG, 1898 in mm.*

Characters			NSMT Mo-63957	Specimen in USNM	Specimen in Zool. Mus. Copen.
Sex			—	—	female
DML			230	235	218
Tail L			50	52	54
MW			40	42	44
FL			114	103	101
FW			95	84	89
FBL			100	—	—
HL			28	35	33
HW			32	28	35
ED			22	—	24
NCL			23	—	22
NCW			7	—	8.5
FCL			22	—	21
FCW			5.8	—	7.0
AL	right	I	90	103	74*
		II	92	110	110
		III	70**	113	105
		IV	104	104	108
	left	I	88	—	91
		II	91	—	115
		III	91	—	114
		IV	102	—	110
1/2AAC	right	I	20s/1s+17h	22s/19h	—
		II	22s/1s+19h	24s/2s+21h	—
		III	18s/13h**	22s/2s+20h	—
		IV	44s	50s	—
	left	I	18s/1s+17h	—	21s/2s+20h
		II	24s/1s+20h	—	22s/2s+20h
		III	22s/1s+21h	—	21s/2s+21h
		IV	46s	—	50s
TL	right		240	280	150
	left		238	—	145
TCL	right		35	33	35
	left		34	—	34.8
DSC			150-160	160-170	—
DMSC			50-60	70-80	—
VMSC			50-60	55-65	—
TCAF			HHhhhs	HHhhss	HHhhhh

DML, dorsal mantle length; Tail L, tail length; MW, mantle width; FL, fin length; FW, fin width; FBL, fin base length; HL, head length; HW, head width; ED, eye diameter; NCL, nuchal cartilage length; NCW, nuchal cartilage width; FCL, funnel cartilage length; FCW, funnel cartilage width; AL, arm length; 1/2AAC, proximal half length of arm armatures count, expressed marginal suckers/midian suckers+hooks; TL, tentacle length; TCL, tentacular club length; DSC, dactylus sucker count; DMSC, dorso-marginal sucker count; VMSC, ventro-marginal sucker count; TCAF, Tentacular club armatures formula expressed in the number of hooks or suckers from distal to proximal with symbols H indicating the distal large hook, **H**, the central large hook, h, the proximal small hook and s, the proximal small sucker. * arm tip lacking; ** regenerated arm.

tacular stalk, about 120–140 small suckers are scattered near the base of stalk.

Buccal membrane has 7 lappets, connected to the dorsal borders of Arms I and II, and to the ventral borders of Arms III and IV, being of DDVV-type. Outer lip is thin, darkly pigmented. Inner lip is thick, muscular with numerous small fleshy warts.

Beaks, radula, gladius and viseral organs were not observed because of scarcity of available specimens.

Discussion: Among the known *Gonatus* species, *G. antarcticus* is considered to be closely related to *G. fabricii* - *G. steenstrupi* complex in the North Atlantic and *G. californiensis* in the Northeast Pacific (KRISTENSEN, 1981; YOUNG, 1972). According to LÖNNBERG (1898), *G. antarcticus* has greatly reduced marginal suckers and compressed hooks on Arms I–III. The relative smallness of marginal suckers of Arms I–III in comparison with that of Arm IV was recognized in the present specimen. However, the expression of "greatly reduced" seemed to be somewhat exaggerated. In the recent systematic study of Atlantic *Gonatus*, KRISTENSEN (1981) pointed out that *G. antarcticus* has very strong tentacles with numerous (118–190) small suckers on the median portion of the tentacular stalk and rather small clubs with more numerous suckers (270) than in any other *Gonatus* species. These characters were confirmed in the present study. KUBODERA and OKUTANI (1981) calculated some bodily proportions of seven *Gonatus* species. From their table, it is clear that *G. antarcticus* has comparatively narrower fins than other *Gonatus* species. IMBER (1978) considered that *G. californiensis* is synonymous with *G. antarcticus* and suggested that the ranges of the two populations are almost certainly confluent via the eastern central Pacific. However, *G. californiensis* is clearly distinguishable from *G. antarcticus* by the characters mentioned above.

The present study revealed that the arrangement of hooks on the proximal portion of the central large hook of manus apparently separates *G. antarcticus* from others. *G. antarcticus* has 3–4 hooks proximal to the central large hook among which the most distal one is the largest and decreasing rapidly in size proximally. Such a serial decrease in size of the hooks distal to the central large hook has never been seen in other *Gonatus* species in the Northern Hemisphere. This character is equally observed in three specimens examined and considered to be one of the important specific characters of *G. antarcticus*.

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Plate 1

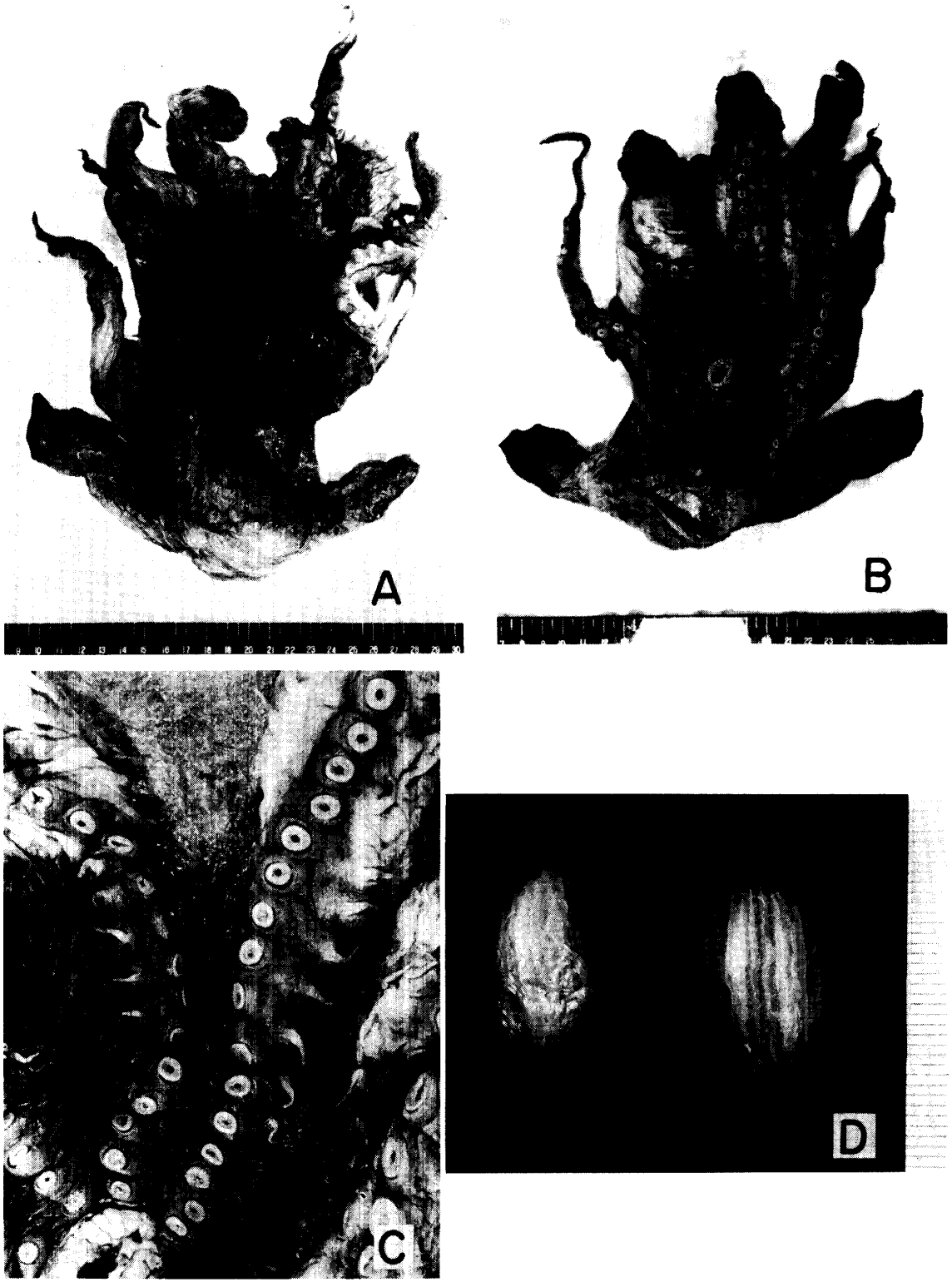

Plate 1. Grimpoteuthis antarctica *n. sp. A. Dorsal view of holotype; B. Ventral view and oral surface of holotype; C. Close-up of suckers and cirri (holotype); D. The most advanced eggs from holotype.*

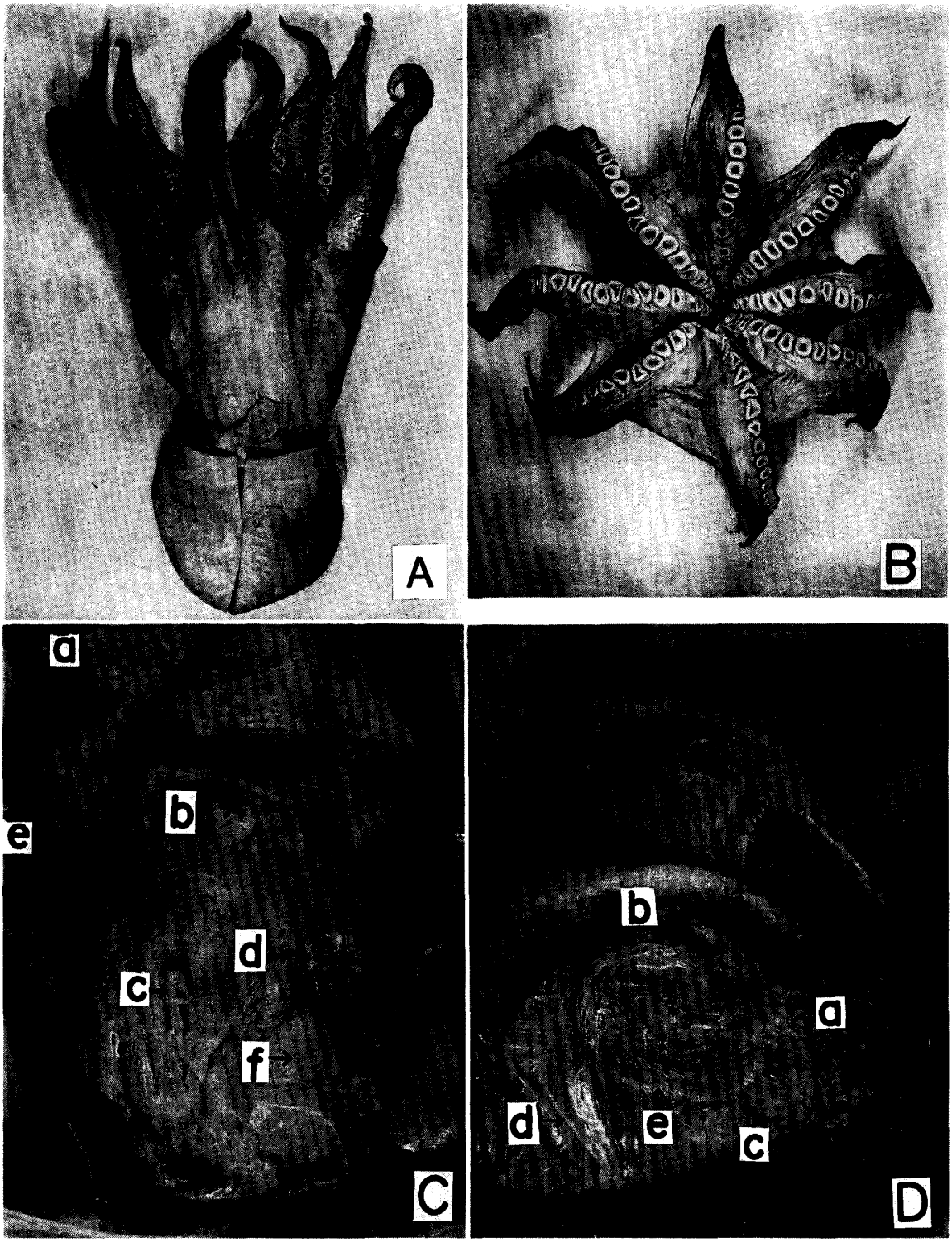

Plate 2. Megaleledone senoi *TAKI. A–D. NSMT Mo-63960; A. Ventral view; B. Oral surface; C. Ventral view of the viscera, mantle and funnel cut open, C-a, funnel organ; C-b, anus; C-c, mantle septum; C-d, penis opening; C-e, gill; C-f, penis diverticle; D. Dorsal side of male genital organs; D-a, spermatophoric duct; D-b, accessory spermatophoric gland; D-c, Needham's sac; D-d, testis; D-e, sermatophoric gland.*