

Morphologic characteristic and classification description of one species Octopodidae in Antarctic waters

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Abstract Morphologic characteristic and classification description of female octopus *Pareledone turqueti* collected by R/V *Xuelong* during the 22nd Expedition in the Antarctic waters is discussed. The results indicate that this species belongs to suborder Incirrina, Family Octopodidae, Subfamily Eledoninae, Genus *Pareledone*, *Pareledone turqueti*. It is characterized by having soft and smooth skin without papillae, funnel organ VV-shaped, crop, ink sac, anterior and posterior salivary gland present, developed radulae with 7 small heterodont teeth, gills with 7 lamellae on the inner and outer demibranch respectively. Arms moderate with uniserial suckers, no enlarged arm formula is $\textcircled{E} = \text{III I} = \text{IV}$, web formula is c = d e h a.

Key words *Pareledone turqueti*, Antarctic, morphologic characteristic, classification

1 Introduction

In the waters surrounding the Antarctic, more than 10 genera and 25 species of Octopodidae are distributed, of which *Pareledone* is one of the most abundant resources^[1]. The octopus *Pareledone* mostly belong to a local population around the Antarctic, and is mainly distributed in the edge of the continental slope and around the island of the southern Antarctic front with less than 1000 m water depth, while rarely appeared in the north of the Antarctic front^[2]. The Octopus played an important role in the Antarctic marine ecosystem, on the one hand, they mainly feed on crustaceans, Annelida, fish and Ophiuroidea^[3], and on the other hand, they are prey of *Mirounga leonine*^[4] and *Leptonychotes weddellii*^[5]. According to the octopus collected in the waters near Zhongshan Station during China's 22nd Antarctic scientific expedition, the description of the morphological characteristics of the octopus was tried, and the preliminary determination of the taxonomic status was made.

2 Materials and methods

2.1 Sources of sample

One female sample of octopus collected at the water depth of 20 m near Zhongshan Station (69° 20'S, 76° 31'E) of the Antarctic (Figure 1) on February 12, 2006, during the

Antarctic Expedition made by R/V *Xuelong*.

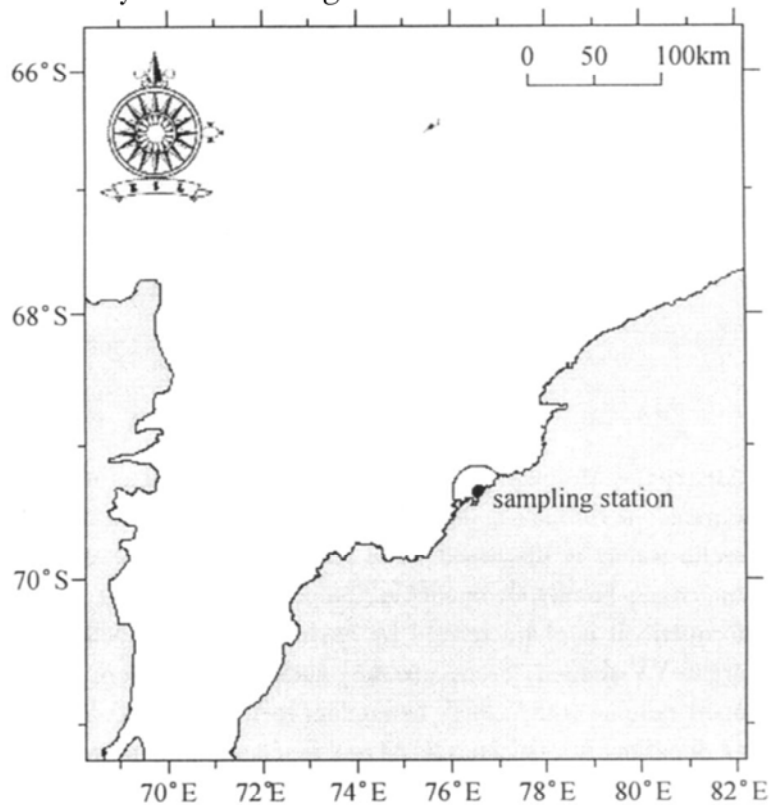


Fig 1 Sampling station

2.2 Analysis of Morphologic parameters

Based on the reference from Roper and Voss (1983)^[6], the morphologic parameters are measured, including total length, mantle length, mantle width, head width, diameter of pallial aperture, funnel length and free-funnel length, funnel shape, arm length, number of sucker, sucker diameter, web depth, number of gills, the diameter of buccal mass, radula length and width, length of anterior and posterior salivary gland. Morphologic parameters about beak are based on the references^[7-9], consisting of the hood length, crest length, rostrum length, rostrum width, lateral wall length, baseline length, wing length, jaw angle, lateral wall angle and so on. The above parameters are measured by use of the rule (accuracy up to 1 mm) and vernier caliper (accuracy up to 0.01 mm).

3 Results

3.1 Description of outer shape

For the mantle of octopus, there is dark purple on the back, white with slightly purple on the belly. For the arm parts, there is dark purple near the mouth of web, white on the base of the arm and web, and purple on the lateral web. There also have the flesh sucker (Figure 2A, B, C). For the skin, it is soft, smooth, with no papillae and a large number of purple chromatophores (Figure 3).

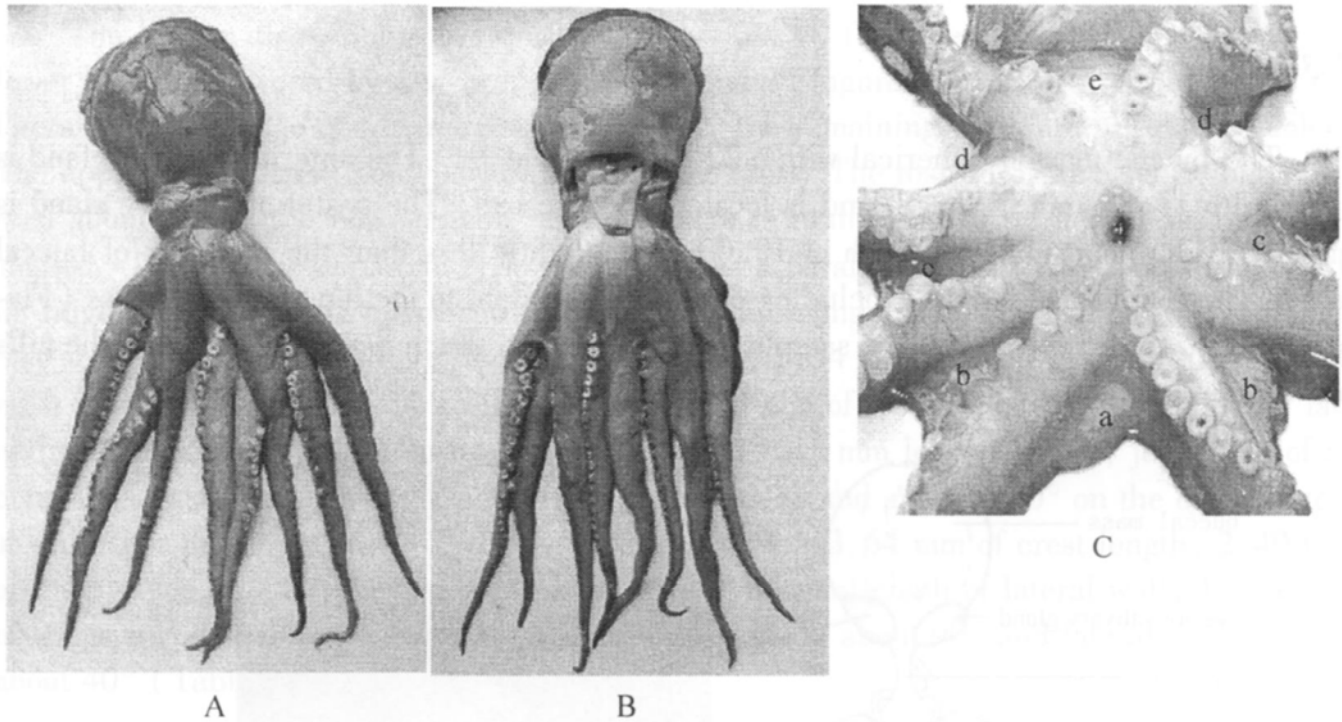


Fig 2 A: dorsal view; B: ventral view; C: oral view.

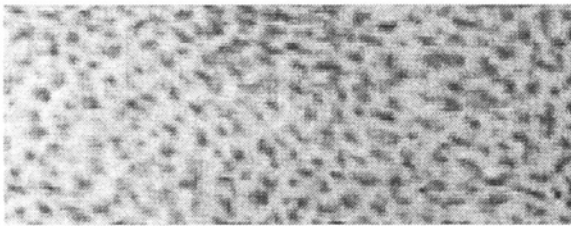


Fig 3 Skin with much chromatophores

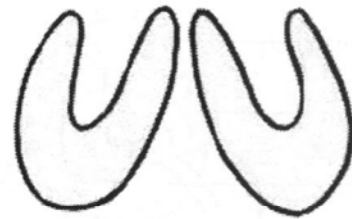


Fig 4 Scheme of funnel (from Alcock *et al* 2003^[3]).

The size of octopus is medium with 131 mm mantle length, 433 mm total length. Its mantle belongs to egg-shape; the former part is narrower than the rear; the head width about 63 mm is less than mantle width (112 mm) (Figure 2A, B). Eye is great with a 28-60 mm diameter which occupy 45% of the head width. Funnel organ belong VV – shaped (Figure 4) with 46 mm of total length and 32 mm long of the free-funnel. The diameter of pallial aperture attains to 71 mm which accounts for 63% of the head width.

3.2 Feature of arm

There is medium length on the arm, which is about 2 times as long as the mantle. The lengths of arms I, II, III, IV are 289 mm, 311 mm, 310 mm and 284 mm respectively. The arm order is II = III, I = IV. Suckers uniserial, aperture simple, without enlargement. The number of sucker on the arms I, II, III, IV are 53, 55, 55 and 53 respectively, which basically is the same. The number of suckers grows with the increase of arm length. The first and second sucker in the each arm have smaller sizes, and the suckers from third to eighth become larger in size; after that the size of suckers gradually reduce. The size of the biggest sucker attains to 7.20 mm in diameter. Web is deeper; the depth of web for the parts a, b, c, d, e attain 48 mm, 55 mm, 78 mm, 64 mm and 73 mm respectively, and the web formula is $c = d + e + h + a$ (Figure 2C).

3.3 Feature of head parts

The buccal mass is spherical with a 22.10 mm diameter. The anterior salivary gland is small with 14.80 mm in length and is located over the ball. The posterior salivary gland is great with the heart-shaped length of 19.00 mm, slightly less than the diameter of buccal mass. The esophageal length (including crop) is equivalent to the length of intestines (Figure 6A, B, C). Shell lost in the sample but with ink sac. Each demibranch within the gills has seven lamellae (Figure 6).

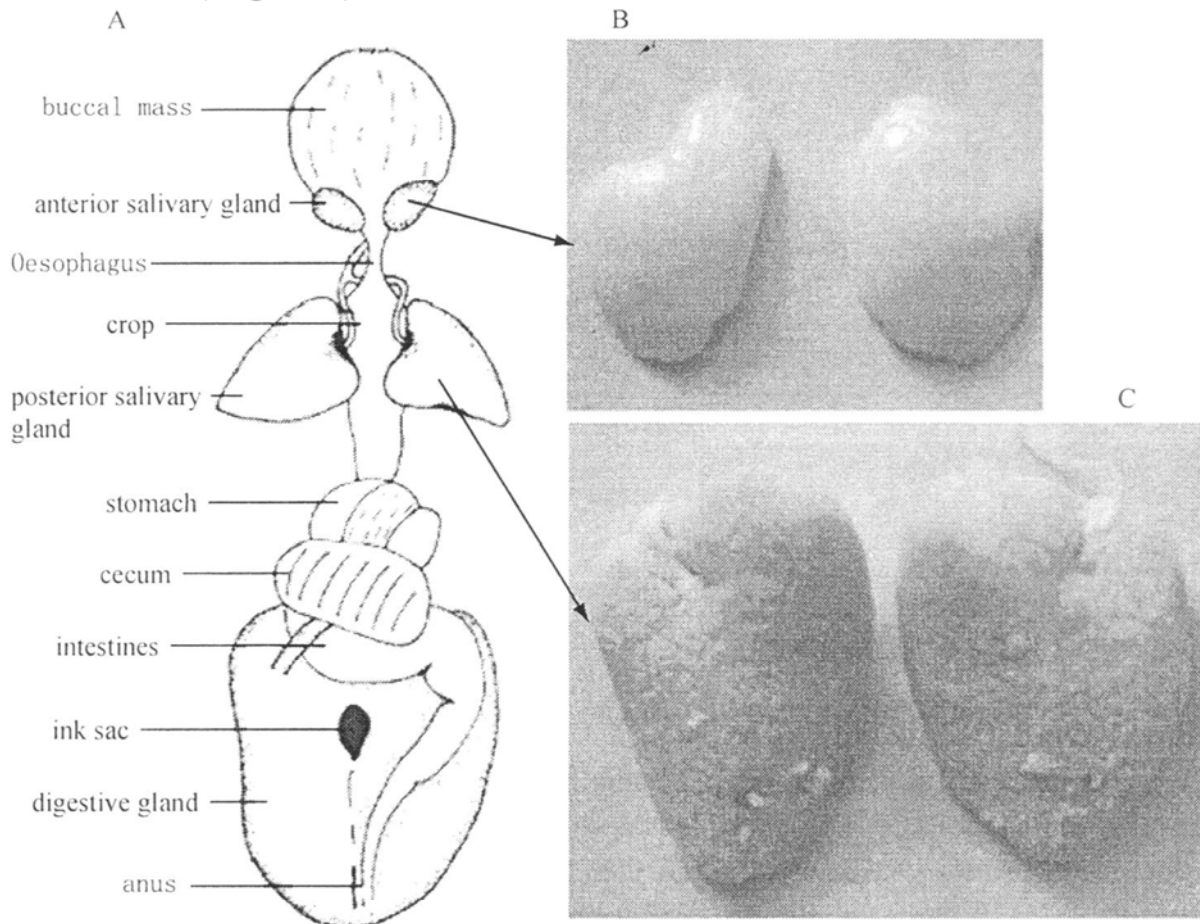


Fig 5 A: Scheme of digestive system (from Allcock *et al* 2003^[3]); B: Photo of anterior salivary; C: Photo of posterior salivary.

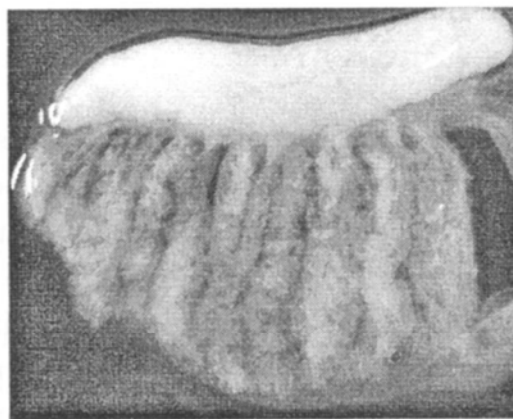


Fig 6 Gill (×1 time).

The beak with medium size consists of two parts. The lateral wall on the upper and lower beak are covered by a layer of white membrane (Figure 7). Apart from the hood, the lateral wall and edge of wings being translucent, the remaining parts are all dark in color. The upper hood is short, only covering $2/5$ of the crest. The rostrum is also short, only covered about $1/3$ of the hood length, the top shape is blunt. The wing is long and earlobe-shaped. The crest is apparent. The lateral wall is a parallelogram, being smooth and with no ridge. There also are micro-serrated teeth and bite wing tooth. The Morphologic parameters of the beak are as follows: for the upper beak, 8.54 mm of hood length, 20.74 mm of crest length, 3.37 mm of the rostrum length, 3.33 mm of rostrum width, 16.04 mm of lateral wall in length, 4.00 mm long wingspan and 17.43 mm long baseline; jaw angle of about 120° , sidewall angle of about 30° , 4.01 mm deep and angle of 60° on the end of lateral wall. For the lower beak, 7.23 mm of hood length, 13.64 mm of crest length, 2.49 mm of rostrum length, 2.69 mm of rostrum width, 17.67 mm length of lateral wall, 11.51 mm of wingspan, 15.35 mm of baseline length, jaw angle of about 90° and lateral wall angle of about 40° (Table 2).

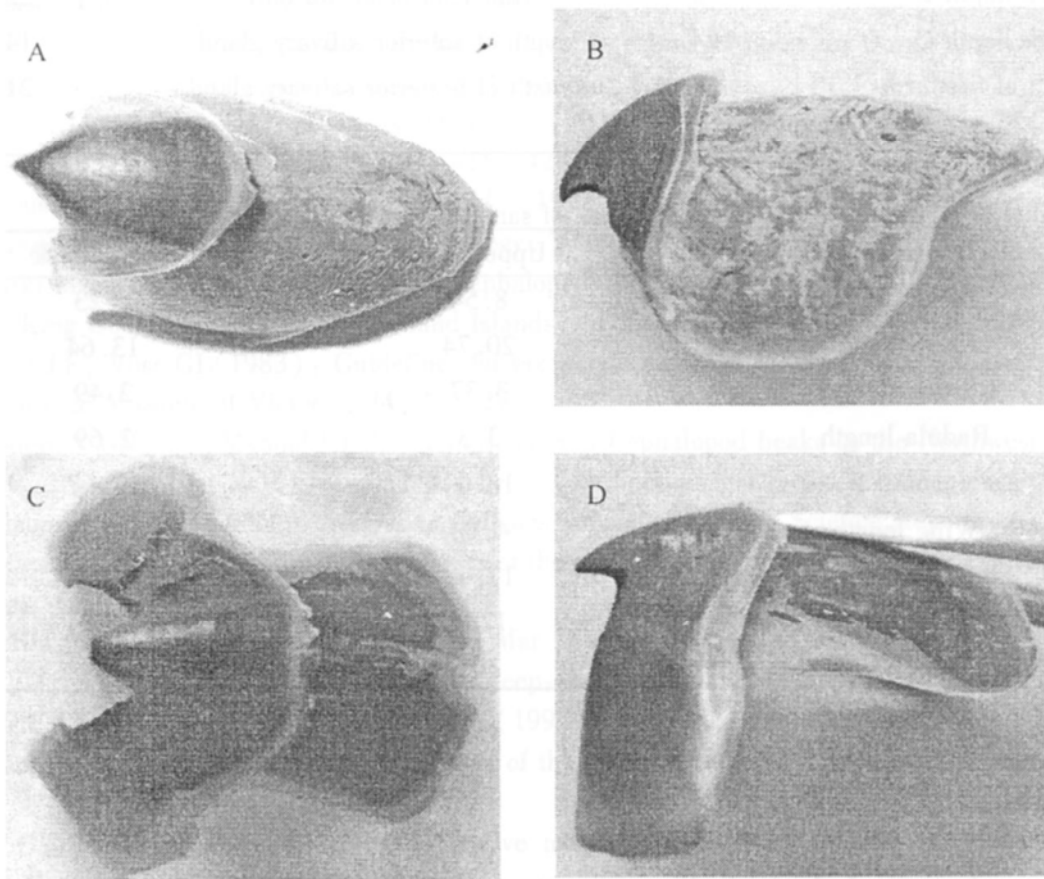


Fig 7 Photo of beak (A: upper beak dorsal view; B: upper beak lateral view; C: low beak dorsal view; D: low beak lateral view)

The developed and curled radula up on the mouth is 22.20 mm in length and 4.50 mm in width, consisting of 1 serial rachidian teeth, four lateral teeth and two marginal teeth. The rachidian tooth is great with leave shaped and tricuspid, the middle sharp is longer and the two side sharps are short. The first marginal tooth is small and unicuspid, the second marginal tooth is greater than the first unicuspid, and also is unicuspid. The marginal tooth is single sharp, dogtooth-shaped and slender (Figure 7).

Table 1 Value of morphologic parameters of sample

Morphologic parameters	Value(mm)	Morphologic parameters	Value(mm or number)
Total length	433	length of third arm	310
Dorsal mantle length	131	length of fourth arm	284
Ventral mantle length	113	number of sucker on the first arm	53
Mantle width	112	number of sucker on the second arm	55
Head width	63	number of sucker on the third arm	55
Diameter of pallial aperture	71	number of sucker on the fourth arm	53
Funnel length	46	diameter of sucker	7.20
Free-funnel length	32	inner gills(left /right)	7/7
Funnel shape	VV	outer gills(left/right)	7/7
Web depth A	48	diameter of eye	28.60
Web depth B	55	radula length	22.20
Web depth C	78	radula width	4.50
Web depth D	73	diameter of mouth ball	22.10
Web depth E	64	length of anterior salivary gland	14.80
Length of first arm	289	length of posterior salivary gland	21.00
Length of second arm	311		

Table 2 Value of morphologic parameters in beak of sample (mm)

Morphologic parameters in beak	Upper beak	Lower beak
Hood length	8.54	7.23
Crest length	20.74	13.64
Rostrum length	3.37	2.49
Radula length	3.3	2.69
Lateral wall length	16.04	17.67
Wing length	4.00	11.51
Baseline length	17.43	15.35
Jaw angle	120°	90°
Lateral wall angle	30°	40°

4 Discussions

Based on the morphological characteristics, the classification status of the octopus belongs to suborder Incirrina, Family Octopodidae, Subfamily Eledoninae, Genus *Pareledone*, *Pareledone turqueti* (the same name is *Eledone turqueti*, *Moschites turqueti* and *Graneledone turqueti*). According to the records, the largest mantle length of *Pareledone turqueti* attains 150 mm^[10], and it is widely distributed in the waters through 25 m to 1116 m depth around the Antarctica^[10], mainly ranging from 100 m to 200 m water depth^[11]. It is also found that the abundant resources of this octopus appeared around the South Georgia Island, South Sandwich Islands and South Orkney Islands^[12-13]. However, it is the first report that *Pareledone turqueti* was collected in the depth of 20m at the Zhongshan Station (69° 20'S, 76° 34'E) of the Antarctic.

Pareledone turqueti likes the other species of *Pareledone* genera in which the eggs hatched in the seabed, its size is about 12-13 mm, and the hatched larvae do benthic life. Daly and Rodhouse (1994)^[13] also described the morphological characteristics of *Pareledone turqueti*. Allcock *et al* (1997)^[12] analyzed the population structure of *Pareledone turqueti* in the Antarctic region by using isoenzyme electrophoresis. To understand the Antarctic marine ecosystem, it is needed to make effort in studying the cephalopod resources and biology in the Antarctic.

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