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Heteropod molluscs from waters around the Selvagens Islands (Gastropoda: Carinarioidea)

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DE VERA, A., R. R. SEAPY & F. HERNÁNDEZ (2006). Sobre moluscos heterópodos en las aguas de las Islas Salvajes (Gastropoda: Carinarioidea). *VIERAEA* 34: 33-43.

RESUMEN: Un total de 48 moluscos heterópodos fueron separados de las muestras de zooplancton procedentes de la campaña TFMCBMSV/00 a las Islas Salvajes. De las once especies identificadas, *Atlanta meteori*, anteriormente considerada como especie de distribución Indo-Pacífica, es registrada por primera vez para el Océano Atlántico. De este mismo material *Atlanta selvagensis* fue descrita como nueva especie. Los demás resultados son comparados con los obtenidos anteriormente en las cercanas aguas de las Islas Canarias.
Palabras clave: Islas Salvajes, Heteropoda, Carinarioidea

ABSTRACT: Heteropod molluscs were removed from zooplankton samples collected during cruise TFMCBMSV/00 to the Selvagens Islands. A total of 48 specimens were obtained. Among the eleven species of heteropods identified, *Atlanta meteori* was previously regarded as an Indo-Pacific species and was recorded here for the first time from the Atlantic Ocean. The second, *Atlanta selvagensis*, is a new species. The species records are compared with those obtained previously from the nearby waters of the Canary Islands.
Key words: Selvagen Islands, Heteropoda, Carinarioidea

INTRODUCTION

The marine environment of the Selvagens Islands has been studied over the past thirty years. The first studies were on benthic invertebrates and were carried out by researchers of the Museo de Ciencias Naturales de Tenerife (TFMC). These studies included monographs on the molluscs (García-Talavera, 1978), echinoderms (Moreno & Bacallado, 1978) and polychaetes (Núñez & Sosa, 1978). More recently, additional works

have been published on the fishes (Falcón *et al.*, 2000), echinoderms (Pérez Ruzafa *et al.*, 2002) and opistobranch molluscs (Malaquias, 1996), as well as a review of the algae (Parente *et al.*, 2000). However, the planktonic fauna of the waters around the Selvagens Islands has not been the subject of any specific investigation.

Studies of planktonic taxonomy by the pelagic biodiversity group from the TFMC have been carried out in the Canary (Hernández, F. y S. Jiménez, 1992, 1996) and Cape Verde Islands (Vinogradov *et al*, 2004, León *et al.*, 2005). Regarding zooplankton from the waters around the Selvagens Islands, studies have been completed on the decapod larvae (Lindley & Hernández, 2000, Lindley *et al.*, 2002), Mysidacea (Wittmann *et al.*, 2004), Nemertea (Hernández and Jiménez, in press), and a new species of heteropod mollusc, Atlanta selvagensis (De Vera & Seapy, in press)

The present study presents records of heteropod mollusks captured in plankton samples collected from 1000 meters to the surface.

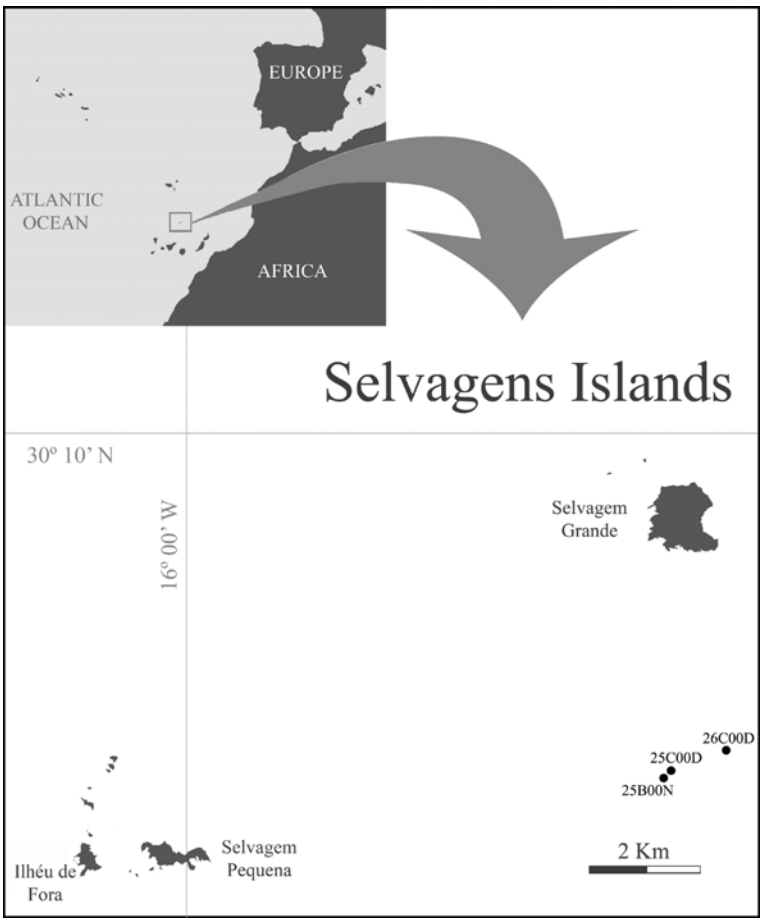


Fig. 1. Map of the Selvagens Islands, located in the Northeastern Atlantic Ocean.

MATERIAL AND METHODS

Zooplankton samples were collected from Selvagens Islands waters (Fig. 1) between 25 and 30 September 2000 during Cruise TFMCBMSV/00 of the Oceanographic Vessel *Taliarte*. Samples were collected from vertical hauls to a maximal depth of either 500 m or 1,000 m using a triple WP-2 net system, in which the three nets are banded together around the outside to form a triangular grouping, with a three-point bridle (one bridle wire attached to the outside of each net) and a fourth bridle wire in the center of the three nets. Each net had a mouth opening of 0.25 m^2, and the mesh size was 200 µm.

The latitude, longitude, date, time, and maximal tow depth for each tow are summarized in Table I. A flow meter was suspended in the mouth opening of each net to determine the volume of water filtered during each tow. The resultant samples were fixed with 4% formalin-sea water solution for a period of about one week, and transferred after this time to 70% ethanol.

Sample Code	Sample Numbers	Date, Time	Latitude, Longitude	Maximal Tow Depth
25B00D	1-3	25/09/00 0927 h	30° 06′ 58′′ N 15° 52′ 26′′ W	500 m
25B00D	4-6	25/09/00 1015 h	30° 06′ 58′′ N 15° 52′ 26′′ W	500 m
25C00D	7-9	25/09/00 1110 h	30° 05′ 28′′ N 15° 52′ 05′′ W	1000 m
25C00N	10-12	25/09/00 2000 h	30° 05′ 27′′ N 15° 52′ 07′′ W	1000 m
25B00N	13-15	25/09/00 2115 h	30° 05′ 27′′ N 15° 52′ 07′′ W	500 m
26B00D	16-18	26/09/00 0945 h	30° 06′ 40′′ N 15° 51′ 35′′ W	500 m
26C00D	19-21	26/09/00 1036 h	30° 05′ 45′′ N 15° 51′ 12′′ W	1000 m
26C00N	22-24	26/09/00 2002 h	30° 05′ 24′′ N 15° 52′ 08′′ W	1000 m
26B00N	25-27	26/09/00 2145 h	30° 06′ 33′′ N 15° 51′ 48′′ W	500 m
27C00D	28-30	27/09/00 1035 h	29° 59′ 22′′ N 15° 59′ 39′′ W	1000 m
27B00D	31-33	27/09/00 1146 h	30° 00′ 19′′ N 16° 00′ 29′′ W	500 m
28C00D	34-36	28/09/00 1005 h	29° 59′ 14′′ N 16° 01′ 28′′ W	1000 m
28B00D	37-39	28/09/00 1133 h	29° 59′ 53′′ N 16° 01′ 28′′ W	500 m
28C00N	40-42	28/09/00 2000 h	29° 59′ 12′′ N 16° 01′ 20′′ W	1000 m

Table I. Characteristics of zooplankton samples containing heteropods collected during Cruise TFMCBMSV/00. For the Sample Code, the first two digits refers to the day of collection; the following letter for the maximal depth of the tow (B=500 m; C= 1000 m); the two following digits for the year of the cruise (00 for 2000); and the last letter for whether the tow was taken during the day (D) or at night (N).

Species	Sampling Station	No. Indiv.	Abundance (%)	Density (No. per 1000 m^3)
Atlanta fusca	26C00N-22	1	4,17	0,25
	28C00D-35	1		
Atlanta gaudichaudi	26C00D-20	1	4,17	0,25
	26C00N-22	1		
Atlanta helicinoides	26C00D-19	1	2,08	0,13
Atlanta inflata	26C00N-22	1	2,08	0,13
Atlanta meteori	25C00D-7	1	2,08	0,13
Atlanta peroni	25B00N-13	2	54,17	3,30
	25B00N-14	3		
	25C00D-7	3		
	25C00D-8	2		
	25C00N-10	1		
	26B00D-16	1		
	26B00N-25	3		
	26B00N-26	1		
	26C00D-19	1		
	26C00N-23	2		
	27C00D-29	1		
	28B00D-37	3		
	28C00D-35	1		
	28C00N-14	1		
	28C00N-40	1		
Atlanta selvagensis	25B00N-13	1	16,67	1,02
	25C00D-8	1		
	26C00D-19	2		
	27B00D-31	1		
	27C00D-28	2		
	28C00N-14	1		
Protatlanta souleyeti	25B00N-15	1	6,25	0,38
	25C00D-8	1		
	26B00D-16	1		
Firoloida desmaresti	25C00N-11	1	4,17	0,25
	27B00D-31	1		
Pterotrachea coronata	28B00D-39	1	2,08	0,13
Carinaria challengeri	28B00D-39	1	2,08	0,13
TOTAL	———	**48**	**100,00**	**6,10**

Table II. Species records from sampling stations, including sample code with sample number (see Table I), number of individuals collected in each tow, relative species abundance (expressed as a percentage of the total number of individuals collected), and mean density of each species (number of individuals per 100 m^3).

RESULTS

Species in the Family Atlantidae were most abundant, comprising 44 specimens belonging to eight species from two genera, *Protatlanta* and *Atlanta* (Table II). Three of the remaining four specimens were members of the Pterotracheidae, in the genera *Firoloida* and *Pterotrachea*, and the fourth was from the genus *Carinaria* in the Carinariidae. The full classification of the collected species is given below. Note that the species of *Atlanta* are separated into species groups (after Richter and Seapy, 1999).

Phyllum MOLLUSCA
Class GASTROPODA CUVIER, 1797
Subclass PROSOBRANCHIA MILNE EDWARDS, 1848
Superorder CAENOGASTROPODA COX, 1960
Superfamily CARINARIOIDEA BLAINVILLE, 1818

Family ATLANTIDAE RANG, 1829

Genus *Protatlanta* TESCH, 1908
Protatlanta souleyeti SMITH, 1888

Genus *Atlanta* LESUEUR, 1817

Atlanta fusca species group
Atlanta fusca SOULEYET, 1852

Atlanta inflata species group
Atlanta inflata SOULEYET, 1852
Atlanta helicinoides SOULEYET, 1852 (fig. 3D)

Atlanta peroni species group
Atlanta peroni LESUEUR, 1817 (fig. 3A)

Atlanta gaudichaudi species group
Atlanta gaudichaudi SOULEYET, 1852 (fig. 3B)
Atlanta selvagensis sp. nov. DE VERA & SEAPY, 2006

Atlanta gibbosa species group
Atlanta meteori RICHTER, 1972 (fig. 4)

Family CARINARIIDAE BLAINVILLE, 1818

Genus *Carinaria* LAMARCK, 1801
Carinaria challengeri BONNEVIE, 1920 (fig. 3C)

Family PTEROTRACHEIDAE GRAY, 1843

Genus *Pterotrachea* NIEBUHR (ms. FÔRSKAL), 1775
Pterotrachea coronata NIEBUHR (ms. FÔRSKAL), 1775

Genus *Firoloida* LESUEUR, 1817
Firoloida desmaresti LESUEUR, 1817

Forty-eight adult and juvenile specimens of heteropod molluscs were obtained from fourteen plankton samples (Table II). Larval stages were sorted from the samples, but are omitted here. The species that were most abundant and had the highest mean densities (Table II) were *Atlanta peroni* (54.2% and 3.30 indiv. per 1000 m3), followed by *Atlanta selvagensis* (16.7% and 1.02 indiv. per 1000 m3) and *Protatlanta souleyeti* (6.3% and 0.38 indiv. per 1000 m^3). The remaining eight species had mean abundances and densities of less than 4.2% and 0.25 per 1000 m3.

DISCUSSION

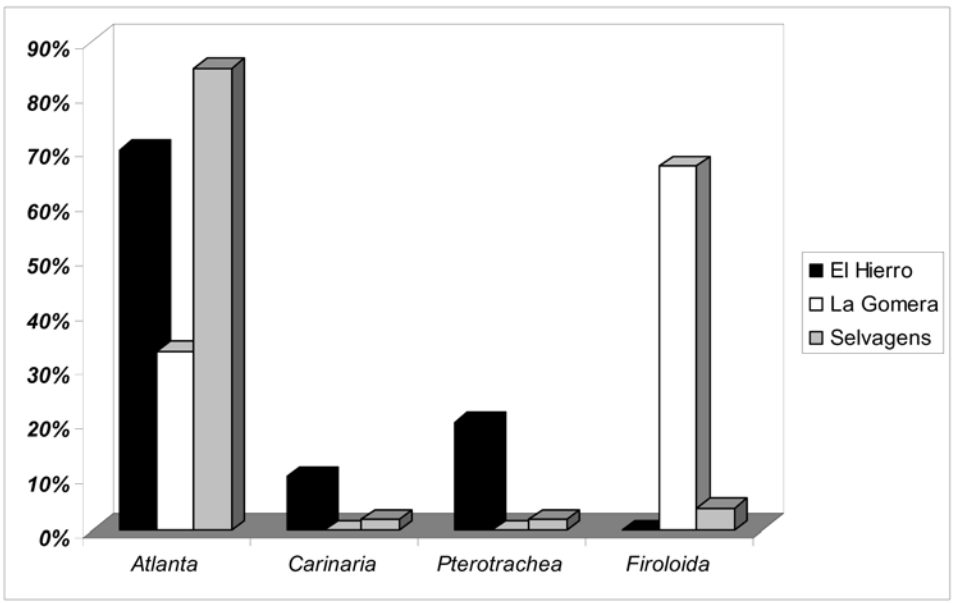
Atlanta peroni is the most common species of heteropod from the Atlantic Ocean (van der Spoel, 1976; Richter & Seapy, 1999). In the present study more than half (54.17%) of the examined specimens belong to this species, with a density in the plankton of 3.3 per 1,000 m^3 (Table II). These results are similar in abundance to those obtained for Canary Islands waters in studies carried out previously. Hernández and Jiménez (1992) found that *Atlanta peroni* accounted for 40% of all Heteropoda at El Hierro Island (fig. 2). This percentage value would have been higher if some of the 30% of the heteropod specimens identified by the authors as *Atlanta sp*. were juveniles of *A. peroni*. At La Gomera, the same authors reported that the genus *Atlanta* accounted for 33% of the heteropod genera. Hernández (*pers. comm*.) said that most of those specimens were *A. peroni*.

Although the atlantids collected in the present study are new records from the Selvagens Islands, it is reasonable to expect that most, if not all, of them would be present in the nearby waters of the Canary Islands, located about 90 nmi to the south. In this case, later analyses of material of the collections of the TFMC, proceeding from previous, unexamined samples might add more species of *Atlanta* to the planktonic fauna from the Canaries (Lozano et al., 2003b), e.g., *A. gaudichaudi*, *A. meteori*, and the newly described *A. selvagensis*.

At El Hierro, La Gomera and Selvagens islands, the percentage of the genus *Carinaria* was low (Fig. 2). In the present study, only one specimen of *Carinaria challengeri* was collected. The low abundance of this species (2.08%) indicates that carinariids are even scantier in these samples from Selvagens Islands, compared with the 10% abundance of *Carinaria lamarcki* at La Gomera and El Hierro. In Canary Island waters there are no records of *C. challengeri*. However, records of *C. lamarcki* from the Canaries are reported in the literature (Hernández & Jiménez 1996; Lozano et. al., 2003). However, because *C. challengeri* was given as a subspecific form of *C. lamarcki* (as *C. lamarcki* forma *challengeri*) by van der Spoel (1976), the above authors possibly combined the two

"formae" (the second being *C. lamarcki* forma *lamarcki*) together as *C. lamarcki* (Hernández, *pers. comm.*).

Among the species in the family Pterotracheidae, only *Pterotrachea coronata* was recorded in the present study. In Canary Island waters, this species has not been recorded until recently (Lozano *et. al*., 2003a). From El Hierro Island waters the only species of *Pterotrachea* found by Hernández and Jiménez (1992) was *P. hippocampus*. Furthermore, among several dozen specimens of *Pterotrachea* collected during the "*Spirula*" and "*Bautismal*" cruises carried out in Canary Island waters, the predominant species was *P. hippocampus* (Landeira, *per. comm.*). This apparent difference in the distribution of these two species in two nearby archipelagos is most likely due to several factors; e.g., the use of small plankton nets to collect large mobile animals, insufficient sampling, and possibly seasonal differences (the present samples were collected in September, while those from the Canaries were taken in May). The identity of the specimen as *P. coronata* is based on the rectangular eye shape (in dorsal view) and the narrow, elongate visceral nucleus (Seapy, 1985).



ISLANDS	*Atlanta*	*Carinaria*	*Pterotrachea*	*Firoloida*
El Hierro	70%	10%	20%	0%
La Gomera	33%	0%	0%	67%
Selvagens	85%	2%	2%	4%

Fig. 2. Abundance (in percentage) of genera from the total of Heteropoda analyzed by Hernandez & Jimenez (1992; 1996) in El Hierro and La Gomera Islands, respectively, compared with the results of the present study in the Selvagens Islands. The total percentage of this latter is not from 100% because the abundance of *Protatlanta souleyeti* was not included.

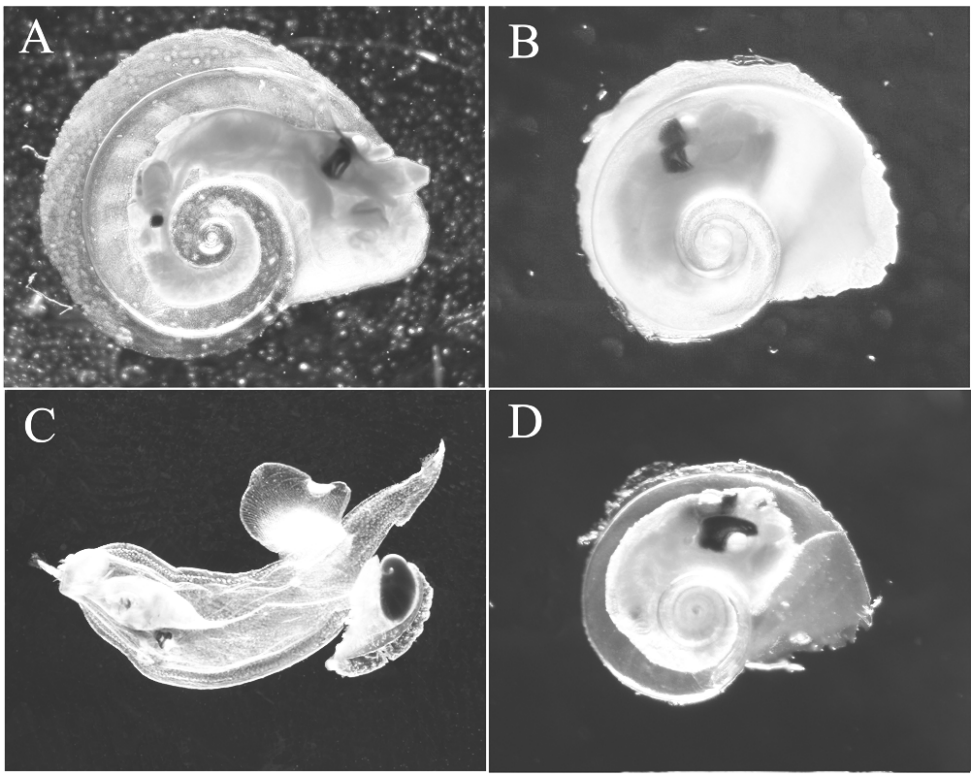


Fig. 3. **A**: *Atlanta peroni*; **B**: *Atlanta gaudichaudi*; **C**: Ventral view of *Carinaria challengeri*; **D**: *Atlanta helicinoides*.

Firoloida desmaresti reached relatively low abundance (4.17 %) and a density of 0.25 per 1,000 m^3. These results can be compared with those from two other localities. In La Gomera Island waters, Hernández & Jiménez (1996) reported that the abundance and density of *F. desmaresti* were high (67% and 0.5 per 100 m^3). However, in El Hierro Island waters, Hernández and Jiménez (1992) did not find *F. desmaresti*. The variability of these abundance and density differences appear to be supported by previous research. This species is usually not present in high concentrations in the Atlantic Ocean, although local populations can be large and can be comparable to the numbers of some of the abundant species of atlantids (Richter & Seapy, 1999).

Besides the identification of a previously undescribed species of *Atlanta* (*A. selvagensis*), the most surprising finding of this study was the identification of a single specimen as *Atlanta meteori*. This represents the first record for this species from the Atlantic Ocean; it was previously collected only from the Indian and Pacific Oceans. Richter (1972) described the species from specimens collected in the Indian Ocean. Seapy (1990) recorded *A. meteori* as moderately common in Hawaiian waters of the North Pacific. In his review of the *A. inclinata* species group, Richter (1990**)** described its distribution as "Indo-Pacific?"; thus indicating that in his opinion it could also occur in the Atlantic

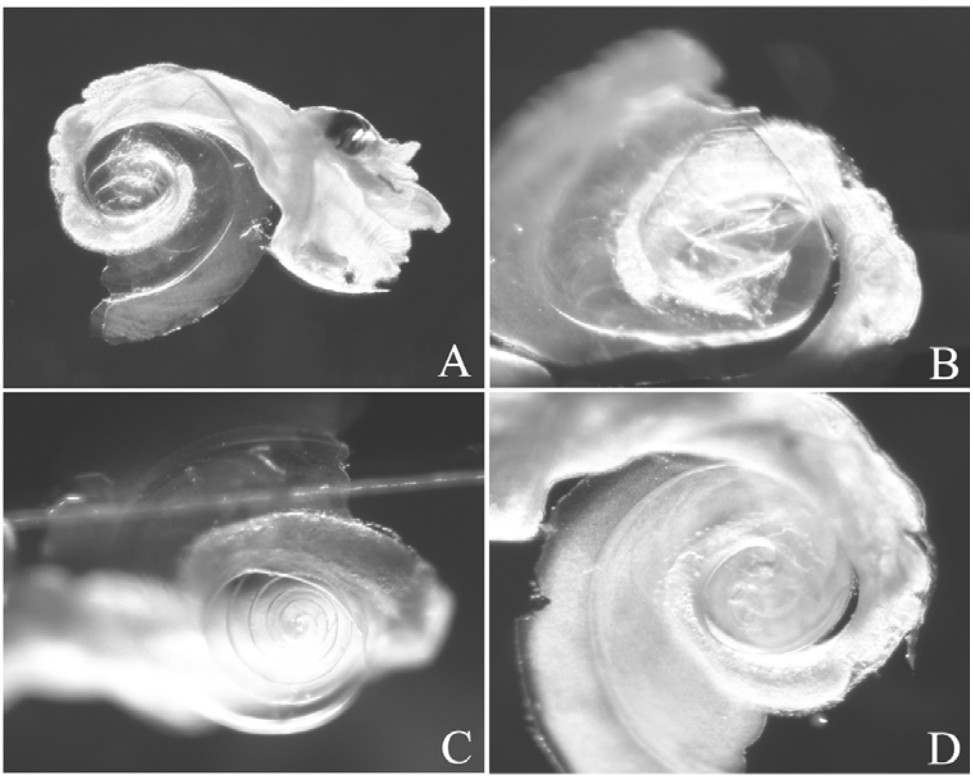


Fig. 4. *Atlanta meteori*. **A**: Complete specimen; **B**: Spire side view; **C**: Spire apical view; **D**: Umbiculus view.

Ocean**,** with the result that its distribution would be circumglobal in tropical to subtropical waters. As a result of this record**,** *Atlanta meteori* becomes the eleventh cosmopolitan species of *Atlanta*, in addition to *A. fusca*, *A. gaudichaudi*, *A. helicinoides*, *A. inclinata*, *A. inflata*, *A. lesueuri*, *A. oligogyra*, *A. peroni*, *A. rosea*, and *A. tokiokai*. Though the specimen captured presents slight fractures in the shell base and last whorl, the spire is completely intact, as well as the soft parts of the animal. The clear and glass-like shell, number of spire whorls (5-3/4), morphology of the eye (type b) and operculum (type b), strongly inclined spire, and lack of spire sculpture clearly align this specimen to the *Atlanta gibbosa* species group (Richter and Seapy, 1999). That the specimen is *A. meteori* and not *A. gibbosa* is shown by the narrowly conical spire (forming an apical angle of 70º) with nearly flat sides, shallow spire sutures that give the spire the appearance of a nearly smooth surface, and the narrow umbiculus (for further details, see Richter, 1990; Seapy, 1990; Richter and Seapy, 1999).

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