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Brachiopods collected from Madeira, off Selvagem Grande Island, (NE Atlantic Ocean) by remotely operated vehicle "Luso" during the year 2010

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With 1 figure and 3 plates

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ABSTRACT: Brachiopods collected from the Selvagens Islands are important elements of the biodiversity developed in this well delimited portion of the eastern Atlantic. Species from deep water are not easily accessible and the use of a remotely operated vehicle was an exceptional opportunity for investigating the brachiopod fauna of the mid-part of the slope in the Madeira Archipelago. Among the material collected (6 species), the terebratulid *Acrobelesia cooperi* (D' Hondt, 1976) is recorded for the first time from the Selvagens.

Keywords: Brachiopoda, Salvage Islands (Selvagens), Madeira Archipelago, bathyal zone.

RESUMO: Os Braquiópodes colhidos nas Ilhas Selvagens são componentes importantes da biodiversidade que caracteriza esta parte bem delimitada do oceano Atlântico oriental. As espécies profundas raramente são colhidas e a utilização de um veículo operado remotamente foi uma oportunidade excepcional para observar os braquiópodes do andar batial da região da Madeira. Das 6 espécies colhidas, o terebratulídeo *Acrobelesia cooperi* (D' Hondt, 1976) é assinalado pela primeira vez para as Selvagens.

Palavras-chave: Brachiopoda, Selvagens, arquipélago da Madeira, batial.

INTRODUCTION

Few brachiopods from the area of Madeira were collected in the 19th century firstly by the expedition of the “Challenger” (DAVIDSON, 1880) and then by the research cruises of the “Talisman” and the “Travailleur” during the years 1880-1883. The brachiopods collected by these last vessels have been studied by FISCHER & OEHLERT (1891). The Madeira Archipelago has also been investigated by the mission of the French ship “Jean Charcot” in 1966 (see LOGAN, 1983). However the Salvage Islands (Selvagens) were never specifically visited by these expeditions. The most recent explorations in this area were the CANCAP-I (1976) and the CANCAP-III (1978) expeditions. Brachiopods collected from these cruises were more diversified and were studied extensively by LOGAN (1983). During these missions, the Salvage Islands were visited in nine collecting stations (see LOGAN, 1983, fig. 3, p. 167) and only four brachiopod species were discovered: *Eucalthis tuberata* (Jeffreys, 1878), *Megathiris detruncata* (Gmelin, 1791), *Leptothyrella incerta* (Davidson, 1880) and *Pajaudina atlantica* Logan, 1988.

The Portuguese mission (EMEPC/M@rBis/Selvagens 2010) with the remotely operated vehicle (ROV) “LUSO” was thus a very useful occasion to investigate once again this quite isolated and rarely visited archipelago.

MATERIAL AND METHODS

Sediment samples were collected during the 2010 oceanographic campaign EMEPC/M@rBis/Selvagens2010 of the Portuguese Task Group for the Extension of the Continental Shelf (EMEPC) to the Selvagens Islands, Madeira Archipelago (Portugal) (Fig. 1), using the suction sampler of the ROV “LUSO”, on board the research vessel N. R. P. “Almirante Gago Coutinho”. All samples are from deep water around Selvagem Grande and were collected on 23 June 2010. Sediments from six stations were sieved in order to obtain the specimens mentioned in the present account.

Specimens are deposited in the collections of the Museu Nacional de História Natural e da Ciência (muhnac), Lisbon, Portugal.

RESULTS

Phylum Brachiopoda Duméril, 1806
 Subphylum Craniiformea Popov *et al.*, 1993
 Class Craniata Williams *et al.*, 1996
 Order Craniida Waagen, 1885

Superfamily Cranioidea Menke, 1828
 Family Craniidae Menke, 1828
 Genus *Novocrania* Lee & Brunton, 2001

Novocrania anomala (Müller, 1776)

Material examined: M@rBis_002601 – One fragment of dorsal valve, Station L10 D06S4, 23 June 2010, 30° 06' 36.100 N / 15° 54' 98.032 W, depth: 669 m. This quite common species in shallow water is represented here only by a fragment, which could be transported material.

Subphylum Rhynchonelliformea Williams *et al.*, 1996
 Class Rhynchonellata Williams *et al.*, 1996
 Order Thecideida Elliott, 1958
 Superfamily Thecideoidea Gray, 1840
 Family Thecideidae Gray, 1840
 Subfamily Lacazellinae Backhaus, 1959
 Genus *Pajaudina* Logan, 1988

Pajaudina atlantica Logan, 1988

Material examined: M@rBis_002596 – One strongly abraded specimen, Station L10 D06 S1. 23 June 2010, 30° 06' 25.707 N / 15° 55' 00.864 W, depth: 700.39 m.

Remarks: Only one specimen has been found and it is strongly worn due to a quite long transport producing erosion of the shell. Bio-erosion (bacterial) is also observed. The brachidium and the hemispondylium are preserved allowing the determination.

Order Terebratulida Waagen, 1883
 Suborder Terebratulidina Waagen, 1883
 Superfamily Terebratuloidea Gray, 1840
 Family Terebratulidae Gray, 1840
 Subfamily Aenigmathyridinae Cooper, 1983
 Genus *Acrobelesia* Cooper, 1983

Acrobelesia cooperi (D' Hondt, 1976)
 (Plate 1, Figs. 1a-d)

Material examined: M@rBis_002592 – Two fragments of ventral valves, Station L10 D06 B4A4, 23 June 2010, 30° 06' 25.516 N / 15° 55' 08.51 W, depth: 652.92 m; M@rBis_002603 – Two specimens, Station L10 D06 S1, 23 June 2010, 30° 06' 25.707 N / 15° 55' 00.864 W, depth: 700.39 m; M@rBis_002598 – Four fragments of ventral valve, Station L10 D06S2, 23 June 2010, 30° 06' 25.306 N / 15° 55' 00.636 W, depth: 700.39 m; M@rBis_002605 – Three fragments of ventral valve, 1 abraded dorsal valve, Station L10 D06S4, 23

June 2010, 30° 06' 36.100 N / 15° 54' 98.032 W, depth: 669 m.

Remarks: Shell equibiconvex, subpentagonal in dorsal outline with a relatively truncate anterior commissure. Lateral commissure straight and anterior commissure rectimarginate. External surface of the shell with numerous, step-like, regular growth lines. Radial short capillae are visible at high magnification.

Beak pointed, triangular in dorsal view, suberect with discrete pustulose ornamentation on its lateral parts. Foramen large, subcircular, submesothyrid with disjunct deltidial plates. Pedicle collar narrow and excavate. Inner socket ridges strong. Outer hinge plates small, concave dorsally. Inner hinge plates absent. Cardinal process very small. Crura relatively thick and straight. Crural processes blunt. Brachidium with very short dyscoliid loop. Descending branches narrow and very small transverse band directed dorsally with small anterior point.

One specimen was drilled probably by a naticid mollusk. Most specimens are fragments of ventral valves.

Superfamily Cancellothyridoidea Thomson, 1926

Family Chlidonophoridae Muir-Wood, 1959

Subfamily Eucalathinae Muir-Wood, 1965

Genre *Eucalathis* Fischer & Oehlert, 1890

Eucalathis tuberata (Jeffreys, 1878)

(Plate 2, Figs. 1a-f)

Material examined: M@rBis_002602 – Two specimens. Station L10 D06 S1. 23 June 2010, 30° 06' 25.707 N / 15° 55' 00.864 W, depth: 700.39 m; M@rBis_002599 – One specimen, Station L10 D06S2. 23 June 2010, (30° 06' 25.306 N / 15° 55' 00.636 W, depth: 700.39 m.

Remarks: Shell ventribiconvex, subtriangular in outline, clearly auriculate in outline. Lateral commissure straight. Anterior commissure nearly rectimarginate. Shell surface of both valves costate with strong tubercles. Beak short, suberect. Foramen hypothyrud with wide triangular disjunct deltidial plates. Pedicle collar developed.

Inner socket ridges narrow with thick crural bases directly developed from them. Free crural processes long and pointed. Loop chlidonophorid with small transverse band dorsally directed (broken in the specimen collected here). One specimen is drilled by a naticid mollusk.

Suborder Terebratellidina Muir-Wood, 1955

Superfamily Platidioidea Thomson, 1927

Family Platidiidae Thomson, 1927

Subfamily Phaneroporinae Zezina, 1981

Genus *Leptothyrella* Muir-Wood, 1965

Leptothyrella incerta (Davidson, 1880)

(Plate 3, Figs. 1a-d, 2a-c)

Material examined: M@rBis_002607 – Four articulated specimens) and one ventral valve, Station L10 D06 B1A10 23 June 2010, 30° 06' 25.516 N / 15° 55' 08.51 W, depth: 600.39 m; M@rBis_002597 – Nine specimens, Station L10 D06 S1, 23 June 2010, 30° 06' 25.707 N / 15° 55' 00.864 W, depth: 700.39 m; M@rBis_002600 – Four specimens, Station L10 D06S2, 23 June 2010, 30° 06' 25.306 N / 15° 55' 00.636 W, depth: 700.39 m; M@rBis_002604 – Five specimens (1 collected living, attached to the substrate), Station L10 D06 S3, 23 June 2010, 30° 06' 27.166 N / 15° 55' 00.267 W, depth: 695 m; M@rBis_002591 – Six specimens, Station L10 D06S4, 23 June 2010, 30° 06' 36.100 N / 15° 54' 98.032 W, depth: 669 m.

Remarks: Shell droplike in outline with pointed triangular beak devoid of tubercles on its lateral parts. Lateral commissure straight. Anterior commissure rectimarginate. The slightly ventribiconvex shell is quite thin, smooth except for several distinct growth lines. Beak suberect with hypothyrud triangular foramen limited by long, narrow, triangular, disjunct deltidial plates. Pedicle collar short. Small dental plates present. Cardinal process and hinge plates absent. Long crura with short and blunt crural processes. Developed narrow descending branches fused with a narrow, high, septal pillar.

Most specimens collected are empty shells, which are often drilled by muricid mollusks.

Superfamily Kraussinoidea Dall, 1870

Family Kraussinidae Dall, 1870

Subfamily Megerliinae Hiller, MacKinnon & Nkielsen, 2008

Genre *Megerlia* King, 1850

Megerlia cf. echinata (Fischer & Oehlert, 1890)

Material examined: M@rBis_002606 – One juvenile with loop, Station L10 D06 B1A10. 23 June 2010, 30° 06' 25.516 N / 15° 55' 08.51 W, depth: 600.39 m; M@rBis_002593 – One eroded dorsal valve, Station L10 D06 B4A4, 23 June 2010, 30° 06' 25.516 N / 15° 55' 08.51 W, depth: 652.92 m; M@rBis_002594 – Two juveniles, Station L10 D06S4, 23 June 2010, 30° 06' 36.100 N / 15° 54' 98.032 W, depth: 669 m.

Remarks: The material collected is quite scarce and does not allow a more precise identification. The specimens are early juveniles (except one abraded adult dorsal valve) and they have a smooth dorsal valve and a very spiny ventral valve. The spines are distributed on the whole surface of the shell, a character visible on the type specimen of FISCHER & OEHLERT (1890). A smooth adult eroded dorsal valve show a smooth surface with lamellose growth lines.

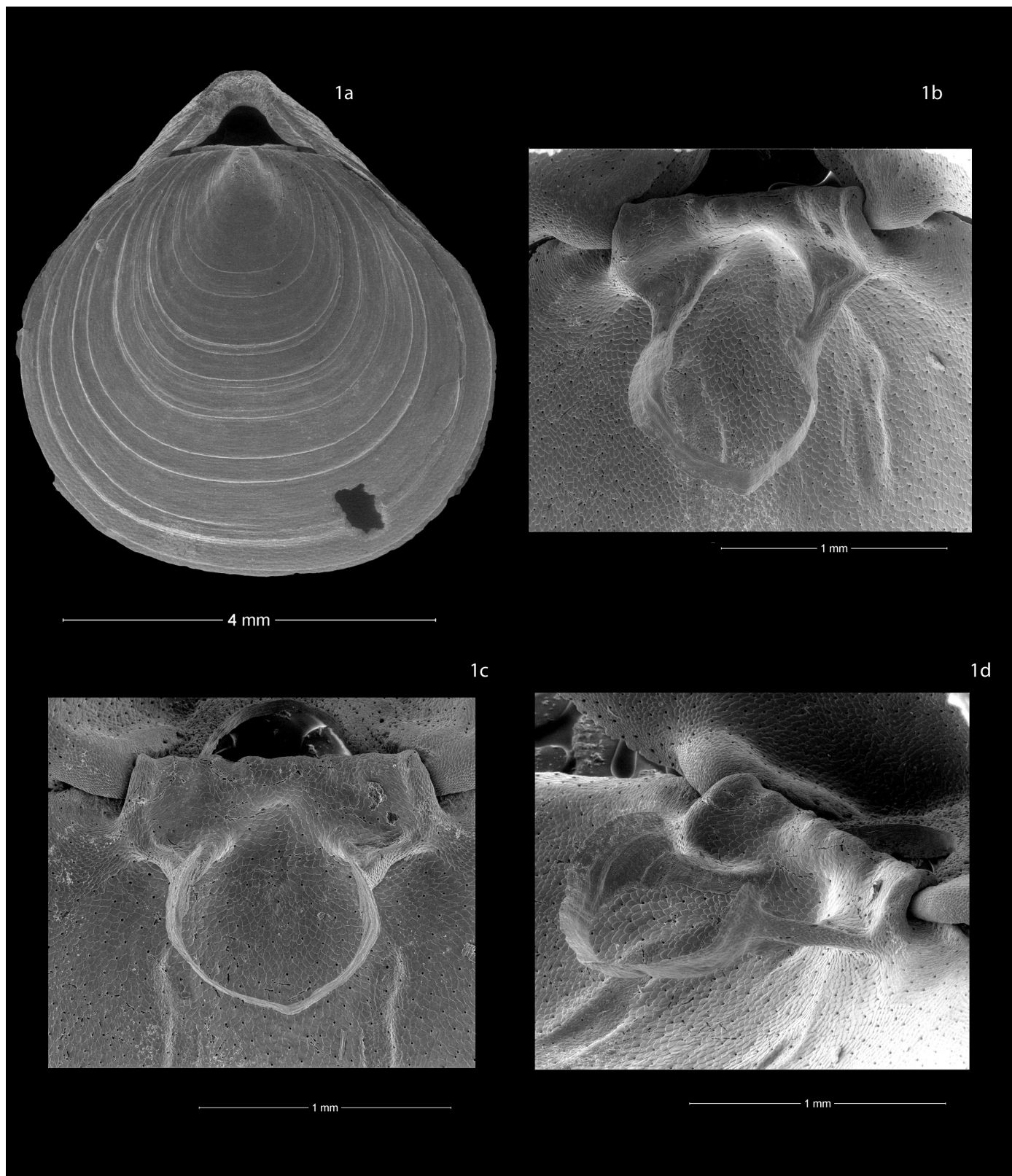


Plate 1 – *Acrobelesia cooperi* (D' Hondt, 1976), a rarely observed terebratulid brachiopod typical from the deep water fauna of Madeira. Collected by the Remotely Operated Vehicle "Luso" near Selvagens Islands: Station L10D06S1_5. 30° 06' 25.707 N / 15° 55' 00.864 W; depth: 700.39 m. 23 June 2010. Specimen with damaged ventral valve, but complete preserved brachidium. [M@rBis_002603].

Fig. 1a – Specimen in dorsal view showing the triangular beak with rounded tip, the wide disjunct deltidial plates, the short pedicle collar and the numerous step-like growth lines on the shell surface.

Fig. 1b – Complete characteristic dyscoliid brachidium in ventral view. Note the blunt crural processes and the poor development of the cardinal process.

Fig. 1c – Brachidium observed in anterior view showing the extremely short transverse band. The internal view of pedicle collar in the ventral valve is clearly visible.

Fig. 1d – Brachidium in oblique lateral view. The straight crura relatively thick are visible with their blunt crural process.

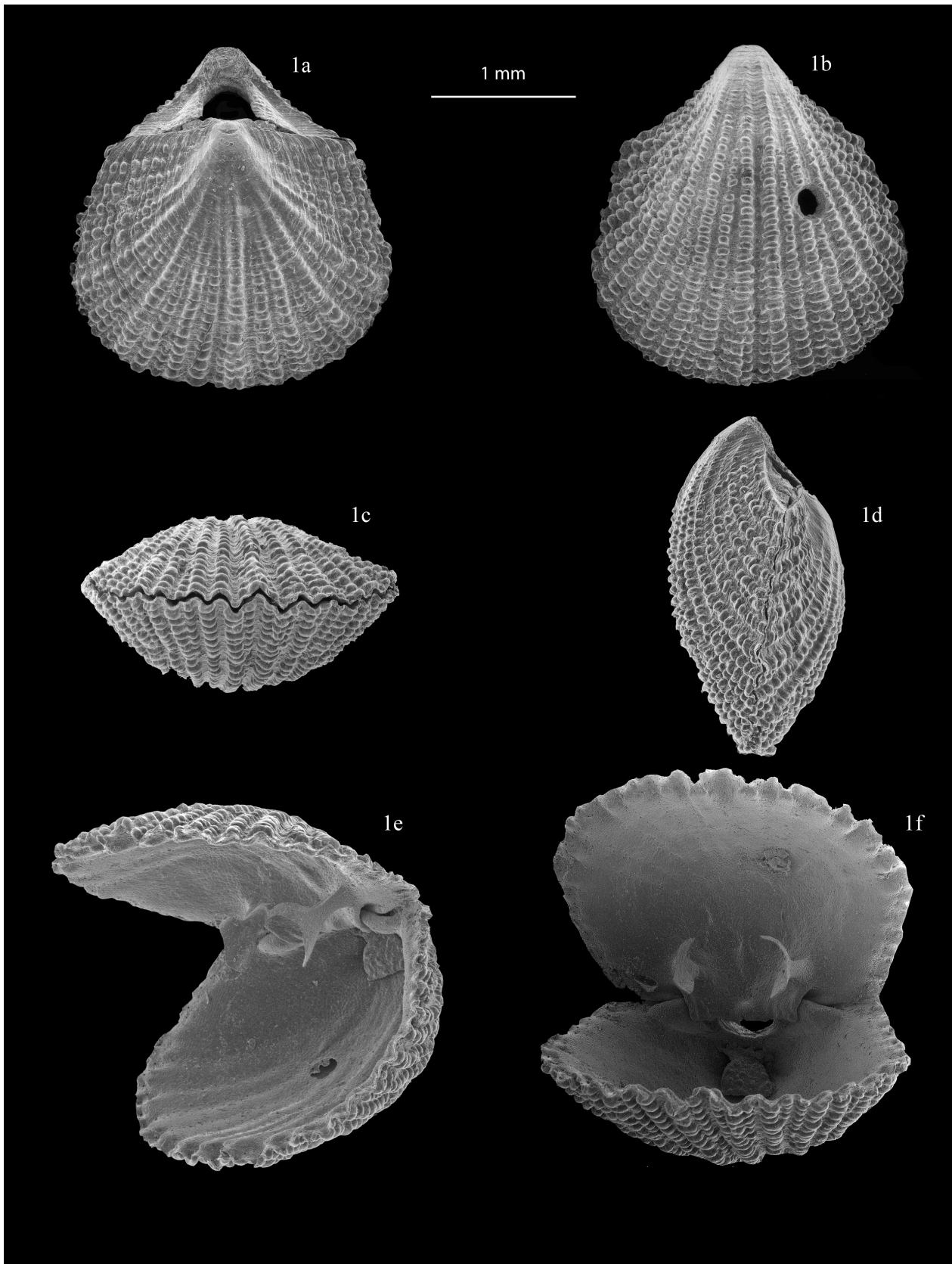


Plate 2 – *Eucalathis tuberala* (Jeffreys, 1878). A deep water Cancellothyridoid brachiopod collected by the Remotely Operated Vehicle “Luso” off Selvagens Islands. Station L10D06 51_4. 23 June 2010. 30° 06′ 25.707 N / 15° 55′ 00.864 W; depth: 700.39 m. (M@rBis_002602).

Fig. 1a – Dorsal view.

Fig. 1b – Ventral view.

Fig. 1c – Anterior view.

Fig. 1d – Lateral view.

Fig. 1e – Opened shell with enlarged lateral view of the brachidium.

Fig. 1f – Opened shell with enlarged anterior of the brachidium (transverse band broken).

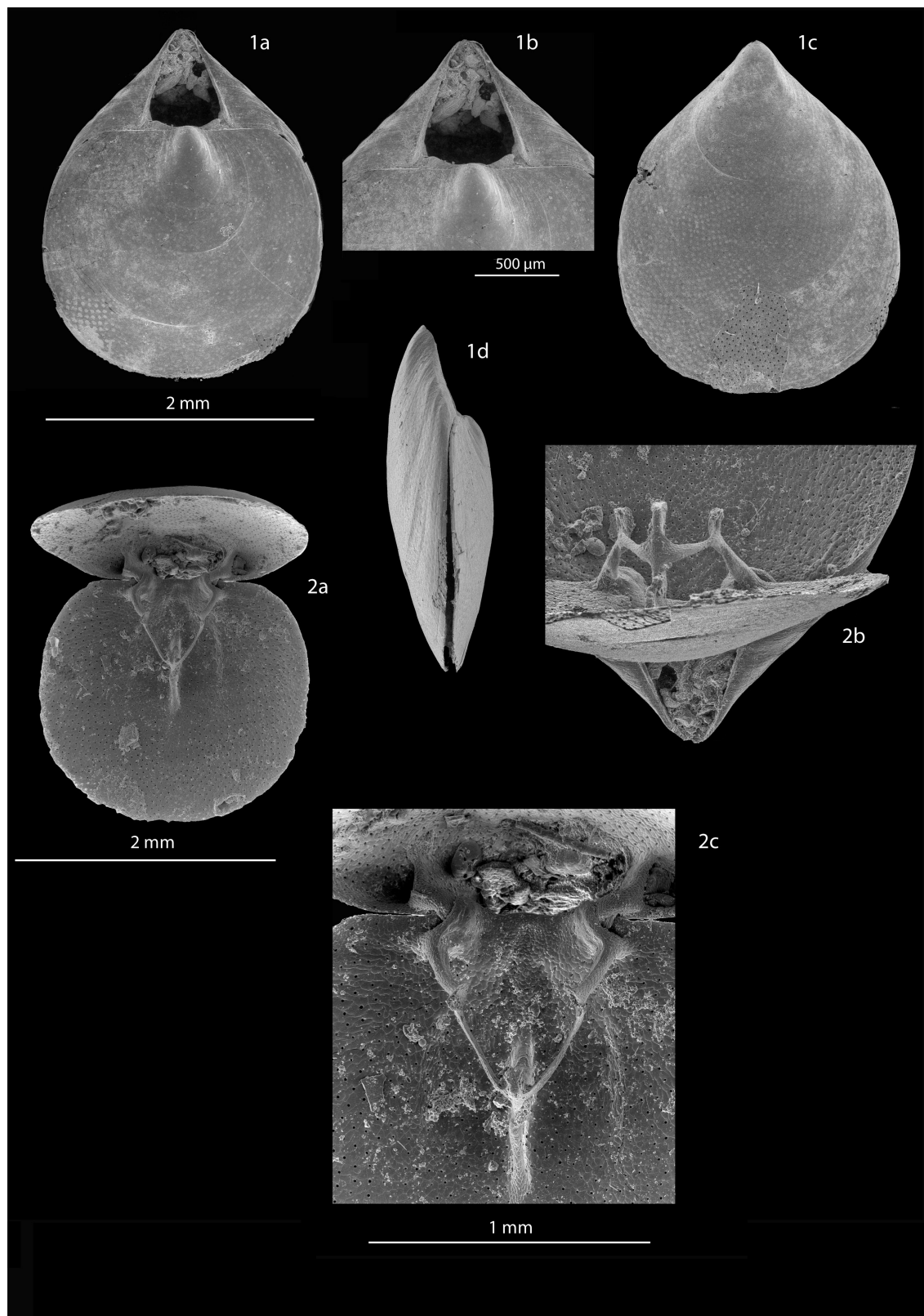


Plate 3 – *Leptothyrella incerta* (Davidson, 1880). Collected by the Remotely Operated Vehicle “Luso” off Selvagens Islands, Station L10D06B1A10_2. 23 June 2010. 30° 06′ 25.516 N / 15° 55′ 08.51 W; depth: 600.39 m. (M@rBis_002607).

Fig. 1a – Dorsal view.

Fig. 1b – Detailed of the beak and foramen in dorsal view.

Fig. 1c – Ventral view.

Fig. 1d – Lateral view.

Fig. 2 – Opened shell with complete brachidium.

Fig. 2a – Dorsal view.

Fig. 2b – Oblique anterior view (scale bar as in Fig. 2c).

Fig. 2c – Detailed dorsal view.

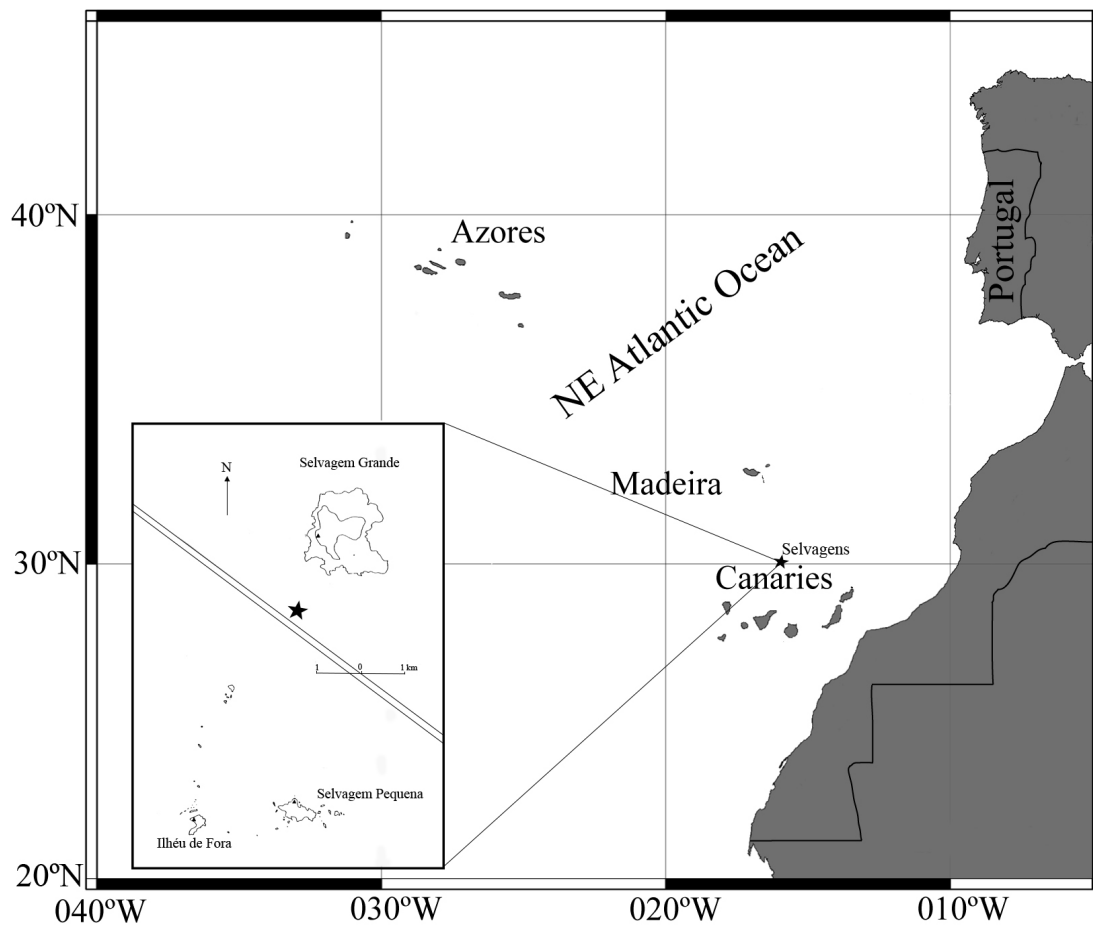


Fig. 1 – The Selvagens Islands in the NE Atlantic Ocean where the specimens were collected in 2010.

DISCUSSION

The material studied does not include new species of brachiopods. However *Acrobelesia cooperi* is found for the first time in the Madeira Archipelago. This species was already observed in the Canary Islands during the CANCEP-II expedition (1977). *Eucalathis tuberata* and *Leptothyrella incerta* are already known from Canary Islands and from Madeira since the CANCEP II (1977) and CANCEP III (1978) expeditions (see LOGAN, 1983).

All these brachiopods are characteristic of deep water environment in Northeastern Atlantic waters. According to LOGAN (2007), *A. cooperi* has a depth range from 330 to 1000 m, *E. tuberata* from 330 to 2995 m and *L. incerta* from 335 to 5300 m. *Megerlia echinata* (*sensu stricto*) should be considered as a deep water species too (400–1970 m), but a revision of the *Megerlia* species is needed for clearing the real status of *M. echinata*. The Atlantic *M. echinata* described by ATKINS (1961) should be precisely compared with the type material collected in the Western

Sahara, off Cape Boujdour (named before “Cape Bojador”) and a phylogenetic study is also needed (see also ÁLVAREZ *et al.*, 2016).

Pajaudina atlantica is not a deep-water species (LOGAN, 2007). This genus and species were erected by LOGAN (1988) for material collected in the Canary Islands. Dead shells from the Salvagem islands, collected during the CANCEP-III expedition (1978; 350–400 m) and previously identified as *Lacazella mediterranea* by LOGAN (1983) are in fact representatives of *Pajaudina atlantica*. This indicates that the fauna of the Salvagem Islands is more in interaction with the Canarian Archipelago fauna than those of the Madeira area.

Collected living specimens are infrequent. Only some specimens of *L. incerta* were living when collected. The percentage of dead brachiopod specimens drilled by mollusk predators is very high reaching 50% for instance among the specimens of *L. incerta*. This indicates that the

level of competition between mollusks and brachiopods could be severe in a deep water situation. It is not commonly observed that brachiopods, which often have a heavily spiculated body, are so appreciated as prey by naticids or muricids.

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