

New record of *Novocrania* (Brachiopoda, Craniida) from Madeira, with notes on Recent brachiopod occurrences in the Macaronesian archipelagos

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The inarticulated brachiopod *Novocrania anomala* (Müller) is recorded for the first time from Madeira Island, bringing the total of living species for that area to six. Updated comparisons of Recent brachiopod diversities between the Macaronesian archipelagos show similar values for Madeira, the Cape Verde Islands and the Azores but higher values for the Canary Islands. Comparisons are also made between shallow-water cave and crevice communities in Madeira, the Canary Islands and the Cape Verde Islands, where dense populations of one or two brachiopod species are thriving in cryptic habitats where competition for space and resources is presumably reduced. No such occurrences have yet been found in the Azores.

Key words: brachiopods, cryptic habitats, Macaronesia, seamounts, check-list

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INTRODUCTION

Logan (1993) summarized the state of knowledge of the diversity, biogeographic affinities, bathymetric range and life habits of Recent brachiopods from the south-east North Atlantic region (Madeira, Canary-Salvage Islands, Cape Verde Islands, and off the mainland of north-west Africa). The study was based on identifications made by previous investigators, plus specimens identified by Logan (1983, 1988, 1993) from 194 stations from the CANCAP I-VII expeditions between 1976-86. Since then further collections of brachiopods have been identified, mainly by Logan (1998) from 48 stations from seven seamounts to the west of Madeira and south of the Azores (SEAMOUNT 2), by Gaspard (2003)

from 52 stations from six seamounts to the north-east of Madeira (SEAMOUNT 1) and by Zezina (2006) from other localities, allowing an up-to-date checklist to be compiled for the whole region (Table 1). In addition, information is here provided on abnormally high densities of one or two species of brachiopods from shallow-water cryptic habitats, such as lava caves, in Madeira, the Canary Islands (El Hierro and La Palma) and Cape Verde Islands (Sal and Santiago).

MATERIAL AND METHODS

Collections made from Madeira by Swinnen and Wirtz and from the Canary Islands (El Hierro and La Palma) and Cape Verde Islands (Sal and Santiago) by Wirtz were saved as dry specimens

or preserved in alcohol. During SCUBA dives to these areas Wirtz also collected and photographed brachiopods and associated biota in the field, then sent specimens and images to Logan for identification and scanning electron microscopy.

RESULTS

NEW RECORD

Two well-preserved dorsal valves of the inarticulated brachiopod *Novocrania anomala* (Müller) were collected by Swinnen from off Cais do Lazareto, near the port of Funchal, Madeira Island from depths of 150 m and 382 m (exact details on request to Swinnen). This species is known from Sagres (Portugal), Atlantis Seamount (SEAMOUNT 2) and the Firth of Lorne (Scotland), as well as in the Mediterranean sea, while its congener *N. turbinata* (Poli) is known from the Cape Verde Islands and north-west Africa, as well as several localities mainly in the southern and eastern part of the Mediterranean (Logan & Long 2001). These authors described and illustrated the major differences between the two species, which mainly involve dorsal valve

brachial protractor and brachial retractor muscle scars from the more typical *N. anomala* from Atlantis Seamount (Fig. 1B) and from the muscle pattern in *N. turbinata* from the Cape Verde Islands (Fig. 1C). In the south-eastern North Atlantic the two species seem to be separated geographically by a line drawn from the Cape Verde Islands to the entrance to the Mediterranean, with *N. turbinata* the dominant species south of that line, as well as in the southern and eastern Mediterranean (Logan & Long 2001).

The species *Pelagodiscus atlanticus*, *Leptothyrella* (formerly *Phaneropora*) *incerta*, and *Megathiris detruncata* were previously recorded in 1983 by Logan from CANCAP I and III expeditions to Madeira in 1976 and 1978, while *Argyrotheca cuneata* and *A. cordata* were identified by the same author in 1983 from single dead shells extracted from sand collected by RV *Jean Charcot* in 1966 (ZARCO expedition) from south-east of Porto Santo island at a depth of 60m. *P. atlanticus* is typically a deep-water species of the lower bathyal zone and was found at depths in excess of 2800m south of Porto Santo, while *L. incerta* is from the upper bathyal

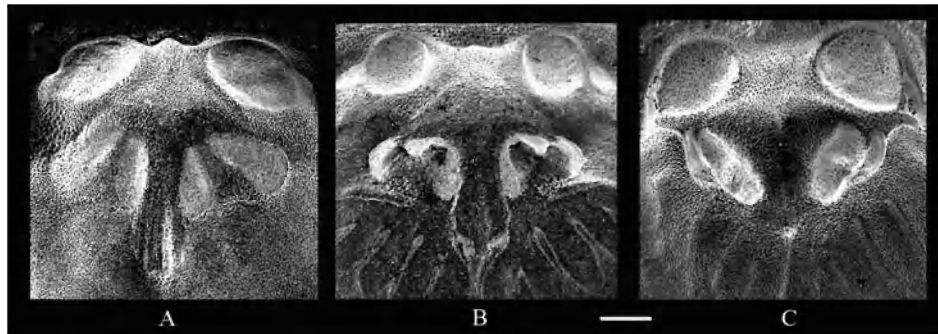


Fig. 1. The pattern of adductor, protractor and retractor muscle scars and median ridge in the dorsal valve of A. *Novocrania anomala* from Madeira Island, off Funchal, 150m; B. *N. anomala* from Atlantis Seamount, 280-345m. C. *N. turbinata* from Tarrafal, Santiago Island, Cape Verde Islands, 15 m. See Logan & Long (2001) for explanation of differences. Scale bar represents 2 mm.

skeletal internal features. These differences are illustrated in Fig. 1. The Madeira specimens, one of which is shown in Fig. 1A, are here assigned to *N. anomala* although they both differ in the shape and degree of separation of the anterior adductor,

zone at 740 m (Logan 1983). Shallow water localities in lava caves and tunnels around Madeira are dominated by *Megathiris detruncata*, easily identifiable by its triseptate dorsal valve (Logan 1979, 2005; Wirtz 1995).

MACARONESIAN BRACHIOPOD DIVERSITIES

Logan (1993) compared the total number of brachiopod species recorded from Madeira with those from the Canary-Salvage Islands, Cape Verde Islands, and north-west Africa. There have

been no taxonomic studies on brachiopods from the Azores since Fischer & Oehlert (1891) listed 3 species from deep waters around the islands from the *Talisman* expedition in 1883. However, Zezina (1985, 2000, 2006) has since identified

Table 1. List of definitively-identified Recent brachiopod species obtained from various localities in the Macaronesian islands region, latitudinal and longitudinal boundaries approximate (sources of information from Álvarez et al. 2005, Dall 1920, Fischer & Oehlert 1891, Gaspard 2003, Logan 1979, 1983, 1988, 1993, 1998, this report, Zezina 1985, 2000, 2006). **Stenosarina davidsoni* Logan, 1998 includes *S. sphenoides* identified by Logan (1988) and *S. crosnieri* identified by Gaspard (2003) in its synonymy.

Species/Locations	Azores	Madeira	Canary Islands	Cp. Verde Islands	SEAMOUNT 1 area	SEAMOUNT 2 area
	35-45° N 20-30° W	30-35° N 15-20° W	23-30°N 15-25°W	10-23°N 20-30°W	33-38°N 10-15°W	29-35°N 26-31°W
<i>Pelagodiscus atlanticus</i>		+			+	+
<i>Novocrania anomala</i>		+		+	+	+
<i>N. turbinata</i>				+		
<i>Cryptopora gnomon</i>	+					
<i>Hispanirhynchia cornea</i>			+			+
<i>Dyscolia wyvillei</i>	+					+
<i>Abyssothyris atlantica</i>						+
<i>Acrobelesia cooperi</i>			+			
<i>Stenosarina davidsoni</i> *	+		+	+	+	+
<i>Terebratulina retusa</i>			+	+		
<i>Eucalathis tuberata</i>	+		+		+	
<i>Eucalathis ergastica</i>	+		+		+	+
<i>Argyrotheca cistellula</i>	+				+	
<i>Argyrotheca cuneata</i>		+	+	+	+	
<i>Argyrotheca cordata</i>		+	+			
<i>Argyrotheca grandicostata</i>			+			
<i>Gwynia capsula</i>					+	
<i>Megathiris detruncata</i>		+	+	+	+	
<i>Platidia anomioides</i>	+				+	+
<i>Leptothyrella incerta</i>	+	+	+	+	+	+
<i>Megerlia truncata</i>			+			
<i>Megerlia echinata</i>					+	
<i>Kraussina mercatorii</i>				+		
<i>Dallina septigera</i>	+		+		+	+
<i>Macandrevia cranium</i>			+		+	+
<i>Thecidellina williamsi</i>				+		
<i>Pajaudina atlantica</i>			+			
<i>Nanacalathis atlantica</i>						+
<i>Chlidonophora incerta</i>	+					+
Number of species 29	10	6	15	9	14	13

another 7 species collected by Russian research vessels, also from Azorean deep waters, to bring the total to 10. The number of brachiopod species recorded from all these localities, plus those from seamounts by Logan (1998), Gaspard (2003) and Zezina (2006) are shown in Table 1.

SHALLOW-WATER OCCURRENCES ON CRYPTIC SUBSTRATES

Shallow-water lava caves and crevices (cryptic substrates) around Madeira, the Canary Islands and the Cape Verde Islands support sessile invertebrate communities comprising mainly sponges, bryozoans, foraminiferans, annelids, tunicates, bivalves and azooxanthellate corals, as well as high densities of small brachiopods. As mentioned above, the dominant brachiopod in Madeira is the pediculate megathyrid *Megathiris detruncata* (Gmelin) figured by Wirtz (1995).

Logan (2005) demonstrated that there are significant increases in the width, thickness and width-thickness ratio between the Mediterranean (La Ciotat) and Atlantic (Sagres, Ponta da Oliveira on Madeira Island) occurrences that may represent a cline. Since then Wirtz has collected a small sample of this species from 16 m depth in Garajau Cave Madeira Island that shows specimens almost 40% wider than the widest from Ponta da Oliveira, which may reflect more favourable growth conditions at Garajau for this species.

Photographs of cryptic substrates and collections of specimens by Wirtz show that similar lava substrates in the Canary Islands of El Hierro and La Palma support the same kind of sessile invertebrate communities as in Madeira but here are colonized mainly by the cementing thecideide brachiopod *Pajaudina atlantica* Logan.

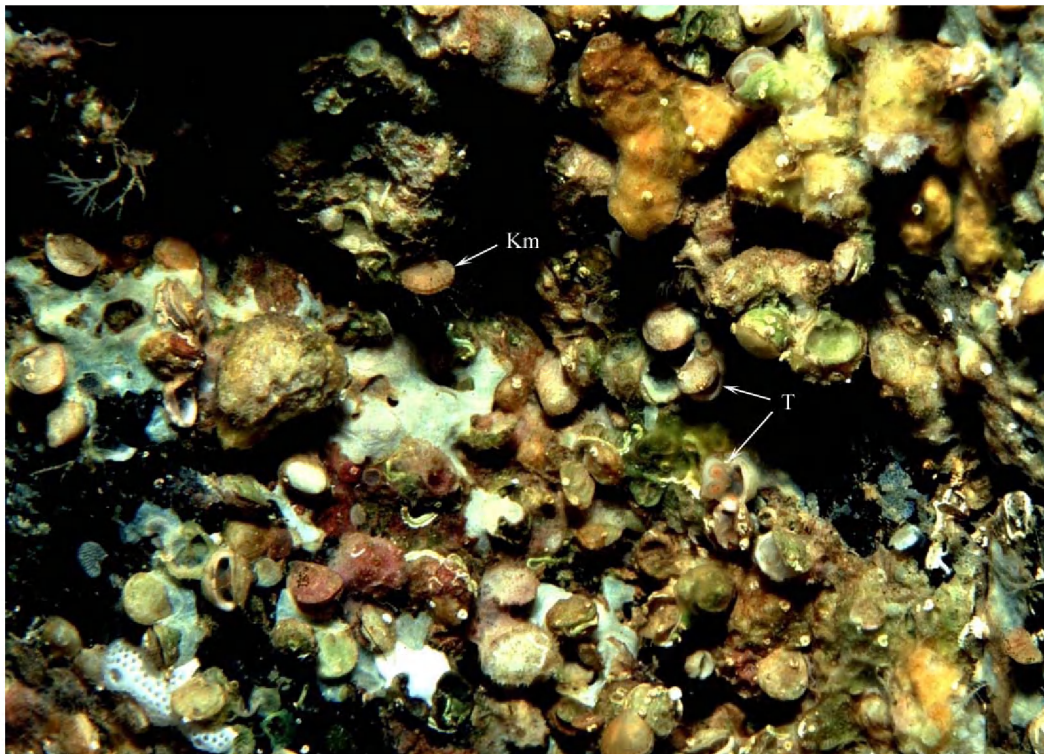


Fig. 2. Dense cluster of small brachiopods in cave at depth of 12 m, Tarrafal, Santiago Island, Cape Verde Islands (photo by P. Wirtz). Km=*Kraussina mercatorii*, T=*Thecidellina williamsi*. Thecidellinids are about 4 mm in width.

These can reach densities of around 5000/m² in some areas (Logan 2004). Álvarez et al. (2005) also show dense populations of *P. atlantica*, as well as rare argyrothecids, from shallow-water caves and ledges in El Hierro and Tenerife.

In the Cape Verde Islands, the cryptic community on the island of Sal includes large numbers of the pediculate kraussinid brachiopod *Kraussina mercator* Helmcke and the cementing craniid brachiopod *Novocrania turbinata* (Poli), while volcanic substrates on the nearby island of Santiago (particularly at Tarrafal at its northern end) and São Nicolau show, in addition to *K. mercator*, dense populations of the recently-described (Lüter et al. 2007) cementing thecideide *Thecidellina williamsi* (Fig. 2). Repeated dives by Wirtz in Azorean caves in Faial, Flores and Terceira down to 35 m depth on lava substrates similar to the other Macaronesian islands have failed to locate any brachiopods, for reasons not yet understood.

DISCUSSION

Updated records from those of Logan (1993) have resulted in a total of 29 species from 23 genera in the area of the south-east North Atlantic from the Azores to the Cape Verde Islands, making this area one of the most diverse for living brachiopods in the northern hemisphere. The disparity in species richness between the Canary Islands and the other archipelagos can perhaps be ascribed to reduced collecting activity in the deeper waters around the Madeira, Cape Verde and Azores islands, although 196 stations bottom-sampled during the CANCEP V expedition to the Azores in 1981 with HNLMS *Tydeman* yielded no brachiopods (Logan 1988).

Of particular interest is the common occurrence of dense populations of brachiopods from shallow cryptic habitats in Madeira, the Canary Islands and the Cape Verde Islands, each location being dominated by different species. The cryptic habitat is favoured by small brachiopods in many areas of the world (Jackson et al. 1971) and may act as a refuge for them against predation and intense competition for space and other resources.

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