

SHALLOW-WATER MOLLUSCS FROM THE FORMIGAS ISLETS,
AZORES, COLLECTED DURING THE 'SANTA MARIA E FORMIGAS
1990' SCIENTIFIC EXPEDITION

Sérgio P. Ávila & José M.N. Azevedo

Secção de Biologia Marinha, Departamento de Biologia, Universidade dos Açores
9502 Ponta Delgada, São Miguel, Açores, Portugal

INTRODUCTION

The Formigas islets are a group of rocks extended in a N-S direction, with about 165 m long by 80 m wide, located 36 km NE from Santa Maria island and 60 km SE from São Miguel island. The highest point, 'Formigão', reaches 11 m. These islets are part of the so called Formigas Bank, an area of shallow waters with roughly 7 km long by 3 km wide, which is located between parallels 37°14'N and 37°17'N, and the meridians 24°43'W and 24°47'W (Instituto Hidrográfico, 1981; Azevedo *et al.*, 1991) and constitutes a Natural Reserve (see Fig. 1).

According to Abdel-Monem *et al.* (1975), Formigas' basalt flows are 4 MY old. Although volcanic, irregular lenses of calcareous fossiliferous sediments, with a K-Ar age between 4-6 MY old, were found by Zbyszewski & Ferreira (1961).

Because of its location and difficult access, Formigas were only studied by a handful of scientists. The XVIth century Portuguese chronicler Gaspar Frutuoso reported the existence of 'búzios' which Azevedo (1991) has interpreted as possibly referring to *Littorina striata* King

& Broderick, 1832 or *Thais haemastoma* Linnaeus, 1758. In 1886, the Italian ship *Corsaro* visited the Formigas islets, the first scientific dredging being made then. The *Princess Alice* expedition in 1895 also stopped there, but no molluscan fauna was described (Azevedo *et al.*, 1991). In 1989, Gofas published the description of a new Rissoidae, *Alvania formicarum* Gofas, 1989, based on material collected by the French scientific mission 'Biaçores', in 1971.

From 3 to 9 of August, 1990, the Marine Biology team of the Department of Biology of the University of the Azores studied the Formigas islets, during the 'Santa Maria e Formigas 1990' scientific expedition. This paper provides the list of the shallow-water molluscs collected during this expedition.

METHODOLOGY

A total of 33 samples were collected (see Table 1), from the intertidal zone to a depth of 45 m. Single plants of *Cystoseira* sp., *Laurentia* sp., *Enteromorpha intestinalis* (k.) Link, *Sargassum* sp. and *Pterocladia capillacea* (S. G. Gmel.) Bornet et Thur were collected at intertidal level and after washed, the molluscs asso-

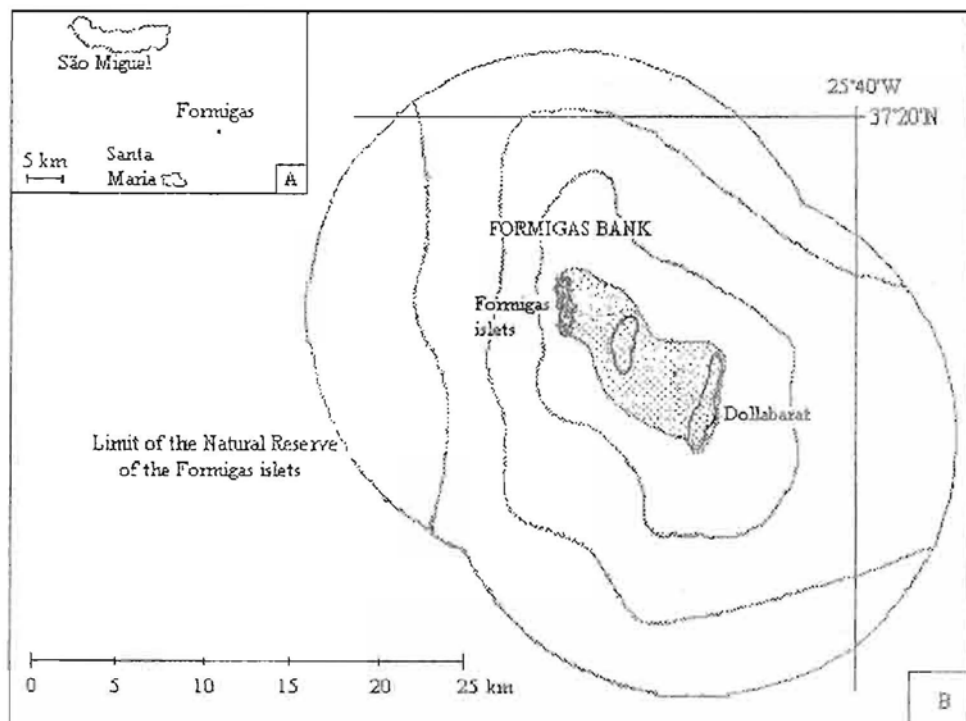


FIG. 1. Location of Formigas islets (A) and the delimitation of the Natural Reserve (B). (Adapted from Azevedo *et al.*, 1991).

ciated to these algae were collected. Qualitative samples were made at intertidal pools, by washing the sediment and boulders. A suction device was used at -15 m and -45 m on a mixed substrate of rock and sand. Some scrapings were performed at the intertidal level as well as subtidal. The molluscs were preserved in alcohol (70%) and were later sorted at the Marine Biology Laboratories of the University of the Azores. All the material is deposited at the Department of Biology of the University of the Azores (DBUA)

under the Reference Collection numbers DBUA328 and DBUA330 to DBUA366. The Polyplacophora, and most of the opisthobranchs are still being studied, so are not referred in this paper. The species determination and the arrangement of families follows Poppe & Goto (1991) for the Gastropoda and Poppe & Goto (1993) for the Bivalvia and Cephalopoda. Specialised works were used for the Littorinidae (Bacheljau & Warmoes, 1992), Triphoridae (Graham, 1988) with corrections extracted from CLEMAM,

TABLE I. Reference Collection number of the DBUA-Department of Biology of the University of the Azores and depth of each sample collected at the Formigas islets during the 'Santa Maria e Formigas 1990' scientific expedition.

intertidal	subtidal	unknown depth
333 (on <i>Cystoseira</i> sp.)	330 (-5 to -9m)	328
336 (intertidal pool)	332 (-6 to -8m)	334
337	335 (-35m)	347
340 (intertidal pool)	338 (-45m)	363
345 (intertidal pool)	341 (-26m)	
346 (on <i>Laurentia</i> sp.)	342 (-45m)	
348 (on <i>Enteromorpha intestinalis</i>)	343 (-6 to -8m)	
349 (on <i>Sargassum</i> sp.)	350 (-6 to -8m)	
351 (on <i>Pterocladia capillacea</i>)	353 (-15m)	
352 (on alga turf)	354 (on <i>Pinna rudis</i> , at -15m)	
356	355 (-15m)	
357	362 (-30m)	
359	364 (-45m)	
360 (intertidal pool)		
361		
366		

Turridae (Nordsieck, 1977) and Ellobiidae (Martins, 1996).

For each species, it is expressed the Reference Collection number of each station where the species is present.

SYSTEMATIC LIST

Phylum MOLLUSCA

Class GASTROPODA

Subclass PROSOBRANCHIA

Order ARCHAEOGASTROPODA

Superfamily PLEUROTOMARIACEA

Family Scissurellidae

Schismope fayalensis Dautzenberg,
1889

DBUA 332, 336, 338, 340, 343, 345,
346, 350, 353, 355.

Family Haliotidae

Haliotis tuberculata Linnaeus, 1758
DBUA 334, 340, 341, 345, 359, 360.

Superfamily PATELLACEA

Family Acmaeidae

Acmaea virginea (O.F. Müller, 1776)
DBUA 341.

Family Patellidae

Patella ulyssiponensis aspera Röding
(1798)
DBUA 359.

Superfamily COCCULINACEA

Family Cocculinidae

Cocculina corrugata Jeffreys, 1883
DBUA 342, 345, 350.

Superfamily TROCHACEA

Family Phasianellidae

Tricolia pullus azorica Dautzenberg,
1889

DBUA 341, 342, 349, 350, 352, 353,
354, 355, 356, 362.

Order MESOGASTROPODA
Superfamily LITTORINACEA

Family Littorinidae

Littorina saxatilis (Olivi, 1792)

DBUA 348.

Littorina striata (King, 1832)

DBUA 341, 345, 359, 361, 366.

Melavhapha neritoides (Linnaeus,
1758)

DBUA 346, 350.

Superfamily RISSOACEA

Family Omalogyridae

Ammonicera fischeriana
(Monterosato, 1869)

DBUA 340.

Omalogyra atomus (Philippi, 1841)

DBUA 336, 340, 343, 345, 350.

Family Caecidae

Caecum sp.

DBUA 355.

Family Rissoidae

Alvania sp.

DBUA 332, 335, 336, 338, 350, 355.

REMARKS: a new species, to be dealt with appropriately elsewhere.

Alvania angioyi van Aartsen, 1982

DBUA 335, 340, 343, 350, 352, 353, 355.

Alvania cancellata (da Costa, 1778)

DBUA 341, 350.

Alvania formicarum Gofas, 1989

DBUA 332, 335, 338, 340, 341, 342, 343,
345, 348, 350, 352, 353, 355, 359.

Alvania postrema Gofas, 1990

DBUA 340, 350, 351, 352, 353, 355, 359.

Alvania poucheti Dautzenberg, 1889

DBUA 350, 352, 353, 355.

Alvania sleursi (Amati, 1987)

DBUA 335, 340, 341, 342, 343, 350, 352,
353, 355.

Cingula trijasciata (Adams, 1800)

DBUA 352.

Manzonina unifasciata Dautzenberg,
1889

DBUA 332, 338, 340, 341, 346, 350,
352, 353, 355.

Setia subvaricosa Gojas, 1990

DBUA 332, 335, 336, 338, 343, 345,
350, 352, 355.

Superfamily CERITHIACEA

Family Cerithiidae

Bittium cf. *reticulatum* (da Costa,
1778)

DBUA 332, 333, 335, 336, 337, 338,
340, 341, 342, 343, 345, 346, 349, 350,
352, 353, 354, 355, 359.

Remarks: this species is very similar to *Bittium reticulatum* (da Costa, 1778) but it differs in the number of the costae on the whorls, which is consistently higher in the Formigas specimens. For instance, according to the description of *Bittium reticulatum* in Graham (1988), this species has between 12 to 20 costae on the last whorl, whilst in *Bittium* cf. *reticulatum* there are between 22 to 26 costae on the last whorl.

Superfamily HIPPONICACEA

Family Fossaridae

Fossarus ambiguus (Linnaeus, 1758)

DBUA 337, 340, 341, 343.

Superfamily TONNACEA

Family Ranellidae

Charonia lampas lampas (Linnaeus,
1758)

DBUA 330.

Cymatium parthenopeum (von Salis,
1793)

DBUA 330.

Family Bursidae

Bursa scrobilator (Linnaeus, 1758)
DBUA 330, 357, 359.

Order NEOGASTROPODA

Superfamily MURICACEA

Family Muricidae

Ocinebrina aciculata (Lamarck, 1822)
DBUA 332, 336, 338, 340, 342, 343, 347,
350, 352, 353, 355.

Family Thaididae

Thais haemastonza (Linnaeus, 1767)
DBUA 345, 353, 359.

Family Coralliophilidae

Coralliophila meyendorffi (Calcara,
1845)
DBUA 332, 345, 350.

Superfamily BUCCINACEA

Family Buccinidae

? *Colus* sp.
DBUA 340.

Family Columbellidae

Columbella adansoni Menke, 1853
DBUA 332, 343, 345, 347, 353, 354, 356,
359.

Family Nassariidae

Nassarius incrassatus (Strom, 1768)
DBUA 332, 353.

Superfamily VOLUTACEA

Family Marginellidae

Gibberula sp.
DBUA 338, 342, 362.
Volvarirza sp.
DBUA 342.

Family Mitridae

Mitra nigra (Gmelin, 1791)
DBUA 338, 341, 343, 347, 353, 356, 359.

Superfamily CONACEA

Family Turridae

Bela sp.
DBUA 338.
Lusitanops sp.
DBUA 343.

Mangelia sp.

DBUA 338.
Mitrolumna olivoidea (Cantraine,
1835)
DBUA 338, 340, 342, 343, 345, 350, 355.
Raphitoma sp.
DBUA 335, 338.

Raphitoma carnosula (Jeffreys,
1869)
DBUA 332, 335, 336, 338, 340, 341, 342,
343, 345, 346, 350, 351, 353, 354, 355.

Order HETEROGASTROPODA

Superfamily CERITHIOPSACEA

Family Cerithiopsidae

Cerithiopsis barleei Jeffreys, 1867
DBUA 343.

Superfamily TRIPHOKACEA

Family Triphoridae

Marshallora adversa (Montagu, 1803)
DBUA 338, 341.
Cheirodonta cf. *pallescens* (Jeffreys,
1867)
DBUA 338, 341.

Family Eulimidae

Eulima sp.
DBUA 338, 341.
Vitreolina incurva (R.D.D., 1883)
DBUA 338.

Subclass OPISTHOBRANCHIA

Order APLYSIOMORPHA

Family Aplysiidae

Aplysia fasciata Poiret, 1789
DBUA 360.

- Aplysia punctata* Cuvier, 1803
DBUA 354.
- Order THECOSOMATA
Suborder EUTHECOSOMATA
Family Cavolinidae
Diacria trispinosa (Lesueur, 1821)
DBUA 338, 355.
- Order NUDBRANCHIA
Suborder DORIDACEA
Family Chromodorididae
Hypselodoris sp.
DBUA 354.
- Family Discodorididae
Discodoris cf. *millegrana* (Alder and Hancock, 1854)
DBUA 345.
- Subclass PULMONATA
Order ARCHAEOPULMONATA
Family Ellobiidae
Ovatella vulcani (Morelet, 1860)
DBUA 341.
- Class BIVALVIA
Subclass PTERIOMORPHA
Order ARCOIDA
Superfamily ARCACEA
Family Arcidae
Arca tetragona Poli, 1795
DBUA 335, 338, 355.
- Order MYTILOIDA
Superfamily MYTILACEA
Family Mytilidae
Trichomusculus semigranatus
(Reeve, 1858)
DBUA 333, 335, 338, 341, 342, 343, 350,
352, 355.
- Superfamily PINNACEA
Family Pinnidae
Pinna rudis Linnaeus, 1758
DBUA 359, 360.
- Order PTERIOIDA
Suborder PTERIINA
Superfamily PTERIACEA
Family Pteriidae
Pteria hirundo (Linnaeus, 1758)
DBUA 363, 364.
- Superfamily PECTINACEA
Family Pectinidae
Hinnites distortus (da Costa, 1778)
DBUA 332, 338, 340, 341, 364.
Palliolium inconzparabile (Risso,
1826)
DBUA 332.
- Family Spondylidae
Spondylus cf. *senegalensis*
Schreibers, 1793
DBUA 338, 341, 342, 364.
- Superfamily ANOMIACEA
Family Anomiidae
Anozia ephippium Linnaeus, 1758
DBUA 340, 355.
- Superfamily LIMACEA
Family Limidae
Limaria hians (Gmelin, 1791)
DBUA 338.
Limaria loscombii (Sowerby, 1820)
DRUA 353, 355.
Limatula subauriculata sulcata
(Montagu, 1808)
DBUA 341.
- Subclass HETERODONTA
Order VENEROIDA
Superfamily LEPTONACEA

Family Erycinidae

Lasaea adansoni (Gmelin, 1791)

DBUA 333, 340, 352, 355, 356.

Superfamily CARDITACEA

Family Carditidae

Cardita calyculata (Linnaeus, 1758)

DBUA 332, 333, 335, 338, 341, 342, 343, 346, 350, 351, 352, 355, 356, 357.

Superfamily CARDIACEA

Family Cardiidae

Pawicardium vroomi van Aartsen, Moolenbeck and Gittenberger, 1984

DBUA 350, 352, 355.

Plagiocardium papillosum (Poli, 1795)

DBUA 338, 340, 346, 350, 352, 353, 355.

Superfamily TELLINACEA

Family Semelidae

Ervilia castanea (Montagu, 1803)

DBUA 342.

Superfamily VENERACEA

Family Veneridae

Dosinia cf. *lupinus* (Linnaeus, 1758)

DBUA 338.

Gouldia minima (Montagu, 1803)

DBUA 338.

Class CEPHALOPODA

Subclass COLEOIDEA

Order OCTOPODA

Suborder INCIRRATA

Superfamily OCTOPODOIDEA

Family Octopodidae

Octopus vulgaris Linnaeus, 1758

DBUA 328.

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