

DEATH AND REBIRTH IN THE DESERTAS ISLANDS (MADEIRA:PORTUGAL)

LAND SNAILS AS A CASE STUDY



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INTRODUCTION

The land mollusc fauna of the Madeiran archipelago has been studied for nearly 200 years.

Study of Pleistocene and Holocene aeolian deposits from Madeira and Porto Santo:

- Enriched the faunistic interpretation.
- Identified many species or forms that are now extinct.

Deserta islands (Chão, Deserta Grande and Bugio):

- There are no such massive aeolian deposits.
- No fossils are known from Chão. Present on Deserta Grande and Bugio.

Fossils studies:

- Mid-19th century by Wollaston (1878) on Bugio.
- Late 20th century by Groh (1985) and Cameron & Cook (1999) in the northern tip of Deserta Grande.

INTRODUCTION

2012:

- Discovery of numerous small, colluvial, fossil-bearing deposits at many locations throughout the Deserta Grande island by Isamberto Silva.
- At many of these sites it has been possible to date shells (Yanes *et al.* in prep.).
- Enabled the examination of the faunal composition and change in the late Pleistocene and Holocene (Teixeira *et al.* in prep.).

Modern fauna:

- Desertas are under surveyed mainly due to inaccessibility of the territory.
- A number of species which are not recorded since the 19th century.
- The last consistent survey was done almost 30 years ago.
- Through LIFE Recover Natura Project (2013-2019), a complete surveyed was conducted, covering the three islands, and the faunal assemblages identified and updated.

OBJECTIVES

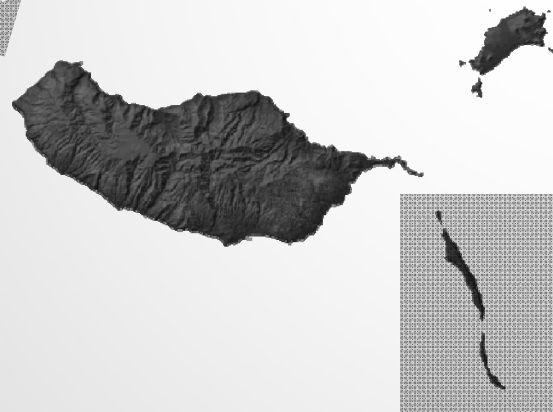
1. Evaluate the Quaternary land snail deposits of the Desertas islands

- Scale of time-averaging of Quaternary land snails from colluvial deposits in Deserta Grande and Bugio.
- Identify and evaluate the Quaternary land snail assemblages in Deserta Grande and Bugio.
- Promote a taxonomic revision of the land snail fauna from Desertas.

2. Establish a complete species inventory of the Desertas islands

- Produce an updated checklist.
- Identify the distribution areas for the critically endangered species.

STUDY AREA



Desertas islands (12,74 Km²)

- Ilhéu Chão
- Deserta Grande
- Bugio
- Nature Reserve
- Natura 2000 SAC
- Hotspot of land snails biodiversity

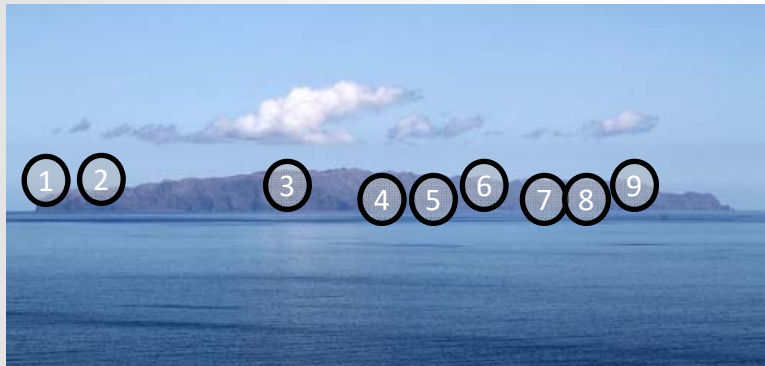


QUATERNARY LAND SNAIL ASSEMBLAGES

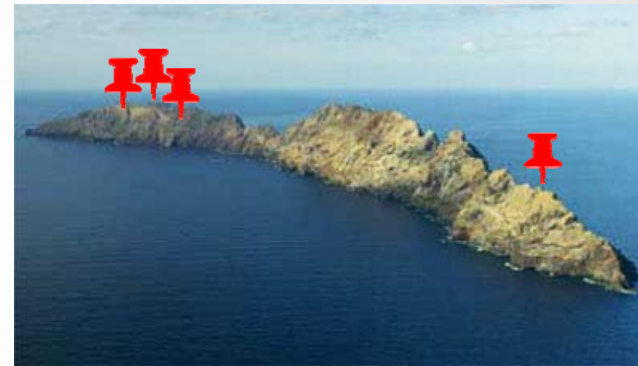
METODOLOGY

1. Sampling collection followed Yanes *et al.* (2013).

- 13 samples sites: 9 on Deserta Grande and 4 on Bugio
- Mostly colluvial and muddy deposits



Deserta Grande



Bugio

QUATERNARY LAND SNAIL ASSEMBLAGES

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Deserta Grande (Malhas Vermelhas 1)



Bugio (Planalto Sul, Site Y)

QUATERNARY LAND SNAIL ASSEMBLAGES

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- Isamberto Silva (Warden of Nature Conservation and Naturalist)
- 13 samples sites: 9 Deserta Grande and 4 on Bugio
- Mostly colluvial and muddy deposits

2. Time-averaging of Quaternary assemblages calculated using:

- Analysis of amino acid racemization (AAR) using reverse-phase liquid chromatography (RPC).
- Radiocarbon analysis was done using the method described in Bush *et al.* (2013).

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3. Identification of the Quaternary assemblages

- Taxonomy follows Wollaston (1878) and Bank *et al.* (2002).
- Evaluation of Museum collections:
 - National Museum of Wales
 - Natural History Museum of London
 - Muséum national d'Histoire naturelle de Paris
 - Museu de História Natural do Funchal

QUATERNARY LAND SNAIL ASSEMBLAGES

TIME-AVERAGING CALIBRATION RESULTS

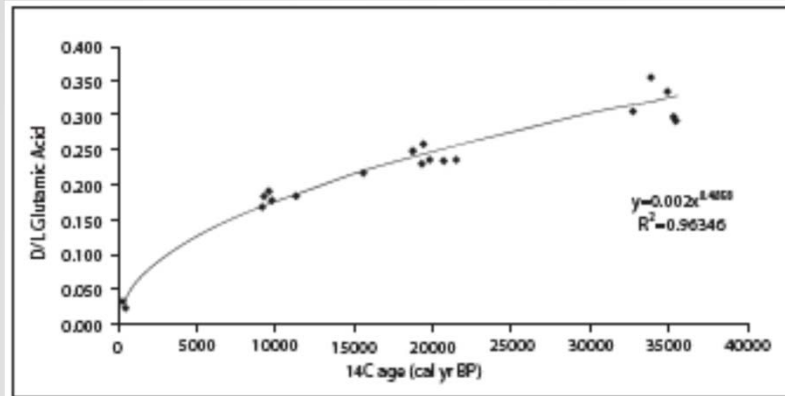


Fig. 1. Calibration curve of land snails from Deserta Grande and Bugio

DG ↑ + 60 Kba (Corgo da Castanheira)
↓ 8.7 Kba (Malhas Vermelhas 1)

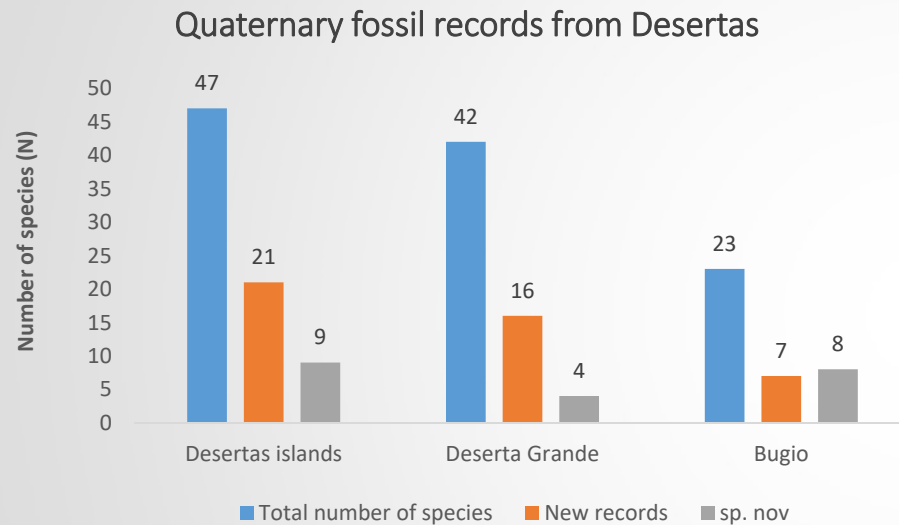
BG ↑ 20.9 Kba (Bugio – Planalto Sul site X)
↓ 8.3 Kba (Bugio – Planalto Sul site Y)

Source:

New, E., Yanes Y., Cameron, RAD, Teixeira, D., Kaufman, D. 2017. Amino-chronology and time-averaging in Quaternary land snail assemblages from Madeira archipelago, Unhiversity of Cincinatti.

QUATERNARY FAUNAL ASSEMBLAGES

PRELIMINARY RESULTS



47 taxa

21 new records for Desertas

9 species new to science:

- *Discula* (2 sp.), *Leiostyla* (4 sp.) e *Actinella* (1 sp.) and *Leptaxis* (2 sp.)

60% of extant fauna is present in the fossil deposits

QUATERNARY FAUNAL ASSEMBLAGES

PRELIMINARY RESULTS

New species

• Lauridae

- *Leiostyla desertensis* sp. nov.
- *Leiostyla simulans* sp. nov.
- *Leiostyla cooki* sp. nov.
- *Leiostyla castanheiraensis* sp. nov.



Frontal and lateral views of the holotypes of *Leiostyla desertensis* (top left), *Leiostyla simulans* (top right), *Leiostyla cooki* (bottom left) and *Leiostyla castanheiraensis* (bottom right). Scale bar, 1 mm.

QUATERNARY FAUNAL ASSEMBLAGES

PRELIMINARY RESULTS

New species

- Hygromiidae

- *Actinella fecundaerrata* sp. nov.



Holotype of *Actinella fecundaerrata* (top left); a paratype of *A. fecundaerrata* from Bugio Planalto Sul site x (top right) and the holotype of *Caseolus pittae* (Paiva, 1866) (bottom right). At bottom left is a fresh shell of *Discula polymorpha poromphala* (R.T. Lowe, 1852), of which *A. fecundaerrata* was regarded by Lowe and Wollaston as *var γ pusilla*. Scale bar 5 mm.

QUATERNARY FAUNAL ASSEMBLAGES

PRELIMINARY RESULTS

New species

- Hygromiidae

- *Leptaxis isambertoii* sp. nov.



Deserta Grande



Madeira (Piedade fossil deposit)



Madeira



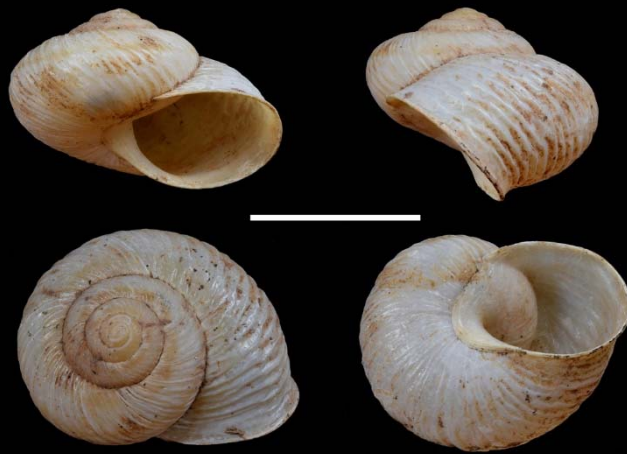
Top two rows: holotype of *Leptaxis isambertoii* sp. nov., fossil, Deserta Grande site Malhas Vermelhas 2. Third row: *Leptaxis furva* var. *grandissima* (Cockerell, 1922), fossil from Piedade, Madeira, McAndrew collection, University Museum of Zoology, Cambridge. Bottom row: *Leptaxis furva* (recent) from Madeira: left from the McAndrew collection, Cambridge, right, a syntype from the Melville-Tomlin Collection, NMW. Scale bar 20 mm

QUATERNARY FAUNAL ASSEMBLAGES

PRELIMINARY RESULTS

New species

- Hygromiidae
 - *Leptaxis groviana antiqua* sp. nov.



Holotype of *Leptaxis groviana antiqua*, fossil, Deserta Grande site Malhas Vermelhas 2. Scale bar 20 mm.

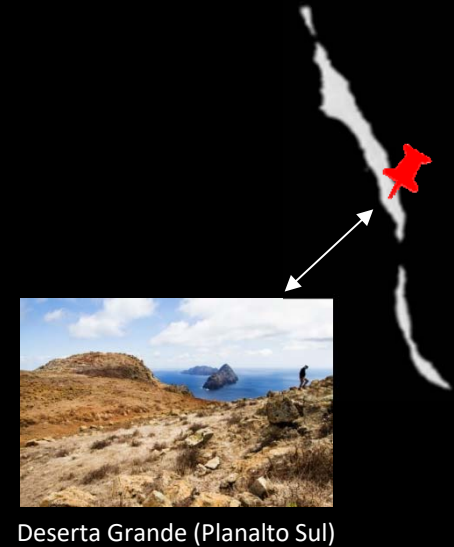
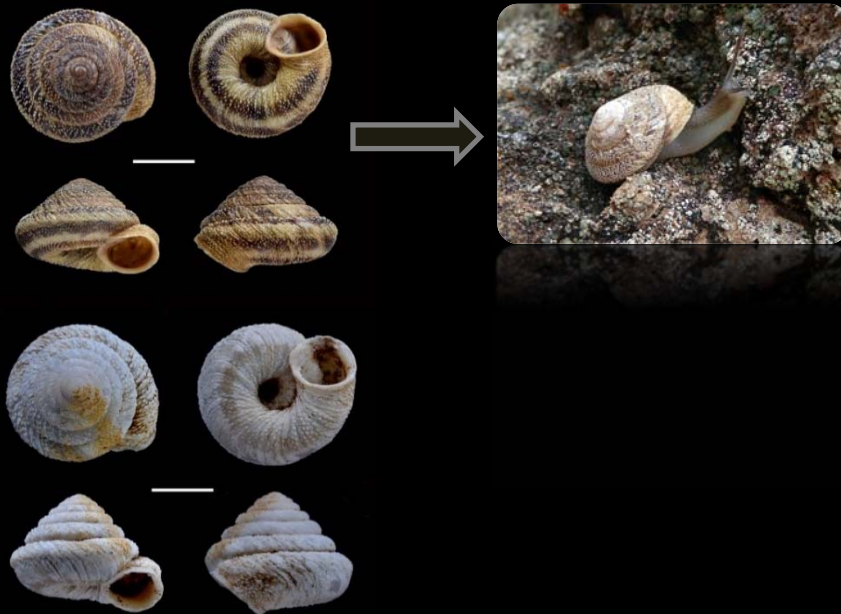
QUATERNARY FAUNAL ASSEMBLAGES

PRELIMINARY RESULTS

New species

- Hygromiidae

- *Discula cameroni* sp. nov.



Above: Holotype of *Discula cameroni* sp. nov. (recent, Deserta Grande at Planalto Sul). Below: paratype of *D. cameroni* (fossil, Deserta Grande site Ponta do Amarelo 1). Right: Living specimen of *D. cameroni* (Deserta Grande, Planalto Sul).

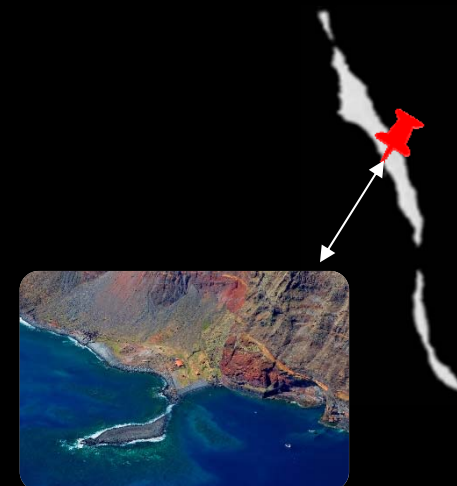
QUATERNARY FAUNAL ASSEMBLAGES

PRELIMINARY RESULTS

New species

- Hygromiidae

- *Discula polymorpha docaensis* sp. nov.



Left, holotype of *Discula polymorpha docaensis* sp. nov. (recent, Doca, Deserta Grande, NMW), center: paratype (fossil, Deserta Grande, site Doca Norte) Scale bar 5 mm; right: Living specimen from Doca.

1. Complete species inventory

- Ilhéu Chão (28 sampling points)
- Deserta Grande (40 sampling points)
- Bugio (14 sampling points)

Sampling methods:

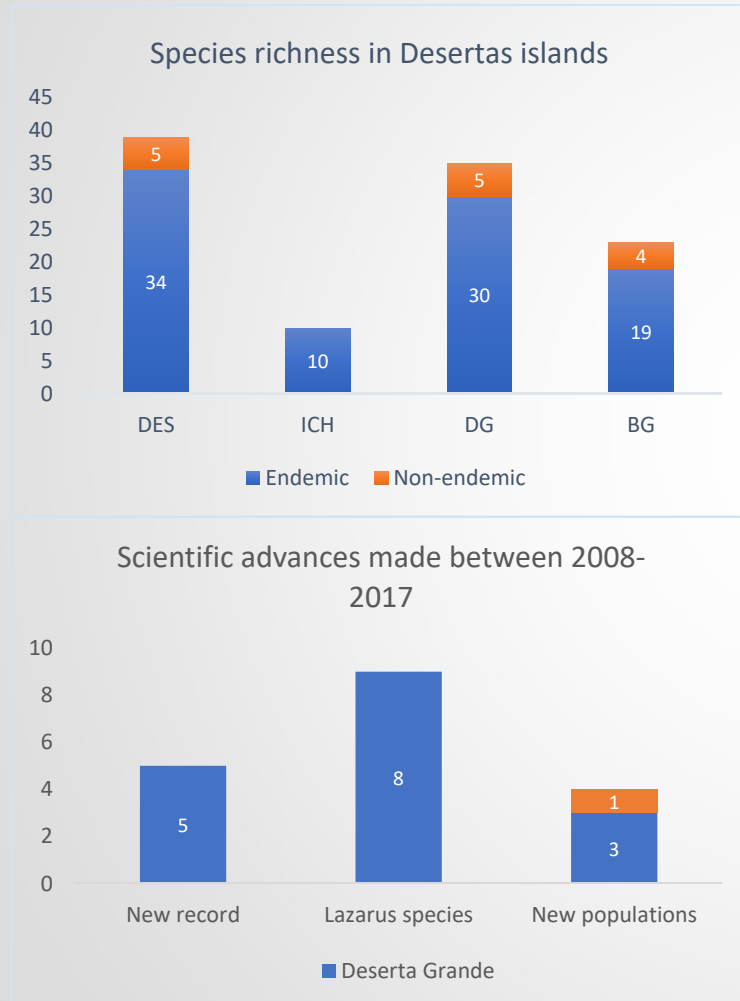
- Squares (20x20 meters)
- Transects (50 meters)
- Random sampling (mainly on cliffs)



Ponta do Amarelo (Deserta Grande)

MODERN FAUNA ASSEMBLAGES

PRELIMINARY RESULTS



39 taxa

5 new records for Desertas:

- *Discula* (2 sp.), *Leptaxis* (1 sp.), *Caseolus* (1 sp.), *Craspedopoma* (1 sp.).

8 Lazarus species:

- *Discula* (1 sp.), *Actinella* (2 sp.), *Atlantica* (1 sp.), *Craspedopoma* (1 sp.), *Geomitra* (2 sp.).

4 new populations found for critically endangered (CR) species:

- *Atlantica calathoides* (2)
- *Discula lyelliana* (1)
- *Discula tetrica* (1)

MODERN FAUNA ASSEMBLAGES

LAZARUS SPECIES



Found in small pockets of refuge:

- $<100 \text{ m}^2$
- Mostly covered by Bracken (*Pteridium aquilinum*)
- Near shore line (10-15 m)



Actinella actinophora



Actinella arcta



Craspedopoma mucronatum



Geomitra grabhami



Geomitra coronula



Atlantica calathoides



Leptaxis simia hyaena



Discula lyelliana



Norte do Risco (Deserta Grande)



Ponta do Amarelo (Deserta Grande)



Fajã Grande (Deserta Grande)

Total number of species for Desertas

0062 ± 3

Pending on the results of ongoing species
determination and molecular analysis results

MODERN FAUNA ASSEMBLAGES

CHALLENGES AND THREATS

Habitat change/fragmentation



19th century



21th century



Deserta Grande (Planalto Sul)



Ilhéu Chão

Invasive species



Goat (*Capra hircus*)



Mice (*Mus musculus*)



Bulbous canary-grass
(*Phalaris aquatica*)



Argentine ant
(*Linepithema humile*)



NEXT STEPS

- ✓ Quaternary fauna
- ✓ Updated checklist for extant fauna

- Habitat restoration actions
- Invasive species eradication (mice, goats and Argentine ant)
- Taxonomic clarification through molecular analysis
- Conservation plans for CR species

2018

An illustration of an iceberg floating in the ocean. The tip of the iceberg is visible above the water line, while the much larger base is submerged. The year '2018' is written in white text on the submerged part of the iceberg.



We are grateful to:

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Fossil dating:



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