Origin and Evolution of the Abyssal Peridotites of Saint Peter and Saint Paul Massif, Equatorial Atlantic Ocean

Future perspectives
St Peter-St Paul is a peridotitic massif which emerge above sea level. 
A rare feature in the world’s ocean.
Peridotites

Solid residues left behind after upper mantle partial melting, process which originate the Mid Ocean Ridge Basalts (MORB)

Mantle Exhumation:

- Low spreading
- Thin crust
- Low magma supply
- High tectonic activity
  (i.e. Oceanic Core Complex)

After Cannat, 1993
The St Paul diving program 1997/1998
Magmatic and Tectonic Processes in the St. Paul Transform
CAPES/COFECUB

CAMPGNE SAINT PAUL

Date: Dec.19, 1997 to Jan. 10, 1998
Location: St. Paul Fracture Zone, Equatorial Atlantic
(0°37′N-25°27′W e 0°56′N-29°23′W)
Vessel: NADIR
Submersible: NAUTILE
Organizers: IFREMER-UBO
Scientific Group: Roger Hekelian, Thierry Juteau,
Susanna Eleonora Sichel, Gleb Udintsev,
Bertrand Sichler, Eulalia Gracia

French submersible Nautil
Dives Sites: St. Paul Transform

- **6 dives** at ASPSP
- **1 dive** at IRT
- **6 dives** at MAR
**Arquipélago de São Pedro e São Paulo**

- **sul**: nível do mar
- **norte**: sub-vertical

- **1200 m**: peridotito não deformado elevação sul
- **45°**: peridotito deformado elevação norte

**Camadas**:
- **Grafite Pelágico de Carbonato**
- **Dolerito**
- **Lava de Basalto**
- **Gadro**
- **Peridotito não deformado**
- **Peridotito Milonítico**
Arquipélago de São Pedro e São Paulo
Bonatti et al. (1970, 1992)
dragagens de WHOI em 1981
mergulhos profundos de Nottle em 1999
graben

Latitude (N)
Longitude (°W)
Results:
Origin and evolution of the mantle rocks of Saint Peter and Saint Paul massif, Equatorial Atlantic Ocean

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A) Sample of a deep dive, which was collected from the depth of 1523 m, with orthopyroxene (Opx) and serpentine (Serp) crystals: B) Mylonitic peridotite of the Challenger Island.

Epicenters and focal mechanisms of the earthquake that occurred during the period from 1971 to 1988
COLMEIA
Cold Mantle Exhumation and Intra-transform Accretion

2013 (5 jan -10 fev)
31 dredges (gabbros and peridotites)
Extreme mantle uplift and exhumation along a transpressive transform fault

*Maia et al (2016)*

St Paul system has been controlled by compressive deformation since 10 million years Ago.

The Southernmost area of SP-SP is composed serpentinized rocks.
Modern day hydrothermal systems may be analogous to those on early Earth.

The hydrogen produced during serpentinization can support microorganisms deep below the seafloor in the oceanic mantle, in hydrothermal chimneys and in hydrothermal plumes.
Frieder Klein and Susan Humphris
Woods Hole Oceanographic Institution (WHOI)
Marine Chemistry and Geochemistry Department

TRITON 3300/3
Up to 1000m

M/V Alucia

2017

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Research Proposal

ATOL DE ROCAS

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Atol das Rocas

Research proposal: To study the geology and the life in the surroundings of the REBIO- Atol de Rocas from the abyssal depths to the subsurface of guyot.

The REBIO is limited to the quota of -1000, which cover three guyots.

REBIO is part of the EW seamounts chain of Fernando de Noronha.

Environmental amortization zone.

The basement of the guyots were never sampled, their geological nature is unknown, but it is associated to a volcanic character, similar to the Fernando de Noronha. However, older than this one, due to its majors distance of the Atlantic dorsal.

Aerial view of REBIO-Atol de Rocas (Phare and Cemetery islands)
Integration of underwater video and acoustic mapping for the biological and geological characterization of the seafloor

Mapping seafloor habitat is the fundamental first step necessary for scientific fisheries management, for monitoring environmental change and for assessing the impact of anthropogenic disturbance on benthic organisms.

Acoustic seafloor characterization has been long recognized as a useful tool for fast geological analysis.

In environmentally sensitive areas underwater video allows the recognition of seabed coverage including species-specific habitats without the need of bottom grabs.

The advantage of this combination is the nearly continuous mapping *versus* sparse probing and a vast reduction in survey time and costs.

This technique has been used for shallow coastal water but very few is done in deeper oceanic waters.
Proposition

Acquisition of acoustical data using single- and multi-beam systems and, if possible, side scan sonar (limited depth operation).

Acquisition of seafloor images to "calibrate" the geophysical data with seabed informations regarding substrate type (sediment or rock), and the presence or absence of a particular benthic species.

Use specific attributes to correlate geophysical data with geological / biological information to map the distribution of benthic communities.

Objective

Discriminate distinct assemblages of benthic species and understand the relationship between seafloor surficial sediments and biota to classify and map the defined benthic habitats.

Develop techniques of acoustic remote sensing for environmental monitoring in deep water areas.
THANKS