INTERNATIONAL SEABED AUTHORITY

At-Sea Training Programme

2013 - 2014

In the Oceanographic Campaign

“EMEPC/PEPC/LUSO/2014”

Supported by

Estrutura de Missão para a Extensão da Plataforma Continental

The Portuguese Task Group for the Extension of the Continental Shelf

27th May - 22nd June 2014

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PART I

INTRODUCTION

The International Seabed Authority (ISA) announced six short-term "Training Opportunities" in 2013-2014 for suitable candidates from developing States provided by two ISA Contractors. Members of the Authority should nominate up to two candidates each for each training programme. The candidates will be selected by the Legal and Technical Commission in July 2013.

In March, 2014 the International Seabed Authority referred to my application submitted in June 2013 for the International Seabed Authority (ISA) training programme and inform me that there was one training place to be provided by the Portugal government on board of one hydrographic vessel from the Portuguese navy. The goals for this oceanographic mission are within the scope of the extension of the continental shelf program. The vessel is scheduled to visit an area near the mid-Atlantic Ridge in the north of the Azores archipelago in order to collect multibeam data to image the seafloor and to collect geological samples for analysis. There will also be one or more biologists onboard in order to collect information on biodiversity. Samples and high-resolution images from the seafloor will be collected with the ROV named LUSO and rated to 6000-meter depth. The mission will start the 27th May 2014 from Lisbon with the duration between 25 and 30 days.

The Portuguese Task Group for the Extension of the Continental Shelf (EMEPC) is a Governmental organization operating under the Portuguese Minister of Agriculture and Sea. Its main mission is devoted to prepare and consolidate the Portuguese submission to the Commission on the Limits of the Continental Shelf of the United Nations.

Several oceanographic campaigns have been promoted by the EMEPC, gathering a substantial marine data collection. To potentiate their exploration, the EMEPC is developing a marine database infrastructure (InforM@r) and the M@rBis project (Marine Biodiversity information system).

The EMEPC is composed by a multidisciplinary team of researchers on marine sciences, Engineering, Education and Outreach, Law of the Sea, Maritime Policy and Governance. It has protocols with national and international partners in the framework of cooperative efforts in marine research, development and education of all levels.

The EMEPC has a competitive infra-structure managing a batch of state of the art scientific marine equipments such as the LUSO ROV. The latter is a work class bathyssaurus XL developed by ARGUS Remote Systems AS, which started operating in 2008 (up to 6000m deep). A national team of ROV pilots has been created since that time, which is now fully autonomous in the operation, maintenance and development of the system.

1.1 Itinerary

25th May: Travel from Bangkok to Lisbon
26th May: Visit to the EMEPC and the vessel NRP Almirante Gago Coutinho operated by the Portuguese navy
27th May: Depart from Lisbon with the vessel NRP Almirante Gago Coutinho
28th May: ROV Training at Sagres
29th May - 1st June: Transit to Azores archipelago
1st June - 2nd June: Ponta Delgada harbour
3rd June - 4th June: Transit to the Maxwell Fracture zone.
5th June - 17th June: ROV dives in the area of the Maxwell Fracture zone
18th June - 21st June: Transit to Lisbon
22nd June: Reach Lisbon port
23rd June: Travel from Lisbon to Bangkok

Table 1.1 Time schedules (Training plan)

	MAY							JUNE																						
	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
			Tr	Tr	T	T	T	P	P	T	T	Op	Op	Op	Op	Op	Op	Op	Op	Op	Op	Op	Op	Op	T	T	T	T	P	

STATE 1 STATE 2 STATE 3

ROV Training at Sagres	Ponta Delgada Port	ROV Dives in the area of Maxwell Fracture Zone

Tr	Training (2 days)	T	Transit (9 days)	Op	Operation (13 days)	P	Harbour (3 days)

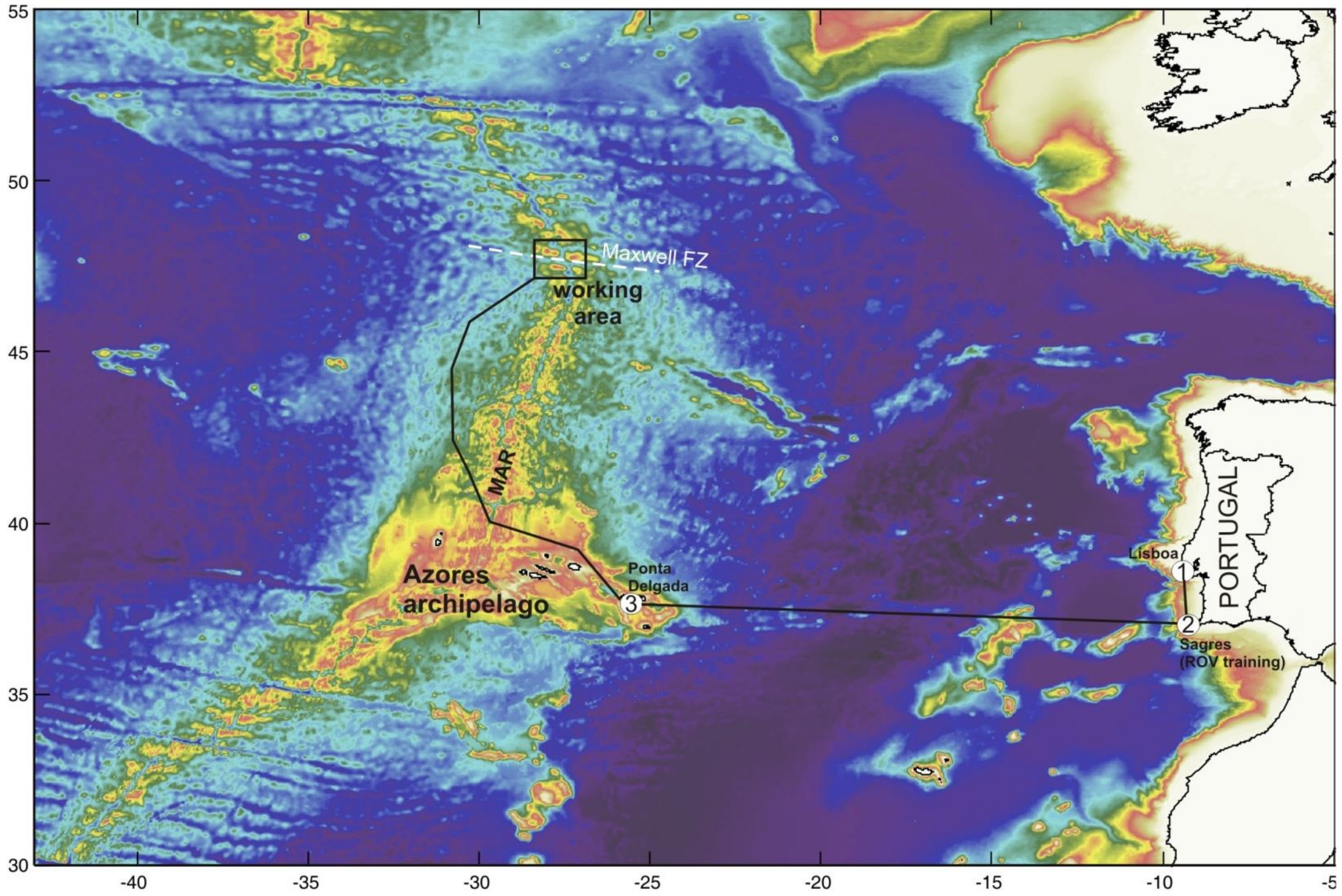


Figure 1.1 Showing the cruise track from Lisbon to Mid Atlantic Ridge (Maxwell fracture zone).

1.2 List of participants

1.2.1 Scientific Component

EMEPC

1. Aldino Campos	Head of EMEPC
2. Pedro Madureira	Chief scientist/Senior Geologist/EMEPC
3. Patrícia Conceição	Geologist/EMEPC
4. Mónica Albuquerque	Biologist/EMEPC/M@rbis
5. Filipa Marques	Geologist/ University of Bergen/EMEPC

ITQB

6. Luis Gonçalves	Microbiologist/ITQB

University of Haifa,

7. Ravit Bennaim	Geologist/University of Haifa

University of Cabo Verde

8. José Manuel Pereira	Geologist/University of Cabo Verde

International Seabed Authority (ISA)

9. Apitida Wasuwatcharapong	Geologist/Department of Mineral Resources, Thailand

1.2.2 ROV Team

10. António Calado	ROV Pilot/EMEPC
11. Andreia Afonso	ROV Pilot/EMEPC
12. Renato Bettencourt	ROV Pilot /DOP/EMEPC
13. Miguel Souto	ROV Pilot/EMEPC
14. Luis Bernardes	ROV Pilot/EMEPC
15. Bruno Ramos	Engineer, ROV Pilot/ DGRM/EMEPC

1.2.3 Ship's Complement

Captain and crews	35	persons

1.3 Objectives

The purpose of this oceanographic campaign, within the scope of the extension of the Portuguese continental shelf program is scheduled to visit an area near the Mid-Atlantic Ridge in the north of the Azores archipelago in order to collect multibeam data to image the seafloor and to collect geological and biological samples for analysis. Samples and high-resolution images from the seafloor will be collected with the ROV named LUSO and rated to 6000-meter depth. Then the cruise will be focused on the acquisition of geophysical data (bathymetric, magnetic and gravimetric) and collection of rocks in the vicinity of Mid Atlantic Ridge in the area of Maxwell Fracture Zone. The collection of information on biodiversity is also aimed. My participation in the cruise was expected to be focused on video interpretation from the ROV, the use of oceanographic equipment and petrographic description and lab treatment of sampled rocks for mineral and geochemical analysis.

1.4 The vessel NRP Almirante Gago Coutinho

Figure 1.2 The NRP "Almirante Gago Coutinho"

Owner	Portuguese Navy
Operator	Hydrographic Institute
Year Built	1985
Built by	Tacoma Boat Comp. USA. (Ex-USNS Assurance). Transferred to the Portuguese Navy in 1999. Undergoing refit and conversion until April 2007.
Main activity	Oceanography and coastal and oceanic hydrographic
Number of bricks	A523

1.5 Area of study

1.5.1 Republic of Portugal

Capital city: Lisbon
Official language: Portuguese
Population: 11,317,192
Currency: Euro
Total area: 92 389 sq km (including Madeira and Azores)
Land: 91959 sq km
Water: 430 sq km

Portugal, officially the Portuguese Republic, is a unitary semi-presidential republic. It is located in South-Western Europe, on the Iberian Peninsula, and it is the westernmost country of mainland Europe, being bordered by the Atlantic Ocean to the west and south and by Spain to the north and east. The territory of Portugal includes an area in the Iberian Peninsula (referred to as *the continent* by most Portuguese) and two archipelagos in the Atlantic Ocean: the archipelagos of Madeira and the Azores. It lies between latitudes 32° and 43° N, and longitudes 32° and 6° W.

The archipelagos of Madeira and the Azores are scattered within the Atlantic Ocean: the Azores straddling the Mid-Atlantic Ridge on a tectonic triple junction, and Madeira along a range formed by in-plate hotspot geology. Geologically, these islands are affected by volcanic and seismic events, although the last terrestrial volcanic eruption occurred in 1957–58 (Capelinhos) and minor earthquakes occur sporadically, usually of low intensity (data from www.wikipedia.com).

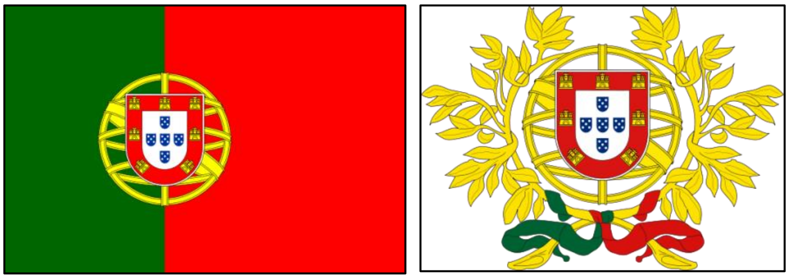


Figure 1.3 Flag and Coat of arms, Republic of Portugal.

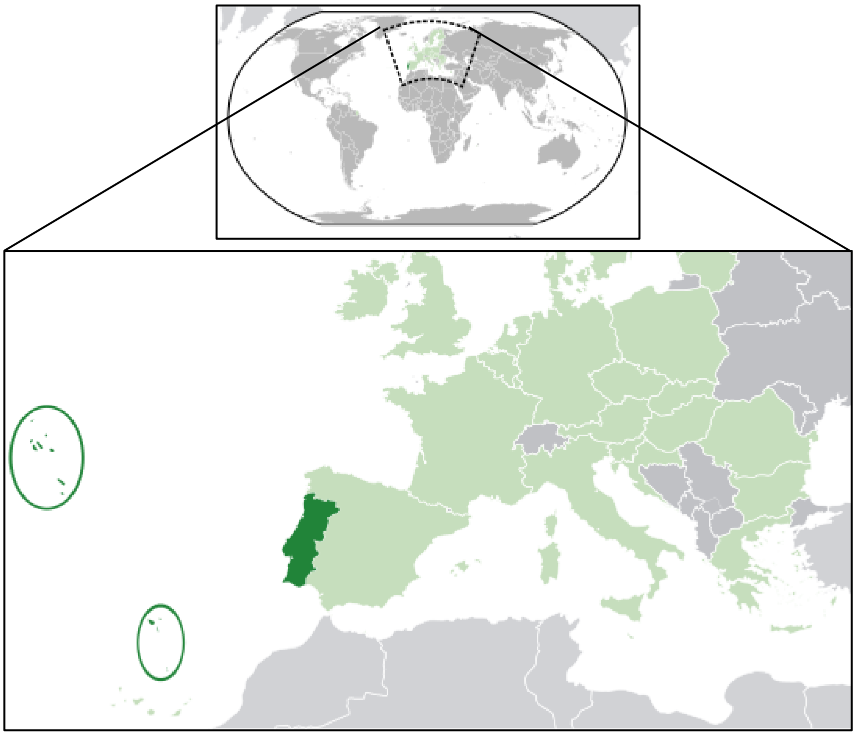


Figure 1.4 Map of Portugal, mainland in dark green area and archipelagos of Madeira and the Azores areas are in dark green circle.

1.4.2 Mid Atlantic Ridge and Maxwell Fracture Zone

The Mid-Atlantic Ridge (MAR) is a mid-ocean ridge, a divergent tectonic plate or constructive plate boundary located along the floor of the Atlantic Ocean, and part of the longest mountain range in the world. In the North Atlantic, it separates the Eurasian and North American Plates, whereas in the South Atlantic it separates the African and South American Plates. The average spreading rate for the ridge is about 2.5 cm per year.

Fracture zones are common features in the geology of oceanic basins. Globally most fault zones are located on divergent plate boundaries on oceanic crust. This means that they are located around mid-ocean ridges and trend perpendicular to them. The **Maxwell Fracture zone** is located in North of Mid Atlantic Ridge.

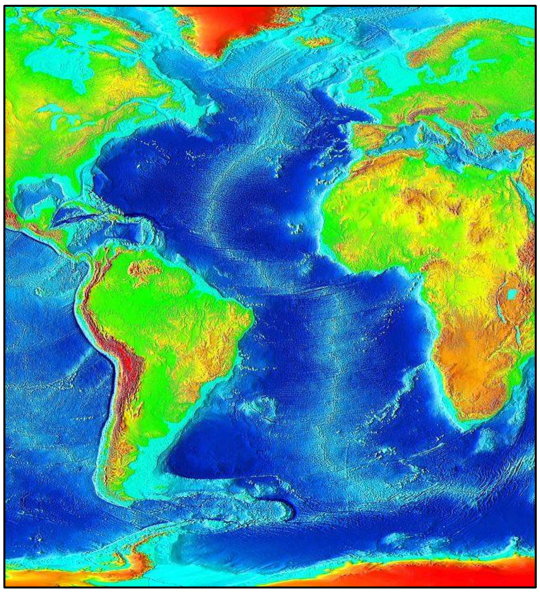


Figure 1.5 Mid-Atlantic Ridge (MAR)

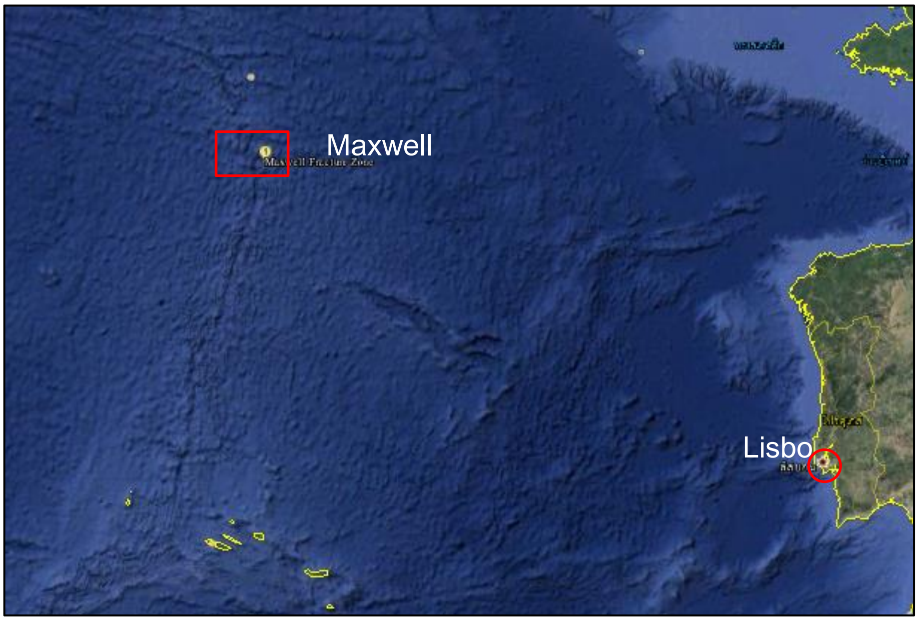


Figure 1.6 Lisbon (red circle) and area of Maxwell fracture zone (red rectangle).

PART II

EQUIPMENTS USED

In this Hydrographic survey for acquiring data, the following equipments were used:

2.1 Multibeam Echo Sounder:

The multi-beam echo sounder is a device typically used by hydrographic surveyors to determine the depth of water and the morphology and nature of the seabed. It is very important for survey to geomorphological mapping. As mentioned, the echo sounder is also used for measuring the depth, and systematic measurements can be compiled into maps of the seabed.

Multibeam echo sounders, like other sonar systems, emit sound waves in the shape of a fan from directly beneath a ship's hull. These systems measure and record the time it takes for the acoustic signal to travel from the transmitter (transducer) to the seafloor (or object) and back to the receiver. In this way, multibeam sonars produce a “swath” of soundings (i.e., depths) for broad coverage of a survey area. The coverage area on the seafloor depends on the depth of the water, typically two to four times the water depth.

2.2 Gravity meter:

Gravity meter is an instrument used measuring the local gravitational field of the earth. A gravity meter is a type of accelerometer, specialized for measuring the constant downward acceleration of gravity, which varies by about 0.5% over the surface of the Earth. In a most basic conception, a gravimeter is simply a highly developed derivation of a scale used for weighing an object. In this way, gravimeters operate on the same principle as any other accelerometer, by measuring acceleration relative to a static basis, but are designed to be far more sensitive than a typical accelerometer in order to measure the minute changes within the Earth's gravity that can happen due the planet's shape or local geological features.

2.3 Magnetometer:

Magnetometers are instruments used for two general purposes: to measure the magnetization of a magnetic material like a ferromagnet, or to measure the strength and, in some cases, the direction of the magnetic field at a point in space. Magnetometers are widely used for measuring the Earth's magnetic field and in geophysical surveys to detect magnetic anomalies of various types. They are also used militarily to detect submarines. Magnetometers can be used as metal detectors: they can detect only magnetic (ferrous) metals, but can detect such metals at a much larger depth than conventional metal detectors; they are capable of detecting large objects, such as cars, at tens of meters, while a metal detector's range is rarely more than 2 meters.

2.4 uSVP- Sound Velocity profiler:

The sound velocity profiler is a self-contained, semi-autonomous device, which collects oceanographic data while the vessel is underway. The sound velocity profiler system includes a computer controlled winch and deployment system for a variety of the free-fall sensor systems. For hydrographic surveys, this tool is used to obtain the sound velocity along the water column, which is fundamental to calibrate the multibeam sensor.

2.5 CTD-Conductivity Temperature Depth:

A CTD device’s primary function is to detect how the conductivity and temperature of the seawater changes relative to depth. Conductivity is a measure of how well a solution conducts electricity. Conductivity is directly related to salinity, which is the concentration of salt and other inorganic compounds in seawater. Salinity is one of the most basic measurements used by ocean scientists. When combined with temperature data, salinity measurements can be used to determine seawater density which is a primary driving force for major ocean currents.

Often, CTDs are attached to a much larger metal frame called a rosette, which may hold water-sampling bottles that are used to collect water at different depths, as well as other sensors that can measure additional physical or chemical properties.

CTDs can provide profiles of chemical and physical parameters through the entire water column. By analyzing these parameters, scientists can make inferences about the occurrence of different water masses and certain biological processes, such as the growth of algae. Sudden changes, or “anomalies,” in one or more of the properties being measured may alert scientists to an unusual occurrence, such as an active hydrothermal vent. Knowledge obtained from CTD devices can, in turn, lead scientists to a better understanding of such factors as species distribution and abundance in particular areas of the ocean.

2.6 ADCP-Acoustic Doppler Current Profiler:

Acoustic Doppler Current Profiler (ADCP or ADP) is a hydroacoustic current meter similar to a sonar, attempting to measure water current velocities over a depth range using the Doppler effect of sound waves scattered back from particles within the water column. ADCP combine several sonar transmitters and receivers, along with amplifiers and signal processing electronics or software. This calculates the speed and direction that the water is moving at over a range of depths, giving a two dimensional profile. ADCPs are able do to do this by using the Doppler effect.

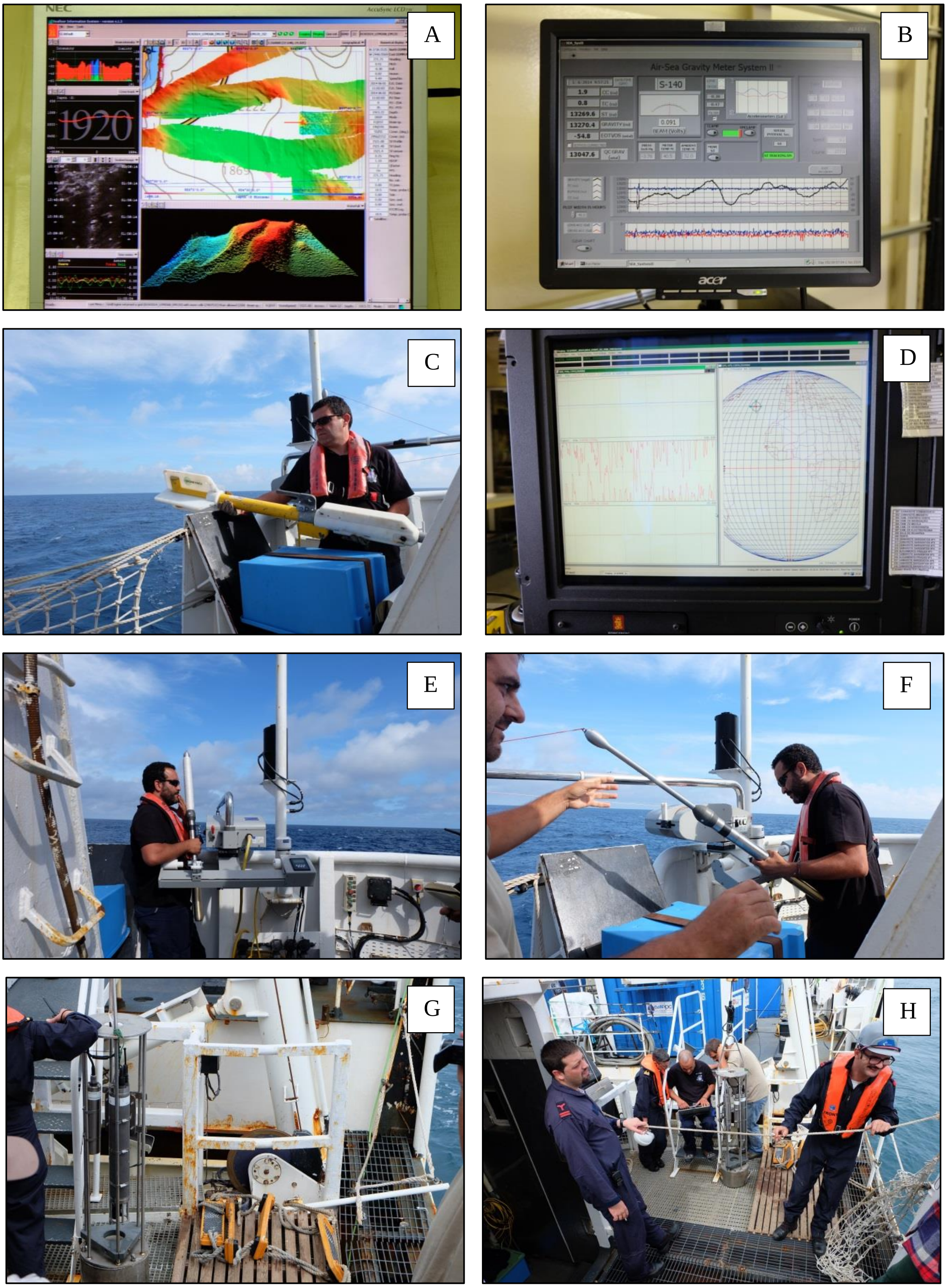


Figure 2.1 A: Multi-beam echo sounder monitor. B: Gravity Meter monitor. C: G-882 Cesium Marine Magnetometer. D: Magnetometer monitor. E-F: SVP-Sound velocity profiler. G-H: CTD-Conductivity temperature depth.

2.7 ROV LUSO

ROV-Remotely Operated Vehicle:

A Remotely Operated Vehicle (ROV) is essentially a tethered underwater robot that allows the vehicle's operator to remain in a comfortable environment while the ROV works in the hazardous environment below sea surface. The total ROV system is comprised of the vehicle, which is connected to the control van and the operators on the surface by a tether or umbilical - a group of cables that carry electrical power, video and data signals back and forth between the operator and the vehicle - a handling system to control the cable dynamics, a launch and recovery system (LARS) and associated power supplies. High power applications will often use hydraulics in addition to electrical cabling. In many cases, the umbilical includes additional strength members to allow recovery of heavy devices or wreckage. Most ROVs are equipped with at least a video camera and lights. Additional equipment is commonly added to expand the vehicle’s capabilities. These may include sonars, magnetometers, a still camera, a manipulator or cutting arm, water samplers, and instruments that measure water clarity, light penetration and temperature.

There are 5 people controlling the ROV operation. The control room has 2 pilots (pilot and co-pilot) while a third element stays at the winch control position. A fourth element is responsible for given support on deck whenever needed, particularly during the launch and recovery operations. These positions amongst the ROV team rotate every 2 hours. A fifth element stays in the vessel bridge, being responsible for the coordination between the ROV and the vessel. Inside the control room, several screens are presenting real time data collected by the ROV (Figure 2.4 and 2.6); image from the sonar to detect objects 50 meters ahead the ROV, Ship and ROV position, CO_2 concentration, CTD graphs comprising temperature, conductivity, salinity, pH, Eh, O_2 and turbidity variation with depth, information on ROV navigation coupled with a depth sensor and an altimeter to track the approximation to the seafloor, OLEX monitor is the program showing the position of the ship and waypoints along the ROV track, pilot dive log and dive log monitor to note pilots rotation and description throughout the diving time, video cameras to monitor the system integrity during operation

ROV general information

Figure 2.2 ROV Luso composition.

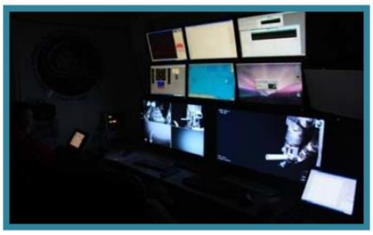
ROV Luso

General

Dimensions	Length 1.9m Width 1.6m Height 2.0m Weight 2000kg
Payload	100Kg
Frame	Aluminium tube T6062
Pods	Titanium Grade 5
Connectors	Titanium Grade 5
Buoyancy	Syntactic foam
Manipulators	1x5 function 1x7 function
Umbilical	6000m Kevlar Armoured Umbilical
Deployment method	Free Flying Latch
Launch method	LARS (Launch And Recovery System)
Total Deck weight	35 Tons (ROV, LARS, Workshop, Control room, Generator)

Standard Equipment Fit

Manipulators	1x5 function Schilling Rigmaster 1x7 function Schilling T4
Cameras	1 x Sony FCBH10 Argus RS FocusZoom HDTV camera 1 x DSPL lowlight Black&White camera 5 x DSPL other cameras
Sonar	Mesotech MS1000
Altimeter	Mesotech 1007
Lights	4 x 250W DSPL Halogen 4 x 150 W Argus RS HID lights
Pan&Tilt	SubAtlantic 24VDC
Depth sensor	SAIV TD 303
Compass	KVH C-100 Fluxgate KVH DSP 3000 FOG Gyro
Samplers	Mini-Drill unit 2 x Push Corers Suction sampler with 5 chambers
Sensors	Teledyne DVL Doppler Contros CH_4 Sensor Contros CO_2 Sensor SAIV CTD TD303 with additional sensors: Dissolved Oxygen, Florescence, Turbidity
Auto Functions	Auto Head Auto Depth Auto Altitude
Hydraulic Compensators	2x SubAtlantic 2700cc 5x SubAtlantic 860cc



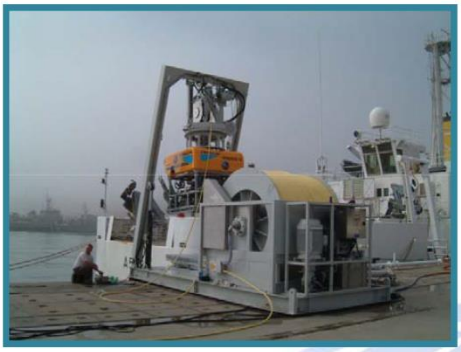
Performance

Bollard Pull	Fwd 370kg Lat 250kg Vert 300kg
Speed	Fwd 3kn Vert 1.6knt

Surface Controls

Control Container	1 x 20" feet Control container (5 Tons)
Transformers	1x 440VAC, 60kVA, 400Hz system (needs to be stable) 1x 60kVA 3300VAC UPS 30kVA
Power panel Inputs	440V (3-phases) 400V (3-phases) 230V (single phase)
Outputs	230V (single phase) 400V (3-phases)
Interface panel available connectors	7 coaxial 4 fiber optics 6 LAN 8 VGA
Control console	Integrated joysticks in pilot chair Integrated touch screen in pilot chair 19" inch rack Options Video Overlay Apple Computer Recording System Manipulator Control Console
Power generator	4 x 2.435 x 2.571 m (L x W x H) (5 Tons) 150kVA, 120 kW, 400V+N (3-phases), 50 Hz Fire detection system Remote control CCTV system
Workshop container	1 x 10" feet Workshop container (4 Tons)

(data from EMEPC)



Power Requirements

ROV power unit	440 VAC, 3-phase, 60kVA, 80A (needs to be stable)
Thrusters	7 x 5.5 kW, 20A, 4 Horizontal, 3 Vertical
Hydraulic Power Unit	2x5.5 kW, 15 lpm, 180 bar

Launch And Recovery System

Winch power input	440 VAC / 45 kVA - 3 phases
Dimensions	5.35 x 2.9 x 3.42 m (L x W x H)
Weight	21 ton (umbilical included)
Capacity	6 100 of 25.7mm umbilical
Winch velocity	75 m / min mid drum 11 rpm

Water input to cool hydraulic system units

Umbilical

Type	Nexans Kevlar Amoured
Length & Diameter	6 100 m x 25.7 mm
Breaking strain	125 kN
SWL	23 kN
Cores	3 x power 8 mm^2 12 x SM 9/125 µm

(data from EMEPC)

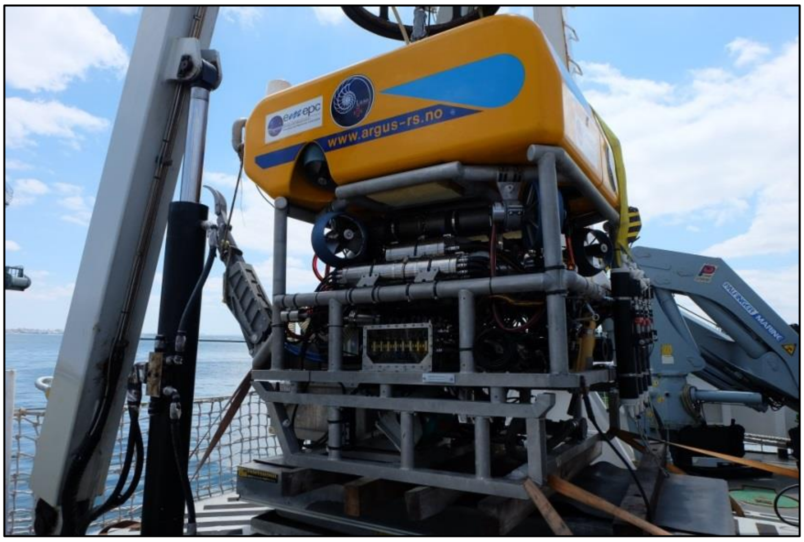


Figure 2.3 ROV Luso.

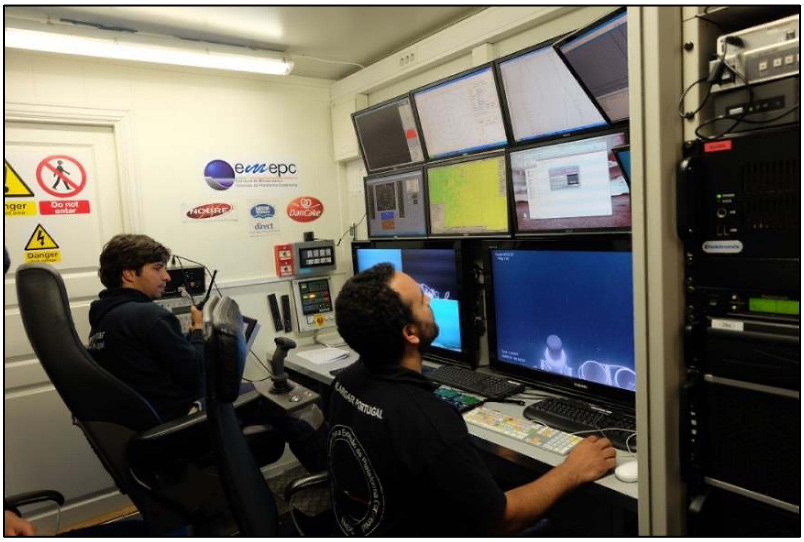


Figure 2.4 Pilot and co-pilot in the ROV control room.

Figure 2.5 Pilot in the winch control position.

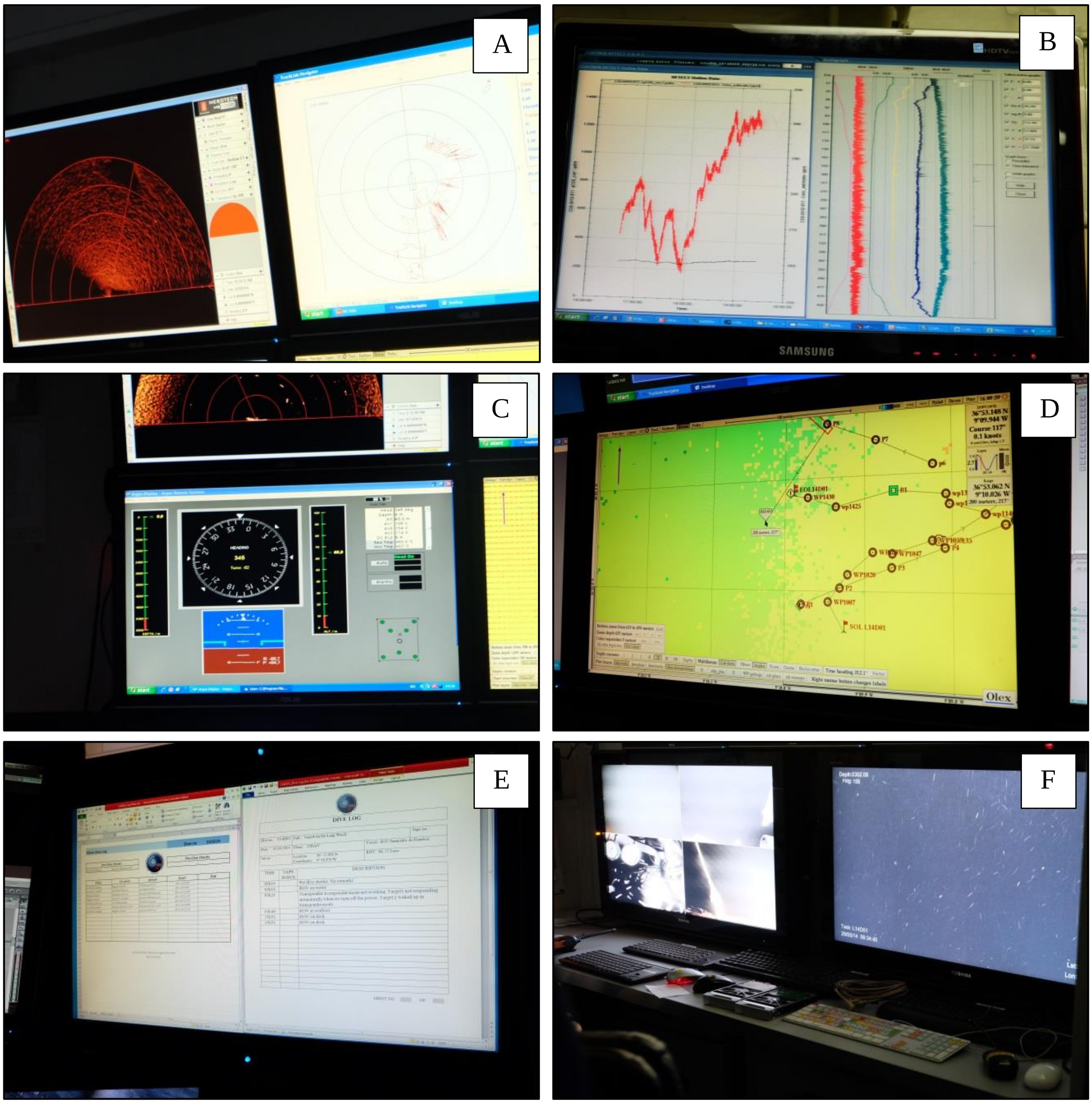


Figure 2.6 A: Sonar and position monitors. B: CO_2 concentration and CTD graphs. C: Olex displaying position of the ship and the ROV. D: Monitor for ROV navigation showing distance between ROV and the bottom. E: Pilot log and Dive log. F: Video cameras monitors on each view (left) and high resolution video camera (right).

PART III

PROCESS OF INVESTIGATION

During the time ROV Luso was operated, the continuous video image can be seen in the monitor screen as see in PART II. Geologists and biologists have to observe throughout the time of ROV diving introducing comments of all important things on the cover program (free software used for video annotation) in the scientists room (Figure 3.1-A). After that when the ROV was on deck, firstly the rock samples were brought to the microbiologist and biologist in order to scratch the microorganisms from the rock samples and to prevent further contamination. Finally, geologists will take the rock samples. There were also water samples from the Niskin bottles which were recovered by the microbiologist, method of sampling as follows:

3.1 Microbiological Sampling Method

3.1.1. Microbiology from the Rock samples:

The rock samples were recovered from the ROV and scratched (Figure 3.1-B and C). The residues were suspended in the 3 ml of filtrate seawater from the corresponding dive. 500 µl were used to inoculate anaerobic ASW media and kept at room temperature. Part was kept at -80°C (adding glycerol).

3.1.2 Microbiology from the Niskin bottles:

- Recover the seawaters from Niskin (~2 l) (4 bottles from dive D03 and 1 bottle from dive D04) (Figure 3.1-D).

- Unfiltered water was conserved at -80°C (400 and 50 ml). Also, unfiltered water was distributed for schott flasks (60 ml, aerobic) and inoculums flasks (20 ml, anaerobic) (add 200 µl Na_2S 5% (w/v), kept at room temperature.

- The seawater sample was filtered (650 ml) under low vacuum pressure conditions onto a 0.20 µm cellulose filter (In samples from D03 were 2 different filtration for each niskin, in D04 was 3 filtrations), (Figure 3.1-D).

- One of the filters was put in an artificial seawater (ASW) agar medium petri plate in an anaerobic jar. Before close the jar an "anaerobic creator" was putted to create an anaerobic atmosphere. The anaerobic jar was kept at room temperature.

- The other filters were washed with 5 ml of the corresponding filtrate seawater. Part was (3 x 800 µl) put in 2 ml eppendorf with 200 µl glycerol and placed at -80°C for long-term storage. 500 µL were used to inoculate three different media (anaerobic ASW, anaerobic ASW plus fructose and aerobic ASW). The filters after the washed were kept at -80°C.

3.2 Biological Sampling Method

3.2.1 Benthic Megafauna:

The benthic megafaunal communities were identified during the dive and the ichthyofauna had also been observed and classified (Figure 3.1-E).

3.2.2 Biology:

Biosamples were collected by the arm, the suction sampler (Figure 3.1-F), scratching the collected rocks and also recovered from the ROV samples drawer. Images of all samples were recorded with a digital camera. Samples were identified under the microscope (Figure 3.2-A) and were kept in the freezer -80°c.

3.3 Geological Sampling

The geological samples during the dives were collected from the sample box in the ROV Luso (Figure 3.2-B). After the first round taken by the Microbiologist and Biologist, rock samples were labeled and images were recorded in the digital camera (Figure 3.2 C).The rock samples were then prepared to be cutted. Rock pieces were made for thin sections and further geochemical analysis (Figure 3.2-D). After that the cutted rocks were put into the oven to be dried at 60ºC (Figure 3.2-E). Finally all of them were described under the microscope (Figure 3.2-F).

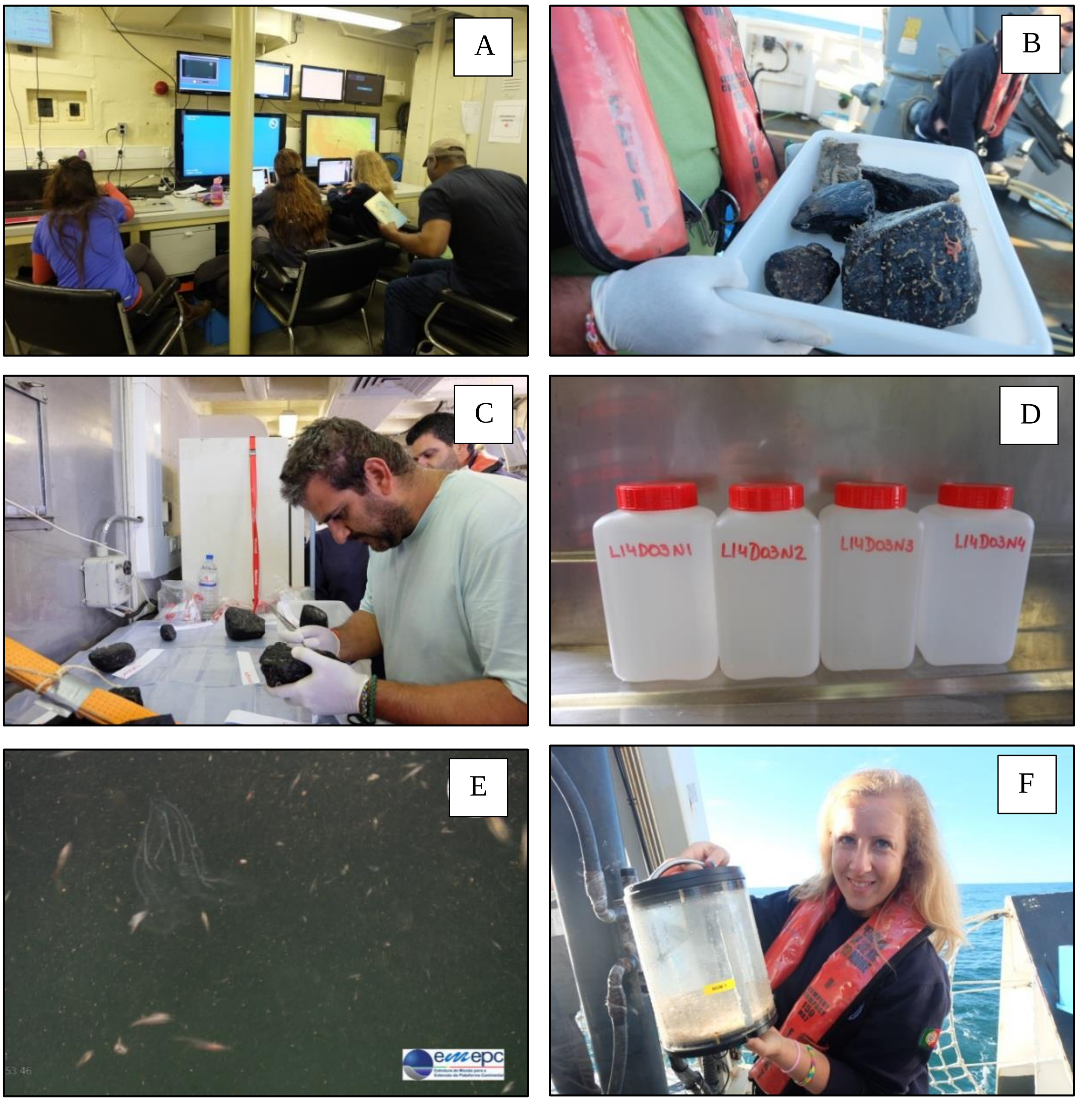


Figure 3.1 A: Geologist and biologist in CAD. B: samples from the ROV box. C: Microbiologist collecting the microorganism. D: Water samples from the

Niskin bottles. E: Benthic megafaunal. F: Suction sample.

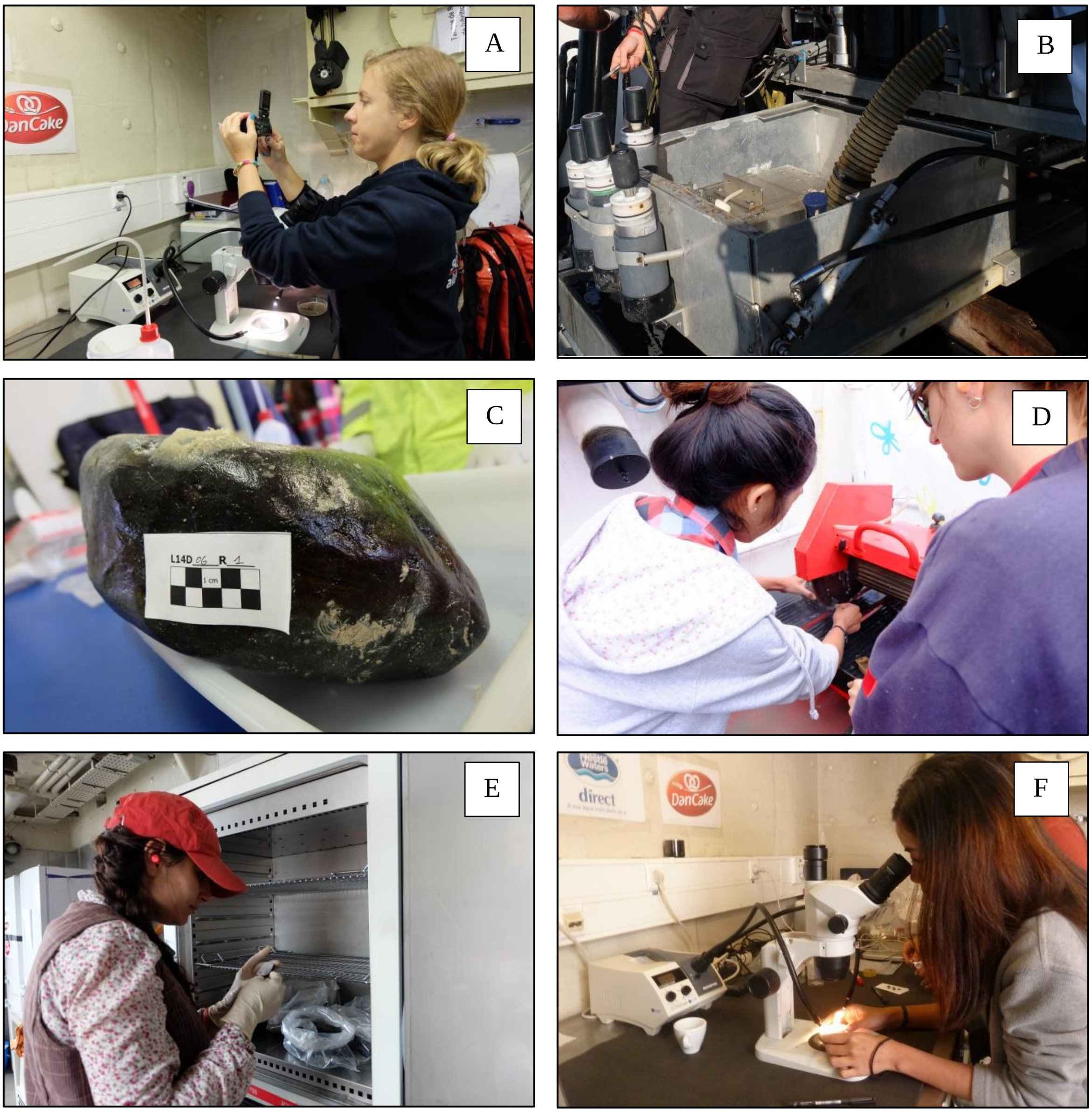


Figure 3.2 A: Biosamples were taken photo and identified under the microscope. B: Sample box. C: Labeled rock sample. D: Geologist cutting the rock sample for thin slide and geochemical analysis. E: Put the cutted rock sample into the oven. F: Petrographic description under the microscope.

PART IV

PERFORMANCE AND EQUIPMENT USED

Table 4.1: Performance Summary

Date	Investigation	Equipment	Remark
27th May	Departed from Lisbon	-	Presentation about security, component of the vessel.
28th May	ROV operation	ROV, Magnetometer	L14D01
29th May	Heading to S. Miguel Island (Azores)	-	-
30th May	Transit	Magnetometer	Launching the boat "Charger Project"
31st May	Transit	-	Checking Equipment
1st June	Arrived Ponta Delgada, ROV test dive at Ponta Delgada port	-	L14D02
2nd June	Heading to Maxwell Fracture zone	-	Scientist entrance
3rd June	Transit	uSVP Magnetometer	ROV Diving Preparation/ Checking Equipment
4th June	Investigation working	-	Weather, wind, current, wave conditions
5th June	Investigation working	-	Wind, current, wave conditions
6th June	Investigation working	-	Wind, current, wave conditions
7th June	Investigation working	-	Wind, current, wave conditions
8th June	Investigation working	-	Wind, current, wave conditions
9th June	ROV operation	ROV, uSVP Magnetometer, CTD	L14D03

Table 4.1: Performance Summary (cont'd)

Date	Investigation working	Equipment	Remark
10th June	Investigation working	-	Firefighting exercise and ROV Checking
11th June	Investigation working	-	ROV Checking
12th June	Investigation working	SVP,CTD	wind, current conditions
13th June	Investigation working	Magnetometor	wind, current, wave conditions
14th June	Investigation working	Magnetometor	wind, current conditions
15th June	ROV operation	ROV, uSVP, Magnetometer	2 dives (L14D04, L14D05)
16th June	ROV operation	ROV, uSVP, Magnetometer	L14D06
17th June	Heading to Lisbon	Magnetometer	-
18th June	Transit	Magnetometer	Firefighting exercise
19th June	Transit	Magnetometer	-
20th June	Transit	Magnetometer	Firefighting exercise
21st June	Transit, ROV operation	ROV	ROV Test-dive (L14D07)
22nd June	Arrival at Lisbon port	-	-

* 27th May to 22rd June, Geophysical Survey by multi-beam and Gravity meter has been operated all time.

PART V

SPECIAL ACTIVITIES AND PORTUGUESE CULTURE

4.1 Launching the boat "Charger" on 30th May 2014

The "CHARGER" (Figure 4.1-A) from the John Winthrop Middle School, Connecticut, USA came ashore in Portugal in January 2014 after having crossed the Atlantic. It was refurbished and relaunched in 30th May 2014 by EMEPC on the vessel NRP Almirante Gago Coutinho including the souvenirs and postcard from Portugal (Figure 4.1-B and C), (for more information go to www.educationalPassages.com) The message to finders as follows;

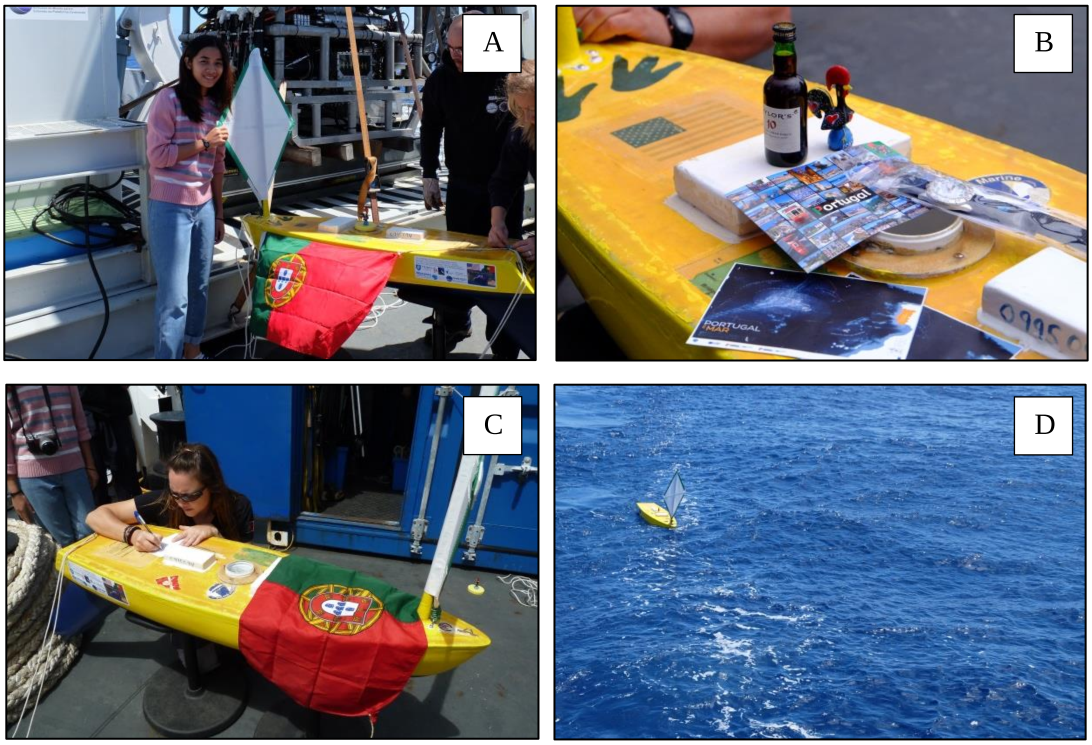
Hello Finders:

This boat, "The Charger", was launched off Cape Hatteras in early May, 2012. It is equipped with GPS and sends speed and position every 2 hours.

If you find me at sea, fix me up as you can. And send me on my way. Please contact us when you can. If you can find me onshore please take me to the nearest school. Hopefully their students will contact my school and together we can decide what to do. At any rate we'd love to hear from you.

Signed,

The Students of John Winthrop Middle School.



Figures 4.1 A: The "CHARGER". B: Souvenirs from Portugal. C: Writing the postcard to finders. D: After launched the boat in Atlantic Ocean.

4.2 Visited Ponta Delgada, São Miguel Island on 1st - 2nd June 2014

Ponta Delgada is the capital of Sao Miguel, the largest island in the nine island of Azores archipelago that sits about 900 miles of the coast of Portugal. The town is very clean and orderly. Almost everything buildings and sidewalks are made from porous volcanic rock, vesicular basalt. Pineapple is the famous fruit and is produced inside glass green houses. In Fajã de Baixo, a village situated only 5 km from Ponta Delgada, you can visit some of these green houses in this private plantation.

Figure 4.2 A: Forte de Sao Bras is a renaissance fortress from the 16th century that was originally build to defend Ponta Delgada against pirate attacks. B: Praça do Município, is an interesting example of the baroque style (17th and 18th centuries). C-D: Part of buildings and sidewalk in Ponta Delgada made from the volcanic rock. E: Pineapples plantation. F: Earing made from volcanic rock (basalt).

4.3 Portuguese Culture

4.3.1 Cuisine

Portuguese cuisine, there are three main courses. Breakfast (pequeno almoço) will served with bread (Figure 4.4-A), café and milk. Lunch (almoço) and dinner (jantar) are usually including soup, (Figure 4.4-B). The soup is a major component in lunch and dinner meals, eaten by served with bread as a first course of a meal. Main dish are always fish and meat such as pork, beef and poultry usually served with a salad, potatoes or rice. Fish recipes, salt cod (bacalhau) (Figure 4.4-C) is very common in Portugal. The dessert is often served after a meal as well such as fruit, ice cream or pudding. The typical desserts e.g. custard tart, rice pudding decorated with cinnamon, (Figure 4.4-D).

Figure 4.3 A: Bread. B: Soup (Soupa). C: Cod Fish (Bacalhau). D: Rice pudding.

4.3.2 Coffee

Coffee is so ingrained into the Portuguese lifestyle. The Portuguese drink coffee all day. It is part of their daily routine to have a coffee every few hours, up to ten a day. Every meal ends with small cups (Figure 4.6-B). Average of 6-7 cups a day is often served after a meal as well.

Figure 4.4 A: Coffee machine. B: A small cup of Coffee.

4.4 Whale and Dolphin watching

In the Atlantic Ocean there are a lot of whales and dolphins. Everyone will hear from the announcement of the vessel where you can see the whales and dolphins.

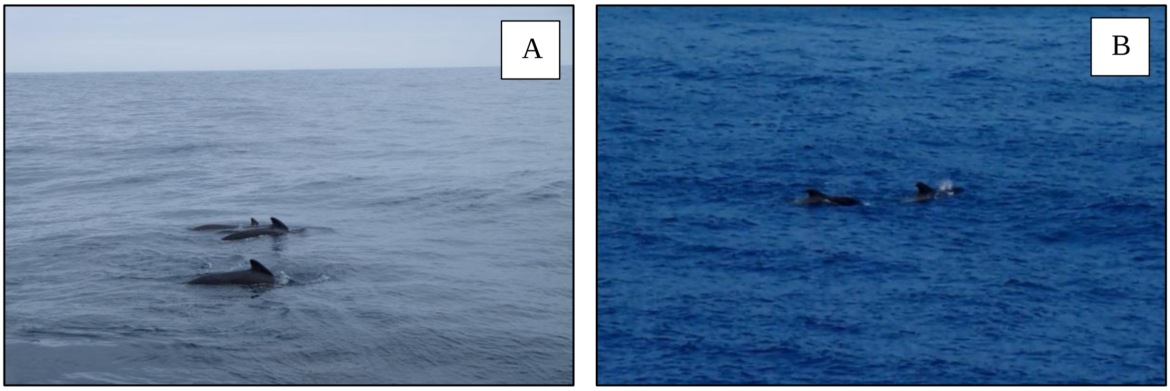


Figure 4.5 A-B: A lot of whales (A) and dolphins (B) in the Atlantic Ocean.

PART VI

SUMMARY

5.1 Conclusion

The cruise EMEPC/PEPC/LUSO/2014 was essentially planned for the exploration in the area of Maxwell Fracture Zone, near the Mid Atlantic ridge, with the ROV Luso. The main goal was the collection of rock samples from the seafloor, although biological sampling was also aimed. In this campaign have totally 7 dives with ROV Luso, 3 dives for training and/or calibration and 4 scientific dives in the Maxwell fracture zone. The work with the ROV was severed limited by the bad weather conditions during the most part of the campaign.

5.2 Benefits from this campaign

1. Able to know the system of working on the vessel, teamworking, coordination between military and EMEPC.
2. Understanding in basic method of the equipment used such as Multibeam echo sounder, CTD, ROV and etc.
3. Able to know about sample management; geological, biological and water sampling.
4. Knowledge and experience from this campaign can be applied in my work and useful for future work.
5. Able to know Portuguese culture such as food, dessert and coffee time and Portuguese language.
6. The best important thing is a friendship that I had received from everyone in this campaign not only from the EMEPC team but also the other scientists from another institution and all crew in the vessel NRP Almirante Gago Coutinho.

5.3 Problems in this campaign

To work on sea there are many constraining conditions that may affect ROV operations e.g. wind, wave, current, weather conditions.

ACKNOWLEDGEMENTS

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I would like to express my most sincere thanks to Mr. Pedro Madureira not only his contact before the campaign begins but also his assistance, guidance and teaching in everything during this campaign and gave me all of his documents to develop my knowledge and to make the report.

I would also like to thank Mónica Albuquerque for her assistance, encouragement and explanation about the biological sample, ROV team; António Calado, Andreia Afonso, Renato Bettencourt, Bruno Ramos and Luis Bernardes for their assistance and ROV explanation, Miguel Souto for his encouragement, explanation about the equipments and laughing all the time during the campaign, Patrícia Conceição and Filipa Marques for their encouragement, illustration and guidance about geological and water sampling management. Moreover, we are thankful to Luis Gonçalves, Ravit Bennaim and José Manuel Pereira for their friendship and opinion sharing.

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Responsibilities : - Geosite and Geoconservation site survey
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5. At-sea working experience - Observer in Geophysical Mapping Survey, Surat Thani Province, Thailand 2013.
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