# Cruise Plan

# DRAKE2018

## Chief Scientists

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## Duration

21 effective days, or 34 total days including transits or others activities of supply to Antarctic Bases and considering departure from Ushuaia and arrival in Punta Arenas.

## Cruise objectives

The general objective of the TASMANDRAKE project is the study of the onset and evolution of the Antarctic Circumpolar Current (ACC). Taking into account the allowed period and that the capabilities of the geophysical equipment on board cannot image the deep structures and sediments, the cruise cannot fulfill the objectives of the TASMANDRAKE Project pertaining to the opening of gateways and onset of the ACC. We have therefore developed and alternative plan for the DRAKE2018 cruise that will allow us to collect mid-penetration to shallow data from the southern Drake-Scotia area (58ºS/62ºS and 60ºW/50ºW) and the South Orkney Shelf (60ºS/63ºS and 50ºW/40ºW). With this kind of capabilities we target those objectives of the TASMANDRAKE Project dealing with: 1) the evolution of the ACC during the Pleistocene and the Holocene; and 2) near-surface structure of continental blocks (i.e., the South Orkney micro-continent and the platform surrounding Elephant Island) and age of the older oceanic crust in Drake Passage. The proposed work is aimed to help land- ocean correlations between the stratigraphy of Seymour/Marambio Island and Ocean Drilling Project Site 696, in order to better understand the break-up and paleogeographic evolution of these continental blocks.

The proposed marine surveys will consist in the execution of predefined transects along which geophysical data will be collected. In addition, we expect to collect sediment cores in specific sites, in order to ground-truth seismic facies with sediment information and provide age constrains of the most recent (Quaternary-Pliocene?) units.

## Geographic setting and proposed study areas

We plan to study two areas (Fig. 1):

A) The study area in the Drake Passage-Scotia Sea area will focus on the Ona basin and the Elephant Island shelf where water depths are between 3000 mbsl (Ona Basin) and <500 m (Elephant Island shelves); and

B) The South Orkney Micro-continent shelf where water depths are mainly shallower than 600 meters below sea level.

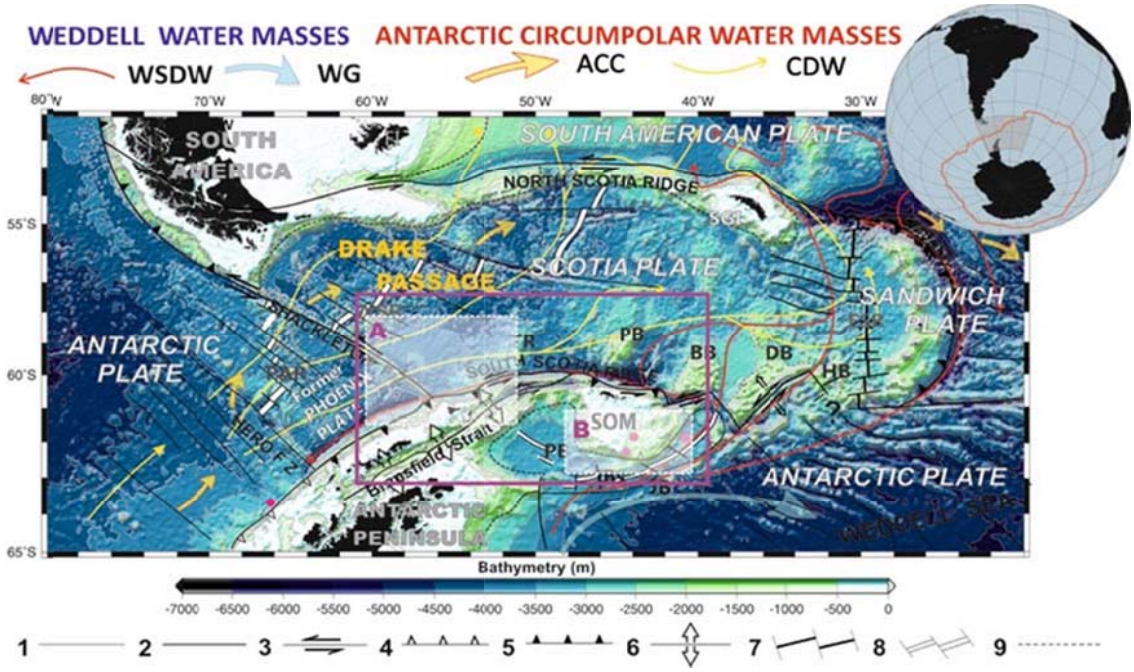


*Figure 1: Proposed location of the DRAKE2018 marine survey in the Ona Basin and Elephant Island shelf (A), and South Orkney Microcontinent shelf (B) working areas (indicated by white boxes).*

## ***Survey Area A: Ona Basin and Elephant Island shelf***

Figures 2 and 4 show the preliminary location of the geophysical work in the Ona Basin and the Elephant Island shelf that is based on preliminary results on existing TOPAS profiles in the area. The proposed location of the lines can be altered as we obtain new geophysical information that can point to new tectonic or sedimentary features of interest. Because of the water depths in the Ona Basin, we propose the use of multibeam echosounder and TOPAS systems in addition to the magnetometer and gravimeter data.

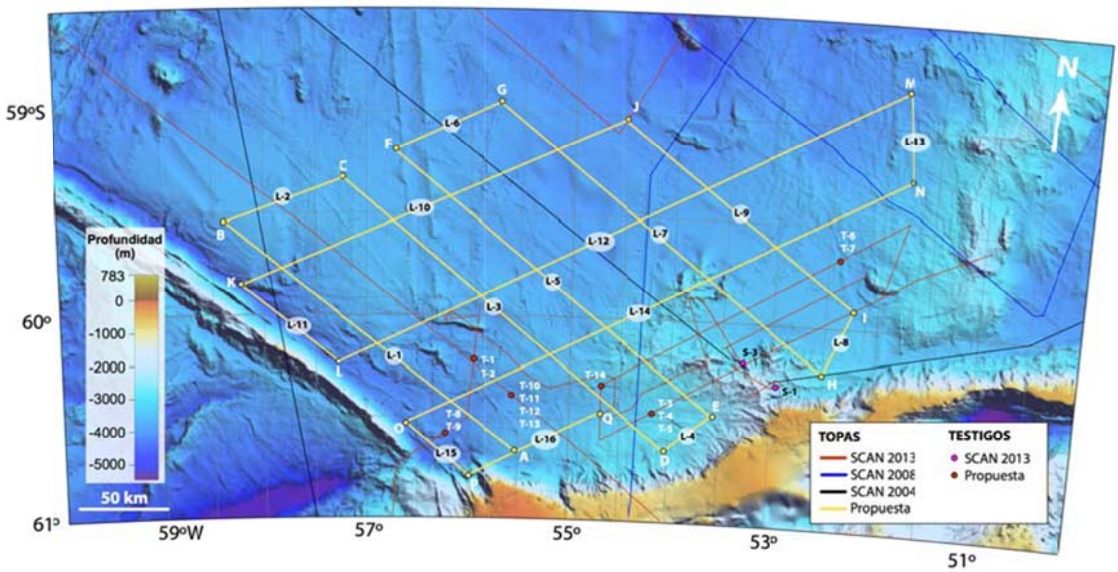


*Figure 2: Location of the geophysical lines and piston/gravity core locations in the Ona Basin.*

In Ona Basin, we also plan to recover gravity cores (Figures 2 and 3). Table 1 shows the potential location of these sediment cores as well as the priority given for their recovery based on depositional environments defined using existing TOPAS and multibeam data sets. In some selected locations in addition to gravity cores, we plan to collect multicores to recover the water-sediment interphase. This plan can be altered as new data obtained during the cruise can show areas of more interest for sampling. Depending on the time available we aim to retrieve a minimum of six cores. Additional cores will be taken based on new information provided by the proposed geophysical survey in the Ona Basin and/or time availability

The survey planned in the Elephant Island shelf plans to use, in addition to the other equipment, the Sparker system to image some of the offshore extension of structures that have been previously mapped onland by members of the scientific team.

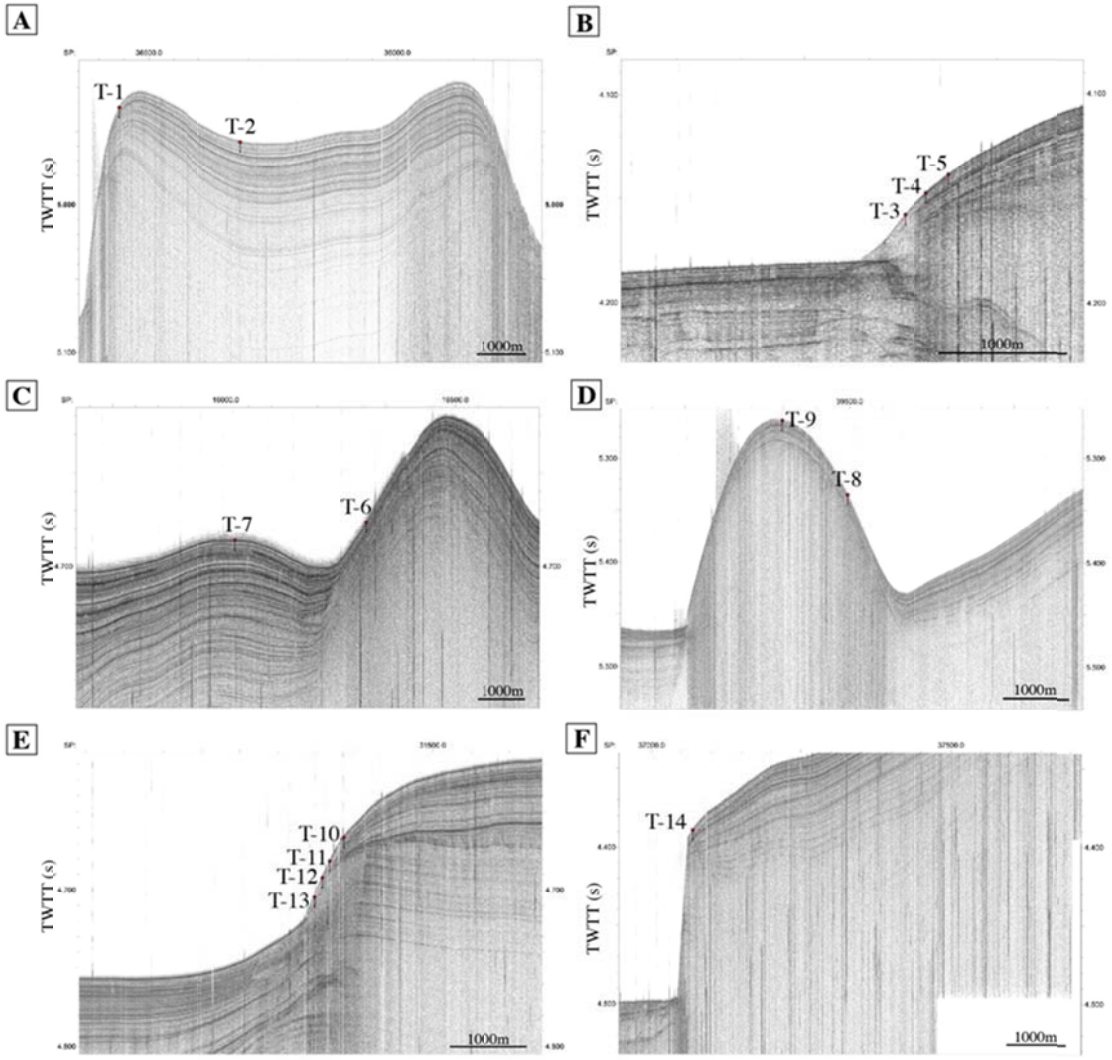


*Figure 3: TOPAS seismic profiles showing the proposed sed ment coring stations. The coordinates for the sampling stations and the pri ority for sampling at each station are provided in Table 1.*

*Table 1: Locations for the piston/gravity core stations and prioritization for their sampling. Final location of the stations may change in the light of news geophysical information obtained during the cruise. Location of each station in Figure 3.*

| Gravity core sites | Latitude | Longitude | Objective | Priority |
|---|---|---|---|---|
| Testigo-1 | 60º11'58.78888''S | 55º58'13.63984''W | Unidad 1 (condensada). Fig. 3A. | 1 |
| Testigo-2 | 60º9'51.78162''S | 55º58'1.22418''W | Unidad 1 (parte superior de la unidad; expandida). Fig. 3A. | 1 |
| Testigo-3 | 60º27'26.31115''S | 54º10'7.76993''W | Unidad 1 (condensada completa) + techo Unidad 2. Fig. 3B. | 1 |
| Testigo-4 | 60º27'24.42010''S | 54º10'5.00953''W | Unidad 1 (condensada completa). Fig. 3B. | 1 |
| Testigo-5 | 60º27'22.98374''S | 54º9'56.12860''W | Unidad 1 (parte superior de la unidad; expandida). Fig. 3B. | 1 |
| Testigo-6 | 59º39'47.44841''S | 52º26'12.14022''W | Unidad 1 (condensada completa). Fig. 3C. | 1 |
| Testigo-7 | 59º40'24.38129''S | 52º28'17.41156''W | Unidad 1 (parte superior de la unidad; expandida). Fig. 3C. | 1 |
| Testigo-8 | 60º34'49.84477''S | 56º14'27.96775''W | Unidad 1 (condensada completa). Fig. 3D. | 2 |
| Testigo-9 | 60º35'20.83421''S | 56º16'0.71579''W | Unidad 1 (parte superior de la unidad; expandida). Fig. 3D. | 2 |
| Testigo-10 | 60º30'59.02725''S | 55º13'51.72582''W | Unidad 1 (parte superior de la unidad; expandida). Fig. 3E. | 2 |
| Testigo-11 | 60º30'57.00844''S | 55º13'57.04916''W | Unidad 1 (condensada completa). Fig. 3E. | 2 |
| Testigo-12 | 60º30'55.37795''S | 55º14'0.17762''W | Unidad 1 (condensada completa) + parte superior Unidad 2. Fig. 3E. | 2 |
| Testigo-13 | 60º30'53.54537''S | 55º14'3.67631''W | Unidad 1 (condensada completa) + parte superior Unidad 2. Fig. 3E. | 2 |
| Testigo-14 | 60º19'27.82255''S | 54º40'18.83090''W | Unidad 1 (condensada completa). Fig. 3F. | 3 |

## ***Survey Area B: The South Orkney Micro-continent***

Figure 5 shown the survey planned for the area of the South Orkney Micro-continent. The water depths in this area allow for imaging near-surface structures and sediment cover with the Sparker system in addition to other geophysical technics, such as magnetometer and gravimeter. A paleogeographic reconstruction conducted in the frame of the TASMANDRAKE Project shows the position of this microcontinent during the Eocene-Oligocene to be aligned with Seymour/Marambio Island. South of the area proposed for this survey, the Ocean Drilling Program Leg 113 recovered sediment cores dated Eocene-Oligocene from Site 696. The survey is aimed at characterizing the structure of the basin where Site 696 is located and the sedimentary environments, which can then be compared with land records from the Eocene-Oligocene at Seymour Island. This land-ocean correlation is one of the objectives of the TASMANDRAKE Project.

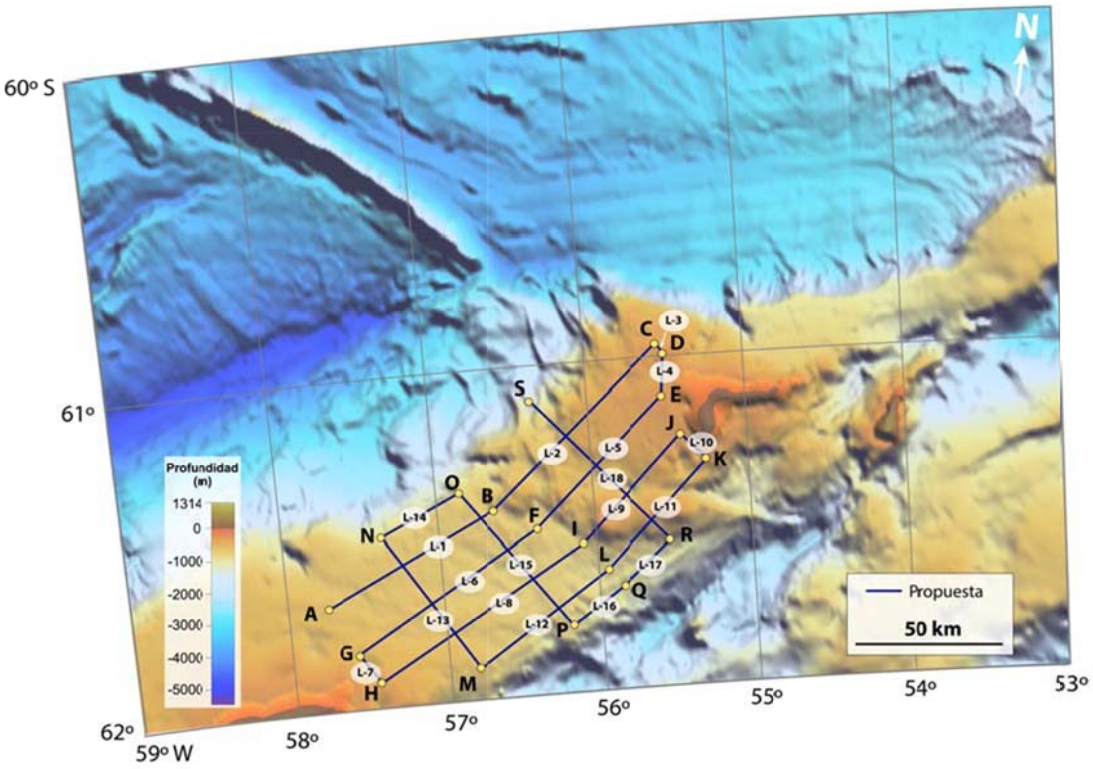


*Figure 4: Location of geophysical survey proposed around the Elephant Island shelf.*

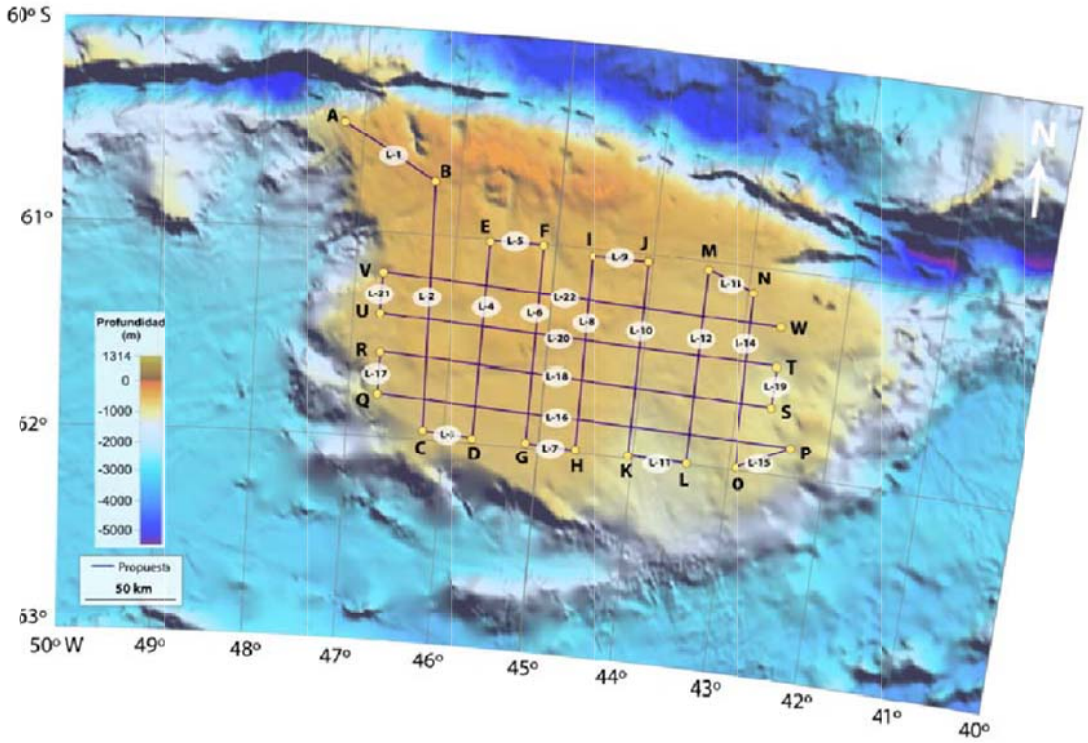


*Figure 5: Location of proposed geophysical survey in the South Orkney Microcontinent.*

**Required geophysical equipment and sampling devices**

1 – SPARKER High resolution seismic to collect a single trace seismic profiles, configured at the maximum energy capacity and streamer length. Post-processing may be conducted with RadExPro software.

2 – TOPAS parametric echo sounder, in order to collect high-resolution sub-seafloor images.

3 –EM120 multibeam echo sounder. Postprocessing may be completed onboard with the assistance of IHM personnel conducted with CARIS and FLEDERMAUS software.

4 – Magnetometer SeaSPY or similar.

5 – Marine Gravimeter BGM and conventional gravimeter for cycle opening/closing in Ushuaia/Pta. Arenas.

6.- Gravity Corer.

7. Multicorer

8 – GPS.

It is expected to collect:

(1) Multibeam bathymetric data along the TOPAS and seismic transects and dedicated surveys.

(2) High-resolution TOPAS profiles, in areas where sediment cores are available, or in areas where the collection of short sediment cores is expected: Ona basin and SOM shelf. Goal: to correlate the seismic and sedimentological data.

(3) SPARKER Seismic data along the Ona basin high, in the Elephant Island shelf, and South Orkney Micro-continent shelf.

(4) Sediment cores and multicorer, in areas where a correlation with high-resolution TOPAS profiles can be established (e.g., Ona Basin).

(5) Gravity and magnetics profiles along seismic transits and dedicated multibeam survey.

(6) In addition, we will sample and filter seawater from 5 m depth and from the multicorers throughout the duration of the cruise. The aim of this work is to calibrate the distribution across the Polar Front of indicators that will be later studied in the core (i.e. diatoms, coccolitophors, pigments, chlorines, etc).

Considering effective survey duration of 21 days, it is expected to devote approximately two thirds of the time to the geophysical acquisition and approximately 5 days to the sediment collection.

## Scientific team

| Institución y nombre | DNI | Fecha de Nacimiento |
|---|---|---|
| Cruise Leaders | | |
| Carlota Escutia Dotti (IACT-CSIC) | 18007850T | 24/12/1959 |
| Fernando Bohoyo Muñoz (IGME) | 53152404W | 03/07/1976 |
| Instituto Andaluz de Ciencias de la Tierra | | |
| Johan Etourneau | Y5368512-G | 17/06/1979 |
| Margarita García García | 44253234S | 23/02/1974 |
| Adrián López Quirós | 76661023E | 26/05/1992 |
| Ariadna Salabarnada Roset | 47734174-C | 14/02/1984 |
| Dimitris Evangelinos | AM951194 | 13/01/1989 |
| Universidad de Perpignan (Francia) | | |
| Serge Berné | 30729102307 | 27/02/1953 |
| Royal Holloway University of London (GB) | | |
| Javier Hernández-Molina | 31237841-T | 26/12/1963 |
| Colgate University (USA) | | |
| Meghan Louise Duffi | 515554132 | 26/07/1996 |
| Geological Survey of Denmark and Greenland (GEUS) | | |
| Lara Felicidad Pérez Miguel | 71019956-G | 27/01/1986 |
| Instituto Geológico y Minero de España | | |
| Estefanía Llave Barranco | 32049069H | 07/05/1974 |
| Pedro Ignacio Ibarra Torre | 50816219L | 27/01/1965 |
| Carmen Rey Moral | 08029621E | 18/03/1969 |
| María Druet Vélez | 52988861N | 02/08/1978 |
| Universidad de Granada | | |
| Jesús Galindo Zaldívar | 24186799E | 13/06/1963 |
| Real Observatorio de la Armada | | |
| CF Manuel Catalán Morollón | 32847606H | 21/07/1962 |
| Instituto Hidrográfico de la Marina | | |
| CF. Federico Yanguas Guerrero | 22960973G | 10/03/1966 |
| CC. Juan Bautista Manzano Ruiz | 53116475E | 22/11/1980 |
| C1. José Luis Márquez Garcia | 32043249V | 30/03/1972 |

## Work Shifts

It is expected to work on a 24 h basis, at an average ship velocity of 4 knots with Sparker system and up to 10 knots without Sparker system..

The minimum scientific personnel required on the DRAKE cruise is 18/20 (9 scientists from the Subproject 1 and 10 scientists from Subproject 2) and is distributed as follow:

2 Cruise leaders (12 h watch slot)

Watch slot 1 (00:00-4:00 and 12:00 to 16:00)

5 researchers (Watch leader, Multibeam bathymetry, Seismics, TOPAS, Gravity and Magnetics; includes postprocessing)

Watch slot 2 (04:00-8:00 and 16:00 to 20:00):

5 researchers (Watch leader, Multibeam bathymetry, Seismics, TOPAS, Gravity and Magnetics; includes postprocessing)

Watch slot 3 (08:00-12:00 and 20:00 to 00:00):

5 researchers (Watch leader, Multibeam bathymetry, Seismics, TOPAS, Gravity and Magnetics; includes postprocessing)

2 researchers in data post-processing and navigation (Mapping production; Multibeam bathymetry, Seismics, TOPAS, Gravity and Magnetics projects)

The present research group has a large experience in these techniques from the BIO Hespérides and many others vessels. We also request the following technical personnel (6/7 technicians) by UTM team on board BIO Hespérides:

- 2 seismic technicians (1 acquisition system)

- 1 technician for the instruments (SIMRAD swath bathymetry, TOPAS, gravimeter, magnetometer)

- 1 technician (computer sciences)

2/3 Mechanic technicians to take samples and operate seismic
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