



## **Notification of research cruise: R/V “Sarmiento de Gamboa” NEAREST cruise (Gulf of Cadiz)**

### **PERMIT to survey in PORTUGAL**

#### **GENERAL INFORMATION**

##### **Part A**

- 1. Vessel name:** BO Sarmiento de Gamboa
- 2. Period of work (planned):** between 1st and 30<sup>th</sup> May 2010
- 3. Research organisation:** CSIC, Barcelona, Spain
- 4. Operator and owner (if different):** Operator, CSIC, Spain
- 5. Characteristics and details of the vessel:**

Flag: **Spain**

Type of vessel: **Oceanographic Research Vessel**

Year built and country: **2007 by CNP Freire, Spain**

Length / width **70,5 m**

Length p.p.: **62,0 m**

Design Draught: **4,60 m**

Scantling Draught: **4,90 m**

Depth to main deck: **5,00 m**

Tonnage: Gross = **2630 GT**

Dead weight: **850 tpm**

Maximum Speed: **14,5 knots**

Prop. Power: **2400 kW**

Fuel: **528 m3**

Endurance: **40 days**

Accommodation (crew + research) **16+26**

Classification society: **Bureau Veritas, +HULL Special Service  
Oceanographic and Fishing Research/Unrestricted  
Navigation/+MACH+AUT-UMS, AUT-CCS, ALM SDS COMF-1, SYS-  
NEQ 1 DYNAPOS AM/AT**

Register port: **Vigo**

Call code: **E A K F**

Phone:

- INMARSAT: +870.761.143.975 / INMARSAT: +870.761.143.979  
VSAT:+34.931.845.898
- Cellular: +34.679.510.317

Email: [capitan@sdgamboa.cmima.csic.es](mailto:capitan@sdgamboa.cmima.csic.es)

## 6. Crew:

Name of masters

**Ramón Argibay Fernández**      **76516018D**

**David Dominguez Añino**      **31247505G**

Number of crew people: 42

16 marine crew (Spanish)

26 survey crew (Spanish, Portuguese, Italian, French, British, Algerian and Moroccan nationals).

## 7. Researchers:

Name and address of main scientists

### In Spain:

**Dra. Eulàlia Gràcia Mont / Dr. Rafael Bartolomé de la Peña**

Consejo Superior de Investigaciones Científicas (CSIC)

Unidad de Tecnología Marina

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**Prof. Dr. Juan José Dañobeitia**

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### In Portugal:

**Dr. Pedro G. Terrinha (Cc. Dr. Fatima Abrantes)**

INETI – National Institute for Engineering, Technology and Innovation (Instituto Geologico e Mineiro)

Dept. Geologia Marina

Estrada da Portela

2721-866- Alfragide

PORTUGAL

Phone: 351-21-4705400 (switchboard)

Fax: 351-21-4719018

Email: [pedro.terrinha@ineti.pt](mailto:pedro.terrinha@ineti.pt)

## **List of marine survey technicians and scientists: (Maximum 26)**

Rafael Bartolomé de la Peña (ESP)

Eulàlia Gràcia Mont (ESP)

Marcel.lí Farran Vert (ESP)

Claudio Lo Iacono (ITA)

Ximena Moreno Mota (ESP)

Hector Perea Manera (ESP)

Sara Martínez-Loriente (ESP)

Elena Piñero Melgar (ESP)

Zoraida Roselló Espuny (ESP)

Nathalie Babonneau (FR)

Pedro Terrinha (POR)

Eduardo Rubio Culebras (ESP)

Susana Diez Tagarro (ESP)

Manuel Jesus Roman Alpiste (ESP)

Pablo Rodriguez (ESP)

Jose Luis Alonso (ESP)

Marcus Packard (ESP)

Ramon Ametller (ESP)

System manager (ESP)

Technician GeoEel streamer(UK)

Technician Gun-Array (UK)

Technician compressors (UK)

Invited Algeria (AL)

Invited Morocco (MOR)

Invited Portugal (PT)

## **8. Geographical zone where the vessel will work (latitude and longitude to be provided):**

North-western corner: 38°N, 13°W

South-eastern corner: 34°N, 7°W

(See attached map in **ANNEX-I**)

*\* The study area corresponds to Spanish, Portuguese and Moroccan ZEE waters. A permit to survey in Moroccan waters has also been requested.*

## **9. Short description of the purpose of the cruise:**

The main objective of the NEAREST cruise is to investigate and characterize the geomorphology and geometry of active tectonic structures recently identified in the SW Portuguese area, which may be sources of large earthquakes and tsunamis. We will focus especially on the sources of instrumental earthquakes of  $M_w > 6.0$ , such as the 1969  $M_w$  8.0 Horseshoe Abyssal Plain Earthquake, the 1964  $M_w$  6.6, near the Guadalquivir Bank and the 1960  $M_w$  6.2 from the Moroccan margin. These structures may represent a seismic and tsunamigenic hazard for the surrounding coasts of South Iberia and North Africa. Submarine landslides will be also explored, in particular the ones on the north Gorringe Bank and Portimao Bank. During the cruise, we will be mainly using multichannel seismic reflection together with other marine geophysical methods (swath-bathymetry, gravity, magnetics and sub-bottom profiler).

## **10. Dates and names of planned call ports (before and after work):**

Embarking port: Almería or Cartagena (Spain), 1<sup>st</sup> May 2010

Debarking port: Cadiz (Spain), 30<sup>th</sup> May 2010

## **11. Logistic requirements in call ports:**

None.

## DETAILED INFORMATION

### Part B

- 1. Vessel name:** BO Sarmiento de Gamboa
- 2. Period of work (planned):** between 1st and 30<sup>th</sup> May 2010
- 3. Goals of cruise and general methodology to be used (explain):**

The main objective of the cruise is to investigate structures recently mapped in the SW Iberian Margin (ESF EuroMargins SWIM compilation), in three particular areas: a) the area around the Guadalquivir Bank, possible source of the 1964 Mw 6.6 earthquake; b) the area of pull apart basins from the Moroccan margin, near the epicentre of the 1960 Mw 6.2 earthquake; c) the strike-slip SWIM lineaments N and S, and area of the 1969 Mw 8.0 Horseshoe earthquake. This is essential to assess for seismogenic and tsunamigenic structures in the area, as we can learn about the fault parameters of the sources of larger, destructive events, such as the 1755 Lisbon Earthquake and Tsunami.

To accomplish this goal we will use a high-volume G-gun array specially designed for relatively high penetration without losing resolution in the sedimentary layers. To record the MCS data, we will use the 3 km long Sercel multichannel digital streamer (240 channels) towed behind the vessel at a survey speed of 5 knots. The 3 survey areas mentioned above will be mainly investigated for marine paleoseismology objectives. The survey will be designed acquiring short, closely spaced profiles perpendicular to the faults in order to obtain their fault seismic parameters (e.g. slip rate, recurrence interval, maximum EQ produced). Once accomplished, we will do few selected long MCS profiles for regional, geodynamic objectives.

Simultaneously to the seismic survey, we will use the hull mounted swath-bathymetry system to map un-surveyed areas, the hull mounted sub-bottom profiler Parasound to image the shallow sediments 0-80 m below the seafloor, a gravimeter and a magnetometer. Submarine landslides will be also explored with the same methods in particular the ones to the north of the Goringe Bank or south of the Portimao Bank. Finally, and to complete the ESF EuroMargins SWIM compilation, we will try to do swath-bathymetric imaging in areas not previously mapped to complete the bathymetric compilation of the SW Iberian Margin.

No moorings, no deep-towed vehicles and no explosives will be used.

- 4. Add one map at an appropriate scale showing the geographical working zone where the work is planned, the locations of sampling stations (if any), the tracks of survey lines (if any), the location of moored equipment (if any), and any other relevant information :**

See attached map for preliminary cruise plan.  
Preliminary sample location shown on attached map  
Preliminary survey lines shown on attached map.

**5. Type of samples, if any (i.e., geological / water / plankton / radioactive isotopes):**

No samples will be taken.

**6. Details on moored equipment, if any: None**

**7. Explosives, if any:**

None.

**8. Details and references on:**

**a) Previous / future related cruises:**

Since the European project **BIGSETS** (*Big Sources of Earthquakes and Tsunamis*, 1998-2000), during which a very successful scientific cooperation started between scientists from Portugal, Italy and Spain, several collaborative cruises have been carried out in the area. Scientific cooperation has culminated in the projects European Science Foundation (ESF) **Euro-MARGINS SWIM** project (*Earthquake and Tsunami Hazard in the SW Iberian Margin: Deep structure, high-resolution imaging and paleoseismic signature*, 2003-2006), and the present-day project from the **EU FP VI NEAREST** project (*Integrated observatories from near shore sources of tsunamis: Towards an early warning system*, 2006-2010), with representatives from Italy (N. Zitellini, coordinator), Spain, Portugal, France and Morocco, among other partners.

In the frame of the above mentioned collaborations, the following cruises have been carried out in the area:

**• 1998 / BIGSETS cruise**

**PI:** Nevio Zitellini (Univ. Bologna, Italy)

**Study Area:** Gulf of Cadiz and SW Portuguese Margin

**Objectives:** Study the active deformation in the SW Iberian Margin (Marques de Pombal fault and Gulf of Cadiz)

**Equipment:** Multi-channel seismics, sub-bottom profiler, coring

**Vessel:** RV Urania (ITALY)

**Dates:** 5 November to 5 December 1998

**• 2000 / PARSIFAL cruise**

**PI:** Juan José Dañobeitia (ICTJA-CSIC-Barcelona, Spain)

**Study Area:** Gulf of Cadiz and SW Portuguese Margin

**Objectives:** Bathymetric mapping with Simrad EM12 and exploring internal structure of active faults in the SW Portuguese Margin

**Equipment:** Swath-bathymetry, magnetics. gravity, sub-bottom profiler, refraction seismics (OBS)

**Vessel:** RV Hesperides (SPAIN)

**Dates:** 13 to 30 May 2000

• **2001 / HITS cruise**

**PI:** Eulàlia Gràcia (ICTJA-CSIC-Barcelona, Spain)

**Study Area:** SW Portuguese Margin

**Objectives:** High-resolution imaging of active faults (Marques de Pombal, Sao Vicente Canyon and Horseshoe Faults) and associated landslides in the SW Portuguese Margin

**Equipment:** Deep-towed sidescan sonar (TOBI) swath-bathymetry, gravity, TOPAS, heat flow, gravity corer, multicorer.

**Vessel:** RV Hesperides (SPAIN)

**Dates:** 2 September to 4 October 2001

• **2002 / VOLTAIRE cruise**

**PI:** Nevio Zitellini (Univ. Bologna, Italy)

**Study Area:** Gulf of Cadiz and South Portuguese Margin

**Objectives:** Study the active deformation in the Gulf of Cadiz (Lagos and Portimao canyons, Portimao Bank, Guadalquivir Bank, etc.)

**Equipment:** Multi-channel seismics, sub-bottom profiler

**Vessel:** RV Urania (ITALY)

**Dates:** November to December 2002

• **2003 / PICABIA-PRIME cruise**

**PI:** Jean Louis Turon (U. Bordeaux), Eulàlia Gràcia (UTM-CSIC-Barcelona, Spain)

**Study Area:** SW Portuguese Margin

**Objectives:** Marine paleoseismic study of active faults and landslides in SW Portuguese Margin based on the obtention of long cores

**Equipment:** Swath-bathymetry, sub-bottom profiler, Giant piston coring CALYPSO, MST

**Vessel:** RV Marion Dufresne (FRANCE)

**Dates:** 15 to 25 July 2003

• **2003 / GAP cruise**

**PI:** Achim Kopf (U. Bremen, Germany)

**Study Area:** Gulf of Cadiz

**Objectives:** Gibraltar Arc Processes. Multidisciplinary cruise to study the present day processes occurring in the Gulf of Cadiz (mud volcanoes, gas hydrates, active faults, landslides).

**Equipment:** Swath-bathymetry, sub-bottom profiler, seismics, gravity corer, TV grab, multicorer, heat flow probe

**Vessel:** RV Sonne (GERMANY)

**Dates:** 24 November to 24 December 2003

• **2004 / MATESPRO cruise**

**PI:** L. Matias, L. Mendes-Victor, P. Terrinha (U. Lisboa, Portugal)

**Study Area:** Southern Portuguese Margin

**Objectives:** Bathymetric mapping of the Northern part of Gulf of Cadiz

**Equipment:** Simrad EM 120 swath-bathymetry

**Vessel:** RV Dom Carlos (PORTUGAL)

**Dates:** 29 June to 8 July 2004

• **2004 / SWIM cruise**

**PI:** Nevio Zitellini (Univ. Bologna, Italy)

**Study Area:** Gulf of Cadiz and SW Portuguese Margin

**Objectives:** Sampling the active deformation in the SW Iberian Margin

**Equipment:** Coring, dredging, sub-bottom profiler

**Vessel:** RV Urania (ITALY)

**Dates:** 26 August to 9 September 2004

• **2004 / DELILA cruise**

**PI:** M.A. Gutscher (U.Brest, France)

**Study Area:** Southern Portuguese Margin

**Objectives:** Mapping of the Southern part of Gulf of Cadiz

**Equipment:** Simrad EM 120 swath-bathymetry, magnetics

**Vessel:** RV Dom Carlos (PORTUGAL)

**Dates:** 27 September to 10 October 2004

• **2005 / SWIM-Explora cruise**

**PI:** Nevio Zitellini (Univ. Bologna, Italy)

**Study Area:** Gulf of Cadiz and SW Portuguese Margin

**Objectives:** Mapping on the Coral Patch seamount area

**Equipment:** Reson swath bathymetry and sub-bottom profiler

**Vessel:** RV Explora (ITALY)

**Dates:** 30 September to 18 October 2005

• **2006 / SWIM cruise:**

**PI:** E. Gràcia (UTM-CSIC, Barcelona)

**Study Area:** External part of the Gulf of Cadiz

**Objectives:** Seismic survey of the Horseshoe and Coral Patch Faults and y  
Horseshoe Abyssal Plain

**Equipment:** Simrad EM 120 swath-bathymetry, MCS, sub-bottom profiler  
TOPAS, gravimetry, magnetics

**Vessel:** RV Hesperides (SPAIN)

**Dates:** 31 May to 14 June 2006

• **2007 / NEAREST cruise**

**PI:** N. Zitellini & G. Carrara (ISMAR-CNR)

**Study Area:** SW Portuguese Margin

**Objectives:** GEOSTAR deployment and sediment sampling

**Equipment:** CHIRP survey, multicores and gravity cores

**Vessel:** RV Urania (ITALY)

**Dates:** 10 August - 10 September 2007

• **2008 / NEAREST-SEIS cruise**

**PI:** V. Sallarès (UTM-CSIC, Barcelona)

**Study Area:** 2 refraction profiles

**Objectives:** Deep structure across the Gorringe Bank and accretionary  
wedge of the Gulf of Cadiz

**Equipment:** OBS, Simrad EM 120 swath-bathymetry, gravimetry

**Vessel:** RV Hesperides (SPAIN)

**Dates:** 27 October to 13 November 2008

**b) Previously published data related to the planned cruise (add additional page if needed):**

- DIEZ, S., GRÀCIA, E., GUTSCHER, M.A., MATIAS, L., MULDER, T., TERRINHA, P., SOMOZA, L., ZITELLINI, N., DE ALTERIIS, G., HENRIET, J.P., DAÑOBEITIA, J.J. (2005). Bathymetric map of the Gulf of Cadiz, NE Atlantic Ocean: The SWIM multibeam compilation. *250th Anniversary of the 1755 Lisbon Earthquake*, Lisbon (Portugal), 1-4 November.
- GARCIA-ORELLANA, J., GRÀCIA, E., VIZCAINO, A., MASQUÉ, P., OLID, C., MARTÍNEZ RUIZ, F., PIÑERO, E., SANCHEZ-CABEZA, J.A., DAÑOBEITIA, J.J. (2006). Identifying instrumental and historical earthquake records in the SW Iberian Margin using  $^{210}\text{Pb}$  turbidite chronology. *Geophys. Res. Lett.*, 33 (24), L24601, doi: 10.1029/2006GL028417.
- GRÀCIA, E., DAÑOBEITIA, J.J., VERGÉS, J., and PARSIFAL Team (2003). Mapping active faults offshore Portugal (38°N-36°N): Implications for seismic hazard assessment along the southwest Iberian Margin. *Geology*, 31, 83-86.
- GRÀCIA, E., DAÑOBEITIA, J.J., VERGÉS, J., BARTOLOMÉ, R., and CORDOBA, D. (2003). Crustal architecture and tectonic evolution of the Gulf of Cadiz (SW Iberian Margin) at the convergence of the Eurasian and African Plates. *Tectonics*, vol 22, nº4, 1033 – 1058.
- GRÀCIA, E., VIZCAINO, A., ESCUTIA, C., ASIOLI, A., RODÉS, A., PALLÀS, R., GARCIA ORELLANA, J., LEBREIRO, S., GOLDFINGER, C. (2009). Holocene earthquake record offshore Portugal (SW Iberia): Testing turbidite paleoseismology in a slow-convergence margin. *Quaternary Science Reviews*. 2<sup>nd</sup> revision oct 2009.
- GUTSCHER, M.A., MALOD, J., REHAULT, J.P., CONTRUCCI, I., KINGELHOEFER, F., MENDES-VICTOR, L., SPAKMAN, W., 2002. Evidence for active subduction beneath Gibraltar. *Geology*, 30 (12), 1071-1074.
- GUTSCHER, M.A., 2004. What caused the Great Lisbon earthquake? *Science*, 305, 1247-1248.
- LEBREIRO, S.M., VOELKER, A.H.L., ABRANTES, F.G., ALT-EPPING, U., JUNG, S., VIZCAINO, A., THOUVENY, N., GRÀCIA, E. (2009). Sediment instability on the Portuguese continental margin under abrupt glacial climate changes (last 60 ky). *Quaternary Science Reviews*, in press, Oct. 2009.
- TERRINHA, P., PINHEIRO, L.M., HENRIET, J.P., MATIAS, L., IVANOV, M.K., MONTEIRO, J.H., AKHMETZHANOV, A., VOLKONSKAYA, A., CUNHA, T., SHASKIN, P., AND ROVERE, M., 2003. Tsunamigenic-seismogenic structures, neotectonics, sedimentary processes and slope instability on the southwest Portuguese Margin. *Mar. Geol.*, 195(1-4), 55-73.
- VIZCAINO, A., GRÀCIA, E., PALLÀS, R., GARCIA-ORELLANA, J., ESCUTIA, C., CASAS, D., WILLMOTT, V., DIEZ, S., AND DAÑOBEITIA, J.J. (2005). Sedimentology, physical properties and ages of mass-transport deposits associated to the Marquês de Pombal Fault, Southwest Portuguese Margin, *Norwegian Journal of Geology*, 86, 173-182.
- ZITELLINI, N., MENDES, L., CORDOBA, D., DAÑOBEITIA, J.J., NICOLICH, R., PELLIS, G., RIBEIRO, A., SARTORI, R., TORELLI, L., AND BIGSETS TEAM (2001). Source of the 1755 Lisbon Earthquake and Tsunami Investigated. *EOS, Transactions of AGU*, Vol 82 (26), p. 285-290-291.
- ZITELLINI, N., ROVERE, M., TERRINHA, P., CHIERICI, F., MATIAS, L., and BIGSETS TEAM (2004). Neogene through Quaternary tectonic reactivation of SW Iberian passive margin. *Pure and Applied Geophysics*, 161, 565-587.
- ZITELLINI, N., GRÀCIA, E., MATIAS, L., TERRINHA, P., ABREU, M.A., DE ALTERIIS, G., HENRIET, J.P., DAÑOBEITIA, J.J., MASON, D.G., MULDER, T., RAMELLA, R., SOMOZA, L., DIEZ, S. (2009). The Quest for the Africa-Eurasia plate boundary west of the Strait of Gibraltar. *Earth Planet Sci. Lett.*, 280, 13-50.

**9. Name and address of researchers from the coastal state(s) in which waters the cruise will take place, and with whom previous contacts have been established:**

**Dr. Luis Manuel Matias (Cc Luis A. Mendes Victor)**

Centro de Geofisica da Universidade de Lisboa  
Campo Grande, Edificio C8, Piso 6  
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Phone: +351-217500812  
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**Dr. Pedro G. Terrinha (Cc. Dr. Fatima Abrantes)**

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Phone: 351-21-4705400 (switchboard)  
Fax: 351-21-4719018  
Email: [pedro.terrinha@ineti.pt](mailto:pedro.terrinha@ineti.pt)

**10. Say:**

**a) Are researchers from the coastal state going to be invited to visit the vessel once at port?**

No port from the coastal state is envisaged

**b) Will an observer from the coastal state be accepted on board during the research cruise and, if of application, which will be the dates and embarking / debarking ports?**

Yes, Portuguese colleagues are invited to take part in the cruise and will collaborate in joined research, as we have been doing in previous cruises and projects. Senior scientists (Dr. P. Terrinha) and young researchers are invited to take part in the cruise. The NEAREST cruise is the last of a series of cruises carried out in the frame of the FP VI EU NEAREST project.

Embarking port = Almería or Cartagena (Spain)

Debarking port = Cadiz (Spain)

**c) When the data collected during the requested cruise will be made available to the coastal state and by which means?**

A digital copy of the data acquired during the cruise will be delivered at the end of the cruise to the Portuguese national senior scientist embarking, as we have done in previous cruises in this area.

**Research equipment / Coastal state**

**11. Complete the table below – one copy per coastal state (by answering “yes” or “no”)**

PORTUGAL

<i>Provide a list of the main scientific equipment that is going to be used, saying the waters where it will be used / installed</i>	<i>Fisheries research within the established fishing limits</i>	<i>Research related to the continental shelf beyond the limits of the coastal state</i>	Distance to shore		
			<i>Within 12 nautical miles</i>	<i>Within 12 and 50 nautical miles</i>	<i>Within 50 and 200 nautical miles</i>
Swath bathymetry and backscatter (Simrad EM120). Hull-mounted on “BO Sarmiento de Gamboa”	No	Partly	No	Yes	Yes
Sub-bottom profiler PARASOUND Hull-mounted.	No	Partly	No	Yes	Yes
Gravimeter. Hull-mounted	No	Partly	No	Yes	Yes
Multi-channel seismic reflection. Surface towed behind vessel.	No	Partly	No	Yes	Yes
Magnetometer. Surface towed behind vessel.	No	Partly	No	Yes	Yes
Coring systems. Over-the-side during stations	No	Partly	No	No	No

# ANNEX-I

Location Map and objectives of the cruise in the Gulf of Cadiz.

