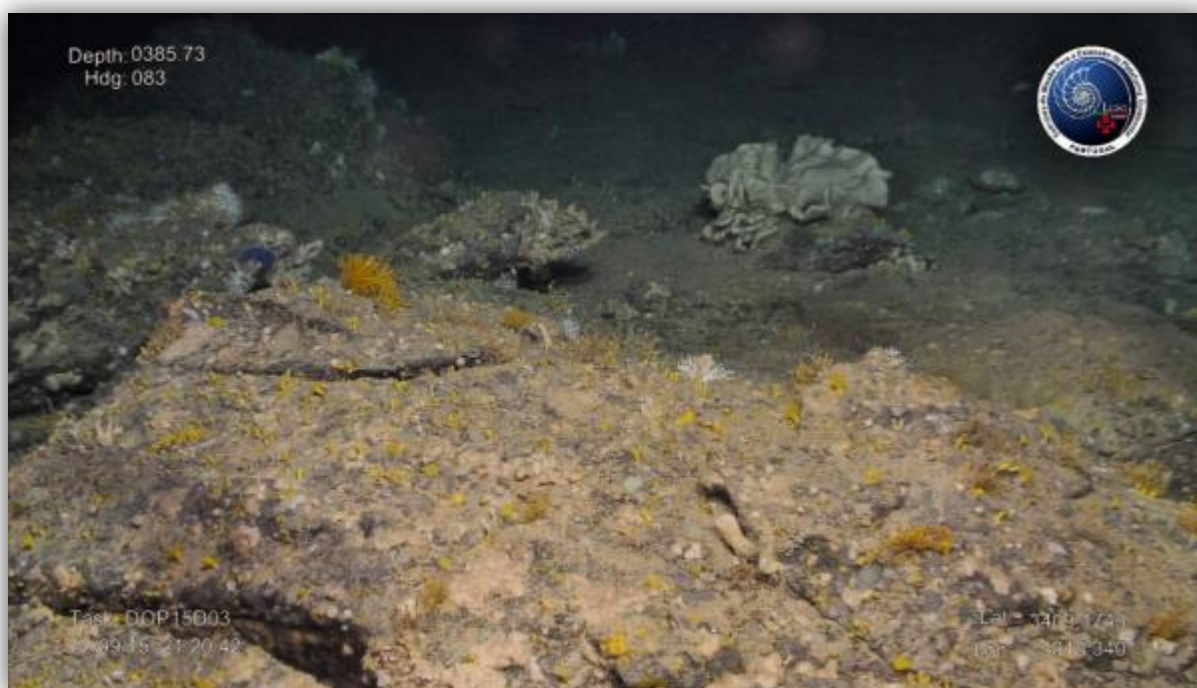


Cruise report BIOMETORE 2015 to the Great Meteor Complex seamounts (Atlantis and Irving) onboard the NRP *Almirante Gago Coutinho*

(14th September to 1st October 2015)



Benthic community at the top of Atlantis seamount dominated by cold-water corals and sponges

Project: BIOMETORE (EEA)

Partners: IMAR UAç, DOP UAç, IPMA, ESTM IPL, EMEPC

NRP *Alm. Gago Coutinho*, 1st of October 2015

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Project: BIOMETORE Biodiversity in seamounts: the Madeira-Tore and Great Meteor (EEA)

Partners: IMAR UAç, DOP UAç, IPMA, ESTM IPL, EMEPC

Objectives: (i) to map benthic communities inhabiting the seamounts of the Great Meteor Complex (Figure 1) with the ROV *Luso*; (ii) identify new vulnerable marine ecosystems; (iii) collect biological and seawater samples; (iv) collect multibeam and backscatter data; (v) collect oceanographic data to characterize oceanographic processes and planktonic communities.

Vessel: NRP *Almirante Gago Coutinho*

Chief scientist: Marina Carreiro-Silva

Scientific team:

Marina Carreiro-Silva, Telmo Morato, Íris Sampaio, (IMAR UAç, MARE), Ana Martins, Clara Loureiro (DOP, UAç), André Gonçalves (IPMA), Catarina Mendes (IPL, ESTM).

ROV *Luso* team:

António Calado, Andreia Afonso, Bruno Ramos, Carlos Neto, João Quintas (EMEPC), Renato Bettencourt (IMAR UAç)

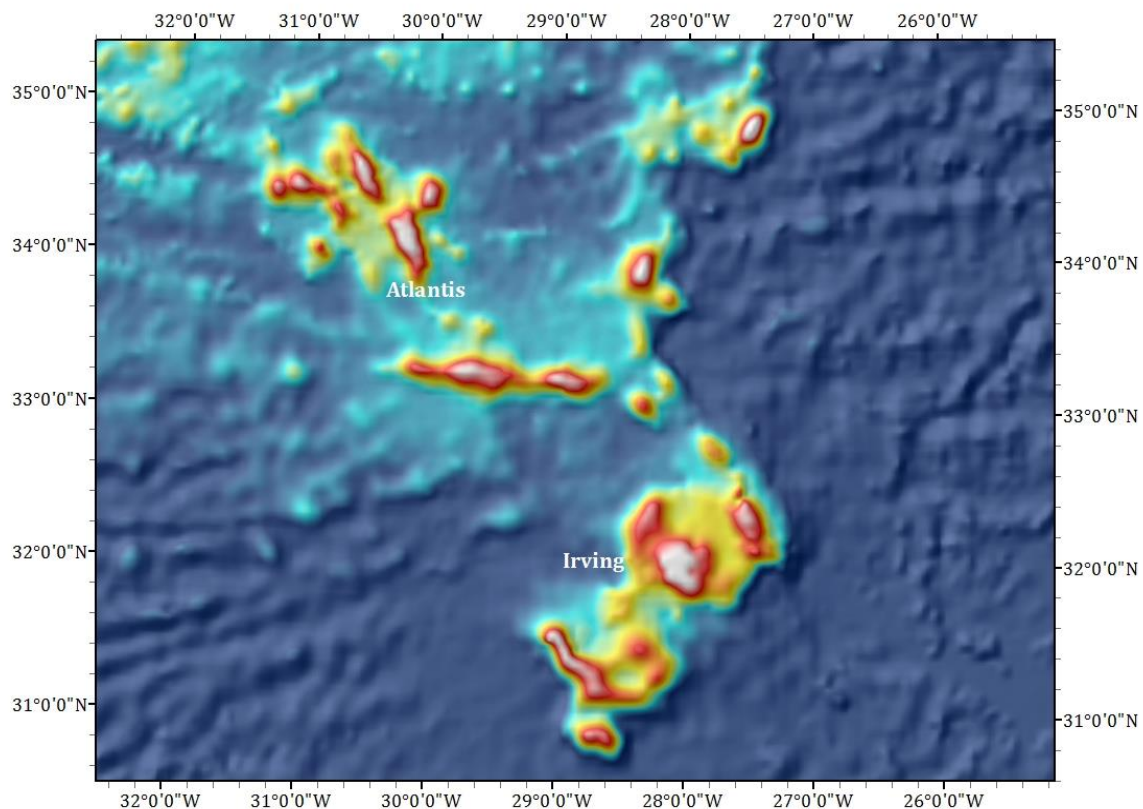


Figure 1- Map with the location of the seamounts Atlantis and Irving visited during the Biometore 2015 cruise onboard the NRP *Alm. Gago Coutinho*.

Cruise summary (Mainland Portugal local time; ROV images with UTC time similar to Azores summer time)

14/09/2015 - 20/09/2015: Transit

Departure from Base Naval do Alfeite onboard NRP *Alm. Gago Coutinho* at 13:00 (Figure 2). After a few miles, one of the generators that feed the ship propulsion system broke down. This resulted in a reduction of the vessel speed from 8.0 knots to 7.01 knots and a 24-hour delay in the arrival to the Atlantis seamount. As compensation, the *Comando Naval* offered an extra day at sea at no extra cost. A sound velocity profiler (SVP) was attempted with no success. However, multibeam and backscatter data were collected during the whole transit to the Atlantis seamount.



Figure 2- NRP *Alm. Gago Coutinho* departing from the Base Naval de Lisboa towards the Great Meteor Complex seamounts.

20/09/2015: Arrival at Atlantis seamount and beginning of the oceanography sampling

Arrival at the Atlantis seamount at 19:50. The Oceanography work was initiated right after arrival continuing all throughout that night. The stations included CTD profiles (obtained from an OCEAN SEVEN 320Plus IDRONAUT WOCE-CTD multiparameter probe incorporating an IDRONAUT Milano MK DECK UNIT), which included as well, sensors for turbidity and dissolved oxygen measurements. The CTD data processing was accomplished using the REDAS-5 software (IDRONAUT S.r.l., 2006), Excel, and Ocean Data View (ODV). The CTD was mounted on a General Oceanics Model 1015 Rosette multi-bottle array (with two Niskin bottles of 2,7 L each and nine Niskin bottles with 8 L each, respectively). CTD casts and water column biological samplings (i.e. for phytopigments, nutrients, picoplankton, phytoplankton, environmental DNA (eDNA), DNA, microscopy, scanning electron microscopy, microplastics, particulate organic matter and coccolitophores) were made at stations 6, 7, 8, and 9 (at selected water depths, depending on station total depth) (Table 1, Figures 3 and 4). With the exception of station 8, where no water samples were made, in all other stations, two CTD casts were made per each station.

Table 1 – List of CTD stations performed on Atlantis and Irving seamounts and Far-field station during the Biometore 2015 cruise.

Date	Station	Location	Latitude (N)	Longitude (W)	Depth (m)
22/09/2015	AT1	Atlantis	34°13.873'	30°22.639'	1,100
22/09/2015	AT3	Atlantis	34°01.873'	30°22.639'	2,370
21/09/2015	AT5	Atlantis	34°07.873'	30°15.439'	310
21/09/2015	AT6	Atlantis	34°01.873'	30°15.439'	420
20/09/2015	AT7	Atlantis	34°13.873'	30°08.239'	2,460
21/09/2015	AT8	Atlantis	34°07.873'	30°08.239'	1,600
21/09/2015	AT9	Atlantis	34°01.873'	30°08.239'	730
24/09/2015	IR1	Irving	32°03.747'	28°12.559'	770
25/09/2015	IR5	Irving	31°57.747'	28°05.359'	250
25/09/2015	IR6	Irving	31°51.747'	28°05.359'	1,030
25/09/2015	IR9	Irving	31°51.747'	27°58.159'	500
28/09/2015	RF03	Far-field	35°50.460'	17°25.080'	3,000

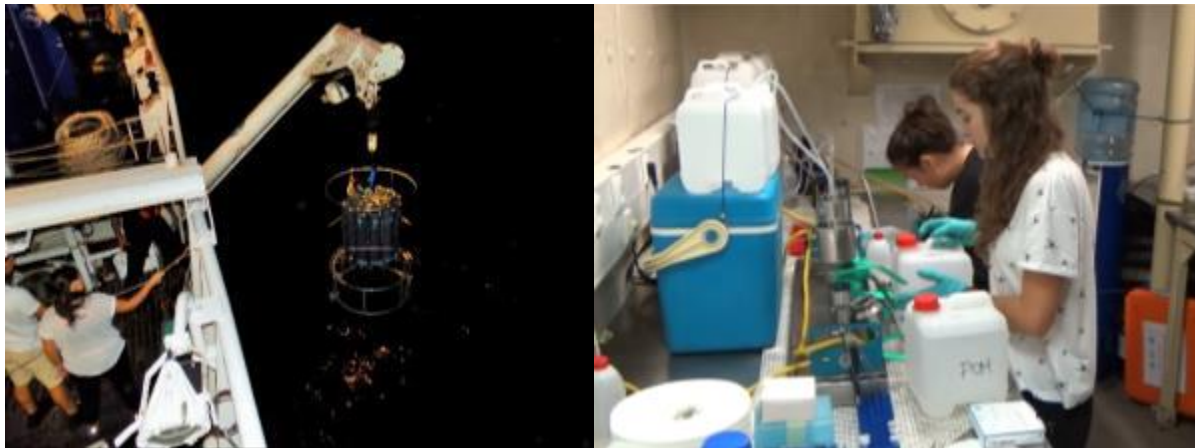


Figure 3- (Right) CTD/Rosette deployment for the collection of seawater samples and measurement of physical-chemical data; and (left) onboard seawater processing at the vessel's wet laboratory.

In some stations a second CTD, normally installed in the EMEPC ROV platform, was kindly provided by the ROV team on board and installed in the IH Rosette system such as to test sensors performance and also to obtain extra water column oceanographic information. During the entire cruise time, daily (and hourly) meteo-oceanographic information was obtained directly from the NRP *Alm. Gago Coutinho*, allowing the collection of relevant information for posterior cross-analyses with the oceanographic data. Multibeam and backscatter data were collected between sampling stations.

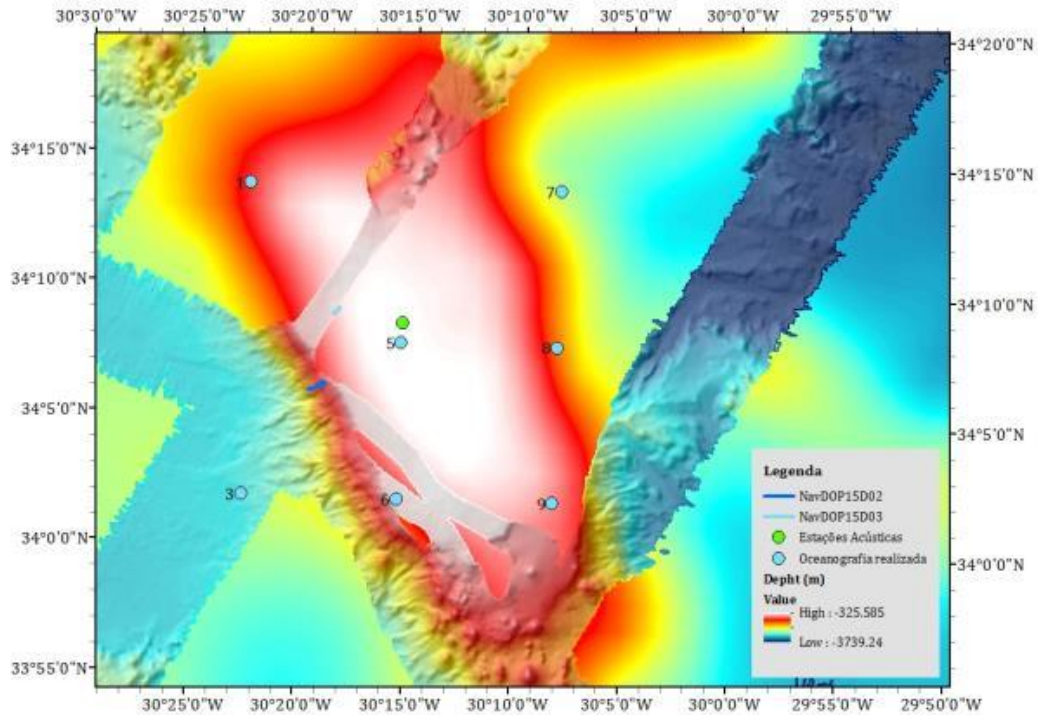


Figure 4- Map showing the location of the oceanography sampling stations (blue dots), the ROV Luso dives (blue lines), and the acoustic station (green dot) at the Atlantis seamount.

21/09/2015: Recovery of the acoustic station and beginning of ROV surveys

CTD vertical casts were completed by around 8:00 but water filtrations continued up to roughly 11:00. The vessel was positioned close to the acoustic station deployed by the biotelemetry and cetacean group. At 10:00, the acoustic station Vr2W SN 113612 (Figures 4 and 5) was successfully released by Ore SN 35913 and recovered by the NRP *Alm. Gago Coutinho* rib. The vessel was positioned at the location of the first ROV dive in the West flank of the Atlantis seamount (DOP15-D01, Table 2).

Table 2- Location of the 4 dives with ROV Luso, covering a total distance of 5,900m and a mean distance of 1,200m per dive. The ROV distance from the bottom varied between 0.7 and 1.2 m and laser distance was 0.65 cm.

Date	Dive code	Location	Latitude (N)	Longitude (W)	Distance (m)	Bottom duration	Depth 0	Depth 1
21/09/2015	DOP15-D01	Atlantis	34°05.910'	30°19.528'	-	00:10	-	-
			34°05.910'	30°19.528'				
22/09/2015	DOP15-D02	Atlantis	34°05.983'	30°19.580'	1,200	03:25	1,335	850
22/09/2015	DOP15-D03	Atlantis	34°06.264'	30°18.979'	640	03:20	415	385
24/09/2015	DOP15-D04	Irving	32°01.767'	28°12.306'	2,560	06:35	1112	492
			32°02.499'	28°11.094'				
25/09/2015	DOP15-D05	Irving	31°52.075'	28°03.948'	1,500	03:25	592	327
			31°52.727'	28°03.449'				
TOTAL					5,900	20:55	1,335	327

However, the vessel's dynamic positioning system failed and was only successfully restored by 17:30. The ROV dive DOP15-D01 started at 18:30 but had to be interrupted during descent (18:30) due to failure of the ROV's illumination system. The ROV team repaired the system but there was no time left for a new dive. The vessel was then positioned at the next oceanographic sampling station at around 20:00 (Table 1, Figure 4). CTD Stations 1, 3 and 5 were sampled throughout that night for the same physical/biological/chemical parameters as those obtained the night before. In this case, meteo-oceanographic information was also obtained directly from the NRP *Gago Coutinho*. Multibeam and backscatter data were collected again between stations.



Figure 5- Recovery of the acoustic station and deployment of ROV Luso for the first dive at the Atlantis seamount.

22/09/2015: ROV diving at the Atlantis seamount

CTD vertical casts were completed by around 8:00 but water filtrations continued up to roughly 10:30. The vessel was positioned at the location of the second ROV dive (DOP15-D02) in the West flank of the Atlantis seamount (Table 2, Figure 4). The dive started at 9:00 at 1,330 m deep and was interrupted around 12:45, when the ROV umbilical was trapped in a longline fishing gear at 880 m depth. Real time video annotation during the dives was done with the OFOP software (<http://www.ofop-by-sams.eu>). The ROV transect was initiated in a mixed bottom of sand, rocks and lava beds, where different types of benthic communities were observed, including the cold-water coral species *Iridogorgia* sp., *Acanella arbuscula*, cf *Corrallium tricolor*, the bird's nest sponge *Pheronema carpenteri*, and several other unidentified sponges. Several gorgonians, encrusting sponges and sea-stars were observed in a vertical wall. From 1,000 m to shallower depths, the most common substrate type was composed of sand or mixed sand and rock, where several sponge aggregations dominated by the lollipop sponge *Stylocordyla* sp. and other globular-form sponges, were observed. Only a few fish species were sighted, including a few Macrouridae and possibly *Synphobranchus kaupii*. During the transect one biological sampling event was made (Table 3), which included the collection of a specimen of *Iridogorgia* sp (Figure 6). The ROV *Luso* was then trapped in a lost longline fishing gear which prevented the free movement of the ROV. The pilots' operation for the release of the ROV was complex, taking around 3 hours until the complete release and recovery of the ROV to the surface for damage checking.

Table 3- List of biological samples collected during the 4 dives with ROV Luso at the Atlantis and Irving seamounts. Data represents 11 collection events, with a total of 52 collected samples.

Date	Dive	Location	Lat. (N)	Long. (W)	Depth m	Sample	Description
22/09/2015	DOP15D02	Atlantis	34°06.028	30°19.497'	1,235	B01	<i>Iridogorgia</i> sp.
						B01	Crustacea (shrimp)
						B01	Crustacea (shrimp)
22/09/2015	DOP15D03	Atlantis	34°08.976	30°18.538	405		Mixed sample with sediment, small crustaceans and bivalves
						B02	
						B01	Alcyoniidae
						B01	cf. <i>Dendrophyllia cornigera</i>
						B01	Scleractinian 1
						B01	cf. Nudibranchia
						B01	n.i. Porifera 1
						B01	n.i. Porifera 2
						B01	n.i. Porifera 3
						B01	n.i. Porifera 4
						B01	Specimen n.i.
						B01	Crustacea (shrimp) n.i.
						B01	Polychaeta n.i.
						B01	Bryozoa n.i.
						B01	Scleractinian 2 (solitary)
						B01	Hydrozoa
						B01	Scleractinian 3 (colonial)
		Atlantis	34°09.168	30°18.342	385	B02	<i>Villogorgia bebycoides</i> 1
						B02	<i>Villogorgia bebycoides</i> 2
						B02	Crustacea (shrimp)
						B02	Gastropoda (2 specimens)
						B02	Crustacea
24/09/2015	DOP15D04	Irving	32°01.788	28°12.1596	1,080	B02	cf. <i>Dendrophyllia cornigera</i>
						B02	Skeleton of dead Scleractinian
						B02	Caryophyllidae
						B01	<i>Corallium tricolor</i>
							Plexauridae n.i.
						B02	<i>Pliobothrus</i> sp.
						B03	<i>Madrepora oculata</i>
							<i>Parantipathes</i> sp
							Polychaeta
						B04	<i>Madrepora oculata</i> skeletons
							Biogenic sediment
							Sea urchin spines
							Caryophyllidae skeleton
							Unidentified skeletons
							<i>Crypthellia</i> sp. Skeleton
							Polychaeta
							Cruatacea
							Porifera
							Ermit crab
							Ophiouridae
			32°02.331	28°11.596	643	B05	<i>Swiftia pallida</i> (3 specimens)
							Plexauridae white n.i.
						B06	cf. <i>Narella</i> sp.
						B01	<i>Flabellum</i> sp. (2 specimens)
							Stylasterid
							Biogenic sediment
						B02	Plexauridae orange n.i.

*Approximate positions



Figure 6- Representative photo of the dive DOP15-D02 showing the octocoral *Iridogorgia* sp., a rocky outcrop and a lost longline fishing gear.

The vessel was then repositioned at the top of the Atlantis seamount for a new transect. This location was selected with basis on the multibeam data collected during the previous night. Dive DOP15-D03 (Table 2, Figure 4) started at 19:00 at 415 m deep and ended at 23:00 at 380 m depth. The bottom substrate was dominated by patches of sand and mixed sand and rock, with a few small rocky outcrops, throughout the whole transect. The biological communities observed in the sandy areas were dominated by a few sporadic Lithistid sponge aggregations. The rocky outcrops were colonized by several coral species including cf. *Dendrophyllia* sp., *Villogorgia* cf. *bebrycoides*, *Viminella flagellum*, and unidentified scleractinian and stylasterids corals (Figure 7). An aggregation of shrimps cf. *Plesionika narval* was also observed.

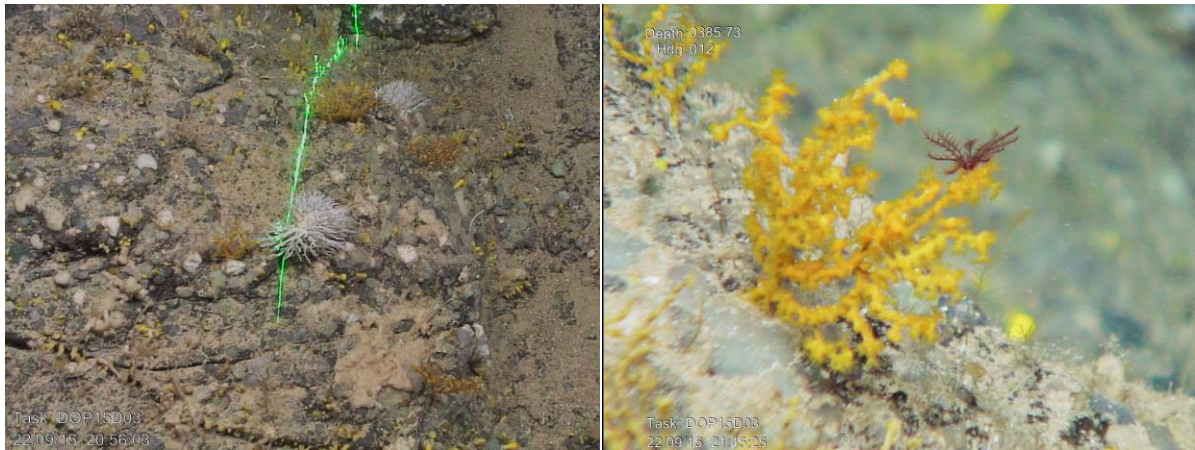


Figure 7- Representative photo of dive DOP15-D03 showing a typical biological community colonizing rocky substrate areas and the octocoral *Villogorgia cf. bebrycoides*.

During the transect 2 biological sampling events were made (Table 3) close to a rocky outcrop colonized by a diverse benthic community. A few fish species were observed, namely *Zeus faber*, cf. *Anthias anthias*, cf. *Phycis blennoides*. During the ROV dives, physical-chemical *in situ* data (temperature, salinity, oxygen, pH, pCO₂, turbidity, fluorescence) were collected by the ROV sensors. The oceanography sampling was cancelled during the nighttime, and instead multibeam and backscatter surveys were performed at the top of the Atlantis seamount. The bathymetry coverage of the seamount was improved, although it did not totally covered the seamount (Figure 8).

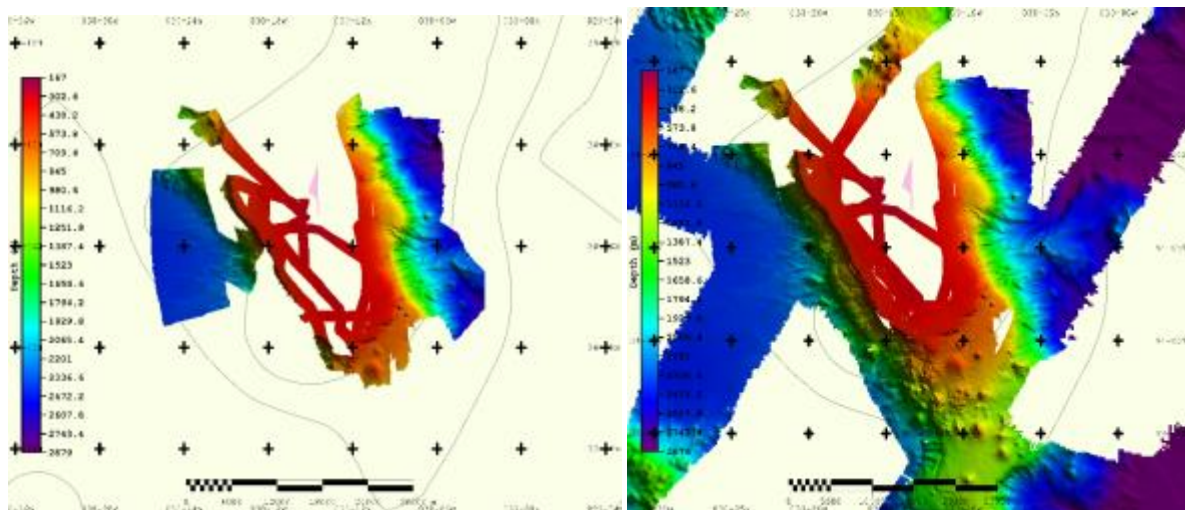


Figure 8 –Summary of multibeam bathymetry data collected for the Atlantis seamount during the BIOMETORE 2015 cruise (left) and total available bathymetry for the seamount (right).

23/09/2015: Transit to Irving seamount

Repositioning of the vessel to a new diving site in the East flank of the Atlantis seamount. After evaluating the meteorological conditions and the stability of the vessel (mostly the pitch), it was

decided to cancel the ROV dive (Figure 9). It was then decided to move to the Irving seamount and the transit began at around 11:00.



Figure 9 - At the vessel bridge, the ROV pilot team and the Captain of NRP *Alm. Gago Coutinho* evaluated the weather and sea conditions before the dive.

24/09/2015: Arrival at the Irving seamount

The vessel arrived at the Irving seamount at 08:15. Problems in one of the 3 vessel generators delayed the beginning of the planned work. In addition, the selected site for the ROV dive in the East flank of the seamount had to be changed because of the wind and tides direction. The vessel was repositioned in the West flank of the seamount, and the ROV dive DOP15-D04 (Table 2, Figure 10) began at 10:40 at a depth around 1100 m and ended at 18:30 at 490m depth.

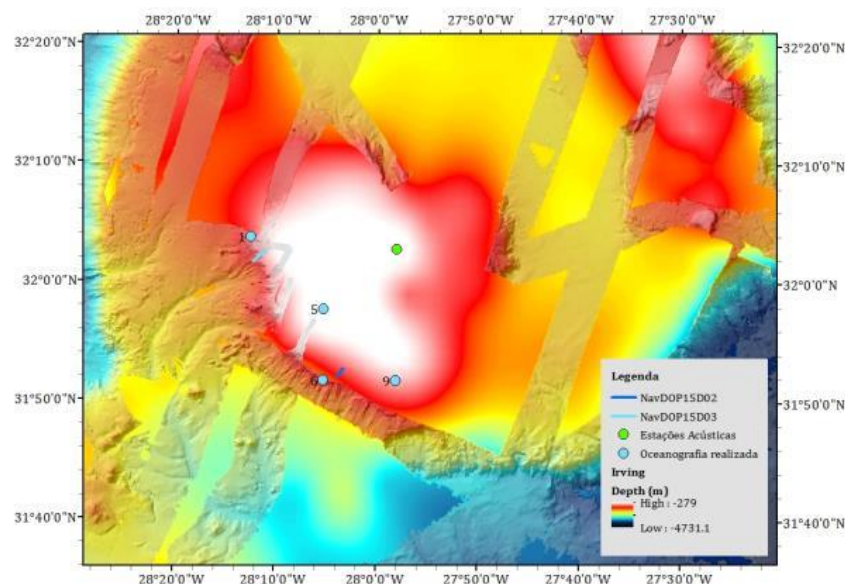


Figure 10- Map showing the location of the oceanography sampling stations (blue dots), ROV Luso dives (blue lines) and the acoustic station (green dot) at the Irving seamount.

The ROV transect was initiated in a mixed bottom of sand and rock, where several colonies of *Acanella arbuscula*, *Paranthipathes* sp. and sponges were observed. Rocky areas were

dominated by the corals *Corallium tricolor*, *Pliobothrus*, and encrusting sponges (Figure 11). At around 900 m depth, a vertical wall colonized by the scleractinian coral *Madrepora oculata* and several sponge species, was observed. A large extension of coral rubble, mainly composed of dead skeletons of *Madrepora oculata*, was also observed at the base of another wall. Flat surface areas between 500 and 600 m were colonized by the coral *Swiftia pallida*, a potential new habitat dominated by *Viminella flagellum* and *Narella* sp., and sea-star aggregations. Few fish records were observed, including Macrouridae, *Synaphobranchus kaupii*, *Chlorophthalmus agassizi* and *Helicolenus dactylopterus*. During the transect 6 biological sampling events were made (Table 3), including the collection of a large specimen of *Corallium tricolor* and coral rubble. The vessel was repositioned for the oceanography sampling at 21:00. CTD casts and water sample collection and filtrations were made on stations 1, 5, 6 and 9 (Table 1, Figure 10). Multibeam and backscatter data were collected between stations, with additional information collected for planning diving site for the next day.

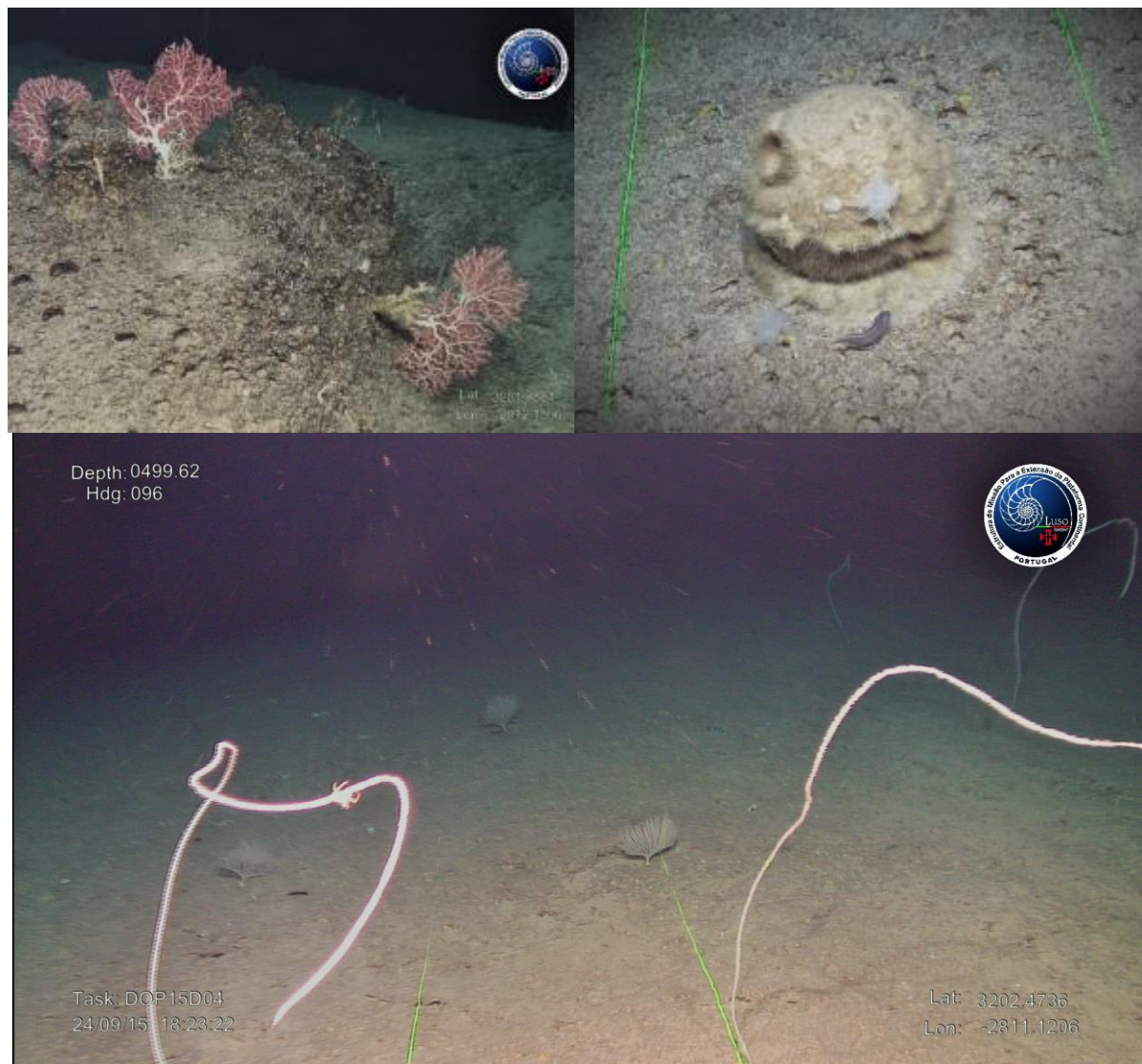


Figure 11 - Representative photo of dive DOP15-D04 showing the octocoral *Corallium tricolor*, an unidentified sponge named as escafandro-sponge and a potential new coral habitat dominated by *Viminella flagellum* and *Narella* sp.

25/09/2015: Last day for scientific work

CTD vertical casts were completed by around 6:00 but water filtrations continued up to roughly 09:30. The vessel was repositioned close to the diving site in the Southwest flank of the Irving seamount. This diving location was selected based on the impossibility of undertaking a dive in the East flank of the seamount due to the direction of the currents and wind. The ROV dive DOP15-D05 (Table 2, Figure 10) began at 8:40 but problems in the HD video recording system interrupted the diving operations. The transect was re-initiated at 10:00 at a depth of 590 m and ended at 13:20 at 372 m depth. The bottom substrate was dominated by sand with a few rocks throughout the whole transect. Biological communities in sandy areas were dominated by *Pliobothrus*, *Enallopsammia* sp., *Paranthipathes* sp. and sponges. Rocky areas were colonized by *Callogorgia verticillata* and whip corals. A few marks on the seafloor were observed in areas covered by biogenic material, possibly as a result of past trawling events in this seamount. This area was less colonized, and a few broken *Callogorgia verticillata* colonies were observed. Between 500 and 600 m, dense coral gardens dominated by *Viminella flagellum* with no signs of fishing impacts and a few colonies of *Paranthipathes* sp, *Narella* sp. and *Enallopsammia* sp. were observed. An extensive community dominated by the solitary scleractinian coral *Flabellum* sp. was observed between 380 and 450 m deep (Figure 12). Throughout the transect some fish species were observed, mostly *Phycis blennoides* in rocky areas and large quantities of *Chlorophthalmus agassizii* at around 400 m depth. At the end of the transect, four large orange roughly *Hoplostethus atlanticus* (Figure 12) and several *Anthias anthias*, *Phycis blennoides*, moray eels and *Capros aper* were observed.



Figure 12 – (Left) Image of the scleractinian solitary coral *Flabellum* sp. and (right) the fish orange-roughy *Hoplostethus atlanticus* close to the end the final ROV Luso dive DOP15-D05.

During the transect, 2 biological sampling events were made (Table 3), including the collection of *Flabellum* sp. and an unidentified Plexauridae coral. The vessel was repositioned close to the acoustic station Vr2W SN 113612 at 16:30, which was successfully released by Ore SN 35913 and recovered by the NRP Alm. Gago Coutinho rib. The collection of multibeam and backscatter data improved the bathymetric coverage of the Irving seamount (Figure 13). The trip back to Lisbon began at 17:30, with the collection of multibeam and backscatter data during the whole transit.

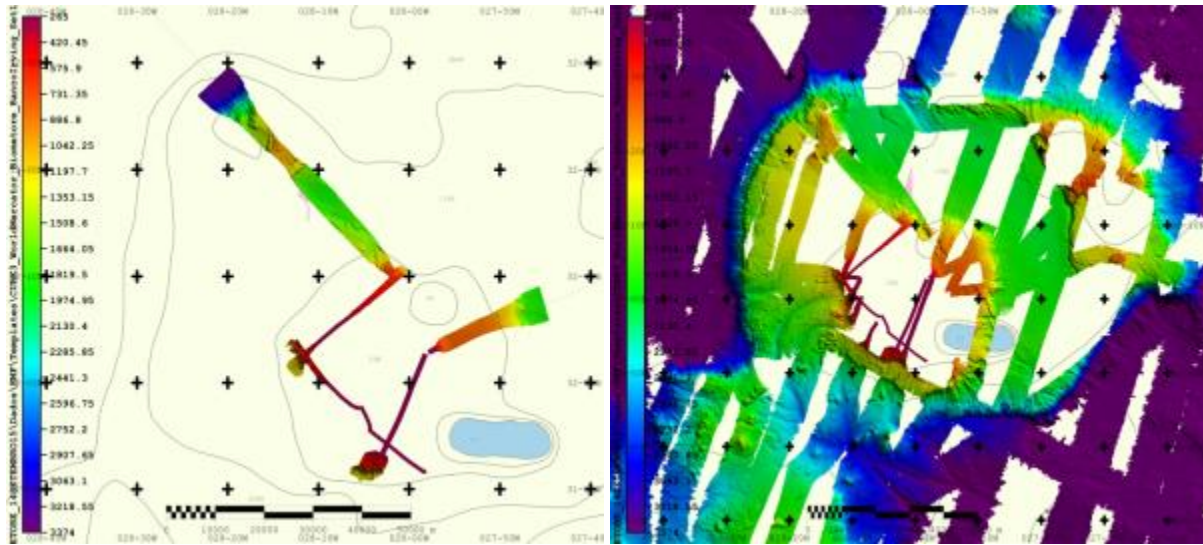


Figure 13 – Summary of multibeam bathymetry data collected for the Irving seamount during the BIOMETORE 2015 cruise (left) and total available bathymetry for the seamount (right).

25/09/2015 - 01/10/2015: Back to Base Naval de Lisboa

During the first few days of transit to Lisbon, the weather conditions were very good and the vessel speed was higher than expected (approx.. 8.3 knots). Therefore, there was time to make an extra *far-field* oceanographic sampling station (Table 1) at 3,000 m depth. The procedure used was similar to the previous stations with two CTD casts made in this station and water sampling at selected depths with posterior filtration on board. This work was initiated at about 16:30 and the final CTD cast was finished by 20:00. Filtrations continued for the following two to three hours. The vessel arrived in *Barra de Lisboa* on October 1st at 03:00 and to Base Naval do Alfeite around 13:00. It's now time to take care of logistics, unload the material and return back home.

Thank you very much to all for such a great cruise (Figure 14).



Figure 14- Group photo with the scientific and ROV team and some members of the NRP *Alm. Gago Coutinho* crew.