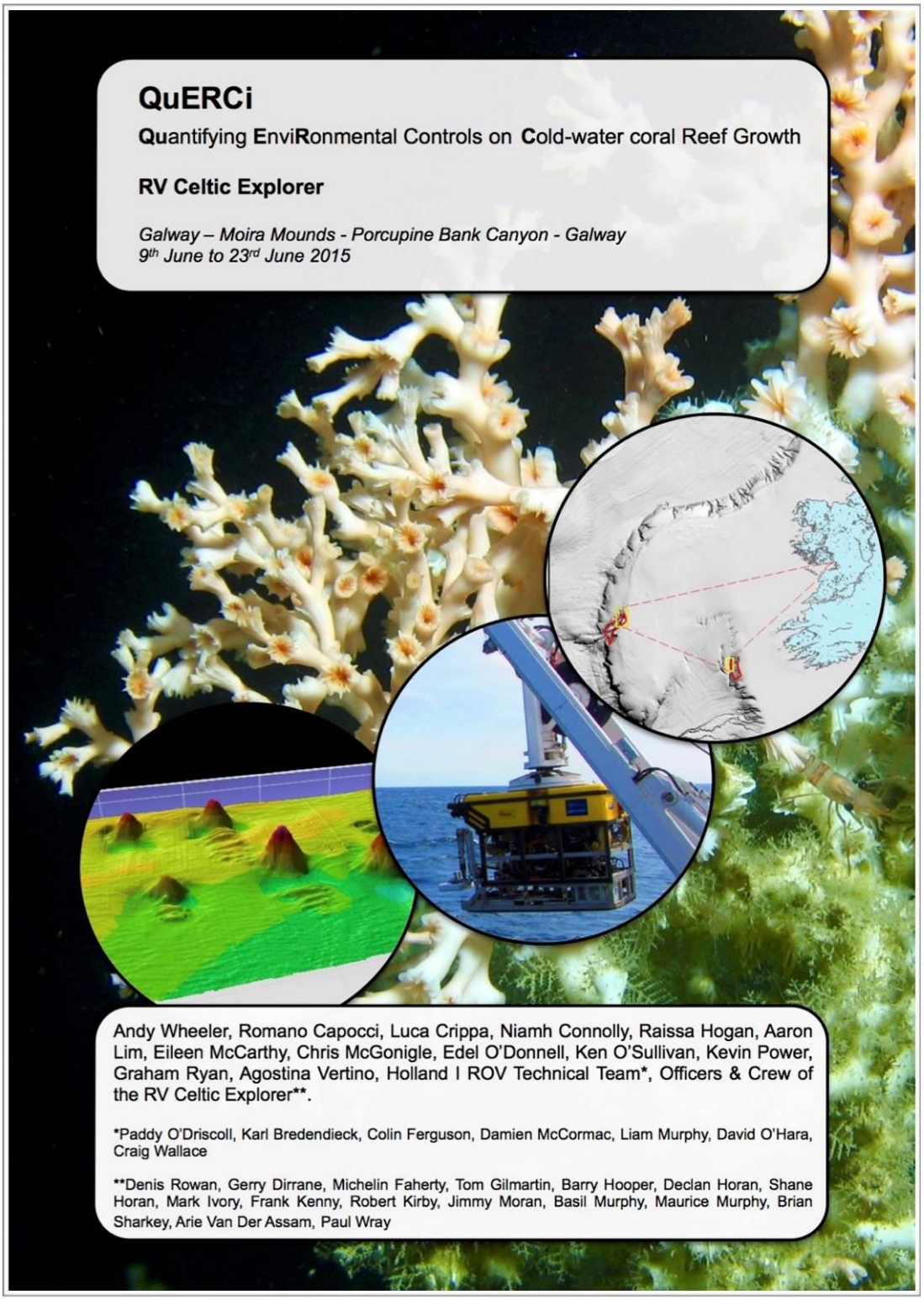
QuERCi
Quantifying EnviRonmental Controls on Cold-water coral Reef Growth
RV Celtic Explorer
Galway – Moira Mounds - Porcupine Bank Canyon - Galway
9th June to 23rd June 2015
Andy Wheeler, Romano Capocci, Luca Crippa, Niamh Connolly, Raissa Hogan, Aaron Lim, Eileen McCarthy, Chris McGonigle, Edel O'Donnell, Ken O'Sullivan, Kevin Power, Graham Ryan, Agostina Vertino, Holland I ROV Technical Team*, Officers & Crew of the RV Celtic Explorer**.
*Paddy O'Driscoll, Karl Bredendieck, Colin Ferguson, Damien McCormac, Liam Murphy, David O'Hara, Craig Wallace
**Denis Rowan, Gerry Dirrane, Michelin Faherty, Tom Gilmartin, Barry Hooper, Declan Horan, Shane Horan, Mark Ivory, Frank Kenny, Robert Kirby, Jimmy Moran, Basil Murphy, Maurice Murphy, Brian Sharkey, Arie Van Der Assam, Paul Wray

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EXECUTIVE SUMMARY

This survey studied cold-water coral reefs in two different SACs (the Belgica Mound SAC and the Porcupine Bank Canyon SAC) in differing seabed contexts.

The eastern chain of the Moira Mounds (1000m wd) occur in and beyond the western limit of the Belgica Mound SAC. This survey produced new mapping coverages of the Moira Mounds whose location, distribution and abundance were vaguely known previously. Groundtruthing using ROV inspection verified the maps and also revealed information on faunal occurences and ecological interactions. Information on the nature of the seabed (bedforms and sediment type) provide good interpretable contextualisation to the reef in terms of hydrodynamics.

The reefs on the edge of the Porcupine Bank Canyon have been mapped at low resolution but are poorly groundtruthed. This survey produced detailed maps of a chain of, now confirmed, cold-water coral mounds on the western lip of the Porcupine Bank Canyon (700m wd). These were also sampled and video imaged and proved to be rich in corals. In addition, a study was made into the adjacent Porcupine Bank Canyon. The canyon floor (2100m wd) was found to be muddy with sea pens and a high concentration of marine snow. As the channel was followed up-canyon it became progressively steeper with coral rubble encountered. The upper slopes exposed vertical craggy rock faces festooned with corals, an occurance not previously known.

A new rock-drilling capacity for the ROV was successfully trialed at depth as proof-of-concept.

BACKGROUND

Corals are not restricted to tropic shallow water seas. Of the 5100 extant coral species, over half are found in deep-water (Cairns, 2007). These include framework-forming Scleractinia that form reefs from the tropics to polar regions (Freiwald *et al*., 2004). Advances in seabed mapping in recent decades has significantly increased our knowledge of the deep-seafloor and thrown the "spot-light" on the hitherto poorly understood but common seabed structures such as cold-water coral reefs..

Through "ecological engineering" these cold-water coral reefs offer habitat for many different organisms and represent a unique speciose habitat in deep-water settings. Biodiversity estimates suggest higher biodiversity on reefs as opposed to off-mound habitats (Henry & Roberts, 2007), increase food web complexity and potential nursery/essential habitats for many organisms including commercial viable fisheries. Biological exploration of cold-water coral reef habitats, and our understanding of the ecological interactions between reef organisms is growing. The importance of cold-water coral reefs as centres of biodiversity is well recognised and has led to extensive international cooperation in the areas of conservation and the designation of marine protected areas (Davies *et al*., 2008). Ireland has designated a number of coral carbonate mound provinces supporting reefs as Areas of Special Conservation and is obliged under the EU Habitats Directive to monitor these designations. Effective management of cold-water coral reefs can only occur if there are good maps, the reef dynamics and controls on growth and decline processes are understood. This survey aims to add some resolution to these issues using Irish examples.

Significant research has been conducted on the mechanisms of cold-water coral reef and carbonate mound growth. Earlier studies were focused on assessing the validity of the hydraulic theory which suggested that coral carbonate mounds were related to hydrocarbon seepage at the seafloor (Hovland, 1990). With a lack of supporting evidence, the consensus opinion is that coral carbonate mound initiation and growth is governed by the same processes as cold-water coral reef development: pelagic-benthic coupling with food supply fuelled by surface productivity, and concentrated and delivered to the seabed under the influence of hydrodynamic processes e.g. water-mass boundary nephaloid layers, internal waves and rigorous tidal pumping (Freiwald, 2002). At present, such conclusions come from qualitative and observational science with minimal parameterisation of critical threshold levels determining the environmental limits for cold-water coral reef ecosystems.

Understanding the nature of coral reef growth requires careful consideration of the roles of abiotic processes; significantly 1) sediment supply and entrapment within the reef, and 2) the influence of environmental variables (temperature, pH, food supply, current intensity) on organism (and principally the control on coral biomineralisation).

Details of tidal resuspension of hemipelagic sediment within coral carbonate mound summit reef systems was studied by Mienis *et al* (2007), the importance of bedload sediment supply to small reefs was studied by Wheeler *et al*. (2008). However, we do not know the details of bedload sediment interaction across larger cold-water coral reefs fields and current regime control of food supply over reef field environmental gradients.

Until we understand in detail cold-water coral reefs' responsive to environmental variables, and the nature of sediment emplacement in reefs (and in particular their ability/inability to receive bedload sediment), we cannot appreciate the specific mechanism of reef growth and therefore predict reef response and vulnerability to climate change. Without this understanding, making effective management for cold-water coral SACs is fraught with difficulty.

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3. SURVEY RATIONALE & OBJECTIVES

The principle aim of this project is elucidate and quantify the abiotic (allogenic) controls on cold-water reef development in Irish waters and in general. We target two distinct settings: the Moira Mounds (Belgica Mound province) and the Porcupine Bank Canyon Mounds. The Moira Mounds are initiated across a wide flat plain of now-buried till. Substrate control does not affect their spatial distribution which appears strongly controlled by variations in the prevailing current regime and bedload sediment transport. The Porcupine Bank Canyon Mounds cluster around the Porcupine Bank Canyon head influenced presumably by up-canyon tidal pumping.

The proposed study has nine principal scientific objectives:

To evaluate the status of cold-water coral reefs in two SACs: in the Belgica Mounds SAC this is to increase our understanding of the habitat; in the Porcupine Bank Canyon SAC this will be the first detailed investigation.

To define and extend the known geographic distribution of cold-water coral reefs (Moira Mounds) in the Belgica Mound Province beyond the SAC and existing high resolution map coverages.

To elucidate the controls of bedload sediment transport, current regime and particular organic matter flux on cold-water coral reef morphology, zonation, diversity and “health”.

To assess the rate of change in cold-water coral reef structures and characteristics.

To assess the control of canyon-head processes on cold-water coral growth.

Qualitatively and quantitatively characterize biomineralized micro-fauna to identify and standardize “Benthic Foraminifera Facies” on- and off-mound and identify possible bioindicators for Moira cold-water corals.

Establish an ecostratigraphy based on planktonic foraminiferal assemblages for the region comparing the Moira Mounds with modern and fossil analogues, characterizing the palaeo/environmental settings in the region and through time, and identifying similarities and differences with modern large and small mounds in the Porcupine Basin (Belgica Mound province).

To add more data to the characterisation of the evolution, phylogeography, ecology and systematics throughout the Porcupine Bank Canyon system focussing on the canyon heads.

To remotely examine Moira Mound initiation stratigraphy.

To this end, this survey has been planned to undertake an ROV investigations of two areas of known cold-water coral occurrence within SACs: the eastern Belgica Mound SAC (Moira Mounds) and the Porcupine Bank Canyon SAC. Through these investigations, between-dive coring and CTD operations, we intend to answer fundamental questions on the environmental controls on reef development in Irish waters which are pertinent globally. We also wished to increase our understanding of the status of these coral habitats in Irish waters and, through ocean exploration into an unexplored hydrocarbon Frontier

Licence block, extend the known distribution of these habitats. We employ a multidisciplinary approach. Our findings are relevant to the global understanding of these important habitats, to Irish environmental policy and regulatory objectives, and to industry.

Description of tasks:

Moira Mounds (Belgica Mounds SAC)

1. Repeat video survey of the Piddington Mound using downward-facing HD camera to assess changes of the last 4 years. Changes in coral growth will be hard to discern but differences in rubble fields and sediment encroachment, incidents of coral colony toppling will be quantifiable. Establishing rates of change in the SAC is an important baseline.

2. Assessment of reef structural and habitat variablity within and between reefs across an environment gradient using ROV-collected video and physical samples. This will involve video surveying a number of mounds across the environmental gradient using downward-facing HD camera. We will quantify reef growth responses as expressed by reef structure and species/facies zonation to the effects of differing sediment supply and current regimes.

3. Macro- and micro-faunal sampling in reef and off-reef habitats

4. Collection of ROV-mounted MBES, this is necessary as existing MBES coverage is too coarse to resolve these small-type coral reefs which appear to extend into the Frontier Petroleum licence block. Exploration of the Frontier Licence Block to assess the “true” distribution of Moira-type reefs.

5. Box-core sampling to quantitatively investigate biomineralized microfauna, coupled with geochemical analyses (phosphorus phases by SEDEX, organic matter, stable isotopes on carbonate shells and organic matter, as well as C/N (to characterize the nature and provenance of the organic matter), dating (by U/Th on corals, AMS^{14} C on foraminifera, and isotope- and eco-stratigraphies (this latter based on relative abundances of planktonic foraminiferal species and/or group with similar ecological significance).

6. Sub-surface imaging of Moira-type mounds in and around the Belgica Mound Province to examine their stratigraphy and relationship to a 'common' initiation horizon/period. We will also collect CHIRP seismic from giant carbon mounds to see if data quality permits a more detailed study planned in the future.

Porcupine Bank Canyon Mounds

1. Reconnaisance mapping of the number of cold-water coral reef mounds around the heads of the Porcupine Bank Canyon using using ROV-mounted Kongsberg EM2040 deep-water multibeam, ROV dives and targetted sampling.

2. Appraisal of canyon head processes in relation to cold water coral distribution using repeat CTD profiling, hull mounted ADCP and nephaloid layer monitoring/sampling over a components of the tidal cycle.

3. ROV video investigation of the upper canyon system to see if coral extend down the canyon, are on the vertical canyon walls and if a coral tallus exists at the base of the vertical canyon wall.

4. Box-core/gravity core sampling to quantitatively investigate biomineralized microfauna, coupled with geochemical analyses (phosphorus phases by SEDEX, organic matter, stable isotopes on carbonate shells and organic matter, as well as C/N (to characterize the nature and provenance of the organic matter), dating (by U/Th on corals, AMS^{14} C on foraminifera, and isotope- and eco-stratigraphies (this latter based on relative abundances of planktonic foraminiferal species and/or group with similar ecological significance).

Ireland has a statutory obligation to monitor SACs under the EU Habitats Directive. This survey assists in this process and furthers our understanding of sensitive habitats.

Previously targeted Moira-type mounds have been subjected to high resolution, full-reef, non-invasive, video mosaicing (VENTuRE survey 2011). Repeat mosaicing using downward-facing HD ROV video will reveal change on a 4 year scale. With the technique now established, we aim to further mosaic Moira-type reefs in similar and different settings across the environmental gradient to tightly constrain the resulting mound variations.

The resolution of existing INSS multibeam is too low to resolve Moira Mounds (approx 10 x 20 x 35 in 1000m water). ROV-based and the new ship-based multibeam data extended into the adjacent Frontier Hydrocarbon Licence Block where reefs are known but not mapped will constrain the zone of active coral growth and allow us to assess the nature of these mounds, their morphometrics and produce a 'true map' of these active, early-stage mounds. This is a first step in deermining baseline environmental conditions in area of potential hydrocarbon reserves.

Sediment, macro- and micro-faunal sampling and water sampling will provide key data to further assist in environmental evaluations of the SACs both spatially and temporally.

4. EQUIPMENT

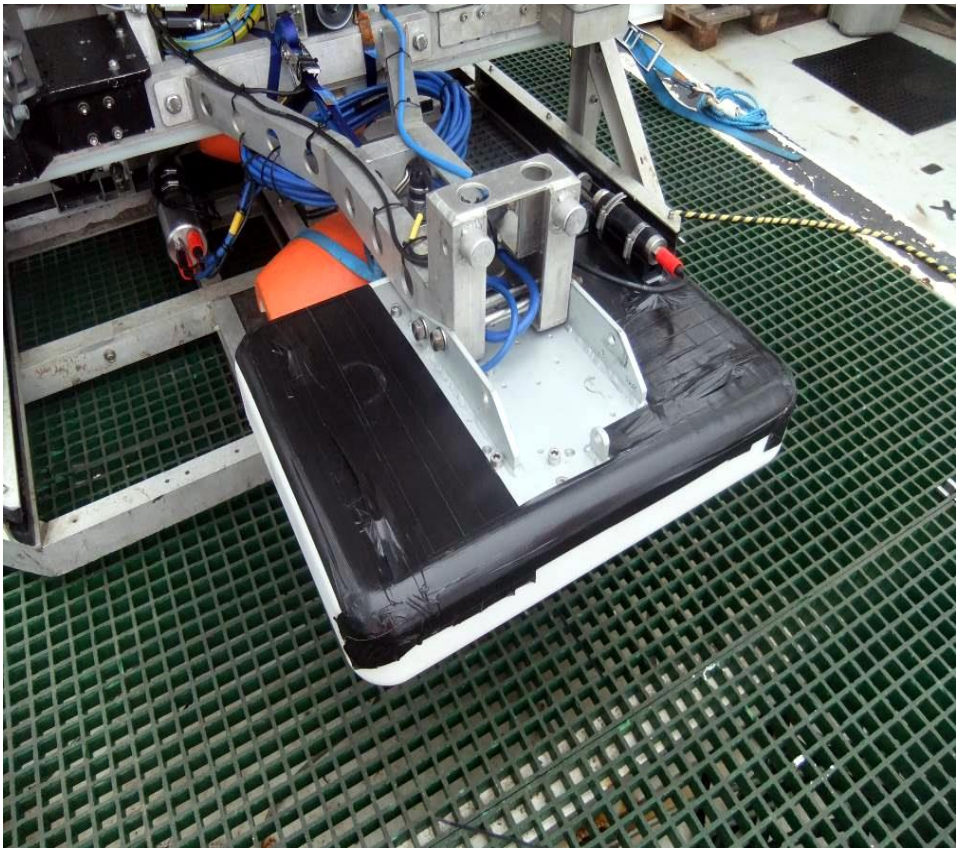
4.1 Research Vessel - RV Celtic Explorer

The Celtic Explorer is a 65.5 m multi-purpose research vessel. The vessel has wet, dry and chemical laboratories, which are permanently fitted with standard scientific equipment and can accommodate 20-22 scientists along with 13-15 crew who are highly skilled with the handling and deployment of scientific equipment. It has a maximum endurance of 35 days.
The Celtic Explorer is equipped with two Trimble 300-D GPS and has Dynamic Positioning.

On the aft deck is a 25 tonne A-frame with 4m outward and inward reach in addition to a 3m, 10 tonne starboard T-frame. The ship also comprises of a midship, forward and aft crane as well as a 6 tonne CTD winch.

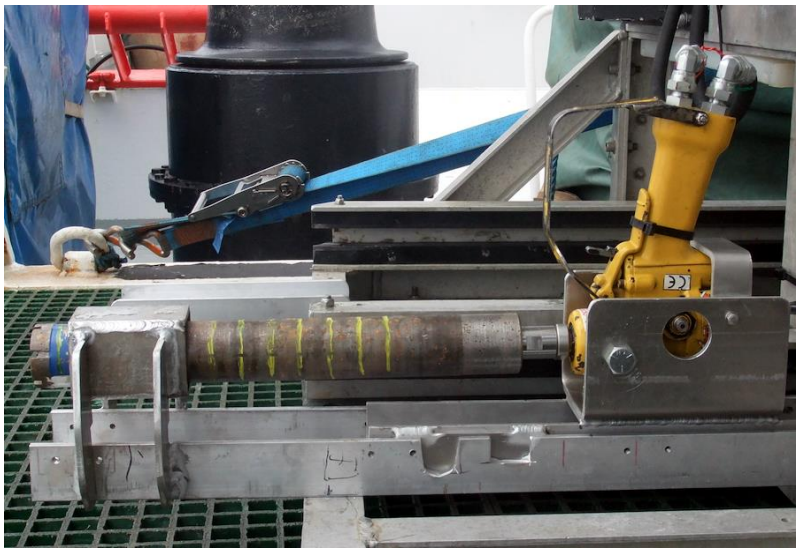
The Holland I 600m depth ROV (remote operated vehicle) is a platform for capturing underwater footage of the seabed and transmitting the video as a live-feed to the scientists aboard the vessel. It has 100 hp with a maximum speed of 3 knots. An EM2040 multi-beam echo sounder is mounted on the vehicle for high resolution bathymetry imagery & precision mapping of the seabed. The EM2040 operates at 200 - 400 kHz and is effective to 600m. The Holland I also has a HDTV camera, low resolution cameras and a HD digital stills with laser rangers. It is also fitted with a CTD and 2 robotic arms for sampling (1X7F and 1X5F) as well as an aspirator.

The Holland I ROV on deck (portside view), teh aspirator tank is at the lower back



Close up of the ROV-mounted EM2040 MBES

The Holland I ROV front view showing the cameras, lights, robotic arms and EM2040 MBES mounted at the front



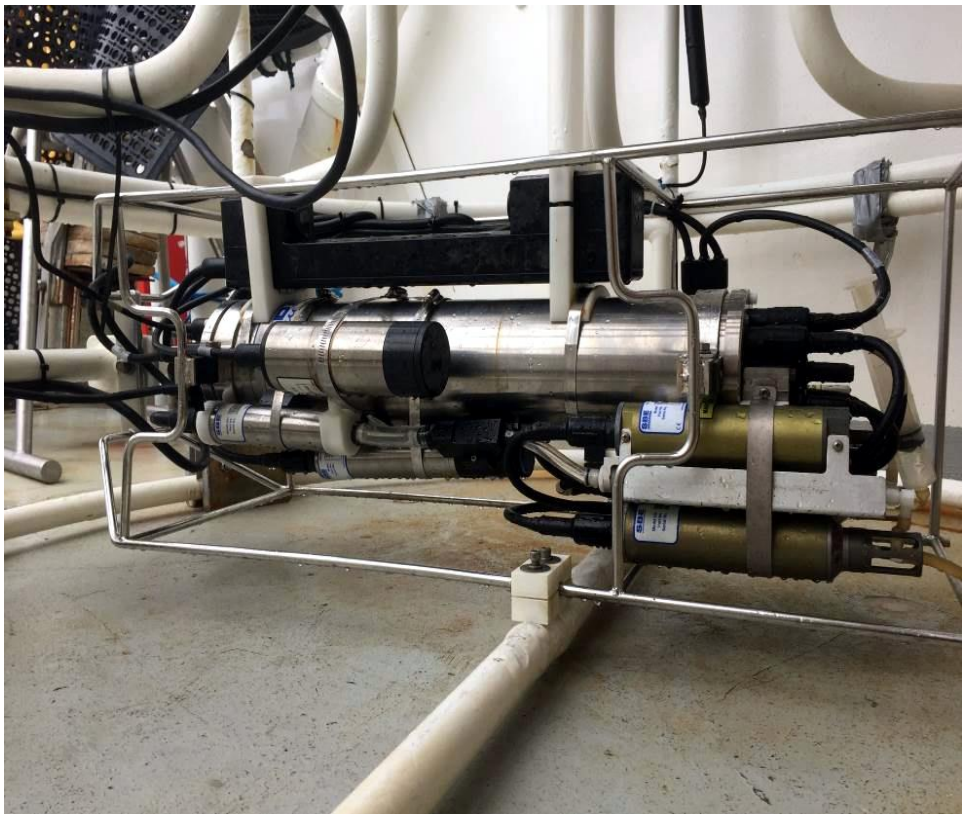
Rock drill mounted on the ROV

4.3 Simrad EM302 multibeam echosounder

The EM302 operates at 30 kHz and is hull mounted. It is effective to 7000 m depth. Its swath width is up to 5.5 times water depth & there are up to 864 soundings per ping. Data is acquired, stored and managed using the Seafloor Information System (SIS).

4.4 Sound velocity probe & CTD

The Valeport SVX2 is fitted with a digital time of flight sound velocity sensor, high stability conductivity sensor, a high accuracy temperature compensated piezo- resistant pressure transducer and a fast response PRT temperature sensor. The instrument is depth-rated to 6000m, weights 11.5 kg in its titanium housing.



CTD and SVP sensors

The SBE 911 CTD with SBE 32 carousel includes the following equipment: Temperature and conductivity sensors, altimeter (for bottom detection), transmissometer, DO sensor and fluorometer.

4.5 ADCP

RD Instruments Ocean Surveyor 486P/50 75 kHz broadband acoustic doppler profiler measures the velocities of water currents, via the doppler effect of sound waves it transmits through the water column.

4.6 IXSea ECHOES 3500 T7 ‘Chirp’

IXSea T7 Chirp is a hull mounted sub-bottom profiler operates at 1.5 - 5.5 kHz with at 237 dB (4 KVA) emitting a 20^{o} beam. The IXSea T7 Chirp works in a

depth range of 5 to 11,000 m wd. It has 7 transponders and data is acquired, stored and managed with Delta acquisition software. Data is processed onboard using Delph interpretation.

4.7 Sonadyne Ranger USBL Positioning Beacon

Ranger 2 is a high performance acoustic position reference system designed for tracking underwater targets and positioning dynamically positioned (DP) vessels. The system (commonly referred to as a HPR system) uses the Ultra-Short Base Line (USBL) positioning method to calculate the position of a subsea target, by measuring the range and bearing from a vessel-mounted transceiver to an acoustic transponder fitted to the target. Multiple subsea targets over a wide area and range of water depths can be simultaneously and precisely positioned. In standard configuration, Ranger 2 allows up to 10 subsea targets to be simultaneously tracked from a surface vessel. Operating ranges of greater than 6,000 metres are achievable and the system supports all industry standard survey and DP output telegrams. One second position updates are achievable in any water depth.

Sonadyne ranger beacons for the USBL system

4.8 Gravity Corer

An OSIL 800 kg gravity corer with a 7 cm diameter bore which can be deployed in a 3 m or 6 m mode, the 6m mode being two coupled barrels. The 3 m mode is pictured below, the additional 3m barrel and coupling (yellow) is behind. The gravity corer is fitted with a core catcher and deployed from the vessel using a LARS system as imaged.

Gravity corer in the launch and recovery sytem (LARS)

4.9 Reineck Box-corer

A Reineck box-corer was used to take undisturbed sediment samples for biological assesment. It has a sampling box area of 10 cm x 17 cm with a maximum penetration depth of 26 cm.

Reineck box-corer

5 TECHNICAL & WEATHER RELATED DIFFICULTIES

12th June
CTD sensors (temperature, pressure, etc) failed (**CE15009_05**). CTD from ROV was moved to the main CTD. These sensors worked (**CE15009_6A&B**) but CTD is now shared between the ship and the ROV. Downtime accrued 2hr.

12th – 13th June
During the night there was difficulties getting realistic readings from the USBL transponder and it was eventually deduced that the the offsets input into the software for the ship transponder was erroneous. New offsets were input and the readings made sense. Calibration could then continue beginning late morning *13th June*. Downtime accrued 8hr (above estimated for 8hr calibration).

13th June
Power failure on ROV encountered at 150m water depth (**CE15009_7A**). Power recovered but dive aborted. Downtime accrued 3.15 hr.

14th June
Experienced jumps of several metres in the ROV naviagation when collecting MBES at 190m above seabed (**CE15009_7B**). Ran a cross line to check navigation. Issue not solved but liveable. Downtime accrued 0 hr.

At 20.00 it was reported that the CTD winch was leaking hydraulic fluid. A repair had been started but it became apparent that the corrosion of the hydraulic fluid pipe was severe. To undertake a repair may cause an even bigger leak requiring a return to shore to fix it. As all the winches (with the exception of the ROV winches) are on a central hydraulic system then a major leak would disable all winches. The decision was made to not use the CTD winch in fear of causing a major leak requiring potential shore-based repair and to monitor the leak. The rate of leakage is affected (to a lesser extent) when the other winches are used. If the rate of leakage increases then we may have to risk a repair at sea, with a risk of having to return to shore, whilst still in the Moira Mounds area rather than have a major leak when we are further offshore. The upshot is that we are unable to take CTD casts anymore as planned for the Porcupine Bank Canyon. However, we are be able to take SVPs and CTDs from the ROV. Downtime accrued 0 hr.

15th June
At 15.00, the ship's engineers have made blanks to seal off the hydraulics on the CTD winch in case a major leak does occur. We are now confident that we can use the hydrographic winch without generating excessive pressure on the hydraulic CTD piping. We will therefore not use the CTD winch, continue using the hydrographic winch and monitor the leak. Downtime accrued 0 hr.

17th June

Steep topography in the canyon caused difficulties with the ROV bottom lock causing the DVL to fall out (**CE15009_23)**. This causes some down time and data problems especially due to the hazardous terrain. Downtime accrued c.2 hr.

19th June
Very unstable ROV navigation at the start of Dive 6 (**CE15009_30**). Eventually the problem was traced to the USBL to ship update rate which had been wrongly reset after a calibration test. Downtime accrued c.3 hr.

Dive 6 (**CE15009_30**) abort pretty much at the end of the dive due to a HD video control cable trapped disabling HD video camera paning. There was also a danger that the cable could come loose and get sucked into the thruster. The push core box lid was also damaged inhibiting further push coring. Bioboxes also getting full. Downtime accrued 0 hr.

20th June
Swell increasing to over 3m today necessitated and change of survey plan. Sea-states and wind speeds prohibited the final ROV dive. Transit was therefore initiated early and extended to allow the planned ROV dive trialing the rock drill to be undertaken off Loop Head adding time to transit but saving marginally on dive descent times. Downtime accrued 2 hr.

The gravity and Reineck corers (**CE15009_32** to **42**) were unable to retrieve decent samples. The terrain was hard and steep in places however it must be said that these devices perform very badly. The Reineck is very small and lacks weight, more suited for harbour work. The gravity corer design is fundementally flawed being a narrow gauge. It was unable to take core in the softest of muds picked from the ROV line. Any self respecting gravity corer would of retrieved sample from most of the sites picked.

6 SURVEY NARRATIVE

All times British Summer Time 1 hr ahead of UTM (station data in UTM)

Galway

9th June, Tuesday – *Sunny, no wind*
Commence mobilisation. Heavy lifting completed.

10th June, Wednesday – *Sunny, no wind*
Continue mobilisation. Wet test of ROV in the Galway basin at **16.00**.

Galway – Galway Bay

11th June, Thursday – *Sunny becoming cloudy, no wind, calm*
Continue mobilisation. Depart Galway Dock **11.45**. Build gravity core LARS and ROV overboard starboard platform. Arrive on station at **14.15**. At **15.25** begin full ROV wet test including inertial navigation and multibeam communications test. Wet test concluded at **23.30** and ROV recovered. Commence transit to Rossaveal at **23.49**.

Galway Bay – Porcupine Seabight

12th June, Friday – *Cloudy, slight breeze, calm*
Tom Crean lauched at **00.28** to transfer Craig Wallace (Sonadyne technician) to Rossaveal and pick up Raissa Hogan (Biologist). At **01.39** recover Tom Crean with Raissa Hogan and commence transit to the Moira Mounds at 13kts. Arrive Moira Mounds survey area at **12.20**. Commenced CHIRP lines over a small carbonate mound 50m tall at **12.46**. First line (**CE15009_01**) was a side swipe (N-S), second (**CE15009_02**) over summit (S-N) and third (**CE15009_03**) was the best (W-E). Finished at **13.47**. Ran a NS hull-mounted MBES line across the Moira Mounds area (**CE15009_04)** from **14.03** to **16.06.** CTD and SVP (**CE15009_05**) experienced *technical problems* with fresh attempts collected at **19.38** and **20.45** (**CE15009_6A&B**)**.** Commenced calibaration of the USBL at **21.22** and continuing overnight.

Porcupine Seabight

13th June, Saturday – *Sunny, windy with a moderate swell*.
USBL calibration continues all morning (see *technical difficulties*). Calibration completed at **13.21**. ROV dived on the Piddington Mound for a patch-test at **14.10** (**CE15009_7A**) but was aborted due to an ROV power failure. 2nd attempt (**CE15009_7B**) at **16.25** successful. Patch test completed at **19.35**. Started MBES 30m off the seabed over the Piddington Mound area at **20.30** (**CE15009_7B**) in high resolution mode. Completed at **22.25** and started MBES at 190m off the seabed (**CE15009_8**) covering a wider central Moira Mounds area.

14th June, Sunday – *Sunny, v. calm.*
ROV dive (**CE15009_8**) continues with MBES at 190m above seabed. End of Dive 2 (**CE15009_8**) at **16.22**. On deck at **17.06**. CTD taken (**CE15009_9**) at **17.11** to further constrain USBL and shipbased MBES. Shipbased MBES lines run for 5 nm to the west to find western limit of the Moira Mds (**CE15009_10**). Mapping commenced at **18.09** and was finished by **18.55**. A CHIRP line (**CE15009_11**) was run at **19.53** over the gravity coring site (this was later moved) to constrain the mound target. CHIRP line was good but target verification was inconclusive. A series of MBES lines (**CE15009_12**) were then run to successful constrain the gravity coring site. Two gravity cores (**GC001 & GC002**) were taken at the same location trying to penetrate the base of a small mound (**CE15009_13 & 14**). Cores penetrated 2.58m and 2.85m respectively but did not contain coral suggesting they missed. At **00.22**, the ROV was put back in the water (**CE15009_15**) with the HD video camera facing downwards. A video mosaic dive c.2m off the bottom of the Piddington Mound with a line spacing of 1m commenced.

15th June, Monday – *Sunny, calm to low swell.*
ROV dive (**CE15009_15**) continues. Video mosaic completed at **19.45**. 50m transect away from Piddington run and transponder (deployed for calibration test) recovered at **20.10**. On deck at **21.00**. Reineck core (**CE15009_16**) taken at **22.28** covered 8cm of sandy sediment. Subequent two attempts failed.

16th June, Tuesday – *Sunny, low to moderate swell, winds rising to 20kts.*
ROV with HD video forward looking and with a biobox for sampling (**CE15009_17**) was deployed at **02.05**. Cracking dive!

Porcupine Seabight to Porcupine Bank Canyon

17th June, Wednesday - *Foggy, moderate swell, winds 15- 20kts.*
ROV recovered at **00.52** (**CE15009_17**). Commence transit at **02.37** to the Porcupine Bank Canyon collected MBES data on the way (**CE15009_18**). Arrive at the Porcupine Bank Canyon and finish line at **15.02**. New EM302 MBES line start imaging the canyon wall (**CE15009_19**) at **11.03**. Finish MBES at **17.30** (**CE15009_22)**. Commence MBES ROV dive (**CE15009_23)** at **17.45.**

Porcupine Bank Canyon

18th June, Thursday – *Sunny, lazy swell*.
ROV MBES dive (**CE15009_23)** continuing all day flying 180m off the bottom up the canyon system and over the cold-water coral mounds on the lip of the canyon. Two lines were flown at 30m off the bottom over one mound and the scarp face. Dive finished at **22.25** and on deck at **23.45.**

19th June, Friday – *Overcast, low swell*.
CHIRP line (**CE15009_24**) and shipbased MBES line (**CE15009_25**) commenced at **01:26** over cold-water coral mounds on the plateau away from the canyon lip. Gravity core deployed at **03:19** trying to penetrate the largest

mound on the lip of the canyon (**CE15009_26A**, **26B** & **26C**). Cores **CE15009_26A** & **26B** penetrated the surface but did not contain coral suggesting a blockage at the seafloor. Small coral fragments were collected within the core catcher. **CE15009_26C** failed to penetrate seabed. A series of CHRIP lines were collected during transit to ROV site both along the lip of the canyon and down the canyon, **CE15009_27**, **28** & **29**. CHIRP line data collection commenced at **04:58** and was completed at **05:55**. ROV with HD video forward looking, biobox for sampling with six push cores (**CE15009_30**) was deployed at **07:27**. Water depth 1962m. Push-cores and bio samples collected. Dive aborted at **23.13** (*see technical issues*).

20th June, Saturday – *Sunny, windy, moderate swell and building*.
ROV redeployed at **02.03** (**CE15009_31**) and proceeded to recover stunning footage up the vertical coral colonised cliff face just below the lip of the canyon and then continued to video inspect the coral mounds south-westerly along the lip of the canyon. A bio sample was taken. ROV on deck at **13.30**. Proceeded to take a largely unsuccessful coring campaign starting at **14.34** till **midnight**. 10 gravity cores were taken (**CE15009_32-35**) recovering only core catchers and short plugs from the coral mounds, tallus slope in the very upper canyon and further down the canyon (*see technical issues*).

Porcupine Bank Canyon to Loop Head

21th June, Sunday – *Light rain, windy, moderate swell*.
Final unsuccessful gravity core taken at **00.44** (**CE15009_36**). On the coral mounds, four Reineck cores were then tried with also limited to no success (**CE15009_37** to **40**) starting at **02.36** and finishing at **05.15**. **CE15009_40** retieved 17cm of sample. A final attempt was made with a gravity corer at **05.47** (**CE15009_41**). Transit to Loop Head commenced at **06.17** with MBES ran all the way (**CE15009_42**).

Loop Head to Galway

22th June, Monday – *Sunny, low swell.*
Arrived on station early morning after hunting with the MBES (line not recorded) for a suitable rock outcrop to drive. A site was chosen south of the channel in the mouth of the Shannon. ROV deployed at **00.54** (**CE15009_43**). After finding a suitable rockface, the ROV successfully drilled a rock core in a smooth and successful operation ROV recovered at **05.45**. Commence transit to Galway. Pick up pilot at **18.10**. Tie up Galway dock **21.00**.

Galway

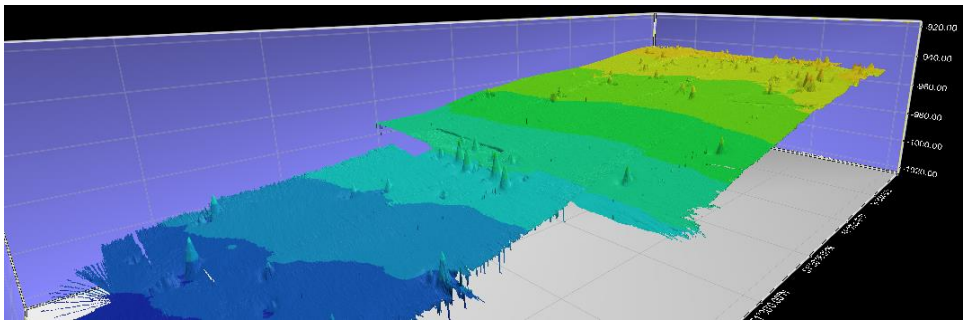
23th June, Tuesday – *Sunny*.
Complete demobilisation.

7 SUMMARY OF AREAS

Moira Mounds, Belgica Mound Province, eastern Porcupine Seabight

A detailed investigation of the western chain of Moira Mounds was undertaken taking a map and explore approach. Mapping coverages were generated using shipbased EM302 multibeam that provided capable of identifying large Moira Mounds but not smaller mounds - no Moira Mounds can be identified on the existing INSS multibeam. As the EM302 has a large swathe this proved useful at extending mapping coverage further west than the existing 30kHz TOBI side-scan sonar and also independently verifiy the location and topographic expression of the larger Moira Mounds in comparison with the TOBI data.

Using ROV-mounted EM2040 multibeam we were able to produce maps of the central area of the western chain of the Moira Mounds at a never before achieved resolution. These new views shows very clearly a far greater number of Moira Mounds than inferred from TOBI data, their exact location and heights. The maps also provide details on mound scours, sediment waves adding crucial contextual data on seabed dynamics and sediment transport pathways. By flying a second EM2040 survey 30m off the seabed we have produced a really high resolution map of the area around the Piddington Mound including 5 other mounds again with the sediment wave dominated seabed context. This map also shows details of mound scours and mound leeway smaller coral banks.

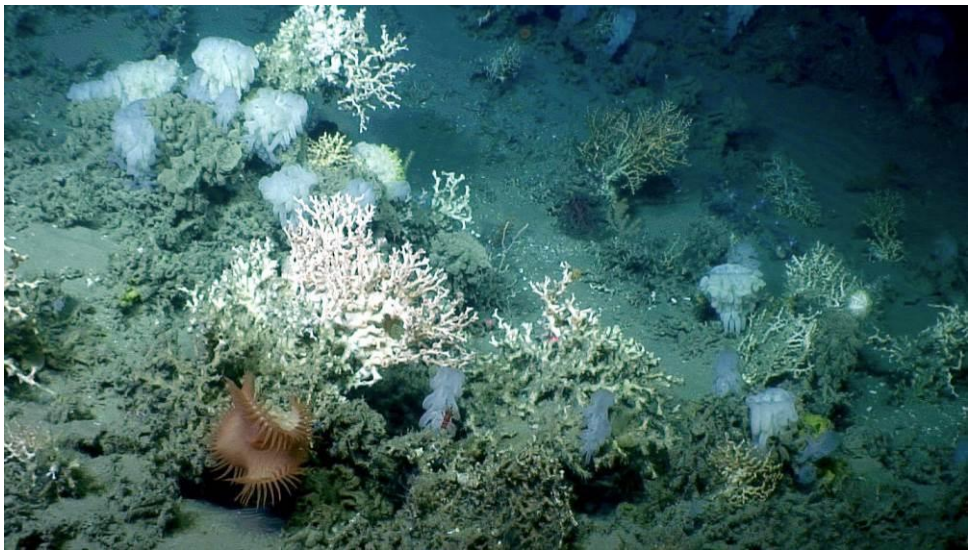


Moira Mounds imaged as topographic features on the EM2040 ROV-collected multibeam data

These maps were groundtruthed by the ROV in video and sample mode. One dive concentrated on producing a 100% coverage video mosaic of the Piddington Mound whilst the other dive explored mound targets north of Piddington adding to groundtruthing collected during the 2011 VENTuRE survey. This dive produced great footage of the reef fauna (sponges, corals (hard & soft), fish, crabs, octopusses, crinoids, anenomes, gastropods, barnicles, etc), The richness of these reefs is startling.

It is also noted that reefs stature, bioerosion and faunal compositon changes from south to north in line with changing hydrodynamics and an increasingly sand dominated seabed. This dive was also successful in collection biosamples for later studies.

A view of one of the Moira Mounds showing several types of hard and soft corals as well as sponges growing of Madrepora oculata frameworks



An actinian with Madrepora oculata, Lophelia pertusa and glass sponges

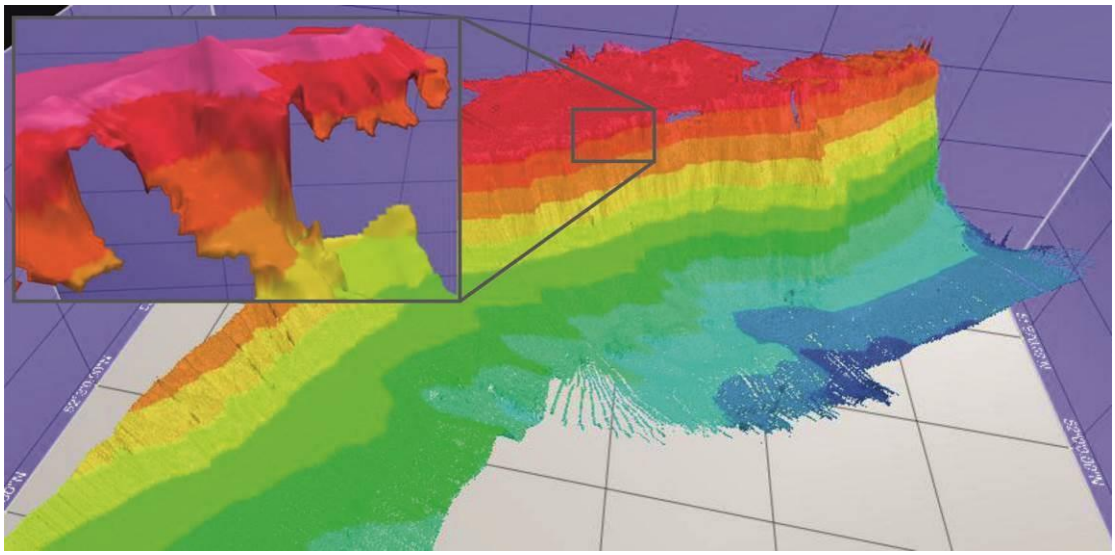
A gorgonocephalus growing on an antipatharian

We also collected some good quality CHIRP lines throught the area showing the sub-seabed stratification and also internal structures to giant mounds.

Additional data collection included Reineck box cores, gravity cores and CTD profiles adding further contextural data.

Porcupine Bank Canyon, Porcupine Bank

A similar approach to data collection was undertaken at the Porcupine Bank Canyon site (map, groundtruth then sample). The ship's EM302 MBES produced a map of the plateau above the western margin of the Porcupine Bank Canyon where cold-water corals were known to occur. This coverage was extended over the lip of the canyon to its central area to a depth of 2100 m water depth. This map resolved that ridge on the lip of the Porcupine Bank Canyon was actually an alignment of mounds (later confirmed by video observation as coral mounds) and revealed details of channel anastamosing down canyon. One of these channels had its headwall directly under one of the coral mounds (named here the Querci Mound) and became a focus of study as there appears a direct connection between the mound's location, on a small promentary on the very edge of the canyon above a vertical rocky crag, and the conduit of the canyon itself below.

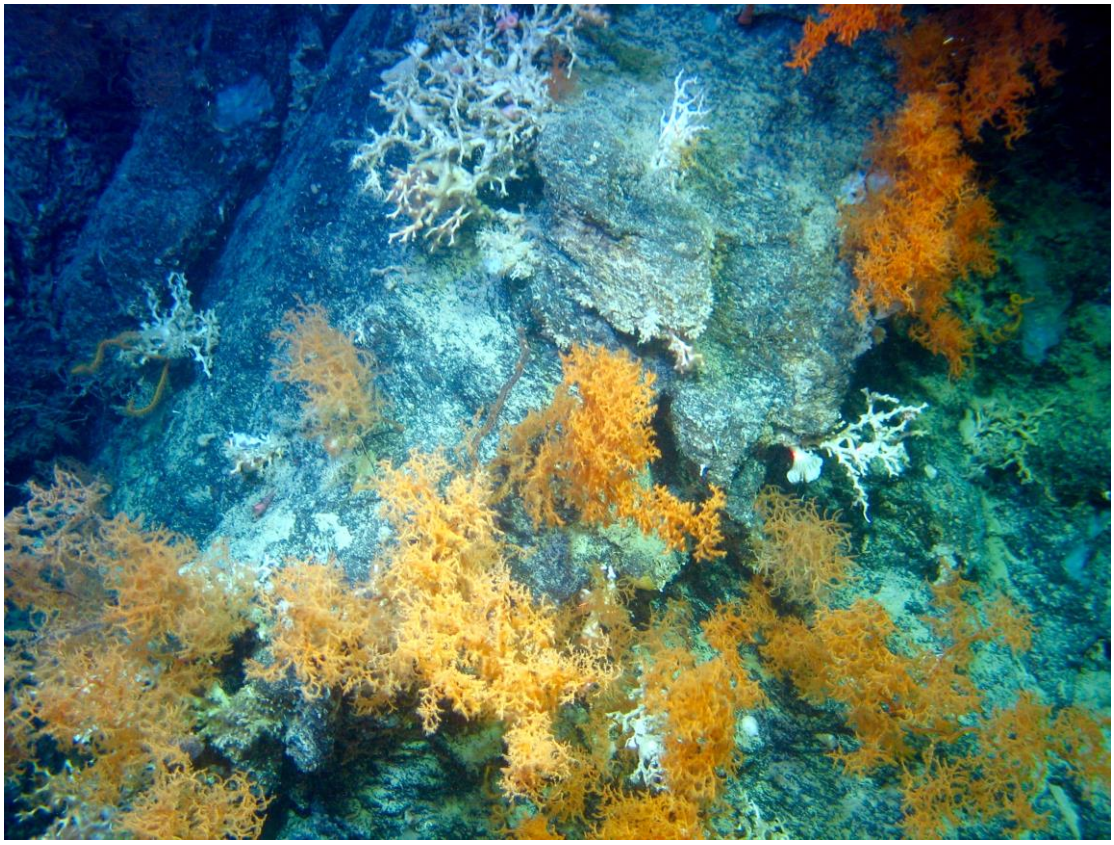


Multibeam echosounder derived digital terrain model of the western flank of the Porcupine Bank Canyon showing the steep canyon wall and coral mounds on the lip of the canyon

ROV-mounted EV2040 MBES data was collected up the canyon to the Querci Mound following one of the channels. This reveals a very steep and craggy headwall. A further EM2040 line was run along the coral mound ridge to the south-west imaging the mounds in detail as well as some of the plateau seabed east of Querci. A few line of very high resolution EM2040 MBES flew 30m above the seabed was collected over the Querci Mound to study its biogeomorphology.

Two long ROV video inspection lines were run inspecting the EM2040 coverages. The bottom of the canyon possessed a muddy substrate with a high degree of POM and detritus in the near seabed water column and settling on the seabed especially at slack water. Occasional dropstones were encountered with crinoids often and a sea pen community sampled. Moving up the canyon, the channel gradient steadily increased with occasional steps, the sediment became sandier and boulders of coral that had tumbled down from above were encountered. Further up the slope still, the sediment contained and increasing percentage of coral rubble.

The CTD data suggests a water mass change at 1350m and again at 700m (coincident with the lip of the canyon).



Typical view of the vertical rock face on the canyon headwall showing Leiopathes sp*. (black coral),* Madrepora oculata *and* Desmophyllum cristagalli*.*

In the upper part of the canyon (headwall) slopes become very steep with sediment and coral fragments resting at their angle of repose. There are patches of dead coral framework (from former reefs occurrences) as exposed. At the very lip of the canyon below Querci the cliff face become vertical with minor overhangs and is colonised by black corals, antipatharians, sponges, *Lophelia pertusa* and other corals. There was also a higher abundance of fish and crabs. This is a previously unseen habitat.

A close up of a Leiopathes sp*. (black coral) attached directly to the rock substrate on the upper canyon headwall supporting a squat lobsters and crabs.*

Typical view of the coral mounds on the lip of the western margin of the Porcupine Bank Canyon showing high stands of Lophelia pertusa *and* Madrepora oculata *with* Desmophyllim cristagalli*. Areas of bioeroded coral exists between the stands.*

ROV video inspection verified that cold-water corals (dominantly *Lophelia pertusa*) former thick coverages on the mounds at their summits and western side with sparcer coral cover on their eastern sides. Inter-mound seabed was sandy with dropstones and occasional corals.

8 WEATHER REPORT

11th June- Galway Bay
12.31: Wind NE, force 4
16.00: Wind E, force 2. Calm, visibility good.

12th June – Transit & E. Porcupine Seabight
04.00: Wind NE, force 3-4, visibility good
05.00: Wind NE, force 2.
07.00: Wind NE, force 2.
08.00: Wind NE, force 3
09.47: Wind NE, force 4
11.56: Wind NE, force 4
16.00: Wind N, force 4, low seas
18.15: Wind N, force 4-5, moderate seas, low swell.
20.00: Wind N, force 4-5, moderate seas, low swell.
21.22: Wind N, force 5.

13th June – E. Porcupine Seabight
04.00: Wind N, force 4-5, moderate seas, moderate visibility.
06.00: Wind N, force 5, moderate seas, low swell.
08.00: Wind NNE, force 4-5, moderate seas, low swell.
10.07: Wind NNE, force 6.
11.52: Wind NNE, force 5.
16.00: Wind NNE, force 5, low sea, good visibility.
20.00: Wind N, force 4, moderate sea, low swell.
22.00: Wind NNE, force 5.
23.55: Wind NNE,force 5.

14th June – E. Porcupine Seabight
04.00: Wind N, force 4, calm sea, good visibility.
06.00: Wind N, force 2, slight sea, low swell.
08.00: Wind N, force 2, slight sea, low swell.
10.30: Wind NNE, force 4.
11.56: Wind NNE, force 4.
16.00: Wind NNE, force 2, calm sea with good visibility.
20.20: Wind light and variable, calm sea, cloudy.
23.40: Weather cyclonic, calm sea.

15th June – E. Porcupine Seabight
04.00: Wind light, calm sea with good visibility.
06.00: Wind light, calm sea, mainly clear with some cloud.
11.50: Wind SW, force 3.
16.00: Wind SSW, force 3, calm, good visibility.
20.00: Wind SW, force 3, slight sea, low, overcast and clear,

16th June – E. Porcupine Seabight
00.00: Wind SSW, force 4.
04.00: Wind S, force 5, low sea, good visibility.

08.00: Wind S, force 4, moderate sea, low swell, overcast, clear.
12.00: Wind SSW, force 5.
16.00: Wind SSW, force 5, low seas, moderate visibility, overcast.
16.00: Wind SSW, force 5, low seas, moderate visibility, overcast.
18.00: Wind SW, force 4, moderate seas, low swell, overcast.
20.00: Wind SW, force 3/4, low seas, overcast.
22.59: Wind SW, force 5, fog.
23.51: Wind SW, force 5, fog.

17th June – Transit & Porcupine Bank Canyon
04.00: Wind SW, force 5/6, low sea, poor visibility, Fog.
05.00: Wind SW, force 4
06.00: Wind SW, force 4/5, moderate sea, poor visibility, Fog.
08.00: Wind SW, force 4, moderate sea, poor visibility, Fog.
11.10: Wind SW, force 4, moderate sea, poor visibility, Fog.
12.34: Wind NW, force 4
16.00: Wind NW, force 2, calm sea, good visibility, overcast.
18.00: Wind NW, force 2, slight sea, moderate swell, overcast, good visibility.
20.00: Wind NW, force 2, slight sea, low swell, overcast, good visibilty.
22.10: Wind NW, force 3.
23.45: Wind NW, force 3.

18th June –Porcupine Bank Canyon
04.00: Wind NW, force 2, calm, low swell, overcast, good visibility.
06.00: Wind NW, force 2, slight sea, moderate SW swell, overcast, good visibility.
08.00: Wind NW, force 2, slight sea, moderate swell, overcast, good visibility.
11.51: Wind W, force 3.
16.00: Wind SW, force 2, calm, clear, good visibility.
18.00: Wind SW, force 2, slight sea, moderate swell, cloudy, clear.
20.00: Wind SW, force 2, slight sea, moderate swell, overcast, clear.
23.55: Wind WSW, force 4.

19th June –Porcupine Bank Canyon
04.00: Wind SW, force 3/4, calm, poor visibility.
08.00: Wind SW, force 2/3, slight sea, low swell, overcast, clear.
10.58: Wind SW, force 4.
11.51: Wind SW, force 4.
16.00: Wind SW, force 3, low sea, low swell, moderate visibility, overcast.
18.00: Wind SW, force 3/4, moderate sea, low swell, overcast, clear.
20.00: Wind SW, force 3, slight sea, moderate swell, overcast, clear.
22.45: Wind SW, force 4.
23.12: Wind SW, force 4.
23.57: Wind SW, force 4.

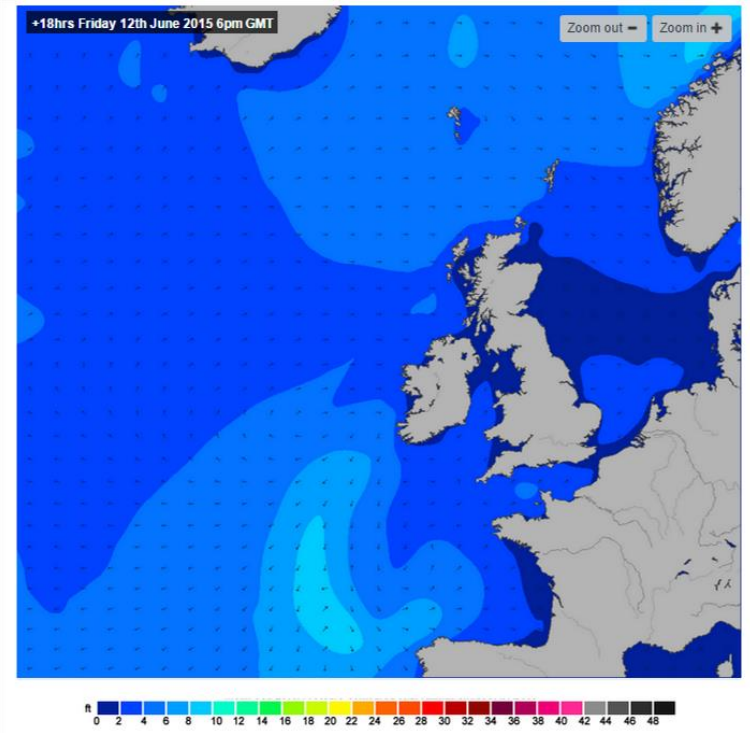
20th June –Porcupine Bank Canyon
04.00: Wind SW, force 4, calm, moderate visibility, overcast.
06.00: Wind SW, force 4, moderate sea, low swell, overcast, clear.
08.15: Wind SW, force 3, slight sea, low swell, cloudy, clear.
11.53: Wind SW, force 5.

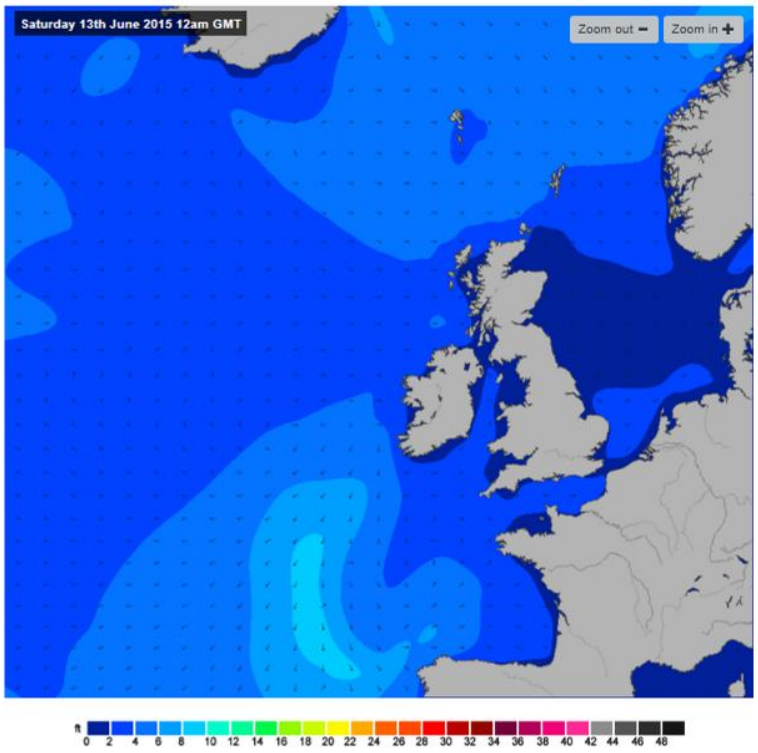
16.00: Wind W, force 5/6, low sea and swell, good visibility.
19.00: Wind W, force 4/5.
21.28: Wind WSW, force 5.
23.50: Wind W, force 5.

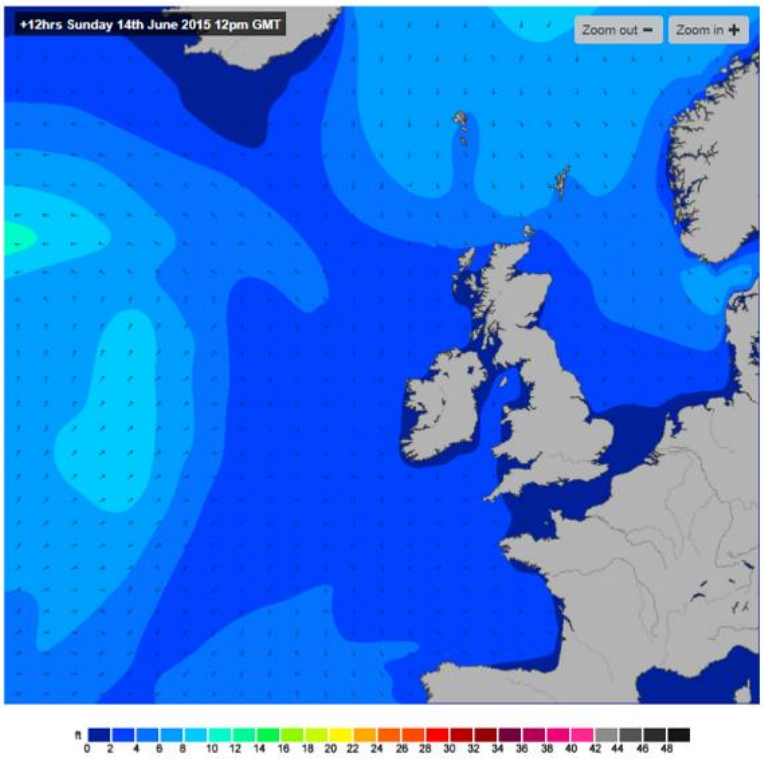
21st June –Porcupine Bank Canyon & Transit
04.00: Wind W, force 5/6, moderate sea, low swell.
08.00: Wind W, force 3.
09.40: Wind W, force 4.
16.00: Wind W, force 4, low swell, low sea, overcast, good visibility.
17.55: Wind W, force 3, slight sea, moderate swell, overcast, clear.
20.00: Wind W, force 2, slight sea, low swell, overcast, clear.
22.35: Wind W, force 4.
23.33: Wind W, force 4.
23.54: Wind NE, force 3.

22nd June – Transit to Galway
04.00: Wind N, force 3, calm, good visibility, overcast.
06.30: Wind N, force 3, slight sea, moderate swell, cloudy, clear.
08.05: Wind N, force 2, slight sea, low swell, cloudy, clear.
09.53: Wind NW, force 5.
11.59: Wind NW, force 4.
16.00: Wind SW, force 3, overcast, good visibility

9 WEATHER CHARTS (SWELL)



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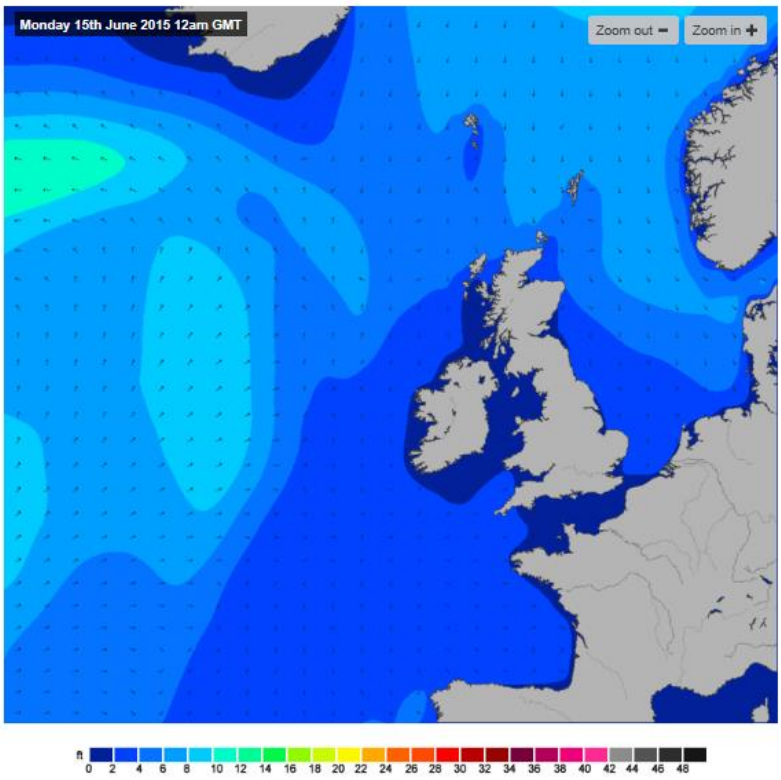
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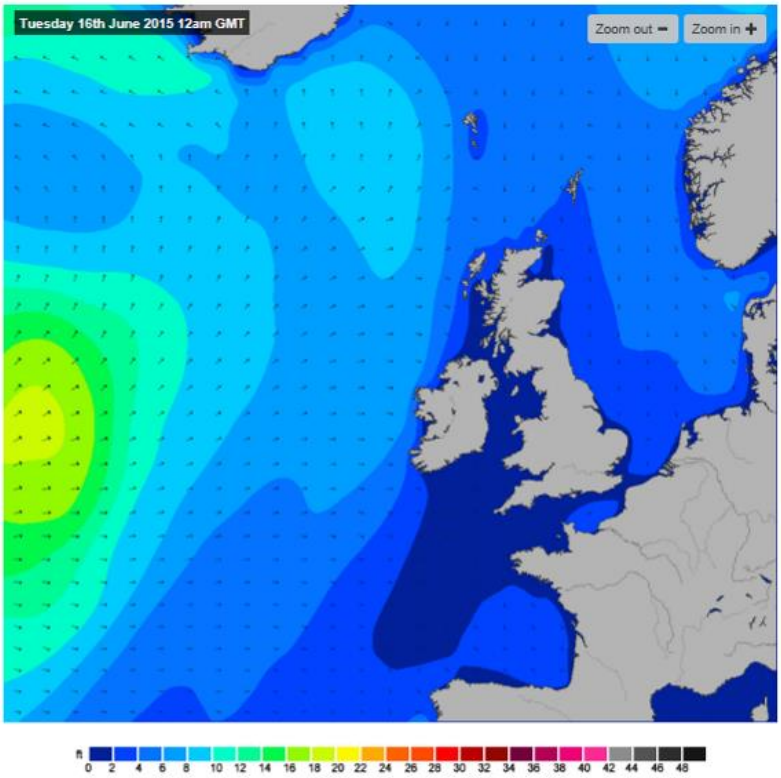
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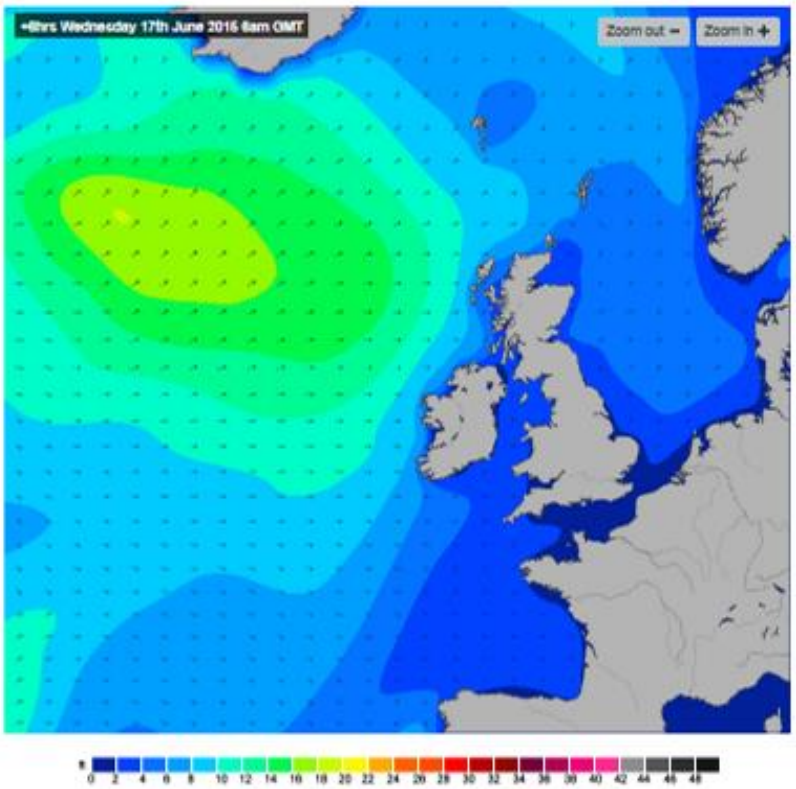
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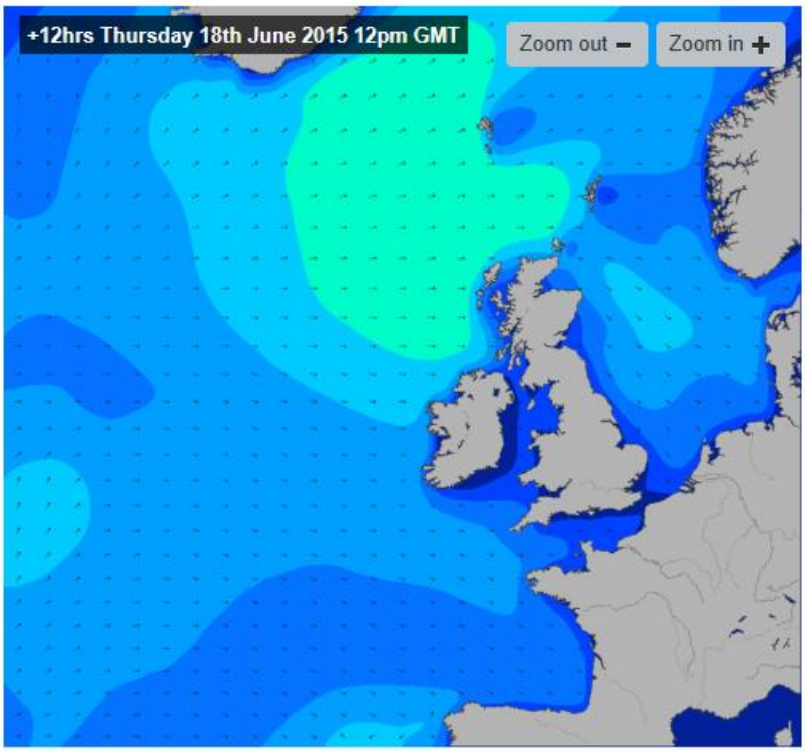
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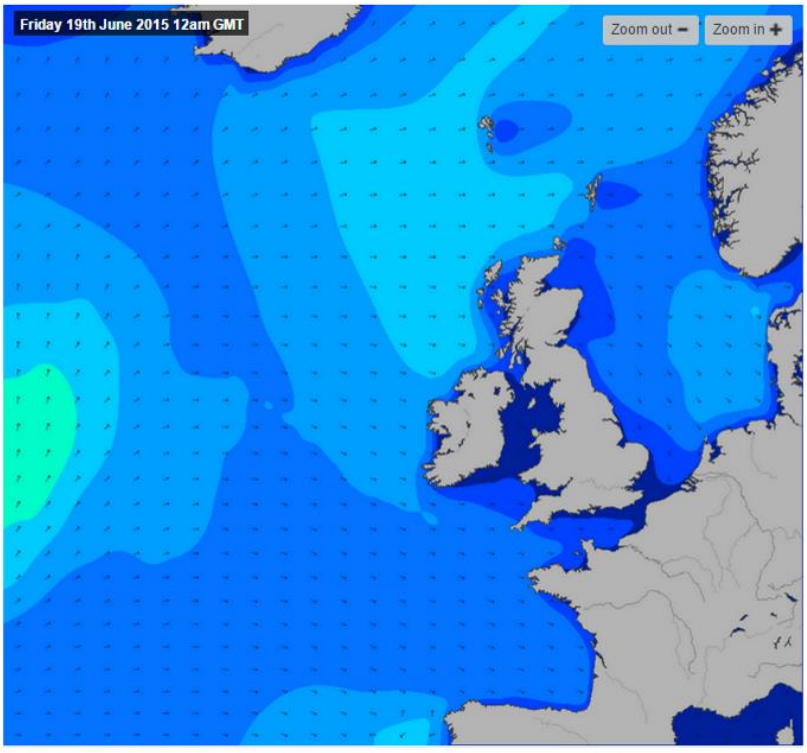
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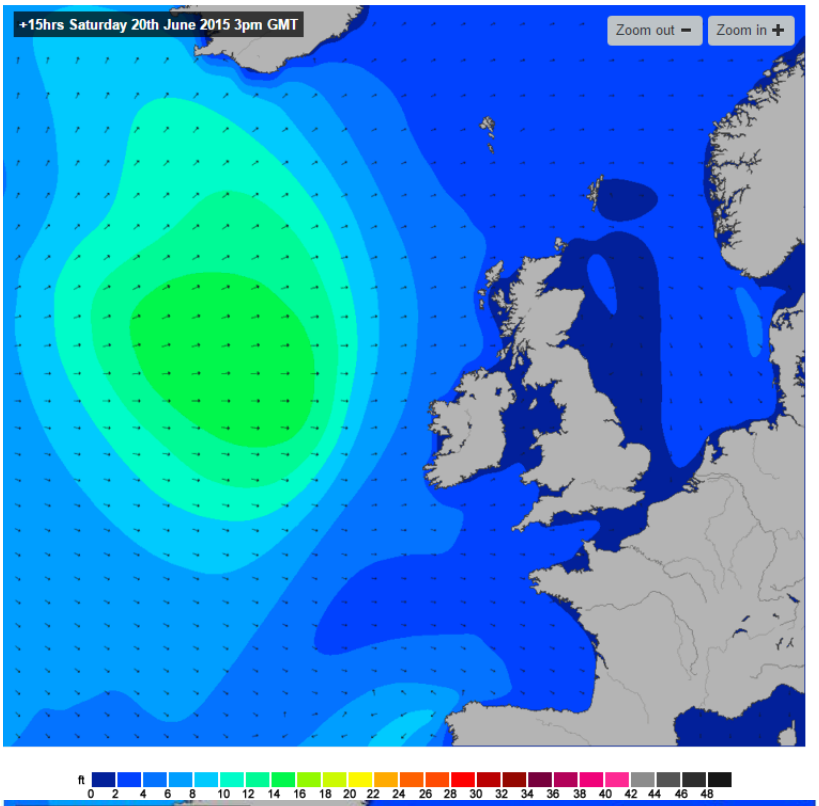
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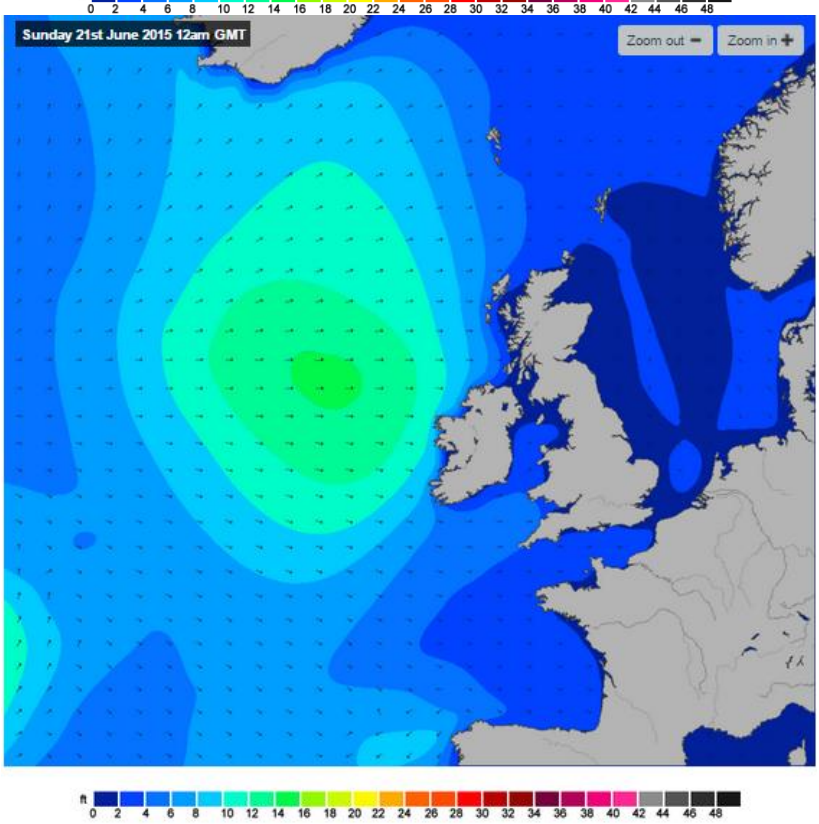
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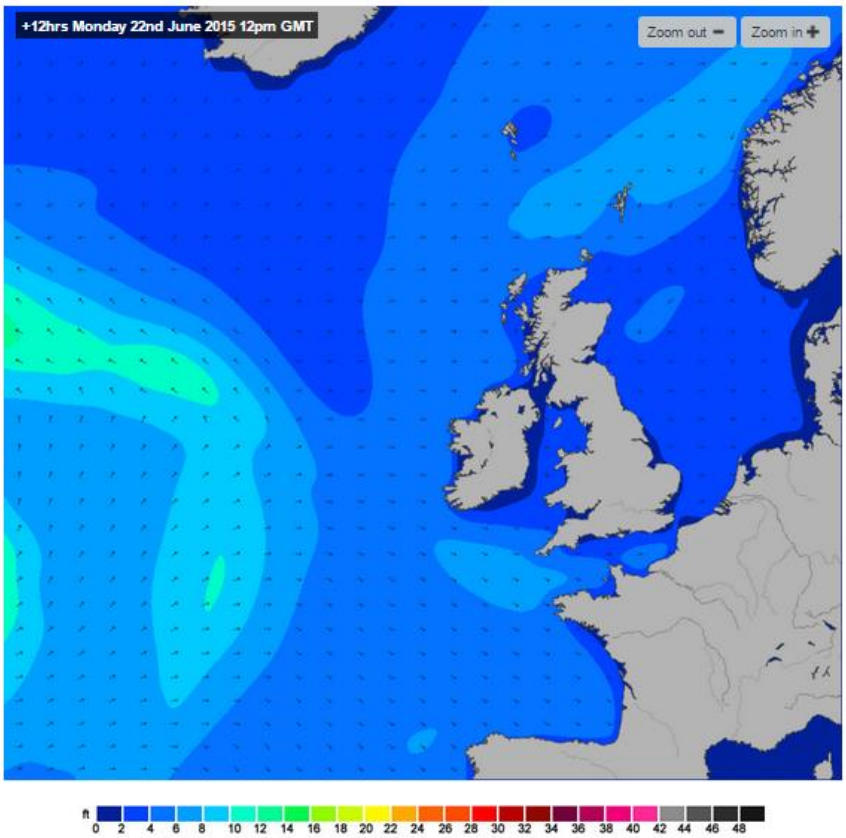
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Appendices

PERSONNEL

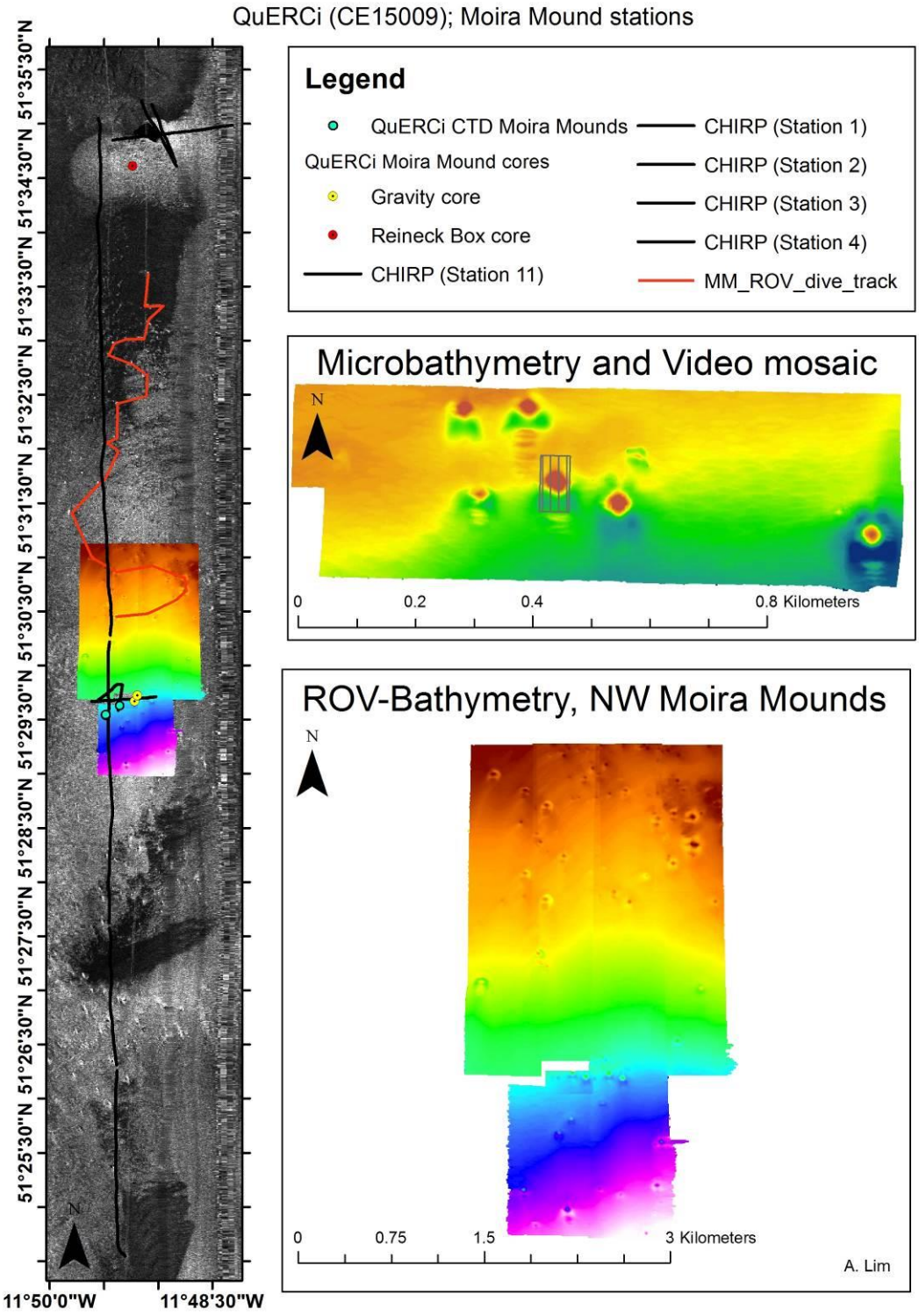
Ship's Crew	Scientific Party
Denis Rowan Master	Prof. Andy Wheeler Chief Scientist (UCC)
Mark Ivory Chief Engineer	Aaron Lim Geologist – Day watch leader (UCC)
Basil Murphy Chief Officer	Dr. Chris McGonigle Biologist – Night watch leader (UU)
Barry Hooper 2nd Officer	Dr. Agostina Vertino Geologist (Unimib, Milan)
Robert Kirby 2nd Engineer	Edel O'Donnell Geologist (UCC)
Paul Wray E.T.O	Eileen McCarthy Geologist (UCC)
Frank Kenny Bosun	Graham Ryan Geologist (GSI)
Shane Horan Bosun's Mate	Kevin Power Geologist (UCC)
Brian Sharkey Technician	Luca Crippa Geologist (Unimib, Milan)
Jimmy Moran Cook	Niamh Connolly Geologist (UCC)
Arie Van Der Assam Technician 2	Raissa Hogan Biologist (NUIG)
Michelin Faherty AB Deckhand 1	Romano Capucci ROV developer (UL)
Tom Gilmartin AB Deckhand 2	Ken O'Sullivan Film Producer (Sea Fever Production)
Gerry Dirrane AB Deckhand 3	
Declan Horan AB Deckhand 4	**ROV Team**
Maurice Murphy Assistant Cook	Paddy O'Driscoll ROV Technican/Pilot (team leader)
	Karl Bredendick ROV Technican/Pilot
	Colin Ferguson ROV Technican/Pilot
	Damien McCormack ROV Technican/Pilot
	David O'Hara ROV Technican/Pilot
	Liam Murphy ROV Technican/Pilot
	Craig Wallace Sonadyne Technican

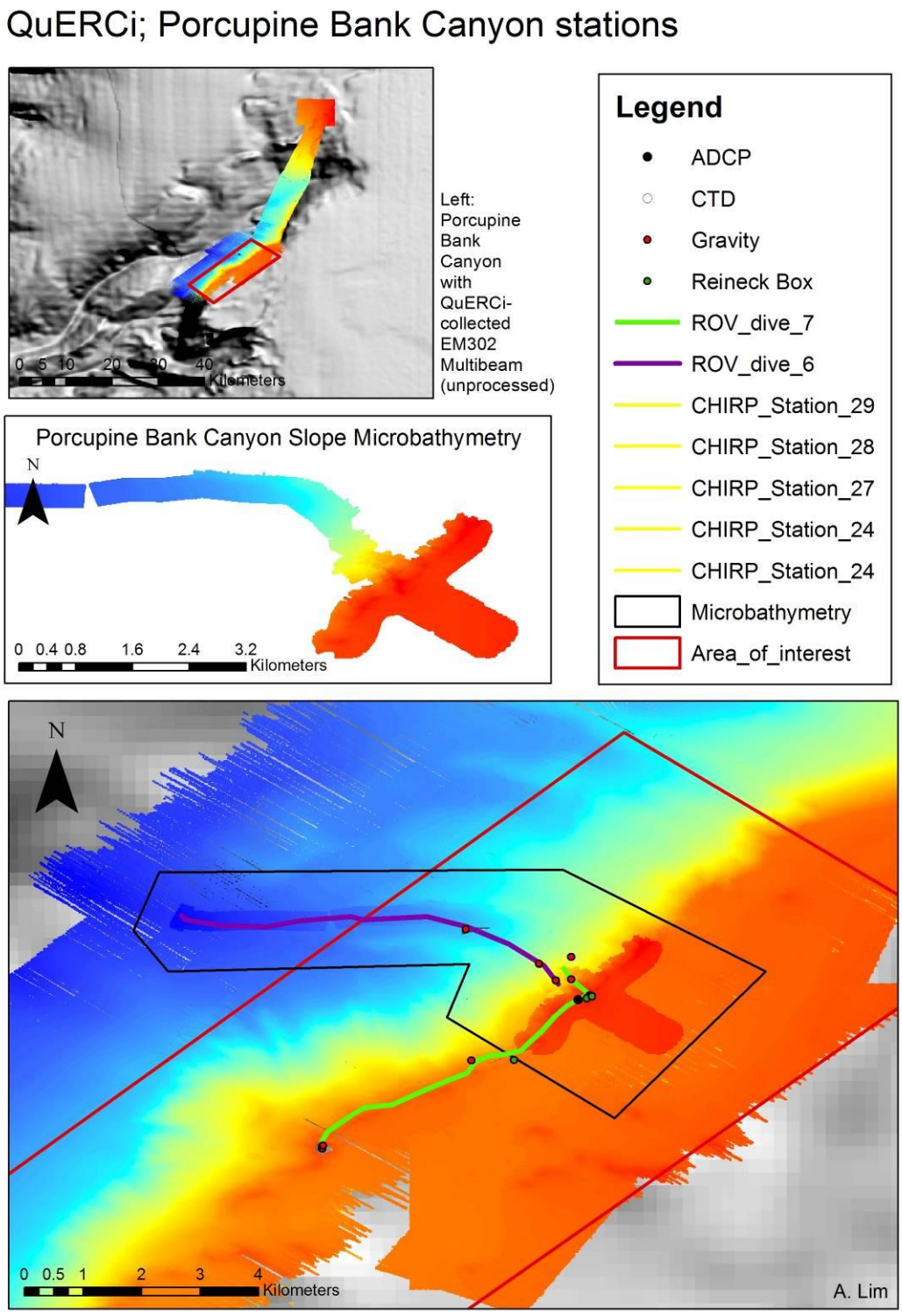
QuERCi Scientists (left to right): Edel O'Donnell, Romano Capucci, Dr. Chris McGonigle, Ken O'Sullivan, Andy Wheeler, Kevin Power, Graham Ryan, Luca Crippa, Raissa Hogan, Arie Van Der Assam, Agostina Vertino,Niamh Connolly, Eileen McCarthy, Aaron Lim.

Officers, crews, scientists and ROV technicians of the CE15009 QuERCi survey on the RV Celtic Explorer

II. AREA MAPS: COVERAGES & SAMPLE LOCATIONS

Moira Mounds, Belgica Mound Province, eastern Porcupine Seabight




QuERCi; Porcupine Bank Canyon stations
0 5 10 20 30 40
Kilometers
Left: Porcupine Bank Canyon with QuERCi-collected EM302 Multibeam (unprocessed)
Legend
ADCP
CTD
Gravity
Reineck Box
ROV_dive_7
ROV_dive_6
CHIRP_Station_29
CHIRP_Station_28
CHIRP_Station_27
CHIRP_Station_24
CHIRP_Station_24
Microbathymetry
Area_of_interest
Porcupine Bank Canyon Slope Microbathymetry
N
0 0.4 0.8 1.6 2.4 3.2
Kilometers
N
0 0.5 1 2 3 4
Kilometers
A. Lim

III STATION LISTS

Master Log sheet										2040			302					
Station Number	**Dive #**	**Date**	**Time (UTC)**	**Lat**	**Long**	**Depth (m)**	**CTD**	**ADCP**	**ROV video**	**ROV MBES**	**Grab**	**B. Core**	**MBES**	**CHIRP**	**Rock drill**	**SVP**	**G. core**	**Note**
CE15009_01		12/06/15	11:46	51°35.2101	11°49.145									✔				SOL N-S
		12/06/15	11:54	51°34.6104	11°48.827													EOL
CE15009_02		12/06/15	12:05	51°34.6415	11°48.845									✔				SOL 2nd Attempt S-N
		12/06/15	12:17	51°35.1750	11°49.064													EOL 2nd Attempt S-N
CE15009_03		12/06/15	12:33	51°34.8469	11°49.420									✔				SOL 3rd Attempt W-E
		12/06/15	12:47	51°34.989	11°48.370													EOL 3rd Attempt W-E
CE15009_04		12/06/15	13:03	51°35.0566	11°49.550								✔	✔				SOL N-S
		12/06/15	15:06	51°24.6400	11°49.370													EOL
CE15009_05		12/06/15	15:50	51°29.5383	11°49.482		✔											Error
CE15009_06_A		12/06/15	17:38	51°29.5412	11°49.484	960	✔											
CE15009_06_B		12/06/15	18:55	51°29.5429	11°49.484	965	✔											
CE15009_07A	D1_265	13/06/15	02:24	51°29.770	11°49.133	967				✔								Patch test, 20m & 200m fly height
CE15009_07B	D2_266	13/06/15	15:25	51°29.6764	11°49.133	967				✔								SOL MBES at 20m Paddington 7b - calibration
CE15009_08	D2_266	13/06/15	22:19	51°29.688	11°48.762	977				✔								High Res Pid + 200m. SOL
CE15009_09		14/06/15	16:11	51°29.6258	11°49.353	955	✔											

Station Number	Dive #	Date	Time (UTC)	Lat	Long	Depth (m)	CTD	ADCP	ROV video	ROV MBES	Grab	B. Core	MBES	CHIRP	Rock drill	SVP	G. core	Note
CE15009_010		14/06/15	17:09	51°29.6374	11°49.420	940							✔					
CE15009_010		14/06/15	17:40	51°29.4778	11°56.073	950							✔					
CE15009_010		14/06/15	17:55	51°28.1620	11°56.118	931							✔					
CE15009_011		14/06/15	18:53	51°29.7110	11°49.347	960								✔				
CE15009_012		14/06/15	19:27	51°29.7053	11°49.107								✔					
CE15009_012		14/06/15	19:53	51°26.6646	11°49.558								✔					
CE15009_013		14/06/15	20:34	51°29.6696	11°49.216	970											✔	Problem with USBL
CE15009_013		14/06/15	20:43	51°29.6666	11°49.217	970											✔	
CE15009_014		14/06/15	22:45	51°29.7202	11°49.190	969											✔	
CE15009_015	D3_267	15/06/15	00:22	51°29.66832	11°49.119	970			✔									Downward Camera
CE15009_016		15/06/15	21:28	51°34.6113	11°49.233	904						✔						
CE15009_017	D4_268	16/06/15	01:05	51°30.4478	11°49.394	947			✔									
CE15009_018		17/06/15	02:37	51°33.7337	11°49.520	919							✔					Transit Line
CE15009_019		17/06/15	14:11	52°02.0060	14°57.962	1233							✔					PBC MBES
CE15009_020		17/06/15	15:21	51°57.6622	15°66.321								✔					PBC MBES
CE15009_021		17/06/15	16:32	52°01.3678	14°56.550								✔					PBC MBES
CE15009_022		17/06/15	17:30	51°55.6944	15°04.353	1054							✔					PBC MBES
CE15009_023	D5_269	17/06/15	21:05	52°00.9199	15°03.342	1971				✔								Test Line. 21:05 Time on the bottom.
CE15009_023	D5_269	17/06/15	21:07	52°00.9176	15°03.331					✔								Centre Line
CE15009_023	D5_269	17/06/15	21:12	52°00.895	15°03.244					✔								Transit Line

Station Number	Dive #	Date	Time (UTC)	Lat	Long	Depth (m)	CTD	ADCP	ROV video	ROV MBES	Grab	B. Core	MBES	CHIRP	Rock drill	SVP	G. core	Note
CE15009_023	D5_269	17/06/15	21:22	52°95.46	15°03.265					✔								Survey Line
CE15009_023	D5_269	18/06/15	05:10	52°00.7469	15°00.031					✔								Survey Line
CE15009_023	D5_269	18/06/15	06:57	52°00.2218	014°59.43					✔								
CE15009_023	D5_269	18/06/15	08:29	52°00.6466	014°58.98					✔								
CE15009_023	D5_269	18/06/15	09:28	52°00.15328	014°59.53					✔								
CE15009_023	D5_269	18/06/15	13:10	52°00.307	014°59.611					✔								
CE15009_023	D5_269	18/06/15	13:57	52°00.19622	014°59.434					✔								
CE15009_023	D5_269	18/06/15	14:39	52°00.143	014°59.465					✔								
CE15009_023	D5_269	18/06/15	16:10	52°59.8922	014°58.730					✔								
CE15009_023	D5_269	18/06/15	18:07	52°00.6048	014°59.632					✔								
CE15009_023	D5_269	18/06/15	18:17	52°00.5432	014°59.585					✔								
CE15009_023	D5_269	18/06/15	18:54	52°00.5417	014°59.674					✔								
CE15009_024		18/06/15	23:48	51°58.1468	15°00.8989	740								✔				
CE15009_024		19/06/15	00:26	51°58.4853	014°58.847	690								✔				
CE15009_025		19/06/15	00:29	51°58.4853	014°58.857								✔					
CE15009_026		19/06/15	02:19	51°58.8119	15°01.9245	615											✔	
CE15009_026		19/06/15	03:02	51°58.8362	15°01.9205	623											✔	

Station Number	Dive #	Date	Time (UTC)	Lat	Long	Depth (m)	CTD	ADCP	ROV video	ROV MBES	Grab	B. Core	MBES	CHIRP	Rock drill	SVP	G. core	Note
CE15009_026		19/06/15	03:48	51°58.8424	15°01.9127	630											✔	
CE15009_027		19/06/15	03:58	51°59.0152	15°01.6650	670								✔				
CE15009_028		19/06/15	04:19	52°00.0451	014°59.701	672								✔				
CE15009_029		19/06/15	04:51	52°00.8919	015°03.079									✔				
CE15009_030	D6_270	19/06/15	06:27	52°00.9266	15°03.3203	1962			✔									ROV Sampling
CE15009_031	D7_271	20/06/15	01:03	52°00.3832	14°59.713				✔									
CE15009_032A		20/06/15	03:48	52°00.2162	14°59.4539	653											✔	Shell fragments
CE15009_032B		20/06/15	14:34	52°00.2162	14°59.4493	653											✔	Shell fragments
CE15009_032C		20/06/15	15:20	52°00.2195	14°59.4466	653											✔	Coral material in core catcher only
CE15009_033A		20/06/15	17:31	52°00.5743	14°59.6308	930											✔	
CE15009_033B		20/06/15	17:57	52°00.3714	14°59.6300	913											✔	
CE15009_034B		20/06/15	19:10	52°00.3594	14°59.7670	980											✔	
CE15009_034A		20/06/15	19:57	52°00.3604	14°59.7712	1074											✔	
CE15009_035A		20/06/15	21:12	52°00.5129	14°59.9232	1289											✔	
CE15009_035B		20/06/15	22:15	52°00.5133	14°59.9255	1260											✔	
CE15009_036		20/06/15	23:44	52°00.8316	15°00.5988	1650											✔	
CE15009_037		20/06/15	01:36	52°00.2162	14°59.4565	652						✔						
CE15009_038		21/06/15	02:26	52°00.1958	14°59.4857	665						✔						
CE15009_039		21/06/15	03:12	52°00.2164	14°59.4389	761						✔						
CE15009_040		21/06/15	04:14	51°59.6268	15°00.1541	630						✔						
CE15009_041		21/06/15	04:47	51°59.6241	15°00.5498	730											✔	

Station Number	Dive #	Date	Time (UTC)	Lat	Long	Depth (m)	CTD	ADCP	ROV video	ROV MBES	Grab	B. Core	MBES	CHIRP	Rock drill	SVP	G. core	Note
CE15009_042		21/06/15	05:17	51°59.6305	015°00.158	740							✔					Transit to Loop Head at 10-12 knots
CE15009_043	D8_272	22/06/15	00:54	52°32.4370	010°05.179	70									✔			Rock Core drilling

Station Log: Multibeam							
station #	**start line name**	**Time (UTC)**	**Date**	**Lat SOL**	**Long SOL**	**MBES type**	**note**
CE15009_04	0	13:03	12/06/2015	51°35.0566	011°49.5508	EM302	SOL . North-South. **Lat/Long coordinates for EM 302 ALL taken from Screen 3 in dry lab!**
CE15009_04	0	15:06	12/06/2015	51°24.6400	011°49.3700	EM302	EOL
CE15009_07A	No Line					EM2040	**Lat/Long coordinates for EM 2040 ALL taken from SIS in ROV Shack!**
CE15009_07B	2	17:18	13/06/2015	51.49495	-11.8212607	EM2040	SOL Calibration
CE15009_07C	29	21:23	13/06/2015	51.4956	-11.81581	EM2040	EOL Calibration and Hi Def
CE15009_08	33	22:19	13/06/2015	51.4948	-11.8127	EM2040	SOL Range reduced to 45degrees, noisy outer beams. At 23:40 there was a problem with the NAV system. The ROV position appeared to jump 25m to port side. At 23:59 ROV was reversed to a distance of 100m (to landmark on port side). It was then flown on to transectory line. The landmark was now showing about 20m port side of its original location. Trying to outrun the landmark. Rebooted multibeam software at 00:29. When the software was restarted the ROV was located 20m starboard side of the line.
CE15009_08	37	00:38	14/06/2015	51.50728	-11.812715	EM2040	The landmark still did not line up. Stopped at 00:40.
CE15009_08	40	01:30	14/06/2015			EM2040	Inertial problem with Hain. Attempt a hard restart.
CE15009_08	41	02:00	14/06/2015	51.5069	-11.8127	EM2040	Replotting the same section. The landmark is appearing North of the original landmark. The ROV was then brought back South on the line to where the landmark was showing on the last run.
CE15009_08	42	02:26	14/06/2015	51.507651	-11.812709	EM2040	The ROV was brought West to East to confirm landmark location. Landmark/feature now showed up South of original location.

station #	start line name	Time (UTC)	Date	Lat SOL	Long SOL	MBES type	note
CE15009_08	43	02:41	14/06/2015	51.5076405	-11.810207	EM2040	The ROV was brought West to East. Landmark/feature seems to have appreared in the same location as the West-East pass.
CE15009_08	43	03:00	14/06/2015	51.507775	-11.8127406	EM2040	A pass was run from South to North. Another jump happened at 03:03.
CE15009_08	44	03:15	14/06/2015	51.508148	-11.8127398	EM2040	Stopped logging.
CE15009_08	45	03:18	14/06/2015	51.508152	-11.812738	EM2040	Made a pass South to North until end of line. No glitches.
CE15009_08	52	05:40	14/06/2015	51.508325	-11.82107	EM2040	When we got to end of line(0054), high resolution mosaic plotted approx 20m away.
CE15009_08	58	07:31	14/06/2015	51.49483	-11.82619	EM2040	When we got to end of line (0056) started new line South to North.
CE15009_08	59	07:56	14/06/2015	51.48662	-11.82582	EM2040	
CE15009_08	65	10:06	14/06/2015	51.51874	-11.81723	EM2040	Start new line
CE15009_08	70	11:40	14/06/2015	51.50241	-11.82568	EM2040	Line count change
CE15009_08	72	12:25	14/06/2015	51.494948	-11.81723	EM2040	Line extending South of grid. Start of line.
CE15009_08	76	13:58	14/06/2015	51.483179	-11.8217873	EM2040	Line back North SOL.
CE15009_010	1	17:09	14/06/2015	51°29.6374	011°49.4200	EM302	Lat/Long coordinates for EM 302 ALL taken from Screen 3 in dry lab.
CE15009_010	2	17:40	14/06/2015	51°29.4778	011°56.0735	EM302	
CE15009_010	3	17:55	14/06/2015	51°28.16205	011°56.11820	EM302	
CE15009_012	4	19:27	14/06/2015	51°29.7053	011°49.1076	EM302	
CE15009_012	5	19:40	14/06/2015	51°29.7097	011°49.0493	EM302	
CE15009_012	6	19:53	14/06/2015	51°29.6646	011°49.5586	EM302	
CE15009_018	7	02:37	17/06/2015	51°33.7337	011°49.5206	EM302	Line ended at 00:11. 14.02.17 17/06/2015 (Transit Lines)
CE15009_019	12	14:11	17/06/2015	52°02.0060	014°57.9626	EM302	PBC MBES Survey Line 1
CE15009_020	15	15:21	17/06/2015	51°57.6622	015°66.3212	EM302	PBC MBES Survey Line 2
CE15009_021	18	16:32	17/06/2015	52°01.3678	014°56.5500	EM302	PBC MBES Survey Line 3
CE15009_022	20	17:30	17/06/2015	51°55.6944	015°04.3530	EM302	PBC MBES Survey Line 4

station #	start line name	Time (UTC)	Date	Lat SOL	Long SOL	MBES type	note
CE15009_023	79		17/06/2015			EM2040	Test Lines 79, 80 & 81. Problem with Software. Pinging but no coordinates can be found.
CE15009_023	80		17/06/2015			EM2040	
CE15009_023	81		17/06/2015			EM2040	
CE15009_023	82	21:05	17/06/2015	52°00.9199	015°03.3424	EM2040	Test Line.
CE15009_023	83	21:07	17/06/2015	52°00.9176	015°03.3313	EM2040	Start of survey line (centre line)
CE15009_023	84	21:12	17/06/2015	52°00.89567	015°03.24423	EM2040	Transit North to parallel line.
CE15009_023	98	05:10	18/06/2015	52°00.7469	015°00.0312	EM2040	Unexplained jump in line. Numbers (Line 85-98). New Survey Line.
CE15009_023	103	06:57	18/06/2015	52°00.2218	014°59.4308	EM2040	At top of canyon grid - North
CE15009_023	107	08:29	18/06/2015	52°00.6466	014°58.98172	EM2040	Return line to 0103
CE15009_023	111	09:28	18/06/2015	52°00.15328	014°59.5354	EM2040	Along top of canyon grid - South
CE15009_023	117	10:25	18/06/2015	51°59.7204	014°59.9513	EM2040	Return line to 0111
CE15009_023	123	13:10	18/06/2015	52°00.307	014°59.61172	EM2040	High Resolution microbathymetry. 400khz. Single sector. Slight tilt.
CE15009_023	127	13:57	18/06/2015	52°00.19622	014°59.43493	EM2040	Reverse of 0123
CE15009_023	129	14:39	18/06/2015	52°00.143	014°59.465	EM2040	Survey on plan behind ridge @ 180m
CE15009_023	133	16:10	18/06/2015	52°59.89229	014°58.73093	EM2040	Return of 0129. 17:38 changed spacing parameter from equiangular to high density equidistant. At 17:57 DVL offset jump.
CE15009_023	138	18:07	18/06/2015	52°00.6048	014°59.6328	EM2040	Reciprocal bearing of 139degrees to back fill an area we lost during the DVL blackout.
CE15009_023	139	18:17	18/06/2015	52°00.5432	014°59.5852	EM2040	Turned back around to carry on along the original (133) line. 18:25 DVL dropped out and the ROV appeared to jump starboard. Restarted the SIS software.
CE15009_023	141	18:54	18/06/2015	52°00.54170	014°59.6747	EM2040	New Line created

station #	start line name	Time (UTC)	Date	Lat SOL	Long SOL	MBES type	note
CE15009_025	25	00:24	19/06/2015	51°58.4853	014°58.8579	EM302	New Line
CE15009_025	26	04:53	19/06/2015	52°00.8728	015°03.3695	EM302	EW Transit at 10knots.
CE15009_042	42	05:17	21/06/2015	51°59.63051	015°00.1581	EM302	Transit to Loop Head @ 10-12knots

Station Log: Sub bottom profiler											
station #	start line name	Start Time (UTC)	End Time (UTC)	Date	Lat SOL	Long SOL	Lat EOL	Long EOL	kHz	Speed (knts)	note
CE15009_01	20150612.11	11:46	11:54	12/06/2015	51°35.2101	011°49.1456	51°34.6104	011°48.8273		5	North-South (In trough)
CE15009_02	20150612.12	12:05	12:17	12/06/2015	51°34.6415	011°48.845	51°34.6105	011°49.0643		3	South-North (Hit summit)
CE15009_03	20150612.12	12:33	12:47	12/06/2015	51°34.8469	011°49.5508	51°34.6106	011°48.3070		3	South West-North East (cross line)
CE15009_04	20150612.13	13:03		12/06/2015	51°35.0566	011°49.4203				5	EM302 Multibeam ran in addition to CHIRP
CE15009_04	20150612.14	13:59		12/06/2015						5	CE15009_04 split into four different files
CE15009_04	20150612.14	14:30		12/06/2015						5	
CE15009_04	20150612.14	14:46	15:06	12/06/2015			51°34.6110	011°49.3700		5	
CE15009_011	20150614.18	18:53		14/06/2015	51°29.7110	011°49.3470				2	To pick Gravity Core target
CE15009_024	20150618.23	23:48	00:07	18/06/2015	51°58.1468	15°00.8989	51°59.4010	14°58.8120		6	To pick Gravity Core target
CE15009_024	20150619	00:26		19/06/2015	51°58.4853	014°58.8477	51°59.1071	015°00.3670		6	To pick Gravity Core target
CE15009_027	20150619.04	03:58	04:16	19/06/2015	51°59.0152	15°01.6650	51°00.0044	14°59.7676		6	Ridge - NE Transit
CE15009_028	20150619.04	04:19	04:28	19/06/2015	52°00.0451	014°59.7017	51°00.8209	014°58.6746		6	Ridge - NE Transit
CE15009_029	20150619.04	04:51	04:55	19/06/2015	52°00.8919	015°03.0798	52°00.9267	015°03.3197		10	Transit - EW to ROV Site

Station Log: ROV											
station #	Dive number	Date	Time (UTC) off deck	Time (UTC) on bot	Lat SOL	Long SOL	Time (UTC) off bot	Time (UTC) on deck	Lat EOL	Long EOL	note
CE15009_07A	D1-265	13/06/2015	13.10	13:38	51° 29.770	11° 49.1336	13:38	14:06	51° 29.770	11° 49.1336	Patch test, MBES at 20m Piddington and 200m MM - ABORTED
CE15009_07B	D2-266	13/06/2015	15:25	17:18	51° 29.676	11° 49.1333	21:23		51° 29.736	11° 48.949	Patch test, MBES at 20m Piddington
CE15009_08	D2-266	13/06/2015		22:10	51° 29.688	11° 48.7620	15:22	16:06	51° 29.626	11° 49.3532	MBES at 190m off seabed. Finsh dive on June 14th.
CE15009_015	D3-267	15/06/2015	00:22	01:09	51° 29.668	11° 49.1190	18:58	20:00	51° 29.511	11° 49.4859	Offset on runs from South to North - ROV appears to be offset to the port side. Offset is not apparent on runs from North to South.
CE15009_017	D4-268	16/06/2015	01:05	01:47	51° 30.447	11° 49.3941	17/06 00:09	00:52	51°33.6067	11°49.1011	Unable to stop CTD software at end of dive
CE15009_023	D5-269	17/06/2015	18:51	20:02	55°00.918	15°03.3284	18/06 21:24	22:54	52°00.82560	15°01.06013	PBC MBES
CE15009_030	D6-270	19/06/2015	06:27	07:46	52°00.9266	15°03.3203	22:13	23:00	52°00.3551	14°59.8152	ROV Video - Canyons
CE15009_031	D7_271	20/06/2015	01:03	01:52	52°00.3882	14°59.7130	11:34	13:30	51°58.954	15°01.74106	
CE15009_043	D8_272	22/06/2015	00:54	01:00	52°32.4370	010°05.1792	04:35	04:45	52°32.42	010°05.330	ROV Rock drilling

Station Log: Cores									
station #	Start Time (UTC)	End Time (UTC)	Date	Lat	Long	Water depth (M)	Core type	Depth penetration (M)	Notes
CE15009_013	20:34		14/06/2015	51°29.6696	011°49.2166	970	Gravity		Abort.
CE15009_013	20:43	21:59	14/06/2015	51°29.6666	011°49.2177	970	Gravity	2.58	3 sections. Time on deck 21:59. Number GC001
CE15009_014	22:45	23:35	14/06/2015	51°34.6113	011°49.2333	969	Gravity	2.58	3 sections. Time on deck 23:35. Number GC002
CE15009_016	21:28	21:45	15/06/2015	51°29.7203	011°49.1902	904	Reineck Box	0.8	Start time-time to hit bottom. End time-time back on deck.
CE15009_026A	01:57	02:19	19/06/2015	51°58.81191	15°01.92451	615	Gravity		Some coral but nothing else in core
CE15009_026B	02:46	03:02	19/06/2015	51°58.8362	15°01.9205	623	Gravity		Some coral but nothing else in core
CE15009_026C	03:34	03:48	19/06/2015	51°58.84244	15°01.91278	630	Gravity		
CE15009_032A	03:34	03:48	20/06/2015	52°00.21623	14°59.45399	653	Gravity		Very little - shell fragments (min scale)
CE15009_032B	14:18	14:34	20/06/2015	52°00.21629	14°59.44935	653	Gravity		Coral/shell fragments - very little
CE15009_032C	15:03	15:20	20/06/2015	52°00.21956	14°59.44665	653	Gravity		Rubble in core catcher
CE15009_032D	15:50	16:07	20/06/2015	52°00.22172	14°59.45925	653	Gravity		Changed to older core catcher - coral rubble - small quantity
CE15009_033A	17:03	17:31	20/06/2015	52°00.57434	14°59.63087	930	Gravity		
CE15009_033B	17:48	17:57	20/06/2015	52°00.3714	14°59.6300	913	Gravity		
CE15009_034A	18:52	19:10	20/06/2015	52°00.3594	14°59.7670	980	Gravity		
CE15009_034B	19:39	19:57	20/06/2015	52°00.3604	14°59.7712	1074	Gravity		
CE15009_035A	21:12	21:38	20/06/2015	52°00.5129	14°59.9232	1289	Gravity		No/poor return
CE15009_035B	22:15	22:44	20/06/2015	52°00.5133	14°59.9255	1260	Gravity		No/poor return
station #	Start Time	End Time	Date	Lat	Long	Water depth	Core type	Depth penetration	Notes

	(UTC)	(UTC)				(M)		(M)	
CE15009_036A	23:44	00:26	20/06/2015	52°00.8316	15°00.5988	1676	Gravity		No/poor return
CE15009_037	01:36	01:50 21/06	21/06/2015	52°00.2162	14°59.4565	662	Reineck Box		
CE15009_038	02:26	02:45	21/06/2015	52°00.1958	14°59.4857	665	Reineck Box		Small fragments of coral
CE15009_040	04:14	05:28	21/06/2015	51°59.6268	15°00.1541	630	Reineck Box	0.17	
CE15009_041	04:47	05:05	21/06/2015	51°59.62416	15°00.5498	730	Gravity		No/poor return

Station Log: CTD						
station #	**Start Time (UTC)**	**End Time (UTC)**	**Date**	**Lat**	**Long**	**note**
CE15009_05	15:50	16:20 / 17:05	12/06/2015	51° 29.5383	011° 49.4821	Error - Scrap Data. Depth 960 m temperature sensor broke.
CE15009_06-A	17:38	18:38	12/06/2015	51° 29.5412	011° 49.4840	Depth 960 m Problem with data on cast out.
CE15009_06-B	18:55	19:45	12/06/2015	51° 29.5429	011° 49.4845	Depth 965 m. Second cast to get more accurate SVP.
CE15009_09	16:11	17:01	14/06/2015	51°29.6258	011°49.3532	Depth 955m.
CE15009_017						During Dive 4. Mosaic Area/Piddington. Depth 970m.
CE15009_023	14:26		18/06/2015	52°00.1837	14°59.5636	During Dive 5(PBC, MBES, ROV)

Station Log: Bio Samples																
Specimen sample_ number	**Dive #**	**Researcher**	**Institution**	**preservation**	**Note**	**phylum**	**subphylum**	**class**	**subclass**	**infraclass**	**order**	**Sub order**	**family**	**genus**	**species**
CE15009_001	4	AV	UNIMIB	ETHANOL		Porifera		Hexactinellida			Hexactinosida		Aphrocallistidae	Aphrocallistes	
CE15009_003	4	AV	UNIMIB	ETHANOL		Arthropoda	Crustacea	Maxillopoda	Thecostraca	Cirripedia					
CE15009_004a	4	RH	NUIG	ETHANOL		Crustacea		Malacostraca	Eumalacostraca		Decapoda				
CE15009_005	4	AV	UNIMIB	ETHANOL		Cnidaria		Anthozoa	Hexacorallia		Scleractinia		Caryophylliidae	Lophelia	Lophelia pertusa
CE15009_006	4	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Octocorallia		Alcyonacea				
CE15009_007	4	AV	UNIMIB	ETHANOL		Arthropoda	Crustacea	Maxillopoda	Thecostraca	Cirripedia					
CE15009_008	4	RH	NUIG	ETHANOL		Echinodermata	Crinozoa	Crinoidea							
CE15009_009	4	AV	UNIMIB	ETHANOL		Cnidaria		Anthozoa	Hexacorallia		Scleractinia		Caryophylliidae	Lophelia	Lophelia pertusa

Specimen sample_ number	Dive #	Researcher	Institution	preservation	Note	phylum	subphylum	class	subclass	infraclass	order	Sub order	family	genus	species
CE15009_004	4	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Hexacorallia		Antipatharia		Antipathidae	Stichopathes	
CE15009_010	4	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Hexacorallia		Antipatharia		Antipathidae	Stichopathes	
CE15009_011	4	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Hexacorallia		Antipatharia		Antipathidae	Stichopathes	
CE15009_020	4	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Hexacorallia		Antipatharia		Antipathidae	Stichopathes	
CE15009_014	4	AV	UNIMIB	ETHANOL		Mollusca		Gastropoda							
CE15009_015	4	RH	NUIG	ETHANOL		Echinodermata	Crinozoa	Crinoidea							
CE15009_015b	4	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Octocorallia		Alcyonacea				
CE15009_016	4	RH	NUIG	ETHANOL		Echinodermata	Crinozoa	Crinoidea							

Specimen sample_ number	Dive #	Researcher	Institution	preservation	Note	phylum	subphylum	class	subclass	infraclass	order	Sub order	family	genus	species
CE15009_016b	4	RH	NUIG	ETHANOL		Cnidaria		Hydrozoa							
CE15009_016c	4	AV	UNIMIB	ETHANOL		Cnidaria		Anthozoa	Hexacorallia		Scleractinia		Caryophylliidae	Lophelia	Lophelia pertusa
CE15009_017a	4	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Octocorallia		Alcyonacea				
CE15009_017b	4	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Octocorallia		Alcyonacea		Acanthogorgiidae	Acanthogorgia	
CE15009_017c	4	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Octocorallia		Alcyonacea				
CE15009_017epi	4	RH	NUIG	ETHANOL											
CE15009_018	4	RH	NUIG	ETHANOL		Echinodermata	Crinozoa	Crinoidea							
CE15009_018b	4	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Octocorallia		Alcyonacea		Acanthogorgiidae	Acanthogorgia	
CE15009_018c	4	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Octocorallia		Alcyonacea				
CE15009_018d	4	RH	NUIG	ETHANOL		Echinodermata									

Specimen sample_ number	Dive #	Researcher	Institution	preservation	Note	phylum	subphylum	class	subclass	infraclass	order	Sub order	family	genus	species
CE15009_019	4	AV	UNIMIB	ETHANOL											
CE15009_012	4	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Hexacorallia		Antipatharia		Cladopathidae	Trissopathes	
CE15009_013	4	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Hexacorallia		Antipatharia		Cladopathidae	Trissopathes	
CE15009_021	6	RH	NUIG	ETHANOL		Echinoderm ata	Crinozoa	Crinoidea							
CE15009_022	6	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Hexacorallia		Antipatharia		Schizopathidae	Stauropathes	
CE15009_029	6	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Hexacorallia		Antipatharia		Schizopathidae	Stauropathes	
CE15009_027	6	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Hexacorallia		Antipatharia				
CE15009_024	6	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Octocorallia		Pennatulacea		Kophobelemnidae	Kophobelemnon	
CE15009_028	6	R	NUIG	ETHANOL		Echinoderm	Crinozoa	Crinoi							

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Specimen sample_ number	**Dive #**	**Researcher**	**Institution**	**preservation**	**Note**	**phylum**	**subphylum**	**class**	**subclass**	**infraclass**	**order**	**Sub order**	**family**	**genus**	**species**
CE15009_023	6	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Octocorallia		Pennatulacea		Protoptilidae	Distichoptilum	
CE15009_026	6	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Octocorallia		Pennatulacea		Protoptilidae	Distichoptilum	
CE15009_030	6	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Octocorallia		Pennatulacea		Umbellulidae	Umbellula	
CE15009_031	6	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Octocorallia		Pennatulacea		Umbellulidae	Umbellula	
CE15009_034	6	AV	UNIMIB	ETHANOL		Cnidaria		Anthozoa	Octocorallia						
CE15009_033	6	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Octocorallia		Pennatulacea		Umbellulidae	Umbellula	
CE15009_035	7	RH	NUIG	ETHANOL		Cnidaria		Anthozoa	Hexacorallia		Antipathari a		Antipathidae	Antipathes	
CE15009_036	7	AW	UCC			Cnidaria		Anthozoa	Hexacorallia		Scleractinia		Caryophylliida	Lophelia	Lophelia pertusa

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Specimen sample_ number	**Dive #**	**Researcher**	**Institution**	**preservation**	**Note**	**phylum**	**subphylum**	**class**	**subclas**	**infraclass**	**order**	**Sub order**	**family**	**genus**	**species**
CE15009_036a	7	AV	UNIMIB	ETHANOL		Cnidaria		Anthozoa	Octocorallia		Alcyonacea				
CE15009_ROV frame	7	RH	NUIG	ETHANOL	Ophiuroid										
CE15009_ROV frame	7	AV/RH	NUIG/UNIMIB	ETHANOL	small octocoral										
CE15009_ROV frame	7	AV/RH	NUIG/UNIMIB	ETHANOL	Paramuricea-branch										
CE15009_ROV frame	7	RH	NUIG	ETHANOL	tiny crinoid										
CE15009_ROV frame	7	AV/RH	NUIG/UNIMIB	ETHANOL	stoloniferous										

Specimen sample_ number	Dive #	Researcher	Institution	preservation	Note	phylum	subphylum	class		subclass	infraclass	order	Sub order	family	genus	species
CE15009_001	4	AV	UNIMIB	Pure Ethanol		Porifera		Hexactinellida			Hexactinosida		Aphrocallistidae	*Aphrocallistes*	*Aphrocallistes beatrix*	
						Cnidaria		Anthozoa	Hexacorallia		Actiniaria					
CE15009_001	4	AV	UNIMIB	Pure Ethanol		Echinodermata	Echinozoa	Holothuroidea			Dendrochirotida		Psolidae	*Psolus*	*Psolus squamatus*	
CE15009_001	4	AV	UNIMIB	Pure Ethanol		Anellida		Polychaeta	Errantia		Eunicida					
CE15009_001	4	AV	UNIMIB	Ethanol 70%		Porifera		Hexactinellida			Hexactinosida		Aphrocallistidae	*Aphrocallistes*	*Aphrocallistes beatrix*	
						Cnidaria		Anthozoa	Hexacorallia		Actiniaria					
CE15009_	4	AV	UNIMIB	Pure Ethanol		Arthropoda	Crustacea			Cirripedia	Sessilia	Balanomorpha				
CE15009_	4	AV	UNIMIB	Pure Ethanol		Arthropoda	Crustacea			Cirripedia	Scalpelliformes					
CE15009_	4	AV	UNIMIB	Pure Ethanol												

Specimen sample_ number	Dive #	Researcher	Institution	preservation	Note	phylum	subphylum	class	subclas	infraclass	order	Sub order	family	genus	species
CE15009_	4	AV	UNIMIB	Pure Ethanol		Arthropoda	Crustacea			Cirripedia	Balanopmorphes				
CE15009_002	4	AV	UNIMIB	Pure ethanol		Cnidaria		Anthozoa	Octocorallia		Alcyonacea	Calcaxonia	Primnoidae		
CE15009_003	4	AV	UNIMIB	Pure Ethanol		Porifera									
CE15009_003	4	AV	UNIMIB	Pure Ethanol		Echinodermata	Asterozoa	Ophiuroidea							
CE15009_003/4	4	AV	UNIMIB	Pure Ethanol											
CE15009_005/8	4	AV	UNIMIB	Pure Ethanol		Cnidaria		Anthozoa	Hexacorallia		Scleractinia			*Madrepora*	*Madrepora oculata*
CE15009_005/8	4	AV	UNIMIB	Pure Ethanol											
CE15009_006	4	AV	UNIMIB	Pure Ethanol		Cnidaria		Anthozoa	Octocorallia		Alcyonacea		Plexauridae	?Paramuricea	
CE15009_006	4	AV	UNIMIB	Pure Ethanol		Cnidaria		Anthozoa	Hexacorallia		Actiniaria				

Specimen sample_ number	Dive #	Researcher	Institution	preservation	Note		phylum	subphylum	class	subclass	infraclass	order	Sub order	family	genus	species
CE15009_006	4	AV	UNIMIB	Pure Ethanol	Coral frame, endo-epifauna											
CE15009_007	4	AV	UNIMIB	Pure Ethanol		Cnidaria		Hydrozoa	Hydroida							
CE15009_007	4	AV	UNIMIB	Pure Ethanol		Arthropoda	Crustacea			Cirripedia	Sessilia	Balanomorpha				
CE15009_007	4	AV	UNIMIB	Pure Ethanol		Mollusca		Bivalvia			Pectinoida		Pectinidae	*Delectopecten*	*Delectopecten vitreus*	
CE15009_007	4	AV	UNIMIB	Pure Ethanol		Cnidaria		Hydrozoa	Hydroida							
CE15009_007	4	AV	UNIMIB	Pure Ethanol		Echinodermata	Asterozoa	Ophiuroidea								
CE15009_007	4	AV	UNIMIB	Pure Ethanol		Mollusca		Gastropoda								
CE15009_007	4	AV	UNIMIB	Pure Ethanol												
CE15009_008	4	AV	UNIMIB	Pure Ethanol		Cnidaria		Hydrozoa	Hydroida							
CE15009_008	4	AV	UNIMIB	Pure Ethanol		Cnidaria		Anthozoa	Octocorallia		Alcyonacea		Plexauridae	?Paramuricea		

Specimen sample_ number	Dive #	Researcher	Institution	preservation	Note	phylum	subphylum	class	subclas	infraclass	order	Sub order	family	genus	species
CE15009_008	4	AV	UNIMIB	Pure Ethanol		Anellida	Polychaeta	Errantia		Eunicida			Eunicidae	*Eunice*	*Eunice norvegica*
CE15009_008	4	AV	UNIMIB	Pure Ethanol		Mollusca		Gastropoda	Caenogastropoda		Neogastropoda		Columbellidae	*Amphissa*	*Amphissa acutecostata*
CE15009_008	4	AV	UNIMIB	Pure Ethanol		Echinodermata		Ophiuroidea							
CE15009_008	4	AV	UNIMIB	Pure Ethanol		Cnidaria		Anthozoa	Hexacorallia		Actiniaria				
CE15009_008	4	AV	UNIMIB	Pure Ethanol		Mollusca		Gastropoda	Caenogastropoda		Neogastropoda		Columbellidae	*Amphissa*	*Amphissa acutecostata*
CE15009_008	4	AV	UNIMIB	Pure Ethanol	Large dead coral frame with endo-epifauna										
CE15009_008	4	AV	UNIMIB	Pure Ethanol	Madrepora frame, hydroids and other endo-epifauna										

Specimen sample_ number	Dive #	Researcher	Institution	preservation	Note	phylum	subphylum	class	subclass	infraclass	order	Sub order	family	genus	species
CE15009_009	4	AV	UNIMIB	Pure Ethanol		Cnidaria		Cnidaria	Hexacorallia		Scleractinia		Caryophylliidae	*Lophelia*	*Lophelia pertusa*
CE15009_009	4	AV	UNIMIB	Pure Ethanol		Cnidaria		Hydrozoa	Hydroida						
CE15009_012	4	AV	NUIG	Pure Ethanol		Cnidaria		Anthozoa	Hexacollaria		Antipatharia		Cladopathidae	Trissopathes	
CE15009_014	4	AV	UNIMIB	Pure Ethanol		Mollusca		Gastropoda	Caenogastropoda		Neogastropoda		Buccinidae		
CE15009_015	4	AV	UNIMIB	Pure ethanol		Cnidaria		Anthozoa	Octocorallia		Alcyonacea		Primnoidae		
CE15009_015	4	AV	UNIMIB	Pure ethanol		Anellida		Polychaeta	Errantia						
CE15009_016	4	AV	UNIMIB	Pure ethanol, Ethanol 70%		Cnidaria		Anthozoa	Hexacorallia		Scleractinia		Caryophylliidae	*Lophelia*	*Lophelia pertusa*
CE15009_016	4	AV	UNIMIB	Pure Ethanol		Arthropoda	Crustacea	Malacostraca			Decapoda	Dendrobranchiata			
CE15009_016	4	AV	UNIMIB	Pure Ethanol		Cnidaria		Anthozoa	Hexacorallia		Scleractinia		Caryophylliidae	*Lophelia*	*Lophelia pertusa*

Specimen sample_ number	Dive #	Researcher	Institution	preservation	Note	phylum	subphylum	class	subclass	infraclass	order	Sub order	family	genus	species
CE15009_016	4	AV	UNIMIB	Pure Ethanol		Echinodermata	Asterozoa	Ophiuroidea							
CE15009_016	4	AV	UNIMIB	Pure Ethanol											
CE15009_016	4	AV	UNIMIB	Pure Ethanol	Coral frame, epi-endofauna										
CE15009_017	4	AV	UNIMIB	Pure Ethanol		Cnidaria		Anthozoa	Hexacorallia		Scleractinia		Caryophylliidae	*Lophelia*	*Lophelia pertusa*
CE15009_017	4	AV	UNIMIB	Pure Ethanol		Cnidaria		Anthozoa	Hexacorallia		Scleractinia			*Madrepora*	*Madrepora oculata*
CE15009_017	4	AV	UNIMIB	Pure Ethanol		Cnidaria		Anthozoa	Octocorallia		Alcyonacea		Plexauridae	?Paramuricea	
CE15009_017	4	AV	UNIMIB	Ethanol 70%											
CE15009_018	4	AV	UNIMIB	Pure Ethanol		Cnidaria		Anthozoa	Octocorallia		Alcyonacea				
CE15009_018	4	AV	UNIMIB	Pure Ethanol		Echinodermata	Asterozoa	Ophiuroidea							

Specimen sample_ number	Dive #	Researcher	Institution	preservation	Note	phylum	subphylum	class	subclass	infraclass	order	Sub order	family	genus	species
CE15009_018	4	AV	UNIMIB	Pure Ethanol		Cnidaria		Anthozoa	Octocorallia		Alcyonacea			*Acanthogorgia*	
CE15009_018	4	AV	UNIMIB	Pure Ethanol		Arthropoda	Crustacea	Malacostraca			Decapoda	Dendrobranchiata			
CE15009_018	4	AV	UNIMIB	Pure Ethanol		Arthropoda	Crustacea	Malacostraca			Decapoda	Dendrobranchiata			
CE15009_018	4	AV	UNIMIB	Pure Ethanol											
CE15009_018	4	AV	UNIMIB	Pure Ethanol		Mollusca		Gastropoda							
CE15009_018	4	AV	UNIMIB	Pure Ethanol		Anellida		Polychaeta	Errantia		Eunicida				
CE15009_018	4	AV	UNIMIB	Pure Ethanol		Mollusca		Gastropoda	Caenogastropoda						
CE15009_018	4	AV	UNIMIB	Pure Ethanol		Cnidaria		Hydrozoa	Hydroida						
CE15009_018	4	AV	UNIMIB	Pure Ethanol		Porifera									
CE15009_018	4	AV	UNIMIB	Pure Ethanol	Tiny white branched, "spiny" fragment (sponge?)										

Specimen sample_	Di	Re	Institution	preservation	Note	phylum	subphylum	class	subclass	infraclass	order	Sub order	family	genus	species

number	ve #	searcher													
CE15009_019	4	AV	UNIMIB	Pure Ethanol	*Lophelia* and sabellarid worms										
CE15009_019	4	AV	UNIMIB	Pure Ethanol		Porifera									
CE15009_019	4	AV	UNIMIB	Pure Ethanol		Mollusca		Gastropoda	Caenogastropoda		Neogastropoda		Columbellidae	*Amphissa*	*Amphissa acutecostata*
CE15009_020	4	AV	UNIMIB	Pure Ethanol		Cnidaria		Anthozoa	Hexacorallia		Scleractinia		Caryophylliidae	*Lophelia*	*Lophelia pertusa*
CE15009_11/14	4	AV	UNIMIB	Pure Ethanol		Anellida		Polychaeta	Errantia		Eunicida				
CE15009_	4	AV	UNIMIB	Pure Ethanol		Arthropoda	Crustacea			Cirripedia	Sessilia	Balanomorpha			
CE15009_005	4	AV	UNIMIB	Pure Ethanol		Cnidaria		Anthozoa	Hexacorallia		Scleractinia		Caryophylliidae	*Lophelia*	*Lophelia pertusa*
CE15009_007	4	AV	UNIMIB	Pure Ethanol		Mollusca		Bivalvia			Arcoida		Arcidae	*Bathyarca*	*Bathyarca philippiana*
CE15009_ROV frame (sieved)	4	AV	UNIMIB	Pure Ethanol		Cnidaria		Anthozoa	Hexacorallia		Scleractinia		Caryophylliidae	*Lophelia*	*Lophelia pertusa*

Specimen sample_ number	Dive #	Researcher	Institution	preservation	Note	phylum	subphylum	class	subclass	infraclass	order	Sub order	family	genus	species
CE15009_34	dive6	AV	UNIMIB	Pure Ethanol	Stephanocyathus										
CE15009_ROV frame	dive7	AV	UNIMIB	Pure Ethanol	Live and dead Lophelia colonised by endo-and epifauna										
CE15009_ROV frame	dive7	AV	UNIMIB	Pure Ethanol											*Caryophyllia sarsiae*
CE15009_ROV frame	dive7	AV	UNIMIB	Pure Ethanol	Sponges and other epifauna on dead *Lophelia*										
CE15009_ROV frame	di	AV	UNIMIB	Pure Ethanol	Live *Lophe*										

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Specimen sample_ number	**Dive #**	**Researcher**	**Institution**	**preservation**	**Note**	**phylum**	**subphylum**	**class**	**subclass**	**infraclass**	**order**	**Sub order**	**family**	**genus**	**species**
CE15009_ROV frame	dive 7	AV	UNIMIB	Pure Ethanol	Hydroids and other endo-epifauna on dead *Lophelia*										
CE15009_ROV frame	dive 7	AV	UNIMIB	Pure Ethanol	Corals and associated fauna (worms, bivalves, hydroids, sponges, *Calliostoma* etc.)										
RH: Raissa Hogan															
AV: Agostina Vertino															