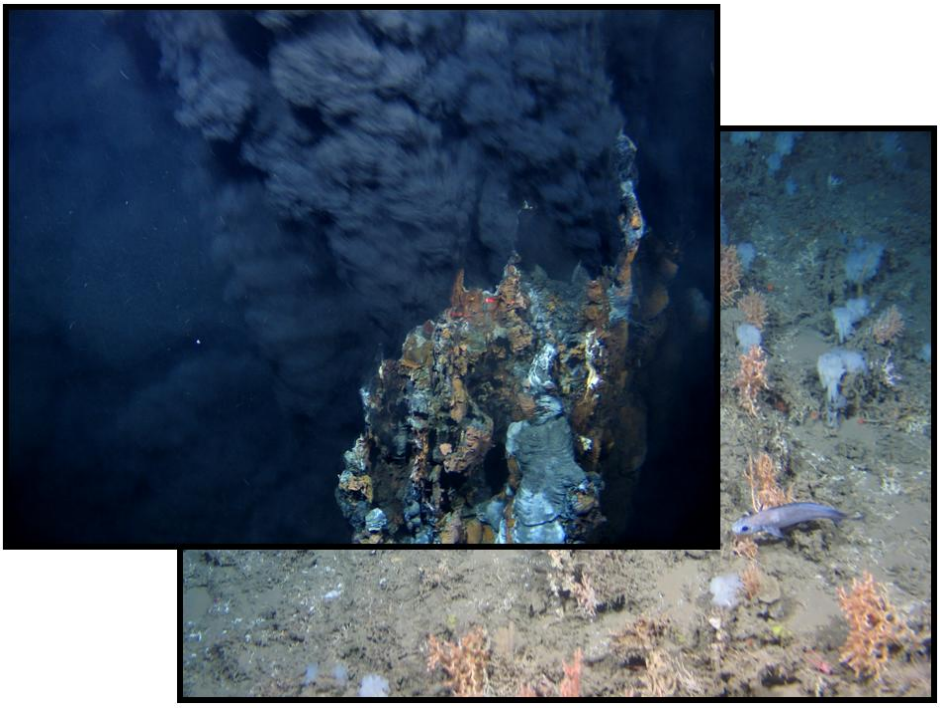
Cruise Report

CE11009: RV Celtic Explorer & Holland 1 ROV

VENTuRE survey

Vents & **Re**efs deep-sea ecosystem study of the 45° North MAR hydrothermal vent field and the cold-water coral Moira Mounds, Porcupine Seabight



11th July – 4th Aug 2011

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The National Parks and Wildlife Service of the Department of the Arts, Heritage and Gaeltacht are acknowledged for their assistance and granting permission to operate within the Special Area of Conservation (002327) - Belgica Mound Province.

This survey would not have been possible without the professionalism, determination and excellence of the ship's officer and crew and the ROV technical team. A particular mention goes to the Master, Denis Rowan, and the ROV day and night shift managers, Jim Nelson and Will Handley. The science team acknowledge the high level of support and diligence offered by the onshore support team in the Marine Institute and P&O Maritime. A particular mention goes to Mick Gillooly (MI) for his help over the weekend during a complex mobilisation and John Joyce (MI) for management of media outreach. Dr. Adrian Glover of the National History Museum, UK is thanked for his assistance in acquiring mini-ROV footage of the Holland 1 for National Geographic Television.

Executive Summary

This survey focuses on two distinct deep-water biogeological systems that have received significant attention in recent years and are recognized as "hot topics" in deep-water research. These are hydrothermal vents, the so-called "black smokers", and cold-water coral reefs. Hydrothermal vents play a key role in replenishing depleted elements in the oceans, supporting unique chemosynthetic ecosystems and depositing ore-grade metal sulphides. Cold-water coral reefs are biodiversity hotspots on continental margins and preserve a unique high resolution geological record of intermediate water depth environmental and climate change.

This is a discovery and exploration cruise hunting and documenting previously undiscovered examples of these important biogeological systems. The survey was documented by National Geographic Television.

Hydrothermal vents: the Moytirra vent field

Hydrothermal vents are the submarine equivalents of geysers and pump large volumes of hot (often c. 350^{o}C) acidic water from vents in the seabed enriched in metals and other elements. When these waters erupt from the seabed they cool and metal sulphides precipitate out of solution in the water (so-called black smoke) and on the seabed forming chimney structures.

The chemical and physical properties of the hydrothermal plume in the water column were traced in order to identify ROV dive sites. With the ROV, visual contact with a newly discovered hydrothermal vent was made and subsequently called the "Moytirra vent field". This occurs to the east of the axial volcanic ridge on the Mid-Atlantic Ridge at the base of the axial valley fault scarp.

Investigations of Moytirra revealed three chimney complexes. "Balor" is a giant chimney c. 20m tall surrounded by shorter more slender chimneys (the "Fomorians") in a horseshoe arrangement. This is the main vent with a high heat flux and high volumes of fluid flow. It is composed of metal sulphides, areas of which are fresh, and in places the chimney surface is c. 150^{o}C causing anhydrite to precipitate. A second chimney complex, "Dian Cecht", has relatively less venting, is a more complex structure up against the base of the 200m cliffed fault scarp. Anhydrite is also precipitating on its surface. The final complex is "Mag Mell" which consists of many organ pipes. It is older and cooler with less venting.

Biologically, Moytirra possesses a vent community consisting of alvinocaridid shrimp, haustorid amphipods, brachyuran crabs, zoarcid, macrourid, and ophidiid fish, polynoid, terebellomorph, and spionid polychaetes, and peltospirid, skeneid, and turrid gastropods. Microbial mats of at least two colours were widespread on the sulfides of the fault scarp wall above the vents.

Vent fluid samples were taken for later geochemical analysis.

Cold-water coral reefs: the Moira Mounds

A previous ungroundtruthed area of suspected Moira Mounds was surveyed within the Belgica Special Area of Conservation (SAC). The Moira Mounds are cold-water coral reefs typically several metres tall and 10s of metres across. Previously groundtruthed examples support live coral occurring east of a chain of giant cold-water coral carbonate mounds, specifically the Thérèse Mound. The examples surveyed occurred to the west of this chain of carbonate mounds which are more plentiful and larger.

A 10km groundtruthing survey confirmed that the vague targets imaged on existing 30kHz side-scan sonar were cold-water coral reefs of the Moira Mound-type. The reefs were up to 10m tall and revealed dense frameworks on mainly dead *Lophelia* coral with some live coral at the tops of some colonies. The dominant *Lophelia* frameworks were exposed and undergoing bioerosion. Nevertheless, they supported significant populations of sponges, gorgonians, black and bamboo corals, fly-trap anemones, squat lobsters and fish (including solitary Orange Roughy). The surrounding seabed supported significantly lower densities and diversities of visible fauna. The stature of the reefs and abundance of live *Lophelia* increased generally and gradually from south to north. There was no evidence of trawl damage although snagged nets and lines as well as notable amounts of marine litter were encountered.

A reef showing the largest colonies of live *Lophelia*, and hence the most active in terms of growth potential, was 100% covered with downward looking HD video. From this dataset, a video mosaic of the entire reef is planned. The reef was also bathymetrically mapped with multibeam at high resolution from the ROV flown at 15m above the seabed. No samples were taken.

Contents

Background

Current state of scientific knowledge

This survey focuses on two distinct deep water biogeological systems that have received a significant attention in recent years and are recognised as "hot topics" in deep-water research.

Hydrothermal vents

This survey capitalises on water column traces of a unique hydrothermal system on the Mid Atlantic Ridge (MAR) at 45°N: a basalt-hosted hydrothermal system at c. 3000m water depth. The hydrothermal system subsequently discovered, named the Moytirra vent field, is located on the edge of an axial valley, which has been studied in unprecedented detail (Searle et al., in press; EPSL). The location of the Moytirra is unique: it is the only vent field known between the Azores archipelago and Iceland. It provided an unprecedented opportunity to study dispersal of fauna in the deep ocean by testing the hypothesis that the Moytirra vent field belongs to a new biogeographic province of chemosynthetic fauna, resulting from the isolation of this section of mid-ocean ridge by the shallow bathymetry of the Azores and Iceland.

The discovery of hydrothermal vents in the Eastern Pacific in 1977 initiated one of the most productive research themes in deep ocean science. The investigation of hydrothermal systems developed on oceanic crust continues to provide fundamental insights into the Earth system. These include the evolution and dispersion of chemosynthetic biology, processes of cooling and alteration of the oceanic crust, the global net chemical fluxes between ocean and lithosphere, and the formation of hydrothermal polymetallic sulphide mineral deposits on the sea-floor.

In the thirty years since their discovery, hydrothermal vent communities have yielded more than 500 new faunal species (Desbruyères et al., 2006), at an average rate of one new species description every 2 weeks (Van Dover et al., 2002). Much of our understanding of the dispersal of deep-sea species in general is based on studies of these ephemeral and insular seafloor habitats (Tyler & Young, 2003), while the existence of communities supported by chemoautotrophic primary production has expanded perspectives of the limits of life and its possible origins (Martin et al., 2008). The continuing discovery of vent sites throughout the world's oceans has shown that these environments are more common features of the deep ocean than originally realised.

Six biogeographical provinces, hitherto distinguished by differences in the taxonomic composition of their communities, have been proposed among vent sites discovered so far (Van Dover et al., 2002; Bachraty et al., 2009). Two further provinces are emerging from initial investigations of vent sites in the Arctic and Southern Oceans (Martin, 2003; Pedersen et al., 2005; Rogers et al., in prep). As most of the ~60,000 km mid-ocean ridge has yet to be explored for hydrothermal activity, differences between these provinces largely reflect their degree of separation along the ridge

system (Tunnicliffe & Fowler, 1996), while the fundamental question of how the provinces originate and are maintained remains unanswered (Tyler et al., 2002).

On the Mid-Atlantic Ridge, two hydrothermal vent biogeographic provinces have been proposed, both south of the Azores (Van Dover et al., 2002). One comprises shallower vent fields on the Azores Plateau, while the other includes deeper vent fields (>3000 m) further to the south. The boundary between these two provinces may be a consequence of bathymetry (Desbruyères et al., 2000) or a change in the regime of potential vorticity (Van Dover et al., 2002).

Species present in the deeper Mid-Atlantic province include the Alvinocaridid shrimp *Rimicaris exoculata*, the anemone *Mariactis rimicarivora*, the mussel *Bathymodiolus puteoserpensis* and the ophiuroid *Ophioctenella acies* (Desbruyères et al., 2000). In the shallower province dominant species include the shrimp *Mirocaris fortunata* and the mussel *Bathymodiolus azoricus*. A more recent global analysis, however, proposes a single biogeographic province for all Mid-Atlantic vent sites south of the Azores (Bachraty et al., 2009).

Significantly, no deep-water hydrothermal vent communities have yet been studied on the Mid-Atlantic Ridge between the Azores and Iceland. Yet hydrothermal vent fields have been located north of Iceland: on the Gakkel (Edmonds et al., 2003), Mohns (Pedersen et al., 2005) and Knipovich (Connelly et al., 2007) ridges. Initial biological observations suggest that these vent communities may belong to a further distinct biogeographic province of chemosynthetic fauna (e.g. Martin, 2003).

The Moytirra vent field surveyed here is the first to be discovered along this section of mid-ocean ridge and thus presents a unique opportunity to test the hypothesis that this region hosts a new biogeographic province containing hitherto unknown species.

Dispersal of hydrothermal vent taxa is thought to occur primarily along mid-ocean ridges (Tunnicliffe & Fowler, 1996) and vent-endemic species are typically absent from sites in shallow water (< 500m; Tarasov et al., 2005). The hypothesis uncedr scrutiny suggested that the shallow section of the Mid-Atlantic Ridge formed by the Azores Plateau may isolate vent communities north of the Azores from those to the south. Formation of the Azores Plateau began around 20Ma and ended around 7Ma (Gente et al., 2003). Further to the north, Iceland may have acted as a subaerial biogeographic barrier since 20 Ma (Verzhbitskii et al., 2008).

Water originating as dense overflows from subpolar seas bathes the eastern flank of the Mid-Atlantic Ridge south to at least 43°N (Lee & Ellett, 1965). This water is mixed with a deep recirculating gyre in the eastern Atlantic and flows south along the flank of the ridge as a deep western boundary current of ~5 Sv (Schmitz & McCartney, 1992). If biogeographic provinces of chemosynthetic fauna are primarily determined by modern hydrographic linkages rather than historical geological connections, then it was hoped that the fauna of north of the Azores may exhibit phylogenetic affinities with vent fauna being discovered at higher latitudes, or with the chemosynthetic

fauna now known on the western European margin (e.g. Dworschak & Cunha, 2007; Genio et al., 2008; Hilário & Cunha, 2008; Rodrigues et al., 2008).

The region of the Charlie Gibbs Fracture Zone also appears to present a biogeographic boundary in the distribution of non-vent benthic invertebrate and demersal fish species on the Mid-Atlantic Ridge (Mironov & Gebruk, 2006; King et al., 2006; Dilman, 2008). This boundary in the biogeography of non-chemosynthetic deep-sea fauna may be a consequence of differences in surface productivity and its export either side of the sub-polar front at 51-52°N (Mironov & Gebruk, 2006). If surface productivity is responsible for this boundary, then the biogeographic patterns of fauna associated with chemosynthetic environments in the region may contrast with those of the non-vent fauna. Elucidating the biogeography of vent fauna in this region therefore offers a potential "control" with which to advance our understanding of deep-sea biogeographic processes in general.

The collection and analysis of metal sulphide vent chimneys and crusts, basaltic rocks from lava flows and vent fluid was also a major objective of the survey. This data will help to discern more about magmatic processes and hydrothermal alteration processes associated with the crust. The Mid Ocean Ridge is where the planet's crust is made and where 80% of the planet's volcanism occurs. Therefore, an understanding of the processes operating in this region is intrinsically fundamental.

Cold-water coral reefs

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, cold-seeps and hydrothermal vents.

Through "ecological engineering" these cold-water coral reefs offer a 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 lead to extensive international cooperation in the areas of conservation and the designation of marine protected areas (Davies *et al*., 2007). Ireland has designated a number of coral carbonate mound provinces supporting such 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 reef dynamics and the controls on growth and decline processes are understood. The

discovery of an additional 143 potential cold-water coral reefs adjacent the Belgica Mound SAC requires investigation.

From a global perspective, Irish waters prove especially favourable to the development of coldwater coral reefs. The successive development, collapse and re-establishment of cold-water coral reefs in the same location over millennia leads to an accumulation of reef deposits intercalated with hemipelagic sediments. Structures formed from such activity, known as coral carbonate mounds (Roberts *et al*., 2006), become preferential sites for renewed coral reef development. Some of the largest examples, and certainly the largest known concentration of coral carbonate mounds occur in Irish waters (Roberts *et al*., in press). This implies that over geological timescales, the Irish continental margin has sporadically supported cold-water coral reef develop.

Significant research has been conducted on the mechanisms of cold-water coral reef and carbonate mound growth. Earlier studies were focussed 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, which is concentrated and delivered to the seabed under the influence of hydrodynamic processes e.g. water-mass boundary nepheloid 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. The rate of cold-water coral reef development is clearly related to the rate of coral exoskeleton growth. This in term is related to both the metabolic rate of the coral organism and the availability of compounds required for biomineralisation: dissolved carbon dioxide ($CO_2(aq)$), carbonic acid (H_2CO_3), bicarbonate (HCO_3) and carbonate (CO_3^{2-}). All of these key variables are climate sensitive. Dodds *et al*. (2007) demonstrated that the cold-water coral *Lophelia pertusa*'s metabolic rate was extremely sensitive to temperature changes implying that increases in ambient temperature would require disproportional larger increases in food supply to sustain coral growth rates. Guinotte *et al.* (2006) also showed the vulnerability of cold-water coral organisms to a shallowing of the Aragonite Saturation Horizon in response to ocean acidification, itself a response to increases in atmospheric pCO_2. Clearly, therefore, the rate of coral colony growth is climate related.

The other side of the reef growth equation is the rate of bioerosion of coral exoskeletons by sponges, fungi and other borers. Even while coral colonies are growing, their bases are being attacked and eventually coral colonies topple. The resultant coral rubble then provides a substrate for new coral settlement. Reef growth is therefore a balance between coral biomineralisation and bioerosion. The supply of sediment entering the reef system has a fundamental control on bioerosion rates by burying coral exoskeletons making them unavailable for further bioerosion prior to colony toppling, and by also providing physical support to the

coral colony itself. Wheeler *et al.* (2008) demonstrated the importance of sediment flux to reef systems with changes in sediment flux proportionally affecting reef height and hence growth rates. Studies of coral carbonate mound geology (Williams *et al*., 2006) demonstrate that volumetrically sediments are more significant mound/reef builders than coral bioclasts. 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 (2007), the importance of bedload sediment supply to small reefs was studied by Wheeler *et al*. (2008). However, details of bedload sediment interaction across larger coral carbonate mounds and their summit reefs are relatively unknown. The slow-down in coral carbonate mound growth rates with altitude has been documented by Kano *et al*., (2007). However, it is unclear if this is in response to an increased restriction on sediment supply through the coral carbonate mound summit reefs or due to temporal changes in optimal reef growth conditions (e.g. increased hydrodynamics and water mass conditions).

Until such time as the response of cold-water coral reefs to climate change, and the nature of sediment emplacement in reefs (particularly their ability/inability to receive bedload sediment), it is difficult to appreciate the specific mechanism of reef growth in addition to predicting reef response and vulnerability to climate change. Without this understanding, evolving effective management of cold-water coral SACs is fraught with difficulty. As such this survey will both groundtruth this area and compare and extend our existing knowledge of reef growth processes.

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Survey Objectives

The VENTuRE survey set out to address the following specific objectives:

1) To locate the source of active high-temperature hydrothermal fluid venting on the Mid-Atlantic Ridge at 45°N and therefore discover the first deep-water hydrothermal vent between the Azores and Iceland;

2) To determine and map the geological setting, geochemistry and history of any hydrothermal activity at the subsequent vent field at 45°N;

3) To characterise MAR macrofaunal communities at the study site by visual, morphological and molecular means. To identify new taxa and establish a sample reference collection;

4) To establish the phylogenetic, phylogeographic or population genetic affinities of the fauna at 45°N, revealing the influences of hydrography, geological history and isolation on vent biogeography;

5) To test whether the vent community at 45ºN belongs to a new biogeographic province of chemosynthetic fauna;

6) To elucidate the consequences of isolation on the life-history biologies of taxa shared between 45°N and other known vents, through analysis of their gametogenic development;

7) Isotopic analyses of biomass dominant taxa to elucidate trophic structure;

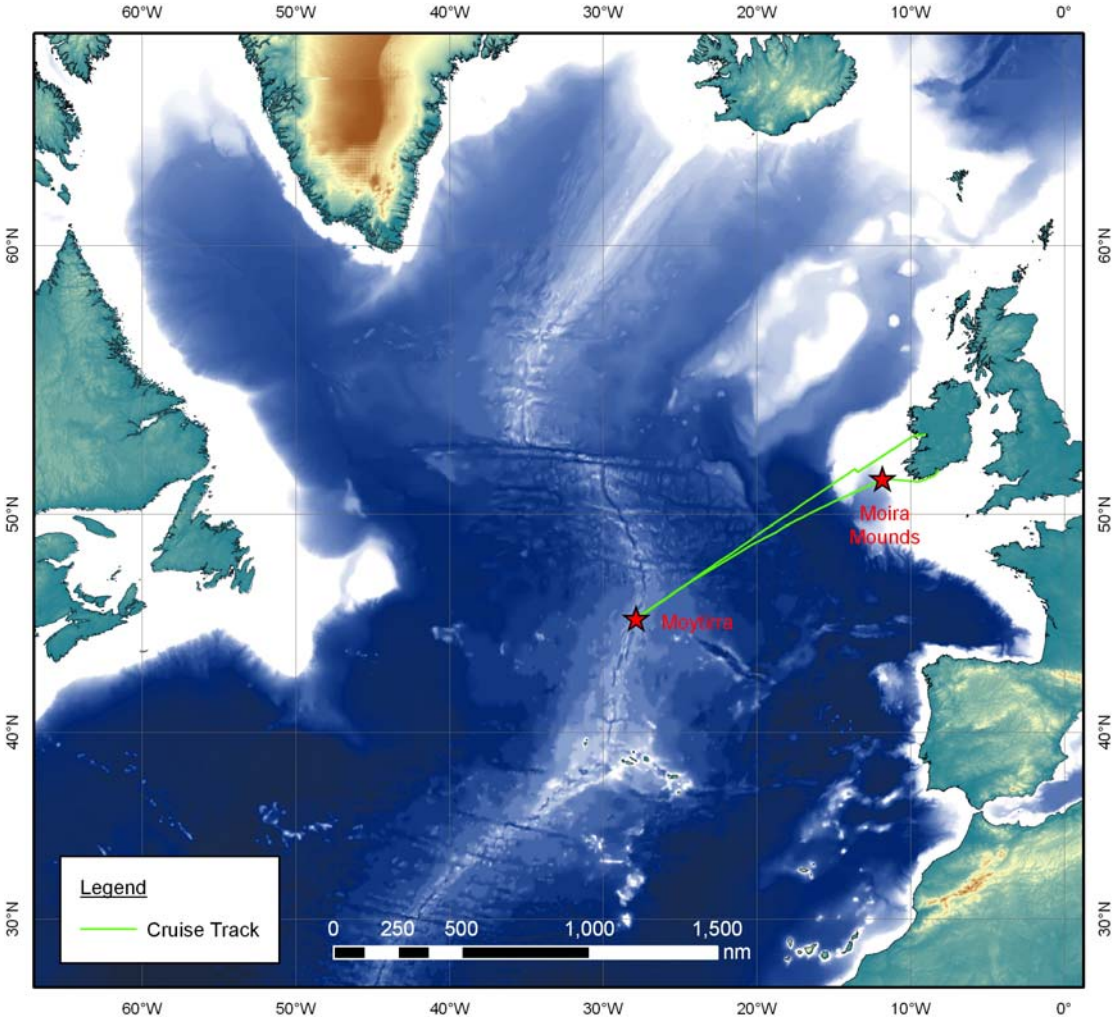
8) To verify the status of reef growth and coral health in the western Belgica Mound SAC.;

9) To study the off-reef and within-reef sedimentary environment to provide evidence for current flow and sediment transport affecting reef development.;

10) To study cold-water coral reef biodiversity and sample fauna for ongoing biodiscovery research;

11) To collect samples of potentially novel organisms for the marine biotechnology community/biodiscovery programme;

Cruise Track



Cruise track and the two principle sites

Equipment

RV Celtic Explorer

The *RV Celtic Explorer* is 65.5m in length and accommodates 35 personnel, including 19-21 scientists. She is a specifically designed multipurpose research vessel and has been adapted to accommodate a variety of Remotely Operated Vehicles including the *Deepwater ROV Holland I.*

She is acoustically silent which minimises fish avoidance and provides an ideal environment for the collection of high quality acoustic data with minimal interference from vessel noise. She has a maximum transit speed of 10 knots.

In ROV-mode she has a starboard winch for CTD and sampling operations and can dredge off her A-frame. The ROV is deployed from her own derrick off the starboard side on the aft deck.

She has adequate wet lab and chemical lab facilities with water supply and a fume cupboard. The dry lab is well equipped with computer and navigation displays.

RV Celtic Explorer

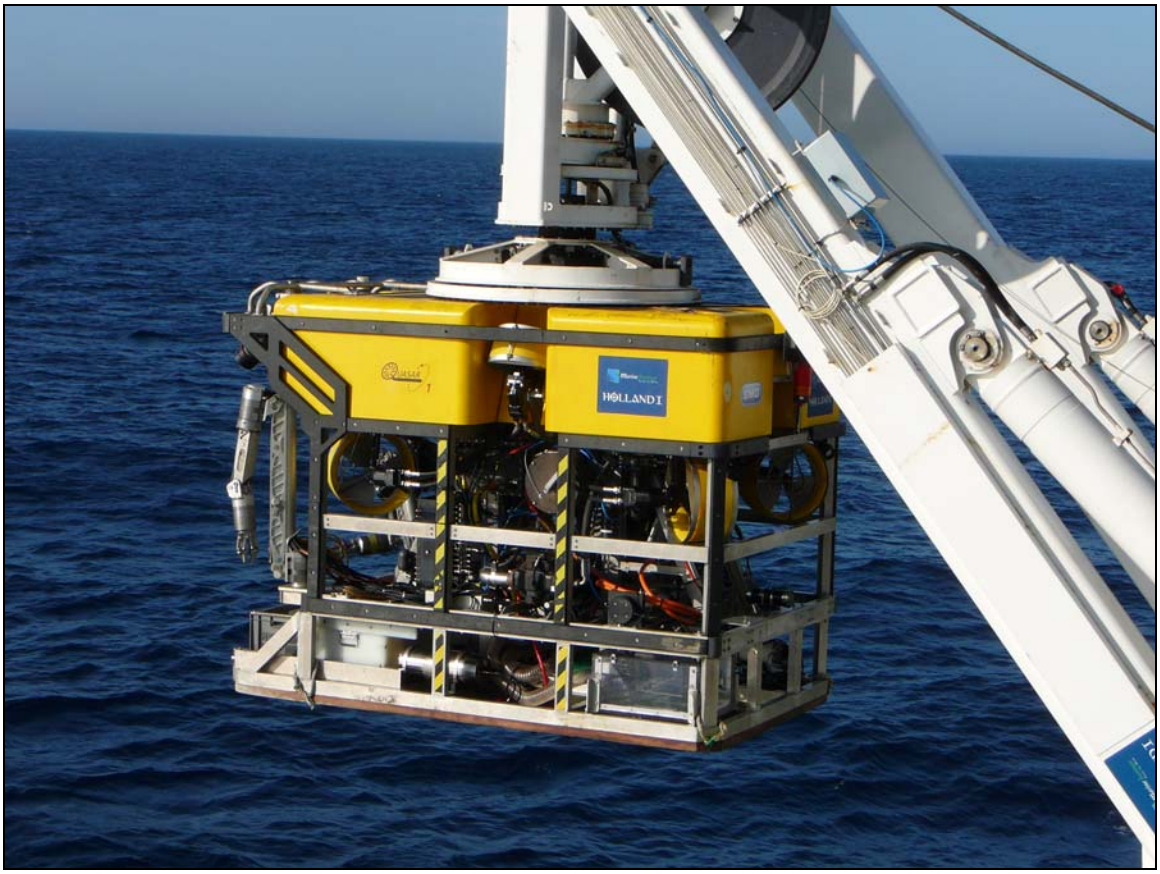
RV Celtic Explorer aft deck mobbed for the *Holland 1* ROV

Dry lab on the *RV Celtic Explorer*

Holland 1 Remotely Operated Vehicle (ROV)

The *Holland I* is a 3000m rated SMD Quasar WROV. She has two manipulator arms and can accommodate a wide range of user equipment including on this survey an aspirator, CTD, Eh meter and Reson multibeam echosounder module (see below). In addition, the vehicle is also equipped with the latest underwater camera equipment including a HDTV camera with laser scalers, forward SD pan and tilt camera and downward SD camera as well as a pan and tilt digital stills camera. The multibeam system was a Reson 7125 acquired using Reson PDS2000 acquisition software.

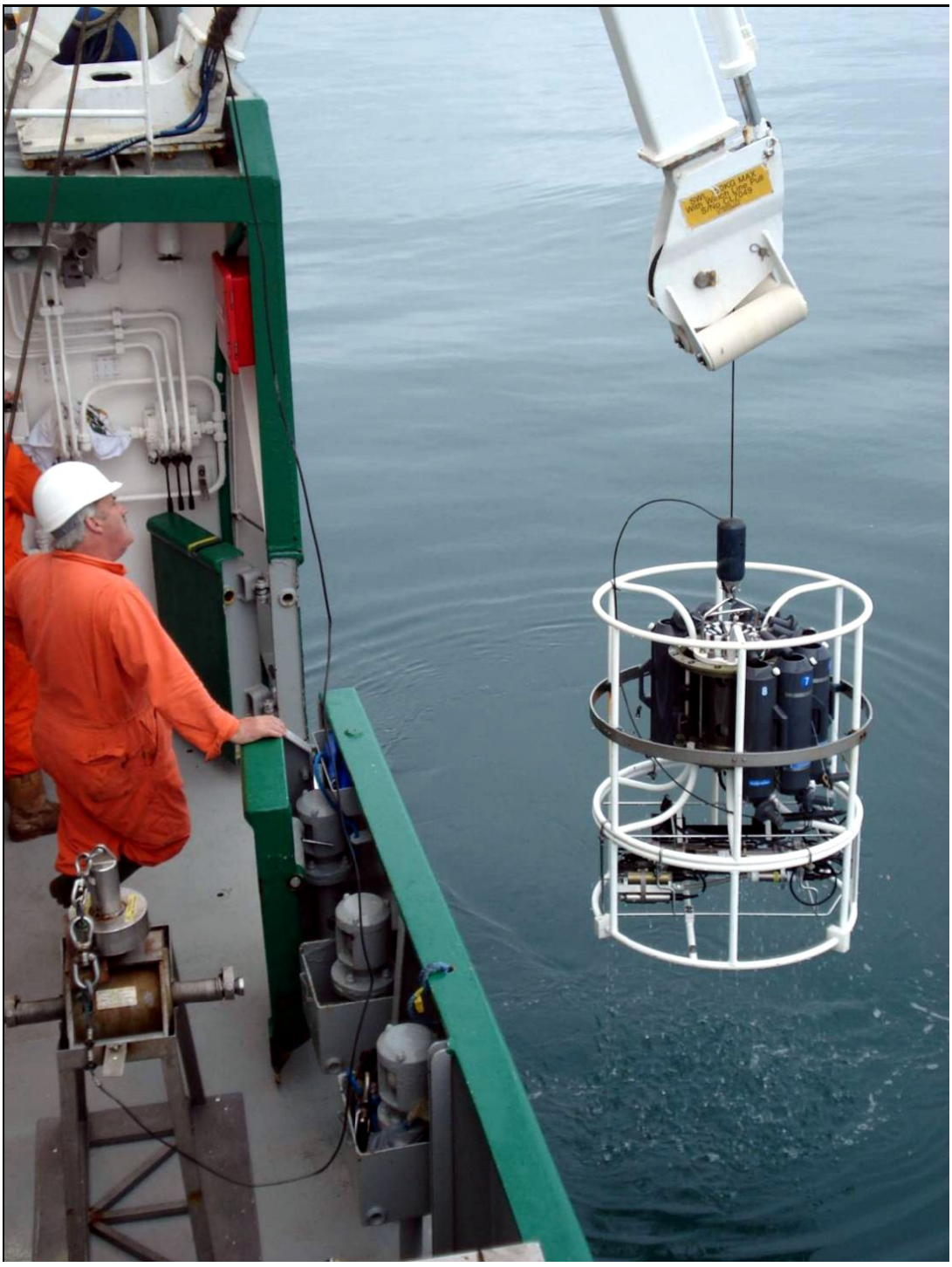
The vehicle is equipped with a high level of auto control features including auto hold which is invaluable in the completion of delicate scientific tasks. The system is fully contained including launch and recovery systems primarily designed to operate from the *RV Celtic Explorer*.



The ROV *Holland 1* being deployed during the VENTuRE survey

CTD

A Sea Bird Electronics SBE 911 plus CTD was used to measure variations in a variety of parameters in the water column. The CTD was fitted with the following sensors: SBE 35 Digital Thermometer, a SBE44plus conductivity sensor, a Digiquartz pressure sensor, a SBE 43 dissolved oxygen sensor, altimeter, fluorometer and a custom made Eh sensor.



Sea Bird Electronics SBE 911 plus CTD

Rock dredge

1m diameter steel, circular jawed rock dredge with a 500 litre chain-mail bag and 20cm diameter pipe dredge trailed behind.

Rock dredge

Day Grab

The Day grab deployed during this survey is a Duncan and Associates Day Grab with a grab size of 30cm x 15cm x 29cm and a weight of 150kg.

Day grab

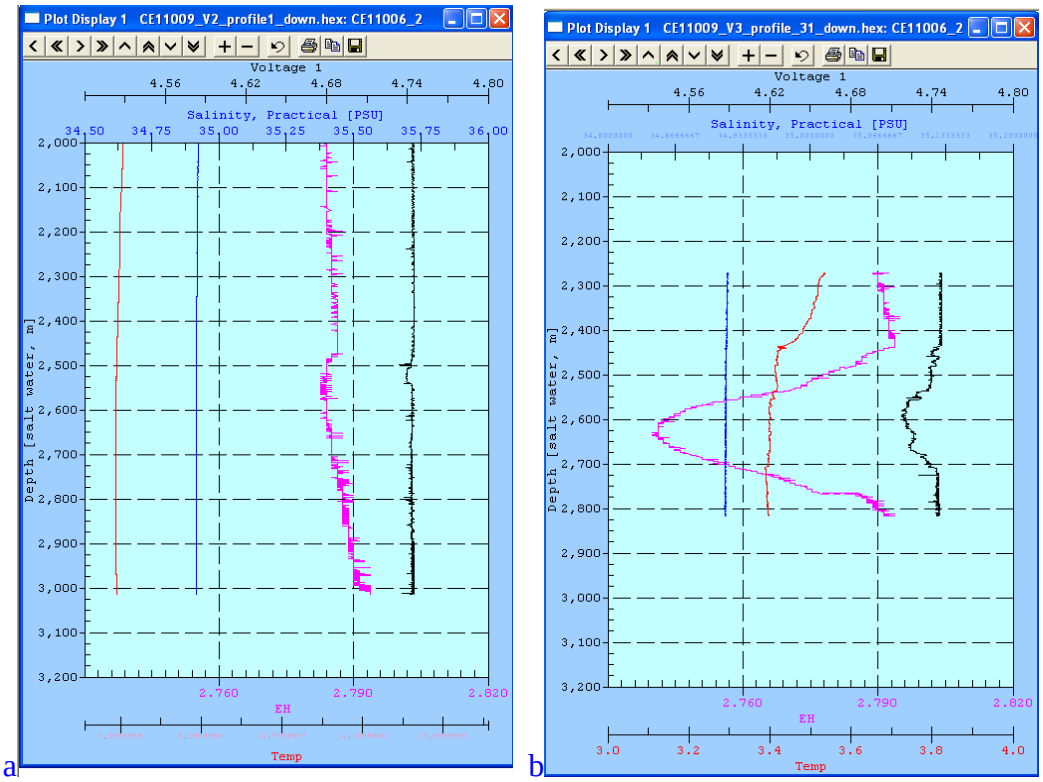
Results Summary

Moytirra vent field

Tow-yo CTD surveys

In order to determine the location of high-temperature hydrothermal venting on the seafloor and subsequently obtain water samples for plume studies, 14 CTD deployments were undertaken. Most comprised of multiple up and down casts along transects at low speed across the surface, often described as 'tow-yos'. Real-time data, including optical transmission, redox potential (Eh) and temperature, were streamed to the surface and interpreted to plan the ongoing survey and ultimately home in on the fluid source.

The initial deployment detected only very faint Eh and transmission anomalies, but after just one and half days of near continuous CTD work a target for ROV exploration that proved to be within just 30m of the actual vent site had been identified.



a b

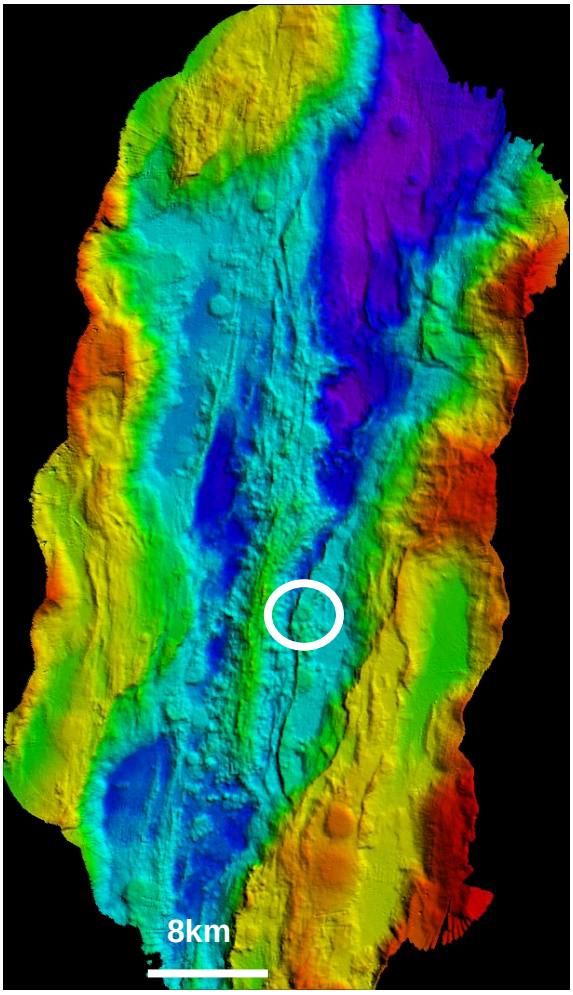
Tow-yo CTD casts showing a) the first faint signal of the plume (Station V_2: cast 3) and b) the first strong signal over the plume defining the dive site (Station V_3: cast 31)

Near to the vent site, strong and structured optical transmission signals with associated positive temperature anomalies and negative deviations in Eh indicated the detection of buoyant 'black smoker' hydrothermal plumes rising from multiple chimney structures on the seafloor.

The Moytirra vent field

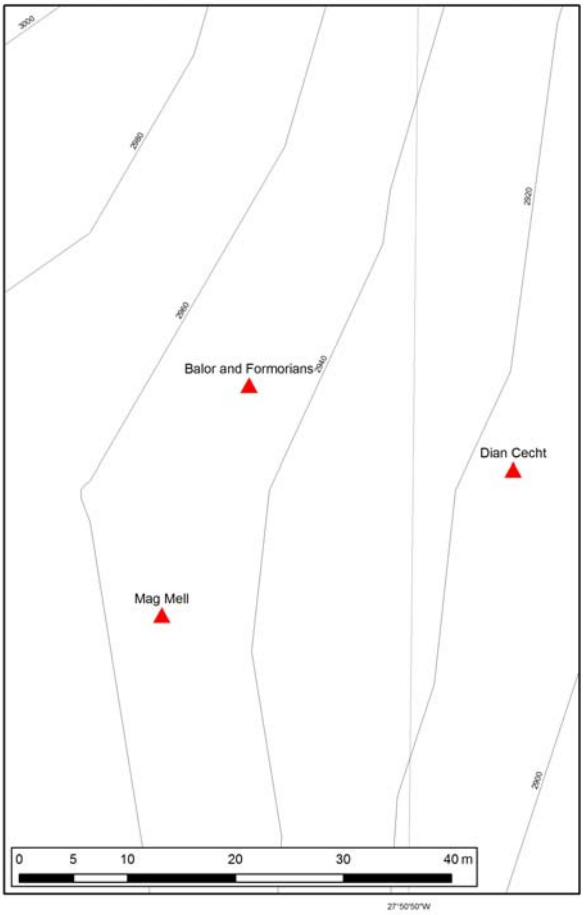
ROV dives found the black metal sulphide-rich plume in the water and traced it down to the first visual contact of the vent site at 22.30 on 24th July 2011, 2 hours into the second vent dive.

The Moytirra vent site is located off and to the east of the axial volcanic ridge at the base of the youngest axial valley fault scarp on the European Plate.



Bathymetric map of the Mid-Atlantic Ridge at 45oN (courtesy of JC24, NOC). The white circle shows the location of the Moytirra vent field

The Moytirra vent field is compact and consists of three chimney complexes. Searches to the north and south with sonar did not reveal any more.



Location of the vent chimneys

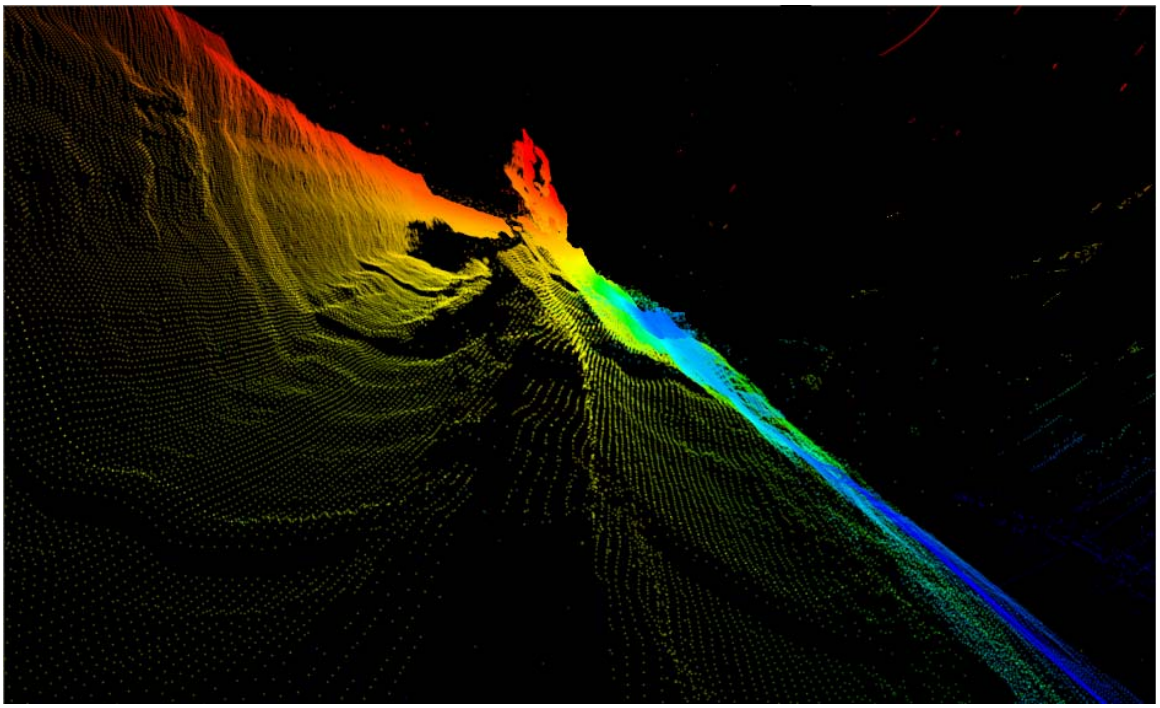
The largest chimney is called “Balor” (c..20m tall and >1m thick near the top) and exhibits a large vent flux. It is surrounded by slightly shorter and more slender chimneys called “The Fomorians”.

To the east, at the very base of the fault scarp, is a complex of chimneys and crusts with a reduced vent fluid flux called “Dian Cecht”.

To the south is an older chimney complex characterized by a large number of slender organ pipes. This is more lithified and has very little active venting. This complex is called “Mag Mell”

Seabed mapping

Due to difficulties cleaning the ROV navigation data collected during the multibeam survey. It is not possible to present an accurate map of the Moytirra vent field. However, observations during collection confirm that the chimneys were covered and details of the basal fault scarp area revealed as shown in the figure below.



Unprocessed multibeam sonar data 3D representation of the Balor chimney as a series of pings plotted against time as opposed to x.y space. Balor is c. 20m tall.

Chimney video mosaics

Framegrabs from HD camera runs were used to create photomosiacs of the entire chimney structures at high resolution: a view that is not possible underwater. Below are two examples: Balor and on the Fomorians.

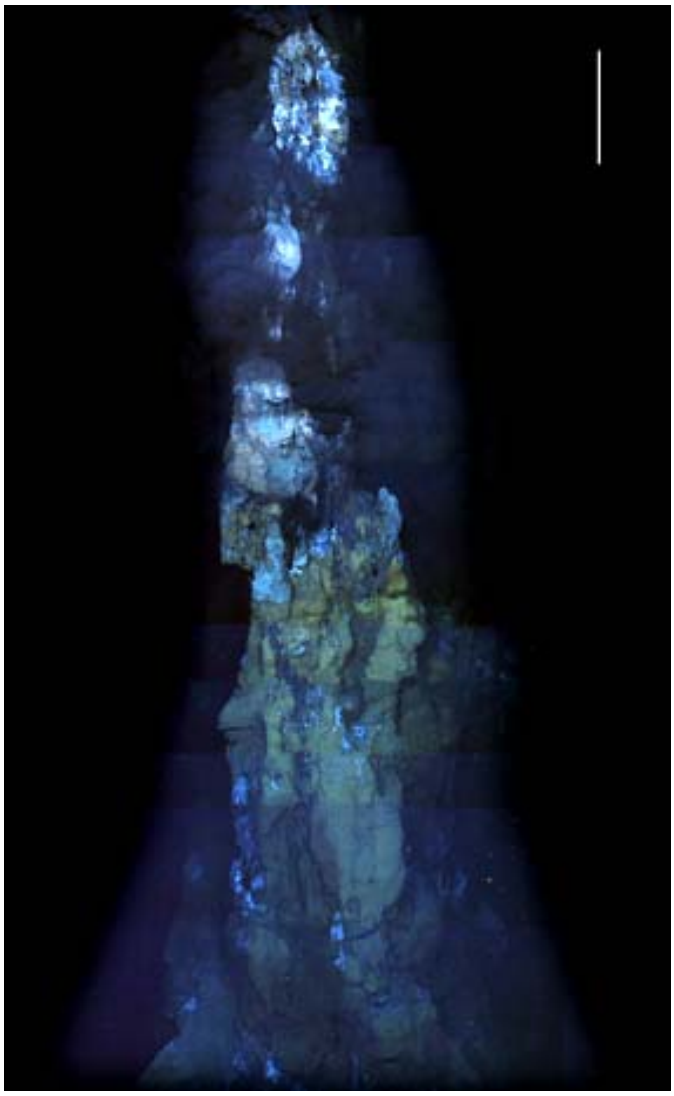
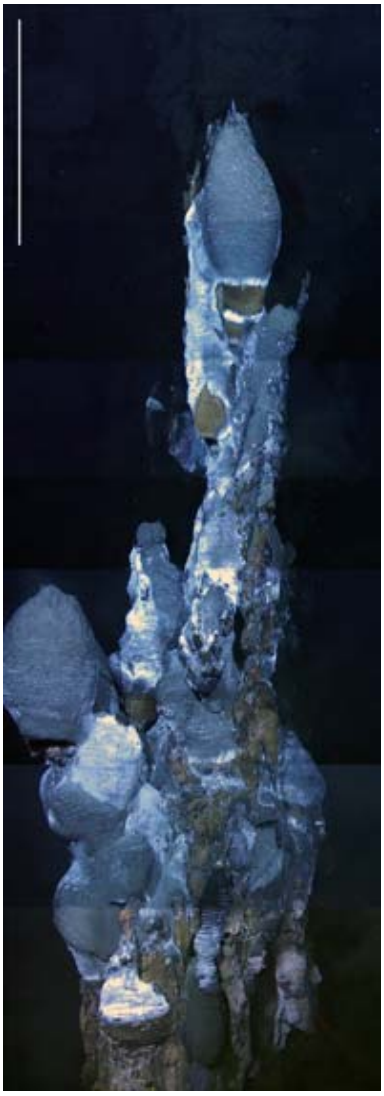
a  b 

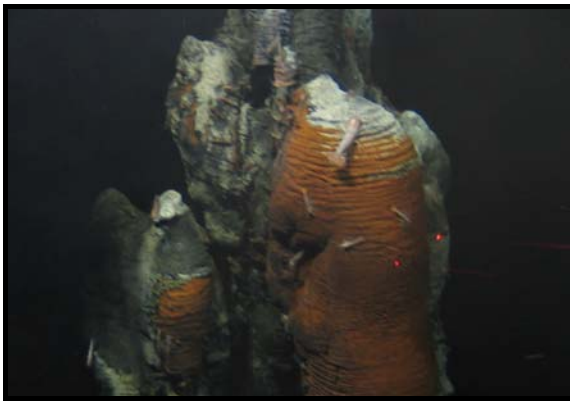
Photo mosaics from the Moytirra vent field showing a) Balor and b) a Fomorian chimney. Scale bar = 1m.

Balor is a pillar-shaped chimney formed from a coalition of pipes. Grey areas are relatively fresh sulphides which, with age, rust to brown. White areas are anhydrite mineralizing from a seawater contact reaction telling us that these parts of the chimney are over 150°C surface temperature. Anhydrite is more common towards the top where the chimney is more active suggesting the base is cool as would be expected. Balor is actively venting black mineral-rich water from three quarter's of the way up the chimney with the main flow from the summit. Biology is not visible at this resolution although large parts of the chimney are visibly uncharacteristic of a lot of vent chimneys.

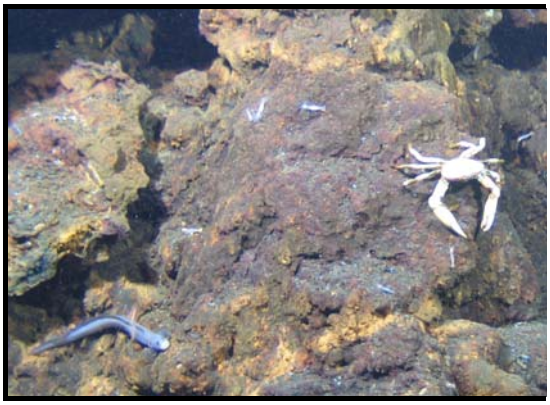
The Fomorian chimney is smaller and more slender with a number of well developed beehives on top of pipes with venting occurring at the summit. Anhydrite is common.

Vent biology

The faunal assemblage at the Moytirra vent field includes alvinocaridid shrimp, which were observed on vent chimneys and on the valley wall above the vent edifices. We sampled at least three distinct morphotypes of this decapod family. Other crustacea included haustorid amphipods, and brachyuran crabs were present on vent chimneys, the valley wall, and sulfide rubble at the base of vent edifices. Chordates recorded at the vent field include zoarcid, macrourid, and ophidiid fish. Specimens of polynoid, terebellomorph, and spionid polychaetes, and peltospirid, skeneid, and turrid gastropods were collected. Microbial mats of at least two colours were widespread on the sulfides of the valley wall above the vents.

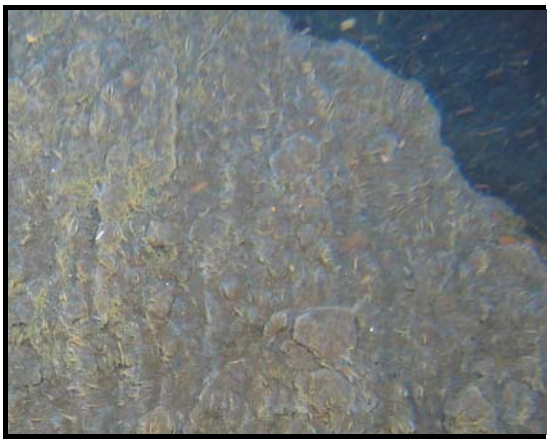


Alvinocaridid shrimp on vent chimney



Zoarcid and brachyuran at chimney base

Peltospirid gastropods



Microbial mats on valley wall

Overall, the assemblage at the Moytirra vent field shows some high-level taxonomic similarities to assemblages at other known Mid-Atlantic vent fields, but also some differences in assemblage structure. Subsequent analysis of specimen identities to species level using morphological and molecular tools will be required to resolve the biogeographic affinity of the assemblage at this site. High-definition video was recorded with laser scale to quantify faunal microdistribution. In addition, samples

were collected for further analyses of stable isotopes, population genetics, reproductive patterns, physiological pathways, metal content of tissues, biodiscovery, and microbiology.

Vent geology

Sulphide samples span a range of types from old weathered ones to fresh fragile ones. The oldest have a thick coating (2-4mm) of red iron oxyhydroxide forming a cauliform texture on the outer surface of the chimney. Inside this layer is fresh, fine to medium grained and slightly porous sulphide. The interface between the oxidised and reduced iron layers is marked by a layer of black material. This is probably rich in manganese and possibly, for the oldest samples, uranium oxide precipitated from seawater.

Younger vent-sulphide samples have thin iron oxyhydroxide coatings with fresh porous sulphide interiors. These rocks are very friable and have a high porosity. Inside are tubular pipes with coarse sulphide linings. Anhydrite forms a matrix to much of the porous sulphide.

The next youngest sulphide group comprises of leafy, tabular chimney fragments with a mixture of coarse and fine grained pyrite mixed with anhydrite in their matrix and veins on the interior side with anhydrite dusted coatings on the external side. The leafy structure of these sulphides indicates a hollow structure for some parts of the chimneys.

Active beehive structures form the next freshest group and these have an anhydrite coating on the external side which is itself ornamented with annular ribs. These ribs have asymmetric profiles such that they are steepest on the side facing upwards. Inside the beehives is a fine grained porous sulphide and anhydrite matrix exhibiting pipe-structures lined with coarse grained pyrite. The annular ribs are apparent internally as annular layering of fine and coarse sulphide.

The final group of sulphide samples form a group of fragile tubes. These range from 10 to 30cm long, 2-4cm in diameter and have anhydrite dusting on the exterior and coarse sulphide crystals in the pipe walls.

Together, the sulphide sample groups represent a stratigraphic profile with increasing height from the base of the sulphide chimney structures to the top. The oldest sulphides are from the dying site and the rest from an active chimney. From these samples, we plan to develop a model for the construction process of the chimneys and hence the major sulphide edifices themselves. We will also investigate the weathering process by which elements are exchanged with seawater as the sulphides are exposed to oxygenating seawater.

Vent geochemistry

Two vent fluid samples were taken for chemical analysis to be performed onshore at NOC.

Mid-Atlantic Ridge seamount geology at 45°N

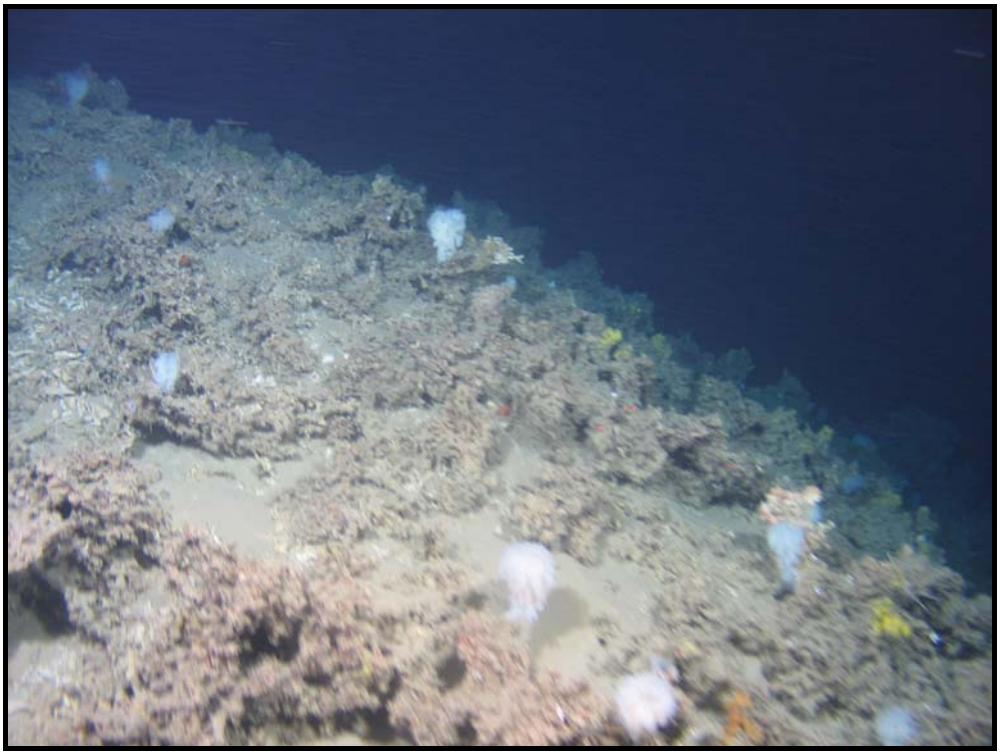
Basalt samples were collected from two flat-topped seamounts. One at an off-axis location and one located on the axial valley floor. The off-axis samples are all weathered with glass rinds altered to palagonite and sericite. Interiors are fresh and have olivine ± clinopyroxene phenoscrysts. The on-axis samples are fresh with glass rinds and generally aphyric, avesicular interiors.

Samples from the axial valley wall adjacent to the vent site are both dolerites and basalts. The dolerites are aphyric to plagioclase phyric with sulphide and iron oxide coatings and fresh interiors. They are probably derived from shallow-level dykes. Some are altered and have sulphide veins in a clay matrix. The basalts are plagioclase phyric, fresh to slightly altered with fresh glass rinds in places indicating a pillow lava provenance.

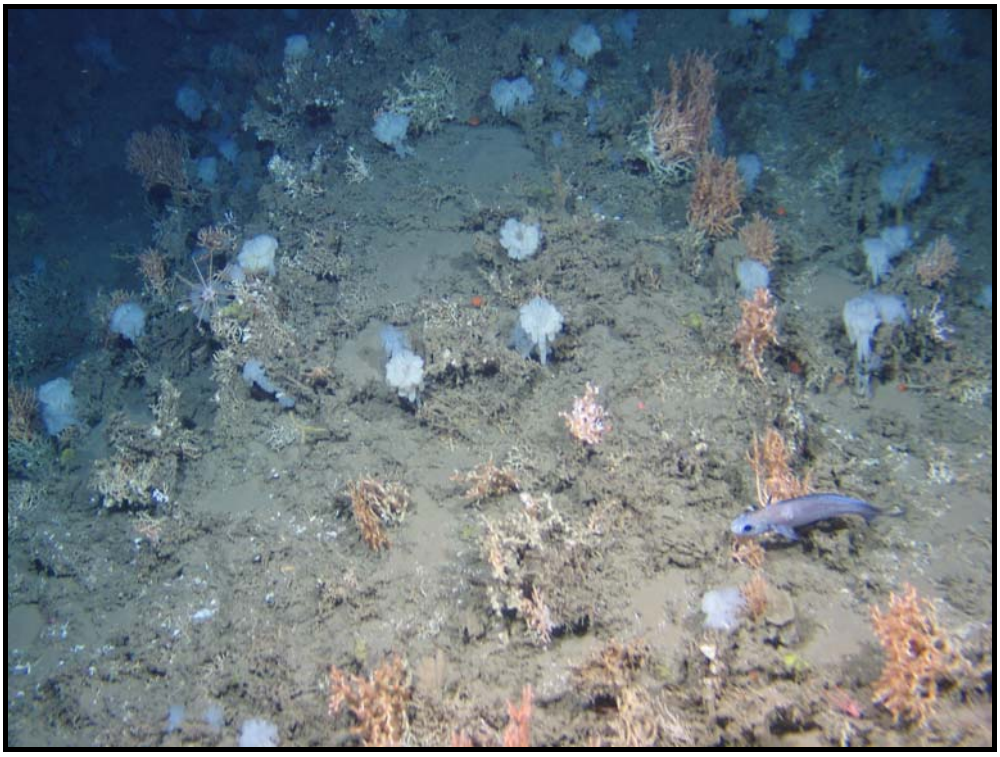
Moira Mound cold-water coral reefs

30 kHz side-scan sonar imagery (TOBI) of the Belgica mound province and Belgica Mound Special Area of Conservation (SAC) imaged a large number of potential Moira Mounds to the west of the giant carbonate mound complex. The Moira Mounds are cold-water coral reefs typically several metres tall and 10s of metres across. Previously groundtruthed examples support live coral occurring east of a chain of giant cold-water coral carbonate mounds, specifically the Thérèse Mound. The examples surveyed occurred to the west of this chain of carbonate mounds which are more plentiful and larger. These were groundtruthed with two long ROV video lines.

The reefs were up to 10m tall and revealed dense frameworks on mainly dead *Lophelia* coral with some live coral at the tops of some colonies. The dominant *Lophelia* frameworks were exposed and undergoing bioerosion. Nevertheless, they supported significant populations of sponges, gorgonians, black and bamboo corals, fly-trap anemones, squat lobsters and fish (including solitary Orange Roughy). The surrounding seabed supported significantly lower densities and diversities of visible fauna. The stature of the reefs and abundance of live *Lophelia* increased generally and gradually from south to north. There was no evidence of trawl damage although snagged nets and lines as well as notable amounts of marine litter were encountered.



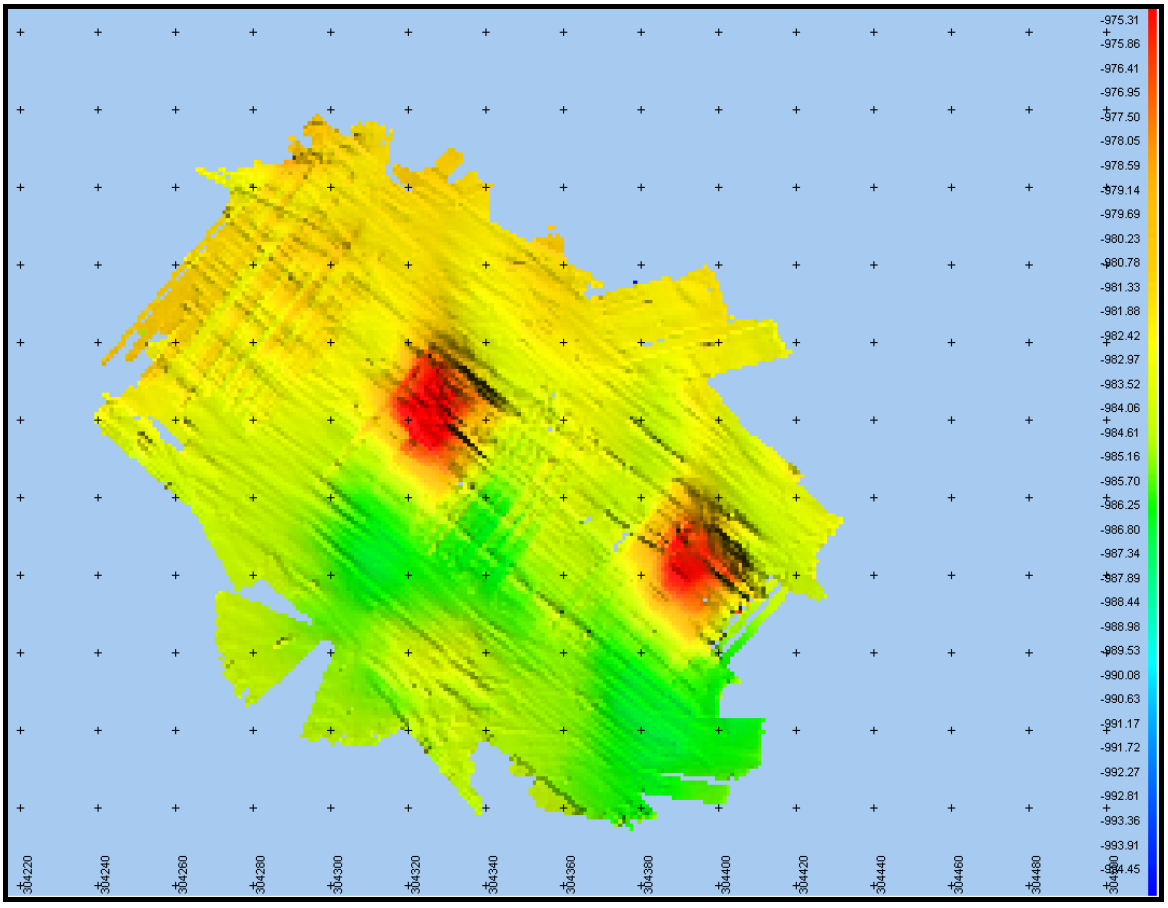
Moira Mound example showing slope angle



Moira Mound image showing live and dead *Lophelia*, sponges and a fish

A reef showing the largest colonies of live *Lophelia*, and hence the most active in terms of growth potential, was 100% covered with downward looking HD video. From this dataset, a video mosaic of the entire reef is planned. The reef was also

bathymetrically mapped with multibeam at high resolution from the ROV flown at 15m above the seabed. No samples were taken.



Unprocessed multibeam images of two Moira Mounds

APPENDICES

A1. Survey log

Monday 11th July, 2011: *sunny, low winds*

53° 16.2'N/09° 03.0'W (Galway Harbour)

Mobilisation of ROV, associated equipment, and scientific equipment. All heavy lifts completed. Mobilisation going well and on schedule. Initial scientific contingent signed on.

Tuesday 12th July, 2011: *sunny, low winds*

53° 16.2'N/09° 03.0'W (Galway Harbour)

Continuation of mobilisation. All going well. All scientific complement (bar one as planned) arrived, signed on and are briefed. At 21.00, the power transformer in the ROV control room "smokes". ROV team assessed possible further damage to ROV. Replacement transformer sought.

Wednesday 13th July, 2011: *sunny, low winds*

53° 16.2'N/09° 03.0'W to 53° 17.3'N/10° 18.2'W (Galway Harbour & West of Inishmor)

ROV check revealed no further damage to ROV and slip rings. Transformer transferred to shore and tested. Transformer confirmed OK. New transformer ordered to arrive on Friday. Cable loops in control container charred. ROV team to test high voltage circuits to find source of problem. Set sail at 16.50 with 5 additional technicians leaving 8 of science party on shore. Transited to the North Channel north of Inishmor with helicopter and shore-based filming for National Geographic Television (NGT). Good footage collected. 18.45 wet tested Sonadyne USBL beacon. Beacon OK. Calibrate d Sonadyne system in 120m water west of Inishmor to positional accuracy of 0.5m (c.6m in 1000m and c.20m in 3000m). Commenced calibration at 23.30.

Thursday 14th July, 2011: *Light winds, cloudy*

53° 17.3'N/10° 18.2'W to 53° 16.2'N/09° 03.0'W (West of Inishmor to Galway Harbour)

Fuse blew on MBES processing unit at 00.30. Finished USBL calibration at 04.25. Transited back to Galway arriving at 16.00. Continued system checks on ROV and MBES. Tied up at 17.00. Took on and tested new transformer, Millipore water and scientists (except 1). Additional technicians disembarked. Final system checks on ROV completed at 21.00.

Friday 15th July, 2011: *cloudy, freshening winds*

53° 09.6.2'N/09° 36.5'W to 53° 17.3'N/10° 18.2'W (Galway Harbour & West of Inishmor)

Set sail from Galway Harbour at 05.15. Waited seaward of the dock gates for the MBES fuse which arrived at 14.30. MBES powered up OK. Commenced transit at 14.55. Continued to test MBES on transit to site 40m wd east of Inishmor arriving at 17.00. CTD deployed 17.05 and Eh meter tested OK and SVP taken. ROV deployed for wet test at 17.45. Wet test completed OK. ROV leaked hydraulic fluid from a valve on the 7-arm but this is not serious and can be fixed. Comms problems between the

USBL, Oxtans and the MBES occurred and were solved as well as the helmsman. Due to ROV team fatigue the patch test of the MBES was abandoned. We are confident we can solve this later and set offsets in post-processing. SVP was taken at 22.00. Transit to Rossaveal at 22.20 to pick up the final scientist and drop off the Reson technician.

Saturday 16th July, 2011: *windy Force 6-7, cloudy*

53°15.3'N/09° 34.1'W (Rossaveal) to 51° 57.8'N/12° 53.0'W

Commenced transit for 45N at 01.50. At 10.00 wind force 6-7 and deteriorating. At 24.00 continuing transit across Porcupine Seabight at 51° 57.8'N/12° 53.0'W in a SW direction.

Sunday 17th July, 2011: *windy Force 6-7, cloudy*

51° 57.8'N/12° 53.0'W to 50° 37.3'N/16° 34.8'W

At 03.40 took some heavy rolls, TMS moved as well as various other items in the rope store. Cabin 312 sprung a leak. Average recorded wave height was 7m. Very uncomfortable. Concerned about safety and movement of large items. Hove to at 51° 44.4'N/13° 27.0'W. Winds gusted at 40m/s. By 10.30 wind dropped to 20m/s and swell slackening. Resumed transit SW at 7.5 knots.

Monday 18th July, 2011: *Windy Force 5, cloudy, moderate swell*

50° 37.3'N/16° 34.8'W to 48° 30.8'N/21° 19.7'W

Continued transit and refined scientific procedures. At 09.00 a meeting with ROV crew to go over data collection and transfer protocols occurred. Work on existing CTD data showed promise of likely targets for the tow-yo CTD stations. Targets are, however, deep at 2995 m. 11.30 Muster. Transit speed 9.5 knots.

Tuesday 19th July, 2011: *Foggy with low swell, wind 15 knots NW*

48° 30.8'N/21° 19.7'W to 46° 35.4'N/25° 25.3'W

Continued transit and refined scientific procedures. Vessel speed 9.5 knots

Wednesday 20th July, 2011: *Foggy with low swell, wind 15 knots NW*

46° 35.4'N/25° 25.3'W to 45° 28.9'N/27° 44.5'W

Finished transit at 9.5 knots arriving on station **V1** for CTD deployment at 12.45. Took SVP with CTD to calibrate CTD altimeter, tested Eh meter and Sonadyne acoustic release ranging. Altimeter calibration good and acoustic release was fine. However, Sonadyne had difficulties resolving depth and the Eh meter had a data spike so will be checked again. On recovery, the CTD was out of the water when it read 27m on the winch. Gerry the bosun was on the ball. We will set depth alarms on the CTD winch and proceed with caution for the future CTD recoveries. Sonadyne calibration test started at 16.05. xyz on Sonadyne was good on this deployment. Calibration completed at 11.45 and beacon released on second try. Fog lifted.

Thursday 21st July, 2011: *calm and sunny, 5 knot winds*

45° 28.9'N/27° 44.5'W to 45° 28.6'N/27° 50.6'W

Sonadyne on deck 00.21. Transited to CTD tow-yo station **V2** commencing at 01.24. CTD tow-yoing continued all day (**V2-V5**) on orthogonal lines detecting the vent

plume in the water column and the plume structure. The tow-yos progressively boxed in the vent site with strong buoyant plume signals indicating that we are near source. CTD winch overheated at 20.10. Was adjusted and continued to work well.

Friday 22nd July, 2011: *Calm Force 3 with 8 kt winds*

45° 28.6'N/27° 50.6'W to 45° 28.4'N/27° 50.8'W

CTD tow-yoing continued at **V6** into the morning further defining our dive target. At 12.45, a live video-conference call was patched through to the School of Biological, Earth & Environmental Sciences, University College Cork with Simon Coveney TD Minister for Marine, Fisheries and Agriculture. At 13.46, we found a very strong buoyant plume signal 10m of the bottom which was a diveable target. CTD tow-yoing finished at 20.00 and ROV deployed up slope of CTD based vent "sweetspot" (**V7: Dive 092**). ROV was on steep rocky escarpment, climbed upslope and had alarm on hydraulic fluid pressure at 22.00. ROV recovery started.

Saturday 23rd July, 2011: *Weather rising with wind increased to 18 kts and swell 1.5 – 2m m by the end of the day*

45° 28.4'N/27° 50.8'W to 45° 28.3'N/27° 50.6'W

ROV recovered and on-deck at 00.55. CTD tow-yo resumed at 02.00 (**V8**) to better define the vent target. At 06.05, the ROV was ready to redeploy, then problem a faulty alarm/gauge a occurred. Wind up to 23 kts, swell 1.5m. It proved difficult to deploy the ROV with surface currents, the wind and swell. Weather deteriorating and ROV deployment was abandoned at 07.30. CTD tow-yoing recommenced at 09.45 after discussions on bridge (**V10**). Tow-yo CTD continued until 19.16 narrowing the potential vent site to on the escarpment at 2850m (**V10-V12**). 4 potential "sweetspots" identified 10m off bottom. ROV deployed at 22.51 diving on the "sweetspot" on the escarpment (**V13: Dive 094**).

Sunday 24th July, 2011: Wind 17 knots with moderate swell at 2m

45° 28.3'N/27° 50.6'W to 45° 28.3'N/27° 50.6'W

ROV **Dive 094** (**V13**) found rising buoyant black "smoke" near the base of the escarpment at 3000m indicating a black smoker below. The escarpment was also covered in sulphide deposits and bacterial films indicative of defuse flow of hydrothermal fluids. The sulphides were thick and mantling the slope. Upslope and to the north, the face revealed sections through pillow-lava basalts. The dive was terminated at 06.26 due to a critical drop in hydraulic fluid pressure. The ROV then underwent an overhaul with O-rings replaced and a series of CTDs taken to further refine the target (**V14-V15**). The ROV was back into the water at 16.19 (**V16: Dive 095**) to perform an gridded Eh, temperature, salinity and transmitometer survey at 2800m water depth to define the plume anomaly accurately. A deeper water gridded survey was planned to finally pin-point the vent or vents. We were concerned that the CTD data may not only point to the deep smokers found on **Dive 094** (**V13**) but there may be other vents that are more diveable. Soon into dive (near end of first 500m line) the transmitometer fails followed by spurious data from the Eh meter. With a lack of confidence in the Eh meter, the gridded survey was abandoned. Instead we took the ROV to the "sweetspot" on the pervious dive for more visual hunting. After hopping down the escarpment, we landed into a black smoker plume.

The signal was very strong and at 3000m we realise the vent was only 10s of meters below us. We decided to go deeper and try to find the source. With an optimal ship's position and maximum cable out **we find the vent site at 3036m at 22.34**.

We confirm that we are the first human's to see the vent site. We have discovered a new hydrothermal vent field which we have named the Moytirra Vent Field (meaning "the Plain of the Pillars"). Moytirra is spectacular with several tall black smoker chimneys over 10m with a big heat flux and sulphide-rich fluid venting (subsequently named Balor chimney and the Formorian chimneys). Moytirra is at the very limit of our ROV capability at 3030m below the sea surface. The setting on the very edge of the axial volcanic ridge and the base of a vertical boundary wall fault scarp is most unusual.

After characterising the main chimney cluster and collecting some sulphides, we headed south parallel to the escarpment hunting for more chimneys and to define the extent of the Moytirra vent field. A further chimney complex was found which had less life, was cooler and probably older. A small amount of black "smoke" was visible. This was subsequently named Mag Mell.

Monday 25th July, 2011: ***Sunny with wind 18knts and a swell of 2m. Freshening by evening and rising to 3m.***

45° 28.3'N/27° 50.6'W to 45° 29.5'N/27° 50.9'W

Low hydraulic pressure necessitated recovery at 02.15. The ROV was quickly turned around and dove again at 06.23 (**V17: Dive 96**). We initially defined the northern extent of the Moytirra vent site. We did not find any more chimneys further north although some "smoke" from below indicated that there was probably a small vent below, too deep for us to reach with the ROV. We then video mosaiced the large showcase chimney (Balor). After video mosaicing, we collected biological and chimney samples. At 18.00 we had a hydraulic power loss to the vehicle and recovered. We then started a tow-yo CTD run from Moytirra heading north along the escarpment at 23.00 (**V18 & V19**).

Tuesday 26th July, 2011: ***Cloudy with showers, wind increased to 27 knots, swell up to 3m.***

45° 29.5'N/27° 50.9'W to 45° 28.7'N/27° 51.0'W

Tow-yo CTDing continued until 09.30. Then we moved to a seamount slightly away from the axial ridge volcano (AVR) to collect dredge samples. During these operations, the ROV was being checked and the MBES head that had developed a fault was subsequently fixed. The fibre optics in the ROV also developed a fault which was fixed. Rock dredging of seamounts off the edge of the AVR commenced to recover samples for petrological analysis in order to determine at the depth at which seamount magma fractionation occurred. Two seamounts were successfully dredged until 20.14 (**V20-V22**). It was not possible to dredge anymore due to a lack of deckhands with the watch change. We therefore proposed a long CTD tow-yo line from the south back to Moytirra to hunt for new vents. At 21.00 we were given indications that the ROV would be fit to dive by midnight. We therefore decided to

abandon the CTD tow-yo to get back on station ready to ROV by 23.00. The ROV continued to have technical problems.

Wednesday 27th July, 2011: ***drizzly weather, wind has swung round to the NW flattening the swell. Swell dropping from 2.6m through the day.***

45° 28.7'N/27° 51.0'W to 45° 28.4'N/27° 50.9'W

ROV technical issues were resolved at 06.00. A number of faults were fixed. Intermittent connectivity in the fibre optics was traced to oil flooding the pod which, on a roll, was blanking a connection. Sensor overheating problems were found. Water from the air conditioning in the ROV shack was slopping on electronics probably causing the main power failure. Deployment was attempted in the dark but abandoned due to chaotic swell conditions as the wind had changed direction. The ROV was successfully deployed at 08.33 in multibeam mode with the Eh sensor (**V23: Dive 097**). The multibeam worked well with the principal areas of coverage centred on Moytirra with 75% overlap. There were however initial PDS2000 teething problems. Severe problems exist with the underwater navigation which will have to be fixed in post processing. The dive eventually aborted after a software hung, ROV on deck at 20.15. The recovery was not perfect as the umbilical slipped off of winch. The ROV was prepared for next dive.

Thursday 28th July, 2011: ***Calm and cloudy. Wind 11 knots***

45° 28.4'N/27° 50.9'W to 45° 28.4'N/27° 50.9'W

ROV **Dive 098** (**V24**) started at 00.58. A new chimney complex was discovered at the base of the cliff (subsequently named "Dian Cecht"). Samples were taken of sulphides (at the base of Balor and Dian Cecht). Anhydrite beehive samples were also taken at Dian Cecht and the southerly older vent site (Mag Mell). Biological samples (big shrimp, *Rimicaris* sp., green limpets, scale worms) collected from Dian Cecht and a crab trap deployed. Microbiology samples were taken from the diffusive flow on the cliff. Temperature tests for vent fluids failed. The ROV was on deck at 18.25 and prepared for next dive.

Friday 29th July, 2011: ***Calm and cloudy. Wind 17 knots***

45° 28.4'N/27° 50.9'W to 46° 19.5'N/26° 00.6'W

ROV **Dive 99** (**V25**) commenced at 02.51 and explored Mag Mell further before doing a HD video mosaic. The crab trap was recovered and the ROV proceeded to Dian Cecht where a site to take vent fluid was explored. The ROV dive was aborted due to a sonar failure. ROV on deck 08.30. The ROV was repaired and the ROV dived again (**V26: Dive 100**) at 10.16. Sampling of vent fluid was successful. ROV back on deck 14.50. Transit to the Moira Mounds, Porcupine Seabight started at 15.05 at 13 knots.

Saturday 30th July, 2011: ***Slight swell, 1.5 m (following beam on,) Force 5***

46° 19.5'N/26° 00.6'W to 48° 23.4'N/21°10.4'W

Made transit to the Porcupine Seabight at 9.5 knots

Sunday 31st July, 2011: ***Slight swell 1.2 m (following beam on), Force 4***

48° 23.4'N/21°10.4'W to 50° 16.1'N/15° 50.4'W

Made transit to the Porcupine Seabight at 9.5 knots

Monday 1st August, 2011: Calm sea, no swell, wind 8 knots

50° 16.1'N/15° 50.4'W to 51° 265'N/11° 49.3'W

Arrived on station at 16.30 and took an SVP (**V27**). Pre-dive check revealed that the ROV had developed a problem with it's one remaining arm loosing our the capacity to sample. It was decided to immobilise the arm and dive in video mode to save downtime. While this was being done, a Day Grab was taken on the edge of the Moira Mound reef field (**V28**). The grab did not release so it was sent down again (**V29**) and was successful. ROV deployed at 19.50 (**V30: Dive 101**). The dive imaged a number of Moira Mounds on 5.5km south-north transect that had not been previously groundtruthed in the westernmost extent of potential Moira Mounds. The Moira Mounds were large structures with a dense exposed coverage of predominantly dead coral with sponges.

Tuesday 2nd August, 2011: Calm sea, no swell, wind 7 knots

51° 26.5'N/11° 49.3'W to 51° 29.7'N/11° 49.2'W

The ROV dive (**V30: Dive 101**) continued until 04.53 when the immobilised arm developed an oil leak and the dive had to be aborted. Two Day grabs (**V31-V32**) where then taken to groundtruth the inter-reef seabed. The ROV was repaired and dived (**V33: Dive 102**) on the remaining more northerly reef targets in the same western Moira Mounds area. Live coral was more abundant on these targets which were also bigger. The ROV was recovered and a background sediment Day grab was taken near to the best reef (**V34**) at 15.30. ROV **Dive 34** (**V35**) was deployed at 16.15 although several technical faults developed and the ROV recovered at 17.21. At 19.19 the ROV dived again (**V36: Dive 104**) and video mosaiced the reef with the largest live coral stands.

Wednesday 3rd August, 2011: Calm sea, no swell, wind 7 knots (Force 4 in the morning)

51° 29.7'N/11° 49.2'W to 51° 24.7'N/9° 3.1'W

Dive 104 (**V36**) continued until 05.14 with the completion of 200% video cover. The final dive (**Dive 105: V37**) commenced at 06.04 during which the reef area was mapped with high resolution multibeam. Transit for Cork commenced at 13.35.

Thursday 4th August, 2011: Calm

51° 24.7'N/ 9° 3.1'W to 51° 53.85'N/ 8° 27.4'W (Cork City)

Finished transit and arrived at Cork at 07.00. A press conference with the Minister Simon Coveney TD was held at 09.30 and post-cruise meeting at 11.30.

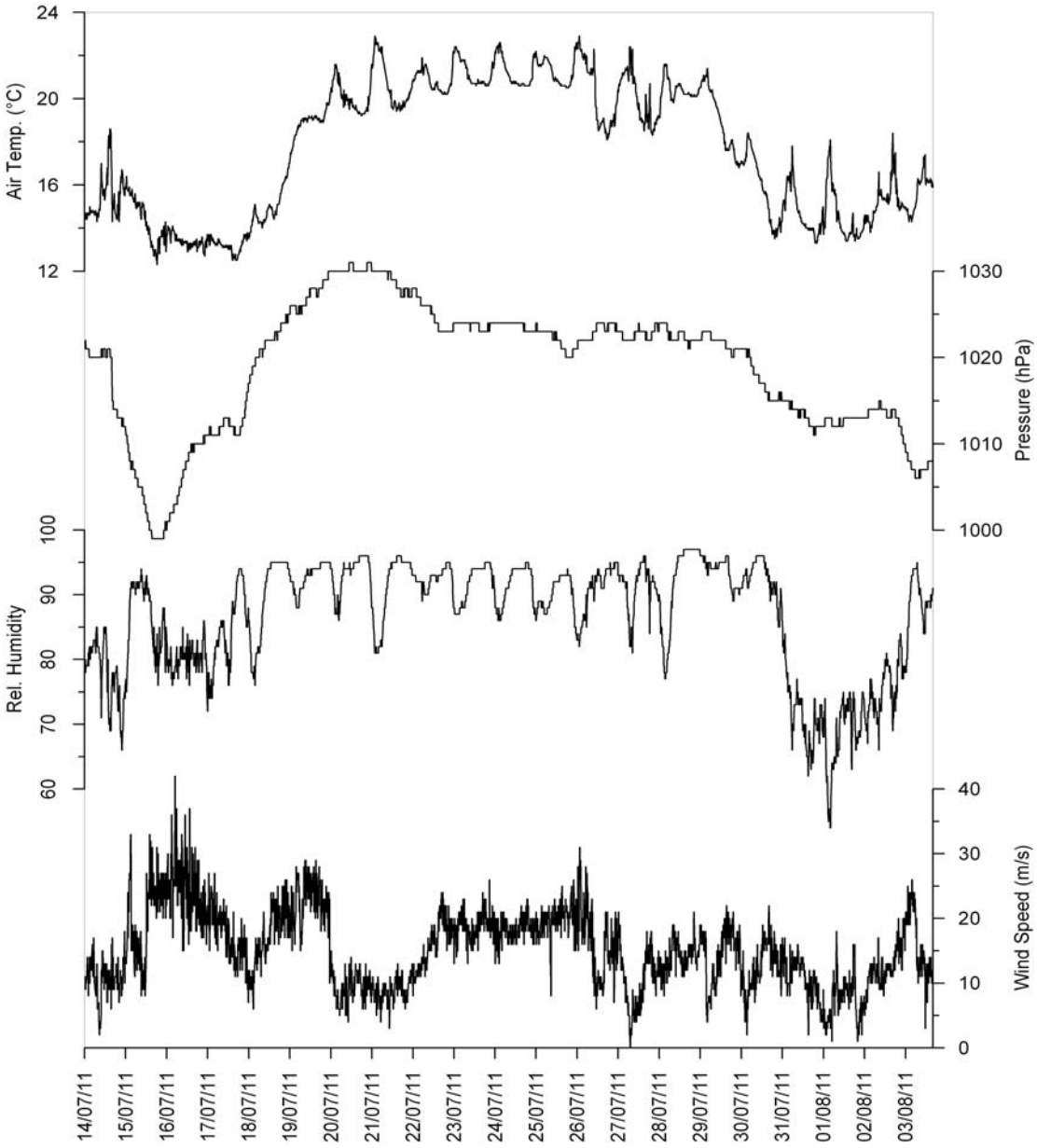
A2. Weather Report

Weather summary

The sea conditions were generally good for most of the survey having a minimal effect on operations. High winds and sea states were experienced at the start of transit from Galway to Moytirra.

At the Moytirra sites, it was relatively calm, generally cloudy, warm and often foggy in the evening. On one day, winds peaked at around 20 knots with swell rising to over 3 m, otherwise good.

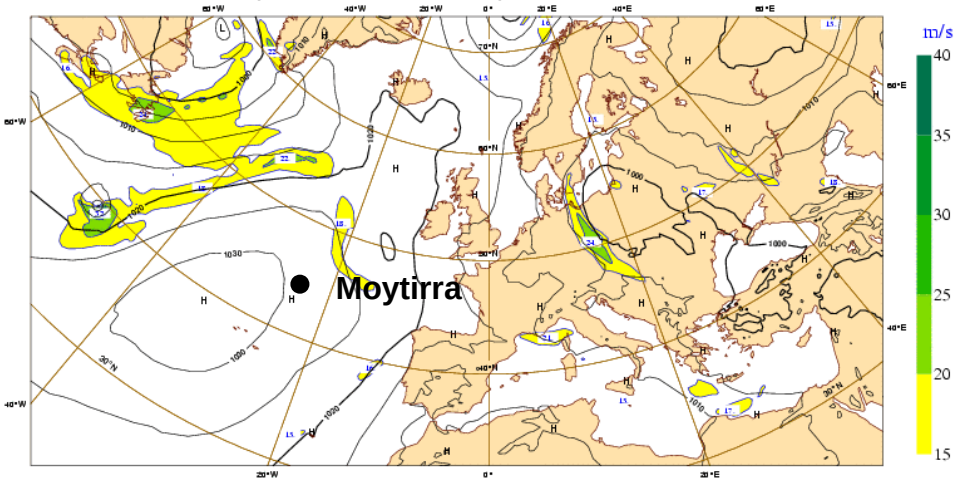
In the Moira Mounds area the sea was calm with no significant wind.



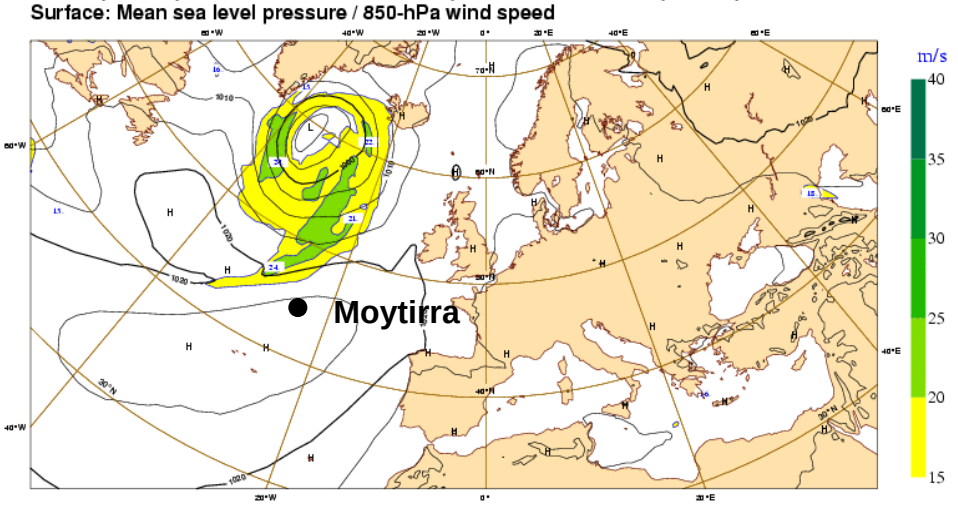
Weather data extracted from underway data

Synoptic Maps (selected)

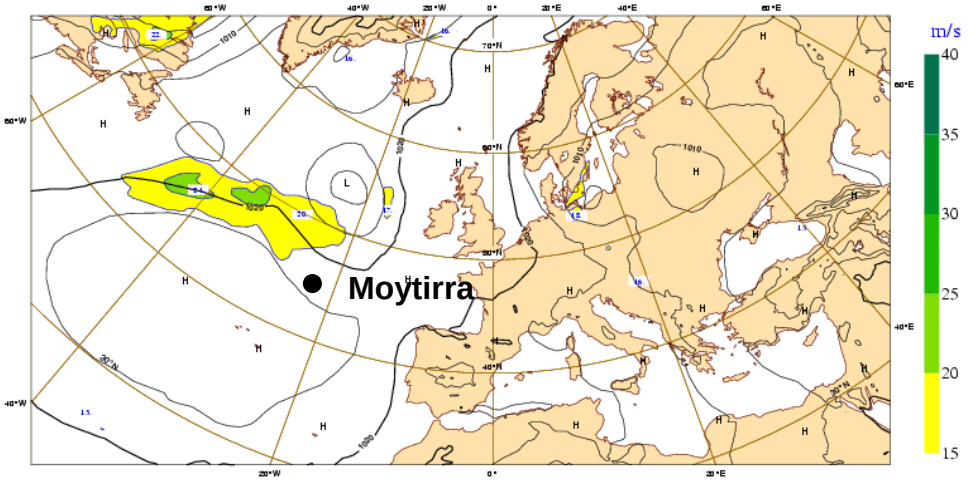
Thursday 21 July 2011 12UTC ©ECMWF Analysis t+000 VT: Thursday 21 July 2011 12UTC
Surface: Mean sea level pressure / 850-hPa wind speed



Tuesday 26 July 2011 12UTC ©ECMWF Analysis t+000 VT: Tuesday 26 July 2011 12UTC
Surface: Mean sea level pressure / 850-hPa wind speed



Saturday 30 July 2011 00UTC ©ECMWF Analysis t+000 VT: Saturday 30 July 2011 00UTC
Surface: Mean sea level pressure / 850-hPa wind speed



A3. Downtime & Technical Issues

Weather downtime

Weather conditions hindered the survey on two occasions only.

On transit out we hit high winds and swell that we took on the beam making the vessel roll excessively. Due to concern regarding the stability of equipment lashed to the deck, it was appropriately decided to hove to and face the swell. This caused a downtime of 7 hours. Transit speeds subsequently were slow adding an additional half day to the transit.

On 23rd July, the wind picked up and swell heights exceeded 2.5m. It was decided too hazardous to deploy the ROV over a 13 ½ hour period. CTDing operations were unaffected however.

On 26th July, the wind picked up again and swell heights exceeded 2.5m. It was again decided too hazardous to deploy the ROV over a 30 hour period. CTDing operations and dredging were however unaffected.

Transit times from Moytirra to the Moira Mounds was slightly delayed by a slight beam-on swell.

For the majority of the survey, sea state conditions were benign and within ROV deployment limits.

Operational report of the Holland 1 SMD Quasar WROV

During the mobilization and power up of the system on board the *RV Celtic Explorer* we had a problem with the 7.5 KVA TX 1 Transformer in the ROV Control Van which overheated when the ships 440 V power was applied. We were advised the following day after testing ashore that the Transformer was serviceable but that the wiring loom connecting it to the power was too light to carry the load. We changed the loom for a heavier grade and (amazingly) managed to have a spare transformer made in Dublin and delivered to us in two days.

During this time the Reson engineer was also having problems with the multibeam system on hire from UCL which had arrived without spares of any kind. A fuse had blown in the Topside unit and was not available in Ireland and had to be brought through Radionics in Dublin form England. Ironically our transformer arrived 3 hours before the fuse.

On site at Moytirra we were working near the rated depth of the ROV for the entire time. Due to the potentially hazardous nature of the sub sea environment, we had decided to Live Boat (dive without TMS) a decision vindicated entirely when we eventually got down to depth and encountered a treacherous topography with hot fluid venting of buoyant water. This decision limited us to around 3000 meters which is the operational limit of the ROV.

On our first dive No 92 on the 22nd of July, which was the first deep dive that the system had done since April and was scraping the 3000m level, the ROV suffered a low HCU / TCU compensator level and we had to abort the dive at 2840m. It was a shame and very disappointing for all concerned but given the depth, the fact that it was the first dive of the trip and that the ROV hadn't been anywhere near that depth in over 4 months and had been sitting in the warehouse during that time, it wasn't really that surprising. We quickly got the ROV ready again but by the time we went to launch the surface current was too strong and twice we had to abort the launch.
By 20:00 on the 23rd we were ready to dive and conditions had moderated sufficiently to allow us to do so. However, again a low HCU comp forced us back up after just over 5 hours on the bottom, with us getting very, very close to the smoker at 2950m.

One must remember that dives 92, 93 and 94 above were exceptionally deep dives, at the rated depth of the ROV and each one was considerably longer than the last so the compression problem in the oil system was being slowly addressed.
Dive No 95 on the 24th continuing into the 25th was of just over 15 hour's duration, the smoker was found at 2945m depth and some extraordinary video and stills footage was shot. The oil comp problem, while still an issue of importance didn't cause the cessation of the dive.

The next one No 96 was aborted because of a total Hydraulic Power Loss caused by over working and consequent over heating of the system. During the dive we were Suctioning, Manipulating and Thrusting powerfully simultaneously.

Dives 97 and 98 were of full duration and successful. Dive No 99 again was aborted late because the Sonar oil had leaked out under the immense pressure stopping the head from sweeping. There was minimum time on the surface to repair it and Dive No 100 was again of full duration with no issues.

We have been unable to get the starboard arm working because we believe that the 2 telemetry boards that we have are both defective, however the Port arm has managed to complete any tasks requiring manipulators.

When we got to the Moira Mounds at a shallower 1080m water depth, the ROVs performed much better with very few problems. However, serious communications problems with the remaining arm meant that it had to be immobilised prohibiting sampling.
I think that overall, given the conditions, the depth and the time the ROV had spent in the warehouse, the ROV has done reasonably well in that we have managed to get it to complete the full scope of the expedition.

Survey protocols

Seabed mapping

ROV based multibeam swath sonar bathymetry was acquired using a RESON seabat 7125 mounted vertically downwards on the ROV. Attitude data were derived from a Ixsea Octans optical gyro and Doppler velocity logging from 60kHz device. A sound velocity profile was acquired prior to the survey. Depth data were from a digiquartz with a seawater calculation to convert from decibars to metres below sea level based on embedded algorithms within the acquisition software PDS2000. Acoustic navigation was derived from a 'Compat 5' Sonardyne USBL beacon positioned on the vehicle with the relevant offsets and lever arms calculated and implemented in the acquisition configuration setup. The sonar was set to acquire data from 512 equidistant beams forming a swath angle of 120° using a pulse length of 20 milliseconds and a ping rate of about 30Hz.

In the acquisition software (PDS2000) a grid model was established with a 1m grid spacing. However, the navigation data proved unreliable and will require substantial processing. Never-the-less, multiple pings were acquired across the vent structures on the side of the west facing cliff scarp, an example of which is presented in this report).

CTD-based water sampling procedures

1) Fill 500mL or 1L acid-cleaned bottle for metals (optionally acidify).
2) Fill blood bag for dissolved gases (poison with 100uL HgCl2)

Geological sampling and processing

Two geological settings were sampled: ROV based sampling of the active vent site sulphides and surrounding mafic rocks, and dredge based sampling of two flat-topped seamounts.

The ROV samples comprised of those samples collected simultaneously with the aspirator biological sampling, and those samples collected discretely by the ROV manipulator arm. The dredge samples were acquired on the basis of combined side-scan sonar imagery and multibeam bathymetry (JC24 – 2008). Two flat-topped seamounts were targeted: one on the eastern axial flank and another in the axial valley floor in the southern end of the ridge segment.

When on board the ship, the samples were first swabbed by the microbiologists and then removed to the bench in the wet lab. If coming from the ROV, the samples were matched with their recorded locations in the sample baskets on the ROV's tray. Once on the bench, the samples were triaged by separating them into groups. For the serendipitous sulphide samples, we distinguished 7 groups, starting with the most

weathered sulphides and working progressively towards the most fresh and youngest. This separation of groups reflected an idealised position on the main sulphide structure with the weathered group representing those samples from near the base of the structure, and the youngest and freshest (organ-pipes) being from the top of the chimney.

Samples collected discretely by the ROV included two active sulphide 'bee-hive' structures and one large spire of weathered sulphide from the dying chimney structure. Other samples included those of weathered, mineralised and relatively fresh mafic rocks from the axial valley wall scarp.

Following triage, the samples were either photographed and bagged in groups, or type samples from each group were picked out and given individual sample tags. The tag format is:

CE11009_<station or dive number>_samples number_R

i.e. Celtic Explorer cruise number_station/dive number_sample_Rock

The oldest and most oxidised sulphide samples are likely to be rich in uranium oxide and hence should be treated with care. All the geological samples will initially go to Southampton and be curated by Bramley James Murton.

All sample descriptions are available in appendix 5.

Biological sampling and processing

Video mosaicing during ROV dives

1) Footage for mosaicing of vent chimneys and their faunal distributions will be obtained using the HD camera and laser scale. The ROV will be positioned facing a "lower corner" of the view to be mosaiced. The pan-and-tilt of the HD camera will be set so that the axis of camera view is vertically and horizontally perpendicular to the front face of the ROV. Zoom of the HD camera will be adjusted to ensure key fauna can be identified in images, bearing in mind that the surface viewed may become more distant from the camera during the survey. The laser scale must also be visible in the frame.
2) The ROV then maintains heading, and position along its fore-aft axis, as much as possible, while moving slowly up and down vertically, stepping across between vertical lines to provide HD footage with ideally ~50% horizontal overlap between lines. The overall movement of the ROV therefore describes a vertical plane across the face of the structure being mosaiced, with the camera view perpendicular to this plane throughout. Zoom setting and pan-and-tilt of the HD camera must not be adjusted during the survey.
3) The scientific watchkeeper in the ROV control van should record the start and end times of individual vertical survey lines (numbering each line, e.g. "Balar north face

mosaic line 1 start" etc), to aid subsequent extraction of frames from HD footage for mosaicing.
4) Framegrab taken from the HD footage are subsequently visually stitched together.

Faunal sampling during ROV dives

1) Description of the sample location within the vent field was taken in the technical log (both as USBL coordinates and depth, but also as a description of the location, e.g. "north face of Balor chimney, three metres from the top"), along with UTC time of collection.
2) Digital stills of the sample target area and good HD video of sample collection is essential, showing the microhabitat being sampled, the sampling procedure, and using the laser scale to allow estimation of the area sampled.
3) For samples of sessile fauna collected using the manipulators, the suction sampler should be deployed over the area being sampled prior to collection, and then following collection, to acquire any small epifauna present.

Processing of samples aboard ship

1) Prior to the ROV leaving the seafloor, buckets of seawater must be present in the refrigerators in the bosun's store outside the wet lab, to provide plenty of cold water for transfer and storage of specimens during triage.
2) After recovery of the ROV, when the scientific watch leader calls biologists forward, samples will be transferred from the ROV to the wet lab using buckets and containers, under direction of the watch leader to avoid confusing samples from different locations. Triage will take place on the bench second on the left from the doorway to the deck. Samples will be sorted into morphospecies using the trays on the bench.
3) Samples awaiting processing will be stored in the refrigerators outside the wet lab, to maintain condition of specimens.
4) Rock samples will be quickly checked for fauna, and specimens removed from their surfaces, prior to their processing for geology.
5) Morphology voucher specimens (see below) of each morphospecies will be photographed using the macrophotography and stereomicroscope systems in the annex lab.
6) Appropriate taxon-specific morphometric measurements (e.g. carapace length) will be recorded for individuals collected, to provide population size-frequency data.
7) All fixation using formalin will take place on deck just outside the wet lab, using appropriate PPE, to avoid any contamination of material being processed for genetics in the lab.

Specimen distribution for each morphospecies sampled

The list below represents the order in which specimens will be distributed for different purposes; however, if sample sizes are small, material from individuals will be shared between purposes (e.g. stable isotopes, population genetics, and RNA expression; population genetics and life-history biology).

1) If the initial sample size of a morphospecies is limited, the number of initial voucher specimens for species ID may be reduced, e.g. to 10 individuals for morphology and 10 for phylogenetics, with the ideal targets of 20 being completed later from a sample on a future dive.
2) For rare morphospecies where only a few individuals are collected, material from voucher specimens will be shared where possible without compromising ability to identify and if necessary describe the species.
3) A whiteboard in the wet lab will record specimen distribution to each purpose for each morphospecies. This will inform targeting of sampling on future dives, to ensure each purpose is fulfilled.

Voucher specimens for species ID

1) Initial specimens will be allocated to taxonomy/phylogenetics, to confirm species identity. For this purpose, a maximum of 20 specimens will be preserved in formalin (for morphological taxonomy), and 20 specimens preserved in ethanol (for molecular phylogenetics). Specimens preserved in formalin will need to be morphologically intact, and will be chosen to provide a range of sizes and sexes, to provide potential holotypes and paratypes for descriptions of new species.
2) These specimens will also be photographed.
3) Specimens preserved in ethanol for phylogenetics may have some tissue removed for population genetics if total sample size of the morphospecies is otherwise low.

Stable isotopes

1) Ten specimens will be frozen at -80ºC for stable isotope analysis, to determine trophic structure of the vent assemblage.
2) If total sample size of a morphospecies is low, tissue can be removed from these specimens for population genetics and RNA expression study.

Biodiscovery

1) One specimen will be frozen at -80ºC for biodiscovery

RNA expression

1) Ten specimens will be frozen at -80ºC for study of RNA expression, where sample size allows. If necessary, tissue can be provided for this purpose from specimens frozen for stable isotopes.

Population genetics

1) An ideal target of 50 individuals per population size cohort will be preserved in ethanol for population genetics. If sample sizes are limited, these individuals can be shared with life-history biology (see below), with muscle tissue being dissected for population genetics, and gonad being preserved for life-history study.

Life-history biology

1) An ideal target of 100 individuals will be preserved in formalin, for histological examination of gonad and gamete development to determine likely mode of larval development, and reproductive synchrony of the population.

Metal content

1) If sample size allows, ten specimens will be frozen at -80ºC for determination of tissue-specific metal contents. If sample size is low, material for stable isotope study can be shared for this purpose. If sample size is ample, ideally the specimens for metal content should be from the same location as those analysed for RNA expression.

Spatial variation

1) Where population numbers and distribution allow, spatially separate samples will be collected from individual chimneys and microhabitats (e.g. chimneys and periphery, particularly for brooding crustaceans; ideal target 100+ individuals per sample) to determine spatial variability in population size-frequency structure (i.e. recording morphometric measurements of individuals in samples from different locations), reproductive development, population genetics, metal content, and RNA expression, preserved as described above for those purposes. Multiple dives will be required to fulfill this purpose (e.g. for species collected using the suction sampler), which will therefore only apply to numerically dominant morphospecies.

Meiofaunal sampling

Meiofauna will be sampled last and will be sucked up and/or filtered from the trays of individual ROV samples and placed in ETHANOL.

Sample labeling

Each sample (i.e. collection of individuals of a morphospecies for each purpose above) will be recorded in a logbook, recording cruise station number, date, dive number, sample ID, details of specimens (e.g. ten intact individuals of shrimp morphospecies 1), preservation method, and purpose (e.g. pop gen, stable isotopes etc).

Each sample container will be labeled indelibly on the exterior with sample details (cruise, date, station number, ROV dive number, sample ID, preservation, purpose). A card or plastic label inside the container will also carry that information, recorded in pencil.

Microbial sampling and processing

Overall aim

To collect representative samples of microbial fauna at the Moytirra vent site, from microbial mats, larger organisms, rock/sulphide surfaces. A particular focus was on microbial sampling from shrimp gut.

Bacterial mats

1) Sample directly from ROV container(s) and before any other handling for other specimens.
2) Wear fresh set of disposable rubber gloves.
3) Take 30 ml plastic sample tube (these are sterile before opening) and sample sediment or bacterial mat by dipping tube into sample. You can use a fresh sterile dropper to collect material and transfer to tube. The dropper must be discarded after a single sample set is taken. Fill the 30 ml tube to half or two-thirds tube. Freeze directly in -80, or place in Styrofoam box with cold freezer packs and transfer to -80 within 20 min. DO NOT ADD ANY PRESERVATIVE. Label frozen for DNA. Note colour of microbial mat, and remarkable character of sample (if any).
4) Repeat for as many tubes as available from sample.
5) For second sample tube only: fill to half tube, add formalin to full volume. Label formalin. Do not store in freezer, store elsewhere.
6) Discard gloves and put on new set for fresh sample set.

Rocks or sulphide surfaces

As above but use the 30 ml tube to scrape off the bacterial mat from the hard surface. You can use a fresh sterile dropper to collect material and transfer to tube. The dropper must be discarded after a single sample set is taken.
For second sample tube only: fill to half tube, add formalin to full volume. Label formalin. Do not store in freezer, store elsewhere.
Only sample rocks if they were placed in a sealed container on the ROV. DO NOT SAMPLE any rocks that have been exposed to open water on the return trip of the ROV. These will have been contaminated by material from the water column and results from these are uninterpretable.

From larger fauna

Most easily by freezing the whole organism in a 30 ml sterile tube, or in a sterile ziplock bag.

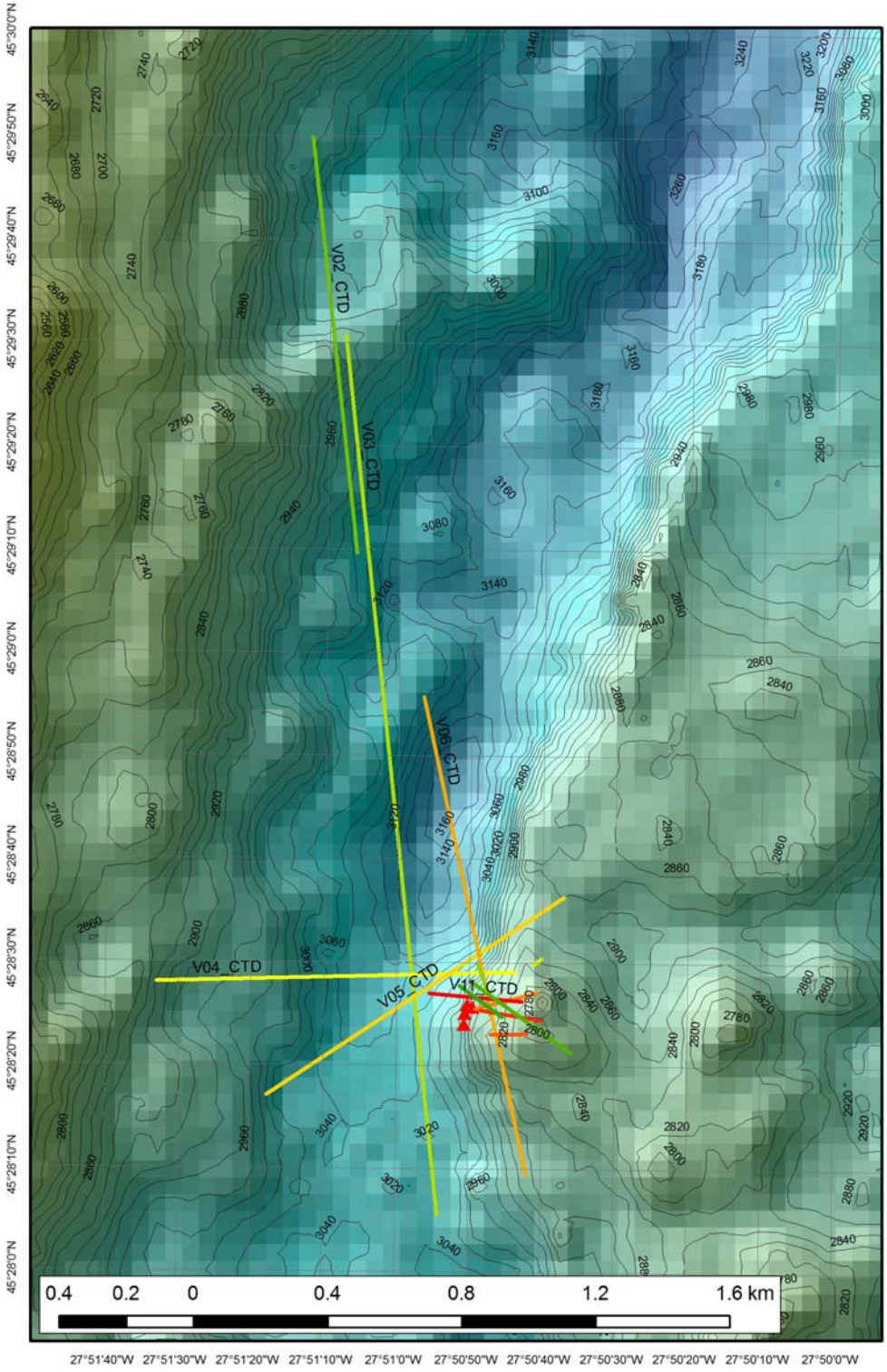
Rimicaris Shrimp

These are the target of a special study. Take up to six whole shrimp. Wrap separately in cling film and place in a sterile 30 ml tube(s) and freeze. Additional six to be dissected.

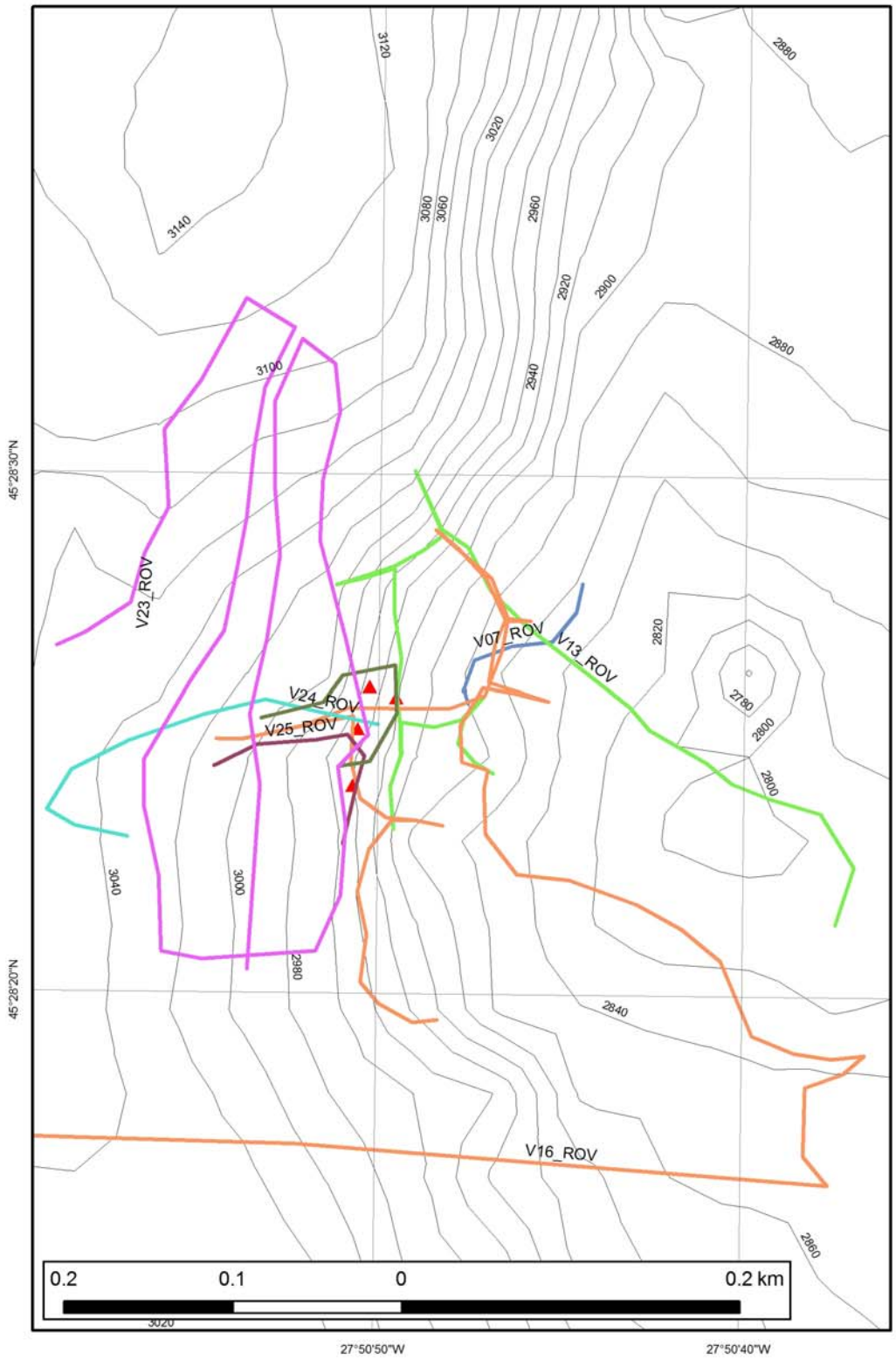
Vent fluid sampling and processing

1) Measure Piston handle extension (to estimate sample volume).
2) Measure **refractive index** of first solution drawn from Ti bottle immediately (after rinsing tubing with a couple of ml of sample to waste).
3) Fill 25 ml glass flask to the top and stopper to exclude air for **Alkalinity**.
4) Fill tube and seal w parafilm for **pH**.
5) Fill 2 x 6ml glass vials to the top and screw on lids to exclusion of air for **hydrogen sulfide**. Refrigerate until analysis (asap)
6) Fill 20ml vial, crimp seal with septum and poison w sodium azide for **gases**. Alternatively, use blood bag, exclude air and poison w sodium azide.
7) ~3/4 fill 2ml snap cap centrifuge tube for **IC** & **Silica.**
8) Fill 1.6ml glass vial to the top and fit red snap-on cap to exclusion of air for **isotopes**.
9) Draw remaining sample into 1L Nalgene bottle and acidify with 1ml distilled HCl per L of sample.
10) Wash remaining 'dregs' into 30ml Nalgene bottle with Milli-Q.
11) Record volume of waste and any volumes different from those described above.

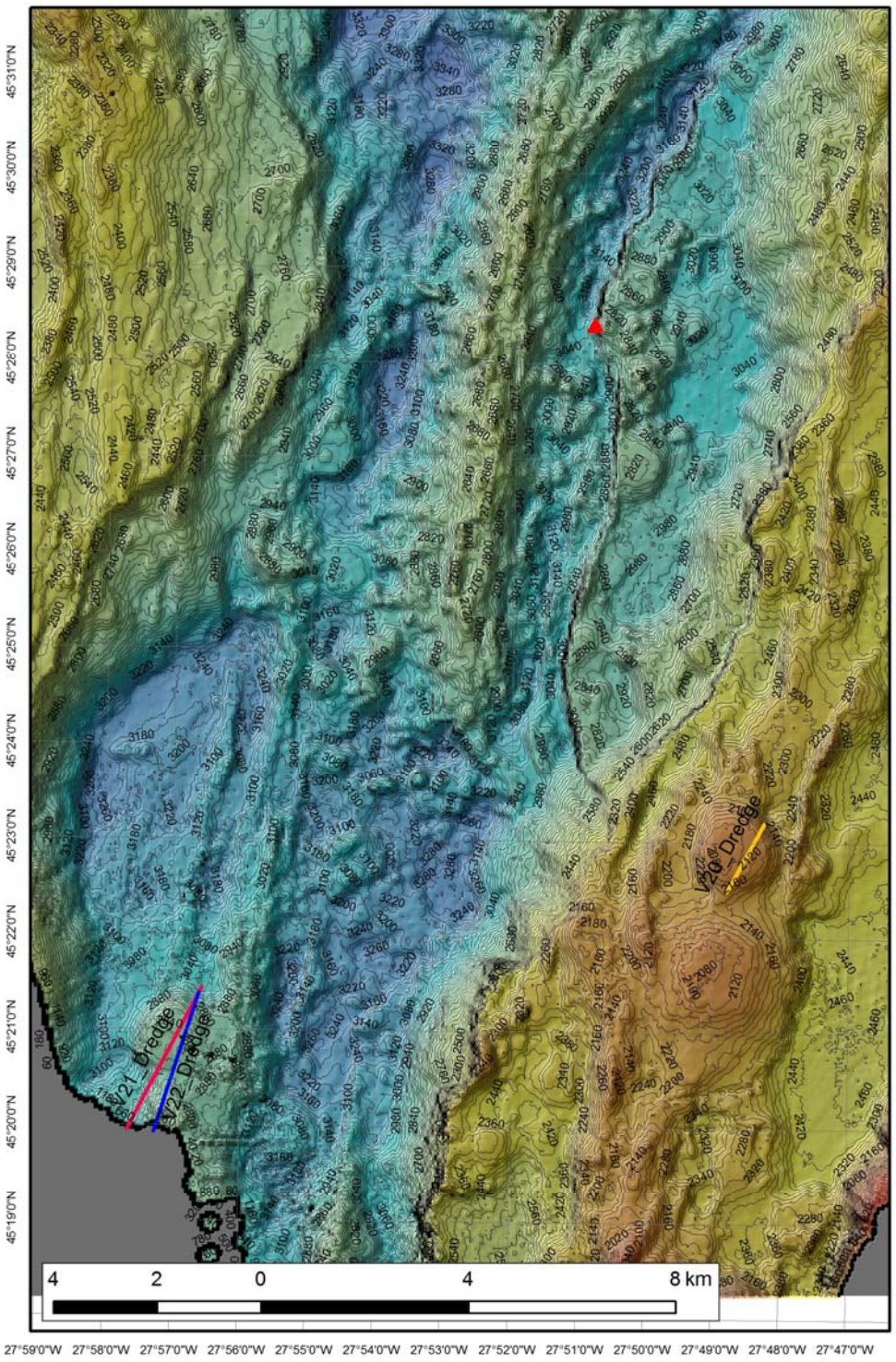
A5. Station Maps



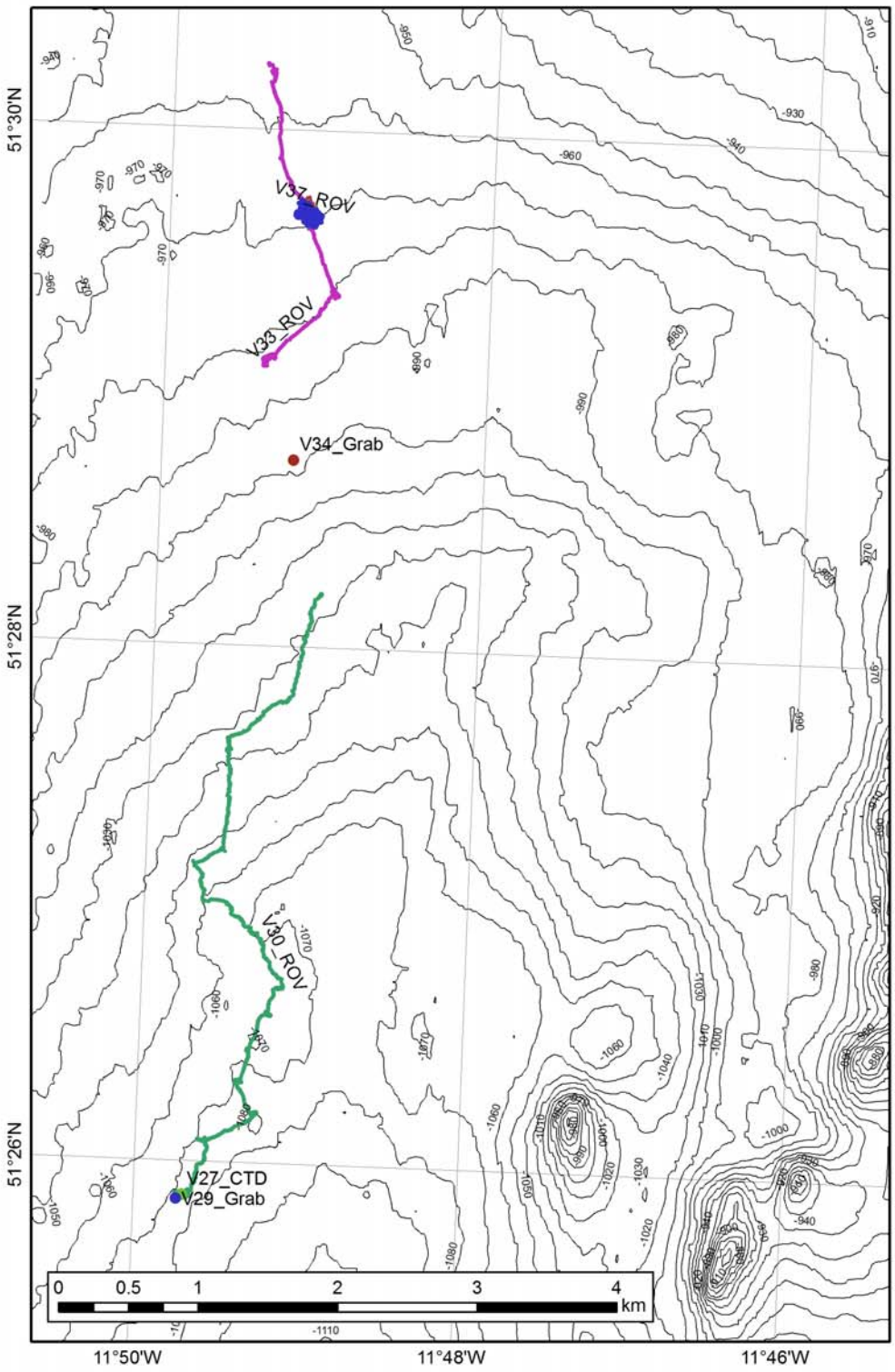
Moytirra: Map of CTD lines



Moytirra: ROV dive tracks



Mid-Atlantic Ridge Axial Valley Seamounts: Dredge transects



List of all stations in the Moira Mounds, Porcupine Seabight

A5. Master Station List

Cruise CE11009 VENTuRE Survey

					in				at bottom					out			Comments
Station No	Dive No	Equipment	Sample	Sub samples for who	Date	Time UTC	Ship_Lat	Ship_Lon	Time UTC	Ship_Lat	Ship_Lon	Water Depth	Cable out	Time UTC	Ship_Lat	Ship_Lon	
V1		CTD			20.07.2011	11.48	45 28.987	27 44.577	12.48	45 28.987	27 44.580	2605					Spike in Eh meter near bottom, recovery slowly
V1		CTD	001W	DG	20.07.2011				13.05	45 28.986	27 44.577						Bottle 1 & 2 @ 2498m wd
V1		CTD			20.07.2011				13.13	45 28.986	27 44.579						Bottle 3 & 4 @ 2200m wd
V1		CTD	002W	DG	20.07.2011				13.17	45 28.986	27 44.579						Bottle 5 & 6 @ 2004m wd
V1		CTD	003W	DG	20.07.2011				13.36	45 28.986	27 44.578						Bottle 7 - 14 @ 963m wd
V1		CTD			20.07.2011							2612		13.57	45 28.988	27 44.579	CTD on deck
V2		CTD Tow-yo			21.07.2011	00.24	45 29.177	27 51.120				3030		8.11	45 29.908	27 51.120	Casts 3-16
V3		CTD Tow-yo			21.07.2012	09.26	45 29.318	27 51.144				2360		16.55	45 28.148	27 50.946	Casts 17-34
V4		CTD Tow-yo			21.07.2013	17.33	45 28.479	27 50.747				2934		21.51	45 28.462	27 51.618	Casts 35-42
V5		CTD Tow-yo			21.07.2014	23.28	45 28.608	27 50.637				2856		22/07/2011 08.11	45 28.251	27 51.354	Casts 43-62: Bottle 1-2
V6		CTD Tow-yo	001W & 003W	DG	22.07.2011	09.01	45 28.162	27 50.711	?	45 28.526	27 50.832	2917					Bottle 1-3: 20-30m off bottom. 2 didn't fire. Start cast 63
V6		CTD Tow-yo	004W & 005W	DG	22.07.2012				12.21	45 28.542	27 50.835	2774					Bottle 4-5: 2675m wd
V6		CTD Tow-yo	006W	DG	22.07.2013				12.24	45 28.539	27 50.834	2781					Bottle 6-7: 2669m wd. 2 didn't fire
V6		CTD Tow-yo	008W	DG	22.07.2014				12.36	45 28.537	27 50.837	2784					Bottle 8: 2483m wd
V6		CTD Tow-yo	009W & 010W	DG	22.07.2015				16.04	45 28.929	27 50.969	2833					Bottle 9-10: 1796m wd. End 80.
V6		CTD Tow-yo			22.07.2016							2830		16.36	45 28.930	27 50.969	on surface

Sub-sample codes: B=Biobox A=Aspirator M=Microbio scoop R=Rock S=Sediment W=CTD Bottle F=Titanium Syringe

Cruise CE11009 VENTuRE Survey

					in				at bottom					out			Comments
Station No	Dive No	Equipment	Sample	Sub samples for who	Date	Time UTC	Ship_Lat	Ship_Lon	Time UTC	Ship_Lat	Ship_Lon	Water Depth	Cable out	Time UTC	Ship_Lat	Ship_Lon	
V7	92	ROV			22.07.2011	19.04	45 28.377	27 50.792	21.10			2852		23.07.2011 '00.05	45 28.4	27 50.8	Recon dive. Steep cliff. Pulled up due to technical problem. Dive aborted due to technical problem
V8		CTD tow-yo			23.07.2011	01.00	45 28.384	27 50.709				2800		04.15	45 28.3817	27 50.7986	Cast 81-86
V9	93	ROV			23.07.2011	05.05	45 28.355	27 50.418				0		05.18	45 28.360	27 50.415	Dive aborted due to sea surface conditions
V9	93	ROV			23.07.2011	06.36	45 28.351	27 50.416				0		06.48	45 28.349	27 50.411	Dive aborted due to sea surface conditions
V10		CTD tow-yo			23.07.2011	08.44	45 28.412	27 50.713				2800					Towed to nxt station. Cast 87-92
V11		CTD tow-yo			23.07.2011	12.17	45 28.435	27 50.706				2800		14.13	45 28.439	27 50.924	Towed to nxt station. Out time is EOL. Cast 93-99
V12		CTD tow-yo			23.07.2011	15.06	45 28.404	27 50.798				2800		18.16	45 28.446	27 50.862	On Deck. Cast 100-107
V13	94	ROV			23.07.2011	21.51	45 28.368	27 50.605	06.26			3040		22.39	45 28.338	27 50.641	Ships position for all ROV lat/long on this sheet. Escarpment hunting dive nr Moytirra
V14		CTD tow-yo			24.07.2011	10.00	45 28.479	27 50.814						11.45	45 28.482	27 50.779	Cast 108 and 109
V15		CTD tow-yo			24.07.2011	12.04	45 28.495	27 50.685				2800		14.25	45 28.495	27 50.690	Cast 110 and 111
V16	95	ROV	001B; 001-6R	Bioteam; B. Murton	24.07.2011	16.19	45 28.276	27 50.988	18.25			3040		25.07.2011 02.15	45 28.366	27 50.829	MOYTIRRA DISCOVERY DIVE
V17	96	ROV	001A; 001M; 001-016R	Bioteam; J.Benzie; B.Murton	25.07.2011	06.23	45 28.386	27 50.897				3040		19.57	45 28.386	27 50.449	Biosampling and video mosaicing
V18		CTD tow-yo			25.07.2011	23.00	45 28.245	27 50.836									Aborted
V19		CTD tow-yo	001W-017W	D.Green	25.07.2011	23.28	45 28.422	27 50.837						26.07.2011 08.17	45 28.422	27 49.072	Casts 113-134. 14 bottles fired
V20		Dredge	001-003R	B.Murton	26.07.2011	10.30	45 23.198	27 48.263	11.08	45 23.201	27 48.262	2300		11.54	45 22.491	27 48.812	

Sub-sample codes: B=Biobox A=Aspirator M=Microbio scoop R=Rock S=Sediment W=CTD Bottle F=Titanium Syringe

Cruise CE11009 VENTuRE Survey

					in				at bottom					out			Comments
Station No	Dive No	Equipment	Sample	Sub samples for who	Date	Time UTC	Ship_Lat	Ship_Lon	Time UTC	Ship_Lat	Ship_Lon	Water Depth	Cable out	Time UTC	Ship_Lat	Ship_Lon	
V21		Dredge	No recovery	B. Murton	26.07.2011	13.59	45 21.437	27 56.552	14.26	45 21.435	27 56.564	3037	2900	06.47	45 19.953	27 57.684	Water depth at EOL is 2840m
V22		Dredge	001R	B. Murton	26.07.2011	16.50	45 23.061	27 54.758	17.57	45 21.382	27 56.605	3113	2980	19.14	45 19.933	27 57.258	SOL at 2840m
V23	97	ROV	None		27.07.2011	07.33	45 28.662	27 50.964	09.47	45 28.521	27 50.851	2927		19.13	45 28.450	27 50.946	MBES & eH
V24	98	ROV	001M-013M & 001A	Bioteam, Geoteam; J.Benzie	28.07.2011	00.58	45 23.406	27 54.898	3.17	45 28.425	27 50.848	2933		18.25	45 28.383	27 50.857	Major sampling dive
V25	99	ROV	001B	Bioteam	29.07.2011	01.51	45 23.381	27 54.864	2.48			2939		07.28	45 28.411	27 50.909	Exploring Mag Mell and crab trap
V26	100	ROV	001-2F	D. Green	29.07.2011	09.16	45 23.413	27 54.906	0.45			2789.8		13:50	45° 28.3707	27° 50.8102	Vent fluid sampling
V27		CTD			01.08.2011	15.35	51 25.861	11 49.723	16.08	51 25.852	11 49.730	1064	1053	16.30	51 25.855	11 49.730	
V28		Grab			01.08.2011	17.00	51 25.876	11 49.657	17.22	51 25.878	11 49.657	1067		17.40	51 25.882	11 49.649	empty
V29		Grab	001-3S	Awheeler	01.08.2011	17.44	51 25.880	11 49.649	18.03	51 25.874	11 49.658	1067		18.24	51 25.874	11 49.657	Full
V30	101	ROV			01.08.2011	18.50	51 25.897	11 49.654	19.44	51 25.852	11 49.730	1100		03.53	51 28.164	11 49.101	Western Moira Mounds explored
V31		Grab			02.08.2011	04.07	51 28.168	11 48.609	4.27	51 28.166	11 49.007	1021		04.42	51 28.164	11 49.006	Empty
V32		Grab			02.08.2011	04.46	51 28.168	11 49.001	05.11	51 28.169	11 49.009	1021		05.33	51 28.164	11 49.005	Didn't trigger
V33	102	ROV			02.08.2011	06.14	51 29.083	11 49.361	06.58	51 29.087	11 49.361	978		13.50	51 30.565	11 49.525	Western Moira Mounds explored further to north inc. best reef
V34		Grab	001B; 001-3S	J.Benzie; A. Wheeler	02.08.2011	14.27	51 29.7218	11 49.175	14.46	51 29.7218	11 49.176	963.4		14.55	51 29.723	11 49.174	100m NW of Dive 103

Sub-sample codes: B=Biobox A=Aspirator M=Microbio scoop R=Rock S=Sediment W=CTD Bottle F=Titanium Syringe

Cruise CE11009 VENTuRE Survey

					in				at bottom					out			Comments
Station No	Dive No	Equipment	Sample	Sub samples for who	Date	Time UTC	Ship_Lat	Ship_Lon	Time UTC	Ship_Lat	Ship_Lon	Water Depth	Cable out	Time UTC	Ship_Lat	Ship_Lon	
V35	103	ROV			02.08.2011	15.13	51 29.677	11 49.141	16.16	51 29.676	11 49.142	999		17.21	51 29.677	11 49.148	wd 965m on day screen. Dive aborted 16.34
V36	104	ROV			02.08.2011	19.19	51 29.675	11 49.144	20.32	51 29.672	11 49.142	987		05.14	51 29.687	11 49.113	wd 964m on dive screen
V37	105	ROV			03.08.2011	06.04	51 29.695	11 49.116				990		11.35	51 29.695	11 49.135	Multibeam

Sub-sample codes: B=Biobox A=Aspirator M=Microbio scoop R=Rock S=Sediment W=CTD Bottle F=Titanium Syringe

CTD Tow-Yo Log

Overall Deployment

Station #: V2

	Date	Time (GMT)	Ship's latitude (N)	Ship's longitude (W)
CTD in water	21.07.11	00.24	45° 29.1771'N	27° 51.1202'W
CTD on deck	21.07.11	08.11	45° 29.9084'N	27° 51.2264'W

NB – CTD not recovered on deck but towed to next station V3

Tow-Yos

Cast (up / down)	Cast #	Start time	Ship's latitude (N)	Ship's longitude (W)	CTD USBL offset	Min Eh @ depth?	Min altitude (m)	Comments
Down	3	00.24	45° 29.177'N	27° 51.120'W	18m	2.767@c.2530m	20	
Up	4	01.44	45° 29.176'N	27° 51.122'W	5m	2.781@2400m	-	
Down	5	02.20	45° 29.300'N	27° 51.135'W	75m		26	
Up	6	02.47	45° 29.300'N	27° 51.139'W	45m		26	
Down	7	03.18	45° 29.389'N	27° 51.153'W	65m		-	
Up	8	03.48	45° 29.387'N	27° 51.150'W	40m		20	
Down	9	04.28	45° 29.511'N	27° 51.168'W	50m		2	Alt. unreliable
Up	10	04.53	45° 29.511'N	27° 51.172'W	45m			
Down	11	05.24	45° 29.598'N	27° 51.183'W	50m			
Cast (up / down)	Cast #	Start time	Ship's latitude (N)	Ship's longitude (W)	CTD USBL offset	Min Eh @ depth?	Min altitude (m)	Comments
Up	12	05.51	45° 29.602'N	27° 51.188'W	35m			
Down	13	06.24	45° 29.701'N	27° 51.199'W	50m			
Up	14	06.53	45° 29.701'N	27° 51.205'W	20m			
Down	15	07.25	45° 29.799'N	27° 51.210'W	50m			
Up	16	07.44	45° 29.802'N	27° 51.212'W	10m			EOL

Overall Deployment

Station #: V3

	Date	**Time (GMT)**	**Ship's latitude (N)**	**Ship's longitude (W)**
CTD in water	21/07/11	09:26	45 29.3121	27 51.1433
CTD on deck	21/07/11	16:55	45 28.1475	27 50.9460

(CTD left in water at end of V2; then repositioned to start V3 tow-yo line – not actually recovered to deck in between)

Tow-Yos

Cast (up / down)	Cast #	Start time	Ship's latitude (N; all **45 deg**)	Ship's longitude (W; **all 27 deg**)	CTD USBL offset m	Min Eh @ depth?	Min altitude (m)	Comments
Down	17	09:26	29.3121	51.1433	200			Reoccupation of profile 4 from V2; started profile with CTD 200 m layback, then stopped until instrument swung under ship
Up	18	10:13	29.2988	51.1425	10	2425 m		
Down	19	10:45	29.1801	51.1269	50			Reoccupation of profile 3 from V2

Cast (up / down)	Cast #	Start time	Ship's latitude (N; all **45 deg**)	Ship's longitude (W; **all 27 deg**)	CTD USBL offset m	Min Eh @ depth?	Min altitude (m)	Comments
Up	20	11:07	29.1836?	51.1269	7	2450		?lat query: recorded
Down	21	11:39	29.0848	51.1040		2450		
Up	22	11:52	29.0813	51.1017		2450		
Down	23	12:07	29.0199	51.0942	150?	2500		"Continuous" tow-yoing from now on
Up	24	12:22	28.9581	51.0878	150?	2475		
Down	25	12:37	28.8975	51.0805	150?	2550		
Up	26	12:51	28.8406	51.0757	150?	2450		
Down	27	13:06	28.8052	51.0651	150?	2550		
Up	28	13:24	28.7289	51.0473	150?	2425		
Down	29	13:41	28.6594	51.0290	150?	2625		Temp range changed to 3-4 deg
Up	30	14:05	28.5629	51.0067	150	2500		Layback 150m at large Eh signal
Down	31	14:25	28.4779	50.9918	150?	2650		Salinity range changed
Up	32	14:51	28.3730	50.9766	150?	2600		
Down	33	15:11	28.2906	50.9655	150?			
Up	34	15:45	28.1475	50.9460	150?			

Overall Deployment

Station #: V4

	Date	**Time (GMT)**	**Ship's latitude (N)**	**Ship's longitude (W)**
CTD in water	21/07/11	17:32	45 28.4794	27 50.7467
CTD on deck	21/07/11	21:51	45 28.4622	27 51.6161

Tow-Yos

Cast (up / down)	Cast #	Start time	Ship's latitude (N; **all 45 deg**)	Ship's longitude (W; **all 27 deg**)	CTD USBL offset **m**	Min Eh @ depth?	Min altitude (m)	Comments
Down	35	17:32	28.4894	50.7473	180 E	2490 m		Eh scale changed for large signal
Up	36	18:40	28.4744	50.7530	180 E	2475		
Down	37	18:58	28.4729	50.8574	180 E	2600?		Paused at 2600 for winch problem. Led to false upping giving a messy profile
Up	38	19:35	28.4721	51.0603	180 E	2425	30 m	Eh scale change
Down	39	19:50	28.4718	51.1499	180 E	2550		
Up	40	20:11	28.4698	51.2756	175	2575		
Down	41	20:30	28.4672	51.3868	175 E	2600	20 m	

Cast (up / down)	Cast #	Start time	Ship's latitude (N; **all 45 deg**)	Ship's longitude (W; **all 27 deg**)	CTD USBL offset **m**	Min Eh @ depth?	Min altitude (m)	Comments
Up	42	20:55	28.4660	51.5371	175 E	2525		Profile 42B is to surface

Overall Deployment

Station #: V5

	Date	Time (GMT)	Ship's latitude (N)	Ship's longitude (W)
CTD in water	21/07/11	23:28	45 28.6076	27 50.6365
CTD on deck	22/07/11	08:10	45 28.2516	27 51.3536

Tow-Yos

Cast (up / down)	Cast #	Start time	Ship's latitude (N; all 45 deg)	Ship's longitude (W; all 27 deg W)	CTD USBL offset	Min Eh @ depth?	Min altitude (m)	Comments
Down	43	23:28	28.6076	50.6365	0	2.777		Water depth 2856 m
Up	44	00:39	28.6045	50.6369	0	2.757		
Down	45	00:56	28.5759	50.7111	70	2.77		
Up	46	01:13	28.5812	50.7079	5	2.761		
Down	47	01:37	28.5469	50.7893	50	2.704		
Up	48	01:59	28.5500	50.7885	20			Bottles 1+2 fired @2560 m; bottle 2 misfired
Down	49	02:17	28.5175	50.8759	0			
Up	50	02:40	28.5194	50.8692	25			
Down	51	02:57	28.4874	50.9495	0			Water depth 2999 m
Up	52	03:17	28.4878	50.9432	25			
Down	53	03:53	28.4538	51.0242	20			
Up	54	04:11	28.4603	51.0206	15			

Cast (up / down)	Cast #	Start time	Ship's latitude (N; all 45 deg)	Ship's longitude (W; all 27 deg W)	CTD USBL offset	Min Eh @ depth?	Min altitude (m)	Comments
Down	55	04:32	28.4378	51.0752	50			
Up	56	04:52	28.4348	51.0788	25			
Down	57	05:21	28.3863	51.1551	50			
Up	58	05:44	28.3825	51.1614	25			
Down	59	06:15	28.3348	51.2308	50			
Up	60	06:32	28.3401	51.2257	25			
Down	61	07:00	28.2932	51.2897	50			
Up	62	07:14	28.2948	51.2976	40			Profile 62B is to surface

Overall Deployment

Station #: V6

	Date	Time (GMT)	Ship's latitude (N)	Ship's longitude (W)
CTD in water	22/07/11	09:01	45 28.1620	27 50.7111
CTD on deck	22/07/11	16.36	45 28.9303	27 50.9680

Tow-Yos

Cast (up / down)	Cast #	Start time	Ship's latitude (N; all 45 deg)	Ship's longitude (W; all 27 deg)	CTD USBL offset	Min Eh @ depth?	Min altitude (m)	Comments
Down	63	09:01	28.1616	50.7107	0		~75 m	Start; water depth 2917 m
Up	64	10:20	28.1593	50.7143	25 m NE			
Down	65	10:38	28.2150	50.7271	60 m SSE			
Up	66	10:57	28.2124	50.7267	50 m E			
Down	67	11:15	28.2825	50.7511	120 m SE		50	2774m
Up	68	11:34	28.3585	50.7769	120se			2771m
Down	69	11:51	28.4241	50.7998	120se	2750	10m	2774m large signal at 45 48.28.50 N 2774 27 50.8249 W layback 150 sse
Up	70	12.12	28.5122	50.8282	150sse	2750	10m	Bottles fired in plume
Down	71	12.46	28.5038	50.8259	40nne	2725	20m	Water depth 2784
UP	72	13.06	28.4363	50.8060	100n	2750		

Cast (up / down)	Cast #	Start time	Ship's latitude (N; all 45 deg)	Ship's longitude (W; all 27 deg)	CTD USBL offset	Min Eh @ depth?	Min altitude (m)	Comments
Down	73	13.24	28.5049	50.8266	20mS	2750	14	2774
Up	74	13.46	28.5877	50.8501	110sw	2500		2780
Down	75	14.01	28.6449	50.8718	120se	2550	50	2806
Up	76	14.19	28.7201	50.8966	150se	2500		2845
Down	77	14.35	28.7853	50.9176	170 se	2590	80	2851
Up	78	14.52	28.8513	50.9401	170se	2500		2845
Down	79	15:15	28.9295	50.9626		2500	10m	2834
Up	80	15.34	28.9307	50.9626	50 se	2500		2835 up to surface- last bottles fired 1500

Overall Deployment

Station #: V8

	Date	Time (GMT)	Ship's latitude (N)	Ship's longitude (W)
CTD in water	23/07/11	01:03	45 deg 28.3855' N	27 deg 50.7124' W
CTD on deck	23/07/11	04:14	45 deg 28.3817' N	27 deg 50.7984' W

Tow-Yos

Cast (up / down)	Cast #	Start time	Ship's latitude (N; all 45 deg)	Ship's longitude (W; all 27 deg)	CTD USBL offset	Min Eh @ depth?	Min altitude (m)	Comments
Down	81	01:03	28.3855	50.7124	0		20 m	Rope and weight system replacing altimeter
Up	82	02:08	28.3813	50.7088	0			Towing while hauling to altitude 100 m and moving ship W at 0.25 kn
Down	83	02:23	28.3878	50.7528	10 m		20 m	
Up	84	02:46	28.3855	50.7567	2 m			
Down	85	03:10	28.3802	50.7952	20 m			
Up	86	03:25	28.3802	50.7961	25 m			Profile to surface

Overall Deployment

Station #: V10

	Date	Time (GMT)	Ship's latitude (N)	Ship's longitude (W)
CTD in water	23.07.2011	08.44	45deg 28.4115	-27deg 50.713
CTD on deck	23.07.2011	11.49	Towed to nxt station	Towed to nxt station

Tow-Yos

Cast (up / down)	Cast #	Start time	Ship's latitude (N; all 45 deg)	Ship's longitude (W; all 27 deg)	CTD USBL offset	Min Eh @ depth?	Min altitude (m)	Comments
Down	87	08.44	28.4115	50.7130	0			
Up	88	10.00	28.4103	50.7189	25m			
Down	89	10.21	28.4115	50.7715	20m			
Up	90	11.04	28.4100	50.7719	25m			
Down	91	11.37	28.4119	50.8099	35m			
Up	92	11.49	28.4119	50.8114				Towed to nxt station

Overall Deployment

Station #: V11

	Date	Time (GMT)	Ship's latitude (N)	Ship's longitude (W)
CTD in water	23/07/11	12:17	45 28.4351	27 50.7061
CTD on deck	23/07/11	14.39	45 28.4393	27 50.9241

Tow-Yos

Cast (up / down)	Cast #	Start time	Ship's latitude (N; all 45 deg)	Ship's longitude (W; all 27 deg)	CTD USBL offset	Min Eh @ depth?	Min altitude (m)	Comments
Down	93	12.17	28.4351	50.7061	23 W		20	2775
UP	94	12.36	28.4363	50.8110	175E			2775
Down	95	12.48	28.4389	50.8457	75E	2850	20	2780. 50m west behind CTD at 2887m
Down again	96	13.15	28.4355	50.8562	50 NE(080)	2875	20	CTD moved 30m W near bottom. Bottom stopped at 2919 when alarm sounded
Up	97	13.23	28.4405	50.8850	75 NE (080)	2850		
Down	98	13.39	28.4370	50.9119	75 E		20	

Cast (up / down)	Cast #	Start time	Ship's latitude (N; all 45 deg)	Ship's longitude (W; all 27 deg)	CTD USBL offset	Min Eh @ depth?	Min altitude (m)	Comments
Up	99	14.10	28.4393	50.9224				Towed to nxt station

Overall Deployment

Station #: V12

	Date	Time (GMT)	Ship's latitude (N)	Ship's longitude (W)
CTD in water	23-7-11	15:06	45 28.4039	27 50.7982
CTD on deck	23-7-11	18.16	45 28.4462	27 50.8619

Tow-Yos

Cast (up / down)	Cast #	Start time	Ship's latitude (N; all 45 deg)	Ship's longitude (W; all 27 deg)	CTD USBL offset	Min Eh @ depth?	Min altitude (m)	Comments
Down	100	15:06	28.4039	50.7982	40 NW		20m	2804m. End offset 40NE
Up	101	15:49	28.4019	50.7975	30 E			
Down	102	15:59	28.4168	50.8141	60NE		20m	2838m. End offset 10E
Up	103	16:17	28.4248	50.8272	40E			
Down	104	16:27	28.4344	50.8463	50E		20m	2861m. End offset 30E
Up	105	16:47	28.4336	50.8451	50NE			
Down	106	16:58	28.4435	50.8602	50E		20m	2950m. End offset 40NE
Up	107	17:25	28.4420	50.8615	50NE			

Overall Deployment

Station #: V14

	Date	Time (GMT)	Ship's latitude (N)	Ship's longitude (W)
CTD in water	24-07-2011	10:00	45° 28.4790	50° 50.8135
CTD on deck	24/07/11	11.45	45 28.4821	27 50.7788

Tow-Yos

Cast (up / down)	Cast #	Start time	Ship's latitude (N; all 45 deg)	Ship's longitude (W; all 27 deg)	CTD USBL offset	Min Eh @ depth?	Min altitude (m)	Comments
Down	108	10:00	28.4790	50.8135	0 m			
Up	109	10:53	28.4782	50.8144				

Overall Deployment

Station #: V15

	Date	Time (GMT)	Ship's latitude (N)	Ship's longitude (W)
CTD in water	24-7-11	12.04	45 28.4950	27 50.6845
CTD on deck	24-7-11	14.24	45 28.4950	27 50.6903

Tow-Yos

Cast (up / down)	Cast #	Start time	Ship's latitude (N; all 45 deg)	Ship's longitude (W; all 27 deg)	CTD USBL offset	Min Eh @ depth?	Min altitude (m)	Comments
Down	110	12.04	28.4950	50.6845	0		20 M	
Up	111	13.34	28.4916	50.6910	0			

Overall Deployment

Station #: v18

	Date	Time (GMT)	Ship's latitude (N)	Ship's longitude (W)
CTD in water	25/07/11	23:00	45° 28.4245	27° 50.8354
CTD on deck	25/07/11	23:00	45° 28.4245	27° 50.8354

CTD ABORTED

Tow-Yos

Cast (up / down)	Cast #	Start time	Ship's latitude (N; all 45 deg)	Ship's longitude (W; all 27 deg)	CTD USBL offset	Min Eh @ depth?	Min altitude (m)	Comments
Down	112	23:00	28.4233	50.8366	0m			Stopped at 190m (23:06) and recovered due to eH sensor problems

Overall Deployment

Station #: V19

	Date	Time (GMT)	Ship's latitude (N)	Ship's longitude (W)
CTD in water	25-07-2011	23:28	45° 28.4218	27° 50.8368
CTD on deck				

Tow-Yos

Cast (up / down)	Cast #	Start time	Ship's latitude (N; all 45 deg)	Ship's longitude (W; all 27 deg)	CTD USBL offset	Min Eh @ depth?	Min altitude (m)	Comments
Down	113	23:29	28.4222	50.8400	0m			
Up	114	00:53	28.4214	50.8369	35m			Bottles 1,3,4 & 6 fired @2891, 2890, 2875 & 2770m
Down	115	01:20	28.4630	50.8183	20m SW			
Up	116	01:46	28.4507	50.8236	15m NW			Bottle 7 fired @ 2690m
Down	117	02:18	28.5038	50.7986	20m SW			
Up	118	02.41	28.5023	50.7971	15m NE			
Down	119	02:58	28.6255	50.7336	150m SW			
Up	120	03:14	28.6987	50.6964	175m SW			Bottle 8 fired @ 2601m
Down	121	03:28	28.7647	50.6603	130m SW			
Up	122	03:42	28.8303	50.6304	150m SW			Bottle 9 fired @ 2544m

Cast (up / down)	Cast #	Start time	Ship's latitude (N; all 45 deg)	Ship's longitude (W; all 27 deg)	CTD USBL offset	Min Eh @ depth?	Min altitude (m)	Comments
Down	123	03:56	28.8990	50.5957	150m SW			
Up	124	04:11	28.9661	50.5636	175m SW			Bottle 10 & 11 fired @ 2768 & 2529m
Down	125	04:26	29.0409	50.5285	150m SSW			
Up	126	04:39	29.0989	50.4997	150m SSW			Bottle 12 fired @ 2564 m
Down	127	04:53	29.1691	50.4648	150m SSW			
Up	128	05:07	29.2259	50.4353	175m SSW			Bottle 13 & 14 fired @2538 & 1436 m
Down	129	05:37	29.2973	50.3986	20m SSW			
Up	130	06:08	29.2988	50.4000	50m NE			Bottle 15 fired @ 2549m
Down	131	06:23	29.3800	50.2825	125m SW			
Up	132	06:37	29.4601	50.1692	210m SW			
Down	133	06:51	29.5441	50.0484	220m SW			
Up	134	07:05	29.6021	49.9731	210m SW			Bottle 16 & 17 fired @ 2580 & 1487m

CTD Water Column Samples

Station #	Bottle #	Sample Depth (m)	Dissolved gases sub-sample	Dissolved metals sub-sample	Scientist
V1	1	2498	Yes	Yes	Darryl Green, NOC
V1	3	2200	Yes	Yes	Darryl Green, NOC
V1	5	2004	Yes	Yes	Darryl Green, NOC
V1	10	963	Yes	Yes	Darryl Green, NOC
V5	1	2560	Yes	Yes	Darryl Green, NOC
V6	1	2892	Yes	Yes	Darryl Green, NOC
V6	3	2892	Yes	Yes	Darryl Green, NOC
V6	4	2675	Yes	Yes	Darryl Green, NOC
V6	5	2675	Yes	Yes	Darryl Green, NOC
V6	6	2669	Yes	Yes	Darryl Green, NOC
V6	8	2483	Yes	Yes	Darryl Green, NOC
V6	9	1496	Yes	Yes	Darryl Green, NOC
V6	10	1496	Yes	Yes	Darryl Green, NOC
V19	1	2891	Yes	Yes	Darryl Green, NOC
V19	3	2890	Yes	Yes	Darryl Green, NOC
V19	4	2875	Yes	Yes	Darryl Green, NOC
V19	6	2770	Yes	Yes	Darryl Green, NOC
V19	7	2690	Yes	Yes	Darryl Green, NOC
V19	8	2601	Yes	Yes	Darryl Green, NOC
V19	9	2544	Yes	Yes	Darryl Green, NOC
V19	10	2768	Yes	Yes	Darryl Green, NOC
V19	11	2529	Yes	Yes	Darryl Green, NOC

V19	12	2564	Yes	Yes	Darryl Green, NOC
Station #	**Bottle #**	**Sample Depth (m)**	**Dissolved gases sub-sample**	**Dissolved metals sub-sample**	**Scientist**
V19	13	2538	Yes	Yes	Darryl Green, NOC
V19	14	1436	Yes	Yes	Darryl Green, NOC
V19	15	2549	Yes	Yes	Darryl Green, NOC
V19	16	2580	Yes	Yes	Darryl Green, NOC
V19	17	1487	Yes	Yes	Darryl Green, NOC

ROV TECHNICAL LOG

Cruise: **CE11009** **VENTuRE Survey**

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DVD RECORDER 3A = AFT MASTER
DVD RECORDER 3B = AFT COPY

Station No.: **V7**

Dive No.: **092**

Date	Time UTC	ROV Eastings	ROV Northings	Water Depth m	Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom
22.07.2011	21.10	433852.8	5035925.8	2762.3	At bottom (Depth in ship time)
22.07.2011	21.10	433852.8	5035925.8	2762.3	DVD Start (depth in ship time)
22.07.2011	21.12	43382.5	5035899.2	2762.1	Laser on(depth in ship time)
22.07.2011	21.12	43382.5	5035899.2	2762.1	start HD (depth in ship time)
22.07.2011	21.16	433832.5	5035899.2	2841	Real depth on ROV
22.07.2011	21.32	NA	NA	2802	we're holding position to sort out navigation issues
22.07.2011	21.49	NA	NA	2760	Lost oil pressure. Begin to come up higher to a lesser depth
22.07.2011	21.54	NA	NA	2682	Begin ascent to surface due to loss of oil pressure.
22.07.2011	23.00	NA	NA	1025	End of DVD

VENTuRE Survey (Vents & Reefs): CE11009 - 11th July – 4th Aug 2011. UCC/NOC/Uni.S/NUIG/GSI

ROV TECHNICAL LOG

Cruise: **CE11009** **VENTuRE Survey**

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DVD RECORDER 3A = AFT MASTER
DVD RECORDER 3B = AFT COPY

Station No.: **V9**

Dive No.: **093**

Date	Time UTC	ROV Eastings	ROV Northings	Water Depth m	Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom
					Aborted

ROV TECHNICAL LOG

Cruise: **CE11009** **VENTuRE Survey**

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DVD RECORDER 2B = DOWNWARD LOOKING COPY
DVD RECORDER 3A = AFT MASTER

Station No.: **V13**

Dive No.: **094**

Date	Time UTC	ROV Eastings	ROV Northings	Water Depth m	Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom
23.07.11	20.47				Start of dive. ROV in water.
23.07.11	22.37	434065.9	5035801	2782	Reached Bottom, lazers on
23.07.11	22.39	434061.9	5035819.9	2767	Dvd's recording
23.07.11	23.26	433929.1	5035920.9	2777	Decision made to move ROV to the end of the line and work backwards from there
24.07.11	00.19				Nat Geo moment
24.07.11	00.28				Science shift change; new observers Boris and Jon
24.07.11	00.31				DVDs stopped for change
24.07.11	00.37				All new media recording, and countdown timer reset
24.07.11	00.51	433792	5035985	2919	Starting traverse line to right (traverse direction ~S, ROV view heading ~100) at this depth
24.07.11	01.02	433799	5035969	2915	Bringing ROV up to avoid obstruction during traverse
24.07.11	01.12				Nat Geo moment - wide angle view of microbial mats "glowing" along the wal
24.07.11	01.16				Nat Geo - microbial mat shots on HD
24.07.11	01.34	433789	5035864	2900	End of traverse line; raised ROV 10 m to begin traverse back to L (direction N, while ROV view is ~090)
24.07.11	01.42	4333802	5035919	2899	Pausing traverse; raising ROV up gulley to find source of sulfide rubble
24.07.11	01.49			2876	Still climbing up sulfide rubble
24.07.11	01.58	433823	5035927	2850	Starting traverse to R at this depth
24.07.11	02.04	433823	5045900	2845	Raised ROV 5 m; starting traverse back to L (direction ~N, ROV view is ~E)
24.07.11	02.24	433835	5035927	2845	End of traverse line, on corner of wall; raising ROV 10 m to start traverse line back to left
24.07.11	02.25				Holding position; DVDs stopped for media change
24.07.11	02.28				HD recording stopped
24.07.11	02.31				New HD brick recording
24.07.11	02.33				DVDs recording
24.07.11	02.33				Turned right starting next transect
24.07.11	03.06				ROV crew handover
24.07.11	03.06				Heading up 10m and then tur roughly to the North and follow the wall in a Northernly direction

Date	Time UTC	ROV Eastings	ROV Northings	Water Depth m	Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom
24.07.11	03.12				Moved N about 40m looking out over the abyss
24.07.11	03.24				Keeping wall in visual an and moving N
24.07.11	03.35				Flying to 433794.192 & 5036087.447
24.07.11	03.56				Arrive 433794.192 & 5036087.447 going for visual at 300(
24.07.11	03.58				Facing slope (roughly East) heading South at 3000m m depth
24.07.11	04.22				Holding position; DVDs stopped for media change
24.07.11	04.22				HD recording stopped
24.07.11	04.26	433835.4	5035935.5	2858.7	New HD brick recording
24.07.11	04.26				DVDs recording
24.07.11	04.27	433835.4	5035935.5		Dive aborted, oil pressure drop
24.07.11	04.31				HD recording stopped

ROV TECHNICAL LOG

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DVD RECORDER 3A = AFT MASTER

Station No.: **V16**

Dive No.: **095**

Date	Time UTC	ROV Eastings	ROV Northings	Water Depth m	Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom
24.07.2011	18.11	433567	5035672	2804	at 2800 m , ctd switched on,
24.07.2011	18.27	433607	5035663	2805	starting survey, Start of line AB
24.07.2011	18.40	433729	50356659	2797	CTD logging stopped and restarted. New file saved as AB2
24.07.2011	19.11	434102	5035659	2815	End of line AB, Start of line BC
24.07.2011	19.16	434025	5035716	2821	End of line BC Start of line CD
24.07.2011	19.23	434100	5035704	2810	CTD log stopped, CTD switched off and sotware restarted due to error with EH meter
24.07.2011	19.28	434055	5035724	2797	restart line CD
24.07.2011	19.35	434088	5035721	2810	CTD stoopped due to a failure in the EH , visuals switched on
24.07.2011	19.42	434059	5035721	2935	ROV at bottom, start visual survey
24.07.2011	19.47	434039	5035718	2936	DVDs and HD recording switched on
24.07.2011	19.49	434022.7	5035732.5	2937.2	problem with DVD copy 3 new DVD requested
24.07.2011	19.51	434030	5035717	2938	Visual Survey started moving north along sea floor
24.07.2011	19.51	434030	5035717	2938	DVD 3b is 3' 40 sec behind the others but is now recording
24.07.2011	20.14	433912	5035818	2875	blue water hop to WP1 At 3000 m
24.07.2011	20.44	433678	503595	2971	CTD switched on for temperature logging, saved as dive 95 continuous
24.07.2011		433747	5035939		start heading E, going up towards slope,
24.07.2011	20.56	433754	5035933		WP 23 reached
24.07.2011	21.17	433799	5035941	2910	on bottom
24.07.2011	21.18	433784	5035928	2909	wp25
24.07.2011	21.30	433778	5035917	2939	WP 26
24.07.2011		433767.4	5035916	2939	Crew change, lazers off
24.07.2011	21.35				Downward camera lost power
24.07.2011	21.37	433765.8	503592.1	2939.9	Change in DVD's
24.07.2011	21.37	433765.8	503592.1		Nat Geo moment
24.07.2011	21.41	433765.8	503592.1		Recording DVDs and HD

Date	Time UTC	ROV Eastings	ROV Northings	Water Depth m	Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom
24.07.2011	21.44				Starting another CTD, Continuous 2
24.07.2011	21.46	433790.9	50935935.3	2940	Downward camera coming back in
24.07.2011	21.55	433790.9	50935935.3	2946	Nat geo moment
24.07.2011	22.08	433772.8	5035929.2	2945.5	Lazers on
24.07.2011	22.14	433768.2	5035917	2942.1	lasers off
24.07.2011	22.19	433768.2	5035917		Nat Geo moment
24.07.2011	22.20	433768.2	5035917	2943	lasers on
24.07.2011	22.22	433768.2	5035917	2944	close up on beehive, lasers on, and stills taken
24.07.2011	22.31	433768.2	5035917	2947.2	stills taken
24.07.2011	22.32	433768.2	5035917	2943.5	lasers switched off
24.07.2011	22.38				attempt to grab a sample
24.07.2011	22.45			2944	minipulator arm out
24.07.2011	00.00	433769.3	5035916.2	2946	sample of chimney taken into draw
24.07.2011	23.02	433775.3	5035941.8	2946	suphide samples
24.07.2011	23.07	433775.3	5035941.8	2946	HD Lazers on
24.07.2011	23.11	433775.3	5035941.8		lazers off
24.07.2011	23.12	433775.3	5035941.8	2946	nat geo: fab footage
24.07.2011	23.14	433775.3	5035941.8	2943	stills
24.07.2011	23.14	433775.3	5035941.8	2943	Starting a new CTD: Continuous 3
24.07.2011	23.21	433769.6	5035882	2938	Other chimneys. 10m Altitude
24.07.2011	23.27	433765.1	5035883.3	2935	nat geo +stills
24.07.2011	23.25	433764.6	5035882	2941	Media change
24.07.2011	23.33	433765	5035882	2941	Recording started
24.07.2011	23.48	433765.6	5035882	2933	Way point 27
25.07.2011	00.08	433760.5	503757.5	2935	Off bottom

ROV TECHNICAL LOG

Cruise: **CE11009** **VENTuRE Survey**

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DVD RECORDER 3A = AFT MASTER

Station No.: **V17**

Dive No.: **096**

Date	Time UTC	ROV Eastings	ROV Northings	Water Depth m	Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom
25.07.2011	08.09	433658	5035932		laser on
25.07.2011	08.22	433741	5035952		start recording DVD
25.07.2011	08.24	433728	5035936		start recording HD
25.07.2011	08.30				first visual of chimney
25.07.2011	08.34	433768	5035944	2968	chimney 10 m to the east ROV @20 m altitude
25.07.2011	08.45	433758	5035948	2966	strong smoke around ROV @ 22 m alt
25.07.2011	08.49	433760	5035949		strong smoke around ROV @ 3019 m alt out of reach
25.07.2011	09.16	433745	5035967		WP 28 northern limit of search, ROV @ 3031 alt out of reach
25.07.2011	09.17	433745	5035967	2971	7.5 m west of the wall. ROV @ 25 m
25.07.2011	09.30	4337745	5035967	2956	ROV @ 17 m alt. in front of smoke
25.07.2011	09.34	433752.7	5035951.1	2928	smoke in water
25.07.2011	09.43	433780.6	5035916.2	2930	WP 29 strong smoke in the water
25.07.2011	09.45	433765	5035919	2933	smoker (WP28)
25.07.2011	09.46				laser off
25.07.2011	09.56				laser on
25.07.2011	10.08	433757	503922	2956	media change stop DVD + HD
25.07.2011	10.12	433783	5036928	2944	Started recording again
25.07.2011	10.12				Began video mosaicing
25.07.2011	10.02	433774	503926.1	2944	Began second video mosaic
25.07.2011	10.25	433788	5035920.6	2938	End of second mosaic
25.07.2011	10.27	43377.3	5035921	2943	Began third mosaic
25.07.2011	10.32	433758.8	5035922.6	2936	End of third mosaic
25.07.2011	10.37	433772.8	5035890.9	2945	Began fourth mosiac
25.07.2011	10.39	433778.8	5035907.1	2935	End of fourth mosaic
25.07.2011	10.41	433786.2	5035901.5	2941	Start of fifth mosaic

Date	Time UTC	ROV Eastings	ROV Northings	Water Depth m	Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom
25.07.2011	10.43	433751.8	5035961.4	2946	End of fifth mosaic
25.07.2011	10.44	433758.8	5035906.2	2942	Start of fith mosaic
25.07.2011	10.47	433804.1	5035905	2938	End of fifth mosaic
25.07.2011	11.14	433783	5035930	2948	At chimney for sampling
25.07.2011	11.23	433758.1	5035921.7	2939	Slurper deployed
25.07.2011	12.00	433730.2	5035930.3	2938	DVD Master 1 and 3b copy failed
25.07.2011	12.00	433730.2	5035930.3	2940	DVD'S Start
25.07.2011	12.01	433730.2	5035930.3	2940	HD Started
25.07.2011	12.02	433779.6	5035942.5	2938	DVD 1 master and 3b copy started(a lag of 3 min and 5 sec)
25.07.2011	12.16	433758.2	5035928	2941	Still deploying slurper
25.07.2011	12.33	433748.3	5035904	2952	Slurper now in operation
25.07.2011	12.46	433765.2	5035907.7	2952	Still taken
25.07.2011	12.47	433765.2	5035907.7	2944	Attempt at Slurp, Not sure if any samples came through
25.07.2011	12.49	433754.2	5035913.4	2941	A piece of crust taken in slurp hose. Not sucked in
25.07.2011	12.51	433785.2	5035920.1	2942	Opening Big Box to drop sample of crust in from the slurp tube
25.07.2011	12.52	433782.6	5035896.2	2941	Sample dropped into (i)
25.07.2011	13.11	433755.5	5035960.7	2923	Slurp appears to not work
25.07.2011	13.16	433761	5035958.6	2909	Moving to higher topogragraphy to test out slurper to make sure the slurper not working is not related to the action of the trusters.
25.07.2011	13.03	433760.1	5035915.2	2952	Still of vent before sampling with slurper
25.07.2011	13.31	433760.1	5035915.2	2952	sampling with slurper. shrimp went in, and more
25.07.2011	13.35	433762	5035903.5	2947	Still taken of vent smoking before sample
25.07.2011	13.38	43375183	5035925.9	2946	Still taken of smoking vent
25.07.2011	13.39	433772.3	5035906.9	2950	still of vent base with rubble at bottom
25.07.2011	13.41	433767.4	50592.1	2950	Many Stills and samples of shrimp
25.07.2011	13.45	433791.8	5035908.1	2950	Samples of shrimp sucked up
25.07.2011	13.49	433773	5035944	2945	stop DVD's
25.07.2011	13.54	433753	5035930	2943	Start DVD's DVD 3 b isn't recording (new one requested)
25.07.2011	13.59	433772	5035933	2948	DVD3b started 4 minutes and49 seconds behind
25.07.2011	14.05	4333779	5035926	2951	Shrimp samples taken
25.07.2011	14.01	4337781	5035937	2943	Squaring up to vent to take more samples
25.07.2011	14.13	433760	5035925	2946	Sample of shrimp

Date	Time UTC	ROV Eastings	ROV Northings	Water Depth m	Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom
25.07.2011	14.16				(NOTE: stills been taken continously by jim nelson)
25.07.2011	14.33	433761	5035909	2950	Samples of shrmp taken.
25.07.2011	14.33	433761	5035909	2949	Photograph taken of sampling area
25.07.2011	14.42	433784	5035916	2950	Sample of shrimp taken
25.07.2011	14.44	433764	5035936	2949	Large sample of shrimp taken
25.07.2011	14.51	433179	5035915	2953	Trying to sample crab
25.07.2011	14.54	433756	5035915	2952	Large shrimp sampled
25.07.2011	14.58	433761	5035908	2950	Sample of shrimp
25.07.2011	15.07	433773	5035921	2950	Shrimp samples taken
25.07.2011	15.07	433780	5035923	2951.4	Possibe Crab sample taken (Not definate)
25.07.2011	15.36	433771	5035910	2946.6	sample of large shrimp
25.07.2011	15.42	433775	5035920	2948	Sample of Crab
25.07.2011	15.45	433770.8	5035924.7	2946	End of dvd
25.07.2011	15.49				Start of DVD and HD 3B had to be changed
25.07.2011	15.53				DVD 3B started
25.07.2011	15.57	433769	5035917	2947	lasers off
25.07.2011	00.00				NAT GEO MOMENT
25.07.2011	16.39				HD not recording started again
25.07.2011	16.04	433774.6	503591509	2946	
25.07.2011	16.47	433760.8	5035909.5	2945	suction sampler put away
25.07.2011	16.53				lost hydraulics, so the vehicle can't move, and is coming back up
25.07.2011	16.55				CTD change

ROV TECHNICAL LOG

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DVD RECORDER 3A = AFT MASTER

Station No.: **V23**

Dive No.: **097**

Date	Time UTC	ROV Eastings	ROV Northings	Water Depth m	Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom
27.07.2011	09.23	433769.4	5036155.7	2928	Note:CTD water depth 2922, Sonardyne depth 2914
27.07.2011	09.25	433762.9	5036117.1	2927	At maximum depth
27.07.2011	09.53	433769.3	5036077.7	2946.4	Start of line 1
27.07.2011	10.09	433757.8	5036027.4	2933.1	Change of heading from 201 to 180 south
27.07.2011	10.12				Vent edifices visible on swatch
27.07.2011	10.13				Nephels and smoke observed by ROV
27.07.2011	10.21				ROV confirms flying at altidue 31m
27.07.2011	10.23				Plume water visible on camera, acoustic interference from hot water on sonar
27.07.2011	10.24				ROV CTD at 5.0C
27.07.2011	10.27				Chimneys still visible on multibeam + multiple ledges/chmineys?
27.07.2011	10.28				Chimey images fading out?
27.07.2011	10.33	433700	5035884.1	2939.5	ROV stopped
27.07.2011	10.34				ROV stopping to address nav data error (speed reading is 63 kn!)
27.07.2011	10.34				Stopping recording data
27.07.2011	10.37				ROV in visible smoke
27.07.2011	10.38	433695.9	5035881	2914.5	Line resumed
27.07.2011	10.38				Started recording swath data again
27.07.2011	10.40				Features visible in swath again
27.07.2011	10.41				Large feature in swath
27.07.2011	10.43				Features less visible
27.07.2011	10.47				Nav diagnosed as not being exported by sonardyne USBL system
27.07.2011	10.48				Stopping ROV to adress nav issue
27.07.2011	10.48	??	??	2936.1	ROV stopped (Nav switched off)
27.07.2011	10.49				Stopping logging swath data
27.07.2011	10.56				Starting nav data again

Date	Time UTC	ROV Eastings	ROV Northings	Water Depth m	Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom
27.07.2011	11.00				Start moving, resume logging again
27.07.2011	11.11	433720	5035810	2944	Line resumed
27.07.2011	11.16	433667	5035829.9	2926	Line stopped
27.07.2011	11.19				Stopped
27.07.2011	11.30				Stop logging
27.07.2011	12.26				Started. Survey Line Number: 1 repeated
27.07.2011	12.27	433695.3	5035769.3	2928.1	line one started.
27.07.2011	12.30				Stopped . Survey Line Number: 1 repeated
27.07.2011	12.30				Started again, recording. Survey Line Number: 2nd repeat, 1 repatec
27.07.2011	12.32				Speed? 0.4 - 0.6, 0.3, reducing to 0.1 kn. Survey Line Number: 2nd repeat, 1 repatec
27.07.2011	13.32	433704	5035893	2922.2	at mid way of first line
27.07.2011	12.36				Ping rate up. Survey Line Number: 2nd repeat, 1 repated
27.07.2011	12.38				Speed will be between 0.2 - 0.3 kn. Survey Line Number: 2nd repeat, 1 repatec
27.07.2011	12.40				Chimney. Survey Line Number: 2nd repeat, 1 repated
27.07.2011	12.41				Chimney. Survey Line Number: 2nd repeat, 1 repated
27.07.2011	12.42	433685.3	5035902.5	2937	midway to end of line one commencing
27.07.2011	12.45				Chimney. Survey Line Number: 2nd repeat, 1 repated
27.07.2011	12.45	433708.9	5035946.9	2922	offsetting track 10 m east ofline
27.07.2011	12.47				Request offset to 10m to east. Survey Line Number: 2nd repeat, 1 repated
27.07.2011	12.51	433756.5	5036003.5	2931	rov and ship now stopped
27.07.2011	12.52				Eh Reduced. Survey Line Number: 2nd repeat, 1 repated
27.07.2011	12.53				Stop. Survey Line Number: 2nd repeat, 1 repated
27.07.2011	12.56	433751.6	5036011.2	2897	rov and ship now headng to line offset A
27.07.2011	12.57				Stop recording files. Survey Line Number: 2nd repeat, 1 repated
27.07.2011	12.59				Start recording. Survey Line Number: Offset from line 1, N to S line 1 repeat again
27.07.2011	13.03				Chimneys. Survey Line Number: Offset from line 1
27.07.2011	13.04				Chimney. Survey Line Number: Offset from line 1
27.07.2011	13.08				360 turn. Survey Line Number: Offset from line 1
27.07.2011	13.08	433755.7	5036012.9	2908	start offset A ro midway A
27.07.2011	13.11				Heading south. Survey Line Number: Offset from line 1
27.07.2011	13.22				Moytirra. Survey Line Number: Offset from line 1

Date	Time UTC	ROV Eastings	ROV Northings	Water Depth m	Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom
27.07.2011	13.24				Chimney. Survey Line Number: Offset from line 1
27.07.2011	13.25				Scarp. Survey Line Number: Offset from line 1
27.07.2011	13.26				Chimneys. Survey Line Number: Offset from line 1
27.07.2011	13.30	433715.3	5035829.6	2924	midway offset A to end of line offset A
27.07.2011	13.38				Small chimneys down the slope. Survey Line Number: Offset from line 1
27.07.2011	13.39	433711.2	5035763.6	2933	end of line offset A
27.07.2011	13.43				Stopped the recording
27.07.2011	13.44				Recording new time ??? Redording start. Survey Line Number: End offset A to south
27.07.2011	13.49	433649.2	5035743.8	2936	start of new line at end 2
27.07.2011	13.50				Stop recording swath video. Survey Line Number: End offset A to south
27.07.2011	13.51				At ??? New line . Stopped recording. Survey Line Number: End offset A to south
27.07.2011	13.52				Start data recording, start logging. Survey Line Number: Line 2
27.07.2011	14.05	433633	5035904	2932	at midway of line 2
27.07.2011	14.35	433746	5036140	2937	end of line, just arrived at start 2
27.07.2011	14.39				Stop, stop recording data, ??? Logging. Survey Line Number: Line 2
27.07.2011	14.39				Logging start. Data recording start. Survey Line Number: Line 3
27.07.2011	14.45	433688	5036163	2918	Just arrived at the end of line 3, beginning transit to midway 3
27.07.2011	14.48				Screen recording, data logging stopped. Survey Line Number: Line 3
27.07.2011	14.48				Screen recording, data loggin started. Survey Line Number: ??? ??? Of waypoint 3, Line 4
27.07.2011	14.59				Little ridge thing. Survey Line Number: ??? ??? Of waypoint 3, Line 4
27.07.2011	15.08				No uplink. Stopped logging ??? Etc stop ROV. Survey Line Number: ??? ??? Of waypoint 3, Line 4
27.07.2011	15.08	433627	5036049	2918	ROV and ship stopped
27.07.2011	15.18				Uplink back, ready to resume; start screen recording data, recording + logging. Survey Line Number: ??? ??? Of waypoint 3, Line 4
27.07.2011	15.19				Reversing back up do don't get gap in data. Survey Line Number: ??? ??? Of waypoint 3, Line 4
27.07.2011	15.19	433620	5036704	2928	ROV and Ship moving 10m back along line before starting logging again as there is data missing from when the ship and ROV stopped
27.07.2011	15.21	433588	5036070	2937	Problem with multibeam, so ROV is on standby
27.07.2011	15.23				Re-startin program. Survey Line Number: ??? ??? Of waypoint 3, Line 4
27.07.2011	15.29				Start recording data + screen (not logging). Survey Line Number: ??? ??? Of waypoint 3, Line 4
27.07.2011	15.30				Stop recording + shut down, clearing CD drive. Survey Line Number: ??? ??? Of waypoint 3, Line 4
27.07.2011	15.41				Start recording data + screen. Survey Line Number: ??? ??? Of waypoint 3, Line 4
27.07.2011	15.43				Logging started - resuming line no gap. Survey Line Number: ??? ??? Of waypoint 3, Line 4

Date	Time UTC	ROV Eastings	ROV Northings	Water Depth m	Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom
27.07.2011	15.45				Multibeam has stopped, logging also stopped - restarting. Survey Line Number: ??? ??? Of waypoint 3, Line 4
27.07.2011	16.56	433630	5036019	2935	ROV back on line towards midway 3
27.07.2011	16.57	433632	5036013	2934	ROV and Ship stopped
27.07.2011	17.07	433649	5036044	2913	ROV is returning to surface
27.07.2011	17.08				Abort
27.07.2011	17.08	433649	5036044	2927	End of dive

ROV TECHNICAL LOG

Cruise: **CE11009** **VENTuRE Survey**

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DVD RECORDER 2A = DOWNWARD LOOKING MASTER
DVD RECORDER 2B = DOWNWARD LOOKING COPY
DVD RECORDER 3A = AFT MASTER

Station No.: **V24**

Dive No.: **098**

Date	Time UTC	ROV Eastings	ROV Northings	Water Depth m	Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom
28.07.2011	02.48				HD brick recording - B014
28.07.2011	02.48				DVDs recording - media #s 078-083
28.07.2011	03.00	4337455.8	5035922	2926	On bottom (altitude 20 m)
28.07.2011	03.14				Having to reinitialise digi stills camera PC software in ROV van
28.07.2011	03.18				Nat geo chimney shots on HD
28.07.2011	03.20				Stills camera software reinitialised
28.07.2011	03.20				Lasers switched on according to console, but not visible on HD video
28.07.2011	03.30				ROV at max cable out - cannot reach flat enough bottom in this area to deploy crab trap
28.07.2011	03.32			2949	Hauling back in last 2 wraps on tether
28.07.2011	04.01	433770.6	5035929	2917	Cliff sulfide fragments (crust covering basalt) knocking into Tray L
28.07.2011	04.07	433770.6	5035929	2914	Sampling more cliff wall suflides into Tray L
28.07.2011	04.11				Photo taken of Tray L showing rock sample collected (could not photograph while held in manip was knocked into tray, rather than grabbed)
28.07.2011	04.37				DVDs stopped
28.07.2011	04.39				HD stopped
28.07.2011	04.40				New HD started
28.07.2011	04.40				New DVDs started
28.07.2011	05.52				Sample of a mixture and sulphide in Box A
28.07.2011	06.24				DVDs stopped
28.07.2011	06.24				HD stopped
28.07.2011	06.27	433784	5035905.1	2929	HD Started
28.07.2011	06.32	433785.4	5035912	2929	DVDs recording - media #s 078-083
28.07.2011	06.36	433775	5035917		start of microbe sampling
28.07.2011	06.57	433785.7	5035907	2928	End of microbial sample, sample in Box F
28.07.2011	06.59	433783	5035907	2928	Deployment of suction sampler
28.07.2011	07.07	433783.3	5035906.3	2928	Suction sampler initiated

Date	Time UTC	ROV Eastings	ROV Northings	Water Depth m	Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom
28.07.2011	07.33	433778.7	5035939.1	2921	Suction sampler sheathed
28.07.2011	07.43	433768.3	5035940	2921	Suction sampler deployed
28.07.2011	07.46	433768.3	5035940	2922	Suction sampler initated
28.07.2011	07.53	433792.3	5035938.7	2920	Suction sampler sheathed
28.07.2011	07.58	433780.4	5035942.3	2920	Suction sampler deployed
28.07.2011	08.07	433786	5035941.5	2919	Suction sampler sheathed
28.07.2011	08.12	433776.9	5035926	2936	Beginning search for further vents
28.07.2011	08.21				New DVDs started
28.07.2011	08.21				New HD started
28.07.2011	08.27				Temperature test probe picked up - outermost probe in front right basket (no label)
28.07.2011	08.30	433755.6	5035921		Deploying temperature test probe at Balor
28.07.2011	08.34	433778.9	5035919.5		Now attempting to deploy probe at a lower chimney
28.07.2011	08.41	433759.9	5035912		ROV secure against Balor chimney, attempting to deploy temperature test probe at a lower vent orifice
28.07.2011	08.52				Abandoning temperature probe deployment - too risky for major damage to vent, and ROV
28.07.2011	08.54				Unlabelled temperature probe recovered to between front and back trays of right-hand basket
28.07.2011	09.37	433781.5	5035902.5	2949.7	ROV stable against wall, near new chimneys, at WP3 (location recorded in science log)
28.07.2011	09.38				Nat geo moment on HD
28.07.2011	09.41				Picking up middle temperature tester - marked with green+yellow tape
28.07.2011	09.46				Temperature test probe dropped - lost below ROV
28.07.2011	09.50				Repositioning ROV to attempt temperature test measurement
28.07.2011	10.06				DVDs and HD stopped
28.07.2011	10.08	433734	5035900.7	2931	HD and DVD Recording started
28.07.2011	10.22	433736.3	5035903.3	2933	Suction sampler recovered
28.07.2011	10.25	433775	5035891	2930	Heading to new chimney
28.07.2011	10.29	433758.3	5035900	2927	Initial temperature probe (earth tape) recovered
28.07.2011	10.39	433778.3	5035906.1	2929	Digital stills technical problem
28.07.2011	10.45	433765	4035885	2931	Lasers on
28.07.2011	10.57	433774.7	5035902.8	2940	Start of first video mosaic
28.07.2011	11.10	4433770	5035883.8	2938	End of first video mosaic
28.07.2011	11.16	433767.1	5035895.7	2940	Deployment of suction sampler
28.07.2011	12.00	433753.3	5035895.6	2953	DVD Change

Date	Time UTC	ROV Eastings	ROV Northings	Water Depth m	Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom
28.07.2011	12.03	433753	5035898.2	2959	HD stopping now
28.07.2011	12.04	433755.3	5035901.3	2960	HD recording
28.07.2011	12.06	433755.5	5035901.8	2957	dvd start except the copy of dvd3
28.07.2011	12.07	433755.5	5035901.8	2957	All recording , including dvd3 copy
28.07.2011	12.12	433760.3	5035902.6	2958	Sampled shrimp (large)
28.07.2011	12.17	433750.7	5035899.5	2958	Problems with arm (twitching)
28.07.2011	12.22	433748.7	5035897	2958	HD dropped out, and came back in again
28.07.2011	12.24	433748.5	50358971	2959	Slurper put back on to the ROV
28.07.2011	12.39	433750.4	5035898.4	2952	Redeployed slurper
28.07.2011	12.47	433751.7	5035899.3	2958	sampling large shrimp
28.07.2011	12.49	433752.3	5035897.8	2958	Sampling limpets and big shrimp
28.07.2011	12.05	433756.4	5035899.6	2959	Dropped slurper
28.07.2011	12.55	433760.6	5035898.9	2962	Trying to put slurper in basket
28.07.2011	13.00	433757.5	5035903	2959	On trnasit to sample fresh anhydrite
28.07.2011	13.05	433758	5035902.8	2957	still of large shrimp
28.07.2011	13.08	433756.9	5035904.1	2955	Stills taken
28.07.2011	13.12	433757.9	5035901.9	2955	More still taken of beehive and shrimp
28.07.2011	13.25	433758.7	5035903.4	2958	Stills of dense population of shrimp
28.07.2011	13.41	433762.2	5035896.8	2958	Stills taken of yellow blobs on the beehive structutre
28.07.2011	13.47	433752.2	5035899.2	2955	Stills taken of crab beehive and shrimp
28.07.2011	13.58	433775.4	5035888	2955	Sampling and stills of Young white beehives
28.07.2011	13.59	433775.4	5035888	2955	Sample of another beehive
28.07.2011	14.00	433775.4	5035888	2955	DVD has gone over 1 hour 50 min's
28.07.2011	14.00	433775.4	5035888	2955	HD stopped recording
28.07.2011	14.04	433777	5035898	2938	HD and dvd start recording (depth taken from ctd)
28.07.2011	14.19	433760	5035890	2942	Hd and digital stills panel and tilt locked
28.07.2011	14.20	433767	5035901	2941	panel 2 working again,
28.07.2011	14.23	433762	5035897	2941	sonar shut down and rebooted
28.07.2011	14.30	433776	5035897	2938	securing geo samples into drawer
28.07.2011	14.46	433775	5035902	2939	rov ascending along slope, trying to locate vent fluids
28.07.2011	15.29	433756	5035901	2957	photomosaic of organ pipe structures, lasers on (depth from ROV)

28.07.2011	15.43	433755	5035884	2957	attempt at sampling organ pipes
Date	**Time UTC**	**ROV Eastings**	**ROV Northings**	**Water Depth m**	**Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom**
28.07.2011	15.55	433765	5035882	2956	,dvd stop recording, chimney piece hit and broken but not collected, piece stuck in the front of drawer
28.07.2011	15.58	433765	5035888	2958	HD stopped
28.07.2011	15.59	433761	5035892	2958	HD and dvd recording started
28.07.2011	16.03	433762	5035895	2957	collection of organ pipe, fell between drawers
28.07.2011	16.07	433759	5035898	2957	third attempt chimney crumbles
28.07.2011	16.29	433754	5035899		end of dive

ROV TECHNICAL LOG

Cruise: **CE11009** **VENTuRE Survey**

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DVD RECORDER 3A = AFT MASTER

Station No.: **V25**

Dive No.: **099**

Date	Time UTC	ROV Eastings	ROV Northings	Water Depth m	Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom
29.07.2011	03.39	433748	5035913.4	2939	Media recording started
29.07.2011	03.49	433724	5035884.3	2940	Lasers on
29.07.2011	03.53	433727	5035890.2	2940	Multibeam restarted
29.07.2011	03.57	433728	5035889.2	2940	Start of mosaic
29.07.2011	04.00	433744	5035884.1	2940	End of video mosaic, lasers off
29.07.2011	04.27	433749	5035914.3	2955	Recovery arm deployed
29.07.2011	04.37	433747	5035896.7	2944	Crabpot recovered
29.07.2011	04.39	433750.3	5035924.2	2925	Heading to Little Chimney waypoint for vent fluid sampling
29.07.2011	05.22	433744.8	5035899.5	2940	Media stopped for change
29.07.2011	05.26	433764	5035909	2944	New media started
29.07.2011	05.30	433769	5035915	2941	Sonar lost
29.07.2011	05.38	433747	5035939	2905	Aborting because of lost sonar

ROV TECHNICAL LOG

Cruise: **CE11009** **VENTuRE Survey**

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DVD RECORDER 2B = DOWNWARD LOOKING COPY
DVD RECORDER 3A = AFT MASTER

Station No.: **V26**

Dive No.: **100**

Date	Time UTC	ROV Eastings	ROV Northings	Water Depth m	Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom
29.07.2011	10.52	433687	5035865.3	2789.8	Media recording starting
29.07.2011	10.52	433687	5035865.3	2789.8	Heading to wall east of Balor on heading 112.9
29.07.2011	11.42	433771	5035876.7	2954	Sample of vent fluid taken
29.07.2011	11.44	433771	5035876.7	2954	Stills being taken throughout
29.07.2011	11.45	433763	5035917	2954	Way point three on sonardyme for sample collection
29.07.2011	11.47	433761	5035902	2954	Ram of fluid sample collector returning to normal
29.07.2011	11.49	433783	5035927	2954	Returning to suface
29.07.2011	12.41	433762	5035912	1745	DVD stopped recording

ROV TECHNICAL LOG

Cruise: **CE11009** **VENTuRE Survey**

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DVD RECORDER 2B = DOWNWARD LOOKING COPY
DVD RECORDER 3A = AFT MASTER
DVD RECORDER 3B = AFT COPY

Station No.: **V30**

Dive No.: **101**

Date	Time UTC	ROV Eastings	ROV Northings	Water Depth m	Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom
01/08/2011	19.30	303448	5701594	906	CTD data are not recording correctly, transmissomter appears to be the only parameter recording correctly
01/08/2011	19.42	303436	5701584	1101	On bottom at WP1
01/08/2011	19.45	303440	5701585	1101	DVDs STARTED
01/08/2011	19.49	303445	5701575	1102	360-degree spin hunting on the sonar
01/08/2011	19.52	303454	5701570	1102	Lasers on
01/08/2011	19.53	303445	5701578	1101	On transit to WP2
01/08/2011	19.55	303442	5701579	1103	ROV Altitude is 1.5m above sediment
01/08/2011	20.14	303569	5701858	1100	ROV altitude is now 2.5 above sediment/bottom
01/08/2011	20.16	303582	5701882	1101	ROV is now 1.5 altitude above sediment
01/08/2011	20.16	303570	5701954	1099	Arrived at WP2
01/08/2011	20.23	303575	5701944	1100	360-degree spin hunting on the sonar
01/08/2011	20.27	303570	5701969	1099	moving 50m to the west
01/08/2011	20.35	303515	5701962	1097	ROV doing a 180-degree spin
01/08/2011	20.36	303528	5701957	1097	No obvious targets on sonar
01/08/2011	20.3	303560	5701945	1098	Heading to new WP A , 400m to the NE and is a TOBI Reef target with a shadow
01/08/2011	20.58	303805	5702058	1102	Zooming in on coral to see if it's alive.
01/08/2011	21.11	303906	5702134	1103	Facing SE of the WP
01/08/2011	21.14	303906	5702123	1104	On transit to WP 3, to the NNE, 300m away
01/08/2011	21.31	303827	5702299	1097	HD Camera shut down and came back on
01/08/2011	21.36	303811	5702323	1100	Stop DVD s
01/08/2011	21.38	303810	5702328	1100	Stop HD
01/08/2011	21.4	303812	5702324	1100	Start recording DVDs and HD

Date	Time UTC	ROV Eastings	ROV Northings	Water Depth m	Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom
01/08/2011	21.57				heading into current 140
01/08/2011	21.58	303791	5702381	1093	loop on ROV tether
01/08/2011	22.13	303826	5702377	1091	move to way point 4, 300 m NE
01/08/2011	22.39	303891	5702698	1092	About half way and finished looking at largely dead mound
01/08/2011	22.45	303931	5702690	1093	Way point 4
01/08/2011	22.46	303933	5702702	1093	Nothing at waypoint 4 heading to way point 5
	23.03	303996		1092	Encounter mound just 50 m east of Way point 5
01/08/2011	23.11	304007	5702853	1084	top of mound
	23.2	304015	5702854	1084	stop recording DVDs and HD
	23.22	304007	5702858	1084	start recording DVDs and HD
	23.23	304007	5702858	1084	Begin transit to next waypoint, ROV raised 5-6m above seabed. No visability.
	23.31	304068.1	5703036.5	1084	Digital still taken of sea bed:
	23.34	304096.1	5703034.8	1091	Coral mound:
	23.52	304026.9	5702912	1092	Leaving coral mound and transit to the next waypoint.
	0.1				broke off transit to look at anomaly on sonar.
	0.12	303978.1	5703373	1090.8	Anomaly = coral mound
	0.13				Resuming transit to waypoint
	0.15	303920.8	5703436	1089.3	Waypoint reached: coral mound
	0.21				Transit to next waypoint
	0.33	303777.4	5703568	1088	Coral mound: not the waypoint.
	0.34				Resuming transit to waypoint
	0.49	303618.8	5703682	1086.7	Waypoint reached (but no coral)
	0.51				transit to the next waypoint.
	01:13				New DVDs and HD started
	01:14	303496.8	5073934.5	1076.3	Starting next ship move, heading 155 deg, for transit to next WP
	01:26	303684.5	5074036.5	1078.8	At WP; starting move to next WP (#1; ~750 m to N)
	01:47				Detouring from line to examine sonar target
	01:47	303734.7	5704426	1067	Target is small coral mound; some live patches

Date	Time UTC	ROV Eastings	ROV Northings	Water Depth m	Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom
	02:07	303745.1	5704827.4	1061	At WP #1; starting move to WP #2 (to NE, 580 m)
	02:36	303879.2	5704895	1060	At WP #2; starting move to WP #3 (heading 012 deg, 930 m)
	03:00				Stopping DVDs and HD brick
	03:03				Starting DVD (HD brick not empty)
	03:05				Starting HD brick
	03:12				Oil leakage in ROV ABORTING, media kept recording while going up. Ended line at WP2
	03:42				Turned off radio
	03:44				Lasers off and lights out
	03:53				ROV out of water
	03:55				A-frame showing low pressure
	03:56				All cameras off
	03:56				Stopped CTD
	03:57				ROV on deck
	03:58				Stopping DVDs and HD brick

ROV TECHNICAL LOG

Cruise: **CE11009** **VENTuRE Survey**

CAMERA/DVD CONFIGURATION:
DVD RECORDER 1A = PILOT Pan & tilt MASTER
DVD RECORDER 1B = PILOT Pan & tilt COPY
DVD RECORDER 2A = DOWNWARD LOOKING MASTER
DVD RECORDER 2B = DOWNWARD LOOKING COPY
DVD RECORDER 3A = AFT MASTER
DVD RECORDER 3B = AFT COPY

Station No.: **V33**

Dive No.: **102**

Date	Time UTC	ROV Eastings	ROV Northings	Water Depth m	Event e.g. at bottom, sample taken, other significant events, DVDs out, DVDs in, off bottom
02/08/2011	06:57:00	304013	5707525	981	start of media
02/08/2011	07:14:00	303989	5707518	1006	transit from WP6 to WP8 no large coral mound at WP6
02/08/2011	07:56:00	304482	5708031	979	360 check for mounds
02/08/2011	08:19:00	304461	5708151	977	laser on
02/08/2011	08:49:00				Media Stopped
02/08/2011	08:51:00	304465	5708133.5	996.4	Media recording
02/08/2011	08:53:00	304465	5708133.5	996	360 check for mounds
02/08/2011	08:55:50	304465	5708133.5	995.7	HD stills taken
02/08/2011	08:56:52	304465	5708133.5	996.7	Heading to next waypoint
02/08/2011	09:01:43	304328.1	5708494	997.1	Resuming transect
02/08/2011	09:15:00	304319	5708597	987	Waypoint 3 added
02/08/2011	09:43:58	304324.7	5708630	986.8	Heading to next waypoint at 0.7knot
02/08/2011	10:36:00				media change
02/08/2011	10:52:00	304077	5709569	951	WayPoint4 coral ridges
02/08/2011	11.34.00	3040570	5709795	975	just recorded some of the sector scan on the sonar
02/08/2011	11.40.	304042	5709801	974	still of coral
02/08/2011	11.50.	304051	5709799	975	carrying on towards WP4 (250m)
02/08/2011	12.01.	304072	5710082	974	stopped at WP4, and doing a starboard scan
02/08/2011	12.06.	304068	5710096	973	scanning to the west by 50m
02/08/2011	12.08.	304041	5710079	973	on transit to next WP 5
02/08/2011	12.11.	304022	5710143	973	went off track to scan starboard
02/08/2011	12.18.	303991	5710171	973	Arrived at WP5
02/08/2011	12.21	303984	5710166	972	stills taken
02/08/2011	12.25	303996	5710182	969	recording the sonar (logging)
02/08/2011	12.28			972	DVD stop
02/08/2011	12.31	303974	5710201	969	DVD start and HD
02/08/2011	12.35	303989	5710233	971	at WP6
02/08/2011	12.49	303966	5710239	975	from last WP to a heading of 298, 70m, towards WP5
02/08/2011	12.54	303988	5710275	968	Dive ended

ROV SCIENTIFIC LOG

Cruise: **CE11009** **VENTuRE Survey**

Station No.: **V7**

Dive No.: **092**

Date	Time UTC	Observation
22.07.2011	21.11	On slope. Angular clasts, rubble.
22.07.2011	21.14	Heading east up scarp salope. Steep slope.
22.07.2011	21.14	On downward facing camera, single shrimp observed.
22.07.2011	21.15	Marine sediment covering basalt rubble
22.07.2011	21.18	Coarse angular clast, covered in marine sediment, rock increasingly becoming exposed. Brittle start observed.
22.07.2011	21.19	Steep cliff
22.07.2011	21.19	1 anemone
22.07.2011	21.20	Basalt rock cliff. Near vertical. Sheared face.
22.07.2011	21.21	top of slope/ledge. 2867 depth reading
22.07.2011	21.21	thick thick sediment cover on edge of slope. Straight ledge.
22.07.2011	21.25	1 sea cucumber
22.07.2011	21.26	heavy sediment cover. Heading north along the scarp.
22.07.2011	21.30	angular basalt on fault scarp.
22.07.2011	21.34	steep slope. Angular basalt, light sediment cover
22.07.2011	21.37	pillow lavas. Light sediment cover.
22.07.2011	21.40	pillow basalt
22.07.2011	21.45	vertical cliff facing west
22.07.2011	21.47	cliff face

ROV SCIENTIFIC LOG

Cruise: **CE11009** **VENTuRE Survey**

Station No.: **V9**

Dive No.: **093**

Date	Time UTC	Observation
		DIVE ABORTED

ROV SCIENTIFIC LOG

Cruise **CE11009** **VENTuRE Survey**

Station No **V13**

Dive No **094**

Date	Time UTC	Observation
23.07.11	22.37	bottom in sight on downward camera
23.07.11	22.39	DVD recording
23.07.11	22.51	Soft sediment, clumps of pterapod shells and pterapod shells scattered throughout the sediment
23.07.11	22.56	brittle star
23.07.11	22.57	brittle star
23.07.11	22.59	burrow bumps
23.07.11	23.00	Roct to top left of screen
23.07.11	23.02	Larger burrows
23.07.11	23.03	Small fish, above, screen 2. Nodgular basalt
23.07.11	23.05	Going backwarde, two brittle star
23.07.11	23.11	Crinoids and burrows, sediment
23.07.11	23.12	Still traversing up hill heading ~300
23.07.11	23.12	Solitary outcrop (~50cm)covered with same thick light white sediment
23.07.11	23.16	Sediment covered nodular outrorop to the right of screen , soft correl?
23.07.11	23.16	Bank of pterapod shells, parallel to rock outcrop. Sorting?current direction..
23.07.11	23.19	Nodular rock depicting the edge of escarpment
23.07.11	23.20	Digital still taken. Possible pillow basalt
23.07.11	23.22	Shrimp
23.07.11	23.32	Still of top of escarpment.
23.07.11	23.24	Ledge on screen 1
23.07.11	23.26	Decision made to move ROV to the end of the line and work backwards from there
23.07.11	23.28	Screen 1 Aft camera, lava flows with mud on top,
23.07.11	23.59	Temp and EH deflection, twinkling in the lazers, smoak in the water. EXCITMENT!!
23.07.11	00.03	Still smoke in the water

ROV SCIENTIFIC LOG

Cruise **CE11009** **VENTuRE Survey**

Station No **V16**

Dive No **095**

Date	Time UTC	Observation
24.07.2011	19.08	EH reading showing an increase as well as a temperature spike from 3.3 to 3.5 degrees. EH reading noow failed failed, this is a possible fault
24.07.2011	19.43	on the bottom: fine sediment with terapods, relatively flat
24.07.2011	19.45	shrimp present. band present, and patches of terapod shells
24.07.2011	19.53	brittle star present. Sediment in waves, with a wavelength of 1-2 m. Terapods present in sediment troughs.
24.07.2011	19.55	Ophiuroid
24.07.2011	19.56	Sediment mantled steep slope. More echinoderms present
24.07.2011	19.58	rock , basalt, white organism attached?
24.07.2011	19.59	Ophiuroid
24.07.2011	20.00	more troughs of terapod shells, isolated rocks
24.07.2011	20.01	large clast ,
24.07.2011	20.02	thicker terapod cover over the sediment
24.07.2011	20.04	large clast. Pinkish echinoderm bottom left corner
24.07.2011	20.06	Black Holothurian
24.07.2011	20.08	Fish. Sediment and pillow lavas with no evidence of sulphides
24.07.2011	20.09	crab ,
24.07.2011	20.11	large angular clasts, basalt and pillows
24.07.2011	20.11	larger echinoderm, pillow with striation
24.07.2011	20.13	pillow rough terrain, possible organisms attached,
24.07.2011	20.14	fish
24.07.2011	20.20	zooplankton
24.07.2011	20.52	laser twinkling, possible evidence of sulphides, sonar shows shadowy echoes
24.07.2011	20.54	turbidity in the water column caused by smoke. Temperature increase to almost 3.5, as well as Eh spike
24.07.2011	20.56	increasing thickness and abundance of smoke, temperature rise to 4.1 ,

Date	Time UTC	Observation
24.07.2011	21.02	lasers disappearing from view in a dense smoke screen
24.07.2011	21.03	very dense smoke, temperature increasing to 3.8
24.07.2011	21.06	sulfides, gac, basalt crust with microbial cover all present, Temperature at 3.4, and eh spike
24.07.2011	21.08	fish
24.07.2011	21.10	temperature increasing to 4 , smoke very dense
24.07.2011	21.12	fish in the middle of smoke, not very clear
24.07.2011	21.13	extremely dense smoke, visible in laser, fast flowing
24.07.2011	21.16	camera 1 unusual fauna, smoke visible flowing vertically
24.07.2011	21.20	SMOKE AGAIN 24 M FROM BOTTOM, WALL IN FRONT, SULFIDES ON BASALT AND BACTERIA
24.07.2011	21.21	SMOKE .FISH VISIBLE ON WALL, 11 M FROM BOTTOM, 3029 M DEPTH,
24.07.2011	21.25	SMOKE IN HD
24.07.2011	21.26	SHRIMP IN THE WATER, EXTREMELY SMOKEY, VENT VISIBLE DEPTH 3029.8 M
24.07.2011	21.28	LOTS OF SMOKE IN THE WATER ORIGINATING FROM THE VENT BELOW
24.07.2011	21.28	LARGEST SMOKE FLOW FROM BELOW, ON HD
24.07.2011	21.30	FISH VISIBLE
24.07.2011	21.31	COMING TOWARDS THE VENT CHIMNEY AGAIN, LOTS OF SMOKE APPROACHING
24.07.2011	21.34	Chimney in view, lazers turned off
24.07.2011	21.36	Stills, taken Chimney
24.07.2011	21.40	Digital stills
24.07.2011	21.41	Recording DVDs and HD
24.07.2011		Bunch of thin chimneys radiating from a thick base, beehive present on the structure. Smoke coming from below
24.07.2011	21:50	Shrimp, beehive on chimney
24.07.2011	21:52	Iron Hydrite and Beehives present on the chimney structure. Also shrimp present
24.07.2011	21:59	Rimicaris. Green limpits present
24.07.2011	22:03	Stills taken of chimneys
24.07.2011	22:08	Lazers on, hanging about the chimneys
24.07.2011	22:11	big shrimp=Rimicaris, crab, green limpits preset on the vent structure.
24.07.2011	22:12	onion peel like beehives

Date	Time UTC	Observation
24.07.2011	22.13	white thing, looks like a possible clam
24.07.2011	22:14	shimmering water
24.07.2011	22:16	shrimp and crab on structure
24.07.2011	22:17	shimmering water, NAT GEO
24.07.2011	22:20	large volume of smoke
24.07.2011	22.23	beehive in the shape of an egg timer
24.07.2011	22:24	2 types of shrimp. Shimmering water and beehives present
24.07.2011	22:26	close up of limpits and gastropods. 10m off the sea bed so chimneys at least 10 m high
24.07.2011	22:27	fish
24.07.2011	22.28	black smoke still present. Stunning behive & organ pipes on vent
24.07.2011	22.32	black smoke, sparkly, chimneys
24.07.2011	22:40	crab ,
24.07.2011	22:45	manipulator arm out for sampling
24.07.2011	22:51	shrimp
24.07.2011	22:53	sample of chimney taken by manipulator into draw
24.07.2011	22:55	attempted retrival of scoop with manipulator arm
24.07.2011	23:02	suphide samples taken
24.07.2011	??:??	smoker below
24.07.2011	23:20	Other chimneys from field now in view
24.07.2011	23:24	fish close up. Anhydrite present in cracks
24.07.2011	23:25	lots of zoarthids on chimney
24.07.2011	23:33	Zoarthiid
24.07.2011	23:40	Polycheate swimming
24.07.2011	23.52	Fish

ROV SCIENTIFIC LOG (observations)

Cruise **CE11009** **VENTuRE Survey**

Station No **V17**

Dive No **096**

Date	Time UTC	Observation
25.07.2011	08.42	chimney
25.07.2011	08.44	plume of dense smoke. ROV 25 m alt
25.07.2011	08.45	strong smoke
25.07.2011	08.49	strong smoke
25.07.2011	09.10	some speckling in the laser
25.07.2011	09.17	7.5 m west of the wall, visual of the wall, ROV @ 25 m
25.07.2011	09.19	pillow lava
25.07.2011	09.19	fish and shrimp
25.07.2011	09.27	red shrimp in pilot cam
25.07.2011	09.33	smoke
25.07.2011	09.42	smoke in the aft cam
25.07.2011	09.42	visual on dense smoke
25.07.2011	20.43	shrimp
25.07.2011	09.45	close to smoker
25.07.2011	09.47	anhydrite
25.07.2011	09.47	bee hive structures
25.07.2011	09.50	shrimp
25.07.2011	10.06	fish and shrimp
25.07.2011	10.14	Shrimp
25.07.2011	10.15	Shrimp swimming
25.07.2011	10.15	Various sizes of shrimp
25.07.2011	10.15	Limpets and crab
25.07.2011	10.16	Shrimp and crab

Date	Time UTC	Observation
25.07.2011	10.16	Beehive with smoke
25.07.2011	10.17	Shrimp colony
25.07.2011	10.02	Began second video mosaic
25.07.2011	10.25	End of second mosaic
25.07.2011	10.27	Began third mosaic
25.07.2011	10.31	~10 metres up the chimney, profuse venting
25.07.2011	10.32	End of third mosaic
25.07.2011	10.33	Shrimp carapice
25.07.2011	10.37	Began fourth mosiac
25.07.2011	10.39	End of fourth mosaic
25.07.2011	10.41	Start of fifth mosaic
25.07.2011	10.43	End of fifth mosaic
25.07.2011	10.44	Start of fith mosaic
25.07.2011	10.47	End of fifth mosaic
25.07.2011	11.14	At chimney for sampling
25.07.2011	11.23	Slurper deployed
25.07.2011	11.54	Vent, bee hive, white Anhydrite
25.07.2011	12.07	Fish in background
25.07.2011	12.08	Crab on vent in background
25.07.2011	12.15	Jelly fish in background
25.07.2011	12.19	Jelly fish in the Aft camera
25.07.2011	12.35	Now at depth of 3043, Deepest depth yet
25.07.2011	12.04	Squaring up to vent for first slurp
25.07.2011	12.53	Jelly
25.07.2011	12.57	Fish (depth 3045)
25.07.2011	12.58	Angular clasts of basalt. Looks like a rock fall deposit. Jelly
25.07.2011	12.58	Fish (depth 3044)
25.07.2011	13.05	Material Matting (GAC)

Date	Time UTC	Observation
25.07.2011	13.08	Jelly in background
25.07.2011	13.16	ctenophore, on the pilot camera
25.07.2011	13.23	Fauna- possibly scale worm
25.07.2011	13.31	fishand crabat base of vent
25.07.2011	13.34	Crab
25.07.2011	13.36	Fish
25.07.2011	13.36	3 fish on downward facing camera
25.07.2011	13.39	Fish at base of vent. Cupi
25.07.2011	13.04	bee hive structures and anhydrite deposits
25.07.2011	13.43	Crab
25.07.2011	13.44	Crab
25.07.2011	14.05	Shrimp
25.07.2011	14.11	Crab
25.07.2011	14.12	Anhydrite deposit, beehive
25.07.2011	14.13	Sulfide replacing anhydrite beehive
25.07.2011	14.18	Dense smoke
25.07.2011	14.02	bacterial matting
25.07.2011	14.02	fish along wall face
25.07.2011	14.24	Chimney complex back in view
25.07.2011	14.25	Anhydrite veins within sulfide beehive structures
25.07.2011	14.03	Large shrimp
25.07.2011	14.03	Anhydrite beehive
25.07.2011	14.31	Crab, appears to have the exact same colour as the vent its on (Camoflage)
25.07.2011	14.39	Crab
25.07.2011	14.41	Crab at base of the chimney
25.07.2011	14.47	Beehive smoker
25.07.2011	14.49	Crab about 10cm wide
25.07.2011	14.05	Fish

Date	Time UTC	Observation
25.07.2011	15.00	Dense smoke after breaking some of the vent
25.07.2011	15.05	Beehive structures
25.07.2011	15.14	dense smoke
25.07.2011	15.15	Crab (small)
25.07.2011	15.16	Dense smoke
25.07.2011	15.18	Beehive structures
25.07.2011	15.22	Dense smoke
25.07.2011	15.24	Vent
25.07.2011	15.24	Very dense smoke
25.07.2011	15.31	Crab over vent fumes
25.07.2011	15.45	End of DVD
25.07.2011	15.49	Start of DVD and HD
25.07.2011	15.57	beehive
25.07.2011	00.00	nat geo moment. veined beehive. Shrimp
25.07.2011	16.05	shrimp slurp
25.07.2011	16.07	smoke
25.07.2011	16.08	vent stacks
25.07.2011	16.11	dense smoke
25.07.2011	16.13	dense smoke
25.07.2011	16.15	sight back
25.07.2011	16.23	attempting snail collection scraping/suction
25.07.2011	16.24	smoke again
25.07.2011	16.26	sight back
25.07.2011	16.27	older chimneys
25.07.2011	16.28	back on active chimneys
25.07.2011	16.03	shrimp slurp
25.07.2011	16.35	smoke
25.07.2011	16.04	sight back

Date	Time UTC	Observation
25.07.2011	16.44	on smokers again no life

ROV SCIENTIFIC LOG

Cruise **CE11009** **VENTuRE Survey**

Station No **V23**

Dive No **097**

Date	Time UTC	Observation
27.07.2011	10:12	Eh, temp and nephels spike ,eH value of ~2,2 (min) Temp just over 5.0°C (max),
27.07.2011	10:16	Strong plume signal
27.07.2011	10:22	In the smoke plume
27.07.2011	10:26	Temp, eH and nephels beginning to stabalise
27.07.2011	11:57	jelly fish
27.07.2011	12:34	salinity spike and a small increase in temperature
27.07.2011	12:49	smoke coming into screen
27.07.2011	12:51	spike in transmissometer, eh and temp upto 3.6 433758.8 east 5036028.8 north
27.07.2011	12:56	spike in transmissometer, eh and temp upto 3.6 433751.0 east 5036001.8 north
27.07.2011	13:02	transmissometer and temp small spike 433763.3 east 5035900.8 north
27.07.2011	13:11	smoke in the water
27.07.2011	13:11	eh spike and temp spike to 3.65
27.07.2011	13:27	Jelly fish
	13:26	
27.07.2011	14:05	Very small spike in transmissometer (4.670) at a depth of 3019 (E 433633, N 5035904)
27.07.2011	14:14	Jelly fish
27.07.2011	14:19	Jelly fish
27.07.2011	14:23	Small spike in Transmissometer (4.580) at a depth of 3019, E433706 N 5036025
27.07.2011	14:25	Notable spike (off the scale)in eH at a depth 3019 E 433714 N503608
27.07.2011	14:28	eh returned back to normal
27.07.2011	14:35	Transmissometer spike 3012(depth)
27.07.2011	14:51	Spike in eH at a depth of 3024m below sea level. E433672 N5036122
27.07.2011	14:58	Spike in transmissometer at 3009m below sea level E433617 N5036052

Date	Time UTC	Observation
27.07.2011	15:04	Jelly fish
27.07.2011	15:05	Eh spike at a depth of 3019m below sea level, E 433633 N5036017.3
27.07.2011	15:09	Small increase in temperature at a depth of 3011m
27.07.2011	15:13	Siphonophore
27.07.2011	15:14	Spike in transmissometer at a depth of 3017m to 2.7. E433582 N5036062
27.07.2011	15:21	EH spike at a depth of 3023m E433617 N5036118
27.07.2011	15:31	Jelly fish
27.07.2011	15:46	Jelly fish
27.07.2011	16:59	Jelly fish
27.07.2011	17:08	end of dive

ROV SCIENTIFIC LOG

Cruise **CE11009** **VENTuRE Survey**

Station No **V24**

Dive No **098**

Date	Time UTC	Observation
28.07.2011	02.58	in midwater, approaching wall from the west
28.07.2011	02.59	Smoke visible from sources below, on HD
28.07.2011	03.00	temperature and Eh signals on ROV CTD
28.07.2011	03.04	Wall in sight - basalts covered with sulfides, microbial mats
28.07.2011	03.13	Heading to base of Balor chimney to being sampling ops
28.07.2011	03.16	Chimneys in sight on pilot cam
28.07.2011	03.20	Top of Balor on HD
28.07.2011	03.23	Wall in sight - descending to look for suitable area for crab trap deployment
28.07.2011	03.27	Fish on HD
28.07.2011	03.28	Macrourid fish on HD
28.07.2011	03.31	Fish on HD
28.07.2011	03.44	Still looking for site to deploy crab trap - ledges here judged not appropriate (risk of dislodging)
28.07.2011	03.46	Preapring to position on wall to sample sulfides
28.07.2011	03.55	Fish on HD
28.07.2011	04.02	Sampling sulfide crust on wall basalts into front Tray L
28.07.2011	04.07	Repositioning to sample more cliff wall sulfides
28.07.2011	04.08	"Sulfide crust" on wall appears, on closer inspection, just to be microbial mat - rock is actually basalt
28.07.2011	04.13	Fish on HD
28.07.2011	04.15	Preparing to scoop for microbes on cliff wall
28.07.2011	04.16	???Bright object on seafloor on HD
28.07.2011	04.17	Need to deploy crab trap to reach scoops in tray
28.07.2011	04.31	Looking for Balor chimney - but we appear to be over another, deeper vent source; we are at max possible depth, although nav shows Moytirra WP?
28.07.2011	04.49	Trying to drop crabpot

Date	Time UTC	Observation
28.07.2011	04.54	Crabpot dropped N50358998 E433775 Depth 3044m (on ROV) 2938m (on CTD) Waypoint Crab trap
28.07.2011	04.57	Trap sliding down repositioning trap
28.07.2011	04.59	Some kind of worm on HD
28.07.2011	05.02	Trap sliding down ended up stationary might be possible to recover
28.07.2011	05.04	Large fish on HD
28.07.2011	05.09	Looking for a good spot for sulfide samplig
28.07.2011	05.18	Sampling mixture of basalt and oxidised sulphide with scoop "thick yellow" band E433773 N503893 Depth 3038 (ROV) 2932 (CTD)
28.07.2011	05.20	Metal handle on "thick yellow" scoop broke, scoop lost
28.07.2011	05.21	Using "thin yellow" scoop to sample a mixture of basalt and oxidised sulphide
28.07.2011	05.32	Hard to sample. The substrate just crumbles
28.07.2011	05.48	Fish on HD
28.07.2011	05.52	Sample of a mixture and sulphide in Box A
28.07.2011	05.57	Trying to sample sulphide with the "thin yellow" scoop. N5035887 E433769
28.07.2011	06.05	Aborting sampling takes too long
28.07.2011	06.10	New chimney very close to the wall
28.07.2011	06.12	HD stopped and started
28.07.2011	06.14	chimney toppled by prop wash
28.07.2011	06.20	At wall sampling snot
28.07.2011	06.36	potential rimicaris
28.07.2011	07.30	2 Scale worms caught by suction sampler
28.07.2011	07.36	Basalt sample gathered, placed in Box I
28.07.2011	07.40	Basalt sample taken at 433768.7 E 5035941.7 N placed in Box J
28.07.2011	07.49	Scale worm gathered
28.07.2011	07.50	Scale worm gathered
28.07.2011	07.50	Scale worm gathered
28.07.2011	07.51	Scale worm gathered
28.07.2011	07.52	Zooarcid gathered
28.07.2011	07.57	Large scaleworm in picture

Date	Time UTC	Observation
28.07.2011	07.59	Scale worm gathered
28.07.2011	08.00	Scale worm gathered
28.07.2011	08.01	Scale worm gathered
28.07.2011	08.02	Scale worm gathered
28.07.2011	08.22	At Balor, preparing to test temperature
28.07.2011	08.24	Picking up temp test probe - outhermost one of front left basket (no label)
28.07.2011	08.34	Attempting to deploy temperature probe at chimney below Balor
28.07.2011	08.38	Rimicaris on HD video? Crab "predatory" behaviour vs shrimp also observed
28.07.2011	08.40	ROV stable up against Balor chimney - preparing to use temperature test probe on a lower vent orifice
28.07.2011	08.52	Abandoning temperature probe attempt - too risky for damage to vent or ROV
28.07.2011	09.00	Moving to "small chimney" WP from earlier in dive, to attempt temperature test there, as can sit on the bottom
28.07.2011	09.06	At base of wall, looking along it for small chimney
28.07.2011	09.10	Cusk eel on HD
28.07.2011	09.11	checked along wall to N, now turning S to look for former small chimney
28.07.2011	09.22	Still hunting for small chimney; dry lab checking depth on head-up display of previous DVD
28.07.2011	09.28	2 x cusk eels on wall on HD?
28.07.2011	09.29	Zoarcid on HD
28.07.2011	09.30	New beehives on base of wall now in sight - 433778.4 5035902.5 3041.1 m
28.07.2011	09.32	Several more beehives visible on wall below us, on downwards camera view
28.07.2011	09.34	having moved further S along wall, now seeing new larger chimney right against wall
28.07.2011	09.36	ROV stable against wall for attempting temperature test
28.07.2011	09.37	WP3 placed here 3039.7 depth, 433781.5 5035902.5
28.07.2011	09.43	Deploying yellow+green tape-marked temperature test probe
28.07.2011	09.47	yellow+green temp tester dropped, attempted to pick up blue-tape marked tester
28.07.2011	09.52	Great view of beehive complex beneath us on downward-looking view
28.07.2011	09.55	Zoarcids on HD; area here also has shrimp (large and small), and limpets on beehive surfaces
28.07.2011	10.02	Still attempting to set up ROV at vent source on wall for temperature test measurement
28.07.2011	10.26	Black smoke on HD

Date	Time UTC	Observation
28.07.2011	10.27	Shrimp colony on new chimney
28.07.2011	10.37	What seems like another new chimney found at 433788 E 5035894.4 N
28.07.2011	10.49	What looks like dead chimneys
28.07.2011	10.55	Rimicaris on HD video
28.07.2011	11.01	Zonarcid and limpets
28.07.2011	11.02	Rimicaris
28.07.2011	11.03	Crab
28.07.2011	11.06	Nat Geo moments galore!!!
28.07.2011	11.33	Shrimp right in the HD close up
28.07.2011	11.34	Shrimp close up in HD
28.07.2011	11.47	Searching for the new vent after losing it following S video mosaic
28.07.2011	12.09	Squaring up to sample large shrimp
28.07.2011	12.01	coloney of shrimp
28.07.2011	12.01	Shimmering around base of vent
28.07.2011	12.13	Fish
28.07.2011	12.26	Smoke and sediment blown into the water
28.07.2011	12.27	Large scale worm in front of HD camera
28.07.2011	12.41	Thick black smoke
28.07.2011	12.43	Large shrimp on chimney
28.07.2011	12.25	What appears to ba an Anhydrite Beehive
28.07.2011	12.59	Dense black smoke
28.07.2011	13.04	Large shrimp on chimney
28.07.2011	13.05	close up of beehive structure
28.07.2011	13.07	Old beehive structure
28.07.2011	13.01	chimney
28.07.2011	13.17	close up of shrimp swimming
28.07.2011	13.27	Dense black smoke
28.07.2011	13.33	Crab

Date	Time UTC	Observation
28.07.2011	13.34	Dense smoke
28.07.2011	13.36	Smoke clear. Bacterial mat on wall comes into view
28.07.2011	13.37	Vent fish
28.07.2011	13.38	Close up of vent fish
28.07.2011	13.38	Dense smoke
28.07.2011	13.39	Vent with anhydrite veins
28.07.2011	13.41	Pyrite around parts of vent, shimmering. Yellow blobs on beehive and all facing same direction
28.07.2011	13.43	Anhydrite
28.07.2011	13.43	Crabs and fish around base of vent
28.07.2011	13.44	Large cluster of shrimp blown off vent from thrusters
28.07.2011	13.46	Crab
28.07.2011	13.46	Beehive shrimp, crabs peas, all in one scene
28.07.2011	13.49	Young white anhydrite beehives
28.07.2011	13.57	2 beehives, 1 white and young, one covered in Fe oxide and old
28.07.2011	14.01	base of vet covered by dense pea's
28.07.2011	14.04	HD start recording, attempt at sampling green limpets
28.07.2011	14.03	damaged behive shows anhydrite forming
28.07.2011	14.51	barren substrate moving up the wall
28.07.2011	14.59	approaching vent fluid flow
28.07.2011	15.03	beehive
28.07.2011	15.05	anhydrite in cracks of the sulfides
28.07.2011	15.08	smoke located for possible vent fluid sampling
28.07.2011	15.12	beehive with anhydrates, shrimp
28.07.2011	15.13	sulfide rabble on wall, few eel like fish, 1 crab
28.07.2011	15.17	dead sulfides,
28.07.2011	15.22	vent in view again
28.07.2011	15.25	old organ pipe chimney strucutres
28.07.2011	15.30	fish

Date	Time UTC	Observation
28.07.2011	15.42	isolated shrimp
28.07.2011	16.03	collection of organ pipe, fell between drawers
28.07.2011	16.07	third attempt chimney crumbles
28.07.2011	16.20	fourth attempt to collect overhanging pipe falls between drawers
28.07.2011	16.23	fifth attempt large chimney collected!!!!
28.07.2011	16.29	end of dive

ROV SCIENTIFIC LOG

Cruise **CE11009** **VENTuRE Survey**

Station No **V25**

Dive No **099**

Date	Time UTC	Observation
29.07.2011	03.39	Media recording, heading to Dead Chimney waypoint to video mosaic
29.07.2011	03.52	At site
29.07.2011	03.57	Start of video mosaic
29.07.2011	04.00	Fish
29.07.2011	04.00	End of mosaic
29.07.2011	04.05	Searching for crabpot to recover
29.07.2011	04.08	Jelly on screen
29.07.2011	04.17	Possible new chimney @ 433743E 5035679 N
29.07.2011	04.21	Row of dead chimneys
29.07.2011	04.21	Crabpot sighted on downward cam
29.07.2011	04.22	Zoarcids
29.07.2011	04.23	Row of dead chimneys, possibly exhibiting diffuse flow
29.07.2011	04.25	Swimming Sea cumbers
29.07.2011	04.26	Sediment covered wall
29.07.2011	04.36	Tusk eel
29.07.2011	04.37	Crabpot recovered
29.07.2011	04.39	Heading to Little Chimney waypoint for vent fluid sampling
29.07.2011	05.05	Little Chimney site reached, trying to identify suitable sampling point
29.07.2011	05.34	Swimming shrimp
29.07.2011	05.38	End of dive

ROV SCIENTIFIC LOG

Cruise **CE11009** **VENTuRE Survey**

Station No **V26**

Dive No **100**

Date	Time UTC	Observation
29.07.2011	10.52	Heading to wall east of Balor
29.07.2011	11.03	By wall escarpment at a depth of 2900 m
29.07.2011	11.09	Temp spike to a max of 7.4 degrees easting 433762 northing 5035921
29.07.2011	11.12	Shrimp on the vent face
29.07.2011	11.13	Fish
29.07.2011	11.13	Believe we are on Balor
29.07.2011	11.15	2x Rimicaris and many Miricaris shrimp on vent near beehive
29.07.2011	11.28	Trying to locate source of vent plume to allow water sampling to occur.
29.07.2011	11.03	Large shrimp possible Rimicaris
29.07.2011	11.37	Trying to sample vent fluid from Balor chimney
29.07.2011	11.42	Fluid sample taken from the Balor plume flow

ROV SCIENTIFIC LOG

Cruise: **CE11009 VENTuRE Survey**

Station No.: **V30**

Dive No.: **101**

Date	Time UTC	Observation
01/08/2011	19.43	Rippled sand with dropstones. Ripples are straight crested
01/08/2011	19.43	Scabbard fish
01/08/2011	19.45	Dropstone with smaller clasts deposited behind it. Indication of current
01/08/2011	19.46	Shrimp
01/08/2011	19.47	Sea urchins
01/08/2011	19.47	Angular dropstones
01/08/2011	19.47	Anemone on dropstone
01/08/2011	19.48	Fish
01/08/2011	19.48	Squid
01/08/2011	19.51	Rat tail fish
01/08/2011	19.51	Patchy gravel
01/08/2011	19.53	Ripples crests are sinuous
01/08/2011	19.54	Shrimp. Urchin on downward facing camera
01/08/2011	19.54	Lophelia and Acanthogorgia
01/08/2011	19.56	Gravel filling scours behind dropstones
01/08/2011	19.57	Fish
01/08/2011	19.57	Dead Lophelia
01/08/2011	19.58	Rat tail fish
01/08/2011	19.58	Large fish
01/08/2011	19.58	Dead Lophelia rubble
01/08/2011	19.59	Sediment wave
01/08/2011	19.59	Patchy dead coral rubble
01/08/2011	20.00	Rat tail fish

Date	Time UTC	Observation
01/08/2011	20.00	Bits of coral rubble in the sand and urchins
01/08/2011	20.01	Gravel lags behind ripple troughs
01/08/2011	20.02	Fish
01/08/2011	20.03	Sediment wave
01/08/2011	20.04	Shrimp
01/08/2011	20.06	Purple urchin
01/08/2011	20.07	Fish on bottom left of HD screen
01/08/2011	20.09	Gravelley patch
01/08/2011	20.09	Fish
01/08/2011	20.10	What appears to be a subtle sediment wave
01/08/2011	20.12	Rat tail fish
01/08/2011	20.12	Ripples regularly change from straight crested to sinuosly crested. Dead coral.
01/08/2011	20.12	Shrimp
01/08/2011	20.13	Dead coral on dropstone
01/08/2011	20.13	What appears to be a subtle sediment wave
01/08/2011	20.15	Shrimp and patchy gravel
01/08/2011	20.15	2 purple urchins and an anenome
01/08/2011	20.16	Sea star and a rat tail fish
01/08/2011	20.17	Patchy gravel
01/08/2011	20.17	Gravel scour behind dropsones
01/08/2011	20.18	Sea urchins on dropstone. Shrinmp. Rat tail fish. Coral (acathagorgia)
Date	20.18	Gravel lags behind dropstones
01/08/2011	20.19	Ripples becoming more sinuous again. Large fish.
01/08/2011	20.20	Coarser sand deposited between crests
01/08/2011	20.21	Cupi eel?
01/08/2011	20.23	One patch of coral rubble smothered in sand with a live Acathogorgia
01/08/2011	20.24	Dropstone with a lag of gravel behind
01/08/2011	20.25	Squid

Date	Time UTC	Observation
01/08/2011	20.26	Squid
01/08/2011	20.26	Shrimp
01/08/2011	20.28	Rat tail fish
01/08/2011	20.28	Patchy gravel, deposited between crests
01/08/2011	20.29	Fish, rat tail fish and purple urchin
01/08/2011	20.30	Purple urchin. Wavelength of ripples decreasing.
01/08/2011	20.30	Fish, perhaps a ling?
01/08/2011	20.31	Large coral rubble
01/08/2011	20.32	Coral rubble
01/08/2011	20.33	Large either anenome or a coral
01/08/2011	20.33	Gravel lag behind dropstone
01/08/2011	20.34	Coral on a dropstone
01/08/2011	20.36	Fish and coral rubble
01/08/2011	20.37	Squid
01/08/2011	20.37	Large accumulation of gravel lag behind a relatively large dropstone
01/08/2011	20.38	Patchy gravel
01/08/2011	20.38	Squid
01/08/2011	20.40	Two fish
01/08/2011	20.42	Squid
01/08/2011	20.42	Coral rubble
01/08/2011	20.43	Several dropstones with gravel lags, all with the same orientation.
01/08/2011	20.44	Rat tail fish
01/08/2011	20.45	Fish
01/08/2011	20.45	Highly sinuous ripples
01/08/2011	20.46	Large boulder with coral and gravel surrounding
01/08/2011	20.47	Fish
01/08/2011	20.48	Coral rubble
01/08/2011	20.49	Highly sinuous ripples

Date	Time UTC	Observation
01/08/2011	20.50	Coral rubble
01/08/2011	20.50	Acanthagorgia
01/08/2011	20.51	Patches of dead coral with sand migrating over it (coral patch is only a few meters in size)
01/08/2011	20.51	Fish
01/08/2011	20.53	Cuspate ripples
01/08/2011	20.53	Coral rubble to the right
01/08/2011	20.55	Eel
01/08/2011	20.56	Small coral patch, and seems to be others on the sonar
01/08/2011	20.56	Squid, fish and cuspate ripples
01/08/2011	20.57	Larger patches of coral rubble on dropstones
01/08/2011	20.57	Acanthagorgia and a sea urchin
01/08/2011	20.59	Coral is alive
01/08/2011	20.59	Fish
01/08/2011	21.00	Appears to be less coarse gravel here, and more cuspate ripples
01/08/2011	21.01	An anenome on a dropstone, with coral rubble around it
01/08/2011	21.02	Patchy gravel
01/08/2011	21.03	Patches of coral
01/08/2011	21.03	Squid
01/08/2011	21.04	On the edge of a sediment wave (active sand transport)
01/08/2011	21.04	Coral rubble
01/08/2011	21.05	Straight crested ripples appear to dominate here
01/08/2011	21.06	Small isolated coral colonies, apears to be live. A bit of a slope
01/08/2011	21.07	Dropstones, straight crested ripples. New fish to dive
01/08/2011	21.08	Trigger fish?
01/08/2011	21.11	Coral
01/08/2011	21.11	Acanthagorgia, small coral patches and fish.
01/08/2011	21.12	Acanthagorgia on dead coral rubble
01/08/2011	21.13	Sea star and a rat tail fish

Date	Time UTC	Observation
01/08/2011	21.15	Coral rubble
01/08/2011	21.16	Patchy gravel and sea star
01/08/2011	21.16	Band of sinuous crests
01/08/2011	21.17	Purple urchin
01/08/2011	21.19	Coral rubble and patchy gravel
01/08/2011	21.20	Patchy gravel
01/08/2011	21.20	Purple urchin
01/08/2011	21.20	Straight crested ripples
01/08/2011	21.21	Sediment wave of coarse gravel
01/08/2011	21.22	Rat tail fish
01/08/2011	21.22	Coral rubble on dropstones
01/08/2011	21.22	Patchy gravel. Acanthogorgia
01/08/2011	21.23	Eel
01/08/2011	21.23	Dropstones and patchy gravel. Coral rubble with a sponge and possibly a bamboo coral
01/08/2011	21.24	Straight crested ripples. Big orange fish.
01/08/2011	21.25	Sinuosly crested ripples
01/08/2011	21.25	A band of coarse sediment which grades away as we progress NW
01/08/2011	21.26	Patchy gravel/possible sediment wave
01/08/2011	21.27	Coral rubble
01/08/2011	21.27	Rat tail fish, fish, urchin
01/08/2011	21.28	Rat tail fish
01/08/2011	21.28	Coral rubble within gravel lags, and live coral (Acanthagorgia) on dropstone. Anenome
01/08/2011	21.32	Basket star. Squid
01/08/2011	21.33	Rat tail
01/08/2011	21.33	Patchy gravel
01/08/2011	21.33	Spiny sea urchin
01/08/2011	21.33	Coral rubble
01/08/2011	21.34	Coral rubble

Date	Time UTC	Observation
01/08/2011	21.35	Coral patch
01/08/2011	21.35	Bubble sponges on coral
01/08/2011	21.42	Off mound squid
01/08/2011	21.43	Lots of patchy coral, sponge, sand waves coral largely dead - not broken
01/08/2011	21.44	Patch of rubble, eel
01/08/2011	21.44	Gravelly sediment
01/08/2011	21.45	Sea urchin, limpet
01/08/2011	21.46	Sandy sediment again
01/08/2011	21.46	Large solitary coral
01/08/2011	21.47	Moving upslope lots of dead coral. Many sponges coral colonies formerly 30 cm tall . Rare live polyps, gorgonians
01/08/2011	21.49	Pencil urchins, monkfish. Anemone on top of gorgonian
01/08/2011	21.50	Squat lobsters, whip coral , still moving upslope
01/08/2011	21.51	Anemone , lobster, sediment finer grained
01/08/2011	21.54	Some live coral tips , green sponge, grenadier, pencil urchins
01/08/2011	21.55	?Ascidian/spopnge near summit good exposure of coral heavily bioeroded formerly a dense coral reef
01/08/2011	21.56	At top of mound depth 1092.6
01/08/2011	21.57	Stylasterine coral
01/08/2011	22.00	Ripple marks . Angel fish
01/08/2011	22.00	lots of dead coral on bank, bioeroded, anomnes on dead coral, starfish
01/08/2011	22.02	going downhill
01/08/2011	22.03	good view in aft camera
01/08/2011	22.04	very steep
01/08/2011	22.07	lots of toppled coral framework
01/08/2011	22.09	sediment mounds about 30 cm high
01/08/2011	22.10	indurated patch of sedimnt appears vertical , dead shells disatriculated, looks like little burrows on small ridge
01/08/2011	22.11	behind ridge lots of small fragments
01/08/2011	22.13	appears smaller fragments towrds the base of the mound
01/08/2011	22.16	on flat again coarse sediments with stones

Date	Time UTC	Observation
01/08/2011	22.17	gravelly sediment with dead coral
01/08/2011	22.18	back to sandy sediment with rocks
01/08/2011	22.20	ripples sand waves
01/08/2011	22.26	rippled sand with possible forams, some dropstones
01/08/2011	22.27	fish and big monkfish plus organism at base of rock
01/08/2011	22.28	live Lophelia , 2 water bottles, sponges
01/08/2011	22.29	as head up sloope less live coral (5%) , desmophyllum,
01/08/2011	22.30	squat lobster, stylasterines, ?anemone, gastropod
01/08/2011	22.32	big snail = 10 cm
01/08/2011	22.33	starfish, contouring round edge, less coral , gorgonian
01/08/2011	22.34	spimy urchins , dead coral, sponges, plastic blanket
01/08/2011	22.35	bucket top
01/08/2011	22.37	Live Desmophyllum, and ?holothurian
01/08/2011	22.38	Rubbish.
01/08/2011	22.39	?Starfish
01/08/2011	22.41	on flat sandy sediment with ripplies and stones
01/08/2011	22.58	digital still of seabed betwen 2 waypoints, rippled sand with coarse gravelly shell in the troughs, bifurcating straight crested ripples
01/08/2011	23.04	another mound same character: fine grained sediment, sponges on largely dead corals
01/08/2011	23.05	gorgonians, squat lobsters, starfish, fish
01/08/2011	23.00	transecting over top of mound, largely dead silted, fragmented coral with clusters of sponges
01/08/2011	23.11	at top of mound 1084 m depth
01/08/2011	23.13	at base on other side on rippled sand with stones
01/08/2011	23.18	red sponge
01/08/2011	23.31	Digital still taken of sea bed: straight crested ripples & pebbles
01/08/2011	23.34	Coral mound
01/08/2011	23.35	sponge, soft coral
01/08/2011	23.37	fan coral (photo taken)
01/08/2011	23.38	fishing floats x 2

Date	Time UTC	Observation
01/08/2011	23.41	increasing frequency of drop stones
01/08/2011	23.43	fan coral sinous ripples in sand behind coral
01/08/2011	23.44	yoghurt pot (photo taken)
01/08/2011	23.44	Acanthogorgia coral
01/08/2011	23.46	plastic bags and various debris (plastic bottle, bag, waterproof jacket, beer can)
01/08/2011	23.48	whelk laying eggs
02/08/2011	00.07	dropstone with coral
02/08/2011	00.09	dropstone with coral
02/08/2011	00.16	Acanthogorgia coral
02/08/2011	00.16	coral mound (waypoint reached): Lophelia, sponge, mush the same as before.
02/08/2011	00.22	transit to next waypoint
02/08/2011	00.22	Sinous sediment waves
02/08/2011	00.34	coral mound (PHOTOS TAKEN) not the waypoint. Mound the same as previous mounds
02/08/2011	00.36	profusion of dropstones
02/08/2011	00.37	photo of 'fish'. No clue as to identity ROV crew saw it.
02/08/2011	00.38	lot of urchins
02/08/2011	00.45	large sediment waves with small scale ripples superimposed
02/08/2011	00.48	dropstone with coral (PHOTO TAKEN)
02/08/2011	00.50	waypoint reached but nothing there.
02/08/2011	00.52	small coral mound
02/08/2011	00.53	Another small coral mound
02/08/2011	00.56	small ray
02/08/2011	00.59	fishing net (PHOTO TAKEN)
02/08/2011	01.01	cuspate ripple around coral on drop stone
02/08/2011	01.03	large drop stones.
02/08/2011	01.04	large coral mound, lots of sponge, boarfish,
02/08/2011	01:17	Passing over small coral patch, large dropstone
02/08/2011	01:19	Passing across sediment waves, indicating n-s current direction (ROV heading is 039 degrees)

Date	Time UTC	Observation
02/08/2011	01:23:42	Munida / Munidopsis squat lobster on HD
02/08/2011	01:25	Running along edge of small scarp / dip in sedimented seafloor
02/08/2011	01:26	Pair of echinoids
02/08/2011	01:35	Moving N to next WP across sediment waves, occasional echinoid, occasional eel-shape fish
02/08/2011	01:36	Squid on HD
02/08/2011	01:36	Large fish, head-down feeding
02/08/2011	01:38	Another large fish
02/08/2011	01:39	Dropstone
02/08/2011	01:47:45	Squid on HD
02/08/2011	1:42:00	Boulder; coral patches appearing
02/08/2011	01:43	Coral patch, "minimound"
02/08/2011	01:45	Squid overtaking us on HD
02/08/2011	01:48	Fishing gear on small coral mound
02/08/2011	01:49	Another coral mound ahead, some living coral, dropstone, large fish
02/08/2011	01:51:56	Close fly-by by squid on HD
02/08/2011	01:52	Another coral mound, dropstone
02/08/2011	01:53:30	Nice colonies on HD
02/08/2011	01:54	Large cushion star on coral
02/08/2011	01:55	Small coral patch
02/08/2011	01:58	Field of small dropstones
02/08/2011	02:01	Approaching coral rubble, with fish, large venus flytrap anemones
02/08/2011	02:02:30	Flytrap anemones, fish, bamboo coral, on coral patch, large dropstone in centre, and a bottle on dropstone
02/08/2011	02:03	Anthomastus soft coral in patch
02/08/2011	02:04:45	Ray on HD
02/08/2011	02:06	Dropstone with small stones suggesting current running S, rather than N here
02/08/2011	02:14	Large Lophius monkfish on HD
02/08/2011	02:16	More coral rubble, dropstone
02/08/2011	02:17	Another small coral mound

Date	Time UTC	Observation
02/08/2011	02:18:44	Another ray
02/08/2011	02:20	Dropstone with gorgonians
02/08/2011	02:22	Coral mound, fish
02/08/2011	02:23	Patch of coral rubble
02/08/2011	02:25	Another coral patch
02/08/2011	02:27:20	Ray on HD
02/08/2011	02:28:40	3 x eel-fish on HD
02/08/2011	02:29:10	very active dogfish/smooth-hound on HD
02/08/2011	02:30:48	Ray on HD
02/08/2011	02:31	Bottle
02/08/2011	02:31	Approaching coral mound
02/08/2011	02:33	Elasmobranch in distance on HD
02/08/2011	02:39	Dropstone-centred coral patch
02/08/2011	02:41:00	Coral patch, flytrap anemone, echinoids, scorpion fish
02/08/2011	02:43	Cidaroid urchin on rippled sand (ripple wavelength ~10 cm)
02/08/2011	02:44	Large ?Coryphaenoides on HD
02/08/2011	02:47	Coral patch, flytrap anemones
02/08/2011	02:51	dropstone, coral rubble
02/08/2011	02:52	Another coral patch on small sedimented ridge
02/08/2011	02:55	Coral patch on another sedimented rise; flytrap anemones; galatheid squat lobster
02/08/2011	02:57	Coral patch
02/08/2011	03:08	Coral patch on HD
02/08/2011	03:09	Shark on HD

ROV SCIENTIFIC LOG (observations)

Cruise: **CE11009** **VENTuRE Survey**

Station No.: **V33**

Dive No.: **102**

Date	Time UTC	Observation
02/08/2011	06:59	transition gravel patch ripples
02/08/2011	07:02	gravel patchy
02/08/2011	07:04	coral mound with large drop stone
02/08/2011	07:05	fish
02/08/2011	07:16	gravel patches in ripple troughs
02/08/2011	07:18	fish
02/08/2011	07:25	less gravel patches, gravel more randomly distributed
02/08/2011	07:30	gravel patches
02/08/2011	07:33	random gravel
02/08/2011	07:34	fish
02/08/2011	07:37	Large hake. Small coral on dropstone
02/08/2011	07:39	Sinuous ripples with abundant gravel.
02/08/2011	07:40	Small gravel ridge marking edge of sediment wave
02/08/2011	07:41	Can of beer (empty) and lots of fish
02/08/2011	07:42	Gravel scour behind boulder
02/08/2011	07:42	Grenadier fish
02/08/2011	07:52	Ripples with wavy crests
02/08/2011	07:55	Gravel scour behind boulder
02/08/2011	07:58	crest of sediment wave
02/08/2011	07:59	boulder and coral rubble
02/08/2011	07:59	fishing line
02/08/2011	08:00	coral mound with large drop stone
02/08/2011	08:01	more fishing line

Date	Time UTC	Observation
02/08/2011	08:02	orange roughy
02/08/2011	08:06	fish
02/08/2011	08:07	net
02/08/2011	08:12	lost fishing gear
02/08/2011	08:13	off the mound
02/08/2011	08:14	Sinuous ripples with abundant gravel
02/08/2011	08:19	large boulder and large gravel patch
02/08/2011	08:20	sediment waves,sinuous ripples with abundant gravel and gravel patches in troughs
02/08/2011	08:30	fish
02/08/2011	08:36	octopus
02/08/2011	08:39	orange roughy
02/08/2011	08:42	coral rubble
02/08/2011	08:43	overgrown sediment waves, boulder on crest,
02/08/2011	08:50	coral surrounding boulder
02/08/2011	08:55:50	HD stills taken
02/08/2011	08:57:54	Fish
02/08/2011	08:57:54	Gravel at base of slope heading up terrace
02/08/2011	09:00	Gorgonic coral
02/08/2011	09:02:51	Boulder
02/08/2011	09:03	Straight crested sand ripples
02/08/2011	09:04	Increased gravel and cobbles as well as varying ripples heading upslope
02/08/2011	09:07	Sinuous ripples propagating upslope of feature wih live coral
02/08/2011	09:09	Isolated colonies of live coral, "fly trap" anenome
02/08/2011	09:09:50	Ling ,HD stills taken
02/08/2011	09:11	Squat lobsters
02/08/2011	09:11:58	Squid
02/08/2011	09:12	Crab
02/08/2011	09:15:00	Waypoint 3 added, BEST WE'VE SEEN SO FAR, POSSIBLE VIDEO MOSAIC TARGET

Date	Time UTC	Observation
02/08/2011	09:18	Downward loking camera showing good stuff
02/08/2011	09:20	Moving up slope, live coral visible
02/08/2011	09:21	Good coral shot
02/08/2011	09:25	Myctophid fish
02/08/2011	09:25:56	Good coral shot, HD stills taken
02/08/2011	09:28:04	Good coral close up
02/08/2011	09:30:38	Close up of feathery gorgonian
02/08/2011	09:34	"coral dyke"
02/08/2011	09:36	Litter visible
02/08/2011	09:38	Cuspate ripples at base of slope
02/08/2011	09:39	Moving back upslope
02/08/2011	09:43	Top of slope and over
02/08/2011	09:43:58	Heading to next waypoint at 0.7knot
02/08/2011	10:44	coral and sponges on flat seabed
02/08/2011	10:46	undulating seabed overgrown by coral patches and sponges
02/08/2011	10:49	coral and sponge ridges
02/08/2011	10:57	edge of coral ridge
02/08/2011	11:05	Desmophylum
02/08/2011	11.11	Coral with gorgonians and sponges, black corals, lophelia is small but live at the ends.
02/08/2011	11.21	straight crested and sinuous ripples. Dropstones with gravel lag
02/08/2011	11.24	patchy gravelly
02/08/2011	11.25	dropstones with gravel lag
02/08/2011	11.29	sinuous ripples
02/08/2011	11.30	Gravel lag at base of mound. Coral rubble. Sponges. Mostly dead coral. One acanthagorgia alive.
02/08/2011	11.31	mound is about 20m in diameter. Squat lobster
02/08/2011	11.32	spikey urchin
02/08/2011	11.33	fine sediment suspended in the water column
02/08/2011	11.36	squat lobster/crab

Date	Time UTC	Observation
02/08/2011	11.37	Fish on coral
02/08/2011	11.38	Black coral
02/08/2011	11.38	straight crested ripples at base of mound
02/08/2011	11.39	close up of coral
02/08/2011	11.40	More black coral
02/08/2011	11.43	straight and sinuous ripples
02/08/2011	11.43	patchy gravelly
02/08/2011	11.44	Gravel deposted betwwen crests.gravel lag behind dropstones.
02/08/2011	11.45	straight crsted ripples
02/08/2011	11.46	large dropstones with gravel lag
02/08/2011	11.48	straight crested ripples. Fish.
02/08/2011	11.48	dropstones with gravel lag
02/08/2011	11.49	cuspate and sinuous ripples
02/08/2011	11.50	coral rubble and gravel
02/08/2011	11.52	sraight crested ripples
02/08/2011	11.53	relatively large dropstones with gravel lags
02/08/2011	11.54	sinuous ripples
02/08/2011	11.55	patchy gravel
02/08/2011	11.56	dropstone with gralvel lag. Close to dropstone, appears to be angular
02/08/2011	11.57	sinuous ripples
02/08/2011	11.57	coral on dropstone
02/08/2011	11.58	sinuous and straight crested ripples
02/08/2011	11.59	large dropstone with gravel lag. Large red fish
02/08/2011	12.00	sinuous ripples
02/08/2011	12.01	patchy gravel
02/08/2011	12.04	Fish
02/08/2011	12.05	patchy gravel and sinuous ripples
02/08/2011	12.05	Cuspate and sinuous ripples. Dropstones

Date	Time UTC	Observation
02/08/2011	12.07	Large dropstone with gravel lag, and urchins within lag
02/08/2011	12.08	sraight crested ripples with gravel deposited within crests
02/08/2011	12.09	patchy gravel
02/08/2011	12.10	Large dropstone with gravel lag
02/08/2011	12.11	sand dominated patch(no gravel)
02/08/2011	12.16	a series of sediment waves
02/08/2011	12.19	Mound. Sponges. Coral rubble. Some live coral. Fish.
02/08/2011	12.2	Nurella ?, alive, and clean. No crabs present
02/08/2011	12.21	octocorals
02/08/2011	12.21	small black coral
02/08/2011	12.23	coral rubble
02/08/2011	12.23	Purple sea urchin
02/08/2011	12.23	Rat tail
02/08/2011	12.26	Coral rubble
02/08/2011	12.27	Boer fish
02/08/2011	12.31	appears to be much fine sediment suspended in the water
02/08/2011	12.33	sinuous ripples
02/08/2011	12.33	sponges and coral rubble
02/08/2011	12.34	Coral rubble and sea urchins
02/08/2011	12.35	ripples and fish on mound
02/08/2011	12.35	Orange roughy
02/08/2011	12.38	Dead corals, smothered by sediment
02/08/2011	12.38	fish
02/08/2011	12.39	Mound is roughly 5m in height
02/08/2011	12.40	gravel appears to be finer on the mound
02/08/2011	12.41	much dead coral, some live coral
02/08/2011	12.42	Mound dominated by sponges
02/08/2011	12.43	sea urchins

Date	Time UTC	Observation
02/08/2011	12.44	rat tail
02/08/2011	12.44	very coarse, rounded, gravel patch
02/08/2011	12.45	sediment wave, where there is a sharp gradient between the gravel and finer sediment wave.
02/08/2011	12.46	straight and sinuously crested ripples
02/08/2011	12.47	coral rubble, some live coral
02/08/2011	12.48	Orange roughy
02/08/2011	12.5	sinuously crested ripples
02/08/2011	12.51	Aborting Dive

Geological Sample log

Station	Group No. & Name	Sample Code	Title
V16	Beehive	CE11009_095_001R	Beehive Sulphide
V16	Beehive	CE11009_095_002R	Pipe from interior of beehive
V16	Beehive	CE11009_095_003R	Beehive exterior from non-smoking beehive
V16	Beehive	CE11009_095_004R	Massive Sulphide non-smoking beehive
V16	Beehive	CE11009_095_005R	Massive Sulphide interior pipe from extinct beehive
V16	Beehive	CE11009_095_006R	Dead Beehive
V17	1 Mineralised Dolerite	CE11009_096_001R	Angular Dolerite
V17	1 Mineralised Dolerite	CE11009_096_002R	Mineralised Dolerite
V17	2 Massive Sulphide	CE11009_096_003R	Massive Sulphide
V17	2 Massive Sulphide	CE11009_096_004R	Massive Sulphide
V17	2 Massive Sulphide	CE11009_096_005R	Massive Sulphide
V17	2 Massive Sulphide	CE11009_096_006R	Massive Sulphide Chimney Fragment
V17	3 Leafy Sulphide	CE11009_096_007R	Leafy Sulphide
V17	3 Leafy Sulphide	CE11009_096_008R	Leafy Sulphide
V17	4 Chimney Pieces	CE11009_096_009R	Chimney Piece
V17	4 Chimney Pieces	CE11009_096_010R	Chimney Piece
V17	4 Chimney Pieces	CE11009_096_011R	Chimney Piece
V17	5 Organ Pipes	CE11009_096_012R	Organ Pipe
V17	5 Organ Pipes	CE11009_096_013R	Organ Pipe
V17	5 Organ Pipes	CE11009_096_014R	Organ Pipe
V17	6 Anhydrite	CE11009_096_015R	Anhydite
V17	6 Anhydrite	CE11009_096_016R	Anhydite
V20	Dredge sample	CE11009_V20_001R	Olivine Phyrric Basalt
V20	Dredge sample	CE11009_V20_002R	Olivine Phyrric Basalt
V20	Dredge sample	CE11009_V20_003R	Olivine Phyrric Basalt
V24	Rock	CE11009_098_R001	Dolerite
V24	Rock	CE11009_098_R002	Pillow fragments and Breccia
V24	Rock	CE11009_098_R003	Altered Dolerite
V24	Beehive	CE11009_098_R004	Active Beehive
V24	Beehive	CE11009_098_R005	Active Beehive Fragments
V24	Beehive	CE11009_098_R006	Active Beehive (broken)
V24	Organ pipe	CE11009_098_R007	Active smoker organ pipes
V24	Massive sulphide	CE11009_098_R008	Low active vent field (Spine)
V24	Rock	CE11009_098_R009	Assorted glass
V24	Organ pipe	CE11009_098_R010	Coarse pyrite pipe fragments
V26	Massive sulphide	CE11009_100_R	Active chimney @ Balor
V29	Sediment Grab	CE11009_V29_S	Sediment with Dropstones and Coral rubble
v34	Sediment Grab	CE11009_V34_S	Sediment with Dropstones and Coral rubble

BIOSAMPLE SUMMARY SHEET

RV Celtic Explorer Cruise CE11009 Venture Jul-Aug 2011
Moytirra vent field, 45 deg N MAR, ~2940 m

Taxon	Species ID Formalin	Species ID EtOH	Stable isotopes Frozen -80C	Microbiology Frozen -80C	RNA expression Frozen -80C	Metals Frozen -80C	Pop gen EtOH	Reproduction Formalin	Biodiscovery Frozen -80C	TOTAL
Small alvinocaridid shrimp	**11**	**10**	**10**	**2**	**10**	**10**	**120**	**100**	**10**	283
Sample numbers	CE11009_095_001B/1F CE11009_096_001A/1F	CE11009_096_001A/2A	CE11009_098_001A/3VC	09_096_001A/3MVC	CE11009_096_001A/4VC	CE11009_098_001A/4VC	CE11009_096_001A/5A CE11009_098_001A/1A CE11009_098_001A/6A	CE11009_096_001A/5F CE11009_098_001A/2F	CE11009_098_001A/5VC	
Peltospirid limpets	**0**	**11**	**60**	**14**	**60**	**60**	**228**	**206**	**60**	699
Sample numbers		CE11009_095_001R/1A CE11009_096_001A/13A	CE11009_096_001A/16VC CE11009_098_001A/29VC	9_096_001A/10MVC 9_098_001A/33MVC	CE11009_096_001A/15VC CE11009_098_001A/30VC	CE11009_096_001A/17VC CE11009_098_001A/31VC	CE11009_096_001A/11A CE11009_096_001A/12A CE11009_098_001A/28A CE11009_098_001R/1A	CE11009_096_001A/14F CE11009_098_001A/27F	CE11009_096_001A/18VC CE11009_098_001A/32VC	
Large alvinocaridid shrimp	**1**									1
Sample numbers	CE11009_096_001A/6F									
Brachyuran crab	**5**	**1**	**0.5**		**0.5**					7
Sample numbers	CE11009_096_001A/7F CE11009_099_001BS/6F CE11009_099_001BS/7F CE11009_099_001BS/8F	CE11009_098_001A/13A	CE11009_096_001A/8VC		CE11009_096_001A/8A					
Ampharetid polychaete	**1**									1
Sample numbers	CE11009_096_001A/9A									
Polynoid polychaetes	**1**	**1**	**0.5**		**0.5**					3
Sample numbers	CE11009_098_001A/14F	CE11009_098_001A/15A	CE11009_098_001A/16VC		CE11009_098_001A/16VC					
Third alvinocaridid shrimp	**2**	**1**	**0.5**	**1**	**1**	**0.5**				6
Sample numbers	CE11009_098_001A/11F CE11009_098_001A/12F	CE11009_098_001A/10A	CE11009_098_001A/8VC	09_098_001A/9MVC	CE11009_098_001A/7VC	CE11009_098_001A/8VC				
Mid-water jelly	**1**									1
Sample numbers	CE11009_098_001A/17F									
Amphipods		**2**								2
Sample numbers		CE11009_098_001A/18A								
Turrid gastropods	**1**	**3**								4
Sample numbers	CE11009_098_001A/24F	CE11009_098_001A/20A								
Spionid polychaete		**1**								1
Sample numbers		CE11009_098_001A/21A								
Skeneid gastropods	**12**	**10**	**9**		**10**	**9**				50
Sample numbers	CE11009_098_001A/23F	CE11009_098_001A/22A	CE11009_098_001A/26VC		CE11009_098_001A/26VC	CE11009_098_001A/26VC				
Ampharetid polychaetes	**2**									2
Sample numbers	CE11009_098_001A/25F									
Unident polychaete	**1**									1
Sample numbers	CE11009_098_001A/34F									
Egg case		**1**								1
Sample numbers		CE11009_098_001A/19A								
Zoarcid fish	**0.2**	**0.2**	**0.2**				**0.2**	**0.2**		1
Sample numbers	CE11009_099_001BS/1F	CE11009_099_001BS/2A	CE11009_099_001BS/3VC				CE11009_099_001BS/5A	CE11009_099_001BS/4F		

GRAND TOTAL **1063**

ROV Holland-1 Dive 095
BIO SAMPLES
RV Celtic Explorer Cruise CE11009
Moytirra vent field, 45 deg N MAR
24/07/2011

001B samples found in bioboxes on ROV tool tray

Sample	Description	Purpose	Holder
CE11009_095_001B/1F	1 x formalin-fixed berried small female alvinocaridid shrimp TL 25.6 mm CL 7.5 mm	Species ID	Jon
CE11009_095_001B/2F	1 x formalin-fixed juvenile alvinocaridid shrimp TL 13.8 mm CL 3.8 mm	Species ID	Jon

001R samples collected from surface of chimney fragment collected for geology

Sample	Description	Purpose	Holder
CE11009_095_001R/1A	1 x EtOH-fixed peltospirid limpet	Species ID	Jon

ROV Holland-1 Dive 096
BIO SAMPLES
RV Celtic Explorer Cruise CE11009
Moytirra vent field, 45 deg N MAR
25/07/2011

001A samples collected by ROV aspirator

Sample	Description	Purpose	Holder
CE11009_096_001A/1F	9 x formalin-fixed small alvinocaridid shrimp	Species ID	Jon Copley
CE11009_096_001A/2A	10 x EtOH-fixed small alvinocaridid shrimp	Species ID	Jon Copley
CE11009_096_001A/3MVC	2 x -80C frozen small alvinocaridid shrimp	Microbiology	John Benzie
CE11009_096_001A/4VC	10 x -80C frozen small alvinocaridid shrimp	RNA expression	Jon Copley
CE11009_096_001A/5A	85 x EtOH-fixed small alvinocaridid shrimp	Pop gen	Jon Copley
CE11009_096_001A/5F	85 x formalin-fixed small alvnocaridid shrimp	Reproduction	Jon Copley
CE11009_096_001A/6F	1 x formalin-fixed large alvinocaridid shrimp	Species ID	Jon Copley
CE11009_096_001A/7F	2 x formalin-fixed brachyuran crabs	Species ID	Jon Copley
CE11009_096_001A/8A	EtOH-fixed leg of damaged brachyuran crab	RNA expression	Jens Carlssen
CE11009_096_001A/8VC	1 x -80C frozen damaged brachyuran crab	Stable isotopes /	Jon Copley
CE11009_096_001A/9A	1 x EtOH fixed ampharetid polychaete	Species ID	Jon Copley
CE11009_096_001A/10MVC	4 x -80C frozen peltospirid limpets	Microbiology	John Benzie
CE11009_096_001A/11A	50 x EtOH-fixed small peltospirid limpets	Pop gen	Jens Carlssen
CE11009_096_001A/12A	50 x EtOH-fixed large peltospirid limpets	Pop gen	Jens Carlssen
CE11009_096_001A/13A	10 x EtOH-fixed peltospirid limpets	Species ID	Jon Copley
CE11009_096_001A/14F	86 x formalin-fixed peltospirid limpets	Reproduction	Jon Copley
CE11009_096_001A/15VC	10 x -80C frozen peltospirid limpets	RNA expression	Jens Carlssen
CE11009_096_001A/16VC	10 x -80C frozen peltospirid limpets	Stable isotopes	Jon Copley
CE11009_096_001A/17VC	10 x -80C frozen peltospirid limpets	Metals	Jon Copley
CE11009_096_001A/18VC	10 x -80C frozen peltospirid limpets	Biodiscovery	Patrick Collins
CE11009_096_001A/19A	EtOH-fixed remainder rubble 250 um sieved from aspirator box	Meiofauna	John Benzie

001R sample picked from chimney sulfides collected for geology

Sample	Description	Purpose	Holder
CE11009_096_001R/1A	EtOH-fixed egg mass from chimney sulfide	Species ID	Jens Carlssen

ROV Holland-1 Dive 098
BIO SAMPLES
RV Celtic Explorer Cruise CE11009
Moytirra vent field, 45 deg N MAR
28/07/2011

001A samples collected by ROV aspirator

Sample	Description	Purpose	Holder
CE11009_098_001A/1A	15 x EtOH-fixed small alvinocaridid shrimp	Pop gen	Jens Carlssen
CE11009_098_001A/2F	15 x formalin-fixed small alvinocaridid shrimp	Reproduction	Jon Copley
CE11009_098_001A/3VC	10 x -80C frozen small alvinocaridid shrimp	Isotopes	Jon Copley
CE11009_098_001A/4VC	10 x -80C frozen small alvinocaridid shrimp	Metals	Jon Copley
CE11009_098_001A/5VC	10 x -80C frozen small alvinocaridid shrimp	Biodiscovery	Patrick Collins
CE11009_098_001A/6A	20 x EtOH-fixed small alvinocaridid shrimp	Pop gen	Jens Carlssen
CE11009_098_001A/7VC	1 x -80C frozen third alvinocaridid shrimp	RNA	Jens Carlssen
CE11009_098_001A/8VC	1 x -80C frozen third alvinocaridid shrimp	Isotopes / metal	Jon Copley
CE11009_098_001A/9MVC	1 x -80C frozen third alvinocaridid shrimp	Microbiology	John Benzie
CE11009_098_001A/10A	1 x EtOH-fixed third alvinocaridid shrimp	ID	Jon Copley
CE11009_098_001A/11F	1 x formalin-fixed male third alvinocaridid shrimp	ID	Jon Copley
CE11009_098_001A/12F	1 x formalin-fixed female third alvinocaridid shrimp	ID	Jon Copley
CE11009_098_001A/13A	1 x EtOH formalin-fixed brachyuran crab	ID	Jon Copley
CE11009_098_001A/14F	1 x formalin-fixed polynoid polychaete	ID	Jon Copley
CE11009_098_001A/15A	1 x EtOH-fixed polynoid polychaete	ID	Jon Copley
CE11009_098_001A/16VC	1 x -80C frozen polynoid polychaete	Isotopes / RNA	Jens Carlssen
CE11009_098_001A/17F	1 x formalin-fixed midwater jelly	ID	Jon Copley
CE11009_098_001A/18A	2 x EtOH-fixed amphipods	ID	Jon Copley
CE11009_098_001A/19A	1 x EtOH-fixed egg case	ID	Jens Carlssen
CE11009_098_001A/20A	3 x EtOH-fixed turrid gastropods	ID	Jon Copley
CE11009_098_001A/21A	1 x EtOH-fixed spionid	ID	Jon Copley
CE11009_098_001A/22A	10 x EtOH-fixed skeneid gastropods	ID	Jon Copley
CE11009_098_001A/23F	12 x formalin-fixed skeneid gastropods	ID	Jon Copley
CE11009_098_001A/24F	1 x formalin-fixed turrid gastropod	ID	Jon Copley
CE11009_098_001A/25F	2 x formalin-fixed ampharetid polychaetes	ID	Jon Copley
CE11009_098_001A/26VC	28 x -80C frozen skeneid gastropods	Isotopes / metal	Jens Carlssen/Jon Copley
CE11009_098_001A/27F	120 x formalin-fixed peltospirid limpets	Reproduction	Jon Copley
CE11009_098_001A/28A	125 x EtOH-fixed peltospirid limpets	Pop gen	Jens Carlssen
CE11009_098_001A/29VC	50 x -80C frozen peltospirid limpets	Isotopes	Jon Copley
CE11009_098_001A/30VC	50 x -80C frozen peltospirid limpets	RNA	Jens Carlssen
CE11009_098_001A/31VC	50 x -80C frozen peltospirid limpets	Metals	Jon Copley
CE11009_098_001A/32VC	50 x -80C frozen peltospirid limpets	Biodiscovery	Patrick Collins
CE11009_098_001A/33MVC	50 x -80C frozen peltospirid limpets	Microbiology	John Benzie
CE11009_098_001A/34F	1 x formalin-fixed unident polychaete	ID	Jon Copley

001R sample picked from chimney sulfides collected for geology

Sample	Description	Purpose	Holder
CE11009_098_001R/1A	3 x EtOH-fixed peltospirid limpets	Pop gen	Jens Carlssen

ROV Holland-1 Dive 099
BIO SAMPLES
RV Celtic Explorer Cruise CE11009
Moytirra vent field, 45 deg N MAR
29/07/2011

001BS samples collected by "bucket sub"

Sample	Description	Purpose	Holder
CE11009_099_001BS/1F	1 x formalin-fixed thoracic-organ dissected zoarcid fish	ID	Jon Copley
CE11009_099_001BS/2A	1 x EtOH-fixed liver tissue from fish	ID	Jens Carlssen
CE11009_099_001BS/3VC	1 x -80C frozen liver tissue from fish	Isotopes /	Jon Copley
CE11009_099_001BS/4F	Eggs from fish	Reproduct	Jon Copley
CE11009_099_001BS/5A	Eggs from fish	Genetics	Jens Carlssen
CE11009_099_001BS/6F	1 x formalin-fixed brachyuran crab	ID	Jon Copley
CE11009_099_001BS/7F	1 x formalin-fixed brachyuran crab	ID	Jens Carlssen
CE11009_099_001BS/8F	1 x formalin-fixed brachyuran crab	ID	Patrick Collins

Microbial sample log

Sample number	Description	Preservation
CE11009_096_001M	rock	frozen -80
CE11009_096_002M	sediment and water	frozen -80
CE11009_096_001A/3MCV	whole shrimp (2)	frozen -80
CE11009_096_001A/10MCV	whole limpets (4)	frozen -80
CE11009_098_001M	old sulphide	frozen -80
CE11009_098_002M	young beehive	frozen -80
CE11009_098_003M	crusty brown (sulphide)	frozen -80
CE11009_098_004M	"snail trail" 1	frozen -80
CE11009_098_005M	"snail trail" 2	frozen -80
CE11009_098_006M	scoop rock	frozen -80
CE11009_098_007M	scoop sediment	frozen -80
CE11009_098_008M	scoop sediment	frozen -80
CE11009_098_009M	scoop sediment	frozen -80
CE11009_098_010M/F	scoop sediment	formalin
CE11009_098_011M	slime from beehive	frozen -80
CE11009_098_012M	Drawer D sediment	frozen -80
CE11009_098_013M	Drawer C sediment	frozen -80
CE11009_098_001A/9MCV	Rimicaris shrimp whole (1)	frozen -80
CE11009_098_001A/33MCV	Peltospira limpets whole (10)	frozen -80

Onboard Vent-Fluid Sub-Sampling Log

Sample	Piston Length (cm)	RI (‰ salinity)	Alkalinity	pH	H_2S	CH4	IC & SiO_2	IC & SiO2 dilutions	isotopes	Bulk (H^+)	Dregs
CE11009-V26 (H100)-F1	18.1	39	Yes	Yes	Yes		Yes		Yes	Yes	Yes
CE11009-V26 (H100)-F2	18.1	38	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes

A7. Naming features

Several new features were discovered on the seafloor on the mid-Atlantic Ridge during this survey which have been named for ease of reference. As a discovery on an Irish vessel,names from Irish mythology were taken as inspiration. The Fomorians were evil giants in Irish mythology with associations with the sea, underworld and fire. n comparison, iImpressions of the newly discovered vent field suggest large often brutish sulphide structures and somewhat hellish conditions with large volume of black sulphide-rich water emitting from the top of vents. The following names were applied to features.

The Vent Field

"Moytirra"

Derives from "Plain of the Pillars" and is the site of two battles in Irish mythology , one between the Formorians and the Tuatha Dé Danaan

Largest, most active showcase chimney

"Balor"

Giant, evil king of the Fomorians who fought and lost against the Dé Danaan in the 2nd battle of Moytirra. Associations with the sea, fire and underworld. He possessed a third eye in the middle of his head which took four men to lift the eyelid with a brass ring. Once open the eye was a powerful weapon that scorched the landscape and killed all with its poison.

Slender chimneys surrounding Balor

"The Fomorians"

The warriors for whom Balor was their king. Fomorian derives from "underworld phantoms". After the 2nd Battle of Moytirra, the Fomorians fled into the sea.

Chimney complex at base of the cliff

"Dian Cécht" (pronounced dee-an kekt)

God of Healing who saved Ireland from the Goddess of War's baby son whose ashes from serpents in his heart he threw into the River Barrow causing it to boil. He was also present at the Battles of Moytirra

Southerly chimney complex that is now largely inactive

"Mag Mell"

Mythical realm where glorious warriors go after death.

A8. Personnel

Name	Responsibility	Affiliation
Ships Crew		
Denis Rowan	Master	P&O Maritime
Basil Murphy	Chief Officer	P&O Maritime
Laurence Kirwan	Officer On Watch	P&O Maritime
Rob Inglis	Chief Engineer	P&O Maritime
Ted Sweeny	2nd Engineer	P&O Maritime
Paul Wray	ETO	P&O Maritime
Gerry Carthy	Bosun	P&O Maritime
Shane Moran	Bosun's Mate	P&O Maritime
Ken O'Neill	AB1	P&O Maritime
Thomas Grealy	AB2	P&O Maritime
Vincent Devitt	AB3	P&O Maritime
James Moran	Chief Cook	P&O Maritime
Lou Richard	Assistant Cook	P&O Maritime
Gordon Fury	Technician	P&O Maritime
ROV Team		
Jim Nelson	ROV Day Shift Supervisor	Marine Institute
Will Handley	ROV Night Shift Supervisor	Freelance
Paddy O'Driscoll	ROV Pilot Tech	Marine Institute
Dave Turner	ROV Pilot Tech	Freelance
Karl Bredendiech	ROV Pilot Tech	Freelance
Rob Carpenter	ROV Pilot Tech	Freelance
National Geographic Television		
Chris King	Cameraman & Sound Engineer	Freelance
Scientific Team		
Dr. Andy Wheeler	Chief Scientist	University College Cork
Dr. Bram Murton	Watch leader, Geology (leader)	National Oceanography Centre, Southampton (NOC)
Dr. Boris Dorschel	Watch leader	University College Cork
Patrick Colins	Macrofauna (leader)	Nat. Uni. Ireland, Galway
Dr. Jens Carlsson	Genetics (leader)	University College Cork
Dr. Jon Copley	Macrofauna & genetics (co-leader)	Uni. Southampton
Dr. Darryl Green	Plume Geochemistry (leader)	NOC
Prof. John Benzie	Microbiology (leader)	University College Cork
Maria Judge	Geologist	Geological Survey of Ireland
Aaron Lim	Geologist	University College Cork
Alice Antoniacomi	Biologist	University College Cork
Mark Coughlan	Geologist	University College Cork
Kirsty Morris	Biologist	NOC
Verity Nye	Biologist	University of Southampton

Left-right: Lou Richard, Basil Murphy, Kirsty Morris, Jimmy Moran, Verity Nye, Dennis Rowan (Master), John Benzie, Rob Carpenter, Paddy O'Driscoll, Maria Judge, Bram Murton, Mark Coughlan, Dave Turner, Will Handley, Gerry Carthy, Patrick Collins, Andy Wheeler, Jens Carlsson, Boris Dorschel, Jim Nelson, Alice Antoniacomi, Jon Copley, Lar Kirwan, Darryl Green, Vinny Devitt, Aaron Lim, Karl Bredendiech, Chris King, Shane Moran, Ken O'Neill, Paul Wray, Ted Sweeney, Gordon Fury, Thomas Grealy, Rob Inglis.

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Aug 04, 2011

Explorers discover deep-sea hydrothermal vents

Comment

By Dan Vergano, USA TODAY

Updated

An Irish-headed expedition reports the discovery of a deep sea vent field almost 10,000 feet down in the Atlantic Ocean.

The Moytirra Vent Field, reported by a team led by Andy Wheeler of University College, in Cork, Ireland, rests on the mid-Atlantic ridge north of the Azores islands. Hydrothermal vents typically form deep-sea chimneys covered with minerals and release boiling waters into undersea ecosystems crawling with strange shrimp, snails and

"On the first dive, we found the edge of the vent field within two hours of arriving on the seafloor," said Wheeler, in a statement. "The (sub) descended a seemingly bottomless underwater cliff into the abyss. We never reached the bottom, but rising up from below were these chimneys of metal sulphides belching black plumes of mineral-rich superheated water."

Moytirra means the 'Plain of the Pillars', in Gaelic, the name of a battlefield in Irish myth. The field's tallest chimney stands more than 32 feet tall , and is named "Balor" after a mythological giant.

The investigation was supported by the Irish government and the National Geographic Society, for a 2012 National Geographic Channel series, "Alien Deep".

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Irish scientists find new life in Atlantic's depths

By Eoin English

FRIDAY, AUGUST 05, 2011

THEY are creatures from the abyss described as the closest things to extra-terrestrial life which can be found on this planet.

Irish scientists who have charted a previously unknown system of deep sea vents in the middle of the Atlantic revealed stunning images yesterday of potential new species they found living near underwater volcanoes some three kilometres below the ocean surface almost 1,500 kilometres off the west coast.

Vivid orange shrimp-like animals which see in infrared through a third eye, and scaly alien-like snails and worms are among many new lifeforms which thrive in these deep dark toxic depths.

"It is too early to say whether some of them are new species or not but we are confident that at least three will prove to be," VENTuRE mission leader Dr Andy Wheeler, from University College Cork (UCC) said.

How they survive in these extreme conditions could have huge potential for medical purposes, and how the vents form could also help the country's mining industry, he said.

His team, which included scientists from the National Oceanographic Centre (NOC) in Southampton, the University of Southampton, NUI Galway, and the Geographical Survey of Ireland, returned to the port of Cork yesterday after their 23-day mission on board the State's marine research vessel, Celtic Explorer.

The mission was one of the most technically challenging ever undertaken by the ship.

In a briefing by the scientific team onboard the vessel yesterday, Dr Wheeler said they spent several days surveying the mid-Atlantic ridge, where the European tectonic plate and the American plate spread, and discovered within days the new vent field on the European side of the ridge.

They deployed the vessel's remotely operated submarine, the Holland 1, down to explore.

Operating at the very limits of its mechanical ability, it descended 3,000 metres along a seemingly bottomless underwater cliff into the abyss.

"We never reached the bottom but rising up from below were these chimneys of metal sulphides belching black plumes of mineral-rich superheated water," Dr Wheeler said.

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"Often the search for vents takes much longer and our success is testament to the hard work and skill of everyone on board."

NOC's Dr Bram Murton hailed it as a major discovery.

"Our discovery is the first deep-sea vent field known on the mid-Atlantic Ridge north of the Azores," he said.

"Although people have been crossing this ocean for centuries, we are the first to reach this spot beneath the waves and witness this natural wonder.

"The sense of awe at what we are seeing does not fade, and now we are working hard to understand what our discovery tells us about how are planet works."

The newly charted vent system has been named the Moytirra Vent Field – after a battlefield in Irish mythology.

The largest chimney found is more than 10 metres high and has been named Balor after a legendary giant.

Patrick Collins, from NUI Galway's Ryan Institute, who led Ireland's marine biological team investigating the unique ecosystem, said: "Everyone on board is proud of this Irish discovery. In comparison with other vent fields, Moytirra contains some monstrous chimneys and is in an unusual setting at the bottom of a cliff – a real beauty."

He is now working with Jon Copley of the University of Southampton to catalogue and characterise the species found at the vents.

Minister for Agriculture and the Marine, Simon Coveney hailed the discovery and praised all involved in the expedition.

"It is a major statement by Ireland that we are serious about marine research," he said.

Chief executive of the Marine Institute, Dr Peter Heffernan, said the mission clearly demonstrates Ireland's capacity to undertake world-class research, as well as the benefits of international cooperation.

"This targeted use of research funding by our organisation, which has enabled senior Irish scientists to lead this survey in partnership with international colleagues, has resulted in scientific discoveries of global interest which will enhance Ireland's growing reputation in deep-sea exploration."

The expedition team also included Dr Boris Dorschel, a marine geologist with UCC, Professor John Benzie, a marine geneticist from UCC, Dr Darryl Green, a marine geochemist with the NOC, Dr Jens Carlsson, a marine geneticist from UCC, Patrick Collins, a marine biologist with NUI Galway, Mark Coughlan and Aaron Lim, marine geologists from UCC, Alice Antoniacomi, a marine geneticist with UCC, Maria Judge, a marine geologist with the Geological Survey of Ireland, Verity Nye, a marine biologist with the University of Southampton, and Kirsty Morris, a marine biologist with NOC.

The mission had two aims – the first was to study the first hydrothermal vent field detected along the mid-Atlantic ridge between the Azores and Iceland – which proved a huge success.

But on their return voyage to Ireland, the team also studied the significant westward extension of a known field of deepwater coldwater corals.

This area of active coral growth in the Porcupine Seabight has been declared a Special Area of Conservation because its unique ecosystem supports a wide variety of marine life.

The expedition deployed the Holland 1 to estimate the abundance and density of live coral.

The mission was recorded by a film crew from National Geographic for its Oceanus television series, to be broadcast in 2012.

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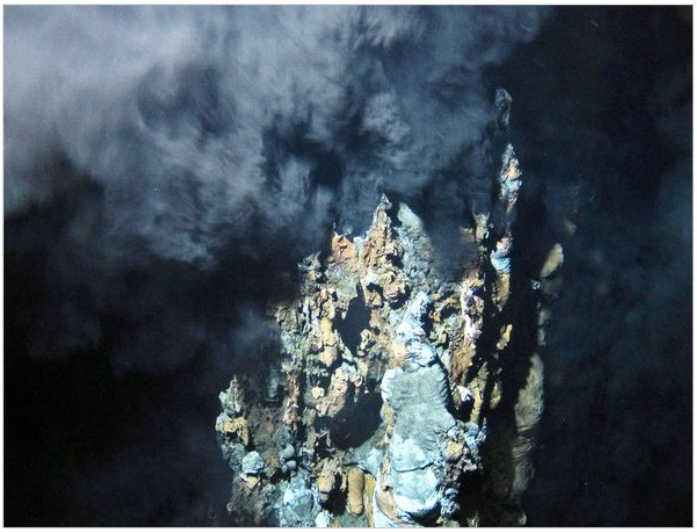
Major Deep-Sea Smokers Found—"Evolution in Overdrive"

Teeming with strange animals, volcanic vent field is North Atlantic first.



Volcanically heated fluid rises from a deep-sea "smoker" seen at the newfound site this summer.
Photograph courtesy Provision/Marine Institute

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Brian Handwerk
for National Geographic News
Published August 8, 2011

Deep under the North Atlantic, scientists have discovered a rare system of smoking volcanic vents and three-story "chimneys," according to scientists aboard the research vessel *Celtic Explorer*.

A hotbed of "evolution in overdrive," the site teems with strange animals that have been living there "perhaps for a millennium," said marine biologist Jon Copley. "And we're the first to see this place."

The vent field lies along the Mid-Atlantic Ridge, an undersea mountain range extending the length of the Atlantic that's created by the slow separation of tectonic plates.

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The first hydrothermal vent zone to be explored on the ridge north of the Azores (map), the smoker site lies some 9,850 feet (3,000 meters) underwater, said expedition leader Andy Wheeler. (Read the deep-sea vent expedition blog.)

"It exists at the bottom of this steep, 650-foot [200-meter] fault escarpment." The teams remotely operated vehicle (ROV) "descended down the side of this cliff—and the side of the cliff was coated in bacterial slime—until we could see plumes of smoke coming up from below, and we found the chimneys reaching up," added Wheeler, a geologist at Ireland's University College, Cork.

Deep-sea chimneys are created when volcanically heated water carries metal sulfides up from below the seafloor. As the minerals pile up, the knobby towers take form.

(Related: "Deepest Volcanic Sea Vents Found; 'Like Another World.'")

Some of the study sites were so deep that the team's roughly SUV-size ROV—limited by its 3,000-meter (9,850-foot) tether to the ship—could investigate only chimney tops and cliff sides.

"We really were pushing the machines we had to the edge," said marine biologist Patrick Collins of the National University of Ireland. "And that's a credit to the ROV pilots—they pulled it off."

By the end of the ordeal, the researchers had christened the tower-spiked site Moytirra—"plain of the pillar"—after a battlefield of Irish myth.

Such pillars may someday be prized not only for their scientific richness but also for their ability to enrich corporate coffers, expedition leader Wheeler said. "These chimneys, in many cases, have higher metal concentrations than some land-based ore reserves, so there is some economic interest," he said. "Some shallow-water examples are being looked at for potential deep-sea metal mining."

Such reserves might even be renewable, in a sense, because the chimneys grow over time, Wheeler added.

(Watch a video of hydrothermal vents.)

Creatures of the Alien Deep

Much of the attention focused on hydrothermal vents centers on their wide varieties of unusual ocean life—and Moytirra is no exception. (See pictures of hydrothermal vents.)

The newfound vents are home to a menagerie of creatures adapted to darkness and crushing water pressures, species that thrive despite waters volcanically heated to near boiling. (See "Earth's Hottest 'Bods' May Belong to Worms.")

High-definition pictures and video as well as collected specimens reveal orange shrimp, twisting scale-worms, eel-like fish, and swirling mats of bacteria.

"One shrimp we found, that's been seen at other sites, has lost its eyes but developed a new type of 'eye' on the top of its thorax that senses near-infrared light," he said. The vent shrimp's mysterious photoreceptor doesn't have a lens and so can't form an image, but the feature may be tuned to detect the very faint light produced by the hydrothermal vents.

"It's an example of what happens to organisms when they become isolated and evolution goes into overdrive," Wheeler said.

Soon animals collected by the crew will undergo lab analysis, and the researchers' hopes are high. The National University of Ireland's Collins said, "We're going to get lots of answers out of it and add to the history we have for vent ecology. But it's also going to pose lots of new questions."

(Also see "Hydrothermal 'Megaplume' Found in Indian Ocean.")

Deep-Sea Mystery

Among the questions the team hopes to answer: How did these creatures get here?

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The hardy NASA rover is within a few hundred miles of Endeavour crater, where it will spend the next few years studying Martian geology.

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Ryan Park from *The Bachelorette* talks about his experience on the show and his work for the last 10 years in solar.

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The isolated chimney field represents a key midpoint between vents south of the Azores and north of Iceland—leading researchers to wonder whether the Moytirra species originated in one of those two locations.

"We're trying to see how this new vent site is related to its neighbors," said expedition leader Wheeler.

"There is a lot of research to be done, but one thing that's obvious is that it has some associations with species of the Azores and that poses the next question: How did they get over the shallow area of the Azores plateau and back down here into the deep?"

That mystery and others could be solved sooner rather than later, given the relative convenience of Moytirra, said Copley, whose work was funded in part by the National Geographic Society's Expeditions Council. (The Society owns National Geographic News.)

"This is the closest known deep-sea vent field to mainland Western Europe," he said. "So I'm hoping this is something we'll be able to visit repeatedly to see how these systems change over time. That's something we don't understand well here in the Atlantic."

See the expedition in action in the 2012 National Geographic Channel series Alien Deep.

SPECIAL AD SECTION

NATIONAL GEOGRAPHIC KIDS

The Irish Times - Friday, August 5, 2011

Strange creatures lurking on floor of Atlantic may hold clues to origin of life

LORNA SIGGINS and MICHELLE McDONAGH

CLUES AS to how life began on the planet may be gleaned from the volcanic vent system which Irish and British scientists have discovered in the middle of the Atlantic Ocean.

Several unusual species, including a blind shrimp with an infrared "third eye", were identified on the deep-sea mineral-rich volcanic field some 1,500km off the Irish coast.

This shrimp has been located on other vent systems, but biologists will analyse data to see if hitherto unidentified animals can be confirmed, expedition leader Dr Andy Wheeler of University College Cork, said yesterday.

The new biogeographical area, well outside Irish waters, has been named "Moytirra", or "plain of the pillars", after a battlefield in Irish mythology. It is the first such hydrothermal system to be identified between the Azores and Iceland, lying on the mid-Atlantic ridge where Europe separates from the Americas.

The largest of its volcanic chimneys, towering over 10m at the foot of a cliff, has been named "Balor" after the legendary Irish giant, according to Patrick Collins from NUI Galway's Ryan Institute, who led Ireland's marine biological team on board.

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Mr Collins will be working with Jon Copley of the University of Southampton to catalogue and characterise creatures among a "riot of life", as Mr Copley describes it, in an "unlikely haven on the ocean floor". The first indication of this system on the mid-Atlantic ridge was detected by British scientists with the national oceanography centre at University of Southampton three years ago.

Hydrothermal vents are fissures or cracks in the earth's surface, funnelling enormous volumes of boiling sea water enriched with minerals from volcanic sources through chimneys or "black smokers". The complex communities they support thrive on chemosynthesis, totally independent of sunlight.

The first such vents were discovered in the eastern Pacific about 30 years ago, and some 500 new faunal species have been recorded in six biogeographical provinces charted to date.

Scientists from Southampton teamed up with researchers at UCC, NUIG, and the Geological Survey of Ireland to find out more, and left Galway last month on the State research ship, Celtic Explorer, with the support of the Marine Institute and the National Geographic Society.

Dr Wheeler said that the team found the edge of the vent field some 3,000m below, using the ship's remotely operated vehicle, within only two hours of arriving at the location.

Such was the heat of the chimneys' water, at 350 degrees, that scientists had to use titanium syringes to extract samples.

"These animals are living in a harsh, toxic, acidic environment full of heavy metals – a place that would usually kills other organisms so the enzymes generated in their bodies may have potential for medical research. The discovery could also be very important for Ireland's hydrothermal mining industry," Dr Wheeler said.

Dr Bramley Murton of the British oceanography centre, who led the mineralisation study on the expedition, said the unique environment was one where "geology and biology have come together to form something as close to extraterrestrial life as we get on this planet". National Geographic filmed the work for inclusion in its Alien Deep series, due to be broadcast in 2012.

Speaking on the Celtic Explorer yesterday, Minister for the Marine Simon Coveney paid tribute to all involved. Among the team on board was geological survey geologist Maria Judge who last year piloted the remote controlled subsea vehicle on board the James Cook vessel which discovered the world's deepest known hydrothermal vents on the Caribbean's Cayman trough.

As part of this new project, secondary school students were invited to design their own deep sea creature. The winner may have one of the new species at the vents named after him or her.

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Gold rush under the ocean for Irish mid-Atlantic team

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By Ralph Riegel
Friday August 05 2011

IRISH scientists have struck gold in a deep-sea discovery that could yield a multi-million-euro mining boost.

The Irish-led team made the discovery 3km down on the Atlantic ocean floor by identifying a field of volcanic vents spewing up rare metals from the earth's core.

Backed by the National Geographic Society, they discovered the new volcanic vent field in the mid-Atlantic between the Azores and Iceland.

While it is in international waters, Ireland's role in identifying and mapping the area will yield a key share in the available rare metal resources, including copper, gold, zinc and sulphides.

However, the capability of exploiting the rare metals will be some years away as technology is still being developed to cope with the enormous pressures at such sea depths.

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The Irish Times - Thursday, May 5, 2011

What lies beneath?

The species of octopus discovered by NUIG's Patrick Collins in Papua New Guinea

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- Awake? Maybe not completely

In a few months, a team of Irish and British scientists will boldly go where no man has gone before – to the depths of the Atlantic ocean, writes **LORNA SIGGINS**, Marine Correspondent

WHAT SEA MONSTERS lurk in the pitch-black depths of the mid-Atlantic?

A team of Irish and British scientists will soon find out, and their efforts and discoveries will be filmed by National Geographic.

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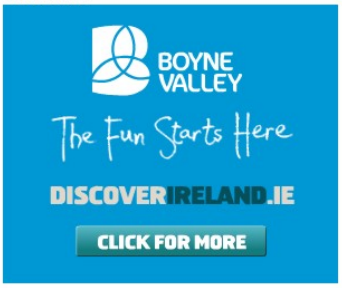

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The Irish Times - Wednesday, July 13, 2011

Irish marine expedition to map new ecosystem

Biologist Patrick Collins of NUI Galway beside the Celtic Explorer at Galway docks yesterday. He described the expedition as the "most technically challenging marine research ever undertaken by Ireland".Photograph: Joe OShaughnessy

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LORNA SIGGINS, Marine Correspondent

IRISH SCIENTISTS are about to embark on one of the most challenging research expeditions undertaken by the State's research ship, *Celtic Explorer*.

National Geographic has booked berths on the ship to record the expedition, led by Dr Andy Wheeler of University College Cork, and involving marine scientists from NUI Galway, the Geological Survey of Ireland and the University of Southampton. The ship is due to leave Galway docks today.

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The Irish Times - Thursday, August 4, 2011

Volcanic vent system found in Atlantic

LORNA SIGGINS, Marine Correspondent

IRISH AND British scientists have confirmed discovery of a volcanic vent system and several new marine species some 1,000 miles west of the Irish coast.

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Headline: Riches of the deep

Riches of the deep

PICTURE THIS: two miles down in the North Atlantic and 1,000 miles offshore, black smoke and super-heated water is billowing from a crack in the ocean floor. As we learned this week, exotic fish, crabs and tubeworms live and thrive in this lightless and toxic environment, causing a rewriting of textbooks. The *RV Celtic Explorer* and Irish scientists are exploring the last great frontier on earth courtesy of Government funding. It is not an altruistic exercise. The volcanic vents provide valuable information not only on conditions in which life can develop; they also generate massive amounts of metal sulphides, which may contain silver, mercury, lead, nickel and zinc. Such rich deposits are already extensively mined onshore.

Ireland lays claim to 125,000 square kilometres of underwater territory and overlaying seas – five times its landmass – but research has only begun to expose its potential. Integrated mapping projects of the seabed are providing information on suitable sites for offshore renewable energy projects and for the routing of electricity cables from wind, wave and tidal generators. They also assist in petrochemical exploration and in the charting of safe shipping lanes.

The Geological Survey of Ireland and the Marine Institute are involved in offshore work where new technologies are pushing the boundaries of knowledge. It is the same on land where geoscience has begun to impact on the public imagination because of its potential to generate jobs and economic benefits. State investment has been estimated to return four to six times the capital outlay. That was certainly the case with the Tellus project, a subsurface geology survey designed in Dublin but only completed in Northern Ireland. Based on the information gained, the Belfast authorities took in four times the survey costs in new mining licence fees. The work is now being undertaken here.

Detailed geological information drives mineral exploration, fishing activity, energy projects and various ecological issues. But it doesn't stop there. Studies are currently under way assessing the availability of onshore geothermal energies for electricity generation. Water hot enough to do so with existing technology has been widely found at 5,000 metres. The work goes on. Knowledge of Ireland's complex geology is incomplete. That must be remedied if long-term water demands are to be met through the exploitation of aquifers. Government investment in such basic, life-enhancing information must not become an optional extra.

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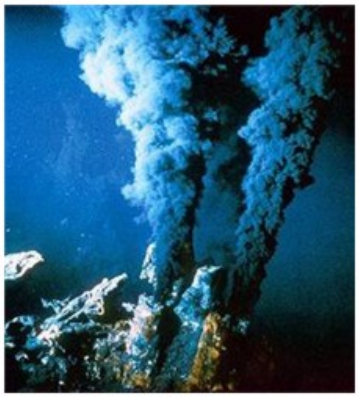

On the next Futureproof, we will be speaking to Dr. Andy Wheeler from UCC about a groundbreaking deep-sea study that will be captured by a film crew from National Geographic

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New Field of Hydrothermal Vents Discovered Along the Mid-Atlantic Ridge

ScienceDaily (Aug. 5, 2011) — The Irish-led VENTuRE scientific expedition aboard the national research vessel RV *Celtic Explorer* has discovered a previously uncharted field of hydrothermal vents along the Mid-Atlantic Ridge -- the first to be explored north of the Azores.

First time ever seen by human eyes, the Moytirra vent field. Picture shows chimneys of metal sulphides (black and rust coloured) formed at 3,030 metres below sea level. They have been precipitated from hot fluid erupting from the volcanic mid-Atlantic Ridge. The white material is anhydrite. (Credit: Image courtesy of Marine Institute - Foras na Mara)

The mission, led by Dr. Andy Wheeler of University College, Cork (UCC), together with scientists from the National Oceanography Centre and the University of Southampton in the UK, NUI Galway and the Geological Survey of Ireland, returned to Cork on August 4th from an investigation 3,000 metres below the surface of the sea using the Remotely Operated Vehicle (ROV) Holland 1.

Hydrothermal vents, which spew mineral-rich seawater heated to boiling point by volcanic rock in Earth's crust below, are home to a rich variety of marine life that thrives in complete darkness on bacteria fed by chemicals. The investigation was supported by the Marine Institute under the 2011 Ship-Time

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Ireland: Scientific Expedition Discovers New Field Of Hydrothermal Vents Along Mid-Atlantic Ridge

Posted on Aug 5th, 2011 with tags along, Discovers, Expedition, field, Hydrothermal, Industry, Ireland, Mid-Atlantic, New, News by topic, of, ridge, Scientific, Subsea, Vents

The Irish-led Venture scientific expedition aboard the national research vessel RV Celtic Explorer has discovered a previously uncharted field of hydrothermal vents along the Mid-Atlantic Ridge — the first to be explored north of the Azores.

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Sunday, July 17, 2011

North Atlantic's Hydrothermal Vents: Irish expedition sets out to study the Mid-Atlantic Ridge

Marine scientists have examined some of the world's deep ocean thermal vents that harbor remarkable sealife found no where else on the planet. Living without sunlight, sometimes in temperatures that could bake bread, bacteria, worms, and crabs flourish at the site of these vents which often spew what looks like smoke but is actually a rich cocktail of minerals. The vents typically exist along fault lines that run deep in the ocean.

Welcome to the RTSea Blog!

RTSea Productions believes that one of the best ways to educate and motivate the public regarding conservation is through open communication. It is hoped that through blogs like this one, information will be disseminated across the Internet and, in so doing, will illuminate others as to the serious challenges that lay before us in preserving and protecting our natural resources.

To visit the **RTSea Productions** web site, click here.

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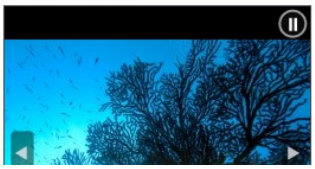

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WEDNESDAY, JULY 13, 2011

Irish marine expedition to map new ecosystem

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IRISH SCIENTISTS are about to embark on one of the most challenging research expeditions undertaken by the State's research ship, *Celtic Explorer* .

National Geographic has booked berths on the ship to record the expedition, led by Dr Andy Wheeler of University College Cork, and involving marine scientists from NUI Galway, the Geological Survey of Ireland and the University of Southampton. The ship is due to leave Galway docks today.

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A TEAM of scientists from Ireland have made a fascinating discovery – new life beneath the sea.

First time ever seen by human eyes, the Moytirra vent field. Picture shows chimneys of metal sulphides (black and rust coloured) formed at 3,030 metres below sea level.

Image: Marine.ie

The VENTuRE team, which comprises marine scientists from University College Cork (Biological, Earth and Environmental Sciences), the National University of Ireland (NUI) Galway, Geological Survey of Ireland and University of Southampton and National Oceanography Centre in the UK, made the discoveries at the mid-Atlantic ridge in the Atlantic Ocean.

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Field of hydrothermal vents discovered along the Mid-Atlantic Ridge

BY CHILLYMANJARO– AUGUST 9, 2011
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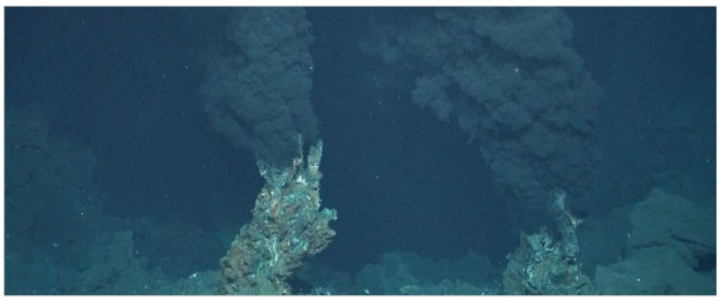

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The Irish-led VENTuRE scientific expedition aboard the national research vessel RV *Celtic Explorer* has discovered a previously uncharted field of hydrothermal vents along the Mid-Atlantic Ridge – the first to be explored north of the Azores.

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Here's to the crazy ones, the misfits, the rebels, the troublemakers, the round pegs in the square holes... the ones who see things differently -- they're not fond of rules... You can quote them, disagree with them, glorify or vilify them, but the only thing you can't do is ignore them because they change things... they push the human race forward, and while some may see