IODP
INTEGRATED OCEAN DRILLING PROGRAM

UK newsletter 36

August 2011

NATURAL ENVIRONMENT RESEARCH COUNCIL

ECORD
European Consortium for Ocean Research Drilling

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Front cover: The *Joides Resolution* on Expedition 335 © Michelle Harris, NOCS.
Back cover: Waterspout seen from *Joides Resolution* on Expedition 335 © Michelle Harris, NOCS.

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Foreword

Dayton Dove (UKIODP Science Programme Coordinator).

It has been another very active year for UK scientists in IODP with 14 scientists taking part in 8 expeditions, 7 on the *JOIDES Resolution (JR)* and 1 on the *Chikyu* (There were no MSP expeditions in the past year). In this newsletter there are articles describing:

1. The attempt to test the relative motion of hotspots at the Louisville Seamount Chain(Exp.330),
2. The efforts to 'document the extent and nature of microbial life in sediments beneath the low-productivity heart of the ocean' (Exp. 329),
3. The attempts to 'understand the thermal structure and plumbing network of the mineralization processes' in an active hydrothermal field (Exp. 330), and
4. The forth phase of the Superfast campaign, which 'endeavours to understand magmatic accretion of new ocean crust at fast spreading ocean ridges.'(Exp. 335).

The upcoming year again promises to be busy, with the notable exception of the Tsunami damaged *Chikyu*, which should return to IODP work in summer 2012. With regards to the *JR*, news that the ship would only do 6 months IODP work in the next year rather than 8 was met with an extremely impressive response from the science community, with individuals and groups alike expressing their support for the programme. Inadvertently this series of events served as an urgent reminder to funding agencies of just how many scientists rely on the results of IODP. Whilst Exp. 337 was unfortunately postponed, recent events have resulted in an extra expedition being scheduled, Exp 342, which will have a UK co-chief. The next MSP expedition will be in 2013.

It has also been a year of preparation, developing the science goals and organizational structure of the post–2013 IODP, the International Ocean Discovery Program. Mike Bickle (Cambridge) was chair of the Science Plan Writing Committee with both Damon Teagle (NOCS) and Heiko Pälike (NOCS) as members. In this newsletter Mike outlines the new IODP Science Plan, and Heiko has prepared an excellent primer on the new programme, focussing on the proposal process. The new Science Advisory Structure (SAS) is being populated and the UK has a diverse and excellent set of representatives, including the chair of the Proposal Evaluation Panel (PEP), Dick Kroon (Edinburgh).

The above highlights the strong influence UK scientists have on the international programme and this was further demonstrated during last year's evidence gathering campaign for the UKIODP domestic renewal process. Across a swathe of metrics, including publication outputs and the number of proposal proponents, the UK consistently exhibits disproportionately high marks in terms of investment made. Sasha Leigh, the UKIODP programme manager gives further details of the renewal process within, but I would emphasize the very positive response from the review panel.

There is an ongoing review of the recent Site Survey Investigation grant round. Earlier in the year approximately £2.2 million was allocated in the UKIODP Standard and Small grants round, funding 12 excellent proposals. The past year also saw two UKIODP 'grant-round meetings' associated with previous UKIODP grants, both being highly successful (see meeting reports within).

The UKIODP review process also highlighted the large population of UK students working on IODP related science, and more effort will be put into engaging these students. This year UKIODP has supported 6 students to attend the always excellent ECORD Summer School and the Science Advisory Panel is now putting final revisions on the plan to hold a UKIODP Student Conference in 2012.

Scientific Results from Recent Expeditions

Expedition 330: The Louisville Seamount Chain

13 December 2010–11 February 2011

Godfrey Fitton (University of Edinburgh), Rebecca Williams (University of Leicester), Louise Anderson (University of Leicester), Lara Kalnins (University of Oxford) and Nicola Pressling (University of Southampton)

The idea that intraplate hotspots are caused by convective plumes originating in the deep mantle was proposed by Morgan (1971) to explain long, time-progressive chains of ocean islands and seamounts, such as the Hawaii-Emperor seamount chain (HESC). The Louisville seamount chain (LSC) in the southwest Pacific Ocean is another example, and was the subject of IODP Expedition 330.

The widely held assumption that hotspots are fixed with respect to the Earth's spin axis and to each other has led to their use as a reference frame for the determination of absolute plate motions. However, palaeomagnetic studies on drill core recovered from the Emperor seamounts during ODP Leg 197 showed a ~15° southwards movement of the Hawaiian hotspot between 80 and 47 Ma (Tarduno et al., 2003). The implied ~40 mm/yr movement of the Hawaiian hotspot seriously undermines the hypothesis that the Pacific hotspots form a fixed reference frame in the deep mantle. It is now clear that mantle plumes, if they exist, can drift with the large-scale return flow in the asthenosphere required by plate motion and subduction (e.g. Steinberger et al., 2004). This raises a fundamental question: do the Pacific hotspots move independently of each other or do they all drift together? IODP Expedition 330 was designed to answer this question by drilling five LSC seamounts (Figure 1) that were formed over roughly the same time interval (77-50 Ma) as the HESC seamounts drilled during ODP Leg 197.

It is evident from the available radiometric dates determined on LSC dredge samples that the LST, like the HESC, does not follow a simple linear distance-age relationship (Koppers et al., 2004). Palaeomagnetism and high-precision radiometric dating of samples recovered during IODP Expedition 330 will determine whether the Louisville hotspot shows the same ~15° shift in palaeolatitude as the Hawaiian hotspot (Tarduno et al., 2003). If the Louisville and Hawaiian hotspots did not move by the same amount in the same direction over time, this would indicate considerable relative motion as predicted by mantle flow models (Steinberger et al., 2004; Koppers et al., 2004). This is clearly of great importance in understanding mantle dynamics and was the principal objective of IODP Expedition 330. Another objective of the expedition was to recover samples of relatively unaltered basalt for geochemical and isotopic analysis. Before Expedition 330 only moderately to highly altered dredge samples were available from the LSC.

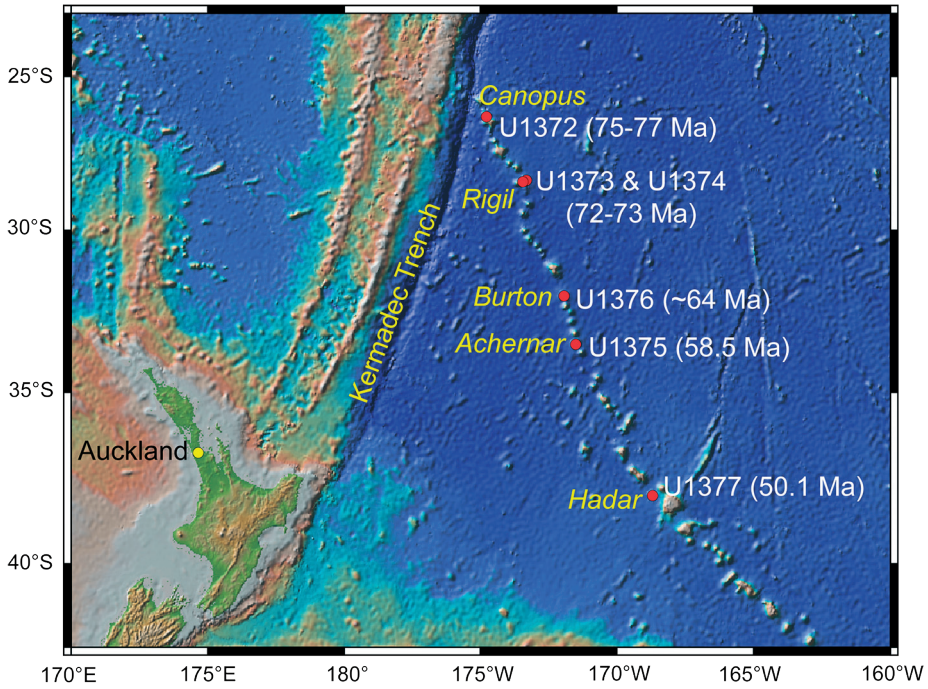

Figure 1
Bathymetric map of the southwest Pacific Ocean showing the northwestern half of the prominent Louisville Seamount Trail and the location of the IODP Expedition 330 drill sites. Estimated ages are from the Expedition 330 Preliminary Report (Expedition 330 Scientists, 2011).

By contrast, many of the rock samples recovered during Expedition 330 are exceptionally fresh (Figure 2).

The Louisville seamounts comprise at least 75 individual volcanoes, 50 of them more than 3 km high, aligned to form a chain 4300 km long (Lonsdale, 1988). Their age decreases from ~77 Ma at the northwest end of the chain, where it is being subducted beneath the Kermadec trench, to ~1 Ma at the southeast end (Koppers et al., 2004). Forty of the seamounts have flattened tops, implying that they grew above sea level, and these are now preserved as coral-free guyots. None of the more recent (<12 Ma) seamounts, however, reached sea level. The LSC thus appears to be in decline (Lonsdale, 1988), and the present-day location of the hotspot is uncertain. In this respect the LSC differs markedly from the HESC, where magmatic productivity is currently increasing.

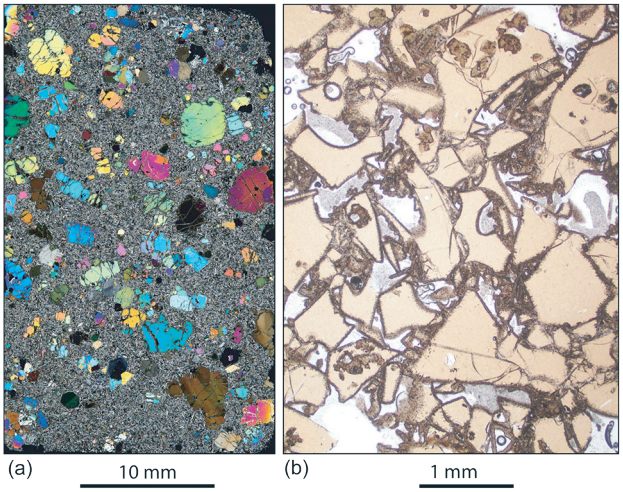

Figure 2
Thin section photomicrographs of volcanic rocks from Site U1376 (from Expedition 330 Scientists, 2011).
(a) Olivine-augite-phyric basalt (sample 330-U1376A-8R-6, 136–140 cm; thin section 255). Photomicrograph was taken with crossed polars.
(b) Remarkably fresh basaltic glass shards in hyaloclastite breccia (sample 330-U1376A-17R-1, 140–143 cm; thin section 262). Photomicrograph was taken with plane-polarized light. Homogeneity of the glass suggests that the fragments quenched very rapidly, and the shape of the shards suggests they are bubble-wall fragments. Voids between the glass shards are unfilled. Darkening of glass around shard edges is due to numerous minute tubes formed by micro-organisms.

IODP Expedition 330 drill sites

IODP Expedition 330 drilled five guyots, spread out along a ~2000 km section of the older part of the LSC (Figure 1). One of these guyots (Burton) had previously been named, and the other four were named by the Expedition 330 shipboard scientists after the four brightest southern hemisphere stars: Canopus, Rigil (from Rigil Kentauri, or Alpha Centauri), Achernar and Hadar.

The expedition was extraordinarily successful in its recovery of volcanic rocks. At Site U1374 on Rigil Guyot, for example, 522 m was drilled, with a record-breaking 87.7% hard-rock recovery. Many of the rocks recovered at all five guyots contained fresh olivine and/or fresh glass (Figure 2). A detailed account of the drilling results can be found in the Preliminary Report (Expedition 330 Scientists, 2011). The following is a brief summary of these results.

Site U1372 (Canopus Guyot)

Drilling penetrated 232.6 m into Canopus Guyot and recovered a succession of sedimentary and volcanic rocks that covers the latter part of the constructional phase of the seamount, a brief subaerial phase, and its final subsidence below sea level. The sedimentary succession consists of ~13.5 m of sandy foraminiferal ooze resting on ~32 m of basaltic breccia and conglomerate. Beneath this, the igneous basement section (187 m penetrated) can be divided broadly into an upper (83 m thick) part consisting of lava flows and a lower (104 m thick) part mostly composed of volcaniclastic rocks. The lava flows range in composition from aphyric to highly olivine-phyric basalt. Flows in the topmost 27 m of the basement succession have peperitic tops, implying interaction between lava and carbonate mud, whereas those in the next 29 m have scoriaceous and oxidised tops, suggesting that these were erupted during a brief subaerial episode. The occurrence of hyaloclastite in the deeper flows implies submarine eruption.

Site U1373 and U1374 (Rigil Guyot)

Two sites were drilled on Rigil Guyot. The short sequence of volcanic and sedimentary rocks recovered at Site U1373 suggests volcanism and subsequent erosion in a shallow-marine or beach environment. Only 66 m were cored at this site because failure in the deployment of a free-fall funnel led to its being abandoned. The recovered succession consists, from the bottom upwards, of a 22 m thick inflated aphyric basalt flow followed by a 10 m series of thinner lava flows, all of which have blocky peperitic or brecciated flow tops. These thinner flows range in composition from aphyric basalt to highly olivine-augite-phyric basalt. The overlying 34 m thick sedimentary succession consists of basaltic conglomerate containing three auto-brecciated basalt lava flows. There is no pelagic sedimentary cover at this site.

Site U1374 is located ~10.3 km west of Site U1373. Drilling here penetrated ~7 m of foraminiferal ooze followed by ~10 m of volcanic sandstone before the first of the basement volcanic units was encountered. As with Site U1373, the upper part of the volcanic succession at Site U1374 represents subaerial volcanism in a shallow-marine or beach environment, although the much thicker succession cored at Site U1374 extends down into breccias erupted under submarine conditions. An upwards progression from deep submarine to subaerial volcanism is seen in the various breccia types recovered at this site, which range from green hyaloclastite breccia with frothy basaltic clasts (marine) through blocky breccia (shallower marine) to scoriaceous (near sea level or subaerial). Massive flow lobes and thicker lava flows occur within the breccias, and their abundance increases upwards in the succession. Above ~290 metres below sea floor (mbsf) individual packages of volcanic breccia are usually terminated by sedimentary intervals, and a dramatic increase in the thickness and grain size of these intervals above ~115 mbsf probably indicates the point at which parts of Rigil Guyot started to emerge above sea level and erosion proceeded more rapidly. The phenocryst assemblage in the breccias and lava flows changed from plagioclase-dominated in the lower part of the succession to olivine-dominated in the upper part, suggesting that the magmas became generally more basic with time. The lower 186 m of the succession drilled in Hole U1374A is intruded by sheets of aphyric basalt, which were interpreted as dykes.

Site U1375 (Achernar Guyot)

A cover of loose breccia on the summit of Achernar Guyot frustrated two attempts at drilling and the site was abandoned after recovering three cores from two holes. A succession consisting of pelagic ooze over basaltic breccia was found in Hole U1375A. Hole U1375B yielded 57 cm of core composed of olivine microgabbro.

Site U1376 (Burton Guyot)

With a base diameter <30 km, Burton Guyot is one of the smaller volcanoes on the Louisville chain, and Hole U1376A was drilled into the centre of its summit shelf, unlike the previous drill sites which were located on shelf edges. The youngest rocks recovered from Burton consist of a ~23.5 m thick succession of volcanic sandstone and breccia resting on a ~15 m thick unit of algal limestone. The volcanic sand and breccia therefore provides evidence for a rejuvenation or post-erosional phase of volcanism, the only such evidence encountered during Expedition 330. Clasts in the volcanic breccia include small peridotite xenoliths, and some of the basaltic clasts contain partly resorbed orthopyroxene xenocrysts. A ~3.5 m thick layer of basaltic conglomerate separates the algal limestone from the igneous basement of the guyot, which consists of a succession of submarine pillow basalts, hyaloclastites, and auto-brecciated lava flows. Drilling Hole U1376A into the centre of Burton Guyot provided direct access to a deeper portion of the seamount, explaining why no subaerial volcanic rocks of the pre-erosional (shield-forming) phase were encountered.

The uppermost part of the pre-erosional volcanic succession consists mostly of olivine-augite-phyric basaltic pillow lavas, sheet flows and breccias. Some of these basaltic rocks are exceptionally fresh (Figure 2(a)). An erosional surface separates these from a lower unit composed of aphyric and olivine-phyric basaltic breccia with occasional thin flow lobes. Hyaloclastite breccia composed of fresh glass shards (Figure 2(b)) is common in the lower part of the succession. The lower unit is intruded by basaltic dykes that appear to be truncated at the erosion surface. The presence of olivine and augite phenocrysts in the basalts recovered from Site U1376 and the complete absence of plagioclase phenocrysts suggest that the seamount magmas were alkaline and more basic than those represented by most of the volcanic rocks drilled at the other sites.

Site U1377 (Hadar Guyot)

Hadar Guyot is the smallest seamount drilled during Expedition 330, and consists of a single volcanic centre with a base diameter of ~25 km. Like all the Louisville seamounts drilled, it has a flat summit shelf, and Site U1377 was placed near the centre of this shelf. As at Site U1375, the shelf was covered with loose breccia and this made drilling difficult. Two holes were drilled: Hole U1377A to 53 mbsf and Hole U1377B to 37 mbsf, both with rather poor recovery. The recovered succession consists of foraminiferal ooze separated from the volcanic basement by foraminiferal limestone and basalt conglomerate. The basement volcanic rocks encountered in both holes are trachybasalt flows erupted in a submarine environment. Flow-banded sheet flows were found in both holes, and pillow lavas in the deeper part of Hole U1377B.

Palaeomagnetism and downhole logging

Since the principal objective of Expedition 330 was to determine the palaeolatitude at the time of formation of each of the five guyots, it was essential that a large number of individual igneous units that cooled in situ be recovered from each site. Shipboard palaeomagnetic measurements suggest that enough *in-situ* cooling units have been collected to achieve this objective, and this should be confirmed by shore-based studies. Downhole logging can play a critical role in this by providing a more complete record of the drilled succession and determining the form of incompletely recovered igneous bodies. A full programme of downhole logging was carried out at Sites U1374 and U1376. An additional downhole tool, the third-party Göttingen Borehole Magnetometer (GBM), was also successfully deployed at these sites. This tool measures three orthogonal components of the magnetic field in situ down the borehole and will complement detailed demagnetization studies of the cored, but azimuthally unoriented, basaltic basement samples by providing direction information.

Expedition objectives and the role of UK participants

The Expedition 330 Preliminary Report (Expedition 330 Scientists, 2011) lists seven scientific objectives to be addressed in the post-expedition phase of research.

1. Constraining the palaeolatitude history of the Louisville hotspot between 80 and 50 Ma.

2. Reconstructing the age systematics along the Louisville Seamount Trail.

3. Characterizing the geochemical evolution of the Louisville mantle source.

4. Testing the genetic relation between the Louisville hotspot and the 120 Ma Ontong Java Plateau.

5. Determining the degree, potential temperature, and depth of partial melting for Louisville magmas.

6. Adding crucial palaeoceanography and palaeoclimate data at 40°–50° S palaeolatitudes in the Southern Ocean.

7. Exploring the unique geomicrobiology and fossil microbial traces within the seamount igneous basement.

Five scientists from the UK sailed on Expedition 330 in a variety of roles. Louise Anderson was the logging staff scientist and Lara Kalnins was part of the physical properties team. Nicola Pressling was one of four palaeomagnetists on board. Godfrey Fitton and Rebecca Williams both sailed as igneous petrologists. These UK participants will play key roles in addressing five of these seven objectives.

Nicola Pressling (Southampton) will collaborate with Jeff Gee (Scripps Institution of Oceanography), Toshi Yamazaki (Geological Survey of Japan) and Hiroyuki Hoshi (Aichi University, Japan) in performing a comprehensive program of thermal demagnetization on all drill core samples to estimate the palaeolatitude of all five drill sites (objective 1). In addition, the palaeomagnetism group will investigate the origin of the magnetic remanence using a variety of rock magnetic experiments. Nicola will also attempt to reorient the core using downhole logging data from the Formation MicroScanner (FMS) tool which identifies structural features on the borehole wall that can be correlated with fractures observed in the core.

Louise Anderson (Leicester) will examine and interpret downhole logging data in order to obtain a clearer picture of the volcanic architecture at sites U1374 and U1376. This will assist in the recognition of in-situ cooling units and therefore contribute to objective 1. She will also collaborate with Svenja Rausch (University of Bremen) in addressing objective 7 through a study of microbiological films on basaltic glass shards (Figure 2(b)).

Godfrey Fitton (Edinburgh) will carry out XRF analyses for major and trace elements and Rebecca Williams (Leicester) will carry out ICP-MS analyses for trace elements on the same suite of basalt samples from all five sites (objectives 3 and 4).

Godfrey Fitton will collaborate with Michael Dorais (Brigham Young University) to use major element analyses of basalt samples combined with electron microprobe analyses of phenocrysts to investigate magmatic evolution processes and determine the degree of mantle melting and mantle potential temperature (objective 5).

Rebecca Williams will collaborate with Jörg Geldmacher (IODP, TAMU) to provide Hf-isotope analyses (objective 3).

Lara Kalnins (Oxford) will develop the ship-based physical properties filtering/plotting code package further and try to extract K, U, Th concentrations from the natural gamma-ray data. She will also construct subsidence curves for each seamount to produce subsidence rates, and use the density and velocity data, together with seismic data, to estimate elastic lithosphere thickness at each seamount. This information will contribute to the achievement of objective 5.

Concluding remarks

Expedition 330 was extraordinarily successful in recovering samples and data that will allow all of its stated objectives to be realised. The expedition collected the first in-situ rock samples from one of the three primary Pacific hotspot trails (Hawaii and Easter are the others) and established a record for hard-rock recovery. Some of the volcanic rocks collected are fresh enough for helium-isotope measurements, melt inclusion studies, and glass analysis. UK participants played an important part in the expedition and will contribute fully to subsequent shore-based research. This article provides only a very brief account of some of the results of the expedition. The reader is encouraged to look at the IODP Expedition 330 Preliminary Report http://publications.iodp.org/preliminary_report/330/index.html for a much more comprehensive account.

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Expedition 329: South Pacific Gyre Microbiology

9 October–13 December 2010

Nathalie Dubois (University of Manchester), Christopher Smith-Duque (University of Southampton), and the IODP Expedition 329 Shipboard Science Party

Introduction

On October 12th 2010, 31 scientists from 11 countries, including two UK participants, set sail on the *JOIDES Resolution* from Papeete, Tahiti, to document (by recovering in-situ sediment and basement) the extent and nature of sub-seafloor life within the South Pacific Gyre (SPG), the least biologically active zone of the world's oceans (Figure 1). Given that the SPG represents one of the largest expanses of water on Earth and that it has never been explored by scientific ocean drilling, exploring this region makes IODP Expedition 329 an exceptional undertaking. This expedition and the subsequent post-cruise studies to come will make great strides in advancing our scientific understanding of the interactions between the hydrosphere, biosphere and lithosphere.

The primary purpose of Expedition 329 was to document the extent and nature of microbial life in the sediments beneath the low-productivity heart of the ocean. Almost all sites where subseafloor life has been studied previously are located on ocean margins (ODP Legs 112, 180, 201, and 204 and IODP Expeditions 301, 307, and 323) or in the equatorial ocean (ODP Legs 138 and 201), which are areas of relatively high productivity. However ocean gyres, which are low productivity zones and make up the vast majority of the open ocean, remain poorly understood. Quantification of subseafloor biomass in the SPG redresses the strong bias of sampling in high productivity zones, therefore the results from Expedition 329 will be used to place strong constraints on the size of Earth's subseafloor biomass and total biomass.

Although Expedition 329 focused on microbiology, the recovered cores provide an unprecedented opportunity to document a sedimentary system and basement that has never been explored by scientific ocean drilling. Samples recovered from the SPG during Expedition 329 will for instance lead to key advances in understanding of several geological processes, including:

1. The factors that control evolution of hydrothermal circulation and chemical alteration in oceanic crust.
2. Models of regional tectonic history.
3. Geodynamo models.
4. Models of glacial–interglacial ocean-climate change.

Figure 1
IODP Expedition 329 shipboard science party. (Photo: John Beck)

The South Pacific Gyre

The SPG is often described as Earth's largest oceanic desert. It is the largest of the ocean gyres and its centre is further away from any continental landmass than the centre of any other gyre. Surface chlorophyll concentrations and primary productivity are lower in the SPG than in other region of the world's oceans (Behrenfeld and Falkowski, 1997) and its surface water is the clearest in the world (Morel et al., 2007, Figure 2). In addition, such low productivity has contributed to some of the slowest sedimentary burial rates in the ocean (Jahnke, 1996). All these conditions make the SPG the ideal region for exploring the nature of subseafloor sedimentary communities and habitats in the low-activity heart of an open-ocean gyre.

In terms of achieving the secondary objectives of Expedition 329 the SPG area is also ideal for testing hypotheses of the factors that limit hydrothermal circulation and chemical habitability in aging oceanic crust, for example, sedimentary overburden or basement permeability. It contains a continuous sweep of oceanic crust with thin (1–130 m) sedimentary cover spanning thousands of kilometres and more than 100 Ma of seafloor age. Sediment thickness ranges from <3 to 122–130 m and generally increases west and south of the centre of the gyre. This sediment thickness trend is consistent with greater sediment cover on older crust and on crust located farther away from the centre of the gyre.

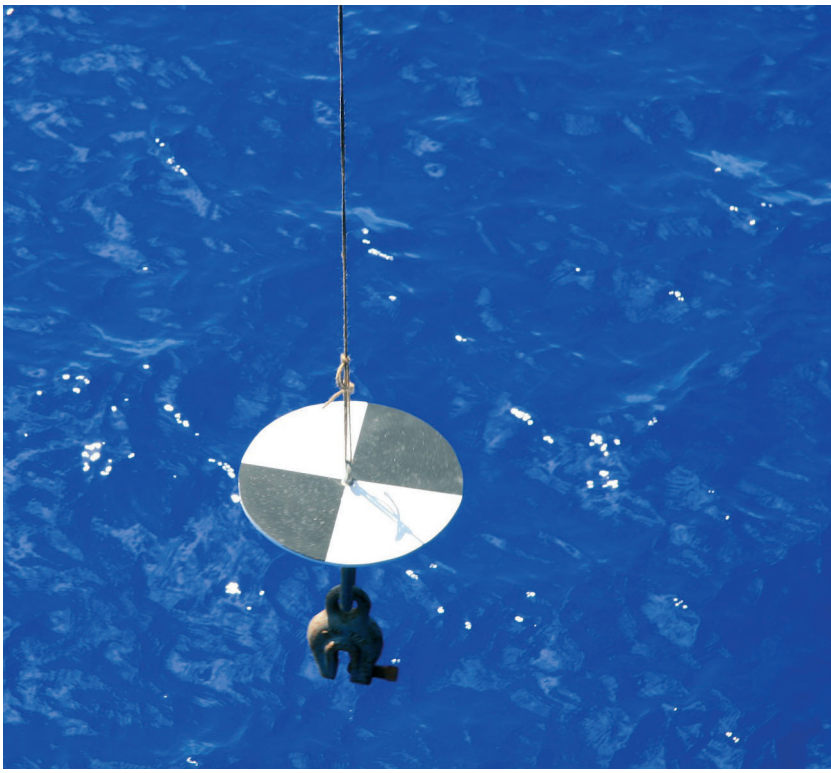

Figure 2
Picture of the deployment of the Secchi Disk at Site U1365 (Photo: Carlos Alvarez-Zarikian).

Drilling Operations

Operations were conducted in 42 holes at 7 carefully chosen sites ranging from 3749 to 5707 meters below sea level. Our general strategy was to core the entire sediment column multiple times at seven sites and to core the upper basement at three sites. We cored 1321.8 m of sediment and basalt and recovered 1168.8 m of core. Downhole logs were collected in one hole.

Expedition 329 Sites span nearly the entire width of the Pacific plate in the Southern Hemisphere between 20° and 45° S. The sites are located along two transects, hinged in the centre of the SPG (Figure 3). The first transect progresses from the western edge of the gyre (Site U1365) to the gyre centre (Site U1368). The second transect trends south from the gyre centre (Site U1368) through the southern gyre edge (Site U1370) to the northern edge of the upwelling region south of the gyre (Site U1371). To cover the expanse of the SPG we sailed 6655 nmi (4503 nmi during the transit from the first site to the last site) over a period of 61 days, of which 33.7 days were spent on site. The duration and distance covered during Expedition 329 (although not unprecedented) represents one of the longest and furthest travelled in scientific ocean drilling history.

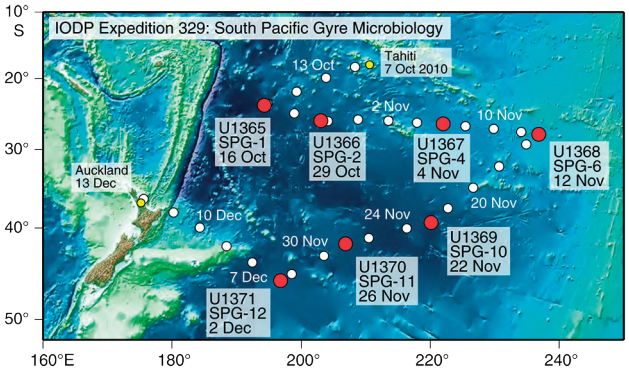

Figure 3
Track map and location of sites drilled on Expedition 329 produced with GMT using the GEBCO One Minute Grid.

The sites were selected so the full range of surface-ocean productivity conditions present within the SPG is represented. Expedition 329 Sites therefore ranged from the extremely low productivity (gyre centre, Site U1368) to the moderately high (for open ocean) productivity at the southern edge of the gyre (Site U1371). The sites in the northern sequence have been continuously away from shore lines and beneath the low-productivity gyre waters for many tens of millions of years. The sites in the southerly transect have remained within the southern portion of the SPG (Sites U1369 and U1370) and just outside it (Site U1371) also for tens of millions of years.

In addition to the range in productivity, Expedition 329 Site locations cover a wide range of crustal ages, spreading rates, and tectonic/volcanic environments. The northern sequence of sites (U1365–U1368) is placed on basaltic basement of steadily increasing age from east to west. Basaltic basement ranges in age from 7 to as much as 125 Ma (Site U1365). Basement age of the southern sites ranges from 39 to 73 Ma. Their water depths generally follow the classic trend of increasing water depth with increasing basement age (Parsons and Sclater, 1977).

Scientific Objectives

The four primary objectives of Expedition 329 were to:

1. To document the habitats, metabolic activities, genetic composition and biomass of microbial communities in subseafloor sediment with very low total activity.

2. To test how oceanographic factors (such as surface ocean productivity, sedimentation rate, and distance from shore) control variation in sedimentary habitats, activities and communities from gyre centre to gyre margin.

3. To quantify the extent to which subseafloor microbial communities of this region may be supplied with electron donors (food) by water radiolysis, a process independent of the surface photosynthetic world.

4. To determine how basement habitats, potential activities and, if measurable, microbial communities vary with crust age and hydrologic regime (from ridge crest to abyssal plain).

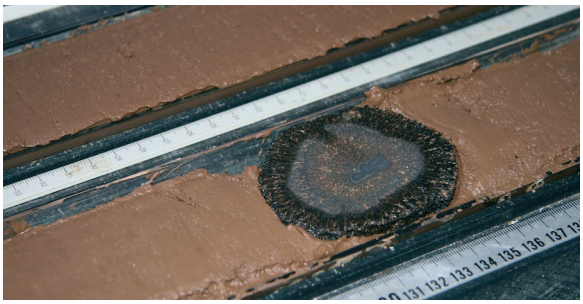

Figure 6
Picture of a manganese nodule (Photo: John Beck)

Technical advances

To meet objectives of Expedition 329, a wide range of instruments and techniques that are seldom used on scientific ocean drilling expeditions were successfully employed. These included among others: O_2 optodes, microelectrodes, contamination monitoring measurements, shipboard cultivation and radiotracer facilities, and GC with HgO reductive gas detector (H_2 analyzer). Details of their Expedition 329 application are provided in the 'Methods' chapter of the Expedition Report (Expedition 329 Scientists, 2011).

In addition, two novel technical approaches were successfully trialled during Expedition 329, with the intention of refining them heavily for future application. The first of these techniques was shipboard flow cytometric cell counting. The second was the highly successful application of the Natural Gamma Ray (NGR) core logging instrument for shipboard quantification of absolute concentrations of ^{238}U-series elements, ^{232}Th-series elements, and potassium.

Preliminary Results

Unfortunately, due to the moratorium period and the current status of our Expedition's manuscript (under review), we are unable to share our detailed findings, however we can still present a brief summary offering a glimpse of the interesting and diverse science that took place during EXP 329.

The dominant lithology at the older (58 to ≤120 Ma) deeper sites within the gyre (Sites U1365, U1366, U1369, and U1370) is zeolitic metalliferous clay. Manganese nodules occur at the seafloor and intermittently within the upper sediment column at these sites (Figure 6), whereas chert and porcellanite layers are pronounced in the lower half of the sediment column at Sites U1365 and U1366. Carbonate ooze is dominant at the youngest and shallowest sites (Sites U1367, U1368), while siliceous ooze is dominant at the southernmost site (U1371). At all three sites where basaltic basement was rotary cored (Sites U1365, U1367, and U1368), extrusive lava flows, fractured pillow basalt and pillow basalt respectively were recovered.

Concentration profiles of dissolved oxygen, dissolved nitrate, dissolved phosphate, dissolved inorganic carbon, dissolved hydrogen, total solid-phase organic carbon and total solid-phase nitrogen, as well as microbial cell counts were used to determine microbial activity and habitability. Documentation of genetic composition and additional aspects of biomass, the role of radiolysis, and sedimentary and basaltic habitability must await shore-based study.

High-resolution measurements of dissolved chloride and nitrate concentrations in interstitial waters of the SPG, as well as formation factor measurements, will provide the opportunity for reconstruction of glacial seawater characteristics through the SPG. Given the importance of this region in terms of ocean circulation, such reconstruction will greatly contribute to understanding of the global ocean-climate system.

Life at Sea

Where do you possibly begin, in a cruise even veteran 'frequent floaters' will struggle to forget (in a good way of course!)? An endeavour that manages to capture the spirit of true exploration into the unknown, whilst combined with the adventure of sailing the vast expanse of South Pacific was something we were all lucky to be a part of. Nine weeks at sea is a long time by anyone's reckoning, and one can begin to understand why the sea can send people into a delirium of madness, superstition, and tall tales–even if you are watching a movie/going to the gym, whilst enjoying a latte in your shift break! Departing from the busy, if slightly chaotic version of paradise that is Papeete (Tahiti) was the realisation that the JR was to be our home for the next 9 weeks. Raurotonga, chief of the remote and beautiful Cook Islands would be the last sighting of land for ~8 weeks.

In between coring, describing, sampling, analyses, and report writing there are few things more relaxing than staring into the endless deep blue of the pacific, which only intensified as we sailed into the gyre. In fact the water took on a deep blue/purple hue in the centre of the gyre, a colour that is unique to the South Pacific Gyre (see Figure 2). Our rather meaty on-deck BBQ's were a welcome break from the galley routine and it also gave us the unusual opportunity to feed some opportunistic oceanic white tip sharks. Indeed for a 'lifeless' ocean gyre the presence of mahi-mahi (which occasionally ended up on a dinner plate), white tips, tuna, minke whales, albatross, and even a puffer fish show that life can prevail here, though one suspects that our very presence piqued the interest of everything within a 1000 mile radius of us! It even seemed to attract satellites! On November 3, the Eutelsat W3B satellite (launched Oct. 28) declared a total loss following discovery of a sizable leak in its fuel reservoir was guided toward an atmospheric re-entry above the South Pacific Ocean to be destroyed. Thankfully, the JR just left the "space debris zone" (Figure 4) as the satellite crashed down.

A couple of rocki'n sugar and caffeine fuelled parties gave us the opportunity to let our hair down with the ships roll adding to some of the more funky swingers of the party. An ingenious version of pool devised by Rey (chief crane operator) that allowed cue based sports to take place on a rocking ship led to the inevitable pool competition (held on every expedition). Despite the feeling that the 'visitors' (Scientists) were just going to get trounced early on a few of us took part. One scientist (who I am afraid to mention at this point) made unprecedented progress to the final, which had an atmosphere fitting for the final at the crucible. Anticipation was at fever pitch, the rumours flied and half the ship turned out to watch – so this is what it is like to play sport in front of a crowd! After a dramatic 1 ½ hrs Rey came out on top, Captain Alex gave a closing speech and handed out our prizes – then the report writing continued (Figure 5). Pool, Kite flying, parties, BBQ's with sharks, gym, movies – makes it sound like we do no work at all, however our more socially orientated activities remain a very important part of the expedition objectives. Social cohesion and down-time gave us all something else to focus on, helped us work as a team even more effectively, and really underlined the meaning of work hard, play hard.

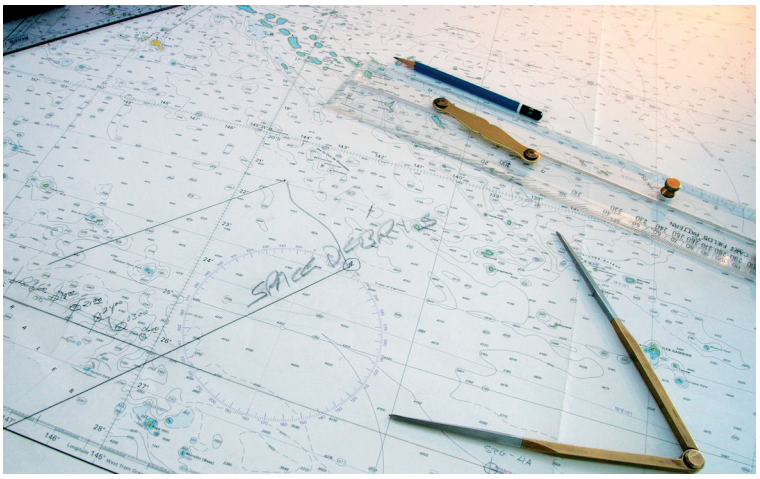

Figure 4
Space debris zone (Photo: Jill Lynch).

Figure 5
Picture of Rey (right) and Christopher Smith-Duque (left) (Photo: John Beck).

Conclusion

IODP Expedition 329 was highly successful in fulfilling the scientific objectives originally laid out in the proposal. In addressing out scientific aims we:

1. Documented many fundamental aspects of subseafloor sedimentary habitats, metabolic activities, and biomass in this very low-activity sedimentary ecosystem;

2. Significantly improved understanding of how oceanographic factors control variation in subseafloor sedimentary habitats, activities, and biomass from gyre centre to gyre margin;

3. Quantified the availability of dissolved hydrogen throughout the sediment column; and

4. Documented first-order patterns of basement habitability and potential microbial activities.

A broad range of post expedition scientific studies from samples recovered during Expedition 329 will add to our findings during shipboard studies, thus allowing us to fully address all the expedition objectives in greater detail.

Two scientists sailed as UK representatives on IODP Expedition 329: Christopher Smith-Duque (petrologist, University of Southampton, Figure 5) and Nathalie Dubois (organic geochemist, University of Manchester, Figure 7).

Figure 7
Picture of Nathalie Dubois (Photo: Joe Monaco)

Participants in Expedition 329

D'Hondt, S,
F. Inagaki,
C. Alvarez Zarikian,
H. Evans,
N. Dubois,
T. Engelhardt,
T. Ferdelman,
B. Gribsholt,
R. N. Harris,
B. W. Hoppie,
J.H. Hyun,
J. Kallmeyer,
J. Kim,
J. E. Lynch,
S. Mitsunobu,
Y. Morono,
R. W. Murray,
T. Shimono,
F. Shiraishi,
D. C. Smith,
C. E. Smith-Duque,
A. J. Spivack,
B. O. Steinsbu,
Y. Suzuki,
M. Szpak,
L. Toffin,
G. Uramoto,
Y. Yamaguchi,
G. L. Zhang,
X. H. Zhang,
W. Ziebis.

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Figure 8
Expedition logo created by Christopher Smith-Duque. It may take you more than 5 minutes to discover all the hidden details illustrating what happened during Expedition 329!

IODP 331–Deep Hot Biosphere

1 September–30 October 2010

Stephen Bowden (University of Aberdeen), Steven Hollis (University of Southampton)

During the late summer early autumn of 2010, IODP Expedition 331 drilled five sites in the Iheya hydrothermal field, Okinawa trough, Japan. The primary aim of the expedition, sailing on *DSDV Chikyu* (Figure 1), was to investigate the subvent deep hot biosphere of the Iheya North Knoll hydrothermal field (Figures 2 and 3). Consequently the science party had a large proportion of microbiologists (about half of the science party). Other objectives were to relate subsea microbial ecologies to their physical, geochemical and hydrogeological environment and to create artificial hydrothermal vents by running casing to depths that intercepted subsurface hydrothermal aquifers.

The deep hot biosphere must by definition be hot, and much of the drilling took place in relatively high temperature sediments and rocks (55–210 °C at only a few meters beneath sea floor). Additionally, careful attention was paid to contamination monitoring with both chemical tracer and fluorescent beads used in all but the deepest and hottest sections of holes to help differentiate the deep from the surface biosphere. Furthermore, emphasis was placed on high-frequency (one per section) hole-round samples for combined fluid and microbiology assays. These samples were obtained in as geochemically pristine a condition as possible, necessitating the use of breathing apparatus and air-lines to work with core that occasionally contained high hydrogen sulphide concentrations (Figure 4).

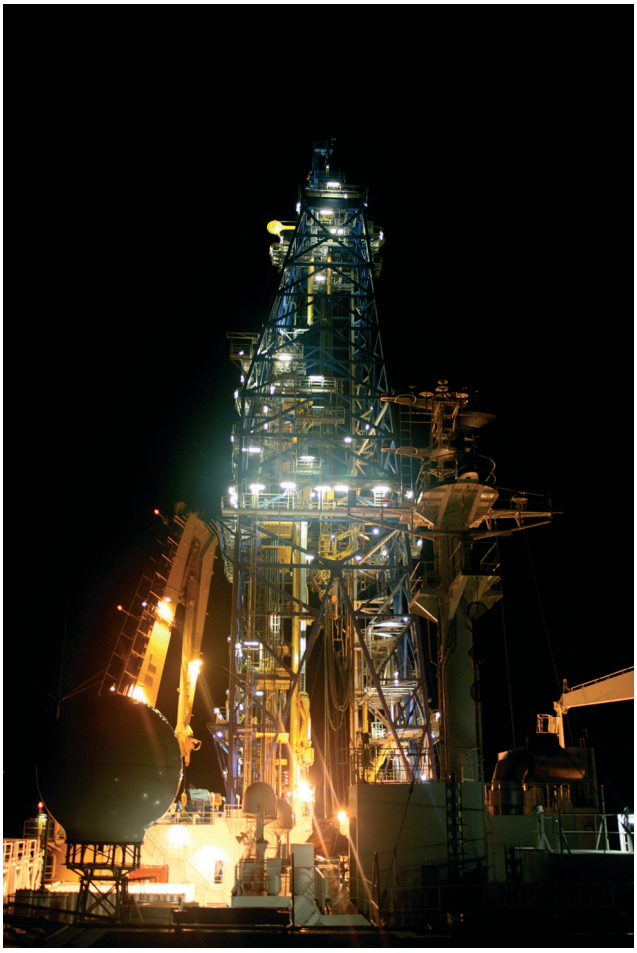


Figure 1
Night operations on DSDV Chikyu.

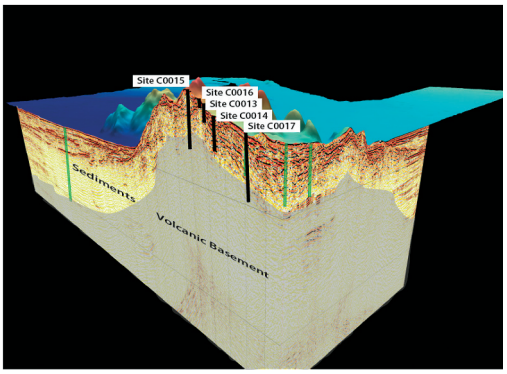


Figure 2
Partial Seismic cube of Iheya ridge showing main drillsite locations.

Figure 3
Crabs and other surface vent biota near big chimney mound.

Post-cruise, microbiologists will continue investigating samples obtained during the expedition, but during the cruise cell-count and cultivation suggested a limited subsurface biosphere at the high temperature drill sites (55 to 150 °C) that were the main target of the expedition.

While much microbiology and geochemistry work must continue post cruise, in contrast the geological value and interest of the samples obtained was more immediate. Coring recovered volcaniclastic successions (rocks generated by explosive volcanic eruptions) at locations up-and down-slope of locales of hydrothermal activity, but closer to hydrothermal vents hydrothermal activity was found to have given rise to new mud and clay deposits rich in sulphide and sulphate minerals (these are potential ore minerals, rich in metals). Encountering these units was a great privilege; typically geologists only see the end products of subsea hydrothermal processes millions or billions of years after formation as volcanogenic massive sulphide (VMS) deposits (Figure 5). Coring at the hydrothermal mound using a larger more robust 4 inch petroleum-industry-style coring system recovered a range of zinc and lead metal sulphides (the rock is entirely composed of metal-rich sulphide minerals) as well as a substantial anhydrite-horizon (a rock layer comprising a calcium-rich salt that precipitates from cooling sea water). Core from these sections yielded samples of museum quality and were a great finale to the expeditions drilling activities.

Post cruise work of the UK's participants will focus on ore petrology, geochemistry and organic geochemistry.

Much of the core encountered during IODP Expedition 331 was intensely hydrothermally altered, silicified and mineralized. In hole COO16B, drilled at the base of the North Big Chimney, disseminated and vein, stockwork-type sulphide mineralization was encountered, including massive sphalerite (Zn)-rich ore closely resembling the 'black ore' of Kuroko-type volcanogenic massive sulphide (VMS) deposits. VMS deposits are predominantly stratiform accumulations of sulphide minerals which precipitate on or below the seafloor due to high temperature hydrothermal circulation within a volcanic pile. Textures and spatial relationships from the 331 core suggest a significant amount of the mineralization precipitated subseafloor. As volcanogenic massive sulphide deposits represent a major source of Cu and Zn within the Earth's crust, these core samples provide a unique opportunity to better understand the development of hydrothermal fluid flow and sulphide mineralization within an actively forming system. In addition, we can test the hypothesis that basement composition and fluid-rock interaction within a continental margin setting is directly responsible for the mineralogical characteristics of the ore.

Figure 4
Training to work with breathing apparatus in core cutting area, cores yielded hydrogen sulphide rich sections.

Figure 5
Massive sulphide deposit (left) and anhydrite horizon (right).

Previous studies on active hydrothermal systems have demonstrated that an extremely effective way of investigating hydrothermal fluid reservoirs, fluid evolution, fluid mixing, alteration and mineralization is through a combination of detailed petrographic studies combined with REE, stable (O, D, S) and Sr isotopic analyses. Ongoing research aims to adopt these techniques to investigate the hydrothermal activity at Iheya North. In particular we seek to:

1. Constrain the fluid compositions responsible for wall-rock alteration, precipitation of vein materials, silicate-sulphide breccias, and massive sulphide;

2. Delineate the nature and extent of seawater entrainment within the sulphide mound;

3. Test for a magmatic contribution to the mineralizing system within the mound;

4. Characterize the extent and nature of fluid – rock interaction and fluid flow within the mound; and

5. Ultimately develop an understanding of the thermal structure and plumbing network of the mineralizing system.

Petroleum is a major component of the organic matter present in the hydrothermally altered pelagic mud found beneath the Iheya hydrothermal field. Most samples analysed so far predominantly yield chemical fossils (fossil fuel biomarkers) from a range of organisms not related to the deep hot biosphere (e.g. marine phytoplankton and flowering plants). The level of 'cooking' evidenced in the molecular structures of the chemical fossils and other petroleum components so far analysed suggests that many intervals must have hosted hotter fluids in the recent past, and/or that the petroleum found in the near subsurface originates from a deep/hotter part of the basin (Figure 6).

Minerals precipitated from hydrothermal fluids trap small inclusions as they form and some inclusions contain organic matter. Thus, future work will extract organic matter from specific mineral phases and examine the non-petroleum lipid biomarker to better relate them to mineral forming process associated with the deep hot biosphere.

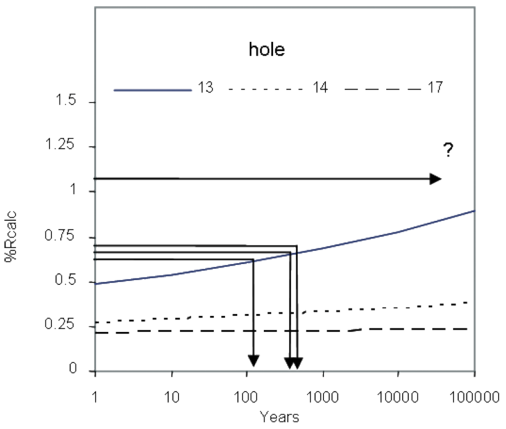


Figure 6
Evaluating the level of 'cooking' of organic matter within samples. Plot of the level of thermal maturation for a given duration of heating at 23 mbsf for three drill sites. Arrows correspond to measured values and the accompanying heating durations.

IODP Expedition 335–'Superfast Spreading Rate Crust 4'

Michelle Harris[1], Damon Teagle[1], Johan Lissenberg[2], Antony Morris[3] and Expedition 335 Science Party
(13 April–3 June, 2011)

[1]National Oceanography Centre Southampton, [2]University of Cardiff, [3]Plymouth University

In April 2011 the *JOIDES Resolution* returned to ODP Hole 1256D for the fourth drilling cruise of the Superfast Spreading Crust campaign. This campaign endeavours to understand magmatic accretion of new ocean crust at fast spreading ocean ridges. Such crust accounts for ~50% of the ocean floor and approximately 30% or the Earth's surface. ODP Leg 206 and IODP Expeditions 309/312 recovered a complete intact section of upper ocean crust and recovered the first in situ cores of gabbro at 1157 metres sub-basement (msb) (Teagle et al 2006, Wilson et al 2006), and IODP Expedition 335 sought to build on those successes by advancing Hole 1256D several hundred metres through the dike-gabbro transition and into cumulate lower crust.

Background

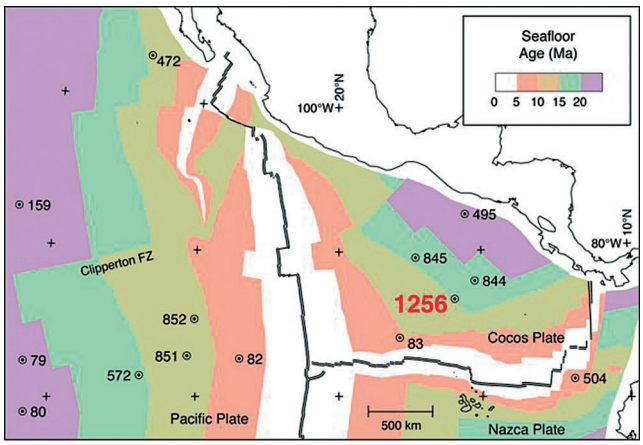
ODP Hole 1256D is located in the eastern equatorial Pacific Ocean on 15 Ma ocean crust (Figure 1) that formed during an interval of superfast spreading (220 mm/yr full spreading rate). Superfast spreading rate crust was specifically targeted to exploit the observed inverse relationship between spreading rate and depth to seismically imaged axial low velocity zones that are interpreted to be magma chambers (Purdy et al 1992, Carbotte et al 1997, Phipps Morgan 1993). This should minimize the drilling distance to gabbroic rocks and therefore drilling time. Extrapolating this relationship to superfast spreading rates predicted that gabbros should be recovered between 1025 and 1300 msb. During Expedition 312 the first in situ gabbro cores were recovered within the depth range predicted, realising a long-term ambition of the lithosphere community (Teagle et al 2006, Wilson et al 2006). By the end of Expedition 312 Hole 1256D had penetrated through 250 m of sediment overlying ~810 m of lavas and a thin (~340 m) sheeted dike complex above a complex ~100 m-thick transition zone of gabbros intruded into dikes. The lower~60 m of the sheeted dikes, as well as the dike screens hosting the gabbroic intrusions, are strongly recrystallized to granoblastic textures by contact metamorphism.

Figure 2
The C9 RCB coring bit that was destroyed on the first coring run of Expedition 335 'Stumpy'. The completely rounded and abraded bit was something that the drillers have never seen before (Expedition 335 Prelimiary Report).

However, the overarching goal of the Superfast campaign to understand the magmatic accretion of fast spread ocean crust remained, necessitating further drilling in Hole 1256D.

Sampling of lower ocean crust formed at fast spreading rates is sparse, and consequently much of our understanding regarding the magmatic accretion of the lower crust is based on observations from ophiolites. Two end member theoretical models have been proposed for the magmatic accretion of the lower ocean crust, the gabbro glacier (e.g., Henstock et al., 1993; Phipps Morgan and Chen, 1993; Quick and Denlinger 1993) and multiple sills (e.g., Kelemen et al., 1997, Korenaga and Kelemen, 1997; MacLeod and Yaouancq, 2000; Boudier et al., 1996) models. These theoretical models differ primarily in the location of crystallisation, with the gabbro glacier model predicting all of the lower crust to form by crystallisation in a high level melt lens with subsequent ductile downward flow. In contrast the multiple sills model suggests that the lower crust is built by sills of melt that crystallise in situ at depths throughout the lower crust. These theoretical models yield different predictions (e.g, bulk composition, distribution and magnitude of hydrothermal circulation) that could be readily tested given appropriate samples. Thus, in situ cores from cumulate gabbros would allow major advancement in our understanding of how a significant proportion of the Earth's crust formed.

Figure 1
Regional map showing the age of the ocean crust. The location of ODP Hole 1256D is shown on ocean crust formed at 15 Ma at a superfast spreading rate. Figure from Wilson et al., 2006.



Expedition 335 Operations

After a drilling hiatus of more than 5 years an eager group of scientists boarded *JOIDES Resolution* in Puntarenas Costa Rica for IODP Expedition 335 'Superfast Spreading Rate Crust 4'; the long awaited and hard fought for return to Hole 1256D. Operations during Expedition 335 were challenging from the start and eight re-entries were required before coring could resume and a total of twentyfour re-entries were made with a record of >150 miles of pipe trip throughout the voyage (Exp 335 Prelim Report). On the first re-entry an obstruction in the borehole at ~920 metres below seafloor (mbsf) was encountered. This was also a problem interval at the beginning of Expedition 312 where 5 days of reaming and cleaning were required before the bottom of the Hole was reached and drilling operations could continue. During Expedition 335 a patient and persistent strategy involving a combination of existing and new techniques were used in order to re-open Hole 1256D to its full depth. This included combinations of drill bits and junk baskets, cement plugs and high viscosity mud sweeps. During this time the science party took advantage of the Expedition 312 cores that were onboard and engaged in observing and describing the plutonic complex cores in order to (1) test and revise the new core description software onboard that had not previously been used to describe plutonic igneous rocks, and (2) to provide a set of uniform observations that would be consistent with the cores recovered during Expedition 335.

16 days after arriving on station and in celebration of the Royal wedding, the bridge at ~920 mbsf was passed and Hole 1256D was opened to its full depth. Coring resumed and the Hole was advanced from 1507.1 to 1520.2 mbsf. Cores 335-1256D-235R through 238R returned a mixture of granoblastic basalt with small intrusions of evolved plutonic rocks. When the C-9 hard formation coring bit was recovered to the drill floor it was found to be utterly destroyed and ground to a smooth stump (Figure 2). The granoblastic dikes are notoriously difficult to drill and a drill bit was also extensively damaged during Expedition 312. A series of fishing and milling tools and junk baskets were deployed to recover junk from the destroyed drill bit and clean the Hole. During this stage of operations additional complications also occurred with the drilling assembly becoming clogged with sand-sized drill cuttings. However, cleaning operations also yielded surprises, including the recovery of large 'frozen chicken'-sized cobbles up to 3.5 kg, more akin to samples that might be recovered during field work than ocean drilling. Thanks to the determined efforts of the drill floor team, Hole 1256D was reamed, cleaned and the metal junk removed. On the last pipe trip during Expedition 335 coring in Hole 1256D resumed and the Expedition ended with the uplifting announcement of 'core on deck'. To preserve the hard efforts of the extensive remediation during Expedition 335, two cement plugs were placed in Hole 1256D to stabilise the base of the hole and the problematic 920 mbsf interval, hopefully preserving the good condition of the Hole ready for future drilling.

In total an impressive suite of granoblastic rocks and minor gabbroic rocks were recovered that preserve a complex history of recrystallization, hydrothermal alteration and small scale intrusions that otherwise may not have been observed given the small diameter of the core (Figure 3). These rocks form part of the conductive boundary layer that separates the predominantly intrusive magmatic system in the lower crust and the hydrothermal system in the upper crust.

Of greatest importance is that Hole 1256D has been stabilised, cleared of drill cuttings and metal junk and is open to its full depth, preserving the significant investment of ODP and IODP. The onus is now on the ocean drilling program for a timely return to deepen Hole 1256D to build on the monumental efforts of the JOIDES Resolution during Expedition 335.

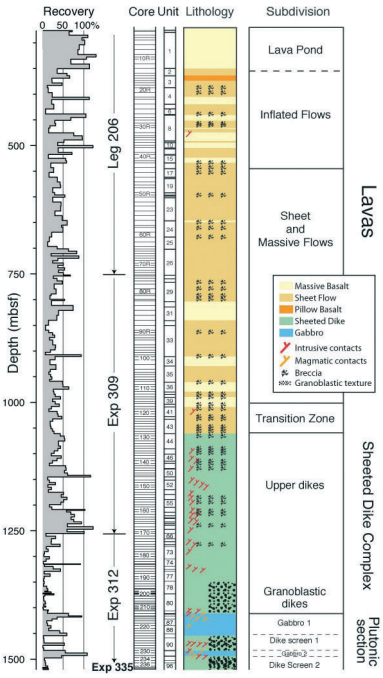


Figure 3
The lithostratigraphy for Hole 1256D at the end of Expedition 335.

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Expedition 335 Science Party 2011 Prelim Report 335.

Education–Outreach

Expedition 328: School of Rock

4–18 September 2010

David Edwards (Freelance Science Educator, Public Speaker)

Five years ago it was decided there should be an annual IODP educational program for teachers and educators. Normal expeditions, however, are too long for this purpose, so for two years the 'School of Rock' as it became known, was held at the core repository in Texas, and for another two years it was held while the ship was in transit from one port to another (but that of course means no science projects are running). Last year was special: there was an unusually short expedition of 10 days duration–a great length of time for teachers and also the ship would be in action. Sixteen educators, predominantly American, were selected and in September 2010 I found myself the only British representative climbing the gangway of the *JOIDES Resolution* at Victoria, British Columbia to accompany Expedition 328 into the NE Pacific to sink an electronic observatory into the seafloor to measure pressure changes and porewater chemistry; data that could be used to better understand tectonic activity and contribute knowledge about the water cycle.

The Consortium for Ocean Leadership, who ran the 'School' on the ship, were clear on the outcomes they were looking for: They wanted us to learn as much as we could about the science, yes, but also develop novel and creative ways to disseminate what we'd learned back to our students, pupils or museum visitors. To this end, we had busy daily schedules. We worked on cores: preparing smear slides, assessing pore water chemistry, and interpreting what the cores were telling us. Scientists running this expedition's project regularly dropped in to our seminar room to give us talks on the science, as well as how scientific projects like this are managed. As we were a diverse range of educators (from schools, museums, universities, public radio stations) there was also a lot of pedagogy and technical skill in-house, which was exploited by the organisers by getting us to share our expertise with the others. We'd been encouraged to bring laptops, cameras, camcorders, and sound recorders and were given license to roam the ship (apart from the drill floor) and interview whoever we wanted. In the evenings we blogged (another new experience for many of us) and experimented with novel software, whether it was for creating comic book stories or editing video footage. Several of the school teachers held on-board video classes with their pupils back home: live sessions where they interviewed scientists and showed their pupils what life and science was like on the ship.

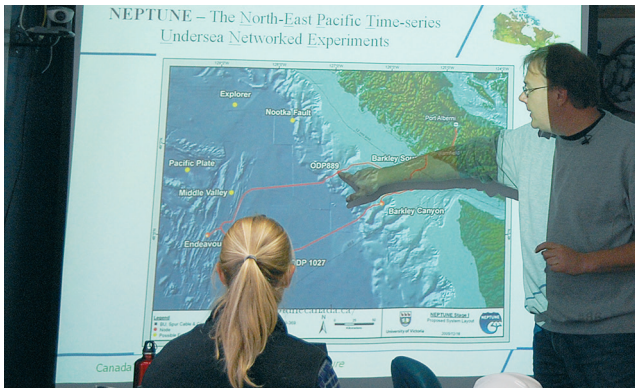
The School of Rock organisers were also very keen that we acquired multimedia skills so that on our return we could present what we'd learned to our students in the most effective ways and they wanted us to think about how we would use what we'd learned. We made great friendships with the other 'Rockers' so we will be open to wider educational influences from them, and we gleaned inspirational ideas from hearing what other educators do in their establishments.

We were encouraged to produce a plan of how we would use our experience when we returned to our respective institutions: through Facebook, webinars and email lists we have shared ideas and feedback on how we have done. I, for example, am providing public lectures around the UK on the IODP program and my experience on the ship.

IODP School of Rock:
www.iodp-usio.org/Education/SOR.html

David's Personal webpage:
www.inspiringpublicspeaker.co.uk/

Audio slide show and youtube clips:
www.inspiringpublicspeaker.co.uk/environmental-talks/seafloor-exploration-speaker.htm



Recent Scientific Workshops

Relative sea level, ice sheets and isostasy: past, present and future. A workshop summary

Ian Bailey (NOCS), Mark Siddall (Bristol University), and Tina van de Flierdt (Imperial College)

**Instead of hosting a stand-alone grant round workshop for the 2010 UKIODP 'Ice Sheets and Sealevel' grant round, UKIODP supported the attendance of 8 scientists, and made a small contribution to the organization of the PALSEA workshop.*

In late September 2010, 78 international scientists met in Bristol in southwest England to attend the third annual PALSEA workshop: Relative

Sea level, ice sheets and isostasy: past, present and future (Fig. 1). PALSEA (or PALeo-constraints on SEA-level rise) has been holding workshops since 2008, which bring together researchers from a diverse range of related fields, including climate, ice-sheet and earth systems modelling, field glaciology, marine archaeology and palaeoceanography. The common goal for everybody is to generate improved reconstructions of sea-level change and ice-sheet-ocean interactions associated with the waxing and waning of continental ice-sheets during the geological past, in order to better constrain future sea-level rise.

In 2010, the workshop was hosted at Bristol University by the Department of Earth Sciences with funding from the UKIODP, IMAGES, PAGES, WUN, Black Swan funding (Univ. Bristol), BRIDGE (Univ. Bristol) and Global Change Initiative (Bristol), guaranteeing the attendance of a number of key researchers. The city of Bristol, which has maritime history extending back to the Middle Ages and a long-standing connection to sea-level research spanning back to the turn of the 19th century, provided an excellent setting.

Of immediate societal concern is the rise in sea level that may occur over the next 100 years due to the melting reduction of continental ice-sheets due to anthropogenic global warming. In the face of rising global temperature, decreased stability in the Antarctic and Greenland ice-sheets has the potential to alter the position and morphology of coastlines, causing flooding of coastal settlements and shortages in the food and freshwater supplies of hundreds of millions of humans. Instrumental records offer detailed insights into the most recent history of sea-level change from the past two centuries though tidal gauge measurements, over the past several decades from altimetric data and for less than one decade from gravimetric data. Unfortunately, to understand the potential magnitudes and rates of future sea-level change and the likely sensitivity of ongoing sea-level rise to increases in temperature, we cannot rely on the instrumental record alone. Critical in this regard is the longer-term perspective that can only be provided by evidence encoded in the geological record.

Figure 1
PALSEA scientists take a moment out from workshop presentations to discuss each other's research.

Estimates of past sea level can be extracted from the geological record by dating accurately ancient coral reefs and mangrove swamps that grew close to sea level or palaeo-shorelines that are now either buried deep under water or perched high above current sea level. The resultant records detail the history of past sea level relative to a fixed point of local significance, such as the sea-bed. As such, they are not only influenced by the global imprint on sea level of the history of continental ice sheets, but also by regional lithospheric tectonics and sediment loading which can introduce differential movements between land and sea.

In order to reconstruct the eustatic or global component of relative sea-level change in the geological past, however, it is not only necessary to correct individual records for regional tectonic contributions, but also for changes in topography due to mantle convective flow and the response (or geo-isostatic adjustment, GIA) of the Earth to changes in lithospheric loading due to the continental ice-sheet growth during repeated glacial cycles (Fig. 2). Historically, only tectonic loading has been widely corrected for, whereas mantle dynamics and GIA have been assumed to impact negligibly. A principal focus for PALSEA 2010 was therefore to discuss and advance how the scientific community can use palaeodata from sea-level and ice-sheet reconstructions at a range of temporal scales with geophysical modelling to further improve predictions of future sea-level rises and Earth system states over the next century. At the workshop, a particular emphasis was placed on how the community can better adjust relative sea-level records for mantle and GIA contributions using realistic ice distribution and Earth models for both the last deglaciation following the maximum in global ice volume 21 thousand years ago and past warm intervals such as the mid Pliocene warm period (MPWP, ~3.3-2.9 million years ago), when Earth's atmospheric pCO_2 levels were last comparable to today, e.g. ~350 to 450 ppmv, but temperatures were ~2-3 °C higher.

Over four days, the workshop considered through oral and poster presentations and panel discussions a range of aspects and applications of palaeo-ice-sheet and sea-level reconstructions. A notable highlight was the importance to palaeo-sea-level research of material recovered by IODP and ODP. The first continuous coral reef record for the Pacific Ocean to span the last deglaciation was drilled off Tahiti during Expedition 310, and new proximal records for the Miocene and Pliocene were drilled off the Wilkes land margin and the East Antarctic Ice Sheet (EAIS) during Expedition 318. Research on these archives was reported at PALSEA 2010 to be instrumental in constraining the timing and magnitude of meltwater pulse-1A (at 14.5–13.7 thousand years ago) (Deschamps et al., 2009), in establishing that the penultimate deglaciation (~137 thousand years ago) occurred earlier with respect to northern hemisphere summer insolation than the last deglacial (Thomas et al., 2009) and in demonstrating dynamic behavior of the EAIS during the late Miocene and Pliocene (Williams et al., 2010).

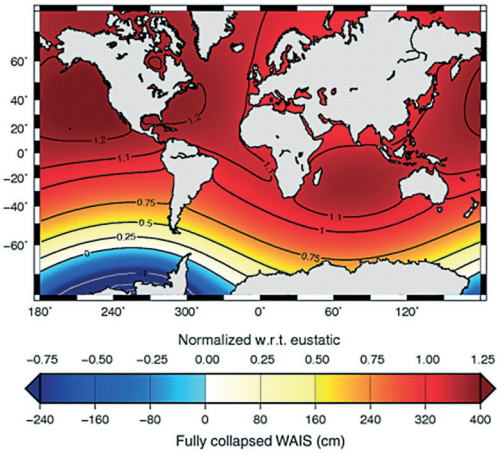


Figure 2
Modelled sea level rise after collapse of the West Antarctic Ice Sheet taking into account the effects of self gravitation, elastic rebound of the lithosphere, and Earth rotation perturbations. (Bamber et al., 2009).

Major outcomes of the PALSEA 2010 workshop were as follows:

1. Palaeo-data can be used to constrain models of GIA and, consequently, ice sheet evolution and large-scale Earth structure. In turn, GIA models should be applied to correct instrumental records of more recent changes in order to isolate both eustatic sea-level signal and the contribution of that signal from individual ice sheets. In particular, refined GIA data will allow improvements in the assessment of ice-mass loss from the large continental ice sheets using gravimetric satellite data.

2. Data from the last several thousand years (and increasingly from archeological research) can inform the scientific community by delimiting the Holocene baseline of sea-level change and the pre-industrial response of sea level to climate phenomena such as the Little Ice Age.

3. Data from earlier warm periods has the potential to inform us about the response of sea level, and stability of the Antarctic and Greenland ice sheets, during warmer climates. In particular there exists a myriad archive of untapped fossil beach escarpments that has the potential to greatly improve sea-level estimates for the MPWP.

4. The PALSEA community will continue to work towards improving techniques for the generation of, and reduction in uncertainties associated with reconstructions of records of relative sea-level and ice-sheet extent and commit to the foundation of a global, transparent and quality monitored database.

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Climate Forcings and Feedbacks Workshop Cardiff University, 17–18 November 2010

Ian Hall (Cardiff University) and Darren Gröcke (Durham University)

In November 2010, twenty UK based scientists gathered in Cardiff for a Workshop on Climate Forcings and Feedbacks. The purpose of this meeting was to review the outcomes of the UKIODP 2008 programme of the same name and to identify potential key contributions, to further understanding of global palaeoclimate, of future drilling under IODP.

The strength of UK science in addressing the themes of climate forcings and feedbacks was clearly demonstrated: the group spanned a wide range of geological time periods and proxies, addressing both physical and biogeochemical feedbacks when discussing past climate change. Speakers were encouraged to offer 'review with open/pressing questions and particularly those that might be addressed with future drilling' to promote interaction, and this certainly happened throughout the workshop sessions, and during the social event at a local Thai Restaurant.

The workshop opened by short statements from all of the participants about their research interests. Sessions were loosely ordered on the basis of their respective temporal scale covering *Tectonic, Orbital,* and *Millennial Timescales*.

Seven speakers provided insights into *Tectonic* scale climate forcings and feedbacks during the first session, including ocean-atmosphere coupling (Darren Gröcke, Durham University) and biodiversity (Jackie Lees, University College London) in the Cretaceous, Cenozoic temperature and pCO_2 reconstructions (Paul Pearson, Cardiff University and James Rae, Bristol University). Paul Pearson prompted a particularly animated discussion following his presentation, questioning whether paleoclimate research on past greenhouse climates can provide constraints on the modern 'climate sensitivity' (the global average temperature increase due to a doubling in atmospheric CO_2). It was agreed that there is an urgent need for better data, both temperature and pCO_2 reconstructions, and the generation of detailed SST records for the Mesozoic and Cenozoic to compare with benthic records. The potential of the TOP proposal to drill offshore Tanzania was highlighted as a potential ideal location for addressing these issues. The session continued with talks addressing the transition from greenhouse (Eocene) to the icehouse (Oligocene) climates (Dave Bell, University of Edinburgh and Helen Coxall, Cardiff University) and the importance of ocean gateways in regional and global ocean circulation, focused on the forthcoming Mediterranean Outflow Expedition (20 November 2011 - 20 January 2012, based on IODP Proposal 644-Full, Dorrick Stow, Herriot-Watt University).

The afternoon finished with a keynote presentation, generously sponsored by the Geological Society's 'Marine Studies Group', by Jerry Dickens evocatively entitled *Where's the petatonne gorilla in global models for climate and carbon cycling? (and how does it behave with and without a leash)?* The talk provided an overview of the potential trigger mechanism of the early Cenozoic hyperthermals, or transient episodes of warming. The largest of the hyperthermals, the Paleocene Eocene Thermal Maximum (PETM or ETM-1) at roughly ~56 Ma, is marked by a global warming of >5 °C and was followed by at least two additional, but smaller warming events, ETM-2 and ETM-3 (also known as the 'ELMO' and 'X' events, respectively). Jerry explained his appealing idea (Dickens et al., 2011) for the presence of a large seafloor CH4 capacitor that reduces in mass between 57 and 50 Ma because of deep-sea warming and successive short-term carbon injections or 'burps' during the hyperthermals, but partly refills because of deep-sea cooling and increasingly higher carbon input. Discussion following his talk identified the next challenge, which is to explain why the cycle of filling and discharge ended in the Eocene.

The second session discussed Orbital scale climate variability ranging from the evolution of Plio-Pleistocene transitions (Sindia Sosdian, Cardiff University), orbital forcing of the Indian (Martin Ziegler, Cardiff University) and East Asian monsoons (Peter Clift, University of Aberdeen) and the mid-Pleistocene Transition. This latter topic clearly demonstrated the complimentary expertise present within the UKIODP Community that allow us to tackle both surface and deep ocean circulation change (Ian Hall, Cardiff University and Phillip Sexton, Open University), quantify temperature changes (Erin McCymont, Newcastle University), and begin to assess biological responses (Alan Kemp, University of Southampton) to these transitions. If there can be a perception that we already know what happened during the Plio/Pleistocene, then new results shown at the meeting and the ensuing discussions demonstrated that we are still being challenged to explain what happened and why.

The final session addressing millennial scale climate change started with an overview by Stephen Barker (Cardiff University) of attempts to reconstruct Greenland climate variability over the last 800 kyr using the ice core temperature record from Antarctica. The reconstruction based on a reformulation of the thermal bipolar seesaw model (which implicates the Atlantic Meridional Circulation, AMOC) and suggests that abrupt shifts in Northern Hemisphere climate were a ubiquitous feature of the Late Pleistocene. Ocean circulation and the links to climate dynamics also featured heavily in the remaining talks which focused on the Marine Isotope Stage 5a/4 glacial inception (David Thornalley, Cardiff University), Termination V (Jenny Stanford, Southampton University), ice-ocean interactions (Maryline Vautravers, British Antarctic Survey) and, finally, Southern Ocean surface temperature variability during the Holocene (Amelia Shevenell, University College London).

The Workshop was hosted by the Palaeoclimate and Climate Systems Research Group at the School of Ocean Earth Sciences, Cardiff University and in all, succeeded in its aims. Participants found considerable time for fruitful discussion, establishing several new research collaborations and highlighted the unique and vital research opportunities offered by ocean drilling. And in particular the workshop scientists all agreed that these kinds of workshops are particularly important for the UK IODP community.

IODP/ICDP Workshop in Muscat, Sultanate of Oman

Sarah Mackintosh (Nottingham University)

**UKIODP supported the attendance of 7 scientists to the workshop*

Scientists from the UK recently attended the Geological Carbon Capture and Storage in mafic and ultramafic rocks IODP/ICDP Workshop in Muscat, Sultanate of Oman.

Carbon Capture and Storage (CCS) is considered to be a reliable method to reduce the atmospheric injection of CO_2 of anthropogenic origin and therefore to mitigate global warming due to the increased levels of this greenhouse gas.

Currently, research is mainly focused on geological storage, both onshore and offshore. Large volumes of CO_2 could be safely stored in specific geological structures able to retain it for geological periods. The trapping mechanisms involved in geological storage are similar to the ones that occur naturally for the hydrocarbon reservoirs. Long-term monitoring is required both during and after the injection phase to assure that there are no leakages from the storage site.

In-situ mineralisation is an alternative approach which could be used to capture and store billions of tons of CO_2 per km^3 of rock per year, while eliminating the need for monitoring CO_2 leakage. (Huijgen, W. Comans, R. 2004).

Ultramafic and mafic rocks are the most abundant rocks at the Earth's surface. Observations of active and ancient hydrothermal systems demonstrate rapid and abundant formation of carbonate minerals via reaction of fluids with these rocks. However, in contrast to the many large pilot studies of CO_2 storage into pore space in sedimentary basins, the high carbonation potential of mafic and ultramafic rocks has received relatively little attention. Consequently the IODP and ICDP arranged a workshop to develop partnerships between industry and the oceanic and continental scientific drilling communities to evaluate the potential for CO_2 storage in igneous rocks, and its environmental, economical and societal benefits.

Oman provided the perfect backdrop for the workshop because ophiolites are ideal rocks for carbonation and the Country has one of the largest ophiolite suites in the world, the 'Semail Ophiolite' which extends for about 350 km with a width of 40 km and an average thickness of 5 km (figure 1). Its potential storage capacity is estimated in more than 1Gt CO_2/yr (Kelemen and Matter 2008). Ophiolites represent a suite of several different rocks originated by the subduction of the ocean seafloor into passive margins followed by the exposition on the continental crust. These rocks are composed mainly by Mg and Fe silicates and their name derives from the merging of 'magnesium' and 'ferric' adjectives.

The workshop was hosted in the splendid Sultan Qaboos University under the patronage of his Excellency Dr Ali Bin Saud Al Bimani. It ran for three days and brought together specialists researching the biogeochemical, mineralogical, mechanical and hydrodynamic processes associated with the reaction and storage of CO_2 rich fluids in ultramafic and mafic rocks.

The workshop was opened by Dr Saif Al-Bahri, the Dean of Science at Sultan Qaboos and Prof Peter Kelemen, Chairman of the Conference and Professor at Columbia University. Presentations from experts across the world were made on a number of areas including the potential of storage in these types of rocks, experiences in practical field and lab work to investigate the potential of the rocks and the hydrogeology surrounding the rocks. IODP panel member Damon Teagle presented on the potential for in situ geological storage in mafic rocks: Fundamental mechanisms and lessons from field observation.

In addition to the oral presentations, most of the participants brought poster presentations on a wide variety of work carried out both in Oman and elsewhere in the world on mineralisation. Each evening, participants were given the opportunity to discuss their work and share ideas.

During the workshop, a number of working groups were formed to discuss barriers to the technology and a strategy for developing storage in ultramafic and mafic rocks. Working groups included those looking at natural systems and in-situ storage on land and sea, kinetics, monitoring and societal issues. Participants highlighted public perception, cost and drilling difficulties as key barriers to the technique.

Following the workshop, scientists got the opportunity to go on two field trips to see the spectacular geology of Oman. The field trips were led by Prof Peter Kelemen, who has been working in Oman for many years. On day 1, we got to visit two large travertine deposits with active alkaline springs emerging from peridotite, and then a large escarpment exposing late Cretaceous listwanite. On Day 2, our group visited three carbonate vein localities, as well as seeing a general overview of lithologies in the Oman ophiolite. The field trips provided a unique opportunity for scientists from across the world to not just see the spectacular geology of Oman but also to learn more about its geochemisty, hydrogeology and the potential for mineral carbonation.

The workshop and field trips were expertly organised by Marguerite Godard, Peter Kelemen and S. Nasir among others and all participants were extremely pleased to have been involved in such a productive and valuable workshop which brought together people working in a wide range of disciplines. Cross disciplinary research is vital to move the wider field forward. If you would like to know more about or collaborate on the work my colleagues and I are involved in please visit www.ncccs.ac.uk or contact me at sarah.mackintosh@nottingham.ac.uk.

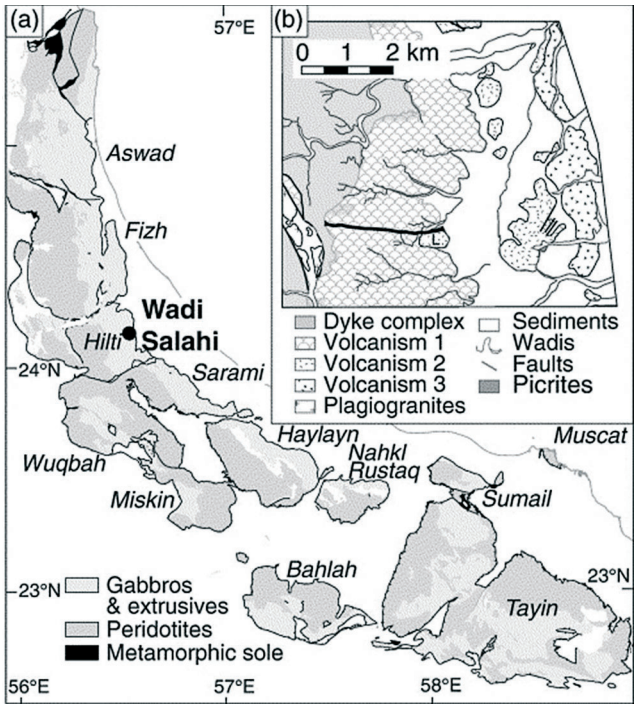

Figure 1
Map of the Semail ophiolite structures (Nicolas et al 2000).

Figure 2
The fieldtrip.

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Figure 3
The stunning geology of Oman.

2011 ECORD Summer School

This year the Bremen based Summer school is entitled 'Subseafloor Fluid Flow and Gas Hydrates', and Urbino again hosts the 'School of Paleoclimatology'.

The ECORD Summer Schools are recognized as excellent, and we encourage all students to apply. PhD students are the most common attendents though undergraduate, and even some early-career scientists have been accepted in the past. Please look out for next year's opportunities on ECORD's website: www.essac.ecord.org/index.php?mod=education&page=summer-school

This year UKIODP is supporting the attendance of 6 students:		
Rosanna Greenop	PhD student	University of Southampton
Margit Simon	PhD student	Cardiff University
Nathalie Dubois	Post-doc	The University of Manchester
Michael Henehan	PhD student	University of Southampton
Tom Chalk	PhD student	University of Southampton
Xinyuan Zheng	PhD student	University of Oxford

Other known UK attendants are:

Sam Bradley-Dosaj (Cardiff University), Anna Joy Drury (Imperial), Lyndsay Fox (Leeds University), Paula Sankelo (Glasgow University), and Joana Gafeira (BGS).

IODP–New Program

The IODP Science Plan: 2013–2023: Illuminating Earth's Past, Present, and Future

Mike Bickle (Cambridge University)

**Professor Bickle was chair of the IODP Science Plan Writing Committee*

IODP formally announced the Science Plan for the proposed 'International Ocean Discovery Program, 2013 to 2023' on 16th June, 2011. The Science Plan is cited as the guide to the 'multidisciplinary, international collaboration in scientific ocean drilling during the period 2013 to 2023'. It presents the scientific justification for renewal of the international ocean drilling program. The Science Plan is the outcome of a lengthy consultative process. In 2009 the INVEST meeting in Bremen, Germany, was attended by about 600 scientists from 21 nations to formulate research priorities which would require access to the new program. During 2010 the Science Plan Writing Committee attempted to distill the most compelling science into a concise report. This was substantially revised into the final version early in 2011.

It is easy to justify a new drilling program. The oceans contain the only continuous time records of a whole range of geological processes. Ocean sediments contain records of the past evolution of the physical, chemical and biological processes in the oceans, processes which exert critical controls on the Earth's surface environment. The oceans cover major tectonic expressions of the solid Earth tectonic processes which reflect their fundamental driving mechanisms and cause major geological hazards. Of particular importance is the role of past climate change in understanding potential climate sensitivity to anthropogenic CO_2 emissions. The major difficulty with writing the Science Plan is how to select potential research topics out of the vast number proposed. A further complication is that the ocean drilling programs are proposal driven. Scientists formulate drilling proposals based on the urgent scientific questions at that time given the infrastructure and resources available. A Science Plan can not hope to specify a scientific program for ten years, nor should it. The Science Plan is a snap shot of the more compelling scientific priorities at the time it was written. The other vital aspect of the research based on ocean drilling is that the work extends far beyond the individual expeditions and the scientists who execute them. The core samples and data from downhole observatories remain available for much future research. There are probably very few, if any, Earth scientists whose research does not depend to some extent on the findings of ocean drilling.

The new Science Plan presents the research objectives under four main themes:

- Climate and Ocean Change: Reading the Past, Informing the Future.
- Biosphere Frontiers: Deep Life, Biodiversity, and Environmental Forcing of Ecosystems.
- Earth Connections: Deep Processes and Their Impact on Earth's Surface Environment.
- Earth in Motion: Processes and Hazards on Human Time Scales.

Climate and Ocean Change

With climate change now of major concern to society, understanding paleoclimate has changed from a compelling academic pursuit to a topic of general concern. The Science Plan highlights four important areas of research:

1. How did Earth's past climate respond to elevated levels of atmospheric CO_2,
2. How did ice sheets and sealevel respond to past warming events,
3. How does past climate change affect regional rainfall patterns such as those associated with monsoons and El Niño and,
4. How resilient are marine ecosystems to chemical perturbations.

Biosphere Frontiers

Priorities in research into the biosphere are seen to include:

1. The origin, composition, and global significance of subseafloor communities,
2. The limits of life in the subseafloor and,
3. The sensitivity of ocean ecosystems and biodiversity to environmental change.

The environments occupied by subseafloor life present us with both new constraints on metabolic processes and novel perspectives on how evolution operates in an environment where organisms are progressively isolated. The continuous high-resolution time records preserved in ocean sediments provide an invaluable archive on the response of ocean ecosystems to environmental change and on the evolutionary responses to such changes.

Earth Connections

'Earth connections' concerns the operation of solid Earth processes and how these interact with the Earth's surficial environment. Topics of prime concern include:

1. The composition, structure, and dynamics of Earth's upper mantle,
2. How seafloor spreading and mantle melting are linked to ocean crustal architecture,
3. The mechanisms, magnitude, and history of chemical exchanges between the oceanic crust and seawater and,
4. How subduction zones initiate, cycle volatiles, and generate continental crust.

The operation of the riser drill ship, Chikyu, presents the exciting opportunity to drill through intact oceanic crust to the mantle for the first time. Non-riser drilling has now penetrated to the top of the gabbroic lower oceanic crust and the complex oceanic crustal architecture at slow spreading ridges is now known to expose whole crustal sections (Fig. 1). The new program should answer important questions about the magmatic and hydrothermal structure of the lower oceanic crust and how oceanic hydrothermal circulation impacts ocean chemistry.

Earth in Motion

'Earth in motion' concerns processes in real time monitored by observatories placed in boreholes. Key questions include:

1. What mechanisms control the occurrence of destructive earthquakes, landslides, and tsunami,
2. What properties and processes govern the flow and storage of carbon in the subseafloor and,
3. How do fluids link subseafloor tectonic, thermal, and biogeochemical processes.

The 2011 Töhoku earthquake was a salutary reminder of potential magnitude of geological hazards. The installation of borehole observatories as part of the Nankai Trough Seismogenic Zone Experiment (Fig. 2) is an important initiative by the IODP program, to be continued into the new program, to provide real-time monitoring in such critical regions. Movement of fluids is central to most geological processes and the improving ability to monitor and sample fluids down boreholes will be central to understanding a whole range of geological processes of environmental importance.

The new Science Plan covers only a small proportion of the science which will be dependent on ocean drilling over the 2013 to 2023 period. This science includes topics of urgent societal concern as well topics of fundamental academic interest. The question that remains is whether the international community has the will to continue to collaborate on funding this most essential and succesful of the international scientific programs.

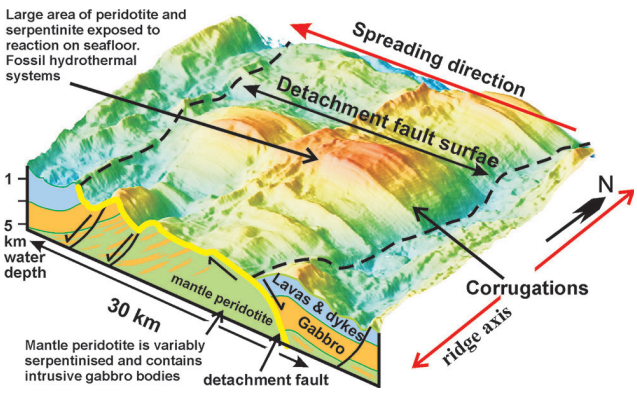

Figure 1
Section through oceanic crust and extensive serpentinised mantle peridotite exposed by low angle extensional faulting at ridge adjacent to Kane Fracture Zone in the Atlantic adjacent to the Kane Fracture Zone.

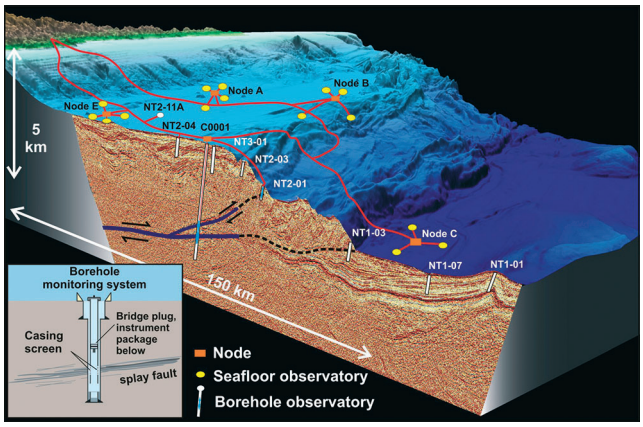

Figure 2
Illustration of the boreholes and borehole observatories being installed as part of the Nankai Trough Seismogenic Zone Experiment. Borehole observatories will monitor strain, seismicity, pore-fluid pressure, fluid composition, and temperature to better understand processes in the seismogenic zone.

IODP Proposal Primer

Heiko Pälike (National Oceanography Centre, Southampton)

**Heiko is a UK representative to IODP's Science Planning Committee (SPC) and the below is an adapted version of a primer developed by the SPC.*

With the new Integrated Ocean Discovery Program ('IODP') comes a new and streamlined process for proposals and proposal evaluation by the Science Advisory Structure ('SAS'). This new system will operate for proposals submitted by October 2011 and beyond. The following illustrates some of the important aspects for proposal writing and evalution to allow for smooth sailing. The main difference to the existing system is that the 'nurturing' phase of proposals is supposed to take place primarily through community driven workshops, and that the science advisory structure will in principle be faster in deciding whether a proposal will be moved forward or rejected. This has the important consequence that new proposals will only be considered a maximum of two times as pre-proposals and two times a full proposals before they are moved forward or rejected. The following explanations are adapted from a draft version of a new 'IODP proposal guide primer'.

Proposal and Planning process

Science in IODP is conducted on multiple drilling platforms, and is driven by community input and evaluation in the form of proposals that are peer-reviewed. Ocean drilling efforts constitute 'Big Science' for our community. For example, each Expedition costs $8-14 million–this investment in science goes beyond an individual researcher or research group, some of the objectives may go beyond those directly relevant to any given expedition and each project will engage the community more widely. Thus, the proposal structure, review and planning processes are very comprehensive and differ in many aspects from those in typical national-based programs. The biggest difference in the proposal flow is that the IODP process is iterative and improved by input from the community. Throughout this process, the review process is quite open to encourage communication between the science proponents and the planning structure of IODP, and as a result the proponents (roughly analogous to the group of Principal Investigators (PI's)) are in communication with various groups, committees and implementing organizations within IODP, each of whom may require different information from the proponents. It is a system designed to transform exciting science into successful expeditions. Another difference is that a successful drilling proposal will result in drilling of the proposed sites, with a fully equipped platform and associated laboratory, technical support, logging expertise and so on, but the financial responsibilities involved are managed within the program, so there is no budget section in an IODP proposal.

There are some simple steps to follow to help guide you through the proposal process. The goal is to help introduce investigators that are relatively new to the program, to the IODP system, and not to scare you off with a broad array of acronyms that are in use in the program. You may have run across some of these IODP technical terms and acronyms in reading, but these are not really important to the initial stages of submitting a science proposal to the IODP.

Components of the program

There is only one main component of the program that proponents need to understand–the **Science Advisory Structure (SAS)** (Figure 1). This is the part of the IODP that reviews proposals, helps make 'good science' into 'drillable science', and prioritizes drillable science based on impact, logistics and cost factors. The SAS is comprised of members of the scientific community who volunteer to serve on review teams and to provide guidance and critical advice about the science and feasibility of proposals that are submitted.

How do I start?

You start by writing a proposal outlining science achievable by scientific ocean drilling (Figure 2). The science conducted by the program via its expeditions is community-driven. The four major themes of the Science Plan for the IODP can be summarized as Climate, Deep Life, Planetary Dynamics, and Geohazards. The New Science Plan (www.iodp.org/Science-Plan-for-2013-2023/) provides some of the context for the discoveries that we can achieve only through scientific ocean drilling, but is not intended as an exhaustive list.

Expeditions and the overwhelming transformative science that has been made possible through ocean drilling start off as proposals submitted by groups of individuals. Proposals typically come into the program as Pre-proposals which one can submit to the program through IODP-Management International (IODP-MI) (www.iodp.org/drilling-proposals/) at any time, and are reviewed by review committees twice per year. These Pre-proposals are relatively short (up to 8 pages), and their focus must be on ideas that can only be tested through ocean drilling. They range from hypothesis-driven to question-driven, from very discipline-specific to very interdisciplinary, from simple to complex. The key here is that they are interesting to the proponents (those submitting the proposal) and should address questions that are of interest to the global scientific community.

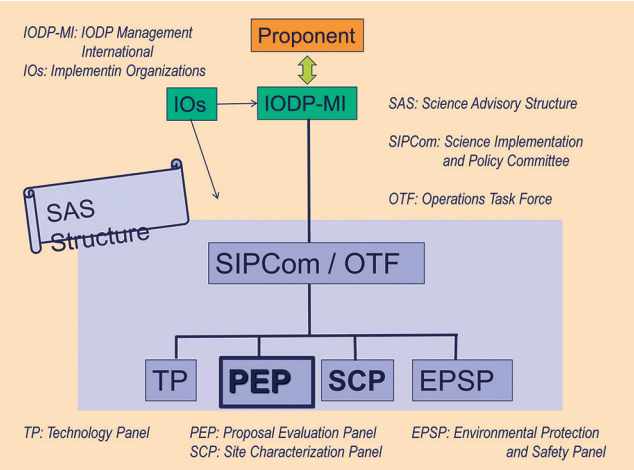

Figure 1.

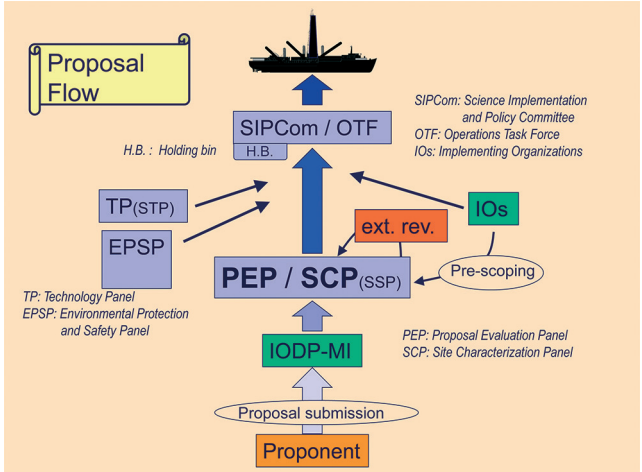

Figure 2.

What is Next?

The review panels within the SAS will receive your Pre-proposal from IODP-MI. Panel chairs will assign watchdogs to examine and present your proposal to the panel, who will review your Pre-proposal and develop recommendations based on their assessment. Soon after the panel meeting, you will receive feedback from the science panel that has reviewed the pre-proposal, with contact information for all of the watchdogs involved in the review, as well as the chairs of the review panel, all of whom you can then contact for additional feedback or clarification. The feedback you will normally receive might range from:

1. Great idea, in line with the science vision of the program, likely achievable by scientific ocean drilling.

2. Interesting concept with potential high impact, but difficult to see how the problem is addressed by scientific ocean drilling.

3. Idea not as interesting or transformative as others received, and thus not likely to move forward as a drilling proposal in its current state.

You will also receive detailed guidance related to the potential scientific impact and ways to increase that impact, the capability of the various drilling platforms to likely achieve your required operational goals, potential limits to the scope of the project considering operational costs or technological availability, encouragement to include a broader range of expertise among the proponent group, encouragement to explore information about the basic site assessment data that is necessary to drill in certain areas in a scientifically sound and environmentally safe manner, etc.

Most importantly, though, you will receive a decision of whether the panel (1) recommends that you develop a full proposal and/or pursue workshop funding to further develop your idea, and potentially coordinate your efforts with other closely-related proposals, into a comprehensive full proposal, (2) encourages you to submit a revised pre-proposal addressing the concerns brought up during review, (3) rejects the pre-proposal.

The recommendation will include the contact information for all of the watchdogs, and you should take advantage of the transparency of the system to contact one or more of the watchdogs to discuss their recommendation and to gain more insight into the next steps for your proposal.

What is a full proposal and what constitutes an excellent one?

A full proposal is an evolution from the Pre-proposal, and includes much more of the operational information necessary to determine feasibility, data availability, and site assessment needs (insert link here to site forms). Think of it as a step from a great idea to one that can be implemented in the real world, within a reasonable length of time and for a reasonable amount of money.

If the recommendation is to develop a full proposal, either independently or in association with a workshop, it is very important to think carefully about the recommendations from the review panel. These recommendations are the basis of much hard work from individual panel members and the collective consideration of the broad range of expertise present on the panels.

Excellent Full proposals range from complicated and extremely interdisciplinary programs to simple and discipline-specific ones, but they do share a number of elements common to all good science proposals:

- They are responsive to input from science panels.
- They have a strong and compelling science question that can only be addressed by drilling.
- They are creative, innovative, and have a high potential for success.

How do workshop proposals and workshops fit into the proposal structure?

As noted above, workshops can be valuable activities for developing community-based scientific plans and prioritizations, and are being expanded in the new structure. Proposals for workshops are of three types: (1) Unsolicited Workshop proposals for thematic workshops that have a potential for developing new scientific approaches, (2) Unsolicited or solicited proposals that will address scientific opportunities in a particular region, with or without a specific scientific theme in mind, with the purpose being to more efficiently use the research platforms in the program, and (3) Proposals specifically solicited by the science panel to develop full drilling proposals, based on one or more favorably-considered pre-proposals reviewed by the science panel. Thus, workshop proposals span a broad range of purposes and contexts, but share the common feature that they are designed to bring ideas quickly to proposals which can be implemented successfully.

What proposals don't move forward?

A number of characteristics cause proposals not to move forward in the system. Although issues with proposals tend to be individual, the reasons that a proposal might not advance in this system are similar to why science proposals in general don't ultimately get funded:

- Science to be addressed that is incremental–i.e., makes only a small step forward.
- Science to be addressed that is one-sided–i.e., doesn't account for alternative hypotheses.
- Proponents who are unresponsive to review comments–i.e., either don't address them when revising a proposal or argue with nearly all of the points of the review.
- Proposals that display little effort on the part of the proponents to make science drillable.
- Proposals that read like a shot-gun approach to a problem (i.e. lets drill everywhere to see what we find), rather than those that critically select drilling targets to answer well defined questions.
- Proposals that do not clearly state how the proposed measurements will be used to answer the proposed questions. A successful proposal will have a clear outline of all proposed sampling, shipboard or shore measurements and/or logging data that are needed and planned.
- Science that is simply undrillable.
- Proposals with scientific objectives inconsistent with the overall goals of the program.

Are there other proposal types for special circumstances?

There are several other proposal types that can result in IODP operations. The most common is when a researcher or research group requests additional data/samples from an already scheduled expedition. In some cases, valuable science can be obtained with a minimum additional time, which can be allocated from an already scheduled expedition. The mechanism to request additional coring or logging is through an Ancillary Planning Letter (APL). These short requests are received by IODP-MI with the same deadlines as all other proposals, and are reviewed by the science advisory structure. The APLs are also reviewed by the science advisory structure, and if approved, are available for implementation in association with a planned expedition.

The other proposal type is a Complementary Project Proposal (CPP). These are full proposals that have a substantial amount of financial support already secured from an entity outside of IODP. These proposals are reviewed by the science advisory structure. Because of the specialised nature of these programs, it is highly advisable to discuss potential plans for developing a CPP with staff at IODP-MI before a proposal is written.

Frequently Asked Questions

The review comments say that I need to bring in other expertise for my Pre-proposal. Why?

When a platform implements an expedition, it is not a single-focus effort–some locations lend themselves to different or interdisciplinary science efforts, and may address related but somewhat independent questions. If you can do more, and do it well, with additional proposal components, it enhances the impact of the project.

Why does it take so long to get a proposal drilled?

Expeditions are complicated and very expensive efforts. Thus, they are carefully planned and often require some additional technological development and site assessment before being scheduled. Additionally, drilling platforms cannot be airlifted. The reality that ships need to slog through the ocean to get from place to place means that operationally, the program is tied to shiptracks. Thus, the expedition schedule is typically defined by ocean region. In order to minimize transits the platforms tend to work in one ocean basin, or one part of an ocean basin, for some time before moving on. Finally, in this current phase of the program, there is not adequate funding for full year operations, and thus the platforms have periods of non-operation limiting the speed at which great proposals can be implemented.

Is IODP an Insider's Club?

No–many programs are driven by 'outsiders', and there are many examples of expeditions proposed by scientists that were totally new to the program. In fact, the IODP actively reaches out to other science programs, like the International Continental Drilling Program, to develop and ultimately conduct large–scale and collaborative projects. Their success can always be traced to a responsive attitude to advice from science panels. Experience with program and process certainly makes things easier, but the "support" system of science panels, national offices, and implementing organizations is a tremendous asset to the overall program, and one we recommend you take full advantage of.

I am not sure if my idea is do-able. Can I ask somebody?

Yes, you can and you should. Your first contact would be the Science managers at the IODP office (science@iodp.org), who will then direct you to the proper individuals for discussion.

I have questions about the review comments on my proposal…am I allowed to talk to someone?

Yes, you are allowed and in fact encouraged to do so. Watchdog names and contact information are on review comments that you will receive after your proposal is evaluated.

I am an early-stage Investigator (Lecturer, Research Fellow, etc.). Should I write a proposal?

Yes, because writing an IODP proposal can help you establish a national/international reputation and broaden your sphere of colleagues. You must be prepared, though, for a long term effort.

Are there ways I can get involved in the program besides writing a drilling proposal?

Yes–by applying to sail on scheduled expeditions:
www.iodp.org/expeditions
and volunteering to serve in the SAS:
www.essac.ecord.org/index.php?mod=participation&page=apply-SAS

UKIODP News

Sasha Leigh (UKIODP Programme Manager, NERC) and Mike Webb (UKIODP Executive Officer, NERC)

It has been a busy year within UKIODP. We have run a successful strategic grant round, the final large round of the current phase of UKIODP, inviting small and standard grant applications from the following topics:

1. Oceanic records of palaeoclimate as constraints on climate modelling.

2. Dynamics of the Earth's interior and its manifestation at the Earth's surface: processes and hazards at oceanic plate boundaries.

3. Microbiology/biogeochemical impacts and feedbacks and interactions of marine biosystems to a changing environment (to include deep-biosphere).

4. The Impact of Ocean Crust Generation and Alteration on the Oceans.

5. Technology Development: Proof of Concept studies for sampling, downhole sampling, downhole instrumentation and new measurements on cores.

6. The marine record of global biogeochemical cycles.

7. High resolution oceanic records of rapid environmental change.

Twelve grants were awarded covering many of the above topics: research includes refining our knowledge of the onset and intensification of northern hemisphere glaciations; establishing further links between climate and the carbon (and other geochemical) cycles; investigating further relationships between oceanography and climate in a wide range of geographic settings (e.g. Antarctic waters, Pacific and Atlantic Oceans); research into fluid flow and crustal interactions at mid-ocean ridges; subduction-zone seismogenic behaviour; enhancing global palaeochronologies via north Atlantic tephra records. We look forward to some extremely exciting results to come from these projects.

As this Newsletter is being written, we are in the process of running a grant round for Site Survey Investigations. This round invited applications for Site Surveys to support IODP Proposals with UK involvement that have already been submitted to the International programme. Both applications for Site Surveys needing ship-time and 'virtual' site surveys (i.e. those exploiting, processing and refining existing seismic data) were invited. The awards will be made by September 2011.

Much has been going on in the international arena with respect to the strategy and structure of a future programme in scientific ocean drilling. This includes publication of the IODP New Science Plan (NSP), produced by a group of high-level experts in the international community. We were pleased that Prof. Mike Bickle, Cambridge University and Chair of the UKIODP Advisory Group, was selected as the Chair for the NSP writing group.

Within the UK, we have also been working on plans for the future, following the end of the second phase of UKIODP in 2013. An independent Review Group met in December 2010 to consider various evidence on past and future benefits arising from the UK's involvement of ocean drilling and it delivered a review report and recommendations to NERC in February 2011. This report will now inform NERC's decision on the level of future UK participation in IODP from 2013 and the development of a proposed new UKIODP research programme, which the Earth Systems Science (ESS) Theme Leader, Prof. Tim Jickells, will is planning to propose as a new action in the 4th ESS Theme Action Plan that will be considered for funding by NERC in 2012. The Review Group was impressed by the detailed evidence base that had been gathered for the review and this included key evidence that was provided directly by the community (in response to the 'Call for Evidence' issued by NERC last year) and by members of the UKIODP Programme Advisory Group, and we would like to take this opportunity to thank everyone for their time in providing this evidence in support of the review.

The international negotiations on the new post-2013 programme are now at an advanced stage and it is hoped that the outcome of these negotiations will be finalised and communicated in the not too distant future. Important decisions on the new Science Advisory Structure are now being made and from a UK and European perspective it is excellent news that the important roles of SIPcom Chair and PEP Chair will now be held by European Prof. Jan De Leeuv. (the Netherlands) and Prof. Dick Kroon (UK).

We look forward to an exciting year of IODP-related research and planning for the new programme to fully support and involve the exceptional research community we have here in the UK.

UKIODP Awarded Grants

2011 Site Survey Investigation Grant Round

Proposals are currently being reviewed, announcement early autumn 2011. Proposals fall into 2 categories:

1. Outline Bids for Ship-Borne Site Survey Investigations (full bids to be invited following Outline Bid evaluation).

2. Full proposals for 'Virtual' Site Surveys (land-based site survey investigations using already collected seismic data with no ship-time).

* Applications must be associated with an IODP drilling proposal which has already been submitted to IODP and which has high-level UK involvement, particularly those with a UK Lead Proponent.

2010 Standard and Small Grants Round

In late summer 2010, awards were announced for the UKIODP Standard and Small Grants round. 26 Proposals were submitted, 12 (6 Standard and 6 Small) or which were funded with a total RC contribution of ~£2.2 mil. Encouragingly, there was generally a very high standard of proposed research, with unfortunately meant that several good proposals went unfunded.

Rapid Response Grants

Recently awarded grants

1. Michelle Harris, NOCS, Exp 327: Determining the evolution of ridge-flank hydrothermal fluids from the Juan de Fuca Ridge Flank.

2. Jennifer Rutter, NOCS, Exp 327: Bulk rock alteration of basalts from the Juan de Fuca Ridge Flank.

3. Lyndsay Fox, Leeds, Exp 320/321: Climate variability during the mid-Miocene climate optimum.

4. Bridget Wade, Leeds, Exp 320/321: Planktonic foraminiferal biostratigraphic calibration to the astro- and magneto-chronology at Site U1334.

5. Godfrey Fitton, Edinburgh, Exp 330: Testing the mantle plume hypothesis through IODP drilling on the Louisville Seamounts.

6. Chistopher Smith-Duque, NOCS, Exp 329: Low temperature alteration at IODP Exp. 329 Site U1368. Constraining the fluid evolution during and timing of hydrothermal alteration using Calcium Carbonate veins from young ocean crust in the South Pacific Gyre.

PI	Grant	Institute	Title
Sexton	Small	Cardiff University	Role of Ocean Biogeochemical Reorganisation in the Intensification of Northern Hemisphere Glaciation
Wilson	Standard	University of Southampton	Coupled change in global climate and the carbon cycle across the Eocene-Oligocene transition: New insight from the Pacific Ocean, IODP Exp 320
Sparks	Standard	University of Bristol	Development and analysis of a database of volcanic ash layers from ocean drilling cores as a record of global explosive volcanism
Teagle	Standard	University of Southampton	Ocean Basement Calcium Carbonate Veins as Recorders of Past Ocean Chemistry and the Global Carbon Cycle
Swann	Small	BGS	Bering Sea diatom isotope records during the onset of Northern Hemisphere Glaciation
Ridgwell	Small	University of Bristol	Orbital Modulation of Eocene Carbon Cycle and Climate (OMECCC)
Lear	Standard	Cardiff University	Testing ice sheet models and modelled estimates of Earth's climate sensitivity using Miocene palaeoclimate data
McNeill	Standard	University of Southampton	Core to regional scale synthesis of fault zone properties and fluids at subduction zones: Drivers of seismogenic behaviour
Bendle	Standard	University of Glasgow	Greenhouse (BIGWIG)
Barker	Small	Cardiff University	A direct link between ocean circulation and abrupt climate change?
Van De Flierdt	Small	Imperial College London	Antarctic Deep Water Circulation and Continental Weathering from the Eocene Greenhouse to the Oligocene Icehouse (IODP Expedition 318, Wilkes Land)
Hodell	Small	University of Cambridge	Testing the stratigraphic and paleoenvironmental resolution of sediment drifts off West Antarctica for IODP drilling

2012 UKIODP Student Conference

A two day, UKIODP funded student conference is being planned and will likely occur in May 2012. The original motivation for holding the conference was in response to student demand and funding is now available. We hope to engage a moderatly large group of students who are interested in IODP related science, who may not yet have been directly involved in the programme. The specific agenda aside, the primary goal is to get a group of students together in one room so they may interact with their peers, exchange ideas, and take advice from more senior and IODP-experienced scientists on the scientific and practical elements of the programme.

The conference will include:

1. Presentations by IODP-experienced UK scientists on the scientific questions to be addressed in the new programme.
2. Advice on how to interact within the programme e.g. proposal writing, access to samples,
3. Open poster sessions and discussion, and
4. Workshop excercises.

Key Points:

- We will likely invite ~40 post-graduate students for a 1.5–2 day meeting.
- All attendees will prepare posters for open discussion.
- The application process will be competitive and application materials are expected to include:
    1. Brief Letter of Intent,
    2. CV,
    3. Letter of support from Supervisor.

*Final details of the conference will be announced in autumn, 2011 through the regular 'UKIODP Announcements' email.

UKIODP Grant Guidance

Available Awards

Strategic grants

To support UK membership in the international Integrated Ocean Drilling Program (IODP), NERC runs a UK research programme to enable UK scientists to:

1. Participate in and obtain material from drilling expeditions,
2. Ensure that IODP carries out the best and highest priority science, and
3. Capitalise on the results of IODP drilling and UK technologies, allowing them to benefit from technological advances in deep sea drilling.

The current phase of NERC's UKIODP science support started in September 2008 and runs until 2013. Part of the funding for the programme is directed toward supporting research grants with the objective of taking forward IODP-related research in the UK.

*There will be no more strategic grant rounds prior to end of current programme, 2013.

Rapid response grants

IODP rapid response awards support a limited number of small-scale, short research activities specifically related to IODP Leg objectives. They are typically awarded to help with sample processing costs or small equipment purchases. Please note that applications for Rapid Response Grants will now need to be costed under FEC requirements. The maximum amount, to include all FEC costings is now £2,750 for Rapid Response Grants (*Meaning that UKIODP will pay max of £2200, the other £500 to be recovered from the University).

Proposals (no more than two pages long) should clearly state the aims, deliverables and the case for support. Where relevant, the proposal should be supported by a statement from an IODP Leg co-chief or chief scientist. For students, this may be replaced by, or combined with, a statement from an appropriate member of the departmental academic staff.

Rapid Response proposals will be reviewed by members of the UK IODP Committee and awards will be limited by the funds available for this scheme. Although there is no closing date, applications should be submitted by e-mail to the science coordinator (ukiodp@bgs.ac.uk) as early as possible.

Expedition and post-cruise funding

From 1 April 2010, any PhD students or Post-Doctorates sailing on IODP expeditions and receiving FEC for their participation will be required to submit a post-cruise grant application not longer than 2 months following their return from the expedition.

An outline of this potential work must be included in the FEC application (see below) although UKIODP appreciate this is just an indication and not a commitment to the work plan.

Participation in an IODP expedition does not guarantee post-cruise funding.

Full economic costing guidance for expedition participants

Under full economic costing, all IODP expedition participants from the UK are eligible to apply to NERC for funding to cover their time on board ship. As with research grants, awards will be made at 80% FEC.

The different categories of expedition participant and eligible costs are listed below:

Co-chief

- Directly Incurred costs:
  - Staff Time (for offshore and onshore co-chief activities).
  - Travel and Subsistence (for expedition, sampling parties and post-cruise meetings).
- Directly Allocated costs:
  - Estates Costs (only for time spent onshore).
- Indirect costs:
  - Only for time spent onshore.

Expedition participant (sailing)

- Directly Incurred costs:
  - Staff Time (for offshore only).
  - Travel and Subsistence (for expedition, sampling parties and post-cruise meetings).
- Directly Allocated costs:
  - Estates Costs–not eligible.
- Indirect costs–not eligible.

Expedition participant student (sailing)

- No costs eligible.
- Expedition, sampling party and post-cruise meeting Travel and Subsistence costs should be claimed via the UKIODP Science Coordinator. ukiodp@bgs.ac.uk

Applications for FEC must be submitted via the Research Councils' Joint electronic-Submission system (Je-S) at least 1 month ahead of the expedition start date. The 'scheme' should be completed as 'Directed FEC' and the 'call' as 'IODP'.

See the Je-S website for information on the Je-S process. Further information, including details on Full Economic Costing, is also available in the NERC Research Grants Handbook for Full Economic Cost Grants. Potential applicants are reminded that they and their institution must be registered with Je-S, in order to submit applications.

Standard NERC rules for institutional and investigator eligibility apply to all components of the call. For example, submissions must be made via UK universities or NERC-recognised bodies.

Application submission requirements

Expedition participants claiming FEC must submit their proposal in a Small Grant format through the Je-S system. Previous Track Record must not exceed two sides of A4 and the Description of the Proposed Research must not exceed two sides of A4 (including all necessary tables, references and figures). The Justification of Resources should be completed as a separate item. Up to an additional two sides of A4 may be used for this purpose. A CV of the expedition participant is required, (up to two sides A4 for each CV).

Applications we would expect to see submitted to NERC via the Je-S system would contain the following documents:

- Application Form.
- Attachments including:
- Case for Support incorporating the Previous Track Record (up to two sides A4) and Description of Proposed Research (up to two sides A4).*
- NB: This is one attachment in the Je-S system.
- Justification of Resources (up to two sides A4).
- CVs for Principal Investigator named in the proposal (up to two sides A4).
- Impact Plan (up to two sides A4).

* If participating as Co-chief the case for support should include more detail and we therefore require up to four sides A4.

Applicants can use their original application to sail as a basis for this submission although specific information is required on their own contribution to the cruise. Impact plans are required and should include the wider significance of the work completed on the expedition.

Guidance for submission of final reports for FEC applications

Je-S will prompt a final report to be submitted following the end date of the FEC award. This final report should be submitted in the requested format, using 'Not Applicable' in sections where necessary. The Summary section should be completed in up to 4,000 characters, including information on cruise reports, core recovery data, any preliminary microbiology/core chronology and any information that was taken onboard (eg logging, geophysical, etc data). Some information on the PI's plans for follow-up work should also be included. Links to relevant cruise reports, cruise diary updates, etc should also be included.

Advice on application and administrative arrangements is available from the Programme Administrator: afox@nerc.ac.uk or the Programme Manager: snbl@nerc.ac.uk.

Any queries regarding the Je-S system and submission of applications should be directed to the dedicated Je-S Helpdesk.

Post-cruise support for post-doctoral and post-graduate research assistants

The new guidance below will be applied to grants submitted on or after 1 June 2011.

This scheme provides additional support for Post-Doctoral Research Assistants (PDRAs) and Post-Graduate Research Assistants (PGRAs) who sail with the Integrated Ocean Drilling Program (IODP) on behalf of the UK. The scheme aims to ensure that more PDRAs and PGRAs can complete up to 6 months post-cruise research. The application procedure is separate from the main UKIODP strategic grant rounds and has specific conditions.

Specific conditions for post-cruise support applications

- As with applications to any other NERC grant scheme, applications must be led by a Principal Investigator from an eligible UK institution. The PDRA or PGRA should be named as the Recognised Researcher for the application. All eligibility criteria are the same as for all other NERC directed programme grant applications.
- Applications must be on behalf of a PDRA or PGRA who has been accepted as (not simply applied to become) a UK shipboard participant on a forthcoming IODP expedition.
- The application must cover a discrete body of work based only on material collected during an IODP cruise. It must not be a continuation of any other unrelated project funded by NERC or other organisations.
- Candidates should notify the UK IODP Science Co-ordinator, Dayton Dove and the NERC UK IODP Programme Administrator, Amy Vitale, that they intend to submit a post-cruise application before sailing. Applicants will need to give a brief description of the post-cruise work that they intend to perform, and submit their proposal in Small Grant format via the Research Councils' Joint electronic-Submission system (Je-S). See the 'Full Economic Costing guidance for expedition participant' page for more details.
- On return to port, the candidate should notify the NERC UK IODP Programme Administrator, Amy Vitale, that the necessary samples have been obtained, otherwise funding will not be made available.
- You must apply not longer than two months following the return from the expedition (if you think you have exceptional circumstances, please contact UK IODP Science Co-ordinator: ukiodp@bgs.ac.uk.
- Both PDRA and PGRA applications will be peer reviewed and the final decision will be made by members of the UK IODP Committee. Awards will be limited by the funds available for this scheme.
- At least one first-authored peer-reviewed publication should result from the work.
- All other conditions and eligibility requirements are the same as for other NERC funding and can be found on the forms and handbooks section of this website.

Special criteria for PDRA applications

- Applications for Post Cruise Grants will now need to be costed under FEC requirements. The maximum amounts (at 100%), to include all Directly Incurred and Directly Allocated costs is now £25k to cover up to six months of post-cruise research (maximum funding limits will be adjusted for periods under six months on a pro rata basis). Extra time will be allowed only if another funding source is procured.
- To be eligible for this funding, a PDRA must hold a recognised PhD. Doctoral students can apply if they are close to submitting their thesis, or have submitted at the time of sailing, but funds will not be released until the student has successfully defended their thesis.

Special criteria for PGRA applications

- Applications for Post Cruise Grants will now need to be costed under FEC requirements. The maximum amounts (at 100%), to include all Directly Incurred and Directly Allocated costs is now £21k to cover up to six months of post-cruise research (maximum funding limits will be adjusted for periods under six months on a pro rata basis). Extra time will be allowed only if another funding source is procured. This applies to applicants taking a PhD break.
- To be eligible for this funding, a PGRA must be at least 18 months into their PhD before taking up the award.

Full financial guidance is available from the NERC website: www.nerc.ac.uk/research/programmes/ukiodp/grants/postcruise.asp

Please direct initial queries to programme administrator: afox@nerc.ac.uk or the Science Coordinator: ukiodp@bgs.ac.uk.

Arctic Scientific Drilling Initiative

Following the publication of the UKIODP prepared brochure (www.ecord.org/pub/Arctic-brochure.pdf) which encourages Academic and Industry collaboration on Scientific Drilling in the Artic, ECORD are hosting an exhibition space at the upcoming AAPG organized 3P Arctic Conference (www.3parctic.com/). On behalf of ECORD, Matt O'Reagan (Cardiff University) and other internationally-based Arctic scientists will join ESO managers and a group of previously engaged Industry representatives to push the case for improved collaboration between Academia and Industry.

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IODP Panel Members from the UK

*The Science Advisory Structure (SAS) for the new post-2013 programme will be active prior to 2013, and the UK has already made nominations for specific posts. Some of the below members will remain active in the equivalent panel, but in some cases there will have new members. Unfortuntately, at the time of writing the new panel members have not been verified by IODP-MI, so we can not yet publish names.

Science Advisory Structure Executive Committee (SASEC)
Damon Teagle, National Oceanography Centre, Southampton

Science Planning Committee (SPC)
Heiko Pälike, National Oceanography Centre, Southampton

Science Steering and Evaluation Panel liaison (SSEP)
David Hoddell, University of Cambridge
John Maclennan, University of Cambridge

Scientific Technology Panel liaison (STP)
Marc Reichow, Department of Geology, University of Leicester

Engineering Development Panel liaison (EDP)
John Thorogood, Drilling Global Consultant

Site Survey Panel liaison (SSP)
Peter Clift, University of Aberdeen

Environmental Protection and Safety Panel liaison (EPSP)
Bramley Murton, National Oceanography Centre, Southampton

ECORD Science Operator Science Manager
Dave McInroy, British Geological Survey

ECORD Industrial Liaison Panel Chairman
Richard Hardman, Consultant

Useful Websites

Integrated Ocean Drilling Programme (UK)
www.ukiodp.bgs.ac.uk

www.nerc.ac.uk/research/programmes/ukiodp/

ECORD Sites
European Consortium for Ocean Research Drilling (ECORD)
www.ecord.org

ECORD Science Support Advisory Committee
www.essac.ecord.org

IODP Central Sites
IODP Management International Inc.
www.iodp.org

Initial Science Plan for IODP
www.iodp.org/isp

JAMSTEC
www.jamstec.go.jp/chikyu/eng/index.html

IODP Science Advisory Structure
www.iodp.org/sas

IODP Implementing Organisations
Centre for Deep Earth Exploration (CDEX)
www.jamstec.go.jp/chikyu/eng/index.html

ECORD Science Operator
www.eso.ecord.org

JOI-Alliance US Implementing Organisation
www.iodp-usio.org

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JOI-Alliance US Implementing Organisation
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IODP National Offices
Finland
http://iodpfinland.oulu.fi/

France
www.iodp-france.org/

Germany
www.iodp.de/

Italy
www2.ogs.trieste.it/iodp/

Netherlands
www.iodp.nl/

Portugal
http://e-geo.ineti.pt/ecord/

Spain
http://carpe.usal.es/~iodp/

Switzerland
www.swissiodp.ethz.ch

IODP China
www.iodp-china.org/chs/

IODP Korea
www.kodp.re.kr

ODP Australia
www.odp.usyd.edu.au

IODP Related Sites
European Science Foundation (ESF)
www.esf.org

Japan Drilling Earth Consortium (J-DESC)
www.j-desc.org/

International Continental Scientific Drilling Program (ICDP
www.icdp-online.org/contenido/icdp/front_content.php

Lamont Doherty Earth Observatory
www.ldeo.columbia.edu

MEXT Ministry of Education, Culture, Sports, Science and Technology
www.mext.go.jp/english/

National Science Foundation
www.nsf.gov

Natural Environment Research Council
www.nerc.ac.uk

USSSP U.S. Science Support Program
www.usssp-iodp.org

ODP Legacy Sites
Joint Oceanographic Institutions for Deep Earth Sampling
www.ifm-geomar.de

Consortium for Ocean Leadershio
www.oceanleadership.org/

ODP Wireline Logging Services
www.ldeo.columbia.edu/BRG/ODP/

Science Operator Texas A&M University (TAMU)
www-odp.tamu.edu/index.html

Mid-Ocean Ridge Links
InterRidge Office
www.interridge.org

NOAA Vents Programme
www.pmel.noaa.gov/vents

DeRIDGE
www.deridge.de

Margins Links
HERMES (hotspot ecosystem research on the margins of European seas)
www.eu-hermes.net/

US Margins Programme
www.nsf-margins.org/

NERC Marine Programmes

Joint Climate Research Programme
www.nerc.ac.uk/research/programmes/jointclimate/

Oceans 2025
www.nerc.ac.uk/research/programmes/oceans2025/

RAPID
www.nerc.ac.uk/research/programmes/rapid/

Technology Proof of Concept
www.nerc.ac.uk/research/programmes/technologypoc/

Completed NERC Marine Programmes

Autosub Under Ice (AUI) Programme
www.nerc.ac.uk/research/programmes/autosubunderice/

COAPEC (Coupled Ocean-Atmosphere Processes and European Climate
www.nerc.ac.uk/research/programmes/coapec/

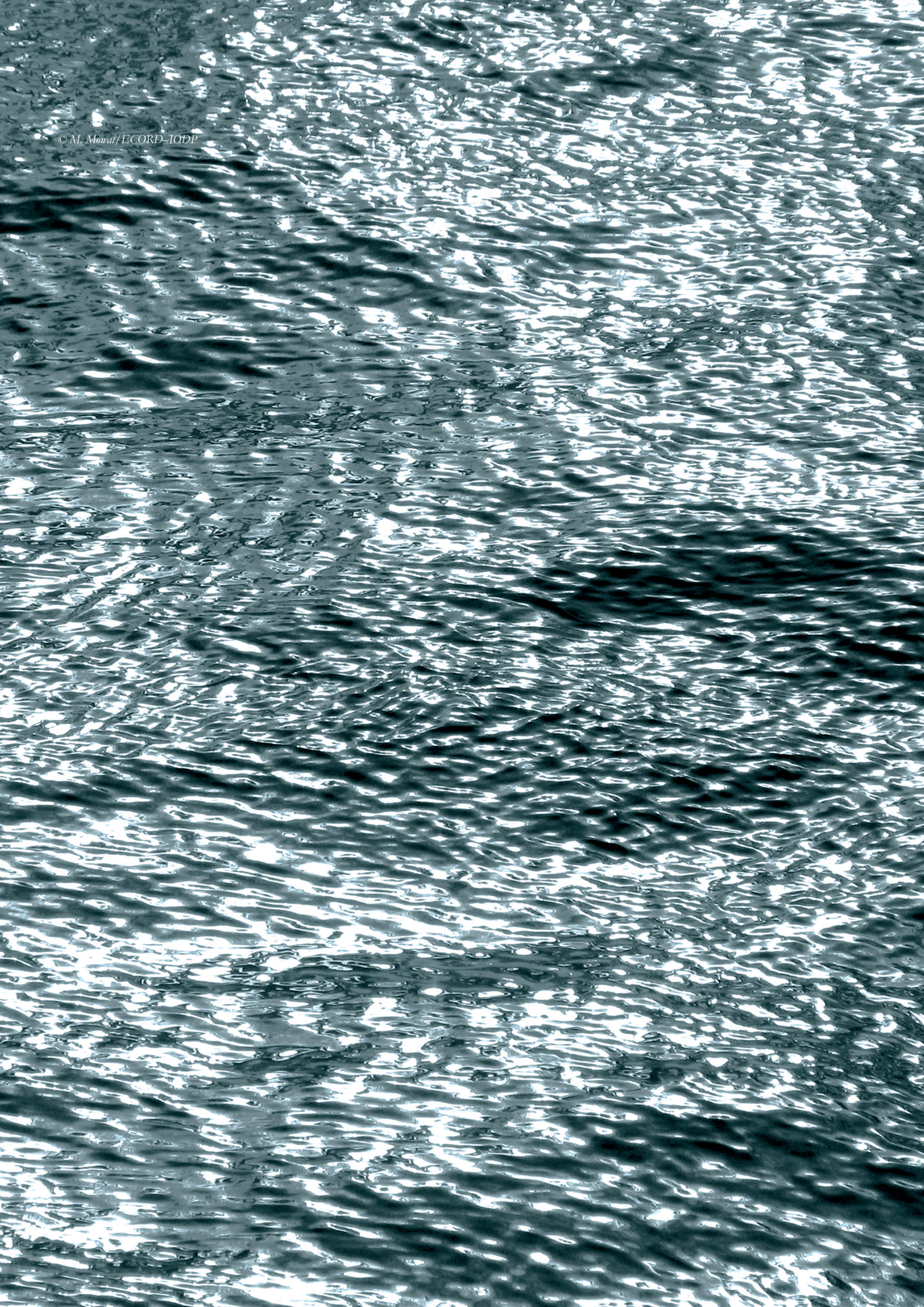
Ocean Margins LINK Programme
www.nerc.ac.uk/research/programmes/oceanmargins/

Surface-Ocean/Lower-Atmosphere Study (SOLAS)
www.nerc.ac.uk/research/programmes/solas/

Acronym List

www.iodp.org/acronyms/

ACEX	Arctic Coring Expedition
BCR	Bremen Core Repository
BoG	Board of Governors
CDEX	Center for Deep Earth Exploration
CDP	Complex Drilling Projects
DSDP	Deep Sea Drilling Project
ECORD	European Consortium for Ocean Drilling Research
EDP	Engineering Development Panel
EMA	ECORD Management Agency
EPC	European Petrophysical Consortium
EPSP	Environmental Protection and Safety Panel
ESO	ECORD Science Operator
ESSAC	ECORD Science Support and Advisory Committee
ETF	Engineering Task Force
GCR	Gulf Coast Repository
ICDP	International Continental Scientific Drilling Program
IIS-PPG	Industry-IODP Science Program Planning Group
ILP	Industry Liaison Panel
IO(s)	Implementing Organization(s)
IODP	Integrated Ocean Drilling Program
IODP-MI	Integrated Ocean Drilling Program Management International
ISP	Initial Science Plan
J-DESC	Japan Drilling Earth Science Consortium
JOI	Joint Oceanographic Institutions, Inc.
KCC	Kochi Core Center Repository
LUBR	Leicester University Borehole Group
MEXT	Ministry of Education, Culture, Sports, Science, and Technology (Japan)
MOST	Ministry of Science and Technology (People's Rep. of China)
MSP	Mission Specific Platform
NanTroSEIZE	Nankai Trough Seismogenic Zone Experiment
NERC	Natural Environment Research Council (UK)
NSF	National Science Foundation (USA)
ODP	Ocean Drilling Program
OTF	Operations Task Force
PEP	Proposal Evaluation Panel
PI	Primary Investigator
POC	Platform Operations Costs
SAS	Science Advisory Structure
SASEC	Science Advisory Executive Committee
SIPCom	Science Implementation and Planning Committee
SOC	Science Operating Costs
SPC	Science Planning Committee
SSEP	Science Steering and Evaluation Panel
SSP	Site Survey Panel
STP	Scientific Technology Panel
TAP	Technology Advice Panel
TP	Technology Panel
USAC	United States Advisory Committee for Scientific Ocean Drilling
USIO	United States Implementing Organization
USSAC	United States Science Advisory Committee
USSSP	United States Science Support Program



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August 2011

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