IODP
INTERNATIONAL OCEAN DISCOVERY PROGRAM

UK newsletter 39

2014

NERC SCIENCE OF THE ENVIRONMENT

ECORD European Consortium for Ocean Research Drilling

Recent UK based IODP expedition participants

Expedition 353 Kate Littler (University of Exeter) and Pallavi Anand (Open University)

Expedition 352 Julian A Pearce (CO Chief) Julie Prytulak, Alastair H F Robertson

Expedition 351 Sev Kender, Antony Morris, Ivan Savov, Cees van der Land

Expedition 350 Eleanor H John, Martin Jutzeler, Susan H Mahony, Maryline J Vautravers, Lesley E Allen (Outreach)

Expedition 348 Ana Maia

Expedition 347 Barry Cragg

Expedition 346 Andrew C G Henderson, Chuang Xuan, Martin Ziegler

Contents

Front cover: JOIDES Resolution, Expedition 352. (Credit: Tim Fulton, IODP/TAMU).
Back cover: Samples selected for postcruise research await the approval of the Co-chief Scientists, Curator, and Expedition Project Manager before they are collected from the core. (Credit: Amy West & IODP).

Editor: Sean Burke, British Geological Survey, Environmental Science Centre, Keyworth, NG12 5GG
Graphic design: Debbie Rayner

Foreword

Sean Burke (UKIODP Science Program Coordinator)), Vicki Norton (Program Manager-NERC), Mike Webb (Program Executive Officer, NERC), and the UK-IODP Program Advisory Group (see p.30 for membership).

The UK-IODP Program continues to go from strength to strength. After being successfully renewed for 2013–2018 and the launch of new International Ocean Discovery Program, UK-IODP has supported the participation of fourteen UK scientists and co-chiefs on IODP expeditions and provided co-funding to several scientific workshops/conferences including the UK annual IODP Conference both in the UK and internationally. Although relatively few individuals participate directly in offshore operations, this is just the tip of the iceberg of UK-IODP activities as UK scientists make excellent use of legacy core material, are disproportionately represented on new drilling proposals, and are frequently involved as onshore science collaborators.

Within the new program (2013–2018), the UK is set to have significantly more expedition berths than the preceding five years, yielding a fantastic opportunity to further build the UK science community. Within the UK-IODP program, participants will benefit from an improved post-cruise funding model (Moratorium Awards), ensuring they capitalise fully on their offshore experience. UK-IODP will also continue to fund site-survey grants that provide an invaluable mechanism to advance UK proposals within IODP.

Monthly e-newsletters are now distributed to over 600 scientists in the UK who get regular updates on upcoming expeditions, calls and workshops. This newsletter is a great opportunity for you to advertise your grant and publication successes, and alert a large community to future opportunities. So, when you have news, please send a short paragraph to the UK-IODP Co-ordinator Sean Burke. There continue to be IODP publications from UK scientists, illustrating the high level of outputs from the program.

Sally Morgan has been appointed to as the NERC funded UKIODP Directed Knowledge Exchange Fellow and will be based in the Department of Geology at the University of Leicester, where she was recently appointed as a Research Fellow. The aims are to increase the uptake of IODP data, improve the visibility of UKIODP and promote its engagement with industry, while encouraging industry-supported collaborative UKIODP research and identify and promote the potential impact of the IODP investment.

Scientific results from recent expeditions

Expedition 346: Onset and evolution of millennial-scale variability of Asian monsoon and its possible relation to Himalaya and Tibetan Plateau uplift

29 July –27 September 2013

Andrew C G Henderson, Chuang Xuan, Martin Ziegler

Scientific motivation

Understanding the complex ocean-atmosphere-climate processes that drive the Asian monsoon system has a direct bearing on the socio-economic well being of approximately half of the world's population. The evolution of the Asian monsoon system has been intimately linked to major hydrological, ecological and societal change across southern and central Asia. Over geological timescales, the uplift of the Himalayas and the Tibetan Plateau (HTP) is thought to have created conditions necessary for the onset of monsoonal circulation, with periods of extension and further HTP uplift causing intensification of monsoon rains. It is this coupling of climate with tectonics, and its impact on atmospheric circulation e.g. the monsoon, the Westerlies, which comprises perhaps the most significant processes affecting global climatic conditions during the Cenozoic.

Previous drilling investigations in the marginal sea surrounded by the Japanese islands, the Korean Peninsula, and the Eurasian continent[1]—Deep Sea Drilling Project (DSDP) Leg 31 in 1973 and Ocean Drilling Program (ODP) Legs 127/128 in 1989—were focused on reaching the basement to understand the tectonic evolution of the Japan and Yamato Basins. More recently, under the auspices of the International Marine Past Global Change Study (IMAGES) program a series of high-quality CALYPSO piston cores were recovered in the marginal sea using the *RV Marion Dufresne*. The results of this research (Tada et al., 2007) highlight the sensitivity of core sedimentology to glacial-interglacial cycles, as well as abrupt climate events, such as Dansgaard-Oeschger (D-O) events, traditionally identified in the North Atlantic region. Together these previous drilling and coring operations laid the foundations for Integrated Ocean Drilling Program (IODP) Expedition 346.

The aim of Expedition 346 was to recover sediment records suitable for exploring the relationship between atmospheric processes (e.g. the positioning of the atmospheric Westerly Jet circulation), rainfall (e.g. Yangtze River discharge), and oceanic processes (e.g. surface water circulation into and out of the marginal sea, sea ice formation, deep water convection and

[1]IODP Expedition 346 refers to the region of drilling in this way as the official name of the body of water is disputed.

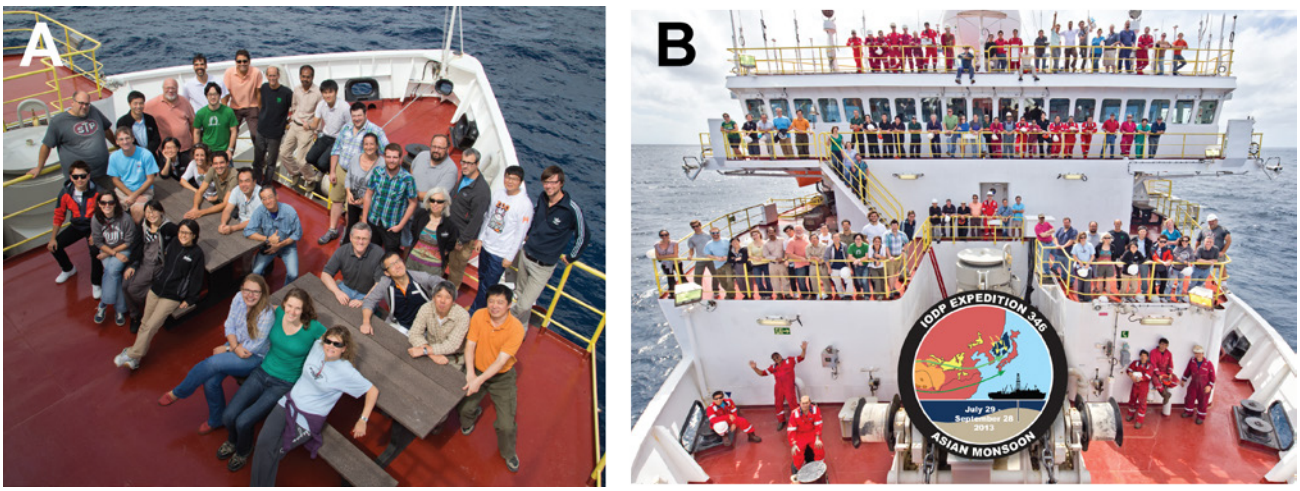
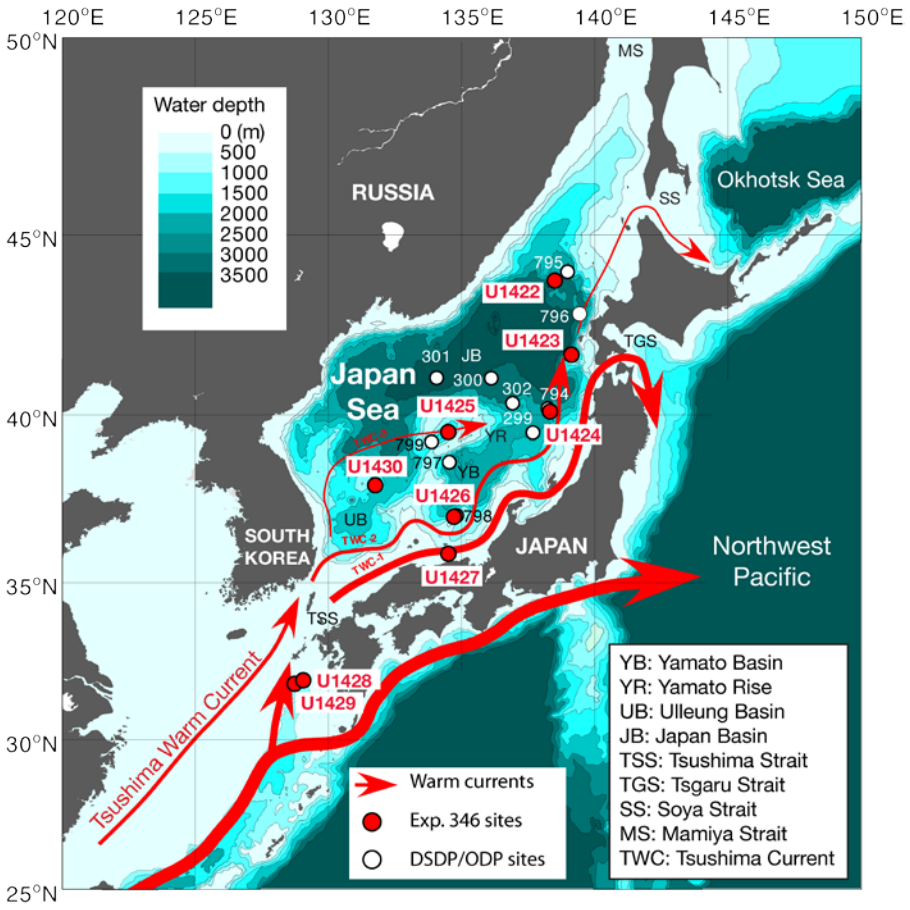


Figure 1.
(A) The Expedition 346 science party; (B) The Expedition 346 group photograph. During an expedition, drilling must continue, the ship must hold position, the engines must run, and people need to sleep. Nevertheless, a near-record 96 out of 125 people on board are represented in this picture. (Credit: William Crawford, IODP/TAMU).

oxygenation, and biological productivity of the surface ocean). The overall research aim was to reconstruct the onset and evolution of orbital- and millennial-scale variations of summer and winter monsoons, Westerly Jet position and intensity, desertification in East and Central Asia, and their interrelationships during at least the last 5 Ma. As a result, our drilling approach reflected a latitudinal transect in the marginal sea to capture all of these processes, as well as a single site in the northern East China Sea, which aimed to monitor the discharge of the Yangtze River (Figure 2).

Figure 2.
Bathymetric map of Expedition 346 sites (red circles) with Sites previously drilled by the Deep Sea Drilling Project (DSDP) and Ocean Drilling Program (ODP) (white circles) also shown. Also illustrated are surface current systems within and surrounding the marginal sea surrounded by the Japanese islands, the Korean Peninsula, and the Eurasian continent.



We began our voyage from Valdez, Alaska (USA), and after a two-week transit, we began our studies in the marginal sea between the Japanese islands, the Korean Peninsula, and the Eurasian continent, and aimed to collect the sediment material necessary to tackle the following specific objectives:

1. Address the timing of onset of orbital- and millennial-scale variability of the East Asian summer monsoon (EASM) and East Asian winter monsoon (EAWM) and their relation with variability of Westerly Jet circulation. Reconstruct orbital- and millennial-scale changes in surface and deep water circulation and surface productivity during at least the last 5 Ma.

2. Reconstruct the history of the Yangtze River discharge using cores from the northern end of the East China Sea, as it reflects variation and evolution in the EASM and exerts an impact on the palaeoceanography of the marginal sea west of Japan.

3. Examine the interrelationship among the EASM, EAWM, nature and intensity of the influx through the Tsushima Strait, intensity of winter cooling, surface productivity, ventilation, and bottom water oxygenation in the marginal sea and their changes during the last 5 Ma.

Shipboard results

The shipboard results have exceeded expectations, with enough high quality sediment archive recovered in only 6 weeks of core recovery during the 2-month expedition to lead to significant developments in our understanding of the ocean-atmosphere system in the marginal seas east of the Eurasian continent. The success of the expedition was, in part, a result of recent and novel advances in drilling technology and newly developed analytical tools, which allowed us to collect and examine sediment records that were impossible to acquire even a few years ago. The newly engineered 'half piston core' system (called the half advanced piston corer [APC]) enabled us to recover the deepest piston core in DSDP/ODP/IODP history (490.4 m in IODP Hole U1427A). That achievement was also the deepest continuously recovered piston cored sequence, initiated at the mudline and penetrating ~500 m solely by piston coring.

Furthermore, these technological advances onboard the *JOIDES Resolution* delivered a series of 'new surprises', in particular pristine

dark–light laminae from ~12 Ma in the marginal sea sediments recovered by piston coring at 410 m CSF-A core depth at IODP Site U1425 and from 210 m CSF-A at IODP Site U1430 (Figure 3). The recovery of this material is stimulating new scientific avenues into Miocene climate dynamics, and such a high fidelity record would not have been possible only a few years ago. We also undertook high-resolution sampling for porewater geochemistry to understand the fate of organic carbon in the marine system. These data are testing the relationship between anaerobic oxidation of methane (AOM), metal chemistry, and organic carbon degradation in shallow marine sediments (Figure 4).

Another important outcome from shipboard activities was the development of finely tuned correlations between drill sites from disparate geographic locations. We have been able to match variations in sedimentology, in particular dark and light layers of hemipelagic sediment at IODP Sites U1422 to U1426 and U1430 (Figures 2 and 5). Shipboard and post expedition efforts demonstrate it is possible to correlate centimeter- to meter-scale dark and light layers suggesting synchroneity and that the entire marginal sea basin responded as a single system to climatic and/or oceanographic perturbations.

The northern East China Sea (IODP Sites U1428/U1429) was targeted to reconstruct the history of Yangtze River discharge, which has been linked to variations in the EASM and in turn, has influenced the palaeoceanographic evolution of the Japan Sea. The target depth was 800 m CSF-A, with an estimated bottom sediment age of middle Miocene. Unfortunately, at Sites U1428 and U1429 we were forced to terminate at significantly shallower depths (~210 and ~185 m CSF-A, respectively) because of the unexpected occurrence of thick and unconsolidated detrital sand. Fortuitously, these two sites actually had higher than anticipated sedimentation rates (~42 and ~50 cm/k.y., respectively) and we were able to successfully recover a continuous sequence of

Figure 4.
High-resolution geochemistry results highlighting processes relating to (A) degradation of organic matter and methane fluxes and (B) linkages between dissolved Fe and Mn chemistry and paleomagnetic signals. IW-sq = interstitial water from squeeze cake, MS = magnetic susceptibility.

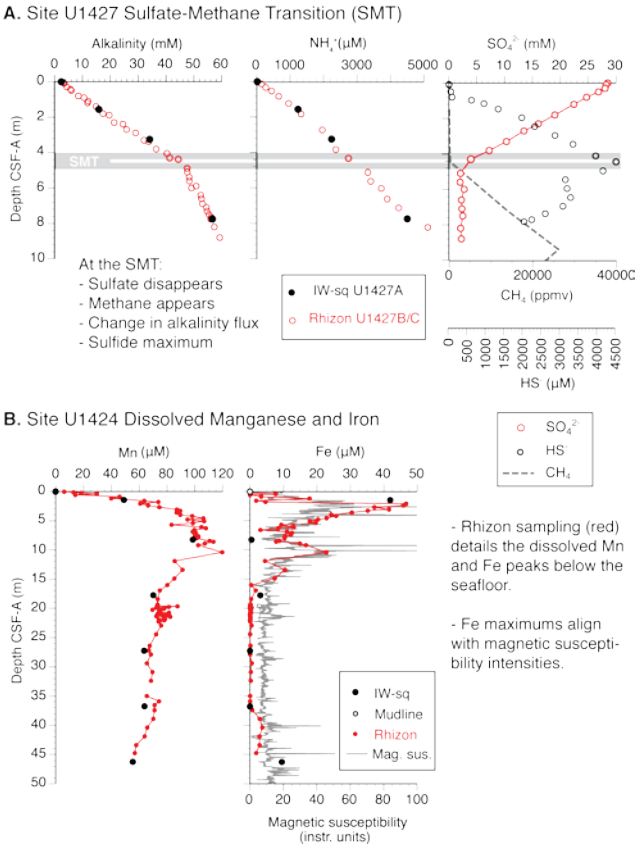
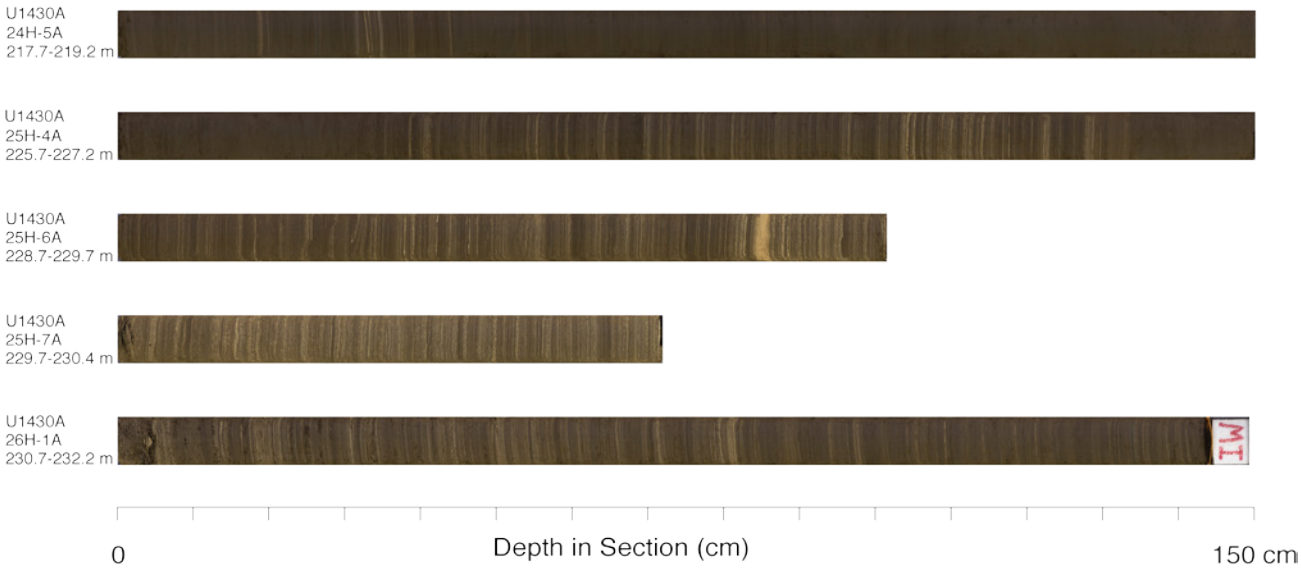


Figure 3.
Typical Miocene laminations of Subunit IIIB, Hole U1430A.



biocalcareous mud that spans the last ~0.35 m.y. With such excellent recovery and high sedimentation rates, we will be able to reconstruct very high-resolution changes in sea-surface salinity and temperature.

Post cruise activities

The post expedition plans now aim to examine the palaeoceanographic response of the marginal sea to variations in Asian monsoon dynamics, changes of glacio-eustatic sea level and westerly jet migration through a multi-proxy approach that will assess changes in surface and deep-water conditions. The UK contingent has plans to undertake research on the following:

- Reconstruct Miocene and Pliocene palaeoceanography of the Japan Basin using diatom isotopes and biogenic silica concentrations;
- Establish a 1 Ma oxygen isotope stratigraphy for the marginal sea that will serve as a basin-wide chronology across Sites U1422-U1426 and U1430;
- Understand the response of the marginal sea to critical climate transitions, such as the mid-Pleistocene transition;
- High-resolution reconstructions of Yangtze river discharge and sea surface temperatures in the East-China Sea over the last 350 000 years, to investigate millennial- to orbital scale variability in the East Asian summer and winter Monsoon during the Late Pleistocene;
- Understanding the nature and origin of finely laminated sections throughout the marginal sea in different time periods (Miocene to Pleistocene);
- Build high-resolution reference magnetostratigraphy for marginal sea sediments using continuous u-channel samples collected from Site U1424 in the Japan Basin;
- Construct age calibrated geomagnetic and environmental changes recorded in late Pleistocene high accumulation sediments from the Yamato Basin (Site U1427) and East China Sea (Sites U1428/U1429).

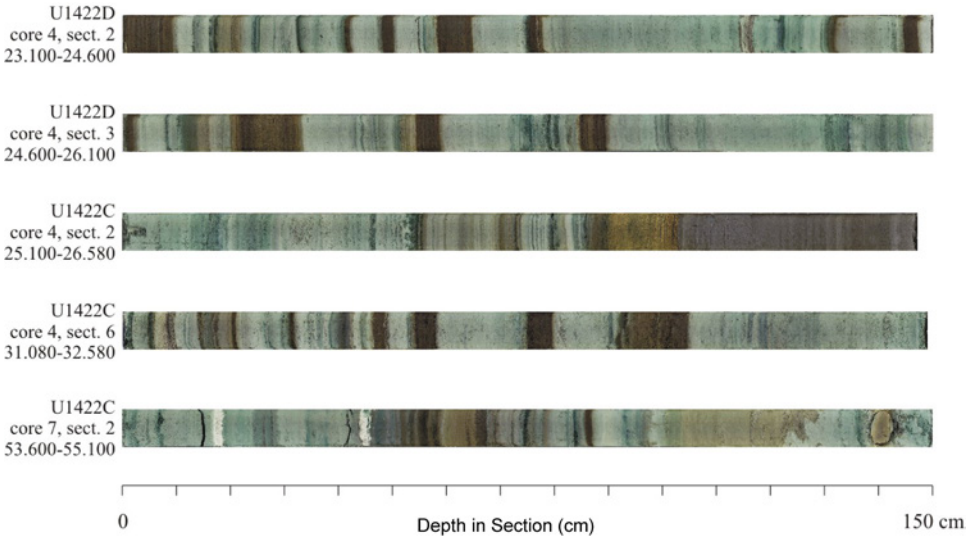


Figure 5.
Representative dark and light layers in Subunit IA, Holes U1422C and U1422D. Note that the contrast in the core images has been enhanced to highlight sedimentary structures.

IODP Expedition 346 shipboard science party (Figure 1)

Ryuji Tada (University of Tokyo); Richard W Murray (Boston University); Carlos A Alvarez Zarikian (USIO, Texas A and M University); Johanna Lofi (University of Montpelier); William T Anderson Jr. (Florida International University); Maria-Angela Bassetti (University of Perpignan); Bobbi J Brace (University of Nebraska); Steven C Clemens (Brown University); Gerald R Dickens (Rice University); Ann G Dunlea (Boston University); Stephen J Gallagher (University of Melbourne); Liviu Giosan (Woods Hole Oceanographic Institution); Marcio H da Costa Gurgel (University of Sao Paulo); Andrew C G Henderson (Newcastle University); Ann E Holbourn (Christian-Albrechts University of Kiel); Ken Ikehera (Geological Survey of Japan); Tomohisa Irino (Hokkaido University); Takuya Itaki (Geological Survey of Japan); Akinori Karasuda (University of Tokyo); Christopher W Kinsley (Massachusetts Institute of Technology); Yoshimi Kubota (National Museum of Nature and Science, Japan); Gwang Soo Lee (Korea Institute of Geoscience and Mineral Resources); Kyung Eun Lee (Korea Maritime University); Cristina I C D Lopes (IPMA); Mariem Saavedra Pellitero (University of Bremen); Larry C Peterson (University of Miami); Takuya Sagawa (Kyushu University); Raj K Singh (Indian Institute of Technology Bhubaneshwar); Saiko Sugisaki (University of Tokyo); Samuel Toucanne (IFREMER); Shiming Wan (Institute of Oceanology, Chinese Academy of Sciences); Chuang Xuan (University of Southampton); Hongbo Zheng (Nanjing Normal University); Martin Ziegler (Cardiff University; Utrecht University).

Expedition 347: Baltic Sea paleoenvironment

12 September–1 November 2013

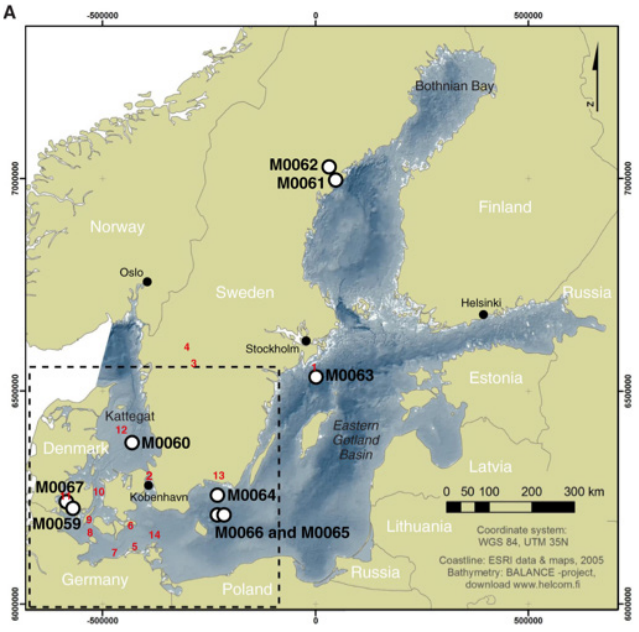
Barry Cragg and the IODP Expedition 347 science party

Expedition 347 started life as a paleoenvironmental expedition to investigate the complexities of the history of the Baltic Sea Basin covering the last interglacial cycle to approximately 140 ky BP. During this period the Baltic has undergone many alternate warm and cold periods resulting in changes from complete coverage with the Scandinavian ice sheet to complete ice sheet melting. With the consequent interplay between land uplift and sea level rise various outlets and inlets around the Baltic to the Atlantic and Arctic oceans have opened and closed and the Baltic Sea itself has varied from a freshwater lake, through brackish phases to marine incursions into many of the sub-basins, and from well oxygenated and oligotrophic to organic rich and partly anoxic. The Baltic Sea also has, and has had, some of the highest sedimentation rates known at 100—500 cm/1000 y. Very early on those working on IODP Deep Biosphere research recognized the uniqueness of this environment and thus Deep Biosphere objectives, and consequently microbiologists, were incorporated into Exp 347. There were four main research themes of the expedition;

1. Climate and sea level dynamics of Marine Isotope Stage (MIS) 5, including onsets and terminations.
2. Complexities of the last glacial, MIS 4–MIS 2
3. Glacial and Holocene (MIS 2–MIS 1) climate forcing
4. Deep Biosphere in the Baltic Sea Basin sediments

These objectives were achieved by drilling in six sub-basins (Figures 1 and 2) that between them covered an overlapping sequence for the entire 140 ky under investigation. These sites exhibit a gradation of bottom water salinities depending on their distance from the Danish Straits with for example Site M0060 in the Kattegat has a salinity of c. 33 compared to Sites M0061 and M0062 in the Ångermanälven estuary with salinities of c. 6. Site M0060 was not only the most marine but this is where the longest cores were obtained to 229.5 mbsf. The lithostratigraphy showed a thin sand layer at the surface overlaying interbedded sand, silt, clay and diamicton and laminated clay with clasts with the lower levels consisting of sandy diamicton, fluvial or deltaic sands and mollusk-bearing silty clay. Sites M0059/67, M0063, M0064, M0065 and M0066 were all similar with a diamicton or sand unit at the base overlain by up to 45 m of laminated/

Figure 1.
Baltic Sea Basin indicating the drill sites M0059 – M0067 (from IODP Expedition 347 Preliminary Report).



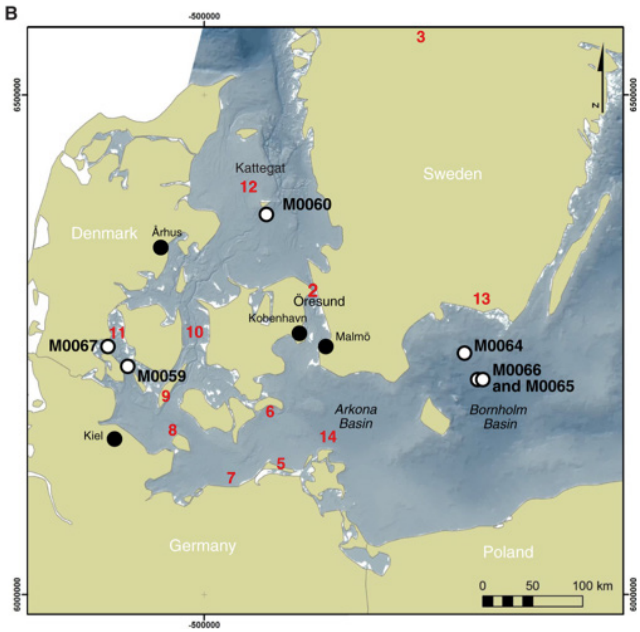


Figure 2.
South East corner of the Baltic Sea indicating drill sites in more detail (from IODP Expedition 347 Preliminary Report).

varved glacial lake clays with between 2 and 35 m of greenish black clay deposited at the top of each site containing mat-like laminations and iron sulphide intervals. Sites M0061 and M0062 in the Ångermanälven estuary have a quite different post-glacial stratigraphy with interbedded sand and silt to laminated/varved silty clays terminating in sand and topped by 8 to 11 m of greenish black clay containing mm to cm-scale laminated iron sulphide intervals indicating suboxic or anoxic conditions with high organic matter deposition. These last two sites had their own specific sampling problems as being close to abandoned paper and pulp factories the surrounding waters, in the past, had been heavily contaminated with organics and heavy metals. Consequently safety concerns meant handling the upper meter of core, obtained using a Rumohr-core, involved full body armour, and the scientists involved being sprayed clean with a hose at the end of sampling.

I sailed as one of six microbiologists on this expedition and our inclusion was something of a logistical challenge. We used a Mission Specific Platform (MSP), The Greatship Manisha with the science area clustered in ten containers at the back of the ship (Figure 3). European expeditions using MSPs generally have few scientists on board as the emphasis is on core collection, with core splitting and sampling occurring at an Onshore Sampling Party some months later, and the presence of six extra scientists in the shipboard party made things a little crowded.

The microbiologists were specifically interested in four of the sites (M0059, M0060, M0063 and M0065). As cores were not being split on the ship we were sampling more or less blind. In order to gather as much information as possible before microbiological sampling it was usual for two Holes to be cored, before the microbiological (MBIO) Hole, that went for intensive geochemical interstitial water (IW) sampling followed by storage, and for one of these two Holes to be the deepest cored. Thus by the time the MBIO Hole was cored a record of the down hole IW chemistry, and a rough idea of the lithostratigraphy (based on examination of the core catcher), was available to direct the microbiologists to the core depths of greatest interest such as geochemical and lithological boundaries. Invariably the MBIO Holes were shorter than the maximum core depths obtained at each Site because whenever the drill string hit significant sand layers core recovery was poor, contamination potential was much higher and sand layers are poorly colonized by bacteria, so providing a natural end to sampling. Maximum Hole depths and MBIO Hole depths at the four Sites listed above (to the nearest mbsf) were, respectively; 118 and 81, 203 and 84, 102 and 90, 47 and 46.

My main areas of expertise are measuring bacterial activity, essentially looking at potential rates of production and consumption of methane from a variety of different substrates using radioisotopic 14C–compounds back in the labs at Cardiff, and this work is now well underway. Additionally, I assess bacterial population sizes using a direct count technique with samples stained using a fluorescent dye and viewed using epifluorescence microscopy to count the cells. This is currently the standard method used on IODP to measure bacterial cell concentrations but it is an extremely tedious procedure, taking both a long time and a certain level of expertise. Three of the microbiologists on this expedition (Nan Xiao, Ray Zhang and myself) were involved in comparing methods to determine if a faster and easier method could be found to measure bacterial population size. I used an epifluorescence microscope provided in one of the science containers, Nan Xiao brought an automatic cell counter with her and Ray Zhang took samples to take back to China when they would be set up on a similar epifluorescence microscope system but using a different, and newer, staining

Figure 3.
The aft end of The Greatship Manisha showing some of the (turquoise) science containers, and the plastic roof providing the scientist's work area, (photo Aarno Kotilainen).

procedure. This expedition proved ideal for this in that we obtained samples with a huge range of cell concentrations and we were able to take multiple and parallel samples that we could all count using our different methods. We are all still working on these samples and hope to publish something next year. In addition to this Ray Zhang will be making counts of virus particles, which are frequently claimed to be as common as bacterial cells, in the sediments. In most marine sediments there is, particularly at depth, severe substrate depletion (e.g. a lack food sources such as the volatile fatty acids acetate and lactate) and bacterial cells stop actively growing, move on to maintenance energy only, and usually more or less shut down and significantly shrink in size compared to cells you might see actively growing in bacterial cultures. Here we enter a grey area of can we distinguish between small bacterial cells and virus particles in deep sediment samples? Ray's work, along with that of other shore-based scientists working on these sediments will address this fundamental question.

Microbiological sampling is like no other core sampling on IODP in that there is no archive half preserved. Additionally, the nature of microbiological work on IODP sediments requires that whole round cores (WRC), sometimes many centimeters in length, and mini-core sub-samples taken with syringes with their ends cut off (Figure 4) are removed from the cores as soon as possible after core retrieval and are either processed or stored under special conditions as fast as possible. This meant that one of the containers was solely for cutting core (Figure 5) and microbiological sampling, and a second container was set up as a microbiological laboratory run at 4°C where cores and syringe samples were variously packed, bagged and sealed in nitrogen filled gas tight bags, or decanted into sterile bottles and jars or preserved in formaldehyde, and then placed in the 4° reefer for fresh samples and the -80°C freezers for stored samples (Figure 6). Such is the immediacy required when dealing with microbiological samples that on four occasions during the expedition small ships came out to meet The Greatship Manisha and the microbiological samples were offloaded and taken to Aarhus University from where they were distributed to all of the shore-based microbiologists who had requested samples, plus the laboratories of the ship-based scientists so that their colleagues could start work on the samples as soon as possible. The international (Deep Biosphere) interest in this expedition was enormous with hundreds of WRC samples and thousands of syringe samples requested so that in many cases almost entire 1.5 m sections of core were sampled for microbiologists and geochemists leaving little or nothing for archiving.

One of the most important pieces of information needed by microbiologists is if their samples could have been contaminated during coring from either seawater, drilling mud or sediments from higher in the Hole. Contamination from larger and more active bacteria in seawater, drill muds or near-surface sediments could completely destroy the usefulness of any samples obtained. Therefore a perfluorocarbon (PFC) tracer was added to the drill fluids to detect the potential for contamination. As soon as the core catcher was removed on the rig floor three samples were taken, using 3 x 5 mL syringes with their ends removed, in a transect across the core end. These mini-core samples

Figure 4.
Microbiological sampling of the end of the core with sterile cut-off syringes, (photo Aarno Kotilainen).

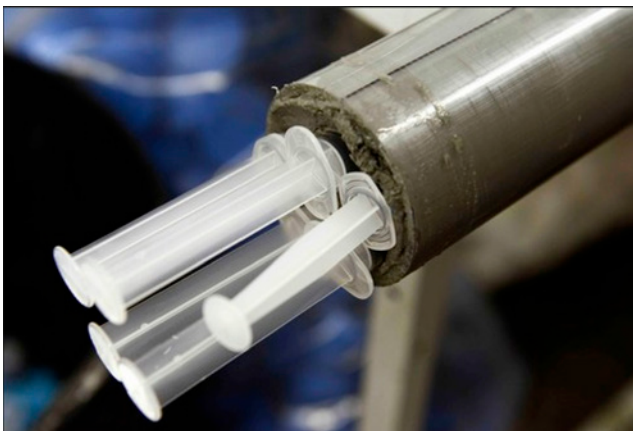


Figure 5.
Dealing with a core in the MBIO core-cutting container showing (l to r) Mary Mowat, Michael Kenzler & Barry Cragg, (photo Bo Jorgensen).

were immediately transferred to sealed glass vials that were transported to shore at the end of each site along with the sediment samples. They were analysed for PFC in Aarhus during the period of the cruise providing the shipboard scientists with rapid feed-back information on the potential for their samples to be contaminated. This led in at least one instance to some re-sampling of sediment cores when it was realized samples already taken were likely to be too contaminated to be useful.

The intensity of microbiological sampling also ensured that the shipboard geochemists were kept very busy. A knowledge of the IW chemistry is vital in determining microbial presence, the nature of microbial communities and assemblages and their activities. This meant that the geochemists were dealing with many more IW WRC than is usually the case. Additionally microbiologists needed measurements of ephemeral components of the IW such as pH, alkalinity and ammonium in addition to salinity and sulphide and the safety

Figure 6.
Nan Xiou, one of the microbiologists, working with her cell counter in the microbiology overflow lab, microbiologists office and -80°C freezer room, (photo Bo Jorgensen).

methane measurement and this also greatly increased the geochemist's workload.

The site of major interest for microbiologists was M0063 — the Landsort Deep, the deepest part of the Baltic at 459 m (Figure 7). This is a basin that frequently in the past, and currently, has anoxic bottom water, and this means that rapidly depositing organic matter accumulates without bioturbation, as macrofauna cannot survive under these conditions, and sapropel layers are formed with very high total organic carbon (TOC) concentrations. At Site M0063 this meant TOC of greater than 6% compared to a more normal 0–1%. Anoxic bottom water also ensures that the low levels of sulphate in the water are depleted by pelagic and surficial sulphate-reducing-bacteria above and at the sediment surface leaving the IW of the sediments essentially sulphate-free. This absence of sulphate allows methanogenic bacteria to utilize the organic matter almost immediately it arrives at the sediment surface and this makes for a very gassy core. After losing one or two cores onto the deck we moved to using a two-meter core stroke with a three-meter core liner just to accommodate core expansion on retrieval. Methane concentrations were huge reaching more than 42 mmol/L in one core, well over normal saturation levels of around 1.25 mmol/L, making accurate measurement of in situ methane concentrations in the upper 60 m of M0063 impossible. This all indicates rapid bacterial methanogenic activity and high bacterial populations. Measurements of the former are still being processed however a major finding is that some of the near-sediment-surface bacterial populations measured were the highest we have ever seen in marine environments away from estuaries with many cell counts exceeding 10^{10} cells/cm^3. Actually counting some of these sediments proved difficult as there were so many cells often clumped in what appeared to be bacterially-produced biopolymer films, probably leading to underestimates of cell numbers. One of my activities now back in the lab is to work on ways of breaking up these clumps, and I suspect, if successful, we will find that the true cell numbers are even greater. Given such high numbers of bacterial cells in these Baltic sediments it seems likely the Deep Biosphere community associated with Exp. 347 will be producing some fascinating data from these samples for some years to come.

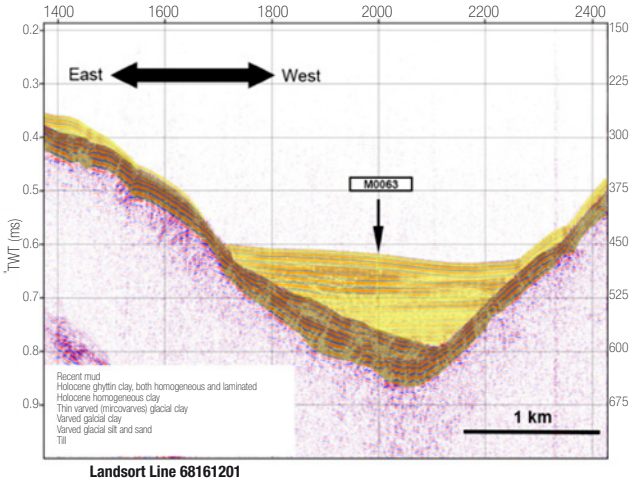
The specific objectives of the Deep Biosphere theme were;

1. To understand how the environmental and depositional history of the Baltic Sea system through glacial-interglacial transitions has altered microbial communities.

2. To analyze microbiological and biogeochemical responses to major shifts a). between limnic, brackish and marine phases, and, b). between high and low deposition of terrestrial versus marine organic and clastic material.

3. To understand how microbial processes in subsurface sediments control the mineralization of buried organic matter, the release of nutrients, and the formation of methane.

Figure 7.
Transect along seismic line 68161201, crossing Site M0063 Landsort Deep. (from IODP Expedition 347 Preliminary Report).



Expedition 348 – NanTroSEIZE Stage 3: Plate boundary deep riser 312 September

13 September 2013 – 20 January 2014

Ana Maia and the Expedition 348 Science Party

The Nankai Trough Seismogenic Zone Experiment (NanTroSEIZE) is a multi-expedition drilling project designed to provide a better understanding of fault mechanics and seismogenesis along subduction plate boundaries. The main scientific objectives of the NanTroSEIZE project comprise characterizing the nature of fault slip and strain accumulation, fault architecture, fault and wall rock composition, and state variables throughout the active subduction megathrust system.

So far, ten IODP expeditions have taken within the NanTroSEIZE transect, located in the Nankai Trough subduction zone and the Shikoku Basin, offshore the Kii Peninsula, Japan. The >45 holes drilled at 13 sites provided direct sampling, in situ measurements, and long-term borehole monitoring data, crucial to the investigation of a variety of settings from the incoming plate to the forearc basin.

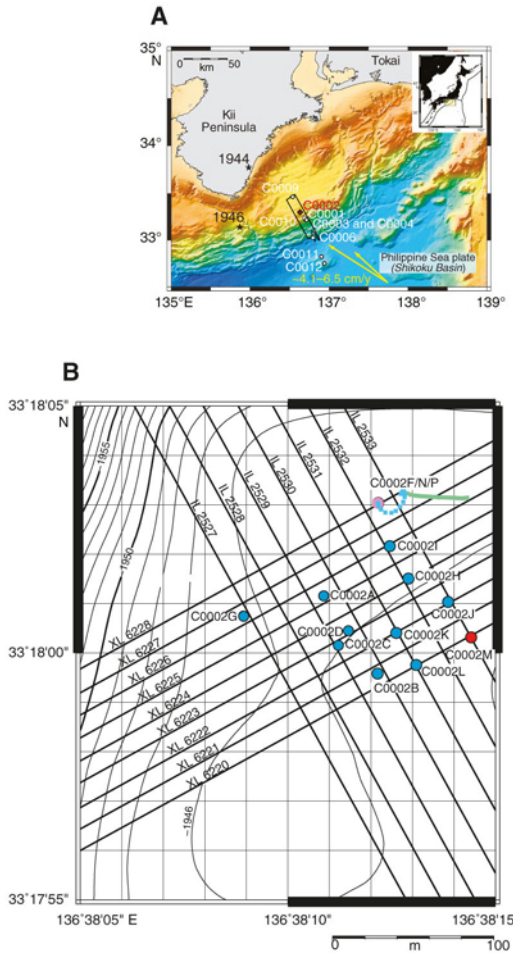
The primary objective of IODP Expedition 348 was the deepening of the existing Hole C0002F (Site C0002) to 3600 m below seafloor (mbsf), extending the operations conducted during IODP Expeditions 326 and 338.

IODP Expedition 348 began on 13 September 2013, when the drilling vessel Chikyu set sail from the port of Shimuzu en route for Site C0002. The science party would come on board much later, on 26 November 2013. Until then, on ship operations would go as planned, in order to collect cuttings, core, and logging data.

During this expedition, riser-drilling operations enabled Hole C0002 to be deepened to 3058.5 mbsf, currently holding the record for the deepest research borehole. To reach this depth, the original Hole C0002F was sidetracked twice, originating Holes C0002N and C0002P as the successively deeper sidetracks. The hole was cased and cemented to 2922.5 mbsf. A test hole for a prototype small-diameter RCB coring system (Hole C0002M) was also drilled near Hole C0002F. The hole was drilled riserless to 475 mbsf, where four cores were collected to 512.5 mbsf.

During drilling, logging-while-drilling (LWD) and measurement-while-drilling (MWD) data, mud-gas, and cuttings data were collected over the interval from 2162.5 to 3056 mbsf in Holes C0002P and C0002N. Six cores were retrieved over a 55.5 m interval from 2163 to 2218 mbsf. Expedition 348 sampled and logged a deep interval within the inner accretionary wedge, including a never-before sampled zone in the lowermost ~1 km of drilling. The science party described all cuttings and core samples, according to lithology, structure, and micropaleontology, and measured rock physical and chemical properties. The sampled sedimentary rocks are composed of hemipelagic sediment and fine turbidite with rare ash. Based on nannofossil

Figure 1.
Map of the NanTroSEIZE region showing all Stage 1, 2, and 3 drill sites. Red = Expedition 348 Site C0002, white = other NanTroSEIZE sites. Black outline = region with 3D seismic data, yellow arrows = estimated far-field vectors between Philippine Sea plate and Japan (Seno et al., 1993). Stars = epicenter locations of 1944 and 1946 tsunamigenic earthquakes.



first and last occurrence data, the interval from ~2145.5 to 2945.5 mbsf has a depositional age of 9.56–10.73 Ma, which is consistent with accretion of a middle Miocene section of lower Shikoku Basin equivalent. Bedding was observed to be quite steep throughout the drilled interval, between 60°–90° in both cores and resistivity image logs. Several structural fabrics were recognised, including common development of scaly clay fabrics with polished and slickensided clayey surfaces. Structural

fabrics became progressively stronger with depth, and carbonate cement and veins were widespread below 2100 mbsf. In the cored interval, a well-developed foliated fault zone was identified at 2204.9–2205.8 mbsf, containing abundant carbonate cement and vein fill. However, it was not possible to determine the overall displacement sense or amount. Log data interpretation suggests at least one additional significant fault zone at ~2220 mbsf, based on fracture intensity and bedding dip anomalies. Log data also show that P-wave velocity (VP) and resistivity follow a trend of increasing with depth to ~1600 mbsf, but vary little from this depth to the bottom of the hole. Average VP actually decreases slightly with depth over this interval, perhaps due to progressively increasing clay content with depth, increased fracturing or rock damage, or pore fluid overpressure.

Life on board *Chikyu* was great! The science party got along very well, and there was always this 'sciency' atmosphere and the exciting feeling of pushing the boundaries in research drilling. We held meetings every couple of days to discuss each group's findings and post-cruise research. New ideas came up and several future collaborations were envisaged.

Deep-ocean drilling entails numerous difficulties and challenges. Bad weather and borehole problems were common issues throughout the expedition, preventing us from reaching the originally planned depth of 3600 mbsf. Despite this,

Figure 2.
Composite seismic reflection depth section extracted from the pre-stack depth migrated 3D seismic volume, showing position of Site C0002 (red) and other NanTroSEIZE sites (black). A. Seismic section in the region around Holes C0002F, C0002N, and C0002P. The heavy solid red line represents the currently drilled borehole, and the dashed line shows the projected extension to the plate boundary fault target. The boxes represent cased sections of Holes C0002F, C0002N, and C0002P (red shows the 36 and 20 inch casing, green represents the 13⅜ inch casing, and blue indicates the 11¾ inch casing liner section. B. Composite seismic depth section of the NanTroSEIZE site and related drilling sites from the Kumano Basin (Site C0009) to the input sites (C0011 and C0012).

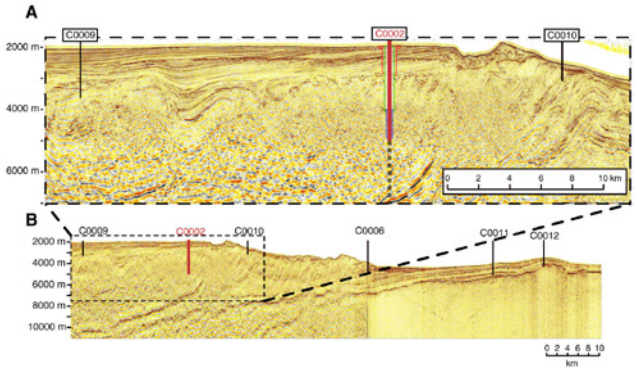


Figure 3.
Expedition 348 Science Party and Co-Chiefs.

Expedition 348 was a great success — the deep interior of the inner accretionary wedge was characterised over the drilled interval, and the hole was deepened and stabilised for future drilling operations which will intersect the megasplay fault at ~4600–5000 mbsf. Post-cruise research will significantly contribute to our knowledge and understanding on fault mechanics and seismogenesis along subduction plate boundaries, and on various other Earth science disciplines.

New discoveries, new challenges — this is what the IODP is all about.

For more information on site specifics and initial results, please refer to the Preliminary Report at http://publications.iodp.org/preliminary_report/348/index.html

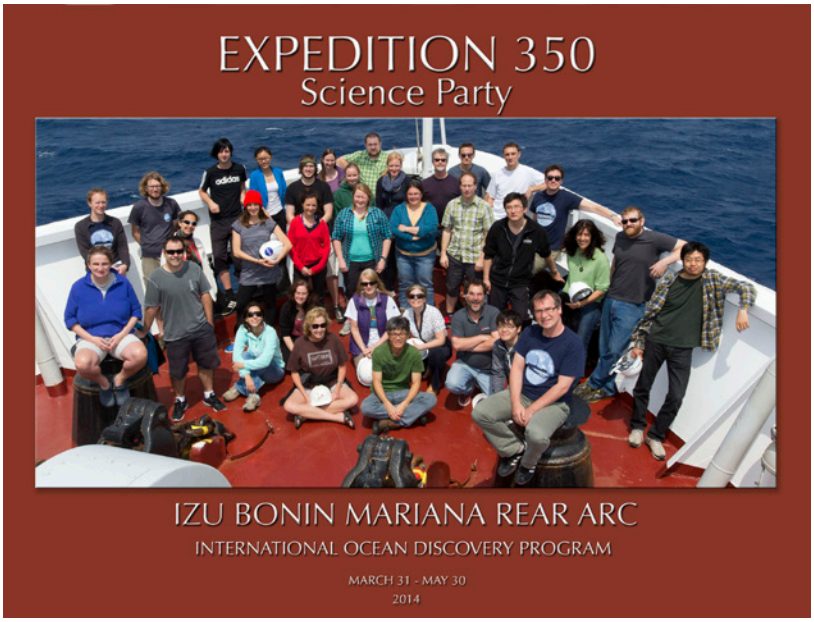
References

Seno, T, Stein, S, and Gripp, A E. 1993. A model for the motion of the Philippine Sea plate consistent with NUVEL-1 and geological data. *J. Geophys. Res.: Solid Earth*, 98(B10):17941–17948. doi:10.1029/93JB00782

Expedition 350 – Izu-Bonin-Mariana rear arc

30 March 2014 – 30 May 2014

Martin Jutzeler and Sue Mahony



The IODP Expedition 350 was the first of an ambitious trilogy aiming to reveal the origins and evolution of the Izu-Bonin-Mariana arc (IBM, West Pacific). The ~30 scientists sailed from the 30 March to the 30 May 2014, under the lead of the co-chiefs Cathy Busby and Yoshihiko Tamura, with Peter Blum as staff scientist. This highly successful expedition was focussed on a single hole in the Izu rear arc, breaking a new record with the longest casing pipe (1085.6 m), and successfully drilled down to >1800 mbsf under >2110 m of water.

This expedition was preceded by two meetings attended by some of us. In January 2014, IODP organised a pre-cruise workshop at College Station which was attended by representatives of the core describers of the three IBM expeditions. This workshop was dedicated to unify the complex and often blurred nomenclature of volcanogenic rocks and sediments amongst the three expeditions, to hopefully produce expedition reports that can be easily compared. In addition, the nomenclatures and textures were simplified and adapted to facilitate the data entry in the IODP-owned DESClogik software. The nomenclature was finalised during transit of Expedition 350 to the first drilling site, and successfully tested during the 2-month cruise.

Cathy Busby, co-chief of the expedition, proposed a discretionary 3-day pre-cruise field trip in the Coastal Range of Taiwan, organised by Prof. J Suppe and local collaborators. This was a fantastic opportunity to socialise with new colleagues we would closely work with for 2 long months, amongst beautiful rocks, hot springs, and food (and some drinks). This field trip was highly successful and we strongly encourage future expedition leaders to follow such concept.

Site U1437 was drilled within a volcano-bounded basin, at relative proximity to Manji, a major seamount that had previously been dredged. Site U1437 recovered large volumes of hemipelagic mud rich in volcanic grains, pumiceous and mafic volcaniclastic beds, and intrusive and autoclastic lavas. The abundance of hemipelagic mud recovered in the upper part of Site U1437 was unexpected by the science party, and the volcaniclastic beds were overall much finer grained than hoped for. This unexpected mud substantially increased the depth of the targeted volcaniclastic beds, thus increasing alteration of its weaker constituents, such as volcanic glass and, to some extent, some mineral phases. However, the hundreds of recovered volcaniclastic beds are extremely interesting by their facies variations through the stratigraphy and their unique geochemistry. The cores from Site U1437 will allow very detailed petrological, geochemical and sedimentological studies of the local (rear arc) and regional (arc front and maybe mainland Japan) volcanism. In addition, volcanic grains will be extracted from the hemipelagic mud to reconstruct the background sedimentation in this particular environment.

Over a couple of days, we drilled the forearc Site U1436, which was previously drilled in the late '80s as Site 792, during ODP Leg 126. This area was chosen for the future ultra-deep drilling to the middle crust (IBM-4), and geotechnicians at JAMSTEC needed fresh samples to characterise the hole conditions. Site U1436 produced some fine examples of mafic and evolved volcaniclastic deposits, allowing a better reconstruction of the recent history of the arc, complementing the earlier cores from Leg 126. As we went there twice during the expedition, Jim Gill, our veteran on board and who was also on Leg 126 (!), insisted saying he would not voluntarily return to this same spot of the Pacific Ocean for a fourth time... Somehow, we understand him.

Several birthdays were celebrated onboard, with amazing cakes baked by the catering staff. The food was fantastic, weekly BBQs and roast dinners with apple crumble and custard made sure that we all needed to use the well-equipped gym. The pocket pool

tournament was great fun, but unfortunately none of us made it past the first round (we may need a few more expeditions for training purposes). ANZAC day saw us playing 'Spinna' thanks to our Australian paleomagnetist Bob Musgrave. Hump day (the half-way point in the expedition) was celebrated with a party in the movie room. Hitting the dance floor as soon as you've woken up was rather an unusual experience for the night shift, but was definitely appreciated as a way to let off some steam. Regular 'Zoom' sessions (similar to Skype) took place with lots of school and interest groups. These shared the experience of life on board ship, with tours of the labs to observe and interact with scientists at work, and observe the core flow. After drilling at Site U1437 for a couple of weeks, the locals apparently upgraded us to the status of a reef. We were treated to some wonderful spectacles, large squid catching flying fish out of the air at 1 am, thousands of tuna circling the JR on a sunny afternoon, albatross battling across the windy ocean, and the amazing sunrises and sunsets really brought home how lucky we were to be there.

We are currently working on the samples that got shipped to our respective offices, and several task groups have been put in place, as well as personal studies. We are all already looking forward to our next gathering, which will be (apart from conferences) the post-cruise meeting in Morocco, where Julien Berger proposed the scientific meeting in Marrakech, followed by a field trip to an accreted arc. The highly successful expedition is indebted to all staff aboard the JR, who made this expedition exceptional and unforgettable!

Expedition 351 – Izu-Bonin-Mariana Arc Origins

01 May 2014 – 30 July 2014

Sev Kender, Antony Morris, Ivan P Savov and Cees van der Land

Introduction

UK scientists Cees, Ivan, Tony and Sev sailed on recent IODP Exp. 351 as an Inorganic Geochemist, Sedimentologist, Paleomagnetist and Paleontologist respectively. They were part of a 30-strong international scientific team (http://iodp.tamu.edu/publicinfo/gallery/exp351/), who's aims were to drill a deep borehole into the crust of the Amami Sankaku Basin (ASB; Fig. 1) to investigate the origin of the Izu-Bonin-Mariana (IBM) subduction system. One of the aspects of plate tectonics that is still little understood is subduction initiation, which is primarily due to a lack of data from such regions. As the Kyushu-Palau Ridge marks the position of the onset of IBM subduction in the Eocene, Exp. 351 aimed to characterise and date the age of the underlying crust and overlying sedimentary archive (Table 1), in order to build a model of oceanic-oceanic subduction initiation. The full aims and background of the expedition can be found here (Arculus et al., 2013 http://publications.iodp.org/scientific_prospectus/351/351sp_7.htm).

Aims and objectives

1. Determine the nature of the original crust and mantle that existed in the region prior to the beginning of subduction in the middle Eocene.
2. Identify and model the process of subduction initiation and initial arc crust formation.
3. Determine the compositional evolution during the Paleogene of the Izu-Bonin-Mariana arc.
4. Establish geophysical properties of the Amami Sankaku Basin.

Photo 1.
A quick photo opportunity after a nice meal in the sun. From top left: Gemma Maxwell, Kathie Marsaglia, Cees van der Land, Clara Sena Da Silva, Tony Morris, Frank Tepley III, Vincent Percuoco, Sev Kender, Martin Neuhaus, Philipp Brandl, Adam Bogus, and Alyssa Stephens.

Life on the ship

The *JOIDES Resolution* was a joy to be on, and operations ran smoothly with plenty of work to keep us busy and out of trouble. During the one-week casing, which stabilises the borehole and prevents it from collapsing when drilling deeper, several things took place to fill the time, including science seminars, Photoshop and Illustrator classes, and a treasure hunt organized by the Staff Scientist, Yeoperson, and Teacher at Sea. We spent hours hunting around areas of the ship we had never been to before, trying to collect stamps and answer questions related to the ship. It was a good way to speak to some of the drilling, support and catering staff that we otherwise do not have much contact with. The night and day shifts drew the contest, after something of a controversy that seemed quite important at the time, and so a play-off was sprung on us one morning. All personal belongings (and dignity?) were left in the lab, as we headed to the helideck for a series of childhood games including an egg-and-spoon race (see Photo 2), 'cookie-on-your-face' contest and more. Another 'interesting'

Figure 1.
Location of the Amami Sankaku Basin (ASB) and the Kyushu-Palau Ridge (KPR). General setting and bathymetry (blue deep, red shallow) of the bounding trenches, basins, and ridges comprising the Philippine Sea Plate. Location of IODP Site U1438 is shown by large star.

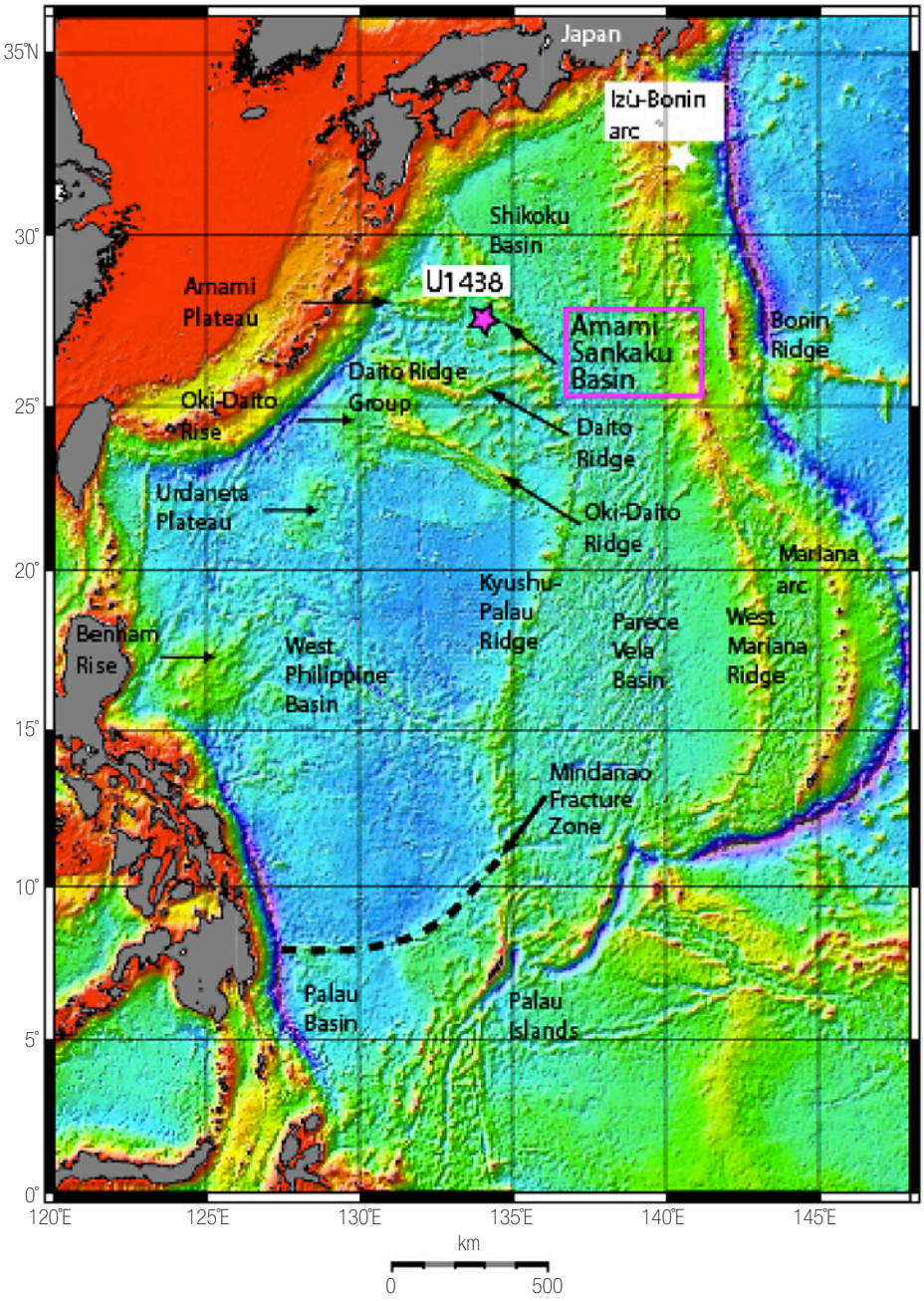


Table 1.
Stratigraphic layers expected at Site U1438 (from Expedition 351 Scientific Prospectus; Arculus et al. 2013).

Sedimentary intervals*	Depth (meters below sea level [mbsl])	Age	Thickness (m)	Lithology
A	4720–4830	Plio/Pleistocene	110	Pelagite
B	4830–4990	Upper Miocene	160	Turbidite
C	4990–5300	Lower Miocene	310	Turbidite
D	5300–5790	Oligocene/Eocene	490	Turbidite
E	5790–6020	Eocene or older	230	Hemipelagite
	6020–	Mesozoic		Basement

* Based on seismic studies

development during the expedition was having to turn back to Yokohama after only a day's travelling out to sea, because some of the scientists and staff had been issued the wrong visa. As the immigration boat came to rendezvous with us, there was a somewhat surreal passport handover in the middle of the ocean. We also had to navigate our way around 'Super Typhoon' Neoguri (http://en.wikipedia.org/wiki/Typhoon_Neoguri_(2014)), which cost us several days drilling but did not affect the overall success of the expedition, and we were the first IODP expedition to carry out a 'Flash Mob' surprise party, which can be viewed on You Tube here (http://www.youtube.com/watch?v=JTeZPWACnRs).

Scientific results

Expedition 351 was incredibly successful, in that we were able to reach all of our objectives and come away with some really exciting initial results and cores for future study. The expedition results are still under embargo, but we reached basement, and

Photo 2.
Frank Tepley III comes storming in for a famous victory, as Cees runs in to congratulate, in the great treasure hunt play-off final.

returned ~1500 m of cores containing ash deposits, hemipelagic clays and silts, turbiditic clays, sands and gravels (Photos 3 and 4) all documenting the birth and death of the KPR system throughout the Cenozoic. Micropalaentological (Photo 5) and palaeomagnetic recovery was great (considering the turbiditic setting), and so we were able to reconstruct a robust age model for the entire site. A wide range of follow-up research is now taking place, which includes igneous petrology, sediment and ash geochemistry, Neogene palaeoceanography, and palaeomagnetic tectonic reconstructions.

Photo 3.
Ivan Savov with Alex Bandini (background) examining a thin section.

Photo 5.
A benthic foraminifera in thin section, collected from one of the cores that contained coarse sands. This 'giant' single-celled foraminifera (about 0.5 cm across) would have housed symbiotic algae in the numerous chambers in its shell, and would therefore have lived on a reef within the reaches of sunlight.

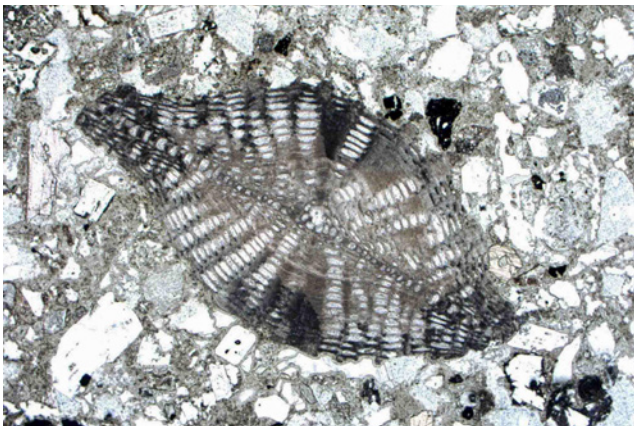


Photo 4.
A close-up image of interbedded light and dark coloured clays and silts from Site U1438, showing characteristic bioturbation (Image approximately 7 cm across).

Expedition 352 – Izu-Bonin-Mariana Forearc

30 July 2014 – 29 September 2014

Julian Pearce (Co-Chief Scientist), Alastair Robertson, Julie Prytulak and Sally Morgan

The aim of IODP Expedition 352 was to drill a section through the volcanic sequence of the inner wall of the Bonin Trench. This sequence is believed to record magma genesis and geodynamics from the start of Western Pacific subduction at about 52 Ma through to the start of arc volcanism some 8 m.y. later. The principal hypothesis to be tested is that subduction begins by sinking and roll-back of the subducting plate accompanied by sea-floor spreading. As normal (slab-parallel) subduction takes over, so the volcanic arc develops, initially erupting boninite, an unusual high-magnesium, high-silica magma. A second hypothesis is that this setting is where many ophiolite complexes form, including some of the largest and most studied such as the Troodos Massif of Cyprus and the Semail Nappe of Oman. By coring and downhole logging, we aim to provide a vertical reference section to enable the geochemistry and stratigraphy of our subduction initiation section to be compared with possible on-land equivalents. Interpreting the lava chemistry in terms of magma genesis will, we hope, provide insights into the precise changes in geodynamics during subduction initiation. Structural data, and studies of the nature and composition of inter-lava sediment and the deep-sea sedimentary cover, will also contribute to understanding the early history of crustal accretion above subduction zones.

There are four of us from the UK in the science party: Julian Pearce, petrologist/geochemist from Cardiff, is a Co-chief Scientist; Alastair Robertson, sedimentologist/geologist from Edinburgh, is sailing as a Sedimentologist; Julie Prytulak, isotope geochemist from Imperial College, is sailing as a Petrologist; and Sally Morgan, petrophysicist from Leicester, is Logging Staff Scientist. At the time of writing, we have spent some two weeks on site. We aimed to drill the full lava sequence via two offset holes: BON-1A through the lower part and BON-2A through the upper part. So far, we have cored sediment at BON-2A (now Site U1439) and touched boninitic basement. Leaving that site ready for future basement coring, we moved the c. 8 km eastwards to BON-1A (now Site U1440). There, we cored sediment, set a re-entry mini-system and are presently on the second drill bit, having penetrated some 200 m of pillow lavas, sheet flows and hyaloclastites below some 100 m of sediment cover. To great petrological excitement, we are presently drilling what appears to be a MORB-like rock termed Fore-arc Basalt (FAB), which fits well into a model of subduction initiation rollback and spreading. The FAB is glassy in places which will allow us to obtain reliable analyses of water and volatile elements and so be able to track in some detail the inputs from the nascent subduction zone.

UK scientists aboard IODP Expedition 352, Izu-Bonin-Mariana Forearc, from left Sally Morgan, Julian Pearce, Julie Prytulak, and Alastair Robertson.

Expedition 353 – Indian Monsoon rainfall

29 November 2014 – 29 January 2015

UK participants: Kate Littler and Pallavi Anand

The primary objective of this expedition is to reconstruct changes in Indian monsoon precipitation and circulation since the Miocene at tectonic to centennial timescales. Analyses of these newly recovered sediments will help us better understand linkages between monsoon variability and both external (e.g. insolation) and internal (e.g. global ice-volume, ocean-atmosphere heat and moisture exchange) forcing to the Earth's climate system. New reconstructions from the core monsoon region, Indian margin and Andaman Sea, will provide estimates of summer monsoon precipitation changes; these will be valuable in separating the mixed summer and winter monsoon signals from the existing terrestrial records, based on Chinese loess and stalagmites. Astoundingly, scientific ocean drilling has never previously taken place in the Bay of Bengal north of 5ºN, leaving a huge gap in our understanding from the core regions of Indian summer monsoon precipitation.

Two UK scientists were part of the Exp. 353 shipboard party: Kate Littler, a sedimentologist/geochemist from the University of Exeter, who sailed as a Sedimentologist, and Pallavi Anand, a foram geochemist/palaeoceanographer from the Open University, who sailed as a Physical Properties specialist. Over the course of the expedition, over 4.28 km of cores were recovered from 6 different sites (U1443–U1448), despite the expedition encountering unexpected clearance issues to drill in Indian waters which delayed coring activities at the outset, a lightening strike in port at Singapore which damaged the hydraulics, and a snapped core wire during coring operations which sent the core barrel hurtling back down the 2 km hole. Despite these setbacks, cores from all of the major target sites were recovered, most with double or triple coring and all with excellent recovery, marking the expedition out as a resounding success. Along with the success of drilling mud, we enjoyed Christmas Carol singing, Christmas and New Year feasts, Sunday BBQs on the deck and first International JR Ping Pong Championship!

Site U1443 was a re-drill of ODP Site 758 on the Ninetyeast Ridge, a critically important open ocean site for Neogene palaeoclimate studies in the Indian Ocean that is now largely depleted, where well preserved sediments of late Pleistocene to late Campanian age were once again recovered. At Site U1444 we recovered sediments associated with the middle-lower section of the Bengal Fan, encompassing a mixture of unconsolidated sands and distal mudstone turbidites, of late Miocene to late Pleistocene age. Sites U1445 and U1446 were drilled on the Indian Margin, recovering high-resolution, fine-grained sediments laid down in the Mahanadi Basin since the Miocene. After a 3-day transit across the Bay of Bengal, coring operations in the Andaman Sea firstly recovered high sedimentation-rate Miocene to late Pleistocene sediments at Site U1447, followed by middle Miocene to late Pleistocene sediments at Site U1448, in the last few days of the expedition. At all sites, the Advanced Piston Corer (APC) tool was used to refusal, generally followed by the more recently developed HAPC (Half APC) tool, which greatly improved the recovery in the challenging transition zone between soft oozes/muds and more lithified chalks/mudstones where the extended core barrel (XCB) tool is required.

Photo 1
ECORD scientists aboard the JR during Exp. 353. L–R: Ed Hathorne (geochemist; Germany), Wolfgang Kuht (co-chief; Germany), Karen Gariboldi (palaeontologist; Italy), Clara Bolton (palaeontologist; France), Milos Bartol (palaeontologist; Sweden); Pallavi Anand (physical property specialist; UK), Kate Littler (sedimentologist; UK), Philippe Martinez (sedimentologist; France), Sam Taylor (palaeomagetist; France); Markus Fingerle (education officer; Germany), Oscar Romero (palaeontologist; Germany).

Scientific workshops

UK-IODP support for scientific conferences and workshops

Through direct funding, and/or by providing travel and subsistence funding for participating scientists, UK-IODP has recently provided support for the workshops described in this section. UK-IODP is also providing funding for the upcoming meeting 'Micropalaeontology and the IODP, Past, Present and Future Applications' hosted by The Micropalaeontological Society (TMS) http://www.tmsoc.org/agm2013.htm. Hosting and/or participating in IODP-related meetings is an important factor in maintaining UK scientist's success within the program. If you would like to attend an IODP conference, or better yet host an event in the UK, please contact the Science Coordinator for further information (ukiodp@bgs.ac.uk).

ECORD summer schools

The UK-IODP has funded the participation (€1000) of five UK students in the always excellent ECORD summer schools in Bremen and Urbino. A further five students received funding directly from ECORD (http://www.essac.ecord.org/index.php?mod=education&page=summer-school).

- The Urbino summer school in Paleoclimatology, Italy.
- ECORD summer school on Deep Sea Sediments: From Stratigraphy to Age Models (MARUM), University of Bremen, Germany.

UK participants	University	Program
Adele Cameron	Open University	Urbino
Matt Carmichael	Bristol	Urbino
Max Holloway,	BAS	Urbino
Jamie Lorna Lakin	Leeds	Urbino
Cherry Newsam	UCL	Urbino
Rhian Ress Owen	Leeds	Urbino
Charlotte Spencer Jones	Newcastle	Urbino
Chris Poole	Leeds	Bremen
Rosie Sheward	NOCS	Bremen

IODP Workshop: Brazilian Equatorial Margin (BEM), Maresias (São Paulo, Brazil)

4–6 February, 2014

Tom Dunkley Jones

This workshop, one of series hosted by the Brazilian IODP community in 2014, aimed to develop new drilling proposals along the Brazil Equatorial Margin (BEM). Twelve UK-based scientists participated, with expertise spanning tectonics, geophysics, margin evolution, palaeoceanography, geochemisty and micropalaeontology. The workshop, hosted by Luigi Jovane of Universidade de São Paulo (USP), had the immediate advantage of taking place at a quiet beach hotel, some three hours outside of São Paulo. In this seclusion, participants were rapidly thrown together and got to work in small, focused groups trying to pick apart potential drilling targets along the BEM. The task was not an easy one. Many targets of interest along the BEM were either too deeply buried for non-riser drilling, within highly sensitive environmental controls zones or in regions without good seismic reflection profiling.

On day two, after discussion of an existing pre-proposal for the BEM (828-pre, Jovane), groups began to settle around three key science themes:

1. **Neogene:** palaeoceanography, eustasy and mixed carbonate and siliciclastic systems. Discussions of potential drilling proposals focused on the Para' Maranhao basin with coordinators Andre Droxler (Rice, USA) and Cainho Hoorn (UVA, Netherlands);

2. **Tectonics:** transform faults, basement tectonics, neotectonics. Discussions of potential drilling proposals focused on the Barreirinhas, Ceara' and Potiguar basins, with coordinators Hilário F. Bezerra (UFRN, Brazil) and Paola Vannucchi (Royal Holloway, UK).

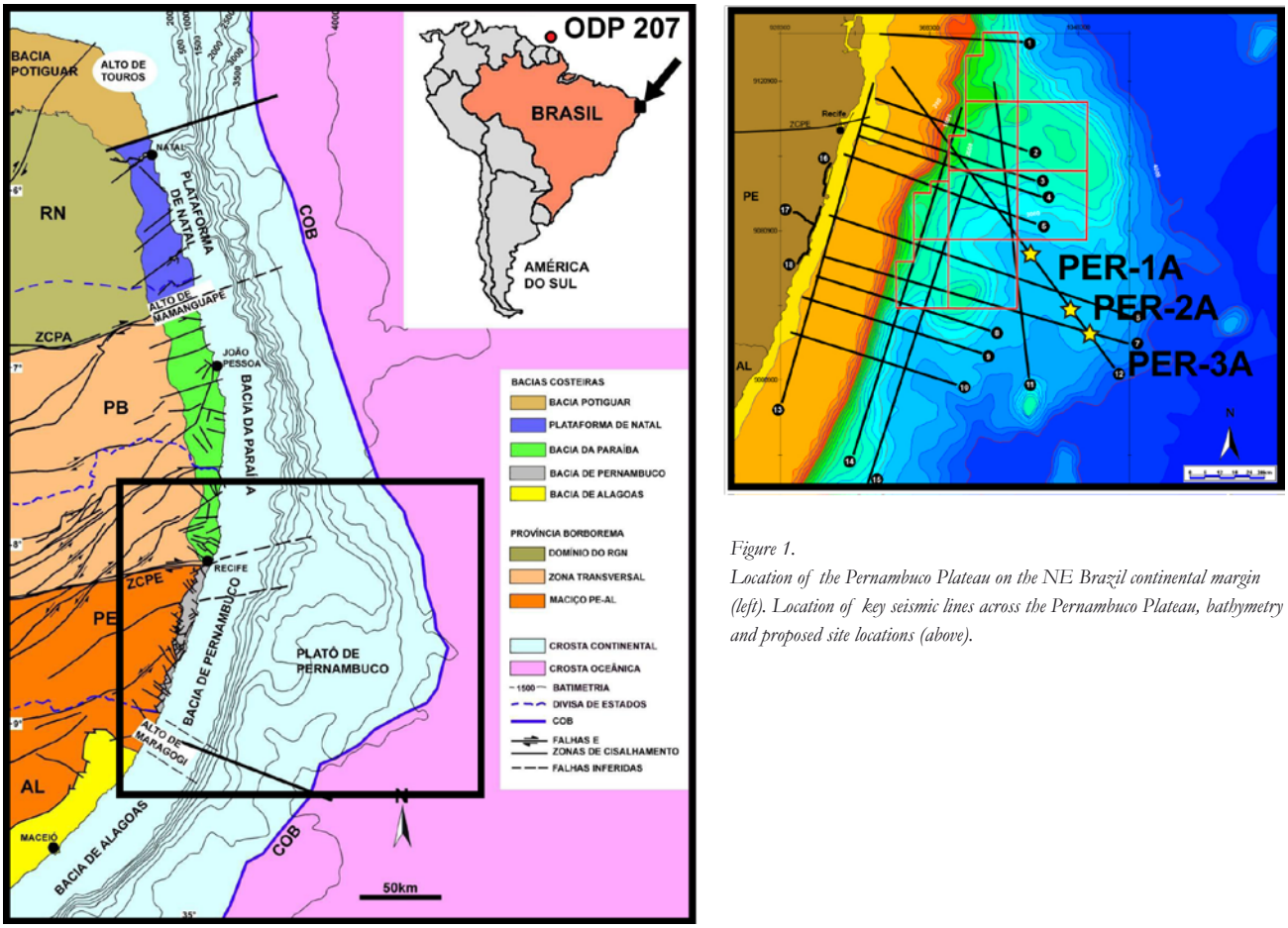


Figure 1.
Location of the Pernambuco Plateau on the NE Brazil continental margin (left). Location of key seismic lines across the Pernambuco Plateau, bathymetry and proposed site locations (above).

3. **Cretaceous/Paleogene Equatorial Gateway:** Timing of Equatorial Atlantic gateway opening, tropical Atlantic paleoceanography of the Late Cretaceous and Paleogene (anoxic events, hypertermals, climate changes). Discussions of potential drilling proposals focused on potential sites in the Pernambuco, Paraiba and Potiguar basins.

UK participants became most involved in discussions around Themes 2 and 3. Paola Vannucchi, Jason Morgan (Royal Holloway) and Tim Minshull (NOC) are actively working on identifying suitable drilling targets on the major central Atlantic transform fault systems to address the science questions outlined in Theme 2. After a follow up meeting with some of the UK participants at the University of Birmingham in March 2014, a new pre-proposal (864 Equatorial Atlantic Gateways; Dunkley Jones) was submitted on the 1 April 2014 to address Theme 3. This was reviewed by the IODP Science Evaluation Panel in June, with the recommendation that it be developed into a full proposal.

Pre-proposal 864 focuses on potential drilling targets on the Pernambuco Plateau, on the NE Brazil Continental margin. Although not formally part of the 'Brazil Equatorial Margin', the Pernambuco Plateau was identified as one of the few areas on the BEM/NE Brazil continental margin, where preliminary seismic profiling indicates that Paleogene and Late Cretaceous sequences would be accessible by non-riser drilling. The Pernambuco Plateau is also located just to the south of the final hypothesized 'pinch-point' of the Equatorial Atlantic Gateway, making it ideally placed to record the development of oceanic connections between Central and South Atlantic waters. New records in this region will allow us to address scientific questions within four themes: (i) to determine the timing and oceanic-source (Central Atlantic v. Southern Ocean) of the South Atlantic flood event and use post-flood water-depth estimates to constrain models of depth-dependent lithospheric stretching; (ii) to generate multi-proxy records of tropical marine and terrestrial climates under conditions of extreme warmth; (iii) to test the resilience of tropical ecosystems and biotas to major environmental perturbations, including Oceanic Anoxic Events (OAE 2&3), the end-Cretaceous mass extinction, early Paleogene hyperthermals and the greenhouse/icehouse transition; and, (iv) to understand the processes controlling deep biosphere communities, especially in regions with extensive and deeply buried organic material.

Development of the full proposal 864 will be supported by a MagellanPlus workshop, 'Drilling the Cretaceous-Paleogene Tropical South Atlantic' hosted by Tom Wagner and Tom Dunkley Jones at Newcastle University, in February 2015. Interested potential participants should email Tom Wagner for further details (thomas.wagner@newcastle.ac.uk).

UK Maresias Particpants: Alexander Dickson, David Iacopini, James Bendle, Jessica Whiteside, Ken McCaffrey, Kirsty Edgar, Paola Vannucchi, Stephen Jones, Steven Bohaty, Thomas Wagner, Tiago Alves, Tom Dunkley Jones.

2014 UK-IODP General Conference

5 November 2014

Sean Burke (UK-IODP Science Coordinator; BGS)

Held at the Royal Geographical Survey, London the one day conference included a series of excellent talks covering the diversity of research conducted within IODP, along with a poster session, and discussions. The talks were organised into short (15–20 min) addresses.

The next General Conference is tentatively planned for autumn 2015.

Sessions and speakers were:

Oceans and climate

Tina van de Flierdt (Imperial), Antarctic drilling—Results from IODP Expedition 318

Christian März (Newcastle), The Conservative, the Diagenetic, and the Ugly Facets of pore water geochemistry in the North Pacific

Dorrik Stow (Heriot Watt), Onset of Mediterranean outflow into the North Atlantic

Javier Hernandez Molina (Royal Holloway), The IODP proposal Drake-Scotia Seaways

Jessica Whiteside (Southampton), Constraints on TEX86 Sea Surface Temperatures across the Cenomanian/Turonian in the Northwestern Atlantic Ocean

Earth in motion

Paola Vannucchi (Royal Holloway), Costa Rica subduction zone drilling

Lisa McNeill (Southampton), The role of input sediments on subduction earthquake size and type

Martin Palmer (Southampton), Results from Expedition 340 Lesser Antilles volcanism and landslides, including eruptive and slope failure history

Knowledge exchange

Sally Morgan (Leicester), Knowledge exchange: a new initiative for UK IODP

Earth connections

Antony Morris (Plymouth), IODP Expedition 351 Izu-Bonin-Mariana Arc Origins and the lithostratigraphic record of subduction initiation

Julie Prytulak (Imperial), IODP Expedition 352: Preliminary results from drilling the Bonin forearc

Michelle Harris (Southampton), Hydrothermal circulation in fast spread ocean crust—where and how much? Insight from ODP Hole 1256D

Figure 1.
Tina van de Flierdt (Imperial), Antarctic drilling—Results from IODP Expedition 318.

Outreach

On March 30th 2014 I boarded the JOIDES Resolution in Keelung Harbour, Taiwan, as an Education Officer for Expedition 350. We were headed for the Izu-Bonin-Mariana Rear Arc, about 150 km south of Japan. The purpose of Expedition 350 was to find the answers to a range of geological questions about the evolution of oceanic to continental crust in a subduction zone and rear arc system. There were three main areas of investigation. We attempted to drill back as far as the Early Oligocene or Eocene times when it is believed the subduction of the Pacific Plate underneath the Philippines Plate was initiated.

I am a geologist, lecturing in A Level Geology at Truro-Penwith College, Cornwall, so the opportunity for me to deepen my knowledge of the research process in order to be able to inspire my students was too good to miss. Our cohort of nearly 90 students were very keen to find out what is involved on a research ship, and eagerly waved me off on my 2 month sabbatical. During my absence the students all took part in live video links from on board.

My remit started well before the expedition began. By going through many geological contacts and organising teacher evenings through local STEM networks, I enrolled the interest of schools, colleges, home education groups, adult groups and museums from across the UK before I left. I also built on the wonderful work that Dr Susan Gebbels did as the last UK based Education Officer on Expedition 345 in Dec 2012–Feb 2013. She passed on a lot of useful information and contacts to me so I could continue the work she had started. By the time I embarked I had produced a long schedule of live video-conference broadcasts from the ship to be streamed directly into learning spaces. People 'on-shore' were able to see the action on the ship in real time and ask questions of the scientists and watch them working. Because the audiences were mainly lay people or younger pupils and science students, the thrust of the sessions was 'how, where, why and by whom is this research carried out'?

The total number of broadcasts done by myself and my American colleague, Julia DeMarines, was 117 — beating the previous

record by a considerable margin! We spoke to people across the globe—Australia, Japan, Iraq, numerous European countries, Canada and the USA amongst others. Working alternate 12 hour shifts meant that I could cover Japan and Australia at midday, through Europe and into the UK in the early evening and even East Coast USA before midnight when I finished, and my colleague could then take over the rest of the USA and across to Hawaii during the night and into the morning. It was particularly exciting to see all my classes of students sitting in the geology lab back at home grinning at me—nearly 6000 miles away! Apart from the video-broadcasts, I also prepared some maths and navigation based teacher resources for the Deep Earth Academy website.

I stepped off the ship in Yokohama on 30 May 30, following an amazing 2 months at sea, and after getting home to Cornwall at teatime on Monday 2nd June, I was back in my geology lab at 9.00 am on Tuesday morning recounting my adventures to my students! My lecturing commitments mean that I haven't been able to run any workshops or follow-up sessions with schools during term time, although I have had many requests to do this. However, on my return I began a series of evening and holiday lectures based on my experiences and the people I met. The talk series started with a presentation to female Earth science students from across the South West at Plymouth University in July, and then continued into some Café Scientifique presentations in Cornwall over the summer and autumn. I am due to run a session for the Royal Geological Society of Cornwall in the New Year. Over the summer I also organised two family workshops at a local mining heritage site (King Edward Mine—where I am a long-time education volunteer) comparing what is found under the ground in Cornwall with what was found below the seabed.

The most valuable part of the trip for me was being able to increase my own understanding of the science involved in this research from an observer's standpoint. While the scientists were all focussing very hard on their own areas of research interest, I could stand back and get a broader picture of what was going on. I took the time to talk to the drilling and technical crews about what it was like to live and work on board ship—the pleasures and pitfalls of 2 months on and 2 months off! I interviewed many people about their career trajectories through the fields of science and technology. Some were young research scientists still working towards a PhD while others were experienced Professors. Many of these stories I use in my teaching as role models and examples of how anybody can get to the top in geology if they work hard and focus on what they want to achieve.

I became particularly interested in the investigation techniques used in down-hole logging, micropalaeontological dating, geochemistry and thin section analysis. Some of the printed materials and samples I was allowed to bring off the ship now be-deck my lecture room and will form an intrinsic part of my teaching this academic year, allowing me to further inspire a new cohort of potential geologists of the future. More than one student has expressed an interest in going into research as a direct result of watching the live broadcasts from the ship and hearing me talk about the reality of Earth science research opportunities. I hope many more students will benefit from this in the future.

I would like to thank UKIODP for their support, and the team at Ocean Leadership in the USA for choosing me from the list of aspiring sea-farers!

Lesley Allen, Geology Lead, Truro-Penwith College, Cornwall.

lesleya@truro-penwith.ac.uk

UKIODP Knowledge Exchange activities

Sally Morgan has been appointed to as the NERC funded UKIODP Directed Knowledge Exchange Fellow and will be based in the Department of Geology at the University of Leicester, where she was recently appointed as a Research Fellow. Sally has worked within industry and has a long-standing relationship with IODP, first sailing as a UK scientist in 2005. Subsequently she worked at the University of Leicester, and more recently at the Lamont-Doherty Earth Observatory, delivering downhole logging and core petrophysical services to IODP on the JOIDES Resolution and Mission Specific Platforms. More recently, Sally sailed as the Logging Staff Scientist on Expedition 352 in the Izu-Bonin-Mariana Forearc.

The fellowship has four key objectives:

1. To **increase** the uptake of IODP data.
   The various IODP databases provide an unparalleled databank, a baseline audit of which will evaluate and document the current level of use of this valuable resource. The KEF will work in collaboration with the IODP database hosts to move towards improved databases, with enhanced uptake and a means of quantitatively recording data usage.

2. To **improve** the visibility of UKIODP and promote its engagement with industry.
   Industry currently has considerable involvement with IODP, but this is not always transparent. Focused marketing will be employed to better communicate existing collaborations and to seed new ones. This marketing will include participation in industry conferences and seminars, as well as more targeted meetings with individual companies. In addition, social media (LinkedIn, Twitter, Reddit) will be used to help create an active and integrated UKIODP-industry community. The KEF is an ECORD Industry Liaison Panel Observer with the primary function of facilitating increased diversity and reach of the Panel and communicating the ILP's activities to the wider community. The KEF will also facilitate the staging of collaborative industry-hosted seminars (including 'Frontier Exploration' hosted by the London Petrophysical Society on 25 June 2015) and a Complementary Project Proposal workshop to actively bring together the two communities.

3. To **encourage** industry-supported collaborative UKIODP research.
   In 2013, a specific call for UKIODP-CASE studentships delivered a positive response, with 2 awards made. Building on this, the KEF will work in collaboration with NERC and the UKIODP community to increase visibility of IODP on the NERC CASE webpages and JeS forms, including a link for direct contact to the KEF. In addition to promotion of CASE studentships, the potential for ad hoc industry-supported moratorium-style awards will be explored. As interactions with industry are enhanced, further potential UKIODP-industry research synergies will be identified.

4. To **identify** and **promote** the potential impact of the IODP investment.
   The fellowship's strategy is to look both ways, not only fostering UKIODP-industry engagement, but also actively promoting the interaction of the UKIODP research community with UK policy makers. Communication of the impact of IODP science to policy makers and other key stakeholders is essential in order to maximise governmental support for continued ocean drilling research. In collaboration with UKIODP researchers and industry partners, a series of impact case studies will be developed for the Science Impacts Database (with select examples added to the NERC and UKIODP websites) and NERC (Planet Earth) and industry publications (for example, BP and Offshore). The KEF will also engage with government through individual meetings and workshops, involving decision makers and strategists.

Feel free to contact Sally about any KE questions or queries you may have.

Phone: 0116 252 3922
Email: ukiodp_kef@le.ac.uk
Follow UKIODP-KEF on Twitter: @Sci_fOD

Join the community LinkedIn group: The UKIODP-Industry Network.

UKIODP news

Sean Burke (Science Coordinator-BGS), Vicki Norton (Program Manager-NERC)

Websites:
http://www.bgs.ac.uk/iodp/ (Coordinator's website: Program activities, guidance, and scientific highlights)

http://www.nerc.ac.uk/research/funded/programmes/ukiodp/ (Formal website: program announcements and information)

International Ocean Discovery Program (IODP) (2013–2023)

The cuurent phase of IODP commenced in October 2013. All implementing organizations have agreed to administer programmes under the governing goals laid out in the new Science Plan 'Iluminated Earth's Past, Present and Future' (http://www.iodp.org/science-plan-for-2013-2023). UK scientists played a central role in developing the Science Plan which is organized around four themes:

1. Climate and Ocean Change: Reading the Past, Informing the Future

2. Biosphere Frontiers: Deep Life, Biodiversity, and Environmental Forcing of Ecosystems

3. Earth Connections: Deep Processes and Their Impact on Earth's Surface Environment

4. Earth in Motion: Processes and Hazards on Human Time Scales

Structure
The European Consortium for Ocean Research Drilling (ECORD) members have of signed the MoU concerning national contributions to ECORD.

Under the new IODP program, it has been agreed by all the lead funding agencies that there will be a simplified funding model (no 'co-mingled funds'), with lighter management. While maintaining the overarching international umbrella of the program, platform providers will have greater independence.

Details of these agreements are stated in the following letter issued by ECORD:

http://www.ecord.org/Letter_to_ECORD_Science_Community.pdf

ECORD berths
The result of this restructuring is that in comparison with the past 10 year phase, there will be more ECORD (and by extension, UK) berths on JOIDES *Resolution* (JR) and Mission Specific Platform (MSP) expeditions, and fewer on *Chikyu*. It is anticipated that there will be up to 400 ECORD berths on JR over the next phase. ECORD is planning to run and average of one MSP per year, with a minimum of 10 ECORD berths per expedition (i.e. ~100 berths over the 10 year program), it is anticipated that approximately six berths will be available for ECORD scientists on *Chikyu* per year, (i.e. ~60 over the 10 year program).

Co-chief scientists will not count against berth quotas in the new program. All told, it is expected there will be between 500 and 600 ECORD berths over the next 10 year program, a 25–50% increase on the concluding program.

UK-IODP (2013–2018); Next phase for NERC's directed research program

Following the evidence gathering exercise of 2010-2011, the Review in 2011 (http://www.nerc.ac.uk/research/funded/programmes/ukiodp/findings.asp), and the presentation to NERC, the UK-IODP research program successfully renewed for five years (2013–2018), after which time the program will be subject to review. In 2013, the UKIODP Program Advisory Group and Management Office revised the Theme Action Plan (TAP) that was presented by Prof. Harry Elderfield (temporary Theme Leader for Earth System Science (ESS)) to the NERC Science and Innovation Strategy Board (SISB). With SISB's recommendation the TAP was funded by NERC Council in June with a budget of £5.5 m for the first 5 years of the new program. Taking recommendations from the NERC 2011 Review of UKIODP, and knowing early on it would be untenable to maintain the pot of 'ring fenced' grant funding as allocated for 2003–2013 phase, the structure for the new program was defined by the NERC ESS Theme Leader (Prof. Tim Jickells up until October 2012, followed by Prof. Harry Elderfield) with input from the UK-IODP Program Advisory Group. Notable elements of the new program include:

- Moratorium Awards (new) — incorporates participation costs for IODP expeditions (continued) and post-cruise funding (continued) (~£2.5 mil over 5 years)
- Site Survey Grants (continued) (~£2.2 mil)
- Knowledge Exchange Function (new) (~£0.2 mil)

The British Geological Survey will continue to provide the UKIODP Science Coordination function, and NERC will continue to administer the program (~0.5 mil).

Moratorium awards
These awards combine salary support for expedition participants and funding for post cruise research. Moratorium awards are available to all IODP expedition participants, however available funding for post cruise research will depend on career stage:

PhD student — £25000

Post-doctoral researcher — £50000

Tenured scientist — £25000

Applications for Moratorium Awards will be made through JeS prior to joining expedition. Further detail and guidance is available on the NERC UK-IODP webpages and through the UKIODP mailing list.

Knowledge Exchange program
The NERC Ocean Drilling Review highlighted that more could be done to engage more widely in Knowledge Exchange activities. In response Dr Sally Morgan has been recruited to a new role within UKIODP as a Knowledge Exchange Fellow, on a part-time basis for 3 years, further details are above.

Further news on the Knowledge Exchange post will be forthcoming through the UK-IODP mailing list.

Site survey grant rounds
A key requirement of the IODP proposal evaluation process is that potential drill sites have adequate site surveys to justify selection of safe drill sites. UK-IODP will continue to make available resources to allow the UK community to acquire such site surveys, since they are essential for UK-lead expedition applications. These grants in the past have been important for establishing UK's leadership in UK-IODP.

It is anticipated that there will be one call for Site Survey Grants over the remainder of the existing program.

Science coordination

- Continue to communicate program news and opportunities to network of over 500 UK scientists who engage in IODP-related research.
- Support UK scientists participating in IODP expeditions as well as those engaged in the IODP Science Advisory Structure (SAS).
- Organise, facilitate, and sponsor science meetings/workshops
- Establish program research priorities with NERC managers and the Program Advisory Group.
- Support student opportunities and outreach (e.g. Summer schools, and Teachers at Sea)
- Regularly publish program literature through newsletters, website, advocacy reports, etc . . .

UK-IODP Program Advisory Group
The chair of the Program Advisory Group (PAG) is Damon Teagle. The PAG comprises delegates to IODP's Science Advisory Structure (SAS) international panels, and several invited members. A 3+1 rotation policy has been implemented on the PAG, which entails three years commensurate with SAS membership, then one further year on PAG.

UKIODP Program Advisory Group (PAG) membership		
All IODP Science Advisory Structure (SAS) panel members plus chair, and other invited members		
Member	**SAS Panel/Role**	**PAG membership ends (3+1)**
Damon Teagle	*Chair of the PAG*	September 18
Dick Kroon (Edinburgh)	*Chair of the Science Evaluation Panel*	December 15
Lisa McNeill (Southampton)	*Science Evaluation Panel*	November 16
Steve Bohaty (Southampton)	*Science Evaluation Panel*	May 18
David Long (BGS)	*Science Evaluation Panel*	September 18
Mads Huuse (Mancester)	*Science Evaluation Panel*	September 17
Bridget Wade (Leeds)	*ESSAC (Tony Morris ESSAC alternate)*	October 16
David McInroy (BGS)	*ESO representative*	Ongoing
Sally Morgan (Leicester)	*Knowledge Exchange Fellow*	October 17
Bridget Wade (Leeds)	*ESSAC (Tony Morris ESSAC alternate)*	October 16

Grants:

UK-IODP Moratorium Award recipients

Cruise Number	Dates	Grant Reference	Title	Participant's name	Research Organisation/ University
350	30 March–30 May 2014	NE/M005240/1	History of large magnitude explosive volcanism in the Japan region: implications for tectonics and long term hazards	Sue Mahoney	Bristol
350	30 March–30 May 2014	NE/M005232/1	Palaeoceanographic records from the NW Pacific, 16-0 Ma	Eleanor John	Cardiff
350	30 March–30 May 2014	NE/M005178/1	Neogene West Pacific tectonic influence on global climate via the Kuroshio Current	Maryline Vautravers	Cambridge
350	30 March–30 May 2014	NE/M005224/1	Submarine eruption and sedimentation processes in the rear Izu-Bonin-Mariana arc	Martin Juetzler	NOC
351	30 May–30 July 2014	NE/M007782/1	Volcanic arc initiation and evolution	Ivan Savov	Leeds
351	30 May–30 July 2014	NE/M007367/1	Rotation of the Philippine Sea Plate	Tony Morris	Plymouth
351	30 May–30 July 2014	NE/M017370/1	Philippine Sea: Neogene NW Pacific Deep Water Circulation	Sev Kender	Nottingham
352	30 July–29 Sept 2014	NE/M008193/1	Geochemical and sedimentological evidence used to characterise supra-subduction spreading processes in the Izu-Bonin-Mariana forearc	Alastair Robertson	Edinburgh
352	30 July–29 Sept 2014	NE/M010643/1	Investigating conditions of subduction initiation with stable isotopes	Julie Prytulak	Imperial
352	30 July–29 Sept 2014	NE/M012034/1	Subduction Initiation Investigated by Drilling of the Izu-Bonin-Mariana (IBM) Forearc	Julian Pearce	Cardiff

Recent rapid response grants
Rapid response grants have supported small-scale, shore research activities relating to IODP leg objectives. As of 15 March 2014, Rapid Response grants are no longer available to ship-based IODP participants (all 3 platforms) as well as shore-based participants on Mission Specific Platform (MSP) expeditions, as these individuals are eligible for Moratorium Awards.

Rapid Response Grants will be available to shore-based Science Party members of JOIDES Resolution and Chikyu expeditions, who are not eligible for the Moratorium Awards.

Get involved—mailing list
Would you like to hear more about research opportunities with IODP? From announcements to join IODP expeditions, to meeting announcements, to funding opportunities, the UKIODP Announcements include monthly newsletter. Email the Science Coordinator (ukiodp@bgs.ac.uk) to have your name added to the mailing list. Also see the websites listed at the top of this section.

UKIODP contacts

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Useful websites

International Ocean Discovery Program (UK)
www.ukiodp.bgs.ac.uk
www.nerc.ac.uk/research/funded/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

Science Plan for IODP (2013–2013)
http://www.iodp.org/science-plan-for-2013-2023

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

IODP core repositories

Bremen Core Repository (BCR) (Germany); Gulf Coast Core Repository (GCR) (US); Kochi Core Repository (KCC) (Japan). Access through central IODP website:
http://www.iodp.org/repositories

IODP national offices

Finland http://iodpfinland.oulu.fi/
France www.iodp-france.org/
Germany http://www.bgr.bund.de/DE/Themen/MarineRohstoffforschung/IODP/Home/iodp_node.html
Netherlands www.iodp.nl/
Portugal http://e-geo.ineti.pt/ecord/
Spain http://www.iodp-icdp.es/
Switzerland www.swissiodp.ethz.ch

IODP China http://iodp-china.org/
IODP Korea www.kiodp.re.kr
IODP Australia and New Zealand http://iodp.org.au/

IODP related sites

Consortium for Ocean Leadership
http://www.oceanleadership.org/; and
http://www.oceanleadership.org/scientific-programs/scientific-ocean-drilling/

European Science Foundation (ESF)
www.esf.org

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

International Continental Scientific Drilling Program (ICDP)
http://www.icdp-online.org/home/

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

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

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

Acronym list

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 (old)	Engineering Development Panel (SAS)
EMA	ECORD Management Agency
EPC	European Petrophysical Consortium
EPSP	Environmental Protection and Safety Panel (SAS)
ESO	ECORD Science Operator
ESSAC	ECORD Science Support and Advisory Committee
ETF (old)	Engineering Task Force
FB	Facility Board (e.g. ECORD and JOIDES *Resolution* FB's; Chikyu IODP board (CIB)
GCR	Gulf Coast Repository
ICDP	International Continental Scientific Drilling Program
IIS-PPG	Industry-IODP Science Program Planning Group
ILP	Industry Liaison Panel (ECORD)
IO(s)	Implementing Organization(s)
IODP	International Ocean Discovery Program
IODP-MI	International Ocean Discovery Program — Management International
ISP	Initial Science Plan
J-DESC	Japan Drilling Earth Science Consortium
JOI	Joint Oceanographic Institutions, Inc.
JR	JOIDE S *Resolution*
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 (old)	Operations Task Force (SAS)
PEP (old)	Proposal Evaluation Panel (SAS)
PI	Primary Investigator
POC	Platform Operations Costs
SAS	Science Advisory Structure
SASEC (old)	Science Advisory Executive Committee (SAS)
SEP	Sceince Evaluation Panel (SAS)
SIPCom	Science Implementation and Planning Committee (SAS)
SOC	Science Operating Costs
SCP (old)	Site Characterization Panel (SAS)
SPC (old)	Science Planning Committee (SAS)
SSEP (old)	Science Steering and Evaluation Panel (SAS)
SSP (old)	Site Survey Panel (SAS)
STP (old)	Scientific Technology Panel
TAP (old)	Technology Advice Panel
TP	Technology Panel (SAS)
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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IODP

INTERNATIONAL OCEAN DISCOVERY PROGRAM

NERC

SCIENCE OF THE ENVIRONMENT