IODP
INTERNATIONAL OCEAN DISCOVERY PROGRAM

UK newsletter 40
2015

NERC
SCIENCE OF THE ENVIRONMENT

ECORD
European Consortium for Ocean Research Drilling

Recent UK based IODP expedition participants

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Back cover: Using a Remotely Operated Vehicle to inspect the drillstring and seabed during IODP Expedition 325 Great Barrier Reef Environmental Changes. (Credit: Mary Mowat).

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Foreword

Sean Burke (UK IODP Science Programme Coordinator)), Vicki Norton (Programme Manager-NERC), Mike Webb (Programme Executive Officer, NERC), and the UK IODP Programme Advisory Group (see p.24 for membership).

The UK IODP Programme continues to play a major part in the International Ocean Discovery Programme and has supported the participation of over 20 UK scientists and co-chiefs on IODP expeditions and provided co-funding to several scientific workshops/conferences including the UK annual IODP Conference and student workshop both in the UK and internationally. A significant number of scientists also participate directly in offshore operations, making excellent use of legacy core material, and are disproportionately represented on new drilling proposals, and are frequently involved as onshore science collaborators.

Within the programme 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 programme, participants will benefit from an improved post-cruise funding model, 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 continues to be IODP publications from UK scientists, illustrating the high level of outputs from the programme.

Scientific results from recent expeditions

Expedition 354 – Bengal Fan

29 January – 31 March 2015

Lyndsey R Fox University of Leeds and Yanina M R Najman, Lancaster University

International Ocean Discovery Expedition 354 to 8°N in the Bay of Bengal drilled a seven site, 320 km long transect across the Bengal Fan. Three deep-penetration and an additional four shallow holes give a spatial overview of the primarily turbiditic depositional system that comprises the Bengal deep-sea fan. Sediments originate from Himalayan rivers, documenting terrestrial changes of Himalayan erosion and weathering, and are transported through a delta and shelf canyon, supplying turbidity currents loaded with a full spectrum of grain sizes. Mostly following transport channels, sediments deposit on and between levees while depocenters laterally shift over hundreds of kilometers on millennial timescales. During Expedition 354, these deposits were documented in space and time, and the recovered sediments have Himalayan mineralogical and geochemical signatures relevant for reconstructing time series of erosion, weathering, and changes in source regions, as well as impacts on the global carbon cycle. Miocene shifts in terrestrial vegetation, sediment budget, and style of sediment transport were tracked. Expedition 354 has extended the record of early fan deposition by 10 My into the late Oligocene.

Figure 1.
Map of the Himalayan erosion system showing the position of existing DSDP and ODP sites documenting the Bengal and Indus Fans or the mon-soon history. Box = location of Expedition 354 Middle Bengal Fan (MBF) drill site transect at 8°N. Bengal Fan sediment isopachs (blue lines; in kilometers) are simplified from Curray et al. (2003) and represent the total sedimentary and metasedimentary rocks above the oceanic basalt as interpreted from seismic reflection and refraction data.

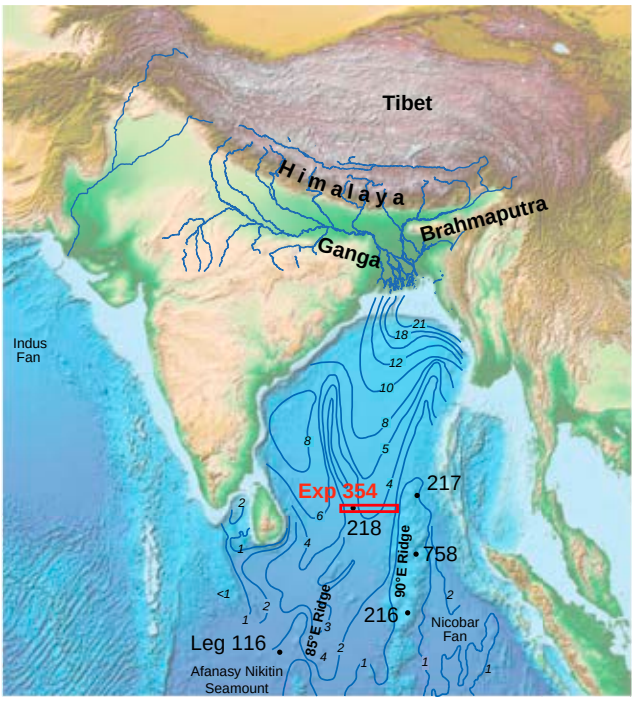
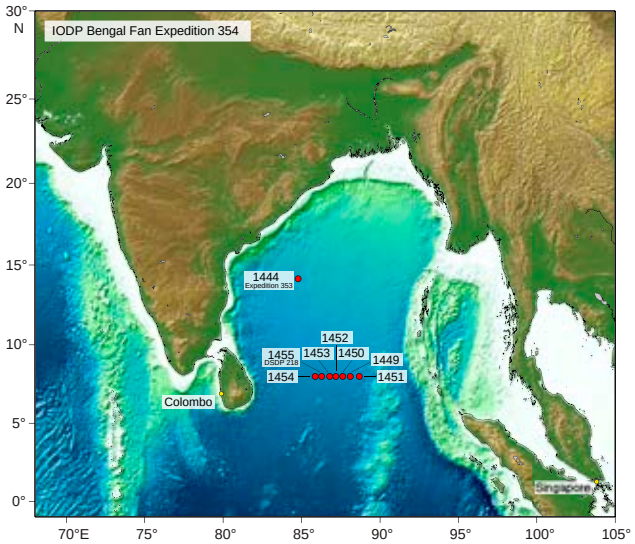


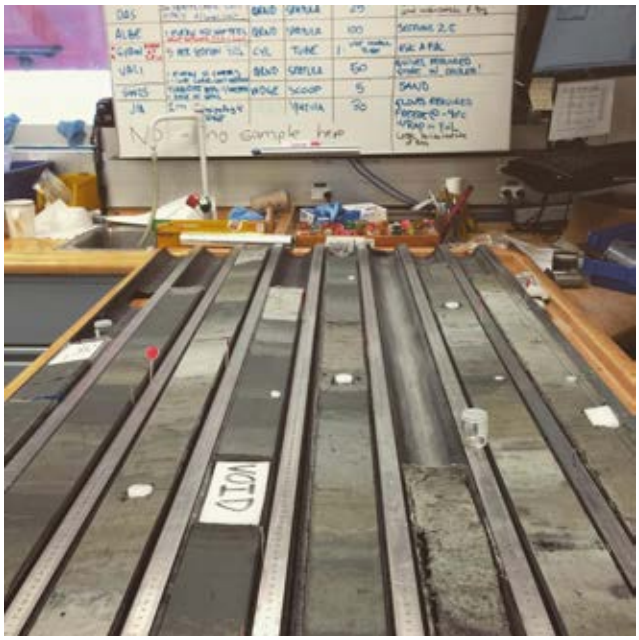
Figure 2.
Location of Expedition 354 drill sites.



Lyndsey Fox who sailed on the expedition went on to say 'Myself and the scientists who sailed on Expedition 354 (Jan–Mar 2015) have been investigating the connection between the uplift of the Himalayas and how the mountain belt has influenced global climate since it started to form 50 million years ago. We drilled a transect of seven Sites across the middle Bengal Fan in water depths of more than 3500 m. The sandy turbidites we were trying to recover often made drilling conditions extremely tricky, however thanks to a patient and dedicated team of drilling technicians we reached over 1 km below the sea floor to recover sediments and rocks spanning almost the entire Cenozoic and set the record for the deepest piston core in IODP history (so far…).

As a micropalaeontologist some of the scientific highlights for me were:

- Using the biostratigraphy, polarity record, and other stratigraphic markers to tie together and correlate all seven Pleistocene transect sites.
- Taking advantage of the fantastic table top scanning electron microscope (SEM).
- Working with a great group of Biostratigraphers and a great science party.
- Having very recently completed my PhD it has been a great experience for me to learn and work with scientists from all over the world. I am already looking forward to seeing everyone again at the sampling party in September and getting started on my post cruise research.



Reference

France-Lanord, C, Spiess, V, Klaus, A and the Expedition 354 Scientists, 2015. Bengal Fan: Neogene and late Paleogene record of Himalayan orogeny and climate: a transect across the Middle Bengal Fan. *International Ocean Discovery Program Preliminary Report*, 354. http://dx.doi.org/10.14379/iodp.pr.354.2015

Expedition 355 – The Arabian Sea monsoon expedition

31 March – 31 May 2015

James A P Bendle, Birmingham University

The Indian (southwest) summer monsoon is one of the most intense climatic phenomena on Earth. Its long-term development has been linked to the growth of high topography in South and Central Asia. The Indian continental margin, adjoining the Arabian Sea, offers a unique opportunity to investigate tectonic–climatic interactions and the net impact of these processes on weathering and erosion of the western Himalaya. During International Ocean Discovery Program Expedition 355, two sites (U1456 and U1457) were drilled in Laxmi Basin in the eastern Arabian Sea to document the coevolution of mountain building, weathering, erosion, and climate over a range of timescales. In addition, recovering basement from the eastern Arabian Sea provides constraints on the early rifting history of the western continental margin of India with special emphasis on continental breakup between India and the Seychelles and its relationship to the plume-related volcanism of the Deccan Plateau.

Drilling and coring operations during Expedition 355 recovered sediment from Sites U1456 and U1457 in the Laxmi Basin, penetrating 1109.4 and 1108.6 m below seafloor (mbsf), respectively. Drilling reached sediment dated to 13.5–17.7 Ma (late early to early middle Miocene) at Site U1456, although with a large hiatus between the lowermost sediment and overlying deposits dated to <10.9 Ma. At Site U1457, a much longer hiatus occurs near the base of the cored section, spanning from 10.9 to ~62 Ma. At both sites, hiatuses span ~8.2–9.2 and ~3.6–5.6 Ma, with a possible condensed section spanning ~2.0–2.6 Ma, although the total duration for each hiatus is slightly different between the two sites.

A major submarine fan draining the western Himalaya and Karakoram must have been supplying sediment to the eastern Arabian Sea since at least ~17 Ma. Sand mineral assemblages indicate that the Greater Himalayan Crystalline Sequence was fully exposed to the surface by this time. Most of the recovered sediment appears to be derived from the Indus River and includes minerals that are unique to the Indus Suture Zone, in particular glaucophane and hypersthene, most likely originating from the structural base of the Kohistan arc. Pliocene sandy intervals at Site U1456 were deposited in lower fan 'sheet lobe' settings, with

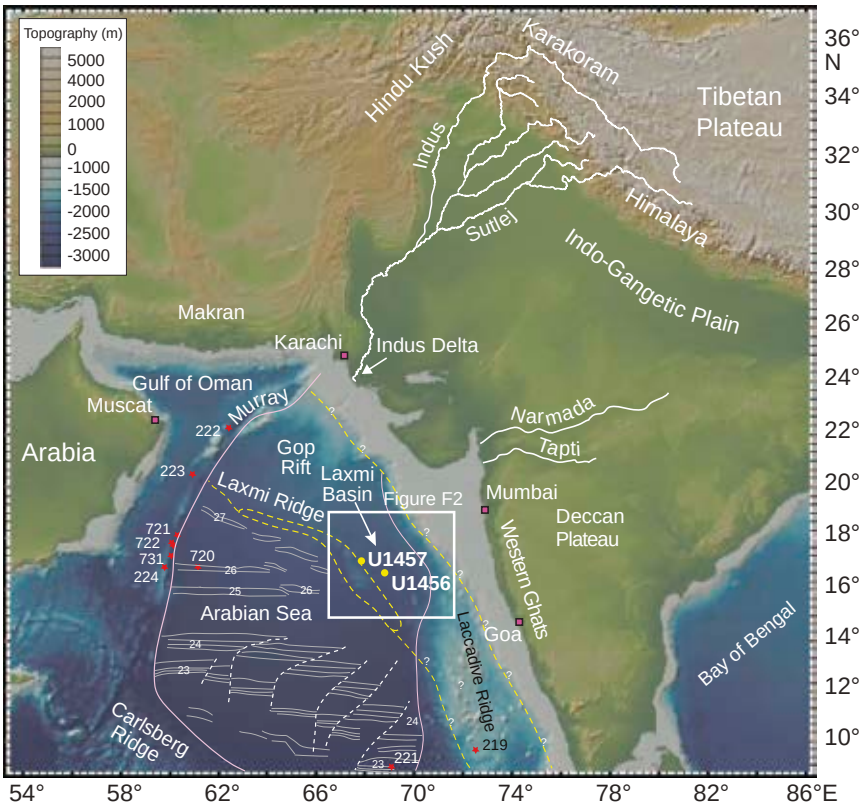


Figure 1.
Bathymetric map of the Arabian Sea and surrounding landmasses from GeoMapApp (Ryan et al., 2009). Yellow circles = Expedition 355 sites, white lines = major rivers and tributaries, red stars = earlier scientific drilling sites that have sampled the Indus Fan, pink line = approximate extent of the fan after Kolla and Coumes (1987), yellow dashed lines = speculated location of the continent/ocean boundary, depending on whether Laxmi Basin is oceanic or conti-nental, gray lines with numbers = magnetic anomalies from Royer et al. (2002), white box = location of detailed map in Figure 2.

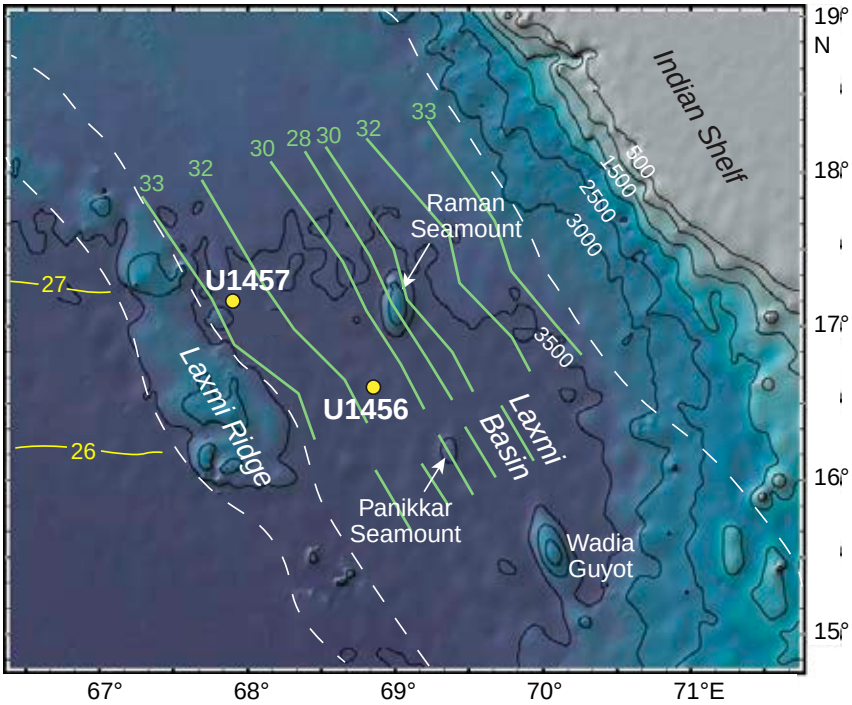


Figure 2.
Bathymetric map of the region around Laxmi Basin showing the location of Expedition 355 sites in relation to other major bathymetric features, especially Laxmi Ridge. White dashed lines = possible locations of the continent/ocean boundary, depending upon whether the crust in Laxmi Basin has con-tinental or oceanic affinity. Magnetic anomalies (yellow lines) from the Arabian Basin are from Miles et al. (1998), whereas those in Laxmi Basin (green lines) are from Bhattacharya et al. (1994). Contours (black lines) are in meters below sea level. Bathymetric data from GeoMapApp (Ryan et al., 2009).

intervals of basin plain turbidites separated by hemipelagic muddy sections deposited during the Miocene. Site U1457 is more distal in facies, reflecting its more marginal setting. No major active lobe appears to have affected the Laxmi Basin since the Middle Pleistocene (~1.2 Ma).

We succeeded in recovering sections spanning the 8 Ma climatic transition, when monsoon intensity is believed to have changed strongly, although the nature of this change awaits postcruise analysis. We also recovered sediment from a large mass transport deposit measuring ~330 and ~190 m thick at Sites U1456 and U1457, respectively. This section includes an upper sequence of slump-folded muddy and silty rocks, as well as underlying calcarenites and limestone breccias, together with smaller amounts of volcanic clasts, all of which are likely derived from the western Indian continental shelf. Identification of similar facies on the regional seismic lines in Laxmi Basin suggests that these deposits form parts of one of the world's largest mass transport deposits.

Coring of igneous basement was successful at Site U1457. Recovery of massive basalt and associated volcaniclastic sediment at this site should address the key questions related to rifting and volcanism associated with formation of Laxmi Basin. Geochemical analysis is required to understand the petrogenesis and thus the tectonic setting of volcanism that will reveal whether it is oceanic basalt or volcanic rock contaminated by underlying continental crust or continental flood basalt. However, the fact that the lavas are massive and have few vesicles implies water depths of eruption likely deeper than 2000 m. This precludes opening of the basin in the presence of a major mantle thermal anomaly, such as that associated with the Deccan Large Igneous Province. Other observations made at the two sites during Expedition 355 provide vital constraints on the rift history of this margin. Heat flow measurements at the two drill sites were calculated to be ~57 and ~60 mW/m^2. Such heat flow values are compatible with those observed in average oceanic crust of 63–84 Ma age, as well as with the presence of highly extended continental crust. Postcruise analyses of the more than ~1722 m of core will provide further information about the nature of tectonic–climatic interactions in this global type area for such studies.

Reference

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Expedition 356 – The Indonesian throughflow expedition

31 July – 30 September 2015

Benjamin Petrick, University of Newcastle Upon Tyne

The Indonesian Throughflow (ITF) is a critical part of the global thermohaline conveyor. It plays a key role in transporting heat from the equatorial Pacific (the Indo-Pacific Warm Pool, IPWP) to the Indian Ocean and exerts a major control on global climate. The complex tectonic history of the Indonesian Archipelago due to the continued northward motion and impingement of the Australasian Plate into the SE Asian part of the Eurasian plate makes long-term (million year) reconstructions of ITF history difficult. The best areas in the Indian Ocean to determine ITF history are either in the deep ocean away from strong tectonic deformation or along passive margin regions that are directly under the influence of the ITF. While previous deep-water ODP and DSDP cores in the Indian Ocean have been used to chart IPWP influence (and by proxy ITF variability), these sections lack direct biogeographic and sedimentological evidence of the ITF. We propose to drill a transect of shelf to shelf margin cores over 10° latitude in the Northwest Shelf of Australia (NWS) to obtain a five million year record of ITF, IPWP and climate evolution that has the potential to match orbital scale deep sea records in its resolution. Drilling the NWS will reveal a detailed shallow water history of ITF variability and its relationship to climate. It will allow us to understand the history of the Australian monsoon and its variability, a system whose genesis is thought to be related to the initiation of the East Asian monsoon and which is hypothesized to have been in place perhaps since the Pliocene or

Figure 1.
Outline of drilling locations (Credit: Bill Crawford, IODP JRSO).

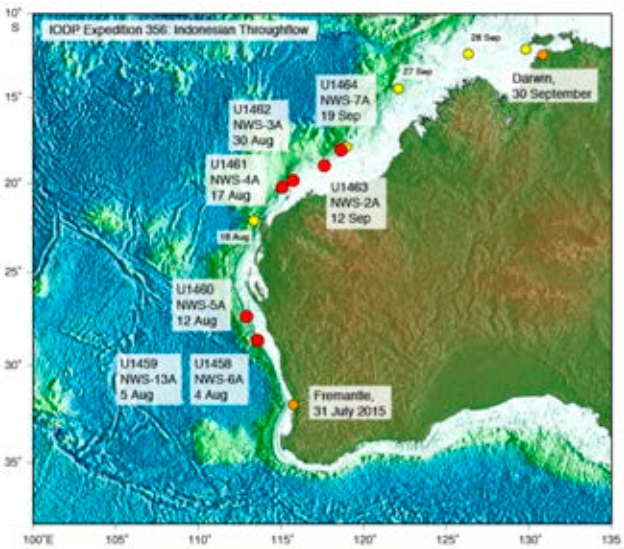


Figure 2.
The research vessel JOIDES Resolution *(JR), in Fremantle, Australia, the morning before the ship sailed on Expedition 356. (Credit: Bill Crawford, IODP JRSO) [Photo ID: exp356_001].*

Figure 3.
The scientists have a lot of work to get oriented. The expedition started off with a short transit of only 14 hours and "core on deck" came shortly after. All of the data that is generated must be entered into the ship's database. The main tool used for core description is DESClogik, a database program developed by IODP. Zenon Mateo (Core Laboratory, IODP JRSO) (center) gives instructions to core describers Tobias Himmler (Sedimentologist, University of Bremen, Germany), Helen McGregor (Sedimentologist, University of Wollongong, Australia), Donald Potts (Sedimentologist, University of California, Santa Cruz, USA), and Lars Reuning (Sedimentologist, RWTH Aachen University, Germany). (Credit: Benjamin Petrick & IODP) [Photo ID: exp356_017]

earlier. It also will lead to a better understanding of the nature and timing of the development of aridity on the Australian continent. Detailed palaeobathymetric and stratigraphic data from the transect will also allow us to construct subsidence curves to constrain the spatial and temporal pattern of vertical motions caused by the interaction between plate motion and convection within the Earth's mantle, known as dynamic topography. The NWS is in an ideal location to study this phenomenon since it is positioned on the fastest moving continent since the Eocene, on the edge of the degree two geoid anomaly. Accurate subsidence analysis over 10° of latitude will resolve whether northern Australia is moving with/over a time transient or long term stationary downwelling within the mantle, thereby vastly improving our understanding of the dynamics of deep Earth processes.

Expedition 357 – Atlantis Massif seafloor processes: Serpentinization and life

26 October – 11 December 2015

Gaye Bayrakci, Sophie Green, Carol Cotterill, Sally Morgan, Michelle Harris and Andrew McCaig

On October 26th, an international team of scientists sailed from Southampton, UK, on board the British *Royal Research Vessel James Cook*. During a 6-week expedition in the Atlantic Ocean the team explored the Atlantis Massif, a prominent, nearly 4000 metre high underwater mountain which is part of the world's longest mountain chain. Led by Co-Chief Scientists Gretchen Früh-Green, ETH Zurich, Switzerland, and Beth Orcutt, Bigelow Laboratory for Ocean Sciences, USA, the team collected cores of rocks using seabed rock drills. The plan was to drill at 11 sites in water depths of 720 to 1770 metres and to recover cores between 50 and 70 metres in length. "Scientifically the sea bed is remarkable because the Atlantis Massif is made up of rocks from the Earth's mantle", says marine geologist Gretchen Früh-Green, who explored this remarkable sub-seafloor region already during expeditions in 2003 and 2005. "In the presence of seawater these rocks produce the greenhouse gas methane, hydrogen and heat, among other things." Such rock reactions excite scientists because they represent possible sources to fuel life in the absence of sunlight and may be analogous to conditions found on other planets, or early in Earth's history. "Among other things we hope to learn more about what kind of life exists on and within rocks at the Atlantis Massif", says marine microbiologist Beth Orcutt. "Moreover we shall investigate the fate of carbon. Do the reactions between rocks and seawater lead to carbon storage in the seafloor? And does this process impact the global carbon cycle and our climate?"

Overall the expedition aims to study

- how mantle rocks are brought up to the seafloor,
- how the rocks react with seawater,
- how carbon is cycled during this process,
- what type of life exists on and within the rocks and how organisms can survive in this extreme environment.

The expedition is conducted by the European Consortium for Ocean Research Drilling (ECORD) as part of the International Ocean Discovery Program (IODP). Two rock drills were installed on the *RRS James Cook*, operated by the British Geological Survey and MARUM, the Centre for Marine Environmental Sciences in

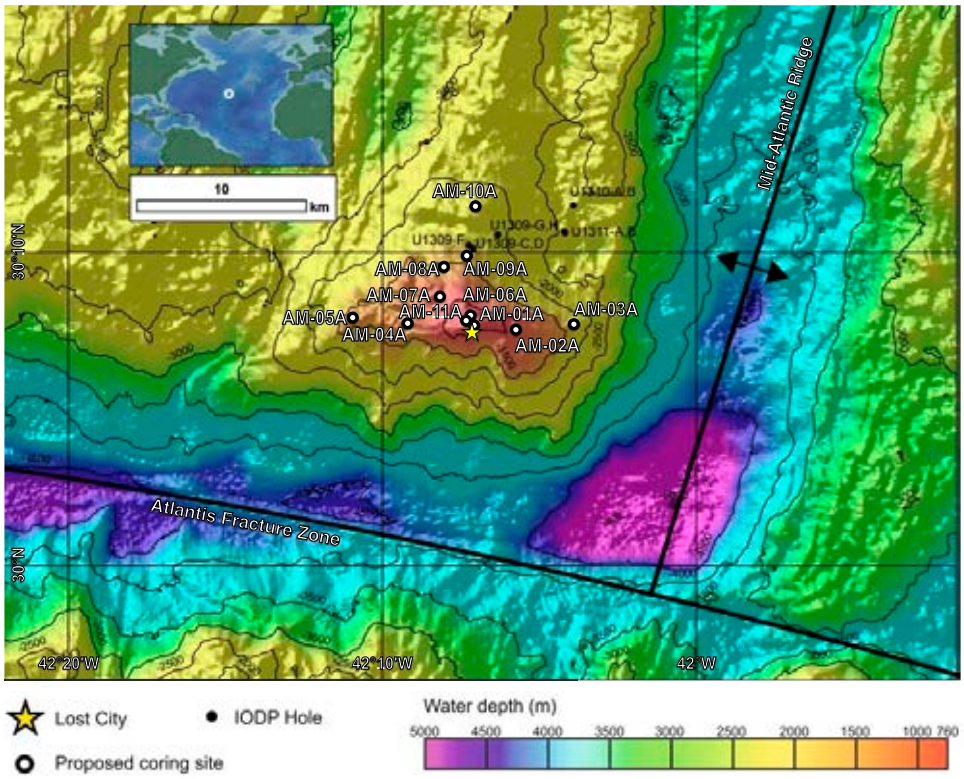


Figure 1.
Site locations for Expidition 357.

Bremen/Germany. It is the first expedition of this kind to use this type of remotely operated drilling technology.

The expedition 357 is a mission specific platform. The *R/V James Cook* arrived at Southampton one week before sailing for the installation of the two drill rigs: Mebo (Marum) and RD2 (BGS). Two teams of engineers from Marum and from BGS were present on board, and they will be operating the drill rigs. A group of ESO scientists, who have significant experience in IODP processes, also arrived earlier and they made ready the necessary equipment and consumables. On the 25th of October, UK IODP organised a icebreaker where expedition participants met the UK scientists from the National Oceanography Centre. The ship sailed from Southampton on the 26th of October at 10:00 and was expected to be at the Atlantis Massif within approximately 8 days. The expedition was expected to last approximately in 46 days.

Gaye went on to report 'During the transit, the first day we had a ship induction talk and an emergency exercise. Eight days of transit was very busy and would be discussing about the core flow, the priority of the drill sites, expected rocks, moratorium research plans of individual scientists and the requirements of IODP regarding to publications. There was some training and demonstrations from the ESO scientists and from Marum and BGS teams about different technologies that will be used during the expedition 357.

Gaye descried her role was to 'use the Multi-Sensor Core-Logger (MSCL) to make measurements of magnetic susceptibility, gamma density, P-wave velocity and non-contact electrical resistivity on the cores. A first the magnetic susceptibility measurement will be done with fast track MSCL-152 prior to microbiology sampling. Then, the whole set of measurements will be carried out with the MSCL-99 on the cores that we will be brought into the room temperature. These measurements will be used for the identification of different rock types and their alteration state, the quantification of their fracture density and their water content and therefore will widely participate to the realisation of the multi-disciplinary goals of the expedition'.

Expedition 359 – Maldives Monsoon

30 September – 30 November 2015

Dick Kroon and Jeremy R Young

The aim of the Maldives Monsoon expedition was to investigate Neogene Indian Ocean environmental change and the onset of the modern carbonate depositional system driven by fluctuations in sea level and ocean currents. Seven sites where to be drilled across the Maldives carbonate system to obtain sediments from the inner-platform to the continental slope including drifts deposits. These will (1) document environmental changes in the Maldives and place the Maldives current system into the larger scale ocean current framework during Neogene global cooling and monsoon evolution, (2) determine the onset of the modern depositional system, and (3) constrain the pre- to post-drowning evolution of the carbonate bank by linking existing seismic stratigraphic and the new sedimentary records.

Scientists returning from the expedition to the Inner Sea of the Maldives reported recovering 3097 m of cores that contain the history of the Indian monsoon and the ocean current system. The international team of scientists retrieved rocks from buried reefs that reveal the growth and demise of ancient coral reefs and sediments from ocean currents that reveal the onset and fluctuations of the Indian monsoon. The monsoon is one of the most dramatic recurring weather phenomena on Earth and affects over a billion people every year. However, little is known about when the monsoon started and how it changed over time, or if it could change again in the future. The monsoon brings rainfall to the continents for agriculture, and on the oceans it is known for its winds that change direction with the winter and summer monsoon. For many years scientists have tried to reconstruct the monsoon history from the rain-induced weathering and discharge into the ocean. In the expedition onboard the research vessel JOIDES *Resolution* a novel approach was taken to extract the history from wind-related features.

Today, the winds of the monsoon drive the ocean currents across the Maldives. These currents, like rivers in the ocean, carry sediment. In the Inner Sea of the Maldives the currents slow down and release the sediment to build large drift deposits. The sediments in these drifts hold the record of climate change and monsoon activity for the last 12 million years. The sediments, however, also bury ancient reef buildups that flourished in the Inner Sea before the monsoon started. These reefs carry the history of sea level changes before the onset of the monsoon.

"We have unraveled the physical evidence of the monsoon and now know the exact timing of when the modern monsoon pattern began, and have shown what consequences the onset of the monsoon had on the coral reefs of the Maldives," says Christian Betzler, Co-Chief Scientist for Expedition 359, from the CEN at the University of Hamburg in Germany. "The scientific results of this expedition will give answers to many fundamental questions about the monsoon and the climate in general."

The team found evidence for a period of global cooling that preceded the onset of the monsoon. This led to an expansion of

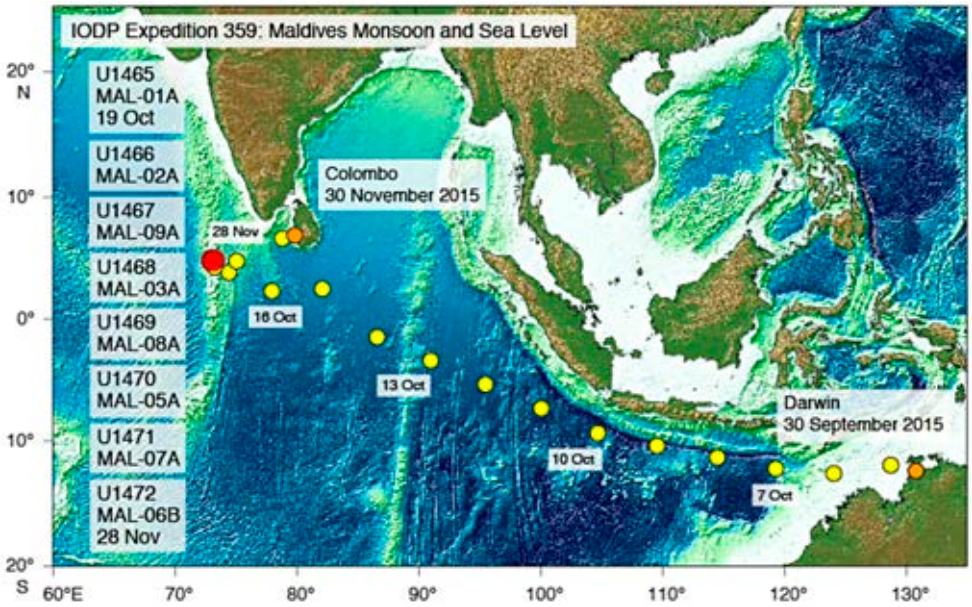


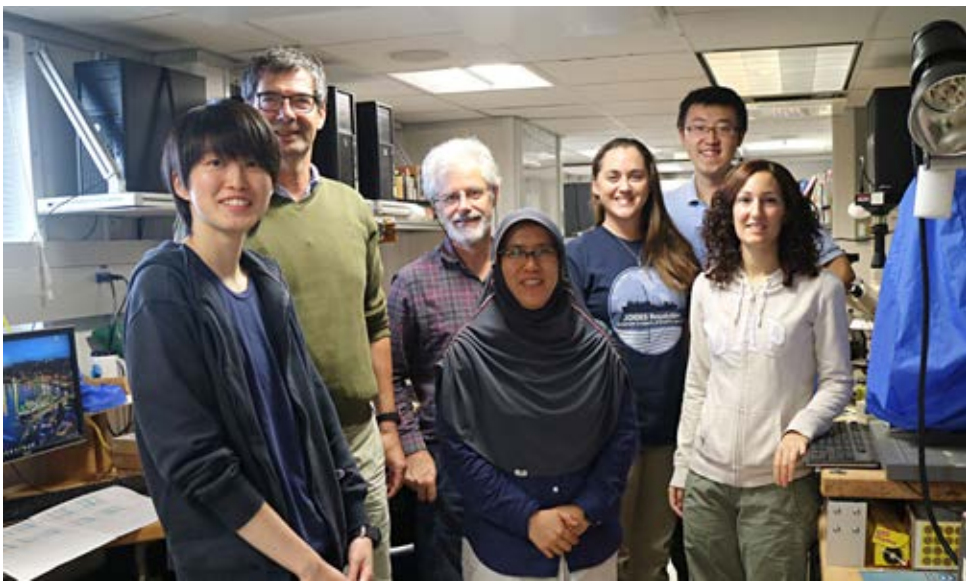
Figure 1.
IODP Expedition 359 Maldives Monsoon and Sea Level.

the West Antarctic Ice Sheet that was responsible for global sea level fall that exposed many reefs in the Maldives. During this global cooling period the monsoon started and currents invaded the Inner Sea of the Maldives. The sediment that was carried by the current buried several reefs. The currents also caused local upwelling that was again detrimental to the reefs. At three of the eight drill sites, these drowned reefs were found covered by current deposits. "Not only the upwelling, which injected nutrients that harmed the reefs, but also the strength of the currents sweeping over the reef flats and along the flanks of the reefs were detrimental for the corals and the reef edifices" states Gregor Eberli, Co-Chief Scientist of Expedition 359, from the University of Miami in the USA.

The scientific party of the cruise was very surprised to discover that the current pattern changed may times, indicating reorganizations and changes in the monsoonal system. Such changes are most likely caused by the variations of the Earth orbital path. The scientists are looking forward to working out the details of the monsoonal evolution that is essential for so many people in Asia and India. This will be done by analyzing the many samples recovered during this expedition.

Figure 2.
Dick Kroon and Jeremy R. Young on Expedition 359.

Figure 3.
Paleontologists in their home away from home — the paleo lab. (Credit: Santi Pratiwi & IODP) [Photo ID: exp359_098].



Expedition 360 – Southwest Indian Ridge lower crust and Moho: the nature of the lower crust and Moho at slower spreading ridges (SloMo Leg 1)

5 December – 30 January 2016

Christopher MacLeod (Cardiff), Antony Morris (Plymouth)

International Ocean Discovery Program (IODP) Expedition 360 formed the first leg of 'SloMo', a multiphase drilling project that aims ultimately to drill through the Mohorovicic Discontinuity, the seismic boundary conventionally regarded as the crust/mantle boundary. The near-uniform depth to Moho, of ~7 km below seafloor in the oceans, coupled with a very regular internal seismic structure to the ocean crust above, has been taken since the inception of plate tectonics to imply that ocean crustal thickness and internal structure is uniform and simple irrespective of spreading rate. However, over the past decade or so this paradigm has been called into question, at least for slower spreading ridges, at which serpentinised peridotites (mantle rocks altered by interaction with water) may be found on the seafloor, sometimes exposed in 'oceanic core complexes', the footwalls of large-offset extensional detachment faults. Despite the obvious tectonic complexity of these regions their seismic structure is typically very similar to ocean 'crust' elsewhere, raising doubts as to whether the Moho, at least in these regions, can therefore indeed represent the boundary between gabbroic igneous crust above and mantle beneath. Perhaps the Moho instead represents a 'serpentinisation front: the lower limit of seawater penetration into the mantle lithosphere? Partially serpentinised peridotite has the same velocity (Vp = ~6 km/s) as gabbro; hence the premise held for the past half century, that the seismic lower 'crust', with Vp = ~6 km/s, must be gabbro because gabbro has this velocity, is false: it could be serpentinite instead, or a mixture of serpentinite and gabbro (Figure 2). In recognising this we have fundamentally undermined all our assumptions about the regularity of ocean crustal structure and mechanisms of seafloor spreading. The consequent implications for our understanding of heat and mass budgets and global element cycling are profound. If indeed much of the lower 'crust', at least at slower-spreading ridges, is made from serpentinite there are further implications still: serpentinisation of peridotite generates heat, hydrogen and methane, which are fuel for microbes. Microbes are increasingly being found in association with serpentinite wherever we have looked for them, raising the spectre that a huge undiscovered microbial biosphere exists in the ocean basement, potentially kilometres below the seafloor, over vast swathes of the ocean basins.

Figure 1.
IODP Expedition 360 location.

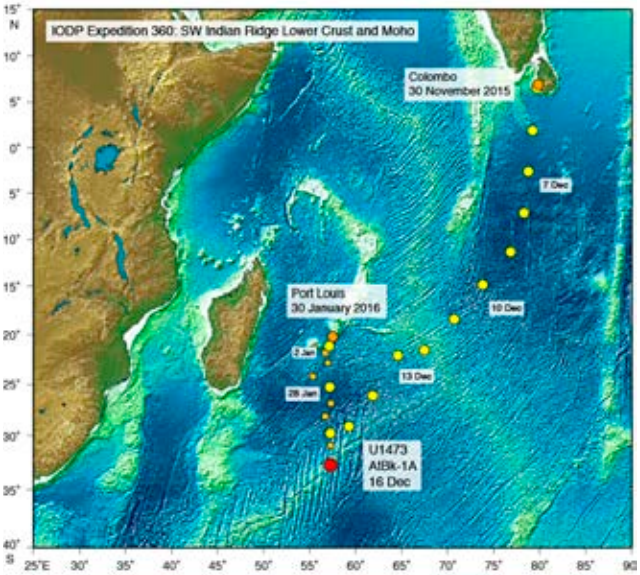
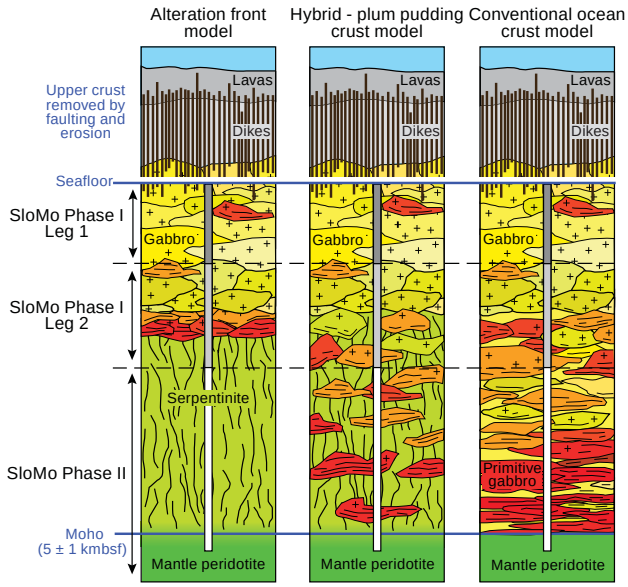


Figure 2.
Alternative models for the lower crust and mantle (Dick et al., 2016 Exp. 360 Prelim. Rept).



The SloMo project aims to drill an ultra-deep hole over a series of expeditions with the ultimate objective of penetrating the seismic Moho and testing the above ideas. On the way to this goal SloMo will test models for the accretion of the igneous lower crust in magma chambers beneath spreading ridges, the hypothesis that the igneous crust/(partially serpentinised) mantle boundary lies at some shallower depth within the seismic lower 'crust' than the

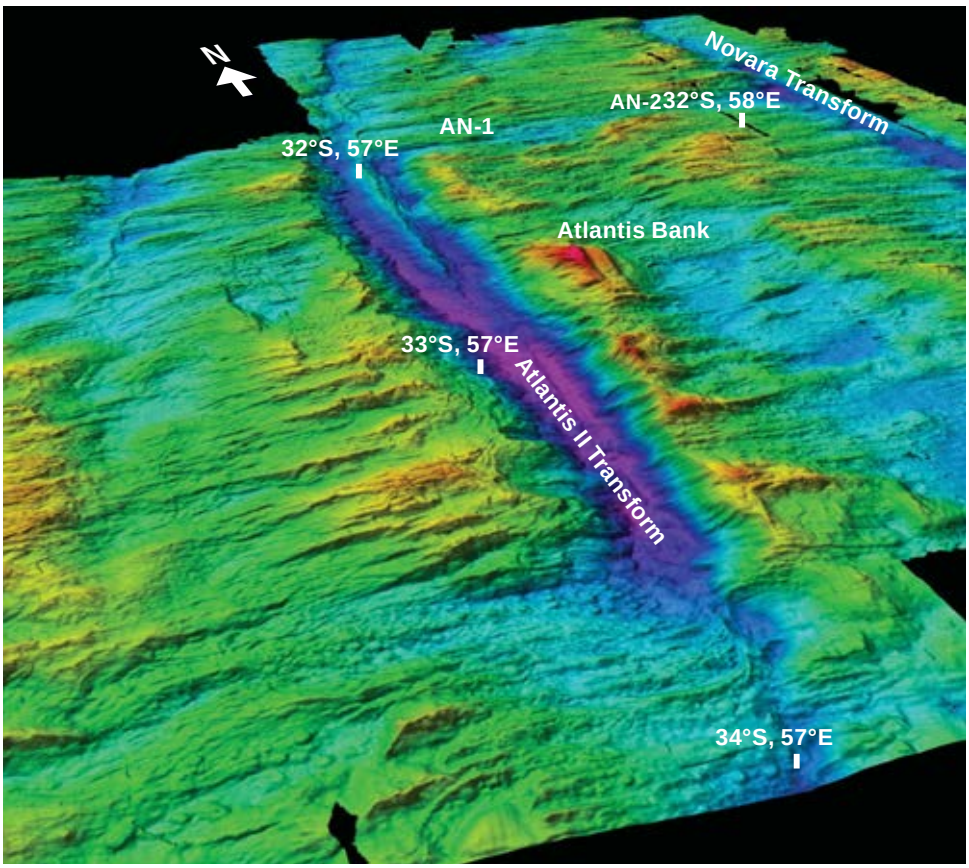


Figure 3.
3D perspective view of the Atlantis II transform, looking NNE. At 700 m water depth Atlantis Bank (red) forms the shallowest portion of an oceanic core complex that borders the 6300 m-deep transform fault zone (Dick et al., 2016 Exp. 360 Prelim. Rept). Warm colours shallow, cold deep.

Moho, and the idea that microbes live deep within the oceanic basement.

The site chosen for this venture is Atlantis Bank, an 11Myr-old oceanic core complex on the ultraslow-spreading Southwest Indian Ridge, adjacent to the Atlantis II transform fault (Figure 3). Atlantis Bank lies at the very shallow water depth of 700 m, and site survey investigations (including NERC-funded seabed rock drilling cruise RRS James Clark Ross cruise JR31 led by Chris MacLeod et al.) have shown that it was once at sea-level and formed an island. Later subsidence has left a flat bare-rock platform, mostly of gabbro, and optimal conditions for drilling. Previous ODP operations at Atlantis Bank (Legs 118, 176 and 179) drilled >1500 m of gabbroic lithologies, variably deformed in the footwall of a detachment fault. The site survey cruises however found serpentinised peridotite on the flanks of Atlantis Bank and, in places, on its summit, this despite a seismic refraction survey by Tim Minshull and colleagues (then Cambridge) that found a Moho reflection at 5–5.5 km below the summit of Atlantis Bank.

Tectonics having removed the upper crust already, and wave erosion having left a stable bare-rock pavement of gabbro, Atlantis Bank was agreed upon by the scientific community as the optimal place to attempt to drill to the Moho and test the hypothesis that the Moho represents an alteration front. SloMo is entirely complementary to ongoing efforts (at Hole 1256D) to drill a whole crustal section 'Mohole' in fast-spread crust in the Pacific, at which the ocean crustal structure is magma-dominated; it and the Moho are likely to be fundamentally different here. It is also complementary to recent IODP Expedition 357, to the Atlantis Massif oceanic core complex on the Mid-Atlantic Ridge at 30°N, which employed seabed rock drills to explore the interactions between tectonics, fluid circulation, and biosphere in near-seafloor serpentinised peridotite.

IODP Expedition 360, 'SloMo Leg 1', sailed from Colombo, Sri Lanka, on 5th December 2015 and arrived at Atlantis Bank (57°E, 32°S) eleven days later. Operations continued until 27th January 2016, albeit with a six day hiatus to evacuate a crew member, and the expedition finished in Mauritius on 30th January. Located on the north-central part of Atlantis Bank, 1–2 km away from the two previous ODP holes (735B and 1105A), Hole U1473A was drilled 789.7 meters below seafloor (mbsf) into massive olivine gabbro cut by isolated dolerite dykes. By comparing the stratigraphies of the three holes we are able to assess the lateral continuity of gabbroic lower crustal stratigraphy for the first time. Much of the gabbro is plastically deformed, related to displacement on the detachment fault that unroofed Atlantis Bank and/or the internal deformation of the detachment footwall. The shallower part of the hole was affected by brittle faulting, culminating in what we believe to be a hydrologically active fault zone at ~469 m below seafloor, and which appears to be associated with microbial activity. This brittle deformation

affected core recovery in the upper part of the hole and also hole stability, to the extent that we lost drill cones in the hole on two occasions and were obliged to fish for them, losing substantial time in the process. Once below the main fault zone, however, conditions were very stable and core recovery increased to a remarkable 96% in the lower 200 m of the drilled interval, including a single unbroken rod of core an unprecedented 2.85 m in length (Figure 4).

Despite all the time lost during Expedition 360 we still achieved the deepest-ever igneous rock penetration from the seafloor during a single 2-month expedition (789.7mbsf), and were successful in establishing a hole that can be reoccupied and is viable to be deepened substantially on future SloMo expeditions.

URLs of examples of the media activities associated with Expedition 360

BBC Science: http://www.bbc.com/news/science-environment-34967750

Nature: http://www.nature.com/news/quest-to-drill-into-earth-s-mantle-restarts-1.18921

Daily Mail: http://www.dailymail.co.uk/sciencetech/article-3342572/Is-life-hidden-Earth-s-mantle-Mission-drill-planet-s-crust-search-samples-super-hot-rock.html

BBC World Service/Radio 4: http://www.bbc.co.uk/programmes/p039jtt7

Figure 4.
Expedition 360 scientists with 2.85 m-long rod of gabbro from Hole U1473A. From left to right: Henry Dick (Co-Chief Scientist), Virginia Edgcomb (microbiologist), Chris MacLeod (Co-Chief Scientist), Tony Morris (palaeomagnetist), Peter Blum (staff scientist), Benoit Ildefonse (physical properties) and Steve Midgley (Operations Superintendent).

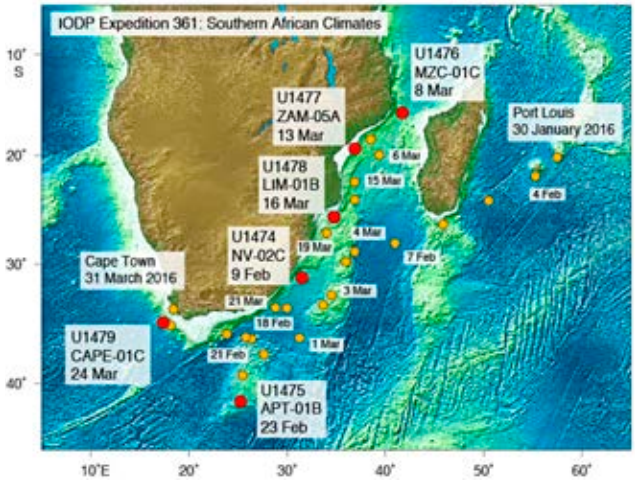
Expedition 361 – South African Climates (Agulhas LGM Density Profile)

30 January – 31 March 2016

Ian R Hall, Sidney R Hemming and Leah J LeVay

International Ocean Discovery Program (IODP) Expedition 361 drilled six sites on the southeast African margin and in the Indian-Atlantic ocean gateway, southwest Indian Ocean, from 30 January to 31 March 2016. In total, 5175 m of core was recovered, with an average recovery of 102%, during 29.7 days of on-site operations. The sites, situated in the Mozambique Channel at locations directly influenced by discharge from the Zambezi and Limpopo River catchments, the Natal Valley, the Agulhas Plateau, and Cape Basin, were targeted to reconstruct the history of the greater Agulhas Current system over the past ~5 my. The Agulhas Current is the strongest western boundary current in the Southern Hemisphere, transporting some 70 Sv of warm, saline surface water from the tropical Indian Ocean along the East African margin to the tip of Africa. Exchanges of heat and moisture with the atmosphere influence southern African climates, including individual weather systems such as extratropical cyclone formation in the region and rainfall patterns. Recent ocean model and paleoceanographic data further point at a potential role of the Agulhas Current in controlling the strength and mode of the Atlantic Meridional Overturning Circulation (AMOC) during the Late Pleistocene. Spillage of saline Agulhas water into the South Atlantic stimulates buoyancy anomalies that act as control mechanisms on the basin-wide AMOC, with implications for convective activity in the North Atlantic and global climate change. The main objectives of the expedition were to establish the sensitivity of the Agulhas Current to climatic changes during the Pliocene–Pleistocene, to determine the dynamics of the Indian-Atlantic gateway circulation during this time, to examine the connection of the Agulhas leakage and AMOC, and to address the influence of the Agulhas Current on African terrestrial climates and coincidences with human evolution. Additionally, the expedition set out to fulfill the needs of the Ancillary Project Letter, consisting of high-resolution interstitial water samples that will constrain the temperature and salinity profiles of the ocean during the Last Glacial Maximum.

Figure 1.
IODP Expedition 361 location.



The expedition made major strides toward fulfilling each of these objectives. The recovered sequences allowed generation of complete spliced stratigraphic sections that span from 0 to between ~0.13 and 7 Ma. This sediment will provide decadal- to millennial-scale climatic records that will allow answering the paleoceanographic and paleoclimatic questions set out in the drilling proposal.

Reference

Hall, I R, Hemming, S R, LeVay, L J, and the Expedition 361 Scientists, 2016. Expedition 361 Preliminary Report: South African Climates (Agulhas LGM Density Profile). *International Ocean Discovery Program.* http://dx.doi.org/10.14379/iodp.pr.361.2016

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.

UKIODP is also providing funding for the ECORD Summer School 2016: Petrophysics, 26 June – 1 July 2016, Leicester, UK

Hosting and/or participating in IODP-related meetings is an important factor in maintaining UK scientist's success within the programme. 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 two UK students in the always excellent ECORD summer schools in Urbino and Bremen. A further five students received funding directly from ECORDhttp://www.essac.ecord.org/index.php?mod=education&page=summer-school).

ECORD – Urbino Summer School in Palaeoclimatology (USSP) –
Past Global Change Reconstruction and Modelling Techniques
University of Urbino, Italy, **July 15 – August 1, 2015**

Bremen ECORD Summer School –
Ocean crust processes: magma, faults, fluxes and life
MARUM, University of Bremen, Germany, **August 31 – September 11, 2015**

UK IODP Student Workshop and National Conference

22–25 September, 2015

The 2015 UK IODP Student workshop and National Conference was held in Allendale and Newcastle respectively from the 22nd to the 25th of September.

Both events were a great success which attracted lots of speakers and significant interest. Students were involved in presentations of their own research and developing expedition proposals.

It is planned to hold the student workshop again next year after such a welcomed event. A big thanks goes to Kate Littler and Bridget Wade for giving up their valuable time. Thanks also to the Newcastle team and presenters at both events. And a very big thank you to the students who made the three days so enjoyable.

UK IODP student reps were identified to help promote the programme within the universities.

For young scientists enquiring about UK IODP please either contact the relevant person below or the UK IODP Coordinator.

Figure 1.
Students enjoying a Skpe call to Exp 356.

Name	Email	University
Alex Clarke	alexander.clarke@live.rhul.ac.uk	Royal Holloway
Serginio Remmelzwaal	serginio.remmelzwaal@bristol.ac.uk	University of Bristol
Jenny Horrocks	j.r.horrocks@durham.ac.uk	Durham University
Sonja Felder	s.felder1@newcastle.ac.uk	Newcastle University
Mark Zindorf	m.zindorf1@newcastle.ac.uk	Newcastle University/School of Civil Engineering and Geosciences
Yuting Li	yl502@cam.ac.uk	University of Cambridge
Kathryn Gunn	klg48@cam.ac.uk	Cambridge (Bullard Labs)
Henrieka Detlef	DetlefH1@cardiff.ac.uk	Cardiff University
Lauren O'Connor	lauren.oconnor@earth.ox.ac.uk	Oxford
Ben Taylor	bjt@st-andrews.ac.uk	St Andrews University
Tom Williams	tom.jw88@gmail.com	British Antarctic Survey
Edward Inglis	e.c.inglis@durham.ac.uk	Durham University (Earth Sciences)
David King	david.king.13@ucl.ac.uk	UCL

Figure 2.
Preparing an expedition proposal

Figure 3.
Students and helpers for the workshop.

Figure 4.
National UKIODP Conference.

Outreach

Promoting the activities and accomplishments of the IODP to large audiences is one of the program's main goals. To achieve this within ECORD, an Outreach and Education Task Force consisting of members from the Managing Agency (EMA), Science Support and Advisory Committee (ESSAC) and the Science Operator (ESO) meet twice a year to plan and co-ordinate media events and activities that raise the profile of the program's science to the public, and the many other opportunities that are open to the science community.

The starting points for finding out about IODP are the main websites (www.ecord.org). ECORD has recently redesigned its website to make it clearer how to find information related to expeditions, science outputs, education and outreach, as well as the reports, brochures and newsletters that are published regularly. The new website will also include articles that describe, for example, a new publication by ECORD scientists or a report from one of the program meetings or workshops.

ECORD also takes information about opportunities to participate in IODP activities to major international conferences at which scientific sessions are organised by IODP scientists. In recent years, a joint booth and Townhall Meeting have been organised in collaboration with the International Continental Scientific Drilling Program (ICDP) at the EGU Conferences held in Vienna and the AGU Fall Meetings in San Francisco. Additional conference events are selected depending on the opportunity they provide to promote IODP in, for example, regions where the program has no member countries, such as at this year's International Geological Congress in Cape Town, South Africa, or to specialist conferences such as the Goldschmidt Conferences on geochemistry, and the International Sedimentological Congress. ECORD also supports conferences and public events attended by its member countries and IODP program partners in the USA, Japan, Australia, New Zealand, India, China, Brazil and South Korea by providing information about the Mission-Specific Platform (MSP) expeditions and other activities. One of the popular resources at exhibits are the replicas of cores that record significant events, such as evidence of the K/Pg boundary in a core collected from the Atlantic Ocean.

Promoting the MSP expeditions and science outputs is one of ECORD's main objectives. To date, ECORD has conducted seven MSP expeditions on behalf of IODP starting with the Arctic Coring Expedition (ACEX) in 2004, through to the most recent expedition to the Chicxulub Impact Crater in April 2016. Before each expedition, a Communications Plan is prepared in collaboration with the Co-Chief Scientists and Expedition Project Manager which describes the steps that will be taken to ensure that the expedition receives maximum publicity. This includes brochures and leaflets explaining the objectives in language that can be understood by the non-specialist—not always an easy task!

A media conference is always held at the beginning of the offshore phase of the expedition at a location close to the port where the platform is preparing to embark on the expedition and, if possible, the media conference is accompanied by a tour of the platform. For example, prior to the Atlantis Massif Expedition (IODP Exp.357) a press conference was held in London, and the following day a tour of the *RV James Cook* was organised in Southampton. A press conference was held in Mérida, Mexico during the week that the Chicxulub Impact Crater Expedition (IODP Exp. 364) science party arrived to transfer to the *L/B Myrtle*, which was already on site. As journalists were not able to visit the platform at that time, a media day was organised a few weeks later, which allowed more than 20 journalists and representatives from Mexican authorities to visit the platform and have a closer look at the operations. Throughout the expeditions, daily reports are provided by the EPM which are made available on the ECORD website. More informal reports of life onboard are provided through social media.

A few months after the offshore phase of the expedition, the entire Science Party meets at the Bremen Core Repository at the city university's Center for Marine Environmental Sciences (MARUM). The Onshore Science Party (OSP) provides further opportunities for outreach, such as the involvement of teachers, who in most cases are not able to participate in the offshore phase of MSP expeditions due to the lack of berths, which are given priority to the operations staff and a smaller group of the Science Party members. Towards the end of the OSP, another media day is organised to allow the Co-Chief Scientists to present their preliminary findings on behalf of the team and give an opportunity to see the laboratories at the BCR and meet the people involved.

Some expeditions attract more media interest than others. For example, the story about the Chicxulub expedition's aim to core through the crater formed by the asteroid that hit the Earth 65 million years ago and led to the extinction of 75% of life including the dinosaurs, has captured wide media attention. Throughout the expedition, a TV production company has filmed the operations team and scientists at work and documentaries will be broadcast in 2017 in a number of countries.

The work of the Education and Outreach Team also includes the production of a twice-yearly ECORD Newsletter that provides up-to-date information to the wide readership. ESSAC also supports a large number of activities that provide opportunities for those who do not get the opportunity to participate in an IODP expedition. These include the Distinguished Lecturer Programme, which allows any organisation to invite one of 5 lecturers to speak about their work. The highly successful Summer School programme provides opportunities for young scientists to join IODP scientists to listen to lectures and present their own work for discussion with experts in topics such as paleoclimatology, submarine geohazards and petrohysics. Scholarships are available to help attend the Summer Schools, as well as Research Grants to support novel work on IODP cores. ECORD also provides a 'Virtual Drillship Experience' through a training course at the Bremen Core Repository. The MagellanPlus

Workshop Series provides support for ECORD scientists who are developing ideas for an IODP proposal.

Finally, in addition to the collaboration with the ICDP, the ECORD team meets at least once a year with outreach colleagues from the USA and Japan to co-operate on spreading the word about the exciting opportunities that IODP presents for the science community, and the fascinating stories of public interest that come from exploring the Earth under the sea.

Further information about all outreach and education activities are available on the ECORD website (www.ecord.org) or from the ECORD Outreach Co-ordinator, Patricia Maruejol (maruejol@crpg.cnrs-nancy.fr).

UK IODP Knowledge Exchange

With a backdrop of political uncertainty in relation to the vote to leave the European Union, coupled with an oil price that will be lower for longer than first expected, it is a challenging yet exciting time for UK IODP knowledge exchange. Over the last year there has been a strong focus on identifying and promoting the impact of IODP research in the UK. A selection of these activities and outputs are outlined here:

Impact Case Studies

As you will be aware from the email requesting completion of the UK IODP Impact Capture Survey (www.iodp.rocks), we have been trying to identify impactful IODP research arising from within the UK. Based on the response from the survey, we will build on the existing portfolio of 8 case studies to help bolster the case for renewal in 2018. In addition to submissions to the NERC database, case studies will also have a narrative developed for publication in an end-user facing publication. An example of such a narrative can be found in GEOExPro: www.geoexpro.com/articles/2016/01/black-blue

UK IODP KE Travel Awards

This discretionary funding is aimed at supporting the UK IODP scientific community in their endeavours to engage with end-users. Individuals are invited to apply to the scheme to support both existing and emerging collaborative ventures with end-users, or to attend conferences that are end-user facing. Early career scientists are particularly encouraged to apply (www.iodp.rocks).

London Petrophysical Society (LPS) seminar

We co-hosted with LPS a very successful and well-attended one-day seminar on 'Old Data, New Tricks: fresh challenges, mature targets and scientific oddities'. The seminar brought together ~50 people from across the hydrocarbon industry and academia with presenters from both sectors, including 4 presentations that centred on IODP expedition data. LPS have shown interest in co-hosting a similar event again in the future.

ECORD Summer School

For the first time UK IODP will be hosting an ECORD Summer School having successfully secured a 10k EURO award from ECORD. The school, to be hosted at the University of Leicester in late June, will provide a unique week-long workshop on petrophysics with training provided by specialists from industry and across the IODP international community. There is also a 'fieldtrip' to Weatherford and the BGS Core store. Of the 30 participants, 8 are early career UK scientists, some of who have existing links with IODP.

Policy

UK IODP has been shortlisted for the 2016 intake of the Royal Society Policy Pairing Scheme. Further information should be available later in the summer.

Communication

Presentations: at meetings, including:

- Future of Hydrocarbon Exploration, Geological Society, London
- APPEX Global 2016, Business Design Centre, London (given by TGS)
- UK IODP General Meeting, Newcastle University

Website: Earlier this year a new UK IODP KE website was launched: www.iodp.rocks. A site aimed at both end-users and the science community to facilitate access to information about UK IODP KE, and with information about data access, opportunities and a blog, it is hoped it will become the primary portal for end-user engagement.

Banners: A series of six pull-up banners are available for use by the UK IODP community to help promote the programme. Further information about the banners and how to access them will be available on the website.

Pathways To Impact

Get in touch for help and advice on writing your PTI statements.

If you have any KE questions or ideas:

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

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

UK IODP news

Sean Burke (Science Coordinator-BGS), Jessica Surma (Programme Manager-NERC)

Websites

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

http://www.nerc.ac.uk/research/funded/programmes/ukiodp/ (Formal website: programme 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 present IODP programme, 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 programme, platform providers will have greater independence

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 programme), it is anticipated that approximately six berths will be available for ECORD scientists on *Chikyu* per year, (i.e. ~60 over the 10 year programme).

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

UK IODP (2013–2018); Present phase for NERC's directed research programme

Notable elements of the current programme 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 UK IODP Science Coordination function, and NERC will continue to administer the programme (~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 — £25 000
- Post-doctoral researcher — £50 000
- Tenured scientist — £25 000

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.

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 programme.

Science coordination

- Continue to communicate programme 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 programme research priorities with NERC managers and the Programme Advisory Group.
- Support student opportunities and outreach (e.g. Summer schools, and Teachers at Sea)
- Regularly publish programme literature through newsletters, website, advocacy reports, etc . . .

UK IODP Programme Advisory Group

The chair of the Programme 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.

UK IODP Programme Advisory Group (PAG) membership		
All IODP Science Advisory Structure (SAS) panel members plus chair, and other invited members		
Member	**Science Advisory Structure (SAS) Panel**	**PAG membership end date**
Damon Teagle (Southampton)	*Chair of the PAG*	September 18
Sally Morgan (Leicester)	*Knowledge Exchange Fellow*	October 17
Rebecca Bell (Imperial)	*Science Evaluation Panel*	January 20
Steve Bohaty (Southampton)	*Science Evaluation Panel*	December 18
David Long (BGS)	*EPSP (Environmental Protection and Safety Panel)*	September 18
Antony Morris (Plymouth) Kate Littler (alternative)	*ESSAC (ECORD Science Support and Advisory Committee))*	October 19
Paul Wilson (Southampton)	*JR Facilities Board*	November 19
Andy McCaig (Leeds)	*SEP*	September 20

UK IODP Moratorium Award recipients

Cruise number	Grant reference	Participant's name	Research Organisation/ University
355	NE/N005414/1	James Bendle	Birmingham
357	NE/N01684X/1	Sally Morgan	Leicester
357	NE/N012402/1	Gaye Bayrakci	NOC
357	NE/P000711/1	Andrew McCaig	Leeds
357	NE/P000061/1	Michelle Harris	Plymouth
359	NE/N012739/1	Dick Kroon	Edinburgh
359	NE/N014049/1	Jeremy Young	UCL
360	NE/N019199/1	Chris Macleod	Cardiff
360	NE/N019210/1	Tony Morris	Plymouth
361	NE/P000037/1	Ian Hall	Cardiff
361	NE/P000878/1	Stephanie Barker	Cardiff
361	NE/N020286/1	Margit Simon	Cardiff

Grants:

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 UK IODP 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.

UK IODP contacts

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ESO External Communication and Scientific Liaison

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agst@bgs.ac.uk

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 Programme (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 Programme
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 Programme
IIS-PPG	Industry-IODP Science Programme 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 Programme
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 Programme

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IODP
INTERNATIONAL OCEAN DISCOVERY PROGRAM

NERC
SCIENCE OF THE ENVIRONMENT