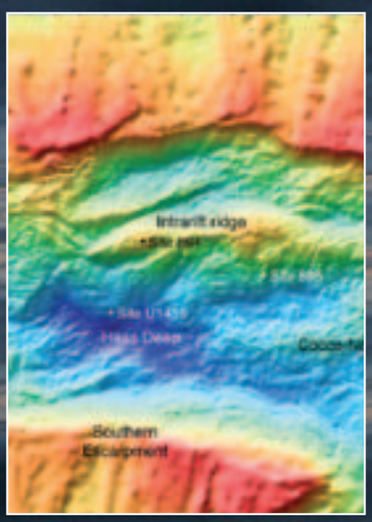
ECORD

EUROPEAN CONSORTIUM FOR
OCEAN RESEARCH DRILLING

ANNUAL REPORT 2013



ECORD
EUROPEAN CONSORTIUM FOR OCEAN RESEARCH DRILLING

IODP
INTERNATIONAL OCEAN DISCOVERY PROGRAM

From 2003 to 2013, European and Canadian scientists have participated in the Integrated Ocean Drilling Program (IODP) as part of the European Consortium for Ocean Research Drilling (ECORD). ECORD co-ordinated the European contribution to the programme through the mission-specific platform (MSP) concept, which allowed the ocean research community to work in technically challenging conditions where the US drillship *JOIDES Resolution* and the Japanese drilling vessel *Chikyu* are unable to operate. The development of the MSP concept has therefore added a new dimension to ocean drilling.

The ECORD Science Operator (ESO) consortium has successfully managed five MSP expeditions for the Integrated Ocean Drilling Program to the Arctic (2004), Tahiti (2005), New Jersey (2009), the Great Barrier Reef (2010), and the Baltic Sea (2013). ECORD's scientific and operational accomplishments have been prolific and of high quality, and are recognised by our global partners as a crucial contribution to the largest marine geosciences programme in the world.

The International Ocean Discovery Program (IODP), which started on 1st October 2013, will build on this legacy and address global challenges facing current and future generations with new research approaches, expanded scientific communities and continued development of its unique collaborative model.

The new IODP programme now involves scientists from 27 countries including the USA, Japan, China, South Korea, India, Australia, New Zealand, Brazil and the 19 ECORD countries, with Israel as its most recent member.

ECORD will continue to fund and implement MSP operations for IODP as an independent Platform Provider, with the aim to implement on average one expedition per year for the duration of the 2013-2023 programme. In future, MSPs might include specifically outfitted polar vessels, jack-up rigs, geotechnical vessels, seafloor drilling systems, long-piston coring, anchored barges and others, as determined by scientific priorities and operational efficiency.

ECORD will also continue to make financial contributions to the US National Science Foundation (NSF) for access to the *JOIDES Resolution* and to the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) for access to the *Chikyu*. Members of ECORD can therefore take part in all IODP expeditions that will address research topics that include climate and ocean change, biodiversity, sub-seafloor life, origin of life, natural hazards on human time scales, as well as the internal structure and dynamics of our planet.

Front cover: *from left to right, bottles of cuttings retrieved during Expedition 348 NanTroSEIZE - Plate Boundary Deep Riser 3 onboard the Chikyu (©JAMSTEC/IODP); drillsite map of Expedition 345 Hess Deep Plutonic Crust operated by the JOIDES Resolution; Greatship Manisha, drillship of Expedition 347 Baltic Sea Paleoenvironment (D. Smith ©ECORD/IODP); core tubes of sediments recovered during Expedition 347 (D. Smith ©ECORD/IODP). Background: the Baltic Sea (M. Mowat ©ECORD/IODP).*

Back cover: *Annick Fehr, Logging Staff Scientific, onboard the Greatship Manisha during Expedition 347 Baltic Sea Paleoenvironment (J. Groeneveld ©ECORD/IODP).*

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ECORD Annual Report 2013

1st October 2012 - 31st December 2013

Prepared by the ECORD Managing Agency,
the ECORD Science Operator,
the ECORD Science Support and Advisory Committee,
the ECORD Facility Board and the ECORD Industry Liaison Panel

Contents

Sand dunes in the Slowinski National Park about 120 km NW Gdansk (photo taken by Dominique Weis during the field excursion of the ESSAC & ECORD Council meetings).

1. FY2013 highlights

The final year of the Integrated Ocean Drilling Program, and the first three months of the new, groundbreaking International Ocean Discovery Program was an intense period for ECORD's scientific, operational, educational and outreach activities.

The **International Ocean Discovery Program** started on 1st October 2013, just as the *JOIDES Resolution* was returning from Expedition 346 Asian Monsoon, the *Chikyu* was operating offshore Japan for Expedition 348 NanTroSEIZE Stage 3, Plate Boundary Deep Riser, and the *Greatship Manisha* was implementing the mission-specific platform (MSP) Expedition 347 Baltic Sea Paleoenvironment, reflecting the continuity in scientific ocean drilling that has been the rule over the last decades.

The smooth transition between the old and new IODP has been made possible through the work done over the last three years by the International Working Group + and, more recently, by the new Facility Boards, to set up a new architecture for IODP, to define the Terms of Reference of the new Advisory Panels, and to detail the Procedures and Guidelines for IODP expeditions.

With the exception of Spain, for which the final decision is still pending, all current ECORD member countries have confirmed their participation in ECORD and defined their level of contribution, allowing ECORD to confirm its major objective to deliver an average of one MSP expedition a year for the IODP. Israel is the newest member of the programme, having joined ECORD at the start of the new IODP in October 2013.

New opportunities for raising the ECORD budget that will be available for MSP operations will be created through potential external co-funding and in-kind contributions, as well as through the possible expansion of the Consortium. Discussions have started with Russia, following a visit of an ECORD delegation to Saint Petersburg in June 2013.

The new **ECORD entities** started their activities in 2013, facing the challenges and taking advantage of the opportunities offered by the new IODP framework. Among these new entities, the **ECORD Facility Board** - the planning forum for MSP expeditions - was the first Facility Board to meet in early March 2013 in Edinburgh, UK. The **ECORD Industry Liaison Panel** - the ECORD link between academia and industry - met for the first time in early May 2013 in Geneva, Switzerland. The **ECORD Vision Task Force** is the ECORD strategic entity in charge of developing a long-term scientific and funding strategy and monitoring ECORD's progress towards the completion of the IODP Science Plan.

Operating mission-specific platforms

The **ECORD Science Operator (ESO)** implemented Expedition 347 Baltic Sea Paleoenvironment from 12th September to 1st November 2013. The objectives of the expedition were to record climate changes over the last 130,000 years in six sub-basins of the Baltic Sea, close to the former Scandinavian Ice Sheet. Seventeen ECORD scientists were invited to participate in the Science Party and the two Co-chiefs are ECORD scientists.

Anticipating future MSP expeditions

ESO also scoped several projects that were prioritised for implementation by the new ECORD Facility Board at its first meeting: Proposals 548 Chicxulub K-T Impact Crater, and 758 Atlantis Massif Seafloor Processes. The number of MSP proposals at various development stages has never been so high in the IODP evaluation and operational structures, and their diversity in terms of science topics (climate change, sea-level change, geohazards, hydrogeology, ocean crust) and geographical distribution, with a special focus on the climate evolution of polar regions (Arctic and Antarctic), demonstrates the great success of the MSP concept.

Participating in IODP expeditions

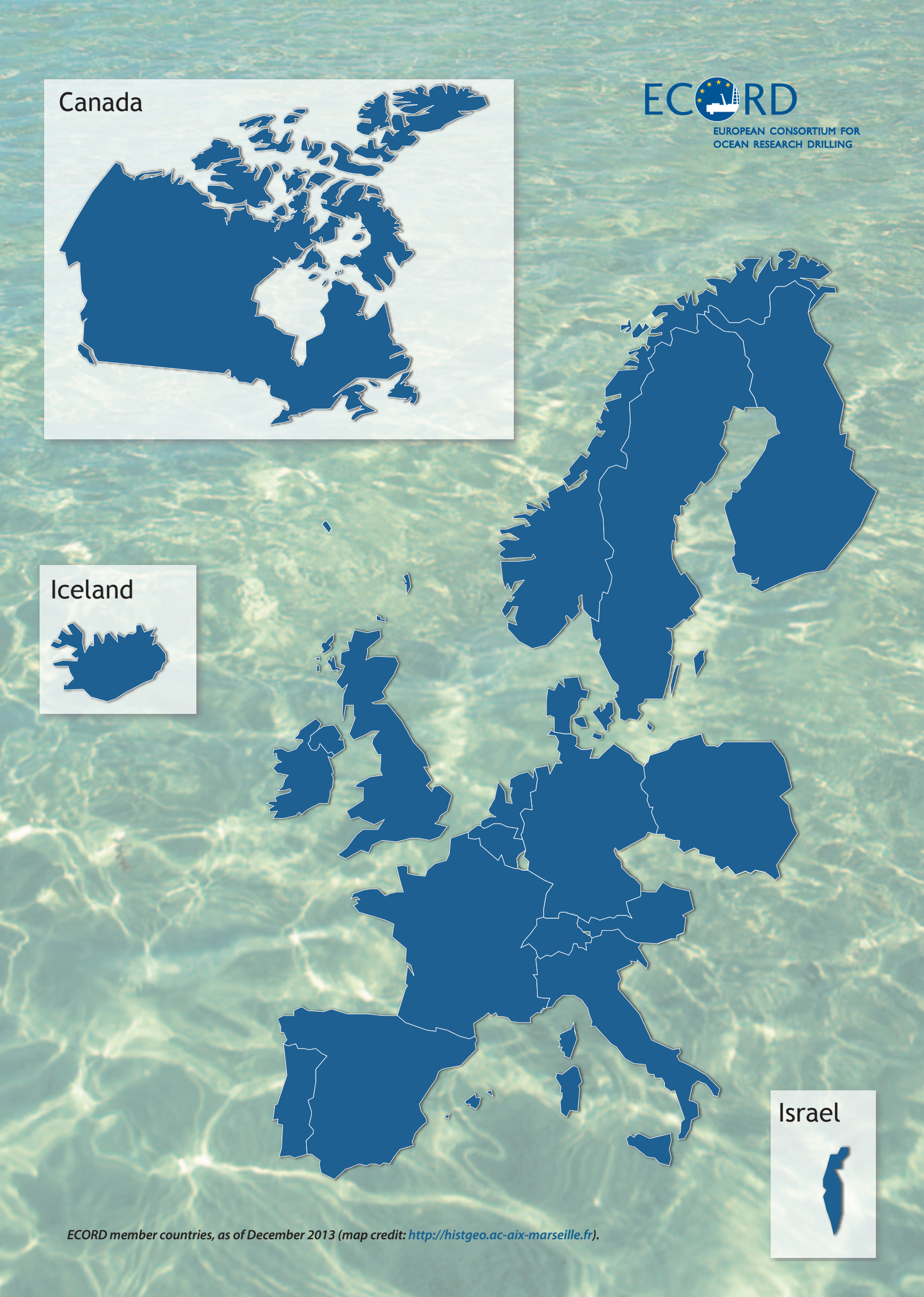
The US drillship *JOIDES Resolution (JR)* implemented four expeditions in the Pacific Ocean:

- Expedition 344 Costa Rica Seismogenesis Project A Stage 2;
- Expedition 345 Hess Deep Plutonic Crust;
- Expedition 341 Southern Alaska Margin Tectonics, Climate and Sedimentation;
- Expedition 346 Asian Monsoon.

Expedition 341S SCIMPI & 858G CORK was an engineering expedition conducted prior to Expedition 341.

The Japanese drillship *Chikyu* continued the ambitious and long-term NanTroSEIZE project offshore Japan to better understand the generation of earthquakes in subduction zones with the implementation of Expeditions 338 and 348 (Nankai Trough Seismogenic Zone Experiment - Plate Boundary Deep Riser 2 & 3).

Forty-seven ECORD scientists, of which two sailed as Co-chief Scientists, were invited to sail on the expeditions implemented by both vessels.



ECORD member countries, as of December 2013 (map credit: http://histgeo.ac-aix-marseille.fr).

The new **Memoranda of Understanding (MoU)** summarising the agreement between ECORD and its partners, the USA (NSF) and their Associate Members, and Japan (JAMSTEC and MEXT), have been finalised. They include a combination of significant co-funding along with berth exchanges to provide access to the *JOIDES Resolution (JR)* and the *Chikyu* for ECORD scientists and access to MSP expeditions for scientists from our partner countries. Based on the projected berths on all platforms, and the significant number of additional berths provided to ECORD Co-chief Scientists who will not count towards the berth quotas, an increase of at least 25% can be expected in the overall number of ECORD berths in the International Ocean Discovery Program compared to the previous programme.

Collaborating

The new ECORD structure should enable the Consortium to simultaneously exercise its functions with greater versatility and to create or improve its partnership opportunities with other science programmes and initiatives (*e.g.* ICDP, IMAGES, EMSO)*, industry and the European Commission (EC).

A high level of technological expertise in sub-seafloor sampling and instrumentation is distributed across institutes and universities in Europe. Working towards the establishment of a **Distributed European Infrastructure for Subseafloor Sampling and Monitoring (DEISM)** to better co-ordinate these various entities will be a major goal. Following the submission in October 2012 of the DEISM and the Distributed European Drilling Infrastructure (DEDI) proposals by ECORD and Deep-Sea and Sub-Seafloor Frontiers (DS3F) respectively, a call related to ocean drilling was included in the new EC Integrated Infrastructure Initiative 2014-2015 document. In co-ordination with ICDP, IMAGES and EMSO, these two pre-proposals will be merged into a single proposal in 2014 with the aim of establishing a unique network designed to initiate technological development and innovation, and to increase and optimise trans-national access to cutting-edge technologies and scientific services by the European science community. This will represent an excellent opportunity to raise ECORD's profile, visibility and efficiency, and better serve the community in Europe, Canada, Israel and associate partners.

In parallel, ECORD is exploring new ways of organising its management and funding, *e.g.* possibly as a European Research Infrastructure Consortium (ERIC).

Engaging the community and reaching out

Three science workshops were funded in 2013 in the frame of the **MagellanPlus Workshop Series Programme**, which is funded by ECORD and ICDP to help scientists from ECORD and ICDP countries develop innovative drilling proposals:

- "Advancing our understanding of Cretaceous Ocean Dynamics by Scientific Drilling", in London, UK;
- "Deep-sea Record of Mediterranean Messinian Events (DREAM)", in Brisighella, Italy;
- "Integrated Southern Ocean Latitudinal Transects (ISOLAT)", in Cambridge, UK.

The potential drilling proposals that will arise from these workshops concern all three IODP platforms: the *JOIDES Resolution*, the *Chikyu* and the MSPs respectively. The ISOLAT workshop strengthens the emerging collaboration between IODP and IMAGES. A large-scale, multiple-objective, multi-site coring proposal is expected to be submitted to IODP in early 2014 and could be the basis for a future IODP MSP expedition.

ECORD has actively promoted scientific ocean drilling at booths organised at major international conferences in 2013 (EGU, Goldschmidt and 3P Arctic), and through the support of the **Distinguished Lecturer Programme (DLP**) designed to promote the scientific achievements of ocean drilling to a large audience within universities/institutes in ECORD member countries as well as European non-ECORD countries. Three prominent lecturers - Roger Urgeles, Spain, Benoît Ildefonse, France, and Claude Hillaire-Marcel, Canada - have visited seventeen universities and institutes across Europe, Canada and Israel in 2013.

Scientific ocean drilling remains highly attractive to young scientists. The two **ECORD Summer Schools** that were organised in 2013, "10th Urbino Summer School in Paleoclimatology", in Urbino, Italy, and "Deep Sea Sediments: From Stratigraphy to Age Models" in Bremen, Germany, attracted more than 120 PhD students and early Post-doctoral researchers, among which 20 were funded by ECORD. Nine **ECORD Research Grants** were awarded to graduate students to conduct research on core material and/or data related to scientific ocean drilling programmes (DSDP/ODP/IODP).

Only a few months after the start of the International Ocean Discovery Program, the current and forthcoming scientific, operational and networking activities promise a bright future for ECORD.

Gilbert Camoin, ECORD Managing Agency Director

Related websites:
http://www.ecord.org
http://www.iodp.org

** ICDP: International Continental Scientific Drilling Program, IMAGES: The International Marine Past Global Change Study, EMSO: The European Multidisciplinary Seafloor and Water-Column Observatory*

2. Operating mission-specific platforms

General planning activities

Throughout 2013, ESO partner institutes continued to prepare for the fifth MSP expedition of the IODP (2003-2013), Expedition 347 Baltic Sea Paleoenvironment. Work also continued on delivering the science from previous MSP expeditions, planning future MSP expeditions, and the representation of ESO at IODP-ECORD advisory panel and committee meetings and workshops.

Invitations were sent to Expedition 347 Science Party candidates on 10th October 2012, on the day that the Scientific Prospectus was published by the USIO Publications Services. The contract for the Expedition 347 drilling vessel *(Greatship Manisha)* was signed on 3rd December 2012, which was followed by a series of meetings and conference calls to plan the technical details of the operation, the deck layout and the vessel schedule. Applications were also submitted to conduct scientific research in Danish and Swedish territorial waters. Initially the expedition was scheduled to start between 1st May - 30th June 2013, after the ship operator completed its duties prior to the ESO contract. The Onshore Science Party (OSP) in Bremen was scheduled to begin in November 2013.

Due to delays in the *Greatship Manisha's* prior commitments, the start of Expedition 347 had to be rescheduled twice, first to July, and then later to September when the expedition finally got underway, departing from Kiel, Germany on 12th September after a mobilisation period in Falmouth, UK. The OSP was rescheduled to start on 22nd January 2014.

As part of the preparations for Expedition 347, ESO took the opportunity to replace three of its containerised laboratories and perform a comprehensive IT upgrade. New containers to house the General Science, Data Management and ESO Office were delivered in April and outfitted at BGS Marine Operations. A completely new container was added to provide a temperature-controlled microbiology

The Greatship Manisha (C. Cotterill ©ECORD/IODP).

lab for the expedition, which was overseen by the ESO team at the MARUM in Bremen. In consultation with the expedition microbiologists, the new laboratory was fitted with equipment not previously used on an MSP expedition. The ESO-Bremen team also made improvements to the existing Curation and Geochemistry containers, including new IT network connections, the acquisition of a pure water system, and a new gas supply route. New equipment, for example a refractometer, gas chromatograph and spectral spectrophotometer, was installed in the Geochemistry container. Although the Petrophysics container was not upgraded, a new "Fast-Track" Multi Sensor Core Logger (MSCL) was installed by the European Petrophysics Consortium (EPC) to allow the fast, non-temperature equilibrated scanning of cores taken for microbiological studies *(page 14)*.

Scientific planning for the expedition was carried out throughout the year by the Expedition Project Manager (EPM) and the ESO-Bremen team, culminating in the production of the Scientific Prospectus, Sample and Measurements Plan, and Core Flow. The ESO-Bremen team was instrumental in producing the Offshore Analyses Handbook for Expedition

Rainbow over the Baltic Sea (C. Cotterill ©ECORD/IODP)

The ESO Team at the start of Expedition 347 (G. Tulloch ©ECORD/ IODP).

Expedition 347 Baltic Sea Paleoenvironment

- Co-chief Scientists: Thomas Andrén and Bo Barker Jørgensen
- Expedition Project Manager: Carol Cotterill
- Assistant Expedition Project Manager: Sophie Green

Expedition 347 Baltic Sea Paleoenvironment took place from 12th September - 1st November 2013. The ESO team onboard the *Greatship Manisha (left)* worked with the Co-chief Scientists and Science Party to successfully complete 50 days of coring and logging operations at 30 boreholes across 8 sites offshore Denmark and Sweden *(map below)*. The expedition recovered more than 1,620 m of high-quality sediment core with an average recovery of 91.5% *(table below)*.

347, producing quick guides for analytical instruments, and for planning in detail the microbiology and geochemistry requirements. The ESO-Bremen team screened incoming sample requests for any special sample handling or offshore equipment/consumables, and to assess the temperature-controlled storage and transport requirements.

A comprehensive IT upgrade was performed prior to Expedition 347. In addition to the purchase of wall-mounted PCs and associated peripherals in the science containers, two new servers were purchased to host ESO's database system (the Drilling Information System, DIS) and associated file server at the Bremen Core Repository (BCR). The old DIS server was upgraded and now hosts ESO's workspace on a file-sharing service. ESO once again contracted Smartcube Gmbh to develop the ExpeditionDIS for Expedition 347, which was deployed on the offshore DIS server in the Database Container. The hardware running the CoreWall system in the BCR lab was also upgraded.

Situated in the heartland of past Scandinavian Ice Sheet advances and retreats, and subjected to repeated glaciations, the coring sites targeted unique geological, microbiological and environmental archives contained within the sediments of six sub-basins in the Baltic Sea Basin (BSB). The recovered sediment cores will aid the investigation of the environmental history and microbiological evolution of the Baltic Sea region over the last 130,000 years, from the beginning of the Eemian interglacial period through the Last Glacial Maximum (LGM) to the present day.

ESO contracted Island Drilling Singapore Pte. Ltd. and Greatship Global Offshore Services Pte. Ltd. to provide the *Greatship Manisha* as the drilling platform *(pages 6 & 8)*. The ship is a multi-purpose platform supply and support vessel, and is the sister ship to the *Greatship Maya* used for Expedition 325 Great Barrier Reef Environmental Changes. The *Greatship Manisha* was fitted with a geotechnical and coring rig supplied by Geoquip Marine (the Geoquip

Location map and approximate ship tracks of Expedition 347.

Expedition statistics	
Number of sites	8
Number of holes	30
Drilled interval	1928.22 m
Open-holed interval	334.3 m
Cored interval	1593.92 m
Core recovery (incl. expanded cores).	1622.76 m
Conventionally calculated recovery	101.81 %
Expansion-adjusted core recovery	91.46 %
Expedition duration	50 days
Number of holes logged	9

GMTR 120 rig), which ran the British Geological Survey Marine Wireline Core Barrel System (BGS-MWCBS), the set of coring tools used for Expedition 302 Arctic Coring (ACEX). The expedition also utilised a gravity corer at two sites to take shallow, undisturbed cores from the top metre below the seabed. The logging contract was managed by the European Petrophysics Consortium (EPC), who

The Greatship Manisha equipped with the drill rig and ESO containers during mobilisation in Falmouth, UK (D. Smith ©ECORD/IODP)

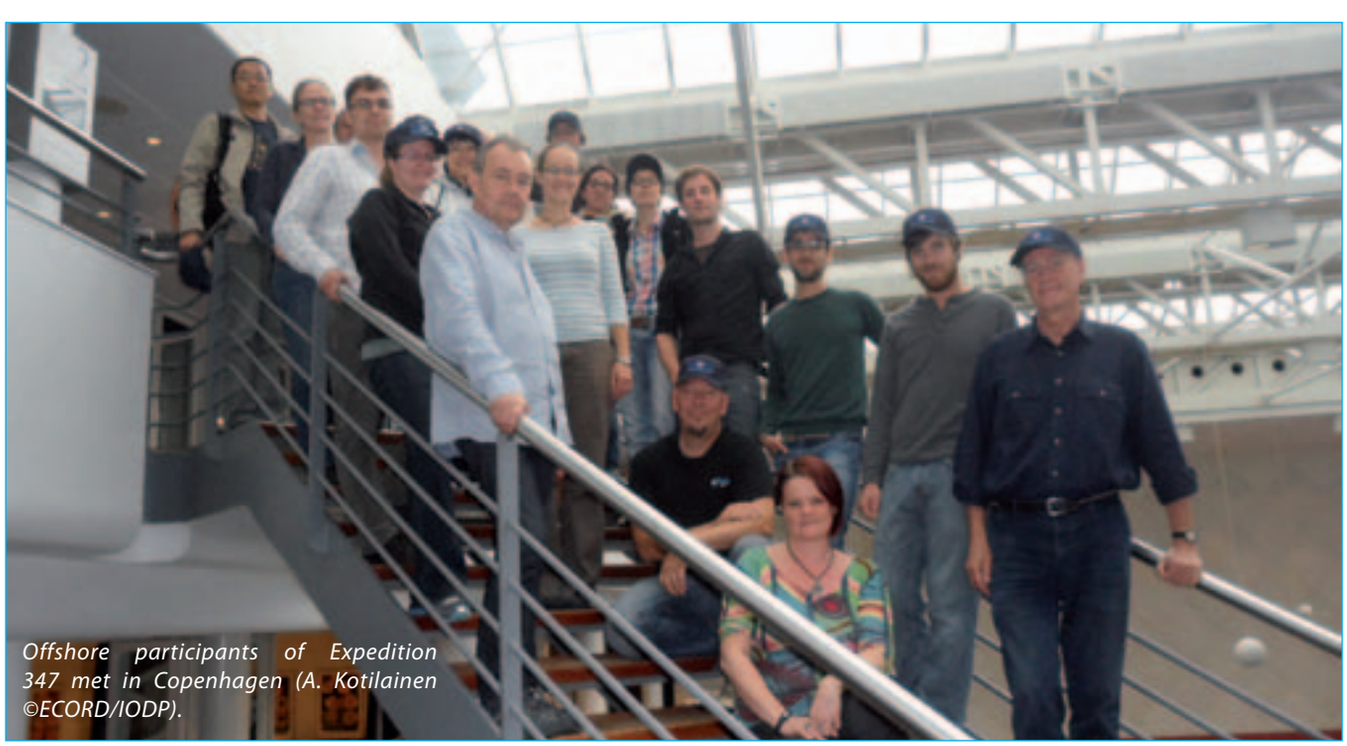
contracted Weatherford Wireline Services to successfully complete downhole wireline logging in 9 holes *(pages 14-15)*. The offshore science programme was effectively carried out in ESO's suite of container labs, outfitted by ESO-Bremen (curation, geochemistry, microbiology), ESO-EPC (petrophysics) and ESO-BGS (science, IT, office) *(above)*. The ESO-Bremen team oversaw the curation of the cores *(page 9)* and the handling and registering of more than 6,000 offshore samples.

Expedition 347 broke several MSP records, including:

- The greatest length of core recovered;
- The highest number of piston cores;
- The highest number of offshore samples;
- The first successful implementation of a large microbiology sampling programme, including tracer injection and the use of a new microbiology container lab;
- The first use of a Fast-Track MSCL for magnetic susceptibility measurements of microbiology cores;
- The expedition cored the deepest borehole to date in the Baltic Sea, reaching a depth of 230 m below seabed.

The *Greatship Manisha* was mobilised in Falmouth, UK, from 1st to 8th September when the ESO containers were loaded onboard and the equipment, IT systems and offices were prepared *(left)*. Meanwhile, the offshore participants of the Science Party, the EPMs and the ESO Science and Outreach Managers met in Copenhagen, Denmark for the Expedition Kick-off meeting *(below)* prior to joining the ship in Kiel, Germany. A media event was held on 5th September to publicise the expedition *(page 38)*.

After departing Kiel on 12th September, the expedition visited **Site M0059 (BSB-3) in the Lille Belt area**. At this site, the cores recovered black mud and greenish-gray clay overlying silty sand in the lowermost part of the sequence. At 89 metres below the seafloor (mbsf) a hard diamicton of sand and stones with little silt was encountered. Tills with this



Offshore participants of Expedition 347 met in Copenhagen (A. Kotilainen ©ECORD/IODP).

composition are known to have a northeasterly provenance and can be attributed to the main ice advance over the area reaching the LGM at around 23 to 21 kyr BP. It seems likely that the diamicton can be assigned to this ice advance.

The first cores are handled by Holger Kulhmann and Alex Wülbers in the curation lab (C. Slomp ©ECORD/IODP).

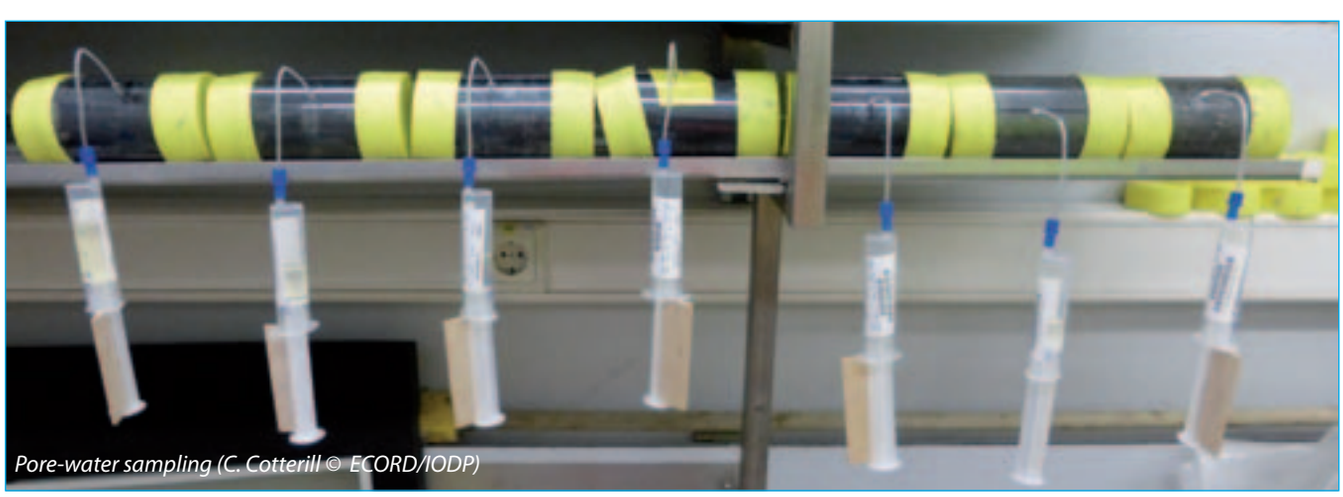
Although Eemian deposits anticipated at 160 mbsf, could not be confirmed by spot-sampling, an increase in resistivity shown by the logging data suggests that a possible Eemian sequence exists between 145 and 155 mbsf.

The next site was **M0060 (BSB-1) southeast of Anholt in the Kattegat.** The top 4.5 m of sediment consisted of very well sorted sand, below which silty clay was recovered. From 18.6 mbsf, mostly stiff Holocene clay was fully recovered. The lithologies at this site are hard deposits of mixed clay and sand with variable composition, ranging from almost pure sand to silty clay. The occurrence of shell fragments of marine bivalves, snails and foraminifera, together with the grain-size succession, indicate that the depositional environment changed several times from shallow water to deeper water and then back again to more shallow water. The expedition also recovered thin sheets of amorphous black plant material with fibrous imprints of cellular plant structure and with indications of initial pyritization. Pieces of the plant material were collected and frozen at -80°C for later DNA analysis, and also provide excellent samples for ^{14}C dating. The possibility to achieve an accurate timescale is therefore very promising.

Luzie Schnieders and Dalton Hardisty in the geochemistry lab (J. Groeneveld ©ECORD/IODP).

After a 4-day transit, the expedition arrived at **M0061 (BSB-10) in the Ångermanälven Estuary** *(page 13)*. Here, the upper sequence consisted of a greenish clay on top of a black sulphide clay, turning into a weakly varved clay with weak sulphide banding. From 13.3 mbsf the sediment became increasingly rich in silt and was pure, well sorted silt at 20.7 mbsf. Cores were difficult to retrieve as the sediment became more and more sandy and, at the base of the hole, hammer coring brought back a granite rock of about 5 cm diameter.

Coring then moved to site **M0062 (BSB-11)** further up the river *(page 7)*. Cores from the upper 15 mbsf contained pure clay, which are expected to be well suited for varve analyses when the cores are split during the OSP. The sediment was coarser with depth, varying between clayey silt and silty sand and drilling continued down to 35.9 mbsf. Correlations based on magnetic susceptibility records from the different holes at both sites M0061 and M0062 are extremely good.



Pore-water sampling (C. Cotterill © ECORD/IODP)

Once operations in the estuary were complete, the expedition moved south again to **Site M0063 (BSB-9) in the Landsort Deep** following a short port call to take on supplies at the Swedish town of Nynäshamn. The sediment cored at this site was a black, homogenous gyttja-clay from the surface down to 16 mbsf. From 18 to 27 mbsf the sediment was a greenish-gray, and in some parts visibly laminated, gyttja-clay. A distinct change in sediment type was recorded from 28 mbsf where bluish-gray clay was recovered. This type of clay is known from other parts of the Baltic Sea to have been deposited during the Ancylus Lake stage. The occurrence of some fossils indicating a brackish environment in the upper part of the sequence may be due to deposition during the initial *Littorina* stage with its gradually increasing salinity. Varved clay was recorded from 57 mbsf down to 93 mbsf where a sandy clayey diamicton was encountered overlying well sorted gravel.

At **Site M0064 (BSB-5) in the Hanoe Bay**, there was only about one metre of Holocene sediment on top of brown, partly varved glacial clay. At 12 mbsf a sandy clayey diamicton was encountered, which from 13 mbsf included gravel and was very compacted and hard. This sequence is typical of the lowermost, proximal part of a glacial clay sequence. At 16 mbsf the diamicton had a greenish-gray

Nan Xiao and Rui Zhang in the microbiology lab onboard the Greatship Manisha (I. Marshall ©ECORD/IODP).

colour and contained only metamorphic and crystalline bedrock fragments, continuing down to about 35 mbsf below which were well sorted sand or gravel. Cretaceous bedrock was recovered at 42-45 mbsf in the different holes at this site.

During drilling at Station BSB-5, the quantification of microbial cells in samples taken at former sites progressed. The first data on cell numbers were available for Station BSB-1 south of Anholt. These data were based on two independent sets of samples and were quantified by two different

Preparing to deploy the ROV for the seabed survey (N. Quintana-Krupinski ©ECORD/IODP).

approaches, both based on fluorescent DNA staining of the cells. One set of samples was stained with acridine orange and cells were counted under the fluorescence microscope. Another set of samples was stained with SYBR Green and cells were counted by flow cytometry. The two approaches yielded very similar data. Cell numbers were very low in the top six metres of well sorted sand, whereas cell numbers were very high in the Holocene and glacial clay below that depth and down to the sand layers starting at 85 mbsf. It is believed that this is the first time that such a comparison of cell numbers has been made on an IODP expedition and the results are very promising for future offshore routine cell counts.

The *Greatship Manisha* then transited to **Site M0065 (BSB-7C) northeast of the island of Bornholm** to drill Holocene and late Weichselian sediments. The sediment below 2 mbsf consisted of homogenous greenish-gray Holocene gyttja-clay. At 13-14 mbsf the sediment changed from gray to light-brown homogenous clay. The clay remained relatively soft and uniform down to 40 mbsf where a hard layer was encountered. The following 6 metres consisted of clay with varying amounts of sand below which the sediment changed to well sorted sand. At 68 mbsf, the sediments recovered were more like diamicton. At 74 mbsf, the Cretaceous bedrock was reached. Interestingly at M0065, while methane was highly super-saturated in the Holocene

mud, it dropped to near-zero in the middle of the glacial clay. The methane profile did not resemble a simple downward progressing diffusion front but rather seemed to indicate a sink for methane within the iron-rich clay. Further chemical and microbiological studies are required to determine the mechanism of methane removal.

By the time site M0065 was completed, good weather conditions, high recovery and faster than expected coring rates meant that the expedition was ahead of schedule, and so two extra holes for paleoceanography were cored nearby at **Site M0066 (BSB-7D)**. Given that some sequences were missed in the Lille Belt area, it was decided to core **Site M0067 (BSB-4)**. At this site, the upper few metres were clayey sand, with some gravel, organic fragments, charcoal and benthic foraminifera. Interestingly, most of the foraminifera in this hole were agglutinated species. Below the top core, the sediment was sand and then well sorted gravel, which led to the hole becoming too unstable and drilling was stopped.

The expedition then returned to the first site **M0059 (BSB-3)** a short distance away, to drill a second complete hole for paleoceanography in order to ensure a good continuous depth record. From 1 mbsf the cores were increasingly rich in gas although the gas escaped from the cores on deck and expansion was modest. Black gyttja-clay was present at this site down to 50 mbsf where it gradually became a homogeneous dark greenish-grey gyttja-clay. From 51 mbsf, homogeneous clay became a greyish-brown glacial clay. The glacial clay unit, at some levels with visible varves, extended down to the bottom of this hole. A piston core to 86 mbsf brought back well sorted sand thereby terminating the hole beneath an almost 30m thick sequence of glacial clay. This last hole of this expedition was dedicated to microbiology and geochemistry. By ending the cruise with a microbiology hole, the live samples were kept as fresh as possible for experiments once they arrived at the receiving laboratories. The coring of a second microbiology hole at Station BSB-3 provided a replication with a different focus on sampling depths in intervals of particular interest. Such intervals were the transition from greyish-brown glacial clay to black gyttja-clay at ca 50 mbsf, indicating a transition from lacustrine to marine conditions, and a conspicuous diffusion front at 60 mbsf.

The offshore phase of the expedition officially ended when the *Greatship Manisha* steamed to port in Kiel on 1st November. Throughout this period, ESO-Bremen team onshore continued to plan and prepare for the OSP which

The Expedition 347 team in Kiel (Captain N. Kanetkar ©ECORD/IODP)

will be held from 22nd January to 20th February 2014 at the IODP Bremen Core Repository and MARUM, University of Bremen

Proposal 548 Chicxulub K-T Impact Crater

ESO has been directed by the ECORD Facility Board to scope the scientific drilling of the Chicxulub impact crater offshore Yucatan, Mexico, based on IODP Proposal 548-Full3. The implementation of the relevant expedition has been tentatively scheduled for the end of 2014 at the earliest by the ECORD Facility Board at its March 2013 meeting. However, a subsequent increase in cost estimates will require the E-FB to review its scheduling plan for FY2014 and 2015 at its next meeting in Bremen in March 2014 *(page 19)*. If final approval is given, the drilling and platform tendering exercise will begin immediately and the expedition could therefore be planned as early as spring 2015.

To prepare for the potential drilling, a geophysical and geotechnical site survey was commissioned to assist with the safe positioning of a liftboat or jack-up platform, required to work in the shallow water of the Yucatan shelf (17 m). Seven companies were invited to tender for the survey work, which included geophysical and geotechnical surveying, from which ESO contracted a partnership of the University of Texas, Gregg Offshore and the Universidad Nacional Autónoma de México (UNAM).

The Chicxulub hazard survey successfully took place from 17th to 22nd April, and a full report and survey data have been submitted by the contractor to ESO. The survey imaged a typical karst topography with a few sinkholes over the area and a small escarpment in the NW, but not in the vicinity of the three drillsites. Small and large scale depressions were mapped, and there are some subtle localised seabed

undulations (~1m in height). The geophysical data suggest that the substrate appears 'hard', which potential vessels will need to consider for landing feet. The surface tow-boomer and CHIRP performed well although they provided negligible penetration due to the hard karst topography. Only two cone-penetration tests (CPT) were managed, which both hit rock and the cones burst. As an alternative, seabed grab samples were taken at sites around the drill sites. The grab samples showed that there is rock at seabed over the entire area with a veneer of sand-sized sediment, which forms ribbons <5-10 cm in thickness across the rock platform. No wrecks or unidentified objects were found.

Proposal 758 Atlantis Massif Seafloor Processes

The objectives of the IODP Proposal 758 can be met using a seabed drill deployed from a research vessel, and is likely to be considerably cheaper than a standard MSP expedition that normally requires contracting a drilling platform from the commercial sector. This proposal will be one of the seven proposals considered for scheduling by the ECORD Facility Board at its next meeting in Bremen in March 2014 *(page 19)*.

ESO are continuing to evaluate all available seabed-drill options, including the evolving RD2 (BGS) and MeBo (MARUM) seabed drills *(page 19)*. The ESO team have been working with the proponents and others to identify new developments in seabed-drill sampling technology that are required to meet the proposal's objectives, and the first ECORD Technology Panel meeting was convened to focus on this topic.

ECORD Technology Panel (ETP): Fluid and microbiology sampling from seabed drills

On 8th November 2012, the first ECORD Technology Panel (ETP) was convened by ESO in Edinburgh, UK. Further ETP meetings will be convened when there is a technological development, identified through project scoping, required to implement one or more proposals.

As described above, the ETP meeting was convened to address the requirements of IODP Proposal 758 Atlantis Massif Seafloor Processes, to sample for fluid chemistry and microbiology from a seabed drill. The meeting was primarily an information-gathering exercise for ESO, and in the first instance was focussed on meeting the minimum requirements of Proposal 758. The meeting participants also considered how to enhance an expedition based on Proposal 758 to provide more of the legacy data expected by IODP (minimum measurements). Lastly, the participants considered future developments that may lead to providing and testing new tools that the microbiology and geochemistry community can use on future proposals.

The outcome of the meeting was a prioritised list of seabed-drill developments to be considered by the ESO and MARUM operations teams.

Related website:
http://www.eso.ecord.org

Selected publications related to MSP expeditions from October 2012 to December 2013

Expedition 302 Arctic Coring ACEX

Chen,T. Y., Franck M., Haley B.A., Gutjahr M., & Spielhagen R. J. (2012). Variations of North Atlantic inflow to the central Arctic Ocean over the last 14 million years inferred from hafnium and neodymium isotopes. EPSL, 82 (9), 353-354,. doi:10.1016/j.epsl.2012.08.012

Rekant, P.V. & Gusev, E.A. (2012). Seismic geologic structure model for the sedimentary cover of the Laptev Sea part of the Lomonosov Ridge and adjacent parts of the Amundsen Plain and Podvodnikov Basin. Russ. Geol. Geophys., 53 (11), *1150-1162*. doi:10.1016/j.rgg.2012.09.003

Sluijs, A. & Dickens, G.R. (2012). Assessing offsets between the $\delta^{13}C$ of sedimentary components and the global exogenic carbon pool across early Paleogene carbon cycle perturbations. Global Biogeochem. Cycles, 26, GB4005. doi:10.1029/2011GB004224

Expedition310 Tahiti Sea Level

Durand, N., Deschamps, P., Bard, E., Hamelin, B., Camoin, G., Thomas, A.L., Henderson, G.M., Yokoyama, Y. & Matsuzaki, H. (2013). Comparison of 14C and U-Th ages in corals from IODP#310 cores offshore Tahiti. Radiocarbon, 55 (4) 1947-1974. doi. 10.2458/azu_js_rc.v55i2.16134

Fujita, K. & Omori, A. Modern and Pleistocene large benthic foraminifers from Tahiti, French Polynesia, collected during IODP Expedition 310. Isl. Arc. *Submitted*

Pretet, C., Samankassou, E., Felis, T., Reynaud, S., Böhm, F., Eisenhauer, A., Ferrier-Pagès, C., Gattuso, J.-P. & Camoin, G. (2013). Constraining calcium isotope fractionation ($\delta^{44/40}Ca$) in modern and fossil scleractinian coral skeleton. Chem. Geol., 340, *49-58*. doi:10.1016/j.chemgeo.2012.12.006

Seard, C., Borgomano, J., Grandjeon, D. & Camoin, G. (2013). Impact of environmental parameters on coral reef development and demise. Forward modelling of last deglacial reefs from Tahiti (French Polynesia). Sedimentology, 60 (6), 1357-1388. doi: 10.1111/sed.12030

Expedition 313 New Jersey Shallow Shelf

Breuker, A., Stadler, S., & Schippers, A. (2013). Microbial community analysis of deeply buried marine sediments of the New Jersey shallow shelf (IODP Expedition 313). FEMS Microbiol. Ecol., 85 (3), *578-592*. doi:10.1111/1574-6941.12146

Dahl, T.W., Ruhl, M., Hammarlund, E.U., Canfield, D.E., Rosing, M.T., & Bjerrum, C.J. (2013) Tracing euxinia by molybdenum concentrations in sediments using handheld X-ray fluorescence spectroscopy (HHXRF), Chemical Geology, 360-361, *241-251*. doi:10.1016/j.chemgeo.2013.10.022

Geosphere Special Issue

Barron, J.A., Browning, J., Sugarman, P., & Miller, K.G. (2013). Refinement of late-early and middle Miocene diatom biostratigraphy for the east coast of the United States. Geosphere, 9, *1286-1302*. doi:10.1130/GES00864.1

Browning, J.V., Miller, K.G., Sugarman, P.J., Barron, J., McCarthy, F.M.G., Kulhanek, D.K., Katz, M.E., & Feigenson (2013) Chronology of Eocene-Miocene sequences of the New Jersey shallow shelf: implications for regional, interregional, and global correlations. Geosphere, 9 (6), *1434-1456*. doi:10.1130/GES00857.1

Fang, L., Bjerrum, C.J., Hesselbo, S.P., Kotthoff, U., McCarthy, F.M.G., Huang, B., & Ditchfield, P.W. (2013) Carbon-isotope stratigraphy from terrestrial organic matter through the Monterey Event, Miocene, New Jersey margin (IODP Expedition 313). Geosphere, 9(5), *1303-1308*. doi:10.1130/GES00851.1

Inwood, J., Lofi, J.et al *(see EPC, page 15)*

Katz, M.E, Browning, J.V., Miller, K.G., Monteverde, D.H., Mountain, G.S., & Williams, R.H. (2013) Paleobathymetry and sequence stratigraphic interpretations from benthic foraminifera: Insights on New Jersey shelf architecture, IODP Expedition 313. Geosphere, 9 (6), *1488-1513*. doi:10.1130/GES00872.1

Lofi, J., Inwood, J. et al *(see EPC, page 15)*

McCarthy, F.M.G., Katz, M.E., Kotthoff, U., Browning, J.V., Miller, K.G., Zanatta, R., Williams, R.H., Drljepan, M., Hesselbo, S.P., Bjerrum, C.J., & Mountain, G.S., in press. Sea-level control of New Jersey margin architecture: palynological evidence from Integrated Ocean Drilling Program Expedition 313. Geosphere, 9 (6), 1457-1487. doi:10.1130/GES00853.1

Miller, K.G., Browning, J.V. et al *(see EPC, page 15)*

Miller, K.G., Mountain, G.S., Browning, J.V., Katz, M.E., Monteverde, D., Sugarman, P.J., Ando, H., Bassetti, M.A., Bjerrum, C.J., Hodgson, D., Hesselbo, S., Karakaya, S., Proust, J.-N., & Rabineau, M. (2013). Testing sequence stratigraphic models by drilling Miocene foresets on the New Jersey shallow shelf. Geosphere, 9 (5),*1236-1256*. doi:10.1130/GES00884.1

Miller, K.G., Sugarman, P.J., Browning, J.V., Sheridan, R.E., Kulhanek, D.K., Monteverde, D.H., Wehmiller, J.F., Lombardi, C., & Feigenson, M.D. (2012). Pleistocene sequence stratigraphy of the shallow continental shelf, offshore New Jersey: constraints of Integrated Ocean Drilling Program Leg 313 core holes. Geosphere, 9 (1), *74-95*. doi:10.1130/GES00795.1

Nilsson, A., Lee, Y.S., Snowball, I., & Hill, M. (2013). Magnetostratigraphic importance of secondary chemical remanent magnetizations carried by greigite (Fe3S4) in Miocene sediments, New Jersey shelf (IODP Expedition 313). Geosphere, 9 (3), *510-520*. doi:10.1130/GES00854.1

van Geldern, R., Hayashi, T., Böttcher, M.E., Mottl., M.J., Barth, J.A.C., & Stadler, S. (2013) Stable isotope geochemistry of pore waters and marine sediments from the New Jersey shelf: methane formation and fluid origin. Geosphere, 9 (1), *96-112*. doi:10.1130/GES00859.1

Expedition 325 Great Barrier Reef Environmental Changes

Felis, T., McGregor, H.V., Linsley, B.K., Tudhope, A.W., Gagan, M.K., Suzuki, A., Inoue, M., Thomas, A.L., Esat, T.M., Thompson, W.G., Tiwari, M., Potts, D.C., Mudelsee, M., Yokoyama, Y., & Webster, J.M., Steeper meridional temperature gradient in the Great Barrier Reef during the last deglaciation. Nat. Geosci., *Submitted*

Gischler, E., Thomas, A.L., Droxler, A.W., Webster, J.M., Yokoyama, Y., & Schöne, B.R. (2013). Microfacies and diagenesis of older Pleistocene (pre-Last Glacial Maximum) reef deposits, Great Barrier Reef, Australia (IODP Expedition 325): a quantitative approach. Sedimentology, 60 (6), *1432-1466*. doi:10.1111/sed.12036

Harper, B.B., Puga-Bernabeu, A., Droxler, A.W., Webster, J.M., Gischler, E., Tiwari, M., Lado-Insua, T., Thomas, A.L., Morgan, S., Jovane, L., and Roehl, U., submitted. Out-of-phase mixed sediment response to glacial-interglacial sea level fluctuations during the penultimate cycle (IODP Expedition 325 Hole 58A: Great Barrier Reef, Australia). J. Sediment. Res.

Herrero-Bervera, E., & Jovane, L. (2013). On the palaeomagnetic and rock magnetic constraints regarding the age of IODP 325 Hole M0058A. Geol. Soc. London Spec. Publ., 373, *279-291*. doi:10.1144/SP373.19

Jovane, L. & Herrero-Bervera, E. On the paleomagnetic and rock magnetic constraints regarding the age of IODP 325 Hole M0058A. *In* Jovane, L., Herrero-Bervera, E., Hinnov, L.A., & Housen, B.A. (Eds.), Magnetic Methods and the Timing of Geological Processes. Geol. Soc. London Spec. Publ. *Submitted*

Lado-Insua, T., Hamel, L., Moran, K., Anderson, L.M., & Webster, J.M. Advanced classification of carbonate sediments based on physical properties. Sedimentology. *Submitted*

Ångermanälven estuary (Bothnian Sea) - Expedition 347 Baltic Sea Paleoenvironment (D. Smith ©ECORD/IODP).

3. Downhole measurements and petrophysics

The European Petrophysics Consortium (EPC) involves three European universities, Leicester (UK), Montpellier (France) and RWTH Aachen (Germany). The EPC central office is located at the University of Leicester and is responsible for the management of the consortium. EPC links into an international logging consortium and its combined petrophysical expertise is available to all scientists involved in IODP.

The EPC team provides high-level scientific and technical support to the IODP and ECORD across the range of highly variable environments drilled by the non-riser and mission-specific platforms (MSP). Downhole logging generates data that link measurements on core to regional geophysical surveys providing an essential means to understand physical properties at all scales. These logging data provide a continuous record that enables *in-situ* formation characterisation, so important in sediments that may change (*e.g.* due to expansion, or drying out) once brought to the surface. Where core recovery is incomplete or disturbed, log data may provide the only way to characterise the borehole section. Where core recovery is good, log and core data complement one another and may be interpreted jointly.

Preparations for Expedition 347

Spring and summer 2013 were spent in preparation for the Expedition 347 Baltic Sea Paleoenvironment *(pages 6-11)*. EPC staff met in Leicester to plan offshore and onshore operations and at BGS Loanhead to prepare and stock the Petrophysics Container and ensure all equipment was working prior to mobilisation *(right)*.

Two Geotek Multi Sensor Core Logger (MSCL) systems were provided for Expedition 347: a "Standard" MSCL-S and a new "Fast-Track" MSCL-152 system. Permits for the import and use of the gamma source (for use in the MSCL-S) in Danish and Swedish waters during Expedition 347 were applied for and granted. Following the ECORD Facility Board meeting in March 2013, steps have been taken to look at gaining permits to import the radioactive source for the MSCL-S into Mexico for the proposed Chicxulub expedition. A living document regarding 'Local Rules' for the gamma source was developed and approved by the University of Leicester's Safety Services.

As part of ongoing development, the existing Standard Set-up and Operating Procedures guides were completely revised for the Standard MSCL and a new set created for the Fast-Track MSCL. Training videos were developed as part of a revised training package and the MSCL measurement log sheets and guidance templates were also re-designed. For the onshore phase, a new Standard Operating Procedure for discrete P-Wave measurements (MSCL-DPW) was drawn-up. EPC staff collaborated with the University of Leicester Computer Science department to develop a Matlab Graphical User Interface that will output statistical data and plots from Iterative Non-Hierarchical Cluster analyses. This development will have applications for future expedition core and downhole logging data analysis.

Preparing the petrophysics container and equipment. IODP Research Associates, from left to right, Annette McGrath, Annick Fehr and Elke Hanenkamp. (S. Morgan ©ECORD/IODP).

Tests were completed in April 2013 to assess the use of a BGO (bismuth germanate) scintillator crystal in the MSCL-XYZ, a system that measures natural gamma radiation (NGR) on whole-round cores. Tests on a range of cores and standard reference materials were undertaken using two different scintillation crystals, NaI (sodium iodide), which was previously used and BGO, which was purchased in collaboration with Geotek Ltd. This was done in order to establish the amount of time that might be saved using BGO instead of NaI and the relative data quality obtained using the different crystals. The tests were successful and indicated a time-saving of 30% using the BGO crystal, which will enable more rapid NGR logging of whole round cores for the Baltic Sea expedition.

A commercial contractor was required for the logging on Expedition 347 for the first time since ACEX in 2004. Following contractual negotiations, Weatherford Wireline

Weatherford Wireline Services logging equipment aboard the Greatship Manisha during mobilisation for Expediton 347 Baltic Sea Paleoenvironment in September 2013 (D. Smith ©ECORD/IODP).

Services were contracted and personnel and equipment were mobilised from Falmouth in September 2013. ESO used Weatherford's Compact toolsuite including the MCG (Gamma Ray, Temperature), SGS (Spectral Gamma) and MAI (Induction), CMI (Micro Image) and MSS (Sonic) *(above)*.

Professional development

As part of EPC's remit to provide **high-level scientific and technical support in logging and core petrophysics**, EPC members have been invited participants at IODP-related workshops and meetings. At the MagellanPlus Arc Drilling Workshop, the uses and interpretation of logging data in arc environments were presented. The DREAM MagellanPlus Workshop discussed locations for multiple-site drilling (including riser-drilling) in the Mediterranean Sea. EPC staff continued collaboration with Expedition 313, 325, and 330 Science Party members and allied scientists. Videos and powerpoint presentations illustrating the downhole logging and core petrophysics operations for Expeditions 302, 310, 313 and 325 were completed for the IODP/ICDP booth at EGU and will ultimately be available from the EPC website. EPC staff undertook XRF core scanning on X313 Hole M0029A cores at the BCR in May 2013 completing data acquisition for an on-going collaborative research project integrating geochemical and petrophysical core properties to core sedimentology. All the core images from Expedition 310 Tahiti Sea Level are now loaded into CoreWall and will be available for future research projects.

EPC staff have given a range of **invited educational presentations and sessions**. These included an '"Introduction to Downhole Logging" at the ECORD Summer School in Bremen *(page 33)*, presentations for the London Petrophysical Society on Hydrothermal Vents and on "Optical, Acoustic & Electrical Images: A lucky dip of scientific applications with the Integrated Ocean Drilling Program" as well as an undergraduate lecture and practical on downhole logging and IODP as part of a third-year undergraduate petrophysics module.

There have been changes in EPC staffing with two IODP Research Associates moving on to new posts this year. The new IODP Research Associates have completed a number of professional courses relating to offshore working and petrophysical analysis; including STCW 95 personal survival training, radiation safety training, standard and Fast-Track MSCL operations, training in the use of CoreWall and petrophysics training courses. Training in specific computing languages and packages *(e.g.* R and LINUX) was also undertaken.

Contributing to *JOIDES Resolution* expeditions

EPC is part of an international consortium for logging that was established in 1992. The consortium is led by the Borehole Research Group at Lamont-Doherty Earth Observatory (US) and also involves the University of Tokyo (Japan). These institutes provide shipboard logging operations and skilled Logging Staff Scientists on each IODP drilling platform, sharing experience and expertise across IODP. EPC has a special arrangement with the US Implementing Organisation (USIO) to contribute to logging activities associated with *JOIDES Resolution* expeditions. In 2012-13, EPC provided the Logging Staff Scientist, Johanna Lofi *(page 16)*, on the successful Expedition 346 Asian Monsoon *(page 28)*.

Related website:
http://www2.le.ac.uk/departments/geology/research/gbrg/iodp/epc

Expedition 313-related publications

Inwood J., Lofi J., Davies S., Basile C., Bjerrum C., Mountain G., Proust J.N., Otsuka H. & Valppu H. (2013). Log-based statistical classification of lithology: IODP Exp 313. Geosphere, 9, *1009-1024*. doi:10.1130/GES00855.1

Lofi J., Inwood J., Proust J.N., Monteverde D., Loggia D., Basile C., Otsuka H., Hayashi T., Stadler S., Mottl M.J., **Fehr A.,** & **Pezard P.** (2013). Fresh and salt water distribution in passive margin sediments: insights from IODP Expedition 313 on the New Jersey margin. Geosphere, 9, *1025-1043*. doi:10.1130/GES00913.1

Miller K., Browning J.V., Mountain G., Bassetti M.A., Monteverde D., **Inwood J., Lofi J.** & Proust J.N. (2013). Sequence boundaries are impedance contrasts: core-seismic-log integration of Oligocene-Miocene sequences, New Jersey shallow shelf. Geosphere,9, *1257-1285*. doi:10.1130/GES00858.1

Johanna Lofi, Logging Staff Scientist, aboard the JOIDES Resolution during Expedition 346 Asian Monsoon (William Crawford, IODP/TAMU).

Other IODP expedition-related publications

Lin, W., Conin, M., Moore, J. C., Chester, F. M., Nakamura, Y., Mori, J. J., **Anderson, L.**, Eguchi, N. and Expedition 343 scientists, 2013. Stress state in the largest displacement area of the 2011 Tohokuoki Earthquake. Science, 339, 687-690, doi.10.1126/science.1229379 - *Following participation in Science Party on Expedition 343 Japan Trench Fast Drilling Project (JFAST) in 2012. Supported by NERC grant to Davies & Anderson.*

Iturrino, G., Liu, T., Goldberg, D., **Anderson, L.,** Evans, H., **Fehr, A.**, Guerin, G., **Inwood, J., Lofi, J.,** Malinverno, A., **Morgan, S.**, Mrozewski, S., Slagle, A., Williams, T. (2013): Performance of the Wireline Heave Compensation System Onboard *D/V JOIDES Resolution*. - Scientific Drilling, 15, 46-50, doi.10.2204/iodp.sd.15.08.2013 - *Following arrangement with USIO to provide Logging Staff Scientists.*

Presentations by EPC Members on IODP expedition data (October 2012 - December 2013)

Anderson, L.M., Salas, E.C., Edwards, K.J., Bach, W., Becker, K. and IODP Expedition 336 Scientists. Investigating the Deep Biosphere using Downhole Measurements, North Pond, IODP Expedition 336. *AGU Fall Meeting, San Francisco, USA*

Harper, B., Gernabeu, A., Droxler, A., Webster, J.M., Thomas, A.L., Tiwari, M., Gischler, E., Jovane, L., **Morgan, S.** and Lado Insua, T. Fore reef upper slope mixed sedimentation response to penultimate glacial interglacial sea level fluctuations: IODP Hole 325-M0058A, Great Barrier Reef, Australia. *AGU Fall Meeting, San Francisco, USA*

Hornbach, M., Manga, M., Adachi, T., Breitkreuz, C.F., Lafuerza, S., Le Friant, A., **Morgan, S.**, Ishizuka, O., Jutseler, M., Slagle, A.L. and Talling, P. In-situ properties of submarine slides along the Lesser Antilles Arc derived from rock physics models. *AGU Fall Meeting, San Francisco, USA*

Inwood, J., Tudge, J. and Harvey, P. Iterative Non-hierarchical Cluster Analysis (INCA): a novel approach to analysing downhole logging and petrophysical data. *AGU Fall Meeting, San Francisco, USA.*

Lado Insua, T., Moran, K., Kulin, I., Farrington, S., Newman, J. and **Morgan, S.** Multivariate approach to optimize subseafloor observatory designs. *AGU Fall Meeting, San Francisco, USA.*

Lofi, J., Inwood, J., Proust, J.N., Monteverde, D., Loggia, D., Basile, C., Hayashi, T., Stadler, S., **Fehr, A.** and **Pezard, P.** Fresh and salt water distribution in passive margin sediments: insights from IODP Expedition 313 on the New Jersey margin. *AGU Fall Meeting, San Francisco, USA*

McGrath, A.G., Inwood, J., Morgan, S., Davies, S.J. and Foster, H. Redox sensitive element mobility in mid-Miocene clays from Unit II of Hole M0027A, the New Jersey Shallow Shelf (IODP Expedition 313). *AGU Fall Meeting, San Francisco, USA*

Slagle, A.L., **Morgan, S.** and IODP Expedition 340 Science Party. Characterization of Lesser Antilles Volcanic Landslide Deposits from Downhole Logging, IODP Expedition 340. *AGU Fall Meeting, San Francisco, USA*

Camerlenghi, A., De Lange, G., Flecker, R., Garcia-Castellanos, D., Huebscher, C., **Lofi, J.**, Krijgsman, W., Lugli, S., Manzi, V., McGenity, T., Panieri, G., Rabineau, M., Roveri, M. & Sierro, F. 2013 Deep Sea Record of Mediterranean Messinian Events (DREAM). *AAPG European Regional Conference. Exploring The Mediterranean: New Concepts In An Ancient Seaway The "sea in the middle of the earth". The Mediterranean. 8th-10th April, Barcelona*

Lofi J., Galvani A., Williams T., Hernández-Molina F. J., Stow D., Llave E. and Expedition IODP 339 Scientists, 2013. Formation MicroScanner (FMS) characterization of a Contourite Depositional System. Insights from IODP Expedition 339 in the Gulf of Cadiz. *AAPG European Regional Conference. Exploring The Mediterranean: New Concepts In An Ancient Seaway The "sea in the middle of the earth" - The Mediterranean. 8th-10th April, Barcelona*

Lofi J., 2013. Seismic atlas of the "Messinian Salinity Crisis" markers in the Mediterranean and Black seas - Volume 2. AAPG European Regional Conference. Exploring The Mediterranean: New Concepts In An Ancient Seaway The "sea in the middle of the earth" - The Mediterranean. 8th-10th April, Barcelona

Lofi J., 2013. Overview of the seismic expression of the Messinian markers. *DREAM MagellanPlus Workshop, Brisighella, 5th-8th May, Italy*

Fehr, A. & Clauser, C. 2013 GGE as part of the European Petrophysics Consortium: Downhole Logging and Core Petrophysics in IODP. *RWTH Aachen University Tag der Geowissenschaften 2013*

Drill rig in operation during Expedition 347 Baltic Sea Paleoenvironment (C. Cotterill © ECORD/ IODP).

4. Anticipating future MSP expeditions

ECORD Facility Board

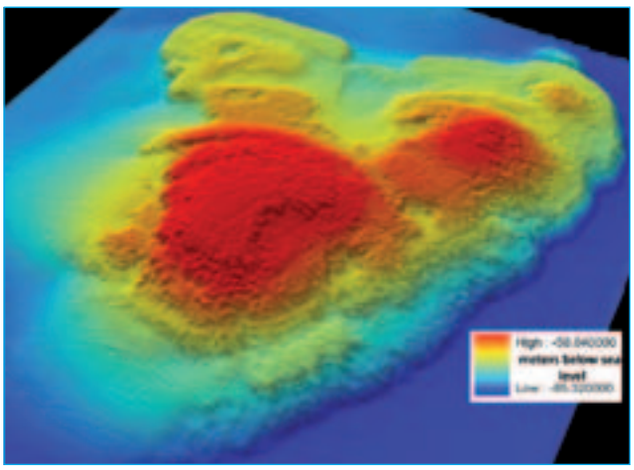
In the new structure of the freshly launched International Ocean Discovery Program, each consortium responsible for providing the three IODP platform types - *JOIDES Resolution (JR), Chikyu* and mission-specific platforms (MSPs), now has a Facility Board to help plan and prioritise their drilling expeditions. The ECORD Facility Board (E-FB) is the key planning forum for providing operational and management oversight of MSP expeditions. The main task of the E-FB is to determine the operations schedule for MSPs in order to implement science proposals forwarded by the Science Evaluation Panel (SEP), based upon science priorities, geographic distribution and costs. The E-FB also approves the expedition section of the Annual ECORD Plan, which includes policies and decisions on the operations schedule, data management, publications, core curation, and engineering and scientific technical development. Strong cross-links to funding agencies, but especially the *JOIDES Resolution* Facility Board *(JRFB)* and the *Chikyu* IODP Board (CIB), provide liaison on the overall IODP decision-making processes.

The E-FB is composed of the **Science Board**, consisting of five scientists from any country funding the IODP, and the **ECORD Executive Bureau**, consisting of members of the ECORD Council, the ECORD Managing Agency (EMA), the ECORD Science Support and Advisory Committee (ESSAC), the ECORD Industry Liaison Panel (E-ILP) and the ECORD Science Operator (ESO). The Science Board members are nominated by the Executive Bureau, and their nominations are approved by the Council, based on the recommendations provided by ESSAC following an open nomination process. Members serve on the E-FB on three-year staggered rotations, while the Chair usually serves for two years. The current members of the Science Board since 1st January 2013 are:

- Karsten Gohl, Alfred Wegener Institute, Germany (Chair)
- Antonio Cattaneo, Ifremer, France
- Gerald R. Dickens, Rice University, USA
- Marta Torres, Oregon State University, USA
- Dominique Weis, University of British Columbia, Canada

At the first meeting of the E-FB in March 2013, **five MSP proposals** were received from the Proposal Evaluation Panel (now SEP) to be considered for scheduling in FY2014 and 2015. The E-FB made the following consensus decisions.

- **Proposal 581-Full2 Late Pleistocene Coralgal Banks** *(Droxler et al.)*. The proposal aims to drill drowned coralgal reefs *(above)* that have grown during the first part of the last sea-level transgression on top of a lowstand siliciclastic paleo-coastline

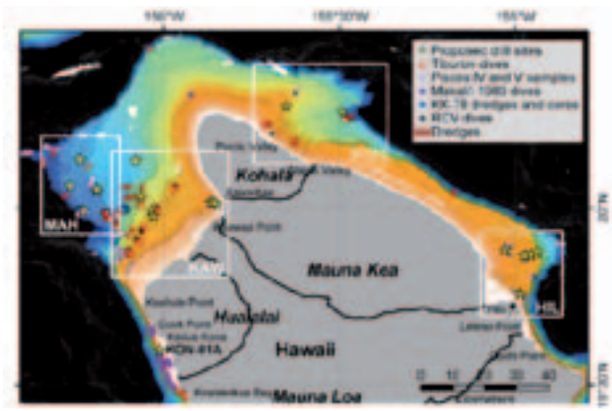


Bathymetry map of the Coralgal Banks (provided by Wes Tunnel, Harte Research Institute).

that developed during the Last Glacial Maximum (LGM) off the coast of Texas in the Gulf of Mexico. The objectives are to decipher the deglacial history of coral growth/demise and sea level from the late Glacial to the Younger Dryas. The plan is to drill 7 holes at 60-70 m water-depth and with 75-100 m penetration using a geotechnical ship with a drill rig. The E-FB did not schedule an expedition and asked the proponents if it would be possible to achieve their objectives by reducing their proposed penetration depths.

- **Proposal 637-Full2+Add6 New England Shelf Hydrogeology** *(Person et al.)*. Drilling is aimed to investigate the distribution of the fresh-brackish-salt water on the New England shelf, its mechanisms and time of emplacement, as well as the quantity of fluid, chemical and nutrient fluxes. The objective is to understand the relationship between hydrogeochemistry, fluid flow and microbial activity by drilling 18 sites at 18-109 m water depths and with 350-800 m penetration, using a large liftboat or industry rig. ESO estimated that the operation would take about 5 months. The E-FB did not schedule an expedition and asked proponents to provide ESO with feedback on how the expedition costs could be reduced if some of the sites are changed. The proponents may also look for funds from outside ECORD.

- **Proposal 716-Full2 Hawaiian Drowned Reefs** *(Webster et al.)*. The objectives are to study the nature of sea-level change in the central Pacific over the past 500 kyr, the response of coral-reef systems to abrupt changes in environment, and its subsidence history. The plan is to drill 11 sites *(page 19)* in 134-1,154 m water depth and with 150 m penetration, using a geotechnical ship with a drill rig (or a seabed drill with long penetration depth). Deeper holes can possibly be drilled with the *JR*. The E-FB did not schedule an expedition but

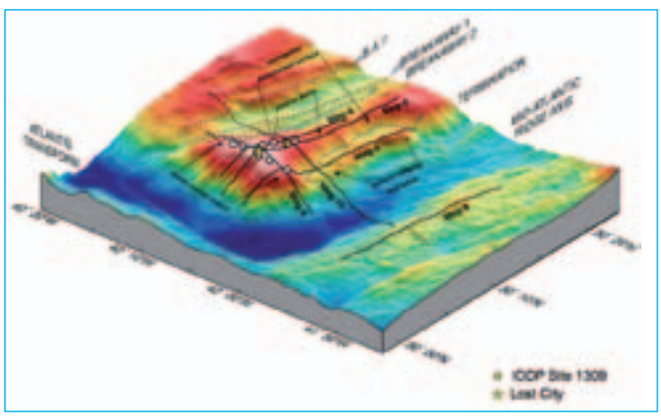


Proposed drillsites of IODP Proposal 716 .

considered this proposal to have a high priority for scheduling after 2015 by using a seabed drill, provided that the proposed science objectives are met. Proponents were offered three options: **(1)** accept the low recovery results risks in a *JR* operation, **(2)** wait until the MeBo200 drill being developed at the MARUM in Bremen, Germany, is in operation, or **(3)** find alternatives to the MeBo drill.

- **Proposal 548-Full3 Chicxulub K-T Impact Crater** *(Morgan et al.)*. This proposal aims to drill the impact crater to study impact dynamics mechanism, the peak-ring lithology and formation, the impact effect on the deep biosphere, the extent of the hydrothermal system, the energy and mass extraction of the impact, and the biotic recovery. The project consists of hypothesis-driven tests, a detailed strategy, and offers opportunities for high-profile outreach communication. The plan is to drill 2 holes in 17 m water depth, each with 1,500 m penetration, using a liftboat or jack-up platform. The E-FB scheduled this proposal, to be implemented by the end of 2014 at the earliest, provided that the budget objectives are met.

- **Proposal 758-Full2 Atlantis Massif Seafloor Processes** *(Früh-Green et al.)*. The aim is to explore the sub-surface of this hydrothermal field (metamorphic core complex) in the South Atlantic and study the processes of serpentinisation (fundamental understanding), deformation and alteration processes of different lithospheric ages and rock types, as well as the microbial activity. The plan is to drill 10 sites *(below)* at 750-1,770 m water depth and with 50-100 m penetration, using a seabed-drilling system from a ship (MeBo and/or the British Geological Survey's RockDrill 2 (RD2), *below*). The E-FB scheduled this proposal, to be implemented in 2015, provided that the budget objectives are met.

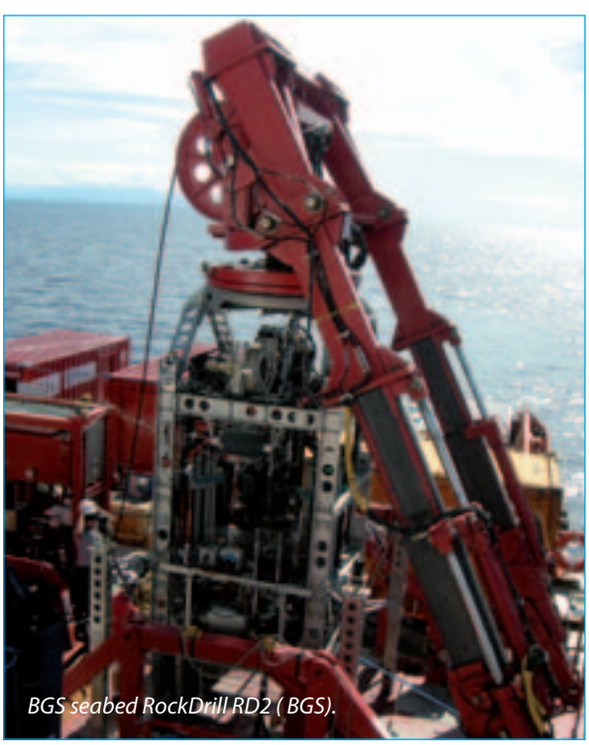


Three-dimensional representation of the Atlantis Massif with locations of proposed drillsites relative to seismic-reflection profiles, the LCHF and IODP Site 1309 (modified from Canales et al., 2004).

Subsequent increases to the cost estimates for these five proposed expeditions, in particular for an MSP expedition to drill the Chicxulub Crater (Proposal 548), will require the E-FB to review its scheduling plan for FY2014 and 2015 at its next meeting in Bremen in March 2014.

** Canales et al (2004). EPSL, 222, 543-560.*

MARUM MeBo deployed from the RV Sonne (MARUM).

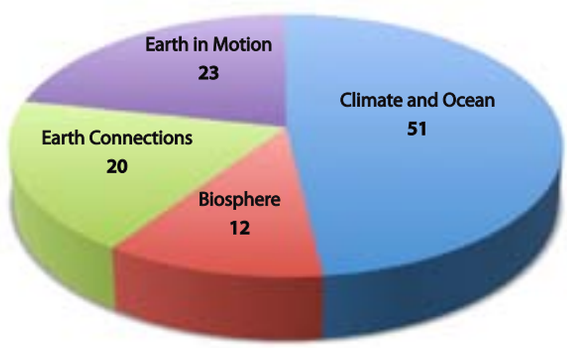


BGS seabed RockDrill RD2 (BGS).

MSP proposals at the Science Evaluation Panel

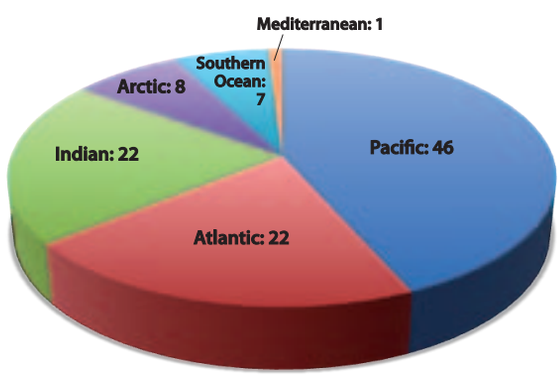
The IODP Proposal Evaluation Panel (PEP) and the Site Characterization Panel (SCP) were combined following the advice from the *JOIDES Resolution* Facility Board in summer 2013. The 'new' panel was named the Science Evaluation Panel (SEP), which evaluates all proposals, regardless of the platform that could be used (*JOIDES Resolution*, *Chikyu* or MSPs).

An impressive number of proposals were submitted to IODP in 2013. There are **106 active proposals** with the Science Support Office (as per 1st October 2013). The proposal objectives are divided according to the research themes of the IODP Science Plan for 2013-2023 *(below)*. Approximately half of the proposals address the Climate and Ocean Change Theme, and the rest address the three other Science Plan research themes, Earth in Motion, Earth Connections and Biosphere Frontiers.



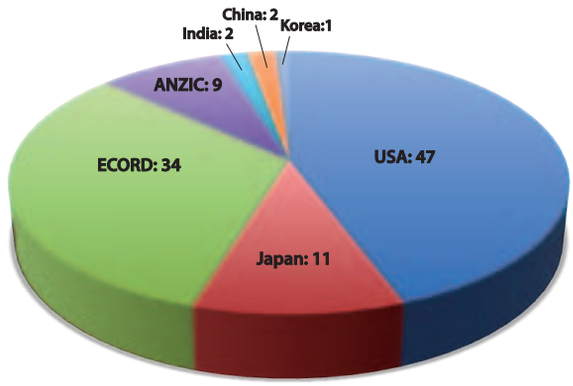
Active proposals by IODP science themes (n= 106).

By geographic distribution, 46 proposals are aimed at research in the Pacific Ocean, 22 in the Atlantic, 22 in the Indian Ocean, and several others in the Arctic, Southern Ocean and the Mediterranean Sea *(below)*. Given the priorities of the IODP Science Plan, more proposals with drilling objectives in the high latitudes are welcome.



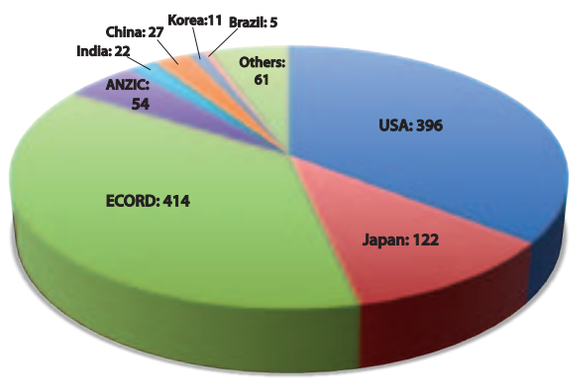
Active proposals by geographic distribution (n= 106).

32% of the lead proponents on all active proposals are based in ECORD member countries *(below)*, making a huge contribution to the scientific efforts within IODP.



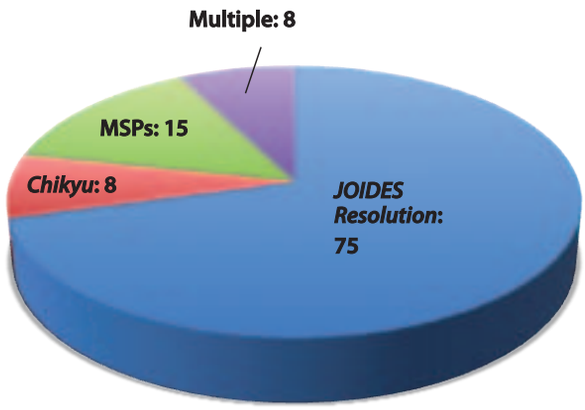
Active proposals distribution by IODP member countries (n= 106).

Notably, there are 414 different ECORD scientists who are active as lead proponents or co-proponents in proposal writing *(below)*. The number of unique ECORD proponents is therefore more than any of the other IODP members, showing that ECORD makes a substantial intellectual contribution to proposal writing.



Geographic distribution of 1,126 proponents for 106 active proposals.

The diagram *page 21* shows the distribution of the 106 active proposals across the various IODP platforms. There are 15 proposals at various development stages (ECORD Facility Board *pages 18-19*, and SEP *table page 21*) planning to use only MSPs, and 2 to combine MSP and *JR* drilling. The number has never been so high, and therefore demonstrates the great success of the MSP concept. These proposals concern a wide range of science topics (climate change, sea-level change, geohazards, hydrogeology, ocean crust), oceans (Arctic, Southern Ocean, Atlantic, Mediterranean and Pacific)



Distribution of proposals by platforms (n= 106). Multiple proposals include 2 MSP + JR and 6 Chikyu + JR.

and drilling environments (ice-covered areas, coral reefs, continental shelves). Most of these proposals concern a pole-to-pole transect through the tropical regions to collect records linking climate, ice-sheet and sea-level histories on geologic time scales, which is one of the major objectives of the IODP Science Plan for 2013-2023.

Related websites:
http://www.ecord.org/ecord-fb.html
http://www.iodp.org/active-proposals
http://www.iodp.org/facility-boards#SEP

MSP Proposals under review at SEP

Proposal number	Short title	Lead Proponent	Country lead proponent	Ocean/Sea	Platform
680-Full	Bering Strait Climate Change	Fowell	USA	Arctic	MSP
708-Full	Central Arctic Paleoceanography	Stein	ECORD	Arctic	MSP
730-Pre2	Sabine Bank Sea Level	Taylor	USA	Pacific	MSP
750-Pre	Beringia Sea Level History	Polyak	USA	Chukchi Sea	MSP+JR
756-Pre	Arctic Ocean Exit Gateway	Jakobsson	ECORD	Arctic	MSP
761-Pre	South Atlantic Bight Hydrogeology	Wilson	USA	Atlantic	MSP
796-Full	Ligurian Landslide	Kopf	ECORD	Mediterranean	MSP
806-Pre	Beaufort Gas Hydrate	Paull	USA	Arctic	MSP
797-Pre	Alaska Beaufort Margin	Ruppel	USA	Arctic	MSP+JR
812-Pre	Ross Sea Glacial History	Wilson	USA	Southern	MSP
813-Full	East Antarctic Paleoclimate	Williams	USA	Southern	MSP

Mission-specific platforms operated by ECORD. From left to right, the icebreaker Vidar Viking on site during Expedition 302 Arctic Coring (M. Jakobsson ©ECORD/IODP), the DP Hunter during Expedition 310 Tahiti Sea-Level (©ECORD/IODP), the liftboat Kayd used during Expedition 313 New Jersey Shallow Shelf (J.N. Proust ©ECORD/IODP) and the Greatship Maya during Expedition 325 Great Barrier Reef Environmental Changes (D. Smith ©ECORD/IODP).

5. IODP Bremen Core Repository

The Bremen Core Repository (BCR) at the University of Bremen, Germany, is one of three IODP core repositories. The other two are the Gulf Coast Repository (GCR) located at Texas A&M University in College Station, USA, and the Kochi Core Center (KCC) in Kochi, Japan. According to IODP convention and practice, the BCR hosts all the cores recovered since the beginning of scientific ocean drilling from the Atlantic and Arctic Oceans as well as the Mediterranean and Black Seas. The BCR is also responsible for providing mobile labs for MSP expeditions and for organising and hosting their Onshore Science Parties.

The BCR currently contains almost **154 km** of deep-sea cores from **87 expeditions**. A total of **76,409 samples** were taken at the BCR for 247 requests (of which 158 were submitted by ECORD scientists) during FY2013. We have been adjusting to the relatively new procedure of sampling all BCR cores using the Drilling Information System (DIS) database and **Curation DIS**, which has proven to be an efficient tool for this purpose.

The **Sampling Party for Expedition 342 Paleogene Newfoundland Sediment Drifts** was held at the BCR from 25th February to 3rd March 2013 *(below)*. 41 participants (science party members as well as shore-based scientists) from 13 countries attended and a total of 33,302 samples were taken. Expedition scientists and their shore-based collaborators made extensive use of analytical equipment in the MARUM labs (two XRF scanners working simultaneously) prior to the Sampling Party. Expedition 342 cores were scanned from January to March 2013 in order to acquire critical data to further improve composite records and refine sampling strategies, as well as to collect data before some of the temporary archive halves were sampled. Dan Brinkhuis (Science Media NL), on behalf of the Consortium for Ocean Leadership, USA, made a video of the Expedition 342 Sampling Party with the BCR reefer and labs at MARUM as the central location - http://youtu.be/J0r2u5xdS7E

The summer of 2013 was also quite intensive and primarily dedicated to preparing the ESO laboratory containers (Core Curation, Geochemistry, Microbiology) and offshore sampling plans for **MSP Expedition 347 Baltic Sea Paleoenvironment** *(pages 6-11)***.** The expedition was carried out from September to November 2013, with eight Bremen participants, and one of the major on-board activities was an exceptionally complex series of microbiological sampling for five dedicated holes. This whole-round sampling required unprecedented procedures for preserving the material at various temperatures for different purposes as well as a number of sample transfers to land-based labs during the expedition.

All BCR samples (almost 1.5 million samples/more than 5,000 sample requests/almost 3,000 individual scientists including samples taken earlier at the East Coast Repository and now re-located at the BCR) are entered into a database that is accessible to the general public for post-moratorium samples - *http://134.102.249.79/BCRDIS/*

The CoreWall-Corelyzer initially used during MSP Onshore Science Parties (OSP) has been continuously undergoing improvements. The CoreWall hardware is permanently installed in the BCR lab and we are continuing to explore new ways to integrate the Corelyzer into our normal daily operations, including education and outreach.

Sampling Party for Expedition 342 held at the BCR in February - March 2013 (courtesy BCR/IODP).

The BCR staff, in co-operation with the other repositories, again contributed to the evaluation of the new 'IODP Sample and Data Request' (**SaDR)** system for sample request submission by scientists. This more streamlined and intuitive system will soon replace the SMCS request system, which has exhibited numerous problems and has very limited IT support.

ESO continues to implement QA/QC (quality assurance/ quality control) procedures during MSP operations. Various work packages related to this topic, encompassing overall policies and procedures for QA/QC, are either in progress or already completed (*e.g.* geochemistry data in a database of past MSP expeditions). For MSP proposals, ESO currently investigating the potential implementation; we are also examining analytical equipment and instrumentation including QA/QC procedures.

Other ongoing activities at the BCR throughout 2013 are the improvement of the online tutorials for both the offshore phase and the Onshore Science Party (OSP), which became available on the web simultaneously with the launch of the new BCR web pages in July 2013 - *http://www.marum.de/en/Offshore_core_curation_and_measurements.html* & *http://www.marum.de/en/Onshore_Science_Party_OSP.html* - as well as the maintenance and upgrade of laboratory containers and equipment, including analytical instruments in operation during OSPs.

This year we provided core material for numerous course studies for different purposes by various instructors. These included core descriptions and visual illustration of geoscientific concepts. Through these efforts, numerous young emerging scientists have been exposed to and inspired by materials from IODP. These were usually visits to the BCR by classes, but in special cases cores were transported to schools within Germany, where they were shown and discussed in their scientific context.

Equally important for informing and educating the general public of our goals and scientific and technical achievements are the frequent visits by representatives of the television, radio and print media. A group from the Workshop on "African Climate Vegetation Interactions 2012", held at the MARUM, University of Bremen - *http://www.marum.de/Tagungen__Workshops_am_MARUM.html* - the president of the Helmholtz Association Prof. Dr. Jürgen Mlynek, the State Counselor to the Bremen Senator for Education and Science, Gerd-Rüdiger Kück, ESSAC Chair Carlota Escutia, and delegations from Belgium, Canada, Colombia, India, Israel, Taiwan, and the USA, were among the visitors in 2013.

The BCR is also an ideal place to train students, with the opportunity to work on real cores and have access to laboratory facilities. Each year since 2007, the ECORD Summer School has presented a different theme related to the IODP science plan. In 2013, the theme was "Deep-Sea Sediments: From Stratigraphy to Age Models " *(below & page 33)*.

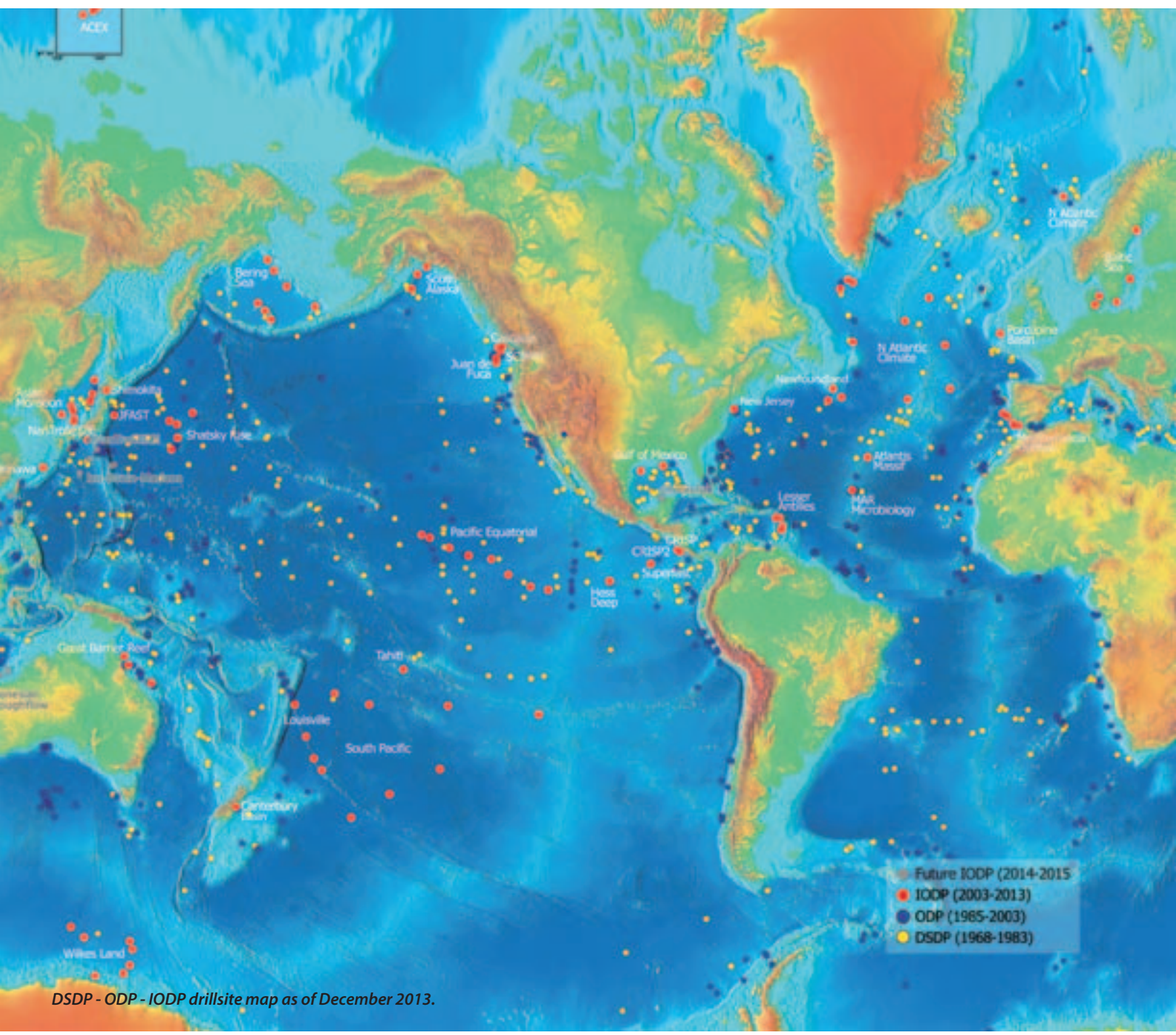
Related website:
http://www.marum.de/en/IODP.html

ECORD Summer School 2013 (Volker Diekamp, MARUM).

6. Participating in IODP expeditions

Participation in IODP expeditions - *http://www.iodp.org/expeditions* - is an excellent opportunity for scientists to be involved in international multidisciplinary teams and to have priority access to unique samples and data. As a contributing member of IODP, ECORD was entitled to an average of **eight scientists on every expedition**. Scientists are selected following an open call for applications, nomination by ESSAC of potential participants, and discussions between the Implementing Organization, the two appointed Co-chiefs Scientists and the IODP member countries/consortia. For ECORD, member country rights are proportional to their financial contribution to the consortium ("quotas"). Selection of the science team is therefore not only based on scientific merit but must also take into consideration the country quotas on a time average. Occasionally, ECORD scientists participate in expeditions that do not count towards their country quota. This happens, for example, when specific expertise is needed for an expedition that has not been fulfilled by any of the IODP member countries applicants through special calls, and/or when scientists sail as observers requested when drilling takes place in territorial waters of an ECORD country.

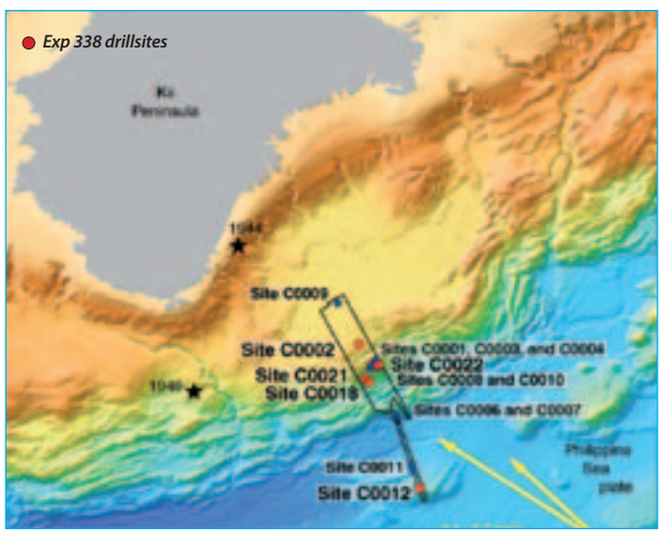
In FY2013, a total of **seven expeditions** were implemented on the three IODP platforms: the *JOIDES Resolution* (4), the *Chikyu* (2), and ECORD mission-specific platforms (1). A total of **64 ECORD scientists** were invited to participate, including **four Co-chief Scientists**.



DSDP - ODP - IODP drillsite map as of December 2013.

Expedition 338 NanTroSEIZE - Plate Boundary Deep Riser 2, *Chikyu*, 1st October 2012 - 13th January 2013

The Nankai Trough Seismogenic Zone Experiment (NanTroSEIZE) during *Chikyu* Expedition 338, aimed at deepening Site C0002 to 3600 m below seafloor. The ultimate goals of the NanTroSEIZE programme are to clarify the structure and formation processes for oceanic plate subduction zones and changes in plate boundary faults with the objective of elucidating the mechanisms for occurrences of mega-earthquakes and tsunamis. After drilling reached 2,000 m below seafloor, sudden changes in sea and weather



ECORD participants (Expedition 338)

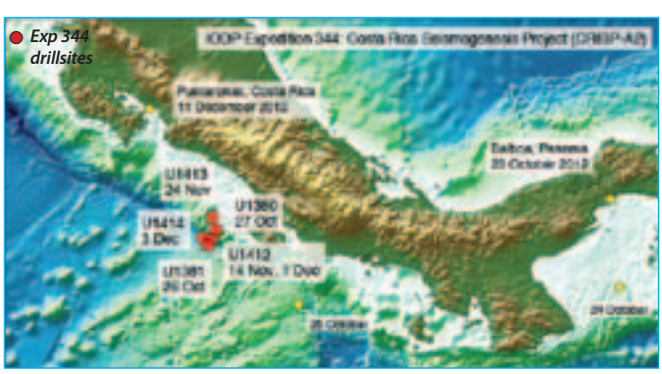
Michael Strasser, Co-chief Scientist	ETH Zurich	Switzerland
Jacob Geersen	University of Southampton	UK
Sebastian Hammerschmit	University of Bremen	Germany
André Huepers	University of Bremen	Germany
María José Jurado	ITJA-CSIC Barcelona	Spain
Kevin Pickering	University College London	UK
Olivier Fabbri	University Franche-Comté	France
Katrien Heirman	Gent University	Belgium
Dean Wilson	University of Southampton	UK

conditions resulted in damage to vital drilling equipment. This resulted in switching to contingency drilling plans, and drilling scheduled for FY2014 at other NanTroSEIZE locations. The scientific objectives of the contingency drilling plans were to obtain information on the history of mega-splay fault activity, the physical properties of the geological strata of the oceanic plate prior to subduction, and the internal structure of the accretionary prism after forming from material accreted from the subducting oceanic plate. The data collected are being analysed and integrated with previously collected data from earlier NanTroSEIZE IODP expeditions.

Renowned oceanographer Walter Munk (left) visits Expedition 338 Co-chief Scientists Michael Strasser (right) and Brandon Dugan on the Chikyu (©CDEX/JAMSTEC).

Expedition 344 Costa Rica Seismogenesis Project A Stage 2 (CRISP2), *JOIDES Resolution*, 23rd October - 11th December, 2013

The Costa Rica Seismogenesis Project (CRISP) objective was to elucidate processes that control nucleation and seismic rupture of large earthquakes at erosional subduction zones. The CRISP Program A focused on the shallow lithologic, hydrologic, stress, and thermal conditions that lead to unstable slip in the seismogenic zone. Together with IODP Expedition 334 (the first expedition of CRISP Program A), these data are providing exciting new insights into the nature of seismogenesis and erosive plate boundaries. The material recovered from the incoming Cocos plate, the toe of the margin, the mid-slope region, and the upper slope region is now being studied and will provide an increased



ECORD participants (Expedition 344)

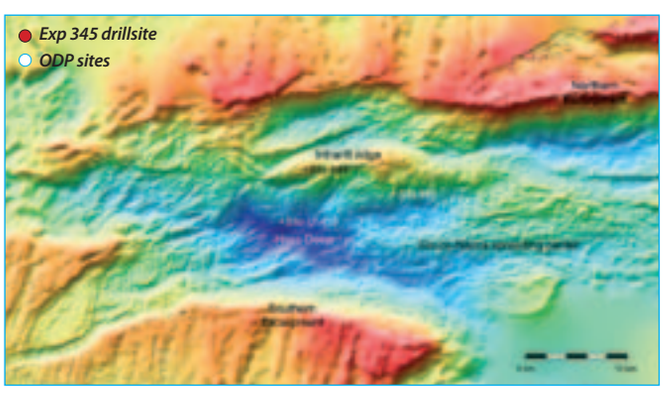
Delphine Charpentier	University Franche-Comté	France
Paula Diz Ferreiro	University of Vigo	Spain
Ken Heydolph	GEOMAR	Germany
Walter Kurz	University of Graz	Austria
Steffen Kutterolf	GEOMAR	Germany
Maria Sandoval Gutierrez	University of Lausanne	Switzerland
Christopher Smith-Duque	NOC Southampton	UK

Samples to be taken from basement core sections of Expedition 344 are discussed. From left to right, Walter Kurz (University of Graz, Austria), Arito Sakaguchi (Co-chief Scientist, JAMSTEC), Cristina Millan (Ohio State University), Robert Harris (Co-chief Scientist, Oregon State University), Yuzuru Yamamoto (JAMSTEC) and Katerina Petronotis (Expedition Project Manager) (John Beck, IODP/TAMU).

understanding of subduction erosion regarding **(1)** the composition, texture, and physical properties of upper plate material, **(2)** the rates of sediment accumulation and margin subsidence in slope sediment, **(3)** the interactions between fluid and rock, the hydrologic systems, and the geochemical processes, **(4)** the stress field along the CRISP transect, and **(5)** the impact of Cocos Ridge subduction, the evolution of the Central American volcanic arc and the development of the volcanic gap inboard of the Cocos Ridge.

Expedition 345 Hess Deep Plutonic Crust, *JOIDES Resolution*,11th December 2012 - 12th February 2013

The main objective for the *JOIDES Resolution* Expedition 345 was to study crustal accretion processes at the fast-spreading East Pacific Rise (EPR) to test competing hypotheses of magmatic accretion and hydrothermal processes at fast-spreading mid-ocean ridges. These hypotheses included the presence or absence of modally layered gabbro, the presence or absence of systematic variations in mineral and bulk rock compositions, and the extent and nature of hydrothermal alteration and deformation. Ongoing work by the science party on petrological, chemical, and structural data for cores of deep primitive gabbros, will be able to address fundamental questions including understanding the proportion of the plutonic lower crust constructed through crustal subsidence and *in-situ* crystallisation; the mechanisms for how the melt is transported from the mantle through the crust; the mechanisms and rates for heat extraction from the lower plutonic crust; and the fluid and geochemical fluxes in the EPR lower plutonic crust.



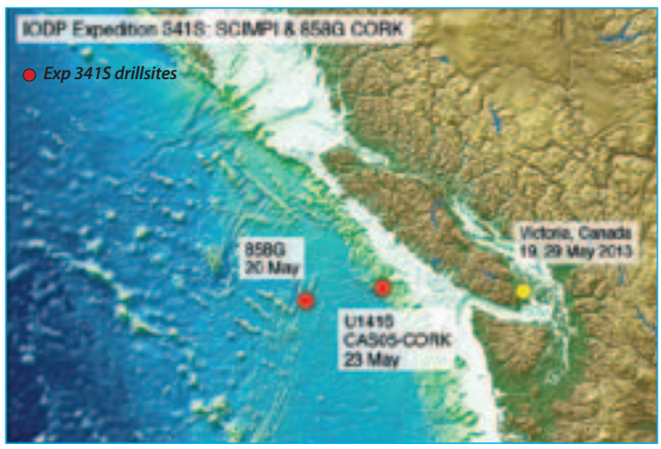
From left to right, Marie Python (Hokkaido University), Georges Ceuleneer (GET, Toulouse), Jinichiro Maeda (Hokkaido University, Japan), and Yumiko Harigane (AIST, Japan) in the core lab during Expedition 345 (William Crawford, IODP/TAMU).

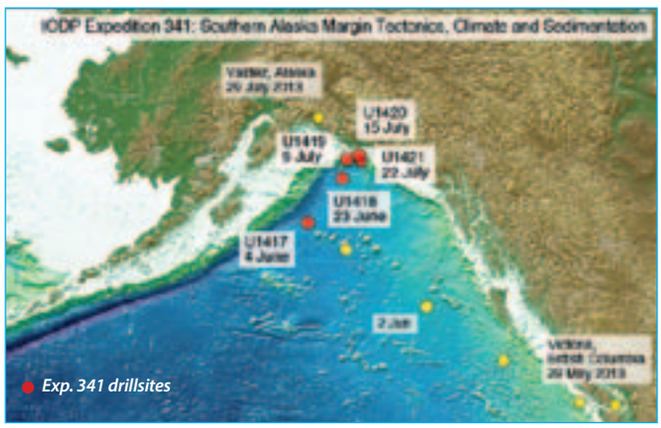
ECORD participants (Expedition 345)

Kathy Gillis, Co-chief Scientist	University of Victoria, BC	Canada
Georges Ceuleneer	GET, Toulouse,	France
Kathrin Faak	Ruhr University Bochum	Germany
Marguerite Godard	University Montpellier2	France
Benoît Ildefonse	University Montpellier2	France
Juergen Koepke	University of Hannover	Germany
Andrew M. McCaig	University of Leeds	UK
Romain Meyer	University of Bergen	Norway
Antony Morris	University of Plymouth	UK

Expedition 341S SCIMPI, *JOIDES Resolution*, 19th - 29th May 2013

Expedition 341S was an engineering expedition conducted prior to the Sciencific Expedition 341. Expedition 341S was dedicated to two separate projects: **(1)** the first deployment of the Simple Cabled Instrument for Measuring Parameters In Situ (SCIMPI) on the Cascadia margin. SCIMPI is a new observatory instrument designed to study dynamic processes in the sub-seabed based on a simple and low-cost approach. SCIMPI was successfully installed in Hole U1416A; **(2)** the replacement of the CORK in Hole 858G for formation pressure monitoring in the Middle Valley axial rift of the Juan de Fuca Ridge. Both installations were targeted to be





incorporated into the NEPTUNE observatory network. The new CORK was not installed because the old CORK could not be removed from Hole 858G.

Expedition 341 Southern Alaska Margin Tectonics, Climate and Sedimentation, *JOIDES Resolution*, 29th May - 29th July 2013

The primary objectives for the *JOIDES Resolution* Expedition 341 was to document the tectonic response of an active orogenic system to late Miocene to recent climate change. For this, they recovered the sedimentary record from the northeast Pacific continental margin that formed during orogenesis at a time of significant global climatic deterioration in the Pliocene-Pleistocene, which led to the development of the most aggressive erosion agent on the planet, a temperate glacial system. Scientists are using the sedimentary provenance and paleoclimatic, glacimarine, and structural sedimentary indicators tied to a multicomponent chronology to generate detailed records of changes in the locus and magnitude of glacial erosion, degree of tectonic shortening, and sediment and freshwater delivery to the coastal ocean and their impact on oceanographic conditions in the Gulf of Alaska, and the resulting continental margin stratigraphic record on the interaction of these processes. Because the oceanographic processes in the Gulf of Alaska directly impact the Bering Sea, results from Expedition 341 are expected to strongly complement those from Expedition 323 by addressing the late Neogene evolution of continental glaciation and freshwater and nutrient inputs, but in a more proximal source to glacial drivers of many of these processes.

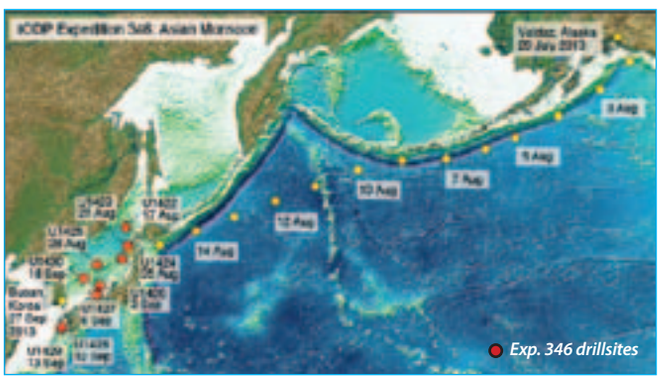
ECORD participants (Expedition 341)

Heinrich Bahlburg	University of Münster	Germany
Matthias Forwick	University of Tromsø	Norway
Christian E. März	Newcastle University	UK
Erin L. McClymont	Durham University	UK
Juliane Müller	AWI	Germany
Oscar Romero	IACT-CSIC, University Granada	Spain
Guillaume St-Onge	ISMER, UQAR	Canada

A derrickman in the derrick at sunrise during Expedition 341(Matthias Forwick, IODP/TAMU).

Expedition 346 Asian Monsoon, *JOIDES Resolution*, 29th July - 28th September 2013

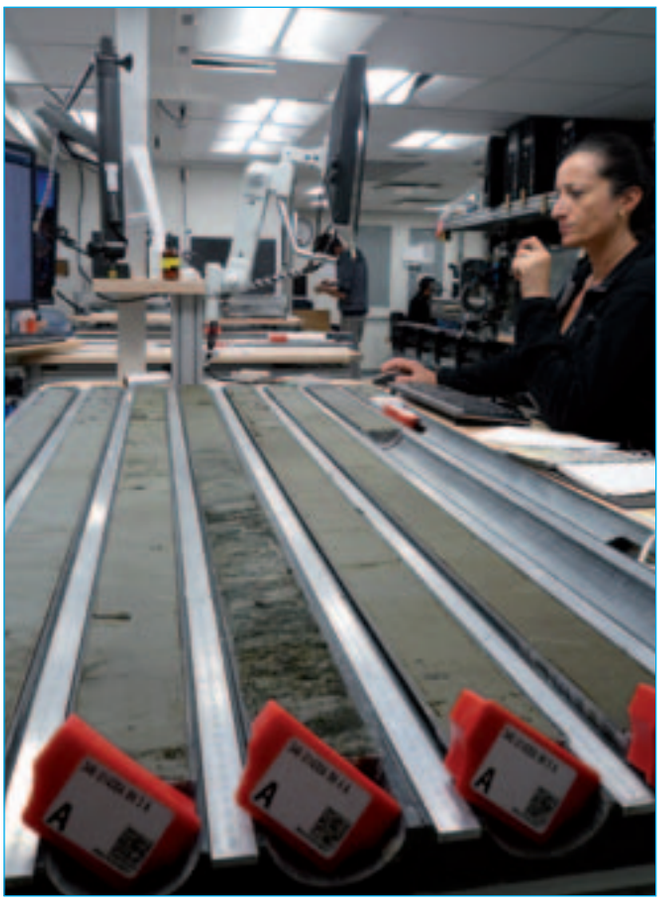
Drilling a transect of sites on the Japan Sea and one site on the northern East China Sea during Expedition 346 aims at testing the hypothesis that Pliocene-Pleistocene uplift of the Himalaya and Tibetan Plateau, and the consequent emergence of the two discrete modes of Westerly Jet circulation, caused the amplification of millennial-scale variability of the East Asian summer monsoon (EASM) and East Asian winter monsoon (EAWM) and provided teleconnection mechanism(s) for Dansgaard-Oeschger cycles. Ongoing work on sediments obtained from the southern part of the Japan Sea transect will be used to reconstruct the behaviour of the Subpolar Front and examine its relationship with the Westerly Jet and sea-level changes, whereas the sediments from the northern part of the transect will be used to identify ice-rafted debris events and reconstruct temporal variation in its southern limit. In addition, a depth transect of sites will reconstruct the ventilation history of the Japan Sea and examine the relation between ventilation and the nature of the influx through the Tsushima Strait and/or the intensity of winter cooling. Sediments obtained from the East China Sea will monitor the Yangtze River discharge history that should reflect variations in EASM intensity.



ECORD participants (Expedition 346)

Johanna Lofi*	University of Montpellier 2	France
Maria-Angela Bassetti	University of Perpignan	France
Andrew Henderson	Newcastle University	UK
Ann E. Holbourn	University of Kiel	Germany
Cristina Lopes	Instituto Português do Mar e da Atmosfera	Portugal
Mariem Saavedra Pellitero	University of Bremen	Italy
Samuel Toucanne	Ifremer	France
Chuang Xuan	University of Southampton	UK
Martin Ziegler	Cardiff University	UK

** Logging Staff Scientist*



Maria-Angela Bassetti (Sedimentologist, University of Perpignan) handles the task of data entry into the database (Saiko Sugisaki & IODP).

Expedition 347 Baltic Sea Paleoenvironment *Greatship Manisha*, 12th September - 1st November 2013

Expedition 347 *(map page 7)* was conducted using the drillship *Greatship Manisha* as a mission-specific platform to understand climate and sea-level dynamics and the responses of the deep biosphere to these changes from Isotopic Stage (MIS) 5 to recent. Sediments obtained during this expedition will provide paleoenvironmental information on a semi-continental scale, as the Baltic Sea drains an area four times as large as the basin itself. Sediments from the Baltic Sea Basin (BSB), located at the heartland of the recurrently waning and waxing Scandinavian Ice Sheet, will provide insights into the complex development history including repeated glaciations of different magnitude, sensitive responses to sea-level and gateway threshold changes, and large shifts in sedimentation patterns. In addition, ongoing studies about the variability (*i.e.*, salinity climate, sedimentation pattern, and oxygenation) that the BSB has undergone during the last glacial cycle will address questions such as its evolution, its biogeochemical processes, and how the postglacial diffusive penetration

ECORD participants (Expedition 347)

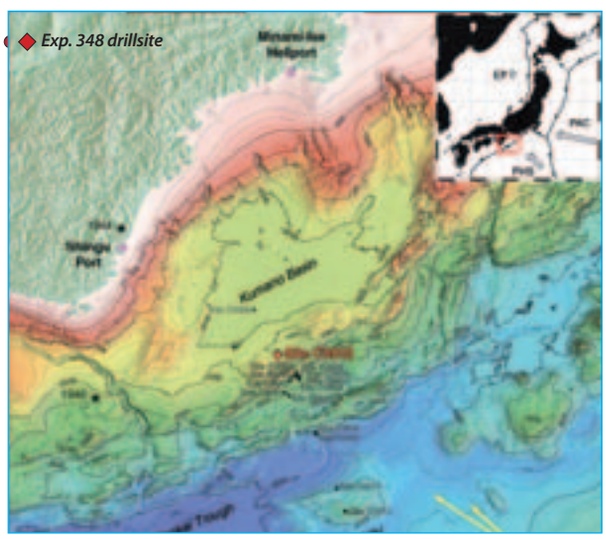
Thomas Andrén, Co-chief Scientist	Södertörn University	Sweden
Bo Barker Jørgensen, Co-chief Scientist	Aarhus University	Denmark
Elinor Andrén	Södertörn University	Sweden
Thorsten Bauersachs	Christian-Albrechts-University	Germany
Barry Cragg	Cardiff University	UK
Anne-Sophie Fanget	University of Perpignan	France
Wojciech Granoszewski	PGI-NRI	Poland
Jeroen Groeneveld	University of Bremen	Germany
Outi Hyttinen	University of Helsinki	Finland
Jørn Bo Jensen	GEUS	Denmark
Michael Kenzler	University of Griefswald	Germany
Aarno Kotilainen	Geological Survey of Finland	Finland
Ulrich Kotthoff	University of Hamburg	Germany
Ian P. G. Marshall	Aarhus University	Denmark
Caroline Slomp	Utrecht University	Netherlands
Ian Snowball	Lund University	Sweden
Andrea Torti	Aarhus University	Denmark

Core stored onboard the Greatship Manisha during Expedition 347 (D. Smith ©ECORD/IODP).

of conservative seawater ions may alter the chemical composition and microbial physiology in the sub-seafloor biosphere.

Expedition 348 NanTroSEIZE - Plate Boundary Deep Riser 3, *Chikyu*, 1st October 2012 - 29th January 2013

The Nankai Trough Seismogenic Zone Experiment (NanTroSEIZE) Stage 3 during *Chikyu* Expedition 348, aimed at deepening and casing Hole C0002F, an effort that was aborted during Expedition 338 *(page 25)* due to damage to drilling equipment by sudden changes in sea and weather conditions.



ECORD participants (Expedition 348)

Ana Crespo Blanc	University of Granada	*Spain*
Pierre Henry	CEREGE-CNRS	*France*
Sebastian Hammerschmidt	MARUM, University of Bremen	*Germany*
Maria José Jurado	IJA-CSIC	*Spain*
Ana Maia	Cardiff University	*UK*
Hiroki Sone	GFZ Potsdam	*Germany*

Casing of the hole aims at preserving the borehole for a later expedition to cross the mega-splay fault to elucidate the mechanisms for occurrences of mega-earthquakes and tsunamis, which is the main target of the NanTroSEIZE programme. The drilling operation during Expedition 348 reached a depth of 3,058.5 mbsf, a world record for the deepest scientific ocean drilling, and successfully obtained data on the physical properties of the geologic strata from logging while drilling (LWD), as well as lithological samples (cuttings and core) from deep in the interior of the accretionary prism. These data and samples are the first ever collected from an active accretionary prism, and cored a substantial fault zone deep within the prism.

Recent publications from ECORD scientists related to DSDP, ODP and *JOIDES Resolution* and *Chikyu* IODP expeditions

Publications related to MSP Expeditions (302, 310, 313 and 325) are listed on pages 12-13 & 15

Bach, W., Jöns, N. & Klein, F. (2013). Metasomatism Within the Ocean Crust. In Harlow, D.E. and Austrheim, H. Eds, Metasomatism and the chemical transformation of rock - Lecture Notes in Earth System Sciences, *253-288*, Springer-Verlag. doi:10.1007/978-3-642-28394-9_8

Bijl, P.K., Bendle, J.A., Bohaty, S.M., Pross, J., Schouten, S., Tauxe, L., Stickley, C.E., Röhl, U., Sluijs, A., Olney, M., Brinkhuis, H., Escutia, C. & Expedition 318 Scientists (2013). Onset of Eocene Antarctic cooling linked to early opening of the Tasmanian Gateway. PNAS, 110 (24) *9645-9650*. doi:10.1073/pnas.1220872110

Brant, C., Coogan, L.A., Gillis, K.M., Seyfried, W.E., Pester, N.J. & Spence, J. (2012). Lithium and Li-isotopes in young altered upper oceanic crust from the East Pacific Rise. G. C. A., 96, *272–293*. doi:10.1016/j.gca.2012.08.025

Chang, L., Winklhofer, M., Roberts, A.P., Heslop, D., Florindo, F., Dekkers, M.J., Krijgsman, W., Kodama, K. & Yamamoto, Y. (2013). Low-temperature magnetic properties of pelagic carbonates: Oxidation of biogenic magnetite and identification of magnetosome chains, J. Geophys. Res. Solid Earth, 118, *6049–6065*. doi:10.1002/2013JB010381

Channell, J.E.T. & Hodell, D.A. (2013). Magnetic signatures of Heinrich-like detrital layers in the Quaternary of the North Atlantic. EPSL, 369, *260-270*. doi:10.1016/j.epsl.2013.03.034

Contreras, L., Pross, J., Bijl, P. K., Koutsodendris, A., Raine, J. I., van de Schootbrugge, B. & Brinkhuis, H. (2013). Early to Middle Eocene vegetation dynamics at the Wilkes Land Margin (Antarctica), Rev. Palaeobot. Palynol., 197, *119-142*. doi:10.1016/j.revpalbo.2013.05.009

Contreras, S., Meister, P., Liu, B., Prieto-Mollar, X., Hinrichs, K.U., Khalili, A., Ferdelman, T.G., Kuypers, M.M.M. & Jørgensen, B.B. (2013). Cyclic 100-ka (glacial-interglacial) migration of subseafloor redox zonation on the Peruvian shelf. PNAS, 110 (45) *18098-18103*. doi:10.1073/pnas.1305981110

Cook, C.P., van de Flierdt, T., Williams, T. J., Hemming, S. R., Iwai, M., Kobayashi, M., Jimenez-Espejo, F.J., Escutia, C, González, J.J., McKay, R., Passchier, S., Bohaty, S.M., Tauxe, L., Sugisaki, S., Lopez Galindo, A., Patterson, M.O., Riesselman, C, Sangiorgi, F., Pierce, E. L., Brinkhuis, H. & IODP Expedition 318 Scientists (2013). Dynamic Behaviour of the East Antarctic Ice Sheet during Pliocene Warmth. Nature Geosciences, 6 (9) *765-769* doi:10.1038/ngeo1889

Dekov, V.E., Rouxel, O., Asael, D., Hålenius, U. & Munnik, F. (2013) Native Cu from the oceanic crust: Isotopic insights into native metal origin, Chem. Geol., 359 (14) *136-149*. doi:10.1016/j.chemgeo.2013.10.001.

Destrigneville, C., Fabbri, O, Henry, P., Agrinier, P. & Karpoff, A.M. (2013). Fluid-sediment interactions in the Nankai subduction zone (NanTroSEIZE): pore fluid and mineralogical records, Procedia Earth Planet. Science, 7, *207-210*. doi:10.1016/j.proeps.2013.03.045

De Schepper, S., Groeneveld, J., Naafs, B.D.A., Van Renterghem, C., Hennissen, J., et al. (2013). Northern Hemisphere Glaciation during the Globally Warm Early Late Pliocene. PLoS ONE 8(12): e81508. doi:10.1371/journal.pone.0081508

Fliegel, D., Knowles, E., Wirth, R., Templeton, A., Staudigel, H., Muehlenbachs, K., Furnes, H. (2012). Characterization of alteration textures in Cretaceous oceanic crust (pillow lava) from the N-Atlantic (DSDP Hole 418A) by spatially-resolved spectroscopy, G. C. A., 96, *80-93*. doi:10.1016/j.gca.2012.08.026

Fox, L.R. & Wade, B.S. (2013). Systematic taxonomy of early–middle Miocene planktonic foraminifera from the equatorial Pacific ocean: Integrated Ocean Drilling Program, Site U1338. J. Foramin. Res., 43, *374-405*. doi:10.2113/gsjfr.43.4.374

Girone, A., Maiorano, P., Marino, M. & Kucera, M. (2013). Calcareous plankton response to orbital and millennial-scale climate changes across the Middle Pleistocene in the western Mediterranean. Palaeogeogr. Palaeoclim. Palaeoec., 392, *105-116*. doi:10.1016/j.palaeo.2013.09.005

Hammerschmidt, S., Davis, E.E. & Kopf, A. (2013). Fluid pressure and temperature transients detected at the Nankai Trough Megasplay Fault: Results from the SmartPlug borehole observatory, Tectonophysics, 600, *116-133*. doi:10.1016/j.tecto.2013.02.010

Holbourn, A., Kuhnt, W., Lyle, M., Schneider, L., Romero, O. & Andersen, N. (2013). Middle Miocene climate cooling linked to intensification of eastern equatorial Pacific upwelling. Geology, 42 (1) *19-22*. doi:10.1130/G34890.1

Houben, A.J.P., Bjil, P.K., Pross, J., Bohaty, S.M., Stckley, C.E., Passchier, S., Roehl, U., Sugisaki, S., Tauxe, L.,van de Flierdt, T., Olney, M., Sangiorgi, F., Sluijs, A., Escutia, C., Brinkhuis, H., & the Expedition 318 Scientists (2013) Modern Southern Ocean plankton ecosystems arose at the onset of Antarctic glaciation, Science, 340 (6130) *341-344*. doi:10.1126/science.1223646

Jaccard, S.L., Hayes, C. T., Martínez-García, A, Hodell, D. A., Anderson, R. F., Sigman, D. M. & Haug, G. H. (2013). Two modes of change in Southern Ocean productivity over the past million years. Science, 339, *1419-1423*. doi :10.1126/science.1227545

Kaufman, D.S, Cooper, K., Behl, R., Billups, K., Bright, J., Gardner, K., Hearty, P., Jakobsson, M., Mendes,I., O'Leary, M., Polyak, L., Rasmussen, T., Rosa, F. & Schmidt, M. (2013). Amino acid racemization in mono-specific foraminifera from Quaternary deep-sea sediments. Quat. Geochron, 16, *50-61*. doi:10.1016/j.quageo.2012.07.006

Kochhann, K.G.D, Koutsoukos, E.AM., Fauth, G. & Sial, A.N. (2013). Aptian-Albian planktic foraminifera from DSDP Site 364 (offshore Angola): biostratigraphy, paleoecology, and paleoceanographic significance. J. Foramin. Res., 43, *443-463*. doi:10.2113/gsjfr.43.4.443

Khélifi, N. & Frank, M. (2013). A major change in North Atlantic deep water circulation during the Early Pleistocene transition 1.6 million years ago. Clim. Past Discuss., 9, *6495-6513*. doi:10.5194/cpd-9-6495-2013

Ikari, M.J., Marone, C., Saffer, D.M. & J. Kopf, A. (2013). Slip weakening as a mechanism for slow earthquakes, Nature Geoscience, 6, *468-472* doi:10.1038/ngeo1818

Mattingsdal, R., Knies, J., Andreassen, K., Fabian, K., Husum, K., Grøsfjeld, K., De Schepper, S.. A new 6 Myr stratigraphic framework for the Atlantic–Arctic Gateway. Quat. Sci. Rev., *Publ. online 19 September 2013*. doi:10.1016/j.quascirev.2013.08.022.

Müller-Michaelis, A., Uenzelmann-Neben, G. & Stein, R. (2013). A revised Early Miocene age for the instigation of the Eirik Drift, offshore

southern Greenland: Evidence from high-resolution seismic reflection data, Mar. Geol., 340, *1-15*. doi:10.1016/j.margeo.2013.04.012

Naafs, B.D.A., Hefter, J. & Stein, R. (2013). Millennial-scale ice rafting events and Hudson Strait Heinrich(-like) Events during the late Pliocene and Pleistocene: a review. Quat. Sci. Rev., 80, *1-28*, doi:10.1016/j.quascirev.2013.08.014

Orcutt, B.N., Wheat, C.G., Rouxel, O., Hulme, S., Edwards, K.J. & Bach, W. (2013). Oxygen consumption rates in subseafloor basaltic crust derived from a reaction transport model. Nature Comms, 4, #2539. doi:10.1038/ncomms3539

Pancost, R. D., Taylor, K.W.R. Inglis, G.N., Kennedy, E.M., Handley, L., Hollis, C.J., Crouch, E.M., Pross, J., Huber, M., Schouten, S., Pearson, P. N., Morgans, H.E.G. & Raine, J.I.. Early Paleogene evolution of terrestrial climate in the SW Pacific, Southern New Zealand. Geochem. Geophys. Geosyst., 14, doi:10.1002/2013GC004935. *Publ. online 26 December, 2013*

Roberts, A.P., Florindo, F., Chang, L., Heslop, D., Jovane, L. & Larrasoaña, J.C. (2013) Magnetic properties of pelagic marine carbonates, Earth-Science Reviews, 127, *111-139*, doi:10.1016/j.earscirev.2013.09.009

Sager, W.W., Zhang, J., Korenaga, J., Sano, T., Koppers, A.A.P., Widdowson, M. & Mahoney, J.J. (2013). An immense shield volcano within the Shatsky Rise oceanic plateau, northwest Pacific Ocean. Nature Geoscience, 6, 976–981, doi:10.1038/ngeo1934

Schindlbeck, J.C., Kutterolf, S., Freundt, A., Scudder, R.P., Pickering, K.T. & Murray, R.W. (2013). Emplacement processes of submarine volcaniclastic deposits (IODP Site C0011, Nankai Trough), Mar. Geol., 343, *115-124*. doi:10.1016/j.margeo.2013.06.017

Schreck, M., Matthiessen, J. & Head, M.J. (2012). A magnetostratigraphic calibration of Middle Miocene through Pliocene dinoflagellate cyst and acritarch events in the Iceland Sea (Ocean Drilling Program Hole 907A). Rev. Palaeobot. Palynol, 187, *66-94*. doi:10.1016/j.revpalbo.2012.08.006

Stocchi, P., Escutia, C., Houben, A.J.P., Bijl, P.K., Brinkhuis, H., DeConto, R., Galeotti, S, Vermeersen, B.L.A., & Expedition 318 Scientists (2013). Relative sea level rise around East Antarctica during Oligocene glaciation. Nature Geosciences, 6 (5) *380-384*. doi:10.1038/ngeo1783

Stoner, J. S., Channell, J. E. T., Mazaud, A., Strano, S. E. & Xuan (2013). The influence of high-latitude flux lobes on the Holocene paleomagnetic record of IODP Site U1305 and the northern North Atlantic, Geochem. Geophys. Geosyst., 14, *4623-4646*. doi:10.1002/ggge.20272

Uenzelmann-Neben, G. (2013). Magma giant. Nature Geoscience, 6, *902-903*. doi:10.1038/ngeo1958

Voigt, S., Jung, C., Friedrich, O., Frank, M., Teschner, C. & Hoffmann, J. (2013). Tectonically restricted deep-ocean circulation at the end of the Cretaceous greenhouse. EPSL, 369-370, *169-177*. doi:10.1016/j.epsl.2013.03.019

Wehrmann, L.M., Ockert, C., Mix, A.C., Gussone, N., Teichert, B.M.A. & Meister, P. (2013). Repeated occurrences of methanogenic zones, diagenetic dolomite formation and linked silicate alteration in southern Bering Sea sediments (Bowers Ridge, IODP Exp. 323 Site U1341), Deep Sea Research Part II: Topical Studies in Oceanography, doi:10.1016/j.dsr2.2013.09.008. *Publ. online 25 September 2013*

Sunrise over the Pacific Ocean during Expedition 345 Hess Deep Plutonic Crust (Tim Fulton, IODP/TAMU).

7. Engaging the community

One of ECORD's main responsibilities is to promote and facilitate ocean drilling within its member countries. The scientific committee of ECORD, ESSAC, has developed a number of activities that contribute to co-ordination of the science community, the preparation of drilling proposals (MagellanPlus Workshop Series Programme) and the training and education of future generations (ECORD Summer Schools, Scholarships, Research Grants and Distinguished Lecturer Programme).

Engaging the community in the development of future drilling programmes

The **ECORD/ICDP MagellanPlus Workshop Series Programme** is designed to support European and Canadian scientists in developing new and innovative science proposals for submission to IODP and ICDP. The programme continues and expands the success of the previous ESF Magellan Workshop Series Programme, through the integration of continental and marine drilling and coring to meet future challenges in Earth, Life and Environmental sciences. The programme has two calls annually. Three MagellanPlus Workshops, dedicated to nurture and create IODP and ICDP proposals, took place in 2013. These workshops were co-funded by other programmes and organisations (*e.g.* ICDP, JAMSTEC, USAC, MEDGATE and IMAGES). In total more than 110 scientists attended these workshops.

- ***Advancing our understanding of Cretaceous Ocean Dynamics by Scientific Drilling, 15th-17th April 2013, London, UK*** - Convenors: Stuart Robinson and Tim Bralawer

In mid April, 47 participants including 22 from ECORD countries met in London *(below)* to discuss the need and potential targets for coring Cretaceous sediments in order to better understand Cretaceous Ocean Dynamics. Scientific key questions were the sensitivity of Cretaceous climate to CO_2, the role of ice in a greenhouse world, Oceanic Anoxic Events, ocean acidification and the impact of high organic carbon burial on the deep biosphere. Regional working groups built during the workshop came up with potential future drilling targets for IODP and/or ICDP.

- ***Deep-sea Record of Mediterranean Messinian Events (DREAM), 5th-8th May 2013, Brisighella, Italy*** - Convenors: Angelo Camerlenghi & Co-proponents

The presence of beautiful outcrops of Messinian sediments made Brisighella in Italy an ideal place to host a workshop focusing on the history of the Messinian Salinity Crises in deep-sea sediments of the Mediterranean (DREAM), in early May. Potential areas and realistic drilling targets were defined based on the investigation of seismic lines during the meeting. Several proposal ideas also emerged to support the multi-phase drilling project concept: salt tectonics and fluids, deep stratigraphic and crustal drilling in the Gulf of Lion (deriving from the GOLD Drilling project),

Participants of the MagellanPlus Workshop on Cretaceous Ocean Dynamics in London.

deep stratigraphic and crustal drilling in the Ionian Sea, deep biosphere, sapropels, and the Red Sea. The "umbrella proposal" for the multi-phase drilling project and a preliminary drilling proposal could be ready for submission by 1st April 2014.

• ***Integrated Southern Ocean Latitudinal Transects (ISOLAT), 23rd-25th September 2013, Cambridge, UK***
Convenors: Ian Hall and Luke Skinner

ISOLAT held in Cambridge in late September 2013 and brought together members of the palaeo-data and climate modelling communities to define scientific questions and targets for coring to investigate the variability of the Antarctic Circumpolar Current (ACC). Besides this scientific focus, the workshop provided the basis for the development and submission of integrated proposal(s) including the acquisition of long (30-50 m) sediment cores along latitudinal transects. In the future, this will hopefully support ECORD to implement long coring as a mission-specific option within the framework of the IODP.

Related website: http://www.ecord.org/magellanplus.html

Training young scientists

Training the next generation of scientists in ECORD member countries is a major goal. Initiated in 2007, the **ECORD Summer Schools** are now well established and attended by a large number of PhD students and Post-doctoral researchers from member countries and beyond. In 2013, two summer schools were sponsored by ECORD.

• ***ECORD Summer School on "Past Global Change Reconstruction and Modelling Techniques", Urbino, July 10th-30th 2013***

This summer school is organised every year under the auspices of the University of Urbino to train a group of students from ECORD member countries, USA, and beyond. The school is designed to train the students in reconstructing past global environmental changes by using the paleoenvironmental indicators in sedimentary strata and modeling. The courses include lectures *(top right)*, field trips *(middle right)* and exercises organised by instructors drawn from an international pool built up to include the top scientists in their field. In 2013, the summer school brought together 64 students from Europe, Canada and three non-ECORD countries, USA, New Zealand and Mexico (17 UK, 11 Germany, 8 Netherlands, 4 France, 2 Italy, 2 Spain, 1 Canada, 1 Denmark, 1 Sweden, 13 US, 3 New Zealand and 1 Mexico).
Related website: http://www.urbinossp.it/

Lecture courses at the 2013 Urbino Summer School (courtesy L Lourens).

Urbino Summer School field trip to the K-Pg boundary exposed in the Bottaccione valley near Gubbio (courtesy L. Lourens).

• ***ECORD Summer School on "Deep-Sea Sediments:From Stratigraphy to Age Models" Bremen, 9th-20th September 2013***

Held at the IODP Bremen Core Repository (BCR), the ECORD Bremen Summer School takes advantage of the "virtual ship" facilities associated with the core repository. Students work on real cores stored at the BCR using the laboratory facilities available at MARUM *(pages 23 & 34)*. In 2013, the summer school brought together 30 PhD students and young Post-docs from Europe and Canada and non-ECORD countries: 2 Austria, 2 Belgium, 1 Chile, 1 Finland, 1 France, 7 Germany, 1 Greece, 2 Italy, 1 the Netherlands, 1 Russia, 5 Spain, 2 Turkey, 3 UK, and 1 USA.
Related website: https://www.marum.de/en/ECORD_Summer_School_2013.html

Group of the ECORD Summer School 2013 in Bremen (Volker Diekamp, MARUM).

ECORD Scholarships

In 2013, ESSAC received 67 applications for ECORD Scholarships. Eight students were funded out of 38 applicants for the Urbino Summer School: 2 from the UK, 2 from Germany, 2 from Netherlands, 1 from Finland, and 1 from Sweden *(below)*.

Scholarship Awardees - Urbino Summer School 2013

Adele Cameron	Open University	UK
Tianyu Chen	GEOMAR	Germany
Julia Hoffman	University Frankfurt	Germany
Stephanie Kaboth	Utrecht University	The Netherlands
Ekaterina Kaparulina	University of Oulu	Finland
Cherry Newsam	University College London	UK
Jawang Wu	Utrecht University	The Netherlands
Afrifa Yamoah	Stockholm University	Sweden

Scholarship Awardees - Bremen Summer School 2013

Gabriela Arreguin	University of Zaragoza	Spain
Arne Deprez	Leuven University	Belgium
Matthew Dumoth	University of Edinburgh	UK
Christian Haller	University of Bonn	Germany
Claire Mckay	Lund University	Sweden
Elda Miramontes	University of Vigo	Spain
Mimmi Oskan	University of Helsinki	Finland
Chris Poole	University of Leeds	UK
Alexandra Romanova	Far East Geological Inst.	Russia
Ariadna Salabardana	IACT	Spain
Rosie Sheward	University of Southampton	UK
Erik Wofgring	University of Vienna	Austria

Twelve students were funded out of 29 applicants for the ECORD Bremen Summer School: 3 from UK, 3 from Spain, 1 from Austria, 1 from Belgium, 1 from Finland, 1 from Germany, 1 from Russia, and 1 from Sweden *(below left)*.

Related website: **http://www.essac.ecord.org/index.php?mod=education&page=scolarships**

ECORD Research Grants

Since 2010, ECORD sponsors merit-based awards for outstanding early-career researchers to conduct research related to the IODP. Research may be directed toward the objectives of upcoming or past DSDP/ODP/IODP expeditions (core material and/or data). The aim of the awards is to encourage young scientists to develop their own project and to become familiar with ocean drilling and to develop new collaborations outside of their home institutions. Twenty applications were received in 2013, and nine grants were funded: 3 from Germany, 3 from UK, 1 from Belgium, 1 from Canada and 1 from Sweden *(below)*.

ECORD Research Grants 2013

Thorsten Bauersachs	C A University	Germany
Claire Huck	Imperial College	UK
Katherine Prentice	Imperial College	UK
Wendy Kordesch	Univ.of Southampton	UK
Marina Martindale	Univ British Columbia	Canada
Katrien An Heirman	Gent University	Belgium
Patten Clifford	Stockholm University	Sweden
Iris Moebius	University of Frankfurt	Germany
Sebastian Hammerschmidt	University of Bremen	Germany

Related website: **http://www.essac.ecord.org/index.php?mod=education&page=grants**

Teachers at Sea

ECORD teachers have the opportunity to participate in IODP expeditions as Education Officers onboard the *JOIDES Resolution* - *http://joidesresolution.org/node/453*. The central goals of this education programme include:

- Providing teachers with an opportunity to participate in sea-going research experiences aboard the *JOIDES Resolution*, working side-by-side with scientists, using current state-of-the-art approaches to solve scientific problems of global interest, and gaining first-hand knowledge of the results of sea-going science expeditions;
- Translating scientific results into useful teaching resources, such as classroom curriculum materials;
- Disseminating these resources into classrooms across the country.

In 2013, two teachers from ECORD member countries, Susan Gebbels (UK) and Jean-Luc Bérenguer (France), sailed onboard the *JOIDES Resolution* to co-ordinate education and outreach activities during Expedition 345 Hess Deep Plutonic Crust *(pages 26 & 40)*. ESSAC was also involved in the selection of teachers to participate in the *JOIDES Resolution* Izu-Bonin-Mariana 2014 Expeditions (Expeditions 350-352). ESSAC received and ranked eight applications (3 UK, 2 Germany, 3 France). Selection of the candidates is ongoing.

Related website: **http://www.essac.ecord.org/index.php?mod=education&page=teacher-workshop**

ECORD Distinguished Lecturer Programme

The Distinguished Lecturer Programme (DLP) is designed to promote the scientific achievements of ocean drilling to a large audience within universities/ institutes in ECORD member countries. ESSAC selects the three "Distinguished Lecturers" who then tour ECORD member countries, and occasionally non-ECORD countries, to present the exciting discoveries from one of the four main scientific themes addressed by the IODP Science Plan. Any university in an ECORD member country may apply to host a lecturer.

The following ECORD Distinguished Lecturers visited 17 universities in Europe, Canada and Israel during 2013.

- ***Claude Hillaire Marcel*** (Université du Québec à Montréal, Canada)***:*** The Arctic Ocean in the Cenozoic climate system;.
- ***Benoît Ildefonse*** (Université de Montpellier, France): Mantle, ocean crust and seawater: where are we, and what is next in Scientific Drilling?;
- ***Roger Urgeles*** (Institut de Ciences del Mar-CSIC, Barcelona, Spain): Submarine landslides and derived tsunamis, new challenges for the IODP.

The current Distinguished Lecturer Programme will continue until June 2014.

Related website: **http://www.essac.ecord.org/index.php?mod=education&page=dlp**

Urbino Summer School 2013

8. Collaborating

ECORD and the European Commission

In FY2013, ECORD has worked on two major projects related to its potential collaboration with the European Commission (EC) **(1)** towards the establishment of a **Distributed European Infrastructure for Sub-Seafloor Sampling and Monitoring (DEISM)** and **(2)** exploring new ways of organising its management and funding, *e.g.* possibly as a European Research Infrastructure Consortium (ERIC).

A high level of technological expertise in sub-seafloor sampling and instrumentation is distributed across institutes and universities in Europe. Following the submission of DEISM *(lead proponent: G. Camoin)* and the **Distributed European Drilling Infrastructure (DEDI)** *(lead proponent: A. Kopf)* proposals by ECORD and DS3F respectively in October 2012, a call related to ocean drilling has been included in the new EC Integrated Infrastructure Initiative 2014-2015 document. The DEISM and DEDI proposals focused on scientific research into the sub-seafloor and were designed to increase and optimise trans-national access to cutting-edge technologies and scientific services to the European science community. Both proposals aimed to improve European collaboration in development and sharing of new, innovative technologies for coring, specialist sampling, downhole logging and long-term sub-seafloor observations, and were likely to stimulate further technological developments in these areas. This represents an excellent possibility to raise ECORD's profile, visibility and efficiency, and better serve the science community in Europe, Canada, Israel and associate partners.

In co-ordination with representatives of other science programmes and initiatives (ICDP, IMAGES, EMSO and Iceland GeoSurvey (ÍSOR)), as well as European institutions (*e.g.* MARUM, Ifremer)) these two pre-proposals will be merged with the aim to submit a full proposal in September 2014. Such a proposal will provide significant added value for the European contribution to IODP, thereby further strengthening Europe's scientific and technological impact on its prominent and ambitious research agenda; it will also benefit other programmes, initiatives and infrastructures through a synergistic collaboration.

The overall objectives of this proposal will include the integration and the sharing of existing technological resources across Europe, the provision of services (*e.g.* science, education and outreach, data management and legacy issues), and enhanced collaboration in the development of new and innovative technologies for investigating sub-seafloor environments.

Europe has a leadership position in the development, innovation and potential commercialisation of many cutting-edge technologies regarding sub-seafloor investigations, which require integration, co-ordination and further developments for maximising their use.

- The use of seafloor robotic coring devices (BGS seabed drills and MARUM MeBo, *page 19*) is increasing and has the potential to drastically cut costs of deep-sea exploration for industry and science;
- Piston corers (IPEV, Ifremer and NIOZ) *(below)* and deep-water vibrocorers (BGS and NOCS) can provide cheaper alternatives to recover undisturbed softer surficial sediments, with opportunities to enhance these technologies and provide new downhole logging techniques;

The giant piston corer Calypso is deployed onboard the vessel Marion Dufresne (Yvon BALUT/Institut Polaire Francais-IPEV).

- The use of piston corers and seabed drills will represent an expansion of the MSP concept;
- New developments by EPC regarding logging capabilities will include miniaturisation of existing technology to be used by robotic drills, and closer integration with technologies developed by ISOR for work in very hot areas;
- The development of sub-seafloor observing systems by MSPs using IODP drill holes is the key next step for ECORD. New developments and priorities that will benefit from shared resources include very deep-water, high-temperature and *in-situ* measurement technologies *(e.g. SmartPlug, page 19)* over extended time periods.

Recovery of the SmartPlug onboard the Chikyu during Expedition 332 NanTroSEIZE-Stage 2 (© JAMSTEC/IODP).

The ECORD Council has set up a working group to explore new ways of organising its management and funding, *e.g.* possibly as a European Research Infrastructure Consortium (ERIC). The working group evaluates the potential benefits as well as the potential constraints for ECORD in developing such an entity in various domains, among which are to secure long-term financial commitment, to increase ECORD visibility, to benefit from VAT exemption, to obtain a legal capacity, and to improve the ECORD co-ordination and governance. The ERIC working group will pursue its investigations in 2014 before reporting to the ECORD Council.

ECORD and other science programmes and initiatives

At the transition between the Integrated Ocean Drilling Program and the International Ocean Discovery Program, ECORD has created or improved its partnership opportunities with other science programmes and initiatives dealing with sub-seafloor scientific research. In addition to the participation of these programmes and initiatives in the DEISM proposal to be submitted in September 2014, ECORD representatives have attended the ICDP and the EMSO Science Conferences that were held in November 2013 in Potsdam, Germany, and in Rome, Italy respectively.

Collaboration between ECORD and IMAGES has been materialised by the funding of the ISOLAT Workshop in the frame of the MagellanPlus Workshop Series Programme. The submission of the first proposal to IODP by the IMAGES science community, based on a transect of long piston cores, is expected for the 1st April 2014 deadline *(page 33)*.

ECORD and ANDRILL have also initiated discussions regarding the potential implementation of a Complementary Project Proposal (CPP) operated by ECORD. EMA Director Gilbert Camoin was invited to an ANDRILL meeting during the AGU 2013 in San Francisco to present the IODP CPP concept and to help the ANDRILL group evaluate the implications of such an option.

Industry

The early part of the ECORD Industry Liaison Panel's activities in 2013 focused on reconnecting with previous ILP members and establishing new links from the hydrocarbon industry, service companies and academia.

A list of 35 contact persons was made and the first ILP meeting was organised in Geneva on 2nd-3rd May 2013. The meeting provided the opportunity to refresh the link between ECORD and industry (represented by Total, ENI, BP and ExxonMobil) and present the new ECORD/IODP structure and long-term vision and scientific research plan. Two focus areas were discussed which gained positive interest from the industry: the Arctic Ocean and the Mediterranean Sea (pre-Messinian salt). Other companies (Noble, Shell, Statoil, Repsol, Anadarko) have expressed interest in taking part in the panel.

A second occasion to meet with industry was during the 3P Arctic Conference in Stavanger in October 2013 focusing on Arctic exploration. ECORD organised an exhibit booth *(page 40)* to meet exploration industry representatives and service companies who were particularly interested in ECORD activities.

The ECORD-ILP programme and strategy was presented at the DREAM MagellanPlus Workshop held in Brisighella on 6-8 May 2013 *(page 32)*. Participation of industry representatives at the workshop was considered very positive and is recommended for future similar events. Their presence adds value by contributing the operators' point of view, especially their experiences from various aspects of drilling offshore. In preparation for the DREAM II MagellanPlus workshop planned on January 2014 in Paris, a visit to the Israeli Gelogical Survey and hydrocarbon companies operating in the Levantine Basin was held at the end of October 2013.

The ECORD-ILP proposed a pro-active approach to bringing industry partners on board by means of:

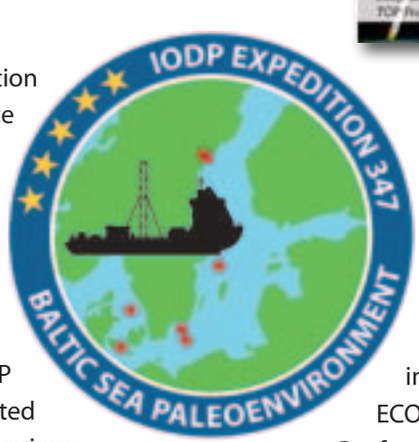
- Easier access to proposal descriptions on the IODP website (*e.g.* executive summary with potential interest for industry);
- Specific information about projects that are ready for discussion and input from industry partners;
- Matching the location of industry interest & IODP activity (*e.g.* from IHS Global: access to world data base of exploration and production operations (offshore interests blocks)).

An issue that will be discussed in 2014 is ECORD's position regarding engagement with oil companies. Developing a clear view as to whether or not the ILP should play a more pro-active role, such as having a 'business development approach' in promoting ECORD or/and *Chikyu* and the *JR* drilling facilities will be an important discussion to have within the ECORD community.

9. Reaching out

Promoting the activities and accomplishments of the IODP to large audiences is a major and constant goal, especially during the transitional period between the Integrated Ocean Drilling Program and the International Ocean Discovery Program. Within ECORD, responsibilities for outreach activities are distributed between EMA, ESO and ESSAC. Each office maintains its own website: EMA manages the ECORD website - *http://www.ecord.org* - which provides access to general information about ECORD and details about publications and resources; the ESO website - *http://www.eso.ecord.org* - gives information specifically related to mission-specific platform (MSP) expeditions and the ESSAC website - *http://www.essac.ecord.org* - describes opportunities to participate in IODP expeditions and events such as the ECORD Summer Schools and Distinguished Lecturer Programme (DLP).

The ECORD Outreach and Education Task Force *(page 47)* met twice during 2013 to co-ordinate the programme's outreach activities, in Salamanca, Spain in February, and in Paris, France, in October. ECORD outreach activities were focussed on promoting the new IODP through participation at selected conferences, publishing the various newsletters and promotional materials *(above)* and also developing activities in relation to the Baltic Sea Paleoenvironment Expedition, which started on 12th September 2013 *(pages 7-11)*

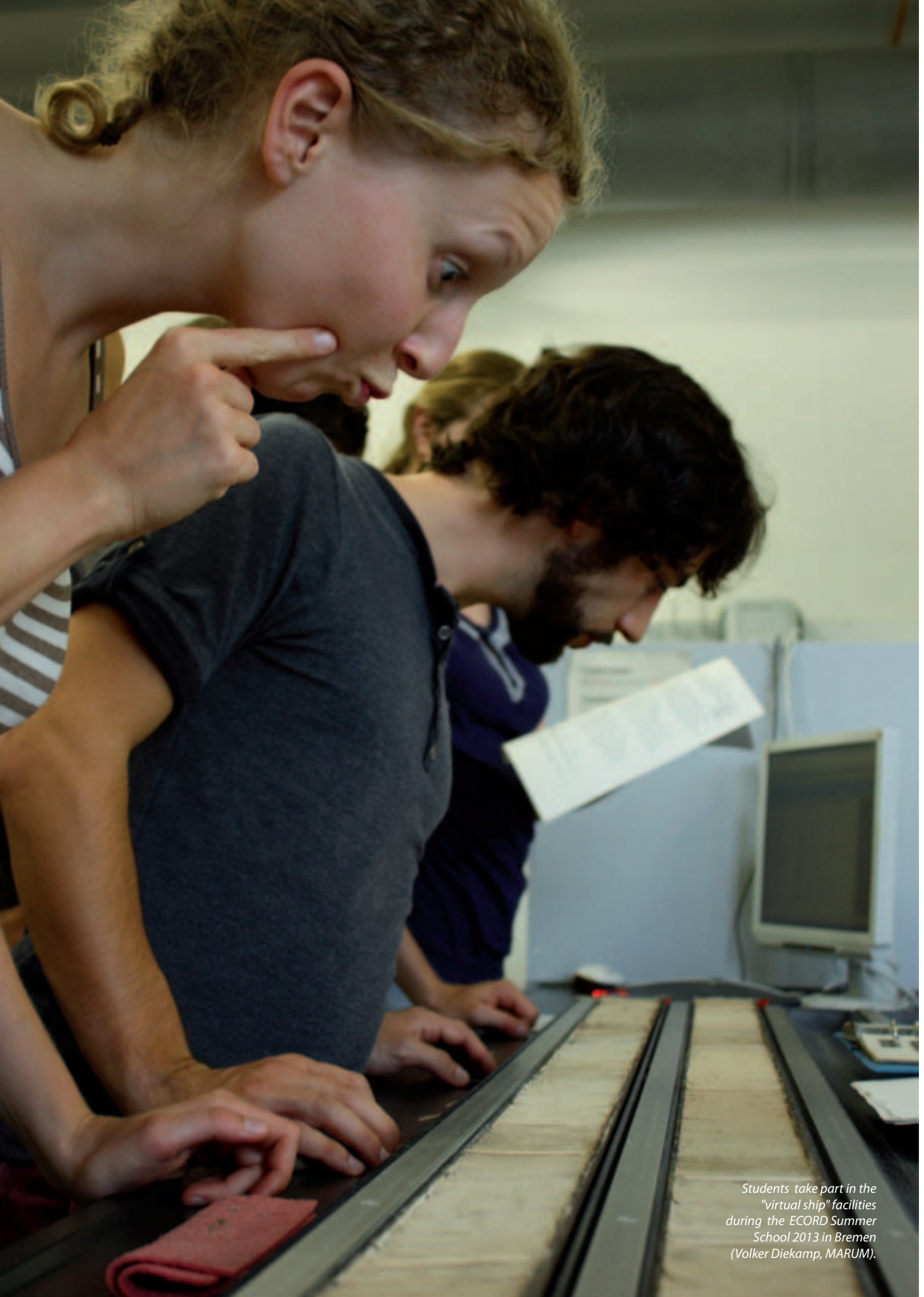


JR port call at Ogden Point, Victoria, BC, Canada. (D. Weis)

During the year, ECORD outreach staff organised a joint IODP-ICDP booth at the Goldschmidt Conference in Florence, Italy, in August and the IODP booth at the 3P Arctic Conference *(page 40)* in Stavanger, Norway. However, the main event for ECORD was the European Geosciences Union (EGU) Conference in Vienna, Austria in April at which ECORD and the ICDP jointly sponsor a booth and support a Townhall meeting. The success of these joint events will lead to similar collaboration in 2014.

Two international media conferences were organised by ECORD. The first event, "Exploring the environmental history of the Baltic Basin", took place in Copenhagen on 5th September 2013, at the start of the Baltic Sea Paleoenvironment Expedition. The other media event, "Discovering our oceans- A new era of ocean research drilling", was held on 9th October 2013, in Paris to mark the start of the International Ocean Discovery Program .

ECORD supported IODP Canada during the successful *JOIDES Resolution* port call on 9th-10th May in Victoria, British Columbia, *(left)* by providing promotional materials. The offer to visit the drillship *JOIDES Resolution* was well received, with a total of 50 visitors, including students, researchers and staff from local universities and various levels of government. ECORD information was also widely distributed at science meetings including the ECORD-ICDP



Students take part in the "virtual ship" facilities during the ECORD Summer School 2013 in Bremen (Volker Diekamp, MARUM).

The ECORD/IODP booth at the 3P Arctic Conference in Stavanger, Norway (A. Stevenson ©ECORD/IODP).

MagellanPlus Workshop Series and public events organised in European countries. ECORD staff also helped their outreach colleagues in Japan and the USA to co-ordinate booths at the Japan Geoscience Union Meeting in Chiba, Japan, in May and at the American Geophysical Union (AGU) Fall Meeting in San Francisco, USA, in December.

The ECORD Newsletter *(page 39)* is published twice yearly to coincide with the EGU and AGU conferences (spring and fall of each year). The newsletter provides the main published source of general ECORD information and also includes reports on recent outreach activities. ECORD produced pre-expedition materials (*e.g.* leaflet, expedition webpage and logo) for the Baltic Sea Paleoenvironment Expedition. Other leaflets explaining the programme objectives and the latest information resulting from the four completed MSP expeditions prior to 2013 are included in an ECORD folder, which is continuously updated.

The final version of the film, entitled "Looking for Life" was released in 2013 and shown at EGU 2013. The video was co-funded by ECORD and explains the scientific outcomes of Expedition 337 Deep Coalbed Biosphere off Shimokita conducted onboard the *Chikyu*.

Two teachers from ECORD member countries, Susan Gebbels (Newcastle University, UK) and Jean-Luc Bérenguer (Lycée International de Valbonne, France), were invited to sail on a two-month expedition as Education Officers onboard the *JOIDES Resolution* during Expedition 345 Hess Deep Plutonic Crust *(page 26)*. Susan and Jean-Luc co-ordinated education and outreach activities to bring geosciences to school classrooms, with live ship-to-shore broadcasts that reached 4,000 participants in 16 countries *(below)*. Information about geosciences was posted on the *JR*'s web portal and several primary schools in France and the UK interacted with the teachers throughout the duration of the expedition. Two Canadian teachers, Jane Londero (Whitehorse, Yukon) and Sarah Thornton (University of Victoria), took part in the 2013 School of Rock, a multi-day workshop designed for teachers and held on board the *JOIDES Resolution*.

To support science education, several IODP resources and educational activities are made available to the general public in ECORD countries. In May 2013, when the IODP-MI office in Tokyo closed, ECORD received two core replicas to add to their collection. Replicas of drilling cores from ODP/IODP expeditions were loaned for teaching in a high school in Valbonne, France, the University of Algarve, Portugal and the 10th Urbino Summer School. The replicas were also displayed at public events such as the science exhibit "Oceano y Tiempo" in Salamanca, Spain, and at two events in Germany, TU Night at Braunschweig University and Hannover IDEEN Expo.

From left to right, Nicole Kurz, Susan Gebbels and Jean-Luc Bérenguer, organise a broadcast onboard the JR during Expedition 345 (© IODP/TAMU).

ECORD continues to share information by posting news and photographs on social network sites. Conveying information to the science community and wider public in this way is especially useful during major events such as the transition to the new IODP and during the Baltic Sea Paleoenvironment Expedition when posts were linked to the expedition logbook giving an insight into the expedition's progress and life onboard the *Greatship Manisha*.

Related websites:
http://www.ecord.org/pi/promo.html
http://www.essac.ecord.org/index.php?mod=education

10. FY2013 and FY2014 budgets

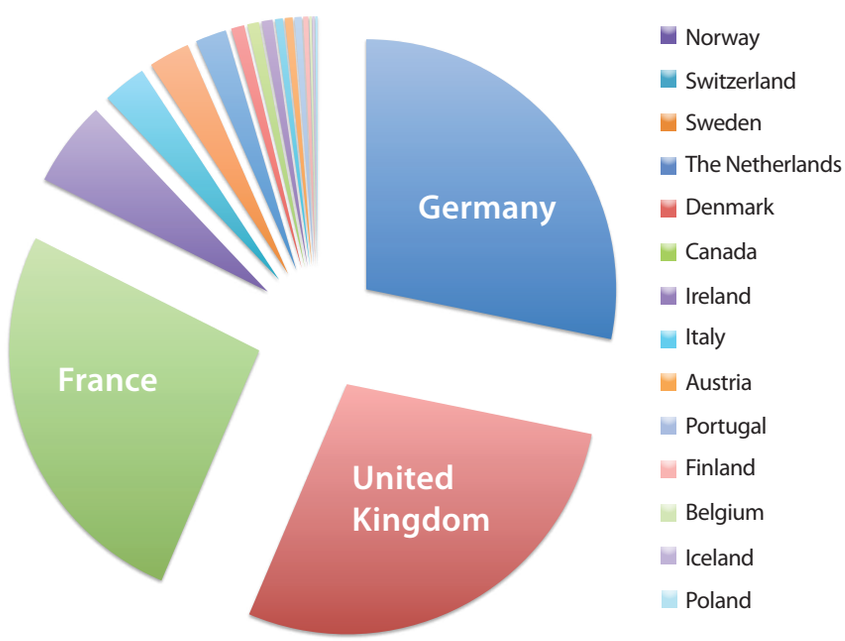
FY2013 ECORD budget

ECORD is currently funded exclusively by its member countries. The contributions to the budget by each member country are unevenly distributed, from USD 5.2-5.6 M for the three major contributors to USD 30,000 for Belgium, Iceland and Poland *(below)*.

To simplify the money flow, it was agreed in 2010 by ECORD, NSF and MEXT that the SOCs allocated to the ECORD Science Operator would be paid directly from the ECORD budget and deducted from the ECORD contribution to the commingled funds.

Austria	100,000
Belgium	30,000
Canada	150,000
Denmark	170,000
Finland	66,380
France	5,164,072
Germany	5,600,000
Iceland	30,000
Ireland	140,000
Italy	100,000
The Netherlands	400,000
Norway	1,100,000
Poland	30,000
Portugal	90,000
Spain	0
Sweden	528,000
Switzerland	560,000
The United Kingdom	5,600,000
Total	**19,858,452**

ECORD member country contributions for FY2013 (USD).



Relative breakdown of ECORD member country budget contributions for FY2013.

On the basis of their contributions, each ECORD member country receives a quota to participate in IODP expeditions *(see page 24)*. According to the agreements signed with the Lead Agencies of the Integrated Ocean Drilling Program, the NSF and MEXT, ECORD has made an annual contribution of USD 16.8 M to the IODP commingled funds to support "Science Operation Costs" (SOCs). These SOCs included support to the Central Management Office (IODP-MI) as well as to Platform Providers to cover the science support activities (analytical facilities, core curation, data management, etc.). As one of the three Platform Providers, the ECORD Science Operator therefore receives money from the commingled funds to cover science costs associated with mission-specific platform expeditions. This budget was negotiated on an annual basis between ESO and the Central Management Office and specified in the IODP Annual Program Plan. The remaining ECORD budget was used to support the MSP "Platform Operation Costs" (POCs), as well as the ECORD Managing Agency and the ECORD Science Support and Advisory Committee.

ECORD FY2013 budget *(in USD)*		
	Income	**Expenses**
FY2012 balance	**11,449,011**	
FY2013 contributions	**19,858,452**	
SOCs to NSF (1)		**13,055,771**
ESO		**15,995,785**
ESSAC (2)		**285,702**
EMA (3)		**379,730**
MagellanPlus		**65,000**
Total	**31,397,463**	**29,781,988**
FY2013 balance	**1,615,475**	

(1) 16,800,000 - 3,744,229 (SOCs for ESO)
(2) FY13 + Oct - Dec 2013
(3) including ECORD outreach

After paying its contribution to IODP commingled funds, ECORD's remaining budget did not allow the implementation of one MSP expedition every year for the Integrated Ocean Drilling Program. Funds had therefore to be accumulated over several years and carried forward. In FY2013, the ECORD Science Operator implemented the fifth and final MSP expedition for the Integrated Ocean Drilling Program - Expedition 347 Baltic Sea Paleoenvironment.

In FY2013, the total ECORD budget was USD 19.86 M *(table page 41)* instead of the 21.4 M that ECORD anticipated.This was due to Spain ceasing its payment to ECORD in FY2011 and the French and Canadian contributions, USD 5.164 and 0.15 M respectively, being lower than in previous years (USD 5.288 M and 0.5 M respectively in FY2012).

After implementing Expedition 347, the ECORD FY2013 budget shows a positive balance of USD 1,615,475 which will be carried over to the International Ocean Discovery Program.

FY2004-2013 ECORD budget

The table *below* details the relative contributions of the ECORD members to the Integrated Ocean Drilling Program, which ended on 30th September 2013. The total ECORD contribution to the Integrated Ocean Drilling Program was almost USD 173 M. A sharp increase in ECORD resources occurred in FY2008 with a budget of about USD 21 M, which remained generally constant until FY2012 when it decreased to USD 20 M and then to USD 19.87 M in FY2013, mainly due to Spain ceasing its member contributions in FY2011, and the decreased contributions from France and Canada.

The three major ECORD contributors - Germany, UK and France - have provided 79% of the total ECORD budget (USD 173 M) over the last 10 years. Their contributions increased regularly from FY2004 to FY2008 and have remained constant during the last 5 years.

The contributions of the other ECORD members have varied sharply during the course of the programme. Most of these ECORD members have either increased (Canada before a decrease in FY2013, The Netherlands, Spain, before ceasing payments in FY201, Sweden, Switzerland) or generally maintained their contributions (Austria Belgium, Finland Iceland, Ireland, Italy, Norway, Portugal). Denmark decreased its contribution after the first four years of the programme, after which it remained constant. Poland joined IODP in FY2012.

ECORD budget 2004 - 2013 *(in USD)*

	FY2004	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	Total
Austria	0	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	900,000
Belgium	0	30,000	30,000	30,000	30,000	30,000	30,000	30,000	0	30,000	240,000
Canada	150,000	150,000	150,000	150,000	300,000	300,000	500,000	500,000	500,000	150,000	2,850,000
Denmark	500,000	500,000	1,000,000	0	200,000	200,000	200,000	170,000	170,000	170,000	3,110,000
Finland	66,380	66,380	66,380	66,380	66,380	66,380	66,380	66,380	66,380	66,380	663,800
France	2,000,000	3,000,000	3,500,000	3,500,000	5,600,000	5,600,000	5,070,274	6,070,274	5,288,000	5,164,072	44,792,620
Germany	2,250,000	3,500,000	7,000,000	0	5,600,000	5,600,000	5,600,000	5,600,000	5,600,000	5,600,000	46,350,000
Iceland	30,000	30,000	30,000	30,000	30,000	0	0	30,000	30,000	30,000	240,000
Ireland	0	130,000	130,000	130,000	145,000	130,000	130,000	140,000	140,000	140,000	1,215,000
Italy	150,000	250,000	250,000	225,000	190,000	190,000	190,000	100,000	100,000	100,000	1,745,000
Netherlands	470,000	0	210,000	210,000	400,000	400,000	400,000	400,000	400,000	400,000	3,290,000
Norway	1,000,000	0	1,400,000	0	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000	9,000,000
Poland	0	0	0	0	0	0	0	0	30,000	30,000	60,000
Portugal	90,000	90,000	90,000	90,000	90,000	90,000	90,000	90,000	90,000	90,000	900,000
Spain	150,000	350,000	350,000	350,000	476,000	762,000	762,000	0	0	0	3,200,000
Sweden	1,312,500*	330,000	330,000	330,000	528,000	528,000	528,000	528,000	528,000	528,000	4,158,000
Switzerland	150,000	350,000	350,000	350,000	560,000	560,000	560,000	560,000	560,000	560,000	4,560,000
UK	4,300,000	3,800,000	4,000,000	3,500,000	5,600,000	5,600,000	5,600,000	5,600,000	5,600,000	5,600,000	45,600,000
	11,306,380	12,676,380	15,386,380	9,061,380	21,015,380	21,256,380	20,926,654	21,084,654	20,302,380	19,858,452	172,874,420

** including USD 900,00 as in-kind contribution (icebreaker Oden during Expedition 302)*

FY2014 ECORD budget

In FY2014, the expected total amount of the ECORD members' contributions is about USD 18.9M *(table below)*, showing a decrease of 7% compared to the FY2013 budget. However, Spain has yet to clarify its participation in the International Ocean Discovery Program. Iceland has recently decided to terminate its participation in IODP after FY2014.

Austria	100,000
Belgium	25,000
Canada	150,000
Denmark	170,000
Finland	80,000
Germany	5,600,000
Iceland	30,000
Ireland	140,000
Israel	30,000
Italy	400,000
The Netherlands	500,000
Norway	1,100,000
Poland	30,000
Portugal	90,000
Sweden	528,000
Switzerland	600,000
The United Kingdom	4,080,000
France	5,200,000
Total	**18,853,000**

ECORD member country contributions for FY2014 (USD).

table *below right* summarises the expected ECORD budget for FY2014 . With contributions of USD 7M to the NSF and a minimum of USD 1M to JAMSTEC to support the *JOIDES Resolution* and the *Chikyu* operations respectively, ECORD has significantly decreased its external costs, which will help to achieve its aim to implement **one mission-specific platform expedition every year** on average for the International Ocean Discovery Program.

Expected FY2014 ECORD budget *(in USD)*		
	Income	**Expenses**
FY13 balance	**1,615,475**	
FY 14 contributions	**18,853,000**	
ECORD-NSF MoU		**7,000,000**
ECORD-JAMSTEC MoU		**1,000,000**
EMA		**315,000**
MagellanPlus		**88,825**
ECORD Outreach		**52,816**
ESSAC		**361,996**
Support to the SEP Chair		**89,627**
BCR		**424,554**
Publications		**150,000**
Total	**20,468,475**	**9,482,818**

Available for ESO	**10,985,657**

The opportunity for members to make direct in-kind contributions will allow them to increase their contributions to the programme if they choose.

Germany, France and the UK will provide 80% of the total ECORD budget, despite a decrease in the UK contribution. Most of the other ECORD members have maintained their contributions to the programme, and a few have increased their funding (Finland, The Netherlands and Switzerland). Israel became the 19th member of ECORD when it joined the International Ocean Discovery Program in October 2013.

The ECORD Council has decided to change the beginning of each fiscal year to 1st January for FY2014 onwards. The

The changes in the functioning of the new IODP has added costs to the ECORD budget, such as the direct support of the Bremen Core Repository (BCR), the support of the SEP Chair, and the funding of publications related to the MSP expeditions. Some other costs will increase, such as the outreach activities. In addition, the ECORD Council has approved an increase to the budget of the MagellanPlus Workshop Series Programme with new opportunities to fund travel costs of ECORD scientists to attend IODP-related workshops in non-ECORD countries.

For FY2014, the total budget available for the ECORD Science Operator is anticipated to be almost USD 11M.

Budgets of ECORD Entities

- ***ECORD Managing Agency (EMA)***

The table *below* summarises the EMA budgets for FY2013 and FY2014 as approved by the ECORD Council in November 2013 for the period 1st January - 31st, December 2014 and also shows the evolution of the EMA budget over the last 2 years. All predicted expenses will remain generally stable with the exception of outreach, which will increase by 16.3% due to all costs being transferred to ECORD in the new programme, and to the increased budget (+33%) for the Magellan Workshop Series Programme, which in future will include travel funds for ECORD scientists to attend IODP-related workshops outside ECORD countries.

EMA budget for FY2013 and FY2014

	FY2013		FY2014		Variance (%)
	€	USD	€	USD	%
Salaries					
Compensation for the Director	47,000	64,860	46,000	63,480	-2.1
Outreach Co-ordinator	46,000	63,480	46,000	63,480	-
Assistant Director	46,000	63,480	46,000	63,480	-
Total salaries	**139,000**	**191,820**	**138,000**	**190,440**	**-0.7**
Travel					
EMA personnel	50,000	69,000	50,000	69,000	-
E-FB, E-ILP*	16,000	22,080	0	0	-100
Meetings	**5,000**	**6,900**	**5,000**	**6,900**	**-**
Consumables	**5,000**	**6,900**	**5,000**	**6,900**	**-**
Support IODP/ECORD meetings	**7,500**	**10,350**	**7,500**	**10,350**	**-**
MagellanPlus	**50,000**	**69,000**	**66,500**	**91,770**	**+33**
Outreach/Databases & other costs	**32,500**	**44,850**	**38,650**	**53,337**	**+16.3**
Overheads	**20,000**	**27,600**	**25,000**	**34,500**	**+25**
Total	**325,000**	**448,500**	**335,650**	**463,197**	**+3.3**

(1€ = 1.38USD); * *Not spent - used to partly compensate the October-December 2013 period following the change of the fiscal year.*

Details of the ECORD Outreach budget are given in the table *below*.

ECORD Outreach budget for FY2013 and FY2014

	FY2013		FY2014		Variance (%)
	€	USD	€	USD	%
Exhibit booths at conferences.					
EGU	8,040	11,095	8,100	11,178	
Goldschmidt 2013	3,024*	4,173	-	-	
ISC 2014	-		5,000	6,900	-
Total booths	**11,064**	**15,268**	**13,100**	**18,078**	**+18.4**
Publications					
Newsletters (2 issues per year)	4,100	5,658	4,100	5,658	-
Annual Report	3,255	4,492	3,300	4,554	
ECORD Folder	1,670	2,304	4,000	5,520	
ECORD internal communications	5,562	7,675	3,550	4,899	
Total publications	**14,587**	**20,129**	**14,950**	**20,631**	**+20.9**
Web courses	**-**		**1,200**	**1,656**	**+100**
Other costs (video, core replica)			**6,500**	**8,970**	**+100**
Shipping costs (mailing, materials)	**2,900**	**4,002**	**2,900**	**4,002**	**-**
Total	**28,871**	**39,399**	**38,650**	**53,337**	**+35.4**

*(1€ = 1.38USD); * including €2,000 refunded for damages during the conference.*

- ***ECORD Science Support and Advisory Committee (ESSAC)***

The table *below* details the ESSAC budgets for FY2013 including October to December 2013, FY2014 as approved by the ECORD Council in November 2013 for the period 1st January - 31st December 2014 and shows the evolution of the ESSAC budget over the last 2 years. There will be a sharp increase in salaries in 2014 to include compensation for the ESSAC Chair and the higher salary costs associated with the relocation of the ESSAC Office to Zurich, Switzerland. An increase of about 33% will support travel for invited speakers at ESSAC meetings. The office costs have decreased by 21.4% due to zero overheads at the Zurich office, and by the transfer of support for workshop scientists to the MagellanPlus Workshop Series Programme. The budget of all ESSAC educational activities remains constant.

ESSAC budget for FY2013 and FY2014

	FY2013		FY2013 (Oct-Dec 2013)		FY2014		Variance (%)
	€	*USD*	€	*USD*	€	*USD*	*%*
Salaries							
Compensation for the Chair	0	0	12,500	17,250	50,000	69,000	
Science Co-ordinator	48,000	66,240	12,000	16,560	99,900	137,862	
Total salaries	**48,000**	**66,240**	**24,500**	**33,810**	**149,900**	**206,862**	**+212.3**
Travel							
Chair	11,000	15,180	4,000	5,520	11,000	15,180	-
Science Co-ordinator	5,000	6,900	3,000	4,140	6,000	8,280	
ESSAC Liaison to SEP meetings	0	0			6,000	8,280	
Total travels	**16,000**	**22,080**	**7,000**	**9,660**	**23,000**	**31,740**	**+43.8**
Office costs	**14,000**	**19,320**	**3,000**	**4,140**	**11,000**	**15,180**	**-21.4**
Support ESSAC meetings							
Organisation	4,000	5,520	2,000	2,760	4,000	**5,520**	-
Travel support for invited speakers	3,000	4,140	1,500	2,070	4,000	**5,520**	**+33.3**
Workshop Scientists support	**5,000**	**6,900**	**0**	**0**	**0**	**0**	**-100**
ECORD DLP	**18,000**	**24,840**	**0**	**0**	**18,000**	**24,840**	-
ECORD Summer Schools	**20,000**	**27,600**	**0**	**0**	**20,000**	**27,600**	-
ECORD Scholarships	**15,000**	**20,700**	**0**	**0**	**15,000**	**20,700**	-
ECORD Research Grants	**15,000**	**20,700**	**0**	**0**	**15,000**	**20,700**	-
Conference travel support *(e.g. EGU)*	**3,000**	**4,140**	**0**	**0**	**5,000**	**6,900**	**+66,7**
Overheads	**17,000**	**23,460**	**3,186**	**4,397**	**0**	**0**	**-100**
Total costs excluding salaries	**130,000**	**179,400**	**16,686**	**23,027**	**115,000**	**158,700**	**-11.5**
Total	**178,000**	**245,640**	**41,186**	**56,837**	**264,900**	**365,562**	**+48.8**

(1€ = 1.38USD).

- ***ECORD Science Operator (ESO***

The following tables summarise the FY2013 ESO platform operations costs (POCs) and science operation costs (SOCs) and detail the expenditure in both categories *(page 46)*.

ESO FY2013 overall expenditure *(in USD)*

	FY2013 Annual Program Plan Budget	FY2012 Carry-forward	FY2013 Actual Operating Budget	FY2013 Expenditure	FY2013 Variance*
Science Operation Costs (SOCS)	3,744,230	1,161,079	4,905,309	4,932,816	-27,507
Platform Operation Costs (POCs)	5,564,677	0	5,564,677	1,157,208	4,407,469
Total	**9,308,907**	**1,161,079**	**10,469,986**	**6,090,024**	**4,379,962**

** Underspend is retained by ECORD*

ESO FY2013 SOC expenditure breakdown *(in USD)*

	FY2013 Annual Program Plan Budget	FY2012 Carry-forward	FY2013 Actual Operating Budget	FY2013 Expenditure	FY2013 Variance
Management and administration	**730,787**	**280,600**	**1,011,387**	**947,052**	**64,335**
Personnel	489,787	189,600	679,387	647,288	32,099
Travel	186,000	66,000	252,000	215,859	36,141
Supplies	15,000	7,500	22,500	22,513	-13
Shipping	0	0	0	281	-281
Communication	0	0	0	548	-548
Equipment	15,000	7,500	22,500	30,563	-8,063
Other	25,000	10,000	35,000	30,000	5,000
Technical, Engineering and Science Support	**2,452,759**	**643,550**	**3,096,309**	**3,404,322**	**-308,013**
Personnel	1,114,060	249,100	1,363,160	1,248,403	114,757
Travel	135,000	27,750	162,750	140,366	22,384
Supplies	639,699	36,700	676,399	639,700	36,699
Shipping	14,000	0	14,000	14,130	-130
Contractual services	25,000	20,000	45,000	45,000	0
Equipment	510,000	300,000	810,000	1,255,023	-445,023
Other	15,000	10,000	25,000	61,700	-36,700
Core Curation	**73,535**	**41,729**	**115,264**	**115,200**	**64**
Personnel	60,535	33,979	94,514	94,450	64
Travel	6,000	3,500	9,500	9,500	0
Supplies	2,000	1,250	3,250	3,250	0
Shipping	5,000	3,000	8,000	8,000	0
Data Management	**367,649**	**170,350**	**537,999**	**359,116**	**178,883**
Personnel	131,249	66,350	197,599	202,482	-4,883
Travel	42,000	6,500	48,500	18,953	29,547
Supplies	6,000	6,000	12,000	512	11,488
Contractual Services	75,000	75,000	150,000	24,793	125,207
Equipment	113,400	16,500	129,900	112,376	17,524
Outreach	**119,500**	**24,850**	**144,350**	**107,127**	**37,223**
Personnel	77,500	19,100	96,600	81,823	14,777
Travel	30,000	5,750	35,750	25,280	10,470
Supplies	12,000	0	12,000	0	12,000
Shipping	0	0	0	24	-24
Total	**3,744,230**	**1,161,079**	**4,905,309**	**4,932,816**	**-27,507**

ESO FY2013 POC expenditure breakdown *(in USD)*

	FY2013 Annual Program Plan Budget	FY2012 Carry-forward	FY2013 Actual Operating Budget	FY2013 Expenditure	FY2013 Variance
Management and administration	**235,470**		**235,470**	**130,039**	**105,431**
Personnel	106,470		106,470	108,210	-1,740
Travel	102,000		102,000	21,601	80,399
Supplies	6,000		6,000	0	6,000
Shipping	0		0	212	-212
Communication	0		0	16	-16
Equipment	6,000		6,000	0	6,000
Other	15,000		15,000	0	15,000
Technical, Engineering and Science Support	**5,329,207**		**5,329,207**	**1,027,169**	**4,302,038**
Personnel	422,907		422,907	418,152	4,755
Travel	40,500		40,500	88,919	-48,419
Supplies	0		0	3,399	-3,399
Shipping	0		0	10,882	10,882
Equipment	0	,	0	593,128	-593,128
Other	4,865,800		4,865,800	-87,311	4,953,111
Total	**5,564,677**		**5,564,677**	**1,157,208**	**4,407,469**

Chalk cliff of the Rosh Hanikra grottos in Israel (photo taken by Julia Gutiérrez Pastor during the field trip of the ESSAC-ECORD Council meetings in Haifa).

11. ECORD Entities

As defined in the ECORD Memorandum of Understanding, ECORD comprises six entities and two task forces *(below)*.

The **ECORD Council** is the funding entity for ECORD and provides oversight for all ECORD activities.
Chair: Mike Webb
Vice-Chair: Guido Lüniger
Council Core Group: Michel Diament (France), Josef Stuefer (The Netherlands) and Anne de Vernal (Canada). J. Stuefer and A. de Vernal have been replaced by Anders Kjaer (Denmark) and Martina Kern-Luetschg (Switzerland) in June 2013.
http://www.ecord.org/c/council.php

The **ECORD Executive Bureau - E-EB** acts as the executive entity between the meetings of the ECORD Council. The E-EB is composed of the Council Chair and Vice-Chair, the Council Core Group, the EMA Director and the Chairs of ESO, ESSAC and ECORD-ILP.

The **ECORD Managing Agency - EMA** is the management entity of ECORD and represents ECORD in all IODP entities. EMA is the fund holder for the consortium in IODP and provides oversight of ESO and ESSAC.
Director: Gilbert Camoin
Assistant Director: Milena Borissova
Outreach Co-ordinator: Patricia Maruéjol
http://www.ecord.org/ema.html

The **ECORD Science Operator - ESO** is the operational entity and is responsible for the implementation of MSP expeditions.
Chair: Robert Gatliff
Science Manager: David McInroy
Operations Manager: Dave Smith
Expedition Project Managers: Carol Cotterill and Sophie Green
EPC Manager: Sarah Davies
Curation and Laboratory Manager: Ursula Röhl
Data Management Manager: Hans-Joachim Wallrabe-Adams
Outreach Manager: Alan Stevenson
Media Relations: Albert Gerdes
http://www.eso.ecord.org

The **ECORD Science Support and Advisory Commitee - ESSAC** is the science committee and is responsible for the scientific planning and co-ordination of ECORD's contribution to IODP.
Chair: Carlota Escutia
Vice-Chair: Gretchen Früh-Green
Science Co-ordinator: Julia Gutiérrez Pastor
http://www.essac.ecord.org

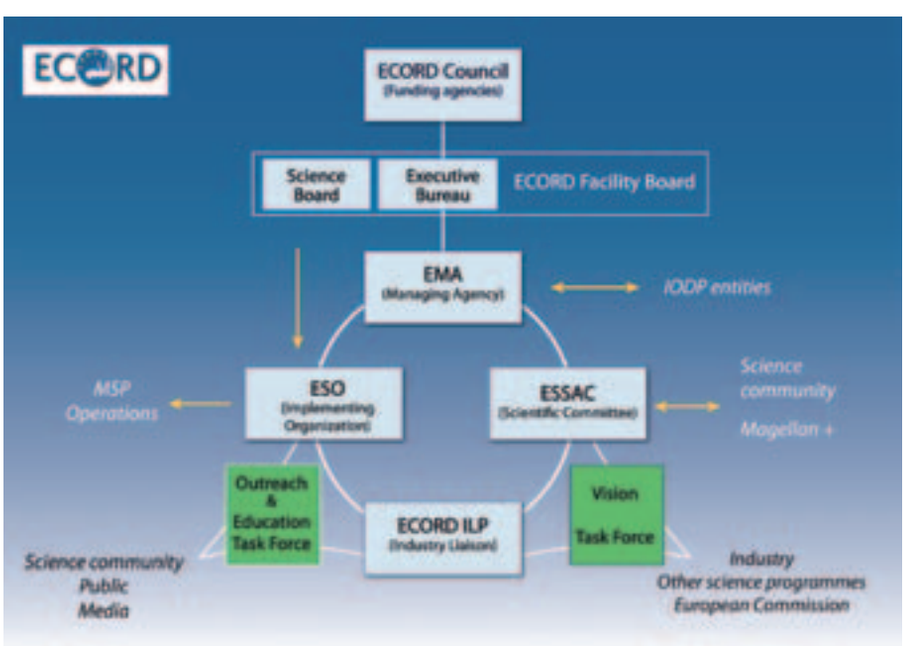
The **ECORD Facility Board - E-FB** is the planning forum for MSP expeditions and is responsible for scheduling drilling proposals and for advising on the long-term planning of ECORD's activities and functions. The E-FB is composed of the ECORD Executive Bureau and a Science Board.
Chair: Karsten Gohl
Members of the Science Board: Antonio Cattaneo, Dominique Weis, Marta Torres and Gerald R. Dickens.
http://www.ecord.org/ecord-fb.html

The **ECORD Industry Liaison Panel - E-ILP** is the link between academia and industry, fostering and promoting scientific and technologic collaboration.
Chair: Andrea Moscariello
http://www.ecord.org/ecord-ilp.html

The **ECORD Outreach & Education Task Force - E-OETF** co-ordinates ECORD's communication tasks, such as outreach/public information and educational activities related to IODP in ECORD countries. The E-OETF is composed of the EMA Outreach Co-ordinator (Chair), ESO Outreach and Media Relations Managers, ESSAC Chair and Science Co-ordinator and EMA Director and Assistant Director.

The **ECORD Vision Task Force - E-VTF** is the ECORD strategic entity in charge of developing a long-term scientific and funding strategy, and monitoring ECORD's progress towards achieving the objectives of the IODP Science Plan. The ECORD-VTF is composed of the ESSAC Chair, the EMA Director and Assistant Director, the ESO Chair and Outreach Manager and the ECORD- ILP Chair.

Contact ECORD: *http://www.ecord.org/contact.html*



Annex - List of Acronyms

ACEX: Arctic Coring Expedition

AGU: American Geophysical Union

ANDRILL: Antarctic Geological Drilling

BCR: Bremen Core Repository

BGS: British Geological Survey

CDEX: Center for Deep Earth Exploration

CIB: *Chikyu* IODP Board

CORK: Circulation Obviation Retrofit Kit

CPP: Complementary Project Proposal

CRISP: Costa Rica Seismogenesis Project

DEDI: Distributed European Drilling Infrastructure

DEISM: Distributed European Infrastructure for Sub-seafloor Sampling and Monitoring

DIS: Drilling Information System

DLP: Distinguished Lecturer Programme

DREAM: Deep-sea Record of Mediterranean Messinian Events

DS3F: Deep Sea and Sub-Seafloor Frontiers

DSDP: Deep Sea Drilling Project

E-EB: ECORD Executive Bureau

E-FB: ECORD Facility Board

E-ILP: ECORD Industry Liaison Panel

E-OETF: ECORD Outreach & Education Task Force

E-VTF: ECORD Vision Task Force

EC: European Commission

ECORD: European Consortium for Ocean Research Drillling

EGU: European Geosciences Union

EMA: ECORD Managing Agency

EMSO: European Multidisciplinary Seafloor Observatory

EPC: European Petrophysics Consortium

EPM: Expedition Project Manager

EPSP: Environmental Protection and Safety Panel

ERIC: European Reseach Infrastructure Consortium

ESO: ECORD Science Operator

ESSAC: ECORD Science Support and Advisory Committee

ETP: ECORD Technology Panel

FY: Fiscal Year

GCR: Gulf Coast Repository

ICDP: International Continental Scientific Drilling Program

Ifremer: Institut Français de Recherche pour l'Exploitation de la Mer

IMAGES: International Marine Past Global Changes Studies

IODP: Integrated Ocean Drilling Program (2003-2013) & International Ocean Discovery Program (2013-2023)

IODP-MI: Integrated Ocean Drilling Program Management International, Inc.

IPEV: Institut polaire français Paul Émile Victor

ISOLAT: Integrated Southern Ocean Latitudinal Transects

ISOR: Iceland GeoSurvey

JAMSTEC: Japan Agency for Marine Earth Science and Technology

JOIDES: Joint Oceanographic Institutions for Deep Earth Sampling

JR: *JOIDES Resolution*

JRFB: *JOIDES Resolution* Facility Board

KCC: Kochi Core Center

LDEO: Lamont Doherty Earth Observatory

MARUM: Center for Marine Environmental Sciences, University of Bremen

MeBo: Meeresboden-Bohrgerät

MEXT: Ministry of Education, Culture, Sports, Science and Technology

MoU: Memorandum of Understanding

MSCL: Multi Sensor Core Logger

MSP: Mission-specific platform

MWCBS: Marine Wireline Core Barrel System

NanTroSEIZE: Nankai Trough Seismogenic Zone Experiment

NGR: Natural Gamma Ray

NIOZ: Royal Netherlands Institute for Sea Research

NSF: National Science Foundation

ODP: Ocean Drilling Program

OSP: Onshore Science Party

PEP: Proposal Evaluation Panel

POCs: Platform Operation Costs

RD2: Rockdrill 2

ROV: Remotely Operated Vehicle

SaDR: Sample and Data Request

SCIMPI: Simple Cabled Instrument for Measuring Parameters In-situ

SCP: Science Characterization Panel

SEP: Science Evaluation Panel

SOCs: Science Operation Costs

TAMU: Texas A & M University

USIO: US Implementing Organization

FY2013 ECORD Members

Austria: Österreichische Academie der Wissenschaften (ÖAW) & Fonds zur förderung der Wissenschaftlichen Forschung (FWF)
Belgium: Vakgroep Geologie - Bodemkunde (UGent)
Denmark: Forsknings- og Innovationsstyrelsen
Canada: Université du Québec à Montréal - Centre GEOTOP-UQAM-McGill
Finland: Suomen Akatemia
France: Institut National des Sciences de l'Univers - Centre National de la Recherche Scientifique (INSU-CNRS)
Germany: Deutsche Forschungsgemeinschaft (DFG)
Iceland: Rannsóknamiðstöð Íslands (RANNIS)
Ireland: The Geological Survey of Ireland (GSI)
Israel: Mediterranean Sea Research Center of Israel (MERCI))
Italy: Consiglio Nazionale delle Ricerche (CNR)
The Netherlands: Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO)
Norway: Forskningsrådet
Poland: Panstwowy Instytut Geologiczny - Panstwowy Instytut Badawczy (PIG-PIB)
Portugal: Fundação para a Ciência e a Tecnologia (FCT)
Spain: Ministerio de Ciencia e Innovación (MICINN)
Sweden: Vetenskapsrådet (VR)
Switzerland: Fonds National Suisse (FNS)
The United Kingdom: Natural Environment Research Council (NERC)

http://www.ecord.org