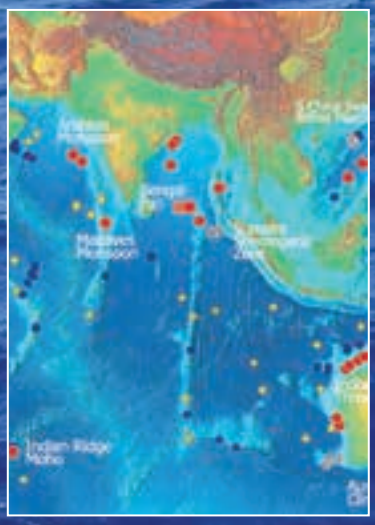
ECORD

EUROPEAN CONSORTIUM FOR
OCEAN RESEARCH DRILLING

ANNUAL REPORT 2015



ECORD
EUROPEAN CONSORTIUM FOR OCEAN RESEARCH DRILLING

IODP
INTERNATIONAL OCEAN DISCOVERY PROGRAM

From 2003 to 2013, European and Canadian scientists participated in the Integrated Ocean Drilling Program (IODP) as part of the European Consortium for Ocean Research Drilling (ECORD). ECORD coordinated 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 IODP 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 1 October 2013, builds on this legacy and addresses global challenges facing current and future generations with new research approaches, expanded scientific communities and continued development of its unique collaborative model.

IODP now involves scientists from 26 countries including the USA, Japan, China, South Korea, India, Australia, New Zealand, Brazil and 18 ECORD countries, including Canada and Israel.

ECORD funds and implements MSP operations for IODP as an independent platform provider, with the aim to carry out 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, seabed-drilling systems, long-piston coring, anchored barges and others, as determined by scientific priorities and operational efficiency. ESO has successfully managed the Atlantis Massif expedition in 2015-2016 and is now preparing for its next MSP expedition to the Chicxulub Impact Crater scheduled to begin in April 2016.

ECORD also continues to make financial contributions to the US National Science Foundation (NSF) and to the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) for support and access to the *JOIDES Resolution* and the *Chikyu* respectively. Members of ECORD can therefore take part in all IODP expeditions that address research topics such as 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, banners of recent IODP MSP expeditions; split cores of Expedition 357 Atlantis Massif Serpentinization and Life during the Onshore Science Party (D. Weis © ECORD/IODP); IODP drillsites of 2015 expeditions in the Indian Ocean; participants of the first ECORD Training Course in Bremen, Germany. Background photo: the Atlantic Ocean seen from the RRS James Cook during Expedition 357 (Y. Morono © ECORD/IODP).*

Back cover: *Aboard the RRS James Cook during Expedition 357 Atlantis Massif Serpentinization and Life (S. Lang ©ECORD/IODP).*

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http://www.ecord.org

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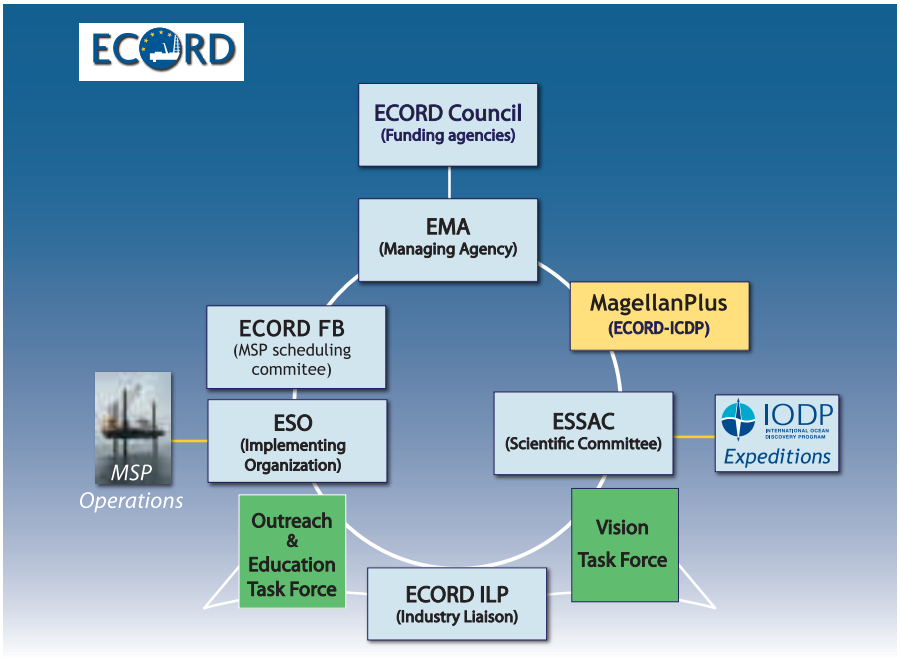
ECORD Annual Report 2015

1 January 2015 - 31 December 2015

Contents

Day shapes onboard the *RRS James Cook* during operations of Expedition 357 Atlantis Massif Serpentinization and Life (H. J. Wallrabe-Adams © ECORD/IODP).

ECORD entities



As defined in the ECORD Memorandum of Understanding, ECORD comprises **six entities** and **two task forces** *(right)*. More information about the ECORD-ICDP MagellanPlus is found on *page 45*.

The **ECORD Council** is the funding entity for ECORD and provides oversight for all ECORD activities.
Chair: Michel Diament (France; 1 January to 31 December 2015)
Outgoing Vice-Chair: Guido Lüniger (Germany; 1 January to 30 June 2015)
Incoming Vice-Chair: Magnus Friberg (Sweden; 1 July to 31 December 2015)
Council Core Group: Martina Kern-Lütschg (Switzerland; 1 January to 30 June 2015), Anders Kjaër (Denmark) and Michael Webb (UK).

The **ECORD Executive Bureau (E-EB)** acts as the executive entity 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 the ECORD-ILP.
http://www.ecord.org/c/council.php

Michel Diament is a Professor at the Institut de Physique du Globe de Paris, where he teaches geodesy and geophysics at undergraduate and graduate levels. His research interests are marine

geosciences, applied geophysics, volcanology, tectonics and geodynamics. His main approach is the use of gravimetry and microgravimetry tools and more recently has focused on satellite gravimetry. Michel has been Deputy Director for Solid Earth and Director in charge of the Institut National des Sciences de l'Univers (INSU) of the Centre National de la Recherche Scientifique (CNRS) and has served or chaired scientific committees and review panels for IRD, IFREMER, CNES, ESA and HCERES. He has been editor of the Geophysical Journal International and is a corresponding member of the "Bureau des Longitudes".

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 the ECORD Science Operator (ESO) and the ECORD Science Support and Advisory Committee (ESSAC).
Director: Gilbert Camoin (France)
Assistant Director: Nadine Hallmann (France)
Outreach Coordinator: Patricia Maruéjol (France)
http://www.ecord.org/ema.html

Gilbert Camoin is a Senior Scientist at the Centre National de la Recherche Scientifique (CNRS) at the Centre Européen de Recherche et d'Enseignement des Géosciences de

l'Environnement (CEREGE) in Aix-en-Provence, France. His major research activities are focused on the records of sea-level, environmental and climatic changes by coral reefs and other carbonate systems. Gilbert was appointed as Director of EMA in January 2012 and served previously as Chair of the ODP/IODP Environment Science Steering Evaluation Panel (2001-2005), Chair of the ECORD Science Support and Advisory Committee (ESSAC) (2007-2009), Member of the IODP Science Planning Committee (2007-2010), and Member of the IODP Science Plan Writing Committee (2010-2011).

The **ECORD Science Operator (ESO)** is the operational entity and is responsible for the implementation of mission-specific platform (MSP) expeditions. ESO is a consortium of three European scientific institutions: the British Geological Survey (BGS); the MARUM - Center for Marine Environmental Sciences, University of Bremen, Germany; and the European Petrophysics Consortium (EPC), which is a partnership between the universities of Leicester (UK), Montpellier (France) and Aachen (Germany). The EPC is responsible for the provision of downhole logging and core petrophysical services across the wide range of geological formations drilled and sampled by MSPs. EPC also has links to the larger international logging community that include personnel at Lamont-Doherty Earth Observatory (USA) and the University of Tokyo (Japan).
Chair: Robert Gatliff (BGS, UK)
Science Manager: David McInroy (BGS, UK)
Operations Manager: Dave Smith (BGS, UK)
Expedition Project Managers: Carol Cotterill (BGS, UK) and Sophie Green (BGS, UK)

EPC Manager: Sarah Davies (EPC, UK)
Curation and Laboratory Manager: Ursula Röhl (MARUM, Germany)
Data Manager: Hans-Joachim Wallrabe-Adams (MARUM, Germany)
Outreach Manager: Alan Stevenson (BGS, UK)
Media Relations: Albert Gerdes (MARUM, Germany)
http://www.eso.ecord.org

Robert Gatliff is the Director for Energy and Marine Geoscience at the British Geological Survey in Edinburgh, UK, and Chair of the ECORD Science Operator. His expertise is based on basin analysis and seismic interpretation of the UK and he has led geophysics and drilling expeditions on the NE Atlantic Margin.

The **ECORD Science Support and Advisory Commitee (ESSAC)** is the ECORD science committee and is responsible for the scientific planning and coordination of ECORD's contribution to IODP.
Chair: Gretchen Früh-Green* (ETH Zurich, Switzerland)
Vice-Chair: Jan Berhrmann (GEOMAR, Germany)
Science Coordinator: Julia Gutiérrez Pastor (ETH Zurich, Switzerland)
http://www.essac.ecord.org

Gretchen Früh-Green is a Professor at the Department of Earth Sciences, Eidgenössische Technische Hochschule - ETH Zurich, and is leading research in marine geology and geochemistry. Her research interests include studies of fluid-rock-microbe interaction and geochemical fluxes during hydrothermal alteration of crustal and mantle sequences exposed in modern ocean basins and in ophiolites. Her studies particularly focus on serpentinization processes and understanding the production and cycling of volatiles and hydrocarbons at slow-spreading ridges. Highlights of her research include the discovery of the spectacular Lost City hydrothermal field at Atlantis Massif and subsequent drilling during IODP Expedition 357. Gretchen has been involved in many phases of the ocean drilling programmes.

The **ECORD Facility Board (EFB)** 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 EFB is composed of the ECORD Executive Bureau and a Science Board.
Chair: Karsten Gohl* (AWI, Germany)
Members of the Science Board: Antonio Cattaneo** (Ifremer, France), Gerald R. Dickens (Rice University, USA), Marta Torres** (Oregon State University, USA) and Dominique Weis (University of British Columbia, Canada).
http://www.ecord.org/ecord-fb.html

Karsten Gohl is a Senior Scientist at the Alfred Wegener Institute for Polar and Marine Research (AWI) in Bremerhaven, Germany, where he has been conducting research on geodynamic, tectonic and glacial-marine sedimentation processes of polar and sub-polar regions since 2000. Following his PhD, Karsten took up a post-doctoral position at the University of Uppsala, Sweden, where he works on deep crustal seismic imaging of cratons before becoming a research scientist at the AWI in 1992. At AWI, Karsten worked on crustal and sedimentation processes of Antarctic margins using marine geophysical methods. He was a Lecturer in Geophysics at Macquarie University, Australia, from 1996 to 1999.

The **ECORD Industry Liaison Panel (ECORD-ILP)** is the link between academia and industry, fostering and promoting scientific and technological collaboration.
Chair: Andrea Moscariello (University of Geneva, Switzerland)
http://www.ecord.org/ecord-ilp.html

Andrea Moscariello is a Professor at the Department of Earth Sciences, University of Geneva in charge of the reservoir geology and sedimentary basins group and developing several research programmes in geo-energy topics (geothermal, hydrocarbon, geological storage of CO_2). From 1997 to 2008 Andrea worked as a geoscientist for Shell International all over the world. From 2008-2011 he was an independent consultant in hydrocarbon exploration and production, Assistant Professor at the Technical University of Delft (The Netherlands) and Visiting Lecturer at the University of Cambridge (UK). Andrea is a member of the Executive Committee of AAPG for Europe, a member of the Research Committee of the EAGE and an expert on energy matters for the United Nations ESCWA.

The **ECORD Outreach & Education Task Force (E-OETF)** coordinates 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 Coordinator (Chair), ESO Outreach and Media Relations Managers, ESSAC Chair and Science Coordinator 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 E-VTF is composed of the ESSAC Chair, the EMA Director and Assistant Director, the ESO Chair and Outreach Manager and the ECORD- ILP Chair.

** rotating off as Chair on 31 December 2015*
*** rotating off on 31 December 2015*

The table *below* summarises the ECORD and IODP meetings that have been held in 2015, as well as the two major science conferences (EGU in Vienna and AGU in San Francisco) where IODP-related scientific sessions and exhibit booths have been organised. Two "IODP Days" have been organised in Istanbul, Turkey *(page 7)*, and Lisbon, Portugal.

The **ECORD Council** meets twice a year with a spring meeting (in Stockholm, Sweden, in 2015) involving the Council and the members of the ECORD Executive Bureau, and a joint fall meeting with ESSAC (in Naples, Italy, in 2015) involving representatives of all ECORD entities as well as representatives from our IODP partners (funding agencies, operators and science committees) and collaborating science programmes.

ESSAC meets twice a year with a spring meeting (in Uppsala, Sweden, in 2015) involving the ESSAC Delegates and EMA and ESO representatives. The ESSAC fall meeting (in Naples, Italy, in 2015) was organised jointly with the ECORD Council.

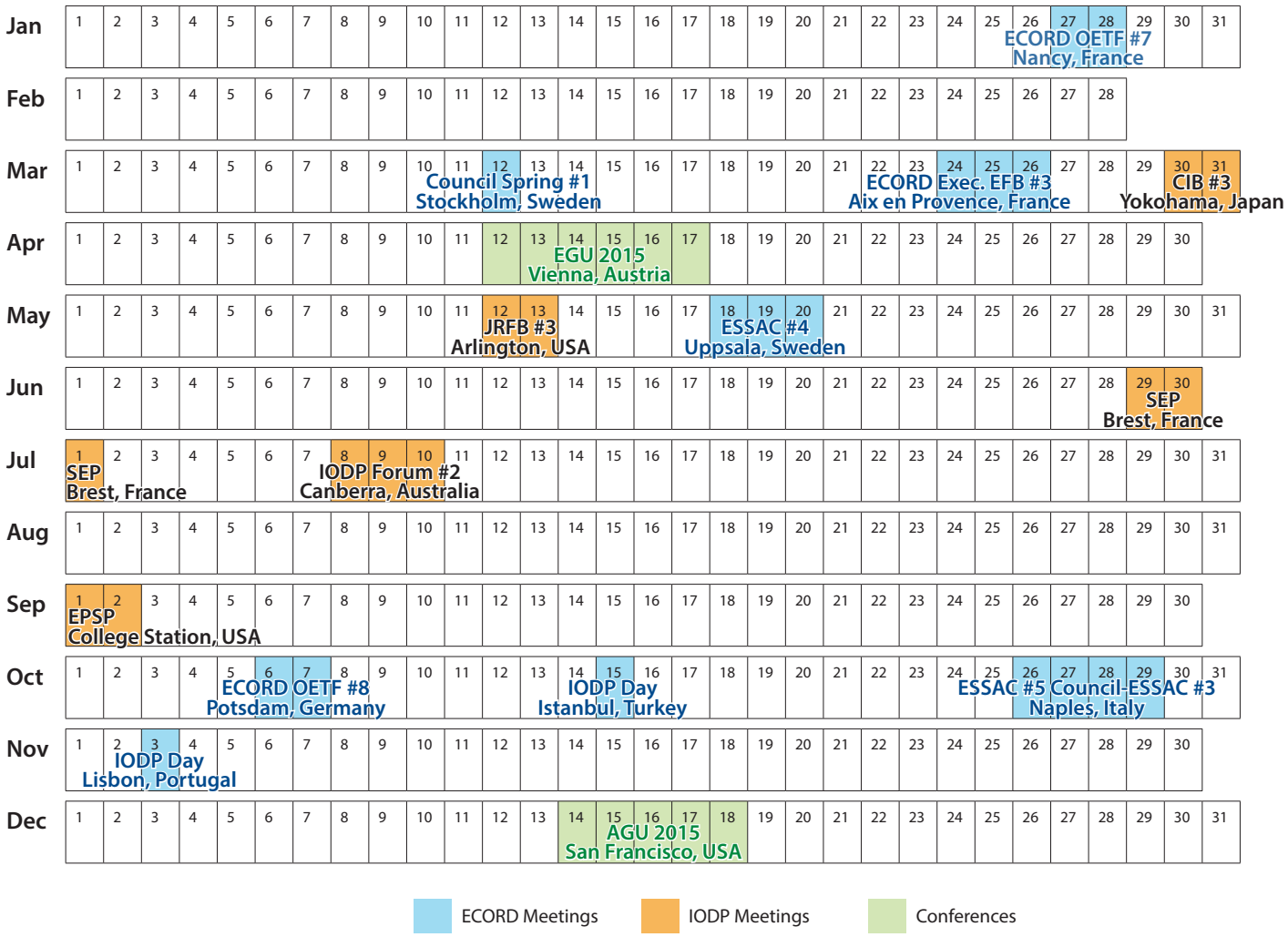
The **ECORD Facility Board** (EFB) meets once a year (in Aix-en-Provence, France, in 2015) and involves its members (Science Board and ECORD Executive Bureau), as well as representatives from our IODP partners (funding agencies, operators and science committees).

The **ECORD Education and Outreach Task Force (ECORD-OETF)** meets twice a year, in January and in October (in Nancy, France, and Potsdam, Germany, respectively in 2015) and involves its ECORD members and an ICDP representative; outreach representatives from our IODP partners are invited to attend the October meeting.

ECORD sends representatives to IODP meetings: the *JOIDES Resolution* Facility Board (JRFB) and the *Chikyu* IODP Board (CIB) meetings, the Science Evaluation Panel (SEP), the Environmental Protection and Safety Panel (EPSP) and the IODP Forum meetings *(page 63)*.

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

ECORD / IODP meetings and conferences in 2015



Inter-bedded shales/red clays and radiolarites of the Lagonegro upper unit (Sasso di Castalda, Basilicate, Italy) - Field excursion of the Council ESSAC meeting, Naples, October 2015 (photo Dominique Weis).

1. 2015 highlights

There were many innovations concerning all ECORD activities in 2015 that have helped increase ECORD's visibility and its role in the International Ocean Discovery Program, and to better serve the scientific community. The first mission-specific platform (MSP) expedition of the 2015-2018 ECORD operational plan for MSP expeditions, Expedition 357 Atlantis Massif Serpentinization and Life, has illustrated new operational and funding schemes for MSP expeditions, with the successful implementation by seafloor drills deployed from a research vessel provided as an in-kind contribution. The creation of the Amphibious Drilling Proposals (ADPs) will increase the collaboration between ECORD and the International Continental Scientific Drilling Program (ICDP). Several new initiatives regarding the education and outreach activities have been introduced to train the next generation of scientists from ECORD member countries, and better promote ECORD and IODP activities and accomplishments to large audiences.

ECORD membership, partnership and management

Following exchanges and negotiations during the last months of 2015, ECORD welcome back in early 2016 one of its historical members, Spain, who withdrew from the Integrated Ocean Drilling Program in 2011. Spain will therefore be the 18th ECORD member country *(map page 8)* in the current programme with an annual contribution of 150,000 € *(page 58)*.

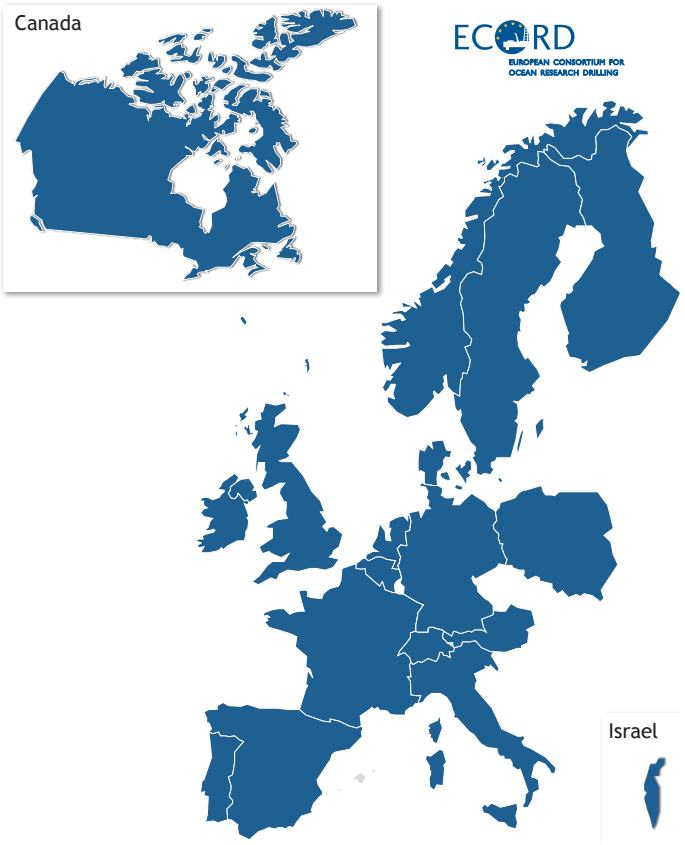
ECORD hopes to further increase its membership soon as there have been positive contacts with Russia and Turkey in recent months. Russian and Turkish representatives attended the ECORD Council-ESSAC joint meeting held in Naples, Italy on 28 and 29 October 2015. In addition, an ECORD delegation and three Distinguished Lecturers presented ECORD activities and science talks during an ECORD-IODP Day organised on 15 October 2015 in Istanbul, Turkey in the frame of the 2nd Coastal and Marine Geology Symposium *(above right)*.

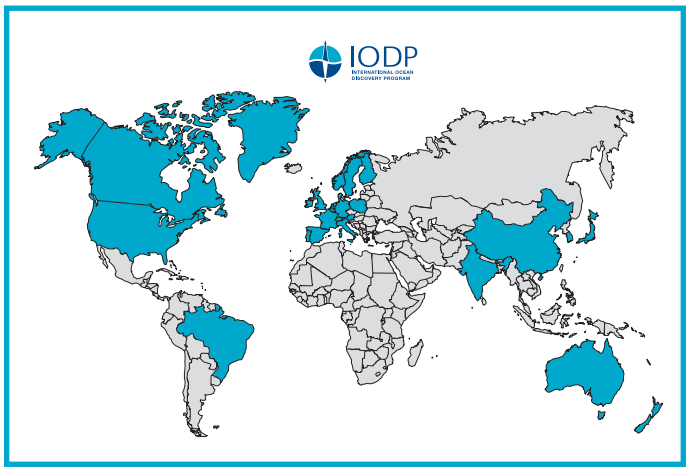
Like the other IODP partners, in 2016 ECORD will define plans for its mid-term renewal, which will take place in 2018 for most of its member countries (13 out of the current 18 members). These plans will include an external evaluation of ECORD's achievements and performance, which is planned in 2017, and a mix of criteria for successful renewal involving both significant science results measured against the Science Plan and the success of its financial model for platform operations. Special attention has been given to the ECORD member countries expecting a decision regarding their financial commitment earlier than 2018 (Denmark, Israel, Switzerland); Belgium will start its new 3-year funding plans in 2017 and Canada is in the process of identifying new funding sources.

ECORD-IODP Day in Istanbul, Turkey, organised during the 2nd Coastal and Marine Geology Symposium.

The ECORD mid-term renewal process will also imply that the two Memoranda of Understanding (MoU), which summarise the agreement between ECORD and its partners, Japan (JAMSTEC and MEXT), and the USA (NSF) and their Associate Members, will be revisited, including significant co-funding along with berth exchanges to provide access to these platforms for ECORD scientists and access to MSP expeditions for scientists from our partners.

The conclusions of the "Sea Change - Decadal Survey of Ocean Sciences" NSF report released early in 2015 will have major implications for the US *JOIDES Resolution (JR)* mid-term renewal plans. NSF has accepted the recommendations of the report, which were centred on restoring a healthier balance between research and infrastructure funding within the Division of Ocean Sciences and including a 10% reduction in *JR* infrastructure costs, the use of part of the income from Complementary Project Proposal (CPP) expeditions and an increase in partner contributions to maintain current quotas of partner shipboard participants for post-renewal *JR* operations. Formal renegotiation of MoUs with *JR* partners, including ECORD, will be required in early 2018, with preliminary negotiations beginning even sooner.





Left, ECORD member countries, as of January 2016; above, IODP member countries, as of January 2016 (map credit: http://histgeo.ac-aix-marseille.fr).

At its spring meeting on 12 March 2015 in Stockholm, Sweden, the ECORD Council reiterated its strong support to the *Chikyu* programme, but also expressed concerns about the delay in the implementation of *Chikyu* expeditions in the International Ocean Discovery Program. A first engineering expedition, with a limited Science Party is scheduled in 2016, and the implementation of the riserless expedition "Nankai Trough Temperature Limit" in January-March 2017 is subject to the availability of funds that have not yet been secured. ECORD has therefore decided to suspend its contribution to the *Chikyu* programme for at least the two years, 2015 and 2016, with the firm intention to continue its membership as soon as the situation changes.

Since the start of the International Ocean Discovery Program on 1 October 2013, ECORD has played a pivotal role in the development of more active collaboration with other science programmes dealing with sub-seafloor coring (IMPRESS) and continental scientific drilling (ICDP). The newly defined Amphibious Drilling Proposals (ADPs) that require both drilling on land and at sea to fully complete scientific objectives that cross the shoreline, exemplify the closer collaboration between ICDP and IODP, especially through ECORD given that most ADPs will likely involve MSP operations. The procedures for the joint evaluation of ADPs have been approved by the IODP Science Evaluation Panel, all three IODP Facility Boards, and the ICDP Executive Committee and Assembly of Governors in 2015. In January 2016, the ADPs' implementation policies have been defined by a working group including two representatives from each programme (D. McInroy and G. Camoin for ECORD/IODP, and U. Harms and C. Koeberl for ICDP) and will be submitted for approval to the IODP Facility Boards, and the ICDP Executive Committee and Assembly of Governors. All procedures will then be in place to carry out the first land-to-sea transects, achieving the scientific objectives of both programmes. ECORD has decided to support the submission of such proposals by allocating a specific annual budget to the organisation of ADP workshops within the MagellanPlus Workshop Series Programme. The emergence of this new category of proposals is demonstrated by the submission of the first proposal combining land and shallow-water drilling on a Ligurian landslide (796-Full; Lead Proponent: A. Kopf), and the organisation of a MagellanPlus workshop to develop an ADP to investigate the initial thermo-mechanical conditions of the Haitian Fault System (Haiti-DRILL workshop, *page 46*, convened in Rueil-Malmaison, France on 26-28 October 2015 by N. Ellouz-Zimmermann and M. Pubellier).

ECORD budget

ECORD is currently funded exclusively by its member countries and more than 80% of its annual budget concern IODP expedition operational costs, including 7.2M USD for funding MSP expeditions. The ECORD FY2015 budget (17.865M USD) *(page 57)* has decreased by 1.2M USD compared to the FY2014 budget due to strong variations in exchange rates between the US Dollar and European currencies in late 2014 and early 2015, which impacted

the contributions of the five countries (Belgium, Denmark, France, Ireland and UK) that use their own currency and not the US Dollar to pay their contributions to ECORD.

This budget must be seen as a minimum budget as the opportunity for any IODP member or non-member country to provide external co-funding and/or in-kind contributions for MSP expeditions (*i.e.* direct operational facilities and services that ESO would normally pay for) may allow them to increase or start their contributions to the programme. Such contributions are rewarded by extra Science Party positions on the MSP expedition for which the contribution has been rendered. The first in-kind contribution to the International Ocean Discovery Program was made in 2015 with the provision of the *RRS James Cook* by the UK as a contribution towards the implementation of IODP Expedition 357 Atlantis Massif Serpentinization and Life *(page 15)*. ECORD intends to generalise in-kind and external co-funding to implement future MSP expeditions.

At the end of December 2015, the ECORD budget showed a positive balance of 12.49M USD, which has been carried forward to the ECORD FY2016 budget to fund the current 5-year MSP operational plan *(page 59)*.

Operating and participating in mission-specific platform expeditions

The 2015-2018 operational plan for mission-specific platform expeditions, which was defined by the ECORD Facility Board in 2014 and 2015, reflects ECORD's aim to deliver one MSP expedition per year on average during the first phase of IODP *(page 21)*. The plan includes four expeditions that address diverse science objectives. Their implementation will be achieved by balancing the numbers of low-, medium-, and high-cost expeditions, and by attracting external co-funding and in-kind contributions whenever possible to provide additional funding to support MSP expeditions.

The IODP Expedition 357 Atlantis Massif Serpentinization and Life *(pages 15-18)*, which was successfully implemented offshore from October to December 2015, and at the subsequent Onshore Science Party in early 2016, was the first expedition of this operational plan and aimed at better understanding the role of serpentinization in driving hydrothermal systems, in sustaining microbial communities, and in sequestrating carbon in ultramafic rocks. The expedition was also the first in IODP to utilise seafloor drills (BGS Seafloor Rockdrill2 and the MARUM MeBo, *page 16*), which were deployed from the NERC research vessel *RRS James Cook* that was provided as an in-kind contribution to ECORD. **Sixteen ECORD scientists**, including one Co-chief Scientist and Lead Proponent were part of the Science Party; three UK berths were related to its in-kind contribution.

The second expedition of this operational plan, IODP Expedition 364 Chicxulub K-Pg Impact Crater, is now scheduled in April-May 2016 and will be co-funded by ICDP. It will investigate the only known impact structure on Earth that has been directly linked to a mass extinction event. **Thirteen ECORD scientists**, including one Co-chief Scientist and Lead Proponent, will participate in this expedition *(pages 21-23)*.

ECORD representatives during the fieldtrip of the ESSAC meeting in Uppsala, May 2015.

Two polar expeditions dedicated to Cenozoic climate changes, Antarctic Cenozoic Paleoclimate (IODP Proposal 813) and Arctic Ocean Paleoceanography (IODP Proposal 708), which are currently being scoped with a view to implementing both expeditions in 2018, the "ECORD Polar Year", completing the 2015-2018 operational plan for MSP expeditions.

The 16 active MSP proposals that are currently residing at the ECORD Facility Board and the Science Evaluation Panel *(page 25)* may partly form the basis of the operational plan that will be defined for the second phase of the current programme. They include a diverse range of science themes (climate and sea-level change, geohazards, hydrogeology, deep biosphere, CO_2 storage), various geographic areas (Atlantic, Pacific, Arctic and Southern Ocean, Mediterranean Sea, Japan Sea) in diverse environments and drilling conditions, as well as a great variety of potential drilling/coring systems (drillships, jack-up rigs, seafloor drills, long piston coring etc.), thus demonstrating the great success and the flexibility of the MSP concept and its contribution to IODP.

Participating in *JOIDES Resolution* IODP expeditions

Forty-three ECORD scientists, including four Co-chief Scientists, were invited to participate in expeditions implemented by the US drillship *JOIDES Resolution (JR) (below)*:

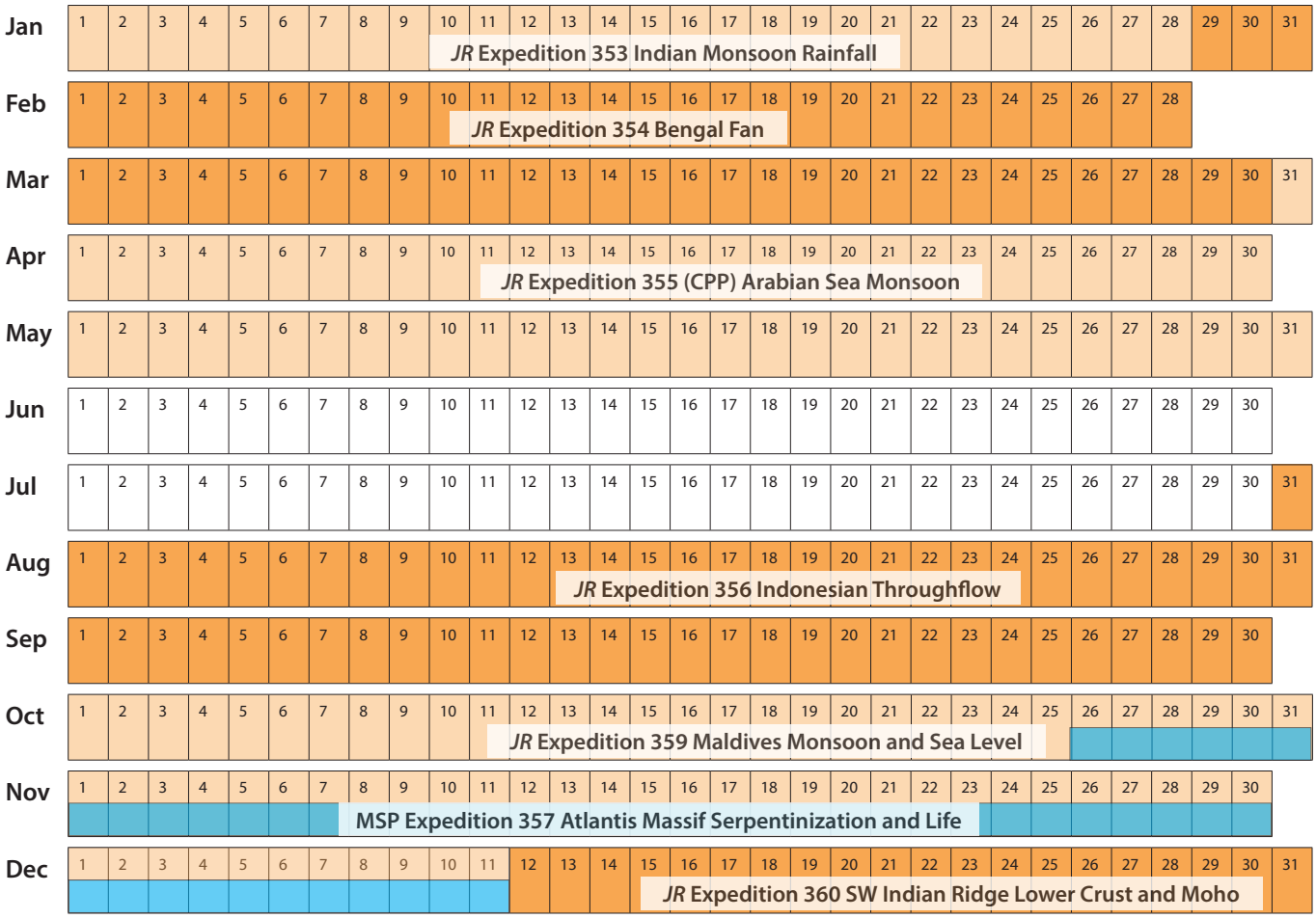
- four expeditions focused on monsoon history and mechanisms (354 Bengal Fan; 355 Arabian Sea Monsoon-CPP; 356 Indonesian Throughflow; 359 Maldives Monsoon and Sea Level) *(pages 28-31)*,
- a fifth expedition dedicated to the structure of the lower crust and the origin of the Moho (360 SW Indian Ridge Lower Crust and Moho) started in December 2015 and was implemented until the end of January 2016 *(page 31)*.

A considerable number of students and early-career scientists had the opportunity to participate in *JR* expeditions, representing half of the ECORD participants in 2015 *(page 27)*.

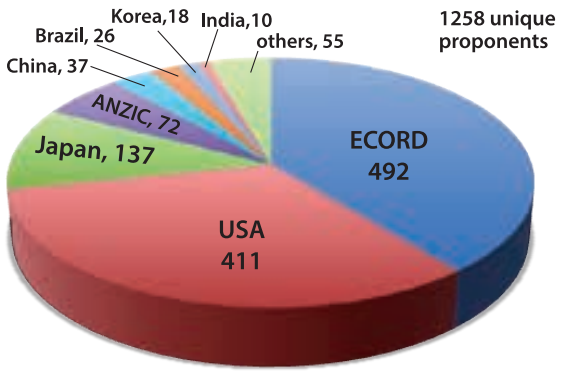
Anticipating next IODP expeditions

The outstanding intellectual contribution of ECORD's science community to IODP is especially reflected by its active participation in the submission of drilling proposals.

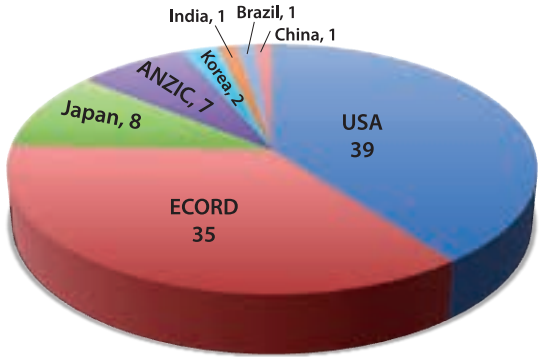
IODP expeditions in 2015



Even with the 11 new proposals that were submitted to IODP in 2015, which is the lowest number since 2011 during the Integrated Ocean Drilling Program (IODP), and much lower than the 36 proposals that were submitted in 2014, ECORD's contribution of unique proponents (492 out of 1258 - 39%, including 35 Lead Proponents *(below)* is larger than that of the USA, followed by Japan, ANZIC and other member countries. ECORD is therefore making a huge contribution to the scientific efforts of IODP, and it is important to note that ECORD's participation regarding proposals in IODP continues to grow (37% in 2014 and 39% in 2015). With five to six workshops organised annually in the frame of the MagellanPlus Workshop Series Programme, ECORD provides substantial support to scientists to develop innovative drilling proposals concerning diverse scientific topics and the use of the three IODP platforms.

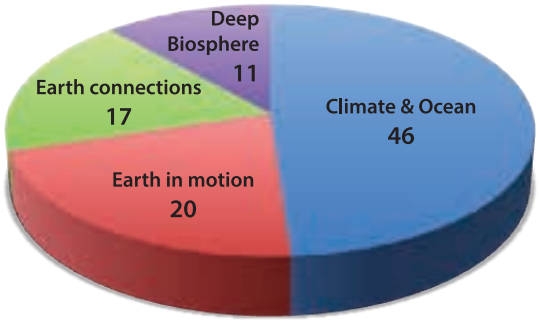


Distribution of IODP active proponents (n = 94) by proponent's member affiliation.



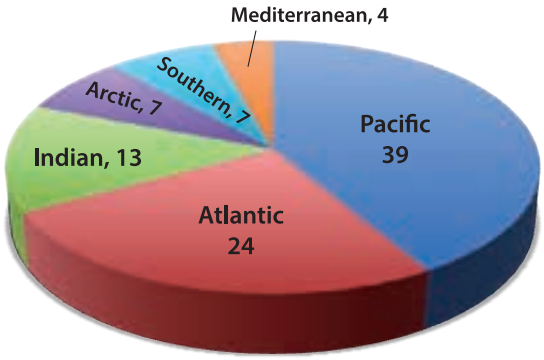
Distribution of IODP active proposals (n = 94) by Lead Proponent's member affiliation.

The distribution of active IODP proposals by Science Plan themes *(top right)* demonstrates a good distribution of proposals in all themes of the Science Plan. About half of the proposals are in the Climate and Oceans Theme, whereas the others are in the Earth in Motion, Earth Connections and Deep Biosphere Themes.



Distribution of active proposals (n = 94) by IODP Science Plan themes.

By geographic distribution *(below)*, the proponents of 39 proposals aim to drill in the Pacific, followed by 24 proposals in the Atlantic, 13 in the Indian Ocean, 7 in the Arctic, 7 in the Southern Ocean and 4 in the Mediterranean Sea. With the planned *JOIDES Resolution* drilling operations in the Atlantic Ocean, Mediterranean, Caribbean, and Gulf of Mexico from 2019 onwards *(page 32)*, the number of proposals concerning these regions is expected to increase significantly in the coming years, in which the ECORD science community will certainly play a pivotal role.

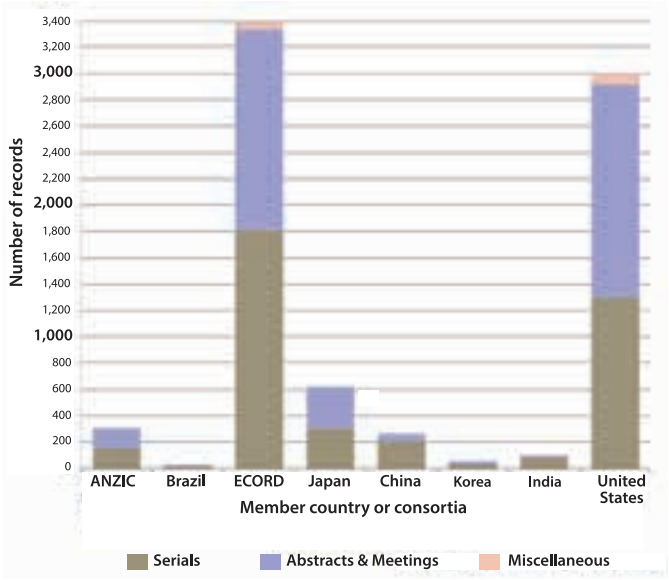


Distribution of active proposals (n = 94) by target ocean.

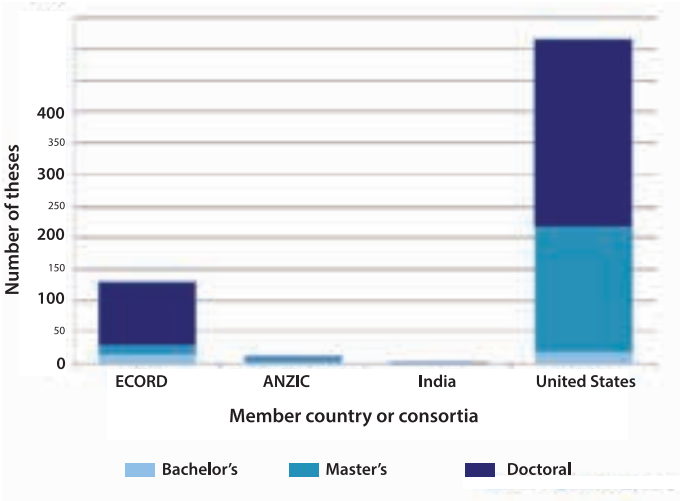
The intellectual contribution of the ECORD science community to the ocean drilling programmes is also reflected by the publication of scientific results related to the legs and expeditions carried out by DSDP, ODP and IODP *(page 33)*. The 2015 issue of the Ocean Drilling Citation Report, which is published annually by Texas A & M University - http://iodp.tamu.edu/publications/AGI_studies/AGI_study_2015.pdf, demonstrates the leading role played by the ECORD science community in the successive ocean drilling programmes *(left and top right, page 12)*. However, these statistics also indicate that efforts from ECORD countries should be provided to increase the number of theses based on programme science *(bottom right, page 12)*.

Member country or consortia	Publications contibuted to	First-authored publications
ANZIC	1,051	625
Australia	723	375
New Zealand	328	250
Brazil	58	42
China	431	343
ECORD	11,832	7,250
Austria	65	20
Belgium	151	74
Canada	1,292	781
Denmark	197	79
Finland	39	35
France	1,804	1,096
Germany	2,802	2,072
Ireland	31	14
Israel	44	30
Italy	740	426
Netherlands	530	302
Norway	453	223
Poland	40	17
Portugal	78	26
Sweden	329	165
Switzerland	462	244
United Kingdom	2,793	1,646
India	227	188
Japan	1,544	1,098
Korea	118	60
United States	10,238	9,067
Total	**25,499**	**18,678**

Number of DSDP-, ODP-, and IODP related contributions to non-programme publications (1969-2014) (ANZIC: Australian-New Zealand Consortium).



Number of DSDP-, ODP-, and IODP related non-Program publications based on first author affiliation (2003-2014)



Number of theses based on programme science (1969-2014).

Engaging the community

ECORD develops multiple science and educational activities aimed at scientists, students, early-career scientists and teachers, which have proved their value and efficiency.

The five ECORD workshops organised in 2015 in the frame of the MagellanPlus Workshop Series Programme *(pages 45-47)*, have provided substantial support to scientists to help develop innovative drilling proposals addressing diverse scientific topics and potentially involving the three IODP platform providers, as well as continental drilling:

- Drilling the Cretaceous-Palaeogene Tropical South Atlantic (2-4 February, 2015, Newcastle, UK);
- Investigating Mediterranean-Atlantic Gateway Exchange - IMAGE - (5-8 May 2015, Rabat, Morocco);
- Mantle, Water and Life: the ultramafic-hosted Rainbow hydrothermal field (10-12 June 2015, Lyon, France);
- Submarine Paleoseismology: Using giant piston coring within IODP to fill the gap in long-term records of great earthquakes (16-18 July 2015, Zurich, Switzerland);
- Haiti-DRILL: A window to the North Caribbean active "sliding doors" Fault System through Scientific Drilling (26-28 October 2015, Rueil-Malmaison, France).

The funding of the Haiti-DRILL workshop illustrates the combined ECORD and ICDP efforts to specifically support the organisation of Amphibious Drilling Proposal workshops in the MagellanPlus Workshop Series Programme through the allocation of a specific annual budget.

The promotion of IODP scientific achievements to a large audience within universities and institutes has been actively conducted by five ECORD Distinguished Lecturers, C. France-Lanord (France), J. Kallmeyer (Germany), A. Morris (UK), P. Vannucchi (UK) and G. Uenzelmann-Neben (Germany) who gave 49 lectures in 13 countries across Europe, Canada, Israel and Turkey *(page 51)*.

A major goal of ECORD is to train the next generation of scientists from its member countries. A total of 143 students and early-career scientists have participated in the ECORD Schools and Grants, 26 of whom received a Scholarship to attend one of the schools *(pages 47-49)*.

Two ECORD Summer Schools were sponsored in 2015: the 12th Urbino Summer School in Paleoclimatology on Past Global Change Reconstruction and Modelling Techniques (15 July - 1 August 2015; Urbino, Italy), and the 9th ECORD Bremen Summer School (31 August - 11September 2015; Bremen, Germany) on ocean crust processes: magma, faults, fluxes and life. In addition, ECORD sponsored four students to attend the International School of Foraminifera, which was also held in Urbino.

The ECORD Training Course was created in 2015 as an additional ECORD educational activity. This new initiative is tailored to provide a "Virtual Drillship Experience" for scientists from academia and industry at the IODP Bremen Core Repository at the MARUM, University of Bremen, Germany.

Eight ECORD Research Grants were awarded to PhD students and early-career scientists to conduct research on core materials and/or data related to successive scientific ocean drilling programmes (DSDP/ODP/IODP).

Major efforts have been aimed at involving teachers in ECORD's educational activities in 2015. Four teachers from ECORD member countries sailed as Education/Outreach Officers on three *JOIDES Resolution* expeditions in 2015: 354 Bengal Fan, 359 Maldives Monsoon and Sea Level and 360 SW Indian Ridge Lower Crust and Moho as part of the Teachers at Sea Programme sponsored by our US partner - http://joidesresolution.org/node/453.

The first official ECORD School of Rock was held in Loulé, Portugal in July 2015 *(page 50)*. This new initiative aims to educate teachers about scientific ocean drilling through the interaction with expedition scientists and former Teachers at Sea, and to create a network of teachers across the ECORD countries. The creation of this initiative was approved by the ECORD Council in late 2014 following the successful teachers' workshop that was held in Sophia Antipolis (France) entitled "Understanding Earth with Ocean Cores" in spring 2014. This successful workshop was the template for the creation of an ECORD School of Rock, a concept that was recently endorsed by the ECORD Council.

Communicating

One of the major and constant goals for ECORD is to promote ECORD and IODP activities and accomplishments to large audiences, including scientists, classrooms and the general public.

In 2015, ECORD actively promoted the IODP and ICDP programmes at major international (EGU, AGU) and national science conferences with the organisation of joint ECORD-ICDP booths under the banner, "Scientific Drilling" *(page 53)*.

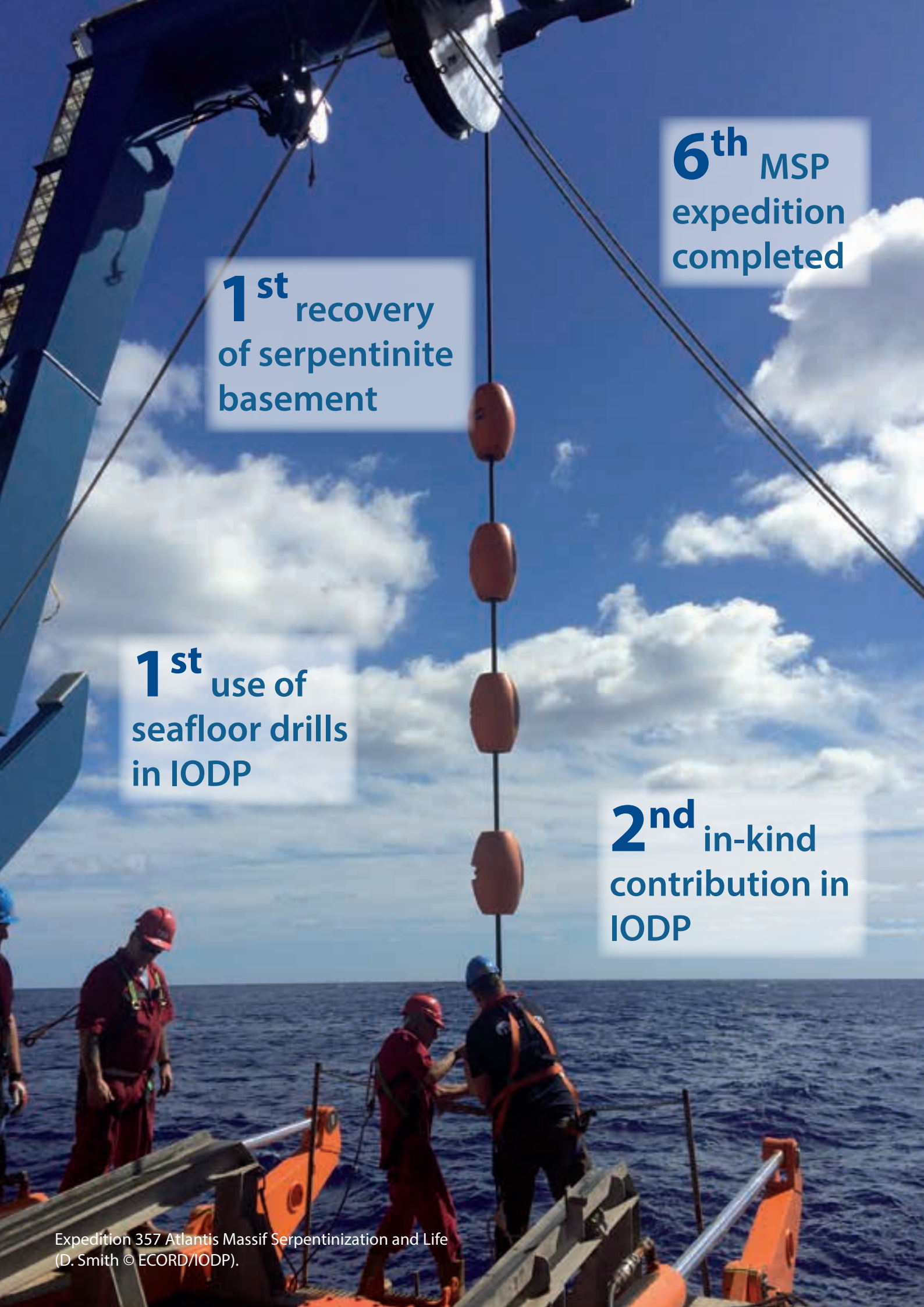
Multiple communications activities related to the MSP expeditions have been carried out in 2015. A communication plan was developed and media activities organised prior to the start of Expedition 357 Atlantis Massif Serpentinization and Life *(page 54)*. Furthermore, communications plans regarding the upcoming Expedition 364 Chicxulub Impact Crater have been developed, including discussions with a TV production company.

ECORD constantly updates and creates educational material that can be used in classrooms, during the ECORD School of Rock and in support of national events across the ECORD member countries.

Finally, to increase ECORD's visibility and to better convey information to the science community and wider audiences, ECORD has recently decided to re-design the three ECORD websites and combine them in a single website dealing with all aspects of the consortium's activities.

Gilbert Camoin, ECORD Managing Agency Director

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



Expedition 357 Atlantis Massif Serpentinization and Life (D. Smith © ECORD/IODP).

2. Operating and participating in mission-specific platform expeditions

Introduction

In 2015, ESO completed the offshore phase of its sixth MSP expedition, Atlantis Massif Serpentinization and Life and prepared for the Onshore Science Party in Bremen in January/February 2016. Plans for MSP Expedition 364 Chicxulub K-Pg Impact Crater to be implemented in April/May 2016 are at an advanced stage and in parallel with these activities, ESO is working on future MSP expeditions that are scheduled for 2018.

The RD2 and MeBo seafloor drills are new capabilities that can be used in MSP expeditions and require constant development to meet the scientific demands of IODP expeditions. In preparation for Expedition 357, ESO worked with BGS and MARUM as well as external companies to advance the seafloor drilling technologies, especially the downhole logging tools and the capability to plug and instrument boreholes.

IODP Expedition 347 Baltic Sea Paleoenvironment

Co-chief Scientists: *Thomas Andrén (ECORD, Sweden) and Bo Barker Jørgensen (ECORD, Denmark)*
Expedition Project Managers: *Carol Cotterill and Sophie Green*
Petrophysics Staff Scientist: *Annick Fehr*

- **Scientific objectives**

The main objective of the expedition was to gain a deeper understanding of the paleoenvironmental evolution of the Baltic Sea Basin through the last glacial cycle, from 130,000 years to the present (*i.e.* Pleistocene to Holocene).

- **Post-cruise activities**

ESO worked with the Co-chief Scientists to coordinate the Science Party and their collaborators as they continued with their post-expedition research throughout the year. The 2nd Post-Cruise Meeting was hosted by Thomas Andrén from 28-29 September at Södertörn University, Sweden, and the first publications related to the expedition are expected to be submitted as high-impact papers in peer-reviewed journals in 2016.

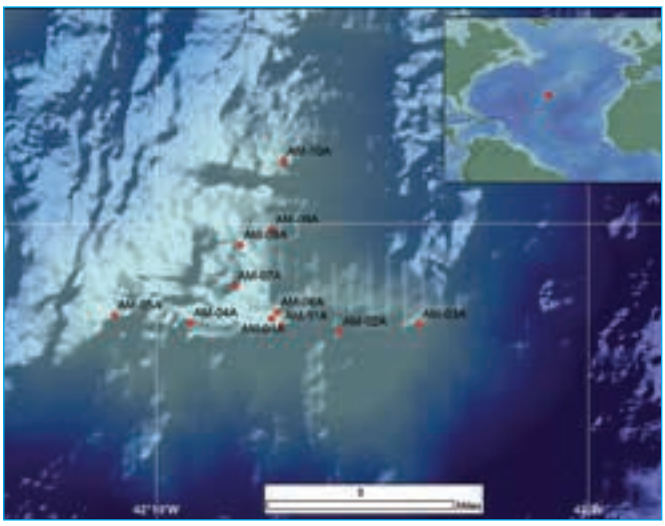
The moratorium period for the expedition ended on 21 February 2015, with the publication of the Proceedings of the IODP Volume 347 at http://publications.iodp.org/proceedings/347/347title.htm. Associated with the end of the moratorium, ESO prepared the expedition datasets for final archive in the PANGAEA database (expedition data) and IODP legacy logging database hosted by the Lamont Doherty Earth-Observatory (logging data). In addition, the quality assurance and control (QA/QC) documentation for the expedition procedures and data were completed. With the end of the moratorium period, the new SaDR sample and data request system (*page 42*) is now being used by scientists to request samples from all DSDP and ODP Legs as well as all IODP expeditions. Improvements will continue as staff from all three repositories currently collect and share ideas that will make the system even more efficient and user-friendly.

IODP Expedition 357 Atlantis Massif Serpentinization and Life

Co-chief Scientists: *Gretchen Früh-Green (ECORD, Switzerland) and Beth Orcutt (USA)*
Expedition Project Managers: *Sophie Green and Carol Cotterill*
Petrophysics Staff Scientist: *Sally Morgan*

- **Scientific objectives**

A major goal of the Atlantis Massif Serpentinization and Life Expedition (based on IODP Proposal 758-Full2) is to better understand the role of serpentinization in driving hydrothermal systems, in sustaining microbiological communities, and in the sequestration of carbon in ultramafic rock.



Location map and drillsites of Expedition 357.

- **Operations**

The offshore phase of IODP Expedition 357 took place from 26 October to 11 December 2015, sailing to and from Southampton, UK. This expedition represented the first use in IODP of remotely-controlled robotic seafloor drills *(below, left)*, the British Geological Survey (BGS) Rockdrill 2 (RD2) and the MARUM Meeresboden-Bohrgerät (MeBo). The expedition was the culmination of three years of IODP-specific technical development and planning, of which the final phase concentrated on the manufacture and modification of new components to improve the capabilities of seafloor drills to meet the expedition's science requirements.

The platform was the research vessel *RRS James Cook*, provided by the UK's Natural Environment Research Council (NERC) as an in-kind contribution *(below, right)*.

The expedition mobilised in Southampton from 18 October, when the ESO team set up the equipment for core and sample curation, core description, microbiology, and geochemistry for the IODP-MSP core workflow, and IT infrastructure including the latest ExpeditionDIS database created by the developer smartcube. The European Petrophysics Consortium (EPC) provided two multi-sensor core logger systems, including the standard system and a fast-track magnetic susceptibility system. The fast-track facilitated the rapid acquisition of physical properties data from all cores, including the whole-round samples taken for microbiological analysis.

The engineering teams from the BGS and MARUM worked with the operators of the *RRS James Cook* to install the two seafloor drills onboard the vessel. The mobilisation *(below)* was the result of several months of careful planning and adaptation work to allow both drills to be carried on the expedition, each one acting as a back-up for the other.

Prior to sailing, a media event was organised by the ESO Outreach team on 22 October at the Foreign Press Association in London, and resulted in several media reports in printed media, online, and on radio, including the BBC *(page 54)*.

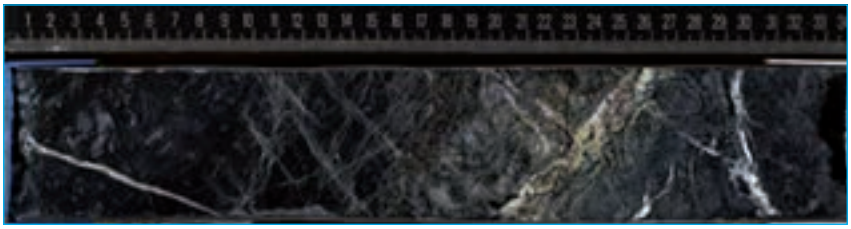
After ten days transit following departure from Southampton on 26 October, the expedition spent 27 days at nine sites on Atlantis Massif, near the Mid-Atlantic Ridge in the North Atlantic Ocean at roughly 30°10'N and 42°10'W, before a 10-day return transit *(map page 15)*. The serpentinite basement was drilled at seven sites along a spreading-parallel, E-W profile to explore the extent and activity of the subsurface biosphere and assess how abiotic

Top left, deployment of the BGS RD2 seafloor drill over the side of the RRS James Cook (D. Smith ©ECORD/IODP); bottom left, deployment of the MARUM MeBo70 seafloor drill over the stern of the RRS James Cook (D. Smith ©ECORD/IODP); right, RRS James Cook in port during mobilisation for Expedition 357 Atlantis Massif Serpentinization and Life (H. Kuhlmann ©ECORD/IODP).

and biotic processes change with aging of the lithosphere and with variations in rock type. Two sites were drilled towards the north and recovered sediments overlying the gabbroic centre of the massif.

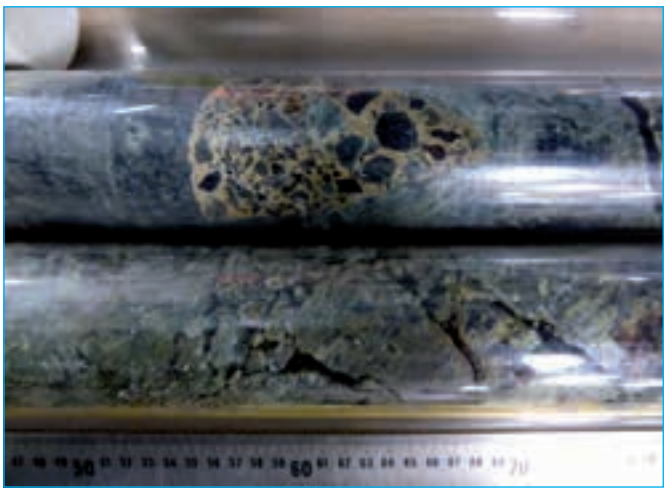
The expedition recovered 57 m of high quality cores (from a total of 17 holes) actively serpentinizing lower crustal and shallow mantle sequences of the detachment fault zone of the Atlantis Massif, where both mafic and ultramafic lithologies are exposed on the seafloor, with an average recovery of 53%. Two boreholes to 16.5 mbsf, with a record average recovery of over 70%, were drilled north of the Lost City hydrothermal vent field, a new achievement in scientific ocean drilling. The cores were highly heterogeneous *(below)*, ranging from moderately to highly altered and deformed serpentinized peridotites, with varying compositions and occurrences of talc-amphibole schist zones. Less abundant lithologies included lithified basalt breccias, rodingites, and metagabbros with cataclastic to (ultra)mylonitic deformation fabrics. The cores were not split at sea, however Science Party microbiologists were able to take samples under clean conditions for culturing and later analysis. Geochemists acquired and analysed water samples for ephemeral properties, which indicated that some interesting early results were emerging.

Prior to the expedition, the rock drills, logging tools and other developments were tested at BGS Edinburgh, offshore West Scotland and at MARUM in Bremen. During the expedition, and for the first time in any ocean-drilling project, two borehole plug systems were installed by a seafloor drill *(top left, page 18)*. Consisting of a valved drill string plug and swellable packer, these borehole plugs will allow future sampling of formation fluids by ROVs, which will facilitate better understanding of the geochemical and microbiological processes in these actively serpentinizing systems. Science Party members have already organised a research cruise to return to the drill sites and sample hydrothermal fluids in the plugged boreholes. The new drill-mounted sensor packages designed for the expedition *(top right, page 18)* were highly successful and consistently delivered real-time chemical information (methane, pH, oxygen redox potential, temperature, and dissolved oxygen), allowing *in-situ* confirmation of ephemeral events such as gas release while drilling. Newly added water sampling apparatus allowed bottom water to be sampled immediately pre- and post-drilling, to augment water samples taken by CTD casts prior to drill landing. The new drill- mounted tracer delivery system (pump system) successfully delivered a geochemical tracer during drilling for contamination tracer testing, which will help assess the validity of the microbiology results.



Example of a high-resolution digital line scan of the split surface of a fractured and veined core from Expedition 357 (© ECORD/IODP).

After arriving back in Southampton, the cores were shipped to the IODP Bremen Core Repository where preparations were made for the Onshore Science Party (OSP), which will start on 20 January 2016. The Expedition Pre-OSP began in Bremen on



Various core materials recovered during Expedition 357: left, first core (metagabbro with strong talc-amphibole alteration) on deck (D. Smith ©ECORD/IODP); right, samples from M0068B (C. Cotterill ©ECORD/IODP).

Successful installation of a packer rod in an expedition borehole. The rod seen protruding from the borehole is equipped with a swellable packer which is intended to seal the borehole. Fluid can be observed flowing out of the packer rod, which was subsequently capped with a valved plug for future ROV sampling (© ECORD/IODP).

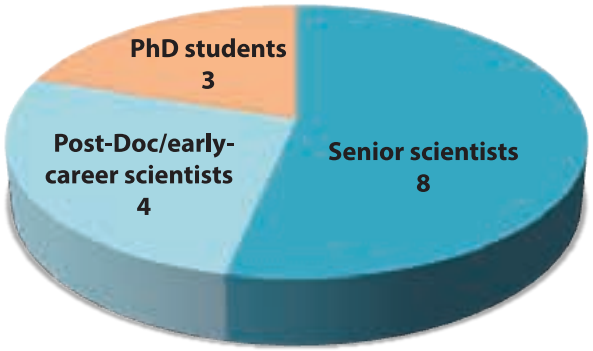
Seafloor drill-mounted sensor and water sampling assembly. Three water sampling bottles (grey) are visible. The two stainless steel cylinders house the various sensors mentioned in the main text. Water is pumped from close to the point of drilling to the sensors via flexible tubing (© ECORD/IODP).

15 December, during which EPC undertook natural gamma ray measurements on the whole-round core. MARUM/EPC also acquired high-resolution linescan images (360°) of the full core in liner, and thin sections were made on initial samples taken (thin section billets, TSBs) offshore. At the OSP, the cores will be split and all data for IODP standard measurements will be acquired by around 60 scientists and operator personnel.

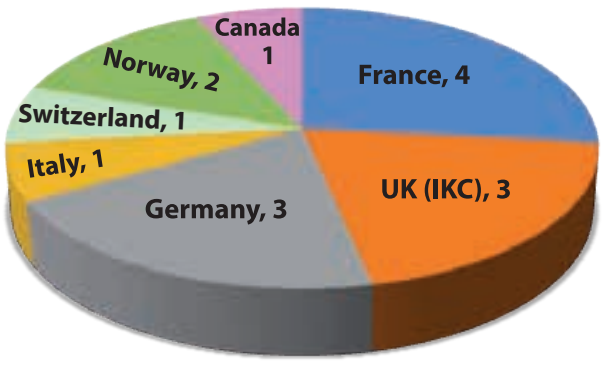
IODP Expedition 357 was a technically challenging expedition, and further work is required to develop the capabilities of seafloor drills. Despite the challenges, technical advancements were made that have provided cores from lithologies not previously encountered in scientific drilling, and new data that will enable the Science Party to undertake many different and innovative studies.

- **Participation**

A total of 15 ECORD scientists were invited to participate in Expedition 357 plus one Swiss Co-chief Scientist, representing a total of seven ECORD countries *(below)*. Three of the 15 scientists participated as the result of in-kind contributions (IKC). There was a balance between students/early career scientists vs. senior scientists *(below)*.



+ 1 Co-chief Scientist (Switzerland)



Expedition web page:
http://www.eso.ecord.org/expeditions/357/357.php

Equipment upgrades

The RD2 and MeBo seafloor drills are evolving systems that are under constant development by technical teams at the BGS and MARUM. To meet the scientific demands of IODP expeditions, new capabilities were identified at previous ECORD technical panel and proponent meetings, in particular downhole logging tools and the ability to plug and instrument boreholes. IODP Expedition 357 served as a catalyst for these new seafloor drill developments, and throughout 2015 ESO worked with technical partners at MARUM, BGS and external companies to achieve new advancements in seafloor drill-rig technology, specifically:

- dual induction resistivity logging tools;
- magnetic susceptibility logging tools;
- seafloor drill string plug for post-expedition fluid sampling by ROV;
- borehole packer system (expanding packer);
- tracer delivery system;
- water sampling system;
- sensor package - CTD/DO/CH4/pH/Redox.

In addition to the developments of seafloor drills, ESO has continued to monitor and improve its general equipment pool. For example, a new satellite system for phone and internet was purchased and successfully used on IODP Expedition 357. This was in response to repeated feedback from Science Party members for more reliable internet access at sea, and to provide a reliable means of offering video communication for media activities.

This year the refurbishment of the EPC offshore petrophysics container was completed. This has increased core storage, extended the capability of the standard multi-sensor core logger (MSCL-S) and maintained the option for accommodating a second 'fast-track' MSCL. The MSCL-S now has the capability to include a double magnetic susceptibility loop option and also has the potential to increase sensor capability further in the future. The refurbished container was fully tested during a month-long research cruise in July as part of the NERC-funded BRITICE-CHRONO project and used offshore on the *RSS James Cook* as part of Expedition 357. During this expedition, the 'fast-track' MSCL was also used to facilitate rapid measurement of cores prior to microbiological sampling. Unlike on

ESO personnel at the fast-track MSCL (S. Lang © ECORD/IODP).

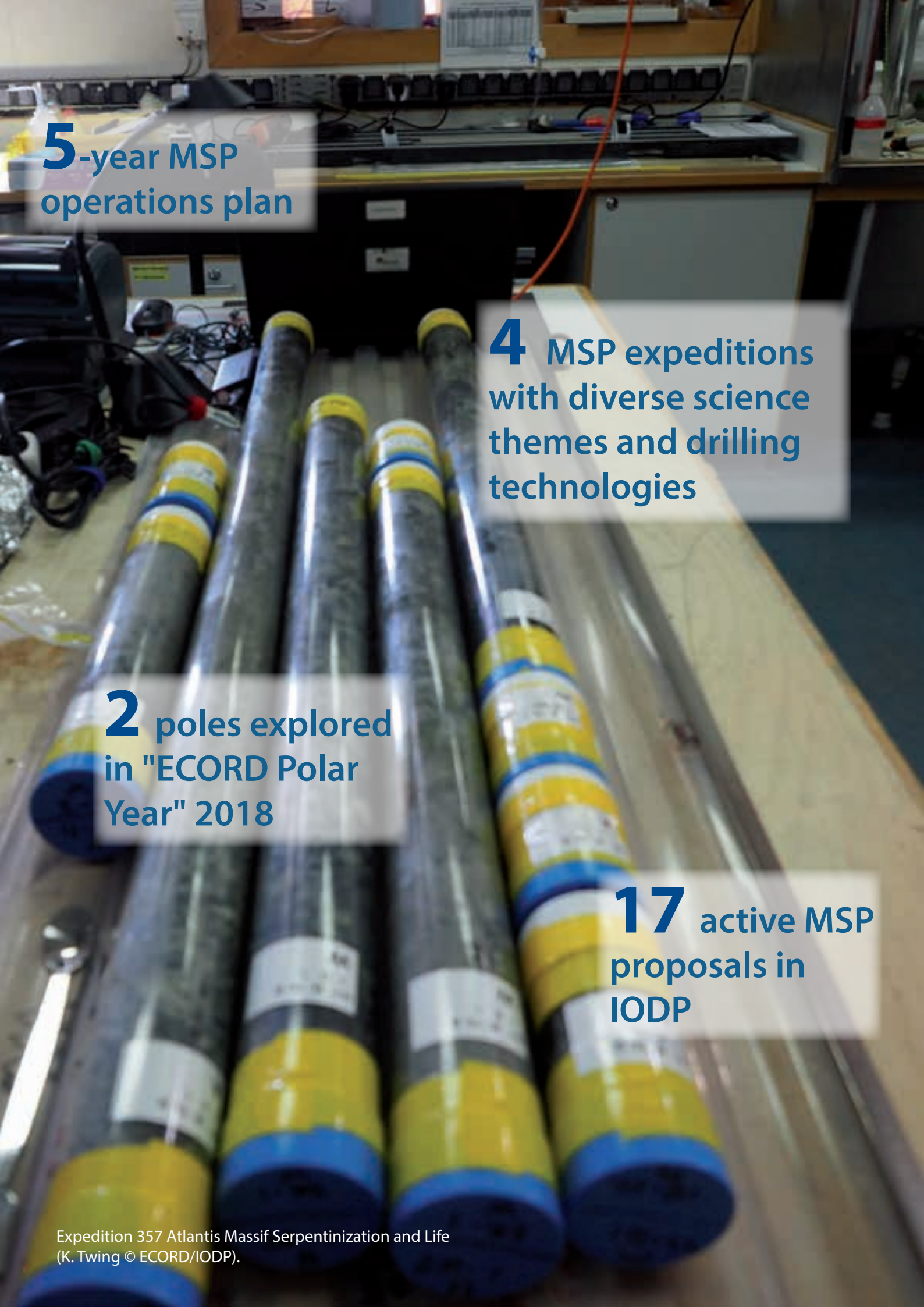
Expedition 347, where the fast-track was housed in the petrophysics container, the fast-track was set up in one of the ship's laboratories *(above)*.

The TEKA-04, owned and operated by EPC Aachen has been maintained and enhanced with software updates. Options for measuring the cores from Expedition 364 Chicxulub K-Pg Impact Crater have already been scoped and plans are in place for acquiring these key data.

Finally, EPC Leicester has acquired multiple TechLog licences from Schlumberger for use on academic projects including for IODP expedition data. This versatile industry-standard software will be invaluable for facilitating, processing, presenting and interpreting of expedition petrophysical data.

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

Expedition 357 Offshore Science Party



5-year MSP operations plan

4 MSP expeditions with diverse science themes and drilling technologies

2 poles explored in "ECORD Polar Year" 2018

17 active MSP proposals in IODP

Expedition 357 Atlantis Massif Serpentinization and Life (K. Twing © ECORD/IODP).

3. Anticipating the next MSP expeditions

Scheduled expeditions

Mission-specific platform (MSP) expeditions related to Proposals 758 Atlantis Massif for 2015, 548-Chicxulub Crater for 2016 and 813 East Antarctic Paleoclimate for 2018 were scheduled at the previous ECORD Facility Board (EFB) meetings in 2013 and 2014. The EFB meeting on 25-26 March 2015 in Aix-en-Provence was dominated by the discussion on scheduling an Arctic expedition for 2018 to complete the five-year MSP operational plan *(below and page 59)*. The proposal 708 Arctic Paleoceanography (ACEX-2) had already been discussed by the EFB in 2014, but the proponents were asked to submit an Addendum with the presentation and discussion of more site-survey data, which they collected in Arctic summer 2014. Consequently, the EFB decided that the proposal to drill one or two sites on the southern Lomonosov Ridge can be scheduled for Arctic summer 2018, provided that the expeditions' costs are limited to 15M USD. This requires full in-kind contributions for icebreaker support. Shortly after the EFB meeting, a workshop was organised by ESO during which the proponents and operators discussed various options for drilling and logistics.

With this latest decision, the EFB has so far scheduled a total of four MSP expeditions until 2018. With proposals 581 Coralgal Banks, 637 New England Shelf Hydrogeology and 716 Hawaiian Drowned Reefs, there are currently three proposals in the EFB holding bin, and more proposals are expected to be forwarded from the SEP. The proposal 730 Sabine Bank was forwarded to the EFB in January 2016.

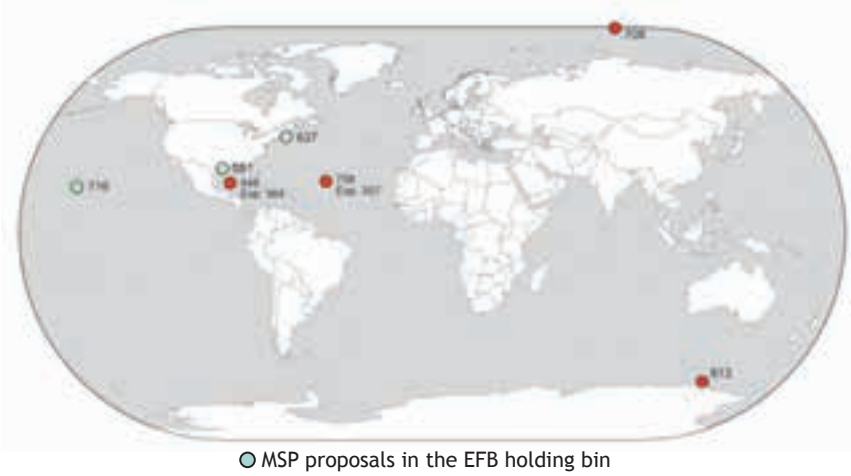
The EFB further developed its long-term scheduling strategy, accounting for the large spread of expedition costs, which largely depend on the required type of drilling platform, and for budget limits on average annual expedition costs. By projecting budget constraints until the end of the current IODP phase in 2023, the EFB expects that one more high-cost expedition, one medium-cost expedition and about three or four low-cost expeditions can be scheduled at future meetings *(table below)*. Provisional reservations have been made for seafloor drilling systems MeBo70/200 and Rockdrill2 to accommodate any proposal demands. The operations of these systems, as well as long-piston coring, can be conducted in the low-cost category provided that the research vessels are contributed in-kind.

- **IODP Expedition 364 Chicxulub K-Pg Impact Crater**

Co-chief Scientists: *Joanna Morgan (ECORD, UK) and Sean Gulick (USA)*
Expedition Project Manager: *Claire Mellett*
Petrophysics Staff Scientist: *Johanna Lofi*

- **Scientific objectives**

The major aim of this expedition is to drill the impact crater to study impact dynamics mechanism, the peak-ring



MSP proposals in the EFB holding bin
Scheduled MSP proposals

Operational schedule for MSP expeditions

2015	2016	2017	2018	2019	2020	2021	2022	2023
758 Atlantis Massif MeBo & RD2 LC	**548 Chicxulub** jack up MC	none (LC?)	**813 Antarctic** RD2 LC-MC **708 Arctic** drillship HC	LC	LC	MC	LC	HC

LC = low-cost (<8M USD), MC = mid-cost (8-15M USD), HC = high-cost (>15M USD) - MeBo and Rockdrill 2 (RD2) are seafloor drilling systems.

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.

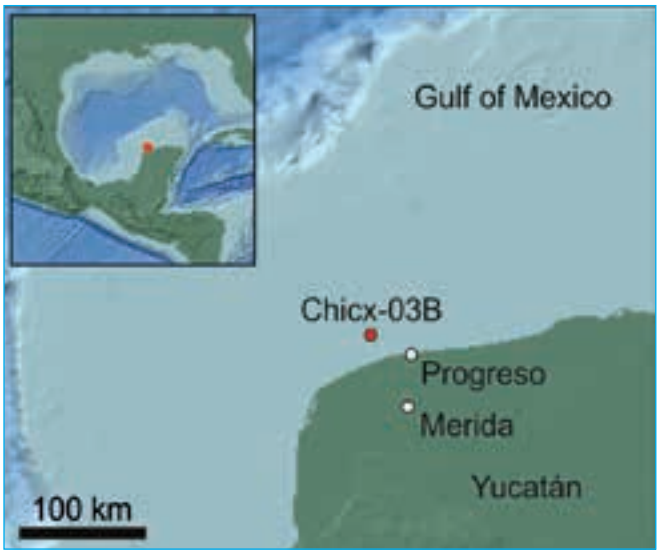
• Operations

Good progress was made throughout 2015 towards implementing Expedition 364, and the drilling platform is due to be on site in April 2016. A major activity was the tendering for drilling and platform services, involving a formal bidding exercise that started with a Notice of Interest in the public procurement database of the European Union. Over several months, potential bidders were assessed and negotiations were held with the preferred bidder, culminating with the signing of a drilling contract with DOSECC (Drilling, Observation and Sampling of the Earth's Continental Crust), the company used for the highly successful IODP Expedition 313 New Jersey Shallow Shelf in 2009.

Similar to Expedition 313, the drilling vessel will be the *L/B Myrtle*, but in contrast the rig setup and coring plan will allow for a total depth of 1500 mbsf to be reached. This will be a single-hole expedition *(top right)*, and ESO is planning for multiple pipe size 'step downs' to mitigate the risk of drilling pipes becoming stuck and to increase the chance of reaching the target depth.

ESO has held regular discussions with the logging contractors and Co-chief Scientists regarding logistics and requirements for downhole logging and vertical seismic profiling experiments. EPC (Montpellier) will undertake the wireline downhole logging and will work alongside the University of Alberta who will undertake the Vertical Seismic Profiling (VSP) experiments, with some equipment also provided by the University of Texas, Institute of Geophysics. EPC and Bremen have investigated requests for additional pre- and post-Onshore Science Party petrophysical measurements.

In the post-impact sediments, the impact breccias and the peak-ring rocks downhole and core petrophysical measurements will be used to ground-truth geophysical models generated from previously-acquired gravity, magnetic, refraction, reflection and magnetotellurics data. In the post-impact sediments (~70% of which will be drilled without core recovery) downhole data and VSP will be key in characterising the depositional sequences and identifying seismic reflection horizons, which will then be used to propagate the stratigraphic ages of the reflectors across the impact basin. Association of downhole and core



Expedition 364 Chicxulub K-Pg Impact Crater: Location of the proposed site,

petrophysical measurements (acquired with a multi-sensor core logger) will provide a robust dataset to tie cores and seismic, and to test existing hypotheses and models. Data integration is critical for improving the community's understanding of the crater structure away from the drill hole.

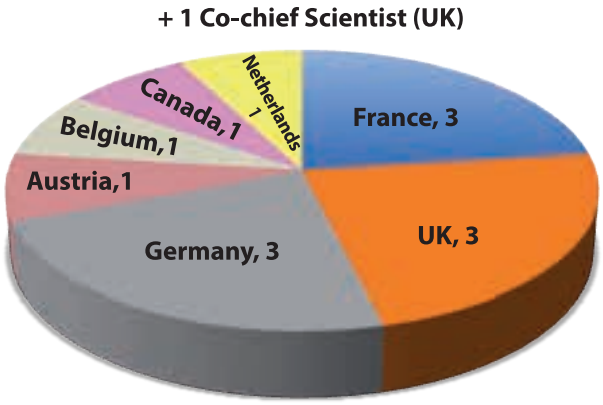
In parallel to the technical planning, scientific planning was undertaken by ESO with input from the expedition Co-chief Scientists. During the call for scientists in the spring, an information webinar was held for potential applicants on 21 April, hosted for the first time by ESO. At its peak the webinar had 40 attendees, with a total of 66 individual registrants. The Call for Scientists was opened to Mexican scientists to facilitate the project permitting, and as part of negotiations with Mexican institutes to potentially provide an in-kind contribution.

A Science Workshop was organised by the Co-chief Scientists and Mexican colleagues in Mérida, Mexico, on 30 and 31 March 2015, and was attended by ESO staff. The primary aim of the workshop was to conduct synergistic planning for the expedition, encourage Mexican participation in IODP, facilitate the permitting, and initiate public outreach and education within the Yucatán. Additional visits were made by ESO to the British Embassy and to the Secretariat of Environment and Natural Resources (SEMARNAT) in Mexico City as part of the permitting effort.

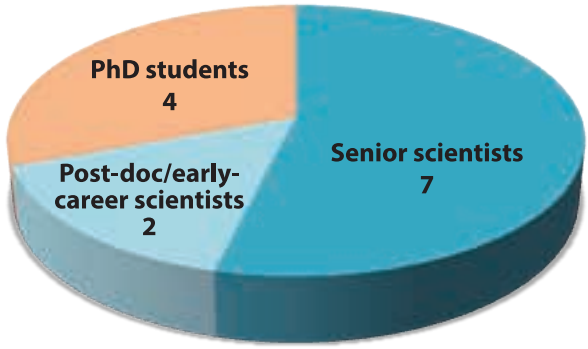
The offshore phase of Expedition 364 will take place in April and May 2016, and the Onshore Science Party in September and October 2016.

• **Participation**

A total of 13 ECORD scientists have been selected to participate in Expedition 364, plus one UK Co-chief Scientist, representing a total of 7 ECORD countries *(below)*.



Again, students/early career scientists represent almost half of the scientists, establishing a good proportion between senior and less experienced scientists *(below)*.



Expedition web page:
http://www.eso.ecord.org/expeditions/364/364.php

• **Proposal 813 Antarctic Cenozoic Paleoclimate**

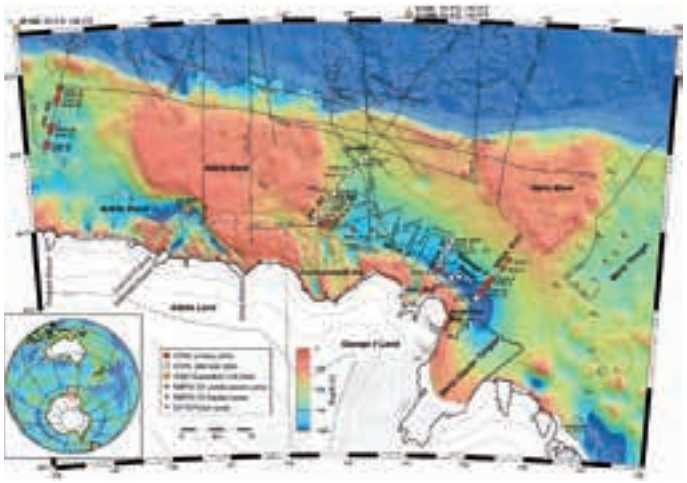
Co-chief Scientists: *Trevor Williams (USA) and Carlota Escutia (ECORD, Spain)*

• **Scientific objectives**

This proposal aims to drill the shallowly-buried strata along the George V and Adélie Land shelf of East Antarctica *(top right)* to obtain a record of Antarctica's climate and ice history from the Eocene (greenhouse) to the Neogene (icehouse).

• **Operations**

Work continued in 2015 on the planning for an expedition based on Proposal 813 Antarctic Cenozoic Paleoenvironment, provisionally scheduled for February to March 2018. A Project Management Team meeting between the proponents and ESO was held on 17 September, to discuss the science requirements of the expedition. Enquiries continued throughout the year to secure an icebreaker to visit the area offshore George V Land and Adélie Land, Antarctica. Enquiries led to an opportunity to contract the *N.B. Palmer* (Division of Polar Programs, NSF), and throughout the year ESO discussed the technical and science support requirements for a seafloor drill MSP expedition to Antarctica with staff from the Antarctic Support Contract (ASC) for NSF. The outlook is very positive; the *N.B. Palmer* can provide the deck space for the RD2 seafloor drill, and has internal laboratory facilities and technical support that ESO can use instead of mobile containerised laboratories.



Proposal 813 Antarctic Cenozoic Paleoclimate (Williams et al.): Transects of primary and alternate sites along existing seismic lines with a total of 18 primary and 29 alternate sites up to 80 m penetration (353-1407 m WD).

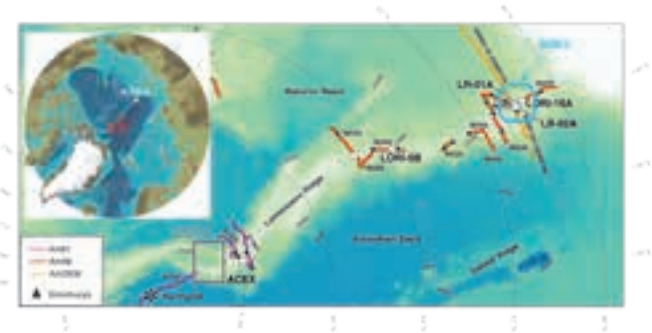
ESO provided a Letter of Agreement between ECORD and NSF to reserve the *N.B. Palmer* for February-March 2018 for this expedition. In 2016, ESO will work closely with the Division of Polar Programs and the ASC to produce an Operational Notice that documents what support from the ASC is required and what ESO will provide.

• **Proposal 708 Central Arctic Paleoceanography (ACEX-2)**

Proponents: *Rüdiger Stein (ECORD, Germany) et al*

• **Scientific objectives**

The overall goal of this proposal is the recovery of a complete stratigraphic sedimentary record on the southern Lomonosov Ridge to reconstruct the continuous long-term Cenozoic climate history of the central Arctic Ocean at high resolution, with a special focus on the Neogene



Map indicating seismic profiles (bold numbers AWI lines) and location of IODP Expedition 302 (ACEX) drillsite and proposed (ACEX-2) drillsites on the Lomonosov Ridge (primary site LR-01A and alternate sites LR-02A, LORI-5B, and LORI-16A). Grey box shows HOTRAX study area (for references see Proposal 708).

and the Pleistocene. Key objectives are related to the reconstruction of the history of circum-Arctic ice-sheets, sea-ice cover, Siberian river discharge, as well as deepwater circulation and ventilation and their significance within the global climate system.

- **Operations**

Work continued in 2015 on the scoping for an expedition based on IODP Proposal 708 Central Arctic Paleoceanography, provisionally scheduled for late summer 2018.

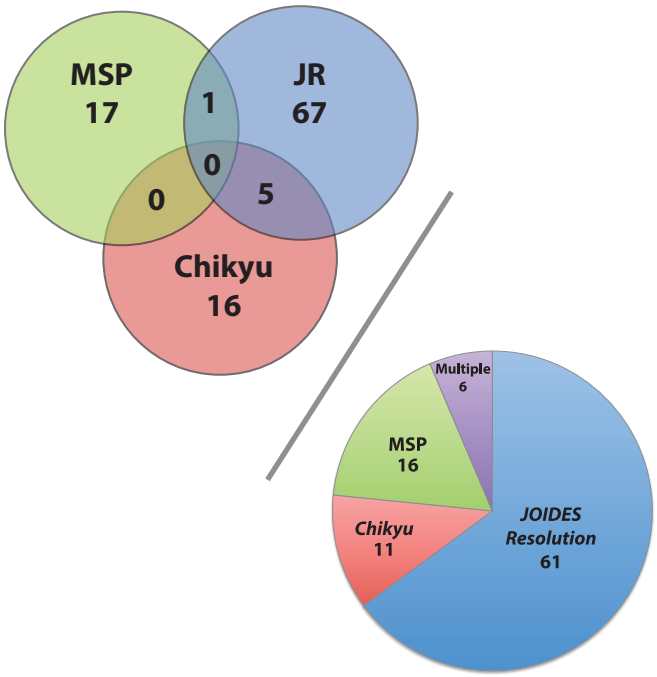
A Project Management Team meeting between the proponents and ESO was held on 17 June, primarily to introduce the proponents to the MSP concept, and to address concerns of the ECORD Facility Board and ESO regarding the depth of the proposed sites (> 2 km of pipe required) and the cost implications of trying to reach such depths.

The main outcome of the meeting was a re-evaluation of the proposed sites by the proponents using information from ESO on technology and costs. Work is underway by the proponents to identify new sites, after which they will write a short addendum for the ECORD Facility Board explaining the new site selection, to which ESO will add an operator comment.

More detailed planning work will commence in 2016, including the tendering for drilling and platform services, acceptance of potential in-kind contributions, and Science Party selection.

MSP proposals at the ECORD Facility Board and at the Science Evaluation Panel

There are currently 17 (including one multiple) active mission-specific platform proposals (as of February 2016, out of the 94 active drilling proposals *(below)*. The objectives of the MSP proposals are quite diverse in terms of science topics, drilling tools, geographical areas and collaboration with other programmes (International Marine Process Reconstruction Study - IMPRESS, and the International Continental Scientific Drilling Program - ICDP) whose scientific objectives are well aligned with those of the IODP Science Plan.



Distribution of IODP proposals by platforms (n = 94). Multiple proposals include 1 MSP + JR and 5 Chikyu + JR (Data provided by the IODP Science Support Office as of 2 February 2016).

Seven MSP proposals currently reside at the ECORD Facility Board *(page 25)*, including three proposals that form the basis of expeditions scheduled in the 2016 - 2018 time window:

- 548 Chicxulub Impact Crater;
- 708 Arctic Ocean Paleoceanography;
- 813 Antarctic Ocean Paleoclimate.

Nine MSP proposals are with the Science Evaluation Panel (SEP) *(page 25)*, and include an Amphibious Drilling Proposal (796 ADP Nice Amphibious Drilling Ligurian Landslide; Lead Proponent: A. Kopf) whose scientific objectives can only be accomplished by combining land and shallow-water drilling. A Multi-phase Drilling Proposal (863 MDP ISOLAT S-Ocean Paleoclimate; Lead Proponent: L. Peterson) could be the first IODP expedition using long piston-coring technology.

Seven Lead Proponents on MSP proposals are based in ECORD countries (Germany, Sweden, Switzerland/Austria and UK), eight in the USA and one is from ANZIC (Australia) *(table below)*.

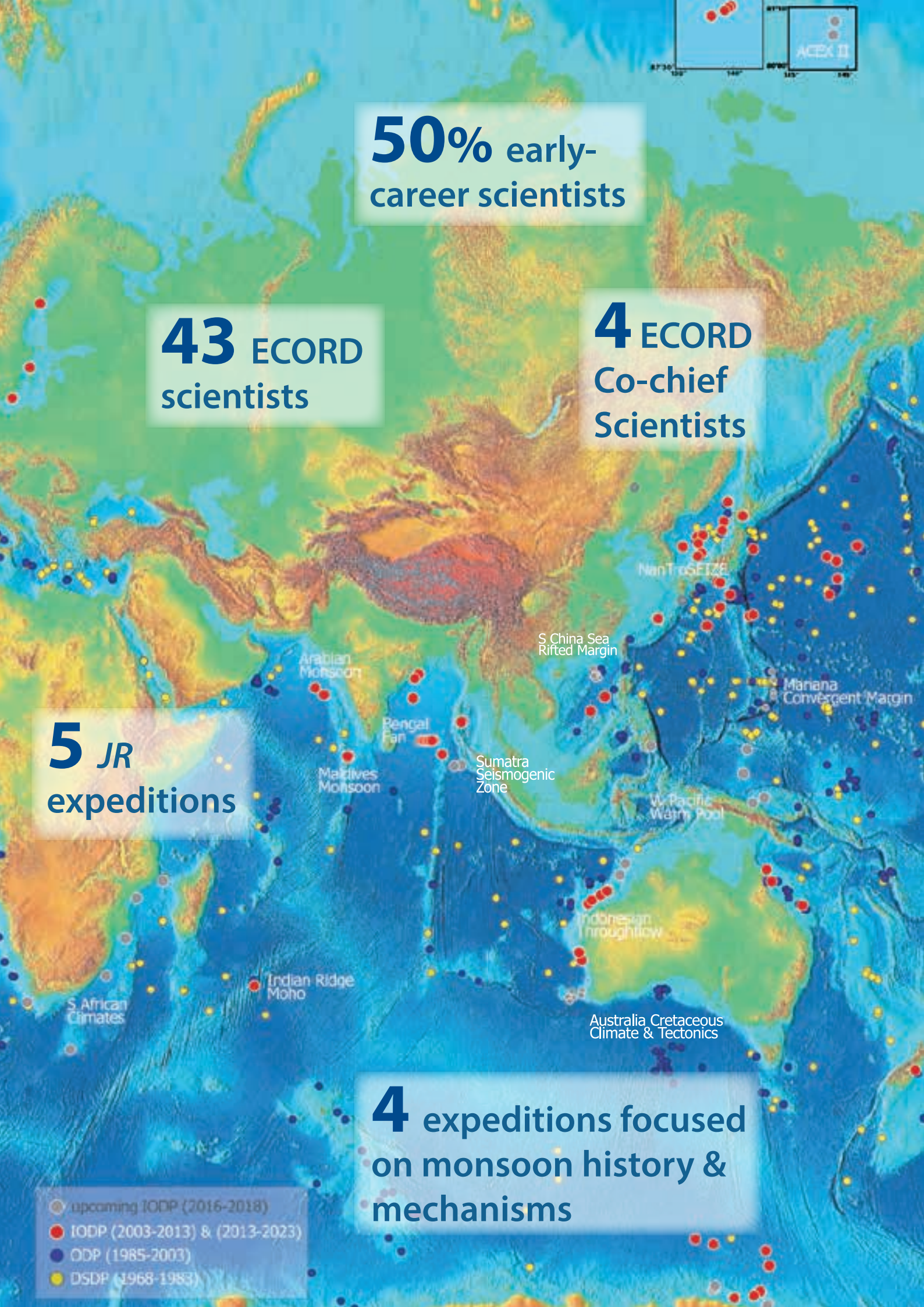
Related websites:
http://www.ecord.org/ecord-fb.html
http://www.iodp.org/active-proposals
http://www.iodp.org/facility-boards#SEP

Mission-specific platform proposals

Proposal #	Short title	Lead Proponent	Country Lead Proponent	Ocean/Sea	Drill Platform
at EFB					
548-Full3	Chicxulub Crater	Morgan	ECORD (UK)	Atlantic	liftboat/jack-up rig
581-Full2	Coralgal Banks	Droxler	USA	Atlantic	geotech. rig/seafloor drill
716-Full2	Hawaiian Drowned Reefs	Webster	Australia	Pacific	geotech. rig/MeBo200
637-Full2	New England Hydrogeology	Person	USA	Atlantic	liftboat/jack-up rig
730-Full	Sabine Bank Sea Level	Taylor	USA	Pacific	MeBo200
708-Full	Central Arctic Paleoceanography	Stein	ECORD (Germany)	Arctic	drillship
813-Full	East Antarctic Paleoclimate	Williams	USA	Southern Ocean	seafloor drill
at SEP					
879-Full	Corinth Active Rift Development	McNeill	ECORD (UK)	Mediterranean	drillship
852-CPP*	North Sea GlaciStore	Stewart	ECORD (UK)	Atlantic	drill rig
796-ADP**	Nice Amphibious Drilling	Kopf	ECORD (Germany)	Mediterranean	geotechnical rig, MeBo
866-Pre	Japan Trench Paleoseismology	Strasser	ECORD (Switzerland/Austria)	Pacific	long-piston coring
863-MDP***	ISOLAT Southern Ocean Paleoclimate	Peterson	USA	Southern Ocean	long-piston coring
812-Pre	Ross Sea Glacial History	Wilson	USA	Southern Ocean	seafloor drill
806-Pre	Beaufort Gas Hydrates	Paull	USA	Arctic	geotech. rig
797-Pre	Alaska Beaufort Margin	Ruppel	USA	Arctic	drill rig (or *JR*)
756-Pre	Arctic Ocean Exit Gateway	Jakobsson	ECORD (Sweden)	Arctic	drillship (*JR ?*)

* CPP: Complementary Project Proposal, ** ADP: Amphibious Drilling Proposal, *** MDP: Multi-phase Drilling Project, JR: JOIDES Resolution,

Expedition 357 (Y. Morono © ECORD/IODP)


50% early-career scientists
43 ECORD scientists
4 ECORD Co-chief Scientists
5 JR expeditions
4 expeditions focused on monsoon history & mechanisms
NanTroSEIZE
S China Sea Rifted Margin
Arabian Monsoon
Manana Convergent Margin
Bengal Fan
Maldives Monsoon
Sumatra Seismogenic Zone
W. Pacific Warm Pool
Indonesian Throughflow
Indian Ridge Moho
S. African Climates
Australia Cretaceous Climate & Tectonics
upcoming IODP (2016-2018)
IODP (2003-2013) & (2013-2023)
ODP (1985-2003)
DSDP (1968-1983)

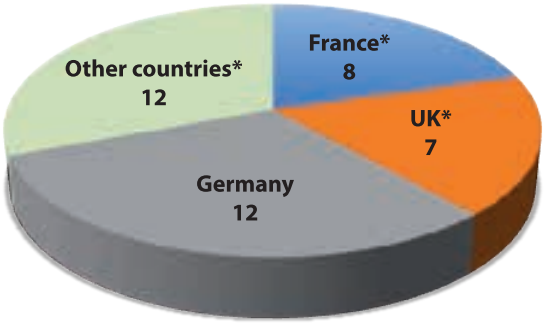
4 . Participating in and anticipating the next *JOIDES Resolution* and *Chikyu* expeditions

Expeditions in 2015

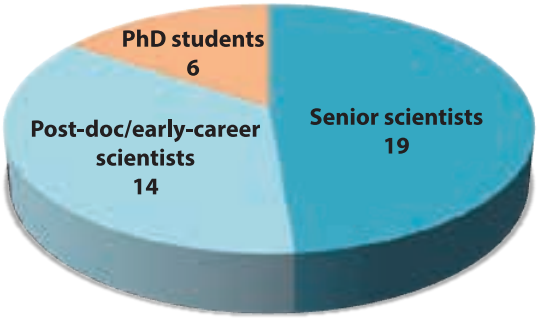
IODP expeditions - http://www.iodp.org/expeditions - provide ECORD scientists with an excellent opportunity to participate in international multidisciplinary ocean drilling projects and to have priority access to unique samples and data.

ECORD, as a contributing member of the *JOIDES Resolution (JR)* consortium, is entitled to an average of eight scientists on every *JR* expedition. Scientists are chosen following an open call for applications and a competitive selection process, which involves nominations by ESSAC and discussions by the implementing organisation, the appointed Co-chief Scientists and the IODP member countries/consortia. ECORD scientists' participation is proportional to the financial contributions of the member countries ("quotas"). Selection of the science team is, therefore, based on both scientific merit and a time-average country quota. However, the quotas do not apply to **(1)** nominated Co-chief Scientists of an expedition (like in all IODP expeditions), **(2)** scientists who are selected following special calls when a specific expertise is mandatory for the implementation of an expedition, and **(3)** scientists who participate as observers when drilling occurs in territorial waters of the relevant country.

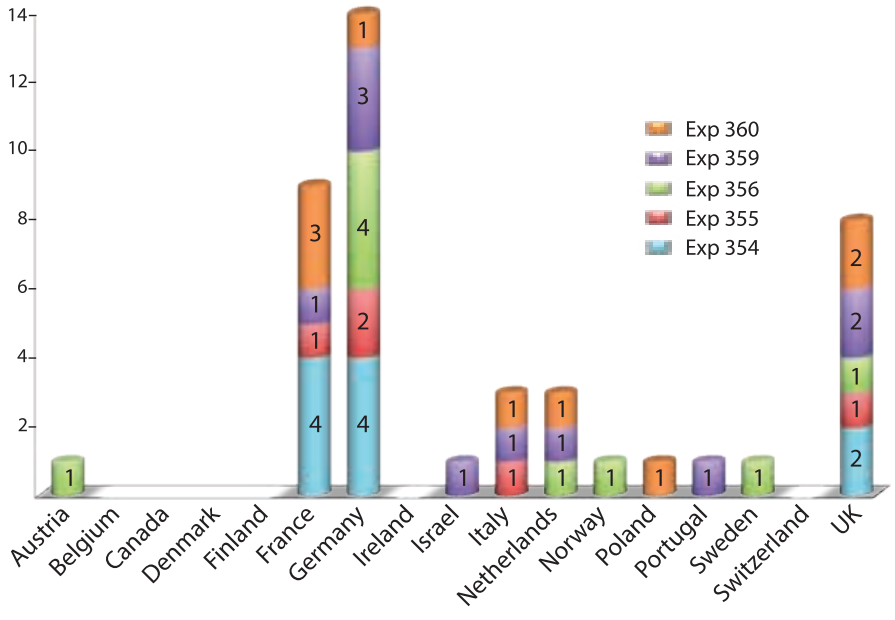
2015 Total = 39 + 4 Co-chiefs (2 Germany, 1 France, 1 UK)



Distribution of ECORD participants based on country affiliations (Expeditions 354 to 360, n =39).
** + 3 special calls (Expeditions 354 and 359, (pages 28 and 30).*



Distribution of ECORD participants based on career stage (Expeditions 354 to 360, n = 39).

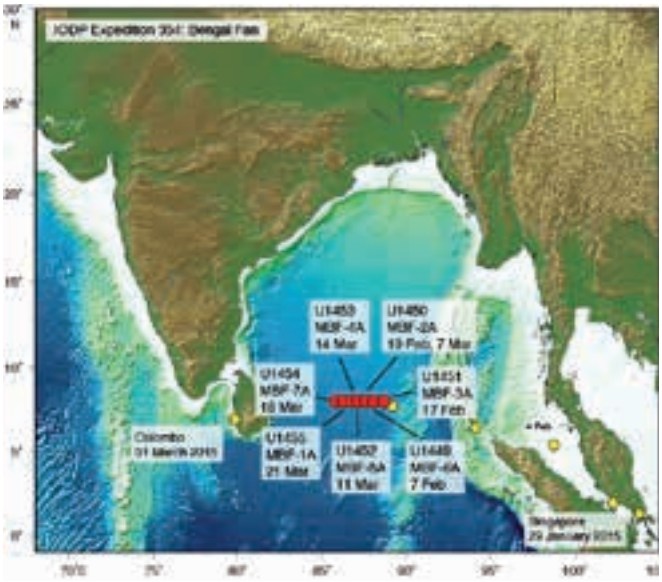


Distribution of participants based on country affiliations (Expeditions 354 to 360) and including four Co-chief Scientists and three Special Calls.

In 2015, ECORD scientists participated in **five expeditions** onboard the *JOIDES Resolution*. Four expeditions were focused on monsoon history and mechanisms. A total of **43 ECORD scientists from 11 ECORD member countries** *(left and above)* were invited to participate, including **four Co-chief Scientists**. Three of the 43 scientists participated as the result of special calls. A considerable number of students and early-career scientists had the opportunity to participate in *JR* expeditions, representing half of the ECORD participants in 2015 *(above)*.

- **Expedition 354 Bengal Fan, 29 January-31 March 2015**

The Bengal Fan Expedition was based on IODP Proposal 552-Full3 and drilled a 320 km-long transect across the middle Bengal Fan to obtain a Neogene and late Paleogene record of Himalayan orogeny and climate. The objectives were to investigate interactions among the growth of the Himalaya and Tibet, the development of the Asian monsoon, and processes affecting the carbon cycle and global climate.



ECORD participants (Expedition 354)

Co-chief Scientists		
Christian France-Lanord	CRPG-CNRS	France
Volkhard Spiess	University of Bremen	Germany
Scientists		
Rishi Ram Adhikari	MARUM, Bremen	Germany
Lyndsey Fox	University of Leeds	UK
Albert Galy	University of Lorraine	France
Pascale Huyghe	Univ J. Fourier, Grenoble	France
Hendrik Lantzsch	University of Bremen	Germany
Laure Meynadier*	IPG-Paris	France
Yanina Najman	Lancaster University	UK
Michael Weber	University of Cologne	Germany

** Participation resulting from a special call*

Teacher at sea		
Diane Hanano	Univ. of British Columbia	Canada

Seven sites (U1449 to U1455) *(above)* were drilled along an east-west transect at 8°N. A spatial overview of the primarily turbiditic depositional system that comprises the Bengal deep-sea fan was provided by drilling three deep-penetration holes to recover a complete sequence of fan deposits and an additional four shallow holes to recover a complete terrigenous record of the Himalayan

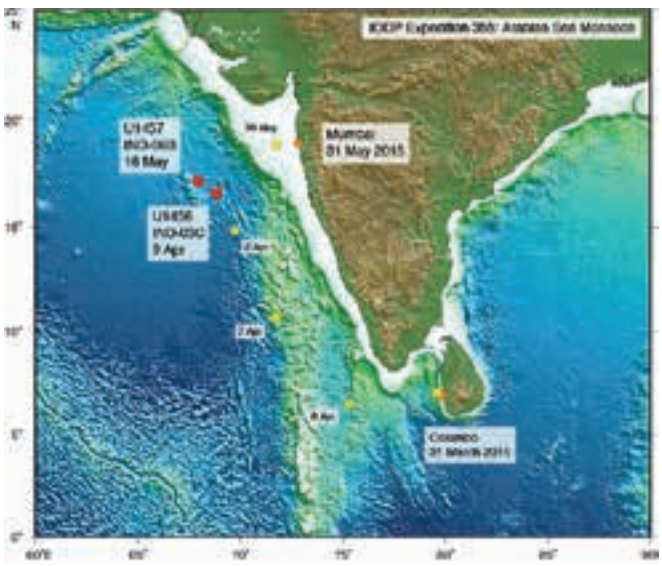
Expedition 354: Co-chief Scientists Volkhard Speiss (University of Bremen) left, and Christian France-Lanord (CRPG-CNRS, France) right, examine the cores of Site U1450 (credit IODP/JRSO).

flux over the last 1-2 My. During Expedition 354, these deposits were documented in space and time, and the recovered sediments have Himalayan mineralogical and geochemical signatures relevant for reconstructing time series of erosion, weathering, and changes in source regions, as well as impacts on the global carbon cycle. Miocene shifts in terrestrial vegetation, sediment budget, and style of sediment transport were tracked. Expedition 354 has extended the record of early fan deposition by 10 My into the late Oligocene.

http://iodp.tamu.edu/scienceops/expeditions/bengal_fan.html

- **Expedition 355 Arabian Sea Monsoon, 31 March-31 May 2015**

The goal of the Arabian Sea Monsoon Expedition, based on IODP Proposal 793-CPP2, was to understand the interaction between the Himalaya and Tibetan plateau uplift and the development and evolution of the Indian (southwest) summer monsoon. During Expedition 355, **two sites (U1456 and U1457**) *(below)* were drilled in Laxmi Basin in the eastern Arabian Sea to document the coevolution of mountain building, weathering, erosion, and climate over a range of timescales.



Expedition 355: James Bendle (University of Birmingham, UK) takes a headspace gas sample immediately after a core is cut into sections on the catwalk. (Bill Crawford, IODP/JRSO) .

Most of the recovered sediment appears to be derived from the Indus River and includes minerals that are unique to the Indus Suture Zone. A major submarine fan draining the western Himalaya and Karakoram must have been supplying sediment to the eastern Arabian Sea since at least ~17 My. Sediments from large mass-transport deposits were also recovered at both sites. In addition, coring of igneous basement was successful at Site U1457. Recovering basement from the eastern Arabian Sea provided constraints on the early rifting history of the western continental margin of India with special emphasis on continental breakup between India and the Seychelles and its relationship to the plume-related volcanism of the Deccan Plateau.

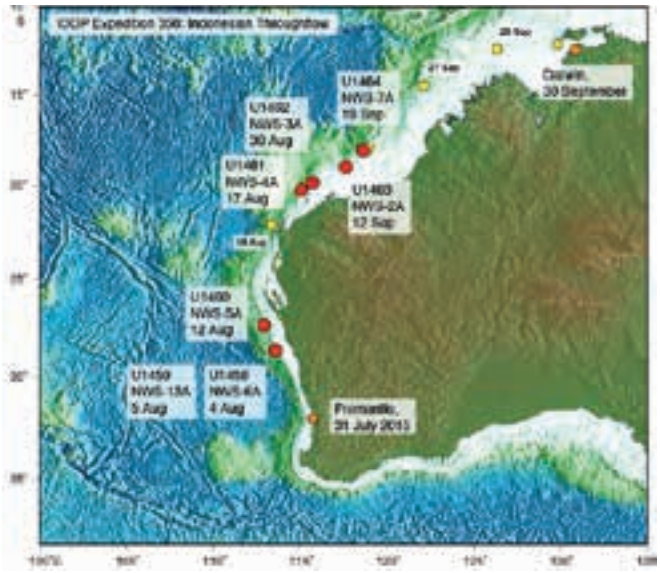
ECORD participants (Expedition 355)

Scientists		
Sergio Ando	University Milano Bicocca	Italy
James Bendle	University of Birmingham	UK
Annette Hahn	University of Bremen	Germany
Stephan Steinke	MARUM, Bremen	Germany
Yu Zhaojie	University Paris XI	France

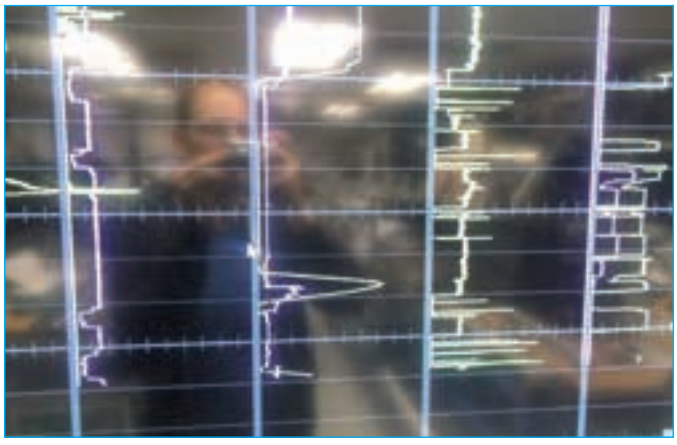
http://iodp.tamu.edu/scienceops/expeditions/arabian_sea.html

- **Expedition 356 Indonesian Throughflow, 31 July-30 September 2015**

The Indonesian Throughflow (ITF) Expedition drilled a latitudinal transect on the northwest Australian shelf to test several hypotheses, including **(1)** that tectonic restriction of the ITF was variable over the last 5 million years; **(2)** that the Australian monsoon has undergone repeated cycles of initiation and shutdown related to solar cycles in the absence of topographic effects; and **(3)** that Australia's rapid northward movement towards the Southeast Asian subduction slab graveyard induced dynamic drawdown



of the Earth's surface that progressively swept southwards across the continent. **Seven sites (U1458 to U1464)** *(above)* were drilled during the expedition. Sites U1458 and 1459 were directly seaward of, and downdip from, the Houtman-Abrolhos main reef complex, which contains the most southerly tropical reefs in the Indian Ocean. The evolution of this reef complex is directly related to the path of the Leeuwin Current. Site U1460 was north of the Houtman-Abrolhos main reef complex and Site U1461 was on the shelf edge of a carbonate ramp. Site U1462 was on the outer edge (87 m water depth) of a middle ramp and Site U1463 was ~150 m from the industry well Picard-1 (141 m water depth) on a flat outer ramp region.



Expedition 356: Benjamin Petrick (Newcastle University, UK) is reflected in the monitor that shows rig instrumentation graphs during drilling operations (Benjamin Petrick & IODP).

The study of the sediments from this transect will document **(1)** the timing and variability of the ITF, the Indo-Pacific Warm Pool and onset of the Leeuwin Current to understand the controls on Quaternary extra-tropical carbonate and

reef deposition, **(2)** a 5-My orbital scale (sub) tropical climate and ocean archive to chart the variability of the Australian monsoon and onset of aridity in NW Australia, and **(3)** the spatial and temporal subsidence patterns along the NW shelf to constrain the interaction between Australian plate motion and mantle convection and ground-truth geodynamic models.

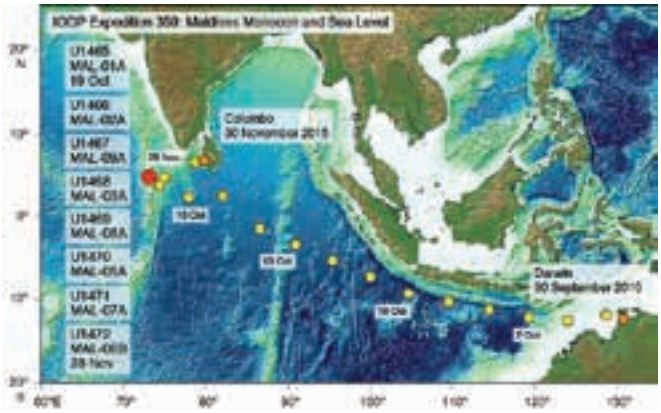
ECORD participants (Expedition 356)

Scientists		
Gerald Auer	University of Graz	Austria
Soma Baranwal	University of Tromsø	Norway
David de Vleeschouwer	MARUM, Bremen	Germany
Jeroen Groeneveld	MARUM, Bremen	Germany
Jorijntje Henderiks	Uppsala University	Sweden
Tobias Himmler	University of Bremen	Germany
Benjamin Petrick	Newcastle University	UK
Willem Renema	Naturalis Biodiversity Center	Netherlands
Lars Reuning	RWTH Aachen	Germany

http://iodp.tamu.edu/scienceops/expeditions/indonesian_throughflow.html

- **Expedition 359 Maldives Monsoon and Sea Level, 30 September-30 November 2015**

The Maldives Monsoon and Sea Level Expedition (IODP Proposal 820-Full) investigated Neogene Indian Ocean environmental change and the onset of the modern carbonate depositional system driven by fluctuations in sea level and ocean currents. Two transects with **eight sites (U1465 to U1472)** *(top right)* were drilled across the Maldives carbonate system to obtain sediments from the inner-platform to the continental slope including drift deposits. A further goal was to establish the time and cause of the drowning of the Kardiva Platform during the middle Miocene and was the target of Site U1465. Site U1466 was in front of the last prograding clinoform of the drowned carbonate platform at Site U1465. Site U1467 was the easternmost site drilled in the Inner Sea of the Maldives and recorded a 630-m thick succession of drift deposits lining the southern flank of Kardiva Channel. Site U1468 was over a succession with the Oligocene/ Miocene boundary at 727 mbsf followed by the basinal to lower slope deposits of the lower-middle Miocene Kardiva Carbonate Platform. Site U1468, together with Site U1466, is a key site to constrain the timing of the platform to drift turnover, to date the sequence boundaries of the Kardiva Platform, and to reconstruct the platform evolution from the Oligocene/ Miocene boundary onwards. Site U1469 was the westernmost site of the northern transect in the western part of Kardiva Channel, which is a wide W-E oriented passage that dissects the N-S running double row



of the Maldives atolls.

The second transect of sites drilled during Expedition 359 is located in the southern branch of the Kardiva Channel. Site U1470 is the westernmost site of this southern transect and formed as a result of the demise of larger carbonate banks during the Miocene. Site U1471 is the eastern end of the southern transect and was positioned on the distal portion of the prograding drift where it thins and is overlain by the

Expedition 359: Co-chiefs Christian Betzler (University of Hamburg, Germany) left, and Gregor Eberli (University of Miami, USA) look at the first core recovered during the expedition (Tim Fulton, IODP/ TAMU).

ECORD participants (Expedition 359)

Co-chief Scientist		
Christian Betzler	University of Hamburg	Germany
Scientists		
Or Bialik	University of Haifa	Israel
Sébastien Haffen	University of Lorraine	France
Dick Kroon	University of Edinburgh	UK
Luca Lanci*	University of Urbino	Italy
Thomas Lüdmann	University of Hamburg	Germany
John J.G. Reijmer	Vrije University Amsterdam	Netherlands
Jesus Reolid	University of Hamburg	Germany
Jeremy Young*	University College London	UK

* Participation resulting from a special call

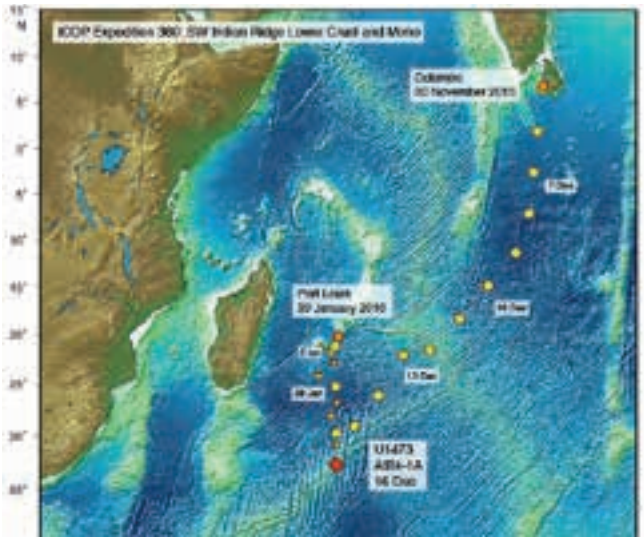
Teacher at Sea		
Michelle Darrieu	French International Lycée, Brussels	France-Belgium

sheeted drift deposits. The final site drilled was Site U1472 in the middle of the southern transect and within the middle part of the west to east prograding contourite fan. These two transects will thus **(1)** document environmental changes in the Maldives and place the Maldives current system into the larger scale ocean current framework during Neogene global cooling and monsoon evolution, **(2)** determine the onset of the modern depositional system, and **(3)** constrain the pre- to post-drowning evolution of the carbonate bank by linking existing seismic stratigraphic and the new sedimentary records.

http://iodp.tamu.edu/scienceops/expeditions/maldives_monsoon.html

• Expedition 360 Indian Ridge Lower Crust and Moho, 30 November 2015 - 30 January 2016

The Indian Ridge Lower Crust and Moho Expedition, the first of a two expedition programme based on IODP Proposal 800-Full, initiated drilling through the Atlantis Bank gabbroic massif 500 m into mantle near ODP Hole 735B. The two major objectives of this expedition were **(1)** to recover the lowermost gabbros and crust-mantle transition to understand the processes creating mid-ocean ridge basalt, and **(2)** to resolve the controversy as to whether the Moho at slow spreading ridges can be



a serpentinization front. Additional objectives include constraining the lateral heterogeneity of the lower crust, the nature of magnetic reversals in plutonic rock, as well as the stress-strain evolution of a plate boundary undergoing asymmetric seafloor spreading.

Expedition 360: The reentry cone being tripped down before release (Christopher MacLeod & IODP).

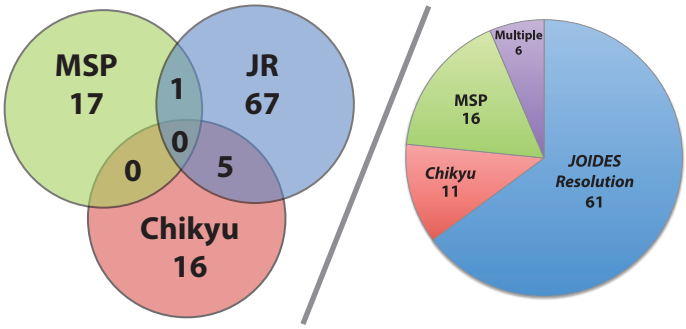
ECORD participants (Expedition 360)

Co-chief Scientist		
Christopher MacLeod	Cardiff University	UK
Scientists		
Jakub Ciążela	University in Poznań	Poland
Carlotta Ferrando	University of Montpellier	France
Lydéric France	University of Lorraine	France
Benoît Ildefonse	University of Montpellier	France
Jürgen Koepke	University of Hannover	Germany
Antony Morris	Plymouth University	UK
Oliver Plümper	Utrecht University	Netherlands
Riccardo Tribuzio	University of Pavia	Italy
Teachers at Sea		
Marion Burgio	L. Barthou High School, Pau	France
Lucas Kavanagh	McGill University, Montréal	Canada

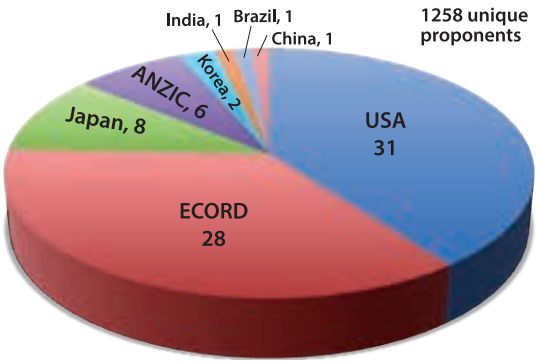
http://iodp.tamu.edu/scienceops/expeditions/indian_ridge_moho.html

Anticipating the next expeditions

Among the 94 active proposals that are in the archives of the Science Support Office (as per 2 February 2016) and besides the 16 MSP proposals *(17%, page 25)*, there are 61 *JOIDES Resolution (JR)* proposals (65%), 11 *Chikyu* proposals (11.7%) and six multiple proposals (6.3%) involving various platforms (five for the *JR* and the *Chikyu*, and one for the MSP and the *JR*).



Distribution of the IODP proposals (n = 94) by IODP drilling platforms (source: IODP Science Support Office, 2 February 2016).



Distribution of non-MSP-IODP proposals by Lead Proponent's member affiliation.

Twenty-eight of the 78 (35.9%) Lead Proponents of non-MSP proposals are based within ECORD as shown *above*.

In addition to the seven MSP proposals that reside with the ECORD Facility Board *(page 25)*, there are 35 proposals at the appropriate Facility Boards ready to be selected for drilling (27 for the *JOIDES Resolution* Facility Board and eight at the *Chikyu* Facility Board).

There are still uncertainties regarding the scheduling of the *Chikyu* expeditions by the *Chikyu* IODP Board in the coming years. A 1-month engineering expedition - Expedition365 NanTroSEIZE Shallow Megasplay LTBMS, with a limited scientific party, is scheduled from 26 March to 27 April 2016 to install a downhole observatory and for a later expedition to drill a 5 km-deep hole through the plate boundary fault system. The implementation of the riserless expedition "Nankai Trough Temperature Limit" in January-March 2017, and of the last riser expedition of the NanTroSEIZE project in 2018, are subject to the availability of funds that have not yet been secured.

The *JR* Facility Board, which is responsible for the annual scheduling and long-term planning for the *JOIDES Resolution* has recently defined a two-year operational plan for 2016 and 2017 that addresses several challenges identified in the IODP Science Plan *(Humphris and Koppers, 2015*.*

Three expeditions will focus on furthering our understanding of climate response to elevated levels of atmospheric CO_2 and controls on regional patterns of precipitation: Expedition 361 South African Climates, Expedition 363 Indo-Pacific Warm Pool Expedition and Expedition 369 Australia Cretaceous Climate and Tectonics Expedition.

In addition to Expedition 360 SW Indian Ridge Lower Crust and Moho, which was implemented at the the end of 2015 to early 2016 *(page 31)*, the Earth Connection theme will include Expedition 366 Mariana Convergent Margin, which will focus on chemical exchange between the crust and seawater in a subduction zone environment, the role of deep fluids in linking tectonic, thermal and biogeochemical processes, and the composition of deep subseafloor communities. Furthermore, a two-expedition CPP (Expeditions 367 and 368), partially funded by the Ministry of Science and Technology of China, will continue investigating continental breakup and crustal architecture at the South China Sea rifted margin.

Expedition 362 Sumatra Seismogenic Zone will be focused on the 2004 rupture zone where one of the largest earthquakes ever recorded generated a tsunami that killed ~300,000 people in coastal communities around the Indian Ocean.

The *JR* Facility Board has recently defined a likely 3-5 year track for the *JOIDES Resolution (below)* to minimise transits and maximise scientific output relative to time and cost. In 2018 and 2019, the *JOIDES Resolution* will implement five expeditions per year and will follow a path from the southwestern Pacific Ocean, through the Southern Ocean, and into the Atlantic Ocean for opportunities to drill there starting in FY19 *(Humphris and Koppers, 2015)*. It is then expected that the drilling vessel will operate in the Atlantic, Mediterranean, Caribbean, and Gulf of Mexico over the next and following few years.

Completed (2015) and planned (2016-2018) JOIDES Resolution expeditions (Humphris and Koppers, 2015).

* Humphris and Koppers, 2015, Eos, doi:10.1029/2015EO040947

5. Selected 2015 IODP publications from ECORD scientists

Publications related to MSP expeditions

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Bremen Core Repository(photo Nadine Hallmann)

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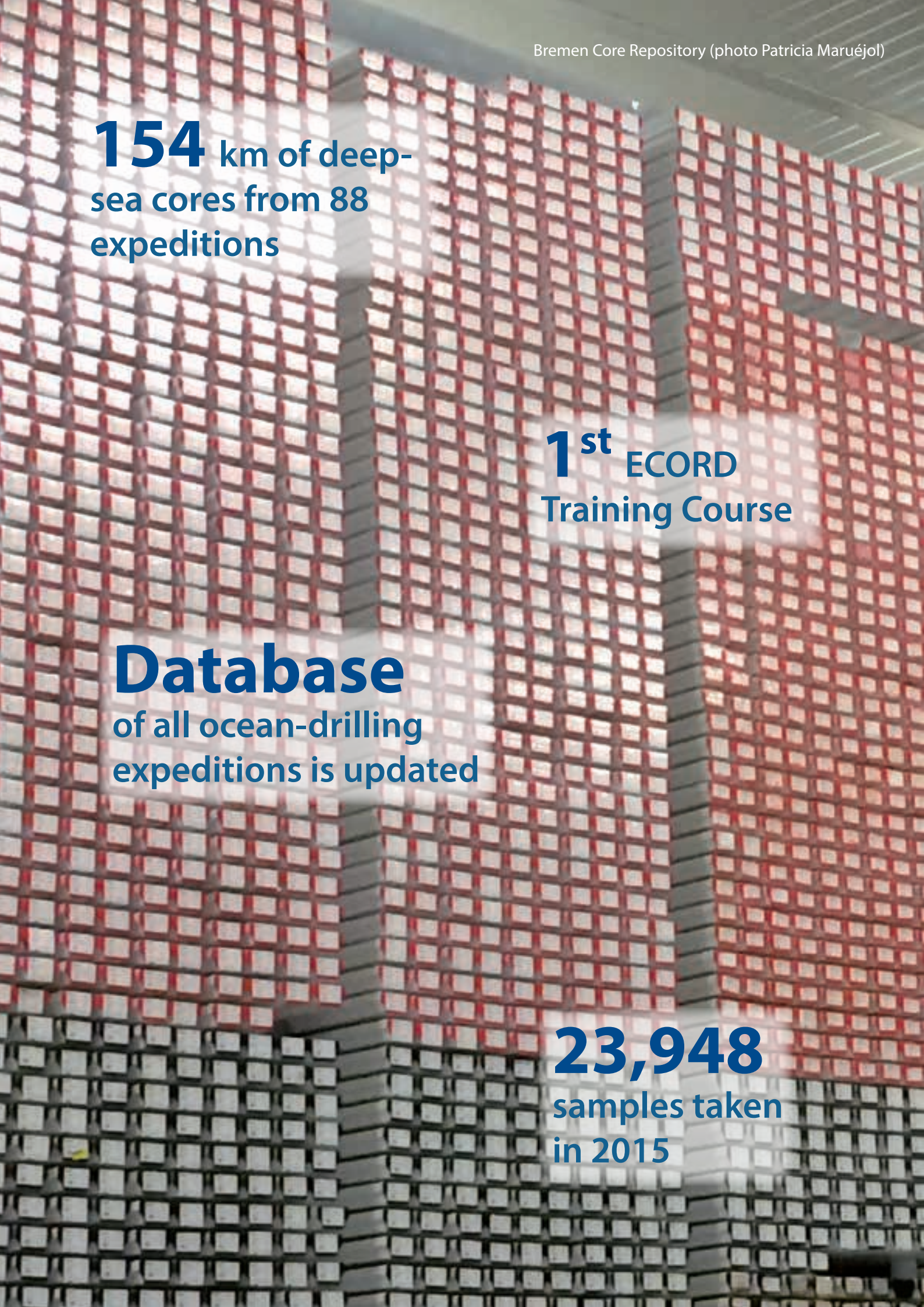


Bremen Core Repository (photo Patricia Maruéjol)

154 km of deep-sea cores from 88 expeditions

1st ECORD Training Course

Database of all ocean-drilling expeditions is updated

23,948 samples taken in 2015

6. Archiving IODP cores: the Bremen Core Repository

The Bremen Core Repository (BCR) at the MARUM, University of Bremen, Germany, is one of three IODP core repositories. The others 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) *(below)*. In accord with IODP convention and practice, the BCR hosts all of the cores recovered since the beginning of scientific ocean drilling from the Atlantic and Arctic Oceans, as well as the Mediterranean, Baltic and Black Seas. The BCR is also responsible for organising and hosting the Onshore Science Parties of mission-specific platform expeditions (MSPs) *(right)* and providing mobile laboratories offshore. The BCR presently contains almost 154 km of deep-sea cores from 88 expeditions (as of January 2016). A total of 23,948 samples were taken at the BCR for 212 requests (of which 143 were submitted by ECORD-country scientists) in 2015.

Cores of Expedition 357 Atlantis Massif Serpentinization and Life during the Onshore Science Party. Working halves are identified by black caps, archive halves by red caps (© ECORD/IODP).

Samples and requests at BCR

During the year, the procedure of sampling all BCR cores has been adjusted using the Drilling Information System (DIS) database and CurationDIS, which has proven to be an efficient tool for this purpose. Improvements to the CurationDIS started with a compilation of prioritised action items. These included a number of important additions to the system, including assignment of IGSN numbers, sub-sample input, QR-code labels, more user-friendly online sample data queries and export of results, and access to pdf files of scanned hard-copy requests through CurationDIS. The core overview image pages were also adapted to present photos of cores with more than four sections. A number of additional minor adaptations were made such as changes to request completion letters. After multiple iterations of suggestions, extensive discussion and testing, the final review and evaluations of the proposed changes have been completed, and, as a result, the repository and online versions of DIS are faster, more powerful, flexible and efficient.

Work on the sample and request database also involved transfer of the Expedition 347 data from the ExpeditionDIS into the CurationDIS at the end of the moratorium period. All BCR samples (over 1.56 million samples/more than 6,085 sample requests/over 3,158 individual scientists, including samples taken earlier at the East Coast Repository (ECR) for legacy cores that are now at BCR) are entered into the BCR DIS Internet Interface database, which is accessible to the general public for

post-moratorium samples at http://dis.iodp.pangaea.de/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 Corelyzer into our daily normal operations, including education and outreach. Visitors are always amazed by the sharp, high-resolution pictures of cores *(right)* and the ability to view the sediments from a complete hole from top to bottom, and to zoom in for extreme close-ups.

The use of the new 'IODP Sample and Data Request' (SaDR) system by the general science community has continued to function well. It is now being used for all requests for samples from all DSDP and ODP Legs as well as all IODP expeditions since the Expedition 347 Baltic Sea Paleoenvironment moratorium phase ended in February 2015.

The Scientific Earth Drilling Information Service - SEDIS http://sedis.iodp.org - has continued in the new IODP and will be maintained and upgraded, for example a new search engine for the Pangaea system is in preparation that will also influence the SEDIS portal. It has recently been updated with metadata for the current expeditions.

MSP expeditions at BCR

ESO has continued to implement QA/QC (quality assurance /quality control) within MSP operations. Various work packages related to this topic, encompassing overall policies and procedures for QA/QC, are now completed (*e.g.*, for geochemistry data in the database of past MSP expeditions). Since the end of Expedition 347, BCR/MARUM staff have worked in collaboration with EPC staff on documenting the QA/QC of all data arising from the expedition. ESO is currently investigating the potential implementation for MSP proposals, together with the examination of analytical equipment and instrumentation including QA/QC procedures.

We are constantly improving the online tutorials for both the Offshore Phase and the Onshore Science Party (OSP): http://www.marum.de/en/Offshore_core_curation_and_measurements and http://www.marum.de/en/Onshore_Science_Party_OSP.html.
Maintenance and upgrade of laboratory containers and equipment, including analytical instruments in operation during OSPs, are ongoing activities in Bremen.

Onshore Science Party of Expedition 357 Atlantis Massif Serpentinization and Life (N. Hallmann © ECORD/IODP).

Further preparations for Expedition 357 Atlantis Massif Serpentinization and Life were finalised during the year, including staff members attending the Project Management Team meeting in Edinburgh in February. BCR/MARUM were instrumental in the planning activities for this project, working in collaboration with the Expedition Project Managers on the Scientific Prospectus, and having BCR/MARUM staff members visit the *RRS James Cook* to ensure efficient planning of the core flow and laboratory infrastructure . BCR/MARUM also continued to plan for core curation and core flow/laboratory options for Expedition 364 Chicxulub K-Pg Impact Crater in collaboration with ESO partners, including attendance at the Project Management Team meeting in Edinburgh in June, when the first Project Management Team Meeting for IODP Proposal 708-ACEX-2 was also held. The BCR Manager also attended the first Project Management Team Meeting for IODP Proposal 813-Antarctica in Edinburgh in September.

The BCR Manager was in charge of the working group of the International Ocean Discovery Program regarding the new MSP Third Party Tool Policy.

Education at BCR

Being located on the university campus in the same building with MARUM and close to the Department of Geosciences, the BCR frequently receives visitors who are meeting colleagues based at the university. This year the BCR provided core material for numerous course studies with a wide range of objectives, including core descriptions and the visual illustration of geoscientific concepts. The use of the materials helps to inspire future scientists to become involved in IODP. In most cases the students have visited the BCR, but occasionally the cores

were taken to schools within Germany, where they were shown and discussed in their scientific context.

The BCR also receives frequent visits by representatives of television, radio and print media. Other important visitors to the BCR included a group from the Bremen Chamber of Commerce, participants of the Alexander von Humboldt Foundation Network Meeting, the Indonesian Minister of Research and Technology, His Excellence Mr. Suhama, Federal Minister Rudolf Leisen of the German Federal Ministry of Education and Research, member of the German Parliament Alexandra Dinges-Dierig, and Se Won Chang of the Marine Geology Department of the Korea Institute of Geoscience and Mineral Resources (KIGAM).

ECORD Bremen Summer School 2015 (photo Volker Diekamp, MARUM).

The BCR is also an ideal place to train students, with the opportunity to work on real cores and have access to laboratory facilities. The new "ECORD Training Course" was held for the first time in March 2015 *(below and page 49)*. The ECORD Bremen Summer Schools present a new theme each year that relates to the IODP Science Plan, and is organised annually since 2007. In 2015, it has been dedicated to the topic of "Ocean crust processes: magma, faults, fluxes and life" *(above and page 48)*.

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

ECORD Training Course 2015 (photo Volker Diekamp, MARUM).

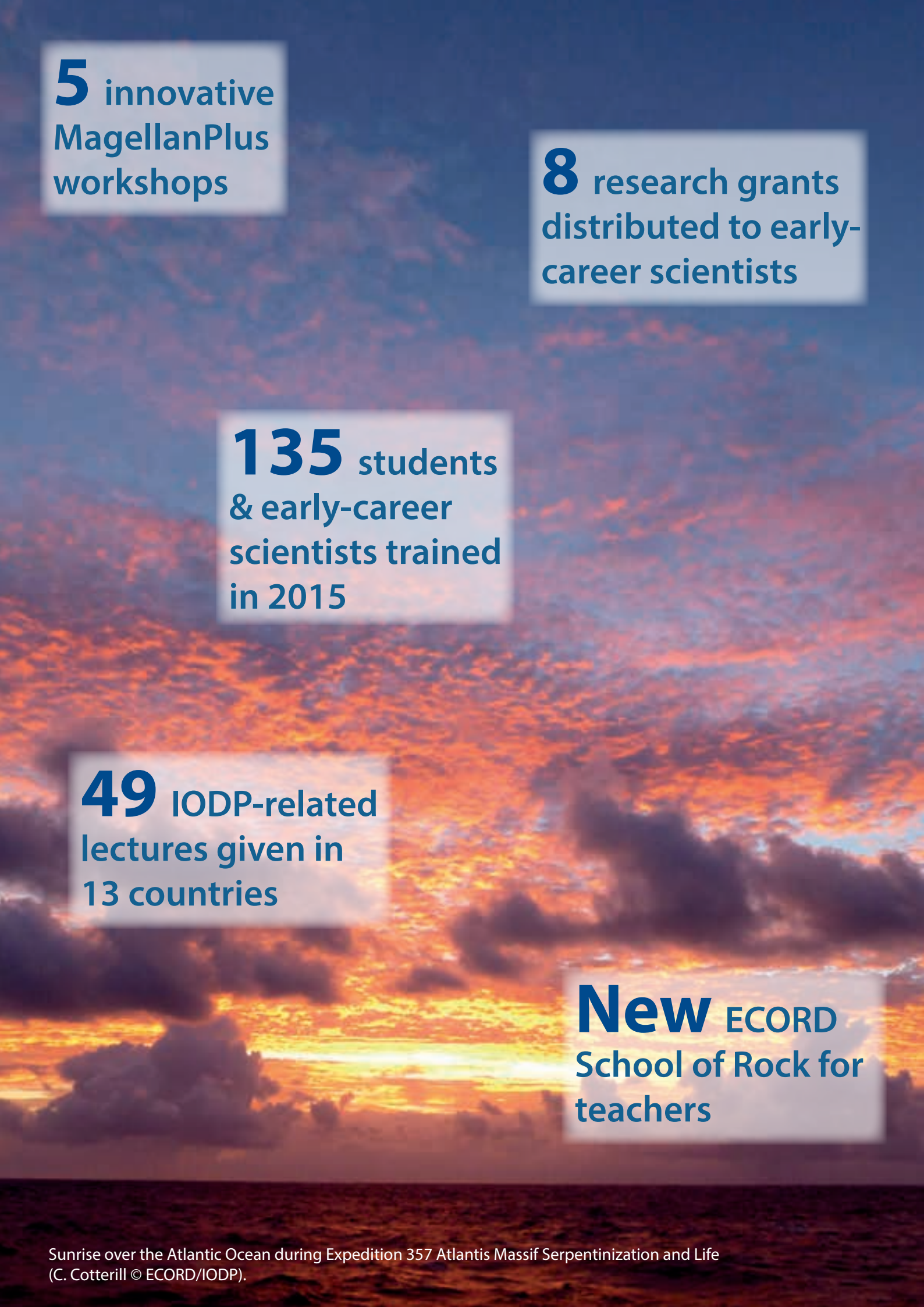
5 innovative MagellanPlus workshops

8 research grants distributed to early-career scientists

135 students & early-career scientists trained in 2015

49 IODP-related lectures given in 13 countries

New ECORD School of Rock for teachers



Sunrise over the Atlantic Ocean during Expedition 357 Atlantis Massif Serpentinization and Life (C. Cotterill © ECORD/IODP).

7. Engaging the community

Development of future drilling proposals: the MagellanPlus Workshop Series Programme

The ECORD-ICDP MagellanPlus Workshop Series Programme is designed to support European, Canadian and Israeli scientists to develop new and innovative science proposals for IODP and ICDP. In 2015, two calls for workshops were issued and five workshops took place.

- **Drilling the Cretaceous-Palaeogene Tropical South Atlantic, 2-4 February 2015, Newcastle, UK**

Conveners: Thomas Wagner and Tom Dunkley-Jones (ECORD, UK)

The goal of the meeting was to start developing a drilling proposal to investigate **(1)** global climate perturbations (Oceanic Anoxic Events-OAEs, hyperthermals) within the context of the opening of the Equatorial Atlantic Gateway (EAG) and the flooding of the northern South Atlantic sub-basin, **(2)** the tectonic evolution of the EAG and its global implications for both the connectedness of Late Mesozoic oceans, as well as the geodynamic controls on the South Atlantic rift and passive margin development, and **(3)** pioneer microbial studies that explore the biogeochemistry associated with petroleum systems, including source rocks and sediments charged with hydrocarbons. **32 experts from 8 countries**, 14 research institutions as well as representatives from the ECORD Industry Liaison Panel (ECORD-ILP) and from two major oil companies, Shell (Shell E&P NL and Shell Petroleum Development Nigeria) and BG Group, joined the workshop *(top right)* to evaluate and further improve the strategy and focus of both IODP pre-proposals, making this event an excellent example of an integrated and truly joined industry-academia partnership. Some good progress, including a rigorous reality check on some of initial ideas provided by the ECORD-ILP members, were very helpful in reaching a clear action plan and further development of the proposals. New ideas were also developed on a possible new proposal on the Angola Basin Deep Biosphere.

- **Investigating Mediterranean-Atlantic Gateway Exchange (IMAGE), 5-8 May 2015, Rabat, Morocco**

Conveners: Rachel Flecker (ECORD, UK) and Javier Hernandez-Molina (ECORD, Spain)

The IMAGE workshop was embedded within an existing Regional Committee on Neogene Stratigraphy (RCMNS) Interim Colloquium entitled Mediterranean-Atlantic

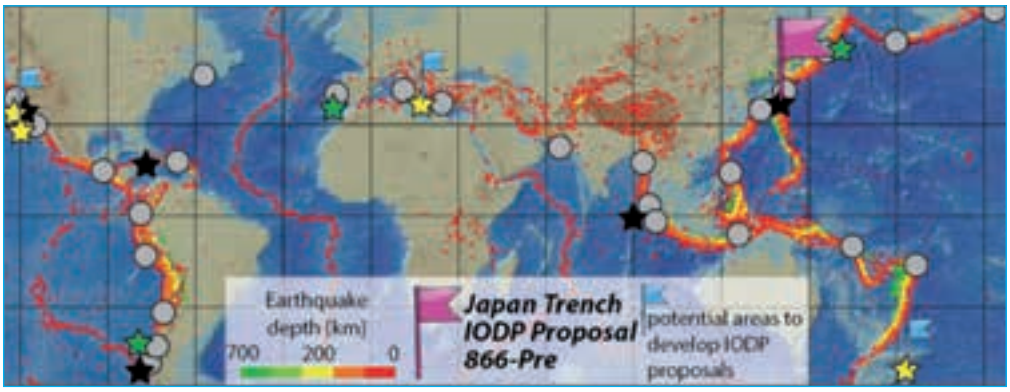
Participants of the MagellanPlus Workshop Drilling the Cretaceous-Palaeogene Tropical South Atlantic.

gateways (Neogene to present) *(below)*. The major aim of the meeting was to start developing proposals for IODP and/or ICDP drilling that recovers a complete record of Miocene Mediterranean-Atlantic exchange.

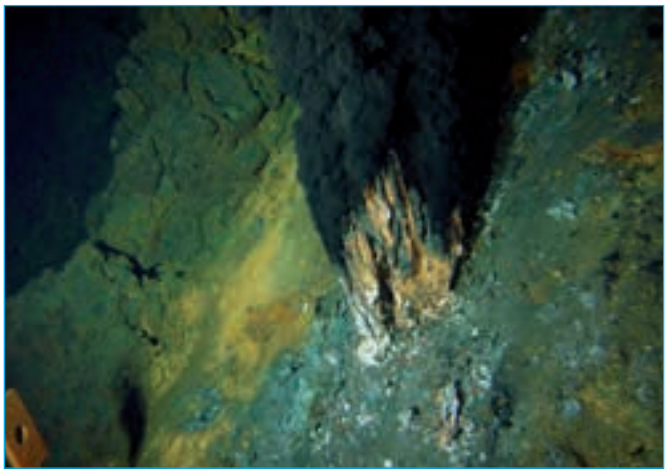
Map of the pre-Gibraltar Atlantic-Mediterranean gateways 5 - 10 My ago.

The workshop was attended by **75 scientists from 13 countries**. Most were from academic institutes, but the meeting also attracted the attendance of, and sponsorship from, several companies including Anadarko, Repsol, CASP, Thermo Scientific and Petrostrat. It is clear from the conference participants that this workshop was successful in attracting both strong participation from scientists involved in IODP Expedition 339 (13) and MEDGATE (17) and a broader community of scientists involved in research on Mediterranean-Atlantic gateways or other marine gateway systems. National IODP offices supported the attendance of participants from UK, France and Germany.

• **Mantle, Water and Life: the ultramafic-hosted Rainbow hydrothermal field, 10-12 June 2015, Lyon, France**
Conveners: Muriel Andreani and Cécile Konn (ECORD, France), Ana Filipa Marques (ECORD, Norway) and Matt Schrenk (USA)
The aims of the meeting were **(1)** to synthesise existing data and our knowledge of processes occurring at the Rainbow massif *(below)* and other high-T and low-T peridotite-hosted sites, such as Logachev, Ashadze, Semenov, or Lost City; **(2)** to identify remaining scientific questions regarding the functioning of these systems, *i.e.* nature of the heat source, composition of the lithosphere involved in fluid-rock reactions, controls on fluid composition and fluid paths, nature and origin of organic compounds and the extent of the deep biosphere; **(3)** to plan a coordinated research effort in the coming years, that integrates the role of ocean drilling in advancing our understanding of the Rainbow hydrothermal system, that could become the high-T reference site for ultramafic-dominated settings; **(4)** to discuss the drilling strategy (*e.g.* location of target sites, multiple shallow holes versus a deep hole, the use of seabed rock drills) and the relevance of long-term monitoring of boreholes with particular attention to environmental impact issues. **26 participants from 7 countries** brought their complementary expertise in geophysics, geology, geochemistry and biology to establish an up-to-date synthesis of our knowledge of the Rainbow massif and more generally on ultramafic-hosted hydrothermal sites.



Compilation of global seismicity, regionally-representative major earthquakes (grey dots), and paleoseismologic data sets (green & yellow stars show arguably complete archives spanning <2 and >5 kyrs, respectively). Black stars show fragmentary and debated records.


Rainbow massif (credit Ifremer/ campagne MoMARDREAMnaut 2007)

• **Submarine Paleoseismology: Using giant piston coring within IODP to fill the gap in long-term records of great earthquakes, 16-18 July 2015, Zurich, Switzerland**
Convener: Michael Strasser (ECORD, Switzerland - now ECORD, Austria)
The workshop was held to discuss and define a strategy for making best use of giant piston coring efforts within IODP designed to make major advancements in submarine paleoseismology. **59 participants (24 students/early-career scientists) from 14 countries** attended the workshop, representing a broad spectrum of expertise ranging from marine geology to seismology. The Japan Trench has been identified as an ideal study area and an IODP Pre-Proposal (Proposal 866-Pre, Japan Trench Paleoseismology) *(above)* has been submitted applying for a multi-coring approach by MSP giant piston coring to recover continuous upper Pleistocene-to-Holocene stratigraphic successions comprising event-deposits, for which the detailed stratigraphic fingerprint and spatial-temporal distribution can be analysed for proxy-evidence of great earthquakes. There is a high potential of using turbidites and other sedimentary features to reconstruct a long history of great earthquakes off NE Japan.

• **Haiti-DRILL: A window to the North Caribbean active "sliding doors" Fault System through Scientific Drilling, October 26-28, 2015, Rueil-Malmaison, France**
Conveners: Nadine Ellouz-Zimmermann and Manuel Pubellier (ECORD, France)
This workshop was organised to develop an Amphibious Drilling Proposal (ADP), to investigate the initial thermo-mechanical conditions of the Haitian Fault System, either associated to a fault locked, or to seismic segments, along the termination of the active transform fault system on the outskirts of the large city of Port-au-Prince (which ruptured in 2010). The objective of the workshop was to design, enlarge and organise teams around the amphibious drilling

operations. The Haitian faults are the best drilling targets because **(1)** they have long lasting and well documented motion through the Tertiary, **(2)** they display strong strain partitioning, and **(3)** this will provide substantial help for Haitian scientific support and population risk assessment. The workshop gathered **36 experts from 10 countries** in the Caribbean region, the Americas and Europe.

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

Training and sponsoring young scientists

- **ECORD Summer Schools and Scholarships**

A major goal of ECORD is to train the next generation of scientists from its member countries and promote IODP-motivated science. ESSAC has established successful education and training programmes that are coordinated annually:

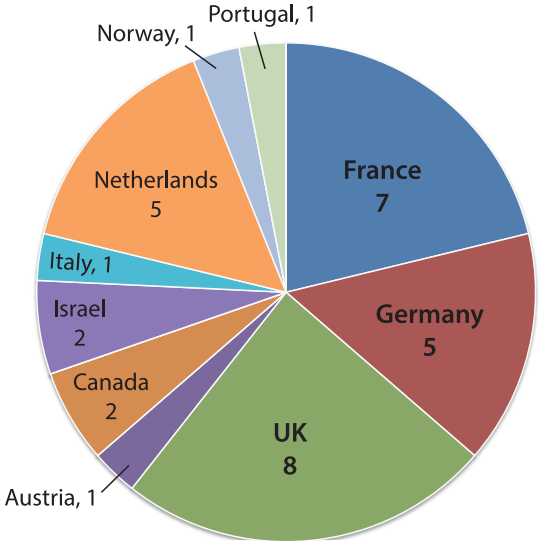
- The **ECORD Summer Schools**, initiated in 2007, are well established and are attended annually by many Masters and PhD students as well as post-doctoral research fellows from ECORD member countries and beyond. Two ECORD Summer Schools and one ECORD Training Course were sponsored by ECORD in 2015.
- The **ECORD Scholarships** provide support to outstanding students to attend the ECORD-sponsored summer schools. 26 scholarships *(right and page 48)* were distributed over a total of 55 applications received in 2015.

• 12th Urbino Summer School in Paleoclimatology, 15 July - 1 August 2015, Urbino, Italy

The Urbino Summer School in Paleoclimatology (USSP) is organised annually by an international consortium of scientists and is hosted by the Faculty of Sciences and Technology at the University of Urbino, Italy. The school is open to students from ECORD member countries, the USA and other countries and is designed to provide training in many different areas of paleoclimatology, including biogeochemical cycling and paleoceanography, continental systems, and aspects of deep-time climate modeling. The 12th USSP course provided an integrated student-centred programme comprised of **(1)** integrated topical lectures by 33 internationally recognised scientists; **(2)** student-centred data-based exercises, investigations, and presentations on field data and modeling results; **(3)** parallel sessions providing groups of participants with more focused selected topics within paleoclimatology **(4)** a regional field excursion to classic Cretaceous and Cenozoic sections *(top right)*, and **(5)** intensive discussions of specific palaeoclimate topics in small student working groups facilitated by dedicated instructors.

The 12th Urbino Summer School field trip to the K-Pg boundary exposed in the Bottaccione valley near Gubbio.

33 applications from 10 ECORD member countries were received and **10 scholarships** from seven ECORD member countries were distributed *(below)*.



Distribution of ECORD applications to the Urbino Summer School 2015 (n = 33)

Scholarship awardees - 12th Urbino Summer School

Henrieka Detlef	Cardiff University	UK
Valerie Menke	University of Hamburg	Germany
Lauren O'Connor	University of Oxford	UK
Igor Obreht	RWTH Aaachen University	Germany
Anna Phillips	University of Toronto	Canada
Cindy Scharder	Utrecht University & NESSC	Netherlands
Amy Sparkes	Cardiff University	UK
Martin Tetard	CEREGE - Aix Marseille Univ	France
Man-Yin Tsang	University of Toronto	Canada
Erik Wolfgring	University of Vienna	Austria

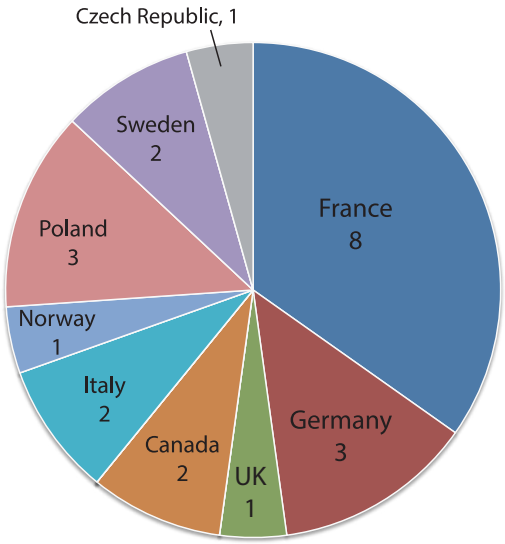
The summer school brought together **72 students from eight ECORD member countries** (Austria, Canada, France, Germany, Italy, Netherlands, Switzerland and the UK) and three non-ECORD member countries (Australia, New Zealand and the USA).

Related website: http://www.urbinossp.it/

• **9th ECORD Summer School on School on "Ocean crust processes: magma, faults, fluxes and life", 31 August -11 September 2015, Bremen, Germany**

The ECORD Bremen Summer School *(below)* was once again held at the IODP Bremen Core Repository (BCR), taking advantage of the "virtual ship" facilities at the repository and the laboratory facilities at MARUM. The two-week course combined lectures and interactive discussions on **(1)** magmatic processes: mantle geochemistry, magma generation, melt-rock interactions, and crustal rock generation, **(2)** tectonic processes and geophysics: detachment faulting, rheology, links between lithology, alteration, and petrophysical properties, and **(3)** hydrothermal processes: fluid-rock interactions, subseafloor life. These topics were further covered by practical exercises, mainly using the facilities of the BCR. The weekend between the first and the second week was partly used for a field trip to visit the Museum of Natural History in Münster to visit the exhibition "Life in the Dark" that also features Mid-Ocean ridge settings.

23 applications from nine ECORD member countries were received and **16 scholarships** from eight ECORD member countries were distributed *(top right)*. This summer school brought together 26 instructors as well as **33 PhD students and young postdoctoral researchers** from



Distribution of ECORD and non-ECORD applications to the Bremen Summer School 2015 (n = 23)

Scholarship awardees - 9th Bremen Summer School 2015

Méderic Amann	University of Strasbourg	France
Valentine Basch	University of Genoa	Italy
Davide Berno	University of Pavia	Italy
Jakub Ciążela	Adam Mickiewicz University	Poland
Kristina Dunkel	University of Oslo	Norway
Sofia Escario	Geosciences Montpellier	France
Carlotta Ferrando	Geosciences Montpellier	France
Manuel Keith	University Erlangen-Nürnberg	Germany
Fabian Kemner	University Erlangen-Nürnberg	Germany
Clifford Patten	Stockholm University	Sweden
Minasadat Seyedali	University of Victoria	Canada
Pierre-Alexandre Teboul	CEREGE Aix-Marseille Univ.	France
Joseph Offei Thompson	Ifremer	France
Zhu Tian*	University of Victoria	Canada
Christoph G. Weinzierl	Univ. Erlangen-Nürnberg	Germany
Richard Wessels	UPMC-IFPEN, Paris	France

* declined

photo Voelker Diekamp, MARUM

ECORD member countries (Germany, Norway, Austria, France, Poland, UK, Italy, Sweden and Canada), US and Spain.

Related website: **https://www.marum.de/en/ECORD_Summer_School_2013.html**

• **ECORD Training Course 2015 " The Virtual Drillship Experience", 9 - 13 March 2015, Bremen, Germany**

A new initiative has been added to ECORD's education activities in 2015: the ECORD Training Course, which took advantage of the setting of the IODP Bremen Core Repository at MARUM to provide a "Virtual Drillship Experience" for scientists from academia and industry. This one-week course, with a focus on the IODP core-flow procedures, was tailored to prepare the participants for sailing on an offshore drillship expedition, and to instill them with an appreciation of the high standards required in all kinds of coring projects. IODP-style lab exercises form the basis of the ECORD Training Course and follow the pattern of the unique "Virtual Ship Experience" developed for the ECORD Bremen Summer Schools. MARUM received 56 applications from 17 countries, which demonstrates the immediate success of this new course. A total of **30 participants** from seven ECORD (Germany, Belgium, France, Denmark, UK, Ireland and Sweden) and **two non-ECORD** (US and Croatia) countries attended the course *(page 43)*. The participants played a very active part, were exceptionally dedicated in contributing to practical exercises and discussions, and also gained initial insights into the legendary multidisciplinary team effort that is crucial for the success of ocean drilling programmes.

Related website: http:// www.marum.de/en/ECORD_Training_Course_2015.html

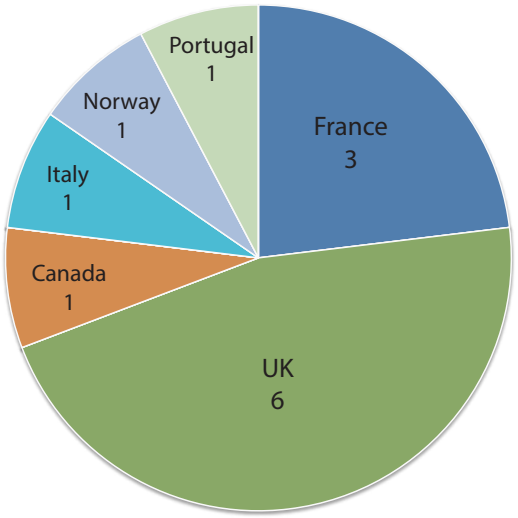
• **International School on Foraminifera (ISF), 3-22 June 2015, Urbino, Italy**

ESSAC funded **four ECORD students** to attend the International School on Foraminifera (ISF), which was held in Urbino, Italy from 3 to 22 June 2015. The ISF is an intensive three-week course taught by an international team of foraminiferal specialists, held at the University of Urbino in June each year. The ISF course provides a complete overview of the foraminifera taxonomy, ecology, and biostratigraphy. The course has particular relevance to scientific ocean drilling, as many participants and lecturers work with IODP material.

Related website: http://www.isf.tmsoc.org

• **ECORD Research Grants 2015**

ECORD supports outstanding early-career scientists by sponsoring merit-based awards for research that is directed toward scientific objectives of past or upcoming DSDP/ODP/IODP expeditions (core material and data). The aim of this endeavour is to foster participation of young scientists in ocean drilling research and encourage them to develop their own projects and to collaborate with other research groups outside of their home institutions. **Thirteen applications** from six ECORD member countries were submitted in 2015 from PhD students and post-doctoral researchers; **eight grants** were awarded from four ECORD member countries: five from the UK, one from Portugal, Italy and Norway *(below)*.



Distribution of applications to the ECORD Research Grants 2015 (n = 13) .

ECORD Research Grants 2015

Montserrat Alonso Garcia	IPMA, Lisbon	Portugal
Soma Baranwal	University of Tromsø	Norway
James Barnet	University of Exeter	UK
Rehemat Bhatia	University College London	UK
Karen Gariboldi	University of Pisa	Italy
Nina Jordan	University of Leicester	UK
Sina Panitz	Northumbria University	UK
Mark Zindorf	Newcastle University	UK

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

Engaging teachers

- **Teachers at Sea**

As part of the "Teachers at Sea" programme, initiated by Ocean Leadership and sponsored by the USA, teachers from ECORD countries have the opportunity to participate onboard the *JOIDES Resolution* as Education Officers on IODP expeditions - http://joidesresolution.org/node/453. The primary objectives of this education programme are to:

- provide educators with the opportunity to sail onboard a sea-going marine research vessel, working along-side scientists and using state-of-the-art scientific approaches
- address problems of global interest and obtain first-hand knowledge of the results of the expeditions;
- translate scientific results into useful teaching resources, such as classroom curriculum materials;
- disseminate education resources into classroom settings and motivate other teachers to use IODP science and materials in their curriculum.

Diane Hanano (Canada) *(top right)*, Michelle Darrieu (France and Belgium), Marion Burgio (France) and Lucas Kavanagh (Canada), were invited to sail on a two-month expedition as Education/Outreach Officers during expeditions 354 Bengal Fan, 359 Maldives Monsoon and 360 Indian Ridge Moho respectively *(pages 28, 30 and 31)*.

Teachers and educators at sea organised education activities with colleagues and scientists during the time of the expedition with many live ship-to-shore broadcasts *(top right)* to support science education and also coordinated IODP resources and educational activities, which were made available to the general public in ECORD countries.

Diane Hanano onboard the JOIDES Resolution holds a ship-to-shore broadcast video during Expedition 354 Bengal Fan. (Tim Fulton, IODP /JRSO)

- **ECORD School of Rock**

Following the successful ECORD School of Rock (SOR) held in France in 2014, the 2nd ECORD SOR was organised by Helder Pereira (Education Officer on Expedition 339 Mediterranean Outflow) at the Secondary School of Loulé, Portugal on 8 to 10 July 2015. Its main goal was to educate participants about the IODP, scientific ocean drilling and Earth Science through the interaction with expedition scientists and former "Teachers at Sea". The three-day long workshop included presentations given by scientists and practical hands-on sessions, developed and tested by scientists and educators who sailed onboard the *JOIDES Resolution*. **Thirty-five teachers** *(below)* from all over the country participated in this very successful

Participants of the ECORD School of Rock 2015

workshop and learned how to bring IODP science to their classroom to explain earth sciences. The event was funded by the Secondary School in Loulé, Fundação para a Ciência e Tecnologia' (FCT), in Portugal. The workshop was also attended by four "Teachers at Sea", Susan Gebbels (UK), Jean-Luc Bérenguer (France), Norihito Kawamura (Japan) and Markus Fingerle (Germany) who sailed as Education Officers onboard IODP expeditions. As a major contribution to the education and outreach objectives of the programme, ECORD continues to support such an initiative, which should be shared and developed across all ECORD countries. Plans are underway to run the next ECORD SOR in 2016.

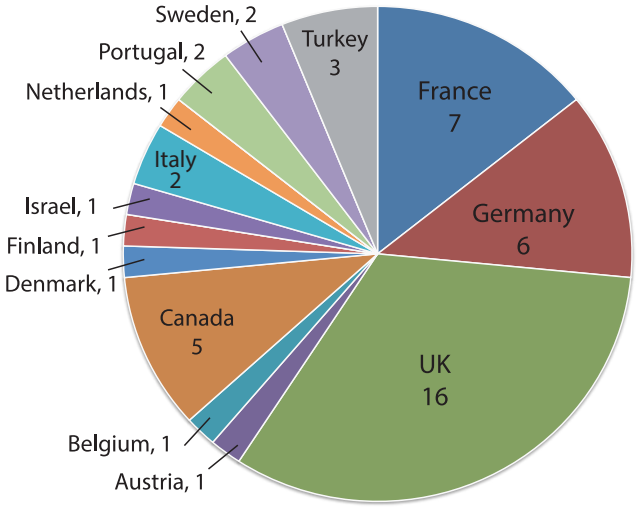
Related website: http://ecord-sor2015.blogspot.pt/?view=snapshot

Promoting IODP science through the ECORD Distinguished Lecturer Programme

The **ECORD Distinguished Lecturer Programme (DLP)** is designed to bring the scientific achievements of ocean drilling to a broad audience within universities/institutes in ECORD member countries. ESSAC selects "Distinguished Lecturers" who then tour ECORD member countries, and on occasion non-ECORD countries, to present the exciting discoveries from one of the four main scientific themes addressed by the IODP Science Plan - http://www.iodp.org/science-plan-for-2013-2023. Any university or institution in an ECORD member country may apply to host a lecturer.

The current DLP will continue until the first half of 2016 and has proven to be a great success, with five lectures that cover the major themes defined in the IODP Science Plan:

- **Christian France-Lanord** (Centre de Recherches Pétrographiques et Géochimiques, CNRS, Nancy, France) - Himalaya: from mountains to drilling in the Bengal fan;
- **Jens Kallmeyer** (GFZ German Research Centre for Geosciences, Helmholtz Centre, Potsdam, Germany) - What controls abundance and activity of microbial life in subsurface sediments? New insights from scientific drilling;
- **Antony Morris** (School of Geography, Earth and Environmental Sciences, Plymouth University, UK) - What can magnetism tell us about oceanic tectonics? New insights from scientific drilling;
- **Gabriele Uenzelmann-Neben** (Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung, Bremerhaven, Germany) - Reconstructing palaeo-circulation: Reading sediment drifts with the aid of IODP information;
- **Paola Vannucchi,** (Earth Sciences Department, Royal Holloway, University of London, UK) - Understanding megathrust earthquakes through ocean drilling.



Distribution of the ECORD Distinguished Lecturer in 2015 and 2016 (n = 49) .

Forty-nine DLP lectures *(above)* were scheduled in 2015 and 2016 with the DLP lecturers visiting 13 ECORD countries. The schedule and more information is available under **http://www.essac.ecord.org/index.php?mod=education&page=dlp**

Participants of the MagellanPlus workshop on Submarine Paleoseismology in Zurich.

ECORD/ICDP exhibition booth at EGU 2015 (P. Maruéjol © ECORD/IODP).

8. Communicating

Promoting the activities and accomplishments of the IODP to large audiences is a major and constant goal. Within ECORD, responsibilities for outreach and education 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 *(page 15)* and the ESSAC website - http://www.essac.ecord.org - describes opportunities to participate in IODP expeditions and educational events such as the ECORD Summer Schools *(page 47)* and Distinguished Lecturer Programme (DLP) *(page 51)*.

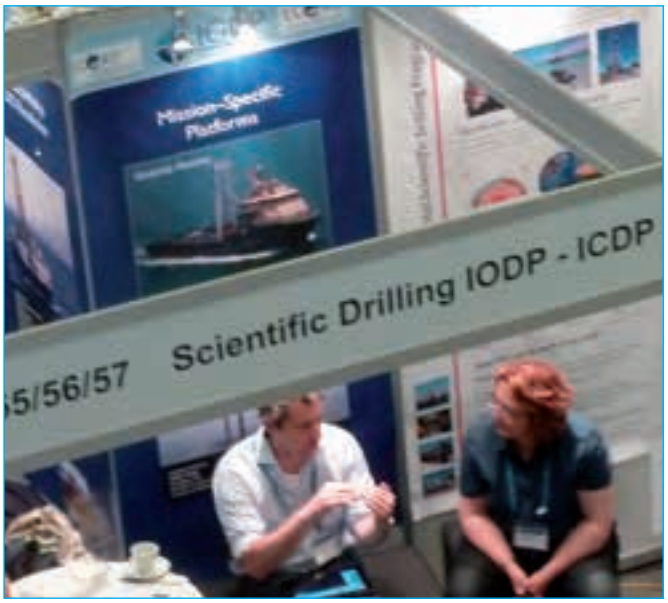
The ECORD Outreach and Education Task Force (E-OETF) *(page 3)* met twice during 2015 to coordinate the programme's outreach and education activities. The first meeting was held in Nancy (France) in January, where we welcomed a new member, Nadine Hallmann, the new EMA Assistant Director, and the second meeting was held in Potsdam (Germany), in October, hosted by our colleagues at ICDP-GFZ. Outreach colleagues at the US Science Support Program and CDEX (Japan) attended the meeting in order to enhance coordination between ECORD, ICDP and IODP partners.

Communicating with scientists

During the year, ECORD outreach staff continued to promote both the IODP and ICDP programmes under the umbrella of "Scientific Drilling" at science conferences *(bottom right)*. A joint ECORD-ICDP booth was organised at the AGU 2015 in San Francisco. ECORD also took part in the Townhall meeting organised during this conference. 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 sponsored a booth *(left)* and supported a Townhall meeting. A new core replica showing the plate boundary fault sampled during Expedition 343 J-FAST was given by CDEX to ECORD to illustrate the Tohoku earthquake *(left)*. This material attracted many visitors in the booth as well as ICDP core scanner demonstrations and 3-D video, and new ECORD videos of EPC activities in MSP expeditions. The success of these joint events will lead to similar collaboration in 2016 at the EGU as well as at the AGU, and the 35th International Geological Congress (IGC) in Cape Town, South Africa.

ECORD supported member countries Canada and Portugal in organising successful exhibition booths at science conferences. ECORD information was also widely distributed at the ECORD-ICDP MagellanPlus Workshop Series *(page 45)*.

During the spring, ECORD provided information to be displayed by outreach colleagues in Japan at the Japan Geoscience Union Meeting in Yokohama.



The ECORD Newsletter *(top, page 53)* 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 every six months, and also includes reports on recent outreach activities. The ESSAC office also distributed short electronic "ESSAC News" to the science community on a monthly basis. Leaflets explaining the programme objectives and the latest information resulting from the five completed MSP expeditions are included in an ECORD folder, which is continuously updated.

Media activities

Media activities were organised in London and Southampton on 22 and 23 October 2015 prior to the start of Expedition 357 Atlantis Massif Serpentinization and Life *(page 16)*. The events were preceded by invitations to media organisations and a press release issued on the day of the media conference held at the Foreign Press Association in London, which created significant media attention, including an article on the BBC website and recorded interviews with the expedition Co-chief Scientists. This was followed by radio interviews in the UK and Germany and articles in national press in several countries, as well as articles on the websites of organisations of the scientists involved in the expedition and IODP members such as JAMSTEC. The following day a further press event was held onboard the *RRS James Cook* *(top right)* coordinated with the Natural Environment Research Council and National Oceanography Centre press officers, which attracted local media interest and included a tour of the vessel.

ECORD also issued a Communications Plan to all of the Science Party members prior to the expedition and developed an expedition flyer with the Co-chief Scientists for distribution at the media events. A logo for Expedition 357 was designed *(page 16)* and used on all publicity materials, including the ESO website, which maintained an expedition web page that included daily reports from the platform throughout the expedition - http://www.eso.ecord.org/expeditions/357/357.php.

In April 2015, ESO outreach staff attended a workshop with scientists involved in the IODP Expedition 364 Chicxulub K-Pg Impact Crater in Mérida, Mexico. Following the workshop, a press conference was held at the Gran Museo del Mundo Maya in Mérida, which involved ESO staff in the preparation of a press release and participation in the media event to answer questions about the upcoming expedition in 2016. Throughout the year, ESO has been working closely with the Expedition 364 Co-chief Scientists to develop communications plans, including discussions with a TV production company who is interested in making a documentary about the expedition. Media activities will be coordinated with outreach representatives from the International Continental Scientific Drilling Program (ICDP) who is co-funding the expedition.

Carol Cotterill, Expedition Project Manager of the MSP Expedition 357 Atlantis Massif Serpentinization and Life conducts a tour of the RRS James Cook for journalists who attended the media event in Southampton (© ECORD/IODP).

Communicating with classrooms and the general public

Replicas of drilling cores from ODP/IODP legs and expeditions - http://www.ecord.org/pi/core-replicas.html - are valuable tools to highlight ODP/IODP science to various audiences. In 2015, core replicas were used to support teaching in high schools (Valbonne and Pau (France), Loulé (Portugal), universities (University of Algarve (Portugal), University College London (UK)) and during the 12th Urbino Summer School *(page 47)*. Such educational materials were also provided to support a large number of national events organised in several European countries: Academy of Sciences in Prague (Czech Republic) by Ales Spicak, 2015 British Science Festival in Bradford (UK) by Sally Morgan, European Petrophysics Consortium (EPC, Leicester), European Researchers' Night in Metz (France) by Marianne Conin and Prof. Mary Ford *(page 55)*, University of Lorraine, Fête de la Science in Saint Etienne (France) by Adélie Delacour, University of Saint Etienne, Fête de la Science in Paris (France) by the Marie-Curie ITN ABYSS, a science

festival in Granada (Spain) by Carlota Escutia, University of Granada, the "Train du Climat" in Nancy (France) by the University of Lorraine, and the COP21 in Paris *(right)* by Paul Pearson, Cardiff University, and a consortium led by Plymouth University.

ECORD online

Conveying information to the science community and the wider public is especially useful during major ECORD/IODP events. ECORD continues to share information by posting news and photographs on its official social media outlets twitter - https://twitter.com/ecord_outreach - and facebook - https://www.facebook.com/essac.ecord - as well as on the photo gallery - http://photo.ecord.org/. Significant progress has been made with increasing the EPC's online presence - http://www2.le.ac.uk/departments/geology/research/gbrg/projects/iodp/epc - and also new video clips of downhole logging operations from MSP expeditions have been uploaded to the ECORD-ESO channel on YouTube.

The ECORD Council has approved the E-OETF's proposition to re-design the three ECORD websites, which will not only increase ECORD's visibility, but will also allow improved navigation to all our visitors.

The core replica Paleocene-Eocene Thermal Maximum (PETM) was shown at the COP21 in early December in Paris to illustrate the reality of extreme climate change (warming and acidification of the ocean). The exhibit event was staged by a consortium of European and US institutes and programmes (photo Plymouth Marine Laboratory).

Related websites:

http://www.ecord.org/pi/promo.html

http://www.essac.ecord.org/index.php?mod=education

@ECORD_Outreach **ESSAC ECORD**

YouTube ECORDESO channel

The core replica J-FAST was used with sandbox demonstrations at the European Researchers' Night by Marianne Conin (right) and Prof. Mary Ford (middle), to illustrate the Earth in motion, especially earthquakes and mountain building (photos Michel Champenois, CRPG/CNRS).

12.5 M USD
at the end of 2015

80% of the ECORD budget for operational costs

37 M USD for 2015-2018 MSP operations plan

7 M USD annually to implement MSP expeditions

A rainbow seen from the *RRS James Cook* during the Atlantis Massif Serpentinization and Life (C. Cotterill © ECORD/IODP).

9. FY2015 and FY2016 budgets

ECORD

- **FY2015 ECORD budget**

ECORD is currently funded exclusively by its 17 member countries.

In FY2015, the total ECORD budget amounted to 17.865M USD *(below)*, showing a decrease of 1.2M USD compared to the FY2014 budget. This is due to strong variations in exchange rates between the US Dollar and European currencies in late 2014 and early 2015 impacting the contributions of five ECORD countries (Belgium, Denmark, France, Ireland and UK) using their own currency and not the US Dollar to pay their contribution.

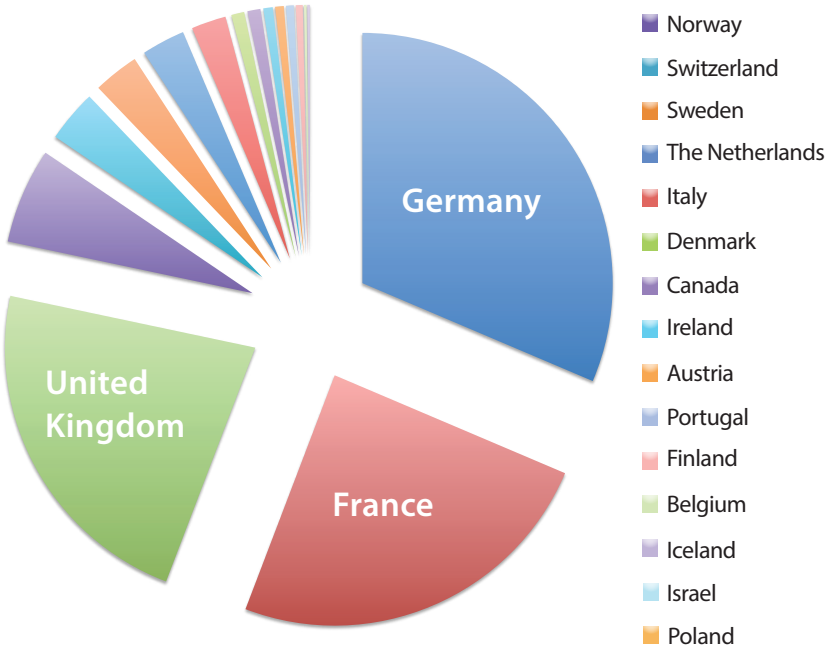
Austria	100,000
Belgium*	28,100
Canada	150,000
Denmark*	150,209
Finland	79,942
France*	4,353,387
Germany	5,600,000
Ireland*	109,172
Israel	29,979
Italy	400,000
Netherlands	500,000
Norway	1,099,979
Poland	30,000
Portugal	90,132
Sweden	527,949
Switzerland	599,964
United Kingdom*	4,016,473
Total	**17,865,286**

* countries paying their contribution in their own currency

ECORD member country contributions for FY2015 (USD).
The amount in USD is based on the exchange rate (when applicable) at the time of the payment by the relevant partner.

The contributions to the ECORD budget are unevenly distributed between the member countries, from 5.6M USD to 30,000 USD *(below)*. On the basis of their contributions, each ECORD member country receives a quota to participate in all IODP expeditions *(page 27)*. In contrast, the participation of ECORD member countries to the ECORD educational programme *(page 47)* is not based on respective financial contributions.

The three major ECORD contributors, Germany (5.6M USD), France (4.35M USD) and UK (4.016M USD), provide about 80% of the total ECORD budget. The contributions of other member countries range from 30,000 USD to 1.1M USD.



Distribution of ECORD member contributions.

This budget must be seen as a minimum budget as the opportunity for members to make direct cash and/or in-kind contributions may allow them to increase their contributions to the programme. This was the case in 2015 with the provision of the *RRS James Cook* by the UK as the in-kind contribution for the implementation of the IODP Expedition 357 Atlantis Massif Serpentinization and Life *(page 15)*.

Canada has decreased its contribution over the last two years while identifying new funding sources.
The table on *page 58* summarises the ECORD budget for FY2015.

The ECORD running costs are very stable and amount to 18.5%, thus allocating more than 80% of the ECORD budget for direct operational costs, including the implementation of MSP expeditions (Expedition 357 Atlantis Massif Serpentinization and Life in 2015) and contributions to

ECORD FY2015 budget *(in USD)*		
	Income	**Expenses**
FY14 balance	8,909,136	
FY15 contributions	17,865,286	
ECORD-NSF MoU		7,000,000
ECORD-JAMSTEC MoU		0**
ESO		6,037,559
EMA		296,411
MagellanPlus		89,000
ECORD Outreach		58,548
ESSAC		350,299
Support for SEP Co-Chair		85,920
Support for ECORD-ILP Chair		12,510
BCR		352,167
Total	26,774,422	14,282,414
FY15 balance	12,492,008	

* 15 months (10/13 to 12/14)
** membership suspended in FY15 and 16

Austria	100,000
Belgium	0
Canada	30,000
Denmark*	150,774
Finland	80,000
France	4,612,000
Germany	5,600,000
Ireland*	157,486
Israel	30,000
Italy	400,000
Netherlands	500,000
Norway	1,100,000
Poland	30,000
Portugal	90,000
Spain*	168,734
Sweden	528,000
Switzerland	600,000
United Kingdom*	3,942,667
Total	**18,119,661**

* countries paying their contribution in their own currency

ECORD member country contributions for FY2016 (in USD).
The amount in USD will be based on exchange rate (when applicable) at the time of the payment by the relevant partner. (1 € = 1.12 USD in this table)

the NSF (7M USD) and JAMSTEC (1M USD) to support the *JOIDES Resolution* and *Chikyu* operations. The ECORD Council decided in March 2015 that it would suspend its membership contribution of the *Chikyu* programme for at least two years, 2015 and 2016, in light of the delay in the implementation of *Chikyu* expeditions in the International Ocean Discovery Program. However, the ECORD Council has reiterated its strong support to the *Chikyu* programme and has reaffirmed its intention to continue its membership as soon as the situation changes.

The ECORD budget shows a positive balance of 12,492,008 USD at the end of 2015 *(top left)* and this sum will be carried forward to the ECORD FY2016 budget *(right)*.

- **FY 2016 ECORD budget**

In early 2016, ECORD will welcome back one of its historical members, Spain, who withdrew from the Integrated Ocean Drilling Program in 2011. Spain will therefore be the 18th ECORD member country and its annual contribution will be 150,000 €. The expected total amount of the 18 ECORD members' contributions is about 18.119M USD *(top right)*. Belgium will not contribute in 2016 as its new funding plans will start in 2017. Canada will make a minimum contribution in 2016 while identifying new funding sources.

ECORD FY2016 budget *(in USD)*		
	Income	**Expenses**
FY15 balance	12,492,008	
FY 16 contributions	18,119,661	
ECORD-NSF MoU		7,000,000
ECORD-JAMSTEC MoU		0*
ESO		10,600,000
EMA		258,944
MagellanPlus		78,400
ECORD Outreach		61,000
ESSAC		291,968
ECORD websites		33,600
BCR		327,384
Total	**30,611,669**	**18,651,296**
Expected FY16 balance	**11,960,373**	

*membership suspended in FY15 and 16.

The table *above* summarises the expected ECORD budget for FY2016 during which the Expedition 364 Chicxulub Impact Crater will be implemented *(page 59)*. A positive balance of about 11.96M USD is expected at the end of FY2016 and will be carried forward to FY2017.

The table *below* summarises the actual and planned funding of the 5-year operational plan of MSP expeditions as defined by the ECORD Facility Board *(page 21)*.

Years	2014	2015	2016	2017	2018
Expeditions	none	357 Atlantis Massif	548 Chicxulub Impact Crater	none or low cost	Prop. 813 Antarctic Paleoclimate Prop. 708 ACEX-2
Operational Costs	n/a	3,500,000	8,500,000	n/a	9,000,000 + 15,000,000
Actual and Expected* Balance end of FY	8,909,136	12,492,008	11,960,000	18,460,000	3,460,000

* Based on annual ECORD contributions of 18.0M USD and fixed costs of 11.5M USD in 2017 and 9M USD in 2018.
In-kind and additional cash contributions not considered.

Budgets of ECORD Entities

- **ECORD Managing Agency (EMA)**

The table *below* summarises the EMA budget for FY2015 as well as for FY2016 as approved by the ECORD Council in October 2015 for the period 1 January 2016 - 31 December 2016; it also shows the evolution of the EMA budget over the last two years. Most of the expenses will remain stable with the exception of a slight increase in salaries (+ 2.17%) and an increased budget (+11.1%) for travel due to the number of ECORD and IODP meetings, as well as scientific conferences (EGU, AGU, International Geological Congress). With the end of support both to the SEP Chair and the ECORD-ILP Chair, the EMA FY2016 budget will show a decrease of 2.42%.

EMA budget for FY2015 and FY2016					
	FY2015*		**FY2016****		**Variance *****
	€	*USD*	*€*	*USD*	*%*
Salaries					
Outreach Coordinator	46,000	57,546	47,000	52,640	2.17
Assistant Director	46,000	57,546	47,000	52,640	2.17
Total	**92,000**	**115,092**	**94,000**	**105,280**	**2.17**
Compensation for the Director	**46,000**	**57,546**	**46,000**	**51,520**	**-**
Travel	**45,000**	**56,295**	**50,000**	**56,000**	**11.1**
Meetings	**5,000**	**6,256**	**5,000**	**5,600**	**-**
Consumables	**5,000**	**6,256**	**5,000**	**5,600**	**-**
Support for IODP/ECORD meetings	**7,500**	**9,385**	**7,500**	**8,400**	**-**
Support for the ECORD-ILP Chair	**10,000**	**12,510**	**0**	**0**	**-100**
***"Scientific Drilling"* journal**	**6,436**	**8,051**	**3,700**	**4,144**	**-42.5**
Overheads	**20,000**	**25,020**	**20,000**	**22,400**	**-**
Total	**236,936**	**296,411**	**231,200**	**258,944**	**-2,42**

* 1€ = 1.251 USD (5 October 2014); ** 1€ = 1.12 USD (22 September 2015), *** based on the budget in €

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

The table *below* summarises the ESSAC budget for FY2015 as well as for FY2016 as approved by the ECORD Council in October 2015 for the period 1 January 2016 - 31 December 2016.

ESSAC budget for FY2015 and FY2016

	FY2015 (€)	FY2016 (€)	Variance (%)	Notes
Salaries				
Science Coordinator (TVÖD E14, 03-12, 2016)	101,015	66,686		1
Science Coordinator ETHZ (01-02,2016)	0	20,000		2
Compensation for the Chair	50,000	50,000		
Assistant for publication database	11,000	0		
Total salaries/compensation	**162,015**	**136,686**	**-15.6**	
Office costs	6,000	6,000	**-**	
Travel				
Chair	10,000	15,000	50	
Science Coordinator	6,000	6,000	-	
Meetings				
ESSAC May meeting	2,000	2,500	**25**	
ESSAC October meeting	2,500	2,500	-	
Travel support for invited speakers to ESSAC meetings	3,000	3,000	-	
Travel support for ESSAC Liaison to SEP meetings	5,000	0	-100	3
Conference travel support	3,000	4,000	33.3	
Education & Outreach				
Support for ECORD Distinguished Lecturer Programme	18,000	10,000	**-44.4**	4
Support for ECORD Summer Schools	20,000	30,000	**50-**	5
ECORD Training Course	7,500	6,500	**-13.3**	6
ECORD Summer School Scholarships	15,000	15,000	**-**	
ECORD Research Grants	15,000	16,000	**6.7**	
Teachers at sea (travel support)	5,000	7,500	**50**	7
Total costs excluding salaries	**118,000**	**124,000**	**5.1**	
Total ECORD contribution in €	**280,015**	**260,686**	**-6.9**	

1 New contract at GEOMAR, based on monthly 2015 figures, +3%.
2 Extension of existing contract at ETHZ, 9932.80 CHF/mo.
3 No longer necessary at 2015 level - Werner Piller is SEP member and will report to the panel.
4 Based on discussions and review of projected expenditures by ESSAC Office.
5 Based on discussions - support of three Summer Schools in 2016.
6 Decrease in support from Bremen.
7 Teachers at Sea changed from 2 to 4, France will support 1, request here is to support 3.

Expedition 354 Bengal Fan: flags used to identify personal samples.(Tim Fulton, IODP JRSO).

- **ECORD Science Operator (ESO)**

The table *below* summarises the expenditure breakdown of ESO for FY2015 in US dollars.

ESO FY2015 expenditure breakdown *(in USD)*				
	2015 Annual Program Plan Budget	**2015 Actual Operating Budget**	**2015 Expenditure**	**Variance***
Management and administration				
Personnel	569,712	569,712	638,569	-68,857
Travel	154,000	154,000	107,870	46,130
Supplies	15,000	15,000	16,504	-1,504
Shipping	0	0	1,258	-1,258
Communication	0	0	16	-16
Equipment	15,000	15,000	14,798	202
Other	15,000	15,000	18,390	-3,390
Total	**768,712**	**768,712**	**797,406**	**-28,694**
Technical, Engineering and Science Support				
Personnel	924,753	924,753	1,082,535	-157,782
Travel	94,000	94,000	142,118	-48,118
Supplies	97,000	97,000	97,013	-13
Shipping	170,000	170,000	94,911	75,089
Communication	0	0	7,348	-7,348
Contractual services	25,000	25,000	0	25,000
Equipment	402,000	402,000	171,366	230,634
Other	2,965,000	2,965,000	3,233,825	-268,825
Total	**4,677,753**	**4,677,753**	**4,829,115**	**-151,362**
Core Curation				
Personnel	65,469	65,469	65,469	0
Travel	6,000	6,000	6,000	0
Supplies	2,000	2,000	2,000	0
Shipping	5,000	5,000	5,000	0
Total	**78,469**	**78,469**	**78,469**	**0**
Data Management				
Personnel	139,899	139,899	151,767	-11,868
Travel	16,000	16,000	8,381	7,619
Supplies	6,000	6,000	0	6,000
Communication	0	0	3,780	-3,780
Contractual Services	75,000	75,000	0	75,000
Equipment	33,400	33,400	17,059	16,341
Other	0	0	37,468	-37,468
Total	**270,299**	**270,299**	**218,455**	**51,844**
Publications				
Contractual Services	**150,000**	**150,000**	**0**	**150,000**
Outreach				
Personnel	68,326	68,326	92,114	-23,788
Travel	16,000	16,000	16,532	-532
Supplies	8,000	8,000	0	8,000
Equipment	0	0	1,240	-1,240
Other	0	0	4,227	-4,227
Total	**92,326**	**92,326**	**114,114**	**-21,788**
Total	**6,037,559**	**6,037,559**	**6,037,559**	**0**

*Any underspend is retained by ECORD

- **Bremen Core Repository**

The table *below* summarises the BCR budget for FY2015 as well as for FY2016 as approved by the ECORD Council in October 2015 for the period 1 January 2016 - 31 December 2016.

BCR budget for FY2015 and FY2016					
	FY2015*		FY2016**		Variance ***
	€	USD	€	USD	%
Salaries					
Personnel (1.6 FTE)	153,013	191,419	160,154	184,177	4.7
Student workers	11,910	14,900	10,000	11,500	-16
Travel	4,237	5,300	2,500	2,875	-41
Supplies	5,995	7,500	6,000	6,900	0
Shipping	15,987	20,000	12,500	14,375	-2.2
SEDIS web portal maintenance & service 24/7 (incl. 0.08 FTE)	9,935	12,429	11,000	12,650	10.7
Indirect costs	80,431	100,619	82,528	94,907	2.6
Total	281,508	352,167	284,682	327,384	1.1

** 1€ = 1.251 USD; ** 1€ = 1.15 USD;* *** based on the budget in €.

- **ECORD Outreach & Education Task Force (E-OETF)**

The ECORD outreach budget is managed by the ECORD Outreach and Education Task Force *(page 4)*. The table *below* summarises the budget for FY2015 as well as for FY2016 as approved by the ECORD Council in October 2015 for the period 1 January 2016 - 31 December 2016. The total budget of FY2016 shows an increase of 16.4% compared to FY2015. This is due to a higher number of exhibit booths in 2016 (EGU 2016, IGC 2016 and AGU 2016), multiple requests for the six core replicas (shipping costs) and the fabrication of a new core replica (other costs).

ECORD outreach budget for FY2015 and FY2016					
	FY2015*		FY2016**		Variance
	€	USD	€	USD	%
Exhibit booths at conferences	14,200	17,764	17,500	19,600	23.2
Publications	13,800	17,264	13,125	14,700	-4.9
Overheads	4,000	5,004	4,018	4,500	0.5
Other costs	4,300	5,380	5,714	6,400	32.9
Shipping	2,000	2502	3,036	3,400	51.8
Travel	8,500	10,634	11,072	12,400	30.3
Total	46,800	58,548	54,465	61,000	+16.4

1€ = 1.251 USD (5 October 2014); ** 1€ = 1.12 USD (22 September 2015); *** based on the budget in €

J-FAST core replica at EGU 2015 (photo J. Gutiérrez Pastor).

10. ECORD participation in IODP panels

The **International Ocean Discovery Program (IODP)** is composed of three platform providers (NSF-USA for *JOIDES Resolution* , MEXT/JAMSTEC - Japan for *Chikyu* and ECORD for MSPs), three Facility Boards, two IODP advisory panels, a Science Support Office and the IODP Forum. The ECORD participation in the IODP entities in 2015 is listed below.

The ***JOIDES Resolution* Facility Board - JRFB** is the planning forum for expeditions using the *JOIDES Resolution*.
ECORD Members of the JRFB: Gilbert Camoin (France), Heiko Pälike (Germany).
http://www.iodp.org/facility-boards#JRFB

The ***Chikyu* IODP Board - CIB** is the planning forum for expeditions using the platform *Chikyu*.
ECORD Members of the CIB: Gilbert Camoin (France), Heinrich Villinger (Germany).
http://www.iodp.org/facility-boards#CIB

IODP advisory panel: Science Evaluation Panel (SEP) evaluates the scientific objectives and relevance of proposed expeditions using all IODP platforms.
SEP ECORD Members: Dick Kroon (UK, Co-chair), Serge Berné (France), Steve Bohaty (UK), Jörg Geldmacher (Germany), Marguerite Godard (France), Marc-André Gutscher (France), Verena Heuer (Germany), Mads Huuse (UK), Sebastian Krastel (Germany), Gilles Lericolais (as alternate to Serge Berné, France), Lisa McNeill (UK), David Mosher (Canada), Matt O'Regan (Sweden), Werner Piller (Austria), Gabriele Uenzelmann-Neben (Germany).
http://www.iodp.org/facility-boards#SEP

IODP advisory panel: Environmental Protection and Safety Panel (EPSP) evaluates the environmental protection and safety of proposed expeditions using all IODP platforms.
EPSP ECORD Members: Martin Hovland (Norway), Philippe Lapointe (France), David Long (UK), Dieter Strack (Germany).
http://www.iodp.org/facility-boards#EPSP

The **IODP Forum** represents the overarching umbrella of the programme and provides advice to IODP Facility Boards on platform provider activity.
Chair: Keir Becker (USA)
ECORD attendees at the IODP Forum in Canberra, Australia: Jan Behrmann (Germany), Gilbert Camoin (France), Robert Gatliff (UK), Karsten Gohl (Germany), Nadine Hallmann (France, Dick Kroon (UK), Werner Piller (Austria).
http://www.iodp.org/iodp-forum



IODP drillships: from left to right, the JOIDES Resolution (photo Wiliam Crawford, IODP/TAMU), the two ROVs (left, MeBo and, right RD2) onboard the RRS James Cook during Expedition 357 Atlantis Massif Serpentinization and Life (G. Früh-Green ©ECORD/IODP) and the Chikyu (© JAMSTEC/IODP).

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List of acronyms

AAPG: American Association of Petroleum Geologists

ACEX: Arctic Coring Expedition

ADP: Amphibious Drilling Proposal

AGU: American Geophysical Union

ASC: Antarctic Support Contract

AWI: Alfred-Wegener-Institute

BCR: Bremen Core Repository

BGS: British Geological Survey

CDEX: Center for Deep Earth Exploration

CEREGE: Centre Européen de Recherche et d'Enseignement des Géosciences de l'Environnement

CIB: *Chikyu* IODP Board

CNES: Centre National d'Etudes Spatiales

CNR: National Research Council (Italy)

CNRS: Centre National de la Recherche Scientifique

COP21 (-UNFCCC): 21st Conference of Parties (- to the United Nations Framework Convention on Climate Change)

CPP: Complementary Project Proposal

CRPG: Centre de Recherches Pétrographiques et Géochimiques

CTD: Conductivity-Temperature-Depth

DIS: Drilling Information System

DLP: Distinguished Lecturer Programme

DOSECC: Drilling, Observation and Sampling of the Earth's Continental Crust

DSDP: Deep Sea Drilling Project

E-EB: ECORD Executive Bureau

E-OETF: ECORD Outreach & Education Task Force

E-VTF: ECORD Vision Task Force

EAG: Equatorial Atlantic Gateway

EAGE: European Association of Geologists & Engineers

ECORD: European Consortium for Ocean Research Drilling

ECORD-ILP: ECORD Industry Liaison Panel

EFB: ECORD Facility Board

EGU: European Geosciences Union

EMA: ECORD Managing Agency

EPC: European Petrophysics Consortium

EPSP: Environmental Protection and Safety Panel

ESA: European Space Agency

ESCWA: Economic and Social Commission for Western Asia

ESO: ECORD Science Operator

ESSAC: ECORD Science Support and Advisory Committee

ETH: Eidgenössische Technische Hochschule

FCT: Foundation of Science and Technology (Portugal)

FTE: Full-time equivalent

FY: Fiscal Year

GCR: Gulf Coast Repository

GEOMAR: Helmholtz Centre for Ocean Research Kiel

GFZ: Deutsches GeoForschungsZentrum

HCERES: Haut Conseil de l'Evaluation de la Recherche et de l'Enseignement Supérieur

ICDP: International Continental Scientific Drilling Program

IFREMER: French Research Institute for Exploitaiton of the Sea

IGSN: International Geo Sample Number

IMAGE: Investigating Mediterranean Atlantic Gateway

IMPRESS: International Marine Process Reconstruction Study

INSU: National Institute of Sciences of the Universe

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

IPG: Institut de Physique du Globe

IPMA: Portuguese Sea and Atmosphere Institute

IRD: Institut de la Recherche pour le Développement

ISF: International School of Foraminifera

ISOLAT: Integrated Southern Ocean Latitudinal Transects

ITF: Indonesian Throughflow

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

JRSO: *JOIDES Resolution* Science Operator

KCC: Kochi Core Center

KIGAM: Korea Institute of Geoscience and Mineral Resources

MARUM: Center for Marine Environmental Sciences, University of Bremen

mbsf: metres below sea floor

MDP: Multi-phase Drilling Project

MeBo: Meeresboden-Bohrgerät

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

MIO: Mediterranean Institute of Oceanography

MoU: Memorandum of Understanding

MSCL: Multi-Sensor Core Logger

MSP: Mission-specific platform

MT: Magnetotellurics

NERC: Natural Environment Research Council

NSF: National Science Foundation

OAE: Oceanic Anoxic Event

ODP: Ocean Drilling Program

OSP: Onshore Science Party

QA/QC: Quality assurance/quality control

RD2: Rockdrill 2

ROV: Remotely Operated Vehicle

RRS: Royal Research Ship

RWTH: Rheinisch-Westfälische Technische Hochschule

SaDR: Sample and Data Request

SEDIS: Scientific Earth Drilling Information Service

SEMARNAT: Secretariat of Environment and Natural Resources

SEP: Science Evaluation Panel

SIIDETEY: Sistema de Investigación, Innovación y Desarrollo Tecnológico del Estado de Yucatán

SOR: School of Rock

UPMC: Université Pierre et Marie Curie

USIO: US Implementing Organization

USSP: Urbino Summer School in Paleoclimatology

TAMU: Texas A &M University

TSB: thin section billets

VSP: Vertical Seismic Profile

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France: Institut National des Sciences de l'Univers - Centre National de la Recherche Scientifique (INSU-CNRS)
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United Kingdom: Natural Environment Research Council (NERC)

http://www.ecord.org