ECORD

EUROPEAN CONSORTIUM FOR
OCEAN RESEARCH DRILLING

ANNUAL REPORT 2021

From 2003 to 2013, the European Consortium for Ocean Research drilling (ECORD) was part of the Integrated Ocean Drilling Program (IODP-1 2003-2013), which became the International Ocean Discovery Program in October 2013.

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-1 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-2), 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.

ECORD funds and implements MSP operations for IODP as an independent platform provider, with the aim to carry out high-profile expeditions and to maintain the implementation of one expedition per year if funding allows for the duration of the 2013-2023 programme. 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. From 2015 to 2021, ESO has successfully managed fourexpeditions to the Atlantis Massif, the Chicxulub Impact Crater, the Rift of Corinth and the Japan Trench Paleoseismology.

ECORD makes 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: Operations during IODP Expedition 386. Credits: N. Okutsu, ECORD/IODP/JAMSTEC.

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www.ecord.org

EUROPEAN CONSORTIUM FOR OCEAN RESEARCH DRILLING

ECORD Annual Report 2021

1 January 2021 - 31 December 2021

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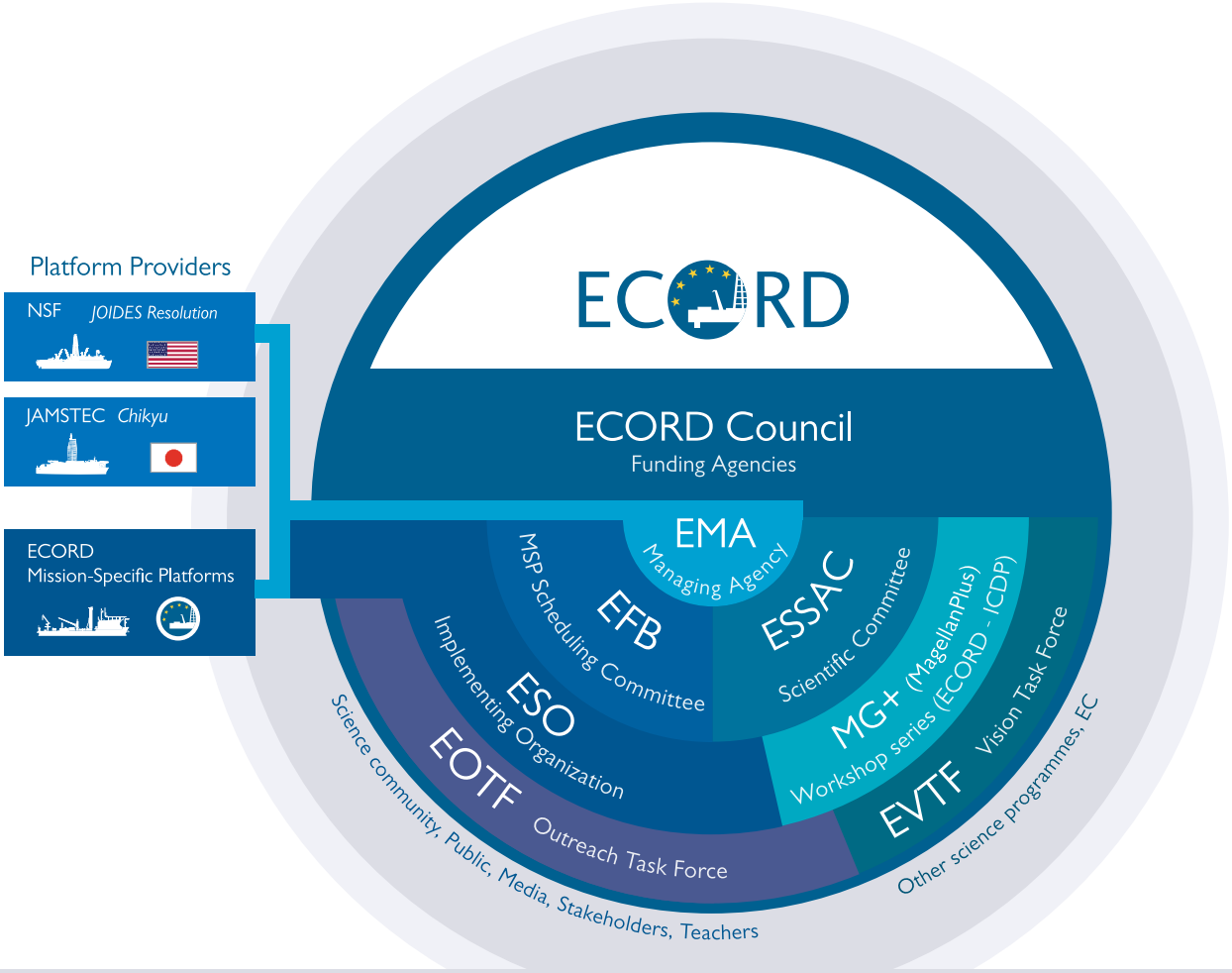
ECORD entities



2021 ECORD Member Countries

Austria	1	Österreichische Akademie der Wissenschaften (ÖAW)
Canada	2	Canadian Consortium for Ocean Drilling (CCOD)
Denmark	3	Danish Agency for Science and Higher Education (DAFSHE)
Finland	4	Suomen Akatemia
France	5	Centre National de la Recherche Scientifique (CNRS)
Germany	6	Deutsche Forschungsgemeinschaft (DFG)
Ireland	7	The Geological Survey of Ireland (GSI)
Italy	8	Consiglio Nazionale delle Ricerche (CNR)
Netherlands	9	Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO)
Norway	10	Forskningsrådet
Portugal	11	Fundação para a Ciência e a Tecnologia (FCT)
Spain	12	Ministerio de Ciencia e Innovación (MCIN)
Sweden	13	Vetenskapsrådet (VR)
Switzerland	14	Fonds National Suisse de la Recherche Scientifique (FNS)
United Kingdom	15	United Kingdom Research and Innovation (UKRI)

EUROPEAN CONSORTIUM FOR OCEAN RESEARCH DRILLING

As defined in the ECORD Memorandum of Understanding, ECORD includes **five entities** (ECORD Council, ECORD Managing Agency – EMA, ECORD Facility Board – EFB, ECORD Science Operator – ESO, ECORD Science Support and Advisory Committee - ESSAC), **two task forces** (ECORD Vision Task Force - EVTF and ECORD Outreach Task Force - EOTF) and **a workshop programme** (MagellanPlus Workshop Series Programme) (diagram on previous page).

www.ecord.org *ema@cerege.fr* @ECORD_IODP ECORD_IODP ECORD IODP

ECORD Council

www.ecord.org/about-ecord/management-structure/council/

The **ECORD Council** is the funding entity for ECORD and provides oversight for all ECORD activities.

Chair	**Michael Webb** (UK; 1 January to 31 December 2021)
Outgoing Vice-Chair	**Bernard Westerop** (The Netherlands; 1 January to 30 June 2021)
Incoming Vice-Chair	**Guido Lüniger** (Germany; 1 July to 31 December 2021)

Council Core Group	**Michael Webb** (UK) **Stéphane Guillot** (France) **Guido Lüniger** (Germany) **Bernard Westerop** (The Netherlands) **Markus Engelhardt** (Norway)

Mike Webb
ECORD Council Chair 2021

Mike Webb is the Head of Marine Research at the UK's Natural Environment Research Council (NERC). He is responsible for developing and delivering large marine research programmes, and overseeing the programming of NERC's research ships and marine facilities. Before joining NERC in 1999, he did a coastal oceanography PhD at the University of East Anglia, followed by a postdoc at the University of Cambridge. Mike has been a member of the ECORD Council since 2009.

EMA (ECORD Managing Agency)

www.ecord.org/about-ecord/management-structure/ema/

Director	**Gilbert Camoin** (CEREGE, France)
Assistant Director	**Nadine Hallmann** (CEREGE, France)
Outreach Officer	**Malgo Bednarz** (CEREGE, France)
Administrator	**Patricia Rieu** (CEREGE, France)

ECORD Managing Agency

EMA is the management body of ECORD. EMA is in charge of the management of the ECORD budget and the contracts with the ECORD partners, the representation of ECORD in all IODP entities and the link between these entities and the ECORD members.

Gilbert Camoin
EMA Director

Gilbert Camoin, PhD, DSc, is a senior research scientist at the CNRS (Centre National de la Recherche Scientifique) and works currently at the CEREGE (Centre Européen de Recherche et d'Enseignement de Géosciences de l'Environnement) in Aix-en-Provence, France. His major research activities are mainly focused on the records of sea-level, environmental and climatic changes by coral reefs and other carbonate systems. He has authored 150 peer-reviewed papers and supervised 11 PhD students and eight post-docs.
Gilbert sailed on ODP Leg 144 and several other cruises, was then lead PI of Proposal 519 and Co-chief Scientist on IODP Expedition 310. He served as Chair of the ODP/IODP-1 Environment Science Steering Evaluation Panel (2001-2005), Chair of the ECORD Science Support and Advisory Committee - ESSAC - (2007-2009), Member of the IODP-1 Science Planning Committee (2007-2010), and Member of the IODP-2 Science Plan Writing Committee (2010-2011). He was appointed as Director of the ECORD Managing Agency in January 2012.

ESSAC (ECORD Science Support and Advisory Committee)

www.ecord.org/about-ecord/management-structure/essac/

Chair	**Antony Morris** (Plymouth University, UK)
Vice-Chair	**Jan Behrmann** (GEOMAR, Germany)
Science Coordinator	**Hanno Kinkel** (Plymouth University, UK)

ECORD ESSAC

ESSAC is the ECORD science committee and is responsible for the scientific planning and coordination of ECORD's contribution to IODP. ESSAC aims at maximising the scientific and technological contribution of ECORD to IODP, as well as promoting appropriate representation of the ECORD scientific community in the IODP Science Advisory Structure.

Antony Morris
ESSAC Chair

Antony Morris is professor of Geophysics and Geodynamics at the School of Geography, Earth and Environmental Sciences at the University of Plymouth. He uses geophysical magnetic methods to investigate fundamental crustal processes. The main focus of his research has been the magnetic analysis of samples of oceanic lithosphere recovered from the world's oceans by the International Ocean Discovery Program and innovative investigations of major ophiolites (slices of oceanic lithosphere that have been emplaced tectonically on to land). He has sailed five times on the *JOIDES Resolution* (IODP Expeditions 304/305, 335, 345, 351, 360) and once on the RRS *James Cook* (part of the UK research fleet, cruise JC21 for IODP Proposal #551). He was appointed as ESSAC Chair in January 2018.

ESO (ECORD Science Operator)

www.ecord.org/about-ecord/management-structure/eso/

ESO is the implementing organisation of ECORD and is tasked with planning and delivering mission-specific platform (MSP) expeditions for the International Ocean Discovery Program (IODP).

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). Each partner contributes specific expertise to ESO, allowing the consortium to build tailored expeditions to suit the requirements of proposals selected for implementation by the ECORD Facility Board. BGS coordinates proposal scoping, expedition planning and project management, contracting of drilling services and vessels, operational oversight, and project permitting. MARUM manages the curation services and scientific facilities required by MSPs, provides data management services, and coordinates the implementation of the Onshore Science Party, hosted at the IODP Bremen Core Repository and laboratories of the University of Bremen. EPC comprises two European universities: University of Leicester (UK, lead partner) and University of Montpellier (France). The consortium provides operational, technical and high-level scientific support for MSP expeditions. EPC is part of the International Scientific Logging Consortium which provides staff for IODP non-riser expeditions.

David McInroy
ESO Science Manager

David McInroy is Team Leader for Ocean Geoscience at the British Geological Survey in Edinburgh, UK, and is tasked with progressing deep-sea geoscientific research within the BGS Marine Geoscience Directorate. David is a geologist and geophysicist with a research background in the evolution and hydrocarbon prospectivity of the UK's Atlantic Margin, and has participated in geophysical data acquisition cruises on the UK's continental shelf. From 2003-2010, David was Expedition Project Manager for IODP Expeditions 302, 310 and 313, and since 2010 has held the role of ESO Science Manager.

British Geological Survey (BGS), UK	
Science Manager	**David McInroy**
Expedition Project Managers	**Jeremy Everest** **Gareth Carter** **Hannah Grant** **Kirstin Johnson**
Drilling Coordinators	**Graham Tulloch** **Michael Togher**
Head of RD2 development	**Michael Wilson**
Head of BGS Marine Operations	**Oliver Peppe**
BGS Business Development Manager	**Grant Affleck**
Data Manager	**Mary Mowat**
MARUM, Germany	
Curation and Laboratory Manager	**Ursula Röhl**
Assistant Laboratory Manager	**Patrizia Geprägs**
Curatorial Scientists	**Holger Kuhlmann** **Alex Wülbers**
Outreach Manager and Media Relations	**Ulrike Prange**
Data Manager	**Vera Bender**
University of Leicester, UK	
EPC Manager	**Sarah Davies**
EPC Project Manager	**Simon Draper**
Petrophysics Staff Scientists	**Erwan Le Ber** **Katharina Hochmuth**
University of Montpellier, France	
Petrophysics Staff Scientist	**Johanna Lofi**

ESO Operations Manager post

In October 2020, ESO said goodbye to Dave Smith who retired from the BGS after 34 years' service. Dave joined the BGS marine operations group in September 1986 having already worked for a time with industry. The ESO team were very sorry to lose a team member who had contributed so much to the ESO project over the last 18 years, with the last 11 years as ESO Operations Manager.

The ESO Operations Manager post at the BGS was advertised in December 2020. Seventeen applications were received, with five applicants invited to interview. An offer was made to the only suitable candidate; however, the candidate rejected the offer and the BGS was not in a position to modify its offer.

A second external advert in June 2021 returned only two candidates, both of which fell far short of the criteria for the ESO Operations Manager post. Consideration was given to outsource the post to either another ESO partner or a private consultancy, however ESO-BGS will instead make use of a spread of existing BGS staff to deliver the duties of the ESO Operations Manager. Duties will be split and spread across a group of people, drawing on staff with experience in offshore contracts and procurement (from BGS Business Development), offshore operations (existing ESO drilling coordinators and staff from BGS Marine Operations), and logistics (staff from BGS Marine Operations and elsewhere in BGS field operations).

Onboard R/V *Kaimei* during IODP Expedition 386. Credits: N. Okutsu, ECORD/IODP/JAMSTEC.

EFB (ECORD Facility Board)

www.ecord.org/about-ecord/management-structure/efb/

EFB is the key 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, through operational and management oversight of MSP expeditions. EFB is composed of the ECORD Vision Task Force (EVTF) and a Science Board.

Chair	**Gabriele (Gabi) Uenzelmann-Neben** (AWI, Germany)
Members of the Science Board	**Michele Rebesco** (OGS, Italy) **Alexandra Turchyn** (Cambridge University, UK) **Beth Christensen** (Rowan University, USA) **Yasuhiro Yamada** (Kyushu University, Japan) **FengPing Wang** (Shanghai JiaoTong University, China)

Gabriele Uenzelmann-Neben
ECORD Facility Board Chair

Gabriele Uenzelmann-Neben is senior scientist at the Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research (AWI) in Bremerhaven, Germany. As a Geophysicist, her research interests include continental margins, geophysics of the polar regions, sediment transport processes, glaciomarine sedimentation, reconstruction of sedimentary environments, climate and oceanic circulation using the high-resolution seismic imaging of sedimentary structures, large igneous provinces LIPs (formation and impact on climate and circulation) and seismic reflection data. Gabi participated in more than 20 cruises as team leader and eight as chief scientist, and has published more than 80 peer-reviewed papers. She was member of the IODP Site Evaluation Panel (2010-2015) and she was ECORD Distinguished Lecturer from 2014 to 2016. Gabi was appointed as EFB Chair in January 2019.

EVTF (ECORD Vision Task Force)

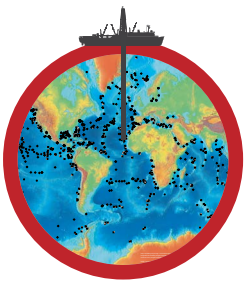
The **EVTF** is the ECORD strategic entity in charge of developing a long-term scientific and funding strategy, and monitoring the ECORD progress toward the completion of the IODP Science Plan.
EVTF is composed of the ECORD Council Core Group, including the ECORD Council Chair and Vice-Chair, the ESSAC Chair, the EMA Director and Assistant Director and the ESO Science Manager.

EOTF (ECORD Outreach Task Force)

The **EOTF** coordinates ECORD communication tasks, such as outreach/public information and educational activities related to IODP in ECORD countries.
EOTF is composed of the EMA Outreach Officer (Chair) and Assistant Director, the ESO Outreach and Media Relations Managers and the ESSAC Science Coordinator. The EMA Director and the ESSAC Chair act as observers

MG+ (MagellanPlus Workshop Series)

www.ecord.org/science/magellanplus/



MG+ is designed to support ECORD scientists in developing new and innovative science proposals to meet the IODP Science Plan challenges.

This programme is co-funded by ECORD and the International Continental Scientific Drilling Program (ICDP).

ECORD and IODP meetings and conferences

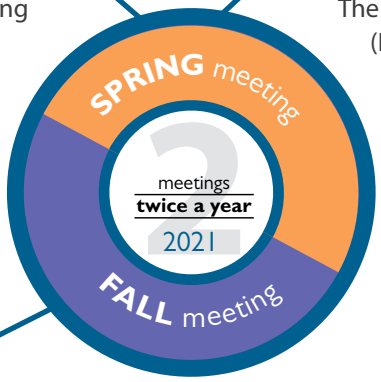
The table on the next page summarizes the ECORD and IODP meetings that have been held in 2021, as well as the two major conferences (virtual EGU and AGU in New Orleans) where IODP-related webinars and booths have been organized.

ECORD Council meetings

The **ECORD Council** meets twice a year: a spring meeting involving the members of the ECORD Council and of the EVTF, and a fall meeting jointly with ESSAC involving representatives of all ECORD entities as well as representatives from other ECORD entities, IODP partners (funding agencies, operators and science committees) and collaborating science programmes.

EOTF meetings

The **ECORD Outreach Task Force** (EOTF) meets twice a year, in February/March and in fall. Outreach liaisons from the US Science Support Program, JAMSTEC (Japan) and ICDP usually attend the EOTF fall meeting.



ESSAC meetings

ESSAC meets twice a year: a spring meeting involving ESSAC Delegates and EMA and ESO representatives, and a fall meeting jointly with the ECORD Council.

EFB meeting

The **ECORD Facility Board** (EFB) meets once a year. Liaisons from ECORD entities and representatives from IODP partners (funding agencies, operators and science committees) attend the EFB meetings.

ECORD representatives at IODP meetings

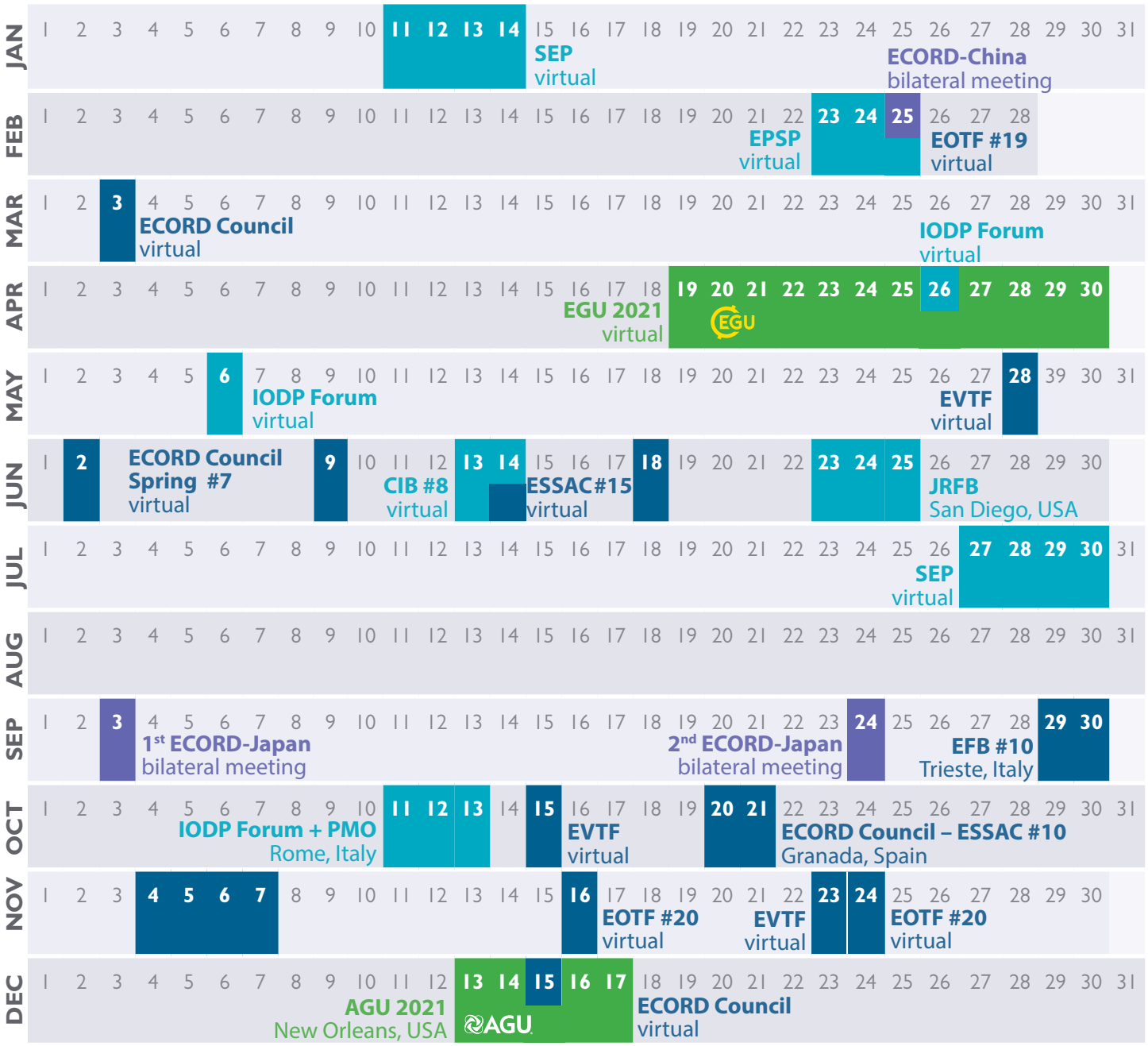
ECORD representatives act as members and/or liaisons to meetings of IODP entities:

- the *JOIDES Resolution* Facility Board (JRFB),
- the *Chikyu* IODP Board (CIB),
- the Science Evaluation Panel (SEP),
- the Environmental Protection and Safety Panel (EPSP),
- the IODP Forum.

See 10. ECORD representatives on IODP panels, *page 122*.

www.ecord.org/contact-ecord/ *ema@cerege.fr*

ECORD / IODP meetings and conferences 2021 calendar



ECORD meetings | IODP meetings | bilateral meetings | International conferences

Figure summarizing the ECORD and IODP meetings that have been held in 2021, as well as the two major conferences (virtual EGU and AGU in New Orleans) where IODP-related scientific sessions and booths have been organised.

Acronyms:
AGU - American Geophysical Union, CIB - *Chikyu* IODP Board, EFB - ECORD Facility Board, EGU - European Geosciences Union, EOTF - ECORD Outreach Task Force, EPSP - Environmental Protection and Safety Panel, EVTF - ECORD Vison Task Force, JRFB - *JOIDES Resolution* Facility Board, SEP - Science Evaluation Panel.

http://www.ecord.org/events-calendar/

1. FY2021 highlights

View from R/V *Kaimei* during IODP Expedition 386. Credits: N. Okutsu, ECORD/IODP/JAMSTEC.

1. FY2021 highlights

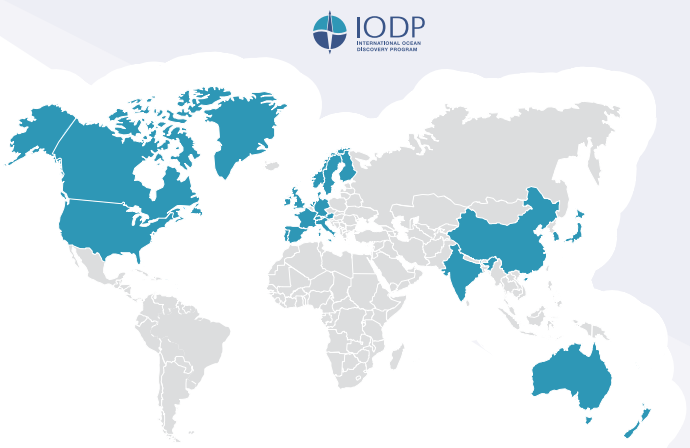
Since its creation in 2003, ECORD has developed a unique European distributed research infrastructure that connects research facilities at multiple sites across Europe and Canada that are engaged in multidisciplinary aspects of subsurface scientific research and have a longstanding culture of cooperation on science, technology and education.

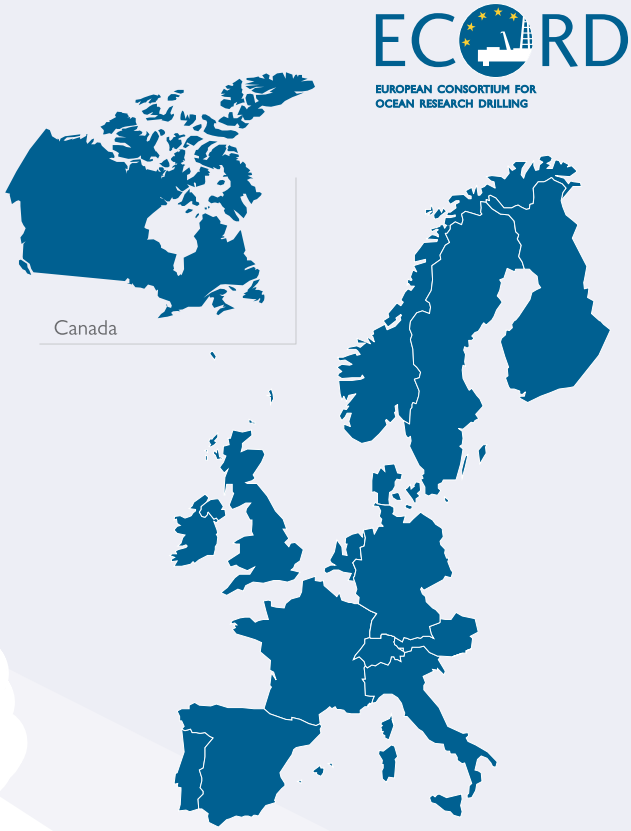
ECORD combines research, education and innovation and offers a unique portfolio of science and educational activities, world-class capabilities, state-of-the-art technology and remarkable knowledge-based resources to the European and Canadian Earth and environmental science community. This portfolio has been significantly enriched since the start of the International Ocean Discovery Program in order to better serve the European and Canadian science communities.

The COVID-19 pandemic that the World has faced over the last two years has strongly affected the activities of our programme with the postponement of many expeditions, workshops, conferences and educational activities. However, all IODP and ECORD meetings have been held remotely and, since a few months, in a hybrid form, thus maintaining the programme active during this difficult period. In addition to its basic functioning, ECORD has implemented a Mission-Specific Platform (MSP) expedition in 2021 and planned another one for 2022. ECORD has also initiated special calls for workshops focused on MSP proposals and developed new resources aiming at improving ECORD science communication.

Before the COVID-19 pandemic, the ECORD Managing Agency (EMA) has been very active in providing information to former ECORD members, including Israel, Iceland, Belgium and Poland. Israel and Iceland have formerly expressed interest in joining the current 15 ECORD members in the future. Following the ECORD-IODP Day that was organized on 3 October 2019 in Athens, Greece, the promising contacts with the Greek science community and authorities have been interrupted by the COVID-19 pandemic and are now in process to be reactivated. In addition, contacts have been established with Croatia, Russia and, more recently, the United Arab Emirates during the COVID-19 pandemic.

Bottom: IODP member countries, as of December 2021.
Right: 15 ECORD member countries, as of December 2021.
www.ecord.org/about-ecord/about-us
(maps credit: *http://histgeo.ac-aix-marseille.fr*).





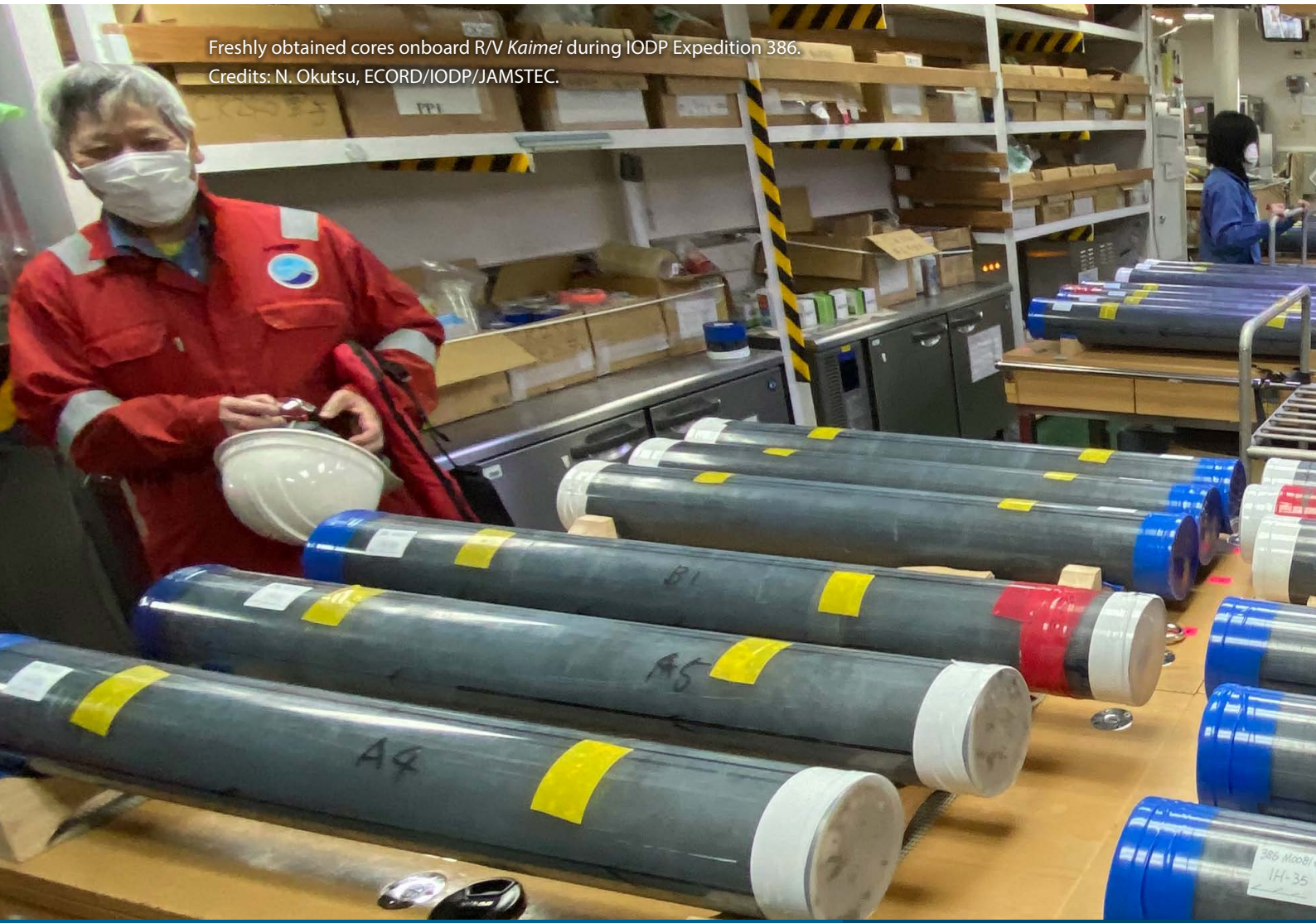
The end of the International Ocean Discovery Program U.S. FY2024 (1 October 2023 - 30 September 2024) has been considered as an 'option' year in Memoranda underlying the JR Consortium to extend the current term (30 September 2023) of the International Ocean Discovery Program. In light of reduced operations and lost opportunities during the COVID-19 pandemic, NSF has decided that unspent funds in U.S. FY2020 and U.S. FY2021 due to reduced operations will be applied to U.S. FY2024 operations.

ECORD has continuously contributed to the JR Consortium throughout the pandemic. At its last meeting that was held in a hybrid form (Granada, Spain and remotely), the ECORD Council has decided to extend the 2019-2023 ECORD-NSF MoU through 2024, as such an option is clearly indicated in this agreement. The ECORD Council has approved EMA's proposition to contribute to the JR Consortium in order to help NSF to consider additional expeditions in U.S. FY2024. The ECORD Council also supported the extension of the 2019-2023 ECORD MoU through 2024, provided that the expected contributions from ECORD funding agencies are available for that year.

In addition, the ECORD Council has decided to extend the terms of the ECORD Managing Agency (Centre National de la Recherche Scientifique – CNRS), the ECORD Science Operator (British Geological Survey – BGS - in Edinburgh), the ECORD Science Support and Advisory Committee (National Institute of Oceanography and Experimental Geophysics – OGS - in Trieste) and the Bremen Core Repository (BCR) through 2024.

The current IODP partners agreed on the extension of IODP through 2024 during the IODP Forum meeting that has been held in Rome, Italy, on 11-12 October 2021. The end of the International Ocean Discovery Program is now planned on 30 September 2024.

This 2021 Annual Report demonstrates that the ECORD science community is very healthy, especially through its leading role in the submission of drilling proposals, its massive and sustained participation to IODP expeditions and in the publication and promotion of cutting-edge results related to the successive ocean drilling programmes.



Freshly obtained cores onboard R/V *Kaimei* during IODP Expedition 386.
Credits: N. Okutsu, ECORD/IODP/JAMSTEC.

ECORD budget

ECORD is currently funded exclusively by its 15 members. In FY21, the total ECORD budget amounted to $17.43M, showing an increase of about $650K compared to the FY20 budget. (see section 9, page XX). Since 2014, the ECORD budget decrease is of $1.5M, mainly due to strong fluctuations in exchange rates between the US Dollar and the national currency contributions of five ECORD countries (France, UK, Denmark, Spain and Ireland).

The ECORD running costs were very stable in 2021, amounting to less than 10% of the members' contributions. With an expected stable budget during the second phase of the programme, more than 90% of which being dedicated to the funding of IODP expeditions.

The ECORD budget is seen as a minimum budget due to the opportunity for members to make direct cash and/or in-kind contributions (IKC), in exchange of extra science party positions. IKC correspond to direct operational facilities and services that the ECORD Science Operator (ESO) would normally pay for.

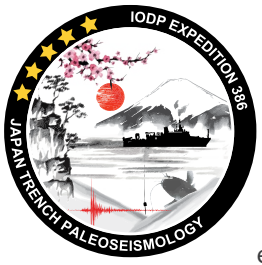
The contributions to the ECORD budget are unevenly distributed between its members, ranging from $5.6M to $80K (see section 9, page XX). The three major ECORD contributors, Germany ($5.6M), France ($4.33M) and UK ($3.54M), provide 77.3% of the total ECORD budget. The contributions of other member countries range from $80K to $1.1M.

The ECORD budget shows a positive balance of $22,678,386 at the end of 2021 and this sum will be carried forward to the ECORD FY22 budget.

Freshly obtained cores onboard R/V *Kaimei* during IODP Expedition 386.
Credits: N. Okutsu, ECORD/IODP/JAMSTEC.

Mission-specific platform (MSP) expeditions
are ECORD's landmark since 2004.

ECORD is one of the three IODP Platform Providers since 2013.



Expedition 386: Japan Trench Paleoseismology

The Expedition 386: Japan Trench Paleoseismology (Co-chief Scientists: M. Strasser, ECORD-Austria and Ken Ikehara, Japan) has been the first IODP expedition implemented since January 2020 and has been the fourth full expedition implemented by ECORD for IODP since 2013, after Expedition 357: Atlantis Massif Serpentinization and Life (2015), Expedition 364: Chicxulub Impact Crater (2016) and Expedition 381: Corinth Corinth Active Rift Development. This expedition aimed at reconstructing the Late Pleistocene-Holocene history of giant earthquakes, which are major geological events with catastrophic societal consequences.

The offshore phase, conducted with the Japan Agency for Marine-Earth Science and Technology (JAMSTEC)-operated R/V *Kaimei* in spring 2021 (13 April - 1 June 2021), has been very successful. The onshore phase on board D/V *Chikyu* docked in Shimizu that was originally planned on 6 October 2021, has been postponed to February 2022 (see 2 – Operating and participating in MSP expeditions). Besides its operational success, this expedition has demonstrated that a collaborative approach involving different IODP Platform Providers (ECORD Science Operator - ESO - and the Institute for Marine-Earth Exploration and Engineering - MarE3 - within JAMSTEC in the case of IODP Expedition 386) and the provision of in-kind contributions (IKC) represent a model for future scientific ocean drilling expeditions implemented in an MSP mode.

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Expedition 377: Central Arctic Paleoceanography (ArcOP)

Since 2020, ESO and EMA have collaborated with the Swedish Polar Research Secretariat (SPRS) to set up operational, funding and communication plans related to the implementation of IODP Expedition 377: Central Arctic Paleoceanography (ArcOP; Co-chief Scientists: R. Stein, ECORD-Germany and K. St. John, USA) that was recommended for scheduling by the ECORD Facility Board (EFB) in March 2019.

This expedition, which has been considered as a first-priority expedition for ECORD by the EFB, aims at reconstructing the long-term Cenozoic climate history of the central Arctic Ocean. The offshore phase is now scheduled in August and September 2022 (see Anticipating future MSP expeditions, *page 47*) and will benefit from IKCs provided by SPRS and the Federal Institute for Geosciences and Natural Resources (BGR) in Hannover, Germany.

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Expedition 389: Hawaiian Drowned Reefs

At its last meeting that was held on 29-30 September 2021 in Trieste, Italy, the EFB has recommended the scheduling of IODP Expedition 389: Hawaiian Drowned Reefs (Co-chief Scientists: J. Webster, ANZIC and A. C. Ravelo, USA), which aims at generating a record of sea-level change and associated climate variability during several controversial and poorly understood periods over the last 500 kyr. The scheduling of this expedition has been approved by the ECORD Council at its last meeting and its implementation is now planned for September-October 2023 (see Anticipating future MSP expeditions, *page 47*).

More on page 56

Based on budget predictions, another MSP expedition could be planned for 2024, provided that the current programme is extended through 2024. Such an expedition should be based on one of the MSP proposals currently residing at the EFB and will be defined at the next EFB meeting that will be held on 20-21 September 2022 in Aix-en-Provence, France.

The eleven MSP proposals that currently reside at the EFB and at the Science Evaluation Panel (SEP), as well as the MSP drilling proposals that will arise from MagellanPlus workshops that will be held within the next two years (see 7 – Engaging the community), may form the basis of the post-2024 MSP expedition schedule. The success of the last MagellanPlus specific call for workshop proposals with scientific themes aligned with the Strategic Objectives defined in the 2050 Science Framework (*https://www.ecord.org/science/magellanplus/*) demonstrates the prominent role that MSP expeditions will play in the future.

The scientific objectives of the active MSP proposals and of the MagellanPlus workshops focused on MSP drilling are quite diverse in terms of science topics, drilling and coring systems and geographical areas, thus illustrating the contribution of the MSP concept to the IODP science.

To further increase operational flexibility of MSP expeditions and to offer more opportunities to the science community, ECORD has defined new options to the proponents through the definition of various implementation plans, including a Basic Plan that will correspond to the minimum requirements for expedition success, and variable operational times that are shorter than the standard two-month expedition. This might serve as a model for the implementation of drilling expeditions in the future.

Sampling cores onboard R/V *Kaimei* during IODP Expedition 386.
Credits: K. Ikehara, ECORD/IODP/JAMSTEC.

ECORD partnership: *JOIDES Resolution* and *Chikyu* expeditions

ECORD's partnership with NSF and JAMSTEC is based on Memoranda of Understanding (MoU) that allow ECORD scientists to participate to expeditions implemented by the *JOIDES Resolution* (JR) and *Chikyu* (*http://www.iodp.org/expeditions*).

At its last meeting that was held remotely on 13-14 July 2021, the *Chikyu* IODP Board (CIB) has recognized that the currently accepted but unimplemented/unscheduled deep-riser drilling projects using *Chikyu* will not be completed during the current phase of IODP. In addition, the CIB has decided that no new *Chikyu* proposals will be accepted in the current phase of the programme. Only riserless drilling proposals currently at SEP will be considered for possible implementation in the 2024/2025 operation window(s) that will include a total of three months for IODP expeditions.

JOIDES Resolution expeditions

Twenty-one ECORD scientists, including three Co-chief Scientists and seven scientists staffed in response to Special Calls were invited to participate to two expeditions that were implemented in 2021 by the JR, albeit with reduced shipboard science parties (see table below and 4 - ECORD participation in IODP expeditions in 2021 on *page 66*):

1. **Expedition 395C: Reykjanes Mantle Convection and Climate** (6 June - 6 August 2021) has been the first expedition implemented by the JR after the most critical phase of the COVID-19 pandemic that started soon after the implementation of IODP Expedition 378: South Pacific Paleogene Climate (3 January - 6 February 2020). While most of Expedition 395 has been postponed to summer 2023, some aspects have been done in 2021. IODP Expedition 395C carried out the general planned objectives of IODP Expedition 395, including testing contrasting hypotheses for the formation of V-Shaped Ridges, understanding temporal changes in ocean circulation and explore connections with plume activity, and reconstructing the evolving chemistry of hydrothermal fluids with increasing crustal age and varying sediment thickness and crustal architecture.

2. **Expedition 396: Mid-Norwegian Continental Margin Magma** (6 August - 6 October 2021) aimed at providing constraints for geodynamic models to test different hypotheses that can explain the rapid emplacement of large igneous provinces and to test the hypothesis that the associated Paleocene/Eocene Thermal Maximum was caused by hydrothermal release of carbon in response to magmatic intrusions.

2021 *JOIDES Resolution* expeditions

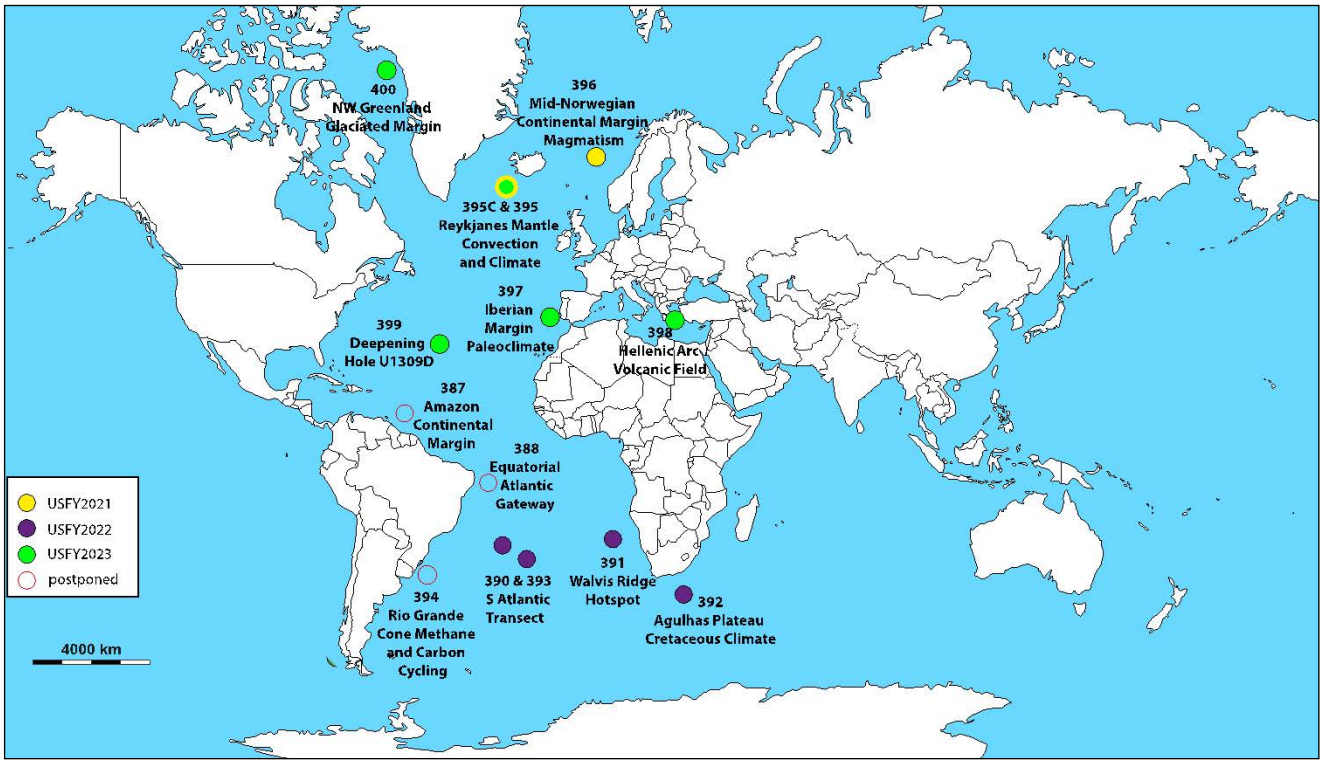
Expedition name	#	Dates	Ports
Reykjanes Mantle Convection and Climate	395C	6 Jun - 6 Aug 2021	Reykjavik / Reykjavik
Mid-Norwegian Continental Margin Magmatism	396	6 Aug - 6 Oct 2021	Reykjavik / Kristiansand

The JR has started in December 2021 the implementation of IODP Expedition 391: Walvis Ridge Hotspot before she implements a series of four expeditions in the Southern Atlantic from December 2021 to August 2022, IODP Expedition 391: Walvis Ridge Hotspot, IODP Expedition 392: Agulhas Plateau Cretaceous Climate, and IODP Expeditions 390 and 393: South Atlantic Transects 1 and 2 (see map and table below). The U.S. FY23 JR scheduling includes five expeditions from October 2022 through September 2023 (see map and table below), IODP Expedition 397: Iberian Margin Paleoclimate, IODP Expedition 398: Hellenic Arc Volcanic Field, IODP Expedition 399: Deepening Hole U1309D, IODP Expedition 395: Reykjanes Mantle Convection and Climate and IODP Expedition 400: NW Greenland Glaciated Margin. Seven out of the ten proposals supporting the 2021-2023 JR expeditions are led by an ECORD scientist.

2022 *JOIDES Resolution* expeditions

Expedition name	#	Dates	Ports
Walvis Ridge Hotspot	391	6 Dec 2021 - 5 Feb 2022	Cape Town / Cape Town
Agulhas Plateau Cretaceous Climate	392	5 Feb - 7 Apr 2022	Cape Town / Cape Town
South Atlantic Transect, Expedition #1	390	7 Apr - 7 Jun 2022	Cape Town / Montevideo
South Atlantic Transect, Expedition #2	393	7 Jun - 7 Aug 2022	Montevideo / Montevideo
Iberian Margin Paleoclimate	397	6 Oct - 6 Dec 2022	Lisbon / Tarragona
Hellenic Arc Volcanic Field	398	6 Dec 2022 - 5 Feb 2023	Tarragona / Heraklion
Deepening Hole U1309D	399	7 Apr - 7 Jun 2023	Ponta Delgada / Ponta Delgada
Reykjanes Mantle Convection and Climate	395	7 Jun - 7 Aug 2023	Ponta Delgada / St. Johns
NW Greenland Glaciated Margin	400	7 Aug - 7 Oct 2023	St. Johns / St. Johns

2021-2023 *JOIDES Resolution* expeditions



Three expeditions that were initially scheduled in 2020 have been postponed, IODP Expedition 387: Amazon Continental Margin, IODP Expedition 388: Equatorial Atlantic Gateway and IODP Expedition 394: Rio Grande Cone Methane and Carbon Cycling due to a lack of permission to drill in Brazilian waters.

At its last meeting that was held in a hybrid form (San Diego, CA and remotely) on 23 - 25 June 2021, the *JOIDES Resolution* Facility Board (JRFB) has confirmed that no new proposals that require the JR to address the Science Plan will be accepted, with the exception of proposals reviewed by the SEP in 2020 that were deactivated, but encouraged to re-apply.

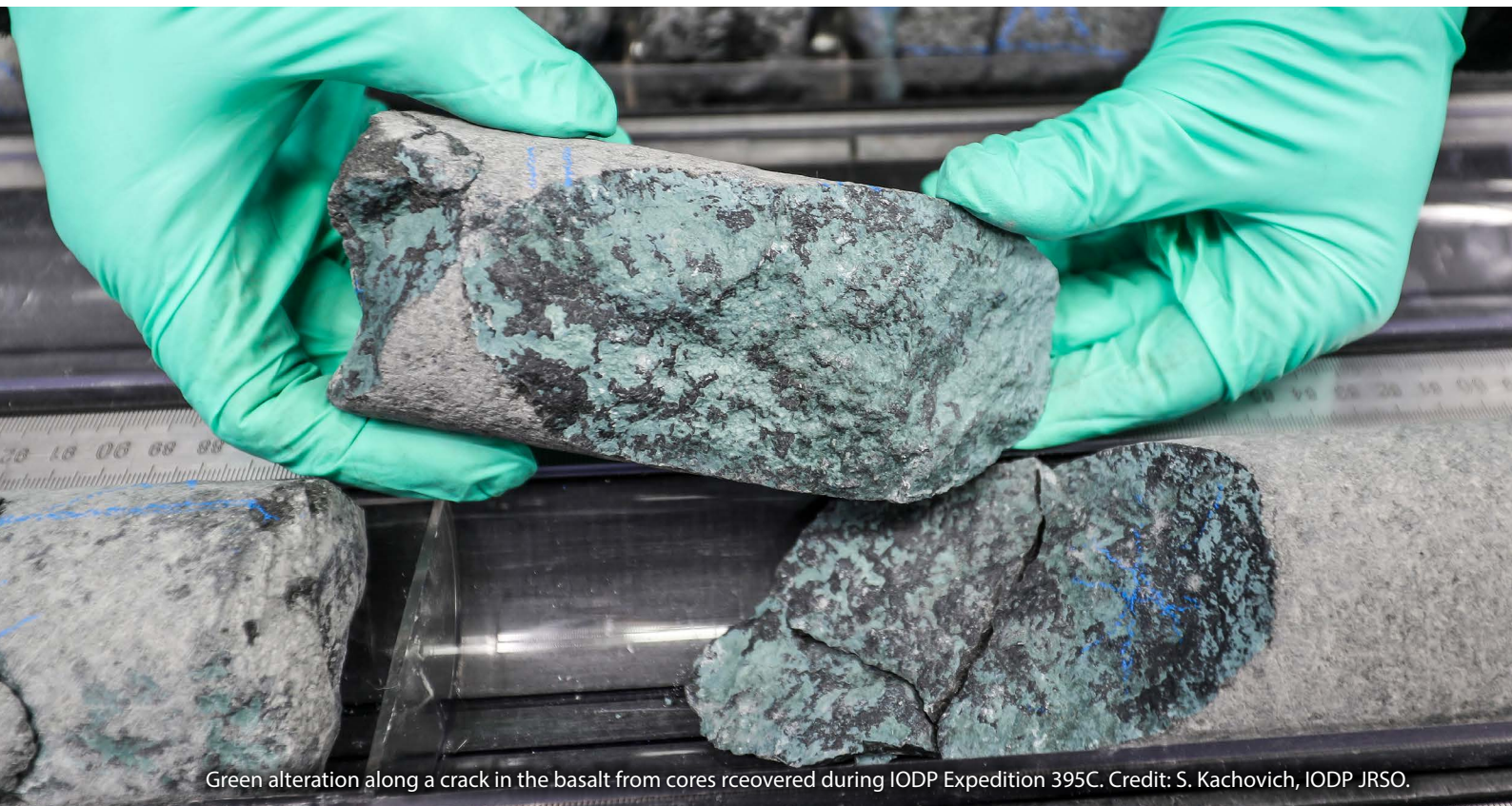
The JRFB also considered the future of the 'orphan' sites that correspond to unimplemented sites on the board for later completion in exceptional circumstances (e.g., mechanical failures of the JR). The JRFB decided that 12 orphan sites from five expeditions will require submission of revised versions that follow the guidelines for proposals addressing the 2050 Science Framework before being reviewed for potential future implementations.

Finally, the JRFB has recommended that, in light of the proposal pressure in the Atlantic Ocean, the JR will stay in the Atlantic Ocean with the possibility of eastern Pacific Ocean drilling through the end of the current programme.

Anticipating next IODP expeditions

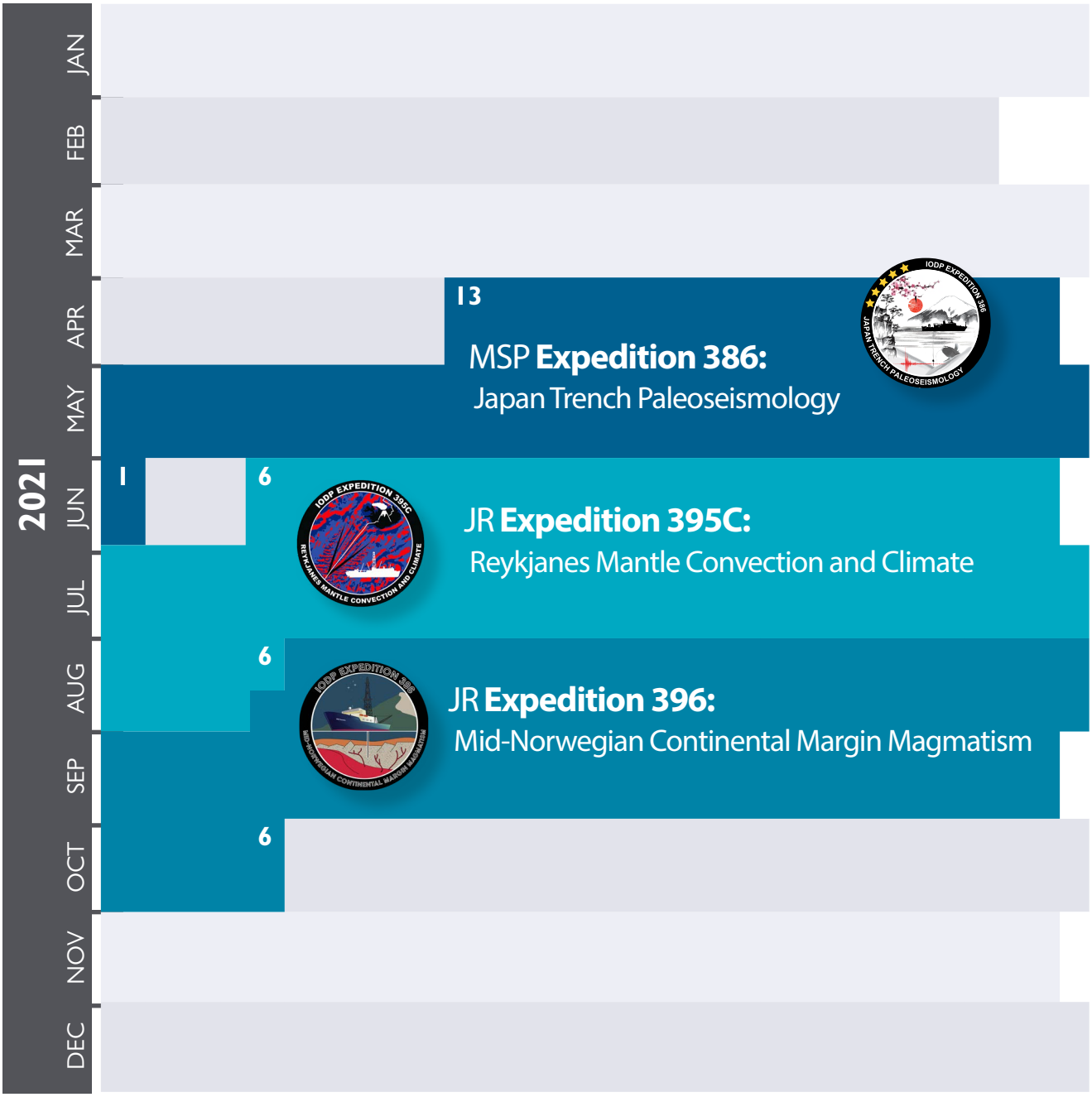
New IODP Proposals

Thirty-two new IODP proposals have been submitted in 2019, i.e. the double than in 2018 (32 vs 16). This is the highest number of new proposals since 2014 – at the start of the current programme - when 36 new proposals were submitted. This demonstrates a strong scientific demand and a sustained involvement of the scientific community in IODP science. This has to be interpreted as a strong signal sent by the scientific community while the IODP partners started to consider and prepare the future of international scientific ocean drilling beyond 2023.



Green alteration along a crack in the basalt from cores rceovered during IODP Expedition 395C. Credit: S. Kachovich, IODP JRSO.

IODP expeditions 2021 calendar



Anticipating next IODP expeditions

New IODP Proposals

Seven new IODP proposals have been submitted in 2021. This is the lowest number of new proposals in a year since the start of the current Program, probably as a consequence of recent JRFB and CIB decisions regarding the acceptance of new proposals.

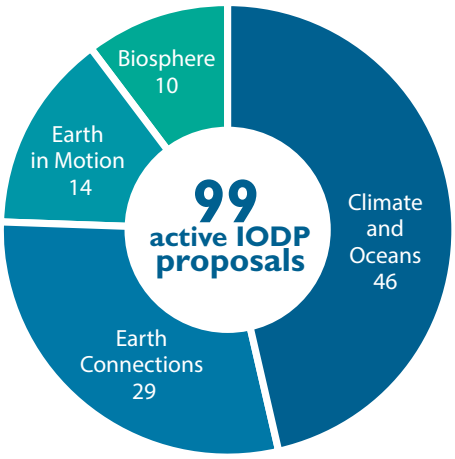
Active IODP Proposals

There are currently 99 active IODP proposals in the archives of the Science Support Office (as of 26 October 2021). Their distribution across the Science Plan themes demonstrates a good to very good proposal pressure in all objectives of the Science Plan (see digram at the top) and rather constant ratios between the two leading themes - Climate and Ocean (46%) and Earth Connections (30%) - and the Earth and Motion (14%), and Biosphere (10%) themes.

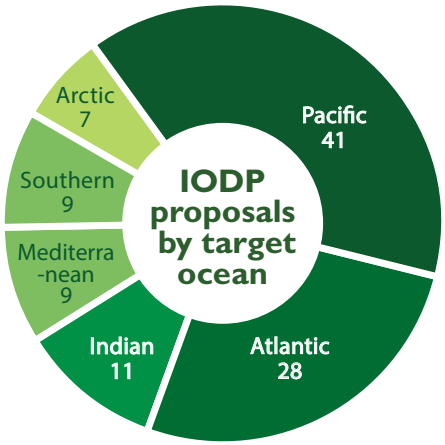
The geographical distribution of active proposals (see diagram on the right) demonstrates global interest of the scientific community and fairly constant ratios between the different oceans, with a sustained interest for the Atlantic Ocean and the Mediterranean that has been encouraged by the FY22 and FY23 JR track .

Fifty-seven active proposals are residing at the appropriate Facility Boards ready to be selected for drilling (43 at the JRFB, seven at the CIB and five at the EFB). Forty-two active proposals are residing at the Science Evaluation Panel.

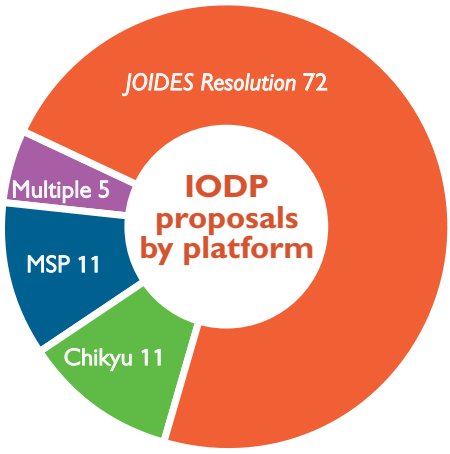
Seventy-two proposals (72.7% of all proposals) concern aim at using the JR, while the number of proposals concerning the other platforms remained fairly constant since several years: 11 MSP and *Chikyu* proposals (11% of all proposals for each); five active proposals concern the use of multiple platforms (see diagram at the bottom). However, the organization and the planning of several MagellanPlus workshops focused on MSP drilling indicate that the number of MSP proposals should sharply increase in the near future and should form the basis of the post-2024 MSP operational plan.



Distribution of active proposals (n = 99)
by IODP Science Plan themes
(Data provided by the IODP Science Support Office
as of 26 October 2021)



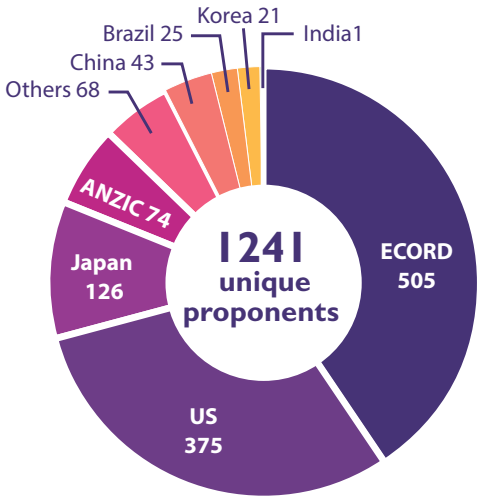
Distribution of active proposals (n = 99) by target ocean
(Data provided by the IODP Science Support Office
as of 26 October 2021)



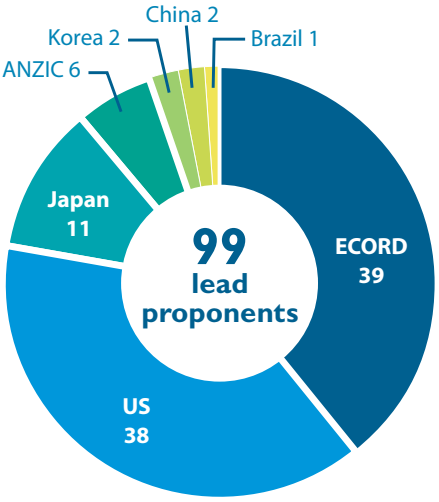
Distribution of IODP active proposals by platforms (n = 99).
Multiple proposals consist of combined *Chikyu* and JR drilling.
(Data provided by the IODP Science Support Office
as of 26 October 2021)

Proponents

Since the start of the current programme, ECORD is providing a huge contribution to IODP science, including the submission of drilling proposals concerning all IODP capabilities. ECORD has a leading role in proposal submission the current programme with percentages of unique proponents constantly above 37% since the start of IODP. Currently, 505 ECORD scientists out of 1241 are proponents of active IODP proposals (i.e. 40.7%), including 39 lead proponents (see figures below).



Distribution of active proposals (n = 99)
by proponents' member affiliation
(Data provided by the IODP Science Support Office
as of 26 October 2021)



Distribution of active proposals (n = 99)
by lead proponents' member affiliation
(Data provided by the IODP Science Support Office
as of 26 October 2021)

Promoting IODP science

The Scientific Ocean Drilling Bibliographic Database and Publication Impact Report (*https://iodp.tamu.edu/publications/AGI_studies/2021_Pub_Impact.pdf*), which is published annually, monitors the valorization of Programme science through publications related to successive ocean drilling programmes from 1969 through July 2021. A total of 6,284 research papers out of 12,262 Program-related papers that have been published in non-Program publications (~51% of the serial publications in the database) were published in 30 highly ranked peer-reviewed journals, based on the Clarivate Analytics 2020 journal impact factor (table below). This demonstrates the impact of the ocean drilling science and the attractivity exerted by the scientific ocean drilling programmes on the science community. It must be reminded here that scientists were encouraged to publish post-cruise research results in English language peer-reviewed journals rather than the Program Proceedings volumes since 1996 only.

Journal	Journal Impact Factor (2020)	Number of Program-related papers published		
		1969–2002	2003–2021	Total
Nature	49.962	239	86	325
Science	47.728	105	104	209
Nature Geoscience	16.908	0	85	85
Earth-Science Reviews	12.413	2	39	41
Proceedings of the National Academy of Sciences of the U.S.A.	11.205	0	69	69
Geology	5.399	244	260	504
Earth and Planetary Science Letters	5.255	265	502	767
Global and Planetary Change	5.114	12	77	89
Geochimica et Cosmochimica Acta	5.010	115	184	299
Geological Society of America Bulletin	4.799	87	32	119
Geophysical Research Letters	4.720	92	130	222
Journal of Petrology	4.515	22	27	49
Marine and Petroleum Geology	4.348	29	68	97
Climate of the Past	4.295	0	121	121
Sedimentology	4.155	21	31	52
Quaternary Science Reviews	4.112	19	147	166
Contributions to Mineralogy and Petrology	4.076	27	40	67
Chemical Geology	4.015	53	127	180
Lithos	4.004	5	42	47
Tectonophysics	3.933	22	60	82
Journal of Geophysical Research (Solid Earth, Oceans)	3.848/3.405	255	156	411
Geochemistry, Geophysics, Geosystems	3.624	35	411	446
Organic Geochemistry	3.607	30	48	78
Marine Geology	3.548	222	239	461
AAPG Bulletin	3.529	27	15	42
Sedimentary Geology	3.397	27	33	60
Journal of Sedimentary Research	3.324	15	26	41
Palaeogeography, Palaeoclimatology, Palaeoecology	3.318	100	316	416
Geosphere	3.298	0	43	43
Paleoceanography and Paleoclimatology*	3.277	177	519	696

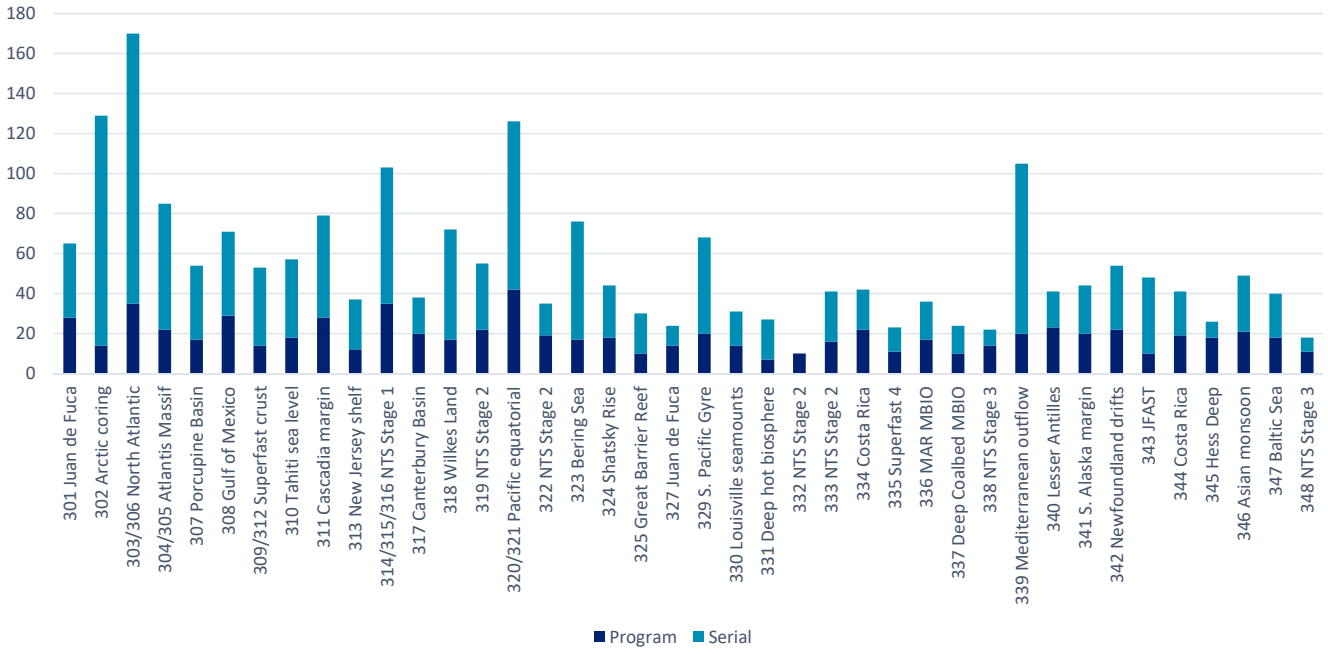
Table illustrating serial publication for peer-reviewed serials showing counts by first author, contributing country, contributing authors, and total contributions by all authors from current IODP member countries (1969–2021).

As every year, the 2021 Scientific Ocean Drilling Bibliographic Database and Publication Impact Report reflects the outstanding intellectual contribution of the ECORD scientists to IODP science. With 12,477 out of 29,368 serial contributions (about 42.5% of total publications) related to the successive ocean drilling programmes, the ECORD science community demonstrates its leading role in the international geoscience landscape (see table below).

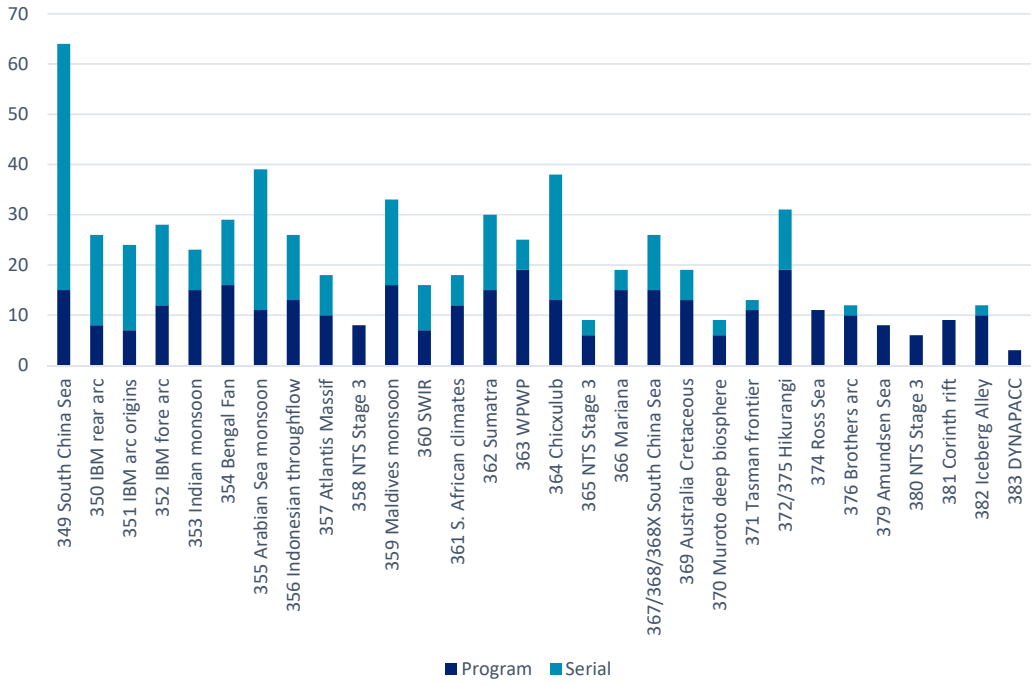
Member country or consortia	First authors of serials	Serial contributions by country	Serial contributions by author	Total contributions
Australia/New Zealand Consortium	369	582	741	1,110
Australia	216	387	473	689
New Zealand	153	195	268	421
Brazil	32	59	65	97
China	546	456	634	1,180
ECORD	**4,561**	**6,171**	**7,916**	**12,477**
Austria	24	58	60	84
Canada	349	444	528	877
Denmark	62	119	133	195
Finland	10	13	16	26
France	661	887	1,238	1,899
Germany	1,112	1,383	1,798	2,910
Ireland	5	25	27	32
Italy	307	402	528	835
Netherlands	245	317	345	590
Norway	150	212	246	396
Portugal	19	57	68	87
Spain	176	293	364	540
Sweden	118	164	173	291
Switzerland	158	250	271	429
United Kingdom	1,165	1,547	2,121	3,286
India	190	124	154	344
Japan	776	969	2,098	2,874
Republic of Korea	63	114	130	193
United States	4,240	3,713	6,853	11,093
Total papers:	**10,777**			**29,368**

Table illustrating serial publication authorship by first author, contributing country, contributing authors, and total contributions (1969–2021). Theses and dissertations are underreported to AGI and are not fully represented.

The MSP expeditions, which are implemented only since 2004 and represent less than 10% of the number of IODP expeditions, have generated a significant proportion of the peer-reviewed scientific publications arising from the programmes (see figures below).



Number of Program and serial publication records for Integrated Ocean Drilling Program Expeditions 301–348 (2003–2021). MSP expeditions are Expeditions 302, 310, 313, 325 and 347.
MSP expeditions 310 and 325 should be combined as they are based on the same proposal (#519)



Number of Program and serial publication records for IODP Expeditions 349–372, 374–376, and 379–383 (2003–2021). MSP expeditions are Expeditions 357, 364 and 381.

The list of the most-cited IODP expedition–related papers as of July 2021 illustrates the high-impact and high-quality science achieved by MSP expeditions (see table below).

Article	Citations (*N*)	Altmetric score
Kallmeyer, J., Pockalny, R., Adhikari, R.R., Smith, D.C., and D'Hondt, S., 2012. Global distribution of microbial abundance and biomass in subseafloor sediment. Proceedings of the National Academy of Sciences of the United States of America, 109(40):16213–16216. **https://doi.org/10.1073/pnas.1203849109**	739	
Sluijs, A., Schouten, S., Pagani, M., Woltering, M., Brinkhuis, H., Sinninghe Damsté, J.S., Dickens, G.R., et al., 2006. Subtropical Arctic Ocean temperatures during the Palaeocene/Eocene Thermal Maximum. Nature, 441(7093):610–613. **https://doi.org/10.1038/nature04668**	702	
Lipp, J.S., Morono, Y., Inagaki, F., and Hinrichs, K.-U., 2008. Significant contribution of Archaea to extant biomass in marine subsurface sediments. Nature, 454(7207):991–994. **https://doi.org/10.1038/nature07174**	591	
Moran, K., Backman, J., Brinkhuis, H., Clemens, S.C., Cronin, T., Dickens, G.R., Eynaud, F., et al., 2006. The Cenozoic palaeoenvironment of the Arctic Ocean. Nature, 441(7093):601–605. **https://doi.org/10.1038/nature04800**	583	
Grimes, C.B., John, B.E., Kelemen, P.B., Mazdab, F.K., Wooden, J.L., Cheadle, M.J., Hanghøj, K., and Schwartz, J.J., 2007. Trace element chemistry of zircons from oceanic crust: a method for distinguishing detrital zircon provenance. Geology, 35(7):643–646. **https://doi.org/10.1130/G23603A.1**	549	
Jakobbson, M., Macnab, R., Mayer, L., Anderson, R., Edwards, M., Hatzky, J., Schenke, H.W., and Johnson, P., 2008. An improved bathymetric portrayal of the Arctic Ocean: Implications for ocean modeling and geological, geophysical and oceanographic analyses. Geophysical Research Letters, 35(7):L07602. **https://doi.org/10.1029/2008GL033520**	516	
Deschamps, P., Durand, N., Bard, E., Hamelin, B., Camoin, G., Thomas, A.L., Henderson, G.M., Okuno, J., and Yokoyama, Y., 2012. Ice-sheet collapse and sea-level rise at the Bølling warming 14,600 years ago. Nature, 483(7391):559–564. **https://doi.org/10.1038/nature10902**	462	
Moore, G.F., Bangs, N.L., Taira, A., Kuramoto, S., Pangborn, E., and Tobin, H.J., 2007. Three-dimensional splay fault geometry and implications for tsunami generation. Science, 318(5853):1128–1131. **https://doi.org/10.1126/science.1147195**	395	
Frost, B.R., and Beard, J.S., 2007. On silica activity and serpentinization. Journal of Petrology, 48(7):1351–1368. **https://doi.org/10.1093/petrology/egm021**	392	Not available
Pagani, M., Pedentchouk, N., Huber, M., Sluijs, A., Schouten, S., Brinkhuis, H., Sinninghe Damsté, J.S., Dickens, G.R., and Expedition 302 Scientists, 2006. Arctic hydrology during global warming at the Palaeocene/Eocene Thermal Maximum. Nature, 443(7103):671–675. **https://doi.org/10.1038/nature05043**	372	

Table illustration number of Program and serial publication records for IODP Expeditions 349–372, 374–376, and 379–383 (2003–2021). MSP expeditions are Expeditions 357, 364 and 381.

Figure below shows all publication records related to IODP (Expeditions 349–372, 374–376, and 379–383) and sorted by the themes and challenges of the IODP science plan (Illuminating Earth's Past, Present, and Future: The Science Plan for the International Ocean Discovery Program 2013–2023). Science plan themes are tied to the primary objectives of each expedition.

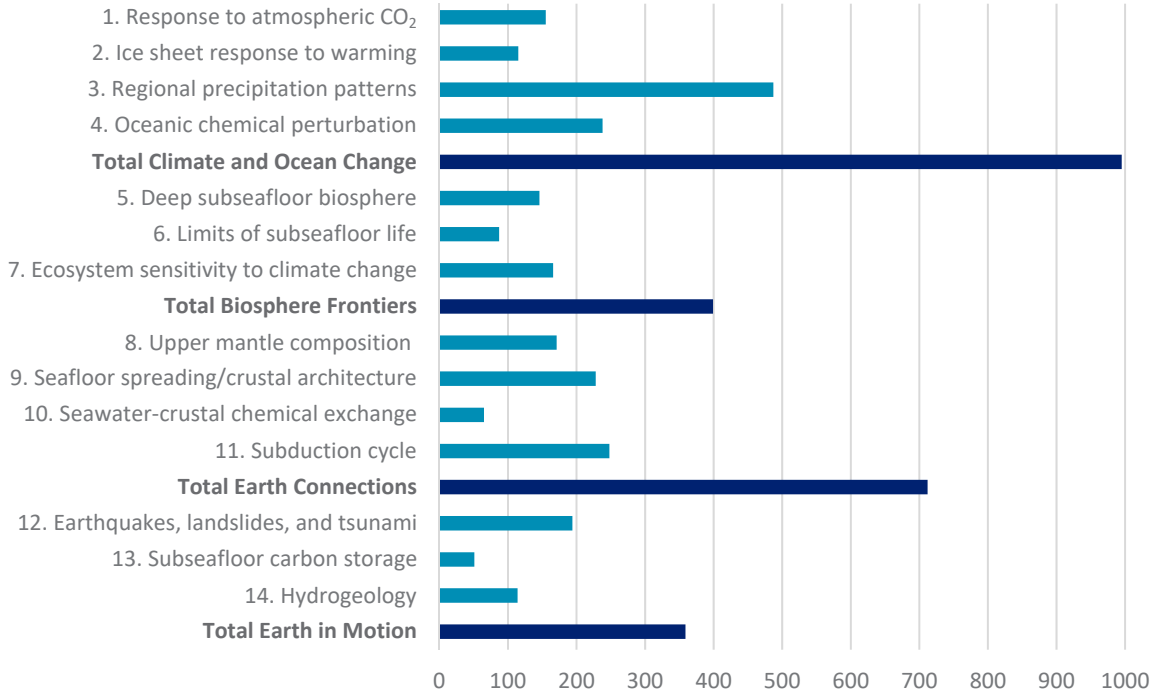


Figure illustrating the International Ocean Discovery Program publication records (all types) by IODP Science Plan theme (2013–2021).

Managing knowledge-based resources

IODP and ECORD implement a sustainable sample and data curation management plan of data conservation and provision to the science community.

Hundreds of kilometres of core, other types of samples (fluids, biota) and data have been acquired and stored in three core repositories (Gulf Coast Repository, College Station, USA; Kochi Core Center, Kochi, Japan; Bremen Core Repository – BCR, Bremen, Germany) where they are made accessible to the international community for post-moratorium studies.

The BCR hosts all the cores recovered since the beginning of scientific ocean drilling from the Atlantic and Arctic oceans as well as the Mediterranean, Baltic and Black Seas. The collection at the BCR currently holds more than 160 km of cores acquired during 91 expeditions. The activities of the BCR have been heavily impacted by the COVID-19 pandemic in 2021, but IODP sample requests were accepted throughout the year, even if the completion and shipment of requested samples was sometimes slightly delayed. In 2021, a total of 20,899 samples were taken at the BCR for 178 requests (of which 110 were submitted by scientists based in an ECORD country).

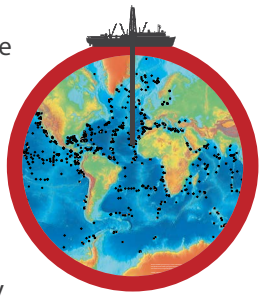
All cores collected during expeditions that will be implemented by the JR in the Atlantic Ocean from 2021 through at least 2023 (see 'ECORD partnership: *JOIDES Resolution* and *Chikyu* expeditions' section on *page 18*), will be stored at BCR before the end of the current programme.

ECORD has developed and maintained several databases in order to make available to the science community all the necessary information to the development of drilling proposals and to allow the scientists to get access to the data collected during the drilling expeditions and keep track of ECORD activities in IODP (see 6. Archiving IODP cores: the Bremen Core Repository, *page 84*). In particular, over 1.78 million samples that were taken on cores that are stored at the BCR are entered into a database, the 'BCR DIS Internet Interface', that is accessible to the general public for post-moratorium samples.

MagellanPlus Workshop Series Programme

The leading role of ECORD scientists in the submission of IODP proposals partly relies on the success of the ECORD-ICDP MagellanPlus Workshop Series Programme (*http://www.ecord.org/science/magellanplus/*; See 7. Engaging the community on *page 90*), which provides a substantial support to ECORD scientists to develop innovative drilling proposals concerning diverse scientific topics addressed by the three IODP platforms and/or the ICDP infrastructure.

Since 2014, 35 MagellanPlus workshops have been organized (on average four workshops per year), involving about 1,100 scientists (23% of early-career scientists on average), and 24 drilling proposals were submitted (see figure below).



The MagellanPlus Programme has been heavily impacted by the COVID-19 pandemic and this programme could restart in late 2021 with the organization of two workshops: 'Black Sea – Mediterranean Gateway Exchange' (22-24 September 2021, Frankfurt, Germany) and 'Mechanisms of rifting of large continental blocks – a case study at the Baltic Sea' (1-3 December 2021, Helsinki, Finland). All workshops that were initially scheduled in 2020 and 2021 will be held in 2022.

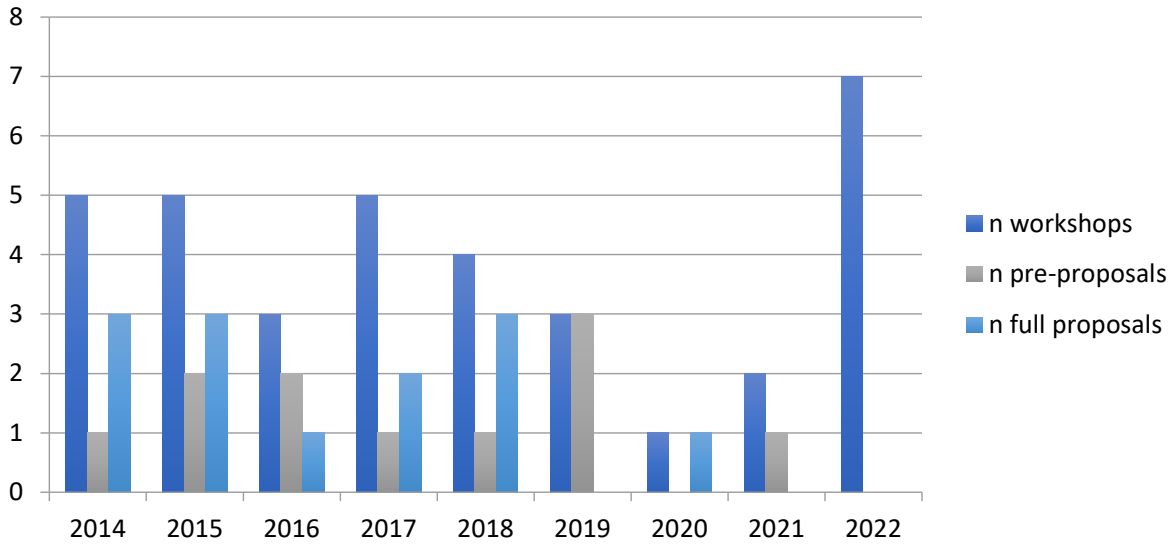


Figure illustrating the MagellanPlus workshops and related proposals since 2014.

ECORD educational activities

Promoting IODP science in ECORD and non-ECORD countries and training the next generation of scientists from ECORD members are major goals for ECORD.

The outstanding portfolio of science and educational activities that ECORD has gradually developed over the last years with high demand from scientists, students and early-career scientists (See 7. Engaging the community, *page 90*).

All ECORD Summer Schools, Scholarships and Training Courses were cancelled in 2020 due to the COVID-19 pandemic.

The 5th 'ECORD Summer School: Downhole-Logging for IODP Science' (formerly 'Petrophysics Summer School') has been organized virtually on 13-17 September 2021.

Ten ECORD Research Grants (*http://www.ecord.org/education/research-grant/*) were awarded in 2021 to PhD students and early-career scientists to conduct research on core material and data related to past DSDP / ODP / IODP expeditions and collaborate with other research groups outside their home institutions.

Promoting activities and accomplishments of IODP to various audiences, including scientists, classrooms and the general public, is a major goal of ECORD through its Outreach Task Force (EOTF).

After cancellation in 2020, the EGU was organized virtually in 2021. ECORD presented a booth in collaboration with ICDP under the umbrella of 'Scientific Drilling' as well as a virtual townhall meeting.

In a similar way, ECORD was associated with our US and Japanese IODP partners and ICDP to organize a booth and daily online chats at the AGU 2021 fall meeting, which was held in a hybrid mode.

The EOTF constantly updates and creates communication and educational material (core replicas, leaflets, videos, brochures, etc.) that are distributed across the ECORD members for exhibitions and exhibition booths, as well as through the MagellanPlus workshops and ECORD Training Course and Summer Schools (see section 8. Communicating on *page 102*).

In addition, since 2019, the EOTF has developed exhibition material for temporary exhibitions in museums and aquariums, thus ushering a new communication environment for ECORD. Unfortunately, plans that have been developed with some museums have been postponed to late 2022 due to the COVID-19 pandemic.

Among the new resources that have been produced, the ECORD Puffersphere has been completed in early 2021 and tested by the EOTF before being displayed for the first time in June 2022 in Trieste. In parallel, new core replicas have been ordered and coral models fabricated.

News promoting ECORD and MSP expeditions frequently appear on national and international Internet portals, TV stations and newspapers. In parallel, the EOTF has prepared the communication plan and promotional material concerning the MSP expeditions 386: Japan Trench Paleoseismology and 377: Arctic Ocean Paleoceanography (ArcOP), as well as the planning of a TV documentary focused on ArcOP.

Zoom chat between offshore and onshore teams from onboard R/V *Kaimei* during IODP Expedition 386. Credits: N. Okutsu, ECORD/IODP/JAMSTEC.

The end of the International Ocean Discovery Program is now planned on 30 September 2024

Over the last months, ECORD has been actively involved in the planning of post-2024 international scientific ocean drilling initiative(s) that will be based on the 2050 Science Framework and in which ECORD intends to play a prominent role.

ECORD has started in late 2021 to define and shape its post-2024 plans internally, especially through the instrumental role of the ECORD Vision Task Force and via continuous exchanges between all ECORD entities. ECORD has also exchanged views on the future with all its current partners through our regular channels of communications and via bilateral meetings despite the impact of the COVID-19 pandemic on our ability to hold in-person discussions. Further bilateral meetings and direct discussions with partners are planned and will be of pivotal importance in coming weeks and months.

ECORD's emerging plans are based on:

1. a commitment to the 'philosophy' of the successive scientific ocean drilling programmes to date;
2. the legacy of its achievements, success and innovations since 2004; and
3. the need to adopt an innovative approach tailored to meet the needs of the post-2024 international landscape.

The broad outlines of ECORD's plans have already been presented during IODP meetings (Facility Boards and Forum meetings) and have culminated in the recent IODP Forum and Inter-Governmental meetings that were held in a hybrid form on 11-13 October 2021 (Rome, Italy).

The 2050 Science Framework (*http://www.iodp.org/2050-science-framework*), which represents a new and innovative approach for conducting science using offshore drilling platforms, must be the foundation of such future initiatives. Based on the well-established operation of the ECORD infrastructure, its successful implementation, its competitiveness in the international research landscape and maximum return from investment, ECORD intends to continue to play a prominent role in post-2024 scientific ocean drilling.

A prominent role for Mission-Specific Platforms (MSP)

Mission-Specific Platform (MSP) expeditions will play a prominent role in achieving the goals of the 2050 Science Framework.

Diversification of drilling and coring technologies

ECORD intends to further develop the MSP concept by diversifying drilling and coring technologies, including riserless drilling, and applying them to all geological environments, as determined by scientific priorities, operational efficiency and better value for money.

Active collaboration with other platform providers

ECORD intends to foster active collaboration with other platform providers, as well as other programmes and initiatives with similar scientific objectives, and implement joint expeditions in "MSP-mode", regardless of the technology and/or the drilling/coring needs.

Any development of post-2024 international scientific ocean drilling initiatives will require current and new platform providers to confirm their participation and work together on a sustainable implementation model, including use of available facilities, core and data legacy agreements and general coordination of independent programmes under the auspices of an 'Alliance'.

There are still uncertainties regarding the availability of drilling platforms to conduct post-2024 scientific drilling related the 2050 Science Framework.

NSF has considered the potential use of the JR in a non IODP-style context beyond 2024. At its 2021 Autumn meeting, the ECORD Council has expressed interest in obtaining details about operational costs associated with the post-2024 use of the JR. This information will be essential for a cost-benefit analysis before any decision can be taken. A possible demobilization of the JR in 2025 will be considered if a viable business model cannot be defined. In parallel, NSF initiated also the process to acquire a new globally ranging non-riser scientific drillship in the next decade.

JAMSTEC considers the use of other vessels to be operated on an MSP mode and using alternative coring tools, such as Giant Piston Coring (GPC) and Boring Machine System (BMS). During their bilateral meetings, ECORD and JAMSTEC have expressed interest in collaborating to implement jointly MSP expeditions in a post-2024 scientific ocean drilling initiative.

China has presented thorough post-2024 plans, including its intention to become a new platform provider and implement an expedition per year on an MSP mode using different vessels with distinctive capabilities to address various scientific objectives of the 2050 Science Framework. During their bilateral meetings, ECORD and China have expressed interest in collaborating in the frame of a post-2024 scientific ocean drilling initiative, including a direct co-operation for the first MSP expeditions.

The end of the International Ocean Discovery Program will represent a major change in the organization of international activities related to scientific ocean drilling. The development of post-2024 scientific ocean drilling initiatives will be characterized by a transition from a single international programme operating with independent platform providers to some form of 'alliance' of independent and collaborative programmes, whose internal organization and mutual collaboration still need to be defined. There are still many challenges to tackle and many issues to be solved within the next months through bilateral and other in-person and virtual meetings. The IODP Forum extraordinary meeting that will be held during the weekend preceding the EGU in Vienna, Austria (7-8 April 2022), will certainly represent a major step in progress towards making concrete plans for the future of scientific ocean drilling. Major issues concerning future initiatives include (among others): systems for proposal and data management, currently the main responsibility of the Science Support Office; the scientific and safety evaluation of drilling proposals, currently the remit of the Science Evaluation Panel and the Environment Protection and Safety Panel, respectively; and the scheduling of drilling expeditions, currently the main task of Facility Boards within IODP.

The development of post-2024 initiatives will also require continuity of core and data legacies, in order to maintain one of the key basic principles of the successive international scientific ocean drilling programmes. During the last IODP-Forum meeting, all current IODP partners hosting an IODP Core Repository expressed a strong will to preserve core and sample collections and to ensure the continued availability of this material to all legitimate scientific users after the end of IODP. The related agreements among current IODP partners will have to be formalized to ensure the continuity of legacy activities throughout the transition between IODP and future scientific ocean drilling initiatives. The provision of a new IODP Core Repository by China in a new phase of scientific ocean drilling would require coordination and agreements between the proposed new core repository and the current IODP core repositories.

Communication plans to inform ocean drilling science communities about the rapidly evolving situation of the post-2024 plans have been set up and will develop further in the next months.

Gilbert Camoin
ECORD Managing Agency Director

Related websites

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

2. Operating and participating in mission-specific platform expeditions

Onboard *Fugro Synergy* during IODP Expedition 381: Corinth Active Rift Development. Credit: J. Everest, ECORD/IODP.

2. Operating and participating in mission-specific platform expeditions

Throughout 2020 and 2021, the COVID-19 pandemic disrupted marine fieldwork in general, including the activities of the ECORD Science Operator (ESO). The greatest impact was felt by Expedition 386: Japan Trench Paleoseismology, which saw both the offshore and onshore phases rescheduled due to governmental and institutional travel restrictions. National lockdown measures and work-from-home guidance prevented ESO staff from regularly attending their offices and face-to-face meetings. While implementation of an expedition was impossible in the early stages of the pandemic, ESO staff were being able to continue management and future expedition planning from home. By early 2021, the opportunity to implement Expedition 386 with a limited number of Japan-based participants had been identified, eventually allowing the offshore phase to be successfully completed between April-June 2021. In parallel to the delivery of the Expedition 386 offshore phase, further scoping and planning for the Onshore Science Party (OSP) took place. Read more on Expedition 386 on *page 36*.

Completed MSP expedition support

IODP Expedition 381

COMPLETED (2017)

Corinth Active Rift Development

Expedition website *www.ecord.org/expedition381*

Expedition 381: Research and peer-reviewed papers

The Science Party and collaborators continued their post-expedition research for Expedition 381: Corinth Active Rift Development, with the majority of papers from this expedition submitted before October 2020. However, several papers, news articles and conference abstracts were published before this date (see the Expedition-related bibliography for details: *http://publications.iodp.org/proceedings/381/381title.html#pgfId-633460*).

ESO-Bremen staff completed IODP long-term data archiving of all Expedition 381 data, including "shipboard" XRF core scanning data that were collected over two months in the years after the OSP. The data is publicly available through the IODP MSP data portal at *http://iodp.pangaea.de/front_content.php?idcat=615*.

Expedition 381: 2nd post-expedition meeting

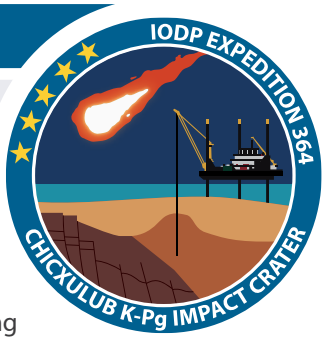
Preparations continued for the Expedition 381 2nd post-expedition meeting, which will be held in Stemnitsa, Greece, 27-30 April 2020. At this meeting, the Science Party members will present the first results from their individual post-expedition research projects, and will coordinate their publication strategies. A field trip has been organised on 1 May for the participants to visit onshore outcrops around the Gulf of Corinth.

IODP Expedition 364

COMPLETED (2016)

Chicxulub K-Pg Impact Crater

Expedition website *www.ecord.org/expedition364*



Erwan Le Ber (ESO-EPC) continued work on his paper related to Expedition 364: 'Permeability and electrical properties of Chicxulub impact crater peak ring'. Erwan also began working on a new Chicxulub research project looking at fluid circulation in the borehole, in collaboration with researchers from Montpellier. Erwan worked with Johanna Lofi (ESO-EPC) on Chicxulub linescan images and downhole data, re-running texture analyses to attempt to increase the amount of features extracted. Erwan also began thermal conductivity measurements on Chicxulub samples with a view to preparing a technical/method paper. Finally, EPC Staff at Montpellier continued developing a collaboration for research on Chicxulub samples with the University of Poitiers for porosity mapping and with University of Texas for permeabilities.

IODP Expedition 386 Offshore phase completed (2021)

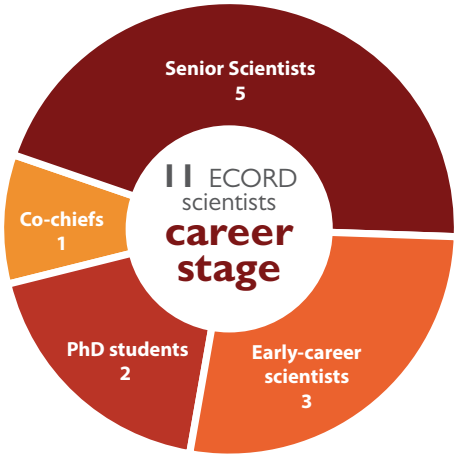
Japan Trench Paleoseismology

Co-chief Scientists	**Michael Strasser** (University of Innsbruck, Austria) **Ken Ikehara** (Geological Survey of Japan, AIST)
Expedition Project Manager	**Jeremy Everest** (ESO, BGS, UK)
Petrophysics Staff Scientist	**Katharina Hochmuth** (EPC, University of Leicester, UK)
Vessels	***Kaimei*** - Offshore phase ***Chikyu*** - Onshore phase
Expedition website	*ww.ecord.org/expedition386*

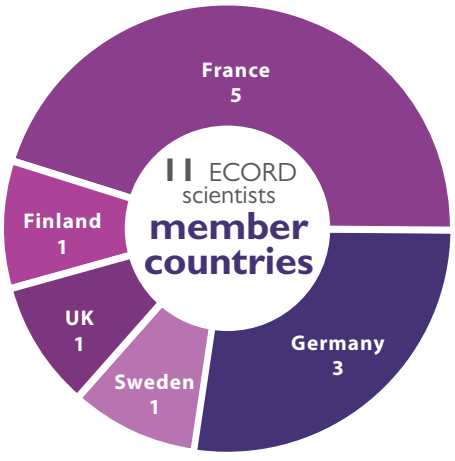
Expedition 386 is being jointly implemented by ESO and the Institute for Marine-Earth Exploration and Engineering (MarE3) within the Japan Agency for Marine-Earth Science and Technology (JAMSTEC).

The strong desire within both ESO and MarE3 for collaboration continued throughout 2020 and 2021, and we successfully worked together to keep Expedition 386 active despite the setbacks presented by COVID-19.

ECORD Participating Scientists			
Antonio Cattaneo	IFREMER, France	Rui Bao	Stockholm University, Sweden
Jean Noël Proust	Université de Rennes, France	Morgane Brunet	Université de Rennes, France
Aaron Micallef	GEOMAR, Kiel, Germany	Chloé Seibert	Institut de Physique du Globe de Paris, France
Joonas Virtasalo	Geological Survey of Finland, Finland	Piero Bellanova	RWTH Aachen, Germany
Christian Maerz	University of Leeds, UK	Ting-Wei Wu	MARUM, Bremen, Germany



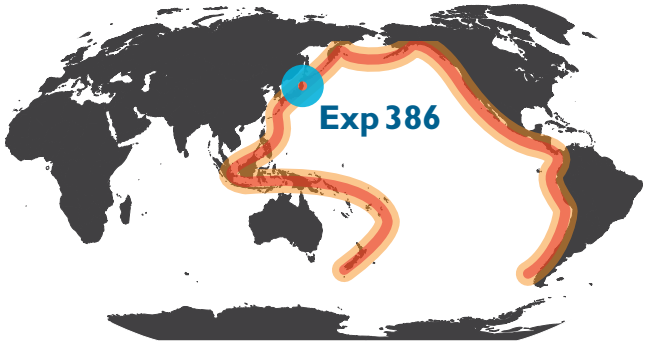
ECORD participants in Expedition 386 by career stage (n = 11)



ECORD participants in Expedition 386 by country (n = 11)

Exp. 386 Scientific background and objectives

Japan is located on the **Pacific Ring of Fire**, an approximately 40,000 km long arc-shaped belt around the Pacific Ocean.



More than 90% of stress accumulated by global plate tectonics is released along active margins through subduction earthquakes, and the majority of Earth's earthquakes occur within the Pacific Ring of Fire, including two of the largest known magnitude: the giant 2004-Mw9.2-Sumatra and 2011-Mw9.0-Tohoku-oki earthquakes. These high-impact earthquakes and associated tsunamis were major geological events with catastrophic societal consequences. Giant Mw9 class earthquakes have a long reoccurrence time, and instrumental and historic records are inadequate to reduce uncertainties in seismic hazard assessment and predictions across time scales relevant to subduction zone processes.

Expedition 386
aims to fill the gap in long-term
records of giant earthquakes

Expedition 386 aimed to use multiple shallow giant piston coring (GPC) at up to 19 primary sites to 40 meters below sea floor (mbsf), in water depths generally between 7 and 8 km (15 sites were in fact cored – see operational summary below). Upper Pleistocene to Holocene sediments were recovered to test and develop submarine palaeoseismology in the Japan Trench. Submarine palaeoseismology is a promising approach to investigate deposits from deep-sea (hadal) environments. Earthquakes leave traces in isolated, poorly-connected hadal trench basins. For example, observed sediment remobilisation event-deposits can be linked to the giant Tohoku-oki earthquake. Expedition 386 aimed to fill the gap in long-term records of giant earthquakes, by testing and developing submarine palaeoseismology in axis-parallel trench-fill basins of the Japan Trench. This is an ideal location to reconstruct a long history of giant earthquakes as event-deposits here have high preservation potential, as conventional coring reveals good agreement between the sedimentary record and historical documents covering the last ~1,500 years. Targets for palaeoseismological investigations over longer time scales are accessible through giant piston coring, potentially unravelling an earthquake history that is 10 to 100 times longer than is currently available, advancing our understanding of recurrence patterns of giant earthquakes and earthquake-induced geohazards globally.

Exp. 386 Expedition planning and implementation

Rescheduling and preparations (2020-2021)

Despite the developing threat of COVID-19 in the early part of 2020, joint expedition planning with MarE3 progressed well, and fortnightly video calls continued to be held between the operators.

In February 2020, shortly before the imposition of lockdowns across the world, ESO staff members D. Smith and G. Tulloch participated in a JAMSTEC giant piston coring (GPC) trial cruise on board the *R/V Kaimei* in the Japan Trench. A 40 m GPC was successfully taken for the first time using the *Kaimei* systems. ESO staff were able to observe the coring, core handling procedures, review health and safety arrangements, and review the procedures for moving cores around the deck and lab areas. The trial showed that ESO and MarE3 could successfully implement a GPC expedition under IODP conditions.

By the end of March 2020, it was clear that the expedition would have to be postponed due to travel restrictions and border closures. ESO, MarE3 and the Co-chief Scientists discussed options to replace and/or redeploy operator staff, strategies for scaling back the science programme and rescheduling options. Our strategy was to keep the expedition open for as long as possible, in the hope that travel restrictions would be lifted. Ultimately the COVID-19 situation did not improve, and the postponement of the expedition was announced. Shortly after, ESO organised and tracked the return of expedition containers and couriered shipments from Asia.

ESO continued fortnightly video meetings with MarE3 to discuss the closing down of the expedition, and to pause expedition planning until the ECORD Council and Facility Board had the opportunity to consider the future MSP schedule. The rescheduling of the expedition for 2021 was agreed at the ECORD Council and Facility Board meetings in June 2020. Following this news, ESO began the process of reactivating expedition planning and notifying the relevant parties. The offshore phase was rescheduled to run from the end of April to mid-June 2021, and the OSP onboard the *Chikyu* from mid-October to mid-November 2021.

The rescheduling of the expedition created the chance for ESO to build on the planning that had taken place in 2020. We took the opportunity to carry out some maintenance and refit work, and upgrade the detail of the container inventories (pictures, dimensions and weights of each individual piece of equipment and consumables), to facilitate customs clearance for the rescheduled expedition. ESO also adapted the Drilling Information System (DIS) to accept trigger cores in parallel to GPC cores. The "Exp. 386 ESO Curation Handbook" that describes all offshore curatorial and ephemeral sampling and analyses procedures was also updated, along with the customisation of logsheet templates for various workstations, to prepare for a situation where the expedition could be run without a full contingent of ESO staff participating.

The extra time also gave ESO the opportunity to monitor and assist with MarE3's modification of the *Kaimei* GPC trigger system, which underwent modification and further tests after a few issues were uncovered by MarE3.

To prepare for the OSP onboard *Chikyu*, ESO staff continued a literature review of the *Chikyu* analytical methods, to compare with our own ESO workstations and procedures, namely in relation to geochemistry analytical methods.

As 2020 progressed, ESO continued to coordinate the Science Party and provided updates on the COVID-19 situation. Two Science Party members had to withdraw after the expedition was rescheduled to spring 2021, and we issued a Special Call to refill those positions. We also regularly checked the individual positions of the Science Party with regard to travelling during the pandemic.

ESO monitored the COVID-19 outbreak very closely, and were in continual discussion with MarE3 about the feasibility of implementing the expedition during a global pandemic. Towards the end of 2020, both operators had the view that it would be extremely challenging to implement the expedition, the main barriers being an entry ban into Japan and quarantine periods. However, we remained hopeful that the situation would improve, and we prepared the Science Party to follow JAMSTEC's infection control measures when joining the *Kaimei* and/or *Chikyu*.

As 2020 drew to a close, we worked with MarE3 on the assumption that we could still implement the expedition as planned in spring 2021. We agreed with MarE3 and ECORD to set a determination date of 15 Feb 2021, taking a "go/no-go" based on the circumstances on that day.

In preparation for a "go" decision, ESO prepared container shipments for core curation, core science (microscopy, photography, geochemistry) and data management, as well as final testing of the Expedition 386 DIS and preparation of laptops for hydroacoustic measurements. During the holiday period at the end of 2020 and beginning of 2021, the COVID-19 situation deteriorated in many countries as concern grew over new variants. As a result, further lockdown measures were implemented and travel restrictions held in place. Nevertheless, we continued our final preparations for both the offshore and OSP phases so we were prepared for every eventuality.

Preparations for reduction in staffing during offshore phase

As the determination date drew nearer, it became increasingly clear that entry into Japan by foreign nationals would not be allowed for the foreseeable future. After discussions involving ECORD colleagues, ESO, MarE3 and the Co-chief Scientists, it was agreed that, if certain compromises were accepted, the two operators could run the offshore phase of the expedition using only staff based in Japan. This plan was further supported by the fact that MarE3 could provide more staff to take on some of the tasks that would otherwise be done by ESO staff. The alternative implementation plan meant only one Co-chief Scientist would sail (Ken Ikehara), with four Science Party members sailing instead of eight. ESO staff would remotely support the offshore team both pre-offshore and offshore to fulfil all IODP requirements. Core would be curated by the MarE3 curators using their own internal GPC recording forms, with the data transferred into the ESO DIS later. Pore water samples would be taken using Rhizon syringes only, initial through liner core description would be limited, and there would be no preliminary onboard core-seismic integration. The correlation work would instead be done after the offshore phase but still ahead of the OSP, utilising existing and any new hydroacoustic data collected during the expedition.

The switch to an offshore phase implemented by a reduced number of participants presented a significant challenge. MarE3 could provide some staff with direct IODP experience, however nobody had direct MSP

expedition experience. It was therefore critical that ESO staff provided comprehensive guidance to the offshore participants, and supported them to deliver an expedition according to IODP principles.

To that end, ESO-Bremen staff created tutorials/guidelines for sampling and curation during the offshore phase to help assist with these procedures remotely. ESO-Bremen staff initiated and completed an offshore sampling plan including a detailed pore water sample split plan. ESO partner the European Petrophysics Consortium (EPC) provided the EPC-MSCL Standard Operating Procedure to MarE3, and further prepared and liaised with MarE3 on MSCL procedures and documentation. ESO-EPC staff were also involved in hydroacoustic data acquisition preparation. The ESO data managers prepared for remote support for all data management activities, including the provision of file templates and data upload workflows.

Even though MarE3 would now directly manage the offshore operation, it was agreed that ESO would still lead the expedition overall on behalf of ECORD. ESO would still coordinate the Science Party, review and QC data coming off the *Kaimei*, remotely support the offshore team and respond to any queries about data quality or procedures. ESO would also continue to be the main issuer of expedition communications: daily reports and social media posts, using material provided by colleagues offshore.

Expedition 386 offshore phase: 13 April - 1 June 2021

The offshore phase eventually began on 13 April 2021. Please see the daily and weekly reports at *https://www.ecord.org/expedition386/expedition-386-reports/* for full details of the offshore phase.

Fifteen sites out of the 19 planned sites were cored, in water depths of about 7.5 to 8 km, with a total of 29 giant piston cores recovered, each with an associated smaller trigger core (see table on *page 40 and 41*). A total of 832.57 m of core was recovered at average 89% core recovery, representing 64% of the planned length.

In addition to coring, ninety new multibeam and sub-bottom profile survey lines were acquired during transit and waiting-on-daylight for GPC operations. This data, which will be part of the expedition dataset, characterises the basin architecture along the whole of the Japan Trench. The Co-chief Scientists have noted that, for all the primary trench basins, we now have sub bottom profiles at very high spatial resolution which will allow the study of the depositional basins in "near 3D".

The coring operations set two new IODP records: the deepest water site ever cored (8023 mbsl), and the deepest sub-sea level sample ever recovered (8060.74 mbsl).

The expedition has been a great operational success, despite poor weather. The captain of the *Kaimei* commented that he could not remember a year when the weather was so poor so late in the season. In addition to the weather, the Kuroshio Current remained obstinately strong and flowed right across some, and adjacent to most, of the planned expedition sites. Due to the challenging environmental conditions, 50% of expedition time was spent operating, with 17% spent in transit. The time spent on GPC operations was maximised by overnight transits to each site, and by careful observation and forecasting of sea surface current and weather conditions.

All planned cores were retrieved from the 1st and 2nd priority sites, and the Co-chief Scientists both agree that the overall number of sites acquired has been highly successful. Only two 3rd priority sites around 38°N could not be cored, due to strong currents.

The Co-chief Scientists are also pleased with the level of recovery, which was very good. At all 1st and 2nd priority sites (and also at three 3rd priority sites) all 20 m and 40 m

Expedition 386 statistics

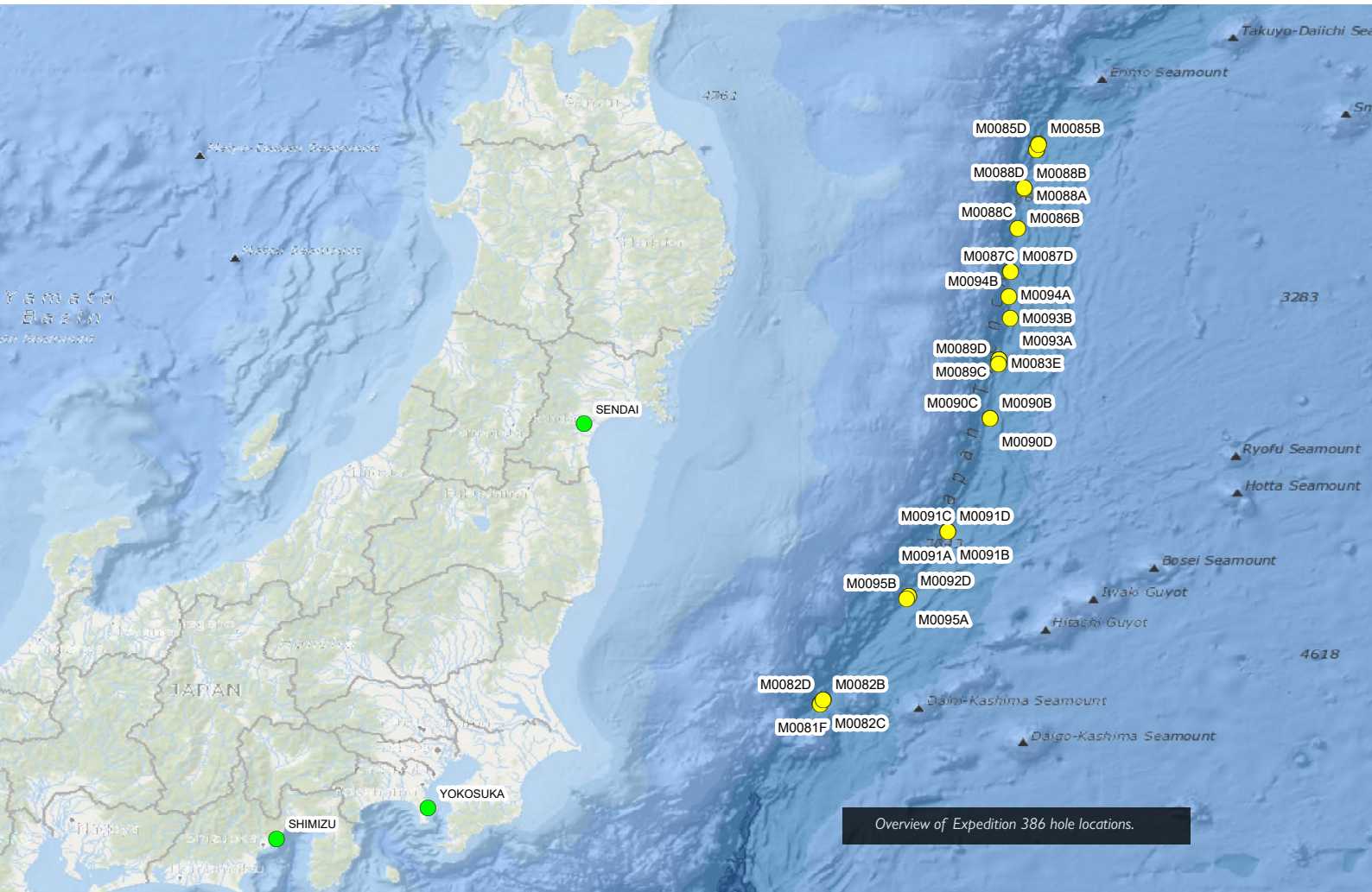
Sites	15
Holes	58
Cores	58
Expedition days	50
Deepest wated depth (record)	8023 mbsl
Deepest sub-sea level sample (record)	8060.74 mbsl
Meters cored	933.5
Meters of core recovered	832.57
Recovery	89%

Expedition 386
The coring operations set two new IODP depth records:

- the deepest water site ever cored (8023 mbsl)
- the deepest sub-sea level sample ever recovered (8060.74 mbsl)

Hole	Latitude	Longitude	Water Depth (m)	Core type	Barrel deployed (m)	Recovered Length (m)
M0081A	36° 4.336' N	142° 44.14' E	8020	Trigger Core	1.5	1.21
M0081B	36° 4.336' N	142° 44.14' E	8020	Giant Piston Core	20	19.89
M0081C	36° 4.287' N	142° 44.126' E	8020	Trigger Core	1.5	1.07
M0081D	36° 4.287' N	142° 44.126' E	8011	Giant Piston Core	40	35.57
M0081E	36° 4.263' N	142° 44' E	8023	Trigger Core	1.5	1.07
M0081F	36° 4.263' N	142° 44' E	8023	Giant Piston Core	40	37.74
M0082A	36° 6.05' N	142° 45.508' E	7993	Trigger Core	1.5	1.455
M0082B	36° 6.05' N	142° 45.508' E	7989	Giant Piston Core	20	18.71
M0082C	36° 6.007' N	142° 45.374' E	8008	Trigger Core	1.5	0.97
M0082D	36° 6.007' N	142° 45.374' E	8008	Giant Piston Core	40	36.77
M0083A	38° 45.413' N	144° 7.755' E	7620	Trigger Core	1.5	1.615
M0083B	38° 45.413' N	144° 7.755' E	7620	Giant Piston Core	20	19.52
M0083C	38° 45.51' N	144° 7.719' E	7626	Trigger Core	1.5	1.4
M0083D	38° 45.51' N	144° 7.719' E	7626	Giant Piston Core	40	36.89
M0083E	38° 45.538' N	144° 7.769' E	7614	Trigger Core	1.5	0.92
M0083F	38° 45.538' N	144° 7.769' E	7614	Giant Piston Core	40	36.61
M0084A	40° 23.726' N	144° 25.328' E	7590	Trigger Core	1.5	0.95
M0084B	40° 23.726' N	144° 25.328' E	7590	Giant Piston Core	20	19.94
M0084C	40° 23.69' N	144° 25.267' E	7600	Trigger Core	1.5	0.46
M0084D	40° 23.69' N	144° 25.267' E	7600	Giant Piston Core	40	35.44
M0084E	40° 23.765' N	144° 25.258' E	7603	Trigger Core	1.5	0.5
M0084F	40° 23.765' N	144° 25.258' E	7603	Giant Piston Core	40	38.771
M0085A	40° 26.244' N	144° 26.231' E	7600	Trigger Core	1.5	0.72

Table: Cores collected during Expedition 386. Preliminary data only, please consult Preliminary and Expedition Reports (Proceedings Volume) for final table. Continues on next page.



Overview of Expedition 386 hole locations.

Hole	Latitude	Longitude	Water Depth (m)	Core type	Barrel deployed (m)	Recovered Length (m)
M0085B	40° 26.244' N	144° 26.231' E	7600	Giant Piston Core	20	18.31
M0085C	40° 26.18' N	144° 26.196' E	7600	Trigger Core	1.5	0.43
M0085D	40° 26.18' N	144° 26.196' E	7600	Giant Piston Core	40	33.69
M0086A	39° 46.756' N	144° 16.524' E	7502	Trigger Core	1.5	1.02
M0086B	39° 46.756' N	144° 16.524' E	7502	Giant Piston Core	20	18.255
M0087A	39° 26.439' N	144° 12.971' E	7520	Trigger Core	1.5	1.475
M0087B	39° 26.439' N	144° 12.971' E	7520	Giant Piston Core	20	18.975
M0087C	39° 26.595' N	144° 13.087' E	7518	Trigger Core	1.5	0.835
M0087D	39° 26.595' N	144° 13.087' E	7518	Giant Piston Core	40	26.345
M0088A	40° 5.487' N	144° 19.65' E	7550	Trigger Core	1.5	1.09
M0088B	40° 5.487' N	144° 19.65' E	7550	Giant Piston Core	20	17.69
M0088C	40° 5.586' N	144° 19.541' E	7525	Trigger Core	1.5	0.96
M0088D	40° 5.586' N	144° 19.541' E	7525	Giant Piston Core	40	36.48
M0089A	38° 43.202' N	144° 7.538' E	7607	Trigger Core	1.5	1.43
M0089B	38° 43.202' N	144° 7.538' E	7607	Giant Piston Core	20	18.01
M0089C	38° 43.228' N	144° 7.508' E	7602	Trigger Core	1.5	0.705
M0089D	38° 43.228' N	144° 7.508' E	7602	Giant Piston Core	40	36.9
M0090A	38° 17.834' N	144° 3.549' E	7445	Trigger Core	1.5	1.145
M0090B	38° 17.834' N	144° 3.549' E	7445	Giant Piston Core	20	19.675
M0090C	38° 17.719' N	144° 3.528' E	7450	Trigger Core	1.5	1.075
M0090D	38° 17.719' N	144° 3.528' E	7450	Giant Piston Core	40	33.935
M0091A	37° 24.747' N	143° 43.729' E	7802	Trigger Core	1.5	0.835
M0091B	37° 24.747' N	143° 43.729' E	7802	Giant Piston Core	20	19.22
M0091C	37° 24.741' N	143° 43.741' E	7812	Trigger Core	1.5	0.765
M0091D	37° 24.741' N	143° 43.741' E	7812	Giant Piston Core	40	31.12
M0092A	36° 54.672' N	143° 25.416' E	7702	Trigger Core	1.5	1.1
M0092B	36° 54.672' N	143° 25.416' E	7702	Giant Piston Core	30	30.7
M0092C	36° 54.663' N	143° 25.431' E	7700	Trigger Core	1.5	0.785
M0092D	36° 54.663' N	143° 25.431' E	7700	Giant Piston Core	40	36.205
M0093A	39° 4.909' N	144° 13' E	7454	Trigger Core	1.5	0.775
M0093B	39° 4.909' N	144° 13' E	7454	Giant Piston Core	30	26.135
M0094A	39° 14.954' N	144° 12.309' E	7469	Trigger Core	1.5	0.805
M0094B	39° 14.954' N	144° 12.309' E	7469	Giant Piston Core	30	18.26
M0095A	36° 53.501' N	143° 24.473' E	7697	Trigger Core	1.5	0.895
M0095B	36° 53.501' N	143° 24.473' E	7697	Giant Piston Core	30	28.345
					Total	**832.566**

Table: Cores collected during Expedition 386. Preliminary data only, please consult Preliminary and Expedition Reports (Proceedings Volume) for final table.

GPC cores were recovered. Average recovery was > 90% at 1st priority sites and between 84-93% at 2nd priority sites. The Co-chief Scientists estimate that >75% of scientific objectives can be addressed with these cores alone.

The additional coring at eight of the 3rd and 4th priority sites at least once with at least the 30 m GPC should guarantee enough sampling material to fully investigate spatial (and temporal) variability of event-deposits.

Throughout the offshore phase, daily video meetings were held between ESO staff onshore in Europe, the MarE3 onshore and offshore teams, and the Co-chief Scientists. The meetings allowed the two operators and the Science Party to report on expedition progress, seek advice and support for offshore activities, and agree offshore strategies to mitigate the impacts of the poor weather and strong currents.

Data was regularly transferred from the ship and checked by ESO staff onshore, with any issues quickly reported back. ESO staff provided remote support and data quality control, including the daily transfer of curatorial data into the ExpeditionDIS-386. After the offshore phases was completed, ESO staff from all partners finalised all offshore curatorial data, the offshore science data folder, and conducted checks for data consistency and completeness before release to the Science Party. This work also involved

the initiation and supervision of the migration of the shared file server system (backend of MARUM ESO Cloud) to a new physical storage space.

The outreach programme was very successful, with live broadcasts from the *Kaimei* to the European Geosciences Union (EGU), and a post-cruise presentation to the Japan Geoscience Union (JpGU). Science Party members gave live talks from the *Kaimei* and Q&A sessions to Japanese Universities and high schools. Thanks to the deepest below-sea level core record, global media picked up on the expedition, with the highlights being coverage by the BBC and National Geographic.

Planning for Expedition 386 Onshore Science Party

Planning for the OSP continued during summer 2021, and ESO/MarE3 continued to monitor the COVID-19 situation ahead of the OSP determination date of 2 August. On that day, due to the COVID-19 situation and the associated travel restrictions, the decision was taken to postpone the OSP to 14 Feb – 15 Mar 2022.

For the remainder of 2021, the fortnightly meetings continued between ESO and MarE3. In parallel, ESO partners reviewed revised sample requests submitted through the SaDR, planned deck/lab layouts and OSP core-flows, devised various procedures (curatorial, geochemistry, visual core description, biostratigraphy, physical properties), produced consumable lists, and carried out sample planning (pore water and core sampling).

Both operators monitored the COVID-19 situation in Japan closely for any signs of an improving situation with regard to international travel. We agreed to set a new determination date of 23 Nov 2021, roughly 12 weeks before the start of the OSP.

All expedition offshore data was made available to the Science Party, including all X-CT scan data and sub-bottom profiler data which was worked on by the ESO-EPC team. ESO staff continued to check and QC data before it was released to the Science Party. The Co-chief Scientists coordinated the Science Party to review the offshore and X-CT data, to identify layers of interest and duplicate intervals to inform the sampling strategy at the OSP.

Early shipping of samples for post-expedition work was initiated. ESO-Bremen initiated and completed a pre-OSP early sample shipping plan (for selected scientist´s IW samples). These samples are usually shipped after the OSP, however the Sample Allocation Committee (SAC) agreed to release some samples that are more likely to be impacted by the growing time delay between coring and analysis.

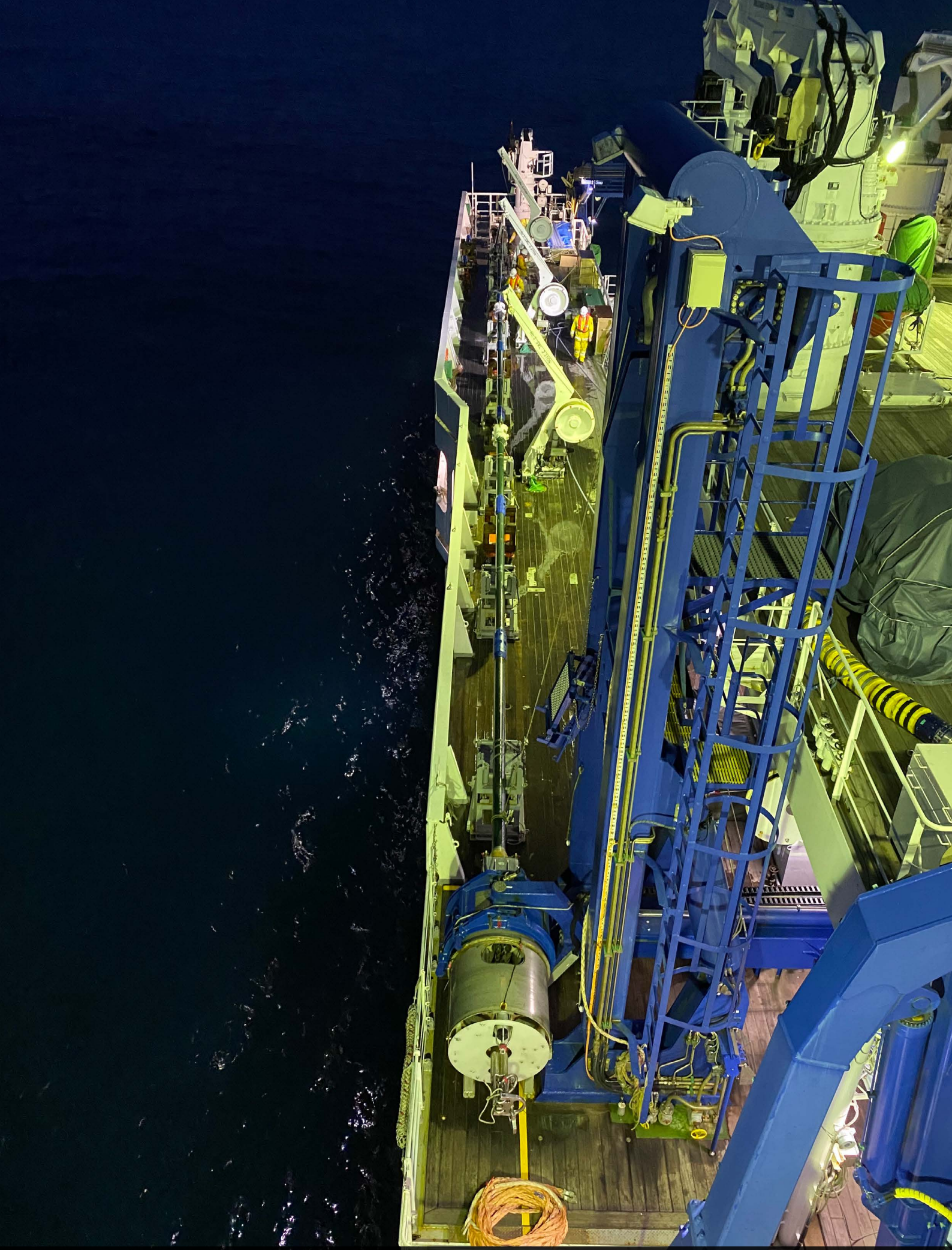
ESO and MarE3 also agreed for MarE3 to start some measurements pre-OSP that would normally be done at the OSP. Headspace gas analysis was started, and was shortly followed by sulphide analysis. This work was done by Marine Works Japan technicians, under the supervision of MarE3. Similar to the offshore phase, ESO staff checked and QC'd the data is it was produced, before release to the Science Party.

ESO continued to provide remote support for X386 data management, mainly the transfer of curatorial data into the ExpeditionDIS-386.

The emergence of the COVID-19 Omicron variant in late 2021 placed new uncertainty on our ability to deliver the OSP as planned. To avoid further delay to the expedition and to allow analysis to start before the cores degraded too much, ESO and MarE3 developed a hybrid OSP model. This approach should allow certain key science activities to take place and provide the Science Party with data and samples to progress their post-expedition research.

ESO and MarE3 designed a hybrid OSP programme that could achieve as much as possible with the staff who might eventually attend the OSP. Our initial assumption was that this might only be the scientists based in Japan, with all other "foreign" participants contributing remotely. MarE3 have the capability to split and image the cores, and carry out sampling for IODP standard measurements.

With the rescheduling of the expedition and the uncertainty of the OSP timing, some participants have found that their expedition commitment now clashes with other work and personal commitments. To accommodate this, we are taking a flexible approach with regard to the timing of expedition contributions, for example the ESO-EPC team are coordinating the Science Party hydroacoustic group on compiling and reporting data ahead of the OSP.
Despite the challenges of COVID-19 during 2020 and 2021, we are pleased to have worked with ECORD, MarE3, the Co-chief Scientists and the Science Party to progress Expedition 386. We hope to be in a position to deliver the Preliminary Report before autumn 2022, and the Expedition data and Expedition Report in March 2023.



View at Giant Piston Corer onboard R/V *Kaimei* during IODP Expedition 386. Credits: N. Okutsu, ECORD/IODP/JAMSTEC

ESO facility, service and general activities

For MSP proposals under investigation for potential implementation, ESO-Bremen staff continued to scope QA/QC procedures for analytical equipment and instrumentation. This involves incorporating QA/QC documentation into offshore laboratory routines, and continuously improving the online tutorials for both the Offshore Phase and the OSP available on the web. Part of the work was to migrate all information on numerous webpages to the new MARUM webpages.

Other ongoing work continued, such as sampling for shore-based requests, and laboratory and equipment upkeep and certification.

The ESO container refurbishment and renewal program continued at all ESO partners from early 2020 and into 2021. The new ESO Curation and ESO Geochemistry containers were equipped and tested (e.g. electrical, supplies, -80°C freezer, fridge, heating and air condition systems), and ESO-EPC took delivery of its new container lab. The lab will be kept at the Geotek premises when not in use for expeditions, where it can be kept powered up and maintained. More recently, EPC staff investigated options for upgrading its fast-track MSCL, and Geotek delivered and installed an upgraded MSCL at the University of Leicester. EPC staff at Leicester were granted access to a larger lab where equipment could be permanently set up. Meanwhile, ESO-BGS shipped three ESO containers to a supplier in Aberdeen for rectifying work.

Data Management

Data management activities in 2020 focussed on the final supporting actions for Expedition 381: Corinth Active Rift Development, and in 2020 and 2021 focussed on the setting up of IT systems for Expedition 386: Japan Trench Paleoseismology (see Expedition 386 planning section above).

Sample information files from Expedition 381 were finalised and associated with the relevant QA/QC documentation. The IODP MSP data portal hosted by the PANGAEA database was updated through the ongoing publication of Expedition 381 datasets.

In addition to data management activities associated with Expeditions 381 and 386, we closely followed the development of the mDIS (next generation DIS) Curation version, driven by the ICDP colleagues in Potsdam, as well as developments of specifications made for an AWI SAMS (SAmple Management System) based on the ICDP mDIS. Furthermore, we initiated listing essential features of potential mDIS Curation and Expedition versions in preparation of specifying our own mDIS for ESO, to place an order for a tailored mDIS version in due course. This proved to be a significant task, with the ESO-Bremen team going through all the existing DIS features in order to define how the new mDIS will be configured for our needs.

Training

Staff training continued throughout 2020 and 2021, to develop staff skills and to meet regulatory requirements. For example, ESO-EPC staff took part in a Python computing skills workshop, and received MSCL training from Geotek in August 2021, while K. Hochmuth received an offer to participate in IODP Expedition 395: Reykjanes Mantle Convection & Climate.

Operations onboard R/V *Kaimei* during IODP Expedition 386. Credits: K. Ikehara, ECORD/IODP/JAMSTEC

3. Anticipating future mission-specific platform expeditions

View from R/V *Kaimei* during IODP Expedition 386. Credits: K. Ikehara, ECORD/IODP/JAMSTEC.

3. Anticipating future mission-specific platform expeditions

Related websites:
www.ecord.org/about-ecord/management-structure/efb
www.iodp.org/active-proposals
www.iodp.org/facility-boards#SEP

SCHEDULED EXPEDITIONS

The preparations for the onshore phase of IODP Expedition 386: Japan Trench Paleoseismology and the offshore phase of IODP Expedition 377: Arctic Ocean Paleoceanography in 2022 are well underway.

At its last meeting that was held on 29 and 30 September 2021 Trieste, Italy, the ECORD Facility Board (EFB) has decided to recommend the scheduling of IODP Expedition 389: Hawaiian Drowned Reefs. This expedition was already scheduled to be drilled in 2019 but had to be postponed for logistical reasons. Preparations at that stage had progressed quite far, and the EFB assumes it should be easy to resume planning of this expedition.

The EFB will then discuss the scheduling of an MSP expedition in 2024, the last year of the current programme, at its 2022 meeting that will be held in Aix-en-Provence on 20 and 21 September 2022. See table and map on *page 48 and 49*.

As IODP concludes, the EFB remains committed to the continuation of mission-specific platform expeditions in a post-2024 scientific ocean drilling programme.

Our goal is to see a smooth transition to the next programme without any gap in drilling. To that end, the EFB intends to transfer all active MP proposals - both at EFB and SEP - to a post-2024 scientific ocean drilling programme. The proponents have been advised that an addendum will be needed to emphasize the link of their proposals' objectives to the 2050 Scientific Framework (*https://iodp.org/2050-science-framework*).

Currently active MSP drilling proposals and MSP proposals that will arise from MagellanPlus workshops and from individual submissions in the next two years may form the basis of a post-2024 MSP-only drilling programme. MSP expeditions are expected to play a prominent role in the achievement of Strategic Objectives defined in the 2050 Science Framework.

Scheduling of MSP expeditions for the two coming years (2022-2023)

2013 2014	2015	2017	2017	2018		2019	2020	2021	2022	2023
347 Baltic	**357** Atlantis	**364** Chicxulub	**381** Corinth	No expedition	ECORD renewal	No expedition	No expedition	**386** Japan Trench	**377** ArcOP	**389** Hawaii
MPSSV *Greatship Maya*	RRS *James Cook* & Seabed drills (*MeBo* & *RD2*)	L/B *Myrtle*	D/V *Fugro Synergy*					R/V *Kaimei* & D/V *Chikyu*	IB *Oden*, IB *Viktor Chernomyrdin* & D/V *Dina Polaris*	TBD
									373 Antarctic Cenozoic Paleoclimate — to be rescheduled	

347 - Expedition 347: Baltic Sea Paleoenvironment
357 - Expedition 357: Atlantis Massif Serpentinization and Life
364 - Expedition 364: Chicxulub K-Pg Impact Crater
381 - Expedition 381: Corinth Active Rift Development

386 - Expedition 386 Japan Trench Paleoseismology
377 - Expedition 377: Arctic Ocean Paleoceanography (ArcOP)
389 - Expedition 389: Hawaiian Drowned Reefs
373 - Expedition 373: Antarctic Cenozoic Paleoclimate

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

The number of active MSP proposals in the IODP system is fairly constant and presently includes eleven proposals concerning various science topics and geographical areas that reside both at the EFB and at SEP.

A higher MSP proposal pressure including different science themes and involving various potential drilling/coring systems in diverse environments would be desirable to provide additional scientific, operational and funding opportunities in the near future.

Since the start of the MSP, IODP expeditions are no longer restricted from enclosed or ice-covered sea areas and shallow-water drilling environments. ECORD intends to develop the MSP concept by diversifying drilling and coring technologies, including riserless drilling, and applying them to all drilling environments, as determined by scientific priorities, operational efficiency and better value for money.

MSP proposals currently at the EFB

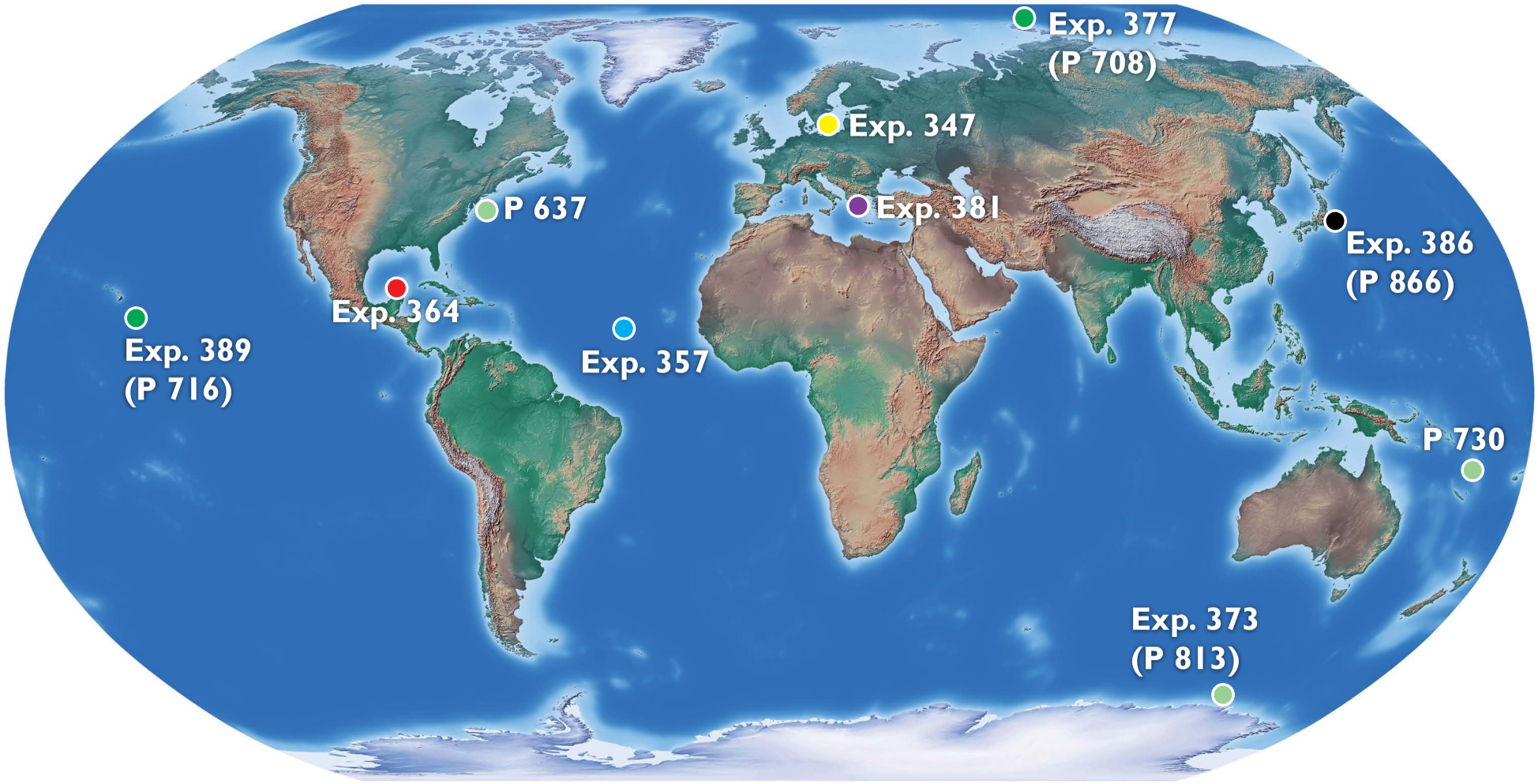
Five MSP proposals currently reside at the EFB (see *page 50*), including the two expeditions that were postponed (i.e., expeditions 373, postponed in 2018, and 389):

- Proposal 708: Central Arctic Paleoceanography (Expedition 377), scheduled for 2022;
- Proposal 716: Hawaiian Drowned Reefs (Expedition 389), scheduled for 2023.

There are currently three proposals in the EFB waiting room:

- Proposal 637: New England Shelf Hydrogeology
- Proposal 730: Sabine Bank Sea Level
- Proposal 813: Antarctic Cenozoic Paleoclimate (Expedition 373)

Mission-specific platform expeditions and proposals at the EFB



Proposals at the ECORD Facility Board

Proposal	Type	Short Title	PI	Ocean	Status
637	Full2	New England Shelf Hydrogeology	Dugan (USA)	Atlantic	EFB
708	Full2	Central Arctic Paleoceanography (ArcOP)	Stein (ECORD-Germany)	Arctic	EFB, Exp. 377, scheduled for 2022
716	Full2	Hawaiian Drowned Reefs	Webster (ANZIC)	Pacific	EFB, Exp. 389, scheduled for 2023
730	Full2	Sabine Bank Sea Level	Taylor (USA)	Pacific	EFB
813	Full	Antarctic Cenozoic Paleoclimate	Williams (USA)	Southern Ocean	EFB, Exp. 373

IODP Proposal 637-Full2

EFB waiting room

New England Shelf Hydrogeology

Proposal (PDF) *https://docs.iodp.org/Proposal_Cover_Sheets/637-Full2_Person_cover.pdf*

Lead Proponent: **Brandon Dugan** (Rice University, USA)

P 637 Scientific objectives

In many coastal settings around the world the distribution of freshwater within continental shelf sediments is far out of equilibrium with modern sea level conditions. One of the most remarkable examples of this can be found on the Atlantic continental shelf off New England where groundwater within shallow Pliocene-Pleistocene sand units over 100 km offshore Long Island are remarkably fresh (~ 3000 mg/l salinity). On Nantucket Island to the North, a 514 meter-deep borehole penetrating the entire Cretaceous–Tertiary sedimentary package showed considerable vertical variations in salinity with extremely fresh (< 1000 mg/l) waters in sand aquifers, higher salinity levels (between 30–70% seawater) in thick clays/silts and intermediate to low salinities in thin confining units, attesting to marked disequilibrium conditions because diffusion tends to eliminate such patterns. Pore fluids within Pleistocene to Upper Cretaceous sands beneath Nantucket Island were also found to be modestly over-pressured by about 4 m above the local water table.

It is hypothesized that the rapid incursion of freshwater on the continental shelf in New England could have been caused by one or more of the following mechanisms: (1) Meteoric recharge during Pleistocene sea-level low-stands including vertical infiltration of freshwater associated with local flow cells that may have developed on the continental shelf during sea level low stands; (2) Sub-ice-sheet recharge during the last glacial maximum; (3) Recharge from pro-glacial lakes. It is further hypothesized that the overpressures could be due to either: (1) Pleistocene sediment loading; or (2) fluid-density differences associated with the emplacement of a thick fresh water lens overlying saltwater (analogous to excess pressures observed in gas legs of petroleum reservoirs). These different recharge mechanisms can be distinguished using environmental isotope and noble gas data.

This work will extend our understanding of the current and past states of fluid composition, pressure and temperature in continental shelf environments. It will help better constrain rates, directions, and mechanisms of groundwater flow and chemical fluxes in continental shelf environments. It will contribute to developing new tools for measuring freshwater resources in marine environments. The apparent transient nature of continental shelf salinity patterns could have important implications for microbial processes and long-term fluxes of carbon and nitrogen and other nutrients to the global ocean.

P 637 Operations

ESO continued to scope this proposal, which continues to offer an exciting expedition option for the ECORD Facility Board to consider in the current phase of IODP. Throughout 2020, ESO continued to have e-mail dialogue with the lead proponent. ESO has begun permitting work for this expedition, a process which is anticipated to be highly involved.

Operations onboard R/V *Kaimei* during IODP Expedition 386. Credits: N. Okutsu, ECORD/IODP/JAMSTEC

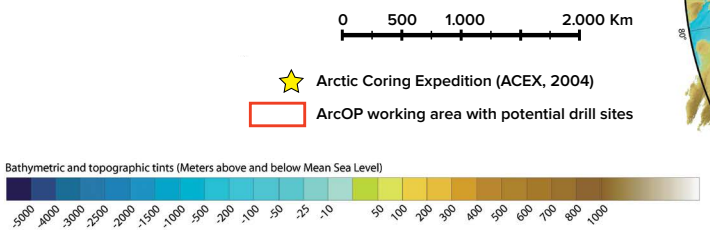
IODP Expedition 377

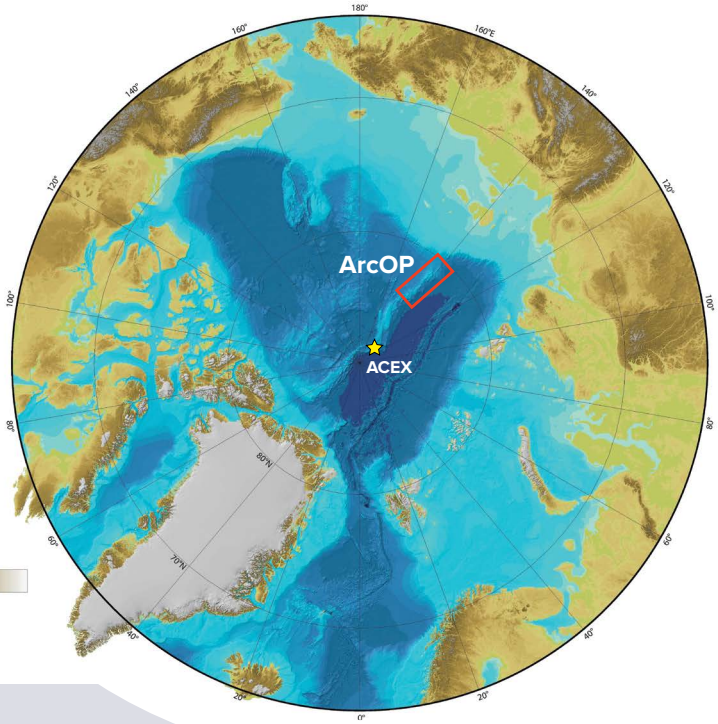
Scheduled for 2022

Arctic Ocean Paleoceanography (ArcOP)

Co-chief Scientists: **Ruediger Stein** (Alfred Wegener Institute, Germany)
Kristen St. John (James Madison University, USA)

Expedition website: *www.ecord.org/expedition377*





Exp. 377 Scientific objectives

Prior to 2004, the geological sampling in the Arctic Ocean was mainly restricted to near-surface Quaternary sediments. Thus, the long-term Pre-Quaternary geological history is still poorly known. With the successful completion of the Arctic Coring Expedition - ACEX (IODP Expedition 302) in 2004, a new era in Arctic research has begun. Employing a novel multi-vessel approach, the first MSP expedition of IODP has proven that drilling in permanently ice-covered regions is possible.

During ACEX, 428 meters of Quaternary, Neogene, Paleogene and Campanian sediment on Lomonosov Ridge were penetrated, providing new unique insights into the Cenozoic Arctic paleoceoceanographic and climatic history. While highly successful, the ACEX record also has three important limitations. Based on the original age model, the ACEX sequence contains a large hiatus spanning the time interval from late Eocene to middle Miocene, i.e., 44.4 to 18.2 Ma. This is a critical time interval, as it spans the time when prominent changes in global climate took place during the transition from the early Cenozoic Greenhouse world to the late Cenozoic Icehouse world. Furthermore, generally poor recovery during ACEX prevented detailed and continuous reconstruction of Cenozoic climate history. Finally, a higher-resolution reconstruction of Arctic rapid climate change during Neogene to Pleistocene times, could not be reached during ACEX in 2004. A return to the Lomonosov Ridge for a second MSP - type drilling campaign within IODP might fill these major gaps in our knowledge on Arctic Ocean paleoenvironmental history through Cenozoic times and its relationship to the global climate history.

Overall goal of the proposed drilling campaign is the recovery of a complete stratigraphic sedimentary record on the southern Lomonosov Ridge to meet our highest priority paleoceanographic objective, the continuous long-term Cenozoic climate history of the central Arctic Ocean. Furthermore, sedimentation rates two to four times higher than those of ACEX permit higher-resolution studies of Arctic climate change in the Pleistocene and Neogene. As demonstrated in the proposal, this goal can be achieved by careful site selection, appropriate drilling technology, and applying multi-proxy approaches to paleoceanographic, paleoclimatic, and age-model reconstructions.

During 2020, the challenges presented by COVID-19 did not severely impact our planning for Expedition 377. In early 2020, ESO fielded enquiries from interested suppliers in response to our publication of a Prior Information Notice (PIN) in 2019, on the Electronic Daily of the Official Journal of the European Union. Those enquiries helped to formulate the full Call for Tenders for the expedition's vessel and drilling facilities (closing date was 20 May 2020), to implement ArcOP in summer 2021.

In parallel, ESO discussed *Oden* scheduling options with the Swedish Polar Research Secretariat (SPRS) and the US National Science Foundation (NSF) via monthly video calls. NSF co-funds NABOS (Nansen and Amundsen Basins Observational System, part of the Arctic Observing Network) with the National Oceanic and Atmospheric Administration (NOAA), and a NABOS cruise was scheduled on the *Oden* immediately before Expedition 377. Many NABOS sites were very close to Expedition 377 sites (from one hour to two days transit away). Both projects wished to make use of the optimal summer weather window, to avoid the ice and also the shorter days towards the end of the season, and we worked with NSF (Frank Rack) to minimise or remove any overlap in schedules. By mid-May, this group had agreed that ECORD could access the *Oden* in August 2021, after a Synoptic Arctic Survey (SAS) cruise earlier in the season. The NSF project (NABOS) would move to 2022.

ESO-Bremen started work on compiling and budgeting for the expedition´s offshore and OSP consumables for the 2021 budget request. This included an evaluation of the costs that needed to be met during 2020, since the ESO 2020 budget was approved before Expedition 377 was scheduled. This included an evaluation of the availability of certain consumables that were in high demand at the time due to the COVID-19 outbreak (e.g., gloves, syringes, and ethanol).

EPC staff continued to investigate logging tool and logging contractor options. Meetings between Leicester and Montpellier EPC staff were held to discuss logging plans, logging containers and logging tools and winches. Montpellier staff met with potential logging container and winch suppliers about the options available. The option selected was for two 10ft containers to enable greater flexibility on board vessels.

In May 2020, ESO-BGS and the major procurement team at UK Shared Business Services (UKSBS) started assessing the commercial bids for major Expedition 377 services. We received commercial bids from companies separately for the drillship and drilling services, and the ice management. The assessment was a two-stage process: 1) technical evaluation without knowledge of costs, then 2) financial and contractual assessment.

The proposed technical solutions were very good, and ESO's opinion is that we could have selected suppliers that would have given a high probability of expedition success. However, the combination of proposed costs for the drilling, drillship and ice management was significantly over budget. At least $37M without contingency was needed (~$41M with 10% contingency), which far exceeded the current ECORD limit of $27M.

All bids were non-compliant compared to the tender specification, primarily due to cost and the costing models provided. We were unable to amend the project specification to the degree required without re-tendering (EU competition rules), and so there was not enough time to re-tender and leave enough planning time for 2021 implementation, and so we were unable implement ArcOP in 2021.

The removal of Expedition 377 from the MSP 2021 schedule was agreed at the ECORD Council and Facility Board meetings held in June 2020. However, time was created in the latter half of 2020 for ECORD, ESO and SPRS to explore alternative approaches (technical and legal) that may have allowed Expedition 377 to be implemented in 2022 or 2023.

In the following months, a series of meetings were held involving ESO, SPRS and their partners, the Swedish Research Council, the Co-chief Scientists, the EMA Director, and the EFB Chair. The meetings focussed on platform possibilities and procurement routes, and possible options for modifying the coring strategy and the scientific approach. The Co-chief Scientists confirmed that, based on the data they have, they could not scale back the coring strategy further without scaling back the scientific objectives. In other words, the de-scoping had hit a limit and there were no obvious alternative sites that could, for example, allow an 'easier' coring strategy and deliver the same objectives.

SPRS presented ECORD with an interim status report that outlined the vessel options they had identified. ESO supplied their own assessment of options identified by SPRS at the ECORD Council meeting in September 2020. SPRS had a high degree of confidence that a platform configuration exists within ECORD's budget, but more time (until Dec 2020) was required to complete negotiations with interested suppliers.

In the final months of 2020, a series of meetings and discussions between ESO, EMA, SPRS and suppliers of ice management, vessel and drilling services took place, which culminated in an offer from SPRS to ECORD in December 2020. On 9 December (ECORD Council meeting), ESO presented an assessment of the SPRS technical offer for the ArcOP fleet, and recommended to proceed with the offer. In addition to ESO's mandate to advise ECORD on all operational matters of MSP expeditions, we also acted as an advisor to SPRS on drilling methodologies as they negotiated with various drilling suppliers interested in the ArcOP opportunity.

In light of the December 2020 SPRS offer, ESO updated the expedition risk analysis which was also presented to ECORD Council on 9 December. ESO worked to introduce measures and gain information to mitigate the risks and reduce the overall scores in most categories.

At the end of the 2020, ECORD Council and the Facility Board gave their approval to proceed with the implementation of ArcOP in August-September 2022, on the basis of the SPRS offer of fleet, drilling and ice management provision. The offer comprised the ice-breaking drillship *Dina Polaris* operated by Geoquip Marine, the research icebreaker *Oden* operated by SPRS, and the diesel-electric escort icebreaker *Viktor Chernomyrdin* operated by Rosmorport.

Over the holiday period and the end of 2020 and start of 2021, ESO assisted CNRS, SPRS and AMS in their contract negations. That work was completed, the contracts were placed, and the post-contract planning phase was started. In the early part of 2021, ESO worked on the detailed operational planning with the ArcOP operational partners. Three representatives from ESO, SPRS and AMS met weekly to keep in touch about ArcOP planning (the ArcOP Operations Management Group, AOMG).

The Call for Scientists was opened on 16 March 2021, with a closing date of 14 May. ESO hosted an information webinar for ArcOP on 30 March, which focussed on the scientific objectives and the technical setup being provided, and how to apply.
An ESO-Geoquip alignment meeting was held on 29 April 2021, and an ArcOP Operations Symposium (for ArcOP operational partner staff) held on 20 May. These meetings progressed some of the operational planning that started in the pre-contract phase, and gave the opportunity for all the ArcOP partners to understand their role, their contribution, and the expectations of all parties involved.
The Program Member Offices (PMOs) sent their shortlisted nominations to ESO by 25 June. Nominations were shared with the Co-chief Scientists, with the Science Party finalised at a meeting on 19 August. Shortly after, the PMOs ratified our staffing choices, and at the start of September ESO issued pre-invites to the Science Party, to check their ongoing interested and availability. By 15 September, all pre-invites had been accepted, and ESO issued the full Online Invitation Pack in mid-October. This is the formal invite which includes substantial participation information that the prospective Science Party are required to read, understand and sign. ESO also issued a Special Call for a Paleogene radiolarian specialist, which is a specialism that was not available from any candidate from any PMO.

A high number of ESSAC scientists were invited - 17 instead of the usual ten. This is due to the requirement to have three IKC positions (two for Sweden and one for Germany). Also, with the loss of Brazil from the program, an extra position was taken up by ECORD. Additionally, it was agreed with ESSAC and EMA to increase the ESSAC contingent by another three to help address some of the national quota imbalances that had been building within the ESSAC system. Within the 17 ESSAC scientists, France, Germany and Norway are strongly represented. For the other PMOs there were eight scientists from the US, four from Japan, and one each for the remaining four associate members. One space was given to Russia, which is an observer position but will also be part of the Science Party. The male-female split was 58% male / 42% female, and the split of senior to junior was also 58% male / 42% female.
ESO staff contributed to the production of the Expedition 377 Scientific Prospectus, which was published online in August (*http://publications.iodp.org/scientific_prospectus/377/*).

Towards the end of 2021, sample requests were submitted and reviewed by ESO and the Co-chief Scientists.

A small ArcOP operator meeting between ESO, AMS and SPRS was held in Copenhagen on 1 December, and was the first time the team members had met physically since partnering for ArcOP. Discussions mainly focussed on the movements and opportunities to visit the *Dina Polaris* (agreed for early February 2022), initial thoughts on deck arrangements, ship accommodation, scheduling, and COVID-19 measures.

The proposed sailing date for ArcOP is 4 August 2022 from Tromsø, with discussions underway about the timing of ESO mobilisation. Other discussions on deck arrangements and accommodation were promising, and will be taken forward during the ship visit.

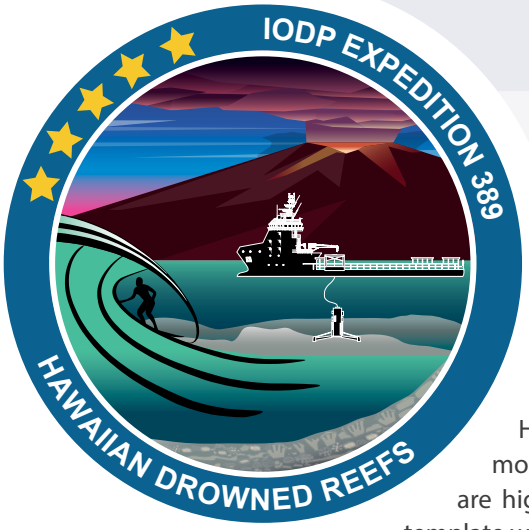
We are confident we can deploy measures to keep the vessels covid-free, using short quarantine periods with PCR testing and controlled boarding after results are returned. We are also considering how to mitigate the loss of staff who test positive just before boarding. This remains an open topic, and further consideration is required. In any event, participating staff are being asked to prepare to spend extra time before sailing for covid control measures.

View at the drilling rig from inside the D/V *Dina Polaris* that will be employed during IODP Expedition 377. Credits: Y. Voroshylov, Geoquip.

IODP Expedition 389

Scheduled for 2023

Hawaiian Drowned Reefs



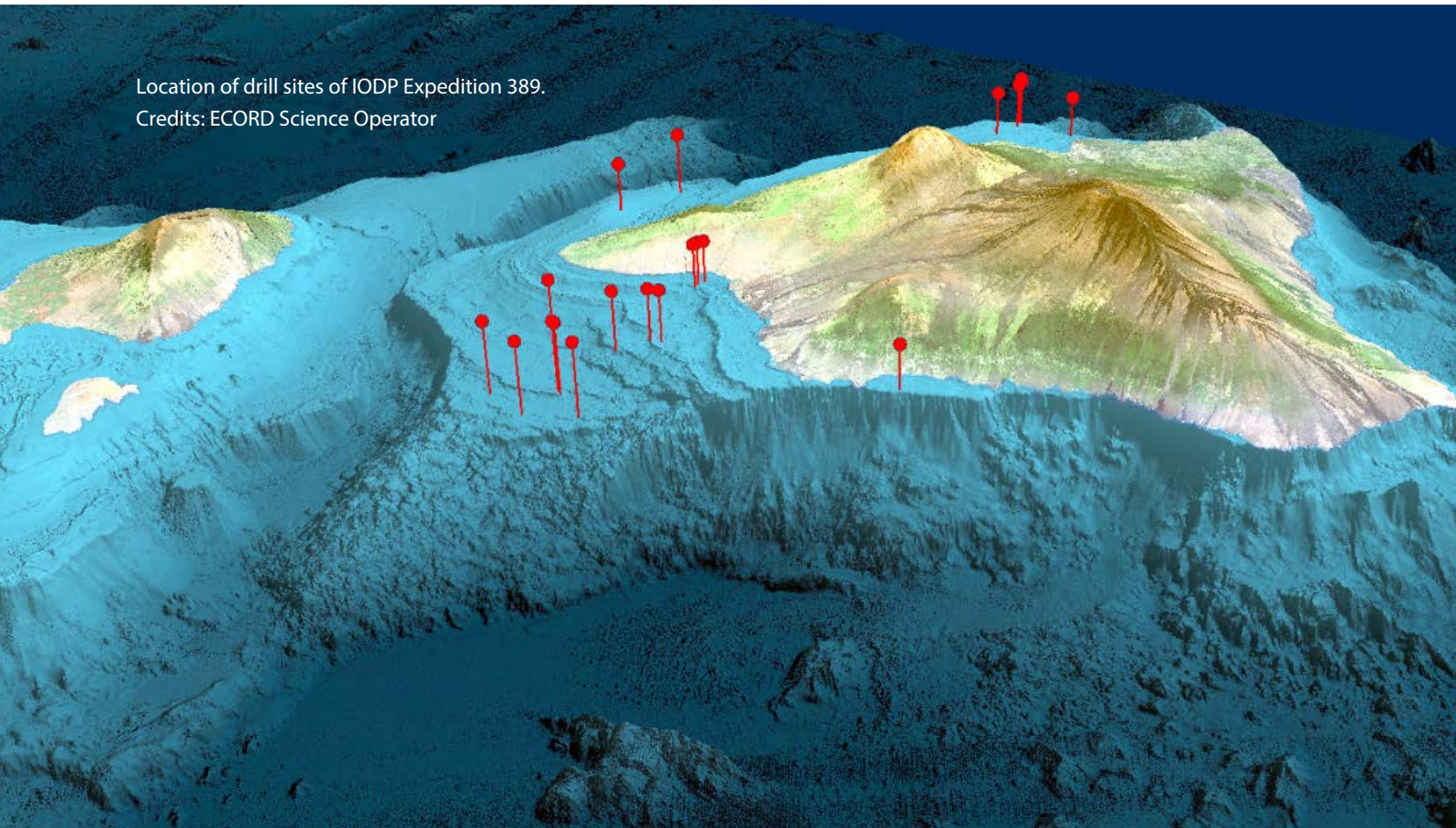
Co-chief Scientists **Jody Webster** (University of Sydney, Australia)
Christina Ravelo (University of California, USA)

Expedition website *www.ecord.org/expedition389*

Exp. 389 Scientific objectives

Our understanding of the links and mechanisms that control eustatic sea-level and global climate changes has been significantly hampered by a lack of appropriate fossil coral records over the last 500 kyr - particularly into and out of the glacial periods. It is proposed to address this problem directly by drilling a unique succession of drowned coral reefs around Hawaii now at -134 to -1155 m. Abundant observational and numerical modeling data indicate that the internal stratigraphy and tops of these reefs are highly sensitive to sea-level and climate changes, thereby providing a firm template with which to conduct these operations.

As a direct result of Hawaii's rapid (2.5-2.6/kyr) but nearly constant subsidence, a thick (100-200 m) expanded sequence of shallow coral reef dominated facies is preserved within the reefs. These reefs span important periods in Earth climate history, either not available or highly condensed on stable (Great Barrier Reef, Tahiti) and uplifted margins (Papua New Guinea, Barbados) due to a lack of accommodation space and/or unfavorable shelf morphology. Specifically, these data show that the reefs grew (for ~90-100 kyrs, albeit episodically) into, during and out of the majority of the last five to six glacial cycles. Therefore, scientific drilling through these reefs will generate a new record of sea-level and associated climate variability during several controversial and poorly understood periods over the last 500 kyr.



Location of drill sites of IODP Expedition 389.
Credits: ECORD Science Operator

The project has four major objectives.

First, to constrain the timing, rate, and amplitude of sea-level variability over the last 500 kyr allowing a definitive test of Milankovitch climate theory and an assessment of controversial abrupt sea level events (meltwater pulses) that occur on suborbital frequencies associated with events occurring in the extra-tropics (i.e., Dansgaard/Oeschger ice core temperature Events, and related Heinrich ice rafted debris Events in N. Atlantic sediment cores).

Second, to investigate processes that determine changes in mean climate and high-frequency (seasonal-interannual) climate variability using high-resolution coral proxy data from times with different climate forcing boundary conditions (e.g., ice sheet size, pCO_2, solar forcing) over the last 500 kyr.

Third, to determine the response of coral reef systems to abrupt sea-level and climate changes, test sedimentary models of reef evolution as well as ecologic theories of coral reef resilience and to establish the role of microbial communities in reef building.

And fourth, to refine the variation through space and time of the subsidence of Hawaii and contribute to understanding the volcanic evolution of the island.

Exp. 389 Operations

This expedition was previously postponed until further notice, and no major planning work was undertaken during 2020 or the first half of 2021. This expedition was re-scheduled for 2023 by the EFB at their September 2021 meeting.

There has been no major change to the operational outlook for this expedition. ESO attempted implementation in 2019, using a commercial seafloor drill system on a commercial vessel. However, the preferred contractor withdrew from the expedition before the contract was signed.

Towards the end of 2021, ESO re-initiated the permitting process, carried out fresh market research on seafloor drill options, and began work on a new Call to Tender for seafloor drill and vessel services to be published in early 2022.

Corals within a core obtained during IODP Expediton 325 onboard *Greatship Maya*. Credits: G. Tulloch, ECORD/IODP.

IODP Proposal 730-Full2

EFB waiting room

Sabine Bank Sea Level

Lead Proponent: **Frederick Taylor** (University of Texas, USA)

P 730 Scientific objectives

Western Pacific Warm Pool (WPWP) coral records of Quaternary climate and sea level continue underachieving their potential due to scarcity of samples. Pre-LGM corals are even rarer than post-LGM with virtually no records prior to ~15 ka; only MIS 3 sea level peaks are dated by corals, while low stands remain poorly defined. Some issues that fossil corals from Vanuatu would illuminate include pre-Holocene WPWP climate variability, including the El Niño-Southern Oscillation (ENSO) and decadal-scale variability, annual cycle sensitivity to insolation, and the response of the South Pacific Convergence Zone (SPCZ) to changes in background conditions and concrete paleosea level evidence. Dated corals from SB and BG would provide unprecedented constraints on the trajectory and rates of convergence and subsidence of a tectonic plate back into the mantle. Because of their geochemical character, corals are perhaps the most precisely datable natural material that records interannual, decadal, and century-scale SST and SSS variability via ^{18}O, Sr/Ca, and, possibly, other proxies at sub-annual resolution. Drilling rapidly subsiding reefs at Sabine Bank and Bougainville Guyot is a new strategy offering many advantages. Both reefs have ridden eastward over the New Hebrides trench outer rise (NHTOR) at mean rates of ~85 mm/yr and are descending into the trench. Bougainville Guyot was drilled at 1066 m depth at ODP Site 831 with extremely poor core recovery. However, an incredibly well preserved ~350 ka *Porites* sp. coral from ~ 240 mbsf produced one of the only credible pre-MIS 5e coral records. This example illustrates how rapid subsidence can facilitate coral preservation. Sabine Bank's surface lies at 5 - 35 m depths and MCS profiles indicate up to 500 m of carbonate subdivided into four major units overlying a faulted basement. SB drilling would produce at least a post LGM record, and possibly much more. The western ends of SB and BG are ~100 ka younger in their stratigraphic evolution than the western ends. This enables a strategy of drilling younger strata at the western edges of SB and BG and progressively older strata toward the trench to compensate for the limitations of the MARUM MeBo 200 Drill which presently has a 70 mbsf capacity, but is being improved to drill to 200 mbsf.

Corals within a core obtained during IODP Expediton 325 onboard *Greatship Maya*. Credits: J. Websted, ECORD/IODP.

IODP Expedition 373

Postponed

Antarctic Cenozoic Paleoclimate

Co-chief Scientists **Trevor Williams** (Texas A&M University, USA)
Carlota Escutia (University of Granada, Spain)

Expedition website *www.ecord.org/expedition373*

Exp. 373 Scientific objectives

Along the George V and Adélie Land (GVAL) shelf of Antarctica, shallowly-buried strata contain a record of Antarctica's climate and ice history from the lush forests of the Eocene greenhouse to the dynamic ice sheet margins of the Neogene. Over these times, Antarctica and the Southern Ocean have played a central role in controlling sea level, deep-water formation, ocean circulation, and exchange of carbon dioxide with the atmosphere. Yet currently there are very few direct records of Antarctic climate and ice conditions from close to the continent. On the GVAL shelf, short piston cores and dredges have recovered Cretaceous and Eocene sediment at the seabed. In 2010, IODP Expedition 318 recovered earliest Oligocene and early Pliocene subglacial and proglacial diamicts, providing direct records of ice advances across the shelf at these times, and confirming that target sediments are accessible at shallow burial depths. However, challenging ice and drilling conditions from the *JOIDES Resolution* resulted in poor core recovery and abandoning sites before the stratigraphic targets were reached. Here, it is proposed to use the MeBo sea bed drill for improved core recovery and easier access to the shelf. It is proposed to drill two stratigraphic transects of shallow (~80 m) holes to investigate Antarctica's role in icehouse and greenhouse climates, and the transitions between the two.

To investigate Oligocene to Pliocene ice sheet dynamics, strata above and below regional erosional and downlap surfaces are targeted to date and characterize major episodes of ice sheet advance and retreat. These direct records of ice extent on the shelf can be set in the context of Southern Ocean records of temperature, ice-rafted debris (IRD) and latitudinal fluctuations of the opal belt, and hence ice behavior can be related to paleoclimate conditions. The ice and climate history of the GVAL margin can provide warm-world scenarios to help understand ice sheet instability in analogous future warm climates.

In the Cretaceous and Eocene greenhouse target intervals: temperature and vegetation records will provide high-latitude constraints on pole-equator temperature gradients and their evolution; the proximity of the sites to the coastal lowlands will enable us to assess the hypothesized role of thawing permafrost in Eocene hyperthermal events; and late Eocene cooling and possible pre-cursor glaciations can also be documented by drilling.

Exp. 373 Operations

Expedition 373: Antarctic Cenozoic Paleoclimate was postponed until further notice in 2018, after a tender exercise demonstrated no vessel availability for the 2019/20 or 2020/21 Antarctic summer seasons.

In early 2020, ESO continued to liaise with the Australian Antarctic Division regarding a planned visit to the icebreaker *Nuyina* before it was delivered to Australia, either in the dockyard in Romania, or at a European port before, during or after Arctic sea trials. We learned from an AAD contact that the ship build was delayed due to the COVID-19 crisis (the shipyard had many positive Covid-19 cases). Ultimately, and due to COVID-19 restrictions, we were unable to visit the ship as planned, and we will arrange a visit when restrictions allow. We also considered the feasibility of using the icebreaker *Laura Bassi* (formerly the *RRS Ernest Shackleton*, now operated by the Italian Istituto Nazionale di Oceanografia e di Geofisica Sperimentale).

MSP proposals at SEP

Six MSP proposals are still currently handled by SEP and could potentially involve diverse drilling/coring technologies:

- 796-ADP: Nice Amphibious Drilling Ligurian Landslide (Lead Proponent: A. Kopf, ECORD-Germany) that will need to be re-structured into the new Land-2-Sea format;
- 931-Pre: East Antarctic Ice Sheet Evolution (Lead Proponent: A. Shevenell, USA), which could involve seabed-drilling;
- 995-Full: Canterbury Bight Offshore Freshened Groundwater (Lead Proponent: A. Micallef, ECORD-Germany), which could be achieved by using a lift-boat;
- 1003-Pre2: N. Cava Volcanic Ash (Lead Proponent: A. Dunlea, USA), which is supported by long piston coring;
- 1005-Full: Sunda Shelf Sea Level (Lead Proponent: P. Clift, USA);
- 1006-Pre: Mediterranean-Black Sea Gateway Exchange (Lead Proponent: W. Krijgsman, The Netherlands).

The EFB has contacted all Lead Proponents to request to link the scientific objectives of their proposals to the 2050 Science Framework (*https://iodp.org/2050-science-framework*), in order to enable a smooth transfer of their proposal to a future MSP-only programme.perational scenarios and costs were updated for the March 2020 and September 2021 EFB meetings.

MSP proposals at SEP

Proposal	Type	Short Title	PI	Country
796	ADP	NADIR: Nice Amphibious Drilling	Kopf	ECORD (Germany)
931	Pre	East Antarctic Ice Sheet Evolution	Shevenell	USA
995	Full	Canterbury Bight Offshore Freshened Groundwater	Micallef	ECORD (Germany)
1003	Pre2	N. CAVA Volcanic Ash	Dunlea	USA
1005	Full	Sunda Sea Level and Weathering	Clift	USA
1006	Pre	Mediterranean-Black Sea Gateway Exchange	Krijgsman	ECORD (The Netherlands)

IODP Proposal 796-ADP

SEP waiting room

Nice Amphibious Drilling

Lead Proponent: **Achim Kopf** (MARUM, Germany)

P 796 Scientific objectives

Submarine landslides, followed by tsunamis, represent a major geohazard and an exciting research target given the wealth of trigger mechanisms and their dynamic interaction. The Ligurian margin, western Mediterranean, is known for its steep topography with numerous landslide scars, however, the cause of these landslides is incompletely understood. Given the geodynamic situation adjacent to the western Alps (with seismicity ranging up to M>6) and the large discharge of water and sediment through the Var River, the lithological variability (coarse sand and conglomerate interbedded with sensitive clay) and different hydrological regimes (coupled to precipitation and seasonal melt-water discharge), as well as the profound human impact on the coast (e.g. collapsed landfill area and construction site in 1979, followed by a tsunami in the Gulf of Antibes), the French portion of the Riviera is an area where various triggers can be studied in a locally confined region.

The fact that the margin comprises permeable delta deposits that underwent transgression calls for an amphibious approach that addresses both the onshore portion of a charged aquifer as well the area into which the fluids are funneled, thus causing elevated pressure in the shallow submarine slope. It is proposed to drill two onshore and four offshore holes at the Ligurian margin to characterize the strata of the Plio-Quaternary Var aquifer, and the marine metastable slope E and W of the 1979 collapse structure and its redeposited material downslope. The target depth at each site will provide reconnaissance data to portions already sampled (onshore groundwater wells, offshore gravity/piston coring) and also characterization of the underlying strata down to the Pliocene puddingstones. Since mission-specific amphibious drilling and borehole instrumentation is proposed, drill cores and downhole-logging information will identify mechanically weak vs. strong layers, hydraulically active horizons, and zones of overpressure owing to groundwater-charging or rapid vertical loading in the Var delta deposits. The related hypotheses may be tested by drilling, and will be comprehensively answered by long-term monitoring of the physical parameters affecting slope failure. Offshore, borehole observatory installation is effortless given water depths of <50 m and will include multi-parameter instruments.

This proposal is designed to unambiguously test multiple-triggers for landslides at the French Riviera, and although locally restricted, the complexity of the area makes this margin a primary site for time- and cost-efficient operations at a glacially affected margin in the NEAM region.

IODP Proposal 931-Pre

SEP waiting room

East Antarctic Ice Sheet Evolution

Lead Proponent: **Amelia Shevenell** (University of South Florida, USA)

P 931 Scientific objectives

The aim is to recover Late Cretaceous to late Quaternary strata from the Sabrina Coast shelf, offshore of the Aurora Basin, East Antarctica. The Aurora Basin extends from the Gamburtsev Mountains to the coast, is one of East Antarctica's largest marine-based catchments, and contains 3-5 meters of sea-level equivalent ice. Models indicate that Antarctica's ice sheets may have nucleated in the Gamburtsev Mountains, reached the Sabrina Coast before continental-scale ice sheets formed, and has remained relatively sensitive to climate perturbations through the Cenozoic. The proposed drilling program will provide key constraints on the: 1) existence of warm high southern latitude climates during the late Mesozoic and early Cenozoic, and 2) evolution of the East Antarctic Ice Sheet in the Aurora Basin from the Paleogene to the last deglaciation. A broad range of datable open marine, glaciomarine, and subglacial sediments are accessible by shallow (150-300 m) drilling, as imaged by high-resolution seismic data and confirmed by piston cores collected during site survey cruise NBP14-02. This accessible archive of past Antarctic climate and ice sheet history will provide data to improve ice sheet and climate model boundary conditions and outputs. This type of data-model integration is required to better understand the response of Antarctica's ice sheets to continued anthropogenic warming.

IODP Proposal 995-Full

SEP waiting room

Canterbury Bight Offshore Freshened Groundwater

Lead Proponent: **Aaron Micallef** (GEOMAR, Germany)

P 995 Scientific objectives

Offshore freshened groundwater (OFG) is groundwater stored in sub-seafloor sediments and rocks with a total dissolved solid concentration below that of seawater. The large majority of OFG has been emplaced by meteoric recharge and is located in siliciclastic, rifted, non-glaciated margins, within 50 km of the coast and down to a water depth of 75 m. The OFG system hosted in the Canterbury Bight, which is located offshore of the South Island of New Zealand, shares these characteristics and is well constrained by geophysical data and numerical models. A hydrogeology-focused drilling campaign that targets two primary sites along a 28 km shore-normal transect in the Canterbury Bight is proposed. In-situ measurements and pumping tests are planned to:

1. determine hydrogeological and petrophysical properties of the aquifer, physical and chemical characteristics of the OFG, as well as the variation of boundary conditions over geological time-scales;
2. sample groundwater for geochemical (e.g., geochemical tracers, environmental isotopes, gas and nutrient analyses) and microbiological (e.g., gene-based analyses, microbial rate experiments, cell enumeration, radiocarbon analysis of RNA) analyses.

It is also planned to install SCIMPI observatories to corroborate and calibrate estimates and measurements of pressure, temperature and salinity, to monitor their variability over at least 9 years, and to estimate hydrologic properties at the borehole scale. Data from the proposed drilling campaign will allow us to address fundamental knowledge gaps related to OFG characteristics, controls and emplacement dynamics, and the role that it plays in global biogeochemical cycles, by:

1. (i) reducing uncertainty in estimations of OFG distribution and dimensions from geophysical data and mathematical models,
2. (ii) estimating the residence times of OFG,
3. (iii) reconstructing the environmental conditions prevailing during recharge,
4. (iv) constraining rates and mechanisms of freshening/salinisation,
5. (v) quantifying biogeochemical cycles and fluxes, and
6. (vi) characterising the abundance, activity, distribution and controls of microbial communities.

The project outcomes will improve the:

1. understanding of key elements, controlling factors and evolution of groundwater systems at the continental margin scale,
2. mapping and volumetric estimations of OFG systems, with direct implications for global water budgets and management of coastal groundwater resources;
3. understanding of biogeochemical cycling in shelf environments and the development of hydrological and reactive¬-transport models;
4. global models of total cellular life and their response to environmental change.

Cores onboard R/V *Kaimei* during IODP Expedition 386. Credits: N. Okutsu, ECORD/IODP/JAMSTEC

IODP Proposal 1003-Pre2

SEP waiting room

N. CAVA Volcanic Ash

Lead Proponent: **Ann Dunlea** (Woods Hole Oceanographic Institution, USA)

P 1003 Scientific objectives

Forecasting volcanic hazards is essential for protecting society, but the drivers and rhythms of eruptions are not well understood and limit predictive models. Alteration of volcanogenic material in marine sediment has been shown to play an important role in carbon cycling with consequences that may impact climate, but the extent of these interactions is far from clear. To move forward we need to understand the feedback mechanisms and relationships of volcanic ash with deep earth processes, the biosphere, and climate.

This project proposes to test four hypotheses:

1a. The rhythms of volcanic activity from the Southern Mexico and Northern Central American volcanic arcs are correlated with glacial-interglacial cycles and/or tectonic events.

1b. Changes in the composition of volcanogenic material deposited over time reflect the evolution of the volcanic arc and reflect changes in sediment composition being subducted to the arc.

2a. The presence of reactive silicates in volcanogenic material plays a major role in the carbon and silica cycles that determine whether CO_2 is released from or sequestered in the sediment.

2b. Microbial abundance, composition, and activity are controlled by the presence of volcanogenic material and its degree of alteration and/or diagenesis.

To test these hypotheses, it is proposed to:

A. construct ~750kyr to 7.5Myr records of the frequency, magnitude, and composition of the volcanic ash (layers and dispersed) in the marine sediments offshore of Southern Mexico and Northern Central America; and

B. constrain the effects of subseafloor post-depositional alteration of volcanogenic material on carbon cycling pathways and the subseafloor biosphere.

Completion of these objectives requires drilling 20 sites along the margin of Southern Mexico and the Northern Central American Volcanic Arc where a prolific amount of volcanic ash is buried in the seafloor. Utilizing modern drilling techniques, novel analytical approaches to characterize sediment and pore water, and state of the art biosphere sampling and analyses, the project will generate research opportunities beyond what can be achieved with the marine sediment drilled on earlier DSDP/ ODP/ IODP expeditions. The resulting research will reveal the role of volcanic ash in deep sea carbon preservation and the biosphere and decipher the relationship and strength of external factors modulating volcanic hazards, thereby helping improve predictions of future explosive volcanic hazards.

IODP Proposal 1005-Full

SEP waiting room

Sunda Sea Level and Weathering

Lead Proponent: **Peter Clift** (Louisiana State University, USA)

P 1005 Scientific objectives

The low-latitude tropics are affected by repeated emergence and submergence of some of the world's largest continental shelves. Initial studies suggest that enhanced chemical weathering and growth of rainforests during times of exposure have a significant effect on global atmospheric CO_2 levels. Unlike their high latitude equivalents, tropical shelves appear to have played a key role on regulating global climate since the Pliocene, but this is presently poorly understood because previous drilling has largely been on the continental slopes making measuring the weathering state of the exposed shelf difficult. The Sunda Shelf in SE Asia is the largest tropical shelf worldwide well-suited for comprehensive, high-resolution studies designed to reconstruct major geomorphic changes on a "Maritime Continent" and to assess associated interactions with global climate. Coupled with regional seismic data drilling will permit a weathering and CO_2 consumption budget to be reconstructed. Moreover, the Sunda Shelf has been the site of extensive methane-emitting wetlands during sea-level highstands that are eroded during regressions and that may further amplify climatic cycles. The sedimentary sequences will be used to evaluate the contribution of the glacial exposure of this major tropical shelf functioning as an enormous CO_2 and methane sink/source and as a second set of "Lungs of the Earth".

IODP Proposal 1006-Pre

SEP waiting room

Mediterranean-Black Sea Gateway Exchange

Lead Proponent: **Wout Krijgsman** (University of Utrecht, The Netherlands)

P 1006 Scientific objectives

BlackGate aims to address fundamental questions concerning the dynamic evolution of the Mediterranean-Black Sea (MBS) gateway and its paleoenvironmental consequences. The importance of Mediterranean connectivity has been recognised, and several accepted IODP projects (IMMAGE, DEMISE) are currently directed at a better understanding of the Miocene gateway systems that led to the rise and demise of the Mediterranean Messinian Salinity Crisis, the youngest and largest salt giant in Earth history, and its consequences for global climate change. The missing link for a comprehensive understanding is the poor constraints on the hydrological fluxes through the Mediterranean-Black Sea gateway, derived from a huge catchment that at times drained much of Europe and Asia. This gateway also drives the Pliocene-Quaternary circulation patterns in the Black Sea and governs its status as the world's largest example of marine anoxia. The exchange history of the MBS gateway is poorly constrained because continuous Pliocene-Quaternary deposits are not exposed on land adjacent to the Black Sea or North Aegean. Gateway exchange is controlled by climatic (glacio-eustatic driven sea level fluctuations) and tectonic processes in the catchment (linking the Black and Caspian seas) as well as tectonic propagation of the North Anatolian Fault zone in the gateway area itself. Changes in MBS connectivity trigger dramatic paleoenvironmental and biotic turnovers. Drilling a Messinian to Recent transect in the Aegean, Marmara and Black seas will recover high-amplitude records of continent-scale hydrological changes during glacial-interglacial cycles, marine and fresh water fluxes, biological turnover events, patterns and processes of anoxia, chemical perturbations and carbon cycling, growth and propagation of the NAF, existence of land-bridges for Africa/Asia-Europe mammal migration and presence/ absence of water exchange during the Messinian salt giant. It is proposed to use a MSP to drill three sites, one on the Turkish margin of the Black Sea (Arkhangelsky Ridge 400 mbsf), one on the southern margin of the Sea of Marmara (North Imrali Basin 750 mbsf) and one in the Aegean (North Aegean Trough 650 mbsf). All sites target Quaternary oxic-anoxic marl-sapropel cycles. Pliocene lacustrine sediments and mixed marine-brackish Miocene sediments will be recovered from the Black Sea and Aegean. MSP drilling is required because *JOIDES Resolution* cannot pass under the Bosporus bridges.

View from onboard *Fugro Synergy* during IODP Expedition 381: Corinth Active Rift Development. Credit: J. Everest, ECORD/IODP.

4. Participating in 2021 IODP expeditions

JOIDES Resolution during IODP Expedition 396. Credits: Peter Betlem, IODP.

4. Participating in 2021 IODP expeditions

IODP expeditions

www.iodp.org/expeditions

IODP 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.

In 2021, **two expeditions** were implemented on the *JOIDES Resolution* (JR).

A total of 21 ECORD scientists from nine ECORD member countries were invited to participate including **three Co-chief Scientists**.

Exp. 395C | Exp. 396

Participation of ECORD scientists

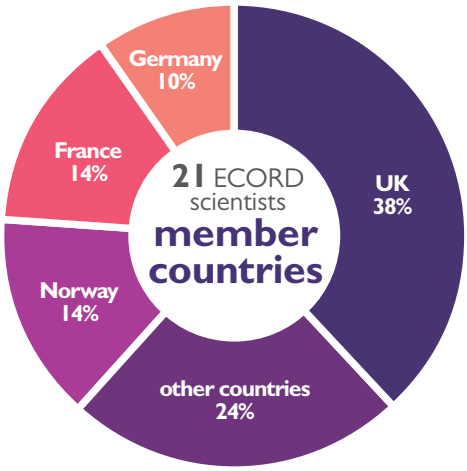
In 2021, ECORD, as a contributing member of IODP, was entitled to an average of seven scientists on every IODP expedition onboard the drill ship *JOIDES Resolution* (JR). Scientists are chosen following an open call for applications and a competitive selection process. After a nomination proposal by ESSAC, staffing discussions are held with the implementing organisations, the appointed Co-chief Scientists and the IODP member countries/consortia.

Participation of ECORD scientists is proportional to the financial contributions of the member countries to the ECORD budget following a quota system. Selection of ECORD members of shipboard Science Parties is, therefore, based on both scientific merit and a time-averaged country quota. However, country quotas do not apply when a specific expertise is requested through a Special Call, or if the expedition occurs in territorial waters of an ECORD member country. In both cases, scientists from ECORD member countries can also sail following special calls or sail as observers.

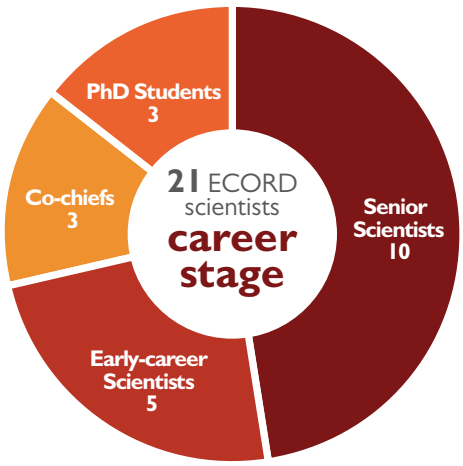
JOIDES Resolution Science Operator

Despite of the effects of the global coronavirus pandemic, two *JOIDES Resolution* expeditions took place in 2021, albeit with reduced shipboard science parties. However, all scientists selected for participation remained part of the formal expedition science teams and will work on the samples collected during offshore operations.

In total, 21 ECORD scientists were selected in 2021, including three Co-chief Scientists and seven scientists staffed in response to Special Calls.



Distribution of ECORD scientists in 2021 IODP expeditions by country (n = 21)



ECORD participants in 2021 IODP expeditions by career stage (n = 21).

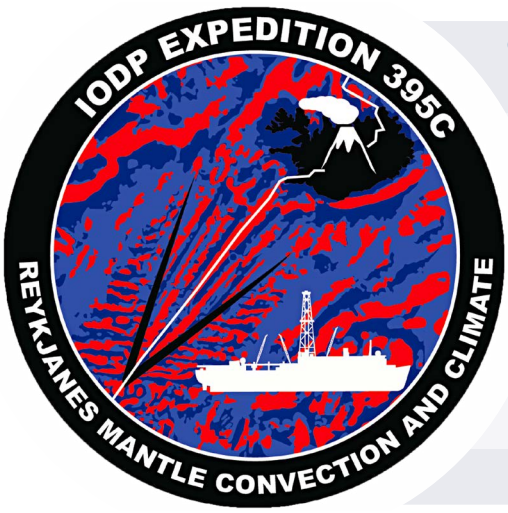
JOIDES Resolution drill in the sun during IODP Expedition 395C. Credits: Sarah Kachovich, IODP JRSO

IODP Expedition 395C

JOIDES Resolution Science Operator

5 June - 6 August 2021

Reykjanes Mantle Convection and Climate: Crustal Objectives



Co-chief Scientist	Anne R. Briais (Institut Universitaire Européen de la Mer, France)
Participating Scientists	David McNamara (University of Liverpool, UK) Bramley Murton (NOC Southampton, UK) Sara Satolli (University of Chieti-Pescara, UK) Paul N. Pearson (Cardiff University, UK) Nicholas J. White (University of Cambridge, UK) Katharina Hochmuth (University of Leicester, UK) Sevasti E. Modestou (University of Bergen, Norway) Gabriel T. Pasquet (University of Pau and Pays de l'Adour, France) Boris T. Karatsolis (Uppsala University, Sweden)

https://joidesresolution.org/expedition/reykjanes-mantle-convection-and-climate/

Exp. 395 Principal goals

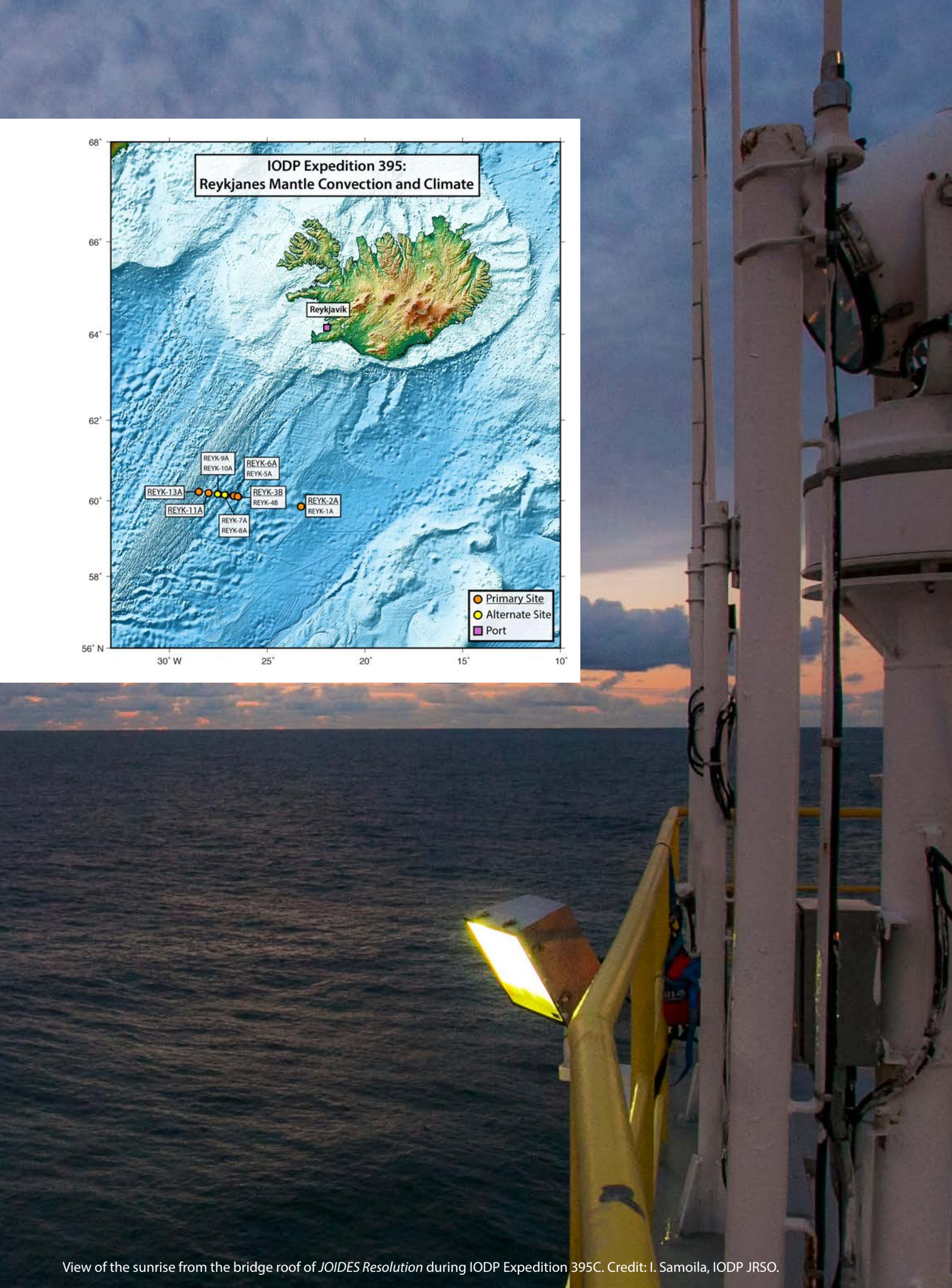
While most of Expedition 395 has been postponed to summer 2023, some aspects have been done in 2021. IODP Expedition 395C carried out the general planned objectives of IODP Expedition 395:

1. To test contrasting hypotheses for the formation of V-Shaped Ridges,
2. To understand temporal changes in ocean circulation and explore connections with plume activity, and
3. to reconstruct the evolving chemistry of hydrothermal fluids with increasing crustal age and varying sediment thickness and crustal architecture.

This was achieved with a greatly reduced scientific presence onboard the *JOIDES Resolution*, with the majority of scientists participating virtually from the shore. A crew of Expedition Program Manager/Staff Scientist and technicians ensured that the science will still be done. The intersection between the Mid-Atlantic Ridge and Iceland hotspot provides a natural laboratory where the composition and dynamics of Earth's upper mantle can be observed. Plume-ridge interaction drives variations in the melting regime, which result in a range of crustal types, including a series of V-shaped ridges (VSRs) and V-shaped troughs (VSTs) south of Iceland. Time-dependent mantle upwelling beneath Iceland dynamically supports regional bathymetry and leads to changes in the height of oceanic gateways, which in turn control the flow of deep water on geologic timescales. Expedition 395 has three objectives:

1. to test contrasting hypotheses for the formation of VSRs,
2. to understand temporal changes in ocean circulation and explore connections with plume activity, and
3. to reconstruct the evolving chemistry of hydrothermal fluids with increasing crustal age and varying sediment thickness and crustal architecture.

This expedition will recover basaltic samples from crust that is blanketed by thick sediments and is thus inaccessible when using dredging. Major, trace, and isotope geochemistry of basalts will allow us to observe spatial and temporal variations in mantle melting processes. We will test the hypothesis that the Iceland plume thermally pulses on two timescales (5–10 and ~30 Ma), leading to fundamental changes in crustal architecture. This idea will be tested against alternative hypotheses involving propagating rifts and buoyant mantle upwelling. Millennial-scale paleoclimate records are contained in rapidly accumulated sediments of contourite drifts in this region. The accumulation rate of these sediments is a proxy for current strength, which is moderated by dynamic support of oceanic gateways such as the Greenland-Scotland Ridge. These sediments also provide constraints for climatic events including Pliocene warmth, the onset of Northern Hemisphere glaciation, and abrupt Late Pleistocene climate change. Our combined approach will explore relationships between deep Earth processes, ocean circulation, and climate. Our objectives will be addressed by recovering sedimentary and basaltic cores, and we plan to penetrate ~130 m into igneous basement at five sites east of Reykjanes Ridge. Four sites intersect VSR/VST pairs, one of which coincides with Björn drift. A fifth site is located over 32.4 My old oceanic crust that is devoid of V-shaped features. This site was chosen because it intersects Oligocene–Miocene sediments of Gardar drift. Recovered sediments and basalts will provide a major advance in our understanding of mantle dynamics and the linked nature of Earth's interior, oceans, and climate.



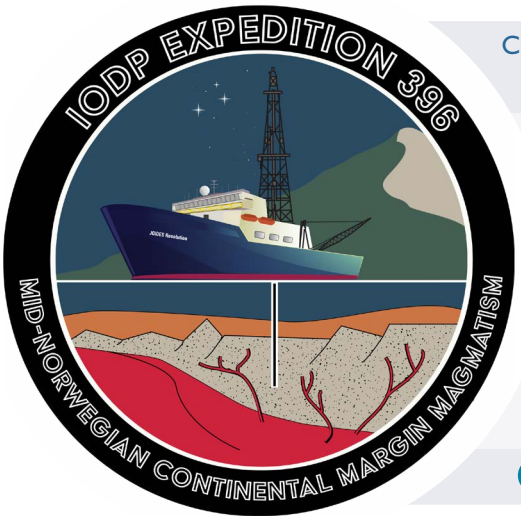
View of the sunrise from the bridge roof of *JOIDES Resolution* during IODP Expedition 395C. Credit: I. Samoila, IODP JRSO.

IODP Expedition 396

JOIDES Resolution Science Operator

6 August - 6 October 2021

Mid-Norwegian Margin Magmatism and Paleoclimate Implications



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Joost Frieling (University of Oxford, UK)
Jack Longman (Carl von Ossietzky University, Germany)
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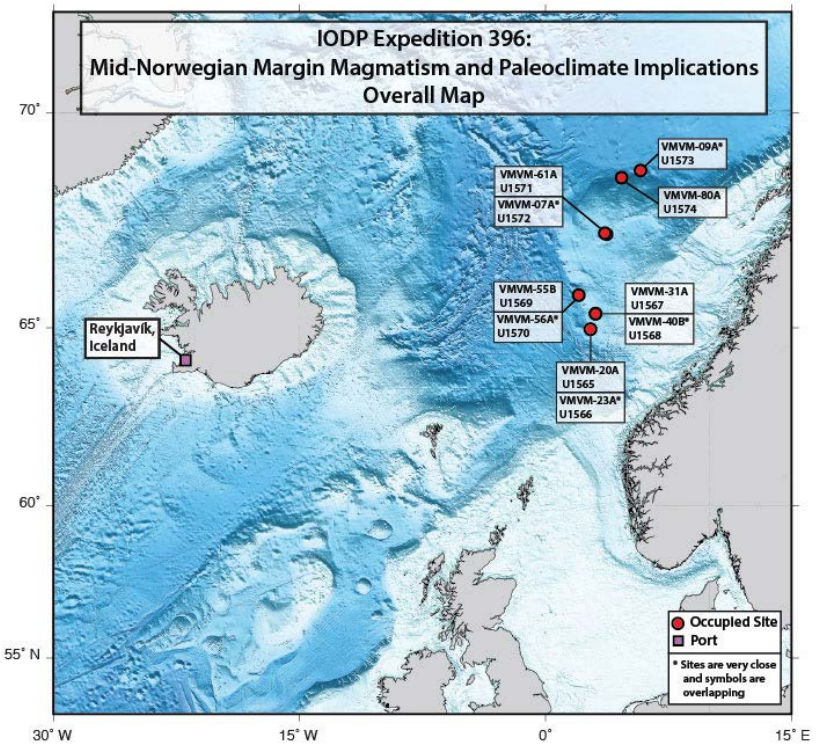
Peter Betlem (University Centre in Svalbard, Norway)

https://joidesresolution.org/expedition/mid-norwegian-continental-margin-magmatism/

Exp. 396 Principal goals

The opening of the North Atlantic about 56 My ago was associated with the emplacement of the North Atlantic Igneous Province, including the deposition of voluminous extrusive basaltic successions and intrusion of magma into the surrounding sedimentary basins. The mid-Norwegian Margin is a global type example of such volcanic rifted margins and is well suited for scientific drilling with its thin sediment cover and good data coverage.



During IODP Expedition 396, 21 boreholes were drilled at ten sites in five different geological settings on this volcanic margin. The boreholes sampled a multitude of igneous and sedimentary settings ranging from lava flow fields to hydrothermal vent complexes, along with thick successions of upper Paleocene and lower Eocene strata. A comprehensive suite of wireline logs was collected in eight boreholes. The main goals of the expedition were to provide constraints for geodynamic models to test different hypotheses that can explain the rapid emplacement of large igneous provinces and the hypothesis that the associated Paleocene/Eocene Thermal Maximum was caused by hydrothermal release of carbon in response to magmatic intrusions.

Successful drilling, combined with high core recovery of target intervals of all nine primary sites and one additional alternate site, should allow us to achieve these goals during post-cruise work.

JOIDES Resolution during sunrise, IODP Expedition 396. Credit: Peter Betlem & IODP.

5. Selected 2021 IODP publications from ECORD scientists

227 publications

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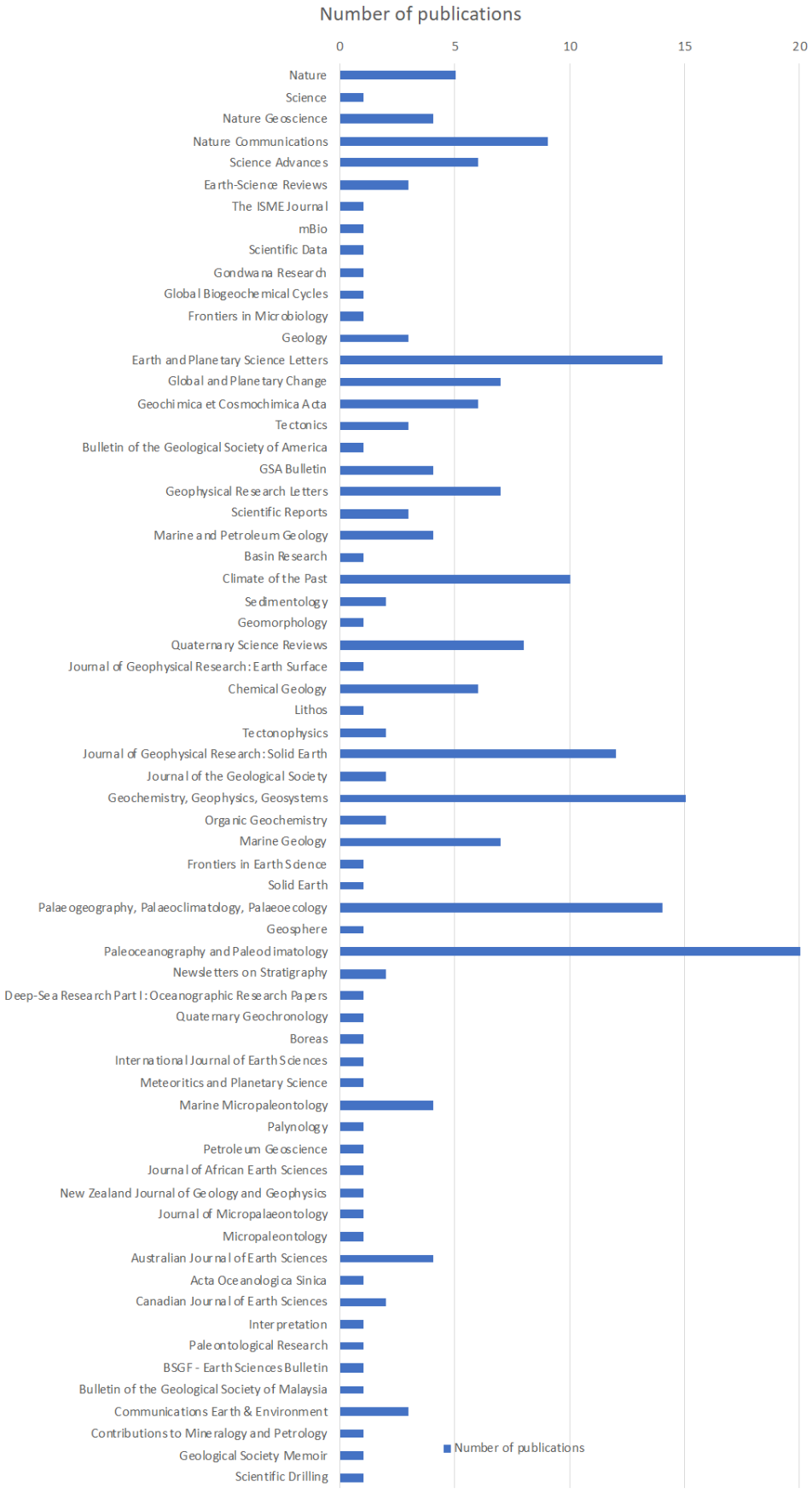

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Operations onboard R/V *Kaimei* during the IODP Expedition 386. Credits: K. Ikehara, ECORD/IODP/JAMSTEC

6. Archiving IODP cores: the IODP Bremen Core Repository

Almost done – Holger Kuhlmann (BCR) finishing a sample request. Credit: Ulla Röhl, MARUM, IODP.

IODP Bremen Core Repository (BCR)

www.marum.de/en/Research/IODP-Bremen-Core-Repository.html

The Bremen Core Repository (BCR) at the MARUM, University of Bremen, Germany, is one of the three IODP core repositories. The other two are the Gulf Cost Repository (GCR) located at Texas A&M University in College Station, USA, and the Kochi Core Center (KCC) in Kochi, Japan (see the map below). In accord with IODP convention and practice, the BCR hosts all the cores recovered since the beginning of scientific ocean drilling from the Atlantic and Arctic oceans as well as the Mediterranean, Baltic and Black Seas. The BCR is also responsible for organizing and hosting the Onshore Science Parties of and providing mobile laboratories and scientific expertise for Mission-Specific Platform (MSP) expeditions.

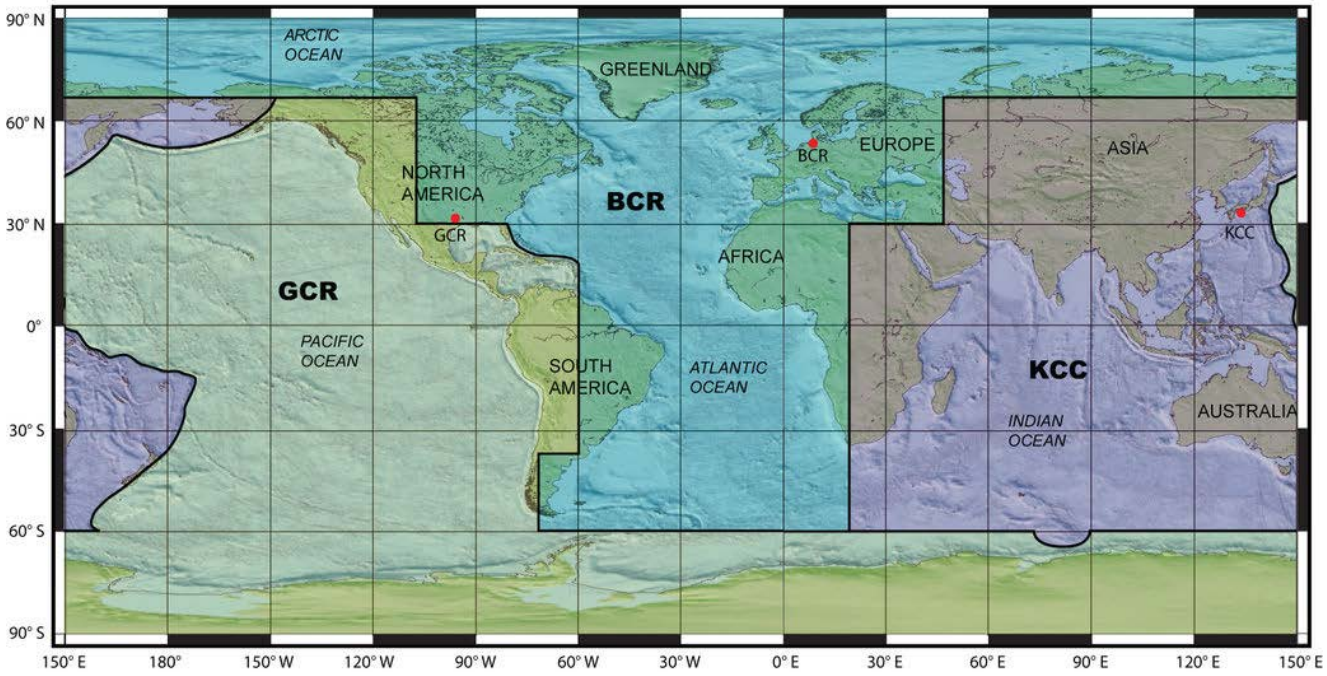
BCR was founded in 1994 and moved to the MARUM building on the University of Bremen campus in 2005. During the DSDP/ODP Core Redistribution project (2006-2008) the collection grew from 75 km to 140 km of cores, currently the collection holds more than 160 km of cores acquired during 91 expeditions.

Universität Bremen ECORD IODP

Effects of the COVID-19 pandemic on BCR operation

As everyone in the world the BCR was also affected by the pandemic in 2021, but in the end any temporary backlogs could be dealt with in a timely manner and there was no substantial sample request stack by the end of the year.

IODP sample requests were accepted throughout the year, but the completion and shipment of requested samples – discontinued during the period of the hard lockdown – was slightly delayed in some cases. Also, not all requesters' institutions were able to accept shipments and therefore the BCR refrained from shipping these samples during some intervals contributing to a temporary batch of non-completed sample requests.



Geographic Assignment of Core Samples to Repositories.
Adapted from Firth, JV, Gupta, LP and Röhl, U (2009) New focus on the Tales of the Earth - Legacy Cores Redistribution Project Completed. Scientific Drilling, 7. 31-33. doi:10.2204/iodp.sd.7.03.2009. [Map Mar 15, 2016].
Retrieved from *http://www.marum.de/en/Cores_at_BCR.html*

Samples, requests, and data management at BCR

BCR statistics

A total of 20,899 samples were taken at the BCR for 178 requests (of which 110 were submitted by scientists based in an ECORD country).

All BCR samples (over 1.78 million samples/more than 7678 sample requests, incl. samples taken earlier at the ECR for legacy cores that are now at BCR) are entered into a database, the BCR DIS Internet Interface, that is accessible to the general public for post-moratorium samples (web interface for curatorial data *http://dis.iodp.pangaea.de/BCRDIS/*).

Repository and sample statistics

	Expeditions	Amount of core (km)
	91	160
	Sample Requests (from ECORD countries)	**Samples taken**
Bremen Core Repository FY21	178 (110)	20,899 (11,371)
Bremen Core Repository (since opening in 1994)	5341	1,108,720
From all cores stored at BCR	7678	1,786,146

Database: the BCR DIS Internet Interface

The CurationDIS (6.3) is currently in operation at the BCR and working smoothly. Since 2019, we closely follow the developments of the next generation of database, the "mobile Drilling Information System" (mDIS, initiated by the ICDP) by hosting or participating in mostly virtual meetings for identifying required functionalities towards a generic mDIS curation version. In 2021, the planning and preparation toward the mobile DIS (mDIS) was intensified. We continually follow and participate in the development of the mDIS, in close collaboration with the ICDP at GFZ Potsdam, the developments for an AWI SAMS (SAmple Management System) also based on the ICDP mDIS, as well as the exchange group sample management (break-out group "mDIS") as part of the University of Bremen Research Alliance (UBRA).

SEDIS: The Scientific Earth Drilling Information Service

The Scientific Earth Drilling Information Service – **SEDIS** (*http://sedis.iodp.org/*) is continued in IODP and being maintained.

View from R/V *Kaimei* during IODP Expedition 386. Credits: N. Okutsu, ECORD/IODP/JAMSTEC.

MSP Expeditions at BCR

IODP Expedition 386: Japan Trench Paleoseismology

All incoming sample request and related scientist´s information have been entered into the Drilling Information system (DIS). BCR staff was involved in container shipments to the RV *Kaimei* and their re-direction for return to Bremen, when ESO staff could not participate in the Offshore Phase. Further support was provided through the discussion of core-flow, core handling, and lab layout of the various versions of the Offshore Phase in 2021 and Onshore Science Party (OSP) planning for 2022.

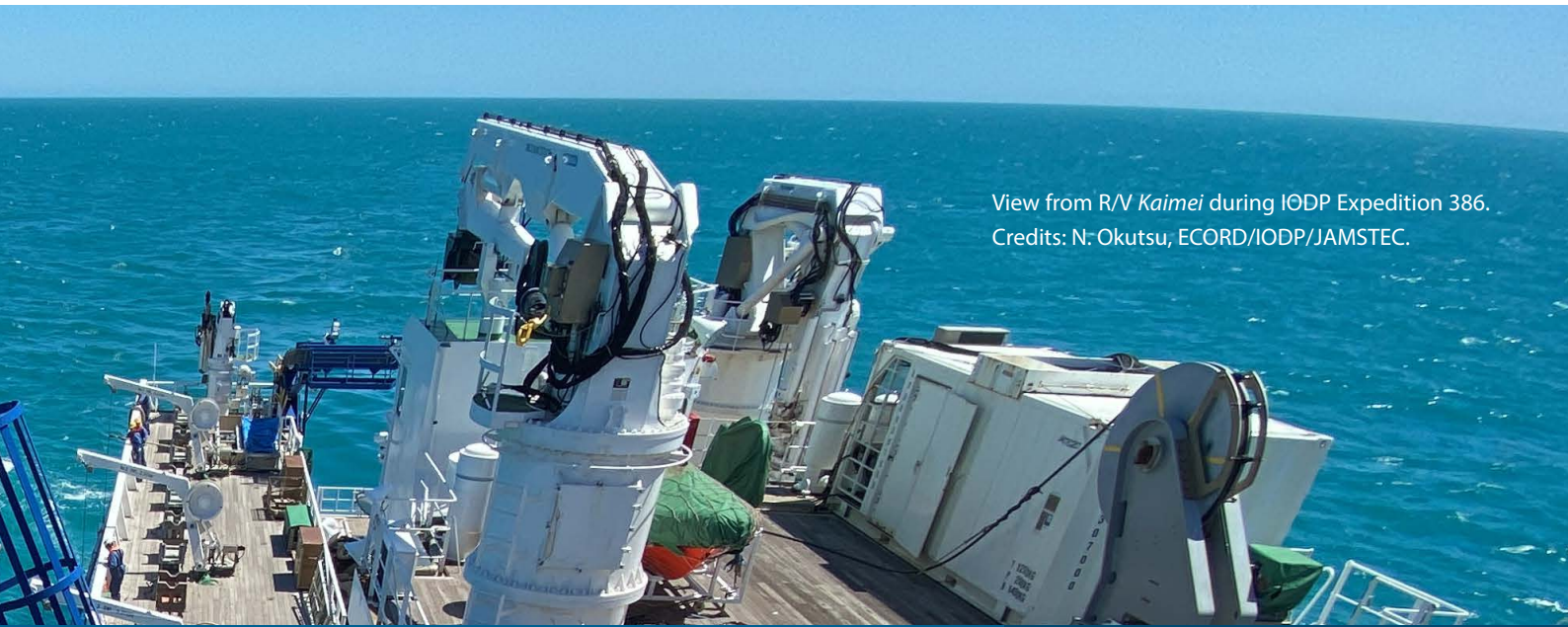
IODP Expedition 377: Arctic Ocean Paleoceanography (ArcOP)

BCR staff attended the IODP Expedition 377 webinar held online at the occasion of the EGU General Assembly in April 2021. The suite of laboratory containers underwent maintenance to be ready for implementation of the Expedition 377 Offshore Phase in summer 2022. All incoming science party members´ sample requests and metadata were integrated into the DIS.

Cores from *JOIDES Resolution* expeditions for the BCR

IODP Expedition 396: Mid-Norwegian Continental Margin Magmatism

Two kilometres of working halves core sections from Expedition 396 arrived at the BCR in October 2021. We closely collaborate with the GCR and plan for the respective Sampling Party (SP) to be conducted between 21– 28 April 2022 in Bremen. We assume that by the end of the SP, **a total of about 20,000 samples** will be taken.



View from R/V *Kaimei* during IODP Expedition 386.
Credits: N. Okutsu, ECORD/IODP/JAMSTEC.

Visitors at the BCR

The location of the BCR on the University of Bremen campus has proven to be very convenient for many visitors, ranging from walk-in scientific visitors, the general public, school classes (including skype conferences to the geo show "unterirdisch" in Cologne at the occasion of the German IODP/ICDP Meeting), and groups of visiting students from other universities in Germany and Europe as well as official delegations visiting the University of Bremen.

Since the Corona measures have been eased between mid-May and mid-December 2021, it was possible to welcome visitors back to labs and reefer of course applying all necessary hygiene concepts including access control at the building's entrance..

In 2021, amongst others, the BCR was visited by participants of the Staff Week "From Cotutelles to Joint Programs – Challenges and Opportunities" organized by the University of Bremen as part of the Erasmus+ project "Joint Programs at Doctorate Level in a European university network: Linking Education and Research towards the European Education Area" (Link EDU-RES); a delegation of the YUFE Alliance (Young Universities for the Future of Europe) from the Universities of Antwerp, Carlos III Madrid, Cyprus, Eastern Finland, Essex, Maastricht, Nicolaus Copernicus in Torun, Rijeka, and Tor Vergat in Rome; a delegation including Prof. Pedro Patarroyo from the Department of Geosciences at the National University of Colombia, and Trade Commissioner E. Nave; and a delegation from the Canadian Embassy accompanied by a representative from the Bremen Senator of Economics, Labor and European Affairs.

Training students

In 2021, the BCR provided again core material for numerous course studies run by various instructors. Due to the pandemic, the BCR provided cores for two classes held in the Geoscience building. The BCR is normally also an ideal place to train students, with the opportunity to work on real cores and have access to laboratory facilities. Nevertheless, the ECORD Training Course and ECORD Summer School programme could not be held as a result of pandemic restrictions. In 2021, we originally planned to hold the postponed 14th ECORD Summer School that will be dedicated to the topic of "Sea level, climate variability, and coral reefs" (now postponed to 2022).

Visits by media representatives

Equally important for informing and educating the general public of our goals and scientific and technical achievements are the frequent visits by media representatives (television, radio and print). For example, J.R. Heinicke, University of Applied Sciences and Arts, Hannover, Germany, visited for photo shooting for a project on climate archives and proxies; photographer H. Retzlaff took pictures for the German TV station's ARD picture archive; photographer Christoph Oeschger and author Gianna Molinari took pictures and interviewed Expedition 377 Co-chief Scientist R. Stein (MARUM) and the BCR manager; a film team from the German TV station ZDF did filming and interviews with A. Sluijs (University of Utrecht) and the BCR manager; and a German TV team (WELT/N24) interviewed the BCR manager.

Filming in the reefer, TV station N24/Welt. Credit: Ulrike Prange, MARUM and IODP.

TV team applying an ultra-macro lense for filming a selected PETM core section in November 2021. Credit: U. Röhl, MARUM.

7. Engaging the community

Zoom chat between offshore and onshore teams from onboard R/V *Kaimei* during IODP Expedition 386. Credits: N. Okutsu, ECORD/IODP/JAMSTEC.

7. Engaging the Community

7.1 Training young scientists

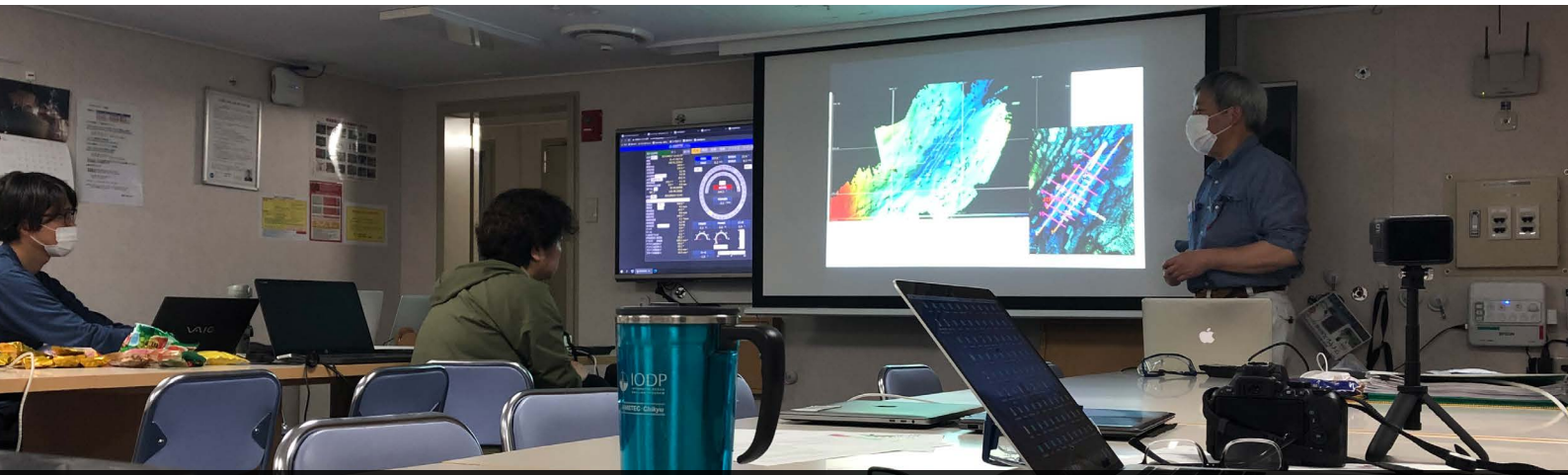
A major goal of ECORD is to train the next generation of scientists from member countries and promote IODP-motivated science.

The **ECORD Summer School**s, initiated in 2007, are well-established and are attended annually by many Masters-level and PhD students as well as post-doctoral research fellows from ECORD member countries and beyond. One virtual ECORD Summer School has been organised in 2021.

In early 2020, ESO-EPC staff continued preparations for the 2020 Petrophysics Summer School. The date was set for 4 – 10 July 2020, and the name changed to "ECORD Summer School: Downhole logging for IODP Science".

All ECORD Summer Schools (2x Bremen, 1x Leicester, 1x Urbino) were cancelled in 2020 due to the COVID-19 pandemic, and this also led to the cancellation of the 2020 round of ECORD Scholarships. At the ESSAC meeting held in early June 2020, some discussion focused on how to invest the money from the ESSAC budget that would have supported these events. It was favored to develop a Summer School-related e-resource based on hands-on analysis of core materials, physical property and logging data, and perhaps also incorporating aspects of site surveys/site location.

While there is no intention to replicate all aspects of the normal summer school programme of events, nor to replace them in any way, it is anticipated to have a product that covers the essence of scientific ocean drilling (drawing upon aspects of the summer schools and ECORD training course, including selected existing exercises) that can then be used by a range of people around the world including university lecturers on geoscience pathways, people who might be selected to sail on future expeditions, and people signing up for the summer schools.

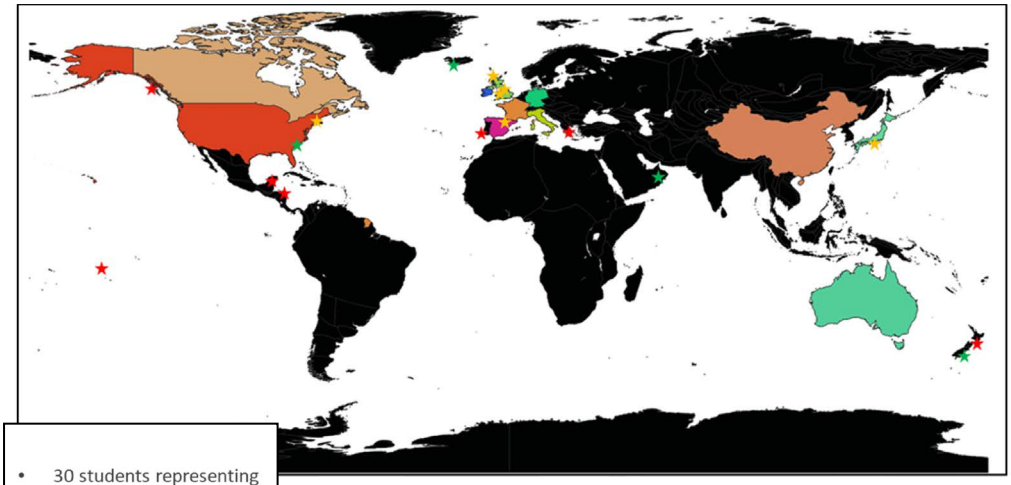


Offshore team communication during IODP Expedition 386 onboard R/V *Kaimei*. Credits: K. Hsiung, ECORD/IODP/JAMSTEC.

ECORD 5th Summer School: Downhole-Logging for IODP Science

Virtual, hosted by EPC at University of Leicester, Leicester, UK , 13-17 September 2021

After a one-year hiatus due to the COVID-19 pandemic, the 5th ECORD Summer School: Downhole-Logging for IODP Science (previously the Petrophysics Summer School) took place via Zoom on 13-17 September 2021. The event was organised by the European Petrophysics Consortium (EPC) and hosted by the University of Leicester.



- 30 students representing 11 countries (17 nationalities)
- Presenters from Columbia University, BGS, MarE3/JAMSTEC, Imperial College London, University of Montpellier
- Exercises covered 3 IODP drilling locations
- Individual group projects covered 6 IODP campaigns worldwide

Twenty-eight early-career researchers from around the globe, representing 17 nationalities from as many different time zones, joined the EPC Team and a group of distinguished guest lecturers online for a week full of insightful presentations and practical exercises.

The week started with a whistle-stop tour through the history of IODP (for example, did you know that Nature Magazine called IODP "the most successful international research collaboration ever"?), as well as the ins and outs of scientific offshore drilling operations (including how to handle drill pipe collars the acrobatic way!) presented by Angela Slagle and Gilles Guerin from Lamont-Doherty Earth Observatory in the US. Peter Finch from the University College of London taught the basic principles of Petrophysics which the students had to promptly apply in fun and challenging, (but not too challenging) log-analysis exercises. In the following days, students listened to exciting accounts of operations and scientific outcomes for past IODP and ICDP expeditions, for example on the Japanese drilling vessel *Chikyu* (Yoshinori Sanada, Japan Agency for Marine-Earth Science and Technology), for mission specific platforms (Dave McInroy, British Geological Survey), and while drilling and logging the Semail Ophiolite in Oman (Dr. Philippe Pezard, Geosciences Montpellier, CNRS, Montpellier University, Montpellier). In between lectures and exercises, Leicester's own Emeritus Professor Mike Lovell educated and entertained the group by highlighting ways of finding useful analogues for rock-fluid interactions in the kitchen (you read that right) - while also answering life's central question of how much salt is the right amount for boiling pasta (if you want to know the answer, apply for next year's summer school!). Finally, students showcased their newly acquired petrophysics skills during a series of exercises and a final group project using data from one of six selected IODP expeditions. The results of the group projects were presented on the last day and organizers, lecturers, and tutors alike were awed by the students' efforts and the quality of the presentations.

According to exit polls, the summer school was very well received by the participants overall. Many voiced their regret that they were not able to join in person and emphasized that Zoom could not replace face-to-face classes – never mind talking core porosity over beer and curry in beautiful Leicestershire. Hopefully, the 2022 ECORD Summer School will return to being an in-person learning event. Fingers crossed!

Simon Draper - *sd227@leicester.ac.uk*
EPC Project Manager, University of Leicester

7.2 Sponsoring research for young scientists

ECORD Research Grants

10 GRANTS awarded

ECORD supports outstanding early-career scientists through the sponsorship of merit-based **awards for research** using core materials and data from previous DSDP/ODP/IODP expeditions.

The aim is to foster participation of early-career scientists in ocean drilling research and encourage them to develop their own projects and collaborate with other research groups outside their home institutions.

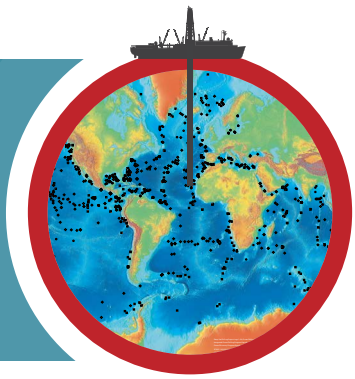
In 2021, ESSAC opened a later call for ECORD Research Grants addressed to early-career scientists to allow them to conduct innovative research related to the International Ocean Discovery Program. The Training and Outreach Subcommittee selected ten proposals for funding (table below) and awarded each up to €3,000 for research that will be carried out in cooperation with host institutions abroad in order to promote mobility and network building among early-career researchers.

ECORD Research Grants awarded in 2021

Name		Project	Host Institution	Awarded (€)
Valentin Basch	ITA	Isotopic heterogeneity and melt aggregation in the lower oceanic crust (IODP Site U1415, Hess Deep, East Pacific Rise)	Louisiana State University, USA	3000
Francesca Battaglia	ITA	Morphobatimetric and seismostratigraphic analysis to map acoustic and sedimentary facies correlated with IODP site U1357, Adèlie Basin, Antarctica	University of Granada, ESP	3000
Morgane Brunet	FRA	Surficial sediment remobilization of the Tuaheni Landslide Complex, New Zealand: Insights from U1517B and U1517C cores correlation	Université du Québec, CAN	2690
Carlotta Ferrando	ITA	Amphibole-rich diabase dikes in the slow-spreading oceanic crust (Atlantis Bank, 57°E, Southwest Indian Ridge): where is the water coming from?	CRPG - CNRS, Nancy, FRA	3000
Tzu-Hao Hunag	SWE	Decoding Marine Silicate Weathering through disentangling silicon phases of sediment	University Tartu, EST	3000
Laurin Kolb	GER	Vegetation reconstruction of SE African hominid environments during the Plio-Pleistocene based on δ13Cwax analyses from IODP Site U1478	University of Notre Dame, USA	3000
Jing Lyu	GER	Neodymium isotopes as a tracer of when Tasman Leakage reached the Broken Ridge (Indian Ocean)	University of Barcelona, ESP	3000
Toshiki Nagakura	GER	Selective addition of substrates for microorganisms living in Guaymas Basin analyzed with NanoSIMS	JAMSTEC, JAP	2300
Samanta Trotta	ITA	Biomarker-derived paleoclimate evidence for the Lower Pleistocene (MIS 48-MIS 41) at IODP Site U1387, Gulf of Cadiz	IPMA Lisbon, PRT	2500
Arne Ulfers	GER	Orbital forcing in the eastern central Atlantic (ODP Leg108 - Site 663) and connections to the African continent during the Pleistocene using XRF-scanning data	MARUM, GER	2900

7.3 MagellanPlus Workshop Series Programme

The ECORD/ICDP MagellanPlus Workshop Series Programme is designed to support European and Canadian scientists **to develop new and innovative science proposals** that follow the major themes of the IODP and ICDP Science Plans.



The MagellanPlus Workshop Series Programme funds workshops and/or travel grants that are expected to lead to or foster high-quality and innovative scientific drilling proposals for submission to IODP and ICDP.

One call for workshop proposals was issued in 2021 for the organisation of workshops in late 2021 or in 2022.

At the 15 May deadline, six proposals were received and four proposals were funded: two regular and two exploratory workshops. The latter aim at generating MSP drilling proposals, either as stand-alone projects or as part of land-to-sea transects that integrate marine and continental coring. Scientific themes of these topical workshops must be aligned with the Strategic Objectives defined in the 2050 Science Framework.

Cores on the deck of R/V *Kaimei* during IODP Expedition 386. Credits: N. Okutsu, ECORD/IODP/JAMSTEC.

Two regular MagellanPlus workshops have been organized in a hybrid-mode in 2021

MagellanPlus: **BlackGate Workshop**
Black Sea – Mediterranean Gateway Exchange
Frankfurt, Germany, 22-24 September 2021

Convenors: Wout Krijgsman (University of Utrecht, The Netherlands), Iuliana Vasiliev-Popa (University of Frankfurt, Germany)

The MagellanPlus workshop "Black Sea-Mediterranean gateway exchange: BlackGate" was hosted by the Senckenberg Biodiversity & Climate Research Centre in Frankfurt, Germany.
The aim of the workshop was to frame scientific objectives and to select suitable drilling sites to MSP-drill a transect to recover the Messinian to Recent (~7 Myr) sedimentary sequences in the Northern Aegean, Marmara and Black seas. In order to achieve this, the workshop brought together 30 scientists in attendance (plus seven particpating online) from twelve different countries, and from multiple disciplines, ranging from geology, paleontology, biogeochemistry and reflection seismics, including 11 early-career scientists.

The exchange history of the Black Sea-Mediterranean gateway is poorly constrained because continuous Pliocene-Quaternary deposits are not exposed on land adjacent to the Black Sea or northern Aegean. Gateway exchange is controlled by climatic and tectonic processes and changes in Black Sea-Mediterranean connectivity trigger dramatic paleoenvironmental and biotic turnovers. Drilling a Messinian to Recent transect in the Aegean, Marmara and Black seas will recover high-amplitude records of continent-scale hydrological changes during glacial-interglacial cycles and allow us to reconstruct marine and fresh water fluxes, biological turnover events, patterns and processes controlling anoxia, chemical perturbations and carbon cycling, growth and propagation of the North Anatolian Fault Zone, the timing of land-bridges for Africa/Asia-Europe mammal migration and presence/absence of water exchange during the Messinian salt giant.

Black-Gate was so successful that we submitted a preliminary proposal for the IODP 1 October 2021 deadline with the following three themes:

- Generation of high-resolution integrated continental-scale climate, sea surface temperature, salinity, anoxia and thermohaline circulations records
- Impact of Black Sea-Aegean gateway connectivity on biogeochemical processes and subseafloor microbial communities,
- Reconstruction of the detrital provenance and tectonic history of the gateway basins and the surrounding mountains.

To achieve the scientific goals, we propose to use an MSP to drill three sites, one on the Turkish margin of the Black Sea, one on the southern margin of the Sea of Marmara and one in the northern Aegean. All sites target Quaternary oxic-anoxic marl-sapropel cycles. Pliocene lacustrine sediments and mixed marine-brackish Miocene sediments will be recovered from the Black Sea and Aegean.

Participants of the BlackGate workshop in the garden of the Senckenberg Biodiversity & Climate Research Centre.

Wout Krijgsman - *w.krijgsman@uu.nl*
Utrecht University

Iuliana Vasiliev - *iuliana.vasiliev-popa@senckenberg.de*
Senckenberg Biodiversity and Climate Research Centre

Anouk Beniest - *a.beniest@vu.nl*
Universiteit Amsterdam

37 Scientists
11 Early-career
12 Countries

MagellanPlus: **Rifting Workshop**

Mechanisms of rifting of large continental blocks – a case study at the Baltic Sea

Helsinki, Finland, 1-3 December 2021

Convenors Pietari Skyttä (University of Turku, Finland), Joonas Virtasalo (Geological Survey of Finland), Christoph Beier (University of Helsinki, Finland)

The objective is to drill a rift with roots in the Archean, and set constraints about the:

1. changes in the periodicity rate of rifting from Archaean to present-day,
2. climate in the Mesoproterozoic,
3. weathering rates in the Mesoproterozoic, and
4. geological controls over the reactivation of rift-faults (and associated faults).

Currently, the organizing team is preparing an IODP pre-proposal.

26 Scientists
3 PhD students
7 Countries

Participants of the Rifting Workshop.

Eight more MagellanPlus workshops will be organized in 2022:
five regular workshops and three exploratory workshops

More info

A more complete overview of all MagellanPlus workshops, reports and summaries can be found at:

www.ecord.org/science/magellanplus

Onboard R/V *Kaimei* during IODP Expedition 386. Credits: N. Okutsu, ECORD/IODP/JAMSTEC.

Five regular MagellanPlus workshops planned for **2022**

MagellanPlus: **TIMOR Workshop** | TracIng Monsoon, Ocean currents and diagenetic carbon Redistribution
Vienna, Austria, 19-22 May 2022

Convenors Uwe Balthasar (University of Plymouth, UK), Jennifer Biddle (University of Delaware, USA), Clara Bolton (CEREGE, France), Hal Bradbury (University of Cambridge, UK), David De Vleeschouwer (University of Münster, Germany), Ann Holbourn (University of Kiel, Germany), Wolfgang Kuhnt (University of Kiel, Germany), Axel Munnecke (University of Erlangen, Germany), Theresa Nohl (University of Erlangen, Germany), Kirstie Wright (Heriot-Watt University, UK), Martin Zuschin (University of Vienna, Austria)

The TIMOR workshop aims to develop an IODP mission-specific platform (MSP) proposal to study two separate but complementary topics in a single expedition:

1. the early diagenetic redistribution of carbon via the microbially driven oxidation of organic carbon, the dissolution of aragonite and the precipitation of calcite, and
2. the palaeoclimatic and palaeoceanographic impacts of Quaternary Monsoon and Indonesian Throughflow variability in the Timor Sea.

MagellanPlus: **SCYLLA Workshop** | Serpentinite diapirs in the Calabrian Subduction sYstem return Lower plate mantLe from EArth's oldest ocean
Bologna, Italy, September 2022

Convenors Luca Gasperini (ISMAR, Italy), Alina Polonia (ISMAR, Italy)

The SCYLLA workshop aims to discuss the rationale to submit an IODP proposal to drill and core underplated serpentinite diapirs in the Calabrian Arc subduction system (central Mediterranean Sea) derived directly from the oldest in situ ocean in the world. It tackles fundamental questions on the structure and nature of subducting slabs and their implications for material recycling, mantle evolution and seismogenesis in subduction zones. This workshop aims to involve a broad scientific community, ranging from sedimentologists, geophysicists, geochemists, volcanologists, and seismologists to microbiologists.

MagellanPlus: **Belize Workshop** | IODP drilling off the Belize Barrier Reef (Central America) to reconstruct postglacial environmental changes
Frankfurt/Main, Germany, 8-10 July 2022

Convenors Eberhard Gischler (University of Frankfurt, Germany), Flavio Anselmetti (University of Bern, Switzerland), Stefano Fabbri (University of Bern, Switzerland)

The aim is to develop an IODP pre-proposal to drill in the deep forereef of the Belize Barrier Reef, western Caribbean Sea. Four tentative objectives are suggested and will be discussed at the workshop:

1. quantification of postglacial reef composition and architecture as response to sea-level and climate change,
2. elaboration of a reef-derived Atlantic postglacial sea-level curve from the western Caribbean,
3. extraction of environmental data on temperature and carbonate saturation during the post-glacial period, and
4. detailing Pleistocene reef initiation and paleoecology.

MagellanPlus: **COSNICA Workshop** | The life cycle of a microplate at a convergent margins
Graz, Austria, September 2022

Convenors: Walter Kurz (University of Graz, Austria), Steffen Kutterolf (GEOMAR, Germany), Jennifer Brandstätter (University of Graz, Austria), Paola Vannucchi (University of Florence, Italy)

The overarching workshop objective is to integrate several drilling projects offshore Nicaragua and Costa Rica under a general umbrella theme, and to develop and brainstorm two IODP-Pre-Proposals targeting the Cocos Plate and the Nicaraguan fore-arc region. The first objective is the result of unsolved questions arising from two CRISP expeditions (Expeditions 334 and 344) and the second objective has a potential amphibian component associated to the ICDP workshop proposal that will be held in March 2020 in Nicaragua to drill the terrestrial part of the Nicaragua depression. These two drilling targets will additionally complement a third proposed project at the Nicaraguan section of the incoming Cocos Plate where bend faults will be targeted and where a successful Magellan workshop was held in 2016 in London.

MagellanPlus: **NorthGreen Workshop** | Northeast Greenland: Unlocking records from sea to land
Copenhagen, Denmark, 21-23 November 2022

Convenors: Lara F. Pérez (GEUS, Denmark), Paul C. Knutz (GEUS, Denmark), John Hopper (GEUS, Denmark), Marit-Solveig Seidenkrantz (Aarhus University, Denmark), Matt O'Regan (Stockholm University, Sweden)

The workshop aim is to develop MSP proposals with focus on Northeast Greenland margins and the surrounding Arctic Ocean. The sensitivity of the northern Greenland Ice Sheet to polar amplification, and year-round sea ice conditions make this region one of the most critical locations on the planet for understanding the effects of global warming. Moreover, with its oceanward connection to the Fram Strait, the Northeast Greenland margin presents a natural laboratory for understanding ice-ocean-tectonic interactions in a gateway pivotal for Earth's climate.

Onboard R/V *Kaimei* during IODP Expedition 386. Credits: N. Okutsu, ECORD/IODP/JAMSTEC.

Three Exploratory MagellanPlus workshops planned for **2022**

MagellanPlus: **Oceanic Life Cycle of Tectonic Plates Workshop** | Investigating the Oceanic Life Cycle of Tectonic Plates with Mission-Specific Scientific Drilling

Plymouth, UK, 4-5 April 2022

Convenors Michelle Harris (University of Plymouth, UK), Thomas Belgrano (University of Southampton, UK), Lydéric France (University of Lorraine, France), Jürgen Koepke (University of Hannover, Germany), Johan Lissenberg (Cardiff University, UK), Alessio Sanfilippo (University of Pavia, Italy), Esther Schwarzenbach (Free University of Berlin, Germany)

The primary goal is to seed Mission Specific Platform (MSP) drilling and MagellanPlus Workshop proposals that address IODP Strategic Objective 2: Oceanic Life Cycle of Tectonic Plates. This will be achieved by bringing together an international group of scientists working on different aspects of the Solid Earth cycle, including (but not limited to):

1. the creation, alteration, and subduction of oceanic lithosphere;
2. rifted margins;
3. seamounts.

The workshop will serve to identify those science questions where MSP drilling is required to advance our current understanding, as well as synergies within the Solid Earth scientific drilling community.

MagellanPlus: **Natural Hazards Workshop** | Mission-specific platform approaches to assessing natural hazards that impact society

Lisbon, Portugal, 7-9 July 2022

Convenors Hugh Daigle (University of Texas, USA), João C. Duarte (University of Lisbon, Portugal), Åke Fagereng (Cardiff University, UK), Raphaël Paris (University of Clermont Auvergne, France), Patricia Persaud (Louisiana State University, USA)

This exploratory workshop will gather representatives from a range of Earth Science disciplines to focus on three topics of natural hazards that impact society:

- Hazards on active margins
- Hazards on passive margins
- Tropical cyclones in the geologic record

The scope is intentionally broad to explore the range of potential hazards projects that can be supported by the 2050 Science Framework. The workshop will have the following goals:

- Outline questions in natural hazards that can be addressed with MSP drilling
- Identify field locations to examine those problems
- Develop three pre-proposals for MSP drilling

MagellanPlus: **IO:DIP Workshop** | Delving Into the Past
Graz, Austria, September 2022

Convenors: Gerald Auer (University of Graz, Austria), Sietske J. Batenburg (University of Barcelona, Spain), David De Vleeschouwer (MARUM, Germany), Anna Joy Drury (University College London, UK)

The IO:DIP Workshop aims to bring together experienced researchers with early-career scientists who have a scientific interest in developing new drilling strategies in the Indian Ocean. IO:DIP has the objective to discuss, advance, and integrate mutually-beneficial drilling proposals for the Indian Ocean. IO:DIP intends to develop a framework of overarching and interconnected research goals, gathered under the umbrella of International Ocean Drilling. Thus, IO:DIP facilitates the synchronization of future Indian Ocean proposals to realize a more cost-effective implementation of large-scale scientific objectives. The workshop will further advance ideas developed during other recent Indian Ocean workshops (e.g., the 2020 Chapman Conference "On the Evolution of the Monsoon, Biosphere and Mountain Building in Cenozoic Asia"; the 2018 SPADE Workshop in Goa; the 2017 workshop "Land-Ocean Interactions Across the Indian Ocean: Toward Regional Integration of Recent Drilling Results" in Rhode Island; and the 2017 "Australasian IODP Regional Planning Workshop" in Sydney), with the express aim to strengthen existing (pre-)proposals and by developing a set of mutually beneficial drilling objectives.

More info

A more complete overview of all MagellanPlus workshops, reports and summaries can be found at:

www.ecord.org/science/magellanplus

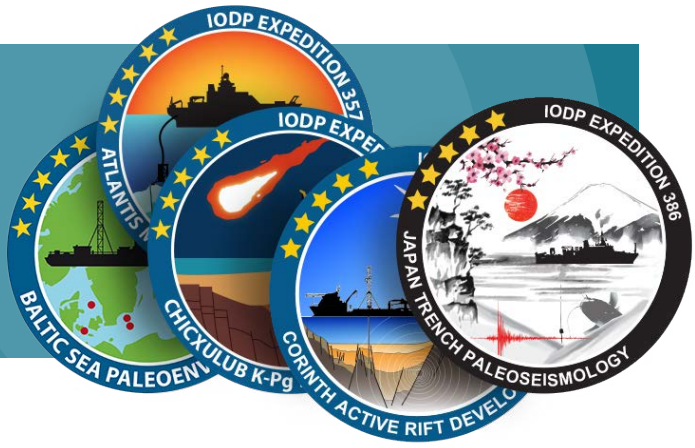
Arranging the cores onboard R/V *Kaimei* during IODP Expedition 386. Credits: N. Okutsu, ECORD/IODP/JAMSTEC.

8. Communicating

A little sculpture created by a member of the offshore team onboard R/V *Kaimei* during IODP Expedition 386.
Credits: N. Okutsu, ECORD/IODP/JAMSTEC.

8. Communicating

Promoting IODP activities and accomplishments to large, often non-scientific, audiences is a major and ongoing goal of the ECORD Outreach Task Force (EOTF).



Within ECORD, responsibilities for outreach activities are distributed between EMA (coordination, publications and web), ESO (MSP expeditions and media) and ESSAC (education), and are coordinated by the ECORD Outreach Task Force (EOTF).

More info

www.ecord.org/outreach

www.ecord.org/resources

ECORD Outreach Task Force

ECORD Outreach Task Force meetings

ECORD Outreach Task Force meetings are attended by ECORD and ICDP outreach teams to enhance cooperation between ECORD and ICDP. Outreach teams representing other IODP entities are frequently invited to join EOTF meetings.

The EOTF met twice during 2021 (virtual meetings): EOTF spring meeting #19 on 24 February and EOTF fall meeting #20 on 16 and 23 November.

EOTF spring meeting #19
24 February 2021, virtual

EOTF fall meeting #20
16 and 23 November 2021, virtual

In person meetings had to make way for virtual appointments because of the global pandemic – though this was also an opportunity to meet regularly and often, especially to discuss ideas and prepare communication actions for IODP Expedition 386: Japan Trench Paleoseismology and Expedition 377: Arctic Ocean Paleoceanography (ArcOP).

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8.1 Communicating with scientists

Promoting IODP/ECORD at conferences, exhibitions and workshops

The EOTF promotes IODP and ICDP under the umbrella of **"Scientific Drilling"** at the EGU (European Geosciences Union, Europe) and AGU (American Geophysical Union, USA), which are meetings attended by thousands of scientists from all over the world every year.

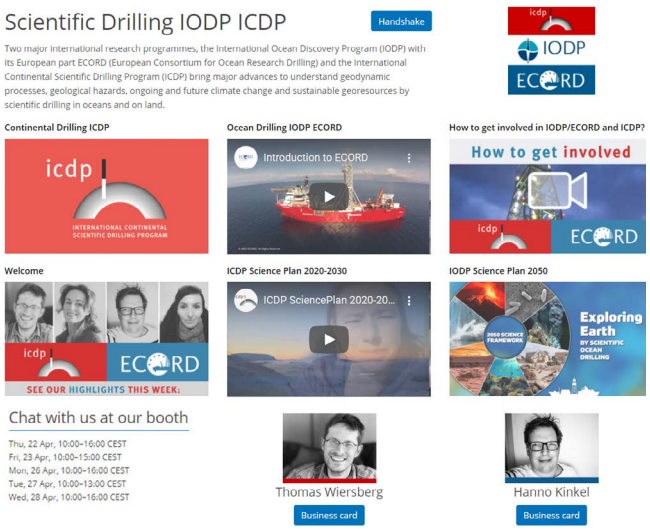
vEGU 2021 Virtual, 19–30 April 2021

www.egu2021.eu *>18 000 scientists from 135 countries*

As in non-pandemic times ECORD partnered up with ICDP to be present at a virtual meeting (the vEGU 2021), with a virtual booth as well as a virtual townhall meeting. In addition to that, ECORD and ICDP organized five webinars on topics relevant to the scientific drilling community as well as society in order to meet the need for information and, above all, to show opportunities for researchers to become involved in ECORD activities.

The webinar topics were:

- IODP and ICDP new science plans, Land-2-Sea proposals
- Exploring IODP Data including a virtual visit to the IODP Bremen Core Repository
- ICDP running and upcoming projects
- IODP Expedition 377 ArcOP
- Student, scientists, stakeholder: how to get involved in IODP and ICDP?



AGU 2021 New Orleans, USA, 13-17 December 2021

https://www.agu.org/Fall-Meeting-2021

EOTF's close collaboration with our US and Japanese IODP partners and the ICDP outreach staff made it possible for us to be present at the AGU 2021 fall meeting. It was held in a hybrid mode with sessions in person as well as virtual events. The EOTF, similarly to the outreach teams of JAMSTEC/MarE3 and IODP China, decided not to participate physically in the AGU 2021, but to focus on virtual means to promote ECORD during this conference. To connect with AGU participants both ECORD and ICDP offered a chat online every day in the afternoon.

8.2 Communicating with the general public

IODP expeditions

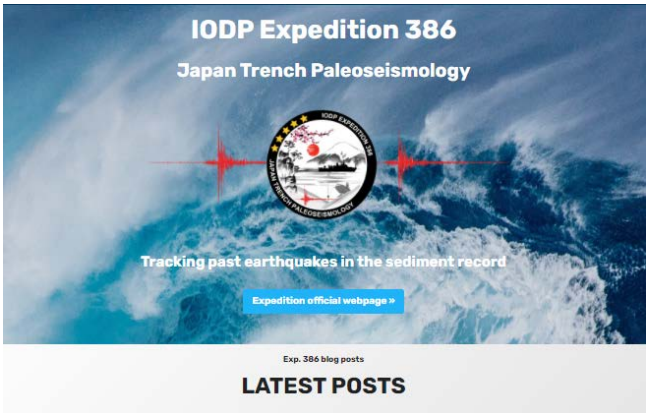
IODP Expedition 386: Japan Trench Paleoseismology

www.ecord.org/expedition386

The start of the Expedition 386, one year later than originally planned due to the pandemic, coincided with the tenth anniversary of the Tohoku-oki-Earthquake. The press release was published and received great attention, especially in Japan.

All activities – again, due to the pandemic – were a common effort between EOTF and our Japanese colleagues from JAMSTEC and MarE3 without whom this would not have been possible. All in-person activities such as ship visits and media days had to be cancelled, the outreach focus was on online activities such as social media and blogposts to give an insight into the operations and challenges of such an expedition.

The *expedition blog* is available online and will be updated during the onshore phase.



https://expedition386.wordpress.com/

In addition to the press release, frequent news items were published online, drawing attention to the expedition and its achievements offshore. Especially the two records – the deepest water site ever drilled at a water depth of 8,023 meters and the deepest sub-sea level sample recovered from 8,060.74 meters below seafloor – were very well received in Japanese and international media. The Co-chief Scientists were interviewed by Wired, Austrian TV ORF, Terra Mater Magazine of Red Bull Media Publishing (Vienna), The Weather Network, Austria Press Agency.

The Expedition was featured in NatGeo Kids and BBC News.

Operations onboard R/V *Kaimei* during IODP Expedition 386. Credits: K. Ikeara, ECORD/IODP/JAMSTEC.

IODP Expedition 377: Arctic Ocean Paleoceanography (ArcOP)

https://www.ecord.org/expedition377

Given the importance and uniqueness of the expedition, the EOTF started early to work on outreach. EOTF is meeting the biggest outreach challenge within ECORD so far with thorough preparation. For this, the EOTF partnered up with communications specialists from our Swedish partner SPRS and representatives of AMS. The common goal is to draw attention to this expedition promoting the science of ArcOP and scientific drilling in general. In order to do that, a press release was issued and translated into five languages (February 2021, *https://www.ecord.org/arcop-a-novel-scientific-ocean-drilling-expedition-to-be-conducted-in-2022/*), the blogsite as well as pre-expedition flyer were updated. A universal document was developed to ensure that each partner has the same general information. A document "Introduction to ArcOP outreach" was also prepared in order to present ArcOP-focused outreach plans as well as to prepare and to set the tone for all outreach activities. The expedition logo was refreshed. The work on a communications plan started early in 2021 and continues. All outreach activities are carefully coordinated with partners, including possible activities to be undertaken from the *Oden*.

After having set up four pitches, a production company was selected in order to cover the expedition: Galaxie Scientifilms will produce and distribute a 90-minute documentary. The planning and storylining started in 2021 after initial interviews with the Co-chief Scientists and other scientists. The filming will commence in summer 2022.

ECORD issued a call for an Onboard Outreach Officer for the ArcOP expedition. Thirty-three applications have been received from eleven different countries around the world. The applicants represented a wide variety of skills and professions, including teachers, photographers, science communicators, videographers and writers. From among shortlisted and interviewed candidates, the EOTF selected an experienced science journalist and TV professional who is working with e.g., ESA, National Geographic, and who is already taking initial steps in order to promote ArcOP outreach actions.

In the time to come all outreach activities are carefully coordinated and fit to measure this unique expedition and the valuable and societal relevant science that will be addressed during ArcOP.

Permanent/long-term exhibitions

Since late 2020, the EOTF has been working towards ECORD presence at permanent exhibitions in museums around Europe. This includes fabrication and donation (or long-term loans) of materials for museums and research institutions as well as loans of the ECORD Puffersphere for dedicated exhibitions.

Exhibition in the Natural History Museum Vienna

The EOTF is working with the Natural History Museum (NHM) Vienna to promote scientific drilling on the occasion of the newly planned, long-term (>10 years) exhibition at the NHM Vienna. The NHM Vienna exhibition will concentrate on geology with the focus on climate and major changes in the atmosphere and biosphere. The EOTF organized fabrication of several core replicas and other models for the exhibition, such as 1:1 models of corals associated with the core replica from Expedition 310: Tahiti Sea Level (see part about ECORD outreach resources on page xx). The planning that started in 2020 was postponed due to COVID-19 pandemic, and the opening of the exhibition, originally planned for 2021 is now postponed to late 2022.

The EOTF invited the ICDP outreach team for this initiative and joint planning for participation in the permanent exhibition at the NHM Vienna is still in place. This joint ECORD-ICDP project will deliver a section in the exhibition where scientific drilling will be promoted and explained. ECORD and ICDP will donate various materials to the NHM Vienna. Video footages and other digital resources are also being prepared. It is planned that representatives of ECORD and ICDP will give talks on the opening day of the exhibition.

8.3 ECORD outreach resources

Core replicas

www.ecord.org/resources/core-replicas

Replicas of drilling cores from ODP/IODP legs and expeditions are valuable tools to introduce ODP/IODP science and to raise awareness about ocean drilling to the public.

Seven replicas of ODP and IODP drilled cores are available for classroom activities and display at temporary exhibitions and conferences in Europe and Canada.
The EOTF ordered fabrication of eight new core replicas from among which, four will be donated to the NHM Vienna.

How to loan a core replica?

To order a loan, contact **Malgo Bednarz** at *bednarz@cerege.fr* with inquiry about the availability of any particular core replica.

ECORD shares the core replicas free of charge, on a temporary basis to sscientists, educators and exhibitors under the conditions described in the loan document.

In 2021, due to the COVID-19 pandemic situation around Europe and worldwide, only two core replicas were not loaned to interested parties. PETM core replica travelled to Henk Brinkhuis in the Netherlands (Royal Netherlands Institute for Sea Research) who cooperated with Dutch Public Broadcast organization for displaying the replica in the TV programme "To The Origin of Humankind and Beyond". The ACEX core replica was sent to the German Maritime Museum for an exhibition in Bremerhaven, Germany, titled: "Change Now! Ships Transform the World".

Models for exhibitions

Four realistic (1:1 scale) models of two species of corals were fabricated. These models will complement the new core replica from Expedition 310: Tahiti Sea Level. Two of the models will be donated to the NHM Vienna for the permanent exhibit.

A new core replica from MSP IODP Expedition 310: Tahiti Sea Level and two realistic models of specimens of corals indentified in cores from the same expedition (left: *Porites lobata*; right: *Pocillopora eydouxi*).

ECORD Puffersphere

The ECORD Puffersphere presents ECORD and its MSP concept on an interactive spherical display, which is to be loaned to museums and aquariums across Europe and showcased at meetings and conferences.

The ECORD Puffersphere is targeted at the general public. The scientific content focuses on an introduction to the four IODP science themes, IODP/ ECORD drilling vessels, selected IODP/ECORD expeditions covering all IODP themes and the three IODP core repositories. It also illustrates and/or animates selected scientific data of ocean acidity, sea-level rise, draining the oceans and tectonic plates.

ECORD Puffersphere has been completed in early 2021 and the project entered the stage of testing by the EOTF. Soon after the testing is completed, the Puffersphere will be transferred for a temporary exhibition at the Interactive Science Museum "Immaginario Scientifico" in Trieste, Italy (starting in June 2022).

Dave McInroy (ESO/EOTF) testing Puffersphere. Photo credits: ECORD/IODP

More info about the Puffersphere display: *https://pufferfishdisplays.com/displays/*

Operations onboard R/V *Kaimei* during IODP Expedition 386. Credits: N. Okutsu, ECORD/IODP/JAMSTEC.

9. FY21 and FY22 budgets

Positive balance of USD 22.7 M at the end of 2021

More than **90%** of the ECORD budget for direct operational costs

View from R/V *Kaimei* during IODP Expedition 386.
Credits: K. Ikehara, ECORD/IODP/JAMSTEC.

9. FY21 and FY22 budgets

FY21 ECORD budget

ECORD is currently funded exclusively by its 15 member countries.

In FY21, the total ECORD budget amounted to $17.43M (below), showing an increase of about $650K compared to the FY20 budget. Since 2014, the ECORD budget decrease is of $1.5M, mainly due to strong fluctuations in exchange rates between the US Dollar and the national currency contributions of five ECORD countries (France, UK, Denmark, Spain and Ireland).

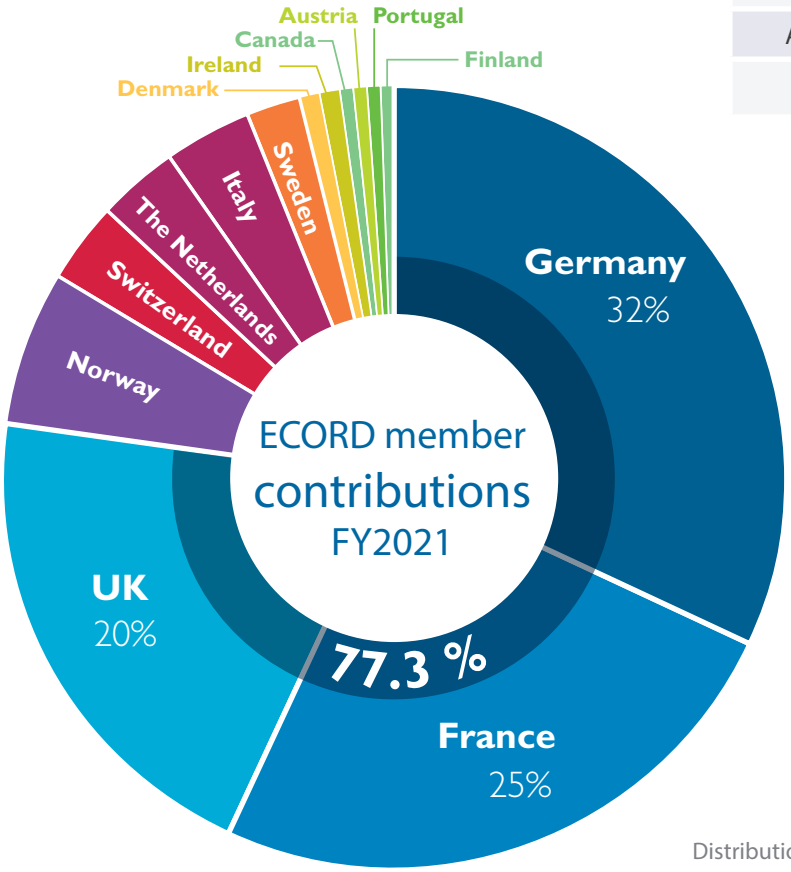
The ECORD budget is seen as a minimum budget due to the opportunity for members to make direct cash and/or in-kind contributions (IKC) that allow them to increase their contributions to ECORD on an expedition by expedition basis.

The contributions to the ECORD budget are unevenly distributed between the member countries, ranging from $5.6M to $80K (below). Based on their contributions, each ECORD member country receives a participation quota for all IODP expeditions. However, the participation of ECORD member countries to the ECORD educational programme (*page 90*) is not based on financial contributions.

ECORD contributions FY21 (USD)	
Germany - DFG	5,600,000
France - CNRS *	4,328,800
United Kingdom - UKRI *	3,545,300
Norway - Forskningsradet	1,100,000
Switzerland - FNS	600,000
The Netherlands - NWO	600,000
Italy - CNR	600,000
Sweden - VR	400,000
Spain - MCIN *	0
Denmark - DAFSHE *	150,400
Ireland - GSI *	120,000
Canada - CCOD	115,000
Austria - ÖAW	100,000
Portugal - FCT	87,700
Academy of Finland	80,000
TOTAL	**17,427,200**

ECORD member country contributions for FY21 (USD). The amount in dollars is based on exchange rates (when applicable) at the time of the payment by the relevant partner.

* Countries paying their contribution in their own currency



Distribution of ECORD member contributions for FY2021

The three major ECORD contributors, Germany ($5.6M), France ($4.33M) and UK ($3.54M), provide 77.3% of the total ECORD budget.

The contributions of other member countries range from $80K to $1.1M.

The table below summarises the ECORD budget for FY21.

The ECORD non-operational costs were stable, amounting to less than 10% of the member country contributions, leaving more than 90% of the ECORD budget for direct and indirect operational costs.

The ECORD budget shows a positive balance of $22,678,386 at the end of 2021 and this sum will be carried forward to the ECORD FY22 budget.

ECORD **FY2021** Budget (in USD)

	FY21 Income (USD)	FY21 Expenses (USD)
FY20 balance	26,284,186	
FY21 contributions	17,427,200	
In-kind contribution *	561,750	
All savings made during the COVID-19 pandemic were substracted from the 2022 budget requests		
ECORD-NSF MoU		7,240,000
ECORD-MarE3 MoU **		3,170,000
ESO		3,123,155
SPRS ***		6,700,000
EMA		343,480
MagellanPlus		86,800
IODP Chairs support		169,000
ESSAC		290,675
BCR		365,490
Outreach basic		56,150
Award ****		50,000
TOTAL	44,273,136	21,594,750
FY21 balance	**22,678,386**	

* In-kind contribution for Expedition 377 provided by the BGR, Hannover, Germany
** Expedition 386 operational costs and annual contribution of $1M to the *Chikyu*
*** Expedition 377 operational costs (downpayment)
**** Compensation for Roz Coggon for her work on the 2050 Science Framework

Operations onboard R/V *Kaimei* during IODP Expedition 386. Credits: K. Ikehara, ECORD/IODP/JAMSTEC.

FY22 ECORD budget

The expected total contributions for FY22 from the 14 contributing ECORD member countries is about $17.35M (see table below).

ECORD contributions FY22 (USD)	
Germany - DFG	5,600,000
France - CNRS *	4,328,800
United Kingdom - UKRI *	3,364,000
Norway - Forskningsradet	1,100,000
Italy - CNR	700,000
The Netherlands - NWO	600,000
Switzerland - FNS	600,000
Sweden - VR	400,000
Denmark - DAFSHE *	150,000
Ireland - GSI *	120,000
Canada - CCOD	115,000
Austria - ÖAW	100,000
Portugal - FCT	90,000
Academy of Finland	80,000
TOTAL	**17,347,800**

The amount in US dollars will be based on exchange rates (when applicable) at the time of the payment by the relevant partner.
* Countries paying their contribution in their own currency

View from R/V *Kaimei* during IODP Expedition 386.
Credits: K. Ikehara, ECORD/IODP/JAMSTEC.

The table below summarises the expected ECORD budget for FY22.

ECORD **FY2022** Budget (in USD)

	FY22 Income (USD)	FY22 Expenses (USD)
FY21 balance	22,678,386	
FY22 contributions	17,347,800	
ECORD-NSF MoU		7,120,000
ESO *		3,362,067
SPRS **		18,000,000
EMA		192,696
MagellanPlus		136,400
IODP Chairs Support ***		242,000
ESSAC ******		190,720
BCR		343,419
Outreach basic		46,550
Outreach ArcOP *******		65,000
TOTAL	**40,026,186**	**29,698,852**
Expected FY22 balance	**10,372,334**	

The amounts in USD are subject to exchange rate fluctuations.
* Including operational costs of Expedition 377
** Expedition 377 operational costs
*** IODP Forum Chair and SEP Co-chair
**** Unspent funds in the amount of $150K have been directly transferred from the Plymouth to the Trieste Office through the CNRS.
***** Onboard Outreach Officer and production of a TV documentary

View from R/V *Kaimei* during IODP Expedition 386. Credits: K. Ikehara, ECORD/IODP/JAMSTEC.

Budget of ECORD Entities

ECORD Managing Agency

The table below summarises the EMA budget for FY21 and FY22, as approved by the ECORD Council in June 2020 and 2021.

EMA budget for FY21 and FY22					
	FY21		FY22		Variance
	€	USD	€	USD	€
Salaries					
Outreach Officer	68.000	84.320	71.400	88.536	3 400 (+)
Assistant Director *	68.000	84.320	0	0	68 000 (-)
Compensation for the Director	50.000	62.000	50.000	62.000	0
Travels and meetings					
Travels EMA CEREGE	50.000	62.000	50.000	62.000	0
Invited speakers to ECORD meetings	3.000	3.720	3.000	3.720	0
Organisation ECORD Meetings	10.000	12.400	10.000	12.400	0
Organisation SEP June Meeting **	0	0	10.000	12.400	10,000 (+)
MagellanPlus					
Consumables / Office costs	3.000	3.720	6.000	7.440	3000 (+)
Overheads CEREGE	25.000	31.000	25.000	31.000	0
Savings 2020-2021 * **			70.000	86.800	70,000 (-)
GRAND TOTAL	**277.000**	**343.480**	**155.400**	**192.696**	**121,600 (-)**

Exchange rate used in FY21 and FY22 budgets: 1€ = $1.24
* Nadine Hallmann (Assistant Director) is now paid by the CNRS
** Organization of SEP meeting in 2022 (not considered in 2021)
*** Savings of $86,800 related to the COVID-19 pandemic

ECORD Science Support and Advisory Committee (ESSAC)

The table below summarises the ESSAC budget for FY21 and FY22 as approved by the ECORD Council in June 2020 and 2021.

ESSAC budget for FY21 and FY22					
	FY21		FY22		Variance
	€	USD	€	USD	€
Salaries					
Science Coordinator (Grade 8/43)	70.306	87.179	69.000	85.560	1,306 (-)
Compensation for the Chair	50.000	62.000	50.000	62.000	0
Compensation for the Vice-Chair	5.000	6.200	5.000	6.200	0
Travels and subsistence					
Science Coordinator	4.903	6.080	8.387	10.400	3,484 (+)
Chair	12.903	16.000	22.016	27.300	9,113 (+)
Office Costs	6.200	7.688	6.452	8.000	0,252 (+)
Meetings					
ESSAC Spring meeting	0	0	2.984	3.700	2,984 (+)
ESSAC Fall meeting	2.700	3.348	2.984	3.700	0,284 (+)
Travel support invited speakers	0	0	3.468	4.300	3,468 (+)
Travel Support ESSAC Liaison to SEP Meeting	2.419	3.000	3.468	4.300	0,731 (+)
Conference Travel Support	2.419	3.000	4.597	5.700	2,178 (+)
Education and Outreach					
ECORD DLP Support *	8.065	10.000	14.919	18.500	6,854 (+)
ECORD Summer Schools	30.000	37.200	30.000	37.200	0
ECORD Training Course	6.500	8.060	6.500	8.060	0
ECORD Scholarships	15.000	18.600	15.000	18.600	0
ECORD Research Grants **	18.000	22.320	30.000	37.200	12,000 (+)
TOTAL	**234.415**	**290.675**	**274.775**	**340.720**	**40,360 (+)**

Exchange rate used in FY21 and FY22 budgets: 1€ = $1.24
Travel and subsistence costs increased by 10% with respect to pre-COVID-19 to include an expected increase in airline and hotel rates post-COVID-19.
* ECORD DLP Support increased by 10% with respect to pre-COVID-19 to include an expected increase in travel costs post-COVID-19.
** ECORD Research Grants increased from $22,320 (pre-COVID-19) to $37,200 in order to provide further support for early-career researchers post-COVID-19 (about four more projects per annum).

ECORD Science Operator

The table below summarises the expenditure breakdown of ESO for FY21 in US dollars.

ESO budget for FY21									
	2021 Annual Program Plan Budget				2021 Expenditure				2021 variance
	BGS	MARUM	EPC	Total	BGS	MARUM	EPC	Total	
Management and administration	239,619	198,812	343,467	781,899	143,182	198,812	343,467	685,461	96,438
Personnel	165,619	148,812	293,467	607,899	137,045	148,812	293,467	579,324	28,575
Travel	50,000	26,000	26,000	102,000	146	26,000	26,000	52,146	49,854
Supplies	7,000	7,000	7,000	21,000	62	7,000	7,000	14,062	6,938
Shipping	0	0	0	0	33	0	0	33	-33
Communication	2,000	0	0	2,000	1,127	0	0	1,127	873
Equipment	5,000	7,000	7,000	19,000	4,770	7,000	7,000	18,770	230
Other	10,000	10,000	10,000	30,000	0	10,000	10,000	20,000	10,000
Technical, Engineering and Science Support	840,926	437,844	601,291	1,880,060	396,416	437,844	601,291	1,435,551	444,509
Personnel	763,926	311,844	501,291	1,577,060	367,547	311,844	501,291	1,180,682	396,379
Travel	48,000	44,000	36,000	128,000	3,899	44,000	36,000	83,899	44,101
Supplies	0	30,000	0	30,000	755	30,000	0	30,755	-755
Shipping	12,000	24,000	12,000	48,000	14,403	24,000	12,000	50,403	-2,403
Communication	4,000	0	0	4,000	29	0	0	29	3,971
Contractual Services	0	0	40,000	40,000	0	0	40,000	40,000	0
Equipment	3,000	3,000	2,000	8,000	9,721	3,000	2,000	14,721	-6,721
Other	10,000	25,000	10,000	45,000	63	25,000	10,000	35,063	9,937
Core Curation	0	87,474	0	87,474	0	87,476	0	87,476	-1
Personnel	0	74,474	0	74,474	0	74,476	0	74,476	-1
Travel	0	6,000	0	6,000	0	6,000	0	6,000	0
Supplies	0	2,000	0	2,000	0	2,000	0	2,000	0
Shipping	0	5,000	0	5,000	0	5,000	0	5,000	0
Data Management	121,032	104,676	31,786	257,494	17,343	104,676	31,786	153,805	103,689
Personnel	12,032	86,676	31,786	130,494	8,462	86,676	31,786	126,924	3,570
Travel	8,000	8,000	0	16,000	0	8,000	0	8,000	8,000
Supplies	6,000	0	0	6,000	0	0	0	0	6,000
Communication	0	0	0	0	1,501	0	0	1,501	-1,501
Contractual Services	75,000	0	0	75,000	0	0	0	0	75,000
Equipment	20,000	10,000	0	30,000	7,379	10,000	0	17,379	12,621
Outreach	75,208	30,655	10,365	116,228	50,282	30,655	10,365	91,302	24,926
Personnel	30,067	22,655	10,365	63,087	17,356	22,655	10,365	50,376	12,711
Travel	8,000	8,000	0	16,000	0	8,000	0	8,000	8,000
Supplies	8,000	0	0	8,000	1,009	0	0	1,009	6,992
Shipping	0	0	0	0	194	0	0	194	-194
Equipment	29,141	0	0	29,141	341	0	0	341	28,800
Other	0	0	0	0	31,382	0	0	31,382	-31,382
Grand Total	1,276,785	859,461	986,909	3,123,155	607,223	859,463	986,909	2,453,595	669,561

Bremen Core Repository (BCR)

The table below summarises the BCR budget for FY21 and FY22 as approved by the ECORD Council in June 2020 and 2021.

BCR budget for FY21 and FY22					
	FY21		FY22		Variance
	€	USD	€	USD	€
Salaries and Fringes (1,6 FTE)	242.040	300.129	249.301	309.133	7,261 (+)
Student workers	12.250	15.190	5.600	6.944	6,650 (-)
Travels	2.520	3.125	0	0	2520 (-)
Supplies	5.040	6.250	2.450	3.038	2,590 (-)
Shipping	19.600	24.304	6.300	7.812	13,300 (-)
Curation database updates	4.200	4.998	7.000	8.680	2,800 (+)
SEDIS 24/7 maintenance/ upgrades (0,08 FTE)	9.100	11.284	6.300	7.812	2,800 (-)
Total	**294.750**	**365.490**	**276.951**	**343.419**	**17,799 (-)**

Exchange rate used in FY21 and FY22 budgets: 1€ = $1.24

Operations onboard R/V *Kaimei* during IODP Expedition 386. Credits: N. Okutsu, ECORD/IODP/JAMSTEC.

ECORD Outreach Task Force (EOTF)

The table below summarises the EOTF budget for FY21 and FY22 as approved by the ECORD Council in June 2020 and 2021.

ECORD Outreach budget for FY21 and FY22					
	FY21		FY22		Variance
	€	USD	€	USD	USD
Core outreach activities					
Annual Report	3.589	4.450	3.589	4.450	0
ECORD Newsletters	3.387	4.200	3.387	4.200	0
Managing core replicas	6.451	8.000	8.871	11.000	3,000 (+)
Models	n/a	n/a	4.032	5.000	5,000 (+)
EGU and AGU booths *	6.411	7.950	16.411	20.350	0
ECORD website (maintenance and development)	1.371	1.700	1.371	1.700	0
Travels	10.484	13.000	10.484	13.000	0
Shipping	2.379	2.950	2.379	2.950	0
Goodies	6.411	7.950	6.411	7.950	0
Office costs	2.863	3.550	2.863	3.550	0
Pre- and post-cruise flyers	968	1.200	968	1.200	0
Expedition logos and stickers	968	1.200	968	1.200	0
TOTAL basic outreach activities	**45.282**	**56.150**	**61.734**	**76.550**	**8,000 (+)**
IODP Expedition 377 outreach					
Production of a TV documentary			28.226	35.000	
Onboard Outreach Officer			24.194	30.000	
Savings 2020-2021			**24.194**	**30.000**	
TOTAL			**89.960**	**111.550**	

Exchange rate used in FY21 and FY22 budgets: 1€ = $1.24
* EGU 2020 has been cancelled

View from R/V *Kaimei* during IODP Expedition 386. Credits: K. Ikehara, ECORD/IODP/JAMSTEC.

10. ECORD representatives on IODP panels

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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 2021 is listed below.

JOIDES Resolution Facility Board - **JRFB**

http://www.iodp.org/facility-boards#JRFB

The *JOIDES Resolution* Facility Board - JRFB is the planning forum for expeditions using the *JOIDES Resolution*.

ECORD Members of the JRFB
Gilbert Camoin (France)
Steve Bohaty (UK)
Marguerite Godard (France)
Steffen Kutterolf (Germany)

Chikyu IODP Board - **CIB**

https://www.jamstec.go.jp/cib/

The *Chikyu* IODP Board - CIB is the planning forum for expeditions using *Chikyu*.

ECORD Members of the CIB
Gilbert Camoin (France)
Achim Kopf (Germany)

Environmental Protection and Safety Panel - **EPSP**

www.iodp.org/program-organization/environmental-protection-and-safety-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)
Toby Harrold (Spain)
Dieter Strack (Germany)

IODP INTERNATIONAL OCEAN DISCOVERY PROGRAM

ECORD EUROPEAN CONSORTIUM FOR OCEAN RESEARCH DRILLING

Science Evaluation Panel - **SEP**

www.iodp.org/program-organization/science-evaluation-panel

Science Evaluation Panel (SEP) evaluates the scientific objectives and relevance of proposed expeditions using all IODP platforms.

SEP ECORD Members
Science
Thorsten Bauersachs (Germany)
Adélie Delacour (France)
Karsten Gohl (Germany)
Kazuyo Tachikawa (France)
Antje Voelker (Portugal)
Christoph Beier (Finland)
Clara Bolton (France)
Anne Briais (France)
Marianne Conin (France)
Lisa McNeill (UK) **(Co-Chair)**
Julie Prytulak (UK)
Paola Vannucchi (Italy)
Maria-Angela Bassetti (France)
Jörg Geldmacher (Germany)
Chuang Xuan (UK)
Site
Silvia Ceramicola (Italy)
Christian Hübscher (Germany)
Uisdean Nicholson (UK)
Michele Rebesco (Italy)
Tim Reston (UK)
Tilmann Schwenk (Germany)
Andrea Argnani (Italy)

IODP Forum

http://www.iodp.org/iodp-forum

The IODP Forum represents the overarching umbrella of the programme and provides advice to IODP Facility Boards on platform provider activity.

IODP Forum Chair
Dick Kroon (ECORD) / Henk Brinkhuis (The Netherlands)

ECORD attendees at the IODP Forum 2021 in May (virtual)
Gilbert Camoin (France)
Rosalind Coggon (UK)
Gretchen Früh-Green (Switzerland)
Marguerite Godard (France)
Nadine Hallmann (France)
Hanno Kinkel (UK)
Achim Kopf (Germany)
Dick Kroon (UK)
Lucas Lourens (The Netherlands)
Guido Lueniger (Germany)
David McInroy (UK)
Lisa McNeill (UK)
Antony Morris (UK)
Michele Rebesco (Italy)
Damon Teagle (UK)
Alexandra Turchyn (UK)
Gabriele Uenzelmann-Neben (Germany)
Michael Webb (UK)

ECORD attendees at the IODP Forum 2021 in Rome 11- 13 October (hybrid)
Henk Brinkhuis (The Netherlands)
Angelo Camerlenghi (Italy)
Gilbert Camoin (France)
Markus Engelhardt (Norway)
Elisabetta Erba (Italy)
Nadine Hallmann (France)
Dick Kroon (UK)
Guido Lueniger (Germany)
David McInroy (UK)
Lisa McNeill (UK)
Antony Morris (UK)
Ursula Röhl (Germany)
France Lagroix (France)
Gabriele Uenzelmann-Neben (Germany)
Michael Webb (UK)
Bernard Westerop (The Netherlands)
André Bornemann (Germany)

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Nadine Hallmann
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David McInroy
ESO Science Manager

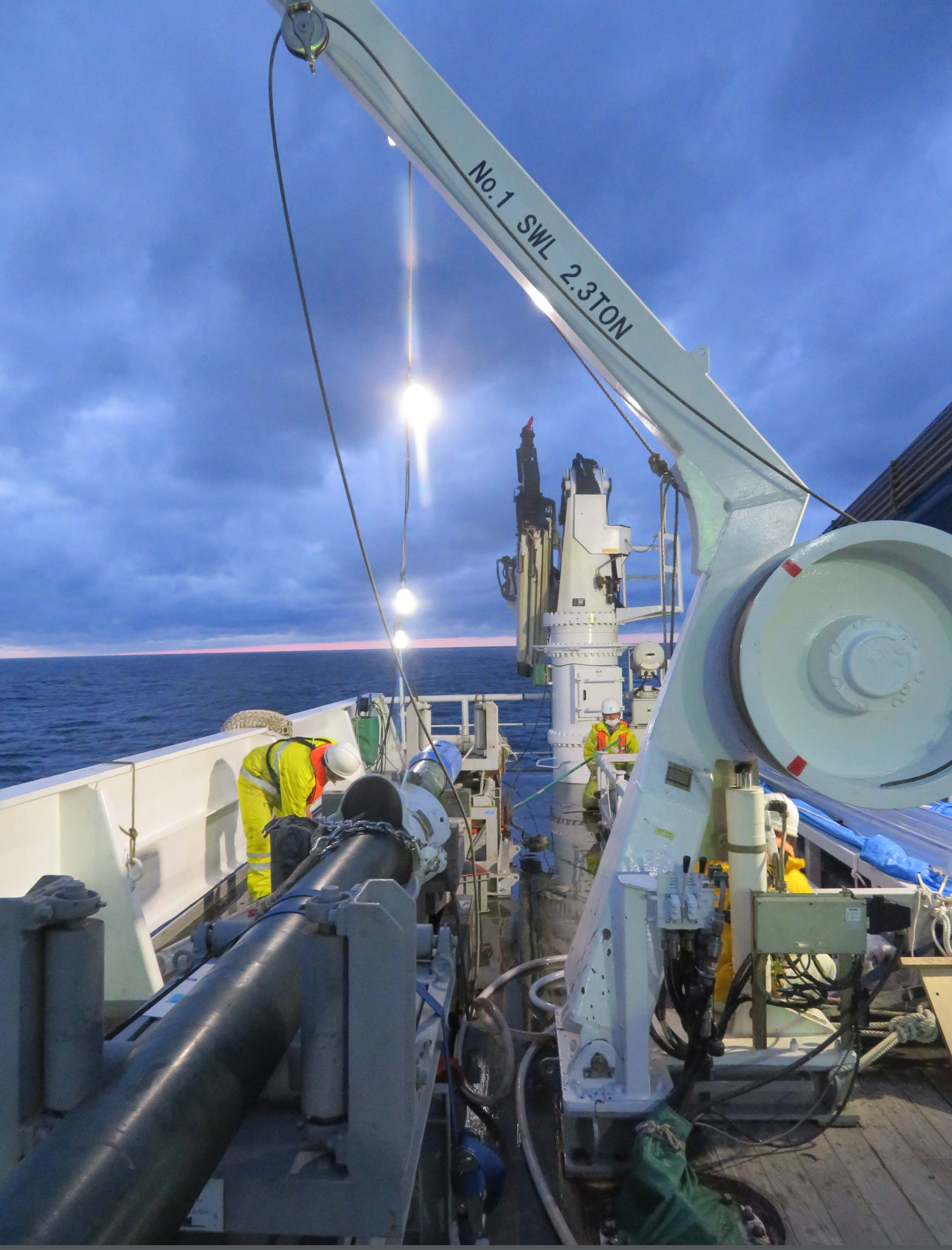
Antony Morris
ESSAC Chair

Hanno Kinkel
ESSAC Science Coordinator

Ulrike Prange
ESO Media Relations

Ursula Röhl
ESO Curation and Lab Manager

Gabi Uenzelmann-Neben
EFB Chair



View from R/V *Kaimei* during IODP Expedition 386. Credits: K. Ikehara, ECORD/IODP/JAMSTEC.

Ab List of acronyms

ABS: American Bureau of Shipping

ACC: Antarctic Circumpolar Current

ACEX: Arctic Coring Expedition

ADP: Amphibious Drilling Proposal

AGU: American Geophysical Union

AIS: Antarctic Ice Sheet

AIST: National Institute of Advanced Industrial Science and Technology

ANZIC: Australian and New Zealand IODP Consortium

APL: Ancillary Project Letter

ArcOP: Arctic Ocean Paleoceanography, IODP Expedition 377

AWI: Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Bremerhaven

BCR: Bremen Core Repository

BGR: Bundesanstalt für Geowissenschaften und Rohstoffe - Federal Institute for Geosciences and Natural Resources, Hannover

BGS: British Geological Survey

CCOD: Canadian Consortium for Ocean Drilling

CDW: Circumpolar Deep Water

CEREGE: Centre Européen de Recherche et d'Enseignement des Géosciences de l'Environnement - Centre for Research and Education in Environmental Geosciences, Aix-en-Provence

CIB: *Chikyu* IODP Board

CNR: Consiglio Nazionale delle Ricerche - National Research Council of Italy

CNRS: Centre National de la Recherche Scientifique - National Center for Scientific Research, France

CRISP: Costa Rica Seismogenesis Project

CT: Computed Tomography

DAFSHE: Danish Agency for Science and Higher Education

DFG: Deutsche Forschungsgemeinschaft - German Research Foundation

DIS: Drilling Information System

DLP: Distinguished Lecturer Programme

DSDP: Deep Sea Drilling Project

EC: European Commission

ECORD: European Consortium for Ocean Research Drilling

EFRAM-ARC: Eastern Fram Strait Paleo Archive

EFB: ECORD Facility Board

EGU: European Geosciences Union

EMA: ECORD Managing Agency

EOTF: ECORD Outreach Task Force

EPC: European Petrophysics Consortium

EPGFZ: Enriquillo-Plaintain Garden Fault zone

EPSP: Environmental Protection and Safety Panel

ESO: ECORD Science Operator

ESSAC: ECORD Science Support and Advisory Committee

ETH: Eidgenössische Technische Hochschule - Swiss Federal Institute of Technology, Zurich

EVTF: ECORD Vision Task Force

FCT: Fundação para a Ciência e a Tecnologia - Foundation for Science and Technology, Portugal

FNS: Fonds National Suisse de la Recherche Scientifique - Swiss National Science Foundation, SNSF

FY: Fiscal Year

GCR: Gulf Coast Repository

GEOMAR: Helmholtz Centre for Ocean Research Kiel

GFZ: Deutsches GeoForschungsZentrum - German Research Centre for Geosciences, Potsdam

GPC: Giant Piston Coring

GSI: The Geological Survey of Ireland

IBM: Izu-Bonin-Mariana

ICDP: International Continental Scientific Drilling Program

Ifremer: Institut Français de Recherche pour l'Exploitation de la Mer – French Research Institute for Exloitation of the Sea

IGSN: International Geo Sample Number

IKC: In-Kind Contribution

INSU: Institut National des Sciences de l'Univers - National Institute of Sciences of the Universe, France

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

ISOLAT: Integrated Southern Ocean Latitudinal Transects

JAMSTEC: Japan Agency for Marine-Earth Science and Technology

J-DESC: Japan Drilling Earth Science Consortium

JOIDES: Joint Oceanographic Institutions for Deep Earth Sampling

JR: *JOIDES Resolution*

JRFB: *JOIDES Resolution* Facility Board

JRSO: *JOIDES Resolution* Science Operator

KAUST: King Abdullah University of Science and Technology

KCC: Kochi Core Center

K-Pg: Cretaceous–Paleogene

LSCE: Laboratoire des Sciences du Climat et de l'Environnement - Laboratory for Sciences of Climate and Environment, Gif-sur-Yvette

LWD: Logging While Drilling

MarE3: Marine-Earth Exploration and Engineering Division

MARUM: Center for Marine Environmental Sciences, University of Bremen

mbsf: metres below sea floor

mDIS: mobile Drilling Information System

MDP: Multi-phase Drilling Project

MeBo: Meeresboden-Bohrgerät - seafloor drill

MG+: MagellanPlus Workshop Series Programme

MINECO: Ministerio de Economía y Competitividad - Ministry of Economy and Competitiveness, Spain

MoU: Memorandum of Understanding

MPI: Max Planck Institute

MPT: Mid-Pleistocene Transition

MSCL: Multi-Sensor Core Logger

MSP: Mission-Specific Platform

NADIR: Nice Amphibious Drilling In-situ Monitoring and Risk Analysis

NanTroSEIZE: Nankai Trough Seismogenic Zone Experiment

NOC: National Oceanography Centre, Southampton

NSF: National Science Foundation

NWO: Nederlandse Organisatie voor Wetenschappelijk Onderzoek - Netherlands Organisation for Scientific Research

ÖAW: Östereichische Akademie der Wissenschaften - Austrian Academy of Sciences

OCT: Ocean-Continent Transition

ODP: Ocean Drilling Program

OFSZ: Oriente-Septentrional Fault zone

OSP: Onshore Science Party

PIN: Prior Information Notice

PMO: Program Member Office

PROCEED: Expanding Frontiers of Scientific Ocean Drilling

QA/QC: Quality Assurance/Quality Control

RD2: Rockdrill2

RELICT: Role of Lithospheric Inheritance on Subduction Initiation

SEDIS: Scientific Earth Drilling Information Service

SFWG: Science Framework Working Group

SEP: Science Evaluation Panel

SPRS: Swedish Polar Research Secretariat

UKRI: United Kingdom Research and Innovation

USCG: US Coast Guard

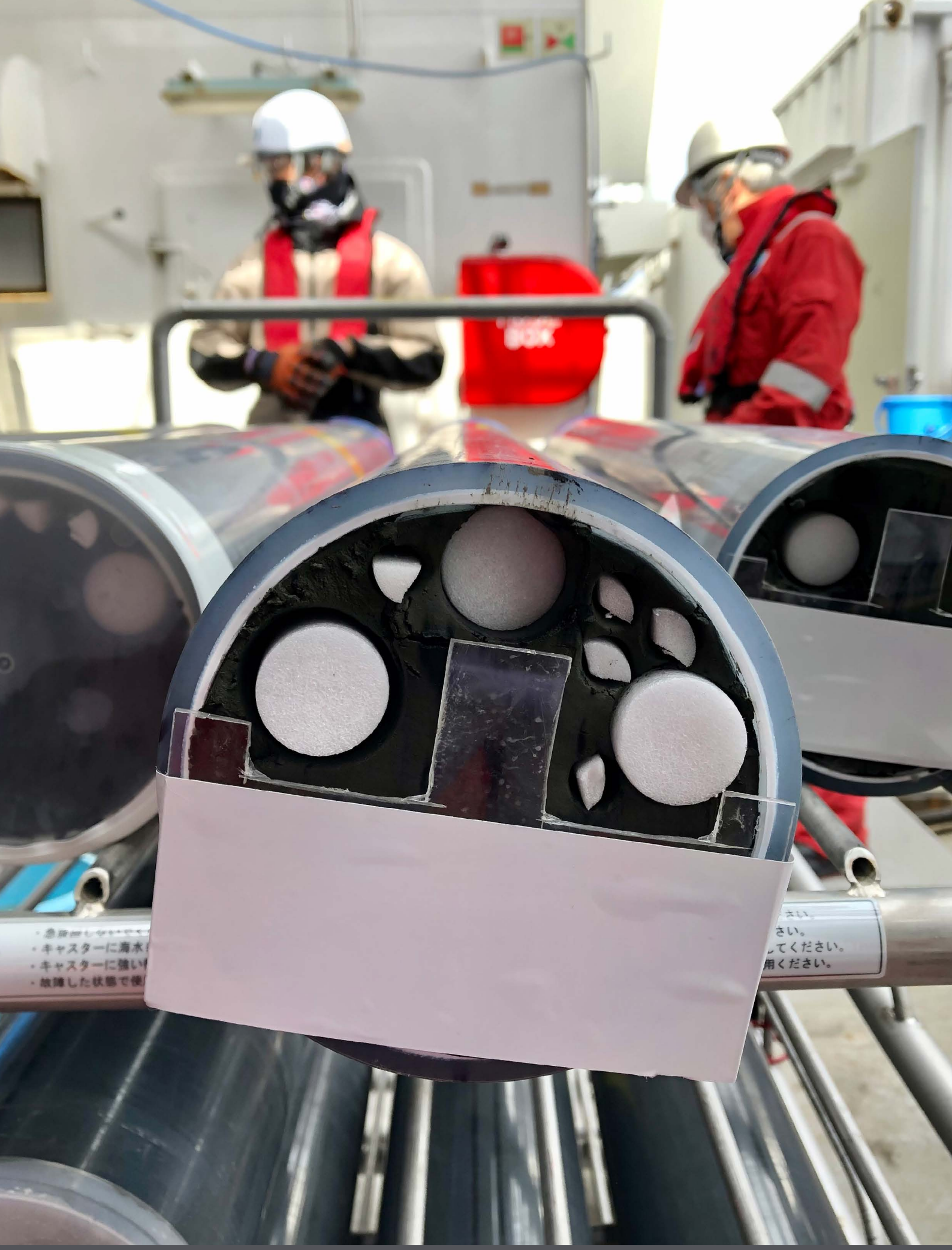
USSP: Urbino Summer School in Paleoclimatology

USSSP: U.S. Science Support Program

VR: Vetenskapsrådet - Swedish Research Council

WAIS: West Antarctic Ice Sheet

XRF: X-Ray Fluorescence



Sampled core onboard R/V *Kaimei* during IODP Expedition 386. Credits: K. Hsiung, ECORD/IODP/JAMSTEC.

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2021 ECORD Member Countries

Austria	1	Österreichische Akademie der Wissenschaften (ÖAW)
Canada	2	Canadian Consortium for Ocean Drilling (CCOD)
Denmark	3	Danish Agency for Science and Higher Education (DAFSHE)
Finland	4	Suomen Akatemia
France	5	Centre National de la Recherche Scientifique (CNRS)
Germany	6	Deutsche Forschungsgemeinschaft (DFG)
Ireland	7	The Geological Survey of Ireland (GSI)
Italy	8	Consiglio Nazionale delle Ricerche (CNR)
Netherlands	9	Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO)
Norway	10	Forskningsrådet
Portugal	11	Fundação para a Ciência e a Tecnologia (FCT)
Spain	12	Ministerio de Ciencia e Innovación (MCIN)
Sweden	13	Vetenskapsrådet (VR)
Switzerland	14	Fonds National Suisse de la Recherche Scientifique (FNS)
United Kingdom	15	United Kingdom Research and Innovation (UKRI)

ECORD
EUROPEAN CONSORTIUM FOR OCEAN RESEARCH DRILLING

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