

# Great Barrier Reef Environmental Changes Expedition January 2010



COOKTOWN  
RIB-01C  
RIB-02A

CAIRNS

NOG-01B

TOWNSVILLE

HYD-01C  
HYD-02A

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ICDP

'A Letter from Finland'

INVEST Conference

'School of Rock' 2009

Tahiti Sea-Level Expedition 310



Fernando Barriga

## From the Council Chair

We live in exciting times for ocean drilling. IODP is fully up and running with a significant landmark in ocean drilling history, the first time that three expeditions have operated simultaneously (*see message from Catherine Mével, page 9*) with the three IODP platforms, *JOIDES Resolution*, *Chikyu* and mission-specific platforms.

The Program, which was designed to run from 2003 to 2013, is now at the stage where it is planning for renewal. Two aspects deserve particular mention, given the large amount of effort that ECORD has put into them; the IWG+ and the recent INVEST Meeting in Bremen.

International Working Group Plus (IWG+) - <http://www.iodp.org/iodp-council/> - derives its name from the previous group (IWG) that set the stage for the transition from ODP to IODP. The group includes representatives from the USA (NSF), Japan (MEXT), ECORD, and from the IODP associate members Australia-New Zealand, South Korea, and China. Other countries/organisations have indicated their interest in participating in the new drilling programme. The IWG+ also includes observers from the IODP committee structures and other organisations. ECORD is represented by eight members from Canada, France, Italy, Germany, Portugal, Spain, and the UK. The mission of IWG+ is not so simple as the objectives are '... to design a new drilling programme, which (1) contributes to the unification of the international ocean research community to explore the Earth, (2) advances future research and discovery through dissemination of data and samples from the drilling, (3) seeks to expand the international sharing of intellectual and financial resources,

(4) is simple, efficient, and able to deliver decisions on drilling proposals fairly and quickly, (5) operates in the most efficient and effective way, at the lowest possible costs, and (6) is driven by scientific questions and is thus open to seek collaborations with programmes using methodologies and infrastructure that may be necessary to complement drilling'.

IWG+ will incorporate its proceedings in a new Science Plan, to be written by a group of no more than twelve or so scientists. The Science Plan will be based on the conclusions of the recent INVEST meeting held in Bremen (*page 16*). This was a truly outstanding manifestation of vitality, with about 600 geoscientists (and engineers) gathered together in late September 2009, all actively involved in discussing the priorities of the new drilling programme - <http://www.marum.de/iodp-invest.html>. We can hardly envisage a better start for the process! I especially emphasise the large proportion of young researchers/graduate students who attended INVEST, blending with experienced architects of the present and past drilling programmes, and new and not so new (e.g. drilling to the Moho) questions and objectives that were raised, some (but not all) with clear economic/social relevance (seabed resources; sub-seabed carbon sequestration).

In short, ocean drilling not only continues to deliver, but promises to strengthen its leading role as one of the most active, productive and truly worldwide science programmes ever. I think we have reason to look forward with confidence.

*Fernando J.A.S. Barriga, ECORD Council Chair, April to October 2009*

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Electronic version is available for download at: <http://www.ecord.org/pub/nl.html>

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<http://www.ecord.org>

Front cover: Regional map showing locations of the Great Barrier Reef Environmental Changes Expedition drillsites at the following areas: Ribbon Reef (RIB-01C and RIB-02A), Noggin Pass (NOG-01B) and Hydrographer's Passage (HYD-01C and HYD-2A).



Dan Evans



Dave McInroy



Alan Stevenson

## The New Jersey Shallow Shelf (NJSS) Expedition

The joint IODP and International Continental Scientific Drilling Programme (ICDP) New Jersey Shallow Shelf (NJSS) Expedition started in April 2009 and is continuing during November as the scientists meet again to analyse the cores at the Bremen Core Repository. Staff Scientist Dave McInroy and ESO Outreach Manager Alan Stevenson describe the progress so far.

On April 30 2009, the Liftboat *Kayd* left Atlantic City, New Jersey to sail to the continental margin off the coast of the USA. On board the platform were staff from the ECORD Science Operator (ESO), the drilling contractors DOSECC and the ship's crew along with Co-chief scientist Greg Mountain of Rutgers University (USA), who jointly led the expedition with Jean-Noël Proust of CNRS, University of Rennes (France). The expedition objectives were to core and log three boreholes in the Paleogene and Neogene sequences (Figure 1) in 35 metres of water some 45-65 km off the coast of New Jersey. The three locations were

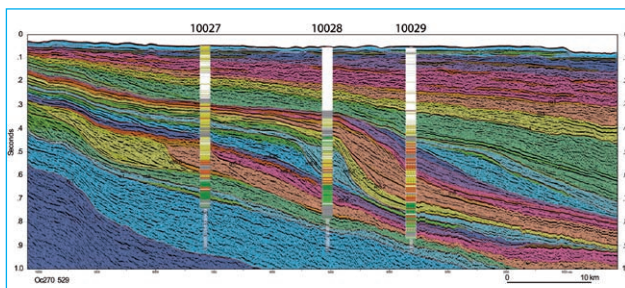


Figure 1: Vertical seismic profiles and drillsite locations.

chosen because previous work had suggested that at depths between 220 and 750 metres below the seafloor, the sediments had been deposited at or near the shoreline 12 to 35 million years ago. By recovering and analysing the microfossils contained within the sandy sediments, the team hope to understand the amplitude and rate of the natural sea-level fluctuations that took place during this key period of dramatic climate change. The New Jersey continental margin is therefore a natural laboratory for tracking the history of global sea level.

Two days after leaving Atlantic City (Figures 2, 3), the *Kayd* arrived at the first drilling location (Figure 4), where it was joined by other members of the science party who had sailed separately from Staten Island. The supply vessel that brought them to the platform was to operate a regular service between the mainland



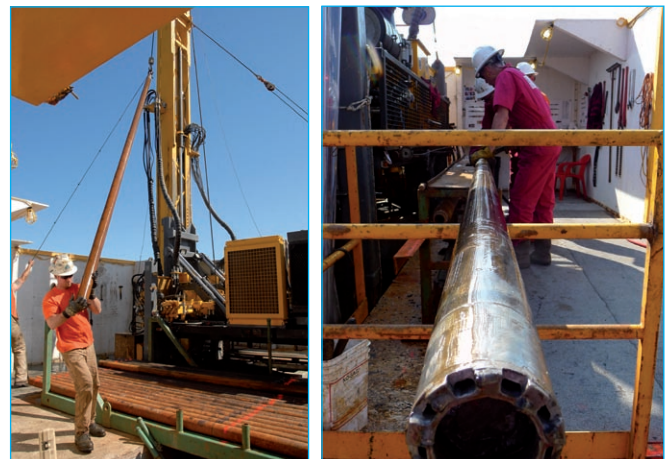
Figures 2, 3: The *Kayd* sets sail from Atlantic City to the first drillsite (© ECORD/IODP).

from Atlantic City and platform, bringing supplies as well as transferring scientists and crew who operated on a rota system throughout the 12-week expedition. Transfer to the *Kayd* was by a 'basket', an exciting experience during some of the rougher weather (Figure 5)! On May 2, the first core was brought back



Figure 4: The *Kayd* on site ready to start drilling; Figure 5: The basket transfers scientists to the *Kayd*. (© ECORD/IODP).

to the platform by the DOSECC drilling engineers and the ESO staff (Figures 6, 7) and expedition scientists went to work carrying out the basic ephemeral measurements, analysing the sediments recovered in the core catchers and making sure that the cores were curated and stored in refrigerated containers, ready to be transferred to the Bremen Core Repository for further



Figures 6, 7: Drilling operations begin on the platform (© ECORD/IODP).

investigation at the end of the expedition. The ESO containers formed a line between the drilling deck and curation containers that the team named 'Main Street', the main hub of the scientific work on board the *Kayd* (Figure 8).

After 3 weeks and recovery of 471 metres of core, the *Kayd* moved on to the second site where a further 28 days drilling produced another 385 metres of core. Drilling at the third and last site started on June 21, and on July 11, the last section of core was on deck. Despite the difficulties of coring the sandy sediments on the New Jersey shelf, the team collected more than 1600 metres of core with ~80% recovery. The total composite penetrated length



Figure 8: 'Main Street'; Figure 9: works start on analysing the cores (© ECORD/IODP).



Figure 11: Greg Mountain, Co-chief scientist of the New Jersey Shallow Shelf Expedition is interviewed by a US television reporter (A. Stevenson © ECORD/IODP).



Figure 10: Simon Barry prepares the wireline tools for logging (C. Cotterill © ECORD/IODP).



Figure 12: The Kayd dominates the Atlantic City skyline (D. Smith © ECORD/IODP).

was 2056 m. The deepest hole reached 757 metres below the sea floor. Vertical seismic profiles and spectral gamma ray logs were obtained at each site and resistivity, magnetic susceptibility, sonic and acoustic image logs were gathered at key intervals (Figure 10). These data, together with multi-sensor track measurements and basic sedimentological analysis of the core catchers (Figure 9), have already revealed the record of ten cycles of relative sea-level rise and fall.

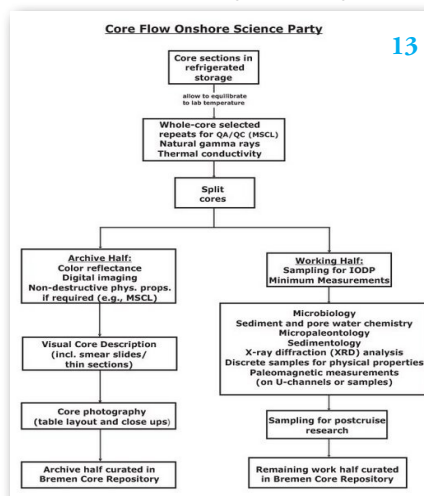
Before the *Kayd* left Atlantic City, a group of journalists had been invited to hear Greg Mountain describe the NJSS expedition science objectives and EMA Director Catherine Mével explained the role of ECORD in funding and managing the IODP mission-specific platform expeditions. The journalists then had the opportunity to visit the *Kayd* and interview the scientists (Figure 11), and crew. The *Kayd* had already attracted significant interest from the local press, as the 80-metre high legs of the liftboat dominated the Atlantic City skyline (Figure 12). The expedition

made the front page of the Atlantic City Press on consecutive days. The media interest was followed up by a visit the platform (in particularly rough conditions!), however the trip led to some high-profile coverage by such as the local NBC News Channel and the Philadelphia Inquirer. These news items and other information about the expedition can be seen on the NJSS expedition web page at <http://www.eso.ecord.org/>

On November 6, 2009, the entire science party (Figure 14) gathered again in Bremen to start the real sampling and analysis

of the cores, the results of which will be compared with and added to our understanding of the past global sea-level record. The Onshore Science Party (OSP) allows the science party members who could not take part in the offshore expedition to join their colleagues to start the process of writing up and publishing their research. The work is expected to take 4-5 weeks.

At the OSP, cores are split and scientists have their first opportunity to study the samples in more detail, as they have access to the full laboratory facilities of the Bremen Core Repository according



to the core flow procedures (*Figure 13*). An essential requirement of the OSP is that scientists stay at the core repository until all core descriptions, initial sampling measurements (the so-called IODP minimum measurements, and some IODP standard measurements), and Preliminary Report writing have been completed. The end of the OSP is the equivalent of coming off an IODP drillship.

Regular reports from the platform in the 'expedition logbook' describe the teamwork that developed between the crew from Montco, who were contracted to provide the platform, the DOSECC drilling engineers, ESO staff and the NJSS science party. The success of the offshore phase of the expedition was all down to the expertise and dedication of the entire team. We look forward to reporting the results of the Onshore Science Party in future issues of the Newsletter.



*Figure 14: the NJSS science party meet in Bremen to start work on analysing and describing the cores (© ECORD/IODP)*

NJSS Expedition 313 - <http://www.eso.ecord.org/expeditions/313/313.php>

### Great Barrier Reef Environmental Changes (GBREC) Expedition

In early January 2010, expedition scientists and staff of the ECORD Science Operator will leave Townsville, Australia to start the Great Barrier Reef Environmental Changes (GBREC) Expedition (IODP 325). Led by Co-Chief Scientists Dr Jody Webster of the School of Geoscience at the University of Sydney, Australia and Dr Yusuke Yokoyama of the Ocean Research Institute at the University of Tokyo, Japan, the team will spend about 45 days at three main sites off the coast of Australia (*see front cover*). The expedition science party consists of 28 scientists, nine of whom will participate in the offshore phase of the expedition. Nine of the scientists are from ECORD countries, the others are from the USA, Japan, Australia, India and China. The entire science party will meet at the Bremen Core Repository in July 2010 to take part in the Onshore Science Party. The platform for the expedition will be the *Greatship Maya* operated by the company Bluestone based in Singapore. The ship 93.6 metres long, 19.7 metres wide and can accommodate 66 scientists/technicians and crew.

The GBREC expedition was designed to establish the course and effects of the last deglaciation in reef settings that developed in tectonically inactive areas located far away from glaciated regions. The initial plan envisaged two complementary expeditions, one offshore Tahiti and the other on the Great Barrier Reef. The first of these, IODP Expedition 310 (Tahiti Sea Level), was successfully completed in 2005 and 2006 and recovered a near-complete record of sea-level change during the last

deglaciation (*see some results from the Tahiti expedition on page 18*).

IODP Expedition 325 proposes to core at several offshore sites along transects on the Great Barrier Reef using the dynamically positioned drilling vessel. The first objective will be to reconstruct the deglaciation curve for the period 20,000 to 10,000 calendar years before present (cal. y BP) in order to establish the minimum sea level during the Last Glacial Maximum and to assess the validity, timing, and amplitude of meltwater pulses (so-called 19 ka MWP, MWP-1A, and MWP-1B events; ca. 19,000, 13,800, and 11,300 cal. y BP), which are thought to have disturbed the general thermohaline oceanic circulation and, hence, global climate. Secondly, we aim to establish the sea-surface temperature variation accompanying the transgression at each transect. These data will allow us to examine the impact of sea-level changes on reef growth, geometry, and biological makeup, especially during reef drowning events, and will help improve the modeling of reef development. The third major objective will be to identify and establish patterns of short-term paleoclimatic changes that are thought to have punctuated the transitional period between present-day climatic conditions following the Last Glacial Maximum. It is proposed to quantify the variations of sea-surface temperatures based on high-resolution isotopic and trace element analyses on massive coral colonies. When possible, we will try to identify specific climatic phenomena such as El Niño-Southern Oscillation in the time frame prior to 10,000 cal. y BP.

GBREC Expedition 325 - <http://www.eso.ecord.org/expeditions/325/325.php>



Albert Gerdes Alan Stevenson

## ECORD Outreach and Education Activities



Patricia Maruéjol



Jenny Lezius

### News from the Outreach Team

Since last April, there have been some changes within the ECORD and IODP Outreach teams. With the transfer of the ESSAC office to Germany, Bonnie Wolff-Boenisch moved to a new position at the ERICON AB project. During the last two years we have had an excellent collaboration with Bonnie and we would like to thank her for the effort and enthusiasm she brought to the ECORD team. We wish her well in her new post. We also take this opportunity to thank the outgoing ESSAC Chair, Gilbert Camoin, for his contribution to our outreach efforts and for being an excellent host during our outreach meetings in Aix. We are happy to welcome Jenny Lezius the new ESSAC Science Coordinator who joined the team in October 2009.

Nancy Light, the IODP-MI Director of Communications left the Washington office in August. We greatly appreciated her work on the program and the strong support she has given to ECORD during her time with IODP. Nancy has taken up a new position and we also wish her well in the future.

The Outreach team met in Aix en Provence on August 5-6, 2009, to plan ECORD activities until the end of 2009 and the future outreach within IODP, in particular the annual IODP Outreach Task Force meeting held on September 22 in Bremen prior to the INVEST Conference.

### Past Conferences and Meetings

- **EGU 2009 - Vienna:** more than 9,000 scientists from all over the world attended the European Geosciences Union General Assembly 2009 at the Austria Vienna Centre, from April 19 to 24, 2009. ECORD organised the IODP booth (1) and joint IODP/ICDP Town Hall meeting with the strong support of our IODP partners (IODP-MI, CDEX/JAMSTEC, J-DESC, IODP-USIO) and ICDP.
- **2009 Joint Assembly-Toronto:** the Canadian Consortium for Ocean Drilling took advantage of the 2009 AGU/CGU/GAC/MAC Joint Assembly meeting in Toronto, May 24-27 to have an information booth (2), which was very successful and a great opportunity to spread the word that the three IODP

platforms had just started their respective expeditions: the renovated *JOIDES Resolution* in the Pacific (#320, #321), the mission-specific platform *L/B Kayd* offshore near New Jersey (#313) and the *Chikyu* phase 2 NanTroSEIZE expedition (#319). Visitors were given copies of the most recent IODP products, such as new issues of the ECORD newsletter, 'Chikyu Hakken' and the latest edition of 'Scientific Drilling'.

The booth was coordinated by H el ene Gaonac'h, science coordinator of the IODP Canada office in Montreal - <http://www.iodpcanada.ca/>. Canadian students, postdoctoral fellows and members of the IODP community contributed to this success.



### ECORD on-line

- Information about the five IODP core replicas, which are available for display at temporary exhibitions, conferences and summer schools in Europe can be found at: <http://www.ecord.org/pi/promo.html>
- The ESO web site - <http://www.eso.ecord.org> - has been re-designed partly to provide more space for new outreach resources, photo galleries and an ESO RSS feed.
- ECORD offers three news feeds for distributing the content of the

ECORD, ESO and ESSAC News. All news can be viewed at-a-glance at <http://www.ecord.org/RSS/ecord-rss.php>

- New videos about IODP and ECORD are featured on YouTube at <http://fr.youtube.com/user/OceanDrilling> and <http://fr.youtube.com/user/ECORDESO>.

### ECORD Educational Activities

There have been many educational activities during the last six months. The ECORD summer schools were held in Urbino and Bremen and the 'School of Rock' 2009 took place on the *JOIDES Resolution*. Some of the students and teachers from ECORD member countries who participated in these events have provided the reports featured on [pages 7, 8, 9 and 11](#).

*ECORD Outreach Team: Patricia Maru ejol, EMA, Alan Stevenson and Albert Gerdes, ESO and Jenny Lezius, ESSAC*  
<http://www.ecord.org/pi/promo.html>



Check ECORD headlines at: <http://www.ecord.org/RSS/ecord-rss.php>

## 'School of Rock 2009' - Cores, CORKS and Crust on the Juan de Fuca Ridge

During two weeks in June 2009, fifteen educators from the USA, Japan, France and Portugal were invited to participate in 'School of Rock 2009' aboard the drillship *JOIDES Resolution (JR)* during Expedition 321 T Cores, CORKS and Hydrogeology on the Juan de Fuca Ridge from San Diego, CA to Victoria, BC, Canada. For the first time two ECORD teachers (*below*), Jean-Luc Bérenguer, a Biology and Geology teacher from France and Hélder Pereira, an Earth Science teacher from Portugal joined a 2-week educational programme for Earth and Ocean Science Educators called 'School of Rock 2009' (SOR 09), sponsored by the Consortium for Ocean Leadership/Deep Earth Academy and IODP-USIO. School of Rock' has been running for four years in the USA. The IODP - USIO takes advantage of transits between scientific operations to carry out seagoing earth systems research and education workshops on board the *JR*.

### Teachers from France and Portugal are the first two European 'School of Rock' graduates

The School of Rock curriculum 'Cores, CORKS and Crust on the Juan de Fuca Ridge' focused on the sub-seafloor observatories called Circulation Obviation Retrofit Kits (CORKS) in Holes U1301A and U1301B which were installed during IODP Expedition 301 and the hydrogeologic, monitoring and sampling experiments conducted there. No drilling was conducted during the expedition; however the derrick was used to lower a pipe string about 2760 metres beneath the ship to repair two CORKS embedded in boreholes in the seafloor. These CORKS had been installed at an earlier date but were not functioning properly due to leakage of seawater into the

boreholes. The repair involved inserting the pipe string into the boreholes - a huge task at such a depth - and pumping cement from the ship into the boreholes to seal them.



*Helder Pereira (left) and Jean Luc Bérenguer (right).*

The 'School of Rock' activities were based on data-rich, hands-on, learner-focused, inquiry techniques. We worked with our fellow teachers in teams to access and analyse data, sample cores, conduct authentic scientific investigations, and discuss our conclusions like scientists do on IODP expeditions (*below*). Besides that we have chronicled our experiences aboard in photobooks and in the blogs posted on <http://joidesresolution.org> to communicate with our students, families, and friends onshore. A video conference was also conducted between the *JR* and Japanese classrooms.

*Hélder Pereira, Loulé High School, Portugal*

### How I became a 'Rocker' on the drillship *JOIDES Resolution*

'School of Rock' is a great adventure for teachers. During a couple of days, teachers were taught by scientists who are actively engaged in IODP research. In addition, shipboard technical staff provided guidance and contents related to hands-on laboratory activities. Each day, the teachers had the opportunity to investigate, conceive and to realise hands-on activities in the classroom. They were very active and produced many educational tools based on the broad topics of oceanographic geosciences.

For example, we were challenged to analyse a suite of cored sediment samples using



*Jean Luc Bérenguer tracks the forams.*

special species of planktonic foraminifer *Neogloboquadrina pachyderma* - as a proxy for examining shifts in glacial/interglacial climate since the late Pliocene in the area of the California Current. After only a short introduction to the use of planktonic forams as paleoceanographic proxies, we washed, sieved and dried the core samples, then examined them under a binocular microscope (*left*). We then collaborated in compiling and comparing our results to published results from nearby Site 1014B (Lyle et al., 1997). Despite the lower sampling resolution, our results for Site 1014A were remarkably similar to those of Site 1014B. This basic activity generated significant interest in using current core samples to teach climate change, and is proving to be transferable to a broad audience of students.

There were many other exciting activities during the 2-week expedition such as examining cores, determining CO<sub>2</sub> in sediments and looking after hydrothermal items. There were so many opportunities to participate in a seagoing experience, to increase our knowledge on mid-ocean

ridges, oceanic crust and seafloor spreading. Now it is time for me, as a good 'Rocker', to convert this scientific experimentation into useful teaching resources, to develop a suite of activities for classroom and to



*On the core deck, 'rockers' investigate rocks.*

bring geosciences into the classroom! Some projects are already planned such as a videoconference with the *JOIDES Resolution* crew during the 'week of science' in France next November, or a hands-on activity with the forams using the downcore samples with my students.

*Jean-Luc Bérenguer, International School Valbonne Sophia Antipolis, France*

## ECORD 2009 Urbino Summer Schools in Paleoclimatology

### Magellan Introductory Course in Ocean Drilling (MICOD) - Urbino July 15-23, 2009

To promote the integration of the various aspects related to the stratigraphy and the sedimentology of deep-sea sedimentary archives of paleoclimate records, the Urbino Summer School in Paleoclimatology (USSP) Consortium has organised the Magellan Introductory Course in Ocean Drilling Sciences (MICOD) held at the University of Urbino between July 15-23, 2009 with the financial support of the European Science Foundation.

With the goal of training a new generation of ocean drilling Earth scientists also able to advantageously view field data in the light of models and vice versa, MICOD brought together 10 leading international experts in the stratigraphy of marine sediments, palaeoceanography, palaeoclimatology, geochemistry and paleoclimate modeling, all of them involved with ODP/IODP in the past, to lecture and mentor 29 typically first-year graduate students from 10 nations. The course has been organised in collaboration with the Consortium for Ocean Leadership 'School of Rock' (page 7), which allowed implementing modules mimicking the typical situation of incoming cores onboard the *JOIDES Resolution*, including initial lab studies.

The course included a 7-day intensive programme covering e.g., an introduction on the deep-sea drilling techniques, followed by a series of lectures and exercises on the stratigraphy of marine sediments aimed at providing information, and analysis of, extant ocean drilling data including the various techniques used to construct age models. Exercises were focused on core description (core replicas and photographs) and the analysis of authentic shipboard data. Theoretical lectures and exercises on the stratigraphy of marine sediments have been complemented by a field component aimed at providing a comparison of the analysed oceanic sequences with

the locally exposed Tethyan sedimentary sequence. The location of Urbino within the Umbria-Marche Basin has provided exceptional field access to the regional stratigraphic records of the Cretaceous and Cenozoic paleoclimatic history and events focused upon by

MICOD, which form an exceptional playground for stratigraphy field works. Several easily accessible outcrops have offered the opportunity for field view of records equivalent to those recovered by Ocean Drilling Science programs (DSDP-ODP-IODP). Field and laboratory work have allowed students to produce original data across intervals marking the evolution of Cretaceous and Cenozoic climates. Produced data will be compared with the deep-sea records to evaluate them in a global context

also using information obtained from lectures focused on the oceanographic and climate system and dynamics.

MICOD provided an integrated student-centred programme comprised of (1) integrated topical lectures by internationally recognized scientists; (2) student-centered data-rich exercises, investigations, and presentations on field data and modeling results; (3) working group sessions providing groups of participants with a more focused coverage of selected topics within paleoclimatology for selected intervals and events (4) a regional field excursion to classic Cretaceous and Cenozoic sections, and (5) intensive discussions of specific palaeoclimate topics in small student working groups facilitated by dedicated instructors. The programme structure included IODP/JOI elements, by incorporating several modules of the 'School of Rock' at the start and an integration of student-centred investigations within the broader structure of a 'virtual IODP leg'.

*Henk Brinkhuis, Utrecht University, The Netherlands*



### 'Past Global Change Reconstruction and Modeling Techniques' - July 23-August 5, 2009

Sixty of my fellow students and I gathered in the tranquil, hilly town of Urbino, Italy for the 6<sup>th</sup> summer school in paleoclimatology. The opening sessions gave us the most current framework for the Cenozoic climate system and an understanding for the unresolved problems from both the modeling and the data perspectives. In addition to the informative in-classroom lectures on proxies and models for past climate reconstruction, we were also fortunate enough to be taken out on a field trip to Gubbio, where many of us posed next to the famous Cretaceous-Tertiary boundary. Back on campus during the CIOPPINO workshop, students not only received valuable feedback for our own work but also heard from our teachers about their exciting new research findings. One of the most challenging and, at the same time, rewarding components of the summer school had to







Catherine Mével

## Message from the ECORD Managing Agency Director

The year 2009 has been a milestone in the life of IODP. For the first time, the three platforms have been operating simultaneously. The first scientific riser drilling expedition was implemented as part of the NanTroSEIZE project. The *Chikyu* drilled down to 1.6 km, opening the road towards the active seismogenic zone of Nankai. As I write these lines, a completely refitted *JOIDES Resolution* is operating its fourth expedition, on the Shatsky Rise, before sailing to the Southern Ocean this winter. The New Jersey Shallow Shelf Expedition, implemented by the ECORD Science Operator (ESO), was a great success: the three planned holes were drilled with a recovery far beyond the dreams of the co-chiefs. The Onshore Science Party started at the Bremen Core Repository and gathered about thirty scientists for a full month, to describe and analyse 1,311.4 m of precious cores ([page 3](#)). I had the privilege to visit the *L/B Kayd* contracted by ESO before it sailed from Atlantic City and was very impressed by the quite spectacular three-legged drilling platform. This last expedition was a joint effort between ECORD and ICDP ([page 17](#)), which contributed financially to platform operation costs. This joint project could become a model for the future. Discussions at the INVEST meeting ([see the message from the Council Chair](#)) emphasised the need for land to sea transects, and ECORD/IODP and ICDP will undoubtedly cooperate more closely.

The ECORD Science Operator is getting ready for the Great Barrier Reef Environmental Changes Expedition, now scheduled in January 2010. Beyond that, the ECORD Council is planning to fund two further MSP expeditions, still to be determined. Two expeditions dedicated to the deep biosphere are now on the horizon, in the *JOIDES Resolution* schedule for 2011 ([page 11](#)), and hopefully they will result in major scientific breakthroughs. The next Science Planning Committee meeting in March 2010 will be crucial to decide what happens before the program ends in 2013.

2009 was also a year of major changes at management level. At its next meeting in November, the ECORD

Council will welcome new delegates from the Netherlands, Norway, Denmark and the UK, to add to the recent changes in representatives from Germany, Spain, Switzerland and France. All of these new delegates will bring a fresh view to the Council at a crucial stage as we plan for a 'new drilling programme', although it is fair to say we will miss the knowledge and experience of all the delegates who have rotated off the Council.

Another major change concerns IODP-MI. The new president Kiyoshi Suyehiro is consolidating the two current IODP-MI offices into a single location in Tokyo, with the aim of increased efficiency. Most of the personnel from the Washington DC office will unfortunately not move for various reasons. They all have been instrumental in making the program function, and I particularly thank Tom Janecek and Nancy Light for their commitment and accomplishments. Recruitments are ongoing and I am looking forward to visiting the new Tokyo office next year.

Last but not least, I welcome the new ESSAC Office. After two years in Aix en Provence, the office moved to the Alfred Wegener Institute in Bremerhaven on October 1<sup>st</sup>. I have no doubt that the new Chair, Rüdiger Stein, and the new Science Coordinator, Jeannette Lezius, will efficiently take up the torch. I take this opportunity to thank the previous ECORD Chair and Science Coordinator, Gilbert Camoin and Bonnie Wolff-Boenisch who formed a dedicated team and ran the office very efficiently for the benefit of the ECORD scientific community in Europe.

To facilitate the approval of a new drilling programme by our decision makers, the last 4 years of IODP must have a big scientific impact. Everything is in place to make it happen.

Catherine Mével, ECORD Managing Agency Director  
<http://www.ecord.org/ema.html>

*Continued from page 8*

be the group assignment. Our group was tasked with investigations of Eocene hyperthermal events and it was through digging into the literature and conversing with our teachers that I gained a unique perspective on this subject I knew nothing about prior to coming to the summer school. My gratitude goes out to the teachers, for tirelessly entertaining my questions and for their encouragements, to staff, for making this such a delightful experience, and to my fellow students, some of whom became friends and collaborators. Finally, I want to thank ECORD for the financial support it provided, without which I would not have been able to attend this summer school.

Amy Chen, ECORD Scholarship Awardee 2009, Ludwig-Maximilians University, Munich, Germany

<http://www.uniurb.it/ussp/>

*Reports of ECORD summer schools continued on page 11*



Rüdiger Stein

## ECORD Science Support & Advisory Committee Updates



Jenny Lezius

Just two weeks before the deadline for writing these ESSAC updates, the ESSAC Office moved from Aix en Provence in France to Bremerhaven in Germany, and we, Jeannette (Jenny) Lezius as new Science Coordinator and myself as new ESSAC Chair, took over the steering wheel from the former Chair Gilbert Camoin and Science Coordinator Bonnie Wolff-Boenisch. As a result, most of this report summarises activities done under the leadership of the previous ESSAC Office.

So what happened during the last few months? ESSAC has been actively involved in finalising staffing of the following expeditions:

- ‘Canterbury Basin’ - Exp.317 with Co-chiefs C. Fulthorpe and K. Hoyanagi, scheduled from November 2009 to January 2010,
- ‘Wilkes Land’ - Exp. 318 with Co-chiefs C. Escutia and H. Brinkhuis, scheduled from January to March 2010,
- Great Barrier Reef Environmental Changes - Exp. 325 with Co-chiefs J. Webster and Y. Yokoyama, scheduled early January 2010,
- ‘Shatsky Rise’ - Exp. 324 with Co-chiefs W. Sager and T. Sano, scheduled from September to November 2009,
- the NanTroSEIZE expeditions scheduled from May to October 2009: Stage 2 ‘Subduction Input’ - Exp. 322 with Co-chiefs S. Saito and M. Underwood and ‘Riser/Riserless Observatory-1’ - Exp. 319 with Co-chiefs L. McNeill, E. Araki, T. Byrne and D. Saffer, expeditions which included the first riser drilling operations by the *Chikyu*.

The second phase of the ECORD Distinguished Lecturer Programme has been very successful with 31 applications from institutions in 16 ECORD and non-ECORD countries to host the 2008-2009 ECORD Distinguished Lecturers, Peter Clift, Achim Kopf and John Parkes. This phase will be active until June 2010.

The budget related to the ECORD summer schools has increased at ESSAC’s request, including the ECORD Scholarship Programme and the funding of the ECORD summer schools. Fifteen young scientists from seven countries were selected from 64 applications from 15 ECORD countries to be funded by ECORD to attend one of the two ECORD-sponsored 2009 summer schools: ‘Past Global Change Reconstruction and Modelling Techniques’, Urbino, Italy, July 2009 ([page 8](#)) and ‘Geodynamics of Mid-Ocean Ridges’, Bremen, Germany, September 2009 ([page 11](#)).

At its 12<sup>th</sup> meeting held in Sesimbra (Portugal), ESSAC decided to fund in 2010 the Urbino Summer School on ‘Past Global Change Reconstruction and Modelling Techniques’ along with two other summer schools on ‘Dynamics of Past Climate Change’ (organisers D. Hebbeln, M. Schulz, and U. Roehl) and ‘Ocean and Climate Changes in Polar and Subpolar Environments’ (organisers Canadian Consortium

on Ocean Drilling) which will be organised in Bremen and Québec, respectively.

At the same meeting, ESSAC also defined the format of a new tool called ‘ECORD Grants’ which will consist of small and short-term grants to cover travel and lab expenses to work on DSDP/ODP/IODP cores and/or data. The objectives of this scheme are to increase the use of relevant material, and to attract still more young scientists and IODP newcomers. This concept has been accepted by the ECORD Council and the first ECORD Grants will be offered in FY2010.



ESSAC has been actively involved in preparation for the INVEST (IODP New Ventures in Exploring Scientific Targets) Conference, which was held from September 23-25, 2009 in Bremen, Germany ([page 16](#)), with the publication of a White Paper on the ECORD, ESSAC and INVEST web sites. This White Paper summarises the outcome of the ECORD-ESF workshop ‘Beyond 2013: the Future of European Scientific Drilling’ which was held in Vienna (Austria) on April 24-25, 2009 ([page 13](#)). The key items of the workshop report include: (1) The future of IODP and ECORD, (2) New research initiatives and emerging fields in scientific drilling, (3) Relationships between IODP and other programs, (4) Collaboration between academia and industry, and (5) New technologies and the Mission-Specific Platform approach. In parallel, ESSAC has initiated a web forum which provides the opportunity to all people interested in scientific drilling to be included in discussions regarding all of the aspects listed above but also concerning IODP achievements and perspectives, the IODP and ECORD structures, and the problems that IODP has faced in the past.

During the EGU 2010 in Vienna, we will organise the IODP-ICDP EuroFORUM 2010 ([page 13](#)). Our proposal has been accepted for an Interdivision Session dealing with major achievements and perspectives in ocean and continental drilling ([for details see box page 13](#)), and a call for oral and poster contributions will be sent out soon.

Finally, Jenny and I gratefully thank Gilbert and Bonnie for all their effort in leading ESSAC and running the ESSAC Office

during the last two years so successfully. We hope that we will be able to continue this job in a similar active and successful way. In any case, we will do our best!

The success of our work and ESSAC as a whole, however, also depends on the active support by the ESSAC delegates and the cooperation with the other IODP/ECORD bodies as well as the scientific community. We hope that the constructive and

efficient cooperation between all of us will continue during the coming two years-. If you have any ideas, suggestions, comments, etc. related to IODP/ECORD/ESSAC, please contact us. We are open for (almost) everything!

*Rüdiger (Rudy) Stein, ESSAC Chair, Jenny Lezius, ESSAC Science Coordinator - <http://www.essac.ecord.org>*

### Future JOIDES Resolution and Chikyu expeditions approved by SPC for late FY2010 and FY2011

For **JOIDES Resolution**: (1) Juan de Fuca Flank Hydrogeology (Proposal 545-Full3) and Cascadia Accretionary Prism CORK (Proposal 734-APL); (2) South Pacific Gyre Microbiology (Proposal 662-Full3); (3) Louisville Seamounts (Proposal 636-Full3); (4) Superfast Spreading Crust (Proposal 552-Full5) + Costa Rica Seismogenesis Project (CRISP) Phase A (Proposal 537A-Full5); and (5) Mid-Atlantic Ridge Microbiology (Proposal 677-Full).

For **Chikyu**, several options for FY2011 expedition are still under discussion, with the NanTroSEIZE Observatory and riser drilling having the top priority.

*In the event that the Kuroshio current does not allow to drill Nankai Trough, Okinawa Trough Deep Biosphere (Proposal 601-Full 3) and Mariana Convergent Margin (Proposal 505-Full 5) have been selected as contingencies.*

*Continued from page 9*

### ECORD 2009 Summer School in Geodynamics of Mid-Ocean Ridges, Bremen, Germany

I was particularly enthusiastic to visit the Bremen Core Repository, which stores about 142 km of deep-sea cores from the Atlantic and Arctic Oceans, Mediterranean and Black Seas. Three of the days at the Bremen Summer School were scheduled to learn core-logging techniques by working on gabbro, peridotite and basalt cores and thin sections. This provided a wonderful opportunity for exchange between scientists from different specialities on petrology, rock structure and alteration. For most of us this was our first insight into the possibilities of on-ship scientific interaction and co-operation, which are so important in ocean drilling programmes. We also left with the vision of the large range of samples stored in Bremen and fully available for future researches.

*Aurélia Colin, ECORD Scholarship Awardee 2009, Centre de Recherches Pétrographiques et Géochimiques, France*



*Students discussing petrological and structural information to included in a core description (photo Benoit Ildefonse).*

The ECORD Summer School on the 'Geodynamics of Mid-Ocean Ridges' was held at the University of Bremen from August 31 to September 11, 2009. 32 graduate students and post-docs attended the school, which consisted of lectures and discussions on different

fields related to mid-ocean ridge processes, along with a field trip to a Devonian submarine volcanic province. We got to know by hand the methods used on-board to study the cores retrieved by the IODP drilling vessels, and had the opportunity to listen to lectures



*During the field trip at the Arnstein volcano in eastern Sauerland (Germany), Jürgen Köpke, Andreas Klügel, Catherine Evvard and Ben Winpenny take a close look at the Middle Devonian volcanic rocks (photo Ásta Rut Hjartardóttir).*

broadcast live from on-board the *JOIDES Resolution*. We also learned about writing IODP proposals

This summer school was therefore an interesting combination of lectures and hands-on experience, which widened my perspective regarding mid-ocean ridge processes, enabled me to get to know people from various countries working in similar fields as me, and gave me an opportunity to get to know better the important work done by the IODP. I would therefore like to thank ECORD for the financial support, which gave me the opportunity to go to the 2009 ECORD Summer School in Bremen.

*Ásta Rut Hjartardóttir, ECORD Scholarship Awardee 2009, University of Iceland*

## Workshop and Conference Announcements

- ◆ ESF Magellan Series Workshops - <http://www.esf.org/magellan>
  - Volcanic basins: scientific, economic and environmental aspects, January 25-28, 2010, Grenoble, France
  - Deadline for Magellan workshop proposals: December 15, 2009**
- ◆ IODP-MI Workshops - <http://www.iodp.org/workshops>
- ◆ ECORD Distinguished Lecturer Programme - <http://www.essac.ecord.org/index.php?mod=education&page=dlp>
- ◆ AGU 2009, December 14-18, 2009, San Francisco, USA - <http://www.agu.org/meetings/fm09>
- ◆ EGU 2010, May 2-7, 2010, Vienna, Austria - <http://meetings.copernicus.org/egu2010>
  - IODP/ICDP EuroFORUM 2010 - <http://meetingorganizer.copernicus.org/EGU2010/session/2717>
- ◆ JpGU 2010, May 23-28, 2010, Chiba, Japan - [http://www.jpгу.org/meeting\\_e](http://www.jpгу.org/meeting_e)
- ◆ AOGS 2010, July 5-9, 2010, Hyderabad, India - <http://www.asiaoceania.org>

## Reports of Magellan Series Workshops

- ◆ **Paleoenvironmental Evolution of the Baltic Sea through the Last Glacial Cycle, March 8-9, 2009, Copenhagen, Denmark**  
 Convenors: Thomas Andrén-thomas.andren@sh.se, Svante Björck-svante.bjorck@geol.lu.se, Jan Harff-jan.harff@io-warnemuende.de, Jörn Bo Jensen-jbj@geus.dk, Bo Barker Jørgensen-bjoergenmpi-bremen.de, and Aarno Kotilainen-aarno.kotilainen@gtk.fi

The workshop, which was held in Copenhagen on March 14 to 16, 2009 and hosted by the Geological Survey of Denmark and Greenland (GEUS), brought together not only those directly involved in the Baltic Sea IODP proposal but also several other scientists interested in the topic and any future drilling campaign. The aims of the workshop were:

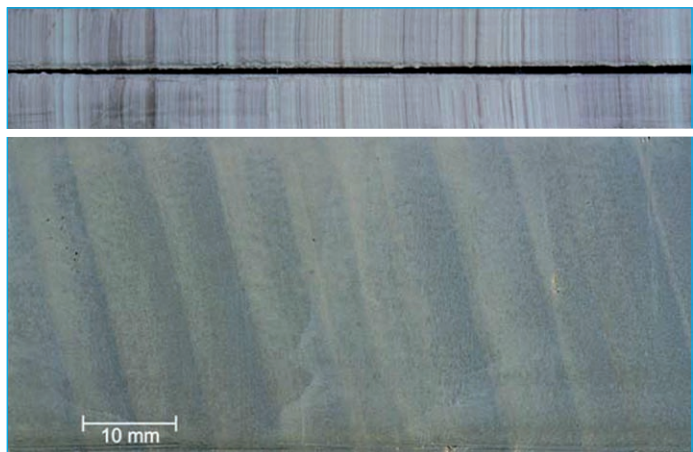
- (1) To bring together a group of geoscientists, young researchers and drilling scientists to exchange ideas about the utilisation of marine drilling technologies for the investigation of marginal seas with special respect to the Baltic Sea, and to summarise the possibilities of paleoenvironmental reconstructions of the border area between the Northeastern Atlantic and Eurasia,
- (2) To justify the targets and sites for a drill campaign in order to sample a complete stratigraphic record as possible of the Baltic Sea Basin (BSB) for the Last Glacial Cycle (LGC),
- (3) To develop a drilling strategy to recover archives of the Late Quaternary history of the BSB,
- (4) To select the optimal proxies for paleoenvironmental interpretations of the development of the BSB during the LGC, and
- (5) To improve the final proposal #672-Full3 for a Baltic IODP drilling campaign.

The final outcome of the workshop manifested itself in a completely rewritten and reorganised proposal to the IODP submitted this year on April 1. These actions were successful and the SSEP decided during their May meeting that the proposal was mature and sent to external reviewers. Last week we received five thorough reviews: they all recommend an IODP drilling project in the Baltic Sea but with a few reservations. We will prepare a response letter to better explain a few matters that were not fully met with in the proposal.

*Varved glacial clay deposited in the Baltic Ice Lake and the Yoldia Sea, two deglacial phases of the Baltic Sea Basin, during the last deglaciation. One varve constitutes a light, silty summer lamina and a dark, clayey winter lamina and represents one year of sediment discharge from the melting ice sheet and its distal sedimentation (photos: S. Björck, upper panel, and T. Andrén, lower panel).*



*A view of the Kalmar Strait between mainland Sweden and the island of Öland, situated in the southern Baltic Sea proper. The small island at the horizon is called Blå Jungfrun (Blue Virgin Island) and was in old times thought to be the place where the witches gathered at Easter. Note the wave-washed and eroded beach, typical for areas that have experienced glacial unloading (photo T. Andrén).*



◆ **Beyond 2013 - the Future of European Scientific Drilling Research, April 24-25, 2009, Vienna, Austria**

Convenors: Gilbert Camoin - [camoin@cerege.fr](mailto:camoin@cerege.fr), Rüdiger Stein - [ruediger.stein@awi.de](mailto:ruediger.stein@awi.de) and Michael Wagreich - [michael.wagreich@univie.ac.at](mailto:michael.wagreich@univie.ac.at)

An international workshop, organised by Gilbert Camoin (CEREGE-CNRS, France), Rüdiger Stein (AWI, Germany) and Michael Wagreich (University of Vienna, Austria), was held on April 24 and 25, 2009 at the Geocenter of the University of Vienna, Austria, to prepare the IODP New Ventures in Exploring Scientific Targets (INVEST) Conference which has been held in Bremen, Germany on September 23-25, 2009. The 'Beyond 2013' workshop has been attended by about 80 scientists from 15 countries.

The major objectives of the workshop were to sharpen the European interests and give weight to the European propositions both on science, technology and management in the future international drilling programme and to discuss future directions of ocean drilling research and related aspects such as ventures with related programmes or with industry.

The workshop has included breakout-group discussions and open discussions with all meeting participants on all key discussion topics including:

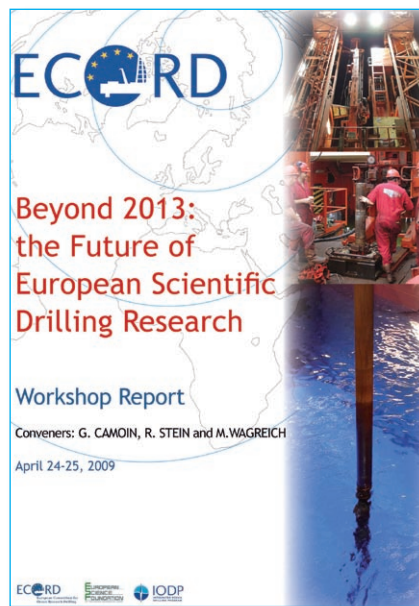
- (1) The Future of ECORD and IODP [science, technology, management],
- (2) The New Research Initiatives and Emerging Fields in Scientific Drilling,
- (3) The Relationships between IODP and Other Programmes, and between IODP and Industry,
- (4) The New Technologies and the Mission-Specific Platform Approach.

The first half-day of the workshop included overviews of those key items and five breakout-group discussions based on those key items. The second half-day of the workshop was dedicated to the continuation of the breakout-group discussions and during the third half-day, the chair persons of the breakout sessions presented a summary of

the relevant discussions in a plenary session followed by a general discussion.

The outcomes of the breakout group discussions were a list of important questions, ideas, suggestions and recommendations regarding the IODP science, technology and management.

The major outcomes of the workshop and outlooks have been summarised at the end of the workshop during a meeting between the convenors and the chair persons of the breakout sessions.



The preliminary results of the workshop 'Beyond 2013' have been considered for planning the INVEST Conference ([page 16](#)) as many scientific topics listed in the "emergent and new fields and topics" of the workshop (Breakout Session 2) have been included in the final list of the breakout sessions of the INVEST Conference. The preliminary results of the breakout sessions 1, 3 and 4, respectively regarding the Future of ECORD and IODP, the relationships IODP/Other Programmes/Industry and the New Technologies and the Mission-Specific Platform Approach, have been also debated at the last meeting of the ECORD Council and are already considered as a basis for further discussions, at both the scientific

level (INVEST) and the funding agency level (ECORD Council and International Working Group IWG+).

Early September the convenors published a 'White Book' on the Future of European Ocean Drilling Research ([above](#)) that has been made available on the ECORD, ESSAC and INVEST web sites. This document was used to prepare the INVEST Conference and at this conference where future directions of scientific ocean drilling beyond 2013 have been discussed.

Detailed reports of the workshops are posted on the ESSAC web site at:  
<http://www.essac.ecord.org/index.php?mod=education&page=scientific-res>

### IODP-ICDP EuroFORUM 2010

#### Achievements and Perspectives in Scientific Ocean and Continental Drilling

The principal goals of the joint Integrated Ocean Drilling Program (IODP) - International Continental Scientific Drilling Program (ICDP) EuroFORUM 2010 are to summarise and review the major scientific achievements in ocean and continental drilling with special emphasis on the European contributions to IODP and ICDP. Furthermore, perspectives and visions for drilling projects using a multi-platform approach will be tackled.

**EGU 2010 Interdivision Session** - <http://meetingorganizer.copernicus.org/EGU2010/session/2717>

Convenors: Rüdiger Stein, Ulrich Harms, Henk Brinkhuis, Gilbert Camoin, Jochen Erbacher, and Ursula Röhl

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<http://www.essac.ecord.org/index.php?mod=about>

## A Letter from Finland

### Finnish Involvement in IODP

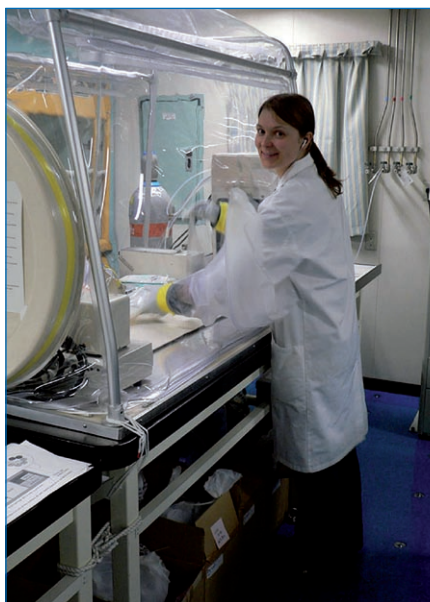
Geosciences have always played an important role in the Finnish economy partly based on Precambrian mineral resources and Quaternary sediments and water resources. Climate evolution studies have been expanded to global-scale studies of the Cenozoic era and by integrating ocean-continent concerns within the IODP program since 2004. Our ECORD membership and IODP related research projects are supported by the Academy of Finland [www.aka.fi](http://www.aka.fi). The major focus has been in educating a new generation of marine geoscientists and participation in scientifically interesting drillings including IODP Exp. 302, 313, 315, and planning of new research projects. The Finnish Graduate School in Geology has benefited from the ECORD lectures and students have participated in its summer schools as well as workshops arranged by the European Science Foundation Magellan Programme.

The Arctic Coring Expedition 302 has provided samples on Arctic climatic history that are studied at the University of Oulu. Using this material, Ninna Immonen has started a new PhD study focusing on the distribution of grain microtextures in late Cenozoic ice-rafted detritus within the larger Past Climate Extremes (PACE) research project led by Prof. Kari Strand.

The most recent involvement relates to New Jersey Shallow Shelf Expedition 313, where geophysicist Henna Valppu is a member of the Science Party as a physical properties specialist.

A young microbiologist, Dr Anna Kaksonen from the Tampere University of Technology, participated in the Nankai Trough Seismogenic Zone Experiment (NanTroSEIZE) Expedition 315 that took place offshore the Kii Peninsula in Japan in 2007. Anna extensively sampled previously unexplored deep sub-seafloor sediments for microbiological studies (*above*). During the expedition, samples were retrieved from whole round cores and preserved for cell counting, DNA- and RNA-based studies, and culturing of microorganisms. Enrichment cultures of sulphate reducers were set up using different electron and carbon sources and incubation temperatures.

Cells in selected samples were then stained with a DNA-binding dye and examined with epifluorescence microscopy. Her collaborator, Dr. Fumio Inagaki, a microbiologist at Kochi Institute for Core Sample Research in Japan, participated in the next NanTroSEIZE Expedition 316. The samples collected during these two expeditions are now being examined by molecular ecological and culturing techniques by Anna Kaksonen.



*Microbiologist Anna Kaksonen (Tampere University of Technology) is preserving samples in an anaerobic chamber for culture-based studies in the microbiology laboratory on the Chikyū during the NanTroSEIZE IODP Exp. 315 (© JAMSTEC/IODP).*

IODP Expedition 318 will drill on the Wilkes Land glacial margin in Antarctica during January and February 2010. Samples will be collected from the shelf progradational wedge foreset to study Eocene sediments, and possibly also from an outer shelf site to study Miocene sediments. The samples will be studied at the University of Oulu in collaboration with the shipboard sedimentologists.

As a new initiative, a full proposal for IODP was submitted for scientific drilling in the Baltic Sea with the title 'Paleoenvironmental evolution of the Baltic Sea through the Last Glacial Cycle'. Prof. Aarno Kotilainen from the Geological Survey of Finland is a co-proponent and an alternate member in the IODP Scientific Technology Panel (STP). The Baltic Sea Basin is one of the world's largest intra-continental basins, which has

served as a depositional sink throughout its geological history. The proposed drilling would provide a unique opportunity to reconstruct high-resolution climatic variability of global importance. A Magellan Workshop was organised in March this year in Copenhagen to fully develop the proposal (*page 12*).

### The National Support Group for IODP and IODP Finland Portal

A support group of 14 experts from universities, state research institutes and the Academy of Finland was established to support Finnish membership in IODP. The support group helps Finnish scientists, students and engineers to participate and obtain material from the IODP expeditions, to benefit from the results and technological advances of the program as well as to encourage them to attend workshops on the various themes of the IODP science plan. The support group covers a variety of expertise from solid-earth geophysics, geochemistry, paleosedimentology to microbiology and Arctic marine technology.

At a national level, there is a close co-operation with the International Continental Scientific Drilling Program (ICDP) (*page 17*).

An IODP Finland web portal <http://iodpfinland.oulu.fi> (*below*) has been set up for researchers and students. It is especially aimed at providing Finnish scientists and



students with an easy gateway to look for opportunities to participate in future expeditions, to request samples, to find educational resources or to begin planning or joining international drilling proposal initiatives. The support group members' contact information and their fields expertise are also displayed.

*Kari Strand, ESSAC delegate, Annakaisa Korja, alternate ESSAC delegate and Eija Kanto, ECORD Council delegate*

## Many Scientists Invest in the Future of Ocean Drilling

A large flock of scientists and engineers - 583 participants from 21 nations - attended the IODP New Ventures in Exploring Scientific Targets (INVEST) Conference to discuss the future of ocean drilling. The conference was held at the University of Bremen, Germany, between September 22 and 25, 2009. The ECORD nations have been strongly involved in the conference as nearly half of the participants (261 over 583) were from 13 ECORD nations.

INVEST focused on defining new scientific research goals of a new ocean drilling programme, expected to replace IODP late in 2013. The discussion of new scientific challenges was cast into five conference themes, of which each had between six and nine working groups. These overarching themes were:

- Co-evolution of Life and Planet
- Earth's Interior, Crust and Surface Interactions
- Climate Change - Records of the Past, Lessons for the Future
- Earth System Dynamics, Reservoirs and Fluxes
- Earth-Human-Earth Interactions

The afternoon of the 25<sup>th</sup> was used to discuss Science Implementation Needs and Goals, including Observatories and Seafloor Experimentation, Tools and Developments, as well as Programme Architecture and Education and Outreach.

Theme and working group sessions alternated with plenary sessions in which the theme chairs reported the results of working group discussions. INVEST also featured 12 invited keynote lectures, ranging in topic from drilling technology to climate prediction to deep Earth processes. Young scientists, program offices, and industry were given the opportunity to present posters. More than 100 white papers were submitted in preparation of INVEST and were discussed in the working group sessions.

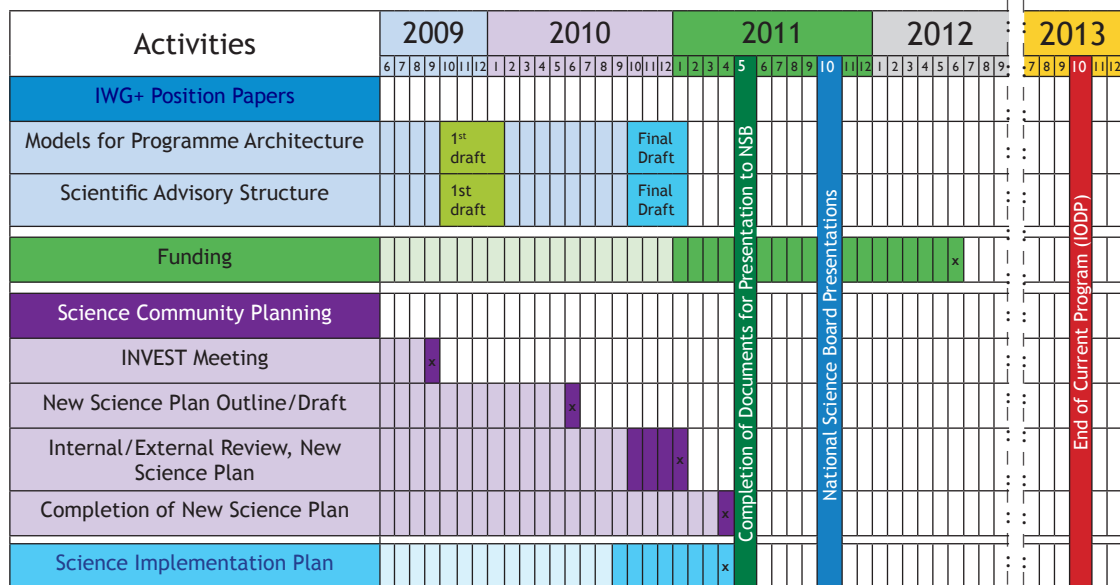
The amazingly large numbers of attendants, including >100 students and early-career scientists as well as the avalanche of white papers provide a strong testament to the continued enthusiasm

within our community and the great interest of scientists from new scientific fields. The meeting made clear just how many first-order questions about our planet are still unanswered and that ocean drilling is of paramount importance in making strides towards answering them. This impression was conveyed in each of the conference themes, but perhaps more exciting was the increased awareness of just how closely linked many subsections from different themes are. A number of new interdisciplinary frontiers that highlight some new directions for science ocean drilling emerged from the discussions. Extreme events, Hominin evolution, and Experimentation below the seafloor are just a few examples. In each of these initiatives, ocean drilling will contribute in a unique and critical way and will decisively break new ground in earth system research.

The unanimous support by a large number of our trusted colleagues to present keynote talks and chair working groups during the INVEST meeting testifies to the widely held appreciation of the unique and critical research opportunities offered by ocean drilling. However, establishing a new programme will take continued and full support and active engagement by the broader community, including representatives of new and emerging fields. The next steps in preparation of the new drilling programme are depicted in the time line scheme (*below*).

A science plan, based on the outcome of INVEST, will be written by scientific community representatives selected and announced by November 15. This science plan, to be drafted in 2010, will form one of the principal documents justifying the new drilling programme. In the meantime, the international working group (IWG+) will develop models for programme architecture and scientific advisory structure.

*Wolfgang Bach (Co-Chair, INVEST steering committee) and Gilbert Camoin (INVEST steering committee)*



*Planning scheme for the new ocean drilling programme (from Hans Christian Larsen, IODP-MI).*



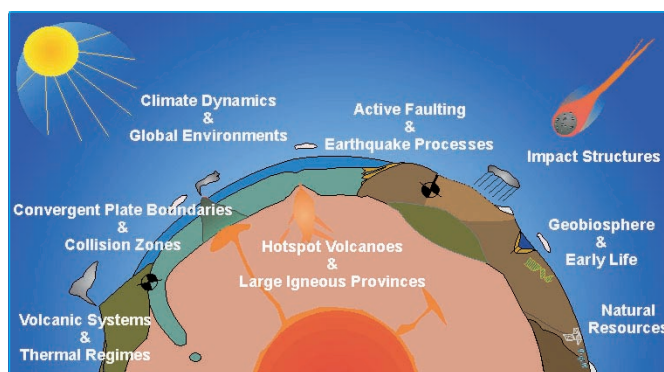


Ulrich Harms

## The International Continental Scientific Drilling Program (ICDP)

Scientific drilling projects on land have been traditionally organised by individual nations. However, efforts to internationalise continental drilling came to a conclusion in the year 1996, when the **International Continental Scientific Drilling Program (ICDP)** was founded. The primary goal was to coordinate and fund continental scientific drilling efforts with research topics of high international priority. Meanwhile 25 drilling projects have been successfully completed within the ICDP. The program focuses on challenging themes of geoscientific and socio-economic relevance such as Climate

second phase, a full proposal is submitted to the ICDP and to other co-funding agencies. It is again assessed by the two panels and, if successful, authorised by the Assembly of Governors of the ICDP. With the ICDP approval at hand, the proponents have to assure that matching financing through other agencies or industry is assured. In addition to the financial support, the ICDP Operational Support Group provides assistance and equipment in the fields of drilling engineering, downhole logging, on-site instrumentation, and data management.



Scientific topics of the ICDP depicted on a global scale Earth section.

Dynamics and Global Environments, Impact Craters and Processes, the Geobiosphere, Active Faults and Earthquake Processes, Hotspot Volcanoes and Large Igneous Provinces, Convergent Plate Boundaries and Collision Zones, Volcanic Systems and Thermal Regimes, and Natural Resources (*above*).

A key to the success of the program is that it provides the necessary start-up financing for cost-intensive large-scale projects at locations of global significance. ICDP co-funds drilling operations from membership fees paid by 17 member countries using the concept of co-mingled funding and international cost sharing.

### Workshop Proposals

In the first phase, unsolicited pre- or workshop proposals are submitted by an international group to the ICDP for peer review through the independent Science Advisory Group. Their detailed assessment and ranking is forwarded to the Executive Committee for approval of a workshop that serves to form a broad science team and to prepare a drilling proposal. In the

### Forthcoming ICDP Research Projects in Europe and the Mediterranean

Paleoclimate research on lacustrine sediments is one of the important components of the program. Cores have been retrieved from lakes in the Americas, Africa, East Asia and now high-resolution sediment records of key importance to understand the climate and environmental evolution around the Eastern Mediterranean will be addressed in the forthcoming years. Lake Van in Eastern Turkey, the fourth largest terminal lake, will be drilled in 2010, followed by the Dead Sea, the lowest basin on Earth, and Lake Ohrid on the Macedonian-Albanian border (*below*), which is the oldest lake in Europe. These lakes are all several hundred metres deep and contain high- to ultra-resolution records of environmental evolution over several glacial-interglacial cycles.



Furthermore, the Campi Flegrei Caldera in Italy will be explored in a research programme including drilling to shed new light on the volcanic risk and geothermal potential in the area of the Gulf of Naples.

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**Member Countries:** Austria, Canada, China, Czech Republic, Finland, France, Germany, Iceland, Italy, Japan, New Zealand, Norway, Poland, South Africa, Spain, Sweden, Switzerland and USA.

## IODP Expedition 310 'Tahiti Sea Level': New Insights from the Older Stuff

Alex L. Thomas<sup>1\*</sup>, Gideon M. Henderson<sup>1</sup>, Pierre Deschamps<sup>2</sup>, Yusuke Yokoyama<sup>3,4,5</sup>, Andrew J. Mason<sup>1</sup>, Edouard Bard<sup>2</sup>, Bruno Hamelin<sup>2</sup>, Nicolas Durand<sup>2</sup> and Gilbert Camoin<sup>2</sup>

The goal of IODP Expedition 310 was to drill into the submerged fossil reefs at Tahiti (*Figure 1*) (Camoin et al., 2007 a&b) to recover material from the early portion of



Figure 1: Mission-specific platform DP Hunter on station during IODP Expedition 310 (©ECORD/IODP).

the most recent deglaciation and to complement the onshore drilling that was undertaken in the 1990's (Bard et al., 1996; Montaggioni et al., 1997; Camoin et al., 1999; Cabioch et al., 1999). The principal scientific objectives were: to constrain the history of postglacial sea-level rise; to use coral skeletal chemistry to reconstruct past environmental conditions in the southern Pacific; and to assess the response of the reefs to sea-level changes, specifically rapid sea-level rise during melt water pulses. During drilling the opportunity was taken to drill deeper beneath the postglacial reef sequence into older 'Pleistocene' reef material, principally to ensure that the entire postglacial sequence was recovered but this older material has also proved valuable in its own right providing exciting new data on past sea levels around the time of the penultimate deglaciation (Termination II).

A recent paper (Thomas et al., 2009) presented results of uranium-thorium (U-Th) dating of corals recovered from these older Pleistocene reef sequences. One of the most significant findings of this research was the recovery of corals from an elevation of 85 m below present sea level (corrected for island subsidence), that date to 137 ka. (*Figure 2*). This implied that sea level had already begun to rise from the penultimate glacial maximum lowstand by this time. This chronological constraint has gone some considerable way to resolve the controversy that surrounded the timing of this deglaciation with respect to

external insolation forcing and also to the relationship between rise in atmospheric CO<sub>2</sub> as recorded in ice cores, and sea level. The timing of the start of the deglaciation is now shown to be near coincident with a minimum of northern hemisphere insolation, therefore making a direct link between northern hemisphere forcing and deglaciation problematic. More significantly the phase relationship between insolation forcing and deglaciation has been shown to be different for this penultimate deglaciation than for the most recent one. Any chronology, based on a constant phase relationship between orbital forcing and climate (Imbrie et al., 1984; Lisiecki and Raymo, 2005), will therefore be in error if millennial scale accuracy is required.

Furthermore a sequence of core-sections, that cover the period 137 - 134 ka., shed new light on the history of sea-level rise during the penultimate deglaciation. The coral assemblage and sediments of the deeper (and dated to 137 ka.) core

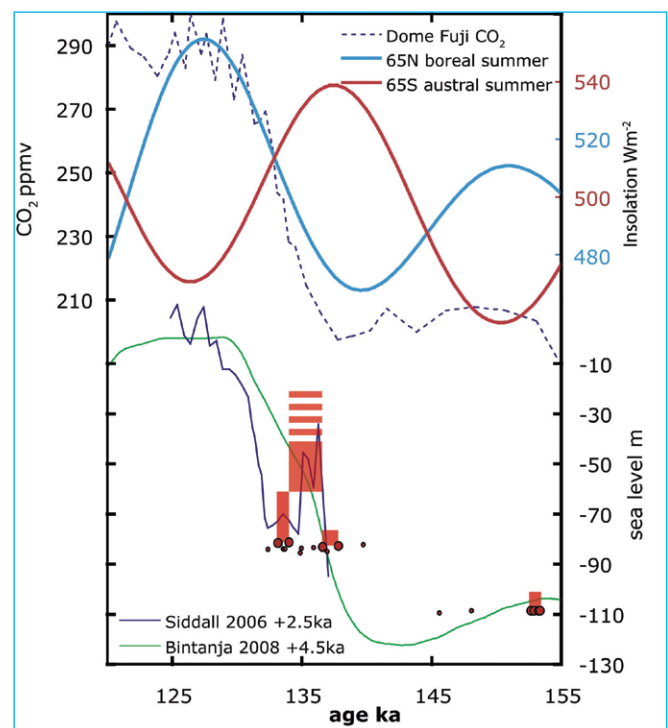


Figure 2: Reconstructed ages and elevations of corals from IODP Expedition 310 (red circles) and inferred water depths in which they grew (red boxes). Shown for comparison are continuous sea level reconstructions of Siddall et al., 2006 and Bintanja et al., 2005, with timings adjusted to agree with the new coral constraints. The timing of sea-level rise relative to CO<sub>2</sub> change and orbital forcing is also demonstrated. Modified from Thomas et al 2009 with permission of AAAS

*The term 'Pleistocene' is used here (incorrectly) to discriminate material older than the last glacial maximum from the post glacial reef sequence, which sensu stricto also includes the Pleistocene - being older than Younger Dryas.*

sectiosuggested a shallow water environment. The subsequent core section above has a coral assemblage (and morphology of corals) suggestive of a deeper-water environment, an unsurprising finding considering sea-level rise during deglaciation. The next core section (dated to 133 ka. ), however, has been interpreted to correspond to shallow-water depth again. This implied that following a period of sea-level rise there was a fall in sea level (red boxes in *Figure 2*) which occurred during the transition from glacial to interglacial, at a time when there was a seemingly monotonous rise in temperature and CO<sub>2</sub> as recorded by ice cores. This sea-level 'reversal' recorded in the coral assemblages at Tahiti confirms its initial observation from corals at the Sialum Terrace and Aladdin's Cave on the Huon Peninsular, Papua New Guinea (Esat et al., 1999), and subsequent interpretations of sea-level fluctuation from the Red Sea (Siddall et al., 2006), and Gulf of Corinth (Andrews et al., 2007). These widely geographically distributed observations now confirm the reality of this sea-level reversal as a globally significant event.

Other Pleistocene corals recovered from IODP Expedition 310 were found to date to 153 ka. placing the first coral-based estimate of sea level from the glacial lowstand during marine isotope stage (MIS) 6. This estimate will provide a useful constraint on our understanding of the nature of MIS 6 ice sheets, allowing models of ice-sheet size and distribution to be tested against new data.

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Achim Kopf

## The Deep-Sea and Sub-Seafloor Frontier Initiative: the future link between EC-funded research and scientific ocean drilling



The **Deep-Sea and Sub-Seafloor Frontiers project (DS<sup>3</sup>F)** represents the continuation of the large Deep-Sea Frontier (DSF) meeting organised by the ECORD Council in Naples in June 2006 as part of the European Commission (EC) funded ECORD-Net project. The outcome of this conference of 70 marine scientists and representatives from the EC and national funding agencies was summarised in the DSF roadmap - <http://ecord.org/enet/dsf-june2007.pdf>. Recently, the EC funded a Coordination Support Action (CSA) to develop a guideline for a better understanding of deep-sea and sub-seafloor processes by connecting marine research in life and geosciences, climate and environmental change, as well as socio-economic issues and policy building. The CSA is based on a strategy that involves sub-seafloor sampling to establish a long-lived research approach that considers (1) the need for a sustainable management of the ocean, and particularly the deep sea with enhanced activity (fishery, hydrocarbon exploration), (2) the necessity of unraveling deep-seated geological processes that drive seafloor ecosystems, and (3) the value of seabed archives for the reconstruction of paleo-environmental conditions and the improved prediction of future climate change.

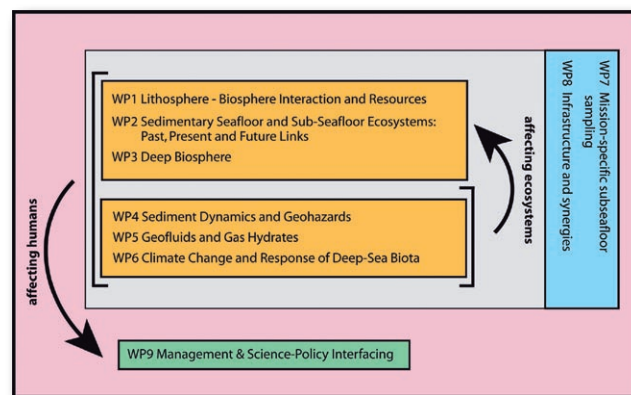
Sub-seafloor drilling and sampling can provide two key components in understanding how deep-sea ecosystems function at present, and how they will respond to global change:

- an inventory of present subsurface processes and biospheres, and their links to surface ecosystems, including seafloor observation and baseline studies,
- a high-resolution archive of past variations in environmental conditions and biodiversity.

For both components, an international effort is needed to share knowledge, methods and technologies, including mission-specific platforms to increase the efficiency, coverage and accuracy of sub-seafloor sampling and exploration.

The deep biosphere has been discovered only within the past two decades and comprises the last major frontier for biological exploration. We lack fundamental knowledge of composition, diversity, distribution and metabolism in sub-seafloor biological communities at Earth's extremes, and their repercussions on seafloor ecosystems and life in the deep sea. There is equally an emerging need to shed light on geodynamic processes fuelling biological activity, and how such processes tie

into the emission of geofuels and the formation of hydrocarbons and other resources. In addition, geodynamic processes may cause natural hazards such as earthquake slip, submarine landslides, or tsunamis with a profound effect for humans and ecosystems. Their governing principles and potential triggers are poorly understood and are often related to the sub-seafloor environment.



PERT diagram illustrating work packages of the DS<sup>3</sup>F.

In summary, the three main research areas in IODP (i.e. solid earth/geodynamics, climate and deep biosphere) and the structure and goals of DS<sup>3</sup>F, (*above*) attest a strong overlap and an emerging need to join forces. This will result in the most efficient use of sub-seafloor sampling techniques and existing marine infrastructure to study the geosystem and its effects on biosphere and marine ecosystems. This will be achieved by a series of thematic workshops within the next two years, reports of which will be condensed into a comprehensive DS<sup>3</sup>F 'White Paper' for sustainable use of the oceans and a Maritime Policy. For potential European contributions to the successor programme of IODP after 2013, this could mean that in addition to co-mingled funds by national funding agencies - as currently managed by ECORD - the EC in Brussels could assist in co-funding individual, mission-specific research projects by providing the basis for post-cruise studies, third party equipment, monitoring networks, or data management. In essence, this would result in a more substantial European contribution to the program than is presently the case.

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