

Report to the ESF on the

Workshop “Beyond 2013 - the Future of European Scientific Drilling Research”

Vienna (Austria), Geocenter, University of Vienna, April 24-25, 2009

Conveners: **Gilbert CAMOIN**/CNRS-CEREGE/France, **Rüdiger STEIN**/AWI/Germany
and **Michael WAGREICH**/University of Vienna/Austria.

Summary

An international workshop, organized by Gilbert Camoin (CNRS-CEREGE, France), Rüdiger Stein (AWI, Germany) and Michael Wagreich (Univ. Vienna, Austria), was held on April 24 and 25, 2009 at the Geocenter of the University of Vienna, Austria and was attended by about 80 scientists from 15 countries. The major objectives to sharpen the European interests in the future international drilling program, to give weight to the European propositions both on science, technology and management, in the IODP renewal process and to prepare the INVEST (*IODP New Ventures in Exploring Scientific Targets*) Conference which will be held in Bremen, Germany on September 23rd-25th 2009 to discuss future directions of ocean drilling research and related aspects such as ventures with related programmes or with industry.

The “Beyond 2013” 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) New Research Initiatives and Emerging Fields in Scientific Drilling ; (3) Relationships IODP/Other Programmes/Industry ; (4) 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 summarized at the end of the workshop during a meeting between the conveners and the chair persons of the breakout sessions. The conveners committed to publish in early september a White Book on the Future of European Ocean Drilling Research to be used to prepare the INVEST Conference and used while at that Conference where future directions of scientific ocean drilling beyond 2013 will be discussed. An extended summary of the White Book will be published in *Scientific Drilling*.

The preliminary results of the Workshop “Beyond 2013” have been already considered for planning the INVEST Conference 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+).

Introduction and background

The Integrated Ocean Drilling Program (IODP) is funded for the period 2003–2013, and is now starting to plan the future of ocean drilling beyond 2013, including the development of new technologies, new emerging research fields as and the societal relevance of this programme.

In this context an interdisciplinary and multinational (USA, Europe, Japan, Asian and Oceanian countries), key conference – INVEST IODP New Ventures in Exploring Scientific Targets - addressing all international IODP partners is therefore planned for September 23rd–25th 2009 in Bremen, Germany (more information at <http://www.iodp.org> and <http://marum.de/iodp-invest.html>) to discuss future directions of ocean drilling research and related aspects such as ventures with related programmes or with industry. The Steering Committee of the INVEST Conference includes 4 ECORD scientists : W. Bach/Univ. of Bremen/Germany, J. Behrmann/IFM-GEOMAR/Kiel/Germany, G. Camoin/CNRS-CEREGE/Aix-en-Provence/France, and H. Paëlike/NOC/Southampton/UK.

The first critical step of INVEST is to define the scientific research goals of the second phase of the Integrated Ocean Drilling Program (IODP), which is expected to begin in late 2013.

INVEST will be open to all interested scientists and students and will be the principal opportunity for the international science community to help shape the future of scientific ocean drilling.

The outcome of the conference will be the base to draft a science plan in 2010 and to define new goals and strategies to effectively meet the challenges of society and future ocean drilling.

The Program Member Organizations (PMO) have organized a series of events to prepare the INVEST Conference.

The US PMO, USSSP, has organized a six-week on-line meeting, Charting the Future Course of Scientific Ocean Drilling (CHART), from Feb.2 to March 13, 2009, to gather input from the U.S. science community regarding future research directions for scientific ocean drilling. The CHART Steering Committee has summarized the more than 500 comments posted on the forum. The final report has been posted mid-May (<http://www.oceanleadership.org/chart>). **The Japanese PMO, J-DESC**, has organized in December 2008 a series of workshops of 20 to 50 participants and concerning various scientific topics : Geohazards, Earth's Interior, Paleoenvironment, Deep Biosphere and Sub-seafloor Aquifer and Technology Development. The workshop reports has been assembled in a volume (“Reports from Japanese domestic workshops for INVEST”) that should be available soon.

During its Fall 2008 meeting, **ESSAC, the ECORD Science Steering an Advisory Committee**, discussed the opportunity to organize a Session of the EGU General Assembly 2009 in Vienna, Austria (April 2009; SSP18/CL64/GMPV23/TS9.3 - co-sponsored by IAS - on "Beyond 2013 - The Future of European Scientific Drilling Research" (<http://meetingorganizer.copernicus.org/EGU2009/session/1355>), convened by G. Camoin and R. Stein, and followed by a 2 days workshop specifically addressing the future of European scientific drilling research and convened by G. Camoin, R. Stein and M. Wagreeich. The steering committee of both events included : W. Bach/Univ. of Bremen/Germany, J. Behrmann/IFM-GEOMAR/Kiel/Germany, A. Camerlenghi/Univ. of Barcelona/Spain, J. Erbacher/BGR Hanover/Germany, U. Harms/GFZ/Potsdam/Germany, J. Kenter/Chevron-Texaco/USA, H. Paëlike/NOC/Southampton/UK, R. Schneider/Univ. of Kiel/Germany.

The major objectives of the ESF workshop “Beyond 2013” were :

- 1) to sharpen the European interests in the future international drilling program ;
- 2) to give weight to the European propositions in the program renewal processes, both on science, technology and management ;
- 3) to prepare the INVEST Conference ;

- 4) to provide the participants with information about the status/process of ongoing discussions and negotiations regarding program structure, and provide them with the expected framework (available drilling platforms and anticipated funding levels).

About 80 scientists from 15 countries attended the workshop (see appendix n°1) that was held at the Geocenter of the University of Vienna, Austria, immediately after the EGU and conceived as a workshop widely open to all scientists with an interest in scientific drilling, including representatives of various scientific drilling and coring programs (IODP, ICDP, IMAGES etc.) and representatives from industry to discuss possibilities of future cooperation/exchange. Through the European Science Foundation funding, the conveners have been able to support of 20 European participants. Concerning the participants, we tried to broaden the participation of young scientists (students, post-docs and early career faculty members) to give them the opportunity to build their careers as the new international drilling program will be created.

Content and structure

The format of the workshop has been designed based on the **key items** that were defined to be discussed (see Appendix n°2) and including :

- (1) **The Future of ECORD and IODP** (science, technology, management).
- (2) **New Research Initiatives and Emerging Fields in Scientific Drilling** (e.g. Arctic Ocean Drilling, Long term evolution, Geohazards etc.).
- (3) **Relationships IODP/Other Programs** (e.g. ICDP, IMAGES etc).
- (4) **Collaboration between Academia and Industry.**
- (5) **New Technologies and the Mission Specific Platform Approach.**

The “Beyond 2013” workshop has included breakout group discussions and open discussions with all meeting participants on all discussion topics.

The **first half-day** of the workshop (Friday April 24 afternoon) included overviews of those key items (the Future of ECORD and IODP [C. Franklin], the Deep Sea Frontier Initiative [C. Mével], the New Research Initiatives and Emerging Fields in Scientific Drilling [J. Behrmann], the Relationships between IODP and Other Programs [T. Johnson], and New Technologies and the Mission Specific Platform Approach [D. McInroy]) and five breakout group discussions based on those key items :

- Breakout session 1 : **The Future of ECORD and IODP** (Chairs : J. Erbacher, C. Franklin) ;
- Breakout session 2 : **Emerging fields/new topics**, including two sub sessions : Sub session A : **Solid Earth and Geohazards** (Chairs : W. Bach, J. Behrmann, D. Teagle) ; Sub session B : **Environment and Deep Biosphere** (Chairs : J. McKenzie, H. Brinkhuis) ;
- Breakout session 3 : **Relationships IODP/Other programs and IODP/Industry** (Chairs : U. Harms, R. Schneider) ;
- Breakout session 4 : **New Technologies and the Mission Specific Platform Approach** (Chairs : P. Favali, D. McInroy).

The **second half-day** of the workshop (Saturday April 25 morning) was dedicated to the continuation of the breakout group discussions;

During the **third half-day** of the workshop (Saturday April 25 afternoon), the chair persons of the breakout sessions (C. Franklin, D. Teagle, J. McKenzie, H. Brinkhuis, U. Harms, and D. McInroy) presented a summary of the relevant discussions in a plenary session. Time was given to workshop participants to comment those summaries.

The products from the breakout group discussions were a list of important questions, ideas, suggestions and recommendations regarding the IODP science, technology and management. They are summarized below.

- Breakout session 1 : The Future of ECORD and IODP

This group discussed the possible structure of a new programme and the role of ECORD in it by posing six questions :

- 1 - Should the science be broader than that which can be accomplished by just drilling?
- 2 - Is the ECORD structure fit-for-purpose?
- 3 - What is the role of ECORD in a future programme?
- 4 - What should be the organisational structure of the IODP?
- 5 - What should be the structure of the New Science Plan?
- 6 - What should we do with existing proposals?

The most important suggestions and ideas brought during those discussions are summarized below :

- The programme must be led and driven by science. Although drilling is a key tool in addressing scientific problems, in many cases it needs to be integrated with other approaches, including seafloor observatories. Furthermore, the structure of the new programme should facilitate development of concrete links between ECORD and the ICDP (question 1).

- At this stage, there is no need for substantial modification of the ECORD structure. Continuing to be involved in an international initiative such as the IODP is clearly the preferred solution for ECORD. However, ECORD is prepared to sustain implementing ocean drilling at the European level, whether or not a full international programme results from discussions at the IWG+ level. A European Ocean Drilling Programme (EODP) would certainly focus on science drilling for societal impact (question 2).

- ECORD should aim to be a “major partner” in the new drilling programme. The workshop recommended the following principle: *“Keep national contributions in Europe at the current level as a minimum and aim to at least double contributions through other means (industry, EC, linking through projects with other programmes, national foundations, etc.)”*(question 3).

- For a future programme, it is essential to think outside of the current IODP structure. “Mean and lean” should be the guiding philosophy for a new, streamlined structure that could involve three different models : strong central management, with central funding; limited central management, with limited central funding; no central management. In a new structure, the “mission” concept should be revisited (question 4).

- The New Science Plan must emphasise “the Big Picture” of science relevant to society. In parallel to the science plan, a separate Implementation Plan should describe how to prioritise missions. It should be developed with co-funding options considered (question 5).

- The preferred solution would be to start afresh, to clearly convey that it is a new programme. Proponents of existing highly ranked proposals that fit in the new science plan should be encouraged to resubmit in the new system but guidelines for submitting proposals need to be set up well before the new programme is agreed (in 2011 at the latest) (question 6).

- Breakout session 2 : Emerging Fields/New Topics

Major topics and hypotheses to be tested by drilling are summarized by the following keywords :

- 1) **Planetary cycles** (exchanges and interlinked feedbacks between the major Earth reservoirs - crust, mantle, biosphere, hydrosphere and atmosphere - : The Serpentinite Sea ; Integrated Earth System Approach ; Climate and tectonics.
- 2) **Sustainable use of the sub-seafloor as a resource** (resource opportunities and

unique geological and biological environments that are yet to be understood) : Gas hydrates ; Deep-sea mining of base and precious metals ; Carbon Sequestration.

- 3) **Geohazards** (Natural submarine geohazards (earthquakes, volcanic eruptions, landslides, volcanic island flank collapses).
- 4) **Extreme Events** (geologically rare events of global significance, such as extraterrestrial impacts on land and sea, super earthquakes and super volcanic eruptions).
- 5) **Experimentation with the seafloor** (collection of long-term observational data ; long-term perturbation and in situ incubation experiments in sub-seafloor systems.
- 6) **Deep Biosphere & Subseafloor Ocean** : Microbiology, (deep) subsurface fluids and biogeochemical cycling ; New insights in controls on carbonate factories (cold/warm) past and present, and relationships to the carbon cycle ; Controls and feedbacks of terrestrial and marine methane emissions ; Critical monitoring and evaluation the (dynamics of) storage of greenhouse gases.
- 7) **Quantifying system earth: determining tipping points and gradualism in Earth's history** : Tracing Carbon – source to sink (Generating quantitative records of the carbon cycle and other relevant global biogeochemical cycles, processes, and related biotic and climate response); Darwin in the ocean (reconstructing biotic evolution and biodiversity ; Dynamics of Polar regions and climate impacts ; Probing unique cases, events and oscillations – new approaches, new tools.

The following regions have been identified as “critical and unknown regions” : Arctic Ocean, Antarctic/Southern Ocean, East African margin, Critical marine fansystems (*e.g., Indus*),

- Mediterranean (subsalt zone), East South American margin.

- Breakout session 3 : Relationships IODP/Other programs and IODP/Industry

The major conclusions of the breakout group discussions were the following :

- The future drilling program should allow for flexible joint technological infrastructure (tools, personnel, exchange of different platforms, knowledge transfer, engineering capacity and development) ;
- Advisory, planning, and decision structure of the future program should enable multi-platform drilling targets (incl. other platforms, observatories) ;
- Mission-specific operations must be included in future ocean drilling to ensure involvement with other programs and to allow for land-ocean, shelf-slope, high-risk areas drilling ;
- The future program should be able to provide funding or in kind contributions to multi-partner projects ;
- IODPs structure should explicitly enable external links (port of entry / interface) to allow development and implementation of joint projects/missions/expeditions.

It has been noted that the structure of the new programme should facilitate development of concrete links between ECORD and the ICDP.

- Breakout session 4 : New Technologies and the Mission Specific Platform Approach

New technologies are existing technologies that are not currently used in IODP and technologies that need development or that need to be built.

The group has identified the following existing technologies that are not currently used in IODP : Shallow penetration drilling (seafloor rock drills, 1-100 mbsf) ; Thin-wall samplers (currently used in industry) ; In-situ CPT (cone penetration testing) ; In-situ geotechnical

sampling and testing ; Instruments for downhole observatories ; Sensors in casing ; Logging-while-drilling or other real-time data transfer (e.g. intelligent pipes).

The technologies that need development or the be built include : Drilling in sea ice (*Aurora Borealis*) ; Develop sea bed drills to handle new tools (logging/LWD/imaging/sampling/fluid sampling/monitoring) ; Mud return system ; Sea bed-based mud circulation system ; Improving coring, stability and recovery in hard substrate/deep crust/high temp. ; Long-term monitoring at high temperatures/corrosive environments ; Multiple downhole instruments (e.g. thermistors for heat flow measurements) ; Fluid sensors for geochemistry for downhole observatories ; Long-term fluid sampling ; Improvement of data transfer methods/rates for downhole observatories ; In-situ incubator for microbiology ; Near sea bed logging etc.

Other points discussed by this group were how to : a) overcome the current limitations on Mission Specific Platform (MSP) expeditions ; b) expand the IODP scientific activities beyond the drilling ; c) improve financial, managerial and technical collaborations between stakeholders.

Results and impact of the event on the future direction of the field

The major outcomes of the workshop and outlooks have been summarized at the end of the workshop during a meeting between the conveners and the chair persons of the breakout sessions. The conveners committed to publish a White Book on the Future of European Ocean Drilling Research to be used to prepare the INVEST Conference and used while at that Conference where future directions of scientific ocean drilling beyond 2013 will be discussed.

We believe that the results of our workshop will especially contribute to develop new scientific objectives, new ways of managing the new international drilling programme, new ways of integrating the available technologies and will help in expressing the technological requirements to achieve scientific objectives of prime importance.

The preliminary results of the Workshop “Beyond 2013” have been already considered for planning the INVEST Conference 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 (see 3rd circular 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+).

The timeline for the preparation of the White Book is the following :

- May 20 : Deadline for submission of the draft summaries of breakout group discussions by the relevant chair persons.
- May 21-June 7 : Draft summaries open for comments
- June 8 - August 15 : Final document written by the conveners
- Late August : Final document posted on ECORD, ESSAC and INVEST websites.
- Early September : Publication and distribution of the White Book. Publication of an extended summary in *Scientific Drilling*.

Besides its overall goal, the workshop also provided the opportunity to a number of research groups to expose their plans regarding future drilling, including both new scientific topics and/or new areas of investigations in breakout and plenary sessions. The workshop participants were able to give recommendations to those research groups such as the organization of ESF Magellan workshops to foster their efforts and to develop drilling proposals at a critical time for the future of scientific ocean drilling.

Workshop “Beyond 2013 - the Future of European Scientific Drilling Research”

Vienna (Austria), Geocenter, University of Vienna, April 24-25, 2009

*Conveners : Gilbert CAMOIN/CNRS-CEREGE/France, Rüdiger STEIN/AWI/Germany
and Michael WAGREICH/University of Vienna/Austria.*

APPENDIX

Appendix 1 : List of participants

Appendix 2 : Final Programme of the workshop

Appendix 1 : List of participants

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Appendix 2 : Final Programme of the workshop

(all events in the Geocenter building)

Friday, 24 April 2009

14:00-16:00 : Opening

14:00-14:15 : Welcome and introduction: Goals of the workshop G. Camoin
14:15-14:20 : Logistics M. Wagreich

14:20-16:00 : General Session and introduction to the breakout session

Chair : R. Stein
14:20-14:40 : The Future of ECORD and IODP C. Franklin
14:40-15:00 : The Deep Sea Frontier Initiative C. Mével
15:00-15:20 : Emerging Fields and New Topics J. Behrmann
15:20-15:40 : Relationships Between IODP and Other Programs T. Johnson
15:40-16:00 : New Technologies D. McInroy

16:00-16:30 : *Coffee break and formation of breakout sessions*

16:30-18:30 : Discussion in breakout sessions

Breakout session 1 : The Future of ECORD and IODP

Chairs : J. Erbacher, C. Franklin

Breakout session 2 : Emerging fields/new topics

- Sub session A : Solid Earth and Geohazards

Chairs : W. Bach, J. Behrmann, D. Teagle

- Sub session B : Environment and Deep Biosphere

Chairs : J. McKenzie, H. Brinkhuis

Breakout session 3 : Relationships IODP/Other programs and IODP/Industry

Chairs : U. Harms, R. Schneider

Breakout session 4 : New Technologies

Chairs : P. Favali, D. McInroy

Saturday, 25 April 2009

9:00-13:00 : Discussion in breakout sessions (cont.)

Breakout session 1 : The Future of ECORD and IODP

Chairs : J. Erbacher, C. Franklin

Breakout session 2 : Emerging fields/new topics

- Sub session A : Solid Earth and Geohazards

Chairs : W. Bach, J. Behrmann, D. Teagle

- Sub session B : Environment and Deep Biosphere

Breakout session 3 : Relationships IODP/Other programs and IODP/Industry
Chairs : J. McKenzie, H. Brinkhuis
Breakout session 4 : New Technologies
Chairs : U. Harms, R. Schneider
Chairs : P. Favali, D. McInroy

13:00-14:00 : Lunch

14:00-17:00 : General session

Chairs : G. Camoin, R. Stein, M. Wagreich

14:00-16:45 : Reports from the breakout sessions by the chairs of the breakout sessions (30 min each) followed by a general discussion on each topic :

Breakout session 1 : The Future of ECORD and IODP
C. Franklin
Breakout session 2 : Emerging fields/new topics
- Sub session A : Solid Earth and Geohazards
D. Teagle
- Sub session B : Environment and Deep Biosphere
J. McKenzie and H. Brinkhuis
Breakout session 3 : Relationships Between IODP and Other programs and Between IODP and Industry
U. Harms
Breakout session 4 : New Technologies
D. McInroy
16:45-17:00 : Conclusions and outlooks
G. Camoin and R. Stein