ECORD
European Consortium for Ocean Research Drilling

Newsletter #5

n°5
October, 2005

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Future challenges for ECORD and IODP

As I write these lines, the ECORD Science Operator is getting ready to implement the second MSP operation. The provision of MSPs to the IODP programme has enabled some of the most highly ranked scientific proposals in the ODP/IODP system, in environments as diverse as the Arctic and Tahiti, to come to fruition.

During the JOIDES Resolution port call in Dublin/ Ireland in April 2005, I had the honour of welcoming Ireland and Belgium as new members to the ECORD consortium in the presence of Noel Dempsey, Irish Minister for Communications, Marine & Natural Resources. Even though ECORD has made the fantastic achievement of getting 17 member countries together in a scientific programme which pools some 14 M USD per annum, ECORD and IODP are facing economic and logistic challenges in the future. MSP operations have shown to be more expensive than first anticipated. To implement MSP expeditions in a cost efficient way (e.g. using back-to-back expeditions, alternating expensive and cheaper MSP operations between fiscal years etc..), it would help the ECORD Science Operator to be able to choose from a pool of highly ranked proposals. At this stage, however, the programme is still dealing mostly with proposals inherited from ODP. Now that ESO has demonstrated the feasibility of running MSPs, we expect the scientific community to submit new exciting proposals.

To meet these future challenges, ECORD is trying to stimulate and nurture pre- and post cruise science by workshops such as the Magellan Workshop Series, seeks collaboration with other programmes such as ICDP, opens the consortium to other countries and last but not least, is actively trying to seek future funding opportunities within the EC. After two years of activity, we also realize that the structure of IODP, inherited from ODP, may need some adjustments to better accommodate the complexity of the programme. Among those, introducing a fast track for strategically appropriate proposals should be considered.

I am sure that we can overcome future challenges and continue to produce important and high quality science in the area of Earth System Science. This field of science is becoming increasingly important in a global change perspective and in the perspective of understanding natural hazards such as the Sumatra earthquake.

Jonas Björck, ECORD Council chair, September 2005

DP Hunter, drillship of IODP Tahiti Sea Level Expedition (IODP Expedition-310) following mobilisation in Tampa, Florida, September 2005 (see page 2).

Operational aspects of the Tahiti Sea Level Expedition

Preparations for the Tahiti Expedition have been far from straightforward for a variety of reasons, but at last the chosen vessel has been mobilised and as we write she is steaming for Tahiti where it is anticipated that the offshore phase will start at the beginning of October and continue to about mid-November.

photo A. Skinner © NERC for ESO

The chosen vessel is the DP Hunter (*below*), a dynamically positioned, 104 m-long ship that has a large moonpool and which has generally been used for diving and ROV work. The drilling contractors are Seacore Ltd, and they installed their drilling equipment on the vessel in Tampa Florida, staring at the end of August. The rig is their R100 (*above*), the same as that used in the Arctic for the ACEX Expedition (IODP Expedition 301).

The water depths involved range from 25 to 310 m, and the project requires the drilling of 3 transects, amounting to a total of 19 holes with penetrations of between 45 and 105 m. All transects are very close to the shore; two are immediately outside the barrier reef, and a third at Tiarei actually extends inside the outer limit of the reef. One of the transects lies immediately outside the entrance to the harbour at Papeete, close to a frequently use ferry route to the neighbouring island of Moorea (*see page 4*) and in full view of aircraft landing at the airport. In view of this proximity of the vessel to the island, there is no doubt that the islanders will become very aware that the expedition is taking place, so that the programme of local outreach at the start of the offshore work will be very important to explain the scientific and practical reasons for the drilling.

With the requirement for very high recovery rates in porous coral, a mining-type 'piggy-back' wireline coring system will be employed. This system is commonly termed 'piggy-back' coring because a mining coring rig is installed on top of the conventional API rig which will deploy drill pipe as conductor pipe to the sea bed, so that all coring is carried out in compensated mode. This type of equipment has been used extensively in other coral reefs worldwide and has a good track record. This drilling system will also be suitable for recovery of the basalt that underlies the coral reef and whose coring will mark the termination of drilling at each location.

The conductor pipe will be a heavyweight drill pipe or casing with an ID of approximately 100 mm and a casing shoe to set it approximately 1 m into the seabed. A seabed baseplate of around 1.5 m diameter and weighing 10 to 12 tonnes will be deployed at the end of the conductor, making re-entry possible. A well-proven wireline overshot core-barrel retrieval system allows continuous coring operations without having to pull the drillstring to recover each core run. A typical core run is expected to be 3 metres, or shorter if this would improve recovery. There will be a range of core bits available, including surface set diamond or tailored impregnated bits.

Living reefs are very sensitive ecosystems, and great care will be undertaken with in order to minimise the impact of drilling on the reefs. Seawater will be used as the drilling lubricant, and the dynamic positioning of the vessel restricts the seabed footprint to that of the hole and the baseplate. Furthermore, on location, the drillstring will be positioned by colour video camera to avoid live corals, and experience elsewhere suggests that few if any cuttings will come to the sea bed due to the porous nature of the reef. No one site will be occupied for more than 2–3 days, so that any influence on the ecosystem at any one location will be very brief. Overall, it is anticipated that the offshore drilling in Tahiti will not have any significant impact on the living reef, but will provide a wealth of data on reef development and the oceanographic conditions in which it grew.

Dan Evans - ESO science manager

photo A. Skinner © NERC for ESO

News from the ECORD Managing Agency

After months of uncertainty, the Tahiti Sea Level expedition is finally scheduled to start in October 2005. Organising a Mission Specific Platform expedition has proved to be more expensive and complex than initially envisioned. Because of the booming situation in the oil industry, contracting a ship for a single operation is not an easy task these days. The ECORD Science Operator has done a wonderful job by finally locating and mobilising a vessel in time to implement the expedition this year. We realize the difficulty for the participating scientists to cope with « flexible » dates. We wish them the best for this exciting new challenge.

Now we have to think about FY2006. The US riserless drilling vessel JOIDES Resolution will finish its last IODP expedition at the end of December 2005 before being decommissioned and replaced by an upgraded riserless vessel. The Chikyu is being tested at sea and will not yet be available for the science community before 2007. Many of the European countries will review their membership in the IODP during 2006 (after the first three years of the programme). It will therefore be important for the credibility of the programme to perform an MSP operation during 2006 to avoid a complete hiatus in drilling. Despite the funding and contracting difficulties, the ECORD Council and the ECORD Science Operator are working hand in hand, with the support of IODP-MI and the Lead Agencies, to make sure that it happens.

Finally, I would like to welcome the new ESSAC office. After two years in Amsterdam, the office is moving to Cardiff. Julian Pearce, the acting chair and Federica Lenci, the science coordinator, take over on October 1st. Jeroen Kenter and Valentina Zampetti have accomplished the great job of setting up the office in Asmterdam, and starting to educate the European scientists to act as a single community in IODP. It was a big challenge and they have gone a long way. Good luck to both of you in your new positions. My thoughts also go to Chris Mc Leod, the new chair. We hope to see him back in activity in the near future.

Catherine Mével, EMA director

ECORD member countries :
Austria, Belgium, Canada, Denmark, Finland, France, Germany, Iceland, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom

ECORD Publications

The ECORD publications are widely distributed at the international conferences (such as EGU in Vienna or Fall AGU in San Francsico) and by each national IODP offices. You may also request paper copies at: **ema@ipgp.jussieu.fr** or download electronic copies from the ECORD website at: **www.ecord.org/pub/publications**

Jeroen Kenter

ECORD *Science Support & Advisory Committee*

Updates

Julian Pearce

Following a series of very successful coring expeditions (*see table*), IODP is close to a temporarily pause in riserless activities. This interruption in scientific coring expeditions is a consequence of next year's planned overhaul of the JOIDES Resolution, the riserless drill ship operated by the JOI Alliance. Because the Japanese riser vessel, the Chikyu (meaning "Earth"), is currently undergoing testing and will not make an active contribution to IODP science until 2007, drilling activities soon be restricted to those carried out on the Mission Specific Platforms (MSP) operated by ECORD.

The IODP drilling schedule : mid to late 2005 Expeditions

expedition	dates	platform
307 - Porcupine Basin Carbonates Mounds	26 April-31 May	riserless
308 - Gulf of Mexico Overpressures	31 May-10 July	riserless
309 - Superfast Spreading Rate Crust 2	8 July-28 Aug.	riserless
310 - Tahiti Sea Level	6 Oct.-20-22 Nov.	MSP
311 - Cascadia Margin Gas Hydrates	28 Aug.-29 Oct.	riserless
312 - Superfast Spreading Rate Crust 3	29 Oct.-29 Dec.	riserless

more information on www.iodp.org

The latest MSP enterprise, the Tahiti Sea Level expedition, has recently embarked from Papeete and will core Pleistocene to Holocene reef tracts around the island of Tahiti (*see photo below*). This expedition aims to obtain core that will enable participating scientists to quantify and precisely time the rise in sea level since the last glaciation and to determine the associated variations in seawater temperature. The expedition evolved from a mostly European proposal. It is of paramount importance to the global community as it will help us to understand climate variations in the recent past and so improve our ability to predict the consequences of future perturbations.

Additional, riserless expeditions that are sailing this Fall are Cascadian Margin Gas Hydrates and Superfast Spreading-rate Crust (*see table above*). The 'Hydrates' expedition targets the processes and models that generate marine gas hydrate in accretionary prisms above subduction zones. It forms yet another step in our attempt to understand this potential valuable energy source and its effect on global climate change. The 'Superfast Spreading' expedition will investigate ocean crust formation and thermal and geochemical budgets in an area where spreading rates are in the order of 200m per 1000 years.

ECORD scientists have participated in high numbers in past ODP science and have contributed as much, or more, in the recent IODP expeditions (*see table page 5*). This contribution has not been restricted to the scientific discoveries and publications. ECORD scientists are also highly visible in the key panels that "drive" the IODP (*see table page 7*). They include a high proportion of young, and often female, scientists and it is these who will help carry and lead the program to a new phase in the future.

The "quiet" window, during which only MSP expeditions will sail, offers a unique opportunity to

Location of the Faa transect, site TAH 01A, close to the harbour at Papeete - Tahiti Sea Level Expedition 310 (photo Gilbert Camoin).

revisit scientific themes and generate new and innovative proposals. To facilitate this, two ESF Programs were initiated in 2005, one of which has been ratified and another will receive official approval very soon. The ESF Marine Coring Program, EuroMARC, is supported by a large number of the ECORD members and a Call for Proposals will be announced this Fall. EuroMARC will provide funds to nurture existing European coring science and help scientists to carry out pilot studies and collect essential data for future expeditions. The ESF Magellan Workshop Series (*see page 9*) will allow the science community to formulate and organize workshops for the development of new, innovative and high quality science proposals. Both programs will be announced officially on the ECORD website.

Valentina Zampetti, ESSAC science officer, has participated in the Expedition 308 located in the Gulf of Mexico.

Although the European science community needs support through the programs mentioned above, the development of highly complex drilling projects also requires a slim and efficient parent organization. A recent meeting in Frascati, Italy, by key members of the IODP science structure translated this requirement into a proposal for change - not a dramatic change, but a move further towards a program that takes corporate responsibility for global scientific challenges and addresses those through carefully managed 'Missions'. In addition, ideas were formulated to make IODP a more pro-active and efficient organization. The so-called "Frascati Report" is currently being reviewed by the broad IODP scientific community as well as outside experts, and a formal proposal is anticipated early this Fall.

ECORD scientists on IODP Expeditions (307-310)

Expedition - 307:
Porcupine Basin Carbonates Mounds
Timothy Ferdelman (co-chief), Germany
Morten Bjerager, Denmark
Barry A. Crabb, UK
Ben De Mol, Spain
Anneleen Foubert, Belgium
Veerle Ann Ida Huvenne, UK
Philippe Léonide, France
Kay Mangelsdorf, Germany
Jurgen Titschack, Germany
observers:
Xavier Monteys, Ireland
Boris Dorschel, Ireland

Expedition - 308:
Gulf of Mexico Overpressures
Jan H. Behrmann (co-chief), Germany
Neil Da Silva, Canada
Tommy Edeskär, Sweden
Christine Franke, Germany
Aurélien Gay, UK
Julia Gutierrez-Pastor, Spain
Julia Schneider, Germany
Roger Urgeles, Spain
Valentina Zampetti, The Netherlands

Expedition - 309:
Superfast Spreading Rate Crust 2
Damon A. H. Teagle (co-chief), UK
Carole Cordier, France
Laura Crispini, Italy
Laura Galli, Italy
Jörg Geldmacher, Germany
Christine Laverne, France
Christopher E. Smith-Duque, UK
Paola Tartarotti, Italy

Expedition - 310:
Tahiti Sea Level
Gilbert Camoin (co-chief), France
Guy Cabioch, France
Pierre Deschamps, France
Thomas Felis, Germany
Alexander Thomas, UK
Alexander Tudhope, UK
Crisogono de Olivera Vasconcelos, Switzerland
Klass Verweer, The Netherlands
Hildegard Westphal, Germany

That the European ocean drilling community is actively pursuing solidification and expansion of not only its science base is demonstrated by the recent EU Article 169 initiative "Deep Sea Floor Frontier" or DEEP-SF. This initiative, supported by representatives of all major European marine science programs, aims to coordinate science activities and funding for deep sea floor science, including the development of observatories, construction of research platforms and new technologies. Developing knowledge and understanding of the oceans and their margins is of paramount importance to society as these form the terrains for energy exploration and carry records of the geological hazards and the ecological and climate changes that threaten the world's population.

From left to right, Julian Pearce, Valentina Zampetti, Federica Lenci and Chris MacLeod outside Cardiff University.

Finally, change is also underway at the ESSAC Office. The office will be moving from Amsterdam to Cardiff on October 1st this year. The office will be headed by Chris MacLeod, the new ESSAC Chair, and Julian Pearce, who will be acting Chair for an initial period. Federica Lenci, from La Sapienza University in Rome, has recently accepted the position as Science Coordinator and so will maintain the 'international flavour' of the office (*see photo above*). Gilbert Camoin, from CEREGE in Aix en Provence, has been nominated and appointed as the new Vice-Chair. One of the challenges of the new office will be to extend outreach both to more ECORD scientists and to scientists from the new EU member states. Another will be to manage and coordinate the new ESF Programs in an efficient manner to maximize the participation and scientific impact of European scientists in the Program. Work is already underway to develop the ESSAC web site to help meet these challenges.

With the transition to a new, more efficient and theme-oriented IODP and a strong science support program through the European Science Foundation, ESSAC is entering a phase of opportunities and challenging new and innovative science that will be headed by a similarly "fresh" ESSAC Office in Cardiff.

Jeroen Kenter and Julian Pearce, ESSAC chairs

Submit a proposal ?
Visit the IODP proposal submission page at:
www.iodp.org/drilling-proposals/
next submission deadline:
April 1, 2006

How to Apply?
Application procedures are available on ESSAC webpage at:
www.ecord.org

Further information on ESSAC at:
www.ecord.org

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IODP Activity in the U. K.

In June 2005 the UK-IODP hosted its first major conference, Palaeoclimate Change: High Latitudes and Ocean Circulation, at the Geological Society of London. Over 150 participants registered for the event which was organised by Ian Hall, Paul Wilson, Mike Bickle and Juergen Thurow. The conference hosted 18 lectures on a number of subjects, ranging from models of the impact of ice sheets and sea ice on climate change (Didier Paillard, Paul Valdes and Rob DeConto), to a long awaited glimpse of the results from the successful ACEX expedition in presentations by Jan Backman, Heiko Pälike and Henk Brinkhuis. Marine sedimentary records of high latitude climate change were discussed in a number of talks including those by Jerry McManus and Harry Elderfield; meanwhile David Beerling gave an intriguing presentation on the evolutionary significance of the occurrence of deciduous forests at high latitudes. Participants ranged from distinguished professors to undergraduate and graduate students who all enjoyed the spectrum of lectures.

An ESF Magellan Series Workshop hosted by Oxford University will follow up this successful event. The Workshop will take place in early October, and its aim is to combine the work of two separate proposal writing groups into one IODP drilling proposal. The workshop will focus on the Environmental Change, Processes and Effects theme of the IODP Initial Science Plan with particular emphasis on high latitude exploration. At the time of writing the workshop is still two weeks away, and the community is eagerly awaiting the outcome of this European collaboration.

IODP Science Advisory Structure

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More information is available on the IODP website at: www.iodp.org

Conferences & Workshops

IODP Workshop on
Climate-Tectonic Drilling in SE Asia
5-7 June, 2006, Kochi, Japan
Contact : Peter Clift - p.clift@abdn.ac.uk

SealAIX'06 - SEA LEVEL CHANGES: Records, Processes, and Modeling
Aix-en-Provence and Giens (France)
25-29 September, 2006
contact : Gilbert Camoin - gcamoin@cerege.fr

IODP INTEGRATED OCEAN DRILLING PROGRAM

ECORD European Consortium for Ocean Research Drilling

Visit our booths at:

AGU Fall - 5-9/12/05, San Francisco
& EGU 2006 - 3-7/4/06, Vienna

AGU

ESF Magellan Deep Biosphere Workshop
26-29 January, 2006, Kartause Ittingen, Warth, Switzerland

Two of the fundamental and unanswered questions facing Earth and life scientists today are, what is the extent of Earth's deep biosphere and what is the character of the extreme life forms populating it? Interest in gaining more knowledge about the microbes inhabiting the marine deep subsurface increased dramatically towards the end of the Ocean Drilling Program (ODP) with the initial exploration and sampling of this largely undocumented biosphere. Drilling revealed that microbial ecosystems apparently thrive in both oceanic igneous crust and in deep (more than 750 m) subseafloor sediments, regions previously thought to be barren. As a result of this interest, microbiology became better integrated into the ODP and culminated in the establishment of a well-equipped microbiology laboratory onboard the JOIDES Resolution and the participation of more and more microbiologists.

To capitalize on the knowledge gained during the Ocean Drilling Program and specifically build on the unqualified success of ODP Leg 201, the ESF Magellan Deep Biosphere Workshop proposes to bring together approximately 25 scientists from the European ECORD member countries to develop ideas and formulate new drilling proposals to study the deep biosphere in sedimentary sequences, as well as in crustal environments. Based on ODP Leg 201 results, the emphasis will, however, be placed on developing proposals to study the processes involved in anaerobic methane oxidation associated with the MSI, but not exclusively. The goal of the workshop is to further integrate microbiology into the new Integrated Ocean Drilling Program (IODP) with the development of specific drilling programs and will be the forerunner of a larger international workshop to be sponsored by the ESF in 2006.

Contact : Judith McKenzie, Swiss delegate to ESSAC - judy.mckenzie@erdw.ethz.ch

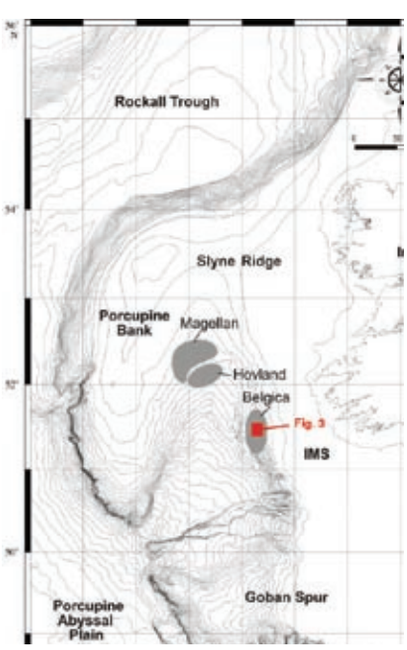
Atlantic Carbonate Mound drilling: challenges ahead

J.P. Henriet

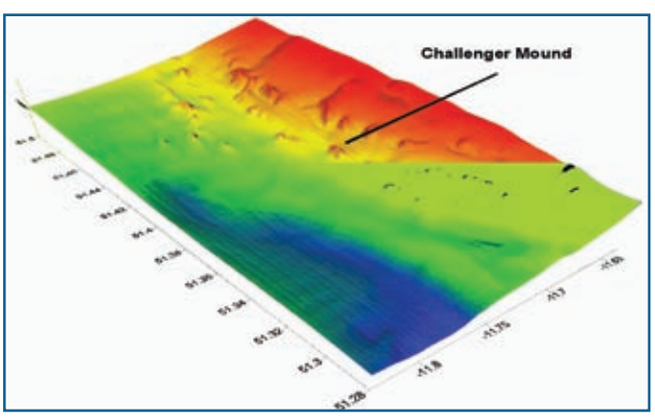
T. Ferdelman

Carbonate mounds are a fundamental and recurrent strategy of life throughout the geological record, from Late Precambrian times onwards. In many hydrocarbon provinces, they form prominent reservoirs. Scientific research on deep water carbonate mounds was stimulated in the early 1990's by the release of industrial data. Consecutive discoveries of large scale occurrences of carbonate mounds and cold water coral reefs along the northeastern Atlantic continental margins has cast new interest on their structure, origin and development. A number of European initiatives such as the EU Framework 5 GEOMOUND, ECOMOUND and ACES projects, the ESF Euromargins MoundForce project as well as national initiatives argue for the increased societal awareness of the environmental and fundamental importance of such deep water coral habitats, and have paved the way for a first scientific drilling of a modern carbonate mound, exposed at the seabed on the western margin of Ireland.

IODP Expedition 307, which drilled in May 2005 "Challenger Mound" in the 'Belgica Mound Province' off western Ireland *(see below)*, has - even before the main analytical homework got started - lifted a tip of the veil on carbonate mounds in the recent ocean. Challenger Mound is a young fossil mound, partly buried. Its identification as a 'dead' mound had positively influenced the drilling decision. The mound body consists of a 155 m thick sequence of cold water coral-bearing sediments of Pleistocene age, characterized by a cyclic alternation of light gray and dark green horizons. The carbonate-rich and light-coloured layers are partially lithified and feature poor coral preservation or even dissolution. The mound base, virtually identical in the on-mound and off-mound holes, is a sharp erosional unconformity, separating coral-bearing mud from a glauconitic and partly sandy siltstone. All holes on Challenger mound were drilled on the seaward slope of the buried escarpment, on which the mound nucleated. The substratum comprises several carbonate-rich lithified horizons, some of which to be correlated with the roof reflectors of sigmoidal cells within the basal drift sequence. Methane appears first below the mound, with a broad zone of anaerobic oxidation of methane (AOM) coupled to sulfate reduction. This mound site seems to bear witness of the subtle intertwining of microbial sulfate reduction and carbonate diagenesis. Stable isotope and biomarker analyses will refine this picture.

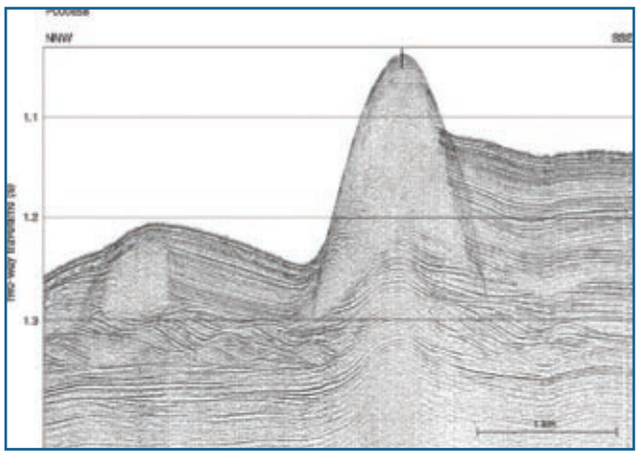


Location of Porcupine Seabight and Expedition 307 operations area (Expedition Scientists, 2005).



AWI multibeam bathymetry of the Belgica Mound Province, W of Ireland.

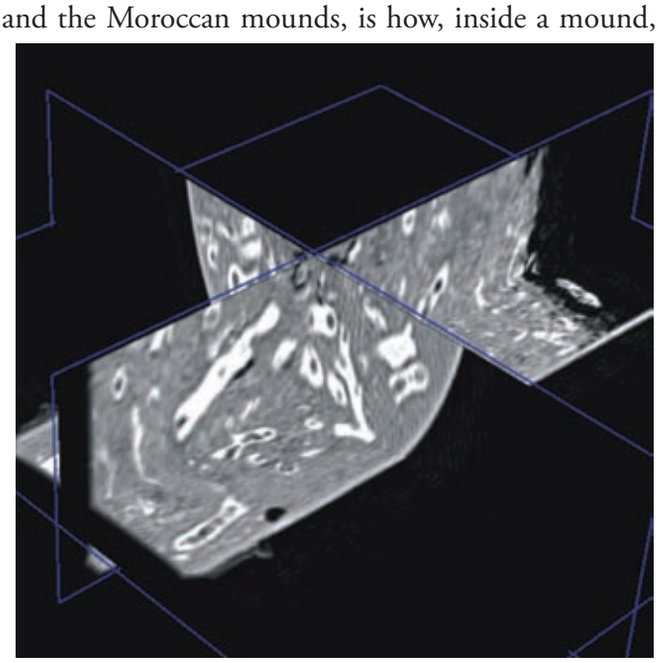
The success of Expedition 307 paves the way for the further exploration of the diverse world of Atlantic carbonate mounds, in first instance. A comparative study of Challenger mound with a juvenile mound, featuring active fluid flow processes, is the logical second step. IODP Proposal 673-Pre focuses on young mounds on the newly discovered Pen Duick Escarpment, off Morocco. These mounds occur amidst giant mud volcanoes and various emanations of methane seepage. Within the targeted mounds, horizons with fresh corals alternate with layers



High resolution seismic section of Challenger Mound (Henriet et al., 2002).

featuring coral dissolution. The front between the AOM and sulfate reduction zones is found at a depth of 4m below seafloor. Below 4m, the methane concentration rises sharply. The front coincides with a peak in precipitation of sulfides and carbonate.

A major scientific question, which can get an answer from the comparative analysis of Challenger Mound and the Moroccan mounds, is how, inside a mound,



High-resolution 3D X-ray CT-scan image (Somatom Sensation 64 Siemens, Forchheim; © A. Foubert & J. Titschack)

the sedimentary template generated by the cycles of Ocean, Climate and Life becomes overprinted by the beat of internal geochemical fronts. Microbial mediation may play herein a primordial role. When this gets elucidated, we will have put the finger on a fundamental process that transforms major oceanic structures into geology.

Technically, mound drilling may benefit from some improvements: logging while drilling (LWD) for instance might be considered to avoid the loss of data in the casing (first 80mbsf). Strategically, these mound studies should be regarded as the stepping stones towards a comprehensive, circum-Atlantic mound research programme, to include the mound provinces off Norway, Angola and Congo, Mauritania, Brazil, Blake Plateau, Orphan Knoll, and more to be unveiled. A comprehension of the Atlantic mound system will lead to a better insight into the global occurrence and significance of mounds and cold water coral reefs.

J.P. Henriet, Lead proponent, T. Ferdelman and A. Kano, Co-chiefs, T. Williams, Staff scientist and the Expedition 307 Scientists

References:

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ERA-NET

ECORD-Net Updates

ECORD-Net: European Research Area for scientific drilling

Project n° ERAC-CT-2003- 510218, European Consortium for Ocean Research Drilling Network

Networking and coordination activities supported financially by the European Commission under the ERA-net scheme have allowed ECORD to create and maintain a structure through which joint drilling programmes can be managed and coordinated, and their results disseminated to the marine scientist community.

- **Enlargement of the ERA**

ECORD now includes Austria, Belgium and Ireland, in addition to Canada as an international member. Meetings will be held in 2006 to discuss integration of a group of Balkan countries.

- **Research technology**

ECORD science programmes can only be carried out around infrastructure which allows sampling of geological formations hitherto never sampled for science. Through ECORD, Europe has for the first time a technological role in IODP (*see also page 2*).

- **Science programming**

A significant effort has been aimed at ESSAC's role in staffing scientific marine programmes and in Europe's representation on international panels. Project scientists are selected following an open call at the European level. To date 90 project scientists from 240 applicants have been selected. ESSAC provides nominations for all international panels which are, in turn, validated by the ECORD Council. Furthermore, ESSAC is actively involved in establishing two ESF programmes to provide funding for pre- and post cruise coring science (*see also pages 4-7*).

- **Integration with other science initiatives**

One of the tasks of the ECORD-net is to establish links with other geoscience programmes that require scientific drilling (including continental drilling - ICDP). Links with ICDP are advancing and have advanced as to producing a joint IODP-ICDP journal in which ECORD participates and formulating joint land-to-sea research drilling transects.

A recent promising development, catalysed by the plan of the European Commission to include Article 169 projects as part of the 7th framework programme, has been a proposal to establish stronger links and joint research programmes with a number of European and international marine science programmes concerned with the Deep Sea Floor Frontier initiative.

This initiative will involve integrating existing research programmes and creation of new programmes in this realm – it will also include identification of key targets for research and observation in the realms of sea-floor sedimentary and volcanic rock systems, fluid flow and resources associated with these systems, ecosystems developed on and below the sea-floor, sedimentary records of climate change & ocean circulation. These programmes will emphasise the societal importance of the development of new resources, risks of climate change and natural disasters, and the stability of ecosystems

The programme will involve, with European industry, creation of new marine infrastructure and rationalisation of existing infrastructure. It will create an added value for Europe as part of international programmes in marine science and in linking sea-floor observatories as part of Global observation systems.

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