

Exploring Escarpment Mud Mound Systems and Mud Volcanoes with new European strategies for sustainable mid-depth coring.

Acronym: Mud Mounds and Volcanoes

Organizers and proponents: Drs. S. Spezzaferri and E. Samankassou, University of Fribourg, Switzerland.

ESF Programme: Workshops on Marine Research Drilling (Magellan Workshop Series)

Abstract: The Mud Mounds and Volcanoes Magellan Workshop brings together the members of IODP and national proposals to plan drilling expedition in 2007. Focus of the Workshop are Mud Mounds and Mud Volcanos in the Atlantic Ocean. It merges discussion on innovating European technology addressing new challenges of site surveying and coring in sensitive areas, and multidisciplinary science, boosting the synergy between a Palaeoceanography research community and a Deep Biosphere cluster.

Scientific Summary

An exploratory cruise of R/V Belgica in 2002 off Larache (Morocco) led to the discovery of apparently juvenile mud mounds in water depths of 500-600 m, topping a cliff: the Pen Duick Escarpment in the El Arraiche Mud Volcano Field (Van Rensbergen et al., 2005). Mud volcanoes are presently considered as one of the hot spots for the deep biosphere because of their potential supply of energy sources and microorganisms from great depths below the seafloor.

They represent also an important source of gas hydrates. The worldwide amount of methane in gas hydrates is considered to contain at least *twice the amount of carbon held in all fossil fuels on earth*. Thus, Mud Volcanoes play an important role in the global carbon cycle, role that still has to be investigated and understood.

In May 2005, IODP Expedition 307 “Porcupine Mound Drilling” cored the first full section of a modern, giant carbonate mound: Challenger Mound in the ‘Belgica Mound Province’, west of Ireland. The mound, 155 m high and rooted on a buried cliff, has yielded an exceptional record of Pleistocene environmental changes (Ferdelman et al. 2005). Cold-water coral intervals are recurrent throughout the mound, though in variable state of preservation. Interstitial water profiles suggest a tight coupling between carbonate diagenesis and microbial sulphate reduction (Henriet et al., 2005).

Mud mounds may host thriving microbial consortia, which control sulphate reduction, methane oxidation and/or methanogenesis. Additionally, they potentially encode timing and amplitude of environmental changes and may provide information on the mechanisms triggering these events (e.g., climate, ice volume, productivity, etc.). Fossil mud mounds are relatively common in the geologic record, on the contrary the formation of modern mud mounds has been observed in very few locations. Understanding modern mound systems is thus fundamental in the reconstruction of past environmental changes. Additionally, up to now the carbonate stored in carbonate mounds has not been considered in any global carbonate budget or any *global model of the distribution of the*

greenhouse gas carbon dioxide. Therefore, the study of carbonate mounds and associated cold-water coral reefs was recognized as one of the first priorities of IOC/UNESCO's new Programme "Geosphere-Biosphere Coupling Processes" (GBCP).

A fundamental and unanswered question facing Earth and life scientists today is, *what is the relation between hydrosphere, geosphere and biosphere?*

The geological setting of Mound Systems and Mud Volcanoes provides a unique natural laboratory for studying and understanding the exciting and constructive interplay between carbonates, geofluids, biodiversity and deep biosphere and to investigate whether there is a causal link between mud volcanoes and mud mounds formation.

The workshop aims to bring together members of the **IODP Pre-Proposals 689** (Mud volcanoes as a window into the deep biosphere) and **673** (Mud Mounds), to plan marine drilling research expeditions to be held in 2007 with the aim to study these two important geological settings. The ultimate product of the workshop will be European-initiated drilling proposals on the Pen Duick Escarpment in the El Arraiche mud volcano field to be submitted to the IODP Science Advisory Structure.

The proposed workshop has been designed to merge:

- discussion on innovating technology, which addresses the new challenges of site surveying and coring in sensitive areas of shallow exploratory drilling and of lander deployments, with
- multidisciplinary science, boosting the synergy between respectively a Palaeoceanography research community and a Deep Biosphere cluster.

.....Innovative technology

The capability of Europe's most promising and innovative tool for ocean margin exploratory drilling: the Remotely Controlled Sea-Floor Drill Rig "MeBo" (Meeresboden-Bohrgerät) developed at the University of Bremen will be presented and its capability to address the target objectives will be discussed.

.....Multidisciplinary Science

A large community of scientists of different disciplines including e.g., geology, biology, microbiology, technology, will closely cooperate and interact during this workshop. This synergy will shape an additional added value amplifying the value of the single projects/proposals well beyond its formal core size, both in operational and analytical terms.

.....Venue and Date of Workshop

The Magellan Workshop will occur over 2.5 days scheduled for 10-13 May 2007 and will be held in the wonderful environment offered by **Murten - The Historical Lakeside Town** (Canton Fribourg), Switzerland.

Murten is the main city of the Fribourg lake district. It is a lovely 800 year old small town which shares the name with the adjacent lake. Thanks to its wonderful setting, Lake Murten is a sought after vacation spot and perfect for day excursions, too. The great

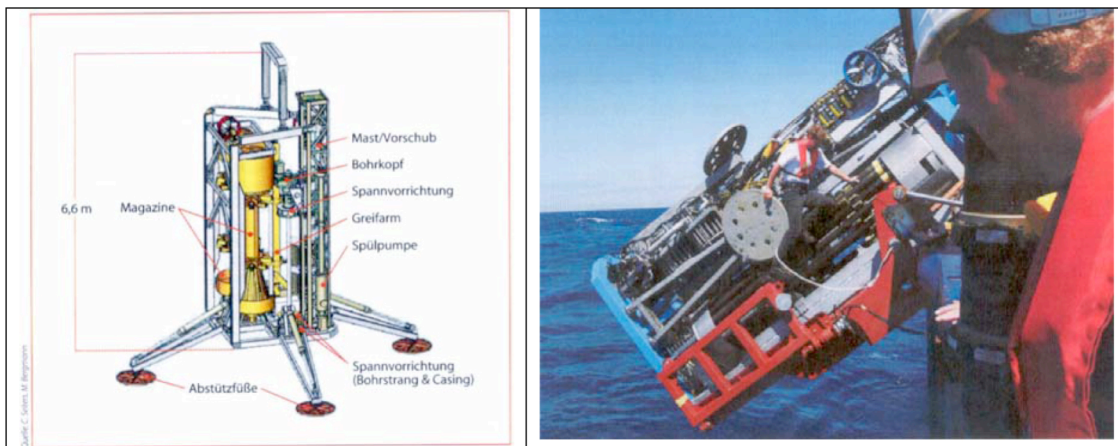
historical significance of the town comes alive when viewing its town wall, extraordinary towers, and wonderful castle; a truly unique Swiss treasure.

Murten's picturesque city center, arcades and romantic views invite visitors to discover a special world. Many hotels in Murten have facilities for seminars and meetings (<http://www.murtentourismus.ch/>).

Additional funding to co-sponsor the participation of keynote speakers will be asked to the Swiss National Foundation.

References:

- Ferdelman, T., Kano, A. and the IODP 307 Expedition Scientists (2005): Modern carbonate mounds: Porcupine drilling. IODP Prel. Rept., 307. doi:10.2204/iodp.pr.307.2005.
- Henriet, J.-P., McKenzie, J.A. and the IODP Expedition 307 proponents (2005): Drilling Challenger Mound (Porcupine Basin, W of Ireland): a contribution to European research on the microbial mediation in carbonate formation at low temperatures? Geophysical Research Abstracts, vol. 7, 06340, EGU Meeting 2005 Vienna, Austria.
- Van Rensbergen P., Depreiter D., Moerkerke G., Van Rooj D., Marsset B., Akhmanov G., Blinova V., Rachidi M., Magalhães V., Pinheiro L., Ivanov M., and Henriot J.P. (2005): The El Arraiche mud volcano field at the Moroccan Atlantic slope, Gulf of Cadiz. Marine Geology 219(1), 1-17.



In Figure: the portable seafloor drill rig Meeresboden-Bohrgerät (MeBo) represent the newest advance and innovation in marine drilling technology at **European dimension**.

The MeBo will be tested/used during drilling campaign that will be discussed during the MAGELLAN workshop and planned for 2007 in a joint European mobilisation of the combination: MeBo on board of R/V Celtic Explorer.

| |
|--------------------------|
| Meeting Programme |
|--------------------------|

Thursday, 10 May, 2007

Afternoon/early evening

Arrival in Fribourg, and transportation to Murten

Welcoming Aperó - Informal gathering of participants before dinner

Dinner

Preliminary discussion

Friday, 11 May 2007

Morning Session

Welcome & Review Workshop Goals: Co-Chairs D. Depreiter and Elias Samankassou

Keynote Speakers: Jean Pierre Henriët: Overview on the Pen Duick Escarpment in the El Arraiche Mud Volcano Field.

Short presentations by participants to define specific topics for drilling expedition to be held in 2007.

Lunch

Afternoon Session

Keynote Speaker: Davy Depreiter: Overview on IODP PreProposal- 689 (Mud volcanoes as a window into the deep biosphere)

Brainstorming sessions in breakout groups

Dinner and Leisure

Saturday, 12 May 2007

Morning Session - Co-Chairs J.P. Henriët and Silvia Spezzaferri

Keynote Speaker: Andrew J. Wheeler.

Title: Overview on the 'Belgica Mound Province', west of Ireland.

Working groups meet to discuss drilling expeditions in 2007

Lunch

Afternoon Session

Keynote Speaker: Jean Pierre Henriot

Title: Overview on IODP Proposal 673 (Mud Mounds)

Working groups prepare reports and outline proposals/propositions for drilling

Working group present reports to gathered participants

Dinner

Continued proposal/proposition writing and completion of reports

Sunday, 13 May 2007

Breakfast & farewell discussion – departure

| |
|---|
| Provisional List of Proposed Speakers/participants |
|---|

The provisional list of participants to the Workshop includes scientists from 10 European Countries: Belgium, Ireland, Italy, Germany, Great Britain, The Netherlands, Portugal, Spain, Switzerland and Sweden.

Keynote Speakers are the Project Leaders of IODP PreProposal 689 (D. Depreiter) and IODP Proposal 673 (J.P. Henriët) and project on the Belgica Mound (A. Wheeler).

Keynote Speakers:

Jean Pierre Henriët - Renard Centre of Marine Geology, Ghent University, Belgium–
Title: Overview on the Pen Duick Escarpment in the El Arraiche Mud Volcano Field.
Title: Overview on IODP Proposal 673 (Mud Mounds)

Davy Depreiter – Renard Centre of Marine Geology, Ghent University, Belgium–
Title: Overview on IODP PreProposal- 689 (Mud volcanoes as a window into the deep biosphere).

Andrew J. Wheeler, - Dept. of Geology and Environmental Research Institute, University College Cork, Donovans Road, Ireland.
Title: Overview on the ‘Belgica Mound Province’, west of Ireland..

Participants:

Belgium

Prof. R. Sennen - Dienst sedimentpetrologie en milieugeologie Afd. Fysico-chemische Geologie Katholieke Universiteit Leuven Celestijnenlaan 200C B-3001 Heverlee Belgium

Dr. S. Louwye - Research Unit Paleontology, Ghent University, Belgium

Prof. W. Verstraeten - Laboratory for Microbial Ecology and Technology, Ghent University, Belgium

Dr. N. Boon - Laboratory for Microbial Ecology and Technology, Ghent University, Belgium

Dr. J. Poort Boon - Laboratory for Microbial Ecology and Technology, Ghent University, Belgium

Ms. Lois Maignien - Laboratory for Microbial Ecology and Technology, Ghent University, Belgium

Dr. D. Van Rooij Boon - Laboratory for Microbial Ecology and Technology, Ghent University, Belgium.

Ms. Anneleen Fouber - Renard Centre of Marine Geology, Ghent University, Belgium.

Mr. Hans Pirlet - Renard Centre of Marine Geology, Ghent University, Belgium.

Germany

Prof. Dr. A. Freiwald - Institute of Paleontology (IPAL), University of Erlangen-Nuremberg, Loewenichstr. 28, 91054 Erlangen, Germany.

Dr. K. Hinrichs - Research Centre Ocean Margins, Marum, Germany

Prof. C. Dullo – Leibniz-Institute of Marine Sciences at Kiel University (IFM-GEOMAR), Ocean Circulation and Climate Dynamics, Paleoceanography, Wischhofstr. 1-3, 24148 Kiel.

Prof. A. Eisenhauer – Leibniz-Institute of Marine Sciences at Kiel University (IFM-GEOMAR), Ocean Circulation and Climate Dynamics, Paleoceanography, Wischhofstr. 1-3, 24148 Kiel.

Dr. A. Rüggeberg – Leibniz-Institute of Marine Sciences at Kiel University (IFM-GEOMAR), Ocean Circulation and Climate Dynamics, Paleoceanography, Wischhofstr. 1-3, 24148 Kiel.

Dr. W. Brückmann W. - Leibniz-Institute of Marine Sciences at Kiel University (IFM-GEOMAR), Ocean Circulation and Climate Dynamics, Paleoceanography, Wischhofstr. 1-3, 24148 Kiel.

Prof. D. Hebbeln - MARUM – Center for Marine Environmental Sciences, University of Bremen, Leobener Strasse, 28359 Bremen, Germany

Dr. J.-B. Stuut - MARUM – Center for Marine Environmental Sciences, University of Bremen, Leobener Strasse, 28359 Bremen, Germany

Dr. K. Mangelsdorf - GeoForschungsZentrum Potsdam (GFZ) Potsdam, Germany

Dr. H. Cypionka - Institut für Chemie und Biologie des Meeres, University of Oldenburg, Germany

Dr. S. Kasten - Alfred Wegener Institute, Bremerhaven, Germany

The Netherlands

Prof. T. C. E. van Weering - Department of Marine Chemistry and Geology, Royal Netherlands Institute for Sea Research (Royal NIOZ), P.O. Box 59, 1790 AB Den Burg, The Netherlands.

Dr. E. Epping - Department of Marine Chemistry and Geology, Royal Netherlands Institute for Sea Research (Royal NIOZ), P.O. Box 59, 1790 AB Den Burg, The Netherlands.

Prof. J. S. Sinninghe Damsté - Royal Netherlands Institute for Sea Research Royal NIOZ, Marine Biogeochemistry Group, PO Box 59, 1790 AB Den Burg, The Netherlands.

Dr. Alina Stadnitskaya - Royal Netherlands Institute for Sea Research Royal NIOZ, Marine Biogeochemistry Group, PO Box 59, 1790 AB Den Burg, The Netherlands.

Mr. Cees van der Land - Royal Netherlands Institute for Sea Research Royal NIOZ, Marine Biogeochemistry Group, PO Box 59, 1790 AB Den Burg, The Netherlands.

Great Britain

Dr. R.J. Parkes, - School of Earth, Ocean and Planetary Sciences, University of Cardiff, UK.

Dr. J. Sas J. - School of Earth, Ocean and Planetary Sciences, University of Cardiff, UK

Dr. Christian Bernd – National Oceanography Centre, Southampton (NOC), University of Southampton Waterfront Campus, European Way, Southampton, UK.

Italy

Dr. G.G. Ori - Int. Research School of Planetary Sciences – Università G. d'Annunzio, Pescara, Italy

Prof. R. Barbieri – University of Bologna, Dipartimento di Scienze della Terra e Geologico-Ambientali - Università di Bologna, Piazza di Porta San Donato 1, Bologna, Italy.

Ireland

Ms. Rory O'Donnel - Dept. of Geology and Environmental Research Institute, University College Cork, Donovans Road, Ireland.

Ms. M. Thieren - - Dept. of Geology and Environmental Research Institute, University College Cork, Donovans Road, Ireland.

Portugal

Dr. L.M. Pinheiro - Department of Geosciences, University of Aveiro, Portugal

Spain

Dr. R. Amils - Centro de Biología Molecular, Universidad Autónoma de Madrid, Spain

Sweden

Dr. N. Holm - Marine Research Center, Stockholm University, Sweden

Switzerland

Dr. S. Spezzaferri – University of Fribourg, Department of Geosciences, Ch du Musée 6, 1700 Fribourg, Switzerland.

Dr. E. Samankassou - University of Fribourg, Department of Geosciences, Ch du Musée 6, 1700 Fribourg, Switzerland.

Prof. J. A. McKenzie - ETH-Zentrum, Institute of Geology, Universitaetsstrasse 16, 8092 Zurich, Switzerland

Dr. C. Vasconcelos - ETH-Zentrum, Institute of Geology, Universitaetsstrasse 16, 8092 Zurich, Switzerland

Dr. Stephanie Templar - ETH-Zentrum, Institute of Geology, Universitaetsstrasse 16, 8092 Zurich, Switzerland