

**Report on the 'Young Researchers Workshop on cold-water coral mound formation' held at the Department of Earth and Environmental Sciences, Katholieke Universiteit Leuven' Belgium from the 13<sup>th</sup> to the 15<sup>th</sup> of May 2009**

*compiled by Boris Dorschel*

**Aims and Objectives**

The aim of the Young Researcher Workshop was to bring together European postdoctoral scientist involved in coral carbonate mound research in order to assess the state of scientific knowledge on mound process, initiation and development and to plan and coordinate further scientific actions for young researchers. The main emphasis was on discussions between the participants addressing the following scientific topics:

- Mound initiation and development
- Sediment dynamics and coral growth
- paleoceanography and paleoclimatology
- Microbial activity
- Diagenesis

In addition, the Friday sessions were dedicated to the development and initiation of collaborations between scientists from different institutions and countries. Potential for joined research expeditions were explored and information on available and future funding schemes (national and European) were collected.

The individual sessions were structured in the way that short review presentations at the start of each session provided condensed general overviews of the topics to be discussed. While the discussion were 'forward-looking' identifying knowledge-gaps, scoping worthwhile next steps and planning future collaborations.

**Participants list**

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Matthias Lopéz Correa (GZN, Erlangen)

Furu Mienis\* (Royal NIOZ, Texel)

Andres Rüggeberg (IFM-GEOMAR, Kiel)

Jürgen Titschack (GZN, Erlangen)

Agostina Vertino (Università Catania)

**Session protocols**

*Wednesday 13 May*

Discussion Theme I – Mound initiation and built-up

Key questions addressed during the discussion:

- 1) Is it possible to quantify mound systems and to develop stronger mound development models?

Answer: Quantitative approaches are limited due to the non-statistical collection of data and samples. Statistical sampling e.g. along a grid in sufficient resolution is not feasible due to exponential increase in samples and data. The better approach is to compile and standardise existing samples and data and to identify missing data sets.

2) How important is the availability of hard substrate for coral settlements?

Answer: hard substrate is important (the main mound building corals *Lophelia Pertusa* and *Madrepora oculata* need hard substrate for the larvae to settle on) but not the limiting factor. In the NE Atlantic not all available hard substrate is colonised.

3) Does Wilson rings represent initial stages of cold-water coral reefs and mounds?

Answer: it is not clear if Wilson rings represent initial mound stages or temporary reef structures. For coral banks to develop, sediments input and erosion processes (bottom currents) have to be balanced (e.g. Traenadjupe off Norway)

4) What is the role of hydrographic and oceanographic conditions?

Answer: All mounds grow on regional unconformities that represent times of non-deposition or erosion. These unconformities developed in response to changing oceanographic conditions (e.g. glacial-interglacial changes).

5) Do small mounds like Darwin mounds, Moira mounds, Norwegian mounds, and Santa Maria di Leuca represent initial mounds?

It is difficult to determine between temporary reef development and mound initiation (lack of samples from mound initiation phase).

During the forward-looking part of the discussion, the following questions were developed as key topics for further research activities towards mound initiation:

- What are the preconditions for mounds to start?
- What type of data/studies is necessary to investigate the start-up phase of mounds?
- What is the role of the tectonics setting (uplift/subsidence)?

With regards to mound build-up and further development additional questions had been phrased out:

- What is the role of bioerosion and is it possible to quantify bioerosion of corals in the sediment cores?
- Can coral assemblages be used palaeo-environment proxy (e.g. food availability and quality, current intensities and sediment input)?
- Are mounds and cold-water corals palaeo-archives for intermediate water depths?

- Which data and information are necessary to model carbonate mound development?

*Thursday 14 May*

The second day of the workshop followed up the idea of modelling a coral carbonate mound. In order to do so, we tried to identify which are in our opinion the most important factors for mound development. In a ‘democratic’ approach, five main factors were identified out of a list of approximate 15 factors. During this exercise, nutrients (food availability) have been voted most important closely followed by currents. Water masses and sediment input was also selected and to a minor extent erosion.

Based on these factors, outlines for possible mound development models were generated. The model sketches were collected and to be collated in the Workshop report compiled by the workshop organisers.

During the second session, the following additional aspects of mound development were discussed:

- Sediment dynamics and coral growth / Palaeoceanography, -climatology
- Microbial activity
- Diagenesis

Key questions out of these sessions were:

- What are the preconditions for corals to colonise – are the conditions different for juvenile and adult corals?
- How does re-suspension influence corals (stress due to over silting, increased food supply)?
- By whom and where are colonisation experiments conducted?
- What can be learned from the fossil record?
- What is the role of biomineralisation (e.g. hardgrounds and lithified layers within the mounds)?

Towards the end of the discussion, the idea was raised to generate a review paper out of the young researcher community. And also the mound development model was addressed again. During the discussion, it was estimated which processes can be realistically be incorporated into the model and how can they be parameterised. There was a general understanding that a modelled approach has to start with a simplified model with only a limited number of parameter (food, bottom currents, water masses, sediment input and preservation). The overview on existing data sets, however indicated that the number of appropriate data sets is quite limited. Especially data on hydrographic conditions at mounds and within coral thickets and data on food availability are rare.

The problems can be overcome by modelling food webs based on data from stand alone pump systems, moorings with sediment traps and ADCPs. Palaeoproductivity can be estimated from geochemically (P/Ca ratios of corals or of foraminifera) Environmental parameters such as bottom current intensities can be estimated from grain size distribution and mound morphologies. For palaeoceanographic reconstructions a plethora of proxies is available (e.g. stable oxygen and carbonate isotopes, faunal assemblages of planktic and benthic foraminifers). In order to understand deposition and erosion processes lab experiments where suggested.

*Friday 15 May*

The last day of the meeting was dedicated to the exploration of national and international funding opportunities and joined cruise options.

Overview of proposals for Post-Docs are available on European web pages (<http://www.erc.europe.eu>, Marie Curie, EUROCORES, DG Environment, COST, ...), Belgium (<http://www.fwo.be>), Germany (<http://www.dfg.de>, <http://www.geonachwuchs.de>), Spain (ICREA), United Kingdom (NERC), The Netherlands (FWO), Italy, MIUR, PRA, FOE, FIRB)

#### **Suggestions for further actions**

1. Development of small scientific research network on postdoctoral level
2. Conceptual model for mounds with different controls: data compilation for 5 main factors
3. Review paper
4. Investigation of new proxies and parameters for 5 main factors for mound development
5. Probably circular Young Researcher meetings in combination with conferences (e.g. EGU)
6. Own EGU session in 2010?
7. Cruise possibilities (and contact persons)
  - a. Northern Norwegian (POSEIDON, G.O. SARS – Andres, Sascha, Pål)
  - b. Rockall / Hatton Bank (PELAGIA – Furu, Henk)
  - c. Mediterranean, Strait of Gibraltar, Santa Maria di Leuca (Ben, Agostina)
  - d. American Margin (Furu)
  - e. Iceland (Matthias)
8. Integration with other projects/campaigns: TRACES (EuroTRACES), COCARDE, CARBONATE, MicroSYSTEMS, Hermione, CoralFISH.