

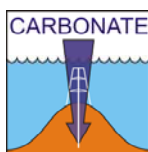
EuroMARC joint CARBONATE/CHECREEF Workshop

**The Geology of Coral-Rich Carbonate
Systems:
from tropical, shallow water to cold, deep-water settings**

**Hotel Iberostar Capo dei Greci, Sant' Alessio, Sicily, Italy
6th - 8th May 2008**



SCIENTIFIC REPORT



CHECREEF

1. Summary

Through the auspices of the ESF-EuroMARC networking activities, the workshop “The Geology of Coral-Rich Carbonate Systems: from Tropical, Shallow Water to Cold, Deep-water Settings” brought together 36 researchers from 11 countries (and two continents). The project allowed networking between a number of research communities and projects including the ESF-EuroMarc CARBONATE and CHECREEF projects as well as IODP Exp. 307 and 310 partners and additional coral researchers.

The workshop set about exploring common problems, new approaches and synergies between our projects and within our research areas. Despite a clear commonality on the use of the coral organism and reef deposits to study past climatic and environmental conditions, the shallow water tropical and cold-water coral communities have rarely interacted, evolving as they have from different research areas: continental margin research and tropic carbonate research communities. Calcareous framework-building (scleractinian) corals form reefs offering complex habitats supporting high biodiversity ecosystems that play important regional roles as centres of enhanced organic respiration, carbonate sinks, faunal nurseries/refugia and speciation/endemism centres. The reefs are also temporal archives that record, often in exceptional high resolution over long time-spans, climate, sea-level, biogeochemical and environmental signals. The application of isotope geochemistry and high resolution sedimentology on these carbonate systems has proven especially powerful.

The workshop heard a number of scientific presentations which gave detailed insights into the studies being undertaken in both communities. Two keynotes from Prof. Italo Di Geronimo, Prof. Antonietta Rosso and Dr. Agostina Vertino were also given on the local carbonate geology that was later explored during the field excursion. These presentations were interspersed by three guided discussion sessions where views were positively aired and debated:

1. Exploring Common Ground I: Coral reefs as palaeoenvironmental archives;
2. Exploring Common Ground II: Reef geology, development models & diagenetic controls;
3. The Way Forward: Joined-up thinking in shallow & deep-water coral geological research strategies.

Finally, under the expert guidance of Dr. Agostina Vertino and University of Catania delegation, we were introduced to the rare exposures of upper Miocene to Plio-Pleistocene cold-water coral and deep marine bio-assemblages.

Delegates concurred that the workshop had been both educational and stimulating, allowing a better appreciation of the science and overlaps between our research areas. Although differences in approach necessitated by differences in the study areas remain, we gained some inspiration from hearing each other's discoveries and theories. It was agreed that a follow-up workshop should occur when new data comes on stream with a more focussed agenda now that common insights have been established.

2. Workshop Programme

Tuesday 6th May 2008

08:30 – 08:50 Registration

08:50 – 09:00 Welcome and announcements, outline of workshop objectives and goals - *Andy Wheeler*

09:00 – 09:15 CHECREEF project outline - *Thomas Felis et al.*

09:15 – 09:30 CARBONATE project outline - *Andy Wheeler et al.*

Scientific presentations (Chair: Dierk Hebbeln)

09:30 – 09:45: Stable strontium isotopes ($\delta^{88}/^{86}\text{Sr}$) in cold-water corals – a new proxy for reconstruction of intermediate ocean water temperatures - *Andres Rüggesberg et al.*

09:45 – 10:00: Unravelling depositional signals throughout a cold-water coral carbonate mound: implications for the environmental controls on Challenger Mound development (IODP Exp.307) - *Mieke Thierens et al.*

10:00 – 10:15: Microbial crusts in Tahitian reefs as record of environmental change during the last deglacial sea-level rise (IODP #310) - *Katrin Heindel et al.*

10:15 – 10:30: Pronounced interannual variability in South Pacific temperatures during the early deglacial – coral-based results from IODP Expedition 310 - *Thomas Felis et al.*

10:30 – 11:00: *Coffee Break*

Scientific presentations (Chair: Daniel Birgel)

11:00 – 11:15: Environmental significance of coralline algae in post-glacial reefs at Tahiti - *Juan Braga et al.*

11:15 – 11:30: Sediment dynamics and palaeo-environment on and around Challenger Mound during its first phases of development - *Veerle Huvenne et al.*

11:30 – 11:45: Palaeo-environment at the start-up phase of cold-water coral mounds, Porcupine Seabight, Ireland - *Ben de Mol et al.*

11:45 – 12:00: Palaeomagnetism and environmental magnetism of postglacial carbonates from the Tahiti Coral Reef - *Steve Lund et al.*

12:00 – 12:15: Carbonate mounds, constraints on coral growth and mound development - *Tjeerd van Weering et al. (cancelled)*

12:15 – 12:30: Modelling internal reef chronology and virtual drill logs using a spreadsheetbased reef growth model (SEALEX) - *Martin Koelling et al.*

12:30 – 14:00: *Buffet Lunch*

Scientific presentations (Chair: Andy Wheeler)

14:00 – 14:15: Mound Perseverance, a cold-water coral carbonate mound in the Magellan mound province - *Hans Pirlet et al.*

14:15 – 14:30: Growth and erosion – the long-term history of recent carbonate mounds from the Irish margin - *Dierk Hebbeln et al.*

Workshop Guided Discussion

14:30 – 15:30: Exploring Common Ground I: Coral Reefs as Palaeoenvironmental archives – chaired *Andres Rüggesberg & Andy Wheeler*

15:30 – 16:00: **Coffee Break**

Guest Keynote

16:00 – 17:00: Mediterranean deep-water coral communities with special emphasis on the S. Maria di Leuca coral mound province - *Antonietta Rosso, Italo Di Geronimo and Agostina Vertino*

Dedicated poster session (17:00 – 18:00)

M. Bjerager, F. Surlyk and L. Stemmerik: Early Paleocene deep-water coral reefs in Øresund, southern Scandinavia

De Mol, L. et al. - Preliminary results of the Belgica CADIPOR III cruise (Gulf of Cadiz): the 'MOUND-4D' concept

Di Geronimo, R. - Cirripeds living in coral reefs from the Andaman Sea: a first account

Hoffmann, J. and Koelling, M. - Freshwater geochemistry and its impact on reef growth and reef alteration

Pirlet, H. et al. - The terrigenous signal within a cold-water coral carbonate mound

Rosso, A. - Bryozoans from Mediterranean deep-water frame-building corals

Sciuto, F. - Ostracods from deep-water coral mounds from off Santa Maria di Leuca, northern Ionian Sea

Titschack, J. et al. - Plio-Pleistocene cold-water coral deposits at La Montagna (Messina, Sicily) – submarine dune or cold-water coral mound

Wheeler, A. et al. - The CARBONATE project: Mid-latitude Carbonate Systems – Complete Sequences from Cold-Water Coral Carbonate Mounds in the Northeast Atlantic

19:00 **Workshop Dinner**

Wednesday 7th May

Guest Keynote

09:00 – 10:00: Plio-Pleistocene deposits from the Messina Strait area: natural archives of the history of Mediterranean deep-water coral ecosystems - *Italo Di Geronimo and Agostina Vertino*

Scientific presentations (Chair: Prof. Rudy Swennen)

10:00 – 10:15: The R.V. Pelagia pre-drilling site survey at the Rockall and Porcupine cold water coral mounds provinces, European Atlantic margin. The CARBONATE project, ESF EuroMARC program - *Henk de Haas et al.*

10:15 – 10:30: Impact of in situ microbial diagenesis on carbonate sequences - *Judith McKenzie et al.*

10:30 – 11:00 **Coffee Break**

Scientific presentations (Chair: Prof. Rudy Swennen)

11:00 – 11:15: Carbonate budget and growth of cold-water coral mounds – implications from Challenger Mound (IODP Exp. 307 – Modern carbonate mounds: Porcupine drilling) - *Jürgen Titschack et al.*

11:15 – 11:30: Submarine slumps enhancing deep-water coral growth (Gondola Slide, SW Adriatic Margin) - *F. Trincardi et al.* – presented *Marco Taviani*

Workshop Guided Discussion

11:30 – 12:30: Exploring Common Ground II: Reef geology, Development models and Diagenetic Controls – *chaired Andy Wheeler & Thomas Felis*

12:30 – 14:00: **Buffet Lunch**

Scientific presentations (Chair: Martin Koelling)

14:00 – 14:15: Carbonate production of polychaete serpulids in bathyal coral mounds from the Mediterranean and likeness with shallow-water tropical reefs -

Rosanna Sanfilippo

14:15 – 14:30: Deep-sea solitary frame-building corals - *Marco Taviani and Agostina Vertino*

14:30 – 14:45: Cold-water coral carbonate mounds on the Irish margin: spatial analysis, drill targets and the CARBONATE project - *Boris Dorschel et al.*

14:45 – 15:00: COCARDE: bridging Ancient and Modern, shallow-water and deep-water carbonate system studies within a JIP scheme - *Jean-Pierre Henriot et al.*

15:00 – 15:30: **Coffee Break**

Scientific presentations (Chair: Martin Koelling)

15:30 – 15:45: The sea floor drill rig “MeBo” - *Tim Freudenthal*

15:45 – 16:00: Challenger Mound: a key to unravel the early diagenesis of carbonate mounds (and their reservoir characteristics) - *Anneleen Foubert*

Workshop Guided Discussion

16:00 – 17:00: The Way Forward: Joined-up Thinking in Shallow and Deep-water Coral Geological Research Strategies – *chaired Andy Wheeler*

CRPs Planning Meeting

17:00 – 18:00: Joint CHECREEF/CARBONATE PI meeting – planning of future networking and project integration initiatives

19:00: **Workshop Dinner**

Thursday 8th May

Geological excursion to see Plio-Pleistocene cold-water coral reef outcrops

Stop 1a: La Montagne, Messina – cold-water coral reef outcrop

Stop 1b: La Montagne, Messina – additional bathyal outcrops

Lunch

Stop 2: Cala S. Antonio, Capo Milazzo Peninsula - cold-water coral and bathyal outcrops

Stop 3: Punta Messinese, Capo Milazzo Peninsula – cold-water coral outcrops

3. A description of the scientific content of and discussion at the event

The workshop consisted of four integrated components: talks, poster sessions, keynote talks and discussion sessions followed by a field excursion.

22 scientific talks were presented covering both cold-water coral and tropic coral geology. These were broad ranging and well received. The talks were supplemented by a limited number of **9 posters** that were reviewed during a poster session and at coffee breaks. The talks and the posters formed the basis of **3 discussion sessions** that were guided by the convenors. The discussion sessions were the main productive focus of the meeting and were used to explore where synergies, overlaps, challenges and lessons can be found. The details of these discussions are presented below as a key deliverable arising from the workshop.

Exploring Common Ground I: Coral Reefs as Palaeoenvironmental Archives

One important palaeoenvironmental utilisation of cold-water coral mound/reef geological archives lies in their potential to record *intermediate water depth* evolution. The coral skeletons itself provide us with high-resolution archives for numerous palaeoenvironmental parameters (introductory summary by A. Rueggeberg) and have the additional advantage that they can be dated precisely. Furthermore, their global occurrence favours them as candidates for basin-wide reconstructions. Also the potential of the mound/reef sediments as archives was put forward here, although a number of issues were raised:

- poor stratigraphies of the coral mound/reef records challenge high resolution reconstructions
- poor correlations (so far) between on- and off-mound records (for cold-water studies) inhibit integration of and comparison between both systems. This prevents the integration of the coral mound records in a regional context and limits their potential for larger-scale reconstructions.

Outside the niche of intermediate water depths, more appropriate (basin-wide) palaeoenvironmental archives (e.g. high deposition deep-sea sites as high resolution deep water and climate records etc.) were suggested rather than the ones provided by coral reefs.

Warm- and cold-water systems appear intrinsically different (type of records, timing of events) and the integration of both in joined-reconstructions, for one thing, will be challenging.

Exploring Common Ground II: Reef Geology, Development Models and Diagenetic Controls

In the introduction to this session (T. Felis & A. Wheeler) it became clear that warm- and cold-water coral systems are subject to different control mechanisms and lend

themselves to slightly different research questions. First of all, can we say that the warm- and cold-water coral records are comparable or of a different nature:

- The time scales captured in both reef systems are of a different magnitude (~ 16 ka for the tropical Tahiti reef vs 2.7 Ma in the Challenger cold-water coral mound)
- Where for cold-water coral systems a vertical section records the reef evolution through time, this assumption cannot be made for the warm-water coral systems, as they are also subject to significant lateral migration through time and/or with changing environments. Therefore, the records present in vertical core sections of both reef types are fundamentally different (and hence the potential of the records is different)
- The difference in coral species (zooxanthellate vs azooxanthellate) is reflected in different environmental controls on both reef systems.

One way of overcoming some of these differences could be in the identification of areas in which warm- and cold-water coral records are more comparable, e.g. shallow cold-water coral mounds vs shallow tropical reefs? Mud-dominated tropical reefs vs mud-dominated cold-water mounds? It was suggested that we should not “warm/tropical” and “cold-water” coral systems as end-members of the coral reef system but perhaps coral reef systems adapted to “carbonate shelves” and “siliciclastic shelves”. From this view point comparative studies may be useful.

Although quite different for both systems, another common interest was found in the diagenetic processes affecting the reef records. Not only is the understanding of these processes in both communities still limited, we all acknowledged the importance of this topic e.g. for the fundamental link from past records to recent ones, to assess the quality of the records and to calculate carbonate budgets (quantification of the reef’s carbonate content alteration).

More common ground was found in the potential record of ocean acidification preserved in coral reefs (A. Eisenhauer is already working on this theme).

The Way Forward:

Joint-up Thinking in Shallow and Deep-water Coral Geological Research Strategies

General key questions, that are valid for both warm-and cold-water coral reef systems, have been proposed:

1. deciphering and comparison of the start-up and shut-down phases of coral reefs (and identification of the controlling factors);
2. carbonate budgets and carbonate storage in both warm- and cold-water reefs
3. assessment of the quality of our reef records (how complete/ unaltered/ representative are they);
4. to which degree can our understanding of these modern systems provide analogues for the past and how can we integrate the knowledge of both “modern” and “fossil” systems;
5. understanding the diagenetic processes in both systems (and in a wider context) in order to understand our systems better;
6. can we study both systems in one area (e.g. Cuba) and hence find an area of convergence in which we can study aspects of connectivity between both systems;

7. although the differences in research themes, both communities do use very similar techniques, methods, proxies. Hence, a standardisation of research methods and analysis protocols for future work (e.g. the Great Barrier Reef drilling and CARBONATE drillings) would benefit all involved and, based on this meeting, we should better coordinate collaboration for future projects.

Furthermore, all participants showed interest in similar workshops in the future. These could then be focussed around a few of these key questions and could include other reef communities (e.g. fossil ones). Another meeting near the end of the projects involved was considered most valuable.

In addition to the above we had **2 keynote talks** from the local University of Catania who have done excellent research on the local carbonate geology. Access to the carbonate geology of Sicily was the reason for choosing this location. The keynotes provided a welcome insight into the local tectonic and palaeo-bathyal setting of these rare exposures of cold-water coral outcrops that have been lifted from the deep-sea to terrestrial altitudes. The keynotes also nicely set the scene for **the field excursion** where we were introduced to the coral reef exposures by the local experts. This field excursion was well received by both cold-water and tropical coral geologists who gained valuable insights and analogues to the contemporary geological settings we mostly study.

4. Assessment of the results and impact of the event on the EUROCORES Programme

An assessment of the “success” of the workshop is best summarised through a consideration of the following statements:

1. The workshop brought together partners from two EuroMARC projects CHECREEF and CARBONATE with a view to exploring the potential for cooperation between the projects. A high level of networking was achieved at a personal level over the duration of the workshop which was specifically chosen for its isolated location.
2. In addition, the workshop provide an early stage, and therefore timely, opportunity for project networking within CARBONATE and CHECREEF.
3. The workshop also showcased these two projects to a wider relevant network of researchers which in itself was worthwhile.
4. Delegates expressed the opinion that the workshop was enjoyable, stimulating and worthwhile.
5. The structure of the workshop was informative with a very high standard of scientific presentations giving deep and thorough insights into coral geology. Delegates felt this was excellent.
6. The workshop was also exploratory in that themed discussions were used as a vehicle to explore where synergies and overlaps exist between research fields that may open collaborative opportunities.
7. Conclusions from the discussions have a significant bearing on the future of potential cooperation between these projects and research fields:
 - a. there are distinct differences between cold-water coral and tropic coral geology and ecosystems which has a fundamental bearing on the nature of the research which can be performed and limits the commonality of approaches. It would be misguided to consider that we are comparing like with like.
 - b. Specifically for CARBONATE and CHECREEF, our objectives are quite different in terms of the time-frame we are studying, the questions we are asking and the approaches we appropriately adopt.
8. An understanding of the research endeavours of our different communities was gained which delegates found useful and worthwhile and it was felt that both projects will benefit from this at an early stage in their development.
9. It is **unlikely** that extensive close cooperative actions between CARBONATE and CHECREEF partners will emerge following this meeting due to our mutual differences. This is appropriate.
10. However, on a more general level we networked well and this will help integration on a general level in EuroMARC and smaller scale cooperation will naturally arise.
11. We agreed that it **would** be useful to repeat the workshop towards the end of the project focussing on specific questions which may form the basis of integrated proposals.
12. In conclusion, the workshop was useful, worthwhile and will enhance cooperation and integration within EuroMARC however on a fundamental scientific level our difference necessitate separate approaches. However, there is potential for future collaboration to address some common research ideas.

5. Full list of speakers and participants

Name	Institution	Project	Country
Agostina Vertino	CNR-ISMAR	-	IT
Andres Ruggesberg	IFM-GEOMAR	CHECREEF	DE
Andy Wheeler	Uni. Coll. Cork	CARBONATE	IRE
Anneleen Foubert	TOTAL	IODP 307	FR
Antonietta Rossa	Uni. Catania	-	IT
Ben De Mol	Uni. Barcelona	IODP 307	ES
Boris Dorschel	Uni. Coll. Cork	CARBONATE	IRE
Daniel Birgel	Uni. Bremen	CHECREEF	DE
Dierk Hebbeln	Uni. Bremen	CARBONATE	DE
Elias Samankassou	Uni. Fribourg	CHECREEF	CH
Francesco Sciuto	Uni. Catania	-	IT
Hans Pirlet	Uni. Gent	IODP 307	BE
Henk de Haas	Royal NIOZ	CARBONATE	NL
Italo Di Geronimo	Uni. Catania	-	IT
Jan Hoffmann	Uni. Bremen	CHECREEF	DE
Jean-Pierre Henriet	Uni. Gent	IODP 307	BE
Jörn Peckmann	Uni. Bremen	CHECREEF	DE
Juan Braga	Uni. Granada	CHECREEF	ES
Judith McKenzie	ETH-Zürich	-	CH
Jurgen Titschack	Uni. Bremen	CARBONATE	DE
Katrin Heindal	Uni. Bremen	CHECREEF	DE
Lies De Mol	Uni. Gent	-	BE
Marco Taviani	CNR-ISMAR	-	IT
Martin Koelling	Uni. Bremen	CHECREEF	DE
Mieke Thierens	Uni. Coll. Cork	CARBONATE	IRE
Morten Bjerager	Uni. Copenhagen	IODP 307	DN
Nina Joseph	Uni. Erlangen	CARBONATE	DE
Paulo Pino	Uni. Catania	-	IT
Raffaella Di Geronimo	Uni. Catania	-	IT
Romain Weil	Uni. Coll. Cork	CARBONATE	IRE
Rosanna Sanfilippo	Uni. Catania	-	IT
Rudy Swennen	Uni. Leuven	CARBONATE	BE
Steve Lund	Uni. South California	IODP 310	USA
Thomas Felis	Uni. Bremen	CHECREEF	DE
Tim Freudenthal	Uni. Bremen	CARBONATE	DE
Veerle Huvenne	NOC-Southampton	IODP 307	UK