

Scientific Report - Participation in the 79th Annual Meeting of the German Paleontological Society

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At the 79th Annual Meeting of the German Paleontological Society I presented a poster with the title “Holocene environmental variability in cold-water coral reefs in Stjernsund, northern Norway, deduced from benthic foraminifera”. This study is part of the ESF-CARBONATE project and concentrates on the investigation of Holocene benthic foraminiferal assemblages in two sediment cores from Stjernsund in Northern Norway. One core was recovered from a cold-water coral reef complex (*Lophelia pertusa*) and the second core from the adjacent Fjordbasin. The faunal assemblages are used to trace climatic and environmental changes across the last ~10 ka. At this stage of my PhD thesis I presented the sedimentary facies and benthic habitat distribution at the surface as well as first results of the benthic foraminiferal assemblages of both cores.

1 Purpose of the participation

The 79th Annual Meeting of the German Paleontological Society took place from the 4th to 7th of October 2009 in Bonn. This year’s theme was “Paleontology - Key to evolution” (Paläontologie - Schlüssel zur Evolution). The program included several sessions and symposia presenting latest results in classical vertebrate and invertebrate paleontology, as well as advances in micropaleontological research. One of the main aspects discussed was the use of fossils as climate and environmental archives, which are a key-focus of my own research project. Since this is the most important meeting for networking activities within the German paleontological community and an ideal presentation platform for marine geosciences, I actively participated by presenting a poster with the title “Holocene environmental variability in cold-water coral reefs in Stjernsund, northern Norway, deduced from benthic foraminifera”.

2 Description of the presented work

2.1 Introduction

In summer 2005 the world's northernmost cold-water coral province has been explored in great detail during RV Poseidon cruise POS-325. One of the key-sites was the Stjernsund-Fjord at 70°N in the West Finnmark District, northern Norway. The 30-km-long, 3.5-km-wide and up to 500 m deep Stjernsund is formed as an east-west oriented glacial trough and comprises a deep-water connection to the open shelf to the west as well as via the Altafjord to the east (Fig. 1). On top of a last glacial terminal moraine the azooxanthellate scleractinian cold-water coral *Lophelia pertusa* builds reef structures at 260 to 230 m water depth. The sill-crest comprises a current-swept environment, influenced by tides and ambient water temperatures between 5 and 6°C. The currents provide a steady nutrient flux and inhibit sedimentation. The adjacent through (~500 m depth) to the east is dominated on the contrary by muddy postglacial sediments.



Figure 1: Map of northern Norwegian fjord systems with the Stjernsund working area highlighted.

2.2 Methods

A series of gravity cores have been taken in an E-W transect across the sill, to investigate the geological and climatic history of the coral reef ecosystem. These cores are investigated in a multi-proxy approach covering benthic biodiversity, carbonate budgeting, sedimentological, geochronological and paleoceanographical analyses, as well as measurements of physical core properties, like XRF-scans, gamma ray, magnetic susceptibility. As part of my PhD thesis I focus on the composition of foraminiferal assemblages, stable isotope- and XRF-analysis. Currently, my studies are concentrated on the on-mound core POS-325-472, recovered at 262 m water depth from the Late Glacial moraine, and on the off-mound core POS-325-482, recovered at 479 m water depth in the fjordbasin. Both cores have been dated at high-resolution with AMS- ^{14}C or U/Th and provide two contemporaneous archives spanning the entire Holocene. Stable oxygen and carbon isotopes of benthic foraminiferal tests as well as faunal assemblages are used to trace climatic and environmental changes across the last ~10 ka. Oxygen isotope compositions ($\delta^{18}\text{O}$) of benthic foraminifera (*Cassidulina laevigata* and *Cibicides lobatulus*) indicate deep-water renewal, while their stable carbon isotope compositions ($\delta^{13}\text{C}$) are used as a proxy for or-

ganic matter flux and for oxygen availability within the sediments. Changes in the faunal assemblages will further trace variations in current velocity, climate, nourishment and seafloor-oxygenation, but will also be used to characterize differences between on- and off-mound communities.

2.3 First results

Cores and JAGO-submersible dives revealed eroded coral rubble, coral pavements, winnowed boulders (glacial lag deposits), pro-glacial debris-flow deposits and glaciomarine-rhythmites overgrown by isolated *Lophelia pertusa* patches on the western flank of the sill. Postglacial coral reef deposits were detected across the sill crest. On top of the Late Glacial moraine *Lophelia pertusa* colonies prosper forming two reefs, each measuring about 400 m across and up to 100 m width. In the outer parts of the reefs *Lophelia* competes with *Paragorgia* and *Mycale lingua* (sponge) for spaces. The offreef-reef transition is sharply marked by living corals growing over rubble apron (FREIWALD et al. 2005). The adjacent fjordbasin comprises muddy sediments.

First analyses of the benthic foraminifers in the on-mound core (POS-325-472) revealed an assemblage dominated by epifaunal attached species like *Discanomia coronata* and *Cibicides* spp.. These species are frequently reported from current swept environments and/or living cold-water coral environments (SCHÖNFELD 2002, MARGRETH et al. 2009). In contrast the fjordbasin communities (POS-325-482) are characterized by (shallow) infaunal species like *Brizalina skagerrakensis*, *Cassidulina laevigata* and *Nonionellina labradorica*. Generally infaunal species are more tolerant towards oxygen deficiency and are characteristic amongst others for fjord environments (e.g. HUSUM & HALD 2004, MURRAY 2006, VÁZQUEZ RIVEIROS & PATTERSON 2008). Remarkable is the extremely low number of planktonic foraminifers in both cores, which can be interpreted as low primary production in the low saline upper water column.

2.4 Conclusions

- Cores and JAGO-submersible transects revealed a complex facies zonation with live reefs, eroded coral rubble, basin-muds and glacio-marine deposits.
- Several on-mound cores show the contact with the underlying till of the Late Glacial terminal moraine, suggesting a Holocene coral growth.
- Planktonic foraminifera are scarce in basin and on-mound cores, reflecting low primary production in the low saline upper water column.
- Benthic foraminiferal assemblages in the on-mound core (POS-325-472) are dominated by epifaunal attached species like *D. coronata* and *Cibicides* spp. Basin communities (POS-325-482) instead are dominated by (shallow) infaunal species like *B. skagerrakensis*, *C. laevigata* and *N. labradorica*.

- The coral mound core comprises several hiatus, reflecting the current dominated setting. The postglacial record instead comprises a homogenous and continuous high-resolution sequence (60 cm/ka) in the fjordbasin.

3 Benefit of the participation

The benefit to participate in the 79th Annual Meeting of the German Paleontological Society was twofold: on the one hand it provided a (inter)national platform to discuss commonalities and new aspects in Recent to Holocene marine research with paleontologist who are mainly used to work with older (terrestrial) material. On the other hand my active participation advanced the visibility of marine research in classical paleontology. Therefore the participation in this meeting and in future Annual Meetings of the German Paleontological Society is considered of great importance for the current and future work.

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