

EuroMARC Short-Term Visit between CRPs (AMOCINT - GLOW)

Scientific Report

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1. Purpose of the visit

Short time visit to the University of Edinburgh, hosted by Prof. Dick Kroon (GLOW) took place between 25 November 2009 – 12 December 2009, to acquire and apply detailed fauna analyses for investigating the relationship between North Atlantic Deep Water (NADW), climate, and the Greenland Ice Sheet during the Penultimate Interglacial (MIS 5e).

As part of the AMOCINT (Atlantic meridional overturning circulation during interglacials) project, high-resolution stable isotopic analysis ($\delta^{18}\text{O}$ and $\delta^{13}\text{C}$) of planktic foraminifera (*G. bulloides*, *N. pachyderma* (sin) and *G. inflata*) and benthic foraminifera (*C. wuellerstorfi*), had recently been carried out on the calypso core MD03-2664 (cored during the IMAGES P.I.C.A.S.S.O cruise of the R/V *Marion Dufresne* of the French Polar Institute), from the Eirik Drift, off the southern tip of the Greenland margin, to reconstruct NW Atlantic climate, hydrography, and Greenland ice sheet activity and their relationship to North Atlantic Deep Water (NADW) variability during Marine Isotope Stage (MIS) 5. Utilizing an array of proxy methodologies is vital to better constrain the aspects of ocean-climate-ice coupling during the previous interglacial. Detailed fauna analyses were therefore necessary and very important in order to better constrain the peak warm period during the last interglacial period and elucidate the interplay between warming and freshening in the near surface water masses due to a reduced Greenland ice sheet. Therefore records gained from the foraminiferal counting will be a vital addition to this ongoing effort to depict the evolution of North Atlantic climate and surface ocean hydrography during Marine Isotope Stage 5e in unprecedented detail.

2. Summary of the work carried out during the visit

During the research stay in the University of Edinburgh, detailed analysis of the

foraminiferal fauna has been carried out. The necessary knowledge and skills were gained in the foraminiferal taxonomy of dominant species in tropical, sub-tropical, transition and polar zones. The method for the foraminiferal counting is acquired and performed on the selected samples from the core MD03-2664, from the Eirik Drift. Two intervals had been chosen in order to constrain the foraminiferal assemblages, based on the $\delta^{18}\text{O}$ results of planktonic foraminifera *N. pachyderma* (sin) and *G. bulloides*: the peak of the MIS 5e, and the transition from MIS6 – 5, in order to better constrain the peak warm period during the last interglacial period and elucidate the interplay between warming and freshening in the near surface water masses due to a reduced Greenland ice sheet. In this purpose, foraminiferal assemblages were analyzed in the 2700-2780cm (every 4cm) part of the core MD03-2664 during the research stay. Sediment samples of the size fraction $>150\mu\text{m}$ were split to give approximately 300 planktonic foraminifera for the counts. The actual number of planktonic foraminifera counted in a sample ranged from 261 to 936 specimens. The planktic foraminiferal assemblages of these first sets of samples and the interpretation of these primary results have been discussed with Prof. Dick Kroon and his team during the research visit.

3. Description of the main results obtained and their potential impact on the development of the individual EUROCORES project

The coiling ratios of *N. pachyderma* provide important information regarding the changes in temperature. Today, the left coiling (sinistral) form of *N. pachyderma* is the dominant species in polar regions, whereas the right-coiling (dextral) form is found in warmer regions. In the *N. pachyderma* (sin) dominated polar regions, typical coiling ratios of *N. pachyderma* (dex) are between 1% and $5\pm 1\%$ from counts of 300 individuals (Bauch et al. 2003). The coiling ratio of *N. pachyderma* (percentages of *N. pachyderma* (dex) of total *N. pachyderma*) and oxygen isotope results of *N. pachyderma* (sin) from the core MD03-2664 are shown in Figure 1. Primary results of the selected samples from the core MD03-2664 show that the *N. pachyderma* (dex) percentage of the coldest and the warmest sample vary between 6.4% and 82% respectively. The assemblage of the warmest samples contains abundances of sub-tropical, tropical species such as *G. bulloides*, *G. inflata*, *G. glutinata*, *G. scitula*, *O. universa*, *N. dutertrei* and *G. ruber*, while the abundance of colder samples have high percentages of *N. pachyderma* (sin) and *T. quinqueloba* (right) and *T. quinqueloba* (left).

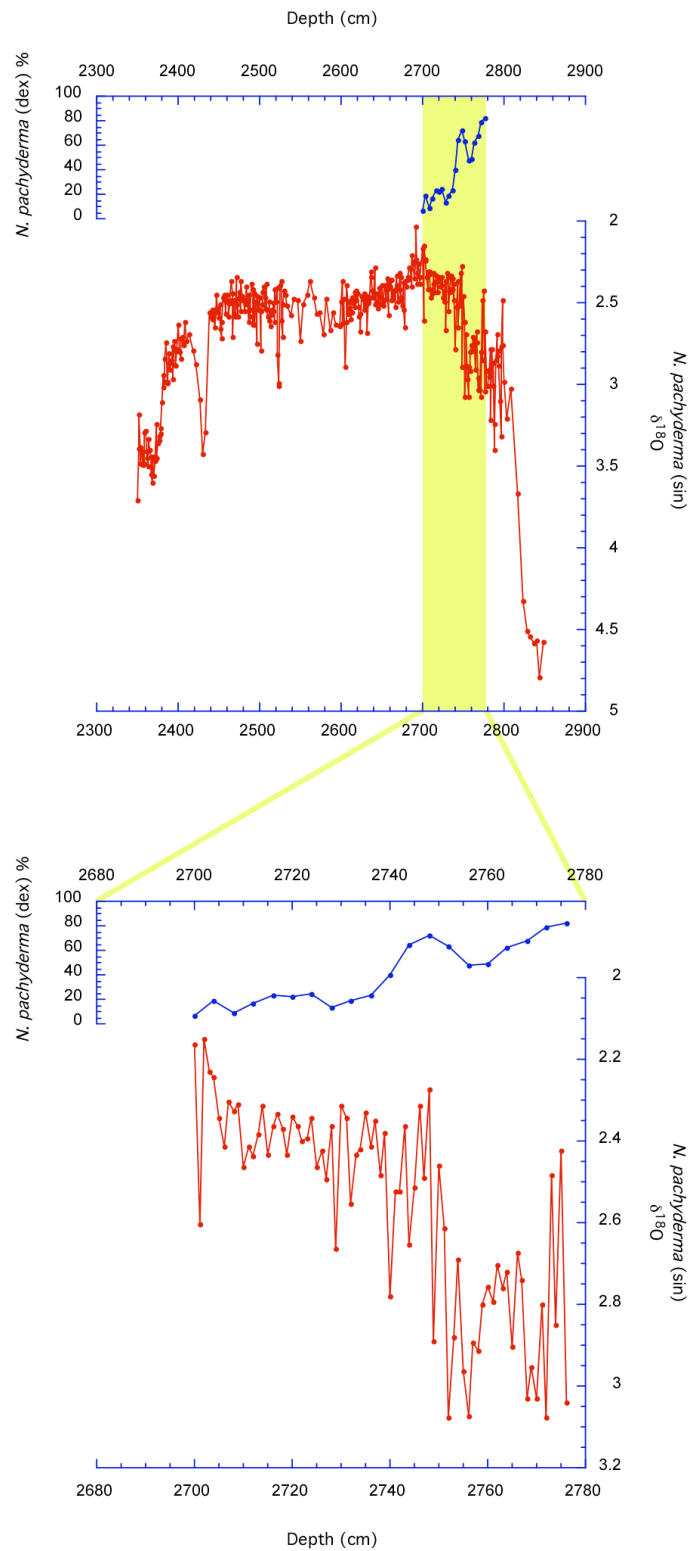


Figure 1. Primary results of *N. pachyderma* (dex) percentage counts compared with *N. pachyderma* (sin) $\delta^{18}O$ results from the core MD03-2664.

The sedimentary sequence from Eirik Drift is a unique site, with unusually high sedimentation rates, and ideal for investigating the relationship between North

Atlantic Deep Water (NADW), climate, and the Greenland Ice Sheet during the Penultimate Interglacial (MIS 5e); which is also one of the key objectives of the AMOCINT project. Therefore, using a multiproxy approach in this site, with the addition of detailed foraminiferal analyses, will have an important contribution on the objectives of the AMOCINT project.

4. Projected publications/articles produced already or to be submitted, resulting from the support

The acquired method of planktonic foraminiferal counting, resulting from the support of the ESF, will be performed through the rest of the selected samples from the core MD03-2664. The final results gained from these analyses will be published.