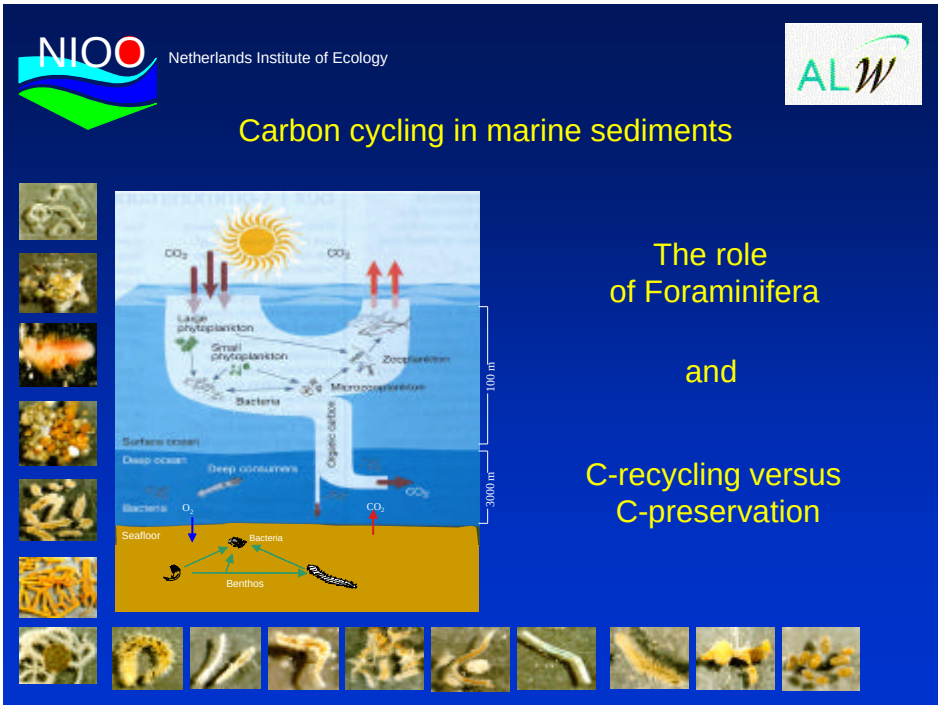
SHIPBOARD REPORT OF CRUISE 64PE193 (FORAMS)

WITH R.V. PELAGIA

TEXEL TO TEXEL, THE NETHERLANDS

12 April - 19 April 2002



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SUMMARY

Cruise 64PE193 was carried out as part of the ALW project “Forams” (ALW project number 811.33.006), primarily for the collection of sediment for long-term (30- 45 days) laboratory experiments at the NIOO in Yerseke. Experiments were designed to examine the short-term versus long-term fate of algal and bacterial carbon in marine sediments. The main sampling location was in the Skagerrak, northeastern North Sea. In addition, sediment was collected from two other depositional sites (German Bight and Friese Front) for on-deck, short-term experiments and experiments addressing specific aspects of carbon recycling versus carbon preservation.

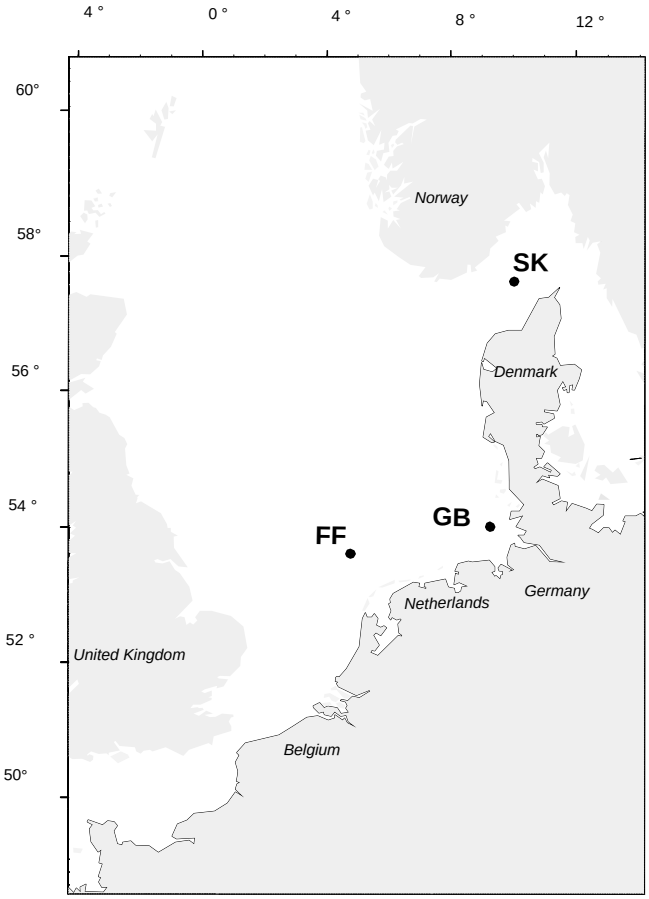

Figure 1. Location of stations.

Station	Position		Water depth	Date sampled
SK = Skagerrak	57° 50 N	10° 01 E	59 m	14 & 15 April
GB = German Bight	54° 05 N	08° 09 E	17 m	16 April
FF = Friese Front	53° 42 N	04° 32 E	33 m	17 April

ACKNOWLEDGEMENTS

Special thanks to the NIOZ-MRF group for providing and arranging the required equipment and facilities (e.g. coring devices and thermo-containers) on board. This and the captain and crew of the R.V. Pelagia contributed to the success of sampling and experiments during this short cruise. Theo Buisman is thanked for organizing the cruise. This research is financially supported by NWO-ALW.

INTRODUCTION and RESEARCH

Carbon Cycling in marine sediments and the role of Foraminifera (Protista).

The fate of phytodetritus shortly after its deposition is poorly understood in terms of which organisms have early access to it and the rates by which it is displaced and decomposed within the seabed (Blair et al. 1996). Understanding the fate of labile organic matter arriving at the seafloor is of great importance as it is the primary driving force of the benthic system. It has an impact on the magnitude and timing of various benthic fluxes and mineralization and life strategies of the benthic organisms (Levin et al. 1998).

Using ^{13}C-enriched diatoms as a tracer of labile carbon, we have recently established the relative importance of the different benthic compartments in the short-term (24 hrs) processing of organic matter (phytodetritus; Moodley et al. 2001, 2002). In contrasting marine environments, foraminifera are responsible for a surprisingly large fraction of the uptake suggesting that they may play a significant role in the trophic pathway of carbon within sediments. In this project, we will further address this question with a combination of experiments, in which we add ^{13}C labeled algae to benthic chambers in short-term deck incubations, and longer-term mesocosm experiments. In the short-term experiments, we will follow during a two to five day incubation period, the response of the benthic system as a whole (sediment oxygen uptake measurements, total inorganic carbon production rates), and the distribution of the labeled algal carbon over the different components of the benthic system. Groups with rapid assimilation will be heavily labeled with ^{13}C. Focus will be on dominant taxa of macrofauna, meiofauna (in particular Foraminifera), and bacteria. Bacterial assimilation will be assessed via analysis of ^{13}C of bacterial biomarkers.

In the longer-term mesocosm experiments the fate of labeled organic matter will be followed over a period of 3 months as it degrades into the older, more refractory classes and may become more restricted in its accessibility for certain groups. Foraminifera are the most powerful proxies in paleoecology yet we have limited knowledge on their ecology. Both the short-and long-term incubation experiments will provide insight into the relative role of Foraminifera in marine food webs and marine carbon cycle. In addition to the direct uptake of algal carbon, foraminifera may also be important grazers on bacteria, but little is known about their trophic dynamics or their ecological role in the sediment food web.

Bacteria are central components in the mineralization of organic matter and account for a major part of benthic biomass. Densities of bacteria in marine sediments are remarkably constant (Schmidt et al. 1998) but the cause of this consistency remains

elusive. Whether bacteria are sinks or links of organic matter is still a matter of debate. The fate of bacterial carbon and the role of the macro-and meiofauna therein will be examined. Using sediments collected during this cruise from the Skagerrak, we will address short-term versus long-term fate of algal and bacterial carbon and the role foraminifera in the benthic carbon cycle and food web using pre-labelled diatoms and bacteria.

In order to study the functional response of the benthos, sediment sampling was conducted at the three depositional sites (SK, DB and FF, see Figure 1). Earlier studies have highlighted the differences among these sites in terms of nutrient fluxes and macrofauna community structure (Lohse et al 1995; Dauwe et al. 1998). We will examine the contribution of three major benthic compartments (macrofauna, meiofauna and bacteria) to abundance and benthic biomass in relation to prevailing conditions.

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R.V. Pelagia Cruise 64PE193

SUMMARY OF ACTIVITIES

Departed from Texel on 12 April at 17.00hrs. See Figure 1 for location of stations. The first station was Skagerrak (SK), occupied 14 and 15 April. Due to excellent weather conditions, sediment sampling was very successful that finally allowed us to return a day earlier in order to initiate long-term laboratory experiments as soon as possible. Work at station DB was done on 16 April and finally work at station FF was done on 17 April. Return Texel on 18 April.

Basic activities at each station: Firstly, one or two CTD deployments for basic water column parameters (profiles of water temperature, salinity and dissolved oxygen concentration). Sediment samples collected with a large box corer. Box cores sub-sampled for macro- and meio-fauna down to 10 cm and environmental parameters including grain size, POC & TON content, Chl *a* and bulk sediment ^{13}C and ^{15}N.

BOTTOM WATER CHARACTERISTICS

Station	Temperature (°C)	Oxygenation (µM)	Salinity
SK	6.5	217.6	34.8
DB	7.1	220.8	31.6
FF	7.2	217.6	34.1

At the SK and DB station, additional box cores were collected for short-term (1-2 days) on-deck experiments at *in-situ* bottom water temperature (in thermo-containers). And at the SK station, a large number of cores were collected and maintained at in-situ temperature for later transport to Yerseke for the long-term mesocosm experiments.

SPECIFIC ACTIVITIES AND EXPERIMENTS

1. Apart from assisting in sampling, Drs. K.F. Uil was responsible for making a film, documenting some of the marine research carried out by the NIOO. A copy of this film will be sent to ALW and the NIOZ.
2. A comparison of macrofauna and meiofauna characteristics will be made between the three sites (aspects of taxa diversity, standing stock and biomass).
3. Short-term fate of algal and bacterial carbon was studied in temperature regulated containers on board at *in-situ* bottom water temperature.
4. Experiments designed to examine the long-term fate of algal and bacterial carbon (30-45 days) will be initiated in climate rooms at the NIOO in Yerseke.
5. Further laboratory experiments in Yerseke with sediment collected from stations SK and FF will include addressing specific aspects such as vertical resource partitioning by meiofauna, direct role of oxygenation in carbon re-cycling and the phenomenon of co-oxidation of carbon in marine sediments.