

Particulate carbon export during a bloom of *Emiliana huxleyi* in the Northwest European continental margin (northern Bay of Biscay)

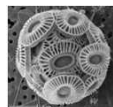
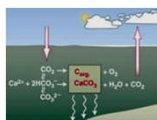
S. Schmidt¹, J. Harlay², A.V. Borges², S. Groom³, B. Delille², N. Roesvros⁴, L. Chou⁴

¹ OASU-EPOC, CNRS – Université de Bordeaux, Talence, France, s.schmidt@epoc.u-bordeaux1.fr
² Unité d'Océanographie Chimique, Université de Liège, Belgium
³ Remote Sensing Group, Plymouth Marine Laboratory, UK
⁴ Laboratoire d'Océanographie Chimique et Géochimie des Eaux, Université Libre de Bruxelles, Belgium

1. Context

Coccolithophores, among which *Emiliana huxleyi* is the most abundant and widespread species,

- are considered to be the main productive calcifying organism on Earth (McIntyre and Be, Deep-Sea Res., 1967);
- often form massive blooms in temperate and sub-polar oceans, in particular at continental margins and shelf seas (Holligan et al., Nature, 1983);
- contribute to the depth export of carbon through primary production (PP) (organic carbon pump) and calcification (CAL), but to the release of CO₂ through calcification (carbonate counter-pump)



Coccolithophores are thus likely to play a key role in the global carbon cycle

2. Objectives of this work

The objective of this work was to assess the impact of coccolithophore blooming on the efficiency of POC and PIC export (derived from ²³⁴Th) from upper waters to depth.

A field investigation, supported by near-real time remote sensing of sea surface temperature (SST), near sea surface Chlorophyll-a (Chl-a) and reflectance, was conducted on the outer shelf of the Northern Bay in May 2002 (cruise BG02/11; RV Belgica).

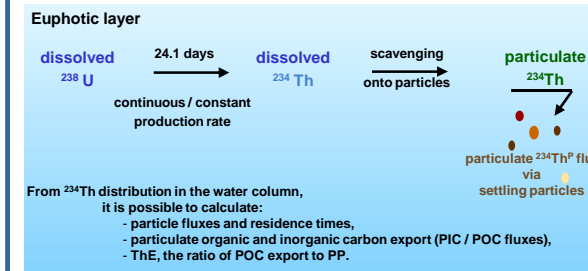
Biogeochemical variables:

PP, CAL, partial pressure of CO₂ (pCO₂), Chl-a, suspended particulate matter (SPM), POC, PIC, ²³⁴Th

were measured in surface waters to quantify particle export in relation with the development of a coccolithophore bloom.

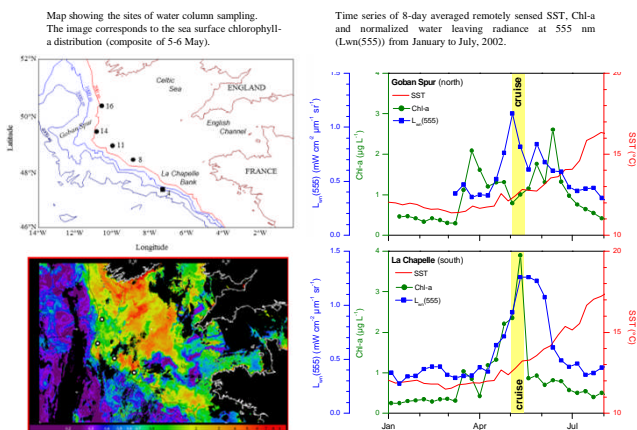
²³⁴Th: tracer of particle export

its short half-life is appropriate to study particle dynamic on timescales of weeks



3. Hydrological and biological context early May 2002 (cruise Be02/11)

along a transect on the outer shelf of the Northern Bay of Biscay between the La Chapelle Bank (south) and Goban Spur (north)

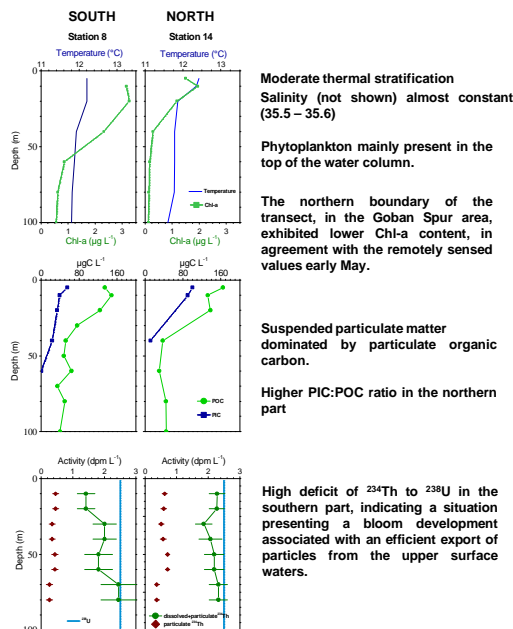


SST increased gradually from ~ 12°C in winter to around 17°C in July 2002. The increase in SST was more pronounced at the La Chapelle Bank, surface waters at the Goban Spur area were 1°C colder.

Remotely sensed Chl-a concentration showed the onset of the spring bloom in March. The bloom of the coccolithophore (Lwn(555) > 0.5) had begun in surface waters of La Chapelle area in mid April 2002 and persisted for two months.

Based on the remotely sensed data, the cruise was carried out during a period of high standing stock of coccolithophores at La Chapelle, and of peak to declining conditions in phytoplankton at Goban Spur.

4. Results



Moderate thermal stratification
Salinity (not shown) almost constant (35.5 – 35.6)

Phytoplankton mainly present in the top of the water column.

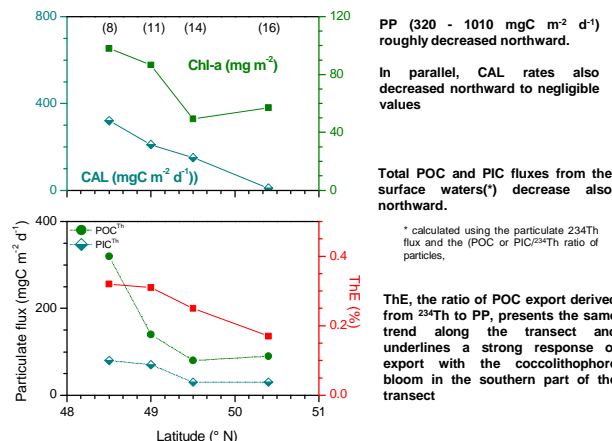
The northern boundary of the transect, in the Goban Spur area, exhibited lower Chl-a content, in agreement with the remotely sensed values early May.

Suspended particulate matter dominated by particulate organic carbon.

Higher PIC:POC ratio in the northern part

High deficit of ²³⁴Th to ²³⁸U in the southern part, indicating a situation presenting a bloom development associated with an efficient export of particles from the upper surface waters.

5. Implications for POC and PIC export



PP (320 - 1010 mgC m⁻² d⁻¹) roughly decreased northward.

In parallel, CAL rates also decreased northward to negligible values

Total POC and PIC fluxes from the surface waters(*) decrease also northward.

* calculated using the particulate ²³⁴Th flux and the (POC or PIC/²³⁴Th) ratio of particles.

ThE, the ratio of POC export derived from ²³⁴Th to PP, presents the same trend along the transect and underlines a strong response of export with the coccolithophore bloom in the southern part of the transect

In conclusion

Despite the high calcification rates at the southernmost stations, surface waters are a net sink of atmospheric CO₂ during the cruise. These results tend to demonstrate the positive impact of coccolithophore bloom on the efficiency of the ecosystem to export carbon to deep ocean.

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