SEDIMENTARY PIGMENTS IN THE BARENTS SEA: SOURCES AND DISTRIBUTION

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INTRODUCTION

Primary production on the Arctic shelves can be particularly high. In some areas, a high percentage of biological production sinks and reaches the sea floor. When benthic production is not sufficient, benthic community structure and function depends on these inputs from overlying pelagic production. Moreover, ice algae may be a significant carbon source for these benthic systems. The Barents Sea is a marginal ice zone, influenced in the south by Atlantic waters, and in the north by Arctic waters (Fig1). Primary production can be very high, and benthic-pelagic coupling is thought to be particularly tight.

Sedimentary pigments can be used as markers of inputs of organic matter to the sediment and therefore, might be useful for monitoring primary production and benthic-pelagic coupling. The most common of these markers is chlorophyll a (chl), a pigment found in all living, photosynthetic organisms. Its various degradation products are markers of processes such as grazing. Aside from chl and its degradation products, there are many other pigments, known as accessory pigments, which are indicative of certain algal groups.

MATERIAL AND METHODS

Sedimentary pigments

At 12 stations (Fig1), sub-cores were taken from a box corer. Each sub-core was extruded and sliced at 1 cm intervals. HPLC analysis was performed using the method of Chen (2001).

Water column pigments

In addition to collecting the sediment at these sites, the water column was sampled at the depth where maximal chla levels were found. The sampled water was filtered (GF/F filters) and HPLC analysis was performed using the method of Wright (1991).

RESULTS

1. Local chlorophyll a inputs

-Local water column chl a is the most determinant factor of sedimentary chl a.
-High correlation with surface fluxes suggests that ice-associated production plays a key role in inputs of fresh organic matter to the benthos.
-The relationship between sedimentary and overlying chl a is not different in spring from the summer; sedimentary chl a depends on short term local production and vertical fluxes.

Phytoplankton and ice algae species

-Fucoxanthin (diatoms) is the most dominant accessory pigment in the sediment (Tab1, Fig4). Diatoms are important phytoplankton (Fig2 and 3) and ice producers, and most likely play a major input of organic matter to the sediment.
-Atlantic waters contain more haptophytes while Arctic waters contain more green algae. 19’-hex-fucoxanthin (haptophytes) and chl b of 80% and 60% respectively in the summer. In the spring however, accessory pigments are dominated by fucoxanthin regardless of the water masses’ influence.

2. Inputs of grazed material

-The main input of degraded pigments from water column is grazed material.
-Sedimentary degraded pigments are related to water column phaeopigments, but the relationship is weaker than for chl a, suggesting that sedimentary degraded pigments depend not only on water column inputs, but also degradation within the sediment.
-Atlantic waters contain more haptophytes while Arctic waters contain more green algae. 19’-hex-fucoxanthin (haptophytes) showed spatial variation matching the water masses patterns in the summer. In the spring however, accessory pigments are dominated by fucoxanthin regardless of the water masses’ influence.

3. Research questions

How do sedimentary pigments vary seasonally and spatially?
Do they reflect overlying local production and processes?

CONCLUSIONS

Local primary production from phytoplankton and ice is the main input of fresh organic matter to the benthos.
-In the spring, diatoms are a particularly important source of organic matter to the benthos. In the summer, inputs of organic matter seem to depend more on the type of water mass.
-Since water column events are episodic, it is hard to study temporal and spatial variations. In the spring, more non-degraded material reaches the sediment, probably due to less grazing. Conversely, in the summer material is more degraded, probably due to increased grazing.
-The relation between benthic oxygen demand and chlorophyll a pigments ratio indicate the importance of food quality for the benthos.
-Benthic-pelagic coupling is very light in both spring and summer.

Figures 1: Map of the CABANERA study area. The stations where sedimentary pigments were sampled are represented by circles (CABANERA I, July 2004, stations 1, 2, 3, 4, diamonds (CABANERA II, July-August 2004, stations 8, 10, 11, 12) and triangles (CABANERA III, April 2005, stations 15, 16, 17, 18).

References


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