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* (chla), a pigment found in all living, photosynthetic organisms. Its various degradation products are markers of processes such as grazing. Aside from chla and its degradation products, there are many other pigments, known as accessory pigments, which are indicative of certain algal groups.

Research questions

How do sedimentary pigments vary seasonally and spatially?

Do they reflect overlying local production and processes?

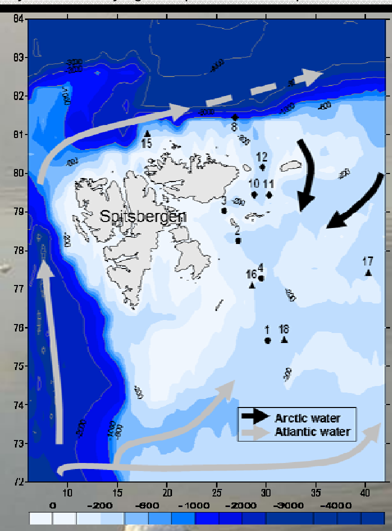

Figure 1: Map of the CABANERA study area. The stations where sedimentary pigments were sampled are represented by dots (CABANERA I, July 2003, stations 1, 2, 3, 4), diamonds (CABANERA II, July-August 2004, stations 8, 10, 11, 12) and triangles (CABANERA III, April 2005, stations 15, 16, 17, 18).

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

Water column pigments and phytoplankton species

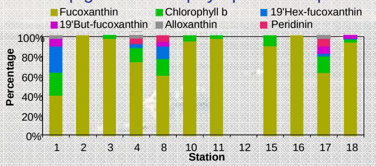

Figure 2: Percentage of water column accessory pigments for each station.

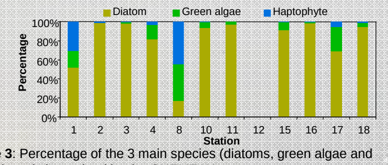

Figure 3: Percentage of the 3 main species (diatoms, green algae and haptophytes) determined by the CHEMTAX program.

Sedimentary pigments

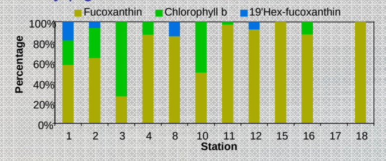

Figure 4: Ratios of the major accessory pigments found in the sediment.

Table 1: Sedimentary pigments determined by HPLC (µg of pigment g^{-1} dw).

Station	Chl *a*	Phorbid *a*	Pphorbid *a*	Phytin *a*	Pphytin *a*	CCE	Fuco	Hex	Chl *b*	Chl *a* / Tpheo
1	0.464	0.296	0.006	1.09	0.142	0.075	0.133	0.041	0.056	
2	0.784	0.47	0.022	3.491	0.537		0.203	0.018	0.093	
3	0.064	1.202	0.015	0.962	0.218	0.037	0.004		0.01	
4	0.309	0.26	0.024	0.501	0.03	0.213	0.152		0.021	
8	0.166	0.081	0.006	0.152	0.026	0.24	0.081	0.013		0.197
10	0.163	0.795	0.039	1.451	0.189		0.024		0.024	0.046
11	1.069	0.633	0.025	1.142	0.159	0.337	0.404		0.01	0.42
12	0.656	0.113	0.016	0.666	0.527	0.036	0.288	0.023		0.073
15	2.801	1.81	0.024	0.245	0.251	1.649	1.541			0.507
16	0.676		0.011	0.134	0.032		0.127		0.017	0.595
17			0.065	0.04						0.14
18	0.421	0.01	0.454	0.171	0.013		0.163			0.591

Local chlorophyll *a* inputs

-Local water column chla is the most determinant factor of sedimentary chla.

-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 chla is not different in spring from the summer: sedimentary chla depends on short term local production and vertical fluxes

	Sediment chla	Total chla	Surface chla flux	Chla flux at 90m
Sediment chla	1			
Total chla	**0.86***	1		
Surface chla flux	**0.96***	**0.88***	1	
Chla flux at 90m	**0.87***	**0.91***	**0.88***	1

Phytoplankton and ice algae species

-Fucoxanthin (diatoms) is the most dominant accessory pigment in the sediment (Tab1, Fig4). Diatoms are important phytoplankton (Fig2 and3) 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 chlorophyll *b* (green algae) 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.

	Sediment chla	Sediment fucoxanthin	Surface chla flux
Sediment chla	1		
Sediment fucoxanthin	**0.98***	1	
Surface chla flux	**0.96***	**0.99***	1

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.

-The ratio sedimentary chla/phaeopigments is higher in the spring. "Fresher" material reaches the benthos in the spring while in the summer, organic matter reaching the sediment is more degraded, especially by grazing.

	Sediment phaephorbid *a*	Sediment CCE	Sediment fucoxanthin	Total water phaeopigment	Total sediment phaeopigment
Sediment phaephorbide *a*	1				
Sediment CCE	**0.76***	1			
Sediment Fucoxanthin	**0.68***	**0.97***	1		
Total water phaeopigment	**0.85***	**0.94***	**0.65***	1	
Total sediment phaeopigment	**0.86***	**0.97***	**0.97***	**0.69***	1

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 chla/phaeopigments ratio indicate the importance of food quality for the benthos.

-Benthic-pelagic coupling is very tight in both spring and summer.

REFERENCES

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