Pelagic-benthic coupling of the eastern Beaufort Sea revealed by sedimentary pigments

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INTRODUCTION

Primary production on Arctic shelves can be particularly high. In some areas, a high percentage of biological production sinks and reaches the sea floor where it is cycled by the benthos. In areas where benthic production is not sufficient, benthic community structure and function are tightly linked to production in overlying pelagic zone and vertical flux. Moreover ice algae may be a significant carbon source for these benthic systems.

The response of benthic communities to deposition of phytodetritus can be very rapid. Part of the organic matter input is stored in the biomass, another part is respired, and another is buried. To test how closely the fate of carbon is linked to pelagic processes, we ask:

How does the variation in productivity regime influence the patterns of organic matter inputs to the benthos? How do benthic processes respond to these variations of inputs?

METHODS

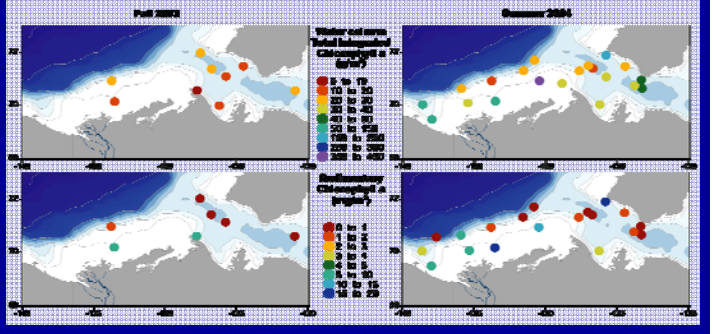
Phytoplankton
POM from the chl max was extracted in acetone and analyzed by HPLC. Phytoplankton species composition was estimated using CHEMTAX.

Sedimentary pigments
Top 2 cm of sediment were analysed by HPLC (Chen 2001) and Fluorometry.

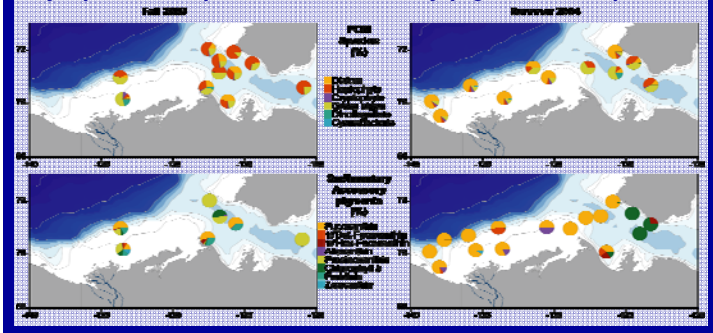
Local inputs of chlorophyll *a*

There is a significant correlation between water column chl *a* and surface sedimentary chl *a*. Highest sedimentary chlorophyll *a* contents found on the shelf, lowest in the gulf.

Water column integrated chl *a* - Sedimentary chl *a*



Phytoplankton species - Sedimentary pigments composition



Phytoplankton species importance

Spatial and seasonal variations in phytoplankton reflected in sedimentary pigments composition.
Summer: shelf sediments show more diatom pigments (Fucoxanthin), and the gulf more green algae pigments (Chlorophyll *b*). Importance of ice-algae diatoms?
Fall: high composition of small cells in the water column reflected in an eclectic sedimentary pigment composition.

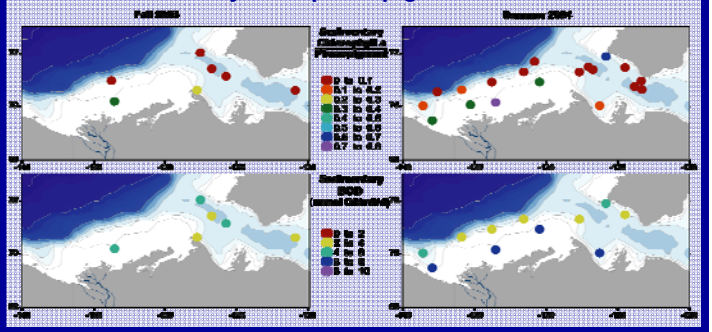
Degradation pigments

Ratio chl *a*/phaeo lowest in the gulf, suggesting inputs of more degraded material there, and fresher organic matter on the shelf. More phaeophorbide (grazing) in the summer.

Sediment oxygen demand

SOD highest on the shelf. Correlation with the sedimentary chl *a* and ratio. Importance of fresh phytodetritus for benthic activities.

Sedimentary chl *a*/phaeopigment ratio - SOD



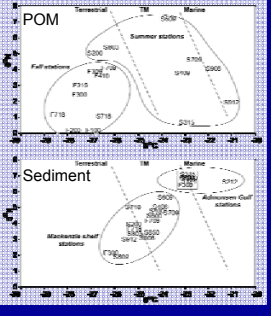
Pigment vs. isotopes as biomarkers

Sedimentary pigments
reflected seasonal and spatial variations in pelagic-benthic coupling

Summer: input of fresh organic matter to the benthos from overlying water
Fall: the material reaching sediment is composed by smaller cells, and more degraded. Inputs from the river

Sedimentary stable isotopes
highlighted spatial variations (POM: seasonal variation)

Shelf area: under terrestrial inputs influence
Amundsen Gulf: marine signature; material reaching the sediment is heavily degraded, benthic activity is low



CONCLUSION

	summer	fall	shelf	gulf
ice algae	√		√	
phytoplankton	√	√	√	√
grazing	√		√	
river input		√	√	
benthic activities	phytodetritus	O.M.	high	low

The pelagic-benthic coupling is particularly tight on the continental shelf, while in the polynya, most of processes seem to occur in the water column.

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