A multiple biomarker approach to tracking the fate of an ice algal bloom

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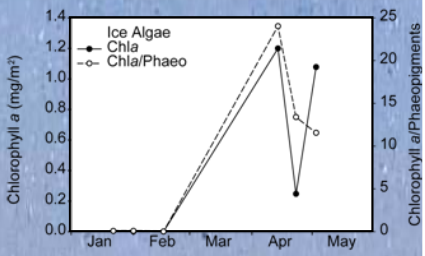
INTRODUCTION

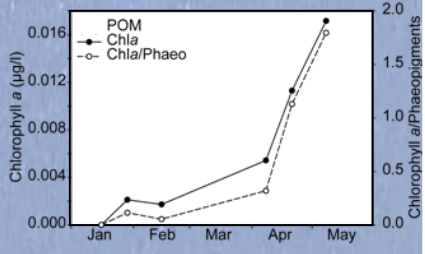
In ice-covered areas in the Arctic, production by ice algae can be the main input of organic matter to the ecosystem. Pelagic-benthic coupling is thought to be particularly tight in those areas. The increase of ice algal production in Franklin Bay from January/February to April/May 2004 was found to be accompanied by an increase in sediment oxygen demand (SOD, Renaud et al. 2007). However sedimentary chlorophyll *a*, which is usually an indicator of inputs of "fresh" organic matter to the sea floor, did not increase. Consequently, it was asked what was the fate of ice algal phytodetritus arriving at the sea floor?

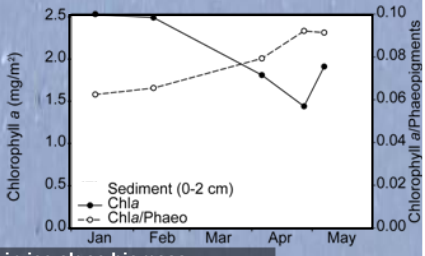
In order to answer that question, photosynthetic pigments from the sea ice, particulate organic matter, and sediment, and diatom frustules in the sediment, were studied from January to May 2004.

Franklin Bay
- seasonally covered by ice
- ice algae as main source for benthos during ice covered period

1) Is there really an increase in ice algae inputs to the sea floor throughout the spring?

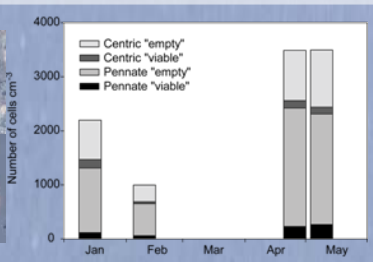






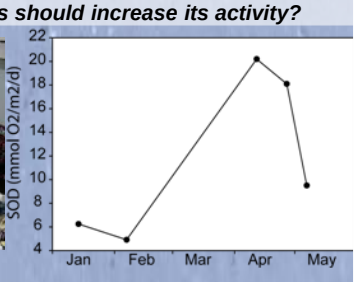
- ✔ Increase in ice algae biomass
- ✔ Increase in vertical fluxes of ice algae
- ✗ No increase of sedimentary chla

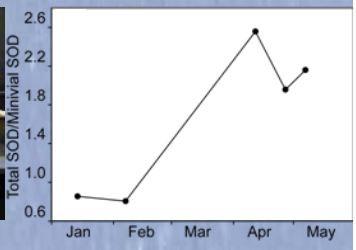
2) What about diatom frustules in the sediment?



✔ Increase in diatom frustules in sediment

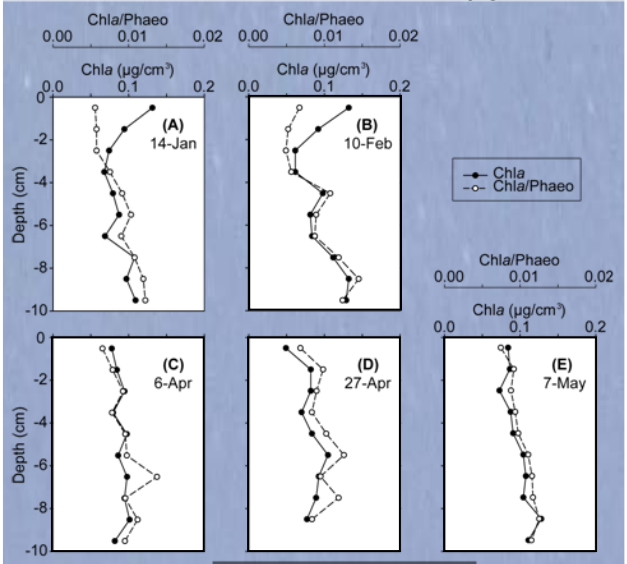
3) So if there is an increase of fresh material reaching the sediment, the benthos should increase its activity?





✔ Increase in macrofauna activity

4) When increasing activity, maybe the macrobenthos increases also bioturbation and burial of pigments?



✔ Increase in bioturbation

SUMMARY

Ice algal diatom cells in the sediment showed an increase in April/May, confirming the higher inputs of fresh ice algae to the sediment. Changes in sedimentary pigment profiles in the first 10 cm suggested an increase in sediment reworking due to the enhanced benthic activities. Finally, changes in phaeopigment composition and increase of total SOD vs. microfauna SOD implied an increase in macrobenthic activities. Benthic macrofauna consumed some of the deposited material and mixed some within the top five cm of sediment. The response of sedimentary pigments to ice algae input can be studied at different levels and it is the combination of these studies that allows understanding the overall fate of phytodetritus in the benthic compartment.