



The National Centre
for Research and Development



Marine sediment indicators in the Gulf of Gdansk and Oslofjord

a comparison of climate change impacts on the ecosystem

Grażyna Kowalewska, Hanna Mazur-Marzec, Gijs D. Breedveld, Tomasz Maciej Ciesielski, Anna Filipkowska, Malgosia Szymczak- yła, Ludwik Lubecki, Magdalena Laerec, Amy M.P. Oen



Institute of Oceanology of Polish Academy of Sciences
University of Gdansk
Norwegian Geotechnical Institute
Norwegian University of Science and Technology



UNIVERSITY OF GDANSK



Eutrophication, increase in biomass and algal blooms are traditionally believed to be a result of anthropogenic nutrient release

However, there are some indications that algal blooms have occurred in pre-anthropogenic times.

Can algal blooms be an indication of climatic change?

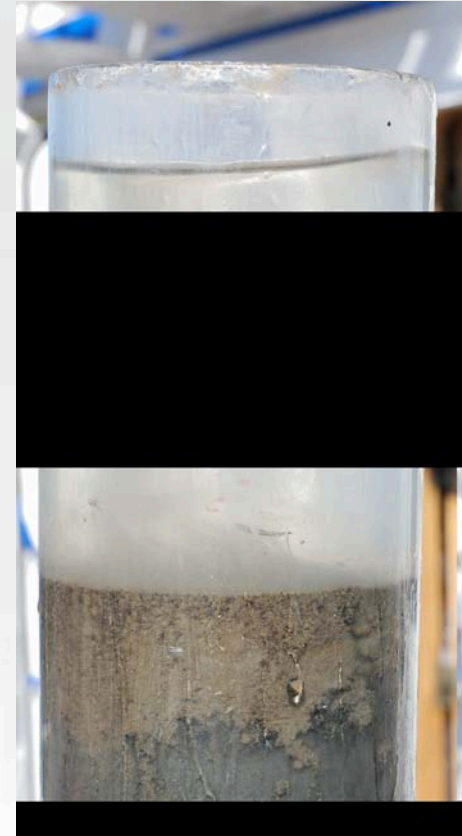
CLISED: Climate Change Impact on Ecosystem Health - Marine Sediment Indicators (2014-2017)



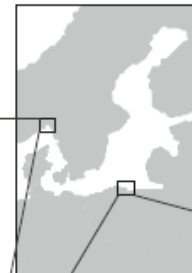
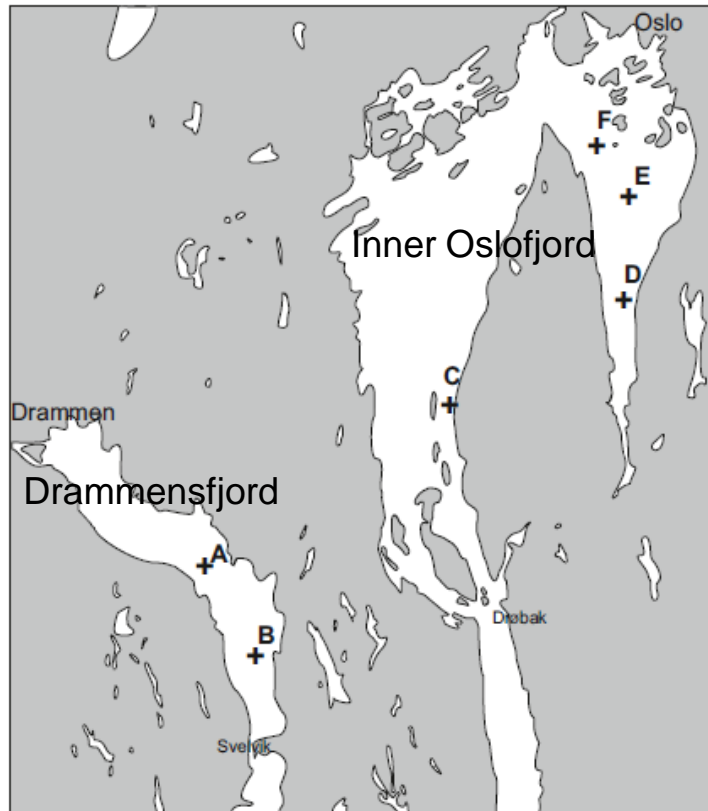
Phase I

Assessment of recent sediments in the Gulf of Gdansk and Oslofjord/Drammensfjord in terms of indicators of primary production, eutrophication and pollution

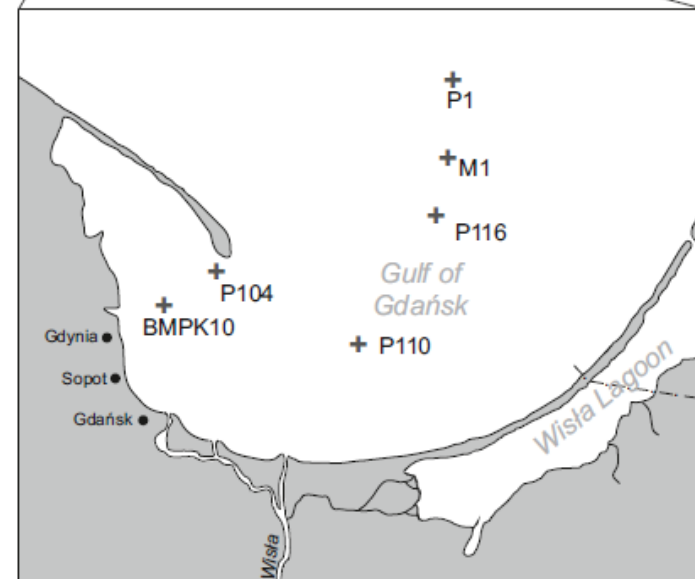
Selection of parameters suitable for deriving historical proxies of climate change in long sediment cores.



Oslofjord



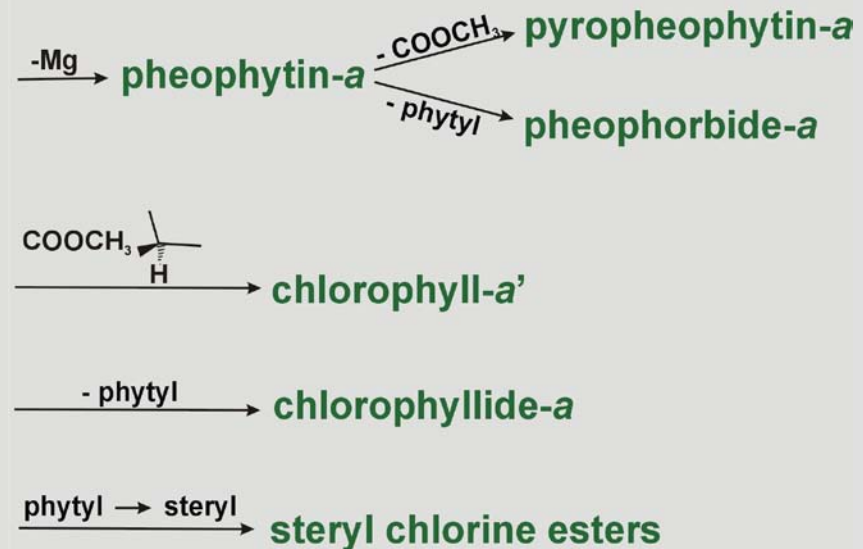
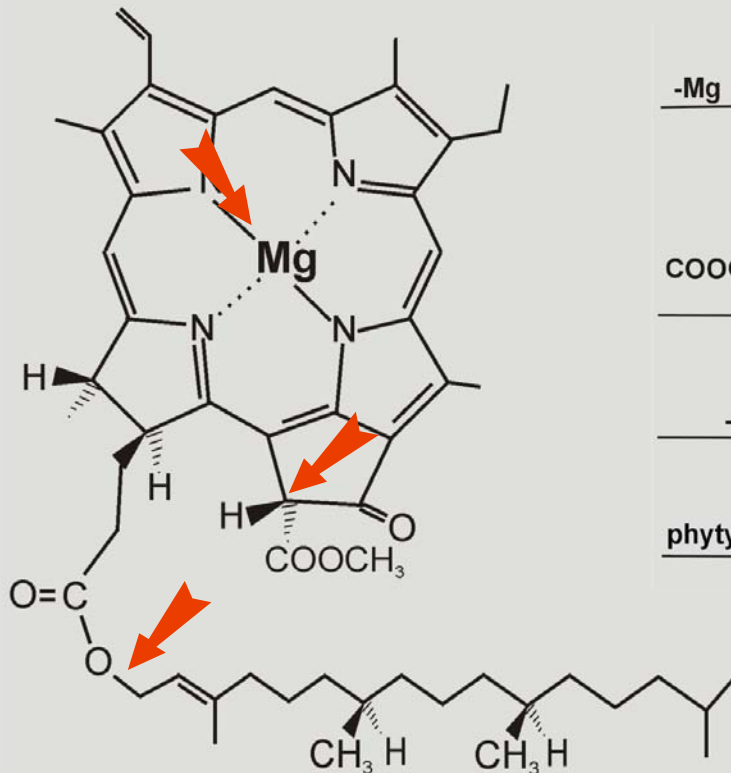
Gulf of Gdansk



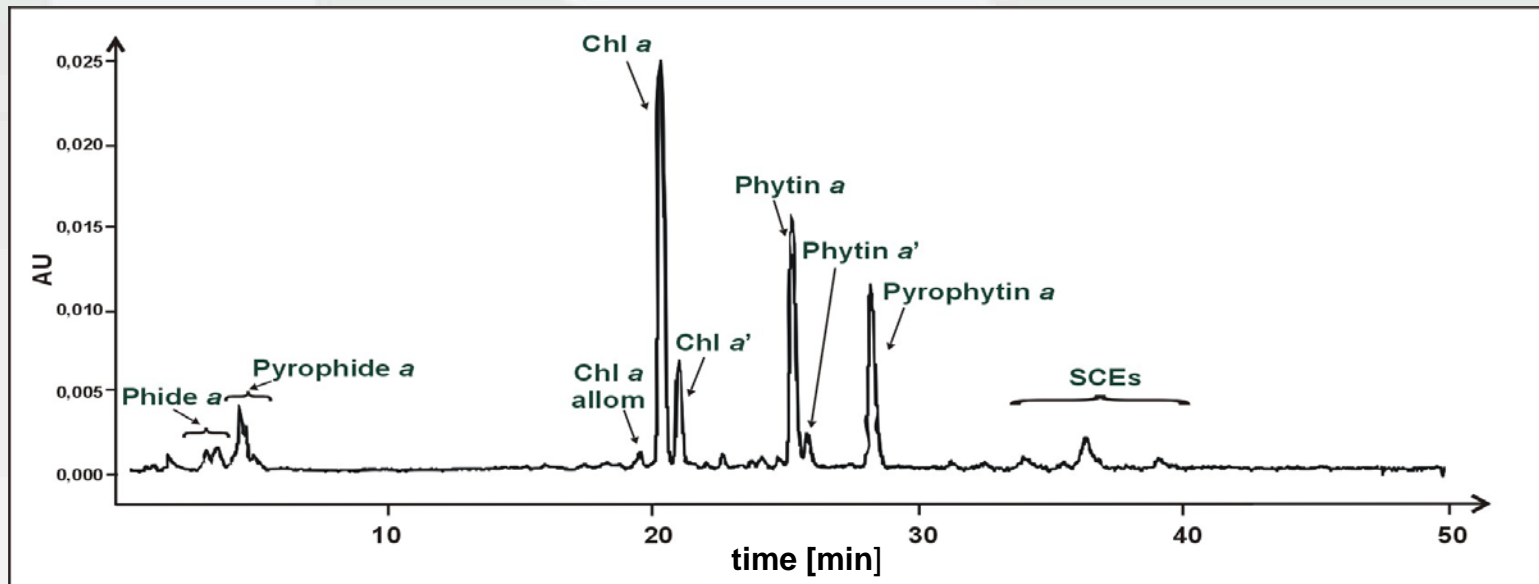
Characterisation of sediments

- phytoplankton pigments and degradation products
- ^{210}Pb sediment dating
- stable isotopes • ^{13}C , • ^{15}N , organic carbon and black carbon
- trace elements
- polycyclic aromatic hydrocarbons - PAHs
- nonylphenols - NPs
- organotin compounds - OTs
- biotoxins and toxin-producing phytoplankton organisms
- mutagenic, genotoxic and endocrine-disrupting activity

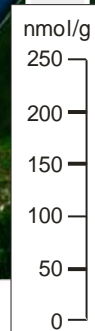
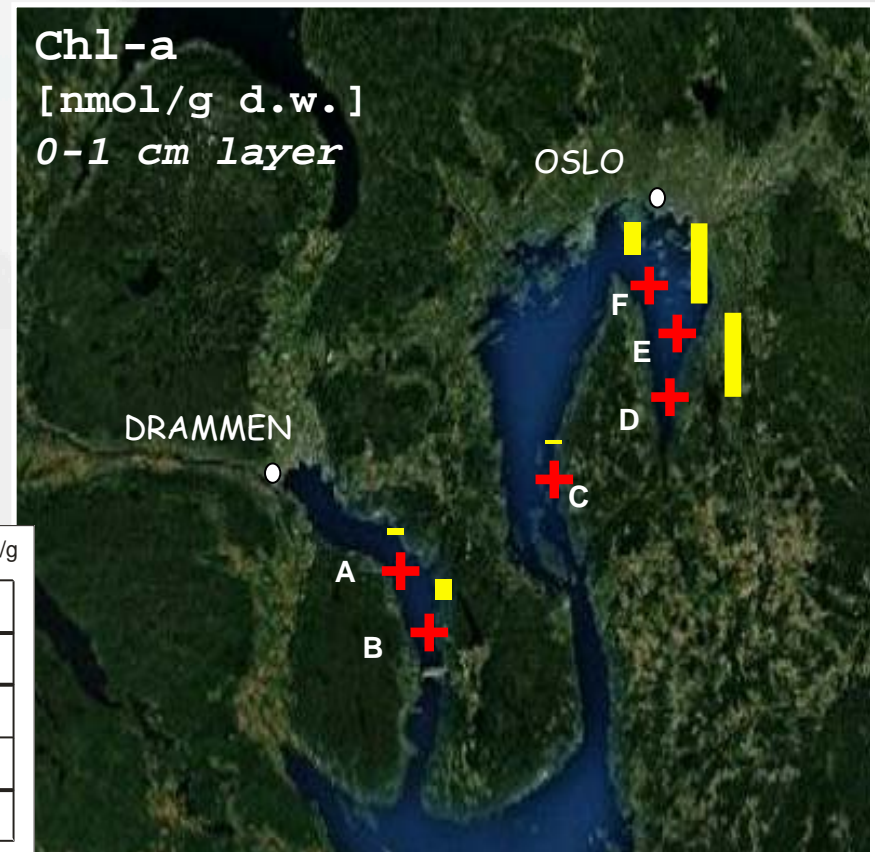
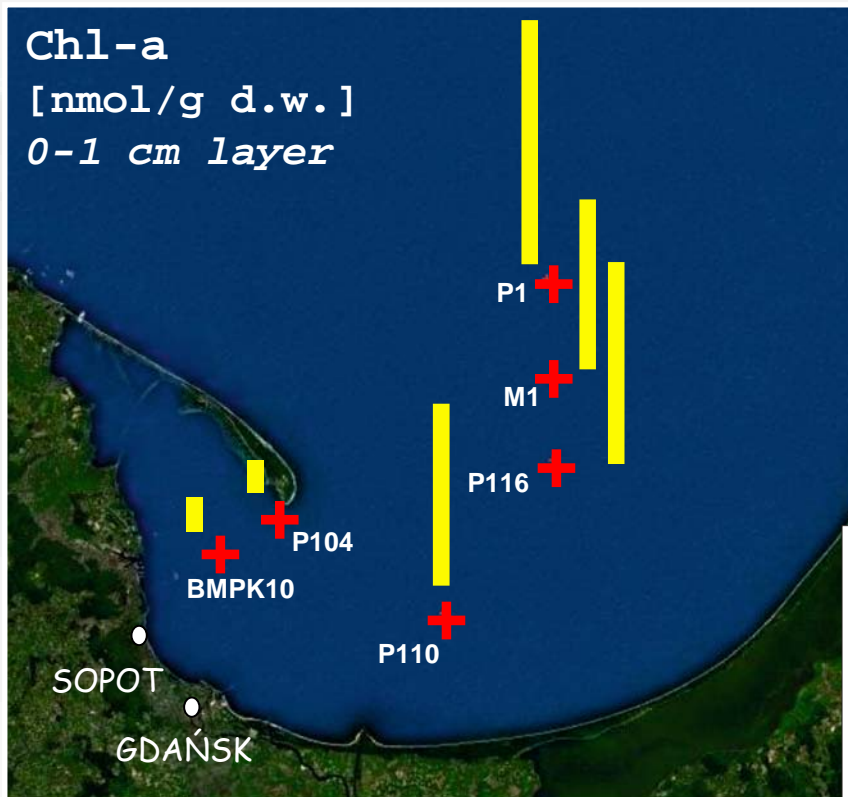
Chloropigments-a occurring in sediments are good quantitative and qualitative **indicators** of **productivity** and **depositional conditions**.



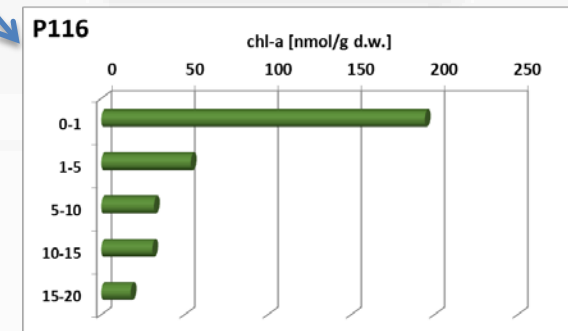
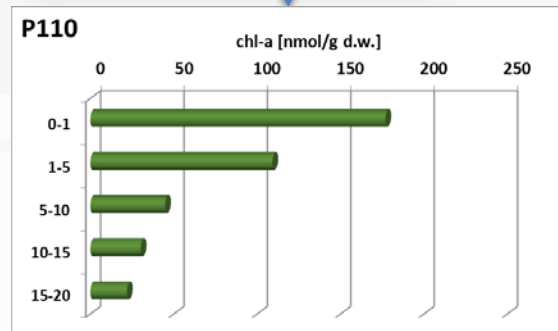
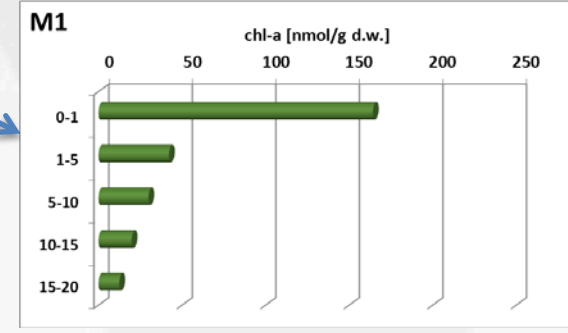
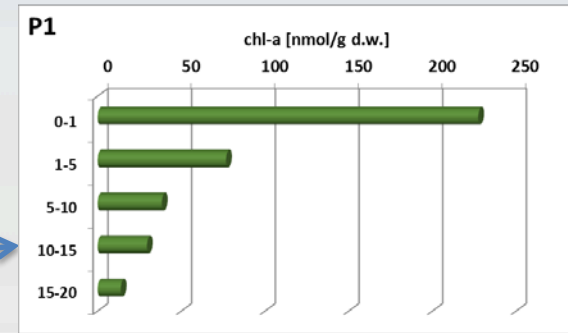
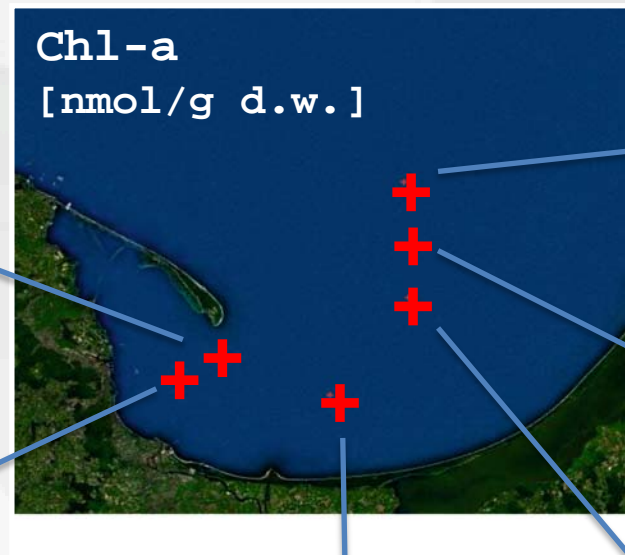
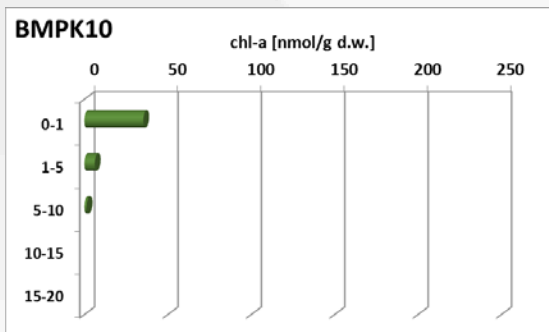
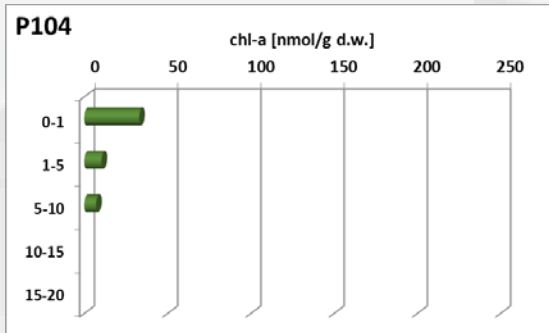
Example of chromatogram (HPLC - DAD, 660 nm)



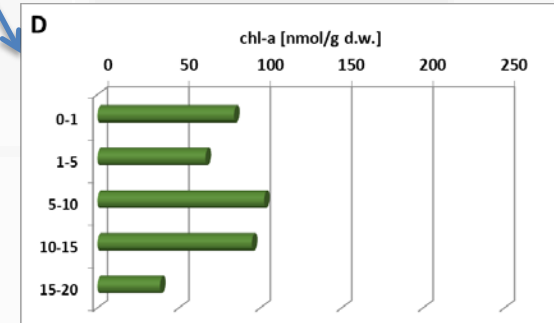
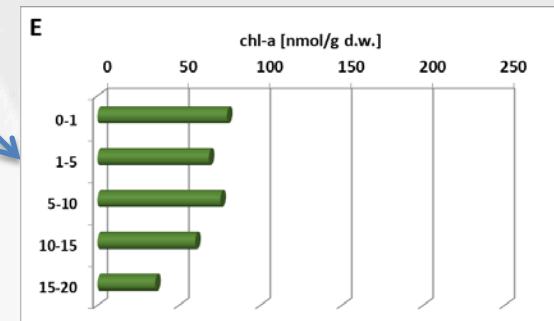
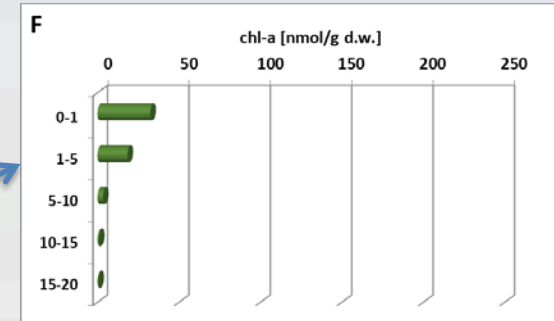
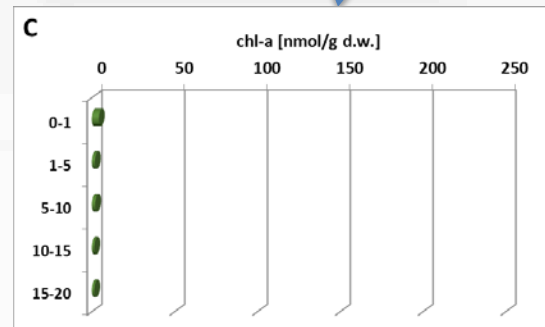
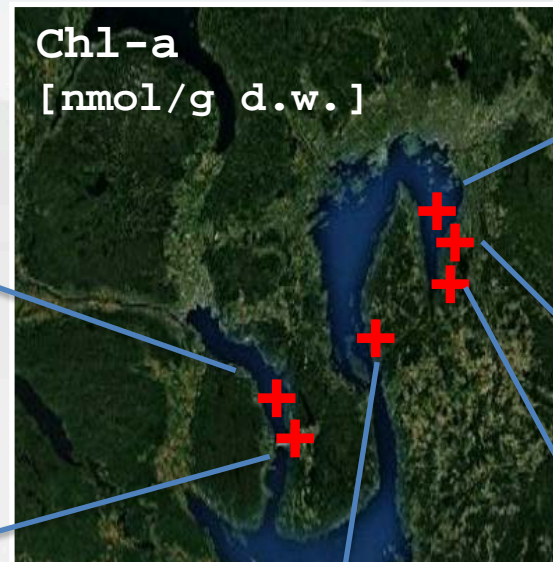
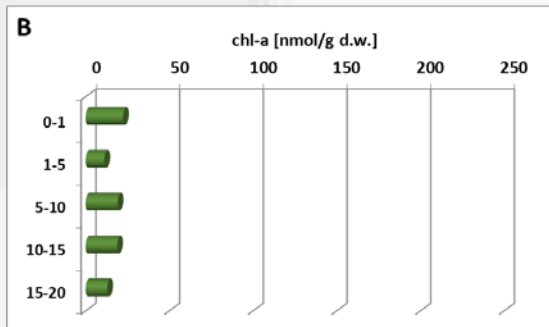
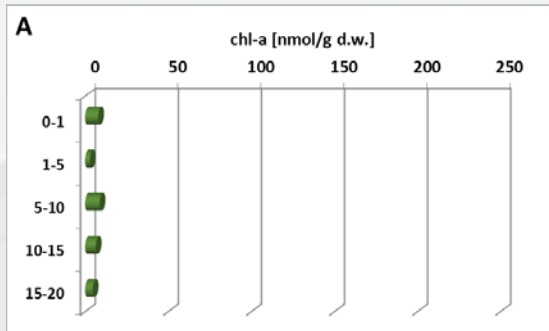
Phytoplankton pigments



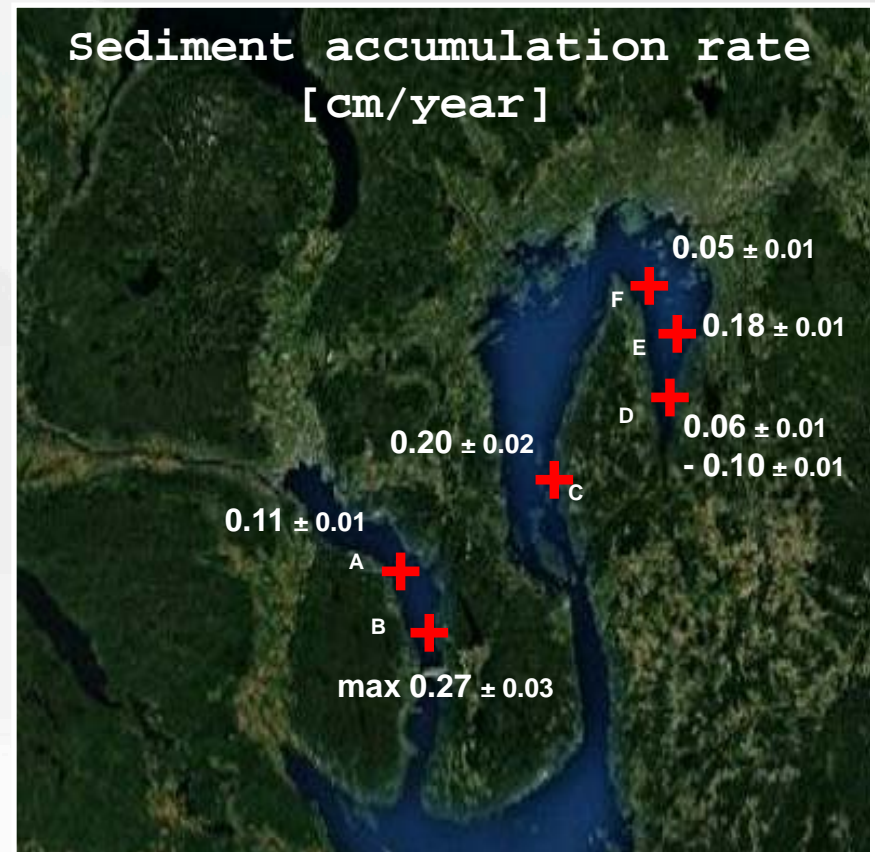
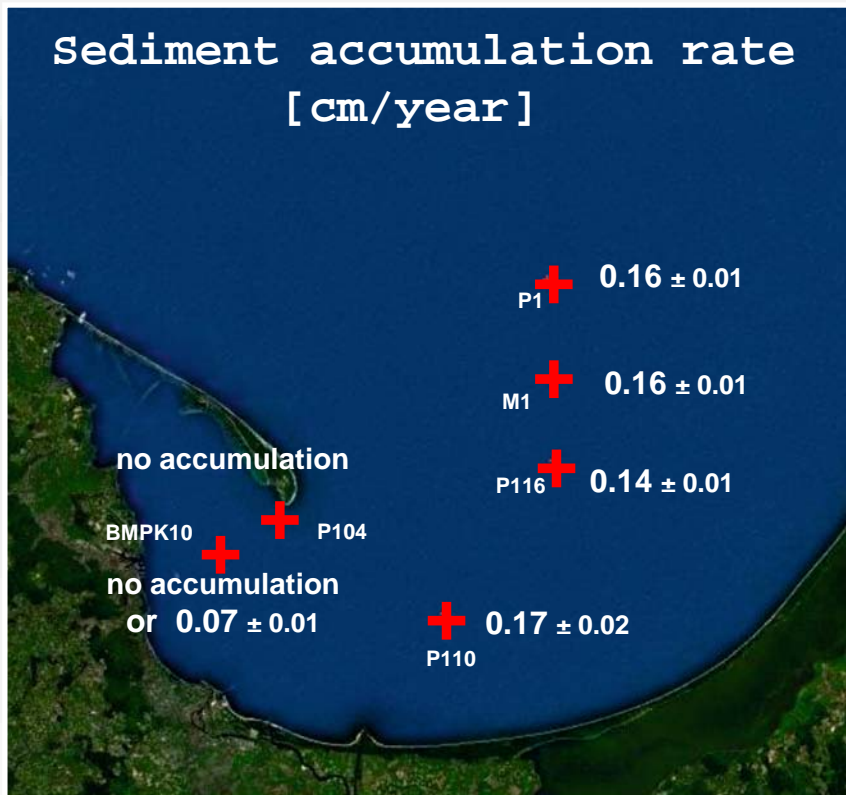
Phytoplankton pigments, Gulf of Gdansk



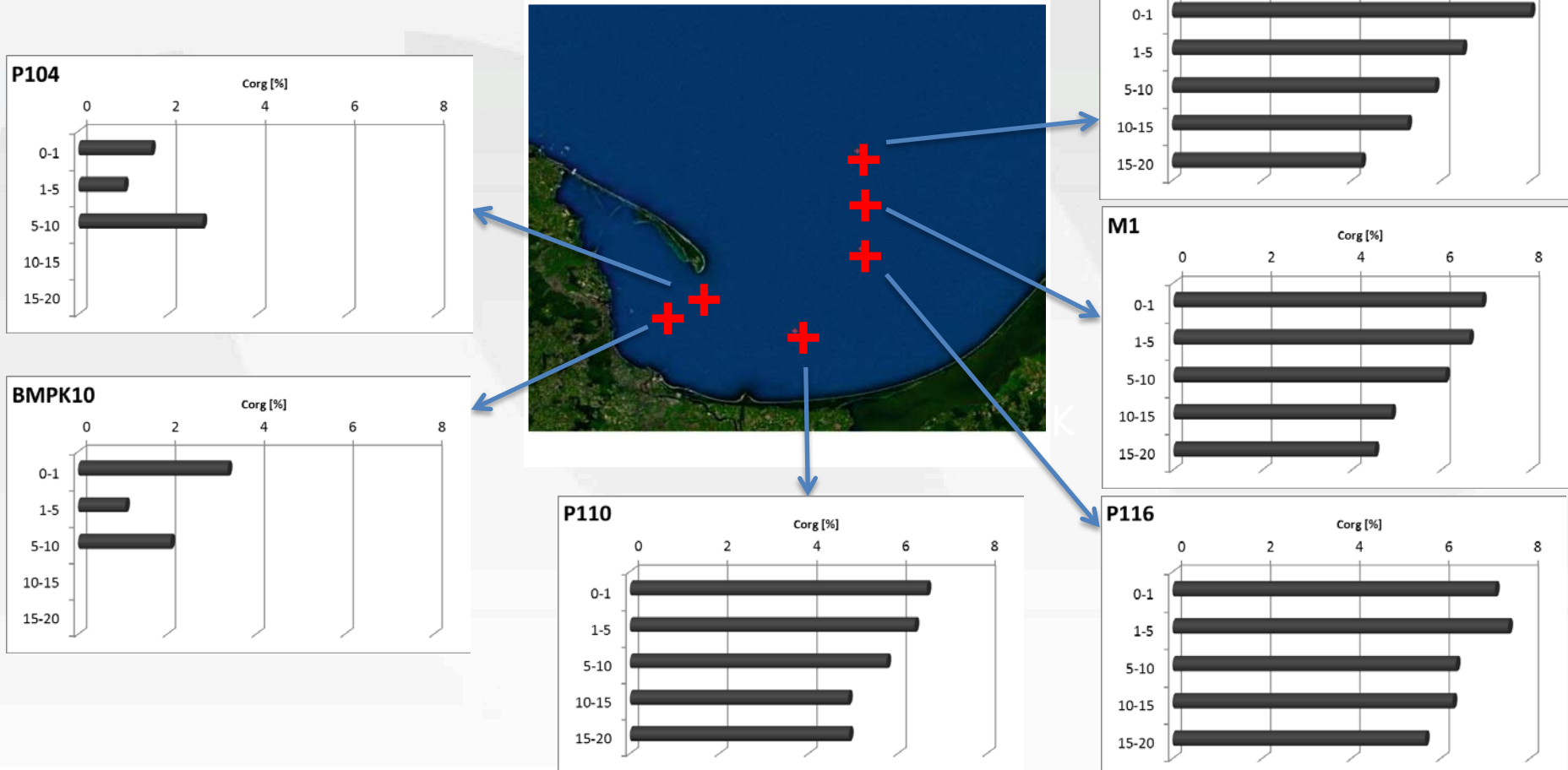
Phytoplankton pigments, Oslofjord



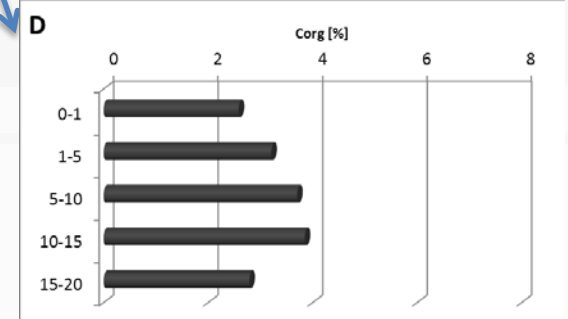
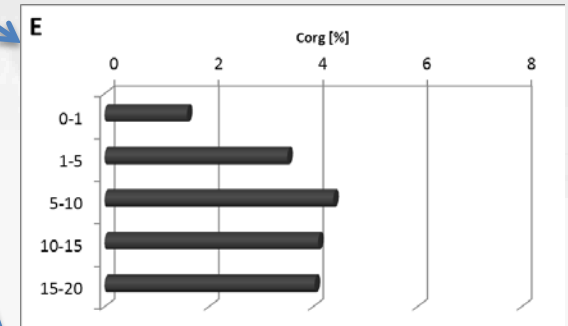
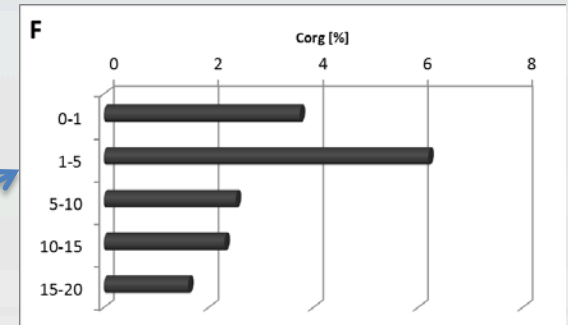
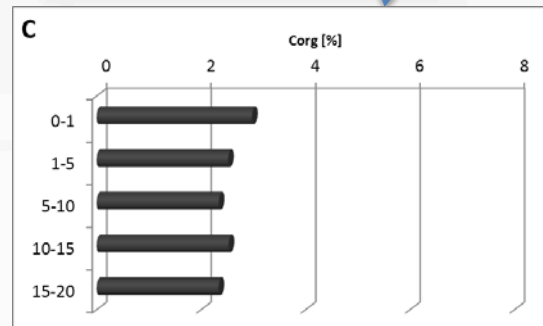
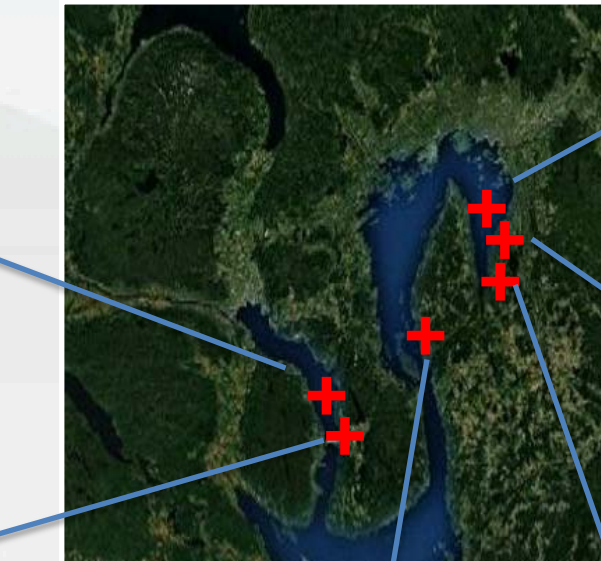
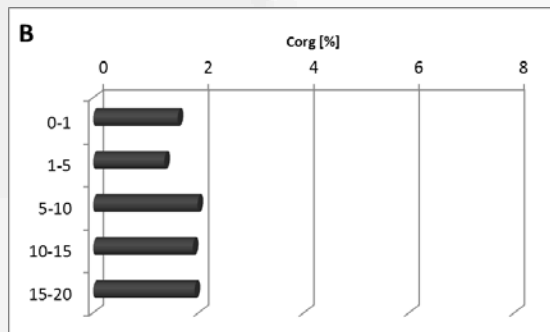
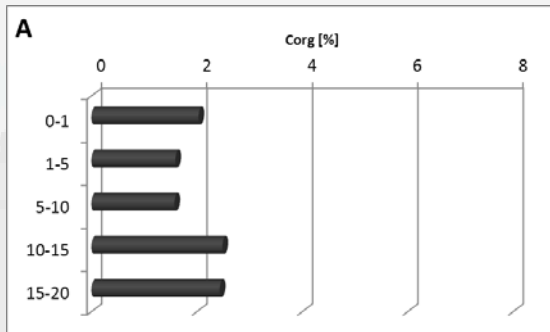
Sedimentation rates based on ^{210}Pb dating



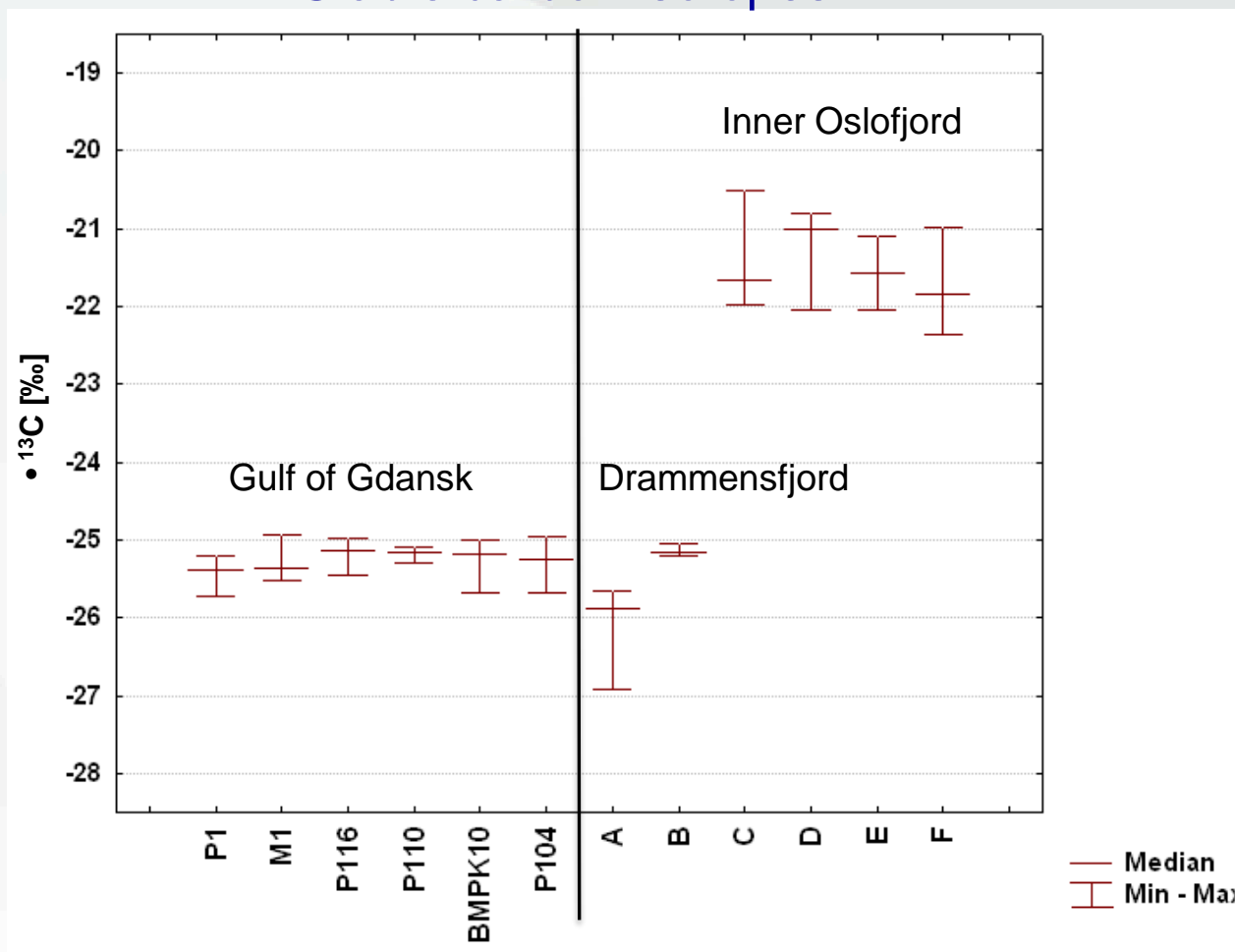
Organic carbon, Gulf of Gdansk



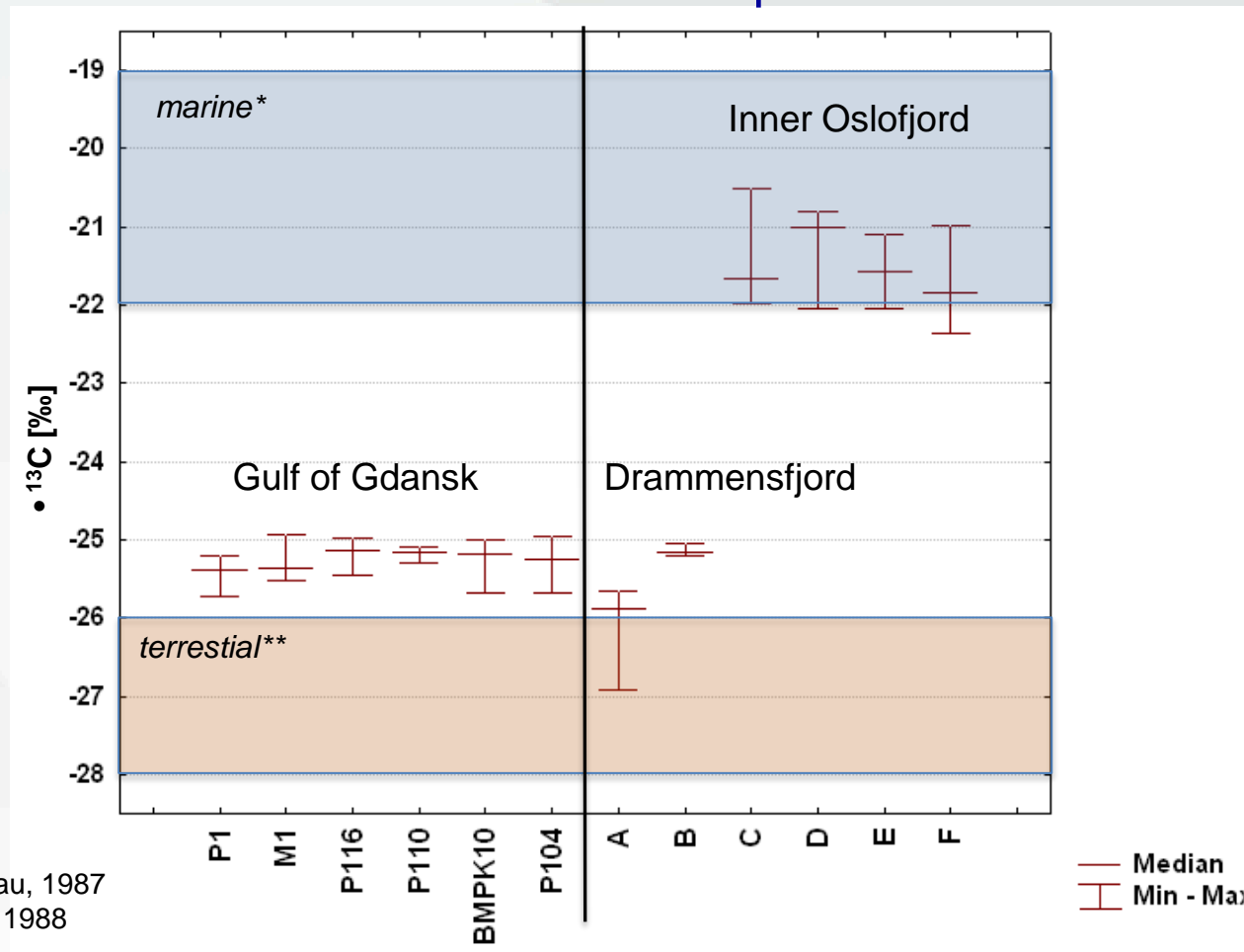
Organic carbon, Oslofjord



Stable carbon isotopes



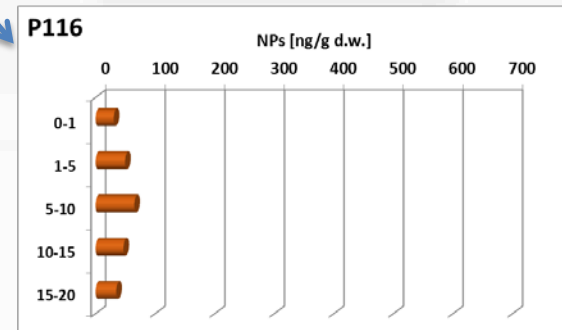
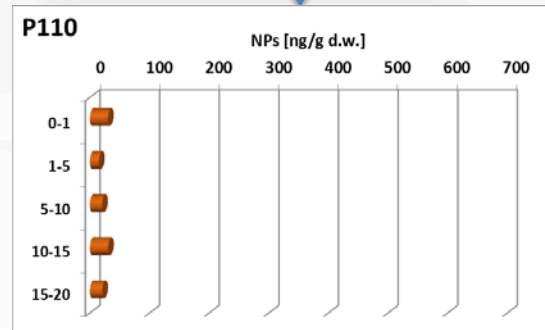
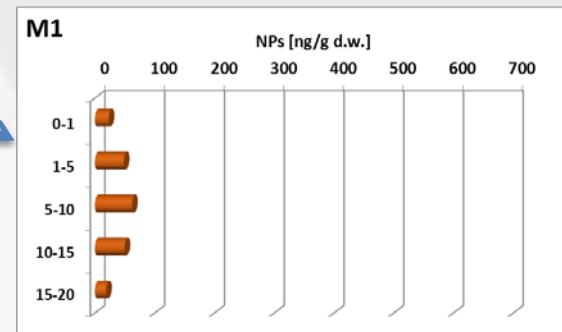
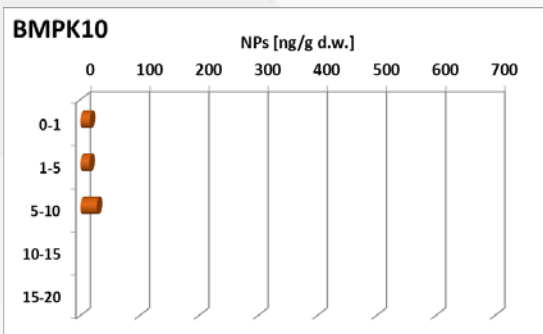
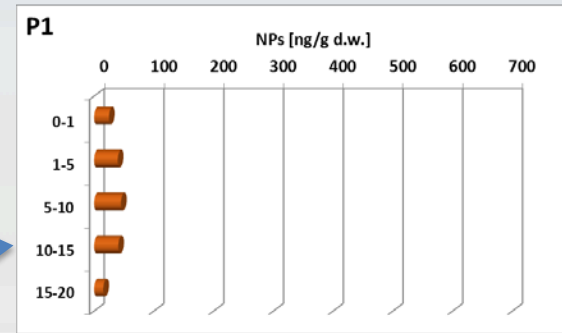
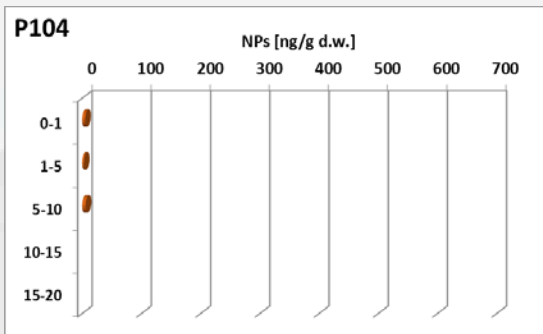
Stable carbon isotopes



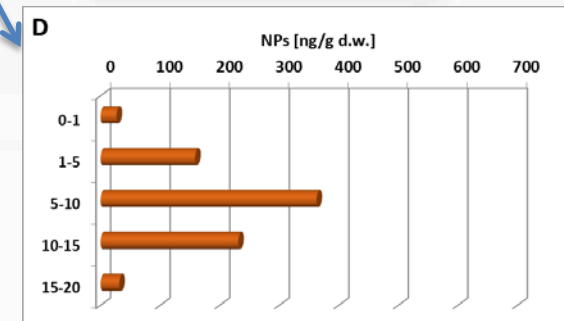
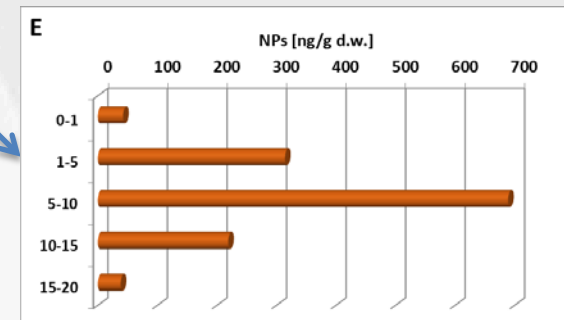
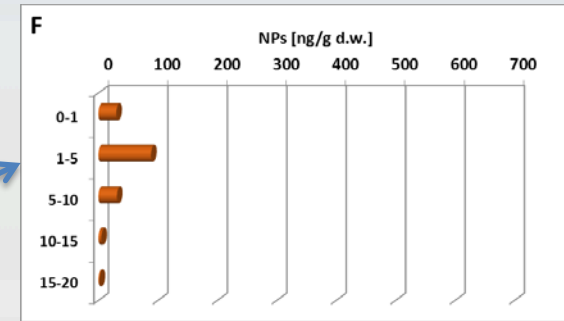
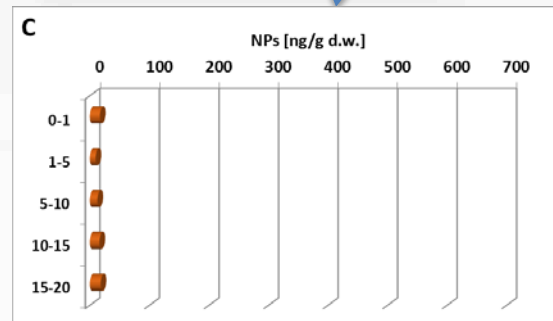
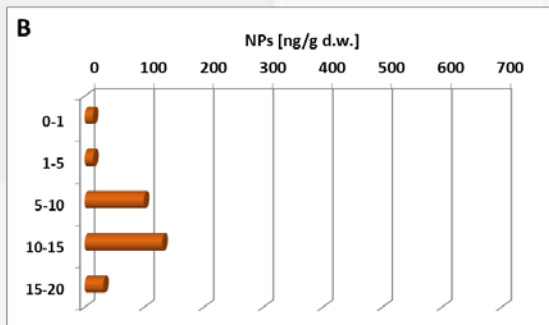
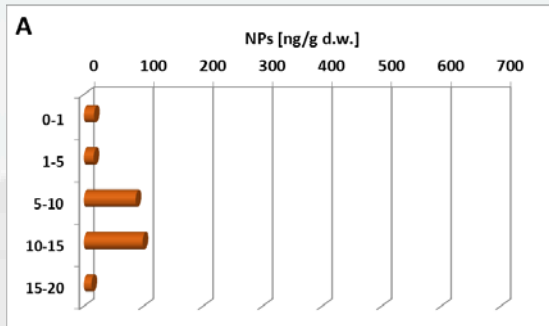
* - Fontugne and Jouanneau, 1987

** - Emerson and Hedges, 1988

Nonylphenols, Gulf of Gdansk



Nonylphenols, Oslofjord



Sediment toxicity

DR-CALUX → 2,3,7,8-TCDD TEQ (PCDD/PCDF and dl-PCBs)

Gulf of Gdansk

Oslofjord

Station	Results [ngTEQ/kg]	Station	Results [ngTEQ/kg]
BMPK10	6.9	A	5.4
P104	2.8	B	3.6
P110	8.6	C	48.0
P116	21.0	D	17.0
M1	31.0	E	67.0
P1	15.0	F	29.0

Summary

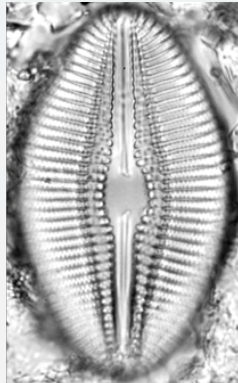
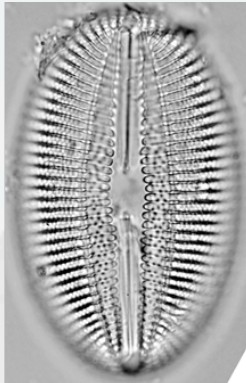
In anthropogenic impacted sediments we find a clear relationship between, phytoplankton pigments, sedimentation rates and organic carbon accumulation as well as presence of cyanotoxins.

Long cores (3-4 m) have been taken in Gulf of Gdansk and Oslofjord to try to derive historical proxies of climate change using these parameters.



Diatoms

Marine Bentic

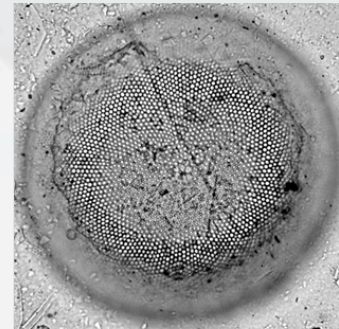


D. smithii
var. *recta*

Marine Planktic

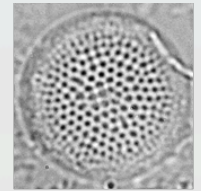
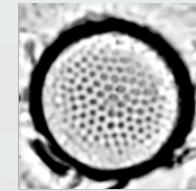


Actinocyclus
octonarius

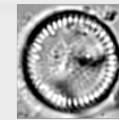


Coscinodiscus
asteromphalus

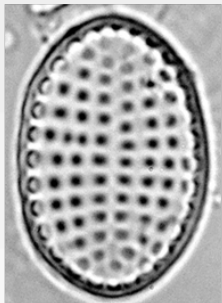
Anthropogenic



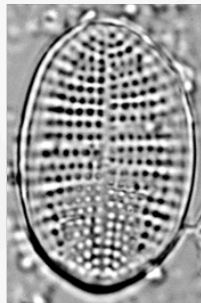
Thalassiosira
levanderi



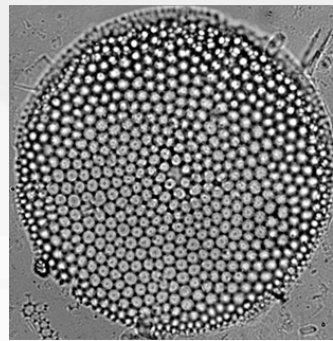
Cyclotella
choctawhatcheeana



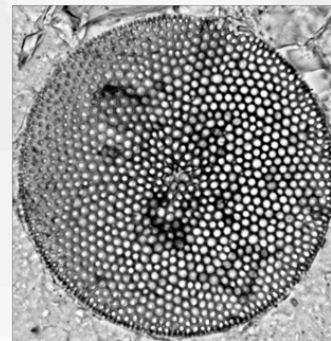
Cocconeis
distans



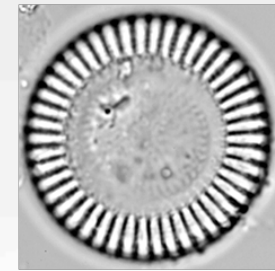
Cocconeis
hoffmannii



Coscinodiscus
obscurus



Coscinodiscus
radiatus



Cyclotella
meneghiniana

Summary diatom diagram for sediment core P116

