



# Metal concentrations and changes in concentrations during the past 150 years in Norwegian marine sediments – results from the MAREANO marine mapping program (2005 - ).

Henning K. B. Jensen (NGU) and Stepan Boitsov (IMR)





# Other weather conditions. ..

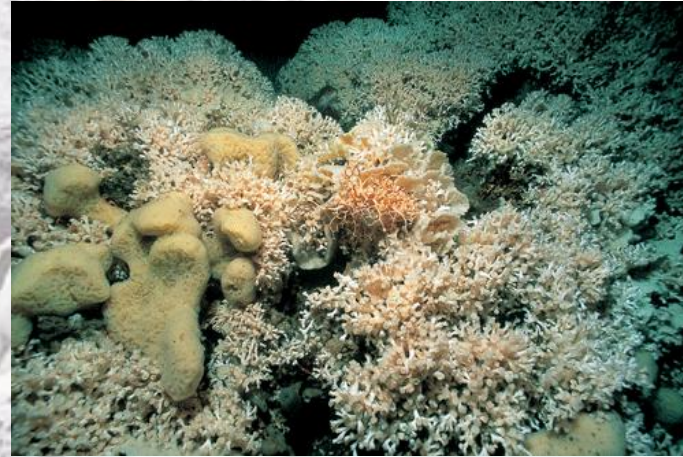
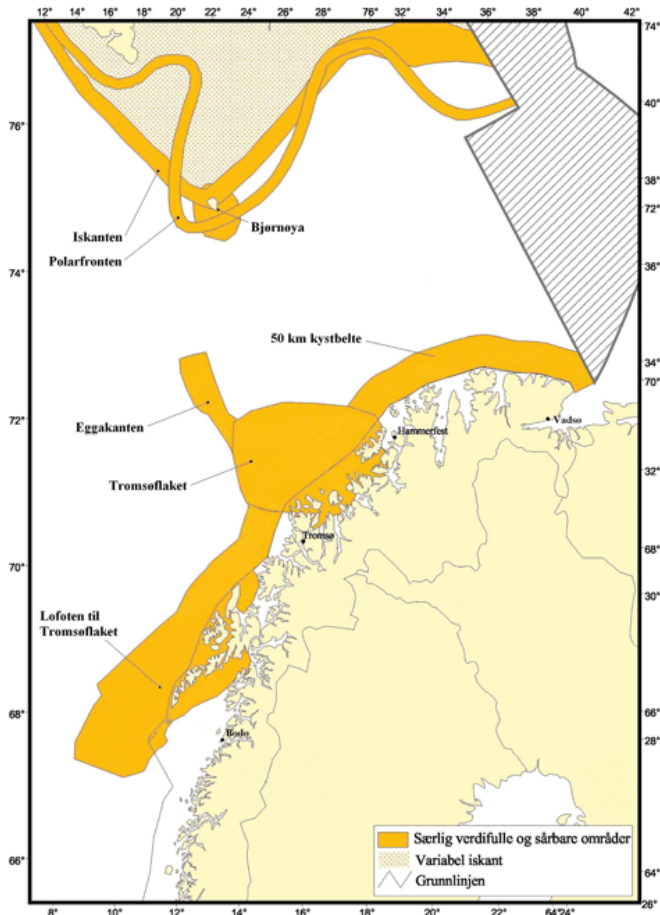




# Pollutants in Barents Sea and Norwegian Sea sediments – A range of sources

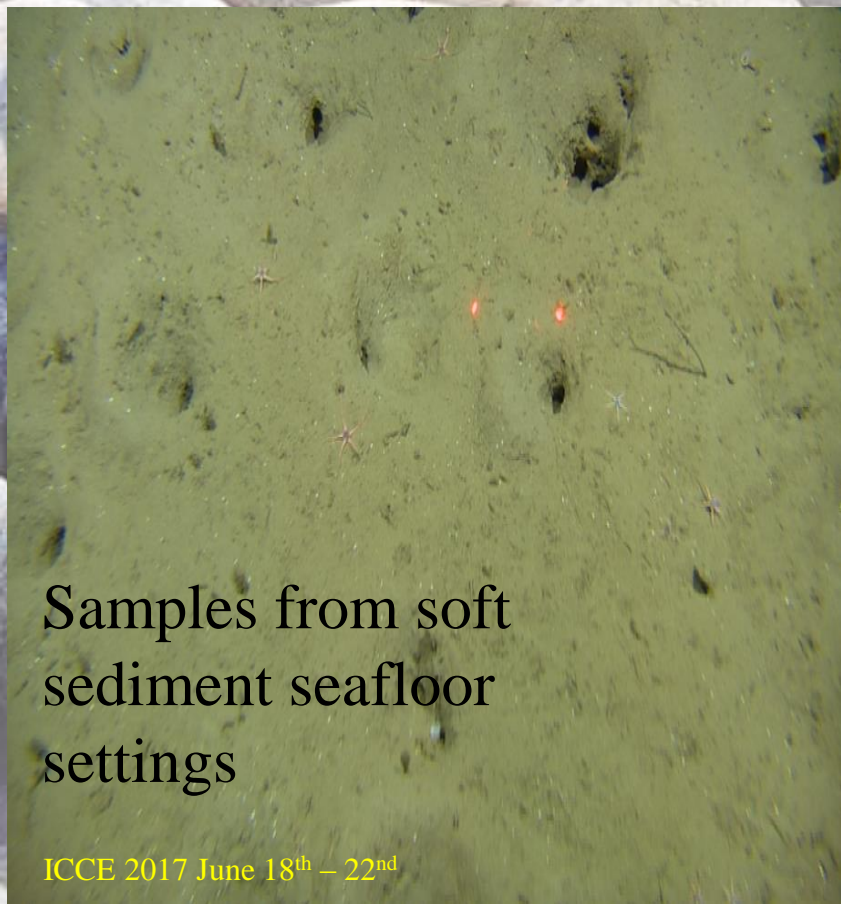
- **Long-range transport: airborne & ocean currents (POPs, radionuclides, heavy metals)**
- **Oil- and gas exploration and –production**
- **Ship traffic, fisheries**
- **Industry and settlements within the region**
- **Military activity – peace and wartime (shipwrecks)**
- **Future? marine ore mining**
- **Natural contributions: bedrock, sediments, leakage from the underground, forest fires, volcanism (metals, petroleum)**

# Particularly valuable and vulnerable areas

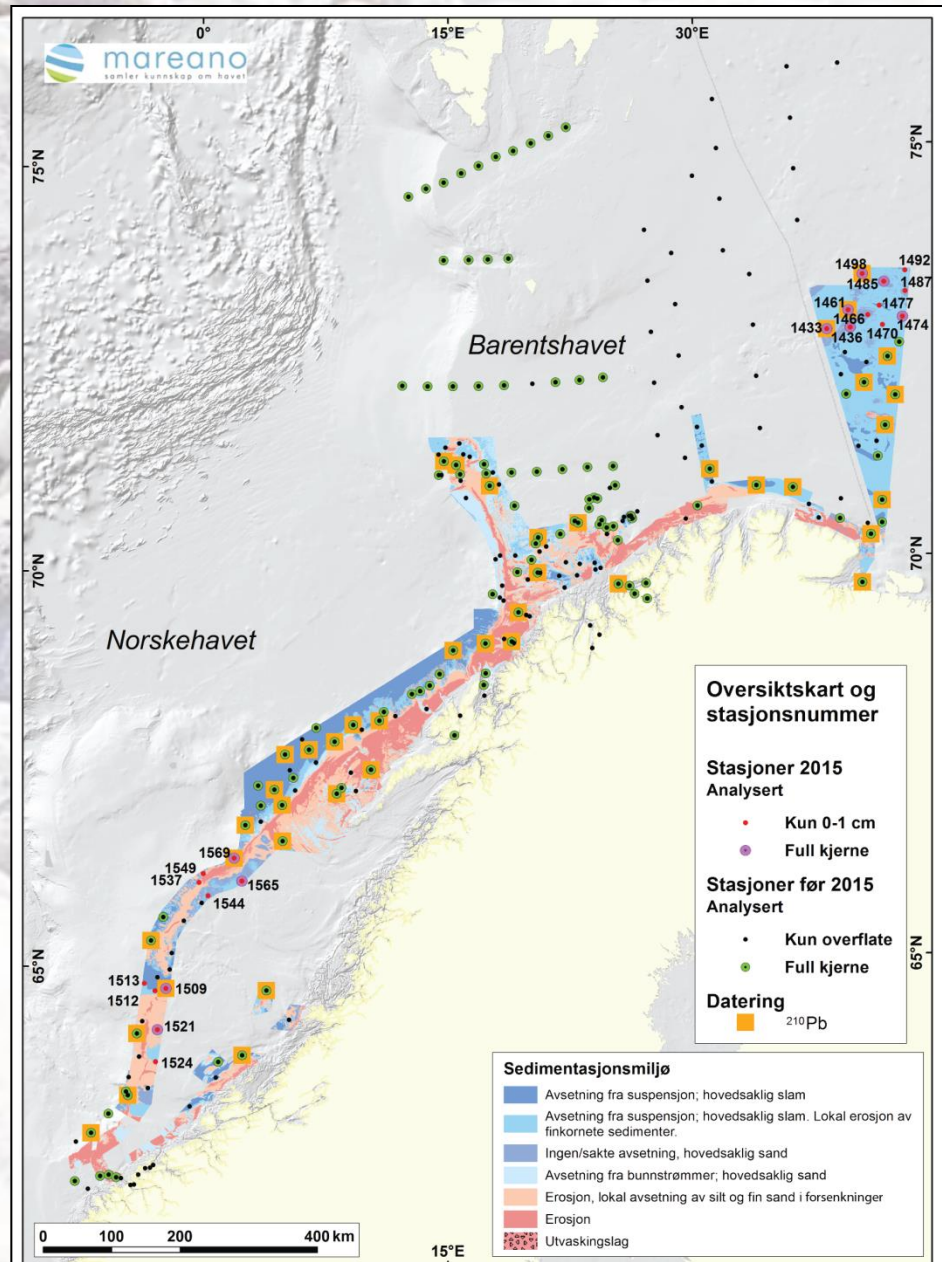




**2006 -2015:188 reported sampling stations**  
**2003 & 2004: 73 stations from the Barents Sea**  
**sampled by IMR**  
**Total : 261 stations,**  
**Approx. 50 stations Pb-210 dated**  
**Sea depths of sampling < 200 m - > 2.700 m.b.s.l.**  
**1 station pr. 2000 km<sup>2</sup>**

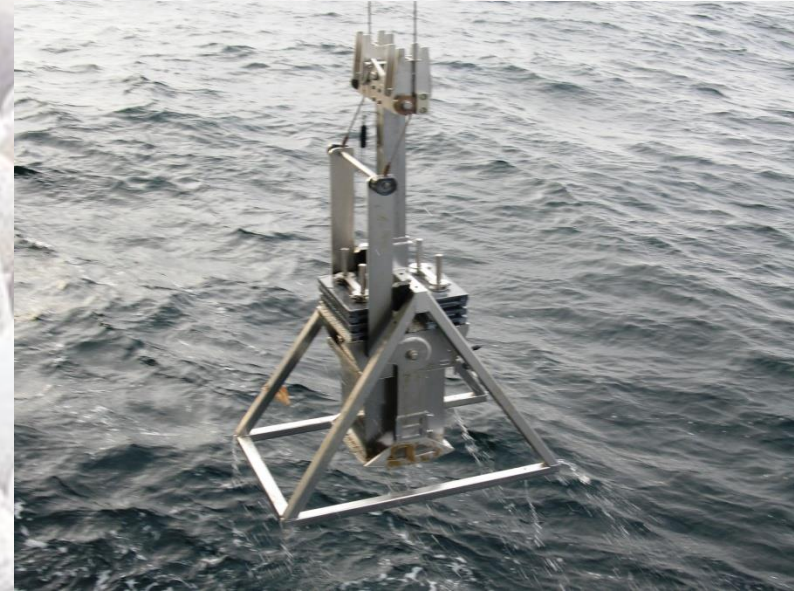
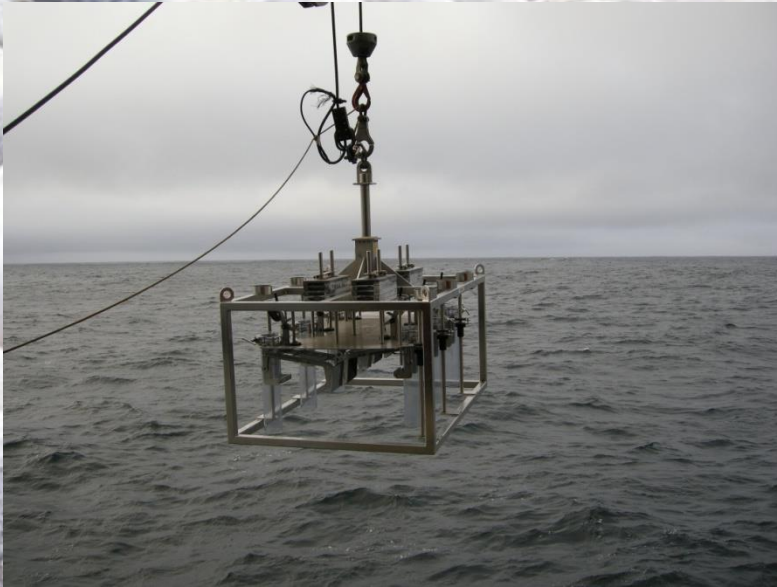


Samples from soft sediment seafloor settings





# Sampling equipment



Cut into 1 cm slices



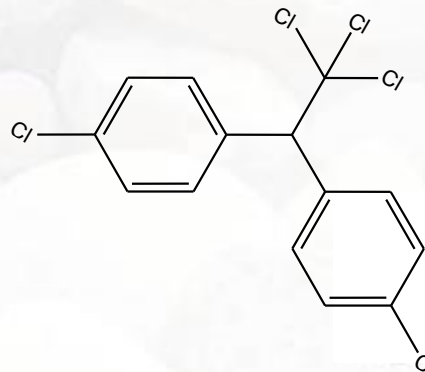
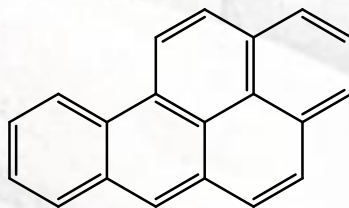
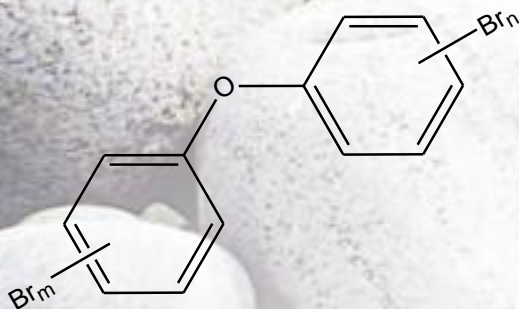
# Inorganic analyses: sediment characterization, metals and radio-nuclides

- Metals (Cd, Cr, Cu, Hg, Ni, Pb, Zn), As
- Ba (barytt i boreslam)
- and 24 other chemical elements (ICP-AES)
- TBT – to 2014
- sediment age determination  $^{137}\text{Cs}$ ,  $^{210}\text{Pb}$ ,  $^{14}\text{C}$
- Sediment characterization:
  - Total carbon, total organic carbon (TOC)
  - carbonate
  - Total sulfur
  - Grain size (Coulter)
  - Water content
  - sediment core x-rays

# Analysed parameters- organic pollutants

## Institute of marine research (IMR)

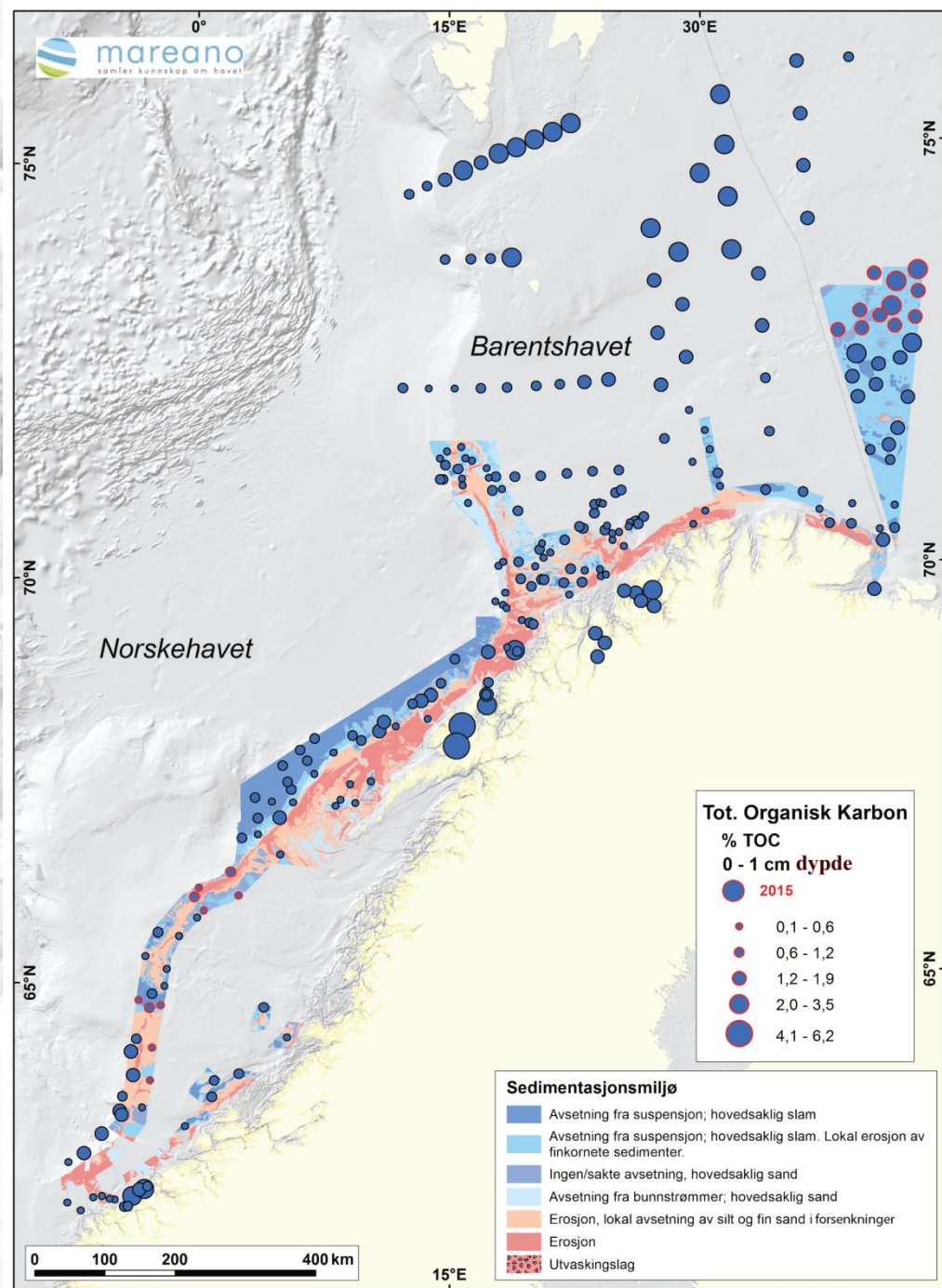
- **Hydrocarbons:**
  - total hydrocarbon content (THC)
  - PAH: 48 compounds incl. PAH16 and NPD
- **Bromated flameredardents: PBDE**
  - 28 congeners
- **Chlorinated pollutants: PCB, pesticides**
  - 18 congeners incl. PCB7, DDT, HCH, HCB, TNC





# Surface sediments

## Total organic carbon (TOC)

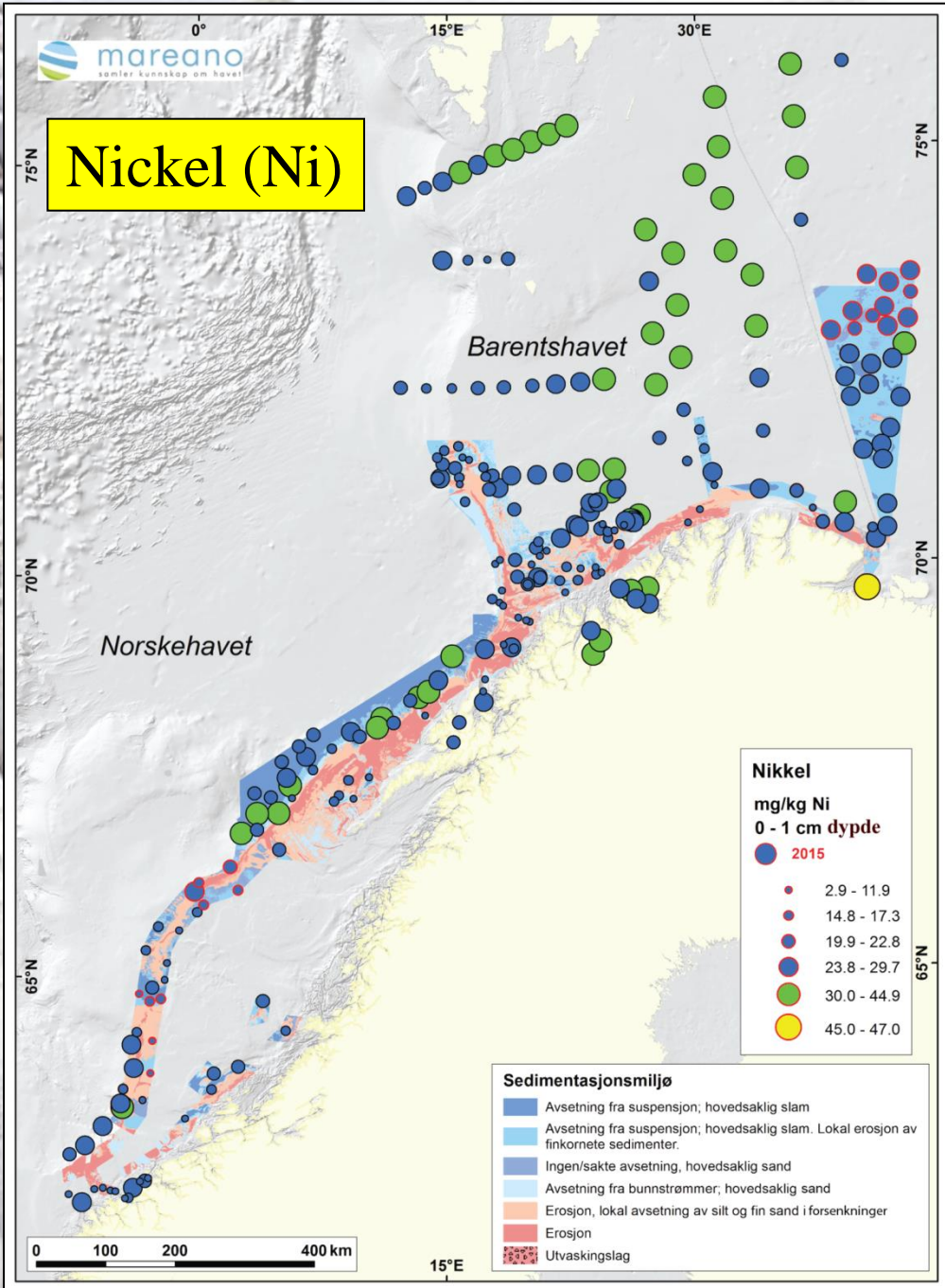


# Presentation of selected metal concentrations in surface sediments.

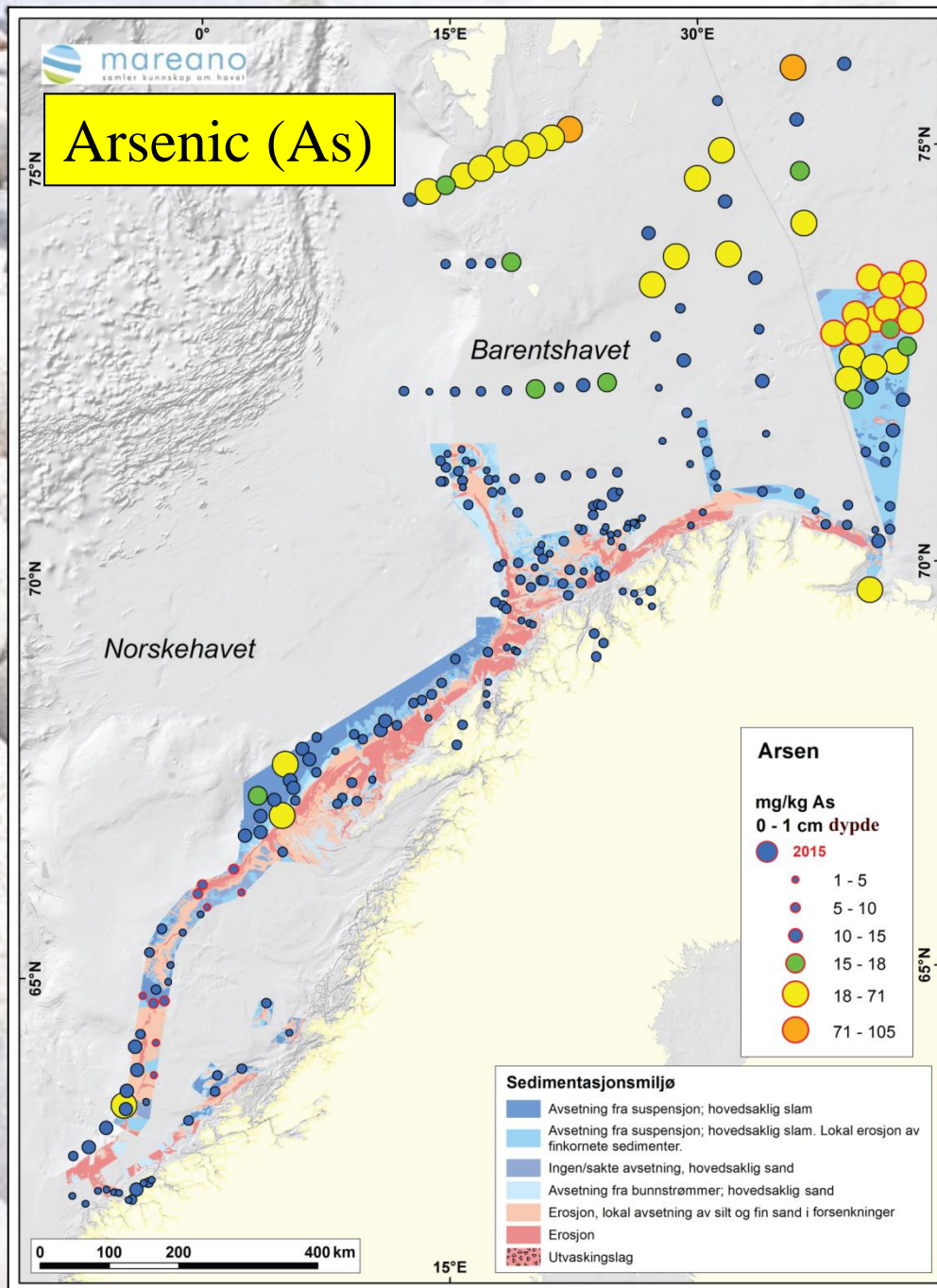
**Norwegian protection agency pollution levels and classification system. Applies for metals and organic pollutants.**

Pollution classes	Environmental condition
I	Background
II	Good
III	Moderate
IV	Bad
V	Very bad

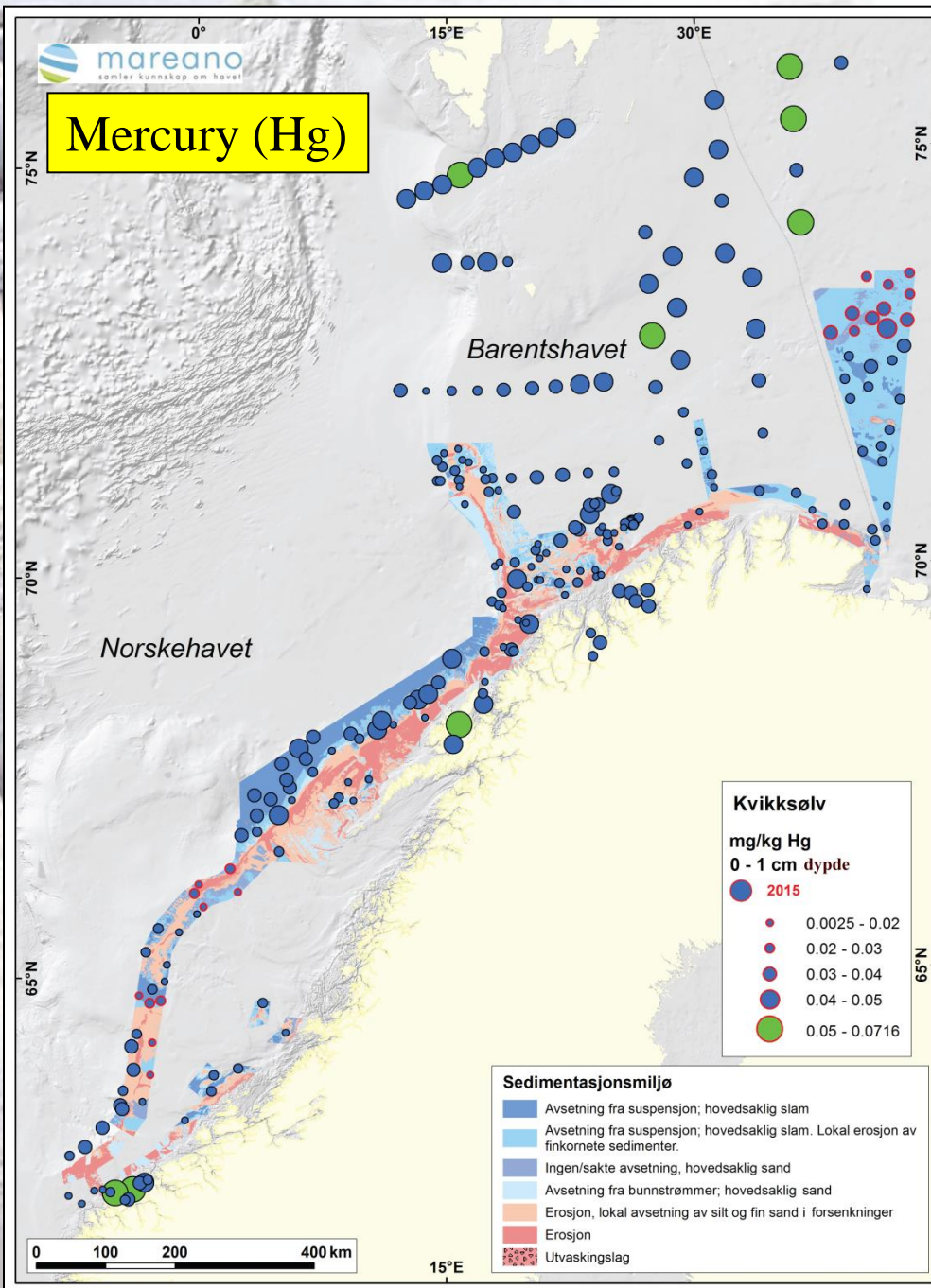


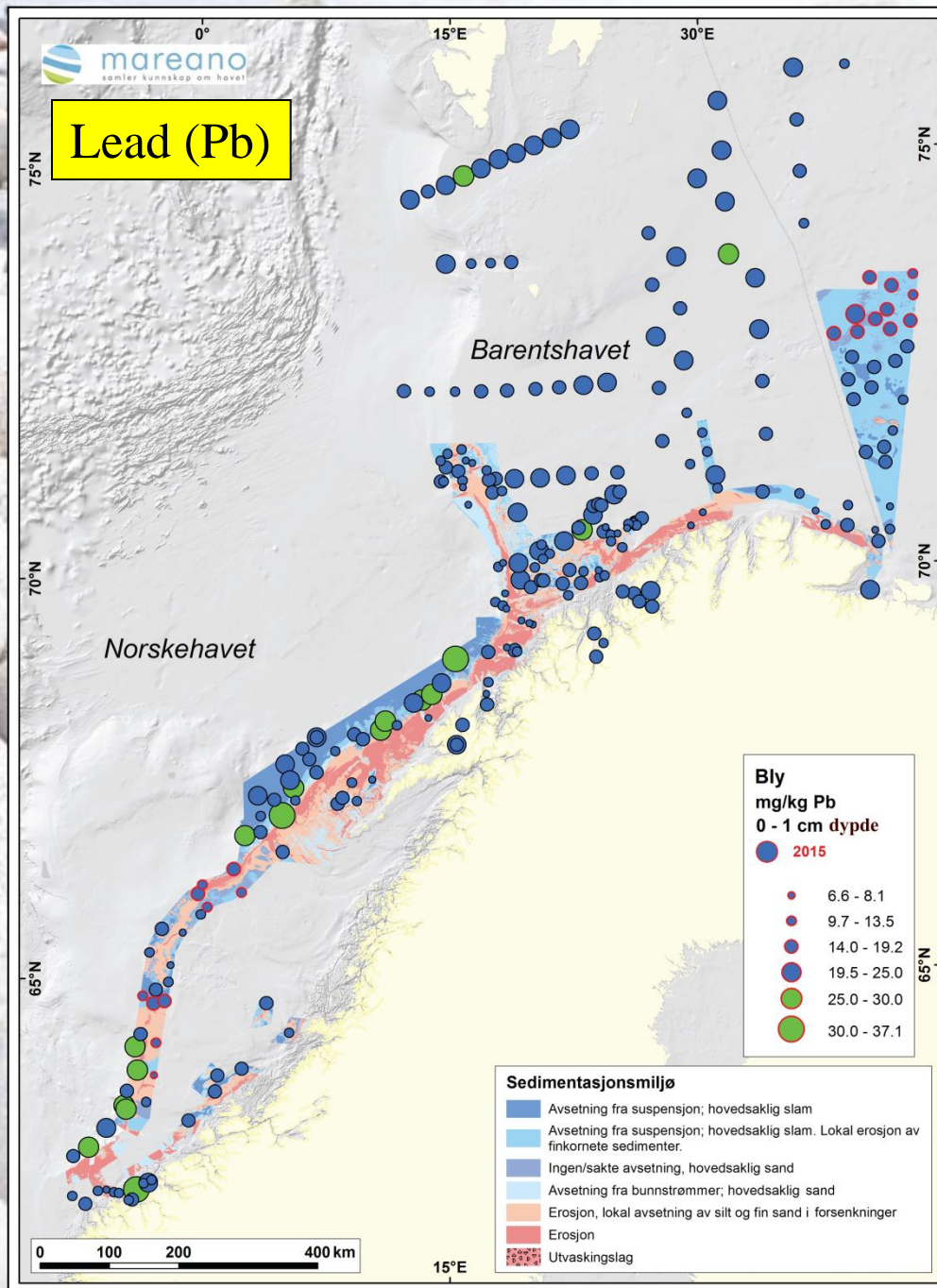


Ni concentrations strongly related to fine-grained part of sediments



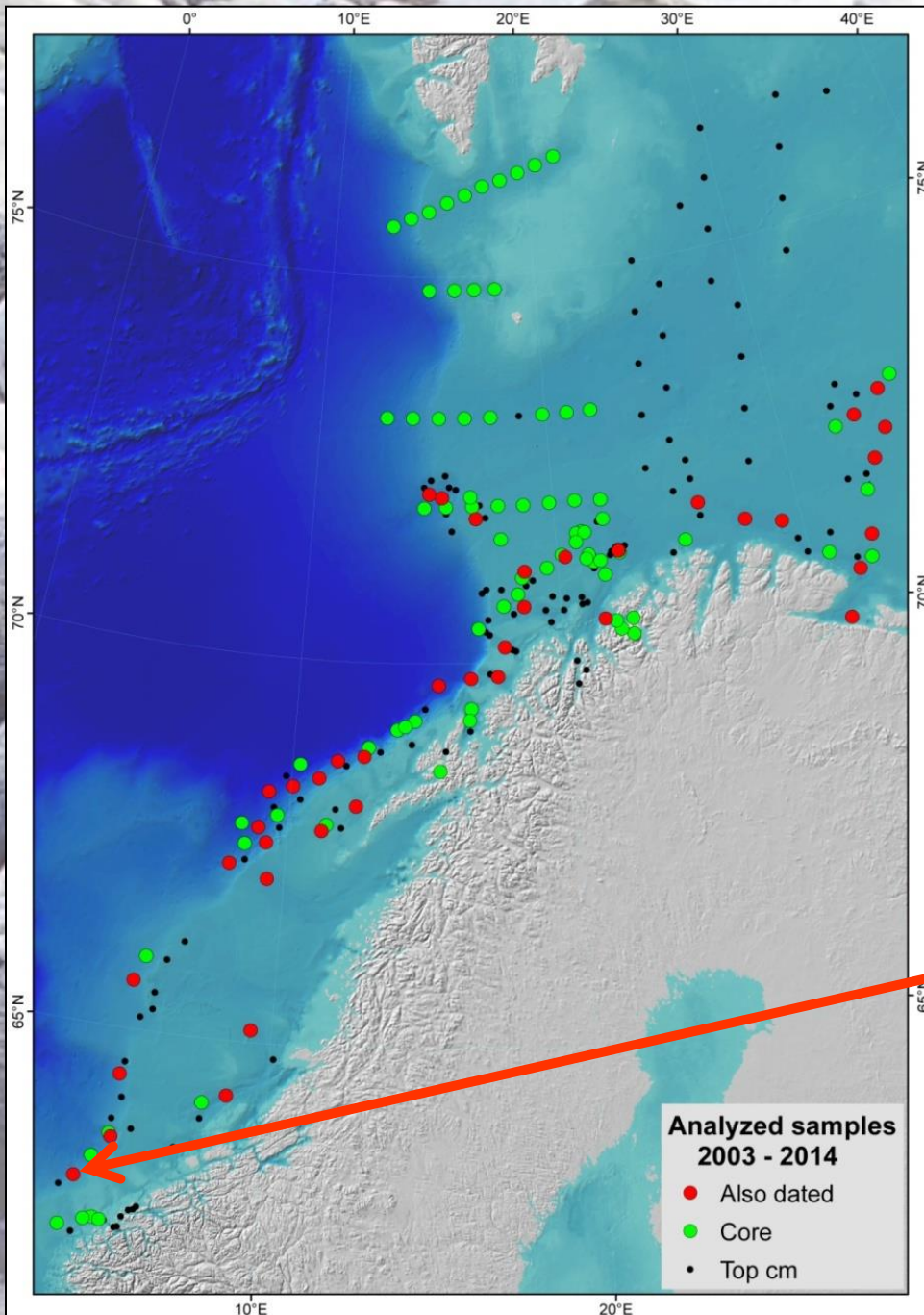




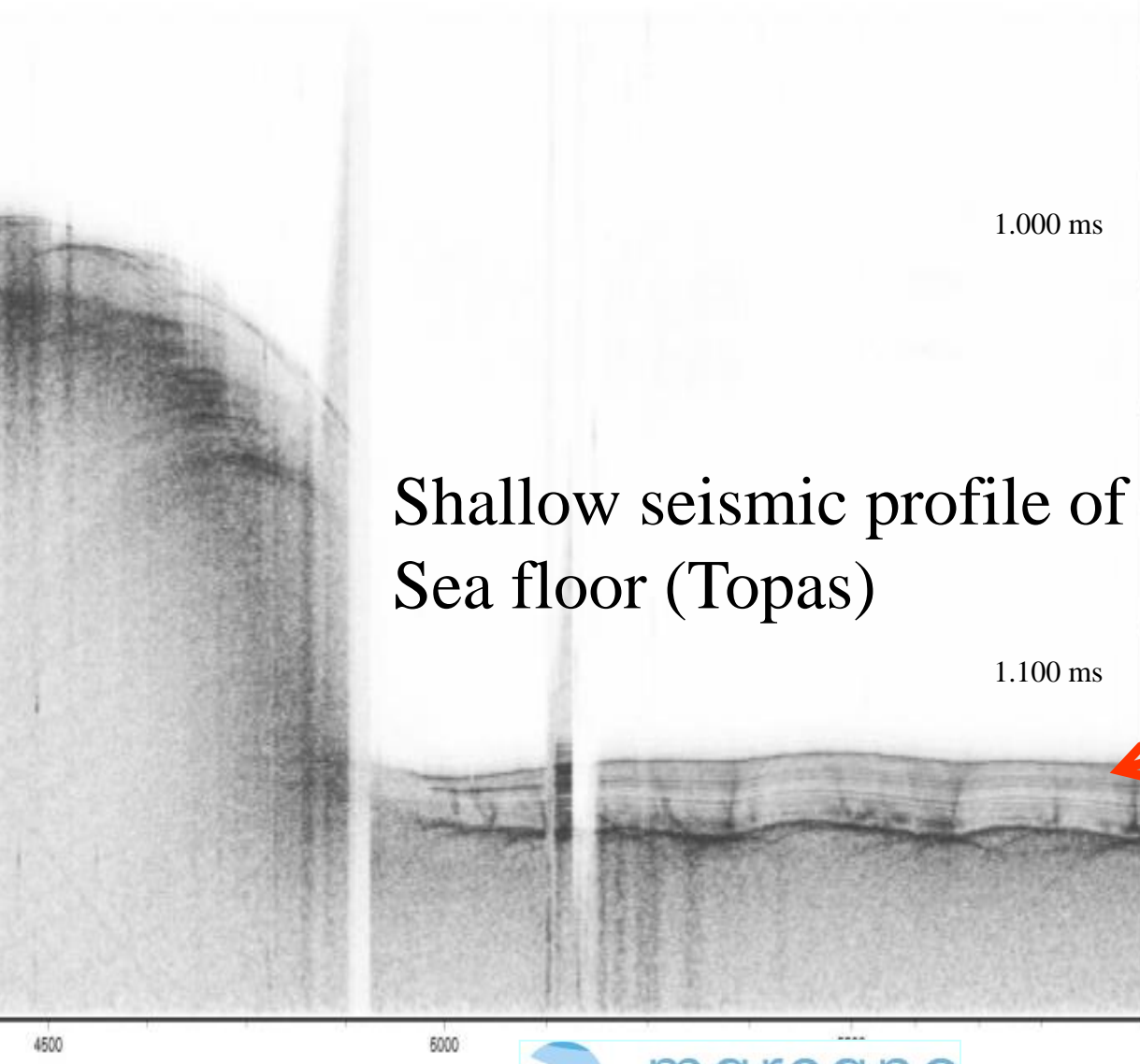




# Changes in selected pollutant levels with time: example from Norwegian Sea slope



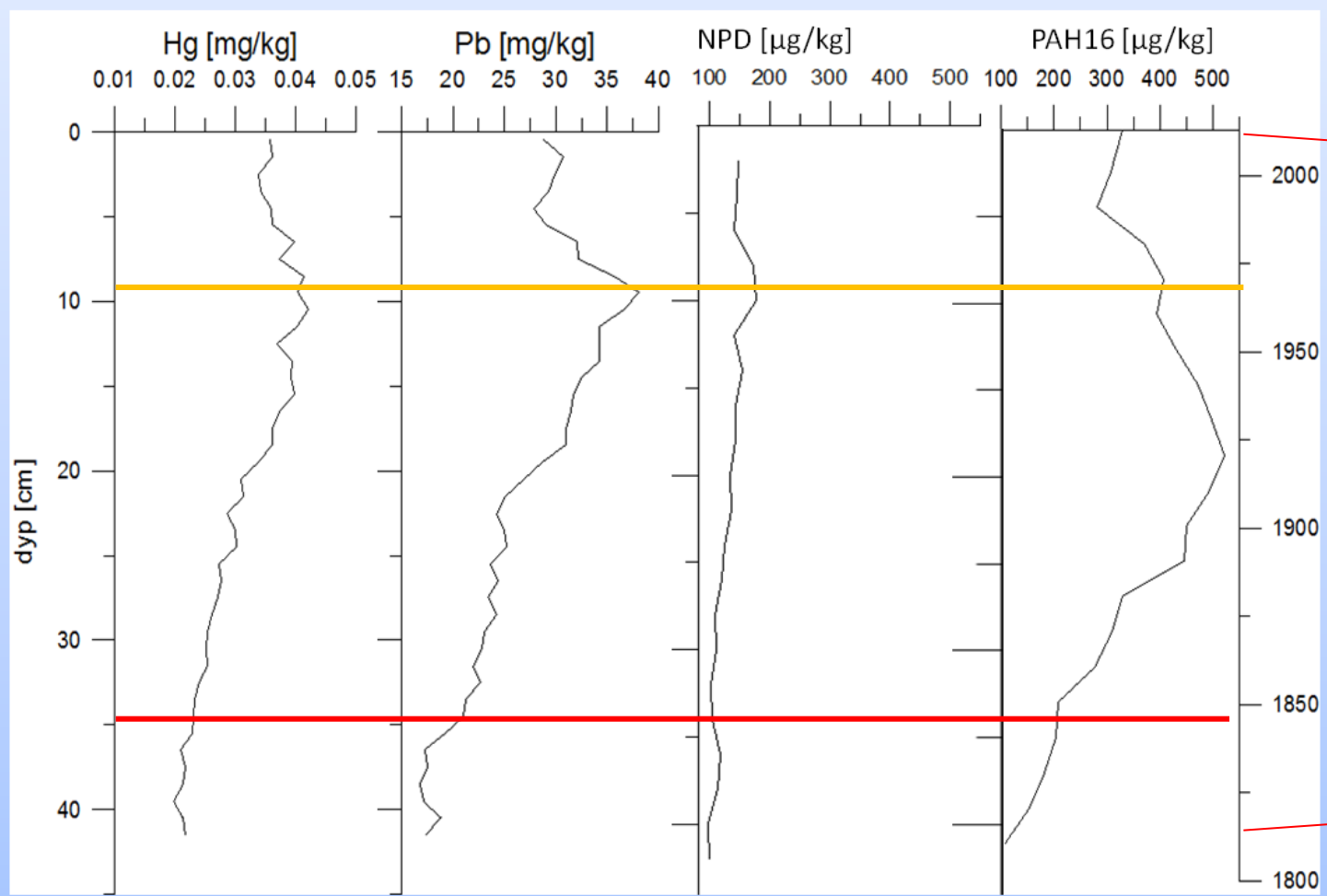
Sediment core R1261MC020: 768 mbsl at shelf edge.



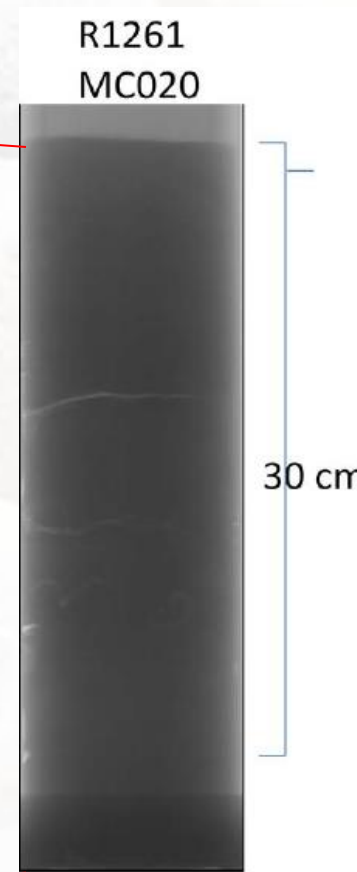


# Lead-210 dated sediment core and derived ages

## R1261MC020, Norskehavet



X-ray of sediment core



# SUMMARY

Generally a clean sedimentary environment with mostly low levels of inorganic pollutants with exceptions:

- Ni: location increased level in Varanger fjord, pollution related.

- Pb and Hg: anthropogenic contribution from 1850'ies 1860'ies, i.e. at the same time as the industrial revolution and the accompanying increased use of fossil fuels like coal and leaded gasoline.

- As: relatively high levels in Barents Sea, most likely natural sources and processes (redox) in top sediments responsible for increases in top layer.

- Acknowledgments: MAREANO funding, IMR (partner)







**Thank You for the attention**