# The International Siberian Shelf Study 2008
# ISSS-08 (IPY#562)

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- **A ship-based marine program along the entire Eurasian-Arctic continental shelf with combined biogeochemical and geophysical observations**


- **Kirkenes to Kirkenes 15 Aug to 25 Sept, 2008 about 13 000 km**
- **130 stations occupied for air- water- and sediment sampling as well as geophysical measurements**

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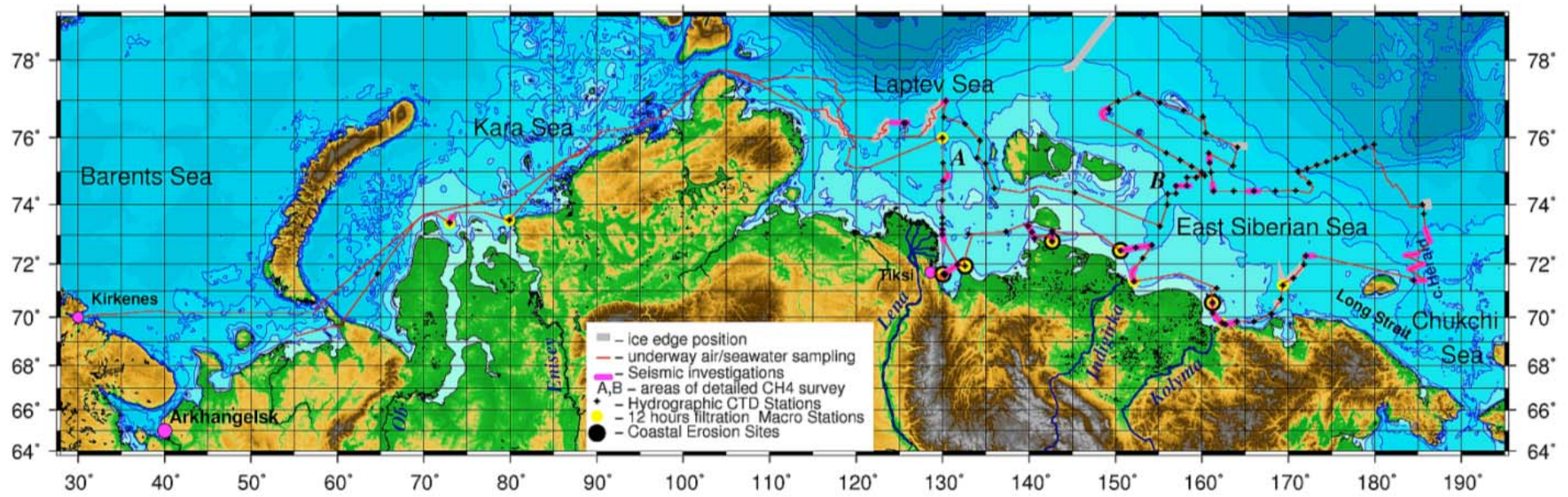


# Why study the Biogeochemistry of Arctic Coastal Seas?

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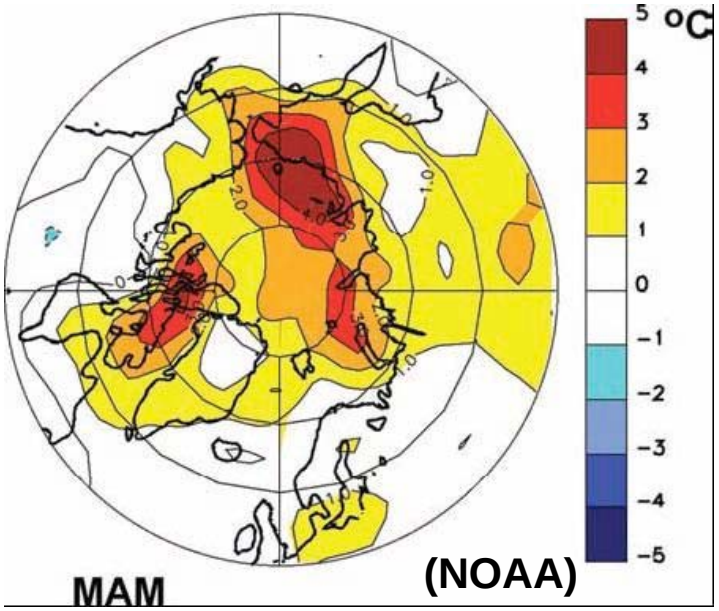
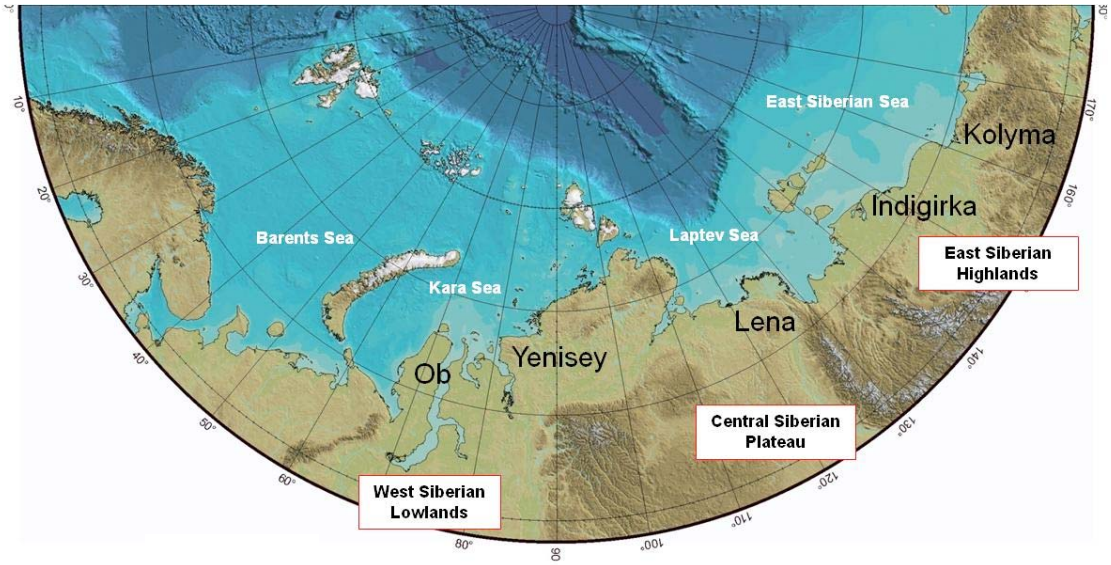
- **Siberian-Arctic records large warming (NOAA)**
- **Huge amount of carbon ”locked up” in drainage basin, costal ice-complex, and shallow subsea permafrost**
- **Changes in freshwater, sea ice and maybe shelf transport**
- **East Siberian Arctic Shelf – LARGEST - Understudied**



# Objectives

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**Transformation and transport of organic carbon in the East Siberian Sea**

- **Input of organic carbon from rivers and coastal erosion**
- **Biogeochemical transformation on the shelf, sedimentation and transport to the Arctic central deep basin**
- **Supply and transport of micronutrients and trace element isotopic tracers from the Siberian Arctic rivers, across the continental shelf, and into the central Arctic Ocean**
- **Release of $CH_4$ and $CO_2$ from the shelf sediments**
- **Benchmark the current state to and how it might be affected by climate change?**

# ISSS-08
# Expedition leader/chief scientist Igor Semiletov
# IARC & POI

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| Theme | Principal Investigators |
|---|---|
| Air-Sea exchange fluxes (energy, CH4, CO2) | Anatoly Salyuk and Natalia Shakhova<br>Far Eastern Branch of Russian Academy of Sciences, Pacific Oceanological Institute + IARC |
| Biogeochemistry | Örjan Gustafsson<br>Stockholm University |
| Geophysics/seismics | Viktor Karnaukh, FEBRAS-POI |
| Marine chemistry | Leif Anderson, Göteborg University<br>Igor Semiletov, IARC, FEBRAS-POI |
| Methane dynamics | Igor Semiletov and Natalia Shakhova<br>IARC, FEBRAS-POI |
| Physical oceanogrpahy | Göran Björk, Göteborg University |
| Sedimentology | Oleg Dudarev, FEBRAS-POI |
| Trace elements and their isotopes GEOTRACES | Per Andersson, Swe Museum of Natural History,<br>Don Porcelli, Oxford Univ. |

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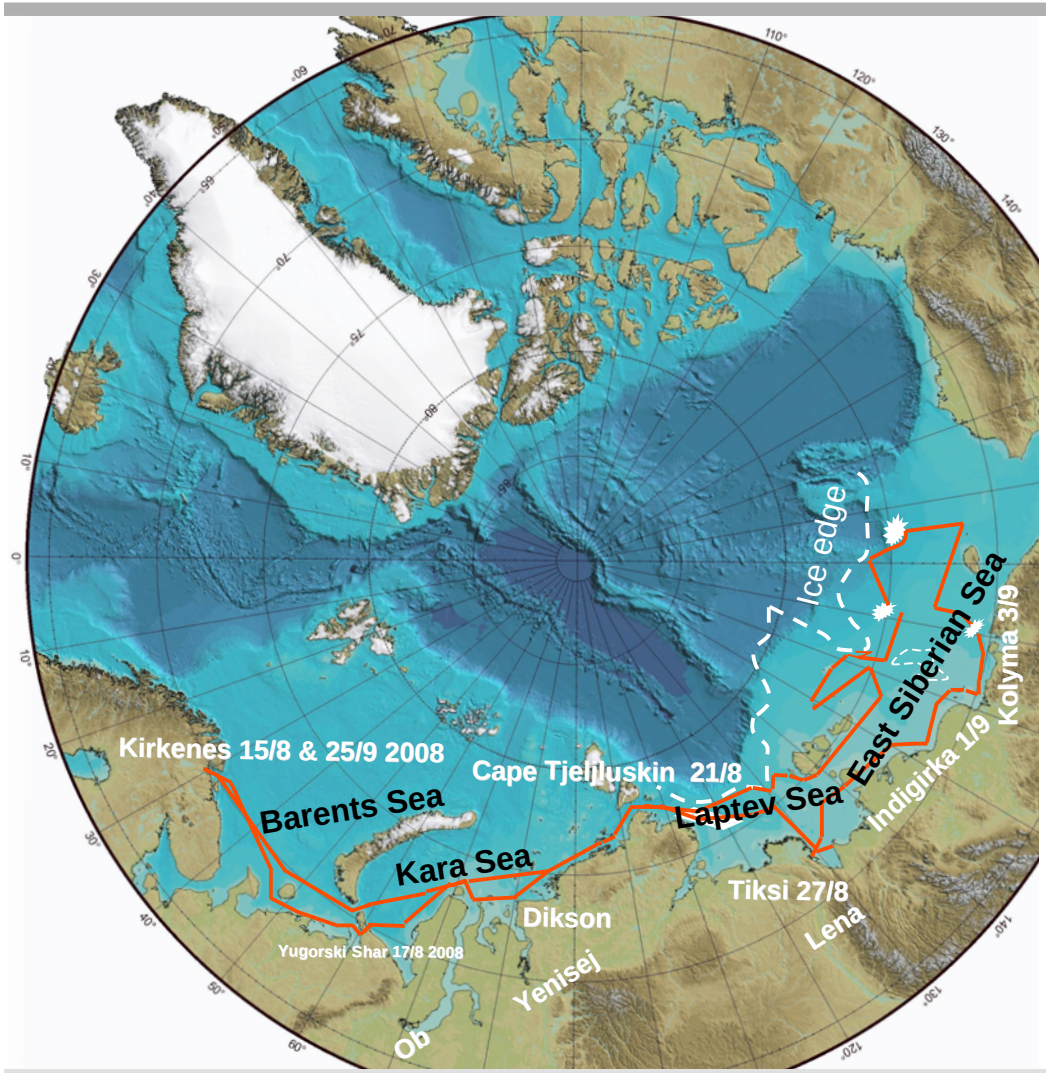


- **Oceanography, CTD, turbidity**
- **Marine chemistry, nutrients, carbonate system & CFC**
- **Meteorology/fluxes $CH_4$ & $CO_2$, ADCP**
- **Biogeochemistry, DOC, TOC, POC $\delta^{13}$C-POC**
- **TerrOC biomarkers, $^{14}$C-TerrOC biomarkers**
- **Sedimentology/mineralogy**
- **Geophysics/geology**

# related work and collaborations during ISSS-08

- **Surface waters from the mixed layer collected using a 14m glasfibre flagpole extended 7m from the bow. Water was pumped directly into a lab container**

- **Go-Flo (60L) on a Kevlar line to obtain waters from below the mixed layer**

- **On board filtration 0.22µm membrane filters. Ultrafiltration in surface water using Millipore prep scale system**

- **Planned analytical work**

Fe concentration (surface waters) and Fe isotopes (in particles). *Luleå university of Technology (LuTU)*
Trace metals (Al, Ni, Cd, Cu, Co, Mn). *LuTU, Oxford university (OU)*
Trace metal speciation. *Stockholm university (SU)*
Nd isotopes, REE, Ba, U-Th and Cr. *Swedish Museum of Nat. Hist. (NRM) and OU*
Hf isotopes, *Geomar, Germany*
Cd isotopes, *Imperial College, London*
He isotopes, *Scripps Inst. of Oceanography*
Si isotopes, *LuTU*
O isotopes (in water), *SU*
$^{234}$Th in water and particles, *SU*. (no counter onboard, samples analysed after returning to Stockholm)

- First results will be presented at the Goldschmidt meeting in Davos, June 2009


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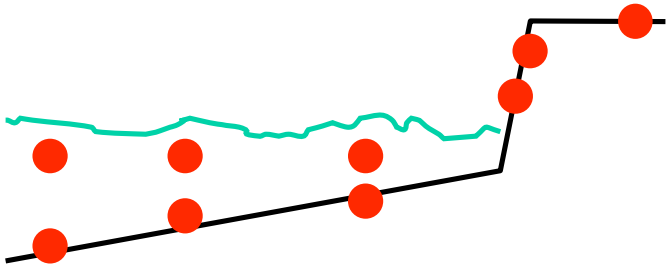
**Is coastal erosion contributing more particulate organic matter to the Arctic Seas than all rivers combined?**

Coastal erosion transect



# The **subsea** permafrost methane issue

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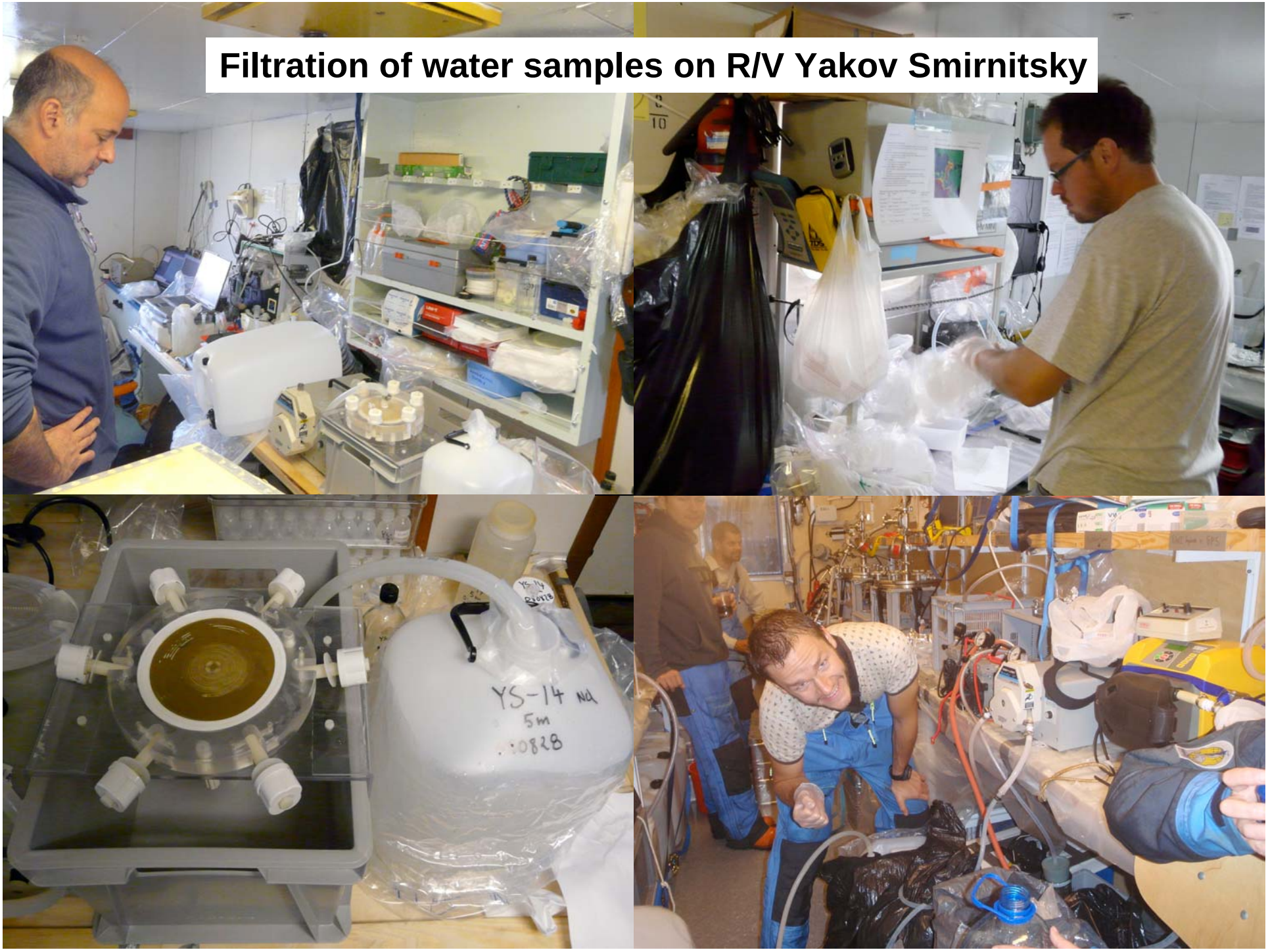
**Methane hydrates exist in the tundra and in the sediment underneath the shallow shelf seas. The subsea methane is exposed to warmer surroundings (seawater)**


**Amount of methane hydrates under ESAS is 1000 - 3000 x$10^{15}$ gC**

**Climate models: 1% of this CH4 to the atmosphere sufficient to cause abrupt climate change (Archer, 2006)**

# Filtration of water samples on R/V Yakov Smirnitsky



**Rare Earth Element and Nd isotope input to the Arctic Ocean: The importance of rivers and geochemical processess on the shelf**

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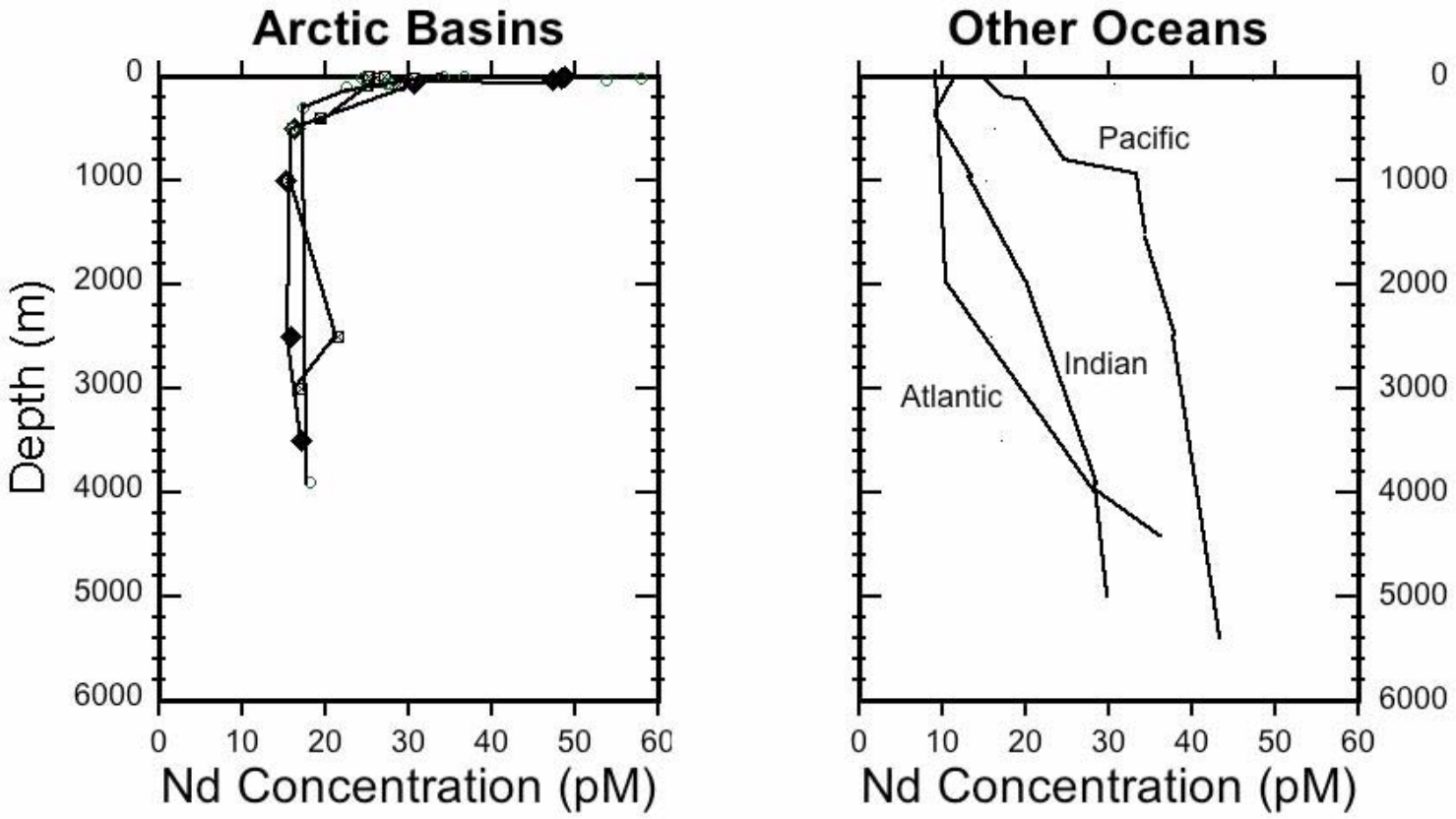


***(Porcelli et al. 2009; Andersson et al. 2008)***

# Nd isotopes (143Nd/144Nd) in the Arctic Ocean: The importance of exchange processes on the shelf

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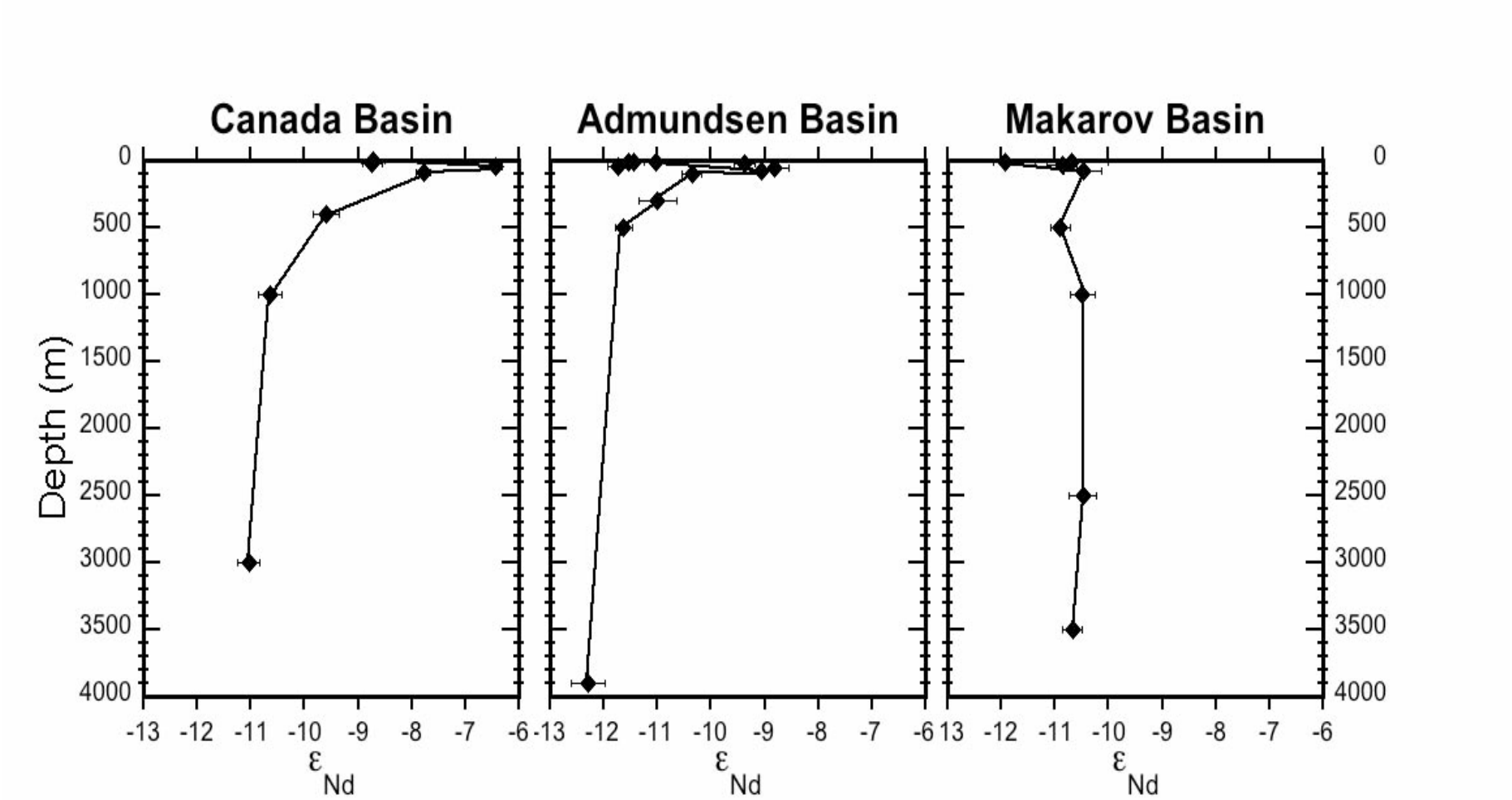


*(Porcelli et al. 2009; Andersson et al. 2008)*

- **Succesful Russian-Swedish coordination of 45-day complex oceanographic expedition on Siberian Arctic Seas**

- **Contribution to alleviate scarcity of biogeochemical and geophysical observations on the East Siberian Arctic Seas**

- **Field data and samples collected from 130 stations; lab work in progress**

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## Conclusions from ISSS for the future GEOTRACES plans in the Arctic

- The importance of the large Siberian shelf areas for the input of elements to the central Arctic Basin
- Large freshwater input
- Carbon storage in permafrost