



International Association of Hydrological Sciences

International Commission of Continental Erosion

Norwegian Water Resources and Energy Directorate

Geological survey of Norway



*The International Polar Year project 317:*

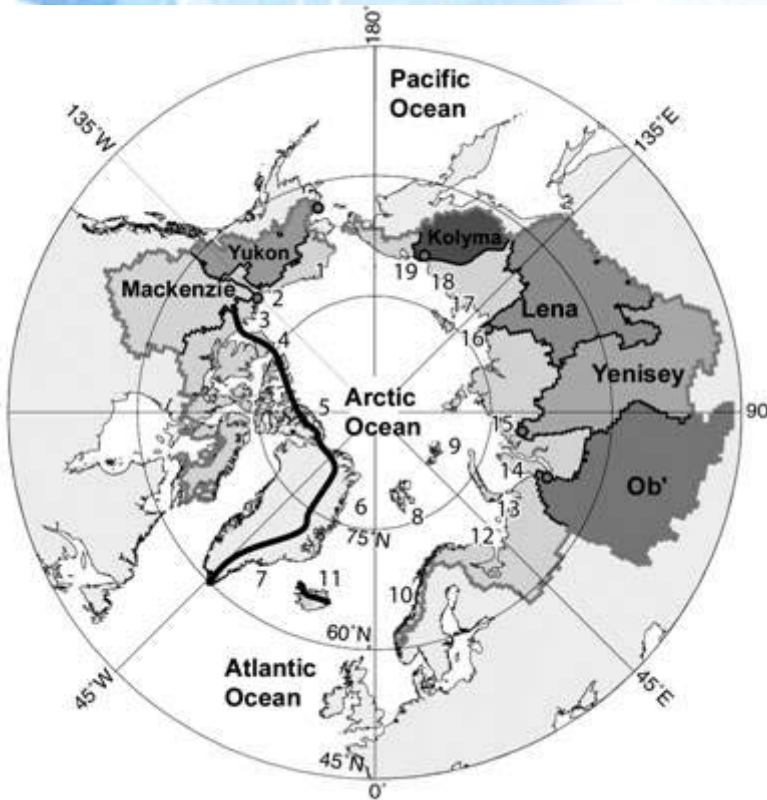
# **“Flux of sediment-associated chemical elements in rivers draining to the Arctic Ocean”**

***Global Geochemical Mapping and Sediment-Associated Flux of Major World Rivers***

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# Flux of sediment-associated chemical elements in rivers draining to the Arctic Ocean

Method: analyses of overbank sediment of floodplains and deltas



## Project objectives:

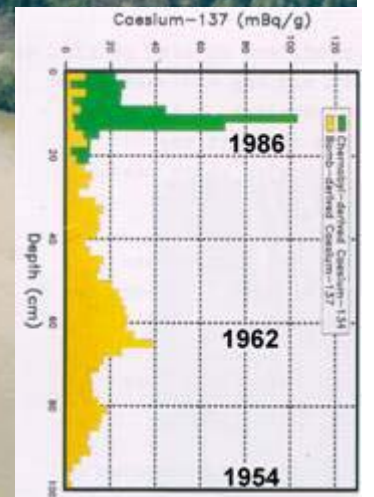
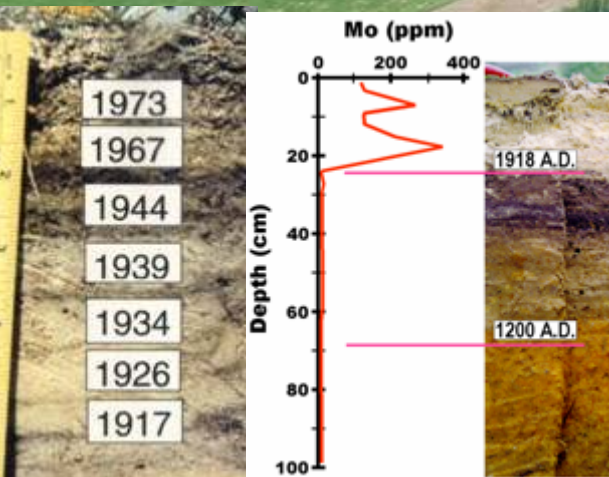
Estimate the modern and historical fluxes of sediment-associated chemical elements

Determine the large – scale patterns in the distribution of chemical elements in regions draining to the Arctic Ocean

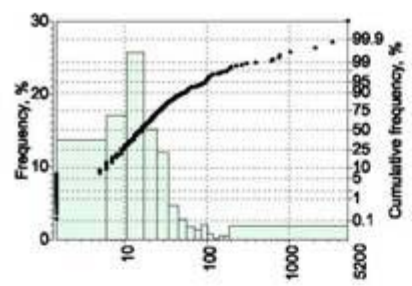
Impact of man-induced changes on sediment sources and sediment flux

Predict the impact of future climate changes on the fluxes.

The chemical composition of overbank sediments from floodplains and deltas may be analysed with Cs137, Pb210 or C14 to identify young and older layers within the sedimentary sequences



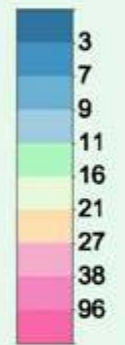
# Overbank sediment maps large – scale patterns in the distribution of chemical elements



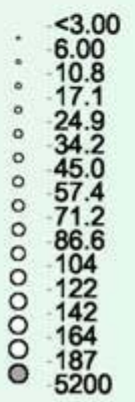
Lead Floodplain Pb

Pb ICP-AES, detection limit 3.00 mg/kg  
 Number of samples 747  
 Median 16.0 mg/kg

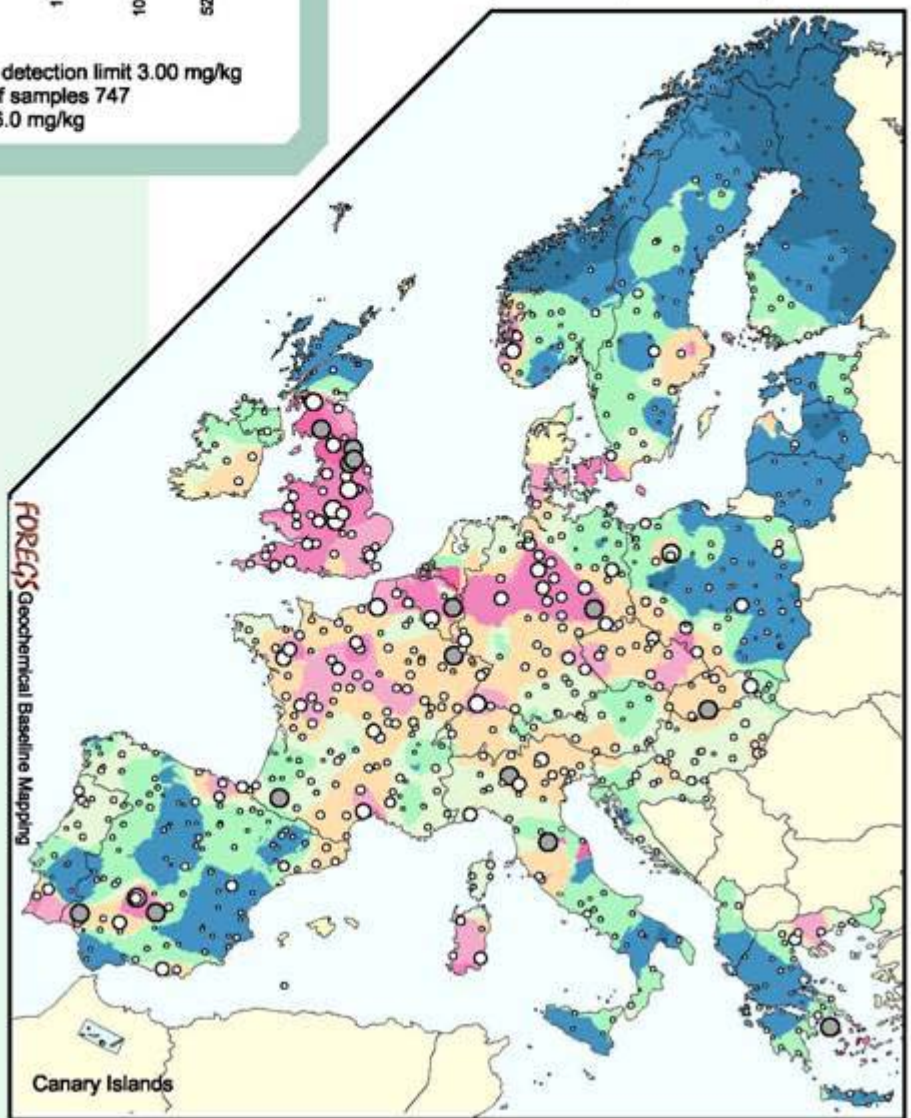
0 500 1000 Kilometers



Pb mg/kg

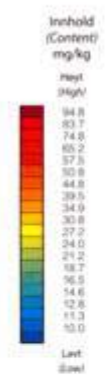


FOREGEO Geochemical Baseline Mapping

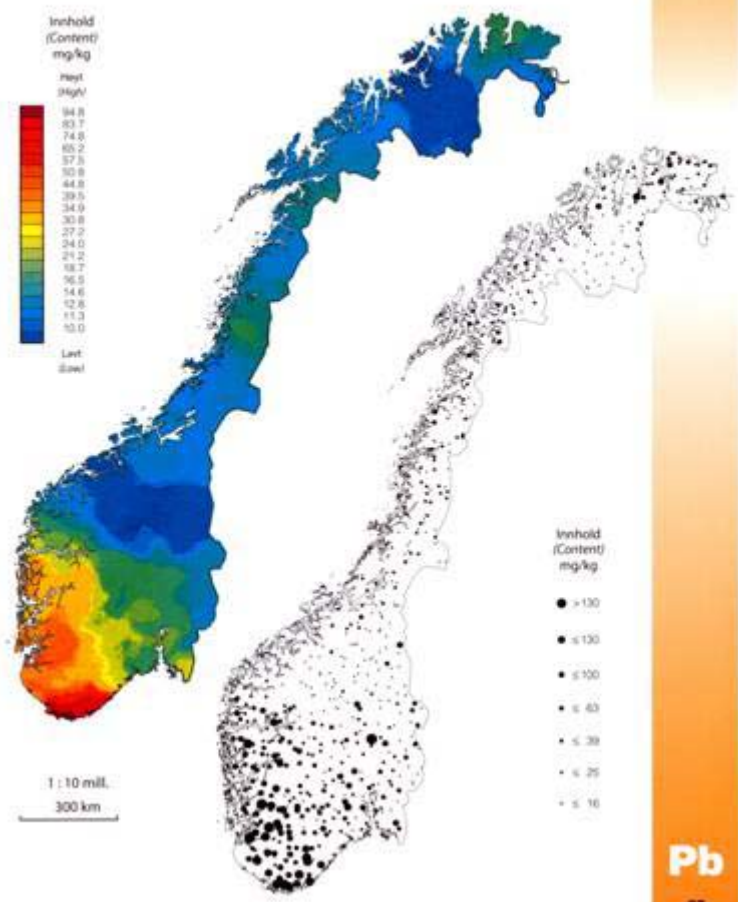


Bly i flomsedimenter  
 Syreløselig del

(Lead in overbank sediments: Acid-soluble part)



1 : 10 mill.  
 300 km



Innhold (Content) mg/kg  
 • > 130  
 • ≤ 130  
 • ≤ 100  
 • ≤ 60  
 • ≤ 38  
 • ≤ 25  
 • ≤ 16

## Sampling strategy for the large deltas

- Number of samples, location
- Long term delta development, selection of samples for dating purposes



**LENA DELTA IN EASTERN SIBERIA**



# Overbank sediment sampling on arctic floodplains

Longyearbyen

Isdammen drinking water reservoir

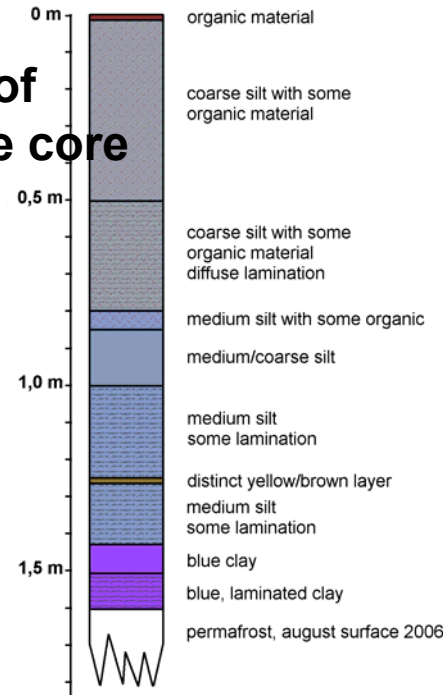
Samples in cross section

Endalselva

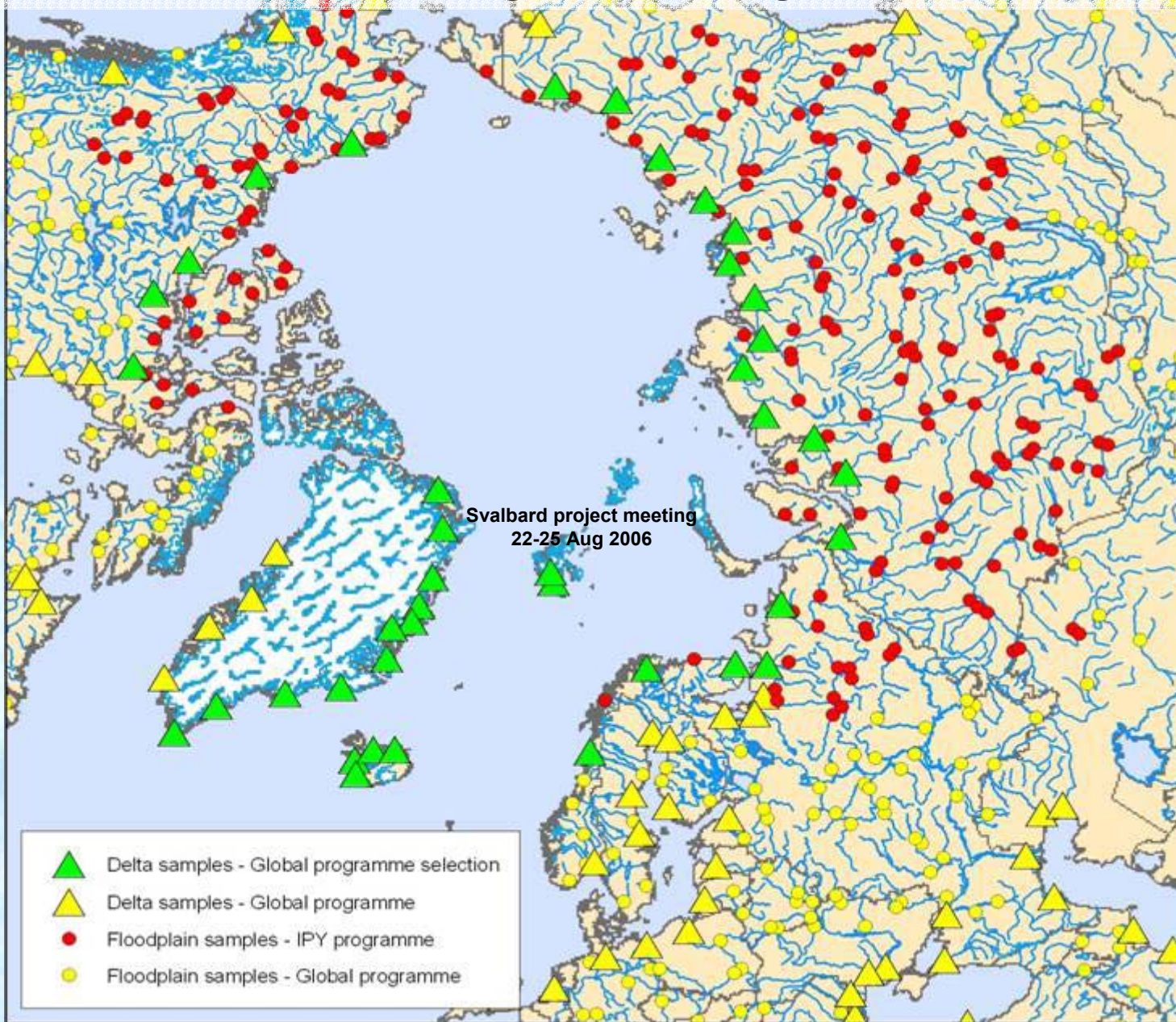
High concentration of Arsenic was found in the core

Adventelva

Overbank sediment profile, river Adventelva



# Investigate large – scale patterns in the distribution of chemical elements in regions draining to the Arctic Ocean



# Relationships between the fluxes and the distribution of sediment sources, and particle bound elements within the drainage basins

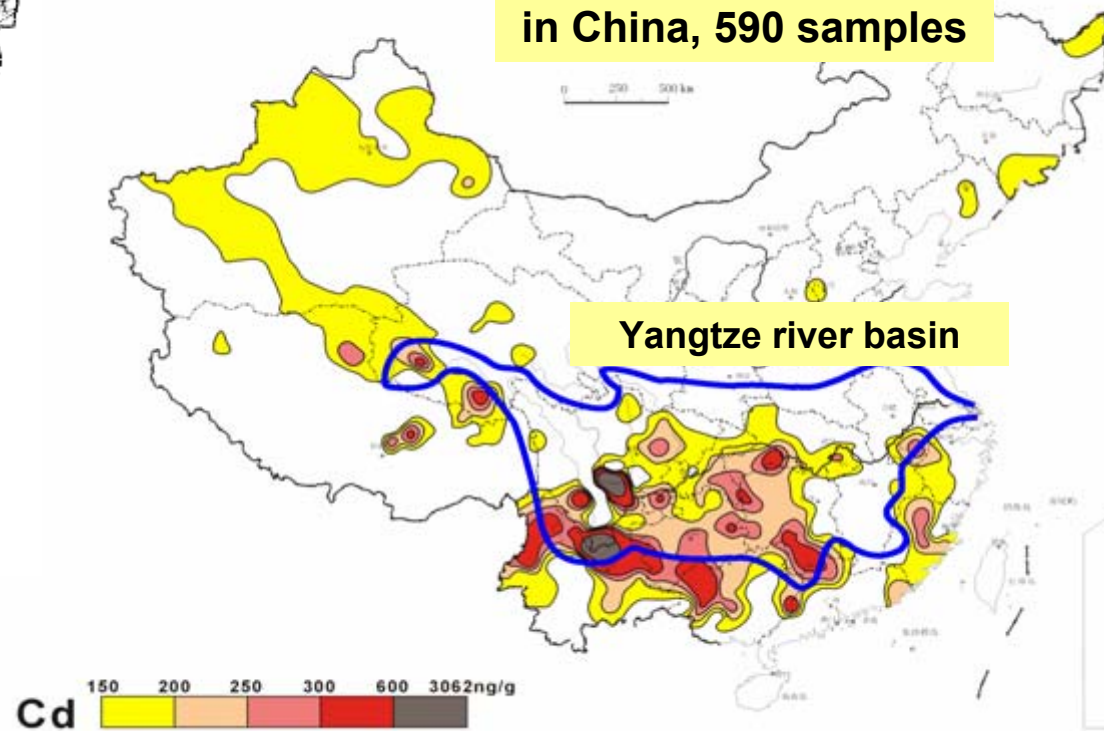
- Processes of erosion deliver particle bound matter to the river channels

## Map of locations of sampling points



spaced survey of China. Inset shows centres of nominal 160 x 160 km cell  
rn has been superseded by that shown in Figure 4-1.

## Map of Cd distribution in China, 590 samples

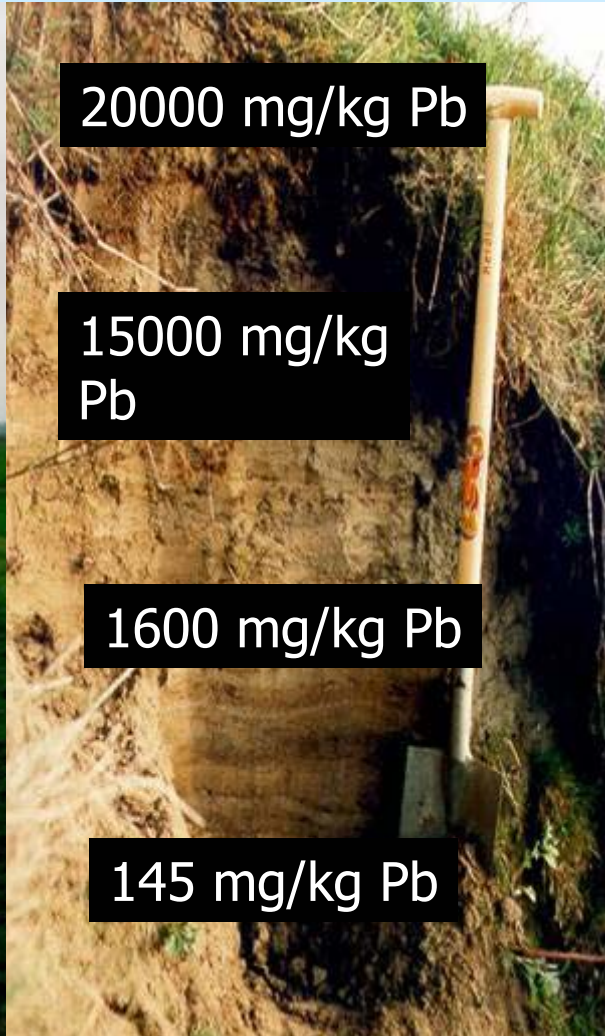




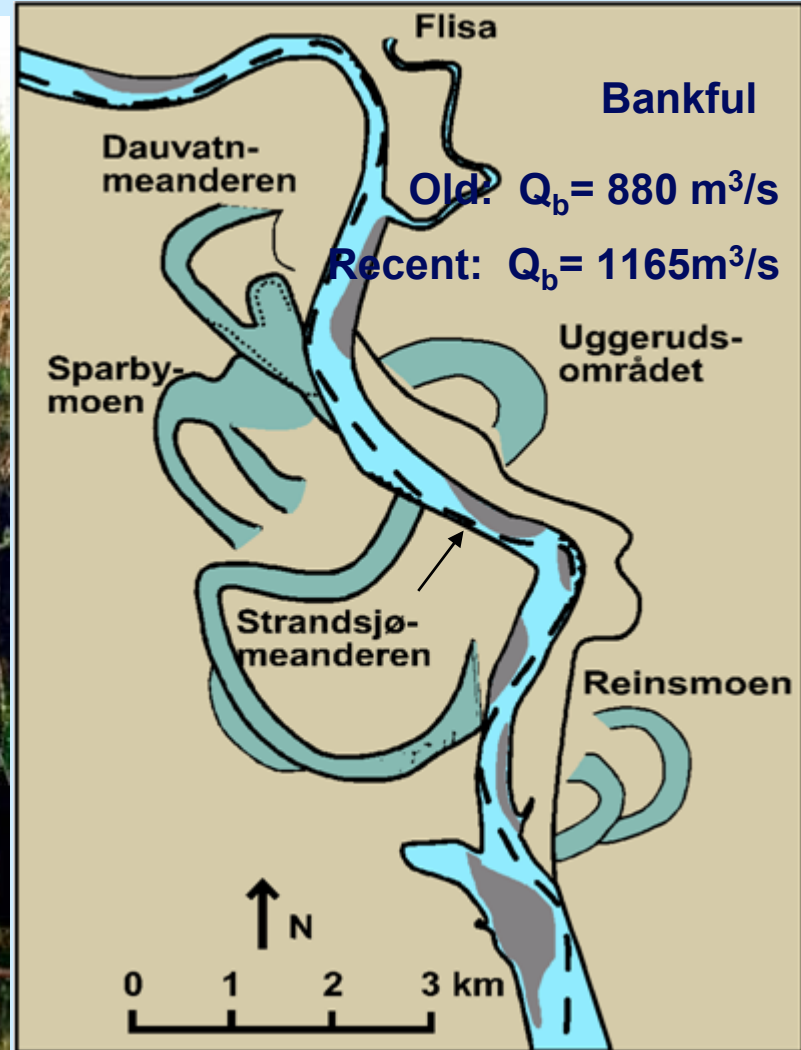


# Climate changes may increase channel erosion and mobilize polluted material

River Innerste, Germany  
Floodplain polluted by old mining activity



Norway 2000 BP-1680 BP  
Change from dry to wet climate caused channel changes

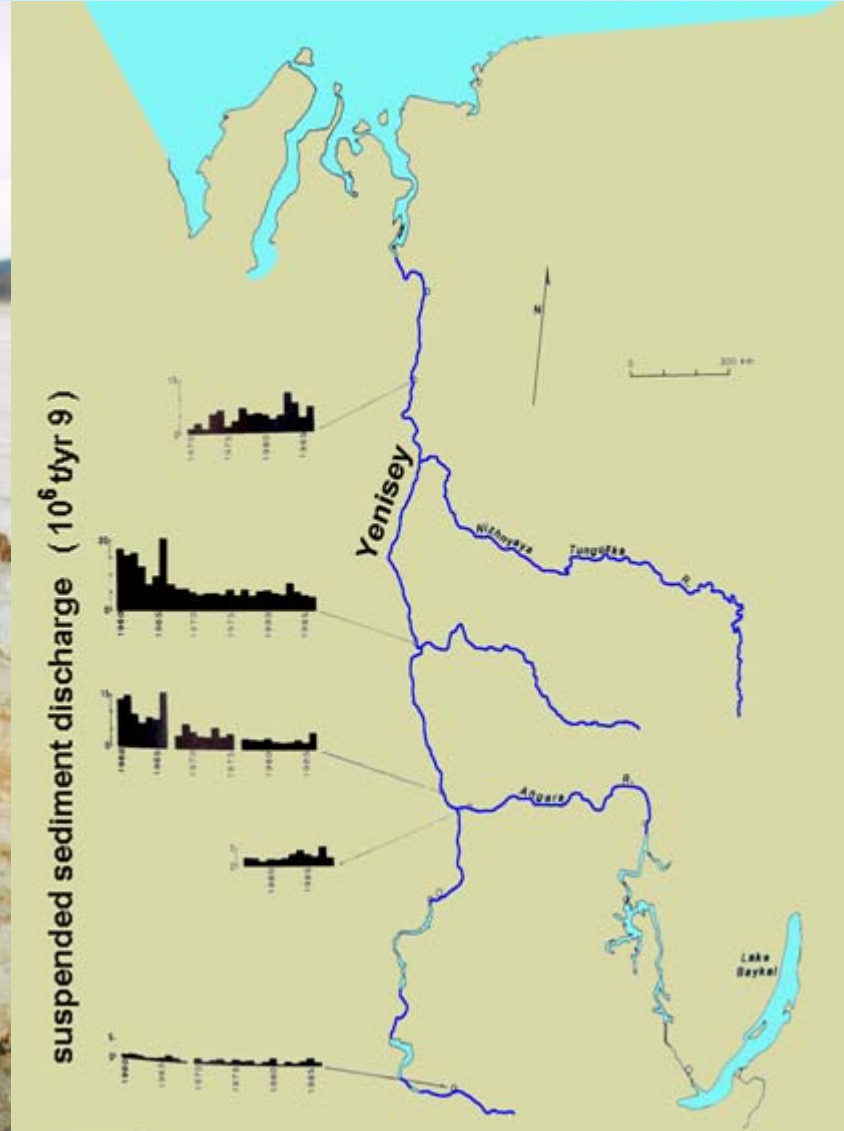




NVE

# Climate change: melting of the permafrost will mobilize particle bound pollutions

Dams: 20% reduction of sediment flux on a global scale



## Project status:

Europe:  
need lower sample/  
sediment flux samples

Green and red dots: Sampling locations  
Delta samples and floodplain samples  
in rivers draining to the Arctic ocean

Sampled areas : Europe  
and China, Cu- distribution

### First IPY project meeting held in Longyearbyen, Svalbard 22-25 August 2006

- A detailed sampling protocol unified for all rivers. Sampling strategy for large deltas
- Preliminary sampling locations in Arctic drainage basins have been determined
- Funding from participating institutions. Some funding from the NRC
- The Russian Interuniversity Council on Erosion and Fluvial processes will participate
- Next meeting in Shanghai October 2007



# Predict the impact of future climate changes on the fluxes to the polar sea.

## Climate change in Norway towards 2100 according to RegClim prediction

- Summer maximum temperatures 2.5–4°C higher
- 5% to 20% increase in total annual precipitation largest increase in the western part
- Extreme rainstorm frequency will increase throughout the country

