Global geochemical mapping and the particle bound flux of major world rivers

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Topics for the talk

- Applied geochemistry and sediments
- Overbank sediment method for geochemical mapping
- Results from continental geochemical mapping
- PCB sources and particle bound flux of PCBs in the Arctic
Geochemists from Geological Surveys and mining companies all over the world collects fluvial sediments for exploration purposes.
Problem: Develop a method for mapping large areas with few samples? 

10000 or more samples in small areas
Dynamics of drainage basins
Norwegian Water Resources and Energy Directorate and Geological Survey of Norway

- Sediment sources
- Sediment transport and sedimentation
- Representativity of overbank sediments for a drainage system
Sediment sources
Sediment source: A stream undercuts an adjacent slope

Major sediment source for tens of km
Important sediment source: Historical mine waste
Major flood in 1995
Overbank sediment

- Dominated by minerogenic material (silt/fine sand fraction < 150µm)
- Small amount of organic matter, normally in specific layers
- Fe-Mn hydroxides are normally not present
- Very poor – if any – soil development
Test for representativity

OVERBANK SEDIMENT

STREAM SEDIMENT
Overbank sediment – a smart sample medium due to natural processes

- The sediment suspended during floods has a widespread origin.
- A composite sample through a vertical section of an overbank represents a large number of sediment sources that have been active at different times and forms an integrated sample of the entire catchment areas.
Test basin

Boulders containing Molybdenite
Nikkel i flomsedimenter
Totalinnhold
(Nickel in overbank sediments: Total content)
Bly i flomsedimenter
Syreløselig del

(In lead in overbank sediments: Acid-soluble part)
Introducing the "overbank sediment method" to Europe

- A large portion of the global population live on floodplains
- Floodplains are important farm land
- Floodplains are often drinking water reservoirs
Sampling of overbank sediments from 800 rivers in Europe
35 % of the floodplains in Europe are polluted with historical mine waste.
Professor Xie from China has tested the "Norwegian method" in China.
Two field teams sampled China (10 million km$^2$) in two years
Top sample 0-25 cm

Bottom sample 75 - 100 cm
The Geochemical Distribution of Cu in China

Stream sediment
6 million samples

Overbank sediment
529 samples
Content of Platiun in overbank sediments in China (N=529)

Follow-up studies have resulted in discovery of several Pt-deposits
Rice fields with high concentrations of DDT and Cadmium
Content of DDT in the upper sample (N=529)
Mercury (Top) / Mercury (Bottom)
Mapping in the arctic
Spitzbergen
Severnaya Dvina
Pechora
Franz Josef island

NGU, NVE and Moscow State University
Content of PCB in overbank sediment from Severnaya Dvina

2040 ng/kg PCB

< 100 ng/kg PCB
Flux of PCB from Pechora (A) and Severnaya Dvina (B)

Top: 6.12 kg PCB/year
Bottom: 0.5 kg/year

Top: 1.0 kg PCB/year
Bottom: 1.5 kg/year
Glacial river Adventelva, Svalbard, Norway
Coal-mine settlement in Spitzbergen
110000 mg/kg PCB in capacitors
PCB in paint, plaster and concrete in buildings from the coal mining settlements on Spitzbergen island

3520 mg/kg PCB in paint
Active erosion and massive spreading of PCB-polluted soils and sediments in Barentsburg, Pyramiden and Longyearbyen

Estimated 2000 kg of PCB in soils from the Bartensburg settlement
Information on the web-site:
- General project information
- Overbank sediments
- Delta sediments
- Porposed sample sites
- Sample protocols
- Contact persons
- Meetings
We are missing North and South America and Africa

Australia is currently being sampled
Thank you for your attention