Environmental Geochemical Atlas of the Central parts of the Barents region

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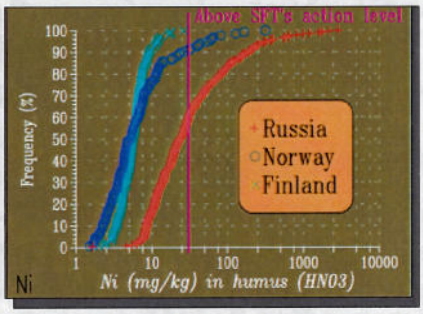
These maps illustrating pollution and natural content of Nickel are only 3 of the more than 400 maps contained in the Atlas

The Ni-Cu smelter in Nikel, Russia

Kola Ecogeochemistry consisted of a pilot project (1992), catchment studies (1994), and regional geochemical mapping in 1995.

Humus (top organic soil of max. 3 cm thickness) is considered to reflect long-term accumulation of many chemical elements, and is biologically important.

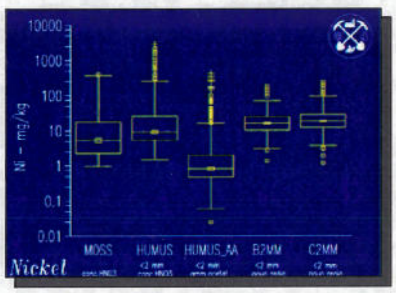
SFT (Pollution Control Authorities, Norway), has selected 30 mg Ni /kg as the action level for soil. In this project, 41 % of the Russian, 10 % of the Norwegian and none of the Finnish samples are above this level.



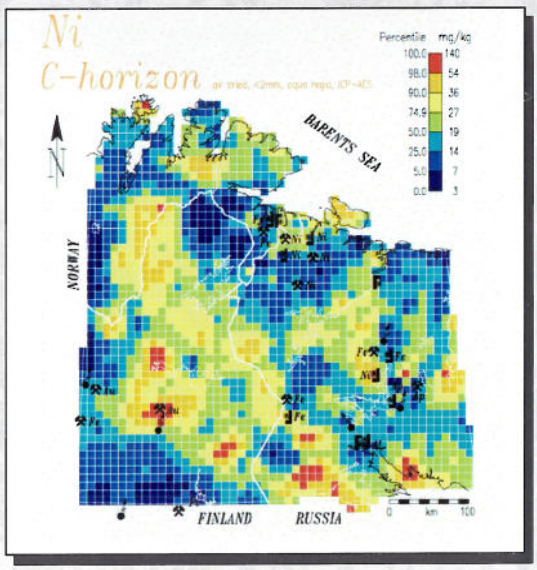
Frequency diagram of Ni in humus for each country

C-horizon (C2mm), the deepest podzol layer, gives a picture of the local non-contaminated background concentration of the elements.

The multimedia boxplot comparisons show the highest median content in the mineral soils (B2MM and C2MM) followed by humus (conc. HNO_3 -strong acid attack) and moss, which actually has the highest maximum Ni values due to air pollution. Major variations in Ni values in all media can also be observed (NB! logarithmic scale).



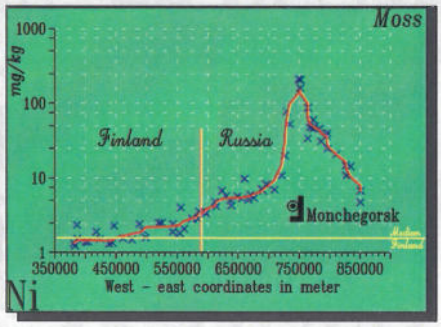
Boxplot comparisons of Ni in various media



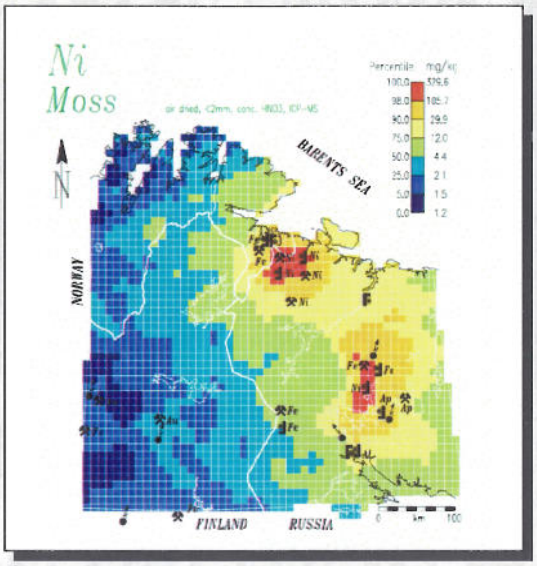
Nickel (Ni) in C-horizon based on 606 localities

Terrestrial moss obtains its nutrients from air and precipitation, and is thus a suitable bioindicator of airborne pollution.

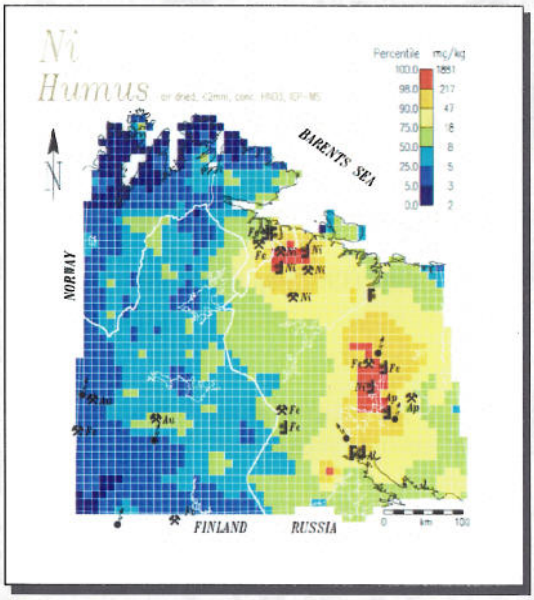
The elevated nickel concentrations caused by the Ni-smelters drop rapidly in the east-west directions. In the western-most part of the mapping area (>150 km from the smelters) it is hard to distinguish between natural background and pollution.



West-east profile of Ni in moss



Nickel (Ni) in moss based on 598 localities



Nickel (Ni) in humus based on 617 localities

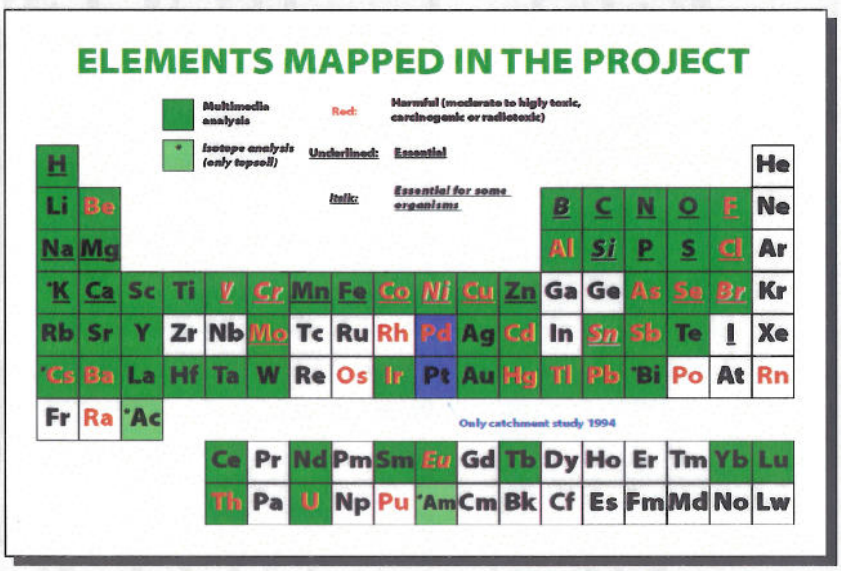
Multimedia

Sampled media	Pilot Project	Catchment Study	RegionalMapping
Snow (particulates and water soluble)	PP	CS	
Rain		CS	
Surface water	PP	CS	RM
Ground water		CS	
Moss	PP	CS	RM
Other vegetation		CS	
Topsoil	PP	CS	RM
Humus	PP	CS	RM
complete Podzol profiles (O, E, B, BC, C-horizons)		CS	RM
Stream sediments	PP	CS	
Overbank sediments	PP	CS	
Quaternary deposits	PP	CS	
Bedrock		CS	

Multielement

- more than 50 chemical elements analysed (see periodic table of elements)
- 6 radioisotopes measured in topsoil
- 15 PAH's in humus

Field sampling of soil



Publications of the project

Äyräs, M., et al. 1995.
Water, Air and Soil Pollution,
85: 749-754.

Äyräs, M., et al., 1997.
Journal of Geochemical Exploration,
58: 269-281.

Äyräs, M., et al., 1997.
Water, Air and Soil Pollution,
98: 361-380.

Boyd, R., et al., 1997.
Journal of Geochemical Exploration,
58: 283-289.

Caritat, P. de, 1996.
Computers & Geosciences,
22: 1191-1192.

Caritat, P. de, et al., 1996.
Aquatic Geochemistry, 2: 149-168.

Caritat, P. de, et al., 1996.
Aquatic Geochemistry, 2: 169-184.

Caritat, P. de, et al., 1997.
Water, Air and Soil Pollution,
94: 191-208.

Caritat, P. de, et al., in press. Accepted:
Environmental Science & Technology.

Garbe-Schönberg, et al., 1997.
Environmental Geology, 32: 9-16.

Kashulina, G., et al., in press. Accepted:
The Science of the Total Environment.

Kashulina, G., et al., in press.
Accepted: **Applied Geochemistry.**

Niskavaara, H., et al., 1996.
Applied Geochemistry, 11:25-34.

Niskavaara, H., et al., 1997.
Environmental Pollution, 96: 261-274.

Räisänen, M.-L., et al., in press. Accepted:
Journal of Geochemical Exploration.

Reimann, C., et al., 1996.
The Science of the Total Environment,
182: 147-158.

Reimann, C., et al., 1997.
Atmospheric Environment,
31: 159-170.

Reimann, C., et al., 1997.
Environmental Pollution, 95: 45-56.

Reimann, C., et al., 1997.
Atmospheric Environment,
246, V.31/23: 3887-3901.

Reimann, C., et al., in press.
Accepted: **Geoderma.**

Väisänen, U., et al., in press.
Accepted: **Water, Air and Soil Pollution.**

Volden, T., et al., in press.
Accepted: **Environmental Geology.**

Web address
http://www.ngu.no/Kola

THE KOLA ECOGEOCHEMISTRY PROJECT

a multimedia, multielement regional geochemical mapping of a 188,000 km^2 area in the European North (land masses between the Artic Circle and the Barents Sea, and 24°E and 35°30'E) - see map

International co-operation project between the Geological Surveys of Finland and Norway and the Central Kola Expedition in Russia

Participation of scientists from 9 different countries (Austria, Belgium, Canada, Finland, Germany, Lithuania, Norway, Russia, United Kingdom) - a total of more than 20 scientists working in the project

Financed by the respective organisations and the Royal Norwegian Ministry of the Environment

Project duration from 1992-1997 in three stages: a Pilot Project (1992/93), a Catchment Study (1994/95) and Regional Mapping (1995/97)

RESULTS AND USE OF DATA

- documentation of the regional distribution and sources of more than 50 elements over a large area ranging form strongly polluted to nearly pristine and covering three different vegetation zones
- proof of the emission spectrum of the different industries in the area and their regional importance
- more than 20 publications in international journals already in 1997
- many interesting new research topics identified
- understanding the processes governing the distribution of elements throughout the area
- baseline data for toxicological studies and for setting meaningful action levels
- prioritisation of remediation actions
- land use planning
- development of a clear and fair legal framework for industrial development in the area and clean-up requirements after closure

POSSIBLE USERS

- governmental bodies (international, national, regional and local)
- industry
- academia (geochemistry, geology, biology, medicine, forestry, geography...)
- people living in the area

CONTACT AND ORDER INFORMATION

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