Geochemistry of Europe

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Geochemistry of Europe

Geochemistry working group
Geochemistry of Europe: History

Typical high density stream sediment survey, early 1980ies: 1 site per 1 – 3 km².

Austria: 30,000 samples,

Germany: 80,000 samples

from: Sæther et al., 2005
Ultra low density geochemical map of the U.S.

K in surface soils of the U.S.A. – map based on 1 site / 6000 km²
Geochemistry of the U.S.

Potassium at the surface of the U.S.A. based on an airborne gamma-ray survey

Sample density equivalent to hundreds of thousands of samples taken on ground.

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www.eurogeosurveys.org
Geochemistry of Europe: The Nordkalott project

One of the first "low density" surveys in Europe

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Many elements show a different regional distribution in the various sample materials. Only a direct comparison allows to draw valid conclusions about sources & pathways of the elements.
Kola Project – low density sampling

C-horizon, <2 mm-fraction, sample density: 1 site / 300 km²!
Geochemistry of Europe: Geochemical Atlas of Eastern Barents Region

(Salminen et al., 2004)

1999-2003: 1,400,000 km², 1 site / 1000 km²
Geochemistry of Europe: The Baltic Soil Survey (BSS project, 1998-2003)

What causes anomalies?
A heat flow anomaly occurs at the site of the As-anomaly.

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Dose – Response Curve

NORMAL HEALTH

Deficiency
Beneficial
Detrimental

Toxicity

Element concentration (e.g., Se, F, Cl, I)

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What causes such dreadful conditions?
Baltic Soil Survey: Pb-concentrations in agricultural soils from northern Europe. TOP: 0-25 cm, BOT: 50-75 cm.
Baltic Soil Survey: Sn-concentrations in agricultural soils from northern Europe. TOP: 0-25 cm, BOT: 50-75 cm.
Geochemistry of Europe – natural gradients

Isostatic Uplift

Topography

Climate

Exist other gradients than distance to Central Europe at the S-tip of Norway?

Vegetation zones

maps from Moen 1998, Thoresen, 2000
**Baltic Soil Survey:** Se-concentrations in agricultural soils from northern Europe. TOP: 0-25 cm, BOT: 50-75 cm.
History

WEGS Geochemistry working group 1985-1993:
- Suggests a Geochemical map of Europe, based on surface water, ground water, surface soil, subsoil and overbank sediments, 9500 sampling sites, 1/500 km²

FOREGS Geochemistry working group 1994-1995:
- Inventory of existing regional geochemical databases

FOREGS Geochemistry working group 1996-2004:
- Geochemical Baseline Mapping of Europe
Sample media

- Stream water (filtered and unfiltered)
- Stream sediment (minerogenic)
- Residual soil, top & bottom
- Humus
- Floodplain sediment

Fieldwork was carried out from 1998-2002 in the form of national subprojects

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Nickel in Topsoil

c. 4,200,000 km²,

1 site / 5000 km²

( from Salminen et al., 2005)
Some parameters reflect human activities

The nitrate concentration of stream water is strongly affected by agricultural practice
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...others predominantly differences in natural conditions

pH in stream water is due to climate.
Aluminium in stream water.
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Hg in Topsoil.

An anthropogenic or a natural pattern?
Thallium in topsoil: long range atmospheric transport?
Focus in Environmental Geochemistry during the last 25 years was on anthropogenic impact.

However, the EuroGeoSurveys geochemical atlas of Europe demonstrates that at the European Scale:

NATURE RULES

Deficiency is probably at least as important as toxicity
Figure 3. Annual precipitation in Europe.

Many large natural (and anthropogenic) gradients exist at the European scale.
Geochemical Mapping of Agricultural Soils (GEMAS)

EuroGeoSurveys cooperation project:
34 European countries
5.6 mill. km²

C. 2500 samples “grazing land soils”

2 sample materials at 1 site/2500 km²

C. 2500 samples “agricultural soil”
GLOBAL GEOSCIENCE MAPS

Geological map of the World

Global seismic hazard map

Seismotectonic map of the World

Gravity map of the oceans

World magnetic field map