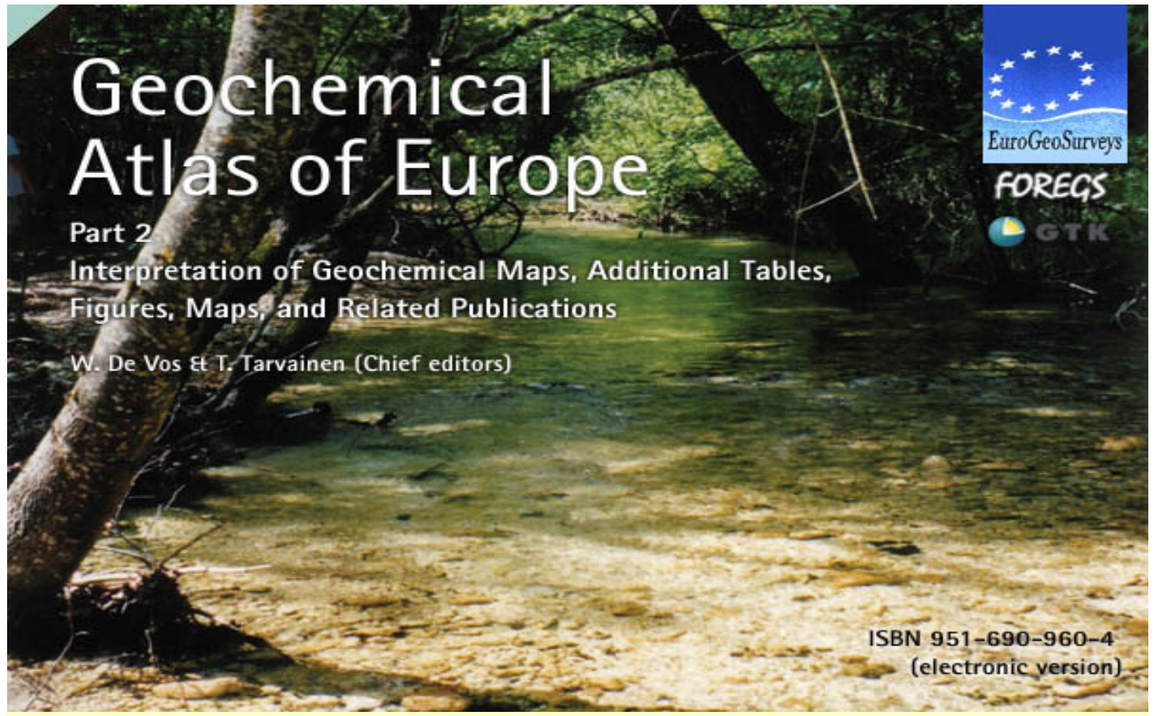

The Geochemical Atlas of Europe provides European decision-makers with data about the chemical composition of the near-surface environment at the end of the twentieth century. The results show that the distribution patterns of water and solid samples do by and large still reflect natural processes at the European scale (*e.g.*, geology, weathering and climate). Effects of anthropogenic activities (*e.g.*, input via fertilisers) can be detected for some elements only.

Altogether, 360 geochemical maps showing the distribution of elements across Europe have been prepared and included in the two volumes of the Geochemical Atlas of Europe:

- Volume 1 presents background scientific information, including the methodology used, as well as the geochemical distribution maps portraying the analytical results, and
- Volume 2 is the interpretative part, with articles describing the distribution of the elements in soil, humus, stream and floodplain sediments and surface water.

Governmental Institutions from 26 countries, most of them members of EuroGeoSurveys, the Association of Geological Surveys of the European Union (the past Forum of European Geological Surveys, FOREGS) have collected samples of:

- stream water & sediment
- floodplain sediment, and
- three types of soil (organic topsoil, minerogenic top- and sub-soil)

from almost 900 stations spread randomly in large and small catchment basins over the sampled countries at an average sample density of 1 site/4700 km^2.

All soil and sediment samples were collected according to a common protocol and prepared at the same laboratory. Samples of the same type were analysed by the same method at the same laboratory. This approach guarantees that the results are directly comparable at the European scale. Sixty-six individual chemical elements and other parameters (such as pH and grain size) were determined. The electronic version of the Geochemical Atlas of Europe is available at:

http://www.gtk.fi/publ/foregsatlas/

Clean and abundant water, fertile and uncontaminated soil are fundamental components of life, and essential assets for Europe's sustainable development. The Geochemical Atlas of Europe provides for the first time an insight into the spatial distribution of chemical elements in a variety of terrestrial sample materials. It clearly documents the broad spatial variability of major and trace element concentrations in stream water & sediments, floodplain sediments, and soils by up to several orders of magnitude. This geochemical variability reflects predominantly natural conditions (climate, weathering & soil formation, geology, biology), which are locally disturbed by other influences, such as human activities.

The combination of local geology, climate and biological activity govern the bioavailability of major and trace elements, and their potential impact on human health. The atlas highlights the natural geochemical variation, and illustrates the difficulty of defining a single threshold value for a specific chemical element in order to characterise the '*good status*' of water, soil and sediments applicable throughout Europe.

The geochemical composition of soil and water affects the yield of crops and livestock, the quality of drinking water, and finally whole local ecosystems. It also affects human health through the intake of water and food. Large populations over the world are affected by deficiency, excess or imbalance of inorganic elements in groundwater, surface water and soil.

The atlas is a voluntary contribution of EuroGeoSurveys to EU policy making, and to our common understanding and management of our environment. It is a first '*geochemical baseline*' against which the next generations will be able to quantify changes, whether natural or human-made. This publication shows the capacity of the European Geological Surveys to serve European policies by undertaking joint projects at the continental scale by joining their efforts and developing common methodologies, syntheses and professional expertises.

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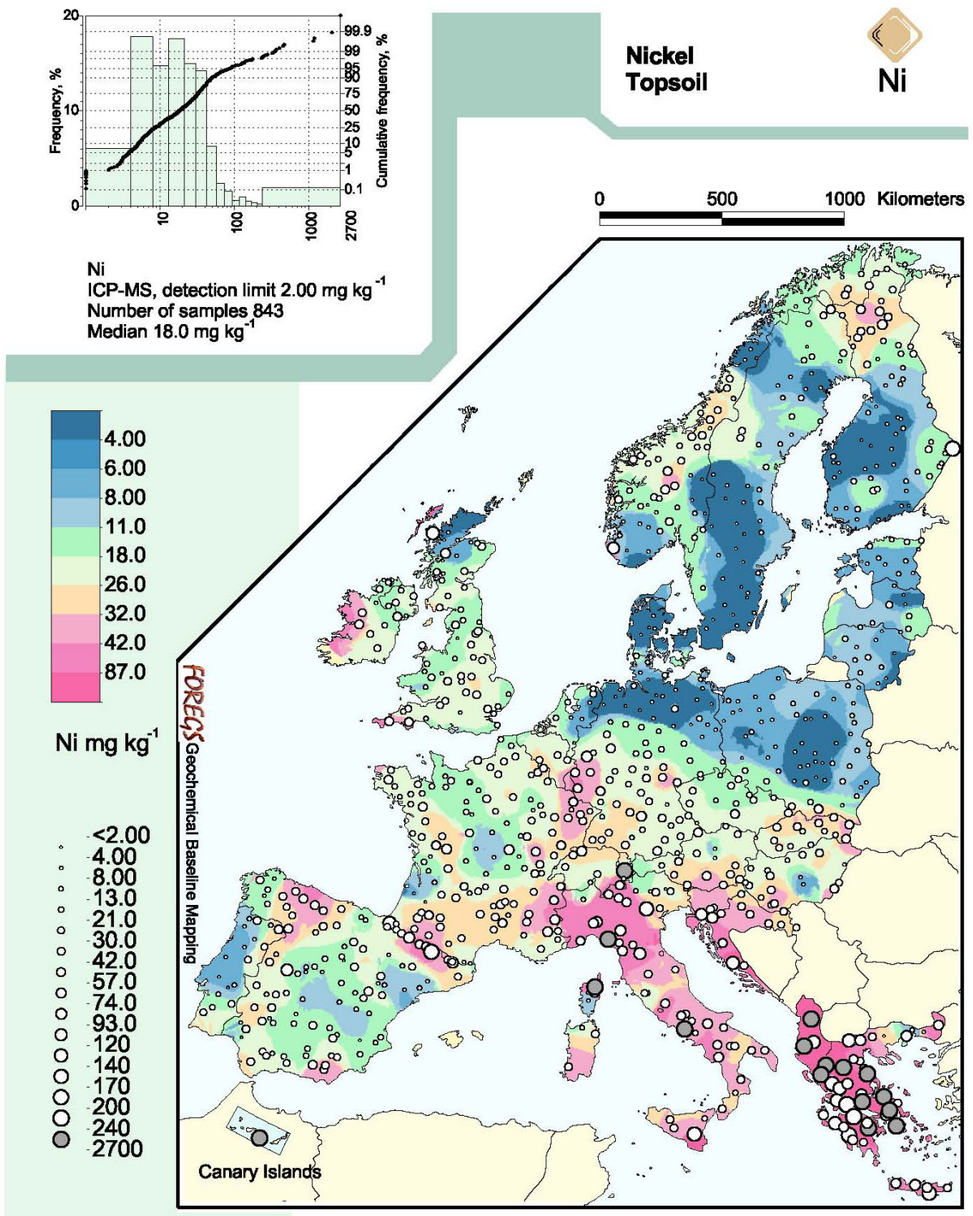

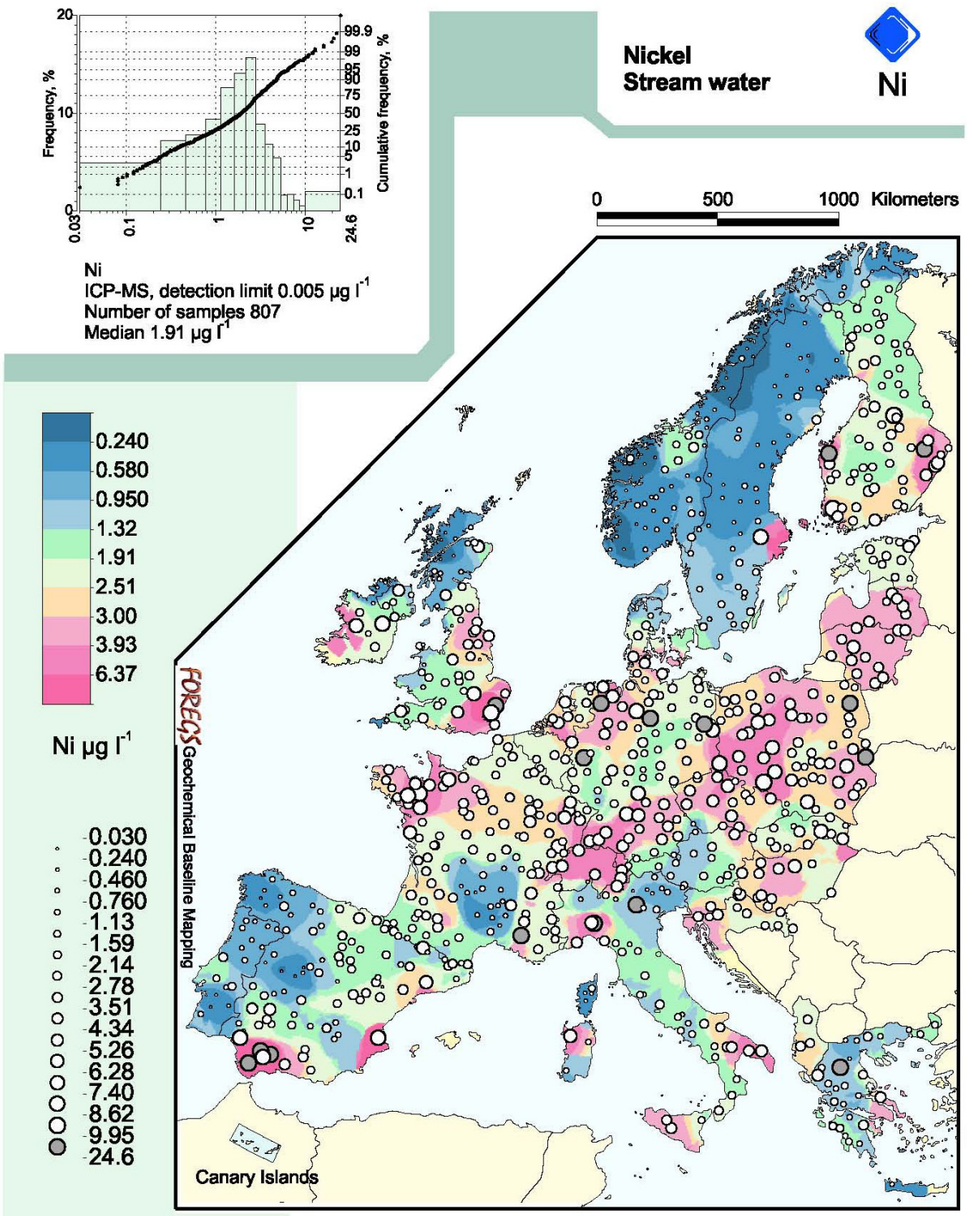

The two geochemical maps demonstrate that natural nickel (Ni) concentrations on the European scale vary by three orders of magnitude in stream water (from 0.03 to 24.6 µg l^{-1}), and by four orders of magnitude in topsoil (from <2 to 2690 mg kg^{-1}). The maps show that nickel concentrations in soil and in stream water do not necessarily correlate.

Nickel is not known to be essential for humans, but traces are found in all human tissues, and some relationships with certain illnesses appear to exist in people with high or low blood nickel levels.

Anthropogenic sources of Ni include fertilisers, steel works, metal smelting and plating and coinage, fuel combustion and detergents. In the presence of some organic complexing agents, Ni is capable of forming neutral or negatively charged complexes, making the metal highly mobile in relation to other trace elements. Consequently, Ni concentrations may be high in stream water contaminated by sewage and leachate from waste tips.

Nickel is enriched in ultramafic and mafic rocks, and shale. Most of the areas with increased Ni-concentrations in the topsoil map are underlain by greenstone belts or mafic and ultramafic rocks.

The maps do not provide evidence for widespread anthropogenic Ni contamination at the European scale. Almost all variations displayed on the maps find their explanations in natural geogenic and climatic factors. However, on a more local scale human influences may occur, as for example the point nickel geochemical anomaly in eastern Spain on the Mediterranean coast at Cabo de la Nao, which has been caused by industrial activities.

A remarkable feature shown by Ni in topsoil is the border of the last ice age, running through the Netherlands, Germany and Poland, with exceptionally low Ni-values to the north of the border, and much higher values to the south of it. On both maps, much lower Ni-concentrations occur in northern, than central and southern Europe. It is thus impossible to define a common "*good quality*" value for Ni in water or soil at the European scale. It is, however, possible to derive "*expected*" natural concentrations for sizable areas within Europe, to detect deviations and to study their cause.