

## The Future of Geochemistry at the Geological Surveys

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In many European countries adequate regional geochemical surveys, based on regionally appropriate sample material (most often stream sediments), often collected at a high sample density, have been completed. The question whether there is anything left to do for geochemists at Geological Surveys may thus appear justified.

Regional geochemical surveys have often been the driving force behind new analytical developments, be it for better detection limits or additional elements. Some recent geochemical surveys have tested the limits of regional geochemistry in terms of required sample density and sample materials and combinations thereof. In a way one can today categorize the classical geochemical surveys as a learning exercise: only now do we really understand how to approach regional geochemistry and only very recently do we have sufficient techniques at hand to produce really good data sets – at all scales.

At the same time there are two major political developments that have an important impact on the tasks of geochemists in Geological Surveys:

- globalisation, and
- urbanisation.

At many surveys regional geochemistry has until quite recently been focused on national scale or local mineral resources related studies. Today data are needed on the continental scale and on a very local and detailed scale in areas where people live. Examples for such data are the recently published „Geochemical Atlas of Europe“ at the continental scale and a variety of urban geochemistry projects that have delivered important data for city administrators at the local scale. Environmental issues play a much more important role than previously and the analytical programs need to be modified accordingly. Mineral resources are also regaining importance with increasing raw material prices, competition for mineral resources between developed and developing societies and the slowly raising political awareness of the long term consequences of the fact that the Earth's resources are limited and often come from rather unstable areas of the planet.

Multi-element geochemistry has had its stronghold in Geological Surveys for more than 40 years. Geological Survey laboratories were at the forefront of developing analytical techniques for inorganic analyses and improving detection limits. Due to the costs of funding of laboratories and the ever increasing prices of the equipment Geological Surveys world-wide are losing this competitive edge. For example, the multicollector ICP-MS allows to study many new and exciting isotope systems. Geological Surveys are for the first time hardly involved in the development, although such data sets would be certainly needed at a regional scale as well as for pure research applications. During the last 10 years multi-media geochemistry has played an important role in regional geochemistry. It could be demonstrated, that to understand the geochemical processes at the earth's surface, directly comparable data on the regional geochemistry of a variety of materials, representing different parts of the ecosystem, are required. Furthermore the importance of scale for the interpretation of geochemical patterns has been recognized. Many of the existing old datasets are no longer suitable to answer the emerging new questions. Examples from countries where already both, old and new regional data sets exist (e.g., Germany, N-Ireland), highlight this aspect.

New geochemical data are thus still needed at different scales: continental, national and local for a variety of different purposes and, most importantly, for a variety of sample materials, preferably collected for direct comparison. Only now, using the new analytical techniques, are we able to get good, reliable data for many important elements. Geological Surveys have a unique opportunity to become national data base centers for environmental data. Universities and contract research organisations do neither work at all scales nor can they guarantee the long term availability of their data. More and better multi-element and multi-media data at all scales, supporting the understanding of processes controlling the transport of substances between lithosphere, pedosphere, hydrosphere, biosphere and atmosphere, and their fate, are urgently needed. Modern geochemical data play also an important role in the emerging field of forensic geochemistry, e.g. tracing the origin of food.

Geosciences link ultimately with many human health (and safety) issues. Close cooperation with biologists, soil scientists, toxicologists, epidemiologists and medical researchers will be needed for future work. Both, continental and urban scale, are ultimately linked via human health issues. Medical Geology may provide an important vehicle to better sell the importance of regional geochemistry to politicians and the general public.

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Zeitschrift/Journal: [Berichte der Geologischen Bundesanstalt](#)

Jahr/Year: 2008

Band/Volume: [77](#)

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