

4.7.P08**The British Geological Survey's
Geochemical Baseline Survey of the
Environment: Arsenic in soil**

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The British Geological Survey (BGS) has a long established geochemical mapping programme and has now mapped some 80% of the land area of Great Britain. The Geochemical Baseline Survey of the Environment (G-BASE) project collects stream sediments and water from low order streams at a density of one sample per 1–2 km². In recent years the sampling suite has been extended to include soils. High resolution geochemical maps can be generated for over 40 elements. The programme started in northern Scotland principally associated with mineral exploration. Demand for geochemical maps is now driven by environmental issues, particularly in response to legislation such as the UK Environmental Protection Act Part IIa [1].

This poster demonstrates the application of G-BASE soil data to the environmentally important issue of arsenic in the environment. A map showing the total concentration of arsenic at around 28,000 individual soil sampling sites throughout parts of England is presented. The mineral content and chemical composition of soils largely reflects the weathering of the underlying parent material - either the solid bedrock or a variety of unconsolidated deposits (such as glacial till). In central and eastern England, the high arsenic concentrations occur in soils derived from Jurassic and Cretaceous rocks. By contrast, in south-west England the highest arsenic concentrations are associated with mineral deposits and the associated mine wastes that have resulted from their exploitation.

Due to the toxic properties of certain chemical elements (including arsenic), the UK government has established SGV's (soil guideline values) for a range of substances to aid the assessment of risk to human health from land contamination [2]. The SGV for arsenic in residential areas and allotments is 20 mg kg⁻¹. This does not mean that soils with arsenic concentrations above this threshold pose a significant risk to human health. It indicates that further work is needed to assess the potential for harm. Soils across large parts of England have arsenic concentrations above this threshold. With the aid of geological maps, this information can help local authorities and consultants establish whether the arsenic is likely to be of natural or anthropogenic origin.

References

- [1] DETR (2000) UK Department of Environment, Transport and the Regions, DETR Circular 02/2000.
- [2] DEFRA, and ENVIRONMENT AGENCY (2002) UK Department for Environment Food and Rural Affairs and Environment Agency

4.7.P09**Distribution of As in shallow
groundwater in the province of
Zeeland, The Netherlands**

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In the province of Zeeland the regional groundwater monitoring network shows that As concentrations vary from lower than 1 to more than 100 µg l⁻¹ at depths between 1 and 20 metres below surface. The As content in some of these shallow groundwater wells show strong seasonal variations. High As values and seasonal variation are thought to be related to reductive dissolution of Fe oxyhydroxides and/or adsorption/desorption processes. Locally - near the border of the province of Brabant - groundwater As values can be related to pyrite oxidation.

However, with the present limited data set, processes behind both seasonal and spatial variation cannot be understood. Because of this, no detailed risk maps can be made predicting high As values in the groundwater.

In order to prepare risk maps and to distinguish the processes leading to the varying As concentrations, two areas were selected for detailed study. In December 2003, two filter depths (1-2 and 15-20 m below surface) at more than 100 locations were sampled and analysed for cations, anions and P by ICP-MS, IC and photospectrometric methods. In addition, boreholes were drilled to update the existing geological maps and to determine As levels in subsurface sediments.

The first results show that As in the groundwater is only enriched 1-2 metres below the surface, and only in specific parts of this area. In As-enriched samples, Fe is low compared to As-poor samples and there is no correlation between Fe and P. The low Fe content suggests that Fe is either removed from the groundwater by a Fe-bearing phase (e.g., siderite) or that As is removed from sediments by a phase that does not release Fe. The first possibility will be tested by analyzing the DOC and DIC content of the groundwater.

In our poster we will show the spatial distribution of As and a number of other elements in the shallow groundwater of the investigated areas. On the basis of the cation and anion associations in the groundwater and the distribution of As in the associated sediments, the processes responsible for the release of the As will be postulated and tested.