THE LINK BETWEEN SOIL GEOCHEMISTRY IN SOUTH WEST ENGLAND AND HUMAN EXPOSURE TO SOIL LEAD

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Introduction

The geological diversity and mineral deposits of south-west England have been exploited since the Bronze Age resulting in soil contamination from potentially harmful elements such as Pb. The area attracts over 500,000 visitors a year, providing an exposure mechanism to bring humans into contact with the natural environment and associated soil contaminants. Humans, particularly children as the most vulnerable in society, are exposed to soil PHE by oral, inhalation and dermal pathways. Ingestion is the primary exposure route with an estimated ingested mass of 100 mg per day. A cumulative toxicant, there is no safe level of exposure to Pb, which is distributed throughout the body affecting multiple body systems and considered to be a priority contaminant under UK contaminated land guidance. Determination of the amount of soluble harmful elements in the gut (bioaccessible) after ingestion is carried out using in vitro methods simulating the gastro-intestinal tract (Oomen et al., 2002). Understanding hazards posed by human interaction plays a significant part in the assessment of risk and risk mitigation enabling the development of fit for purpose land contamination and planning strategies.

Methods

The British Geological Survey (BGS) have recently completed a systematic geochemical soil survey of south-west England (http://www.bgs.ac.uk/gbase/gBaseSW.html), as part of a wider programme of work to map the geochemical baseline of the UK (www.bgs.ac.uk/gbase). For the south-west region, in the order of 1150 shallow (5-20 cm) soils were collected and analysed for 50 elements by X-Ray Fluorescence Spectrometry (XRFS). Fifty samples were chosen for bioaccessibility analysis using a cluster analysis approach followed by UBM extraction (Wragg et al., 2011). A Self Modelling Mixture Resolution (SMMR) approach (Cave et al., 2013) was used to determine the host soil components of bioaccessible Pb.

Results

Figure 1a shows that the mean total Pb concentration was 64 mg kg^{-1} (20-247 mg kg^{-1}), spanning what is considered to be the 'normal' concentration for the area (Ander et al., 2013). Mean bioaccessible Pb was 22 mg kg^{-1} (6-154 mg kg^{-1}), indicating that 34% (17-95%) was mobile in the gut and available for uptake (Figure 1b). The SMMR approach indicated that the available Pb was associated with multiple geochemically distinct components of natural and anthropogenic origin, reflected in large range of Pb bioaccessibility across the south-west of England.

Conclusion

Lead in the test soils is bioaccessible/soluble and therefore available for uptake into the human body: potentially harmful to human health. The SMMR approach identified the geochemical hosts of bioaccessible Pb putting the human availability in context within the wider geochemical character of **the** area. This information can support decision making in risk management e.g. for assigning the most appropriate land use and setting remediation goals for the re-purposing/ development of naturally and anthropogenically contaminated land.

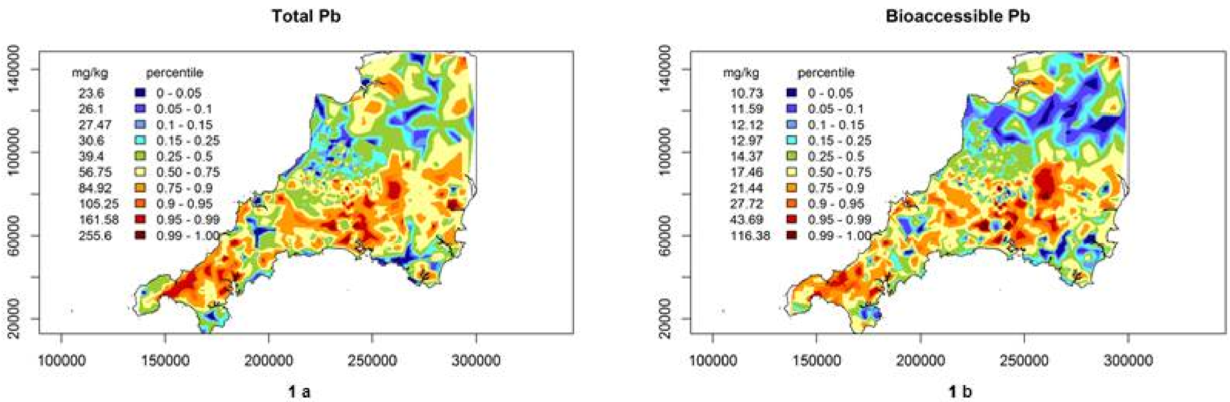

Figure 1. 1a: Interpolated map of soil total Pb concentrations; 1b: Interpolated map of soil bioaccessible Pb concentrations

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