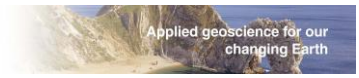
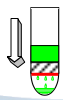
British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL



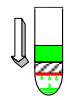
Understanding the Risk to Human Health from Toxic Elements in Soil by Simplifying the Black Art of Sequential Extractions

Mark Cave and Joanna Wragg



What do we want from Sequential Extractions?

- Provide a methodology to determine the physico-chemical forms of PHEs in the soil environment.
- Provide information on the potential mobility of PHEs under different soil conditions, to different 'at risk receptors'
- Ultimately be used as additional lines of evidence to support *in vitro* bioaccessibility testing in the assessment of human health risk from accidental soil ingestion.

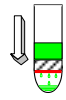


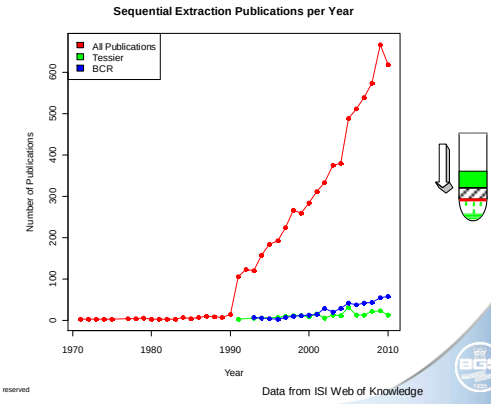
What's wrong with our current approach?

- The so-called 'selective extraction' reagents are not specific for one mineral phase
- The design of the selective extraction schemes leads to a methodological definition of the distribution of trace elements.
- As a consequence of the long reaction times, metals/metalloids that have been released from one target phase can be re-adsorbed onto different phase therefore giving an erroneous element distributions.
- There are many variations which makes comparisons between studies difficult.

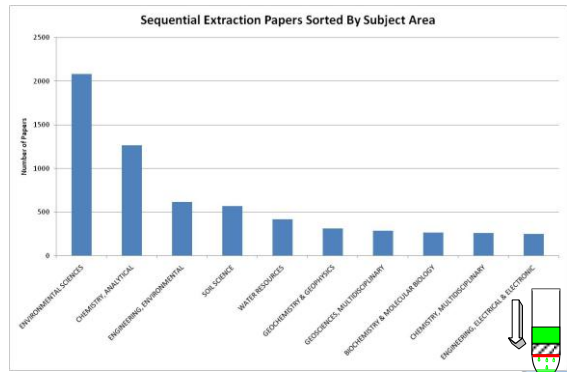
There are procedural difficulties

- The extractants used to target specific phases provide a difficult solution matrix to analyse by atomic spectrometry techniques.
- The extraction schemes are labour intensive (particularly when carried out on large numbers of samples) and very time consuming lasting many hours with a number of sample washing steps between each extractant.





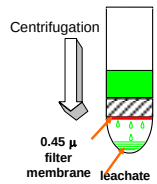
Data from ISI Web of Knowledge



A Different Approach

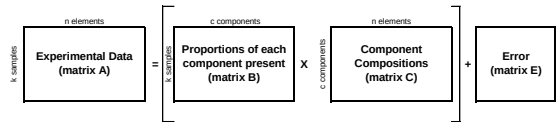
CISED Test
Chemometric Identification of Substrates and Element Distributions

- Separate aliquots of aqua regia of increasing concentration.
- Passed through the sample under centrifugal force.
- Determination by ICP-AES.
- Chemometric data processing .
- Identification of physico-chemical hosts and the metal distributions within the sample under test.



Self Modelling Mixture Resolution SMMR

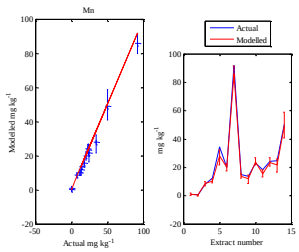
(Un-mixing the mixture)

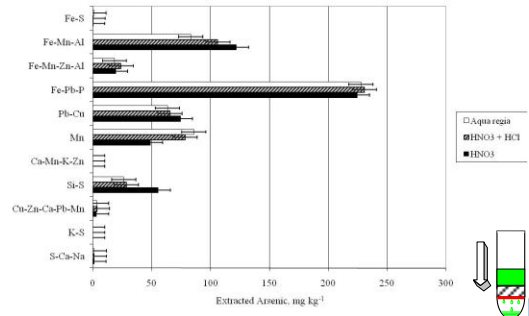


CAVE, M R. 2008. The use of self modelling mixture resolution for the interpretation of geochemical data. *British Geological Survey, IR/08/035.*

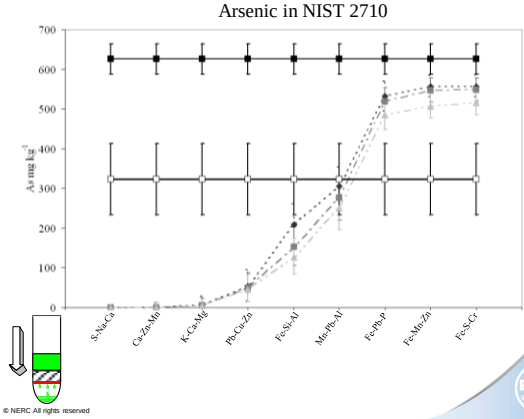
CAVE, M R, MILODOWSKI, A E, and FRIEL, E N. 2004. Evaluation of a method for Identification of Host Physico-chemical Phases for Trace Metals and Measurement of their Solid-Phase Partitioning in Soil Samples by Nitric Acid Extraction and Chemometric Mixture Resolution. *Geochemistry: Exploration, Environment, Analysis, Vol. 4, 71-86.*

Tamar Catchment Soil

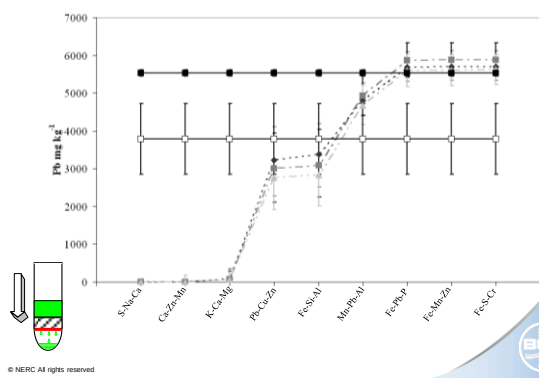




Arsenic in NIST 2710



Pb in NIST 2710



Are you interested?

- Would you like to try a different approach?
- BGS can supply the protocol and the data processing software.
- We wish to set up a an inter-laboratory trial.
- If interested please contact mrca@bgs.ac.uk.