Spatial record of recent anthropogenic changes in the sedimentary soils of the Netherlands; Opportunities for a knowledge-based soil legislation framework

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Much of our knowledge about recent environmental changes – such as the increased anthropogenic emission of various metals – has been inferred from sedimentary records. These paleorecords, however, mainly focus on environmental changes through time. To generalize such changes in a spatial context, geochemical baseline surveys are required.

Using the data from the Geochemical Soil Survey of the Netherlands (Van der Veer, 2006), a geochemical baseline model was developed. The baseline model, based on covariability in pristine sediments, revealed a substantial overall enrichment of metals including Cd, Cu, Hg, Pb and Zn. These enrichments reflect the accumulation of metals in the topsoil compartment as a result of ongoing diffuse input from various anthropogenic sources. The enrichment, generally a factor 2-3 above natural concentrations, varies on a local as well as a regional scale.

Besides tracking environmental changes in a spatial context, the model furthermore offers unique possibilities to derive soil quality standards for a knowledge-based soil legislation framework. In this presentation we will show how the model can be used to derive soil quality standards, and how to take the natural variation of soils, as well as the diffuse enrichment, into account.

Reference

Van der Veer G. (2006). Geochemical soil survey of the Netherlands. Atlas of major and trace elements in topsoil and parent material; assessment of natural an anthropogenic enrichment factors. *Netherlands Geographical Studies* **347**, *248 pp.*

Bionergetics of the buried seafloor

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Major questions in subsurface biosphere research are related to bioenergetics. How much energy is required to support a given amount of biomass? And what is the minimum energy yield of reactions that are biologically utilized? Beyond these, there are related issues, such as, the energetic rules that govern the distribution of subsurface life, in particular, the controls on the distribution and rates of the various energy producing metabolic reactions and the possibility that some buried marine ecosystems rely on radiolytic H_2 as their principle electron donor.

In situ metabolic rates and energy yields of diverse microbial activities in sediments of the eastern equatorial Pacific have been determined based on sedimentary pore fluid chemical profiles. Fe and SO_4^{-2} reduction, and methanogenesis co-occur. These are energetically favorable throughout the sediment column with relatively constant energy yields. Based on this, minimum biologically utilizable energies of reaction can be inferred and it appears that this ecosystem operates as a thermodynamic homeostat.

When combined with reaction rate estimates, based on a numerical solution to the diffusion/reaction continuity equation, these data allow the calculation of an average maintenance energy that is orders of magnitude lower than observed in the laboratory. Based on this, it is inferred that in marine sediments, radiolytic H_2 could support approximately 10^5 while approximately 10^4 could be supported in a water-saturated sediment that has a U, Th, and K similar to that estimated for the Martian crust.