

## Characterization and monitoring transport of DNAPLs at a contaminated site using geophysical methods and numerical simulation

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Locating Dense Non-Aqueous Phase Liquids (DNAPLs) source zones in aquifers are difficult because of DNAPLs' physical properties (low solubility in water and are denser than water). This job is often a bottleneck for the successful remediation and/or control of groundwater contamination. An approach for characterization and monitoring transport of DNAPLs combining geophysical methods and numerical simulation is applied to a site contaminated by Chlorobenzene and Nitrobenzene, located at Yanziji in Nanjing, China.

Since DNAPLs have a very high electrical resistivity, the resistivity methods may be one of the best ways to locate a polluted zone. The results of using resistivity image profiling (RIP) method and ground penetrating radar (GPR) method show that both methods are useful to detect DNAPLs pool and to monitor the migration of DNAPL plume. Due to a limitation of investigating depth by using GPR, RIP results provide more subsurface information than that of GPR.

The T2VOC integrated finite difference computer code (Falta, 1995) for simulating the transport of organic chemical contaminants in non-isothermal multiphase systems has been used for investigation of the feasibility using the technologies of combining Air Sparging (AS) and Soil Vapor Extraction (SVE) system via the long-term *in situ* soil and groundwater sampling. Simulation results show that the success of AS/SVE systems depends highly on the soil at the cleanup sites. When the saturated hydraulic conductivity of the aquifer is too small, such as clay layers, the AS/SVE systems are not as efficient and require longer pumping times and closer well spacings. The higher hydraulic conductivity and smaller porosity could get faster removal efficiency.

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## Influence of soil weathering on the potential iron solubility in soil dust subjected to atmospheric processing

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Iron from mineral dust is the most important external source of iron to phytoplankton in the offshore ocean. While several studies have investigated atmospheric processes that lead to the dissolution of crystalline iron minerals and the formation of iron nanoparticle, no studies have attempted to characterise the soil processes which control the amount of potentially reactive iron in dust. Here, we investigated the iron mineralogy and the weathering of soils from known dust source locations across the Sahara/Sahel in order to determine controls on dust iron solubility using geochemical, mineralogical and high-resolution microscopic techniques.

The atmospheric processing (AP) of soil or standard iron mineral samples was experimentally simulated via an alternation of acidic (pH 2) and circumneutral (pH 5-6) conditions over periods of 24 h each. The potential iron solubility ( $Fe_{psol}$ ) was determined as the percentage of dissolved iron after two cycles between pH 2 and 5-6 and a further day at pH 2 (3 days of actual contact with acid) relative to the total iron (FeT) present in the sample. These values were compared with calculated predictions of iron solubility based on the amount of individual Fe-bearing minerals present in the sample and solubility of corresponding minerals. Calculated and measured  $Fe_{psol}$  of soil samples did not match. We attributed this to the variability in chemical, mineralogical and physical properties of iron minerals (i.e. particle size, crystallinity, presence of impurities) in soil samples compared to standard minerals.

However, we found a clear correlation between the degree of weathering (measured by the Parker, Chemical Index Alteration and FeD (dithionite Fe)/FeT indices) in samples collected in the Sahara/Sahel region (including Bodélé Depression – major actual source of dust) and their potential iron solubility determined after AP. Overall, our results indicate that weathering in soil dust sources is likely to be a major control on the iron solubility of the dust delivered to open oceans.