Arsenic sorption on Holocene and Pleistocene aquifer sediments

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Arsenic (As) contaminated groundwaters in Holocene aquifer pose a serious health concerns for millions of people. In addition, successively increasing abstractions from deep uncontaminated Pleistocene aquifers for municipal and irrigation water supply is potentially inducing As migration from adjacent Holocene aquifers. Adsorption onto sediments is likely the most critical process for the retardation of As migration. However, Holocene and Pleistocene sediments possess different mineral assemblages and different As sorption characteristics, both of which are complex factors that depend on the prevailing geochemical conditions. To adequately predict As retardation and the contamination risks for Pleistocene aquifers it is necessary to understand and quantify the spatially and temporally varying sorption characteristics associated with different sediment types and under varying geochemical conditions.

Here, we present a joint laboratory and modelling study to quantify As sorption characteristics of both Holocene and Pleistocene sediments. We characterise sorption behaviour for a study site near Hanoi (Vietnam), where groundwater is known to migrate from a high As Holocene aquifer to a low As Pleistocene aquifer. Both aquifers are separated by a thin redox-active transition zone that hosts a distinctly unique sediment-type. Fresh representative samples of all three sediment-types were used for batch and column sorption experiments. The results from the batch sorption experiments were used to constrain the development of sediment-specific surface complexation models (SCMs). Preliminary results suggest significantly higher As sorption onto Pleistocene and transition zone sediments compared to Holocene sediments. These SCMs will be incorporated in 1-D reactive transport models (RTMs) to interpret results from the column experiments with varying flow rates. Combined laboratory and modelling results will help to understand and predict the current and future evolution of As distribution at the study site.