



Quantifying reactive transport processes governing arsenic mobility in a Bengal Delta aquifer

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Over the last few decades significant progress has been made to characterize the extent and severity of groundwater arsenic pollution in S/SE Asia, and to understand the underlying geochemical processes. However, comparably little effort has been made to merge the findings from this research into quantitative frameworks that allow for a process-based quantitative analysis of observed arsenic behavior and predictions of its future fate. Therefore, this study developed and tested field-scale numerical modelling approaches to represent the primary and secondary geochemical processes associated with the reductive dissolution of Fe-oxy(hydr)oxides and the concomitant release of sorbed arsenic. We employed data from an in situ field experiment in the Bengal Delta Plain, which investigated the influence of labile organic matter (sucrose) on the mobility of Fe, Mn, and As. The data collected during the field experiment were used to guide our model development and to constrain the model parameterisation. Our results show that sucrose oxidation coupled to the reductive dissolution of Fe-oxy(hydr)oxides was accompanied by multiple secondary geochemical reactions that are not easily and uniquely identifiable and quantifiable. Those secondary reactions can explain the disparity between the observed Fe and As behavior. Our modelling results suggest that a significant fraction of the released As is scavenged through (co-)precipitation with newly formed Fe-minerals, specifically magnetite, rather than through sorption to pre-existing and freshly precipitated iron minerals.