Linking Suspended Sediment in Floodwaters to Groundwater Redox Status and Arsenic Levels along the Lower Mekong River of Cambodia

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Excessive amounts of arsenic (As) in drinking water inflict severe health problems on more than 200 million people globally. Groundwater As concentrations vary markedly across alluvial and deltaic aquifers in Southeast Asia making it challenging to understand the factors linked to this As heterogeneity. Knowledge of these factors, however, is critical for identifying populations at risk of excessive As exposure and for locating As-safe groundwater resources. Research to date has largely focused on understanding how natural and anthropogenic factors affect groundwater As and has demonstrated that the biological reduction of As-bearing iron (Fe) oxides in anaerobic environments is critical for mobilizing As. Seasonal flooding that carries overbank river deposits may be principally responsible for delivering the sediments that typically lead to As mobilization: reactive As-bearing Fe-oxides as well as organic carbon. However, this linkage between sediment presence and groundwater As has not thoroughly been investigated. Here, we used remote sensing to detect suspended sediment concentrations and flooding extent and linked these two factors to thousands of groundwater As concentrations along the lower Mekong River of Cambodia. Surface suspended sediment concentrations were measured from turbidity data in LANDSAT images over a 35-year period between 1984-2019. Our results revealed that distinct ranges of monsoonal flood-derived suspended sediment concentrations were strongly associated with varying As levels across aquifers in Cambodia. More specifically, low mean suspended sediment concentrations (approx. <100 mg/L) correlated with groundwater As <10 ppb. Groundwater As levels were frequently elevated in areas containing suspended sediment concentrations above this 100 mg/L threshold. Together, suspended sediment concentrations and flooding conditions are promising variables that can be used to predict groundwater As heterogeneity across scales along the lower Mekong River of Cambodia.