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Characterizing oxidative conditions of contaminated aquifers in the Mekong River Delta of Vietnam

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Southeast Asia has seen rapid economic and agricultural growth over recent decades. As a result, demand for reliable fresh water has been steadily rising. Groundwater has become increasingly popular to meet these needs but is subject to contamination. Naturally occurring arsenic in aquifers comprised of sediments derived from Himalayan sediments is commonly exhibited in this region, with some groundwater vastly exceeding the World Health Organization's recommended limit of 10 µg/L. There is a substantial body of work focusing on the release mechanisms of arsenic in these aquifers with a consensus that the primary driver is microbially mediated reductive dissolution of ferric oxides that are found as coating on grains in the sediment. Despite this understanding, significant questions remain surrounding the temporal and spatial nature of arsenic release. Changes in oxidative conditions have been attributed to both natural and agricultural processes as organic matter fluxes shift. While arsenic is more common in groundwater from shallow aquifers, deeper waters have now displayed concentrations exceeding 10 µg/L, likely related to both drawn down under certain hydrologic conditions in addition to compaction of sediments from over-extraction. The relationships between these conditions of release and aquifer properties are not well understood. By integrating helium-based residence times ($^{3}H/^{3}He$ and radiogenic ^{4}He) with dissolved chemical concentrations and subsurface chemical tracers (i.e., noble gases), this study expands understanding of the relationship between groundwater age, arsenic concentration, and geochemical conditions in which contamination persists.