

Arsenian Pyrite Formation Concentrates Arsenic within Peat Deposits of the Mekong Delta

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Mekong Delta sediment bears arsenic (As) that can partition to groundwater under anaerobic conditions. Arsenic persists in the groundwater despite repeated aquifer flushing occurring over the past several thousand years. The oxidation state, speciation, and distribution of As and the associated iron (Fe) bearing phases are crucial determinants of As reactivity in sediments. Peat from buried mangrove swamps in particular may be an important host of As in the Mekong Delta. The total concentration, speciation, and reactivity of As and Fe were examined in sediments to a depth of 6 m in a Mekong Delta wetland by X-ray fluorescence spectrometry, X-ray absorption spectroscopy, and selective chemical extractions, respectively. Total As concentrations increased 10-fold in a peat layer at a depth of 6 m from the land surface relative to the overlying sediment. Bulk As EXAFS spectroscopy revealed that As in the peat is predominantly associated with arsenian pyrite. Arsenic speciation in the peat was examined further on a micro-scale using μ XRF and μ XANES spectroscopy coupled with PCA. The multiple energy μ XRF mapping and μ XANES routine was repeated for both Fe and sulphur (S) phase analyses. Our μ XRF/ μ XANES analyses confirm As association with pyrite – a less reactive host phase than Fe oxides under anaerobic conditions. Arsenian pyrite represents a unique host of As that is stable under the reducing aquifer conditions of the Mekong Delta, and indeed throughout S/SE Asia.