Arsenic mobilization in the rhizosphere of *Pteris vittata*, an arsenic-hyperaccumulating fern

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Arsenic (As) is among the most toxic and common soil contaminants, threatening human health through soil ingestion and inhalation. Anthropogenic sources of arsenic in soil include fossil fuel combustion, mining and smelting industries, and use of arsenical pesticides, treated wood, and contaminated irrigation water. Conventional, excavation-based methods of soil remediation are extremely disruptive, unsustainable, and expensive. Arsenic phytoextraction, the use of plants to remove arsenic from soil, is an emerging sustainable *in situ* remediation technology. The arsenic-hyperaccumulating fern *Pteris vittata* accumulates high concentrations of arsenic in its fronds, decontaminating soil with minimal site disturbance. To optimize phytoextraction, we must increase our understanding of the limits on arsenic mobilization, which could depend on geochemical processes related to root exudate-driven nutrient scavenging. We can then manipulate this release, for example through soil treatments, to increase remediation rates.

The objective of this study is to determine mechanisms of arsenic release from soil in the *P. vittata* rhizosphere. In a soil column study, *P. vittata* is planted in columns (40 cm deep, 15 cm diameter) filled with sandy loam soil historically contaminated with arsenic (114 mg/kg). Soil is treated either with phosphorus or mycorrhizal fungi inoculant. A synthetic rain solution is eluted through columns. Porewater samples are collected biweekly at 3 depths and analyzed for pH, redox potential, and concentrations of As(V), As(III), P, DOC, organic acids, and terminal electron acceptors including Fe. Effluent is analyzed for As, P, and Fe concentrations. Arsenic uptake in the fern is tracked by sampling fern pinnae. Preliminary results indicate 120-140 ug arsenic/L leaches from columns. This is not enough arsenic to account for the expected concentrations of arsenic in the fern, suggesting processes in addition to advective transport will supply arsenic for uptake.