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My research goal encompasses understanding the behavior of organoarsenic compounds in the environment. Arsenic has received a large amount of attention in the past decades due to its acute toxicity and ground water contamination, which is occurring on a global scale. In addition to inorganic arsenic species, organic arsenicals are introduced into the environment either naturally or anthropogenically. Monomethylarsenate (MMA) and dimethylarsenate (DMA) have been used as herbicides and pesticides for a long time. Some of them are demethylated to inorganic arsenic, some are percolated into groundwater, and some stay in soil. In some cases, MMA and DMA are the main arsenic species. Those compounds are as toxic as inorganic arsenic and further research into these compounds will be important to understanding arsenic fate in the environment.

At first, MMA and DMA adsorptions on amorphous aluminum oxide (AAO) were investigated. These studies have found, that compared to arsenate (As^V) sorption on AAO, MMA sorption is slightly lower and sorption kinetics are somewhat slower, while DMA sorption is much lower and sorption kinetics are much slower than for As^V. Desorption experiments, using phosphate as the desorptive, result in 30% release of absorbed As^V, while 48% and 62% of absorbed MMA and DMA, respectively, are released. Synchrotron based spectroscopy studies revealed that MMA and DMA form bidentate binuclear complexes with AAO. Based on these results, it is proposed that increasing methyl group substitution results in decreased As sorption and increased As desorption on AAO.

Currently, MMA and DMA sorption and desorption to soils are being investigated. There are eight different soils with various soil morphology used for this study, which can demonstrate what minerals or organic matter affect MMA and DMA sorption/desorption. Long term incubation studies will give insight on the MMA and DMA speciation changes over time due to microbial activities. MMA and DMA in soils are eventually expected to demethylate to arsenate or arsenite over time. Synchrotron based X-ray fluorescence mapping and micro size radiation enables us to see MMA and DMA correlation with particular elements and the distribution of them in the soil matrix.