

## Arsenic in Rice: Capturing Micro-scale Biogeochemical Heterogeneity in Paddy Soils

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Rice contains ~10 times more arsenic than other cereal staples [1], and is the dominant food source of inorganic arsenic exposure to the world's population [2, 3]. The anaerobic biogeochemistry of paddy fields makes them vulnerable to excessive arsenic mobilisation and subsequently assimilation by rice. Uptake typically occurs at root apices, sites of rapid entry for water and nutrients, where radial oxygen losses are highest. Therefore, nutrient and toxic metal uptake must largely occur through zones of oxidation and micro-gradients in H<sup>+</sup> concentration. Yet, the precise processes controlling the acquisition of trace elements in rice are difficult to explore experimentally due to a lack of suitable methods.

Using the diffusive gradients in thin films (DGT) gel based dynamic sampling technology, planar optode and laser ablation-ICP-MS as exemplar techniques, this presentation reviews recent advances in chemical imaging and the measurement of arsenic dynamics in rice rhizospheres. The results highlight the need to consider the kinetics of arsenic mobilisation [4], *in situ* speciation [5, 6], as well as the importance of simultaneous/high resolution measurements of multiple analytes [7], in order to decipher the geochemical processes modulating arsenic remobilisation dispersion and plant uptake by rice roots.

[1] Williams *et al* (2007) *Environ. Sci. Technol.* **41**, 6854–6859 [2] Williams *et al* (2005) *Environ. Sci. Technol.* **39**, 5531–5540 [3] Meharg *et al* (2009) *Environ. Sci. Technol.* **43**, 1612–1617 [4] Sumon *et al* (2012) [5] Moreno-Jiménez *et al* (2013) *Talanta* **104**, 83–89.[6] Sun *et al* (2014) *Anal. Chem. In press*. [7] Stahl *et al* (2012) *Limnol. Oceanogr. Methods*, **10**, 389–401.