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Biogeochemical Modelling of Arsenic in Soil-water-plant Systems in Thailand

Watcharamai, T.[1] and Polya, D.A.[1]

[1] The University of Manchester, School of Earth, Atmospheric, and Environmental Sciences, Oxford Road, Manchester M13 9PL, United Kingdom

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Thailand is a country with an economy considered to be based on agricultural goods, including rice. Groundwater is used for many applications in Thailand, including drinking water and municipal and industrial supplies. Inorganic arsenic in rice is a serious health hazard which is attracting the attention of both researchers and public health authorities across the globe. Whilst over 100 million people worldwide are exposed to arsenic at greater than WHO provisional guide value of 10 μg/L in their aquifer-derived drinking water, for most of the world's 3,000 million people who consume rice as a staple, including Thai people, a further significant source of toxic and carcinogenic inorganic arsenic [1] is likely to be rice. With inorganic arsenic contents of rice commonly greater than 100 μg/kg and sometimes as high as 100s μg/kg, many people are currently consuming greater quantities of arsenic through eating rice than via drinking water [2,3].

An obvious remedy to this problem is to grow rice with lower inorganic arsenic contents – this might be achieved through careful selection of cultivars, through genetic modifications or by modifying the environmental conditions under which the rice is grown [4]. In particular, growing under high oxidizing conditions results in reduced transfer of arsenic from those waters into the rice plant. In a preliminary scoping project, we aim to gain an improved understanding of both the speciation of arsenic and water-plant-soil transfer under various rice cultivation scenarios. To this end, we construct pH-Eh diagrams and track reaction pathways using geochemical modelling software.

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