

## High mercury sorption in low organic matter aquifer material using column experiments.

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Sorption of mercury (Hg) in soils is suggested to be predominantly associated with organic matter (OM). Previous soil column experiments have demonstrated increased equilibrium sorptive capacity for Hg with increasing OM content[1]. We used a series of column experiments to examine Hg sorption and subsequent desorption in low OM (<0.5%), uncontaminated aquifer material. Highly soluble HgCl<sub>2</sub> solutions (46.1±1.1 and 144±6mg·L<sup>-1</sup>) were applied to eight syringe columns of 70.1±0.1g [dw] aquifer material. Two columns were sacrificed for solid phase analyses halfway through sorption, three columns sacrificed at maximum sorption, and three columns after desorption with simulated uncontaminated groundwater. Liquid phase total Hg concentrations (THg) were measured continuously throughout sorption, equilibrium, and desorption phases. Additionally, liquid and solid phase Hg speciation/fractionation and stable Hg isotope analyses were made.

Despite the very low OM content, Hg equilibrium sorptive capacity in these columns was very high: 2250±50 and 3310±80mg·kg<sup>-1</sup> for the 46.1 and 144mg·L<sup>-1</sup> solution experiments, respectively. These values are similar to those determined for high OM (9-25%) Amazonian soils[1]. Sorption fitted a S-shaped uptake profile, although THg continued to increase very slowly during the “equilibrium phase” (Fig. 1). Desorption with the simulated groundwater fitted an exponential rate of decrease in THg in the liquid phase. 47.2±0.7 and 42.7±1.0% of the sorbed Hg was removed during desorption of the 46.1 and 144mg·L<sup>-1</sup> experiments, respectively; yet, some Hg was still being released at the end of desorption experiments. This suggests the majority of HgCl<sub>2</sub> remained unchanged and the highly soluble species was likely physically sorbing to mineral surfaces such as Fe/Mn-oxides and subsequently re-released by flushing with the uncontaminated solution. This speciation was confirmed by liquid and solid phase speciation/fractionation analyses. Nonetheless, elemental Hg (Hg<sup>0</sup>) was detected in speciation/fractionation analyses of solid (Fig. 2) and liquid phases. Reduction to Hg<sup>0</sup> has been identified in aquifers contaminated by HgCl<sub>2</sub>[2]. We endeavour to present Hg stable isotope data for liquid and solid phase samples at the conference, which may reveal additional information on biogeochemical processes occurring in the aquifer.

[1] Miretzky et al. (2005), *Chemosphere*, 60, 1583-1589.

[2] Bollen et al. (2008), *Water Research*, 42, 91-100.

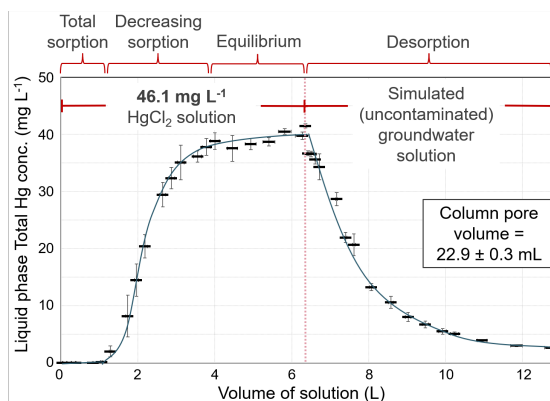


Fig. 1: Liquid phase THg of sorption & desorption experiment

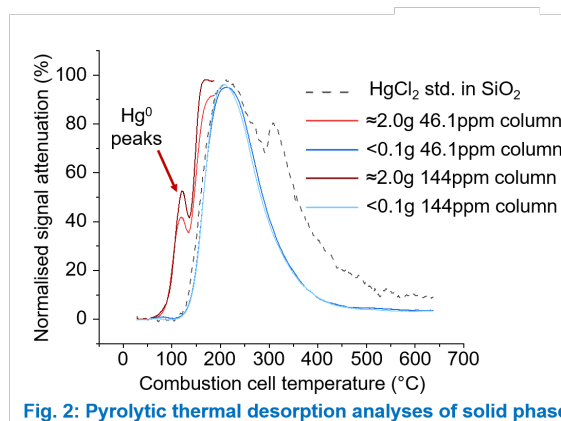


Fig. 2: Pyrolytic thermal desorption analyses of solid phase