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Molecular insights into porewater DOM transformation and relevant effect on arsenic mobility during the surface water-groundwater interaction

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Abstract text:

The surface water-groundwater interaction zones are hotspots where microbe growth, dissolved organic matter (DOM) transformation, and nutrients and trace elements cycling are highly active. However, little is known about porewater DOM transformation and its relevant effect on arsenic mobility during surface water-groundwater interaction. To fill this gap, two porewater sampling profiles (Profiles A and B with depths up to 250 cm and 300 cm, respectively) were established to extract porewater using Macro Rhizon samplers. The extracted porewater, as well as the pond water, were analyzed for dissolved arsenic, Fe(II), and DOC concentrations, and also for DOM molecular characteristics using Fourier transform ion cyclotron resonance mass spectrometry (FT-ICR MS).

Results demonstrate that both porewater arsenic and Fe(II) concentrations in the two profiles were peaked at the depth of around 150 cm with maximum concentrations of 0.74 and 105 μmol/L, respectively. This indicates that porewater arsenic enrichment was likely related to the reductive dissolution of arsenic-bearing Fe(III) oxides. To investigate the transformation framework of porewater DOM during the surface water-groundwater interaction, porewater DOM molecules in Profiles A and B were compared to those of pond water DOM, respectively. The identified unique DOM molecules, which may represent for mobilized DOM molecules during surface water infiltration, were mainly low-O/C-ratio (<0.4) organic compounds. The number of this mobilized DOM pools was positively correlated to porewater arsenic concentrations, which likely indicates that the mobilization of DOM and arsenic were connected during the surface water-groundwater interaction. The study has identified a paradigm describing transformation of porewater DOM molecules and relevant effect on arsenic mobility in surface water-groundwater systems.

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