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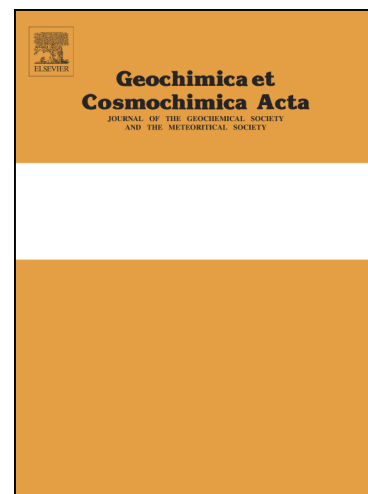
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The role of iron and reactive oxygen species in the production of CO₂ in arctic soil waters

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Abstract

Hydroxyl radical ($\bullet\text{OH}$) is a highly reactive oxidant of dissolved organic carbon (DOC) in the environment. $\bullet\text{OH}$ production in the dark was observed through iron and DOC mediated Fenton reactions in natural environments. Specifically, when dissolved oxygen (O_2) was added to low oxygen and anoxic soil waters in arctic Alaska, $\bullet\text{OH}$ was produced in proportion to the concentrations of reduced iron (Fe(II)) and DOC. Here we demonstrate that Fe(II) was the main electron donor to O_2 to produce $\bullet\text{OH}$. In addition to quantifying $\bullet\text{OH}$ production, hydrogen peroxide (H_2O_2) was detected in soil waters as a likely intermediate in $\bullet\text{OH}$ production from oxidation of Fe(II) . For the first time in natural systems we detected carbon dioxide (CO_2) production from $\bullet\text{OH}$ oxidation of DOC. More than half of the arctic soil waters tested showed production of CO_2 under conditions conducive for production of $\bullet\text{OH}$. Findings from this study strongly suggest that DOC is the main sink for $\bullet\text{OH}$, and that $\bullet\text{OH}$ can oxidize DOC to yield CO_2 . Thus, this iron-mediated, dark chemical oxidation of DOC may be an important component of the arctic carbon cycle.

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