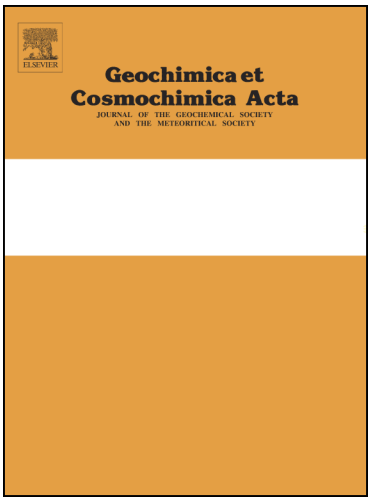

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The role of iron and reactive oxygen species in the production of CO_2 in arctic soil waters

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Abstract

Hydroxyl radical (•OH) is a highly reactive oxidant of dissolved organic carbon (DOC) in the environment. •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, •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 •OH. In addition to quantifying •OH production, hydrogen peroxide (H_2O_2) was detected in soil waters as a likely intermediate in •OH production from oxidation of Fe(II). For the first time in natural systems we detected carbon dioxide (CO_2) production from •OH oxidation of DOC. More than half of the arctic soil waters tested showed production of CO_2 under conditions conducive for production of •OH. Findings from this study strongly suggest that DOC is the main sink for •OH, and that •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.