Iron reduction rates and carbon mineralization in a tropical soil from Puerto Rico

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The biogeochemistry of iron (oxyhydr)oxides is directly associated with carbon mineralization and/or storage during redox fluctuations in soils. Our recent work on soils from the Luquillo Critical Zone Observatory in Puerto Rico explores how fluctuations in redox conditions influence Fe reduction rates. Soils from the upper 10 cm of the Bisley Watershed valley site were exposed to systematic redox oscillations over 40 d in 1:10 soil:water slurries. The oxidation events were triggered by introduction of 21% O_2 and the length of time that oxic or anoxic conditions persisted was maintained at 6:1 (τ_{ox}/τ_{red}) throughout the experiment. After pre-conditioned the soil to fluctuating redox conditions for one month, we imposed 2.5- and 11.6-day redox oscillations and measured 0.5 M HCl-extractable Fe(II) every 12 h to 4 days. We found Fe reduction rates were substantially higher in the shorter frequency treatment, which comprised τ_{ox} lengths of only 10 h, than in the longer frequency treatment, which comprised τ_{ox} lengths of only 40 h. We hypothesize that Fe reducing organisms in these soils are either stimulated by the repeated pulsing of *de novo* Fe(III) or that when the length of oxic conditions (τ_{ox}) becomes short enough, the Fe reducers can maintain activity. These results highlight how the dynamics of redox conditions can constrain rates of Fe reduction and influence ecosystem processes that depend of iron behaviour.