Electronic Supplementary Information for

Biological versus Mineralogical Chromium Reduction: Potential for Reoxidation by Manganese Oxide

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September 30, 2015

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Table ESI-1. Concentrations and proportions of Fe, Cr, and Mn used in Cr(VI) reduction and birnessite oxidation experiments.

<table>
<thead>
<tr>
<th>Microcosm Conditions</th>
<th>Cr(VI) Reduction Experiments</th>
<th>Birnessite Oxidation Experiments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(A) Conc. of Cr(VI) (µM)</td>
<td>(B) Conc. of Fe mineral (g/L)</td>
</tr>
<tr>
<td>RCH1/Hematite³</td>
<td>50</td>
<td>1.3</td>
</tr>
<tr>
<td>RCH1/Al-goethite²</td>
<td>50</td>
<td>1.3</td>
</tr>
<tr>
<td>RCH1/NAu-2³</td>
<td>50</td>
<td>1.3</td>
</tr>
<tr>
<td>RCH1 slow/Hematite³</td>
<td>50</td>
<td>1.3</td>
</tr>
<tr>
<td>Dithionite-reduced NAu-2²</td>
<td>200</td>
<td>0.8</td>
</tr>
<tr>
<td>FeS²</td>
<td>200</td>
<td>0.031</td>
</tr>
</tbody>
</table>

³Cr(VI) reduction experiments contained 1.3 g/L of Fe(III) mineral and 50 µM Cr(VI). Birnessite oxidation experiments contained 500 mg/L Fe-Cr solid and 16 mg/L birnessite.

²Cr(VI) reduction experiment contained 800 mg/L dithionite reduced NAu-2 and 200 µM Cr(VI). Birnessite oxidation experiments contained 800 mg/L Fe-Cr solid and 165 mg/L birnessite.

⁴Cr(VI) reduction experiments contained 31 mg/L FeS and 200 µM Cr(VI). Birnessite oxidation experiments contained 31 mg/L Fe-Cr precipitate and 165 mg/L birnessite.

⁵The mass fraction of Fe in NAu-2 (37.85% for the <1.5 µM fraction) was taken from Keeling et al. (ref. 52 in the manuscript). Al-goethite was assigned a molecular formula of Fe₀.₉₁Al₀.₀₉OOH.

⁶An approximate formula of MnO₂ for birnessite was assumed.
Figure ESI-1. Concentrations of dissolved Cr(VI) and Cr(III) versus time in the RCH1/Al-goethite microcosms. Error bars on symbols are the standard error of mean measurements from duplicate microcosms. The line shows the data fit to a pseudo-first-order rate law.
Figure ESI-2. Concentration of dissolved Cr(VI) versus time in the RCH1/NAu-2 microcosm. Results for only one microcosm (no replicates) is shown because there was no Cr(VI) reduction in the second microcosm. Lines show fit of the data to a pseudo first order rate law.
Figure ESI-3. Concentration of dissolved Cr(VI) versus time in the dithionite-reduced NAu-2 microcosm. Error bars on symbols are the standard error of mean measurements from duplicate microcosms. The line shows the data fit to a pseudo-first-order rate law.
Figure ESI-4. Concentration of dissolved Cr(VI) versus time in the FeS microcosm. Error bars on symbols are the standard error of mean measurements from duplicate microcosms. The line shows the data fit to a pseudo-first-order rate law.
Figure ESI-5. Cr(VI) versus time in precipitates exposed to birnessite.