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AGU FALL MEETING
San Francisco | 14 – 18 December 2015

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Natural Attenuation of Metals from Acid Drainage in Surface Waters: Effects of Organic Matter in the Association of Arsenic to Hydrous Al and Fe Oxyhydroxides and Their Particle Size Distribution

Monday, 14 December 2015
Poster Hall (Moscone South)

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Abstract:
The presence of toxic metals in watersheds affected by acid drainage (AD) imposes a challenge for sustainable supply of water for cities, agriculture and industry. The formation and settling of metal-rich HFO (hydrous ferric oxides) and HAO (hydrous aluminum oxides) is a relevant mechanism for the attenuation of dissolved metals from AD, particularly for arsenic. Organic matter is known to alter the chemical speciation and key physical properties like particle size distribution (PSD) and settling velocity of HFO and HAO particle suspensions. However, available experimental studies focus either on chemical or physical properties.

We used a suite of analytical techniques to probe the effects of organic matter on particle suspensions formed in natural waters and in laboratory model systems. Dissolved organic matter was added at different concentrations (0, 0.1, 0.3, 0.6, 1 and 1.5 mg C/L) to synthetic AD before neutralization with alkaline solutions. PSD and average particle size were measured with laser scattering transmissometry (LISST), while organic matter was characterized by total organic carbon (TOC) and UV-VIS spectrometry.

Larger concentrations of organic matter lead to the formation of particle suspensions with larger particle volume and size. When 1.5 mg C/L were added, the total particle volume concentration increased from 0.67 to 23.7 µL/L, while the mean particle size increased from 102 to 176 µm. These results suggests that organic matter influences the fate of metals from AD. Undergoing measurements include total and dissolved metal analyses with total reflection X-ray fluorescence (TXRF) and ICP-OES to confirm increased removal of dissolved arsenic.

The results from this research are necessary to understand the processes governing natural attenuation of metal contamination in fluvial systems affected by AD and to serve as the basis for enhanced natural attenuation schemes.

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