Influence of dissolved organic matter for the precipitation of nanoparticulate metal sulfides

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Metal sulfide precipitation is traditionally viewed as a process that reduces the bioavailability of contaminant metals in anaerobic settings. Our previous work has demonstrated that dissolved natural organic matter (NOM) can alter the kinetics of ZnS and HgS precipitation, resulting in the stabilization of nanoparticles in aqueous solution. The structure and composition of dissolved NOM varies widely and will control NOM interactions with metal sulfides. Furthermore, we have shown that NOM-coated nanoparticles of HgS may be bioavailable to methyating bacteria. This process depends on the "age" of those nanoparticles. The aim of this work was to investigate how the composition of NOM influences the stability of ZnS and HgS nanoparticles as they nucleate and aggregate in water with dissolved NOM. We utilized dynamic light scattering to monitor relative growth rates of metal-sulfide-NOM particles. We tested nine different NOM isolates that were derived from several different surface waters and represented a wide range of NOM composition. The NOM was observed to reduce particle growth rates, depending on solution variables such as type and concentration of NOM, monovalent electrolyte concentration, and pH. The rates of growth increased with increasing ionic strength, indicating that observed growth rates primarily represented aggregation of charged metal-S-NOM particles. Furthermore, our results indicated that stabilization of nanoparticles occurred mainly with NOM fractions of the greatest molecular weight and aromatic carbon content. Future work will utilized a combination of methodologies (photon scattering, X-ray absorption spectroscopy) to probe the mechanism of metal-sulfide-NOM polymerization during early stages of precipitation. Overall, our results highlight that nanoscale products are formed from reactions between trace metals, sulfide and NOM and that these entities may exhibit unique reactivities.

Isotope evidence for regional precipitation characteristics in the Poyang Lake Basin

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The study of hydrogen-oxygen isotopes tracing of atmospheric precipitation have been extensively used in global water circulation, water vapor source and lake palaeoenvironmental reconstruction etc, and provided significant theoretical evidence for global climate change or region research [1-2]. Region complicated geography and climatic conditions show a great effect on content of precipitation isotope in previous research with obviously different features [3]. In these work, we study isotope compositions and its change pattern of precipitation effects of water circulation in Poyang Lake Basin and its differences compared with large scale or high-altitude area rainfall isotope features.

The results show that: (1) The value of $\delta^{18}O$ and δD show significantly seasonal variability that dry season is greatly higher than wet season, which mainly affected by oceanic air mass and polar continental air mass alternatively; (2) In 2008 and 2009, precipitation line equation in Poyang Lake Basin have the regional or basin features made a greatly differences with global, coastal regions and high-altitude area, whereas being similar to low-altitude of China inland like Fuzhou and Wuhan district, also demonstrated these areas being controlled by the same type of monsoon and water vapor source of rainfall; (3) Precipitation effect in the Poyang Lake Basin is mainly controlled by southeast and southwest monsoon, but southeast monsoon has been a larger contributor.

[1] Sebastian F. M *et al*. (2010) *Earth Planet. Sci. Lett*. **292**, 212-220. [2] Araguas L *et al*. (2000) *Hydrol Process* **14**, 1341-1355. [3] Zhang X P & Yao T D. (1994), *Journal of Glaciolgy and Geocryology* **3**, 202-210.