Total Gaseous Mercury Emissions from Soils in Mercury Mineralization Belt, Southwestern China

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Emission from soils in Global Mercury Belt (GMB) is regarded as one of the most important atmospheric mercury sources. There is, however, a large uncertainty on the estimation of mercury emission flux from this source due to lacking of sufficient on-site mercury emission flux data.

Southwestern China is located on an GMB, and is also regarded as a mineral deposit enriched area associated with low temperature thermal fluid mineralization. The bed rock in this area with a total land area of 900,000 km^2, is enriched with Au, As, Hg, Tl, Sb, Cu, U, Pb and Zn. A number of mercury and other metal mines are discovered in this area. Three mercury mining areas (Wanshan mercury mine, Lanmochang Hg-Tl mine and Danzhai mercury mine) were selected to measure mercury emission rate from soils using dynamic flux chamber made of Quartz glass coupled with high temporal resolved automated atmospheric mercury vapor analyzer (Tekran 2537A) technique[1]. Meanwhile, meteorological parameters such as wind speed, wind direction, air temperature, relative humidity, soil temperature, and intensity of solar radiation were monitored using a portable weather station (Global Water III).

Our result showed that mercury enriched soil is a strong mercury emission source and the maximum Hg emission flux reached 12,000 ng m^{-2} h^{-1}. There are clear seasonal and diurnal variations of mercury emission fluxes in the studied area. Generally mercury emission flux reaches the maxima at mid-day and the minima before sun rise. Mercury emission rate is stronger in summer than that in cold seasons. It is showed that mercury emission flux depended strongly on some of the meteorological parameters, such as solar irradiation, air and soil temperatures. It is also demonstrated that Hg emission flux depends strongly on mercury concentration and speciation in soil.

Reference

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Orthoclase Dissolution Mechanism at Acidic pH: New Constraints

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Background

We have demonstrated the use of X-ray reflectivity to clarify the dissolution of orthoclase in acidic and alkaline environments. Initial measurements revealed the structure of the orthoclase-water interface [Fenter et al., 2000]. Real-time measurements of X-ray reflectivity during dissolution clarified the nature of the dissolution process, in particular the differences in reactive site distributions at acidic and alkaline pH [Teng et al., 2001]. Measurements of Arrhenius behavior demonstrated the ability of X-ray reflectivity to probe apparent activiation energies, thereby demonstrating the sensitivity of the dissolution process to crystallographic control through comparison of the (001) and (010) cleavage surfaces [Fenter et al., 2003].

Results

We have recently extended these measurements to probe the pH dependent dissolution mechanism(s). The dissolution rate of the orthoclase (001) surface was obtained for $1 < \text{pH} < 3.5$, and $51 < T < 76$ °C. These data demonstrate that the dissolution rate cannot be described by a product of separate temperature and pH dependent functions. We also find an unexpectedly strong variation in the apparent activation energy as a function of pH. These results will be discussed in the context of previous silicate dissolution studies with powders, and theoretical models of proton promoted dissolution (Casey and Sposito, 1992).

Acknowledgements

This work was supported by the Geoscience Research Program, Office of Basic Energy Sciences, US Department of Energy.

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