Observations of atmospheric Hg species and depositions in remote areas of China

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From September 2007, we conducted continuous measurements of speciated atmospheric mercury (Hg) and atmospheric mercury depositions at five remote sites in China. Four of these sites were involved in the Global Mercury Observation System (GMOS) as ground-based stations. These stations were located in the northwest, southwest, northeast, and east part of China, respectively, which represent the regional atmospheric Hg budgets in different areas of China. Standard Operating Procedures (SOPs) and QA/QC protocols were implemented at all the sampling sites. Data quality of atmospheric TGM concentration was controlled via periodic internal recalibration with a 25 h interval, and the emission rate of internal permeation source was calibrated every 4 months.

Our measurement data showed that the mean total gaseous nercury (TGM) concentrations were in the range of 1.60 – 2.88 ng m^{-3}, with relatively higher levels observed at sites in Eastern China and Southwestern China and lower levels at sites in Northeastern and Northwestern China. Generalyy, TGM concentrations at most remote sites of China were higher than those reported from background sites in North America and Europe, and this is corresponding very well with the Chinese great anthropogenic Hg emissions. However, at a remote site in Northeastern China, the mean value of TGM concentrations is somewhat lower than the values of 1.7 ng m^{-3} observed in Europe and North America. Gaseous oxidized mercury (GOM) and particulate bounded mercury (PBM) were in the ranges of 3.2 – 7.4 pg m^{-3} and 19.4 – 43.5 pg m^{-3}, respectively. The preliminary result on precipitation showed mean precipitation THg concentrations were in the range of 2.7 – 18.0 ng L^{-1}.

These contineous observations also helps to gain a better insight to the effects of long-range atmospheric mercury transport on TGM variations in ambient air. We showed that Northwestern India was an important source region of Northeastern Qinghai-Tibetan Plateau, indicating this area might also have relatively higher anthropogenic Hg emissions.

Sulfur runs through it: A celebration of Bo Barker Jørgensen's science and a multi-faceted element

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Behind almost every environmentally important redox transformation there lurks a sulfur transformation of some type or another. Through patient observation and elegant experimentation Bo Barker Jørgensen has over the years continuously grappled with this ubiquitous, yet slippery, element. A series of seminal papers in the late seventies set the tone for decades of research in sulfur biogeochemistry, isotope geochemistry and microbial ecology. Employing the highly sensitive radio-label technique, Bo's observation that microbial sulfate reduction is a major process in a wide variety of marine sediments *[1]*, and one that can be tracked into deeply buried sediments (the "deep biosphere"), has provided an important fundament for our understanding of the links between in the carbon, sulfur and oxygen cycles.

Bo's exploration of biotic and abiotic sulfur transformations via sulfur oxidation state intermediates has proved equally influential. Today's research on the microbial ecology in stratified water basins owe a significant debt to the methodological approaches and concepts laid out in a paper written together with G. Kuenen and Y. Cohen, where they examined the microbial cycling of sulfur intermediates in Solar Lake *[2]*. Delving further into the world of sulfur intermediates and microbial ecology revealed the importance of microbial sulfur disproportionation in sediments, and the fascinating links between the giant sulfur bacteria and other element cycles, e.g. oxygen, nitrogen and phosphorus.

These strands culminate in recent studies where Bo has shown that an active sulfur cycle, complete with sulfate reduction, oxidation and disproportionation pathways, functions in the deep methane-bearing zone of marine sediments *[3]*. This research continues to inspire research on the paradoxical and cryptic roles of sulfur intermediates, e.g. elemental sulfur and polysulfides *[4, 5]* in highly reducing sulfidic environments. Sulfur, it seems, is the element that greases the redox cycles in marine environments.

[1] Jørgensen (1992) *Nature* **296**, 643-645. [2] Jørgensen *et al* (1979) *Limnol. Oceanogr.* **24**, 799-822. [3] Holmkvist *et al* (2011) *Geochim. Cosmochim. Acta* **75**, 3581-3599. [4] Milucka *et al* (2012) *Nature* **491**, 541-546. [5] Lichtschlag *et al* (2013) *Geochim. Cosmochim. Acta* **105**, 130-145.

DOI:10.1180/minmag.2013.077.5.6