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Is increasing industrialization affecting remote ecosystem health in the South Americas? Insights from ocean surface water measurements of As, Sb and Pb from a GEOTRACES transect

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Continued industrial development of the South Americas with increasing atmospheric emission of toxic trace metals has lead to a growing concern about possible effects on pristine ecosystem health. Concentration measurements of trace metals in ocean surface waters in the North Atlantic have successfully revealed the global extent of atmospheric pollution in the Northern Hemisphere during economical growth in the USA and Europe, suggesting a similar approach can be applied to the Southern Hemisphere.

To this end, we determined concentrations of lead (Pb), antimony (Sb) and arsenic (As) using voltammetry in surface water samples of the South Atlantic Ocean collected during the third leg of the GEOTRACES West Atlantic Cruise. These elements are volatile and therefore most likely suitable tracer elements of industrial emissions from South America. The samples were not filtered and the solutions were acidified and UV digested. Total concentrations of Pb were detected. Detected As levels correspond to the sum of inorganic species (AsIII + AsV) plus the mono methyl arsenic acid (MMA) while the dimethyl arsenic acid (DMA) is not detected in such conditions. For Sb, detected levels correspond at least to the sum of inorganic fractions (SbIII + SbV).

The measured concentrations for Pb varied from 6 to 23 pM. Concentrations were highest at -35° latitude and lowest at -40° and -50° latitude. We found a decreasing trend from about -35° latitude southwards. The average concentrations of As was 20 nM and of Sb 1.2 nM. Arsenic showed a more significant north to south trend than Sb. Arsenic concentration was highest at -23 ° latitude (21 nM) and the lowest at -43 ° latitude (17.7 nM). Antimony concentration was highest at -31 ° latitude (1.5 nM) and lowest at -35 ° latitude (1.0 nM).

Our preliminary data suggests that the major industrial centres in Brazil (i.e. Sao Paolo, Rio de Janeiro) and Argentina (i.e. Buenos Aires) affect atmospheric metal fluxes to remote environments. The concentrations, however, are not as high as determined in the Northern Hemisphere, suggesting a less drastic impact. That is also reflected in air quality data from the major cities.