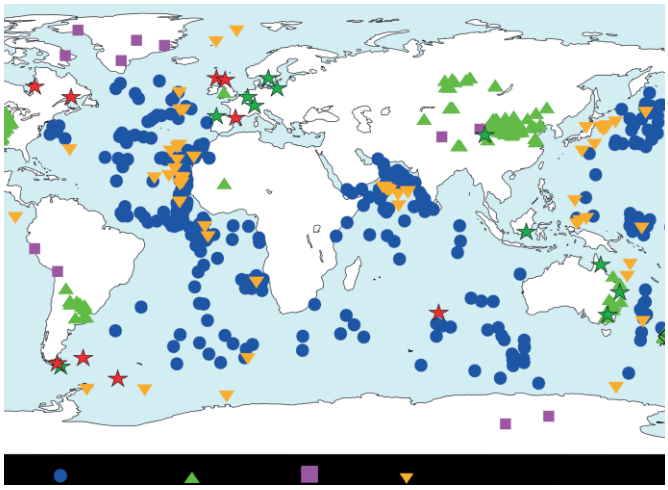
Human and Natural Control on Global Atmospheric Trace Element Cycles



World coverage of dust records, including peats

Preparing aerosol samples collected in the Amazon in the lab

Long-range atmospheric transport is a key process controlling the global geochemical cycle of trace elements and the subsequent deposition controls ecosystem development in remote areas. Mineral dust is thought to be the main source of trace elements, however, human activities play an important role, directly by increasing concentrations in the air or indirectly by leading to increase atmospheric processing of mineral dust. Assessing atmospheric deposition in remote areas has also been crucial to identify the global impact of industrial activities.

One present research focus of my group is o[1]n quantifying the impact of new emerging economies on atmospheric meal cycles. Emerging economies are characterised by increasing industrial activities leading to significant atmospheric emission. Associated with less stringent emission controls, this development has the danger to inversely affect regional and global environmental health. Our work is now trying to assess the importance of this process by studying atmospheric trace element concentrations and sources in remote locations. Present focus is on Brazil as it is the fastest growing economy in South America. We are studying trace element cycles in particulate matter collected in the Amazon Basin and on the Falkland Islands and surface waters from the South Atlantic Ocean. To date, we successfully measured volatile trace elements (Pb, As and Sb) in surface waters and aerosols off the coast of Brazil and established an aerosol collection network in the remote Amazon.

A second research focus is on reconstructing past atmospheric circulation to understand large scale Earth System processes during the Holocene. We use the inorganic, organic and isotope geochemistry of peat bogs to identify past changes in sources and in deposition fluxes of mineral dust and trace elements. This enables us to determine what has controlled atmospheric element cycles in the past (volcanic emissions, desertification, changing circulation) and what impact this has had on regional and global environmental and climate change (paleo productivity, carbon cycle, vegetation growth and species composition). Present focus is on the Southern Hemisphere as most of our current understanding of atmospheric trace element transport and deposition for this region to date is derived from modeling studies resulting in hugely differencing opinions regarding sources and its controls and impact. We obtained recently a peat core from the Falkland Island and are now studying its inorganic, organic and isotope geochemistry. The aim is to establish a detailed chronology of the intensification of the westerly winds reaching the South Atlantic Ocean and to identify the impact of volcanic eruptions.

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Literature:

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