What do we know about phasing out carbonaceous aerosol emissions over the next 30 years?

TAMI C. BOND*, EKBORDIN WINIJKUL, FANG YAN[1,2] AND DAVID G. STREETS[2]

[1]Department of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign, Urbana, Illinois, USA (*correspondence: yark@illinois.edu)
[2]Decision and Information Sciences, Argonne National Laboratory, Argonne, Illinois, USA

Technology choice is the interface between atmospheric composition and anthropogenic activity. The technology used for fuel consumption or industrial activity governs the composition of particulate and gaseous emissions in addition to their quantities. Based on this principle, we present projections of carbonaceous aerosol emissions from years 2010 to 2040 under several economic and mitigation scenarios, using a model that projects the population dynamics of emitters. Important factors in these transitions include consumption growth rates, retirement rates, acceptance of cleaner devices, timing of emission standards, and compliance with those standards. We also include other aerosol species that are co-emitted from major sources of carbonaceous aerosol so that total radiative forcing changes due to single actions can be defined.

Each factor governing trends has social or economic roots, and our dynamic model represents these connections. However, understanding of many of these linkages is uncertain. We present sensitivity studies to explore the impact of these uncertainties on projections, and hence on our understanding of emissions over the next 30 years. While future economic trajectories lead to the greatest uncertainty, lack of knowledge about retirement rates and the contribution of high emitters results in an additional uncertainty in total emissions of 50-100%. We demonstrate the resulting uncertainty in aerosol climate forcing using a global climate model driven by a high, medium and low emission scenario.

Achievable time resolution of compositional/isotopic LA-ICPMS profiles in human tooth enamel

L. BONDIOLI[1], P.F. ROSSI[1] AND W. MÜLLER[2]

[1]Museo Nazionale Preistorico Etnografico 'L.Pigorini', I-00144 Rome, Italy (lucabond@gmail.com)
[2] Department of Earth Sciences, Royal Holloway University of London, Egham, TW20 0EX, UK (w.muller@es.rhul.ac.uk)

The sequential mineralization process operating in mammalian tooth enamel stores time-series information of various environmental proxies including mobility, palaeodiet or heavy-metal exposure. For instance ~15 years of chronology is accessible if multiple human teeth of one individual are utilized. Enamel is characterized by continuous growth amounting to a few micrometer (µm) per day, so in principle almost daily resolution of palaeoenvironmental information could be possible using state-of-the-art microanalytical techniques such as laser-ablation inductively-coupled plasma mass spectrometry (LA-ICPMS). However, the protracted mineralization process, where initial enamel segregation is followed by a maturation process, may potentially lead to dampening or even eradication of any initially varying palaeoenvironmetal input. Understanding this is paramount for the reconstruction of sub-seasonal environmental variables, which has become very important in the past few years.

We present highly-resolved continuous compositional and/or isotopic profiles of human teeth using a new custom-built excimer LA-(MC-)ICPMS system [1]. Such data are combined with detailed enamel histological analyses, which facilitate inter-tooth correlation. This is possible because time-equivalent enamel domains across several teeth with overlapping mineralization intervals can be identified using stress events expressed as Wilson bands. Achievable spatial resolution is ≥10 µm and profiles are analyzed along both coeval time-lines in enamel and across such boundaries. This enables an assessment of the time resolution of (palaeo)environmental proxy information actually stored in human/mammalian enamel. Examples include both modern as well as archaeological samples. Based on the occurrence of very sharp intra-tooth Pb peaks in enamel, with concentrations varying over 3 orders of magnitude, it appears that protracted enamel maturation ultimately does not control the distribution of (trace) elements in enamel.

[1] Müller *et al.* (2009) *JAAS* **24,** 209-214.