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Accurate Reconstruction of Migration and Palaeoexposure (Pb) using spatially-resolved isotopic and elemental Analysis of Teeth by Laser-ablation (MC-)ICPMS

W. Müller (1,2)

(1) Department of Geology, Royal Holloway University of London, Egham, UK, (2) Research School of Earth Sciences, The Australian National University, Canberra, Australia (w.mueller@gl.rhul.ac.uk / Fax: +44-1784-471780 / Phone: ++44-1784-443584)

Biominerals such as teeth and bones are abundant in the fossil and archaeological record, and represent the key archive used in palaeontology, anthropology, or archaeology for the retrieval of chronological, dietary, morphological or genetic information. Soil-buried biominerals, however, are subject to often severe postdepositional chemical alteration due to interaction with pore fluids, and consequently, no accurate *in-vivo* compositional signatures can usually be retrieved for above goals from *bulk* analysis.

In contrast to bones and dentine, tooth enamel is frequently considered to be less prone to chemical alteration due to its greater density and hardness, although alteration generally does occur. What is more, tooth enamel grows incrementally and thus stores time-series information of several years of growth. In case of teeth of an entire human jaw, for example, $\sim$15 years of growth are accessible.

It is clear that progress in the geochemical analysis of teeth must be able to assess the extent of post-depositional alteration, and at the same time being able to retrieve the time information stored in enamel. Both are possible utilizing a new approach, namely high-spatial resolution compositional and isotopic profiling by laser-ablation inductively-coupled plasma mass spectrometry (LA-MC-ICPMS) of soil-buried teeth. This facilitates (1) the successful identification of domains in tooth enamel that have escaped post-mortem alteration, and (2) the retrieval of time-series information from sequentially grown enamel.

Two contrasting applications of such LA-(MC-)ICPMS analyses of teeth will be presented. The first one deals with teeth from Central Asia ($\sim 3^{rd}$ century AD), where the question was to distinguish between sedentary or nomadic subsistence. This was tackled by *in-situ* Sr isotopic analysis of enamel along its growth axis by LA-MC-ICPMS (^{87}Sr/^{86}Sr and ^{84}Sr/^{86}Sr), assuming that movement to and consumption of nutrition derived from geologically distinct areas would leave its imprint in correspondingly changing ^{87}Sr/^{86}Sr ratios. The second application aimed at reconstructing accurate *in-vivo* Pb concentrations of medieval miners (12^{th} century) from SW Germany, whose teeth have lain in Pb contaminated soils for centuries. In this case, unaltered domains in enamel – detected by comparing alteration-prone elements like U, Y, Ce to that of modern teeth – could be identified in compositional profiles despite surface Pb concentrations up to 1 wt.%. Corresponding results of both case studies will be shown.