Geophysical Research Abstracts
Vol. 18, EGU2016-4754, 2016
EGU General Assembly 2016

Trace element profiles in modern horse molar enamel as tracers of seasonality: Evidence from micro-XRF, LA-ICP-MS and stable isotope analysis

Niels de Winter (1), Steven Goderis (1,2), Stijn van Malderen (2), Frank Vanhaecke (2), and Philippe Claeys (1)

(1) Department of Analytical and Environmental Geochemistry , Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussels, Belgium, (2) Department of Analytical Chemistry, Ghent University, Krijgslaan 281-S12, 9000 Ghent, Belgium

A combination of laboratory micro-X-ray Fluorescence (μXRF) and stable carbon and oxygen isotope analysis shows that trace element profiles from modern horse molars reveal a seasonal pattern that co-varies with seasonality in the oxygen isotope records of enamel carbonate from the same teeth. A combination of six cheek teeth (premolars and molars) from the same individual yields a seasonal isotope and trace element record of approximately three years recorded during the growth of the molars. This record shows that reproducible measurements of various trace element ratios (e.g., Sr/Ca, Zn/Ca, Fe/Ca, K/Ca and S/Ca) lag the seasonal pattern in oxygen isotope records by 2-3 months. Laser Ablation-ICP-Mass Spectrometry (LA-ICP-MS) analysis on a cross-section of the first molar of the same individual is compared to the bench-top tube-excitation μXRF results to test the robustness of the measurements and to compare both methods.
Furthermore, trace element (e.g. Sr, Zn, Mg & Ba) profiles perpendicular to the growth direction of the same tooth, as well as profiles parallel to the growth direction are measured with LA-ICP-MS and μXRF to study the internal distribution of trace element ratios in two dimensions. Results of this extensive complementary line-scanning procedure shows the robustness of state of the art laboratory micro-XRF scanning for the measurement of trace elements in bioapatite. The comparison highlights the advantages and disadvantages of both methods for trace element analysis and illustrates their complementarity. Results of internal variation within the teeth shed light on the origins of trace elements in mammal teeth and their potential use for paleo-environmental reconstruction.