



2H Stable Isotope Analysis of Tooth Enamel: A Pilot Study

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Stable isotope analysis of biogenic tissues such as tooth enamel and bone mineral has become a well recognized and increasingly important method for determining provenance of human remains, and has been used successfully in bioarchaeological studies as well as forensic investigations (Lee-Thorp, 2008; Meier-Augenstein and Fraser, 2008). Particularly, ^{18}O and ^2H stable isotopes are well established proxies as environmental indicators of climate (temperature) and source water and are therefore considered as indicators of geographic life trajectories of animals and humans (Hobson *et al.*, 2004; Schwarcz and Walker, 2006). While methodology for ^2H analysis of human hair, fingernails, and bone collagen is currently used to determine geographic origin and identify possible migration patterns, studies involving the analysis of ^2H in tooth enamel appear to be nonexistent in the scientific literature. The apparent lack of research in this area is believed to have two main reasons. (1) Compared to the mineral calcium hydroxylapatite $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$, in tooth enamel forming bio-apatite carbonate ions replace some of the hydroxyl ions at a rate of one CO_3^2- replacing two OH, yet published figures for the degree of substitution vary (Wopenka and Pasteris, 2005). (2) Most probably due to the aforementioned no published protocols exist for sample preparation and analytical method to obtain $\delta^2\text{H}$ -values from the hydroxyl fraction of tooth enamel.

This dilemma has been addressed through a pilot study to establish feasibility of ^2H stable isotope analysis of ground tooth enamel by continuous-flow isotope ratio mass spectrometry (IRMS) coupled on-line to a high-temperature conversion elemental analyzer (TC/EA). An array of archaeological and modern teeth has been analyzed under different experimental conditions, and results from this pilot study are being presented.

References:

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