

Microsampled Ca isotope profiles in modern human tooth enamel – Assessment of physiological controls?

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A comprehensive understanding of the physiological controls on Ca isotope fractionation in skeletal tissues will allow us to reliably extract the environmental signals potentially carried by Ca-isotopes. We present the first microsampled Ca isotope profiles in modern human tooth enamel to evaluate the physiological effects on Ca isotopes.

Enamel microsamples were obtained from thick sections (~50 μm) of human deciduous and wisdom teeth. The former are from early 20th century Italians that clearly showed neonatal growth lines, thus delineating pre- and post-birth enamel segments; and the latter are of Asian origin representing adolescence. A RESOLUTION M-50 193 nm laser-ablation system was used to cut histologically-defined bioapatite microsamples (~2-10 μg Ca), delimited by both enamel-dentine junction (EDJ) and striae of Retzius. Sample mass requirements were achieved in sampling intervals along the EDJ of 500 – 1000 μm . These microsamples were extracted, cleaned, dissolved in HNO_3 before being spiked and analyzed for their Ca-isotope composition.

Ca isotopic data were obtained using an IsotopX Phoenix-62 TIMS, equipped with a $10^{10}\Omega$ resistor for ^{40}Ca . No ion exchange chromatography was performed for enamel microsamples. The procedural blank is ~2 ng. The ^{42}Ca - ^{48}Ca double-spike corrected $\delta^{44/40}\text{Ca}$ of standards NIST 915b, HPSnew, Fisher 07 and NIST 1486 (bone meal) are 0.72 ± 0.23 , 0.71 ± 0.17 , 1.03 ± 0.14 , and -1.03 ± 0.25 ‰ (2sd), relative to SRM 915a, well in line with the published data [1-2]. Proved by Durango apatite, no effect of laser cutting on its Ca isotope composition was found.

Preliminary results of $\delta^{44/40}\text{Ca}$ profiles along the EDJ of modern human teeth appear to indicate a correlation between physiological stress/change and $\delta^{44/40}\text{Ca}$ excursions. The birth event indicated by the neonatal line coincides with a $\delta^{44/40}\text{Ca}$ drop of 1.3 ‰ in a deciduous tooth. The $\delta^{44/40}\text{Ca}$ decrease of 0.4 ‰ in a third molar of a young female may coincide with her menarcheal age. Corresponding data will be presented that should help to interpret the large Ca-isotope variability indicated in bones at some archaeological sites [2].

[1] A. Heuser & A. Eisenhauer., *GGR*, 2008, 32, 311-315. [2] L.M. Reynard et al., *GCA*, 2010, **74**, 3735-3750.