

Nitrogen isotopic composition of tooth enamel bound organic matter as an environmental proxy

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The isotopic composition of fixed nitrogen in the terrestrial environment is sensitive to temperature and precipitation [1, 2]. For this reason, nitrogen isotopes may be a useful tool in reconstructing past terrestrial environmental conditions and climate. Previous work has used the $\delta^{15}\text{N}$ of bone and tooth collagen to study ecologic and environmental changes through time. However, collagen is susceptible to degradation, limiting most studies to date to the last 100 thousand years. To expand the utility of nitrogen isotopes as an environmental proxy farther into the past, we focus on the highly protected pool of organic matter bound within the mineral matrix of tooth enamel. In order to measure the very low concentrations of organic nitrogen that is bound within tooth enamel, we have applied the highly sensitive oxidation-denitrifier method for measuring organic N isotope ratios. Based on a set of modern cow teeth, we find that enamel bound organic matter $\delta^{15}\text{N}$ (EB- $\delta^{15}\text{N}$) has a direct relationship with tooth collagen $\delta^{15}\text{N}$, indicating that the enamel bound organic matter pool reflects the animal's $\delta^{15}\text{N}$ signature and can be compared to previous studies that measure collagen. In addition, we present $\delta^{15}\text{N}$ measurements from modern bison teeth from locations that span a variety of environmental conditions to a) characterize the inherent variability in EB- $\delta^{15}\text{N}$ and b) to investigate the controls on EB- $\delta^{15}\text{N}$.

[1] Amundson *et al.* (2003) *Glob. Biogeochem. Cy.* **17**, 1031-1040. [2] Houlton *et al.* (2006) *Proc. Natl. Acad. Sci. U.S.A.* **103**, 8745-8750