Isotope analysis of dental calculus to study paleodiet: organic-C vs. carbonate-C fractions

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Various biomaterials (e.g. bone collagen) have been analyzed for stable isotopes (especially $\delta^{13}C$ and $\delta^{15}N$) in order to study paleodiet. Curatorial concerns over the destruction of archival material during analysis (albeit small amounts of material) and/or legislation such as NAGPRA in the US that protect cultural remains has increasingly restricted the use of these primary biomaterials. The use of dental calculus, a secondary or "add-on" biomaterial, alleviates some of these concerns, and has been proposed as an alternative isotope proxy to study paleodiet [1]. The isotopic fidelity of dental calculus has been questioned [2], although a quality control criterion of calculus C/N atomic ratio < 12 has been proposed [3]. This study investigated the occurrence of organic-C and carbonate-C fractions in dental calculus for Greenlandic Inuit and medieval sites in the United Kingdom. Calculus was analyzed for bulk compositions, and organic-C fraction compositions after removal of carbonate by fumigation with HCl.

Results to date show a range of bulk C (2.8 to 9.7 wt%, mean 5.2 wt%) and N (0.4 to 2.1 wt%, mean 0.8 wt%) concentrations. Approximately 90% of the total C is present as organic-C, and all of the N is associated with the organic-C fraction. Mean C/N atomic ratios are 7.4 (bulk) and 6.4 (organic-C fraction). Values of $\delta^{13}C_{organic}$ are 0.5 to 3.0‰ (mean 1.6‰) lighter than $\delta^{13}C_{bulk}$. Results suggest the potential use of dental calculus for organic-$\delta^{13}C$ vs. carbonate-$\delta^{13}C$ analyses, and/or as an additional technique to investigate possible sample diagenesis.

[1] Scott & Poulson (2012) *J. Archaeol. Sci.* **39**, 1388-1393. [2] Salazar-García *et al.* (2014) *J. Archaeol. Sci.* **47**, 70-77. [3] Eerkens *et al.* (2014) *J. Archaeol. Sci.* **52**, 64-71.