**Supplemental Text 1: Stable Isotope Methods**

Measures of the stable isotopic composition of a material are expressed in per mil (‰) as the deviation, or delta (*δ*), of the ratio of heavier to lighter isotopes of an element in the sample from the ratio in a reference sample. The reference for carbon (*δ*13C) was the rostrum from the Cretaceous Pee Dee Belemnite formation (PDB), now superseded by Vienna PDB (VPDB). The reference for nitrogen (*δ*15N) is ambient air (AIR; Coplen 1996; Coplen et al. 1983, 1992; Craig 1957; Mariotti 1984). The standard reference material for oxygen (*δ*18O)is Vienna Standard Mean Ocean Water (VSMOW; Coplen 1994). However, many studies, particularly in the Maya area, use VPDB as the reference material (Freiwald 2023), particularly for structural carbonate from bioapatite.

*Bones*

Reed performed light stable isotope analysis of bone samples in the Mass Spectrometry Laboratory of Peter Deines at the Pennsylvania State University in 1992. He analyzed 18 human ribs from Iximche’ for their stable carbon and nitrogen isotope ratios in bone collagen.

A collagen preparation protocol for isotopic and preservation analyses was developed by Reed (1998) based on the widely used 1 N HCl and 0.125 N NaOH procedure (Ambrose 1990; DeNiro and Weiner 1988; Schoeninger and DeNiro 1984). Approximately 1 g of bone from each specimen was crushed to pass through a 24‑mesh screen and washed to remove acid and base soluble contaminants. An extract was produced from the demineralized bone by solubilizing collagen at 90 °C for 15 h. The filtered extract was then lyophilized for 48 h to yield collagen for further analysis.

Only well‑preserved specimens were analyzed using a mass-spectrometer. Well preserved collagen shows an infrared spectrum similar to modern collagen and has a dry weight percentage greater than 2% (Ambrose 1990; DeNiro and Weiner 1988). For infrared spectral analysis, 1 mg of extract was prepared, and characteristic peaks were identified between 800 and 2000 wavenumbers (DeNiro and Weiner 1988).

For isotopic analysis, approximately 8 mg of well‑preserved collagen was placed in a quartz tube along with 1 g of granular copper, 1 g of cupric oxide, and 50 mg of silver. The sample tubes were evacuated and combusted for 3 h at 900 °C to yield a mixture of carbon dioxide and dinitrogen gases. The gas mixture was cryogenically separated for mass spectrometric analysis. The analytical reproducibility for isotopic measurements, based on 13 samples of a commercially prepared collagen standard, is *δ*13Ccol of ± 0.04‰ and *δ*15Ncol of ± 0.12‰.

Teeth

Tykot performed stable carbon and oxygen isotope analysis of the carbonate portion of enamel bioapatite from 43 human teeth from Iximche’ at the University of South Florida in 1999. Analysis of enamel carbonate was done using well-established methods (Tykot 2004). Enamel powder was removed from each tooth using a diamond‑tipped dental drill to minimize the amount of sample destruction. Large samples of 5–10 mg were taken, which penetrated through all enamel layers, to mitigate variation in isotopic ratios found in smaller sampling (i.e., 1–2 mg) that are the result of seasonal dietary variation (Tykot and others 2000). Residual organic content of the tooth enamel powder was removed using sodium hypochlorite (NaClO). Non‑biogenic and adsorbed carbonates were removed with 1 M buffered acetic acid (C2H4O2). Experimental results have shown this to be a reliable method of sample preparation (Koch et al. 1997; Tykot unpublished data). Carbon dioxide was released from the treated tooth enamel powder by reaction with 100% phosphoric acid (H3PO4) in an individual acid bath autosampler, and its isotopic composition was measured with a VG Prism 2 mass-spectrometer. The precision of all analyses is ± 0.1‰ based on replicated analyses of working and international reference materials.

Olsen performed oxygen isotope analysis of the phosphate portion of enamel bioapatite from 23 of the same human teeth previously studied by Tykot. She did this in the Laboratory for Stable Isotope Science at The University of Western Ontario. Analysis of enamel phosphate involved cleaning and dissolving enamel, removing organic contaminants, precipitating silver phosphate (Ag3PO4), extracting oxygen from the Ag3PO4, and assessing postmortem alteration. Enamel was ground to fine powder using a mortar and pestle. About 30–35 mg of each sample was used in the preparation of Ag3PO4 followed a modification of methods described by Stuart-Williams (1996) and Firsching (1961). Extraction of oxygen (*δ*18O) from Ag3PO4 followed procedures adapted from Clayton and Mayeda (1963), Crowson and others (1991) and Stuart-Williams and Schwarcz (1995).

The phosphate oxygen isotope results are expressed relative to Vienna Standard Mean Ocean Water (VSMOW). For the duration of the experiments, the *δ*18O of analyzed Aldrich standard averaged +10.79 ± 0.11‰, which compared well with its accepted value of +10.84‰. Sample yields of CO2 from Ag3PO4 averaged 4.93 ± 0.03‰ *µ*mol/mg and Aldrich standards averaged 4.74 ± 0.06‰ *µ*mol/mg, both of which compared well with the theoretical value of 4.78 *µ*mol/mg. The reproducibility of the oxygen isotope measurements from repeat analyses of the same extraction of Ag3PO4 was ± 0.03‰. Repeat analyses of the same sample using a different extraction of Ag3PO4 had an average reproducibility of ± 0.02‰.

To assess preservation of original phosphate oxygen isotope signatures in these enamel samples, crystallinity index (CI) measurements were obtained using Fourier Transform Infrared (FTIR) spectroscopy following methods designed by Shemesh (1990), Weiner and Bar-Yosef (1990), Wright and Schwarcz (1996), and Surovel and Stiner (2001). The mean sample CI value was 2.98 ± 0.19, which falls within the acceptable range for enamel bioapatite.

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