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The Real Deal? Validation of a Dental Calculus Model Using FTIR

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Dental calculus is increasingly used by researchers looking at diet in past populations. These studies employ a range of methods including microscopy, and DNA and protein extraction. Despite the promise of these methods little attention has been given to the potential biases associated with the accumulation of dietary compounds into dental calculus during the lifetime of an individual. Our recently-developed oral biofilm model has the potential to elucidate these biases by growing in vitro dental calculus in a controlled environment. Here we report on one validation test of the system, which explored whether our model calculus mineralizes in a manner similar to actual calculus. FTIR was conducted on multiple samples across 25 days of model calculus growth. Results show an overall increase in the inorganic component relative to organic over the course of the experiment. This is especially evident in the hydroxyapatite peak at 1040 and doublet at 605 and 565 wave-numbers (cm -1), and a reduction in intensities of the peaks at 1546 and 1654 wavenumbers (cm-1). IR splitting factors (IRSF) ranged from 2.38–3.30, indicating a similar level of crystallinity to modern human-derived calculus samples (IRSF 3.46–3.76). The final model calculus consisted mainly of carbonated hydroxyapatite, the principal component of real calculus, although with a higher organic component than the comparative modern samples. This and prior validation of the model dental calculus suggests that it is a viable method to supplement the analysis of fossil dental calculus.

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