

## XRD WINNING SMILES: ANALYSIS OF DENTAL CALCULUS IN BIOARCHAEOLOGY

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Dental calculus is mineralised plaque on tooth surfaces and is commonly observed on the dentition of archaeological human remains. The presence and extent of dental calculus are routinely recorded as part of osteological analyses of human remains. Within bioarchaeological research, the presence of subgingival calculus has been used to make inferences about the prevalence of periodontal disease within past populations. Also, to a limited extent, dietary evidence from archaeological research has been used in conjunction with data on the severity of dental calculus deposits to make inferences about the diets of past populations.

Much of the knowledge regarding the mineral composition and formation of dental calculus has come from modern clinical dental studies. It is well established that dental calculus invariably has a mixed calcium phosphate mineral composition, with calcium hydroxylapatite (HAP), whitlockite ( $\beta$ -TCP), octacalcium phosphate (OCP) and brushite all having been identified as components, in varying quantities. However, in general, modern dental studies do not consider dietary factors and few bioarchaeological studies that have investigated the mineral composition of dental calculus. Therefore an integrated research approach that investigates mineral composition and direct dietary evidence such as starch granules within the calculus matrix has the potential to make a significant contribution to bioarchaeology.

Results are presented for micro X-ray diffraction (XRD) and Rietveld analysis of dental calculus from two skeletal samples: a collection of human remains excavated from an Anglo-Saxon cemetery site at Sedgeford, Norfolk and a collection of human remains excavated from the Royal Naval Hospital cemetery site at Haslar, Hampshire. The quantitative distribution of mineral phases is considered with respect to starch granules found within the calculi and a discussion concerning the dietary implications of the findings will be presented.

The figure below shows examples of dental calculus (main picture) and the results obtained for the micro XRD analysis of a calculus sample (circled). Composition varies between analysis points: (a)  $\beta$ -TCP, (b)  $\beta$ -TCP and HAP, (c) HAP and  $\beta$ -TCP, (d) HAP and  $\beta$ -TCP (small amount).

