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Diagenesis of human dental tissues

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The chemical composition of the human dental enamel provides information about diet, mobility or health. Despite being the most mineralized, hardest and most durable tissue of the body, diagenetic changes are common and depend on the depositional environment, type of tooth and the chronology of the site. The extent of post-mortem alterations varies for different elements. The disturbance in the abundance of an element does not immediately imply the disturbance of the remaining elements, which can still reflect or at least well approximate in vivo uptake. An additional difficulty in estimating the extent of diagenetic changes comes from the layered nature of the enamel itself and two-stage mineralization process with the maturation-related uptake of elements varying across the enamel. In this study, we investigated 24 ancient human teeth from the Roman Imperial necropolises of Isola Sacra (Lazio, II-IV cent. CE) and Velia-Porta Marina (Campania, I-II cent. CE). We conducted in situ trace element and Sr isotope composition analyses by laser ablation (MC) ICPMS. The analyses were performed as line scans in the internal, middle and external enamel layers. Additionally, we analyzed dentine, which is considerably more susceptible to diagenesis but being chemically similar, approximates the direction of diagenetic change in the enamel. Expectedly the most altered regions of a tooth are near the apex of the crown and cervix, typically expressed as high enrichment in U and Zn. The best preservation of the enamel is found in its internal layer, near the enamel dentine junction. However, it still commonly shows irregular enrichment in Fe, Mn and Ba suggesting some degree of alteration. Barium is typically a lot more sensitive to post-mortem alteration than Sr, which is primarily linked to its much lower abundance. Analyses of contemporaneously mineralized enamel on the lingual and labial sides of a single tooth often show large domains with little diagenetic change permitting to reconstruct the pristine or little altered in vivo uptake of elements for a large part of a tooth.