Synchrotron imaging and Markov Chain Monte Carlo reveal tooth mineralization patterns

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Supplemental Information

S2 Definitions of terms used

Secretion: the initial ordered deposition of mineral and organic enamel matrix where ACP, other mineral precursors or HAp develop into a mineral lattice at 20 - 30% mature mineral density. Matrix proteins, proteases and water constitute the remaining weight %. This process is regulated by ameloblast activity, and the alignment and control of the mineral phase is achieved by concerted deposition and cleavage of the enamel matrix proteins amelogenin, ameloblastin, and enamelin, thus leading to HAp mineral formation (Kwak *et al.*, 2009; Pugach *et al.*, 2013; Lacruz *et al.*, 2017).

Maturation: process of increase of the secreted mineral phase from an initial 20-30 mineral density weight %. This is driven by matrix removal and ion diffusion, and characterized by HAp crystal growth until mineralization is completed. Maturation phase is marked by fluctuations in pH related to matrix protein removal and HAp production, and the slow dissolution and reprecipitation (Josephson *et al.*, 2010; Simmer *et al.*, 2012; Damkier *et al.*, 2014; De Yoreo *et al.*, 2015; Lacruz *et al.*, 2017).

Maturation onset and completion: onset is the steep rise in mineral density after secretion, here defined as when enamel mineral density has achieved approximately 40% of mature levels for a given location (see Methods for more information). This definition allows maturation to be reliably identified in all synchrotron-scanned teeth. Completion is likewise defined as the achievement of approximately 85% of mature enamel mineral density for a given location; most locations continue to increase in mineral density beyond this threshold.

Mineralization: the entire process of ACP/HAp mineral deposition and maturation from the onset of secretion until the complete formation of the enamel crown.

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