MICROCHEMICAL AND STRUCTURAL REGULAR VARIABILITY OF APATITES IN "OVERBUILT" ENAMEL AND DENTIN OF HUMAN MOLAR TEETH

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Keywords: apatite, X-ray fluorescence, Raman microscopy, crystallographic unit cells

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The vast program of making linear elemental profiles along the cross sections of molar teeth was undertaken. The aim was to recognize the structural changes in apatites forming both the enamel and dentin of human tooth. All the trends in linear profiles were strictly determined, in the enamel zone being the increasing or decreasing curves of exponential character if one starts from the tooth surface towards the dentin-enamel junction (DEJ). The results were exaggerated if the detected material was divided in arbitrary way on the prevailing "core" enamel (~93.5% of the total mass) and remaining "overbuilt" enamel. The material in “core” enamel was fully stable and with clearly determined chemical and mechanical features. Totally different and dynamic situation was in the "overbuilt enamel". Here, Ca, P, Cl and F profiles present the decaying while Mg, Na, K and CO_3^{2-} the growing distribution curves. Close to the surface of the tooth, the mixture of hydroxy-, chlor- and fluorapatite is formed, much more resistant than the rest of the enamel. On passing towards the DEJ, the apatite is enriched in Na, Mg and CO_3^{2-}. 3 of 6 phosphate groups were substituted with carbonate groups in this location. In parallel, the Mg is associated with the hydroxyl groups around hexad axes. The mechanisms of exchange reactions were established. The crystallographic structures of new phases located close to DEJ were proposed (Fig.1).

In dentin zone, the variability of elemental profiles is different, with most characteristic changes in Mg and Na concentrations. The Mg content increases even more on passing deeper in dentin, while Na contents decreases along this route. Na concentration reaches maximum very close to DEJ zone. It testifies that the dentin deeply inside the tooth involves more and more hydroxyl groups in pair with decreasing contents of carbonates.

In reality, this evolution of the apatite material in maturing tooth occurs from the deep regions of dentin through DEJ up to internal and finally external layers of enamel.

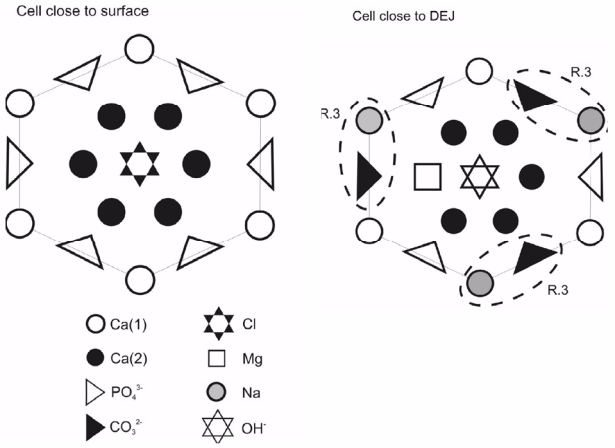

Figure 1. Proposed structures of tooth apatite unit cells: a) close to surface; b) close to DEJ, plane a×a.

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