High Resolution Climatic Record Entombed in Fossil Hominid Dental Enamel – Rajeev Patnaik, Center for Advanced Study in Geology, Panjab University, Chandigarh, India

Global climate has fluctuated drastically since the Late Miocene, causing an overall cooling, drying, fragmentation of rain-forests, occurrence of glacial-interglacial cycles, draughts-floods, effecting tropical Africa and Asia. We humans, apes and our extinct ancestors, grouped together in a family called hominidae, have evolved in response to these climatic fluctuations, by continuously adapting to changing ecological conditions. Therefore, like other terrestrial proxies such as tree rings, palaeosols, speleothemes, fluvio-lacustrine sediments, peat deposits, microfossils, magnetic minerals and plant phytoliths, hominid dental enamel is a potential archive for high resolution palaeoclimate studies. Hominid dental enamel grows periodically in a rhythemic manner producing daily increments known as cross striations. Incremental lines of longer duration comprising on an average 7-9 cross striations are termed as Retzius lines.

Manifestation of these Retzius lines on the tooth enamel surface is termed as Perikymata, which in turn can facilitate the determination of growth rate of an individual. More importantly, these enamel growth lines preserve a continuous record of water and vegetation intake in the form of stable oxygen and carbon isotopes, respectively. The oxygen isotope composition of tooth enamel (or $\delta^{18}O$ bioapatite) is determined by the $\delta^{18}O$ value of herbivore body water ($\delta^{18}Obw$), which is primarily influenced by ingested drinking and leaf water, reflecting the ambient temperature and rainfall. The carbon isotope composition of mammalian tooth enamel ($\delta^{13}C$ bioapatite) is correlated with the type of vegetation that an individual consumes. For instance, C4 grasses have $\delta^{13}C$ values around -10 to -14‰ and C3 trees and shrubs show $\delta^{13}C$ values ranging from -21 to -32‰. Therefore, intra-tooth laser ablation based micro-sampling can provide a record of isotopic variation during the formation of the tooth enamel, representing a partially time-averaged archive of ancient seasonality.

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