

Lithium isotope variations in dental enamel of woolly mammoth molar tooth as a seasonality proxy

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Dental enamel, composed predominantly of hydroxy-apatite, has long been identified as the hardest and most resistant to post-mortem alteration tissue of fossilized remains. Its sequential mineralization investigated by in situ high spatial resolution techniques allows deducing changes of habitat, diet, seasonality or mobility patterns at sub-seasonal resolution. We conducted laser ablation (MC) ICPMS trace element and Sr isotopic composition measurements in dental plates of an Upper Palaeolithic woolly mammoth molar tooth from central Poland. The analyses of different layers of dental enamel showed high compositional variations along and across enamel. While line scans along the enamel dentine junction are consistent in all analysed plates, the middle and external enamel layers show variable maturation effects and possibly weak diagenesis (external enamel). Internal enamel composition shows cyclic changes from cusp to cervix in the abundance of Li, Rb, Zn. Histomorphometric measurements showed that cyclicity reflects annual changes interpreted as a change of grazing regions forced by seasonal variations in food availability related to warm and cold seasons. The latter inference is supported by the accompanying cyclic changes in Sr isotopic composition most likely reflecting the migratory lifestyle of an animal. Seasonal variation in Li concentration provides an opportunity for testing the potential of Li isotopic composition as an additional mobility and seasonality proxy. Due to its low abundance, we applied microsampling method providing about 5-10 ng of Li per analysis. The sampling regions were defined based on the combined results of trace element analyses in different layers, histology and element mapping. The analyses were performed by MC ICPMS Neoma under wet plasma conditions using $10^{13} \Omega$ amplifier for the less abundant isotope ^6Li . The dental enamel of a modern shark was used for testing the chemistry setup as the quality control of mass spectrometric analyses. The analyses, although partially obscured by the localised diagenetic changes, confirm the utility of Li isotopes as a reliable proxy of seasonality in large mammals.