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Triple oxygen isotopes of modern terrestrial mammalian tooth enamel- new implications for paleoenvironmental and physiological research

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Atmospheric O_2 is consumed by mammals for metabolic oxidation. The low triple oxygen isotope ($\Delta'^{17}O$) composition of air O_2 serves as a natural tracer for identifying metabolic oxygen in body water [1]. Bioapatite precipitates in isotopic equilibrium with its parental body water and consequently records information on the air O_2. The $\Delta'^{17}O$ of atmospheric O_2 is directly linked to pCO_2 and gross primary production, hence fossil teeth can be used for paleo- pCO_2 reconstructions.

To provide a modern baseline for this approach, we measured 128 individual mammal teeth for their bioapatite $\Delta'^{17}O$ by automatic BrF_5 laser fluorination. The sample set includes diverse body size and physiology from different habitats. Taxon-specific oxygen mass balance models are developed for resolving principal dependencies and relationships.

The results show that $\Delta'^{17}O$ not only correlates with body mass, but also with initial oxygen anomalies of inhaled air O_2, which allows for pCO_2reconstruction on terrestrial mammalian tooth enamel. This documents the potential of tooth enamel $\Delta'^{17}O$ analysis for metabolic rates of extinct vertebrates and paleoclimate reconstructions, especially for small mammals (Mb < 1 kg).

[1] Feng et al. (2022) Geochimica et Cosmochimica Acta **328**, 85-102.