Goldschmidt 2021 Abstract
https://doi.org/10.7185/gold2021.4444

Triple oxygen isotope fractionation exponent between apatite and water

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Triple oxygen isotope fractionation exponent between apatite and water

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Over the past ten years, high precision measurements of triple oxygen isotope ratios provide the opportunity to experimentally determine triple oxygen isotope equilibrium fractionation exponent between apatite and water ($\theta_{apatite\text{-}water}$). This parameter is important when using the triple oxygen isotope composition of bioapatite as a proxy for paleo CO_2 reconstruction (Pack et al., 2013). Hayles et al. (2018) presented a data set on theoretical equilibrium θ values for oxygen isotope exchange between fluorapatite and water. Here we will present empirical data on the triple oxygen isotope fractionation exponent for equilibrium isotope exchange between apatite and water ($\theta_{apatite\text{-}water}$).

For this purpose, we collected 16 bioapatite samples of modern marine vertebrates (fish and mammals) that mineralized their hard tissues at body temperatures between 1 and 37 °C. The triple oxygen isotope measurements of the phosphate fraction of the bioapatite were conducted by laser fluorination combined with dual inlet gas source mass spectrometry.

Our data confirm the theoretical results of Hayles et al. (2018). Moreover, we detect clear evidence for isotopic anomalous respired oxygen not only for marine mammals (inhaled air O_2), but also for some sharks (respired dissolved O_2). This demonstrates that triple oxygen isotope analyses of bioapatite are a powerful tool for (paleo-)physiological studies.

[1] Pack et al. (2013) Geochimica et Cosmochimica Acta **102**, 306-317. [2] Hayles et al. (2018) Geochim Cosmochim Acta **235**, 237-245.