Triple oxygen isotope composition of bioapatite

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The reconstruction of paleo-atmospheric CO_2 levels by proxies is still on debate. The $\Delta'^{17}O$ of air O_2 varies with atmospheric CO_2 concentrations. Higher CO_2 concentrations result in lower $\Delta'^{17}O$ values of O_2, whereas lower CO_2 lead to a smaller ^{17}O anomaly of air O_2. Pack et al. [1] proposed that bioapatite of terrestrial mammals can be used as proxy for the $\Delta'^{17}O$ of ambient air and hence atmospheric CO_2 levels. Mammals breathe in O_2 to metabolize carbohydrate, fat, and protein. The $\Delta'^{17}O$ anomaly of air O_2 is transferred to the reaction products CO_2 and H_2O. Both, CO_2 and H_2O equilibrate with body water, so that the anomaly is transferred from inhaled O_2 to body water of mammals. Bioapatite crystallizes in isotopic equilibrium from body water. Because body water contains a fraction of anomalous O_2 from respiration of air O_2, bioapatite should carry information on the isotope composition of air O_2. The amount of oxygen from respired air O_2 can be estimated using a mass balance model [1].

We collected modern samples of bioapatite of marine vertebrates that crystallized at temperatures between 0°C and 37°C. For the sample preparation, the modern samples were treated with 2 ml H_2O_2 (30%) for more than 12 hours to remove the organic matter. Afterwards pretreated samples were heated to 1000°C to remove the carbonate fraction of the bioapatite [2]. The triple oxygen isotope measurements of the phosphate fraction of the bioapatite were conducted by laser fluorination using BrF_5.

We will present new data on the temperature dependence of the equilibration θ value between water and bioapatite.

[1] Pack et al. (2013) Geochimica et Cosmochimica Acta. **102**, 306-317. [2] Lindars et al. (2001) Geochim Cosmochim Acta **65**, 2535-2548.