Determination of the stable oxygen isotope composition of bioapatites: an interlaboratory comparison study

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The $\delta^{18}O$ value of the bioapatite phosphate group is widely used to estimate paleotemperatures using conodonts, fish and mammal teeth or to reveal the thermophysiology of extinct species [1,2]. The phosphate group is usually extracted through precipitation of Ag_3PO_4, then converted to CO at high temperature and analysed on an Isotope Ratio Mass Spectrometer [3]. However, the chemical procedures used to extract Ag_3PO_4 and the normalisation methods used to convert raw $\delta^{18}O$ values to VSMOW-SLAP scale significantly differ among laboratories. In this interlaboratory comparison, involving six laboratories, we tested the significance of methodical differences, analysing large fossil shark teeth samples and different aliquots of unofficial isotope standards NBS120b and NBS120c. New results (~400 analyses) confirm that the differences in chemical procedures do not have a significant impact on the final $\delta^{18}O$ values and that all different NBS120c aliquots are indistinguishable. In contrast, the $\delta^{18}O$ value calculated for a sample can be up to 1.7‰ different, depending on the choice of the normalisation method and standards selection ($\delta^{18}O$ of NBS120c varied from 21.7 to 22.9‰, and NBS120b from 21.1 to 22.7‰). The values at the lower ends of these ranges are obtained after normalisation using Ag_3PO_4 laboratory standards [3,4] while values at the upper ranges are obtained using benzoic acids, official reference materials (IAEA601 and 602). This study confirms the critical importance of the consistency in normalisation procedures and standards selection.

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