Stable isotope compositions in shark dental tissues as a proxy to seawater chemistry

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Oxygen isotope composition of shark dental tissue biomineral have been studied in three modern species from monitored environment (temperature and salinity) of the tropical ocean tank at the Blackpool Sea Life Center. Teeth of *Carcharinus plumbeus*, *Carcharhinus melanopterus* and *Carcharias taurus* were collected from deceased specimens in-situ, and from the substrate. Two geochemical methods have been applied to obtain the $^{18}$O / $^{16}$O ratios: (1) the in-situ $\delta^{18}$O measurements of entire fluorapatite oxygen components within separate layers of enameloid and dentine has been carried out using Cameca 1280 secondary ion microprobe (NORDSIM), and (2) conventional IRMS analyses of the $\delta^{18}$O of chemically separated phosphatic component has been performed in parallel on tissue-selective bulk samples. The resulting $\delta^{18}$O values showed intra-tissue uniformity (parallel-bundled enameloid in particular) of each species within the sub-permil precision of the measurements, but gave average 2‰ (1σ = ± 0.35) inter-specific variation, comparable to previously reported 2.5‰ and 2.9‰ taxonomic offsets in fossil vertebrate bioapatite. The $\delta^{18}$O variation within and between species have both histological and mineralogical explanations, and allow us to estimate the extent of ‘vital effects’ as part of the oxygen isotopic fractionation in modern aquatic vertebrate fluorapatite, as well as species-specific biomineralization patterns in sharks.