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Sr and O isotope analyses reveal Late Cretaceous shark teeth in Iron Age strata of Jerusalem

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Combined Sr and O isotope analyses can serve as a powerful tool for assessing fish provenance and even for identifying fossil fish teeth in archaeological contexts [1]. For this purpose, we established a reference Sr and O isotope dataset of extant fish teeth from major water bodies in the Southern Levant (Fig. 1). Fossil shark teeth were identified within Iron Age cultural layers (8–9th century BCE) in the City of David, Jerusalem. Their enameloid Sr and O isotope compositions are both much lower than values typical for modern Mediterranean fish (Fig. 1). Sr isotope stratigraphy places these fossil shark teeth into the Late Cretaceous (~80.3 ± 3.2 Ma). This is further supported by their taxonomy, the high dentine apatite crystallinity, low organic C as well as high U and Nd contents, characteristics that are typical for fossils specimens, and different from those of archaeological Gilthead seabream teeth from the same cultural layers. Iron Age seabream enameloid has modern seawater-like $^{87}Sr/^{86}Sr$. However, elevated $\delta^{18}O$ values of seabream teeth point to a hypersaline seawater habitat (Fig. 1), indicating that these seabreams were probably exported from the hypersaline Bardawil Lagoon in Sinai (Egypt) to the Southern Levant since the Iron Age period, possibly even earlier.

[1] Tütken et al. (2020) *Frontiers in Ecology and Evolution* 8, https://doi.org/10.3389/fevo.2020.570032

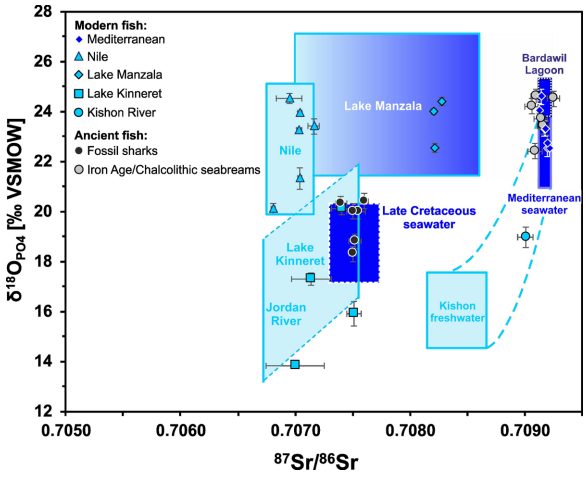

Figure 1: Cross plot of $^{87}Sr/^{86}Sr$ versus $\delta^{18}O_{PO4}$ isotope data for modern fish teeth from Egypt and Israel as well as archaeological Gilthead seabream and fossil shark teeth from the Southern Levant in comparison to the expected ranges of the fish habitats, calculated based on published water data. Note the fossil marine shark teeth fall within the expectation field for Late Cretaceous seawater and about half of the seabream teeth fall in the field of the hypersaline Bardawil Lagoon, Sinai, Egypt.