Gar scales and their terrestrial paleoclimate proxy potential

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Terrestrial climate data is restricted to well-preserved plant remains, fossils, and geologic landmarks such as lacustrine sediments and paleosols. Chemical analyses rely on the exceptional preservation of these sediments, and isotopic analyses of these sediments are rough estimates at best. Furthermore, the resolution of proxies diminishes with increasing age. A reliable, spatially and temporally widespread terrestrial proxy is needed. The unique ganoine scales of gar from the family Lepisosteidae, which are >95% hydroxyapatite and thus are highly resistant to diagenetic alteration, hold much promise towards increasing the resolution of terrestrial paleoclimate knowledge. Gar are an ancient freshwater fish lineage that extends back into the Cretaceous 100 Ma and have remained relatively unchanged during that time span. Fossil gar have been found in Europe, India, South America, and north and central Africa in addition to North America. Modern gar still retain a large geographic range, spreading across the United States east of the Mississippi River from New Hampshire down to the Gulf of Mexico. These fish are an ideal model species as they can withstand temperatures ranging from 4°C to at least 31°C, salinities up to 31 ppt, and do not venture more than a few km's from their place of birth [1]. The $\delta^{18}O_{phosphate}$ of modern gar scales, collected from individuals along a north-south transect across the United States, are measured and compared to the average $\delta^{18}O_{water}$ and temperature of each locality. A $\delta^{18}O_{phosphate}$ calibration line is compared to previously published curves [2] [3]. Coupled with a temperature estimate from an independent proxy, the $\delta^{18}O_{phosphate}$ values of gar scales from the fossil record will allow researchers to see changes hydrological cycle, as seen in $\delta^{18}O_{water}$, through time and space.

[1] McGrath (2010) PhD Thesis, 177 p. [2] Pucéat *et al.* (2010). *EPSL* **298**:135-142. [3] Kolodny *et al.* (1983). *EPSL* **64**: 398-404.