

## Stable isotope geochemistry of Shinfा River (NW Ethiopia) waters, modern and fossil mollusks, and climate during the human diaspora out of Africa

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Shinfā is a tributary of the Blue Nile which begins in the NW highlands and moves through the lowlands of Ethiopia before crossing into Sudan. Upland and lowland regions are characterized by seasonal precipitation patterns with heavy rainfall in the summer and an extended dry season through winter and spring. We present an actualistic isotopic study of the modern and ancient Shinfā river system in order to provide a context for ancient human occupation sites across this region during the Pleistocene diaspora out of Africa.

Rain in the upland and lowland regions have  $\delta^{18}\text{O}$  values of  $\sim -2\text{\textperthousand}$  and reside upon the meteoric water line. Weekly sample collections of waters from the Shinfā river change from  $\sim -2\text{\textperthousand}$  during the wet season to  $\sim +20\text{\textperthousand}$  during the dry season. The latter values are among the most positive  $\delta^{18}\text{O}$  values of water reported; they record hot and dry conditions that lead to extreme evaporation and isotope enrichment of Shinfā waters. Water temperatures vary range from 21-32°C during the dry season.

Modern mollusk aragonite growth series of  $\delta^{18}\text{O}$  range from  $-0.7\text{\textperthousand}$  in the wet season to  $+2.4\text{\textperthousand}$  in the dry season, thus preserving a muted signal of seasonal variation in water  $\delta^{18}\text{O}$  values in conjunction with seasonal temperature variability.  $\sim 40$  Ka old aragonite mollusks associated with human occupation sites preserve  $\delta^{18}\text{O}$  variation ranging from  $-2.5\text{\textperthousand}$  to  $+4.7\text{\textperthousand}$ , suggesting more intense seasonality during Pleistocene human occupation. Furthermore, these data indicate that perennial rivers such as Shinfā were exploited by humans during Pleistocene arid intervals.