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Understanding modern kinetic isotope effect in Anjohibe cave, in Northwestern Madagascar: a key to calibrate speleothem $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$

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Madagascar, an island located ~300km off the eastern coast of Africa, is a natural laboratory to study paleoclimate and paleoenvironment. It holds a key position in the Indian Ocean and in Africa, as information from it has particularly helped fill gaps in paleoclimate reconstruction in the Southern Hemisphere, where such information is still scarce. Madagascar is seasonally visited by the Intertropical Convergence Zone (ITCZ) and experiences monsoon during austral summers. Furthermore, it hosts caves where speleothems can be found. Speleothems preserve a range of continuous geochemical records, mainly stable isotopes, that allow scientists to predict changes happening in the past. In Madagascar, speleothem studies have revealed distinct early, mid, and late Holocene climatic regimes that were linked to the latitudinal migration of the ITCZ, and the monsoonal responses associated with the migration. Other speleothem studies revealed evidence of the African Humid Period, rapid climate changes, and most importantly the shift in $\delta^{13}\text{C}_c$ starting ca. AD 800, that was attributed to anthropogenic activities. Although information from these speleothems is unquestionably significant, there are still gaps in isotopic proxies interpretation, mainly in linking modern environments where these speleothems grew and the signals they preserve. Such modern information is however fundamental to calibrate paleo-based climate and environmental reconstructions in Madagascar, which could be a key to refine their past interpretation. In this study, we performed an in-cave spatial test to understand kinetic isotope effect in Anjohibe Cave and to define oxygen isotopic fractionation between speleothem carbonate and its parent water and carbon isotopic fractionation between speleothem carbonate and the corresponding dissolved inorganic carbon (DIC). Results have been compared with modern calibration studies on speleothems from other locations worldwide, and we found that our data fit within the empirical relationship for cave-specific $\text{CaCO}_3\text{-H}_2\text{O}$ isotope fractionation, grouping a range of monitored caves worldwide, $1000 \ln \alpha = 16.1 (10^3 T^{-1}(\text{°K})) - 24.6$ of Tremaine et al. (2011). Other physico-chemical parameters in Anjohibe Cave have also been measured, and they will be used to discuss potential linkages with the spatial variability in the modern speleothem stable isotopic values and their corresponding parent water and DIC.

Tremaine, D.M., Froelich, P.N., Wang, Y., 2011. Speleothem calcite farmed in situ: Modern

calibration of $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ paleoclimate proxies in a continuously-monitored natural cave system. Geochim Cosmochim Acta 75, 4929-4950.