

Clumped isotope records of East African paleosol carbonate as climate proxy for the last 4.5 Ma, implications for human evolution

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Detailed reconstruction of environmental conditions and climatic history at hominin sites is crucial in providing contextual information and interpretive framework of the evolution and diversification of our ancestors. These data have traditionally retrieved from fossil mammalian tooth enamel and paleosol carbonates using stable isotopes of carbon and oxygen, but recently the development of carbonate clumped-isotope paleothermometry enables us to reconstruct temperature from terrestrial records. Here we present clumped-isotope data from paleosol carbonates from the Awash Basin, Ethiopia, that cover the last 4.5 Ma. Clumped-isotope derived soil temperature values from the Awash Basin in the Pliocene-Pleistocene average 35.0 ± 4.0 °C ($n = 41$). Although there are no significant temporal trends in the data, the average temperature values generally decreased since the last 4.5 Ma. Reconstructed $\delta^{18}\text{O}$ soil water in the Awash Basin was generally steady with low values in the Pliocene. Similarly, low $\delta^{18}\text{O}$ soil water values are reconstructed in the Omo-Turkana Basin, however since ~ 1.5 Ma, the $\delta^{18}\text{O}$ soil water values in Omo-Turkana Basin increased by $\sim 4\text{‰}$. These changes might suggest higher rainfall amount in the Pliocene, changes in the hydrology of the basins or changes in large-scale atmospheric circulation pattern, which might significantly affect the ecosystem and available food resources, where our ancestors lived.