Multi-trophic patterns in mammalian joint and bone morphology and their potential for palaeoenvironmental reconstruction

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During the Plio-Pleistocene transition, marine sediment records indicate global cooling and aridification across Africa, associated with the expansion of grasslands [1]. This trend disrupted existing ecosystems and exposed biological communities to new selective pressures, particularly affecting locomotor adaptations. However, at regional scales, this pattern may have been more complex, as more covered environments could persist along perennial watercourses, allowing a higher diversity of habitats [2]. For South African hominins habitats, the uncertainties are even greater, bearing in mind that these sites are in the temperate zone and outside the rain shadow of the Intertropical Convergence Zone. Here we test whether studying articular joint morphology across several African mammalian taxa simultaneously may provide information about the regional environmental context in which early hominins evolved and diversified.

Ecomorphological studies are commonly conducted on single mammalian groups or using single morphological traits [3,4]. However, Short et al. [5] demonstrated that the ability to detect ecological relationships between joint morphology and vegetation cover is strengthened when animals from multiple trophic levels are considered simultaneously. In this pilot study, we test if further improvements can be made integrating multiple articular joints from multiple trophic levels

To capture community-wide responses, we combine articular joint measurements from the appendicular skeleton of primates, suids, and carnivorans, representing both primary and secondary consumers. Their morphology are analysed in relation to locomotor repertoires, habitat and climatic conditions, both past and present (using the PastClim package). The morphological material used for our pilot studyis housed at the Royal Museum for Central Africa, Tervuren, Belgium.

Uni and multivariate analyses were carried out and demonstrate that habitat conditions reconstruction can be enhance by multi-pronged approach. Besides, care should be taken when inferring current climate/habitat conditions for morphology and the potential for evolutionary lag to morphological evolution needs be considered when analysing fossil remains. Finally, we discuss how the results will inform our reconstruction of South African hominin habitats.

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