
Paleodiet at the high-altitude Cuncaicha rockshelter (Pucuncho Basin, Southern Peru), based on stable carbon, nitrogen, and sulfur isotope abundances in bone collagen

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Résumé

Even though the harsh climate, steep gradient, and high altitudes of the Andean Cordillera present natural hurdles to human settlement, its colonization in the Terminal Pleistocene-Early Holocene was swift and widespread, up to the highest plateaus. The question whether the early settlers of the Andean highlands occupied these challenging environments on a permanent basis remains nonetheless unresolved. Indeed, not only do coastal sites bear archaeological evidence for redundant occupation of the Pacific lowlands and coast; further archaeological evidence also points towards a connection between Andean highland and lowland sites. To evaluate the extent to which these humans were permanently living at high altitude, we used multi-isotopic ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$, and $\delta^{34}\text{S}$) analyses on bone collagen of coeval archaeological human and animal remains from the high-altitude rockshelter Cuncaicha (4480 masl) in the south Peruvian puna. Due to the differential abundances of carbon, nitrogen, and sulfur isotopes in coastal and high-altitude ecosystems, the protein

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ingested by an individual can be traced to food resources originating from either ecosystem thanks to distinctive $\delta^{13}\text{C}$, $\delta^{15}\text{N}$, and $\delta^{34}\text{S}$ values in the individual's collagen. These new isotope results, in conjunction with already published values for carbon and nitrogen, provide insights into the palaeoecology of the Pucuncho Basin, where Cuncaicha is located, and help complete the growing body of knowledge of isotopic baselines in high altitude and arid environments. Additionally, comparing archaeological and modern material provides higher-resolution data on chronological variation of the productivity of the basin and subsequently of human foraging patterns. This paper also presents some of the oldest $\delta^{34}\text{S}$ results on archaeological material in the central Andes, thus expanding our understanding and knowledge of trophic and ecological variation of this element's isotopic ratios in complex mountainous arid landscapes. The obtained results detected a distinct local palaeoecological signal. Despite evidence for a coast-highland exchange system involving Pucuncho Basin, the results from human collagen indicate that Early Holocene foragers relied predominantly on a range of highland terrestrial animal protein resources. This exclusive dietary reliance on highland habitats adds to our understanding of human behavior within highly contrasting yet culturally connected low- and high-lands. In addition, the results are relevant for the study of subsistence strategies by individuals, here the earliest high-altitude Andean settlers, within extreme environments, and subsequent human adaptations.

Mots-Clés: stable isotopes, Andes, paleodiet