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The use of sedimentary ancient DNA from lakes in tracing human-environment interactions in the Western Alps

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Archaeologists working in high altitude-zones in the Alps where faunal remains were absent have until relatively recently, been reliant on palynology in order to infer the probable presence of pastured animals. The development of sedimentary ancient DNA (sedaDNA) analysis has changed this. We are now able, if taphonomic conditions permit, to identify the presence and absence of specific domesticated animals as well as changes in vegetation communities that were a consequence of pastoral activity. Over the past decade, lake sediment DNA has been used by an increasing number of studies to trace past agricultural activities, human presence and landscape changes.

More recently, lake sedaDNA sequencing has proven applicable to investigate the relative impact of human activities, such as transhumance pastoralism, on the vegetation in the catchment of lakes in the Western French Alps and the domestic species used at different time periods. Thus, providing a new outlook on the anthropogenic effect on alpine landscapes.

Our use of sedaDNA is one element in a project designed to elucidate the evolution of transhumance in the Western Alps. While the sequential isotope analyses from domesticated herbivore teeth facilitate our comprehension of seasonal pastoral mobility, the sedaDNA complements this work via its potential for inferring which pastures were frequented and the effect of livestock presence on these environments. This combined approach can demonstrate not only the existence of pastoral practises in the region, but also reconstruct the movement patterns as well as the direct impact of transhumance pastoralism in the Western Alps in a wide chronological and spatial frame.

With the application of advanced bioinformatic techniques, we combine previous data on past and present vegetation with our findings. The genetic data was obtained through the established method of metabarcoding, which is a relevant tool for reconstructing palaeoenvironments. Using the same approach with additional quantitative PCR analysis for mammalian sedaDNA offers even more detailed insights into the presence and possible abundance of domestic species in the lake catchment area.

This application can demonstrate the potential of sedaDNA in reconstructing palaeoenvironments and its relevance in conceptualising long-term ecosystem changes relating to human and non-human agencies.