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## Ancient steroids: Human faecal signals and environmental data from a Holocene sediment record of the Yagour Plateau, High Atlas, Morocco

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The analysis of steroids (stanols and stanols compounds) preserved within Holocene sediment records represents a novel approach to establish past periods of human and herbivore occupation in the Atlas mountains of Morocco. These organic compounds are faecally produced by omnivorous and ruminant mammals; the concentrations and ratios of the compounds are used in this study as proxies for past dynamics of human presence. In this study, stanol analysis is employed in tandem with multiproxy sedimentological, palaeoecological and geochronological data of a lake-margin sediment core to evaluate Holocene human presence around the high-elevation wetland system of the Yagour Plateau, in the High Atlas mountains (31.31°N, 7.60°W, 2460 m.a.s.l.). The site is a vital resource for modern pastoral communities, providing fodder for livestock during seasonal dry periods. Cultural institutions known as Agdals regulate access to this wetland and have been established since early-historic times at least. The Yagour Plateau is well-known for its remarkable abundance of undated petroglyphs, which may relate to the territorial delineation of these Agdals. However, direct dating of archaeological remains is rare and the timing of human presence on the High Atlas rangelands is not well known. Information gained on the dynamics of human presence of remote, high-elevation sites in the High Atlas may be helpful in improving the understanding of the relationships between Holocene climatic, anthropogenic and ecological signals. Here, we present new data from 25 stanol samples spanning the last 13 kyr, complemented by two multiproxy records that include pollen, charcoal and non-pollen palynomorphs. The temporal context of these proxy records is underpinned by high-resolution age-depth radiocarbon chronology. We observe elevated stanol ratios from 6.2 cal ka BP to modern times, likely indicating intermittent human presence on the plateau since the Mid-Holocene. High coprostanol concentrations between 4.9 to 4.0 cal ka BP are similar to modern levels and indicate peak human presence. Faecal biomarkers match well with pollen-based anthropogenic indicators, particularly *Plantago* pollen abundance. This study supports a significant human presence on the Yagour Plateau from the Mid-Holocene onwards, contributing to the study

of long-term human presence and climate dynamics in a sensitive mountain region at the boundary of the Atlantic and Saharan climate systems.