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## The highest altitude paleoecological record of early pastoralism in Africa

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The advent of pastoralism in Eastern Africa is one of the most significant cultural transformations in the continent's history. Traditionally, herding origins and its spreading routes have been studied in the lowlands and described as a complex and lengthy process that began before 4 ka BP and lasted until 1.3 ka BP. This cultural transition has long been argued to have been a process involving both environmental change and population movements. Given the current patchy archaeological data, most studies conclude that no single factor can be identified as a driver of the onset of herding in Eastern Africa, but almost all evidence is from lowland areas. The higher elevations of the Eastern African mountains are sensitive to climate and environmental change, so may be ideal for testing hypotheses of human-environmental relationships. However, the history of pastoralism in the African highlands, especially its connection with regional herding migrations and Holocene climate change, has thus far been poorly explored with few available records.

In this contribution, we provide evidence of early pastoral activities at high altitude in the Bale Mountains of southwest Ethiopia. We present a 4000-year multiproxy palaeoecological lacustrine sequence from Garba Guracha, a cirque lake at 3950 m asl, combining palaeoclimatic and palaeoenvironmental proxies. Our record indicates the distinctive presence of faecal fungal spores (*Sporormiella*, *Cercospora*, *Podospora*) and the expansion of pollen and *seda*DNA from ruderal plants as early as 3.5 ka. To our knowledge, this is the highest altitude record of early animal husbandry traces on the continent. Coeval with the expansion of pastoralism indicators in Garba Guracha, we find important changes in the lake's diatom community, as well as climate fluctuations reconstructed from biomarkers; these may be critical for understanding human occupation at high altitudes. However, archaeological studies conducted in the Garba Guracha basin have proved unfruitful in finding permanent settlements of herders, suggesting hypotheses of seasonal resource use.

We discuss different scenarios of pastoral expansion on the Eastern African highlands under changing local climates, as well as the general context of pastoralist migration across Eastern Africa.