Early Pleistocene grassland dynamics at East Turkana

Indications from shifting patterns of mesic- and xeric-adapted ungulates and new insights into ungulate niche preference

Kaedan O'Brien[1,2], Amanda McGrosky[2,3], Kayla Allen[2,4], Lauren Anderson[2,5], Maryse Biernat[2,3], David R. Braun[2,5,6,7], Amanda "Billie" Guerrero[2,8], Laura Hunter[2,9], Jeffrey Seckinger[2], Felipe Torres[10,2], R. Brendon Zeller[2,4], Degsew Zerihun[11,2], and David B. Patterson[2,4,5]

[1]Anthropology and Integrative Biology, University of Wisconsin-Madison, [2]Koobi Fora Field School, The George Washington University, [3]School of Human Evolution and Social Change; Institute of Human Origins, Arizona State University, [4]Biology, University of North Georgia, [5]Center for the Advanced Study of Human Paleobiology and Department of Anthropology, The George Washington University, [6]Archaeology, University of Cape Town, [7]Human Evolution, Max Planck Institute for Evolutionary Anthropology, [8]Anthropology, University of La Verne, [9]Ecology, Evolution, and Environmental Biology, Columbia University, [10]Instituto de Ciencias de la Tierra, Universidad Austral de Chile, [11]Ethiopian Authority for Research and Conservation of Cultural Heritage

Background

- East Turkana has fossil evidence of inferred sympatry of three to four hominin species (Wood and Leakey, 2011).
- Due to their prevalence in the record, fossil ungulate analyses can provide robust insights into paleoenvironmental dynamics (Bobe and Behrensmeyer, 2004).
- In this study, grassland-indicative ungulate taxa were used to assess the potential aridification of this region during the recession of Lake Lorenyang (Feibel, 2011).

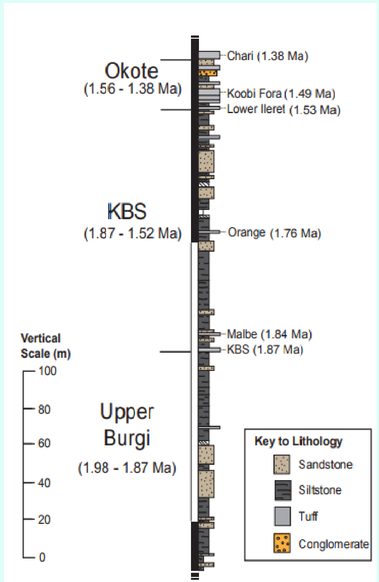


Figure 1

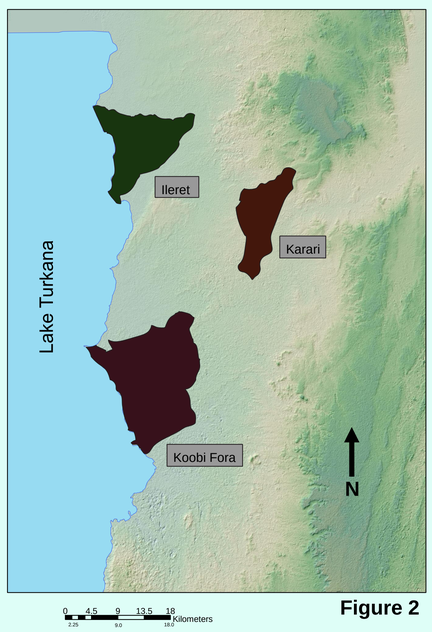
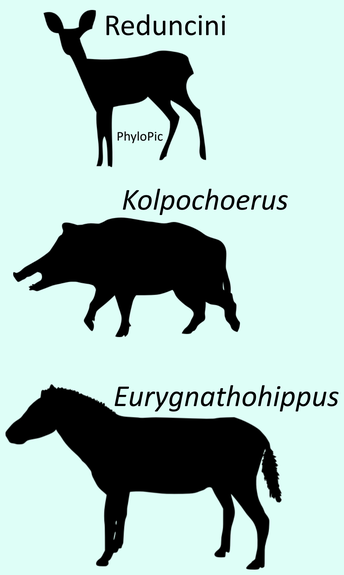
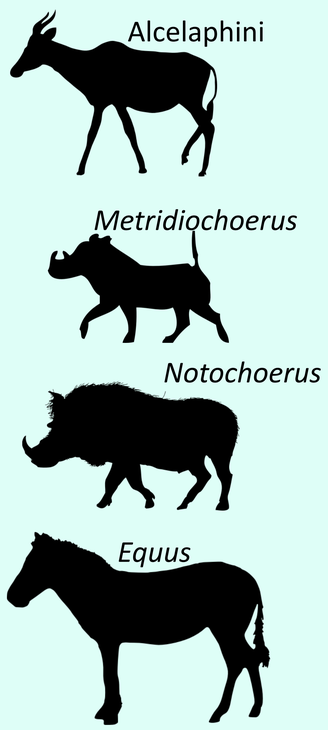


Figure 2

Mesic and Unresolved Taxa



Xeric Taxa

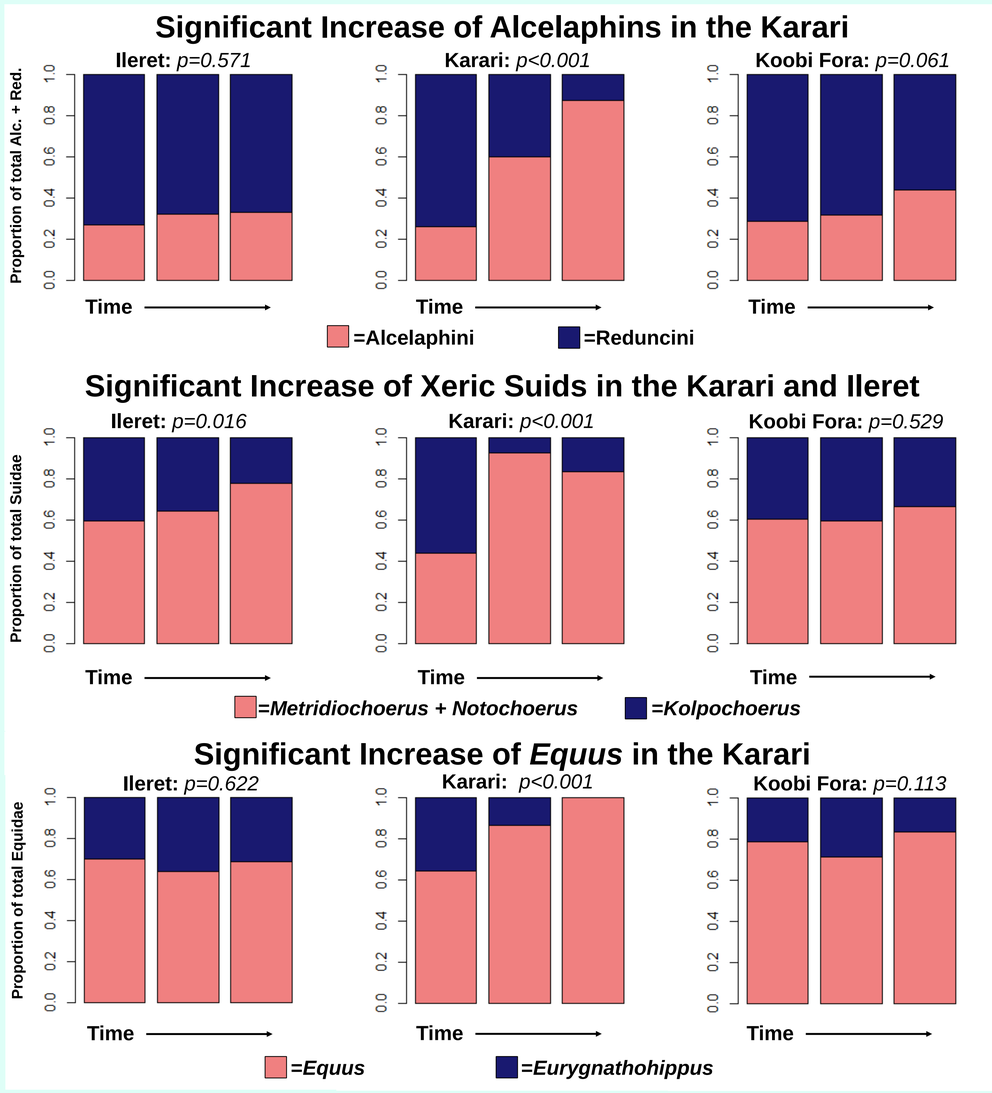


Materials and Methods

- Turkana Basin Paleontology Database
- Turkana Basin Institute Paleontology Database
- Field collections from DBP (2011-2017)
- n=2,583 total for Alcelaphini, Reduncini, Suidae, and Equidae (primarily isolated teeth)
- Upper Burgi, KBS, and Okote Members (Figure 1)
- Koobi Fora, Ileret, and Karari subregions (Figure 2)
- Xeric taxa: Alcelaphini, *Equus*, *Metridiochoerus*, and *Notochoerus*
- Mesic taxon: Reduncini
- Unresolved paleoecology: *Eurygnathohippus* and *Kolpochoerus*
- X^2 tests used to determine significant changes in proportions of taxa over time

Results

- Of the three subregions, the Karari experienced significant ($p<0.05$) faunal turnover for all taxa. Ileret experienced slight turnover in Suidae.
- *Kolpochoerus* and *Eurygnathohippus* track the abundance of Reduncini.



Conclusions and Future Research

- The Karari experienced most significant faunal turnover in these taxa between 2.0-1.4 Ma, with typically xeric taxa replacing typically mesic taxa.
- *Kolpochoerus* and *Eurygnathohippus* may have required mesic habitats, possibly explaining the replacement of these genera in eastern Africa.
- Other taxa (e.g., Cercopithecidae and other Bovidae) may be incorporated into our analysis.
- Contemporary sites such as Olduvai Gorge and others in the Omo Group surrounding Lake Turkana should be analyzed.

References

Bobe, R., Behrensmeyer, A.K., 2004. The expansion of grassland ecosystems in Africa in relation to mammalian evolution and the genus Homo. Palaeogeography, Palaeoclimatology, Palaeoecology 207:399-420.

Feibel, C., 2011. A geological history of the Turkana Basin. Evolutionary Anthropology 20:206-216.

Wood, B., Leakey, M., 2011. The Omo-Turkana Basin fossil hominins and their contribution to our understanding of human evolution in Africa. Evolutionary Anthropology 20:264-292

Acknowledgements

We would like to thank Dr. Henry Bunn, Dr. Ashley Hammond, and Dr. J. Tyler Faith for their insights into this research. Furthermore, this work would not be possible without The George Washington University's Center for the Advanced Study of Human Paleobiology, the National Museums of Kenya, the Turkana Basin Institute, and the amazing staff and seasonal workers of the Koobi Fora Field School. This project was supported by an NSF-IRES grant to KO, National Science Foundation (#1424203) and Wenner-Gren Fieldwork grants to DBP, OISE awards 1358178 and 1358200, and the NSF Archaeology program grant 1624398.