Geophysical Research Abstracts
Vol. 19, EGU2017-16526, 2017
EGU General Assembly 2017

Tectonics and soil edaphics as controls on animal migrations and early human inhabitance in the Kenya Rift

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Animal movements in the tectonically active East African Rift Valley today are influenced by a combination of topography and soil nutrient distribution (soil edaphics). These patterns would have been the same in the past when hominins inhabited the area. Our study in the Kenya Rift shows that soil edaphics and active rift structures play a key role in present day animal movements as well as the for the location of early hominin sites. We carried out field analysis at Olorgesailie and Kariandusi, two key hominin sites in the southern and central Kenya Rift, respectiveley. Based on studying the relationship between the geology, tectonics and soil development we identified 'good' and 'bad' regions both in terms of edaphics and accessibility for grazing animals. We further sampled a large number of soils that developed on the volcanic bedrock and sediments of the region and interviewed the local Maasai shepherds to learn about present-day good and bad grazing sites. Ultimately, we created palaeoenvironmental and spatio-temporal reconstructions for interpreting human land use and exploitation of large mammals in the Kenya Rift for the relevant time frame of approximately 1 Ma BP.

At Olorgesailie the hominin site is located in lacustrine sediments at the southern edge of a playa that extends north and northwest of Mt. Olorgesailie. The lakebeds are now tilted and eroded by motion on two north-south striking faults. The lake was trapped by volcanic flows and alluvial fans from Mt. Olorgesailie and was released by the fault motion leading to deep river incision and exposure of the site. To the west and the north steep fault scarps bound the playa forming a natural barrier for animals. Field observations and information from local shepherds suggest that the abundant trachytes at the valley floor produce poor soils whereas the soils developed on lacustrine and alluvial sediments close to the hominin site provide much more attractive grazing sites for present-day animals. This is supported by our soil analysis. With a lake in the past the Olorgesailie site represents an key example of how early hominins may have used the landscape for their strategic advantage.

At Kariandusi site we investigated the tectonic and volcanic history of the region, and the system of lakes that have undergone periodic expansion and contraction during the Pleistocene in response to climatic and tectonic controls. We used this information to reconstruct topographic features as they would have existed at different periods of the past and their likely influence on patterns of large-mammal movements, and linked this with information from soil analysis. Our results show that Kariandusi occupied a unique window of opportunity in place and time for trapping mammals constrained to move through a narrowly defined topographic bottleneck between edaphically-rich areas during the lake highstand $\sim$1 Ma BP.

Results of our study suggests that both Olorgesailie and Kariandusi sites were used for a simple form of ambush hunting.