Report on Research in 2014/15

The DISPERSE edaphics project Kenya

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(see addresses at end of document)

Background

It is common knowledge among agriculturalists that the quality of soils and the associated vegetation strongly control the health of grazing animals. This is hardly appreciated by palaeo-anthropologists who generally assume that all that is required is water and vegetation. A lack of this understanding greatly limits interpretations of the relation between our ancestors and animals over the last few million years.

It should not be assumed that even lush vegetation is attractive to animals. If it lacks vital trace elements (e.g. phosphorus *P*, sodium *Na,* copper *Cu*, cobalt *Co*) then wild grazing and browsing animals will avoid it and go to considerable lengths and take major risks to seek out better pasture *(Ref 1,2)*. As a consequence animals must move around the landscape at different times of year. In a complex landscape, hominins can use advanced group behaviour to gain strategic advantage. The role of complex landscapes has been discussed in a series of publications *(Refs 3 - 7)* and the role of such landscapes in the evolution of our body form is discussed by Winder et al,. *(Ref 8)*.

Edaphics and animal movements

For this project edaphics can be described as the relative ability of the soils and subsoils, via plant take-up, to supply the necessary nutrients for animal growth and health. To appreciate wild animal movements it is necessary also consider other factors such as the water retentivity of soils, and slope steepness that constrain animal movements *(Refs 1,2)*. An edaphics approach is necessary in Kenya because historical information is not sufficient to determine animal distributions before modern humans became prevalent. Within Kenya major changes have occurred as pastoralists and farmers migrated into the area in the last few centuries and changes have accelerated in the last 50 years. Historical information about the distribution of wild animals is useful but limited. Nonetheless modern domestic animals are similar in their edaphic needs to other herbivores. Thus those places favored and avoided by goats, sheep and cattle and their herdsmen provide evidence for good and bad conditions. Wild animals will have sought the same good areas and avoided the bad ones.

Further information can be found in Research Report for 2013 PDF

Activities during 2014/15

During the 12 months 1 Jan to 31 December the Disperse Edaphics project has pursued the following activities

January meeting in Paris

A 3 week meeting was held in January in Paris with Rucina, Owenga and Klueber and King. The purpose of this meeting was to:-

i) to work on the data collected in the field in August/September 2013. See REPORT 2013_GK for details

ii) to plan the publication based on that field work and lab studies modelling the tectonics of The Olorgesailie region.

ii) to plan further field work

It was concluded that insufficient data had been collected for the Baringo and Kariandusi regions to support a publication but a paper could be written on the Olorgesailie region and could be submitted to a high profile journal. The relation between bed rock geology, and soil characteristics became clear suggesting that future field work should both extend the work around Baringo and Kariandusi and more generally examine the relation between bedrock and soils.

A paper has been submitted to Nature Scientific Reports:-

> ***Animal movements in the Kenya Rift and evidence for the earliest ambush hunting by hominins***
>
> ***Extended Abstract:*** *We present a landscape reconstruction for a key site in the Kenya Rift, Olorgesailie, used by hominins between ~1.2 to <0.5 Ma. It contains hominin artefacts, fossil mammals, and evidence of large-mammal butchery. It was used by Palaeolithic hominins for ambush hunting of large prey animals. We introduce new methods in support of this landuse hypothesis using tools developed to study faults, and soil edaphics by mapping of nutrients critical to the health of herbivores. This allows us to identify the limited routes of movement and grazing areas available to large mammals in the region and show the strategic location of Olorgesailie as a base for their exploitation by hominins. We carried out field analysis to characterize aspects of the geology, soil quality (edaphics) and tectonics in order to identify 'good' and 'bad' regions for grazing animals. First results indicate that the flood trachytes at the valley floor produce poor soils lacking important nutrients, whereas the soils on sediments close to the hominin site are much more attractive grazing sites. As the rift floor today is different from when the site was occupied we created a palaeoDEM using techniques developed to model tectonic faults. This way it is possible to identify how fault motion has changed the landscape and allows us to consider how Homo used the site region to exploit prey species and avoid predators. The faunal community of Olorgesailie is dominated by and large-bodied grazing species such as white rhinoceros and wildebeest. These animals would have been restricted to flatter areas for their routes through the region. Our mapping shows that such routes are limited, and this means that Homo could predict the routes that prey animals would take en route to the sources of drinking water (palaeolake Olorgesailie). The location of the site in relation to the wider landscape shows that the hominins placed themselves in the best position to conduct ambush hunting. Also, few carnivores where present, so the region was much safer for hominins to use for hunting. Our analysis indicates the unique features of the Olorgesailie site and why it repeatedly attracted human activity over a long period of time. It also provides the earliest evidence of strategic landscape use for ambush hunting ever documented.*

September 2014 Field work in the Rift

Field Work in Kenya included Sally Reynolds. She was recruited to the "DISPERSE edaphics project Kenya" because of her extensive knowledge of African mammals past an present. She made a critical contribution to the paper submitted to Nature Scientific Reports.

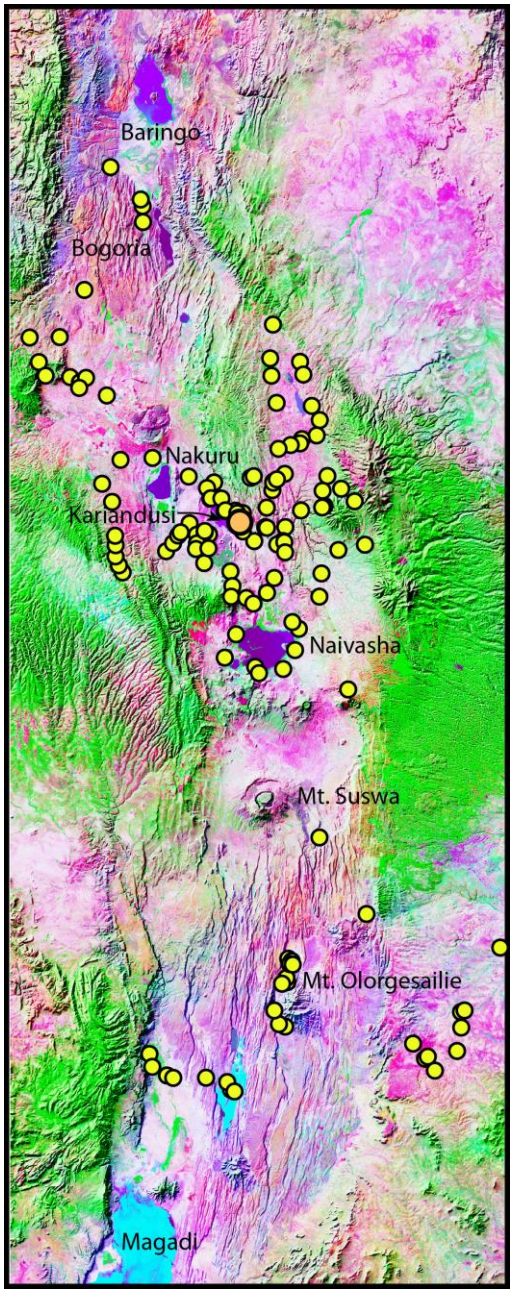


Figure 1.
Points of particular interest. Samples of soil and vegetation was taken at 114 of these points during September 2014. Particular attention was paid to the Kariandusi region and east and west of Olorgesailie. Sampling aimed to characterise soils and vegetation on typical rocks and can be applied to regions where no samples were taken.

The field work concentrated gaining more information on edaphics by interviewing pastoralists and collecting soil samples. Samples were taken to the east and west of Olorgesailie within the rift and some were take on the eastern rift flank. This improved the data in the paper submitted to Science. The data was collected around Kariandusi and extended east and west in the rift as far south as Lake Bogoria. Samples of both soil and plant material were taken for all significant rock types.
Tectonic features were also examined with a view to modelling faulting and creating paleo-landscapes as carried out for the Olorgesailie region.

Munich meeting 29th and 30th January 2015

A meeting was held with the following people in the Department of Earth and Environmental Sciences LMU Munich.

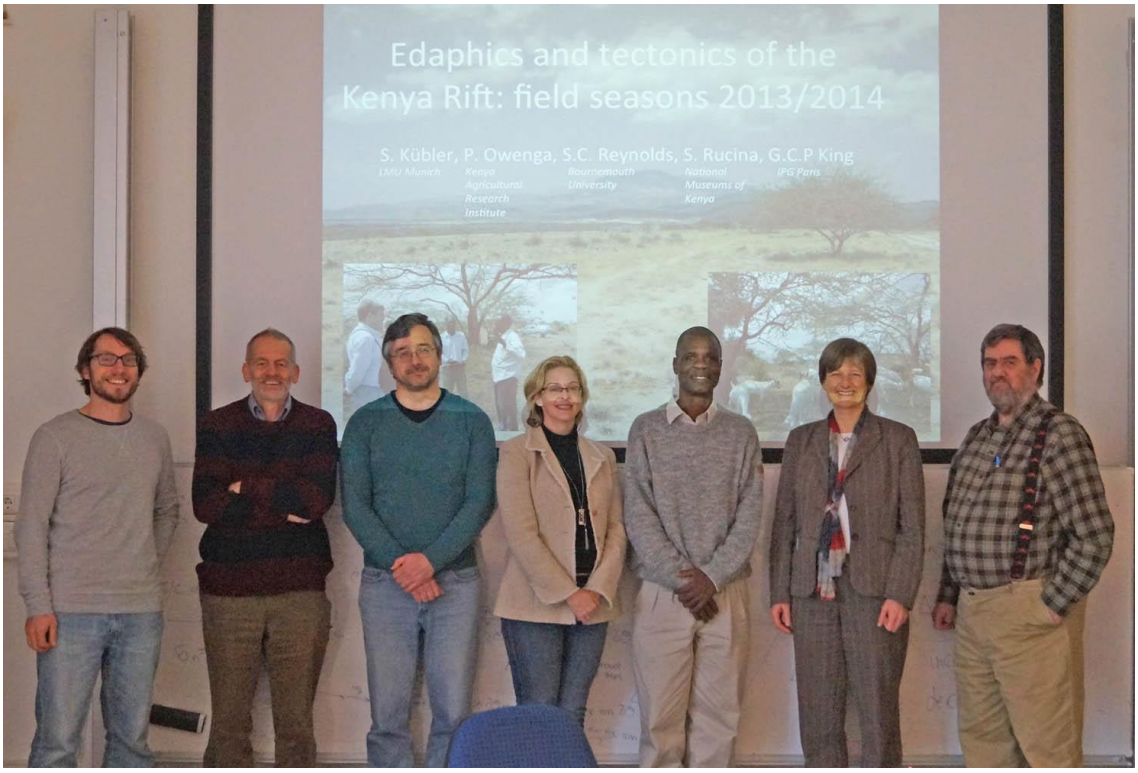
Munich - Ludwig Maximilian University
Prof Anke Friedrich - Head of Department of Earth and Environmental Sciences
Dr Simon Kuebler - Postdoctoral Researcher

Kenya - KALRO (Kenya Agricultural and Livestock Research Organization)
Peter Owenga - Research Scientist

Institut de Physique du Globe de Paris
Prof. Geoffrey King - Research Scientist. Co-director Disperse project

Department of Archaeology, The University of York, England
Prof. Geoff Bailey - Research Scientist. Director Disperse project

Institute for Studies in Landscape and Human Evolution (ISLHE) Bournemouth University, UK
Prof. Matthew Bennet- Director ISLHE



Dr Sally Reynolds - Co-director ISLHE
Left to right:- Simon Kuebler, Geoff. Bailey, Matt. Bennet, Sally Reynolds, Peter Owenga, Anke Friedrich, Geoffrey King.

Objectives of the meeting

1) Allow probable participants in future work in Kenya to meet. In particular introducing Anke Friedrich, Geof Bailey and Matthew Bennet to the core group (unfortunately lacking Dr Stephen Rucina)
2) To consider the possibility that Peter Owenga (Kwengu) should pursue a PhD qualification in Germany or Britain working on a continuation of the Kenya Edaphics Project.

3) To plan further work in Kenya Rift possibly extending into Tanzania and sources of funding.

Proposed Actions

Simon Kuebler, Anke Friedrich - Munich.

Munich will lead two projects:-

1) Seek funding from the DFG to pursue research into soil edaphics and the relation to underlying geology in East Africa. Applications to include Palaeoanthropological Research but also to extend the health of modern animals and humans. Pursue the use of satellite data in conjunction with the German Space Agency.
DFG German Research Foundation (Deutsche Forschungsgemeinschaft)
DAAD German Academic Research Service (Deutscher Akademischer Austauschdienst).

2) Apply for Phd funding for Peter Owenga.

Application deadlines:
DFG - No deadline, but submit at the start of the year
DAAD - 30th September 2015

Geoffrey King - Paris.

Find funding for modest visit East Africa in 2015. This can include remaining Paris Disperse funds plus modest addition from the British Institute In East Africa (BIEA).
The Objectives are

1) To plan future work in Kenya with a possible visit to Tanzania (Olduvai). This can include developing further contacts (geology, medical) for Simon Kuebler's expanded future project.
2) To develop future contact for Sally Reynold's future work.
3) To consider further directions favoured by Geoff Bailey.

Application deadlines:
BIEA - April

Geoff Bailey - York

1) GNB will consider future proposals for marine (expensive) work with a modest land component that could include East Africa and Eastern Mediterranean.
2) The creation of a researcher mobility network. This may have a large coastal archaeology component and not be best combined with on-land work.

Application deadlines:
to be determined.

Sally Reynolds – Matthew Bennet - Bournemouth.

Planning for Bournemouth projects are not yet clear, but GK, SK and SR can combine to produce a pan-rift paper which can also provide material for proposals.

1) Plan B for Peter PhD if Munich is not working
2) Major funding for image processing and agent modeling projects.
3) Possible funding for exploratory visits along Rift (Okavango Delta?)
4) Mobility money for meetings. This group is not likely to be the same as a Geoff Bailey (York) group with a marine/coastal perspective

Application deadlines

Look for mobility money now.

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