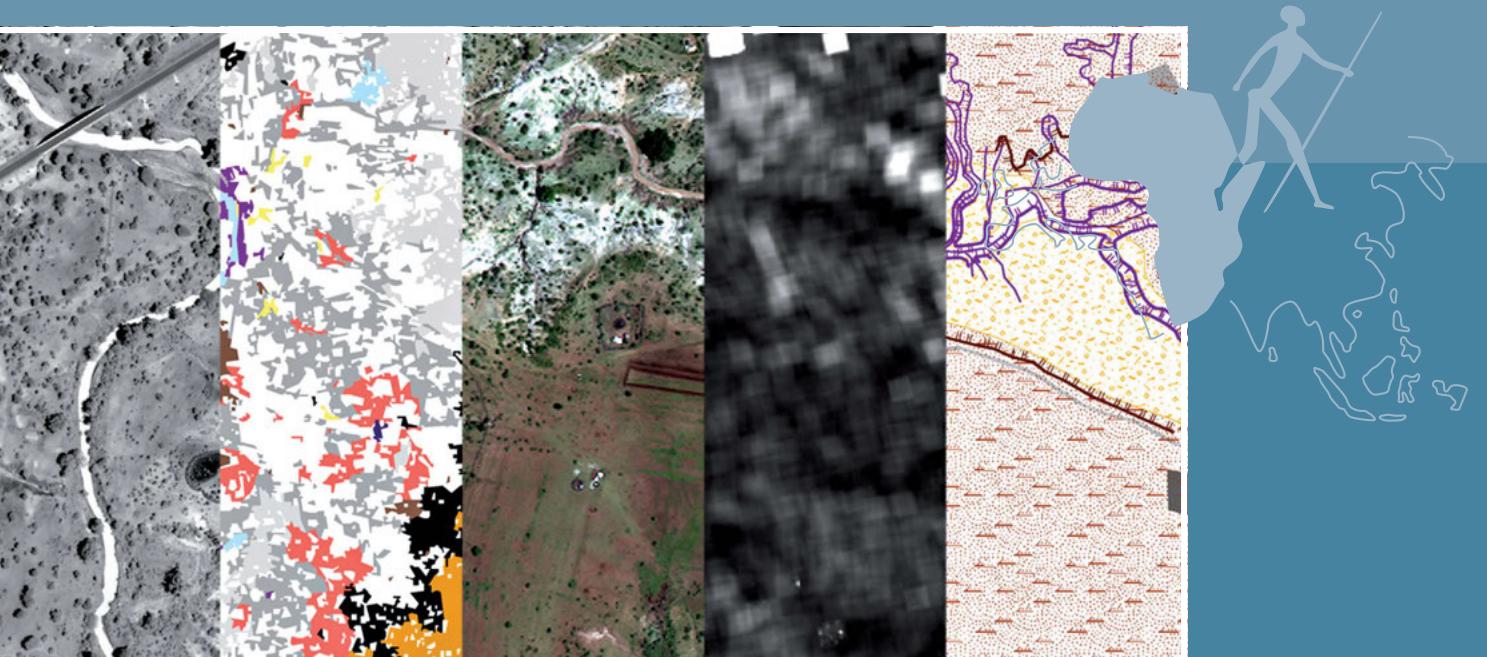




newsletter 11 | 2015

The Role of Culture in Early Expansions of Humans



Different layers of digital information about the landscape are assembled to derive a geomorphological map.
From left to right: WorldView-2 panchromatic scene (0.5 m ground resolution), soil lithologic analyses,
WorldView-2 optical sensor (2 m), SAR Image (TerraSAR-X; 3 m), geomorphological mapping.



**HEIDELBERGER AKADEMIE
DER WISSENSCHAFTEN**
Akademie der Wissenschaften
des Landes Baden-Württemberg



THE ROLE OF CULTURE IN EARLY EXPANSIONS OF HUMANS

Editorial

The eleventh issue of ROCEEH's newsletter presents methods describing the geomorphologic nature of the Lake Manyara basin in the East African rift valley. This issue also presents a short summary of the ROCEEH Conference on Expansions held in Frankfurt from 13–17 July 2015 and introduces the Humboldt Prize awardee, Prof. Dr. David Lordkipanidze.

Geomorphological landscape assessment of the Lake Manyara basin in the East African rift of Tanzania

The East African Rift System (EARS) is an intra-continental ridge system expressed through a succession of rift valleys bordered by uplifted shoulders. The rift valleys include two main chains, with the eastern branch extending a distance of 2200 km from the Afar triangle in the north to the Northern Tanzania Divergence Zone in the south. The western branch stretches 2100 km from Lake Albert in the north to Lake Malawi in the south. Structurally and magmatically controlled processes along the EARS created complex systems of relief and drainage beginning about 45 million years ago during the Eocene, and these processes continue into the present. In addition, tectonic processes have significantly contributed to the formation of the current drainage systems and landforms.

Starting in the Pliocene a series of small lakes developed within the eastern rift branch in northern Tanzania. Modern Lake Manyara represents the remainder of a larger paleo-lake that was originally much deeper. This inland basin consists of lake flats surrounding sodium-rich Lake Manyara. West of Lake Manyara the landscape is dominated by the rift escarpment and the adjoining rift plateau with its volcanic province; to the east, undulating plains are incised by en echelon faults. The Makuyuni River is the largest tributary of the lake, flowing westwards from the northeastern volcanic highlands.

In the early 20th century, German and later British researchers begin investigating East Africa in the search for human origins. En route to Olduvai on the 1934–35 expedition, Kent recognized and later described a section of lacustrine deposits near the village of Makuyuni and suggested a Middle Pleistocene age for them. During campaigns from 1969–70, 1994–95 and 2007–11, the Hominid Corridor Project reinvestigated these deposits. A 30 m section of greyish lacustrine, fossil-rich deposits overlain by brownish-red terrestrial sediments became the type section of the Manyara Beds. During the 2008 field season the field team uncovered two hominin-bearing sites, named MK2 and MK4. From 2007–09, Liane Giemsch conducted archaeological survey in the greater Makuyuni area as part of her doctoral thesis. This research was partly funded by ROCEEH and added 52 new find localities to previous fieldwork conducted by the Hominid Corridor Project. Giemsch's comparative study of Paleolithic artifacts from test excavations identified the majority of artifacts as Middle Acheulean, dating to between 630–400,000 years ago. Giemsch postulated that during the early Middle Pleistocene, hominins made use of the lacustrine fresh water environment of paleo-Lake Manyara.

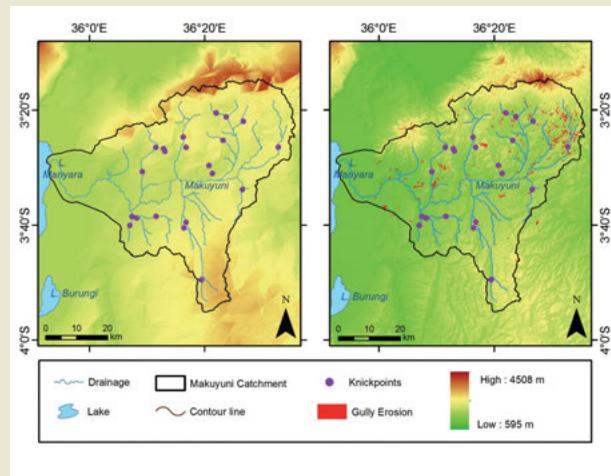
Here we present methods to describe the geomorphologic nature of the Lake Manyara basin and their implications to understanding the evolution of the landscape:

Morphotectonic analyses using Digital Elevation Models (DEMs) of active tectonic regions in mountain ranges and along plate boundaries demonstrate their potential use in tectonic interpretations. We can identify morphometric variables in basins using hypsometric analysis of DEMs. We can also use DEMs and remote sensing images to analyze regional tectonic features from topography. Such an analysis reveals a morphostructural control with a N-S trend for the uplifted Masai Block, as well as tectonic deformation in the Makuyuni catchment area northeast of Lake Manyara. Basin tilting associated with active faulting and uplifting near the Essimingor volcanic cone occurs, as does uplifting along micro-faults. Sub-catchments on the right bank of the Makuyuni River are in a mature equilibrium phase, whereas those on the left bank are in a younger stage of maturity. The results of regional tectonic instability prove that tectonic processes are a significant factor for the current landscape evolution of the Lake Manyara basin.

Geomorphological mapping plays an essential role in understanding surface processes, spatial distribution of landforms, geochronology, natural resources, natural hazards and landscape evolution. We present a small-scale geomorphological map of 1:10,000 for an area around the village of Makuyuni. A geomorphologic database was established for the mapping, and GIS-based analyses and remote sensed feature extractions were included in the mapping procedure.

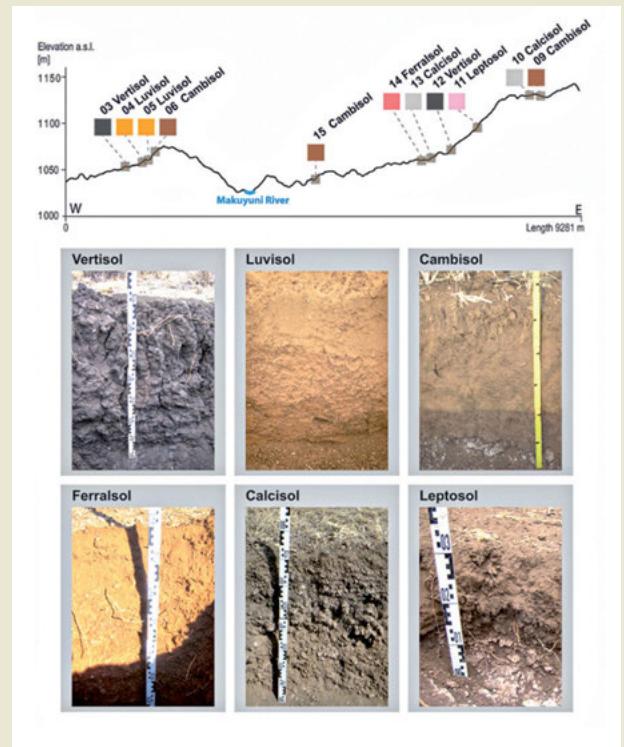
We follow a multi-scale approach with: I) extensive field mapping; II) interpretation of optical and multispectral remote sensing images; and III) the delineation of topographic derivatives. Particular efforts were made to identify and map gully erosion, which is a major threat in the region. This process not only accelerates the loss of topsoil, with an effect on agricultural fields and pastures, but also erodes artifacts and fossils. Thus, in addition to triggering the outcropping of potential find locations, gully processes also contribute to their potential destruction. Consequently, having a geomorphological map of the study area is a prerequisite for future studies with geoarchaeological, archaeological or paleontological focuses.

The spatial distribution of soils and lithology provides additional information for different landscape studies, such as digital soil mapping and landscape reconstruction. The topsoil is generally the most relevant part of the soil, with regard to food production, degradation and soil management. Soil organic matter, moisture content, texture and surface roughness influence the reflectance of the mineral composition of a surface as measured by a multi or hyperspectral sensor. The lithologies and soils of the Lake Manyara basin have complex genetic origins. The Proterozoic gneissic basement, tectonic and volcanic processes, as well as (paleo-) hydrologic processes and the sedimentation of paleo-Lake Manyara all influence soil formation. We identified the



▲ Fig. 1 Morphotectonic analyses reflecting active tectonics and gully erosion. Left: Base-level map constructed for the 2nd and 3rd Strahler order streams and knickpoints. Right: Colored shaded relief, knickpoints of the Makuyuni catchment and gully erosion distribution (digitalized from Google Earth™ images and validated in the field).

Fig. 2 Distribution of soil types along a transect close to the village of Makuyuni.



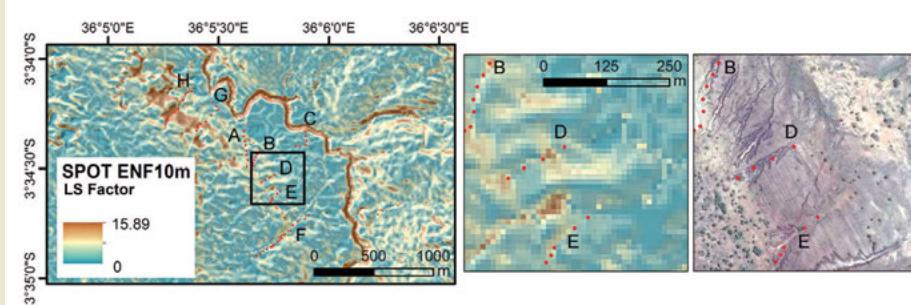


Fig. 3 Indicators of sediment transport and deposition, example of gully systems. From left to right: LS Factor on SPOT DEM (10 m ground resolution); close up of the LS factor for gullies B, D and E, close up underlaid by WorldView-2 data (2 m).



Fig. 4



Fig. 5

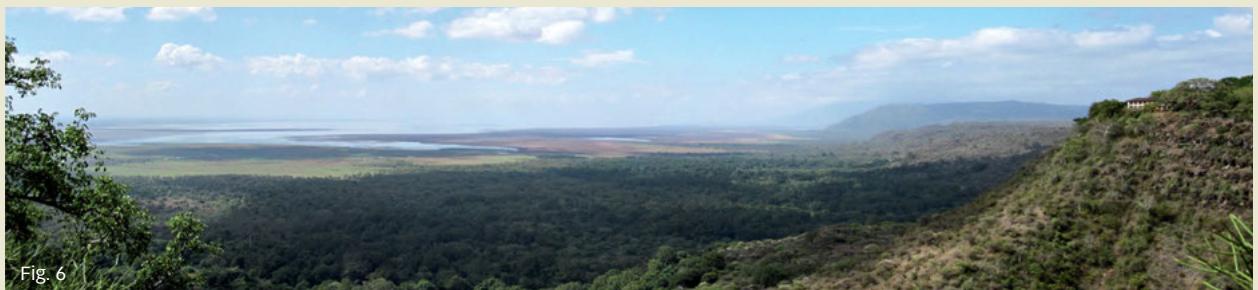


Fig. 4 A gully system cutting into the sediments. In the middle part of the image, greyish lacustrine sediments outcrop (Lower Manyara Beds) which are covered by interbedded fluvial deposits. (Photo: Quénéhervé 2011).

Fig. 5 The landscape around the village Makuyuni: Reddish terrestrial deposits (Upper Manyara Beds) on the left and greyish lacustrine sediments (Lower Manyara Beds) on the right. (Photo: Quénéhervé 2014).

Fig. 6 Lake Manyara basin on the left and the East African rift escarpment on the right. (Photo: Quénéhervé 2014).

spatial distribution of topsoil and related soil types by applying an integrated approach, combining surface characteristics and terrain features. For archaeological field studies and paleontological surveys, high-resolution topsoil and surface substrate information yield better insight than low-resolution soil type maps. Based on fieldwork and laboratory analysis of soil samples we attributed nine soil and lithological target classes. An in-depth interpretation of the classification result was conducted with three soil profile transects.

Gully erosion is a major threat with regard to landscape degradation in large areas of the Northern Tanzanian Rift valley. Gullies efficiently concentrate surface runoff and transport large amounts of sediments rapidly into river networks; gullies adjoining the Makuyuni River expose archaeological and paleontological finds. An assessment

of gullying processes yields valuable information about the landscape and landscape functions, such as sediment load, water quality, landscape stability, soil and groundwater storage, as well as soil fertility and soil depth. The gully systems investigated around the village of Makuyuni are considered to be mature, and hence belong to a static gully phase.

This integrative approach leads to a better understanding of the changing environment in an active rift such as the Lake Manyara basin. Geomorphologic activities led to an exposure of archaeological and paleontological remains and their discovery around the village of Makuyuni, but at the same time threaten their loss through ongoing erosional processes.

Conference Report

Expansions 2015, Frankfurt/Main, Germany

13–17 July 2015

One of the central issues of the ROCEEH research center is to understand the different types of expansions involved in human evolution, to study the developmental processes and mechanisms behind these expansions, and to explore the interdependencies among those different types of expansion. With this in mind, ROCEEH organized an international, interdisciplinary conference with the aim of examining expansions using different methodological and geographical approaches from three perspectives: I) ecospace; II) cultural capacities/performances; and III) range. The conference took place at the Senckenberg Biodiversity and Climate Research Centre in Frankfurt, Germany from 13–17 July 2015. The meeting facilitated exchange and discussion of new research results among more than 70 participants from a variety of scientific fields: Anthropology, Archaeology, Geography, Geosciences, Computer Sciences, Mathematics, Ornithology, Paleoecology, Paleontology and Zooarchaeology. The invited researchers presented their results in five sessions with 45 lectures and 13 posters.

The first day began with a general overview of the conference delivered by Miriam Haidle, the coordinator of ROCEEH. She presented ROCEEH's concept of interdependent expansions of range, cultural capacities, and ecospace, which lead to the project theme of "becoming human". The first session focused on the **Expansions of Ecospace**. Talks by King et al., Bailey et al., Sauer and Saarinen et al. dealt with the environmental constraints of different hominin groups with respect to climate, vegetation, landscape morphology and fauna. Presentations by Blain et al., Horne et al., Maul et al. and Orain et al. comprised quantitative reconstructions of climate and vegetation for different hominin groups based on various approaches and proxies. It is necessary to link such ecological

descriptions with early human cultural performances in order to understand the role of the environment in spatial expansions. The ecospace of a hominin group provides resources, but also depends on the level of hominin capacities and performances needed to acquire them. Several talks addressed food resources within their archaeological context—for example, Bigga discussed the plant foods of *Homo heidelbergensis* from Schöningen, and both Starkovich and Jones examined meat resources of *Homo sapiens* from eastern and western Mediterranean regions.

The second session tackled the **Expansions of Cultural Capacities**. Haidle introduced a model of the "Evolution and Expansion of Cultural Capacities" which brings together several developmental dimensions. Five talks by Wurz, Adler et al., Shimelmitz, Jöris, and Qu and Wang provided regional perspectives on cultural developments over the last 600–400 years in southern Africa, the Caucasus, the Levant, Europe and eastern Asia. Following these talks, several presentations explored differing cognitive aspects of cultural performances. Dapschauskas took a closer look at the expansion of symbolic and ritual capacities in the *Homo* lineage from an interdisciplinary perspective. Kandel et al. introduced the concept of Behavioral Hyperplasticity to explain changes in Middle Stone Age (MSA) culture of Africa, while Garofoli challenged hyper-intellectualism in cognitive archaeology with his Gannet Approach. Finally, Roberts discussed the use of Material Engagement Theory and Metaplasticity to explore Late Pleistocene material change and cognitive capacities.

The first half of the third day led the participants of the conference to the recently reopened Hessian State Museum in Darmstadt with exhibitions on art, culture and natural sciences. The afternoon session, **Multidisciplinary Approaches to Expansions**, featured talks by members of the ROCEEH Graduate Network. This third session of talks covered a



Fig. 7 Participants at the International ROCEEH Conference on Human Expansions in Frankfurt, Germany.

wide-range of topics. Bader et al. discussed expansions in performance during the late MSA, while Stolarczyk suggested a means to assess innovations in the MSA of southern Africa. Scheiffele explored the complexity of fire using cognigrams, and Lüdecke et al. examined the interplay between hominins and their environment. Bachofer et al. reconstructed paleo-landscapes with the help of remote sensing to test their role in influencing evolution and dispersal, while Quénéhervé et al. introduced soil and landscape analysis to predict the distribution of possible find locations. Finally, Will and Stock questioned whether the correlation of body size of early *Homo* related to the first dispersals out of Africa.

The fourth session addressed varying aspects of **Quantification and Modelling**. Rodríguez et al. showed how these techniques serve as a means to predict the distribution of Middle Pleistocene hominid sites, while Palombo used these methods to detect links between dispersals of animals and humans. Volmer examined the effects of competition among carnivores. The contributions of Hölzchen et al., Duppe et al. and Timm et al. used agent-based modelling to explore the dispersal of early humans, as did Gutmann. A series of talks by Schröder-Esselbach, Bolten et al., Heise and Taraz, and Capolongo et al. discussed the advantages and constraints of other modelling approaches. Müller and Sollmann studied the environmental impact of animals and humans

on migration. Finally, Carleton et al. urged a cautionary approach towards the use of inadequate analytical methods in modelling.

The fifth session, focusing on the **Expansions of Ranges**, comprised a series of talks revolving around the effects of ecosystems on the dispersion of hominins delivered by Lordkipanidze, Meijer et al., Bretzke, Kellberg Nielsen et al. and Haupt et al. This concluding session proposed the concept of treating expansions of range as a target variable when reconstructing the dispersals of the various hominin groups.

The closing discussion focused on future options for reconstructing the past by means of modelling. Yet there remain challenges that need to be addressed. Variability needs to be quantified. Questions need to be posed simply at first. Additionally, models should not be seen as reliable reconstructions of a past reality, but rather as tools to understand mechanisms and processes. With regard to the direction of future research, the importance of interdisciplinary work was highlighted in order to gain an understanding of the complexity of interdependent developments in the expansions of culture, environment and range.

*Sophia Steigerwald, Angela Bruch,
Miriam Haidle, Christine Hertler*

HUMBOLDT PRIZE AWARDEE PROF. DR. DAVID LORDKIPANIDZE



Fig. 8 Prof. Dr. David Lordkipanidze and Prof. Dr. Friedemann Schrenk.

Prof. David Lordkipanidze is the principal investigator at the exceptional paleoanthropological site of Dmanisi in Georgia, which has yielded a unique series of 1.8 million years old hominin fossils. The discoveries of his team documenting the first expansions of hominins out of Africa and into Eurasia have greatly influenced our thinking about human evolution.

Now as a Humboldt prize awardee, Prof. Lordkipanidze has strengthened his ties with the scientists of the ROCEEH Research Center. During his research stay in Frankfurt, Prof. Lordkipanidze and members of his team worked with ROCEEH to synthesize environmental information from

the Southern Caucasus on fauna, vegetation and climate in different slices of time—before, during, and after the appearance of *Homo erectus*.

In addition Prof. Lordkipanidze and ROCEEH organized a brainstorming session on “Late Miocene to Early Pleistocene Paleobiology of the Eastern Caucasus” to discuss possibilities for a new international research initiative. This workshop included 19 participants from six countries and took place in Frankfurt from October 9–10. Based on vivid discussion the group agreed that the region is of essential importance. Crucial research questions can be answered with the material and expertise available there, and joint efforts will provide important synergies. To establish and strengthen this cooperative research, the group proposed immediate actions such as the establishment of a joint online database and a follow-up meeting scheduled in 2016.

Furthermore, Prof. Lordkipanidze contributed to the public outreach of ROCEEH by holding a lecture at the Senckenberg Museum in Frankfurt in June. He also lectured at the Hessian State Museum in Darmstadt at the opening ceremony of the exhibit entitled “EXPANDING WORLDS” which displayed original early human fossils from five regions, including Dmanisi.

Who's who?

This issue: Christine Hertler



Christine Hertler



Christine Hertler studies the paleobiology and paleoecology of early humans. She has been based at the Senckenberg Research Institute in Frankfurt since the inception of ROCEEH in 2008. Christine's main research interests lie in the paleoecology of early humans, in modeling early human dispersal and, in a more general sense, in the evolution of relationships between nature and culture. Christine comes from a biological background, having studied zoology, anthropology and psychology at the Goethe University in Frankfurt. Her interests in the history of concepts and methods are reflected in the topic of her doctoral thesis. Her dissertation dealt with the application of morphological methods in evolutionary reconstructions and the link between concepts in evolution and methods for the reconstruction of such processes. In post-doctoral work, she continued to pursue methodological approaches in projects on demographic trends and needs-and-supply systems in human societies. In this junior research group funded through a special program on social-ecological research by the German Ministry of Education and Research, she gathered experience in the specific requirements of interdisciplinary projects. Besides her theoretical inclinations, Christine is a passionate researcher in the field of Pleistocene hominids, particularly *Homo erectus* in Southeast Asia. She started a field project in West Java, Indonesia at the locality of Majalengka in 2004 and continues to collaborate on numerous international studies in the region. She loves all inhabitants of the islands of Southeast Asia, no matter whether human or bovid, and whether present or past.

Forthcoming

- 3rd NECLIME Asian Meeting | Lucknow, India
23–27 February 2016, convened by the director of the Birbal Sahni Institute of Paleobotany (BSIP), Sunil Bajpa, co-organized by Angela Bruch and Torsten Utescher.
- CAA International 2016 | Oslo, Norway
29 March–2 April 2016, Session "Revealing by visualising: Geographic relations in cultural heritage databases" organized by Mieko Matsumoto, Michael Märker, Espen Uleberg and Volker Hochschild.
- 23rd biennial meeting of the Society of Africanist Archaeologists (SAfA) | Toulouse, France
26 June–2 July 2016, Session "Current research on the Middle Stone Age of southern Africa" organized by Nicholas J. Conard and Sarah Wurz.
- Workshop on the Lower Paleolithic of Arabia | Tübingen, Germany
24–26 June 2016, organized by Knut Bretzke and Nicholas J. Conard.
- XIV International Palynological Congress and X International Organization of Palaeobotany Conference 2016 | Salvador de Bahia, Brazil
23–28 October 2016, Session on "Vegetation dynamics and early human expansions (ROCEEH/NECLIME)" convened by Angela Bruch and Natalia Rudaya.
- **100+25 years of *Homo erectus*:** Dmanisi and beyond, International Conference | Tbilisi, Georgia
20–24 June 2016, organized by David Lordkipanidze, Friedemann Schrenk and Angela Bruch.

CONTACT

The Role of Culture in Early Expansions of Humans
Heidelberg Academy of Sciences and Humanities

Senckenberg Research Institute Frankfurt/Main
Eberhard Karls University of Tübingen

COORDINATORS

Miriam Haidle (scientific)
Julia Heß (administrative)

Senckenberg Research Institute
Senckenberganlage 25
D-60325 Frankfurt/Main
miriam.haidle@uni-tuebingen.de
julia.hess@senckenberg.de
www.roceeh.net



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