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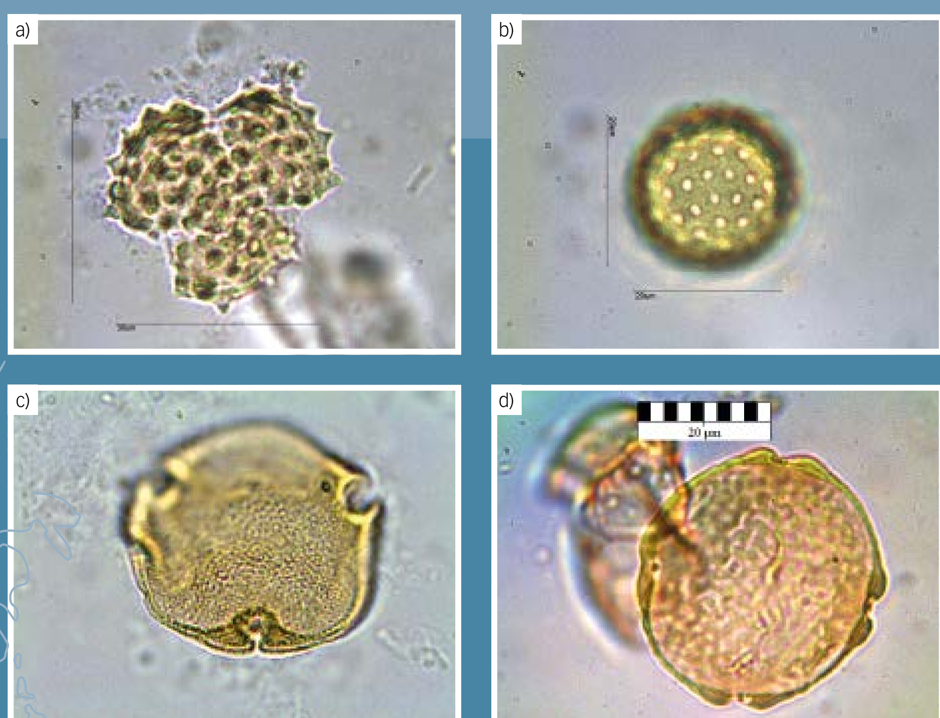
The Role of Culture in Early Expansions of Humans



Early Pleistocene pollen from Vorotan Basin, Armenia:
a) Asteraceae
b) Chenopodiaceae
c) *Tilia*
d) *Zelkova*

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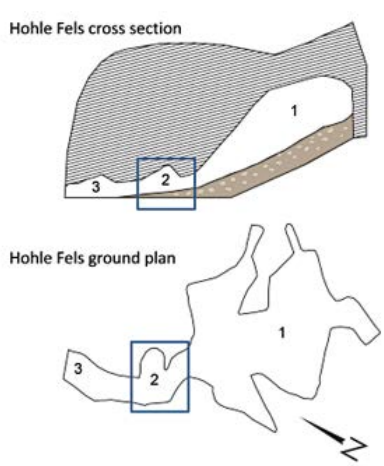
THE ROLE OF CULTURE IN EARLY EXPANSIONS OF HUMANS

Editorial

The ninth issue of the ROCEEH newsletter provides new insights into the study of site formation processes, reports on the reconstruction of Early Pleistocene vegetation in the Southern Caucasus, and introduces the excavations at the Middle to Upper Paleolithic cave site Sefunim in Israel.

Site formation processes in the deposits of Hohle Fels Cave, southwestern Germany

Understanding post-depositional processes is crucial to archaeological and environmental interpretations. Although it is well understood that the physical orientation of finds can yield information on site formation processes, it is still not common practice to record and analyze orientation data. At the Middle to Upper Paleolithic cave site Hohle Fels in the Swabian Jura, post-depositional processes are evident. Investigation of the Gravettian and Magdalenian layers raised fundamental questions about the integrity of finds from these periods. We plan to expand this test study to assess the integrity of Middle and Early Upper Paleolithic assemblages from this key site for studying the dispersal of early modern humans into Europe.



Cross section and ground plan of Hohle Fels Cave showing:
1) cave hall; 2) niche; and 3) entrance corridor.

Hohle Fels is located in the Ach Valley of southwestern Germany, 20 km west of the city of Ulm. Its sediment has both endogenous and exogenous origins. During excavations inside the cave hall in 1870–1871, Oskar Fraas removed a seven meter high cone of sediment. This cone represents the main source of sediment within the niche in front of the cave hall, where excavations began in 1977 and are still underway. In the layers dating to the end of the Gravettian and the Magdalenian, there is also a strong component of exogenous sediment coming from the entrance of the cave. Inside the cave hall the sediments are steeply inclined, while the slope is shallower in the niche. The general slope direction is from southeast (inside) to northwest (outside).

Evidence for post-depositional processes varies across the site. Erosion is documented by a wedge in the northwest of the excavation area which transects the Gravettian layers.

Analysis of the fauna showed that cave bear bones are present in almost all Magdalenian layers, despite the fact that this species went extinct before the Last Glacial Maximum about 18,000 years ago. Furthermore, almost half of the dated worked bones from the Magdalenian layers yielded

An ivory pendant from the Gravettian layers of Hohle Fels Cave (Photo: Hilde Jensen, University of Tübingen).

ages that pre-date the Magdalenian. Finally, refitting of stone artifacts demonstrated that conjoining pieces were mostly broken and separated by great distances. Taken together, these data suggest that the Magdalenian layers were affected by post-depositional processes.

The main goals of our methodological approach were to gain a better understanding of the site formation and post-depositional processes and identify the agents responsible. Therefore, we needed to visualize the various types of post-depositional disturbances and the degree to which they affected the site. Specifically, our aim was to clarify the contextual integrity of the assemblages and separate the Magdalenian from the Gravettian finds.

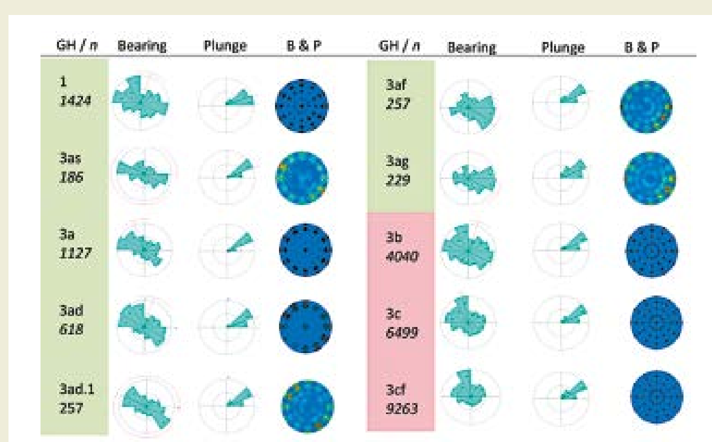
The analysis of the orientation of archaeological finds is based on the assumption that hominids did not preferentially orient artifacts when they discarded them. Patterning in the horizontal orientation indicates post-depositional alteration, whereas randomly distributed orientation more likely represents in situ or minimally disturbed deposits. Vertical distributions are strongly dependent on the natural slope of the layer. Deviations from the natural slope tend to indicate post-depositional disturbances. Since the first systematic excavations began at Hohle Fels, horizontal orientation (bearing) and vertical orientation (plunge) have been recorded for finds with a distinct long axis. Orientation data were analyzed visually and statistically for each Geological Horizon (GH).

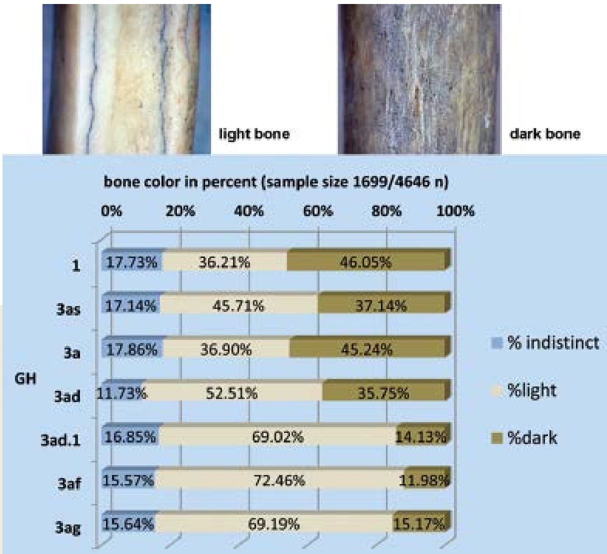
Three primary methods were used to visualize the orientation data: 1) circular histograms presenting bearing and plunge separately; 2) spherical diagrams depicting orientation and plunge combined; and 3) 3D spatial projection to provide a more detailed analysis of the find orientation within the layer and detect areas of localized disturbance that otherwise might have gone unnoticed. In addition to the mean and standard deviation and the length of the mean vector of the data, a Rayleigh test of uniformity shows whether and how strong the data cluster. Shape indices were calculated from computed eigenvalues to distinguish fabric orientation on a ternary diagram.

Further archeological observations allow us to confirm the intrusion of older material into the Magdalenian layers. During the excavation, differences in preservation were noted for bones from the Magdalenian and Gravettian layers. Bones from the Gravettian and older contexts were dark in color, while bones from the Magdalenian layers were mostly light colored and appeared fresh. The dark bones contained within the Magdalenian context seemed to represent disturbances stemming from the older deposits. Thus we recorded the color for a sample of the Magdalenian faunal assemblage (37 %) to test the validity of this observation. Radiocarbon dating of dark and light bones also confirmed our assumption that the dark bones originated in the Gravettian, while the light colored bones came from the Magdalenian. Considering animal species with respect to bone color, we can safely exclude bones of cave bear, mammoth and rhino from the Magdalenian because these animals were extinct by then. Therefore, the inclusion of dark bones within the Magdalenian deposits can be attributed to post-depositional processes.

All of the methods used to analyze the orientation of finds show a distinct difference between the Magdalenian and Gravettian deposits, and even some differences within the

Circular histogram and spherical diagram of bearing and plunge from Magdalenian layers 1–3ag (green) and Gravettian layers 3b–3cf (pink).





Proportions of indistinct (blue), light (beige) and dark (brown) bones within the Magdalenian layers 1–3ag.

Magdalenian deposits. These results coincide with geological and archeological observations. Different types and degrees of post-depositional disturbances have influenced both periods. Sediment of endogenous origin from the cave hall has influenced the orientation of the Gravettian finds, in that they tend to lie parallel to the natural slope. Erosion in this area at the end of the Gravettian formed a steep gully that influenced the slopes of subsequent layers. The perpendicular orientation seen in Magdalenian layers GH 3af and 3ag can result from movement of individual finds that rolled down the slope. This differs from mass or shallow movement of soil where finds are usually orientated parallel to the natural slope. Bidirectional patterning in the orientation of finds from the other Magdalenian layers is most likely influenced by sediments coming from the cave entrance in additional to the sediments coming from the cave hall. The different color of the bones allows us to calculate the degree of disturbance per analytical unit and even to eliminate inappropriate finds from the assemblage.

Maria Malina

Reconstruction of Early Pleistocene Vegetation in Southern Caucasus (Armenia) as Part of the Environment of Early Humans

The region of the Southern Caucasus plays a key role for the spread of humans out of Africa. The oldest fossils and artifacts of the genus *Homo* come from Dmanisi in Georgia and date to 1.85–1.76 Ma. Therefore, the reconstruction of the paleovegetation in the Southern Caucasus is crucial to understanding the environment of those hominins and the causes of their earliest expansions into Eurasia. Early Pleistocene lacustrine sediments are an important archive to reconstruct the environment, especially the vegetation at that time. The sediments of the Vorotan Basin may partly fill a gap in Western Asia. These deposits are located in the vicinity of the town Sisian in the Syunik province of Armenia. These deposits yield pollen and macrofossils of plants with excellent preservation and can be studied in very high resolution. They are located some 250 km southeast of Dmanisi and cover the time span from 1.4–0.95 Ma. As a viable pollen profile is lacking at Dmanisi, the results from the Vorotan Basin are of particular importance, even if the deposits are slightly younger. In addition, the sediments represent the beginning of the Middle Pleistocene transition marking the change in global climate from obliquity-induced 41 ka cycles to eccentricity-induced 100 ka cycles. The outcrops in the Vorotan Basin are thus far the only terrestrial deposits in Southeastern Europe and Western Asia which provide high-resolution data on the vegetation of this period.

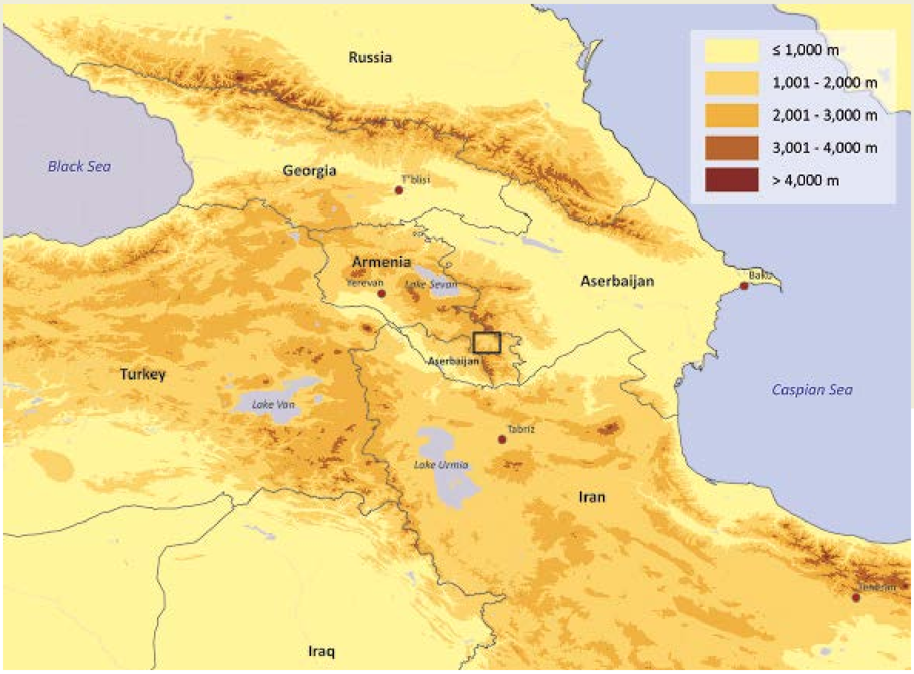
The region is characterized by Quaternary volcanism and widespread lava fields. During the Pleistocene, lava flows from nearby volcanoes blocked the Vorotan valley several times, creating a lake of about 100 km^2. The sediments of this paleolake consist mainly of clayey, silty and fine sandy diatomites with intercalated layers of volcanic ash and pumice. From the ten geological sections studied, we established a precise chronology using a combination of ^{39}Ar/^{40}Ar-dating and magnetostratigraphy. By aligning these dates biostratigraphically with the global marine δ^{18}O-curve, we can estimate the sedimentation rate at about 30 cm/ka.

Paleovegetation in the Vorotan Basin

One important result of the study is that each vegetational cycle is different. Nonetheless, we can make some general statements about the dependence of vegetation on climatic changes in the Southern Caucasus during the Early Pleistocene:

During global **cool periods**, mainly coniferous trees (*Picea, Tsuga, Abies, Sciadopitys*) show a stronger presence. Of the herbs, especially Asteraceae are represented regularly during the glacial cycles. Only during the long lasting cool phase of MIS 30 does *Pinus* increasingly dominate what eventually becomes a closed pine forest.

Open mixed forests prevail during **warming phases** with *Quercus, Carpinus, Juglans, Picea* and *Tsuga*. Especially thermophilous deciduous trees (*Ulmus/Zelkova, Tilia*) are still largely missing. The herb layer becomes very diverse during this phase (Poaceae, Artemisia, Chenopodiaceae) but does not significantly dominate. During the global **warm phases** a mosaic of open forests with thermophilous deciduous trees (*Quercus, Carpinus, Juglans, Ulmus/Zelkova, Tilia*) develops. In some warm phases (MIS 31 and MIS 33) a grass steppe



Map of the Southern Caucasus with rectangle drawn around the study area in the Vorotan Basin of southern Armenia.

develops. During the **cooling phases** the abundances of Poaceae and deciduous trees decline. The increasingly cooler and more humid climate favored conifers (*Tsuga, Abies*) and Asteraceae.

The vegetation in the Vorotan Basin during the Early Pleistocene is characterized by more or less open forests. Treeless steppe does not occur in the sections studied. Despite these similarities, the expression of individual phases is very different. For example, the warm phase MIS 31 is distinct from other interglacials. Also the spread of coniferous forests during cool periods is not uniform.

Importance of the Southern Caucasus for early humans

What do the results tell us about the environment of *Homo erectus* in the Southern Caucasus? Is the vegetation of the Vorotan Basin really comparable with that of Dmanisi? Pollen taxa from two coprolites of Dmanisi show a high degree of agreement with those of the Vorotan Basin. Twenty-two of 27 Spermatophytes in the coprolites are also part of the pollen flora of the Vorotan Basin. The comparison of plant functional types from both paleofloras leads to the same conclusion. *H. erectus* in Dmanisi probably experienced similar environmental conditions to those in the Vorotan Basin, at least with regard to vegetation. The structure of the landscape in the Vorotan Basin, with a lake, several tributaries, riparian vegetation, forest patches and more open areas is also how most researchers view the habitat of *H. erectus*.

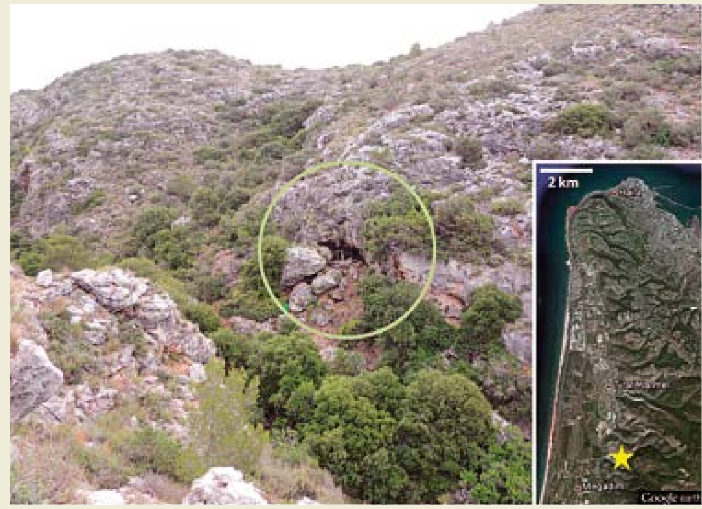
To summarize, we see the extensive mosaic vegetation of the Southern Caucasus, and the conditions in the Vorotan Basin itself, as a suitable habitat for the settlement of early humans. Only long lasting cool phases, which became increasingly common during the Middle Pleistocene Transition, may have worsened living conditions. The change from an obliquity-induced 41 ka climatic cycle towards an eccentricity-induced 100 ka cycle may have been a crucial time span for the existence of *H. erectus* in the region and possibly as served a catalyst for cultural adaptations.

Steffen Scharrer

The Darbas section covers the exceptionally warm interglacial MIS 31 and the first long lasting cool phase MIS 30 (Photo: S. Scharrer)

Excavations at Sefunim Cave, Mount Carmel, Israel

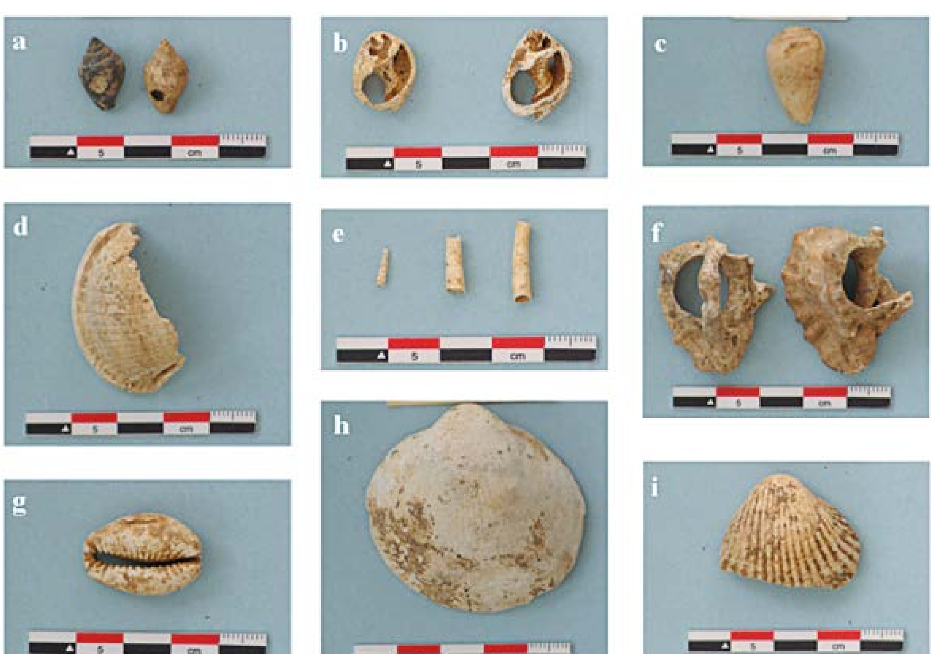
In May, 2013 the ROCEEH team began new excavations at Sefunim Cave in Mount Carmel, Israel in collaboration with our colleagues at the Zinman Institute of Archaeology of the University of Haifa (directed by R. Shimelmitz and A. Kandel). Earlier research by a team from Haifa led by Avraham Ronen between 1965 and 1970 succeeded in documenting a well stratified sequence from the late Middle to Upper Paleolithic, Neolithic and even younger periods, but many questions about the Paleolithic sequence remained unanswered.



Sefunim cave is situated within a prominent limestone ridge about 3 km east of the Mediterranean coastline (Photo: A. Kandel).

With an aim to resolve some of these issues, the research team decided to initiate new excavations at Sefunim for several reasons: 1) to confirm the presence of unexcavated Paleolithic materials at the entrance of the cave, which we estimate to cover more than 12 square meters; 2) to analyze the Middle to Upper Paleolithic transition using radiometric dating, micromorphological soil analysis and botanical studies; 3) to examine the nature of Levantine Aurignacian technology and compare it to other Paleolithic cultures encountered in the stratigraphy of the cave and in the regional; 4) to understand the pattern and tempo of change through the Upper Paleolithic cultural sequence; 5) to conduct detailed archaeozoological studies of the faunal assemblages to determine the nature of subsistence over time, as well as the effects of taphonomy; 6) to establish environmental baseline criteria using microfauna and botanical remains; and 7) to study the largest known dripstone features of Mount Carmel that are present at Sefunim Cave, with the aim of synthesizing regional climatic change during the times that Neanderthals and modern humans occupied the cave.

In summary, the main goal of the new study is to use a multidisciplinary approach to better understand diachronic variation in Paleolithic lifeways in Mount Carmel from the late Middle Paleolithic through the end of the Upper Paleolithic, with a focus on issues of subsistence and the relationship between humans and their environment. Of interest are the transitional lithic industries from Mousterian to Initial Upper Paleolithic, and the nature of the Levantine Aurignacian – to what extent it represents a different lifeway than the contemporary Ahmarian industry.



Examples of marine shells from Sefunim Cave (Photos: A. Kandel).

Our first field season yielded two new anthropogenic horizons attributed to the Kebaran and early Epipaleolithic, and ended in the upper part of the Levantine Aurignacian layer. So far, these layers have yielded many lithic artifacts, well preserved macrofauna and microfauna, bone tools, shell and stone beads, and worked red ocher. In 2014–2015, we plan to carefully excavate and study these layers to gain new insights into this important Paleolithic site.

In addition to the field work, we have studied the lithics artifacts from Ronen's Levantine Aurignacian layer to understand the technological nature of this horizon. Of specific interest is the character of blade production in this industry and how it differs from Ahmarian blade production. We also examined the faunal collection to assess the nature of the assemblage and studied the shell beads to better understand changes in behavior from Paleolithic to Neolithic times. The fauna are well preserved and suitable for further taphonomic studies. The shell beads suggest subtle changes in behavior over time. The Paleolithic beads reflect an assemblage of fewer species that are smaller in size, while the Neolithic beads show a broader spectrum of species and a greater range in size. In both cases, it seems that shellfish did not play a significant role in subsistence strategy, but instead shells were collected from the beach specifically for their use as personal adornment.

Andrew Kandel

Forthcoming

- Conference: 20th Congress of the Indo-Pacific Prehistory Association (IPPA) **(12–18 January 2014)** in Seam Reap, Cambodia. Session: Paleoanthropology of Southern Asia: from the Indian Subcontinent to Australasia. (http://ippa.weblogs.anu.edu.au/communications-and-membership/siem-reap-conference-january-2014/)
- NEOTOMA Workshop: Age Models, Chronologies, and Databases **(13–16 January 2014)** in Belfast, Northern Ireland Invited Mentor: Angela Bruch (http://www.neotomadb.org/events)
- General Assembly of the European Geosciences Union (EGU) **(27 April – 02 May 2014)** in Vienna, Austria. Suggested session by Finn Viehberg, Angela Bruch, and Minoru Yoneda: Always look on the bright side … – Environmental constraints of early human expansions. (http://www.egu2014.eu/)

Who's who?

This issue: Michael Märker

Michael Märker conducting an electromagnetic induction survey at the fossil locality of Makuyuni in northern Tanzania.

Michael Märker has been in the ROCEEH team since April 2008 and focuses on GIS, database and environmental modeling. He studied physical geography at the University of Bonn and earned a Ph. D. in geoinformatics and physical geography at the Friedrich Schiller University of Jena. In his Ph. D. thesis, conducted in a project of the European Union at the University of Florence, he concentrated on modeling regional erosion in South Africa and developed an integrative concept for the assessment of soil erosion. From 2002–2003 he was a post-doctoral research fellow at the Center for Environmental Systems Research, University of Kassel. In three large global assessment projects (Millennium Ecosystem Assessment, World Water Assessment Program, and Water and Climate Dialogue) he studied the present and future status of global freshwater resources using a global hydrological model (WaterGap). From 2004–2008 he worked at the Institute for Geoecology and at the Interdisciplinary Centre for Pattern Dynamics and Applied Remote Sensing of the University of Potsdam studying topics related to geomorphological process dynamics and soil hydrology. Since 2005 he is a lecturer at the University of Florence. Recently his research has focused mainly on landscape reconstruction and landscape evolution modeling, as well as on stochastic environmental and archaeological prediction models. The main methodologies he utilizes in this research are remote sensing, GIS and numerical and stochastic modeling.

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